

# **A parameterized test bed for carbon aware job scheduling**

**Ein parametrisierbares Testbed für kohlenstoffbewusste Jobplanung**

Vincent Opitz

Arbeit zur Erlangung des Grades “Master of Science” der  
Digital-Engineering-Fakultät der Universität Potsdam



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von Vincent Opitz

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## **Zusammenfassung**

This thesis delves into optimizing job scheduling in a High-Performance Computing (HPC) environment with a focus on reducing CO<sub>2</sub> emissions. Given the time-dependent nature of CO<sub>2</sub> emissions, various strategies such as temporal shifting, frequency scaling, and node management have been explored in existing literature. Moreover, job scheduling may involve considerations like priorities, deadlines, and time constraints.

To address these complexities, this work introduces a novel parameterized model that allows integration of multiple scheduling approaches. This model serves as the foundation for developing a scheduler aimed at minimizing carbon emissions while upholding quality of service standards. Validation of the model is conducted using real-world academic data center scenarios.

Through simulation experiments with diverse parameters, our proposed scheduler demonstrates significant reductions in carbon emissions compared to conventional approaches. Specifically, it achieves a 10% reduction for round-robin-scheduled workloads and an impressive 20% reduction for backfill-scheduled workloads.



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# **1 Introduction**

Hallo!



## **2 Background**



### **3 Related Work**





## **4 Methodology**



## 5 Results



## **6 Discussion**



## **7 Future Work**





# A Appendix

## **Eins (ohne extra Eintrag im Inhaltsverzeichnis)**

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### **Eidesstattliche Erklärung**

Hiermit versichere ich, dass meine Arbeit zur Erlangung des Grades "Master of Science" der Digital-Engineering-Fakultät der Universität Potsdam mit dem Titel "A parameterized test bed for carbon aware job scheduling" ("Ein parametrisierbares Testbed für kohlenstoffbewusste Jobplanung") selbständig verfasst wurde und dass keine anderen Quellen und Hilfsmittel als die angegebenen benutzt wurden. Diese Aussage trifft auch für alle Implementierungen und Dokumentationen im Rahmen dieses Projektes zu.

Potsdam, den 4. Juni 2024

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(Vincent Opitz)