SEA Projects

The SEA Projects Family

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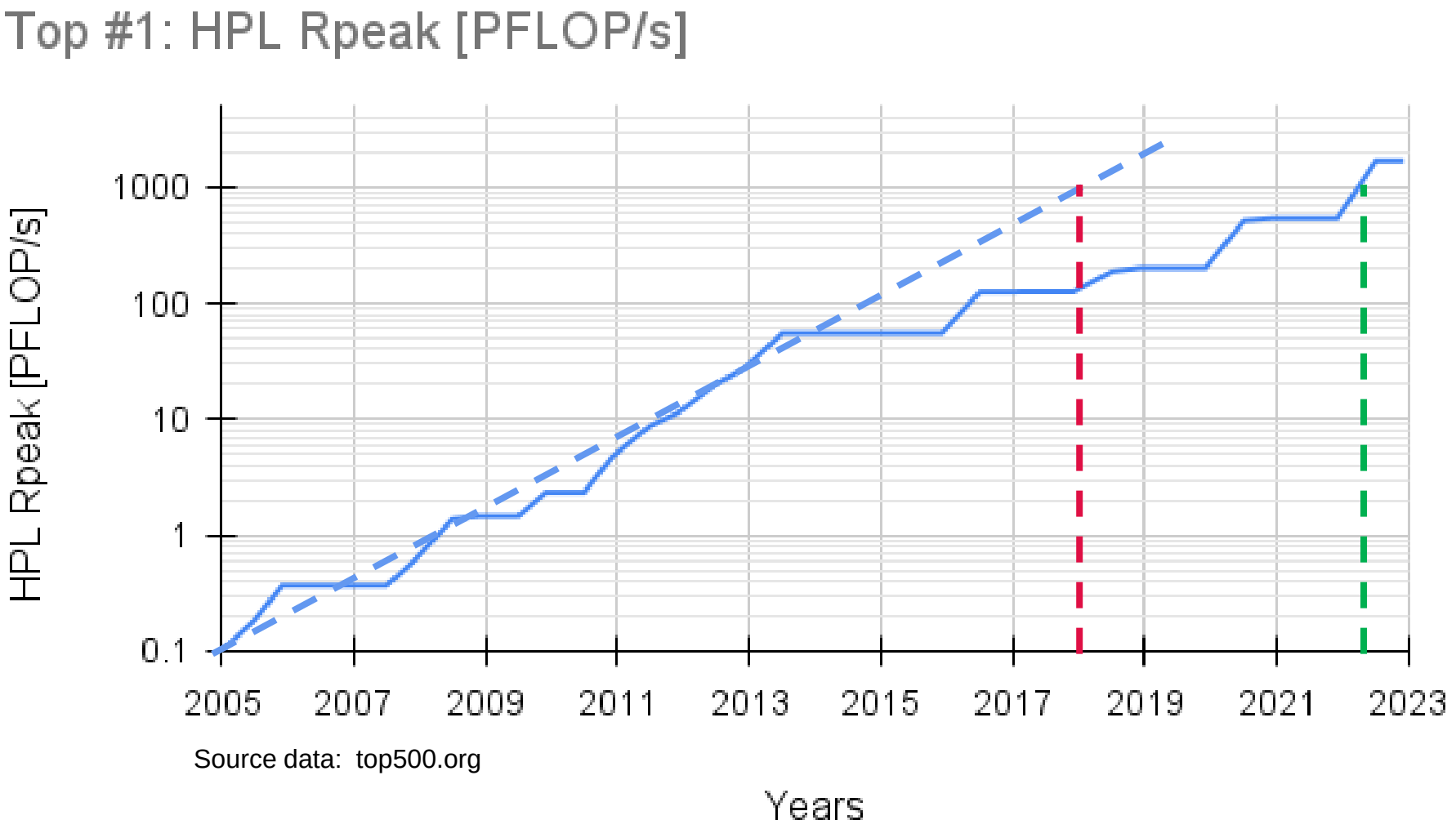
HPC Performance Evolution – Slower than Expected



Source data: top500.org

1997: First **1TFlop/s** computer: (*ASCI Red/9152)*

2008: First **1 PFlop/s** computer: (*Roadrunner*)

