Title: *Generic decentralized self-adaptive context-aware architecture model*

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The thesis aims at studying self-adaptive systems from the perspective of self-adaptation as well as context-awareness strategies, and it proposes a generic context-aware self-adaptive architecture model to support software system with adaptation functionality. The author provides two case studies as a proof of concept of the applicability of the proposed adaptation approach.

The thesis in general reads very well, with clear structure that adds to the understandability. Language imperfections are only minor and very rare. The language level is very good. The topic of the thesis is interesting and relevant to the software engineering research community. The problem is explained and the state of the art is discussed, together with highlighting the related work to the aim of the thesis. The problem being addressed as described in the aim of the thesis is of sufficient level for a doctoral thesis project. The findings are summarized and discussed at the end of the thesis, with outlining future research directions.

At the same time, there is room for improvement within the thesis, which I summarize below, together with addressing the points to be explicitly addressed in the review:

1. Topic fit and timeliness

The topic of the dissertation thesis fits the study program within which the thesis has been submitted. The topic is timely and interesting.

2. Originality and Contribution

The thesis presents interesting results whose originality is to a reasonable extent supported with discussion of the state of the art as well as related work, together with the limitations identified within the related work. See the "Detailed comments" below for indication of the ways in which the contribution could be made even stronger and more distinct from the related work.

3. Publication record of the student

The key results of the thesis have been published in seven papers that the student has written jointly with his supervisor specialist RNDr. Marek Rychly, Ph.D. These are in the thesis listed as [42, 43, 44, 41, 45, 46, 47] and in detail described in Appendix C. I highly value that the student was the main author in all of them. I see such a publication outcome as sufficient for a dissertation thesis.

4. Research experience

Given the publications and the variety of the publication venues, the student seems to demonstrate good orientation in the research community. The CV of the student is rather short, so I am not sure if there was any other involvement in the research community besides publishing the work (e.g. conference volunteering, reviewing, etc.).

Detailed comments

- Within the whole thesis, the individual steps are quite well explained, but it is often not very clear what specific parts of the presented work are novel comparing to the related work. For instance regarding the migration strategy, is it an implementation of already understood way of migration or is there specific novelty that you would like to highlight? You can address this in your thesis presentation.

- Along the same lines, although the thesis is quite clearly focused on the problem of adaptive Service Migration, neither the Abstract nor Objectives (page 10) or Contributions (page 10) are clear about this. In this sense, the reader might easily misunderstand what the thesis really achieves (feel that the thesis claims to achieve more than what it in the end presents).

- In the initial sections of the thesis, emphasis is put on distinguishing the self-adaptation approaches from the context-awareness approaches, while the distinction does not appear to be very clear to me. Both classes seem to be monitoring the environment in some way and reacting to particular changes with an appropriate adaptation strategy.

- Moreover, it seems that the ontology as well as the decision making process are fairly simplistic. That is not necessarily a bad thing, but it would be fair to be explicit about it and to present the reader with the discussion of the simplifications and limitations they imply. For instance, it seems that the decision process basically only follows the CriteriaPriority property values, which are expected to be set by system administrator in the core model and used to prioritize the criteria over each other during decision making. So the whole decision making is fairly predetermined by fixed inputs of expert knowledge that might not be available.

- In the ontology on page 29, I was surprised to see the "valueWithHighestWeight" and "valueWithLowestWeight" as the Criteria Properties. It was not clear to me what was the motivation behind this (picking explicitly the highest and lowest weight) as it seems to me to be limiting to have such absolute properties.

- The formulas (e.g. pages 40-42 and 46-48) seem to have pretty straightforward meaning, although given that some of the terms and variables are not properly defined (for instance the way the PPS function is defined on page 46, or the way the whole Rule 6 is defined and explained on page 47), it is questionable if the formal way of presenting them (comparing to natural language) makes them easier or more difficult to understand.

- I believe that it would be useful if for instance the schema in Figure 5.1 was explained during thesis defense. From the schema, it is not clear to me what is the context that drives the migration, what exactly is being improved by the migration, what exactly is the meaning of the one arrow back up, etc.

- The architecture described on page 49 looks reasonable and straightforward. Again, it would be useful to hear what the author would like to emphasize as the main contribution of the architecture (or its implementation). Please be explicit about it during the thesis presentation.

- It would also be good to better motivate why the migration as such is important to be researched. Given the prevalent cloud deployment of services nowadays (where seamless migration is supported on the server/infrastructure side), the reader would benefit from understanding the cases that give the motivation for this work. Please give this motivation when presenting the thesis.

- The motivating example in Section 6.3 nicely illustrates the work, although one can see that the decisions are highly driven by parameters that might be very hard to give to the method, especially as their fitness to the problem nature might vary depending on the scenario and its context. And the thesis does not go into such a level of detail that would help the reader to see the effects, assumptions and limitations.

- For this reason also, I welcome the two Case Studies presented in Chapter 7, although I am not sure how realistic these case studies are aimed to be. For instance, the first case study that gives the scenario of a service that is being migrated from one car to another, does not seem to be realistic. I could imagine making the scenario a little more realistic by describing it within the context of a fleet of cars of the same owner. But otherwise I am not sure what kind of incentive would make another car willing to host my service - and me trust the response by such a service hosted in another car. This is a general issue with service migration, I believe. How do other works respond to this?

- Also, it is nice that the case studies discuss also the experimental results, although some discussion of the results would be good to guide the reader to understand whether there are any takeaways from these data. For instance, it is not clear what we can learn from Figure 7.5. Are these results good or bad? And why? Can we expect similar results in similar scenarios?

Questions

1. What would you say is the key novelty of your work comparing to the related work and what makes it significant and important to be researched (in relation to my cloud deployment comment above)? You can give an explicit scenario in which the novelty and significance is clearly visible.

2. On page 43, the four properties are given as examples, which are ServicePriority, FreeMemory, PermanentStorageSize, BatteryLifeTime. How and why were these selected? Do these realistically well cover different scenarios you consider? What are those scenarios? What other examples of the properties do you consider in other scenarios?

3. I would like to learn more about the implementation of the approach. The thesis does not discuss this much, so it would be interesting to discuss this at the thesis defence.

Conclusion

All together, I see the value of the research submitted in terms of this thesis, and support it being accepted as a doctoral thesis.

Brno December 3, 2019   doc. Ing. RNDr. Barbora Bühnová, Ph.D.