

# An Application Meta-Model to Support the Execution and Benchmarking of Scientific Applications in Multi-Cloud Environments

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Cloud computing has proven its importance to scientists around the globe on many occasions already. However, as it is still a relatively new technology for many users, the cloud represents another layer of complexity in any workflow. As a lot of research confirms, especially the efficient provision and management of resources in the cloud is a very complex but also very rewarding task. Upon surveying the research in this area we observed many differences in applied methodologies and application cases which impede not only the comparison of these approaches but also the collective usage of the obtained results, e.g., for more accurate resource estimation algorithms that require less additional benchmarking. We propose a novel application and resource meta-model to model not only applications but also the underlying resource infrastructure for application benchmarks in a generic manner. We show how the meta-model is defined and how it can be used to model an application, using a simple web application as an example. We conclude with highlighting the potential benefits of applying this model in different scenarios but also its limits and how it could be expanded in the future.



Mr. **Markus Ullrich** is currently a PhD student at Technische Universität Chemnitz and a research associate at the University of Applied Sciences Zittau/Görlitz where he received his M.S. and B.S. in Computer Science in 2012 and 2010 respectively. From 2009 to 2012, he worked as a software developer for the Decision Optimization GmbH where he developed and tested data mining algorithms for predictive maintenance. He spent three months at the National Institute of Informatics in Tokyo, Japan during an internship where he worked on the modeling of applications and resources in cloud environments.

His current research interests are data mining and cloud computing as well as the simulation and modeling of complex distributed systems.