

Perspective on the HPC Community – An Update from 2017

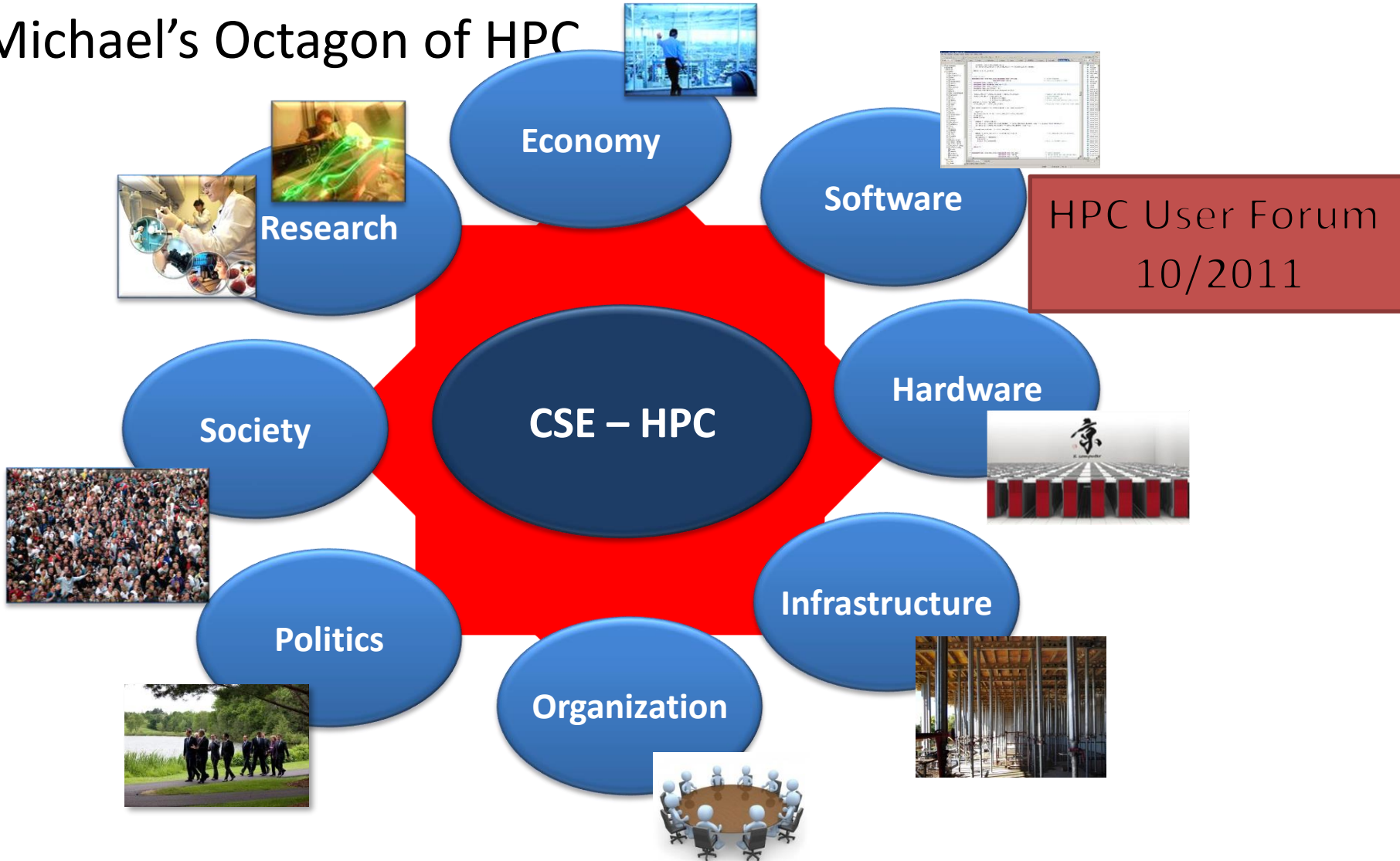
87th HPC User Forum

