Next Generation Exascale Supercomputing with the DEEP-EST Modular Supercomputing Architecture

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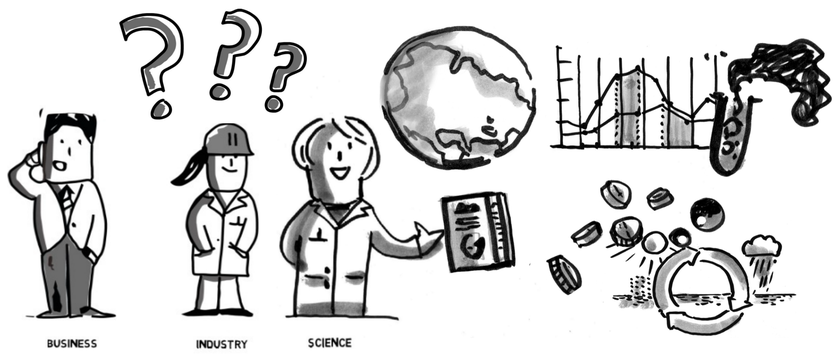
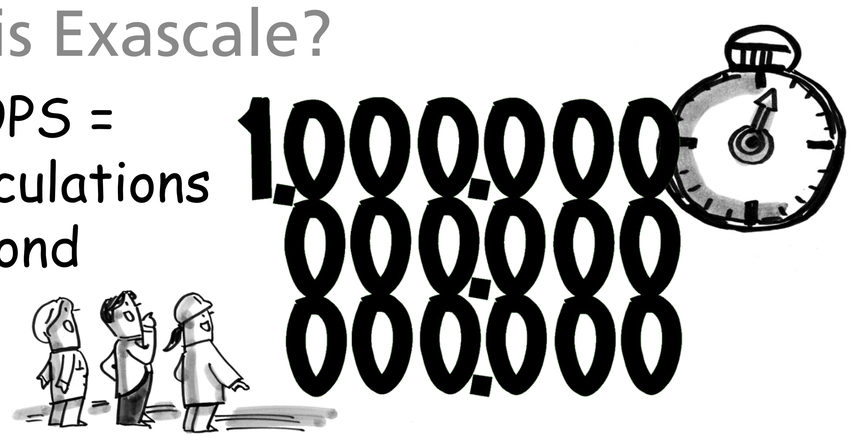
Why Supercomputing?

For simulation and data analysis, e.g. machine learning, weather forecast, investigating climate change, designing new drugs, discovering new materials, understanding nature.



What is Exascale?

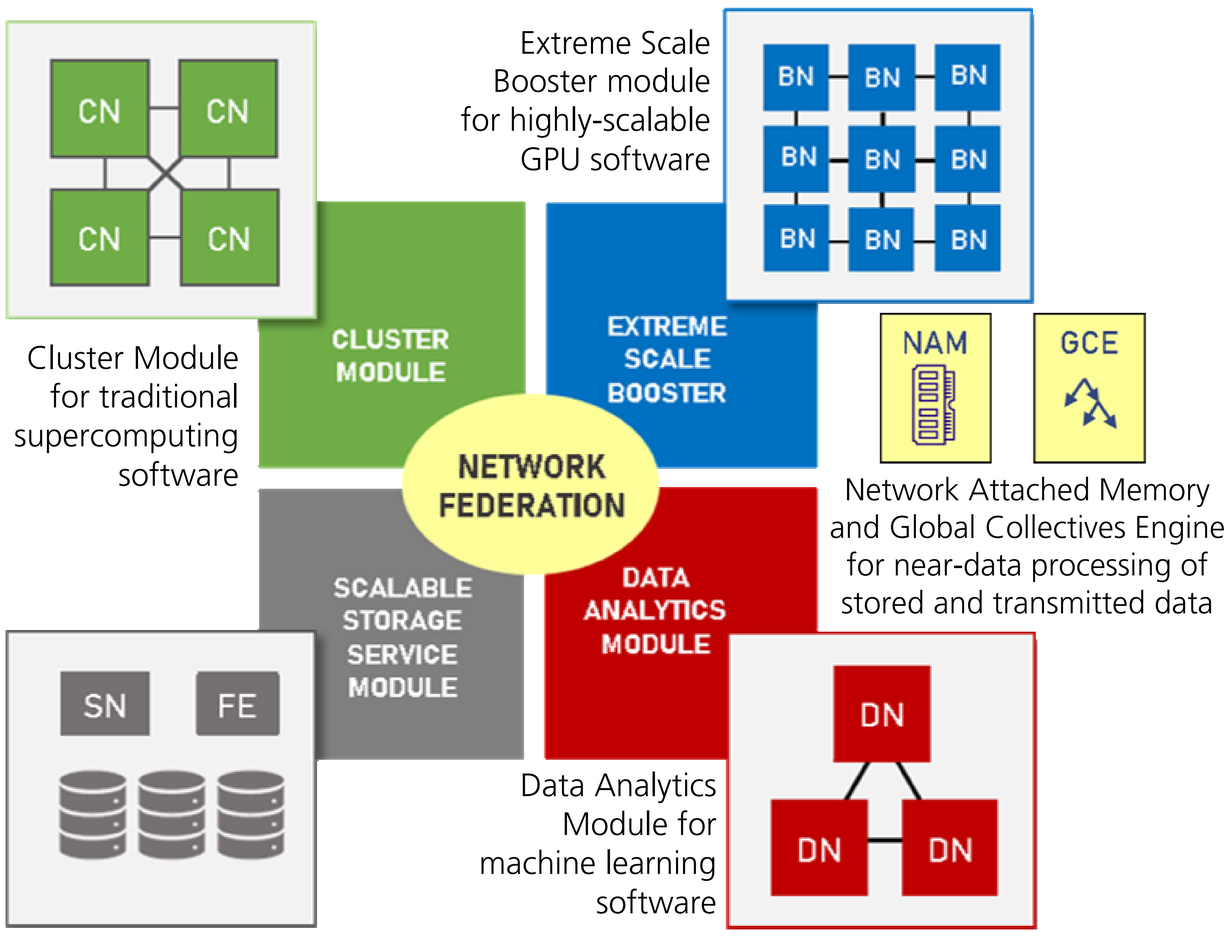
ExaFLOPS = 10^{18} calculations per second



