Collaborative Model-Driven Software Engineering: a Classification Framework and a Research Map [Extended Abstract]

Journal-First Paper Initiative at ICSE 2018

Davide Di Ruscio, Mirco Franzago, Henry Muccini
DISIM Department, University of L'Aquila, Italy
{firstname.lastname}@univaq.it

Ivano Malavolta
Vrije Universiteit Amsterdam, The Netherlands
i.malavolta@vu.nl

ABSTRACT

This proposal is about a study we recently published in the IEEE Transaction of Software Engineering journal [4].
Context: Collaborative software engineering (CoSE) deals with methods, processes and tools for enhancing collaboration, communication, and co-ordination (3C) among team members [5]. CoSE can be employed to conceive different kinds of artifacts during the development and evolution of software systems. For instance, when focusing on software design, multiple stakeholders with different expertise and responsibility collaborate on the system design. Model-Driven Software Engineering (MDSE) provides suitable techniques and tools for specifying, manipulating, and analyzing modeling artifacts including metamodels, models, and transformations [1]. Collaborative Model-Driven Software Engineering (MDSE) consists of methods or techniques in which multiple stakeholders manage, collaborate, and are aware of each others' work on a set of shared models. A collaborative MDSE approach is composed of three main complementary dimensions: (i) a model management infrastructure for managing the life cycle of the models, (ii) a set of collaboration means for allowing involved stakeholders to work on the modelling artifacts collaboratively, and (iii) a set of communication means for allowing involved stakeholders to exchange, share, and communicate information within the team. Collaborative MDSE is attracting several research efforts from different research areas (e.g., model-driven engineering, global software engineering, etc.), resulting in a variegated scientific body of knowledge on the topic.

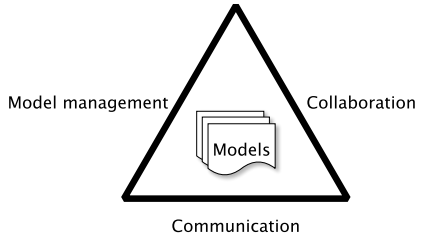

Figure 1: Collaborative MDSE dimensions

Objective: In this study we aim at identifying, classifying, and understanding existing collaborative MDSE approaches. More specifically, our goal is to assess (i) the key *characteristics* of collaborative MDSE approaches (e.g., model editing environments, model versioning mechanisms, model repositories, support for communication and decision making), (ii) their faced challenges and limitations, and (iii) the interest of researchers in collaborative MDSE approaches over time and their focus on the three dimensions of collaborative MDSE.
Method: In order to achieve this, we designed and conducted a systematic mapping study [6] on collaborative MDSE. Starting from over 3,000 potentially relevant studies, we applied a rigorous selection procedure [3] resulting in 48 primary studies along a time span of nineteen years. A suitable classification framework has been empirically defined and rigorously applied for extracting key information from each selected study. We collated, summarized, and analyzed extracted data by applying scientifically sound data synthesis techniques.
Results: In addition to a number of specific insights, our analysis revealed the following key findings: (i) there is a growing scientific interest on collaborative MDSE in the last years; (ii) multi-view modeling, validation support, reuse, and branching are more rarely covered with respect to other aspects about collaborative MDSE; (iii) different primary studies focus differently on individual dimensions of collaborative MDSE (i.e., model management, collaboration, and communication); (iv) most approaches are language-specific, with a prominence of UML-based approaches; (v) few approaches support the interplay between synchronous and asynchronous collaboration.
Conclusion: This study gives a solid foundation for a thorough identification and comparison of existing and future approaches for collaborative MDSE [2]. Those results can be used by both researchers and practitioners for identifying existing research/technical gaps to attack, better scoping their own contributions to the field, or better understanding or refining existing ones.

REFERENCES

[1] Marco Brambilla, Jordi Cabot, and Manuel Wimmer. 2012. Model-driven software engineering in practice. *Synthesis Lectures on Software Engineering* (2012), 1–182.
[2] Davide Di Ruscio, Mirco Franzago, Henry Muccini, and Ivano Malavolta. 2017. Envisioning the Future of Collaborative Model-driven Software Engineering. In *Proceedings of the 39th ICSE Companion (ICSE-C '17)*. IEEE Press, 219–221.

[3] Mirco Franzago, Davide Di Ruscio, Ivano Malavolta, and Henry Muccini. 2016. *Protocol for a Systematic Mapping Study on Collaborative Model-Driven Software Engineering*. Technical Report TR-001-2016. DISIM - University of L'Aquila.

[4] M. Franzago, D. D. Ruscio, I. Malavolta, and H. Muccini. 2017. Collaborative Model-Driven Software Engineering: a Classification Framework and a Research Map. *IEEE Transactions on Software Engineering* PP, 99 (2017), 1–1. https://doi.org/10.1109/TSE.2017.2755039 URL https://tinyurl.com/ya5srlvd.

[5] Ivan Mistrík, John Grundy, Andre Van der Hoek, and Jim Whitehead. 2010. Collaborative software engineering: Challenges and prospects. In *Collaborative Software Engineering*. Springer, 389–403.

[6] Kai Petersen, Sairam Vakkalanka, and Ludwik Kuzniarz. 2015. Guidelines for conducting systematic mapping studies in software engineering: An update. *Information and Software Technology* (2015), 1–18.