Stuttgart, Germany, October 24, 2024

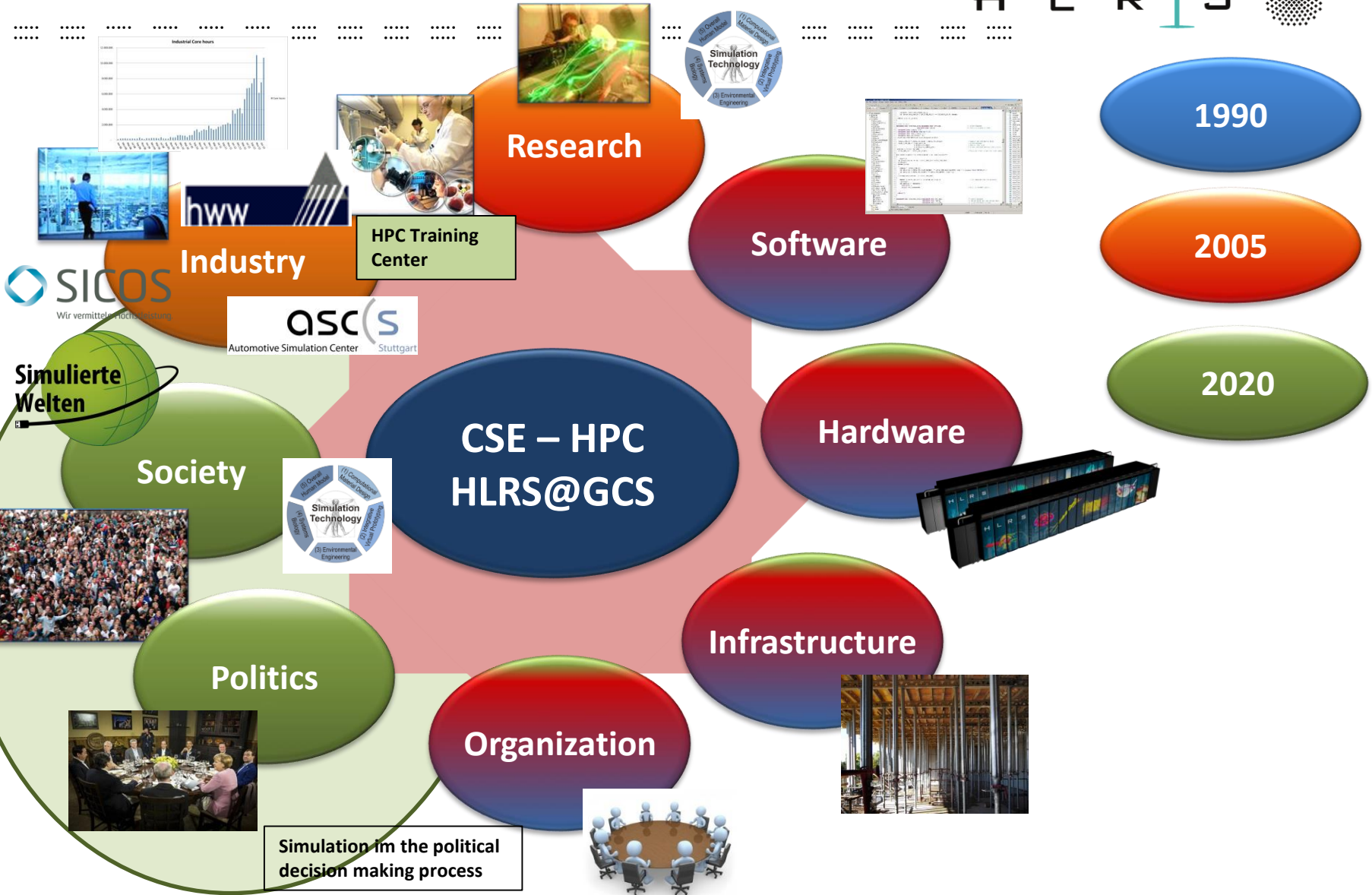
Michael Resch, HLRS/IHR, University of Stuttgart



