Myths and Legends in High Performance Networking

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Borrowing from a Recent Paper

Myths and Legends in High-Performance Computing

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Abstract

In this humorous and thought provoking article, we discuss certain myths and legends that are folklore among members of the high-performance computing community. We collected those myths from conversations at conferences and meetings, product advertisements, papers, and other communications such as tweets, blogs, and news articles within (and beyond) our community. We believe they represent the zeitgeist of the current era of massive change, driven by the end of many scaling laws such as Dennard scaling and Moore's law. While some laws end, new directions open up, such as algorithmic scaling or novel architecture research. However, these myths are rarely based on scientific facts but often on some evidence or argumentation. In fact, we believe that this is the very reason for the existence of many myths and why they cannot be answered clearly. While it feels like there should be clear answers for each, some may remain endless philosophical debates such as the question whether Beethoven was better than Mozart. We would like to see our collection of myths as a discussion of possible new directions for research and industry investment.

Keywords

Quantum; zettascale; deep learning; clouds; HPC myths

Introduction

Any human society has their myths and legends—this also applies to the high-performance computing (HPC) community. HPC drives the largest and most powerful computers and latest computing and acceleration technologies forward. One may think that it's scientific reasoning all the way down in such an advanced field. Yet, we find many persistent myths revolving around trends of the moment.

Since it's late 2022, we started our analysis by asking the all-knowing intelligence ChatGPT "Create myths or legends in high performance computing". In a HAL 9000 manner, it refused to make up something for us: *"I'm sorry [Dave], but as an AI language model, I am not programmed to generate or share myths or legends. My primary function is to assist users with information and general knowledge, and I do not have the ability to create or share fictional content."*. So, even the smartest of internet parrots (Bender et al. 2021) that was itself created with massive high-performace computation running on a large accelerator system still has a long way to go. Thus, we fall back to reasoning among the authors of this work.

We discuss 12 of today's HPC myths, a number customary in our community, similar to a panel statement where we debate supporting and contradicting facts with a healthy exaggeration in one of those directions. We attempt to neither judge nor prove folklore right or wrong but instead try to stipulate an intensive discussion in the community that drives our future thinking.

Myth 1: Quantum Computing Will Take Over HPC!

Numerous articles are hyping the quantum computing revolution affecting nearly all aspects of life ranging from quantum artificial intelligence to even quantum gaming. The whole IT industry is following the quantum trend and conceives quickly growing expectations. The actual development of quantum technologies, algorithms, and use-cases is on a very different time-scale. Most practitioners would not expect quantum computers to outperform classical computers within the next decade. Yet, we have constantly been surprised by advances in device scaling as well as, more recently, artificial intelligence. Thus, the fear of missing out on getting rich is driving the industry to heavily invest into quantum technologies pushing the technology forward.

With all this investment, it seems reasonable to expect that quantum computation, which promises to deliver exponential speedups, will replace high-performance computation as we know it today with its meager linear speedup through parallelism. Yet, the nature of quantum computation poses some severe limitations: First, reading unstructured data into a quantum state seems very challenging. Reasonable future quantum computer designs can read in the order of Gigabit/s while modern single-chip processors are already achieving

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https://arxiv.org/pdf/2301.02432.pdf

- Intended to create discussion and controversy
- May not represent the view of the panel moderator 😜

Myth 8: Everything will be disaggregated!

Myth 12: All HPC Will Be Subsumed by the Clouds!

Myth: Network performance is more important for HPC than for Hyperscalers

Myth: Network performance depends more on hardware than on software

Myth: Programmable networks are the future

Myth: Lossy networks will never work for HPC

Myth: Photonic networks on node will be available in less than 10 years

Myth: One-sided communication is able to achieve better network performance than two-sided