Exjobb opposition report

Reviewer name: Filip Östermark
Date of review: 2018-01-26
Title: *On-demand virtual laboratory environments for Internetworking e-learning: A first step using docker containers*
Author: Andreas Kokkalis

Section I. Evaluation

Andreas Kokkalis thesis report is very well written, and the overall quality is high. The implementation method is scientific, and the Clean Architecture is very clever for testing purposes and for the structure of the implementation. The architecture is very well described in the thesis, and I enjoyed reading these descriptions. The language is good throughout the report with only minor hiccups. The disposition is good and well suited for the subject, although a few subsections were missing numbers (see Section III of this opposition report). The author does a very good job to present related work and its usefulness for this project.

It is a long report, which largely seems to be the result of a necessity for many listings. The author often goes into great detail about the implementation and how the code works. Perhaps in some cases it would have been sufficient with a conceptual description of some parts of the software for the report, and have references for access to the actual source code. Some of the implementation details could have been easier to follow using conceptual images and schematics rather than only display the code along and explain it.

I feel that the evaluation and conclusion partly misses to address some of the goals of the thesis, mainly that the virtual lab environment should be accessible by a student within a reasonable upper bounded time. No such upper bounded access time was suggested in the thesis, and I feel that more extensive latency tests could have been performed, which could include the maximum latency and variance. It would be interesting to see such performance tests in future work.

Table: Report rating of 1 to 5 (5 means excellent) by category.

Category	Rating (1 to 5)
Relevance of content	4
Disposition	4
Evaluation of published results	3
Abstract	5
Conclusion	3
Presentation of related work	5
Language	4

Section II. Recommendations

- The thesis displays and explains a lot of actual source code. This works, but sometimes it is easier to follow and understand a conceptual image rather than the actual code. I believe that this would make it easier to maintain focus when reading the report.
- The goal of this thesis project was to provide virtual laboratory environments for Internetworking e-learning. However, the author does not do much to address the fact that the implementation targets an Internetworking course. Perhaps throughout the thesis, the author could have more connections between different design decisions and requirements specific to an environment for an Internetworking course.
- Footnotes are used extensively throughout the report. I feel that some footnotes might as well have been inline text, as this would have been easier to read. It can be hard to remember the context of a specific footnote by the time you get to the end of the page, and reading the footnote right away disrupts the reading flow.
- One of the requirements of the virtual laboratory environments as stated in Section 3.2 Evaluation process is that *"The resulting container should be available to the user (almost) instantly"*. I feel that the evaluation of this requirement is lacking, as only the mean execution times of the admin's API endpoints are presented. The maximum recorded latency and/or variance is interesting here. I was also left wondering whether these mean execution times also apply to students opening the virtual lab environment.
- The thesis conclusion is missing the required reflections section about ethics and sustainability aspects. Perhaps this is something you should add.

- I personally prefer paragraph space over paragraph indentation to separate paragraphs because I find it easier to read. Perhaps consider this option, even though both are correct to use.

Section III. Detailed Comments for the Author

- In Section 1.4 Research Methodology, the author instantly starts describing what the Design science research method is, but does not explain that this is the methodology used in the implementation process in this thesis project until the end of the section. Please state this fact at the start of the section before explaining what it is.
- Figure 2.5 which shows the states of the container lifecycle has very small text. The image could be made more readable by rearranging the items to make the image more narrow, and thus fit within the text width at a larger size.
- The following headings of 4.2 LTI Tool Client are missing numbers, which I see no reason not to have:
    - Authentication
    - Home Page - List of Images
    - Home Page - Image History
    - Run Container Page
- In Section 4.2 LTI Tool Client, a login form for an admin. I was left wondering about the security of this form. Earlier in the report you describe a TLS configuration for your web server, is this login form covered by this encryption as well, or are the credentials sent as plain text? Perhaps you could add a sentence about its security.
- Figure 4.12 doesn't seem to span the full text width, making the text very small and difficult to read.
- The author introduces an acronym for Tool Consumer (TC) and introduces something else called the Tool Client, which is spelled out for the rest of the thesis. I think that this is potentially confusing, as the reader may be lead to believe that Tool Client is the same as TC, but spelled out. For added clarity, I think that the author could introduce another acronym for the Tool Client, for example TCL or similar. This would make it easier to differentiate between the two.
- Along with this opposition report, I will send back your thesis draft as a commented PDF file. This file points out some minor spelling mistakes and language hiccups, and points at some of the things listed in this opposition report.