Michael's Octagon of HPC



HLRS Long Term Strategy (2014)

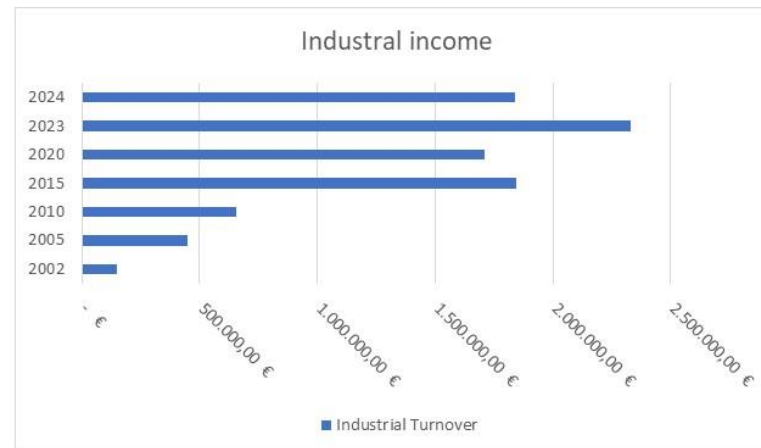
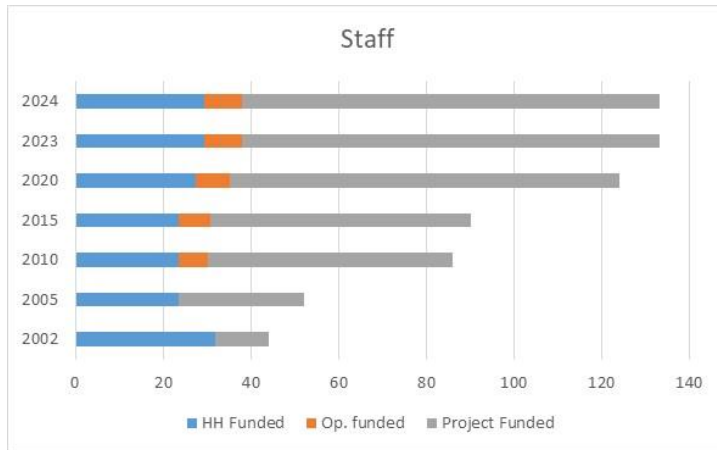


Contents

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WHAT WE SEE

Our KPIs



What we see

- End of Moore's law
- Everybody ~~wants~~ **has** Exascale
 - China
 - Japan
 - US
 - **Korea**
 - **Europe (EU)**
 - **UK (Europe)**
- Energy is **still** a killer **but nobody cares**
- Data **and AI** trump energy



