THE EUROPEAN APPROACH TO THE EXASCALE CHALLENGE
ENCCS Industry Days 2022, Stockholm, Sweden

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EuroHPC Joint Undertaking - Executive Director

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EuroHPC Joint Undertaking

WHO ARE WE?

- A legal and funding entity (Art 187 of the Treaty on the Functioning of the European Union -TFEU)
- Created in 2018 & autonomous since September 2020
- Headquarters: Luxembourg
- Staff: 21 and still growing

OUR MEMBERS

- 32 participating countries
- The European Union (represented by the European Commission)
- Private partners

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BDV BIG DATA VALUE ASSOCIATION

QUIC European Quantum Industry Consortium

ETP 4 HPC EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING

LEVEL AND SOURCES OF EU FUNDING 2021-2027

Digital Europe Program

1.98B Eur

- Infrastructure
- Federation of supercomputing services
- Widening usage and skills

Horizon Europe Program

900M Eur

- Technology
- Application
- International Cooperation

Connecting Europe Facility

200M Eur

- Hyperconnectivity
- Data connectivity

*Member states to match this with national contributions

THE EUROHPC JU POOLS THE RESOURCES OF ITS MEMBERS TO:

Develop, deploy, extend & maintain in Europe a **world-leading supercomputing, quantum computing, service** & **data infrastructure** ecosystem;

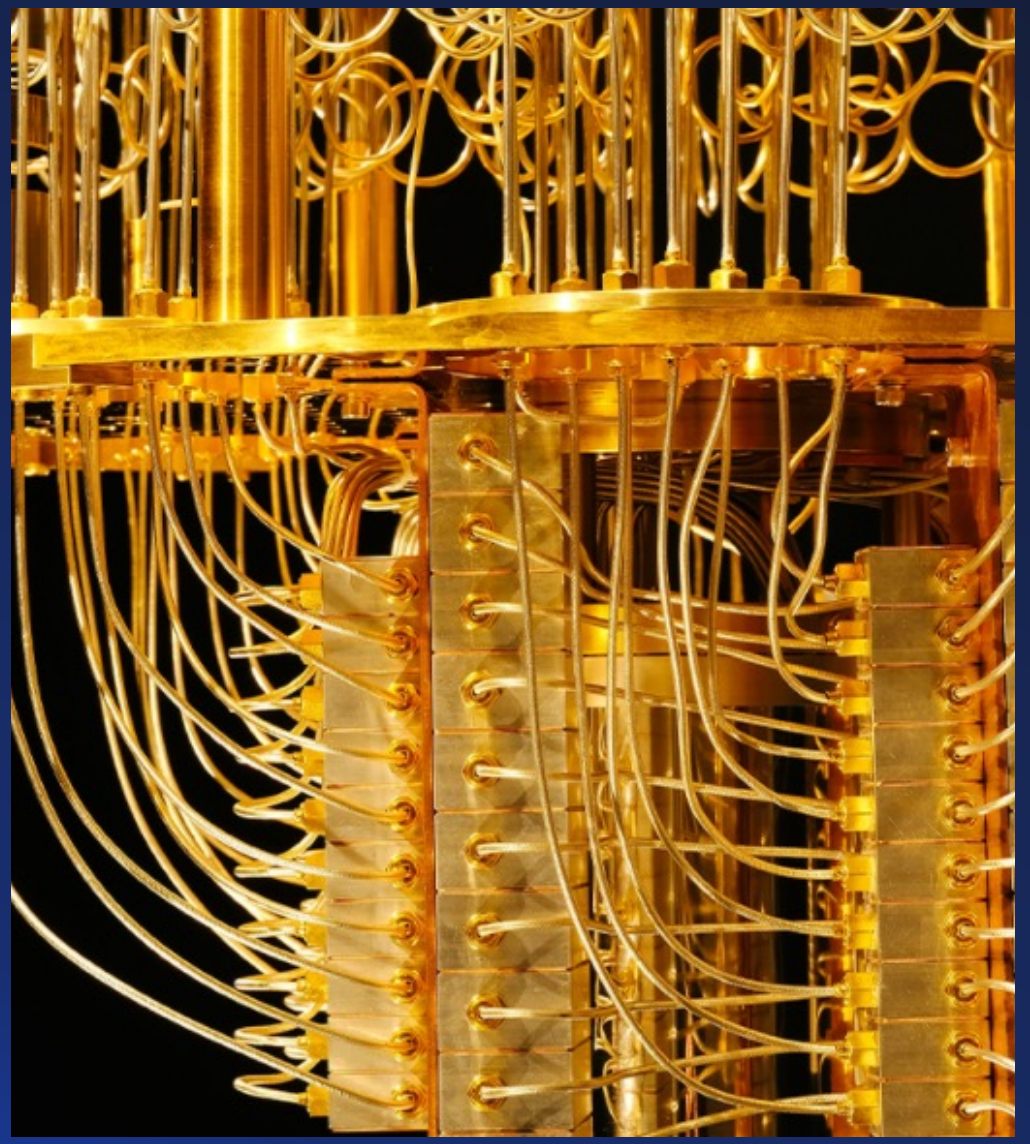
Support the development of **innovative supercomputing components, technologies, knowledge** & **applications** to underpin a **competitive European supply chain**;

