The European High Performance Computing Joint Undertaking
LEADING THE WAY IN EUROPEAN SUPERCOMPUTING

| TREX Symposium, February 5, 2024 |

WHO ARE WE?

- An EU body & a legal and funding entity
- Created in 2018 and autonomous since September 2020
- Based in Luxembourg
- A team of 35 employees, still in the process of recruiting additional employees throughout 2023

OUR MISSION

The EuroHPC JU pools together the resources of its members to:

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

➢ 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 supporting the development of key HPC skills for European science and industry

OUR MEMBERS

- 34 participating countries

- The European Union (represented by the European Commission)

- 3 private partners

Each of our members is represented in the EuroHPC JU's Governing Board

The Governing Board also takes advice from the EuroHPC Industrial and Scientific Advisory Board (INFRAG & RIAG)
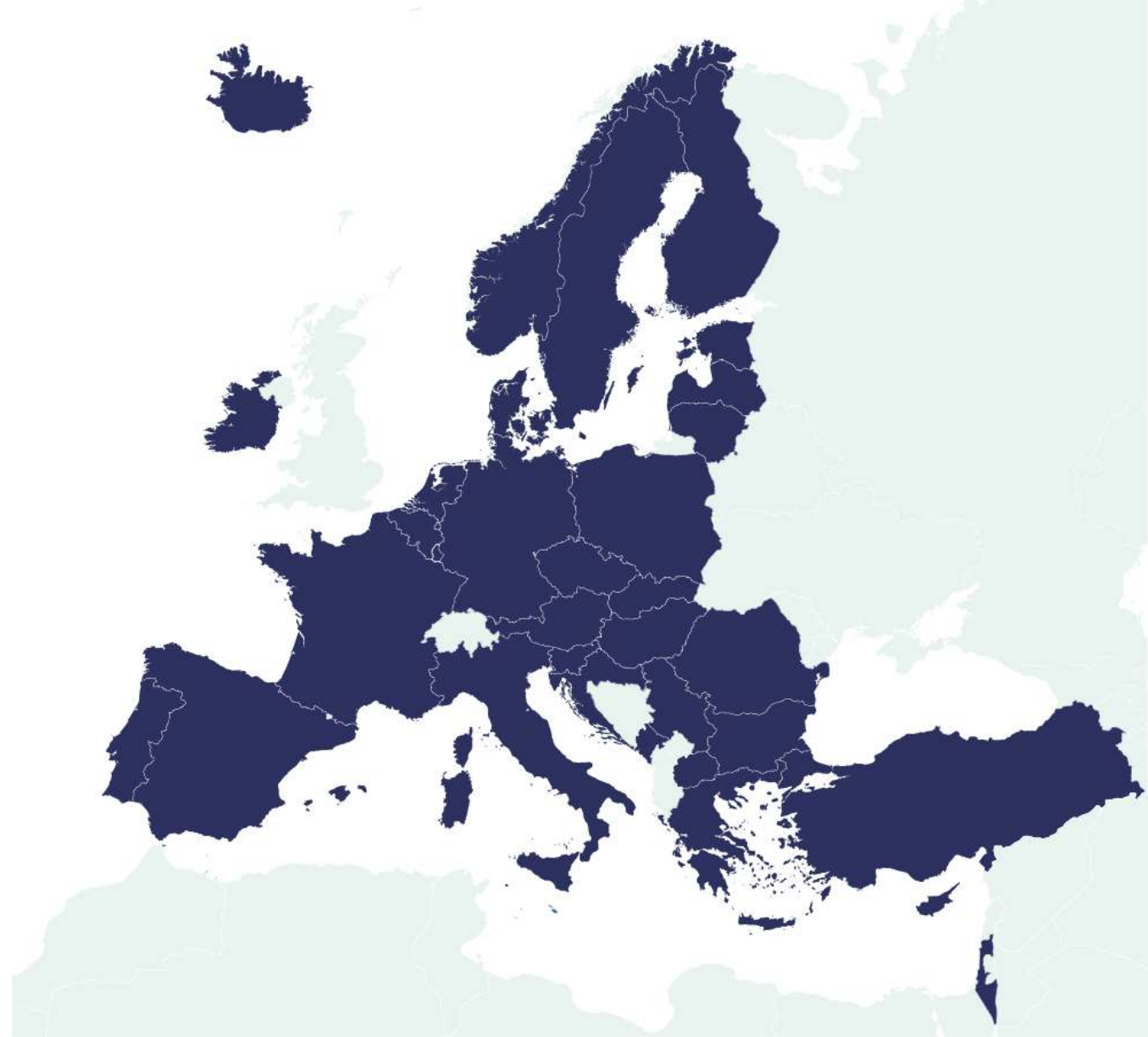
INDUSTRIAL AND SCIENTIFIC ADVISORY BOARD

The two advisory groups provide advice on R&I and Infrastructure, drawing up draft multiannual strategic agendas to guide the activities of EuroHPC in these areas.

