Sunfish: Enabling Predictive Analytics for Datacenters Through Digital Twinning

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June 9, 2026

Motivation

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.

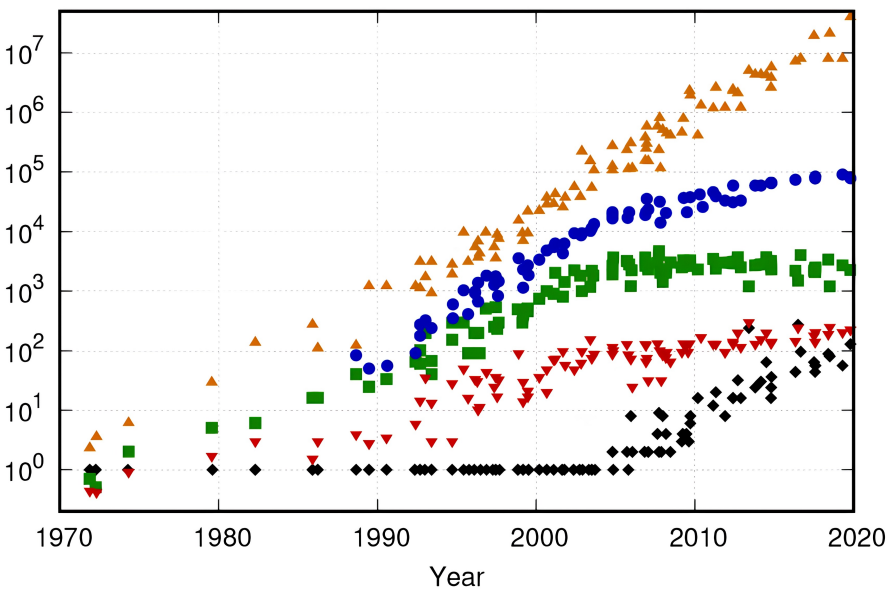

Figure 1.1: 48 years of microprocessor trend data. Legend: ▲ Transistors (thousands), ● Single Thread Performance (SpecINT 10^3), ■ Frequency (MHz), ▼ Typical Power (Watts), ◆ Number of Logical Cores [2].

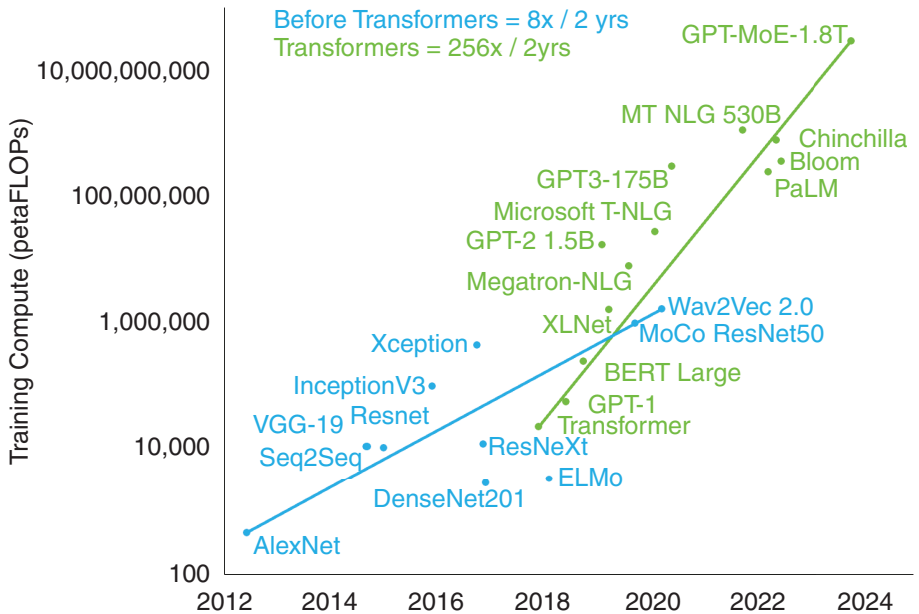

Figure 1.2: Explosive growth in AI computational requirements drives datacenter upgrades (source: NVIDIA Analysis: reproduction with NVIDIA permission by [1]).

Problem Statement

Research Questions

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Main Research Question

How to enable predictive analytics for datacenters through digital twinning?

Research Question 1

How to asses 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?

System model

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Reference Architecture

Results

References

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Extra Slides: Societal Impact