Widen the use of **HPC** & **quantum infrastructures** to a large number of public & private users wherever they are located in Europe and support the development of **key HPC skills** for European science and industry.

INFRASTRUCTURE

- In 2022, the EuroHPC JU will increase the **available computing power** in Europe, with the acquisition of:
  - the first European **exascale** supercomputers,
  - the first **quantum** computers,
  - additional **mid-range** systems.

- In parallel, ongoing process to upgrade the existing EuroHPC systems.



SKILLS & FEDERATION

- Further widen the use of HPC to a large number of public & private users **wherever they are located in Europe,**
- Support the development of **key HPC skills**, **education** & **training** for European science & industry,
- Establish a **one-stop shop** access point for any supercomputing or data service managed by the EuroHPC JU, providing any user with a **single point of entry.**

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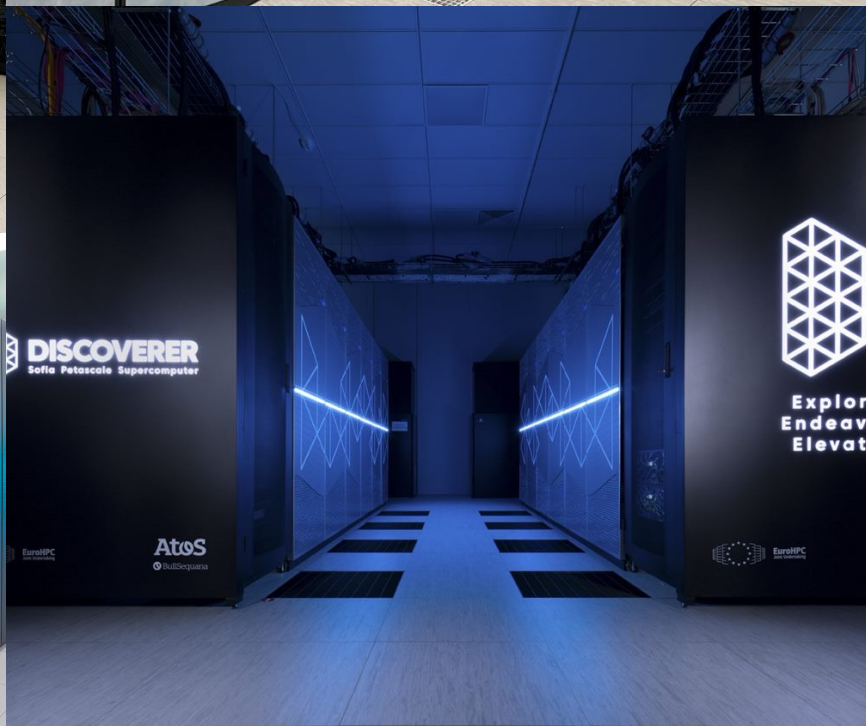
The EuroHPC JU has already procured eight supercomputers:

- 3 Pre-exascale
- 5 Petascale

Total contracts cost: EUR ~360M

5 supercomputers are already operational:

- **Vega** in Slovenia,
- **MeluXina** in Luxembourg,
- **Karolina** in the Czech Republic,
- **Discoverer** in Bulgaria,
- **LUMI** in Finland (LUMI-C partition)