So…. First **1 EFlop/s** computer: **2018 !!**

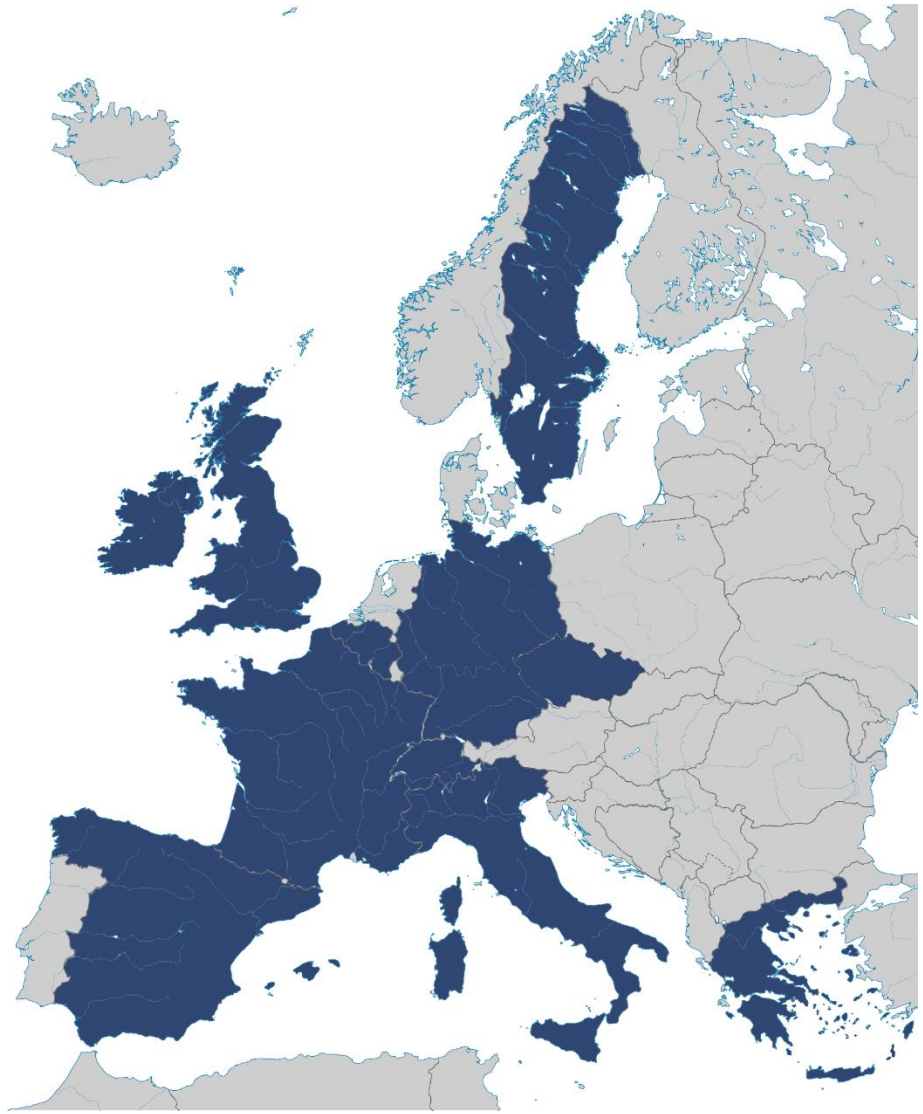
– Well… not really

It took 4 years longer…. **2022** for *Frontier* to appear

Exascale Challenges

- **Application parallelism**
  - Applications must support billions of individual threads
  - Lower-scaling applications / parts of applications should not run on a full Exascale system
- **Truly scalable systems**
  - Huge numbers of devices need to exchange data with each other
  - Collective communication operations are “slowing down” due to larger system sizes
  - Network contention and reliability become worries
- **Energy efficiency**
  - Accelerators clearly beat CPUs for many (most?) codes
  - System heterogeneity is a must
  - Yet – portable accelerator programming is hard
- **Memory and storage**
  - Ever growing gap between compute throughput and memory bandwidth
  - New technologies like HBM suffer from capacity limitations & high energy consumption
- **Workload diversity**
  - Exascale centers must run a wide variety of HPC, AI and data analytics workloads with highest energy efficiency
  - One size does not fit all

The SEA Projects (April 2021 – March 2024)