Next generation supercomputers will be Exascale and significantly faster than current PetaFLOPS-scale supercomputers and thus allow to tackle bigger problems.

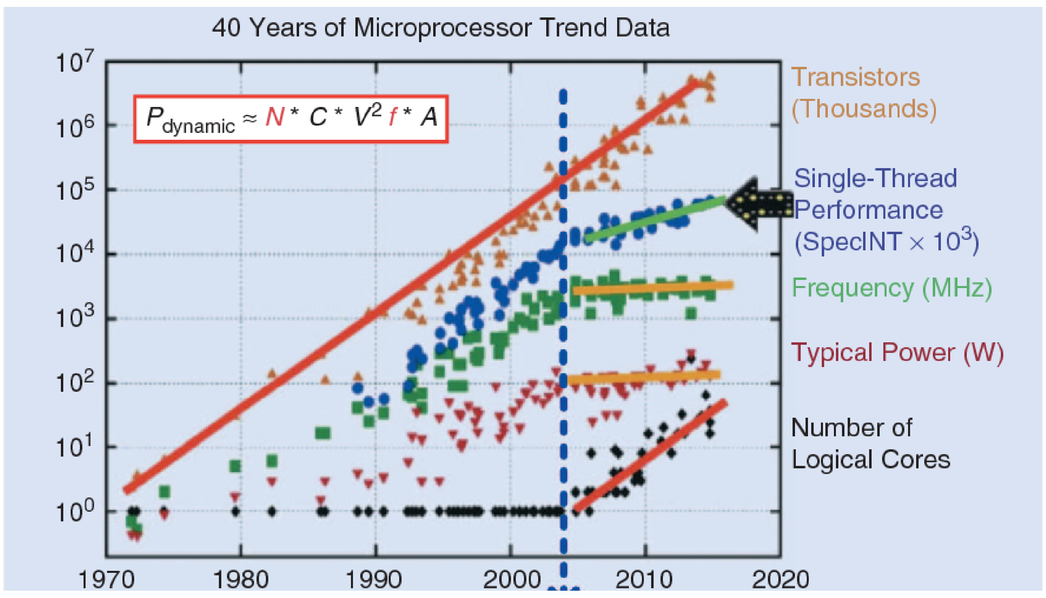
Modular Supercomputing Architecture

Use those hardware and accelerator modules that fit best the specific (sub-)task. Have an extremely fast network federation that connects these modules.



Moore's Law & Limits of Speed Growth

„Number of transistors in an integrated circuit (IC) doubles every two years."



Liming Xiu: "Time Moore: Exploiting Moore's Law From The Perspective of Time", IEEE Solid-State Circuits Magazine 2019, DOI:10.1109/mssc.2018.2882285

Speed and power limits imposed by atom size and energy consumption (=heat).

More Specialised Chips: Accelerators

For specific tasks (e.g. machine learning) specialized accelerator chips are faster and more energy-efficient than general purpose processors (=CPUs): e.g. general purpose Graphics Processing Units (GPU) or Field-Programmable Gate Arrays (FPGA).