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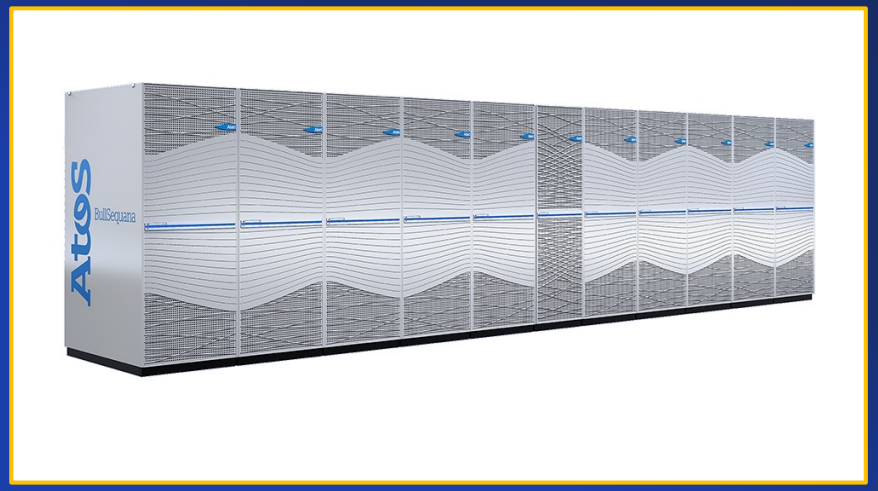
3 more supercomputers are underway:

Leonardo in Italy



CINECA

Deucalion in Portugal

Minho Advanced Computing Center

MareNostrum 5 in Spain

BSC Barcelona Supercomputing Center
Centro Nacional de Supercomputación

MORE ON LUMI…

The fastest & greenest supercomputer in Europe:

- **#3 on the TOP500 list**
- **#3 on the Green500 list**

- Supplied by HPE, based on an HPE Cray EX supercomputer.
- Over **550 petaflop/s of computing power** in its final configuration based on modern GPU processors & a **sustained performance of 375 petaflops**;
- Lending itself to a multitude research problems such as climate change, natural language processing, genomics & pandemic research.
- An **exceptionally green system**: running on 100% renewable hydroelectricity, using free cooling and with its waste heat being used for local district heating.
- A **unique endeavour** between **EuroHPC JU & 10 countries**, investing together in an HPC ecosystem

JUPITER, THE FIRST EUROPEAN EXASCALE SYSTEM

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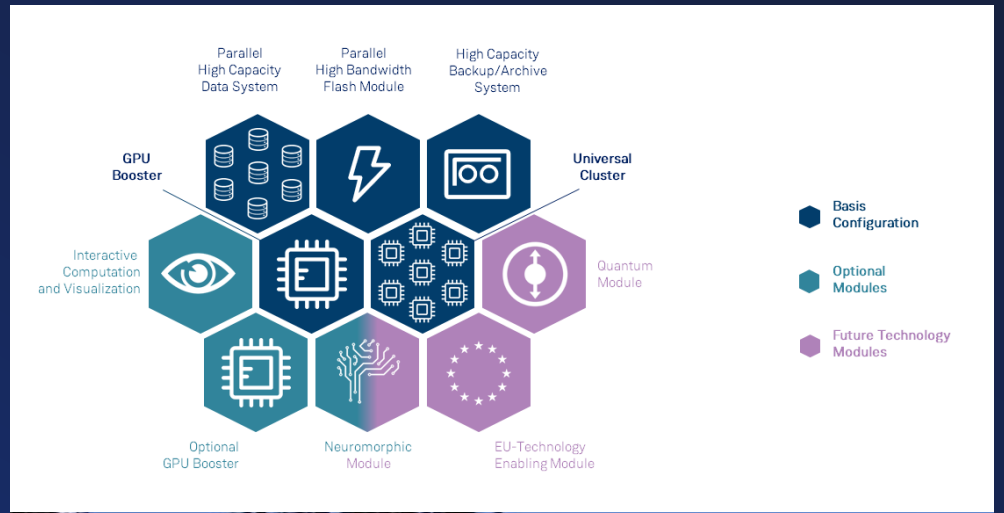
- First European supercomputer to pass the threshold of **one trillion calculations per second**
- Based on a **modular supercomputing architecture**
- Designed as a green computer, **powered by green electricity**, with water cooling system and plans for intelligent use of its waste heat
- JUPITER will help to solve questions regarding climate change, pandemics, sustainable energy production as well as enabling the use of AI and data science on a large scale



NOT JUST ABOUT POWER…

The EuroHPC JU is committed to building supercomputers which are both **powerful** and **eco-efficient** by:

- Procuring **energy efficient systems**, with low requirements for cooling. All our systems are **water cooled**, removing the requirement of high operational costs of air-cooled systems and in parallel reducing the energy footprint.
- Investing in the development of **next generation "green" microprocessors** that rely on energy efficient architectures.