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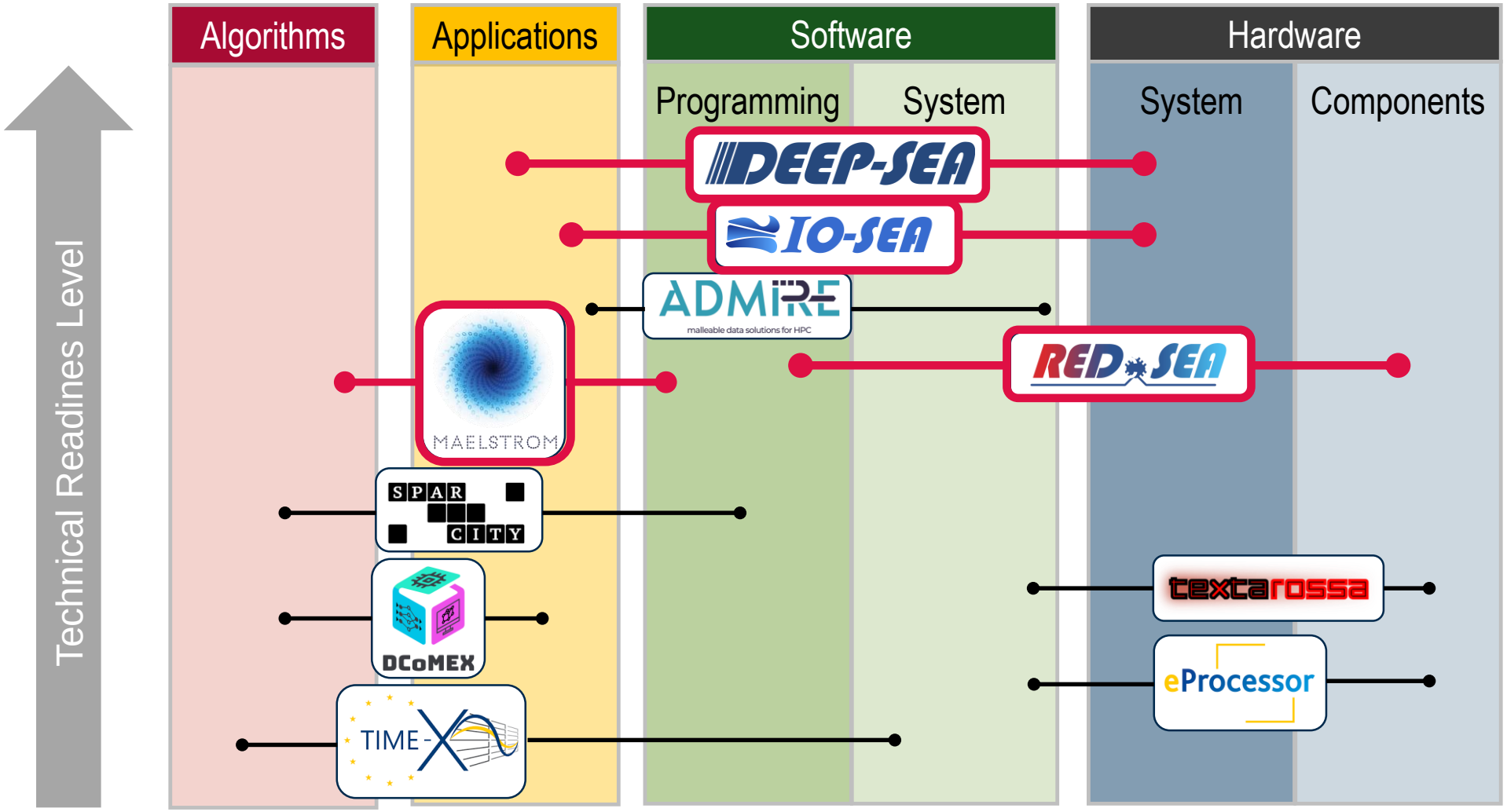
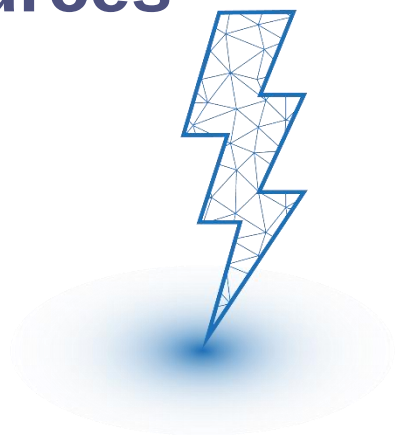
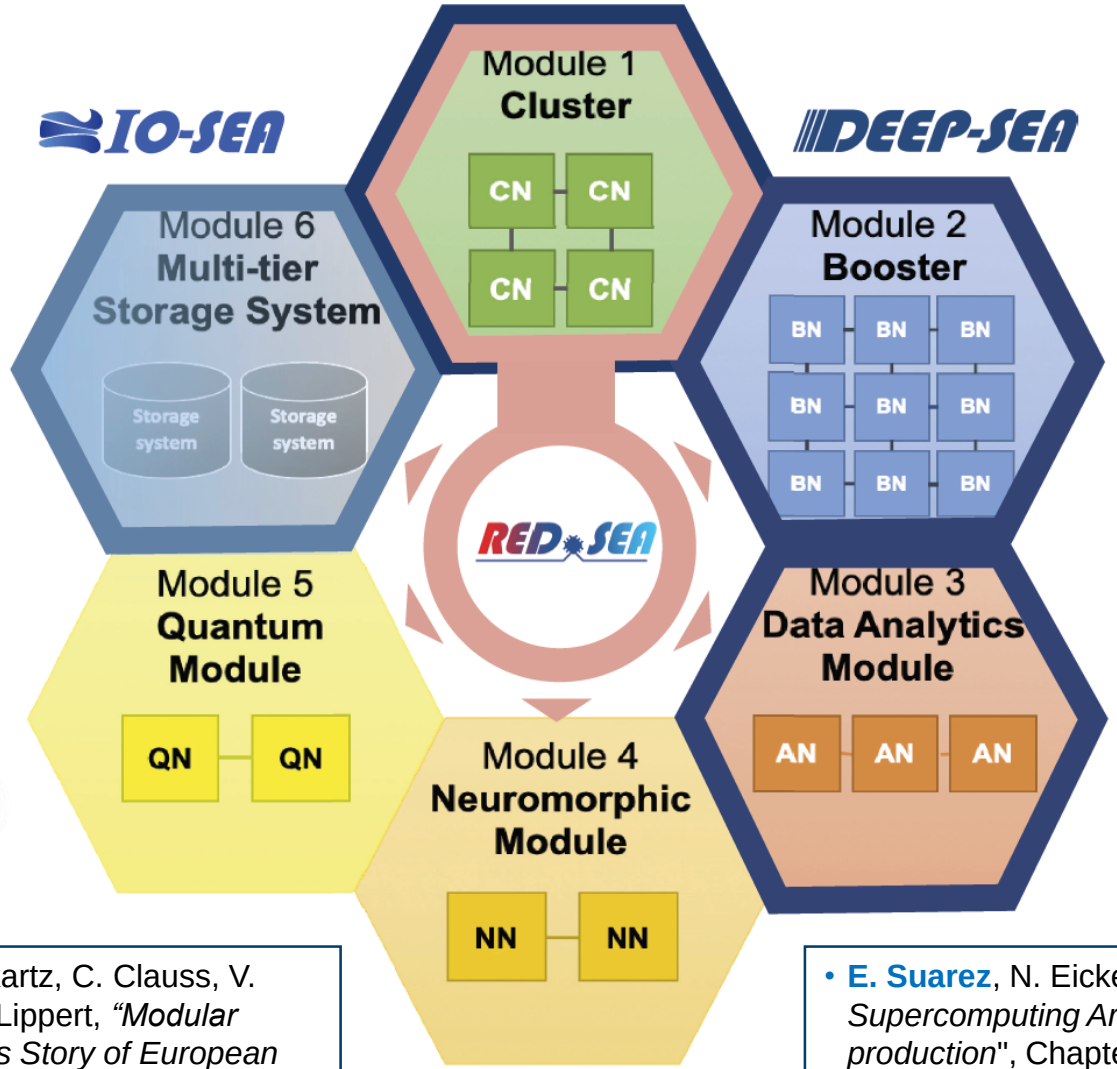
EuroHPC JU Call-1/2019 Exascale Projects



Modular Supercomputing Architecture

Composable heterogeneous resources





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DEEP-SEA

Software stack and programming model for Exascale heterogeneity

IO-SEA

I/O Software stack for Exascale

RED-SEA

Network solutions for Exascale systems

- **E. Suarez,** N. Eicker, T. Moschny, S. Pickartz, C. Clauss, V. Plugaru, A. Herten, Kristel Michielsen, T. Lippert, *"Modular Supercomputing Architecture – A Success Story of European R&D",* ETP4HPC White Paper. (2022) Available at https://www.etp4hpc.eu/white-papers.html#msa.

- **E. Suarez**, N. Eicker, Th. Lippert, "*Modular Supercomputing Architecture: from idea to production*", Chapter 9 in Contemporary High Performance Computing: from Petascale toward Exascale, Volume 3, p 223-251, CRC Press. (2019)

Details on the “Family Members”

Three 10-15 minute presentations

- DEEP-SEA: Hans-Christian Hoppe (JSC)
- IO-SEA: Sai Narasimhamurthy (ParTec AG)
- RED-SEA: Jesús Escudero-Sahuquillo & Pedro J.García (UCLM)

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