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Prof. Pavel Zemcik

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RE: Supervisor's review of Marta Jaroš

Marta Jaroš pursued her PhD studies at the Faculty of Information Technology, Brno University of Technology from 2016 to 2023. Her research was centered around the automation of complex scientific workflows execution in high performance computing environments. During her doctoral work, she delved into several research areas: First, she explored soft computing methods to optimize the parameters of workflow tasks. Second, she investigated data mining techniques to predict execution times for various computational resource configurations and input data volumes. Next, she examined the behavior of cluster batch scheduling systems and their limitations. Last but not least, she also tackled the challenge of multiobjective optimization of workflow execution, considering both execution time and cost factors.

The crux of her doctoral thesis revolves around the creation of an autonomous system for the workflow scheduling and optimization. This core system is composed of four essential modules: Optimizer, Evaluator, Estimator, and Collector. These modules offer extensive flexibility and adaptability. For instance, the Optimizer can utilize various optimization techniques, including evolutionary algorithms. The Evaluator is responsible for assessing quality of candidate workflow schedules using a batch scheduler simulator accommodating diverse cluster configurations. The Estimator has the capability to employ a range of methods, such as simple regression techniques, advanced genetic programming, or artificial neural networks. Meanwhile, the Collector is responsible for maintaining performance data for all executed tasks. All of these modules underwent rigorous testing using a substantial set of realistic benchmarks, and the results obtained were notably impressive.

In addition to her theoretical research in the mentioned areas, Marta Jaroš also created a practical solution known as "k-Dispatch." This system encompasses a comprehensive pipeline for efficiently offloading

complex ultrasound treatment planning and photoacoustic imaging workflows onto an HPC cluster. The system comprises multiple components responsible for data transfers, workflow optimization, scheduling and monitoring, as well as maintaining accounting and performance databases. k-Dispatch has been successfully deployed at the IT4Innovations national supercomputing center and is currently in routine operational use.

Marta Jaroš' work has made significant contributions to the field and has been widely recognized in the academic community. Her core research findings have been published in three prominent Core B conference publications, JSSPP in 2020, 2021, and 2022. In addition, she has co-authored three papers indexed in Scopus, which were presented at PASC in 2020 and 2021, as well as HPCSE in 2019.

Marta has actively shared her work through conference presentations, with one of the most notable being her poster presentation at the "Supercomputing" conference in 2019. Furthermore, she has participated in and contributed to several related publications presented at distinguished evolutionary computational conferences like GECCO and EvoAPPS.

Beyond her research accomplishments, Marta has been an advocate for high-performance computing. She has delivered talks promoting the field at conferences such as SC 2017 and ISC HPC 2021, Girl summer school at FIT 2020 and 2021 and at Social Tech at the University College London. Her dedication and contributions were recognized with the PRACE Summer of HPC Ambassador Award in 2016.

Marta Jaros played a pivotal role in numerous research projects, demonstrating her deep involvement in various scientific initiatives. Notably, she contributed to ten research projects, with some of the most significant ones being EU H2020 Project PAMMOTH and EC EU Project CITRUS, where she was involved in the offloading of photoacoustic and ultrasound neuromodulation workflows onto an HPC cluster. She also served as the principal investigator and was also a team member in two interfaculty IGA projects focusing on accelerating evolutionary techniques. In addition, she was also involved in two other faculty IGA projects and contributed her expertise to two MŠMT projects, MOST and IT4Innovations Excellence in Science. Finally, she participated in a contractual research project in collaboration with ADWITECH System, s.r.o.

In summary, I wholeheartedly endorse Marta Jaroš for the award of a doctoral degree, based on her outstanding study and exceptional research achievements. Her remarkable abilities and demonstrated readiness for independent contributions in the realms of science, research, and development are evident. Marta Jaroš has consistently exhibited the qualities and accomplishments expected of a doctoral candidate, and I believe she is truly deserving of this recognition and honor.

If you would like any further information, please don’t hesitate to contact me.

Sincerely,

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Assoc. Prof. Jiri Jaros, PhD