**Moore's law is dead?
Or maybe not?**

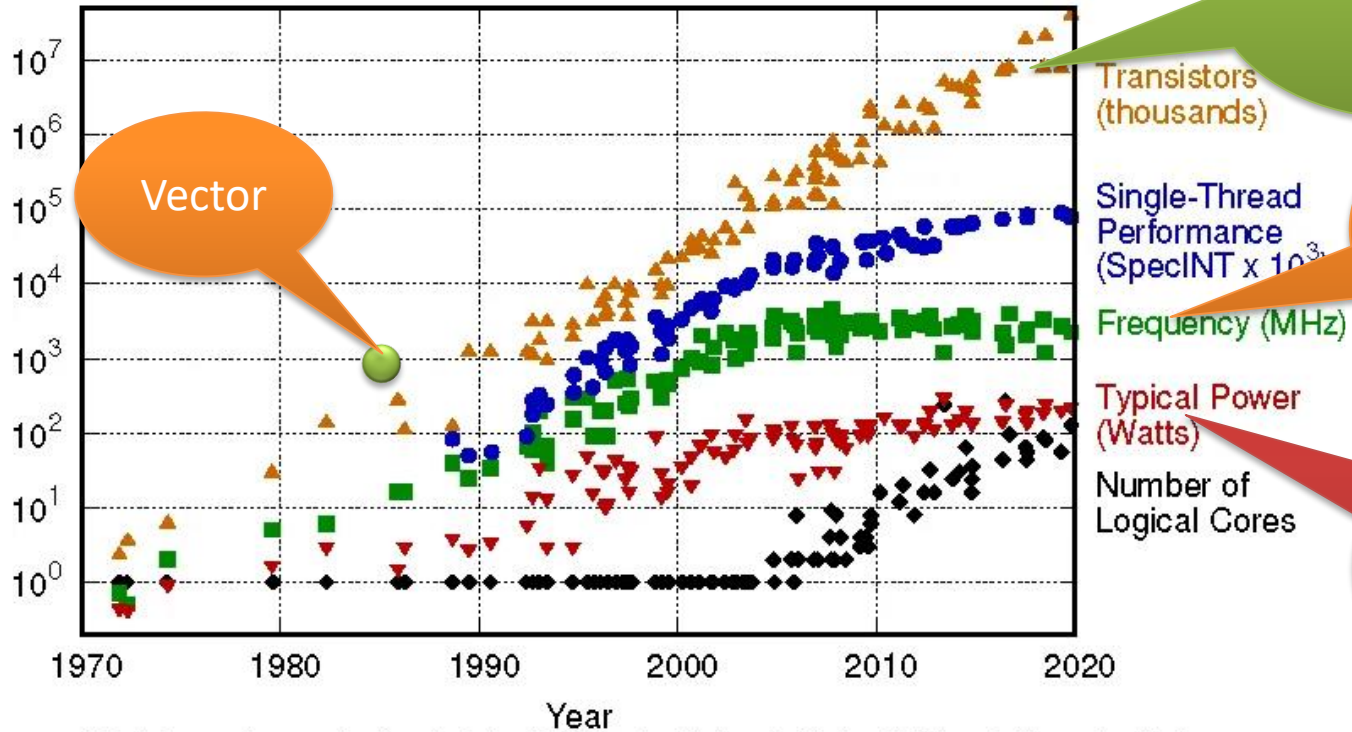
Gordon Moore (3.1.1929 – 24.3.2023)

What did Gordon Moore say?

- “The **complexity** for minimum component **costs** has increased at a rate of roughly a **factor of two per year**”
- Gordon E. Moore, *Cramming more components onto integrated circuits*, Electronics, Volume 38, Number 8, April 19, 1965

Moore's Law and Reality

48 Years of Microprocessor Trend Data



Original data up to the year 2010 collected and plotted by M. Horowitz, F. Labonte, O. Shacham, K. Olukotun, L. Hammond, and C. Batten
 New plot and data collected for 2010-2019 by K. Rupp

<https://www.semianalysis.com/p/a-century-of-moores-law>

The end of Moore's law?

- Jensen Huang (NVIDIA), „Moore's law is dead.“
September 2022, according to:
<https://www.digitaltrends.com/computing/nvidia-says-falling-gpu-prices-are-over/>
- Ann Kelleher (intel), „Innovation is not dead, and we will maintain Moore's Law as we always have, through innovation – innovation in process, in packaging and in architecture.“ February 16, 2022
<https://www.intel.de/content/www/de/de/newsroom/opinion/moore-law-now-and-in-the-future.html#gs.kdgwx2>