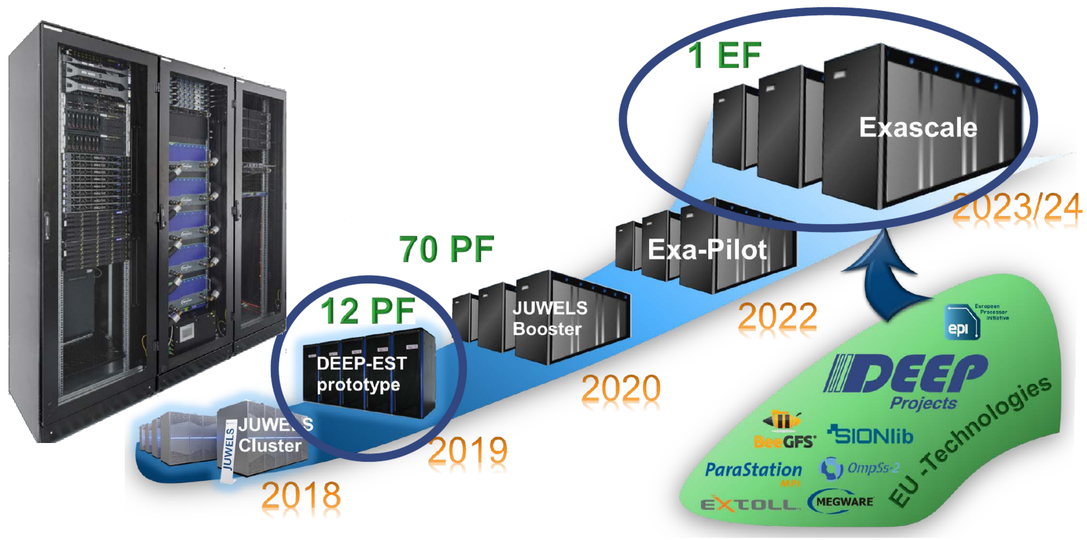
Special networking hardware reduces latency of data transmission between processors.

Specialised Near-Data Processing networking and storage hardware allows to process data already while the data is transmitted and buffered between processors.

New water cooling approaches waste less energy – they even re-use processor heat.

Non-volatile dual in-line memory modules (NVDIMM) accelerate storage to RAM speed.

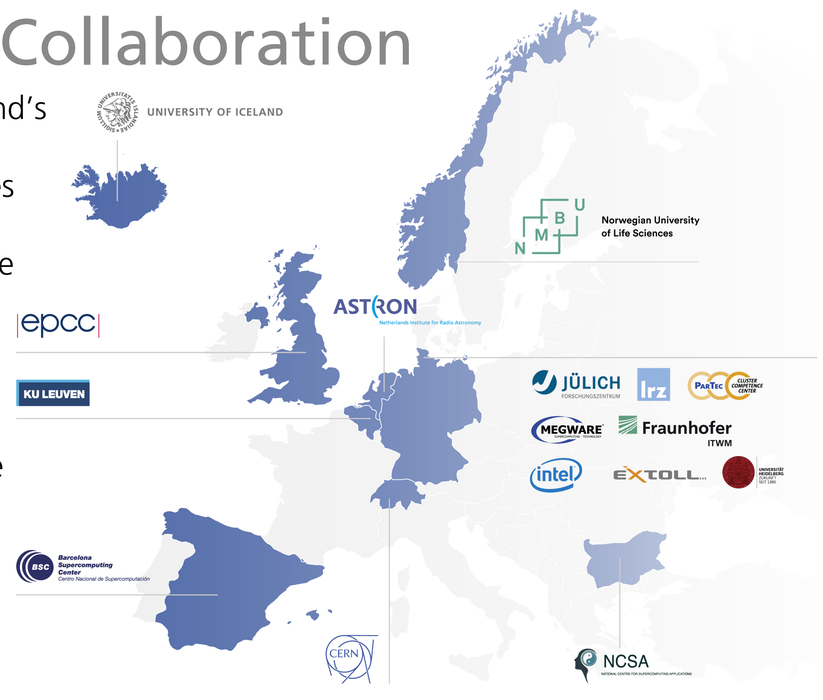
From PetaFLOPS to ExaFLOPS



European Collaboration

The University of Iceland's Computer Science department contributes to the European consortium its expertise in high-performance parallel and scalable machine learning and data analytics.

DEEP-EST is part of the DEEP-ER and DEEP Dynamical Exascale Entry Platform project family.



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DEEP Extreme Scale Technologies

https://www.deep-projects.eu

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