Green and sustainable technologies are a priority for the JU, as part of the European Green Deal's aim to make Europe climate neutral by 2050

WHO CAN ACCESS OUR SUPERCOMPUTERS?

- **What organisations are eligible for access to EuroHPC JU machines?**

Any organisation from a participating state is eligible for access to perform Open Science research. This includes public and private academic and research institutions, public sector organisations, industrial enterprises and SMEs.

- **What are the participation conditions?**

Participation conditions depend on the specific access call that a research group has applied. In general users of EuroHPC systems commit to:

- ✓ acknowledge the use of the **resources** in their related publications,
- ✓ contribute to **dissemination** events,
- ✓ produce and submit a **report** after completion of a resource allocation.

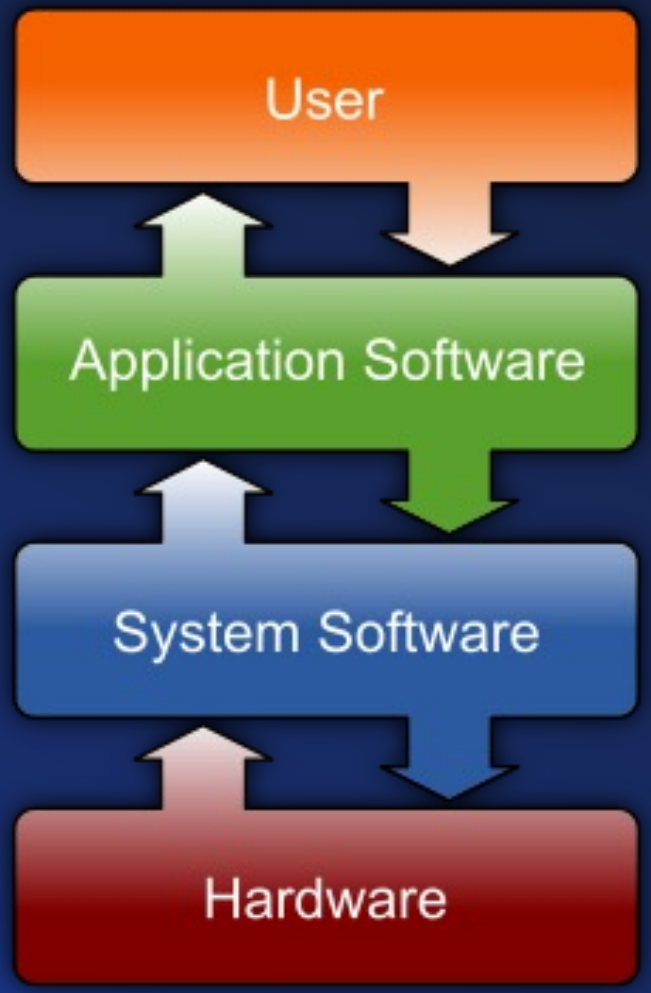
STRATEGIC R&I – INTERVENTION AREAS

Leadership in Use & Skills
Competence Centres and training programmes in HPC commensurate with the labour market

Applications and Algorithms
Centres of Excellence for HPC Applications and new algorithms for European exascale technology

European Software Stack
Software and algorithms, programming models and tools for exascale and post exascale systems

European Open Hardware
Ecosystem for the low power high-end general purpose processor and accelerator