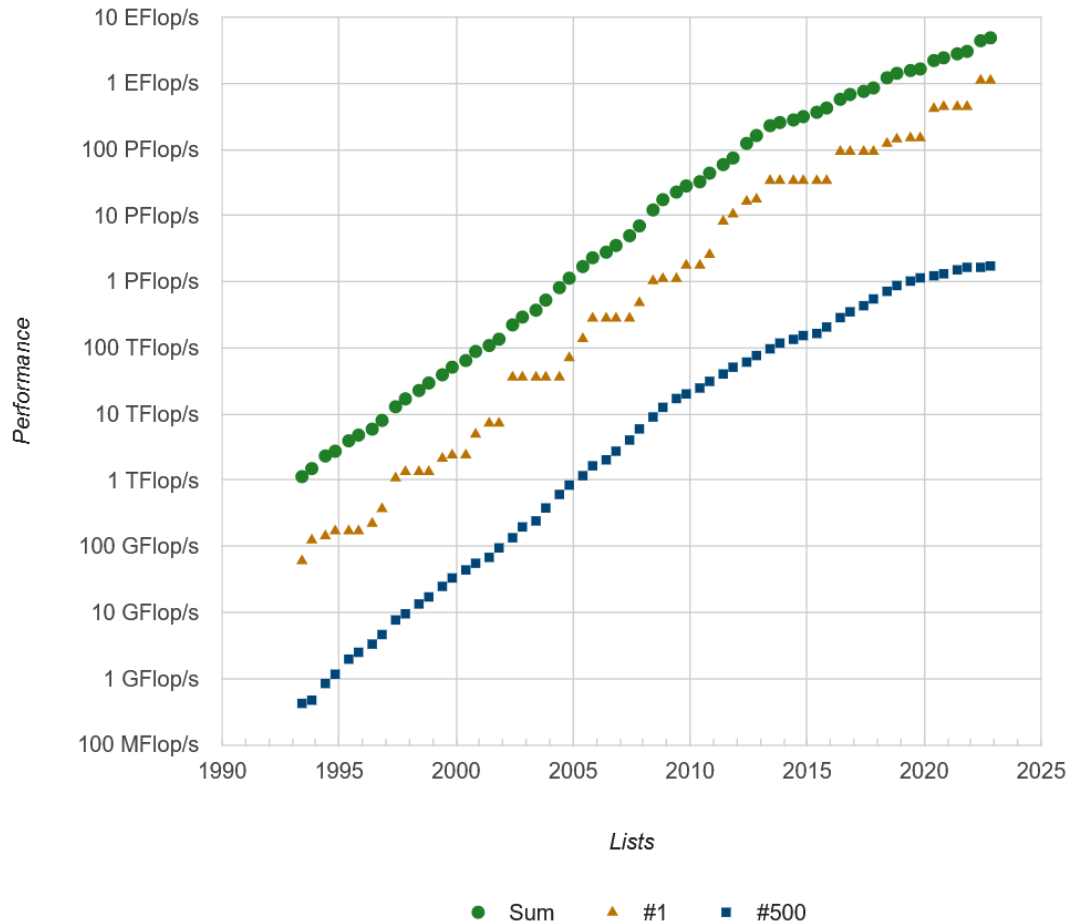
WHAT WE THINK

What we think

- Increase of peak performance will slow down
- Exascale ~~will be~~ **is** a huge success
- Power consumption is prohibitively high
- ~~Data~~ **AI** is a market/field bigger than HPC

