Annex 7: Habilitation thesis reviewer's report

Masaryk University	
Faculty	Faculty of Informatics, MU
Habilitation field	Informatics
Applicant	Ing. RNDr. Barbora Buhnová, Ph.D.
Unit	Faculty of Informatics Masaryk University, Brno
Habilitation thesis	*Quality-Driven Architecture Design of Software Systems*
Reviewer	Prof. Dr. Olaf Zimmermann
Unit	Hochschule für Technik Rapperswil (HSR FHO), Institut für Software

Reviewer's report (extent of text up to the reviewer)

The candidate's habilitation thesis and the articles that it collects reside in the context of software architecture research, specifically in the architectural synthesis phase, but also in architectural analysis and architectural evaluation as described by C. Hofmeister et al [1]. This research field has grown out of the overall software engineering field roundabout 20 years ago [2]. Dedicated conferences such as CBSE, QoSA and WICSA have ben established, which have just been merged into a joint ICSA event, and software engineering periodicals such as IEEE Software, IST, JSS and TSE have devoted special issues on software architectural topics since then. Within this research field, quality attributes and component-orientation are two important topic areas. The reviewed habilitation thesis combines these two topic areas.

The research contributions of the collected articles and the thesis qualify as a blend of foundational work (here: modeling) and method engineering (here: quality assessment, design process support); they are partially tool supported. This research design is in line with established recommendations how to conduct software engineering and software architecture research (see for instance M. Shaw [3]). Not being a theoretical computer scientist or formal methods expert, I reviewed the presented research contributions and the research design through the eyes of a software architecture researcher who has been an active member of this community since 2006; having served as an IT architect in practice before that, I also looked for real-world applicability and potential adoption of the concepts and their implementations.

In her thesis, the candidate demonstrates her ability to leverage her track record and active role in the international software architecture and component-based software engineering communities to help advance the state of the art; she combines quality- and component-oriented concepts in novel, elegant, and practically relevant ways. Her habilitation thesis is well written overall in terms of its structure (i.e., logical flow from topic to topic and contribution to contribution) and language (e.g., introduction of context and concepts, definitions). Realistic assumptions are made and challenges discussed openly and candidly, which is expected and appreciated by practitioners. Chapter 2, 3, 4 of the thesis focus on architectural models (with special emphasis on reliability and performance qualities), as well as related quality assessments and design process support (decision making, optimization). The chapter organization is sound; the contributions have been published at renowned conferences and journals. Some contributions qualify as implementation and validation work; these contributions complement the presented and referenced novel research well. Practicality is demonstrated in challenging and interesting application domains such as embedded systems and enterprise (information) systems. Comparing the chapters, I assess Chapters 2 and 3 to be

slightly stronger and more mature than Chapter 4 (in terms of depth of penetration of the topic area); Chapter 4 still contains valuable research results meeting the thesis criteria.

In summary, reading the habilitation thesis clearly evidences that the candidate contributed to the state of the art in the field in significant ways. The contributions of the individual publications fit together well and result in a contribution on their own.

I would like to conclude my report with a few ideas for future research directions, which originate from my positive reaction on the presented research problems and solutions to them: i) consider an industry/application paper, e.g., in the form of an Insights column instalment in IEEE Software together with an author from industry, ii) apply and extend more research results from the Software Architecture Knowledge Management (SAKM) area [4] in future version of the design process support and optimization; iii) consider an integration with recently updated design methods such as ADD 3.0 [5], and iv) investigate interdisciplinary decision making as for instance suggested by the (W)ICSA MARCH workshop series.

[1] C. Hofmeister, P. Kruchten, R. L. Nord, J. H. Obbink, Alexander Ran, Pierre America: A general model of software architecture design derived from five industrial approaches. Journal of Systems and Software 80(1): 106-126 (2007)
[2] G. Hohpe, I. Ozkaya, . Zdun, O. Zimmermann: The Software Architect's Role in the Digital Age. IEEE Software 33(6): 30-39 (2016)
[3] M. Shaw. Writing Good Software Engineering Research Papers: Mini-tutorial. Proceedings of the 25th International Conference on Soft-ware Engineering. International Conference on Software Engineering. IEEE Computer Society, 2003., Pages 726-736.
[4] M. Ali Babar, T. Dingsøyr, P. Lago, H. van Vliet (eds.), Software Architecture Knowledge Management: Theory and Practice, Springer-Verlag (2009)
[5] R. Kazman, H. Cervantes, S. Haziyev, O. Hrytsay:
Tutorial Summary for Designing Software Architectures Using ADD 3.0. WICSA 2016: 253

Reviewer's questions for the habilitation thesis defence (number of questions up to the reviewer)

1. Are the presented concepts and their prototypical implementations suited for industry projects that apply agile software engineering practices such as test-driven development, continuous delivery, and DevOps? If not, why? If so, how will they have to be adapted?
2. How will the presented concepts and their prototypical implementations have to be modified and extended to be suited for recent additions to the architecture design space – for instance, cloud deployments, ad hoc/dynamic (micro-)service composition, and serverless architectures?

Conclusion

The habilitation thesis submitted by Barbora Buhnová entitled *"Quality-Driven Architecture Design of Software Systems"* **meets** the requirements applicable to habilitation theses in the field of Informatics.

In Rapperswil on 29.03.2017