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Referee Report for the Doctoral thesis „Reproducible Partial-Load Experiments in Workload Colocation Analysis by RNDr. Andrej Podzimek

05.09.2016

Dear Prof. Kratochvíl,

thank you were much for asking me to serve as a referee for the doctoral thesis by Mr. Podzimek. I am glad to accept the invitation and you'll find my report below.

Mr. Podzimek's thesis is motivated by the fact that computing systems are usually operated under conditions of partial processor load levels, i.e., processors being utilized at levels >>0% and <<100%, and these load levels are varying over time. Computer system benchmarks and stress tests aim to investigate the relationship between application performance metrics (such as throughput) and resource utilization (such as processor load). However, most benchmarks and stress tests are designed in a way that they fully utilize the available computing resources. Approaches are missing to systematically investigate performance relationships and effects under partial (also collocated) loads.

The thesis contributes the Showstopper approach and tooling infrastructure for (reproducible) experimental analysis of application performance under (time-varying) partial processor loads, as well as new results on partial processor load effects by leveraging Showstopper to investigate the impact of partial loads on processor pinning configurations, and comparisons of virtualization of environments w.r.t. resource isolation, performance efficiency, and power consumption, including workload colocations scenarios. The Showstopper tool acts as a harness that executes arbitrary benchmarks and throttles the load induced to the processors to the desired level by manipulating the process states using standard POSIX events (SIGSTOP and SIGCONT).

The thesis is structured into three parts (I Introduction and Contribution Overview; II Collection of Papers; and III Related Work and Conclusion), comprising a total number of 11 Chapters. Part I motivates the problem addressed by the thesis, gives an overview of the contributions, and provides a detailed description of the Showstopper tool that has not been previously published at this level of detail. Part II includes the most

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relevant papers by the author that provide a detailed description of the author's contribution. In Part 3, the author discusses related work, draws the conclusions, and provides pointers for future work.

The thesis is well-structured and the (English) language is of very good quality. Particularly, the 2016 FGCS paper provides a nice and comprehensive overview of the research project conducted by Mr. Podzimek together with renowned experts from the performance engineering community. Apart from the collection of research papers, I found the detailed technical description of Showstopper in Chapter 3 to be extremely helpful to understand the concept for controlling processor load.

I judge the thesis contributions as new scientific results, which is confirmed by the fact that the cumulative thesis builds on and is centered around publications that have been previously refereed and accepted in relevant conferences and journals in the field.

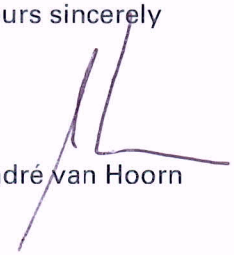
The availability of the Showstopper tool along with its modular and extensible design enable researchers to directly build on Mr. Podzimek's work by assessing effects of partial and collocated loads in other scenarios as well as to implement and quantitatively investigate other components (e.g., different types of load traces, sources of load feedback data, and feedback controller algorithms) for controlling load. Possible extensions, as outlined by the author, include the application to other resources, such as network or memory load.

To summarize, the results by Mr. Podzimek provide important contributions for the area of experimental performance analysis and benchmarking, and prove his ability for creative scientific work.

Selected aspects I would like to discuss during the defense are the following:

- How exactly could the approach be extended from controlling processor load to other resources, e.g., network, memory, etc?
- How could existing energy efficiency benchmarks that use partial load levels achieved by throughput-varying client-side load generators (transaction-oriented), e.g., SPECpower with the Chauffeur WDK, benefit from the approach?
- The presented experiments consider throughput as application-level performance metric. How well does the approach work when considering response times?

Yours sincerely



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