Moore's law was driving innovation

Performance Development

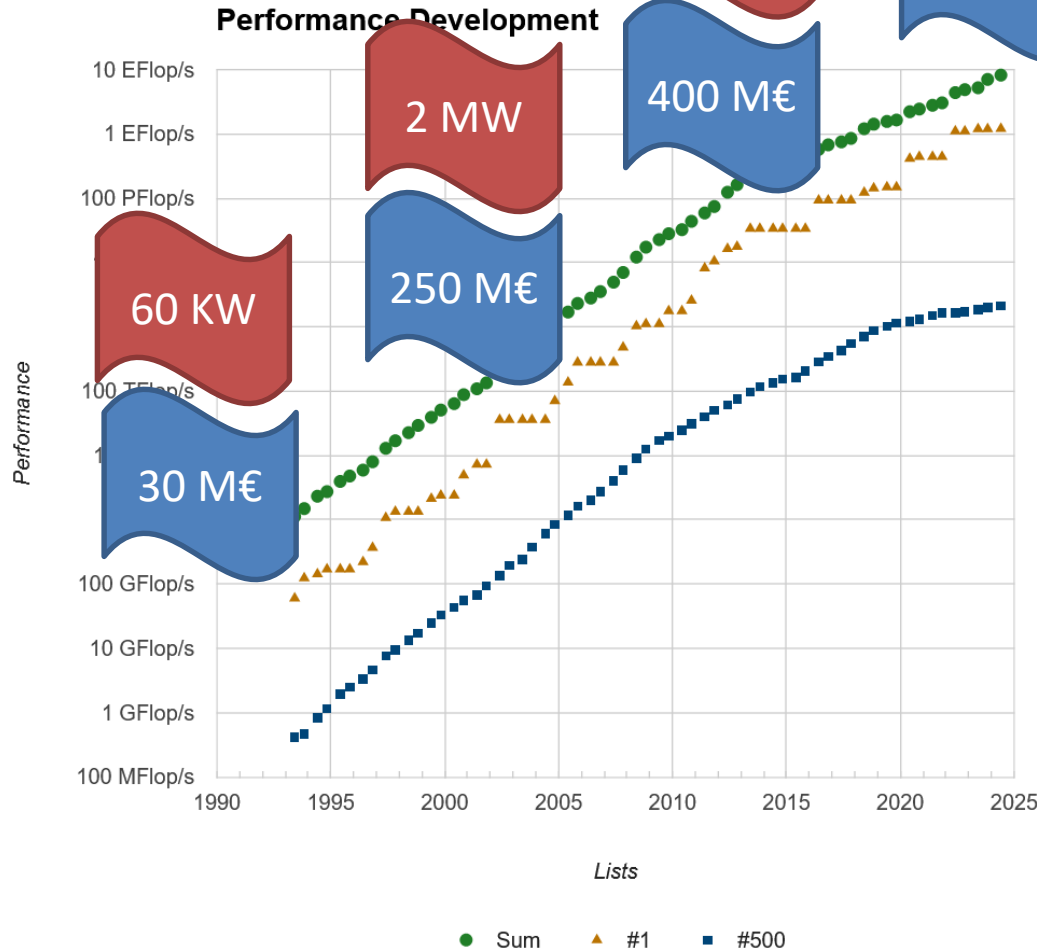


www.top500.org

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#1 TCO / Power in HPC



HPC has a cost issue and a sustainability issue

www.top500.org


WHAT WE DO

What we do

- Moore's law
 - Turn the center around towards solutions / applications
 - **Media Solution Center / Medical Solution Center / City Planning Solution Center**
- Exascale
 - Support Exascale initiatives
- Energy
 - Tune everything to avoid huge power consumption
 - **It worked so well we reduced our energy costs even during the Russian war energy price spike. Our power went down from about 6 MW to about 3,8 MW without a loss of performance**

What we do (continued)

- Data
 - Merge data, **AI** and HPC
- Strategy
 - Focus on solutions and sustained performance
 - Focus on engineering and global systems science
 - Focus on training

A man wearing a light-colored hat and a light blue long-sleeved shirt is walking away from the camera on a paved path. He is carrying a large, red, vintage-style suitcase with gold-colored latches. The background is a bright, open field with a fence line visible in the distance. The overall scene suggests a journey or a transition.

The Future of HPC &



STRENGTHS

- HPC is a well established community
- HPC has a history of disruption
- HPC is a key technology

WEAKNESSES

- Moore's law ends
- Operational costs are exploding



SWOT ANALYSIS HPC



THREATS

- No further breakthroughs
- Lack of government funding
- Lack of interest

OPPORTUNITIES

- New architectures (Neuromorphic, Photonic, Quantum)
- New algorithms
 - AI as a new technology driver



Summary

- Everything changes
- Eternal truths are neither eternal nor true
- “Se vogliamo che tutto rimanga come é, bisogna che tutto cambi” Tomaso di Lampedusa, *Il Gattopardo*, 1958

A digital face composed of a grid of lines, surrounded by floating blue and white particles, with the text "The Rise of AI" overlaid.