INFRAG

The Infrastructure Advisory Group (INFRAG)

- Provides advice on the acquisition and operation of the supercomputers;
- Issues recommendations on the federation and interconnection of the EuroHPC infrastructure;
- Advises on training activities for end-users and opportunities for promoting take-up and use of European technology solutions notably by the national HPC Competence Centres;
- Consults with public and private stakeholders to inform them and collect feedback.

Chaired by Sinead Ryan

RIAG

The Research and Innovation Advisory Group (RIAG)

- Provides advice on potential international cooperation activities;
- Issues recommendations for training and education priorities addressing key competences in HPC;
- Consults with public and private stakeholders to inform them and collect feedback.

Chaired by Jean-Philippe Nominé

LEVEL AND SOURCES OF EU FUNDING 2021-2027

Digital Europe Programme
1.98B Eur

Infrastructure

Federation of supercomputing services

Widening usage and skills

Horizon Europe Programme
900M Eur

Technology

Application

International Cooperation

Connecting Europe Facility
200M Eur

Hyperconnectivity

Data connectivity

*Member states to match this with national contributions

THE EUROHPC SUPERCOMPUTERS

7 inaugurated systems, all ranking among the world's most powerful supercomputers:

- Vega in Slovenia
- Karolina in Czechia
- Discoverer in Bulgaria
- Meluxina in Luxembourg
- LUMI in Finland
- Leonardo in Italy
- Deucalion in Portugal
- MareNostrum5, a pre-exascale system in Spain

3 systems underway:

- Jupiter, the 1st European Exascale supercomputer in Germany
- Daedalus, a mid-range system in Greece

GLOBAL STANDING OF EUROHPC SUPERCOMPUTERS

NOV 2023	TOP500	Green500
LUMI	#5	#7
LEONARDO	#6	#18
MARENOSTRUM 5	#8	#6
MELUXINA	#71	#27
KAROLINA	#113	#25
DISCOVERER	#166	#216
VEGA	#198	#253

EuroHPC Joint Undertaking

TOP 500 The List.

- ❏ Located at and operated by the **Jülich Supercomputing Centre** and supplied by a consortium composed of Eviden and ParTec AG

- ❏ The first European supercomputer capable of **1 exaflop,** or one billion billion (10^{18}) calculations per second

- ❏ A **modular supercomputing architecture**, comprised of a Booster Module (GPU accelerated) and a Cluster Module (general-purpose, high memory bandwidth)

- ❏ The Cluster Module will utilise the **Rhea processor,** developed in the framework of the European Processor Initiative

- ❏ Designed to tackle the **most demanding simulations and compute-intensive AI applications in science and industry**, including:

large neural networks,

simulations for developing functional materials,

digital twins of the human heart or brain for medical purposes,

validating quantum computers,

high-resolution simulations of climate

JUPITER, THE FIRST EUROPEAN EXASCALE

QUANTUM & EUROHPC

<HPC|O.S>

QUANTUM COMPUTERS

- **Six Hosting Entities**

In June 2023, the EuroHPC JU signed hosting agreements with six sites across Europe to host & operate EuroHPC quantum computers.

- **Two procurements launched in 2023:**

  - **EuroQCS-Poland,** located at Poznan Supercomputing and Networking Center

  - **Euro-Q-Exa**, located at Leibniz Supercomputing Centre in **Germany**

  - Further procurements coming soon

- EuroHPC's 1st step towards a European QC infrastructure

- Launched in Dec 21 and will run until the end of 2025

- Aims to integrate **2 quantum simulators**, each controlling about 100+ qubits in :

  - the GENCI supercomputer **Joliot Curie** (France)

  - the JSC supercomputer **JUWELS** (Germany)

CALL FOR QUANTUM EXCELLENCE CENTRES

- Launched 7 November 2023

- Aimed at establishing two European Quantum Excellence Centres (QECs) in applications for science and industry

- Will create a unified centre bringing together European users of quantum technologies and facilitate the development of quantum applications and use cases

COMING SOON:
- Hybrid HPC-Quantum Computing middleware technologies
- Hybrid algorithms and applications
- Calls for further quantum computers

PURSUING GREENER SUPERCOMPUTING

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

ACCESS TO THE EUROHPC SUPERCOMPUTERS

WHO IS ELIGIBLE?