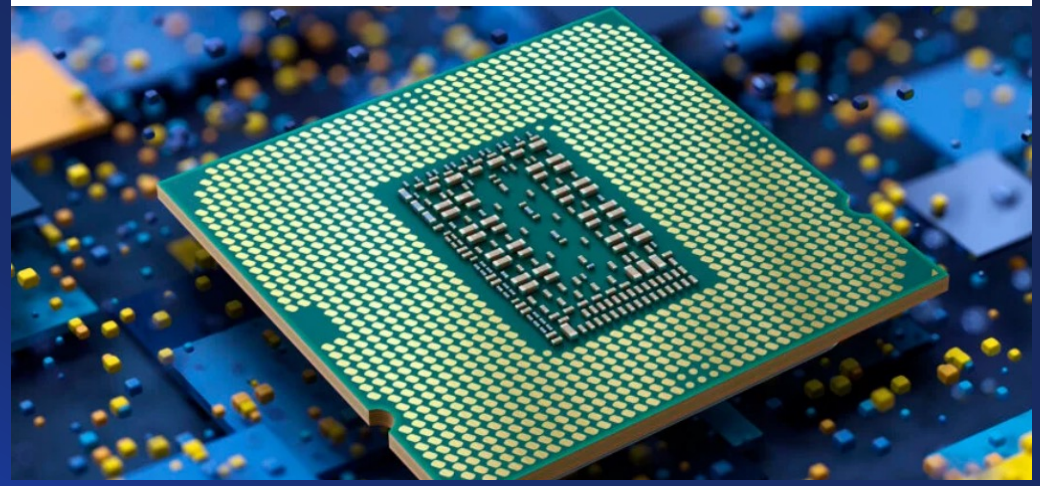
EUROPEAN PROCESSOR INITIATIVE

- **EPI** is a cornerstone of the European initiative towards strategic autonomy in HPC & chip technologies.

- During its first phase (2018-2021), EPI has delivered cutting-edge technologies as the Rhea General-Purpose Processor (GPP) & a proof-of-concept implementation of European accelerator technology.

- The second phase of the initiative is focused on:
  - Finalising the 1st generation of low-power processor units,
  - Developing the 2nd generation of low power accelerator test chips,
  - Enhancing existing technologies for incoming European exascale machines,
  - Developing sound and realistic industrialisation & commercialisation paths.

epi European Processor Initiative



SOFTWARE FOR EXASCALE ARCHITECTURES

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DEEP-SEA

- Deliver the programming environment for future European exascale systems, adapting all levels of the software stack
- Enable dynamic resource allocation, application malleability, programming composability
- Building on previous EU projects and international open-source packages and extending them with focus on compute and memory heterogeneity

RED-SEA

- Gathering key European R&D competences, bringing together top academic centres to pave the way for next generation Exascale interconnects
- Leveraging BXI, the key European Interconnect to adapt it to future technologies

IO-SEA

- Providing novel data management and storage platform for exascale computing
- Ephemeral data nodes and data accessors introduced to allow flexible usage of the system
- Development of advanced IO instrumentalization and monitoring features to leverage latest AI advancements and machine learning to create an efficient system limiting unnecessary data movements

PREPARING FOR EXASCALE

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TEXTAROSSA

- Bridging the gap between current and near-future exascale technologies in order to achieve high-performance and high energy efficiency on these new systems

REGALE

- Paving the way of next-generation HPC applications to exascale systems.
- Defining an open architecture, building a prototype system and incorporating appropriate sophistication in order to properly equip supercomputing systems for effective resource utilisation and execution of complex applications

TIME-X

- Developing the novel approach of parallel-in-time integration as a tool for unlocking the potential of Exascale systems beyond the academic setting and enabling its use and integration for real-time applications

MICROCARD

- Developing exascale software to simulate the electrical behaviour of the heart, which will be applied to real-life use cases and will be made accessible for a wide range of users both as code and through a web interface

CALL FOR NEW ALGORITHMS FOR APPLICATIONS ON EUROPEAN EXASCALE SUPERCOMPUTERS

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Objective: to develop novel algorithms to exploit the full potential of the upcoming European exascale supercomputers.

This will enable HPC applications to use these new computing capabilities in the future and address important computational challenges which are currently intractable

Total budget of EUR 5 million – funded by Horizon Europe

The EuroHPC JU will fund a consortium which will provide financial support to third party projects to develop new algorithms with the highest possible impact.

Call launched in April 2022 and open until 27 October 2022, 17:00

More details on the EuroHPC website

THANK YOU

Keep up with EuroHPC news:

https://eurohpc-ju.europa.eu

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