The Rise of AI

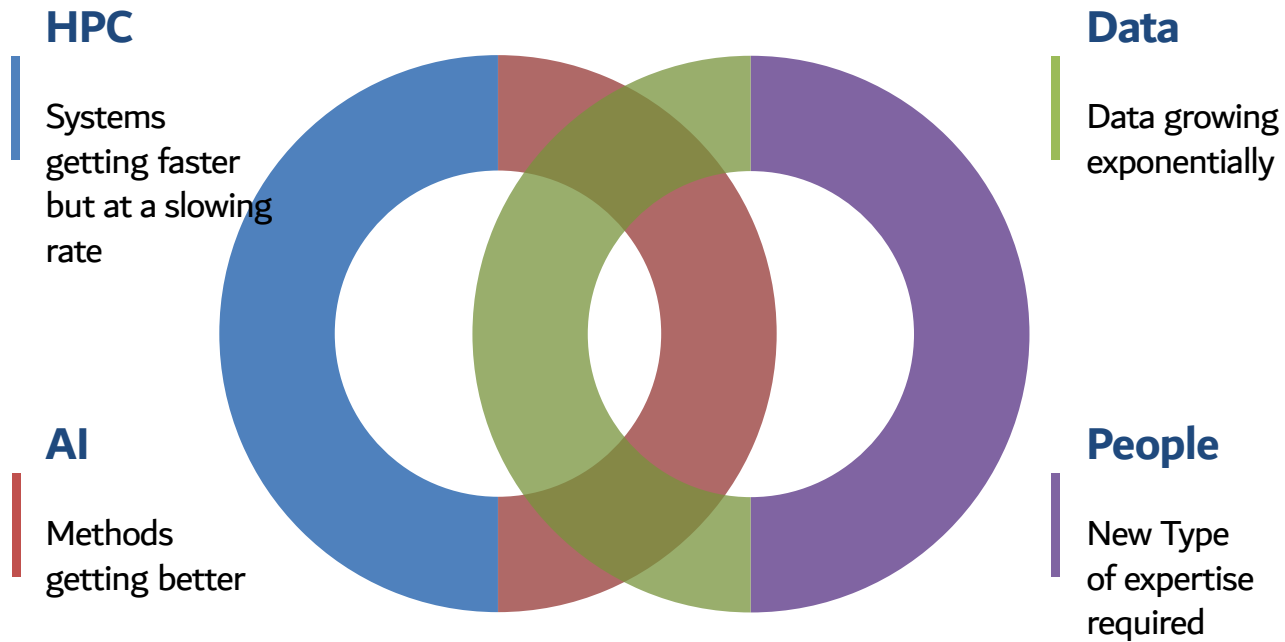
AI around the world (just news)

- EU:
 - AI act / AI regulation
 - AI-Factories (300 M€)
- US:
 - Executive Order on Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence (EO 14110)
 - The National Artificial Intelligence Research Resource (NAIRR)
- UK:
 - 1 bn € for AI
- South-Korea:
 - 260 M€ for an AI system – to be doubled

A digital-themed graphic with a dark blue background. It features a network of interconnected nodes in various colors (blue, green, pink, white) connected by thin white lines. Several thick, wavy lines in shades of blue and green flow across the center, culminating in a large, bright cyan arrow pointing to the right. The text "DIGITAL CONVERGENCE" is written in white, bold, uppercase letters in the lower-left quadrant.

