

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

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

This thesis delves into optimizing job scheduling in a High-Performance Computing (HPC) environment with a focus on reducing CO₂ emissions. Given the time-dependent nature of CO₂ 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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Zusammenfassung

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1 Introduction

warum carbon aware scheduling? welche forschungsfragen

2 Background

hintergrund energie netz, stormproduktion welche arten davon gibt es (temporal, spatial, ressource scaling) welche benefits hat das? hintergrund signals nach denen entschieden wird (marinal / relative carbon) welche metriken gibt es POI-A, etc etc.

3 Related Work

- generell die literaturrecherche mal auswerten aus dem google docs, perhaps da auch ein paar statistics drauß machen. Wie sehr ist das Thema in der Literatur vertreten? lets wait a while going green for less greenslot The War of the Efficiencies: the Tension between Carbon and Energy Optimization

4 Methodology

Modellbeschreibung, welches Modell verfolgen meine Workloads? Workloads haben stages, begründung via der power measurements an den sample ML workloads Softwarearchitekturbeschreibung wie die experiment ausführen / format usw usw

5 Results

das testbed mit verschiedenen parametern mal laufen lassen richtig viele Bilder basteln!!

6 Discussion

welche schlüsse können wir aus den ergebnissen ziehen?

7 Future Work

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

(Vincent Opitz)