

Sunfish: Enabling Predictive Analytics for Datacenters Through Digital Twinning

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Context

Heterogeneous datacenter architectures are common [3] due to the end of Dennard's scaling [2]. Today, computational needs of AI drive managers to diversify datacenters even more [1]. In result datacenters become extremely complex and hard to operate.

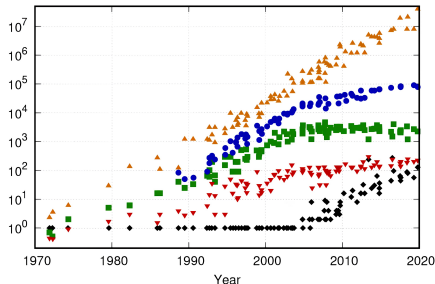


Figure 1.1: 48 years of microprocessor trend data. Legend: ▲ Transistors (thousands), ● Single Thread Performance (SpecINT 10^3), ■ Frequency (MHz), ▼ Typical Power (Watts), ◆ Number of Logical Cores [2].

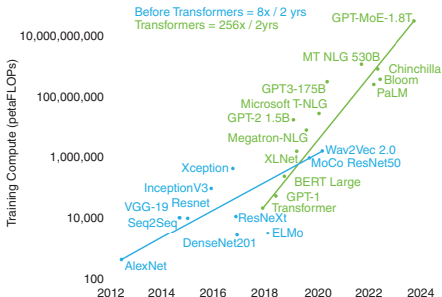


Figure 1.2: Explosive growth in AI computational requirements drives datacenter upgrades (source: NVIDIA Analysis: reproduction with NVIDIA permission by [1]).

Main Research Question

How to enable predictive analytics for datacenters through digital twinning?

Research Question 1

How to assess the current state-of-the-art of digital twinning for datacenters?

Research Question 2

How to design a datacenter digital twin reference architecture using discrete-event simulation and predictive data analytics?

Research Question 3

How to evaluate and validate a datacenter digital twin architecture in relation to system requirements?



Jyotika Athavale, Cullen E. Bash, Wesley Brewer, Matthias Maiterth, Dejan S. Milojcic, Harry Petty, and Soumyendu Sarkar.

Digital twins for data centers.

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URL <https://doi.org/10.1109/MC.2024.3436945>.



M. Horowitz, F. Labonte, O. Shacham, K. Olukotun, L. Hammond, and C. Batten.

48 years of microprocessor trend data, 2019.

URL <https://github.com/karlrupp/microprocessor-trend-data>.



Dejan S. Milojcic, Paolo Faraboschi, Nicolas Dubé, and Duncan Roweth.

Future of HPC: diversifying heterogeneity.

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