DIGITAL CONVERGENCE

Digital Convergence

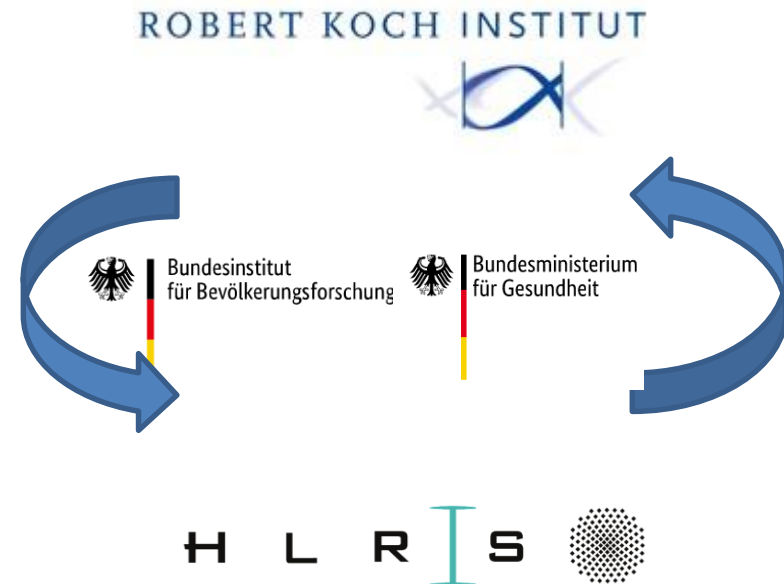
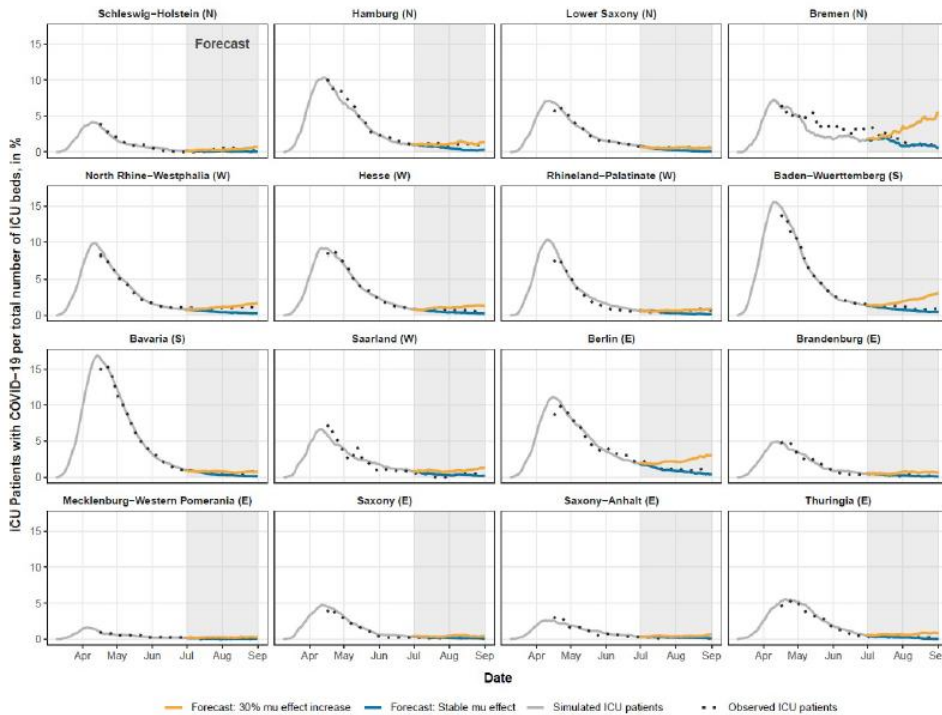


DIGITAL CONVERGENCE AT WORK



Intensive Care Unit Usage during COVID-19

Figure 4: Forecast of COVID-19-related ICU demand in low-dynamic setting (case 2)



Sebastian Klüsener et al, *Forecasting intensive care Unit demand during the COVID-19 pandemic: A spatial age-structured microsimulation approach*, 2021



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