PCAD . . . through SimGrid

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Abstract. *Put the abstract here.*

1. Introduction

High-Performance Computing (HPC) infrastructures are critical for scientific advancement. However, with the increasing concern regarding environmental sustainability cluster and data centers are positioned as majors electricity consumers [cite. . .]. Consequently, optimizing these systems to balance performance with energy efficiency has become a priority for the community.

On approach for this problem and many others in HPC is to use simulators. Simulators aims to address these issues by creating a model of the real system that can be used for predictive analysis in the place of using the actual system. This allows researchers to validate hypotheses and conduct "what-if" scenarios without accessing the physical machine. Using simulations don't only lowers the electricity consumption of HPC systems, but also targets the lack of reproducibility in HPC [Antunes and Hill 2024], ensuring a controlled and reproducible environment for experiments and studies.

In this context, SimGrid is a computational framework capable of simulate several HPC scenarios while maintaining accuracy and versatility [Casanova et al. 2025]. **[talk more about simgrid]**

We show in this work our efforts to create a simulator for the "Parque Computacional de Alto Desempenho" infrastructure present at INF/UFRGS [LPPD] through the SimGrid programmatic interface Simgrid For You (S4U), focusing on the network topology. We show comparative results between the actual cluster and the platform created through simulation, including compute time, network statistics [and energy consumption?] [and what more we do. . .].

This article is structured as follow. Section 2 highlights related work. Section 3 discusses the experimental methodology used in this work, with details about the applications, tools, and systems used in the experiments. Lastly, Section 4 shows and discusses the experimental results, while Section 5 concludes this work.

2. Related Work

Simulating computational through SimGrid is a well-know tool for study HPC infrastructure, [CITE ARTHUR]. . .

Another uses. . . [Grabriela SimGrid/Batsim]

[SimGrid paper]

[Look for some refs]

Differently of the cited works, here we intend to demonstrate the process of creation and validation of a heterogeneous HPC cluster using the SimGrid programmatic interface S4U.

3. Methods and Materials

[Calibration]

[S4U]

[Reproducibility]

4. Results

[Results, differences: accuracy, time, etc. . .]

5. Conclusion

[Is it worth and suitable to use simulators?]

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References

Antunes, B. and Hill, D. R. (2024). Reproducibility, replicability and repeatability: A survey of reproducible research with a focus on high performance computing. *Computer Science Review*, 53:100655.

Casanova, H., Giersch, A., Legrand, A., Quinson, M., and Suter, F. (2025). Lowering entry barriers to developing custom simulators of distributed applications and platforms with SimGrid. *Parallel Computing*, 123:103–125.

LPPD. Laboratório de processamento paralelo e distribuído (lppd). `https://pcad.inf.ufrgs.br/`. Accessed: 2026-02-16.