- Academic and research institutions (public and private)
- Public sector organisations
- Industrial enterprises and SMEs

→ Open to all fields of research

WHICH TYPES OF ACCESS EXIST?

- Regular access
- Extreme scale access
- Benchmark & Development access
- Special access

Regular and extreme scale access calls are continuously open, with several cut-offs throughout the year triggering the evaluation of proposals.

WHAT ARE THE CONDITIONS FOR ACCESS?

Access is free of charge. Participation conditions depend on the specific access call that a research group has applied to.
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

More information on EuroHPC access calls available at: Access to Our Supercomputers (europa.eu)

ACCESS TO EUROHPC SUPERCOMPUTERS IN NUMBERS
REGULAR ACCESS

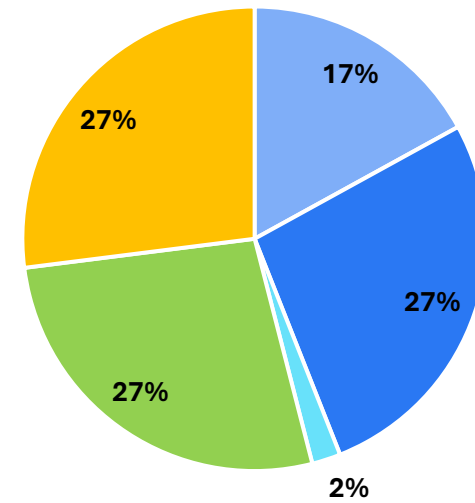### CORE HOURS AWARDED FOR REGULAR ACCESS
(across all cut-offs)

VEGA	481,117,087
KAROLINA	206,900,667
DISCOVERER CPU	278,031,306
MELUXINA	192,458,296
LUMI-C	765,204,976

Total core hours awarded across all systems:
1,923,712,332

RESEARCH DOMAINS DISTRIBUTION FOR AWARDED PROJECTS
(across all Regular Access cut-offs)

- Biochemistry, Bioinformatics, Life Sciences, Physiology and Medicine
- Chemical Sciences and Materials, Solid State Physics
- Earth System Sciences
- Computational Physics: Universe Sciences, Fundamental Constituents of Matter
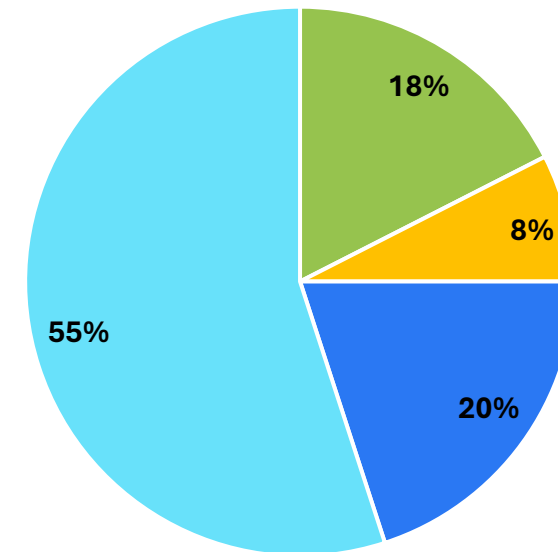- Engineering, Mathematics and Computer Sciences

ACCESS TO EUROHPC SUPERCOMPUTERS IN NUMBERS
EXTREME SCALE ACCESS

RESEARCH DOMAINS DISTRIBUTION FOR
AWARDED PROJECTS
(across all Extreme Scale Access cut-offs)

Total core hours awarded across all systems:
2,885,790,912

Total node hours awarded across all systems:
41,914,156

- 18%
- 8%
- 20%
- 55%

- Chemical Sciences and Materials, Solid State Physics
- Earth System Sciences & Environmental Studies
- Engineering, Mathematics and Computer Sciences
- Computational Physics: Universe Sciences, Fundamental Constituents of Matter

SPECIAL ACCESS – DESTINATION EARTH

- The EuroHPC JU can grant special access to **strategic European Union initiatives** considered to be **essential** for the public good, or in emergency and crisis management situations

- The Destination Earth initiative has been granted **Special Access** to EuroHPC supercomputers

- The project aims to develop a highly accurate digital model of the Earth - **a 'digital twin'** - to monitor and predict environmental change and human impact to support sustainable development

- Users will have cloud–based access to DestinE models, algorithms, applications and natural and socioeconomic data to exploit and test their own models. The overall system and its components (open core platform, digital twins, and services) will be user-friendly and flexible to adapt to a wide spectrum of user needs and scenarios
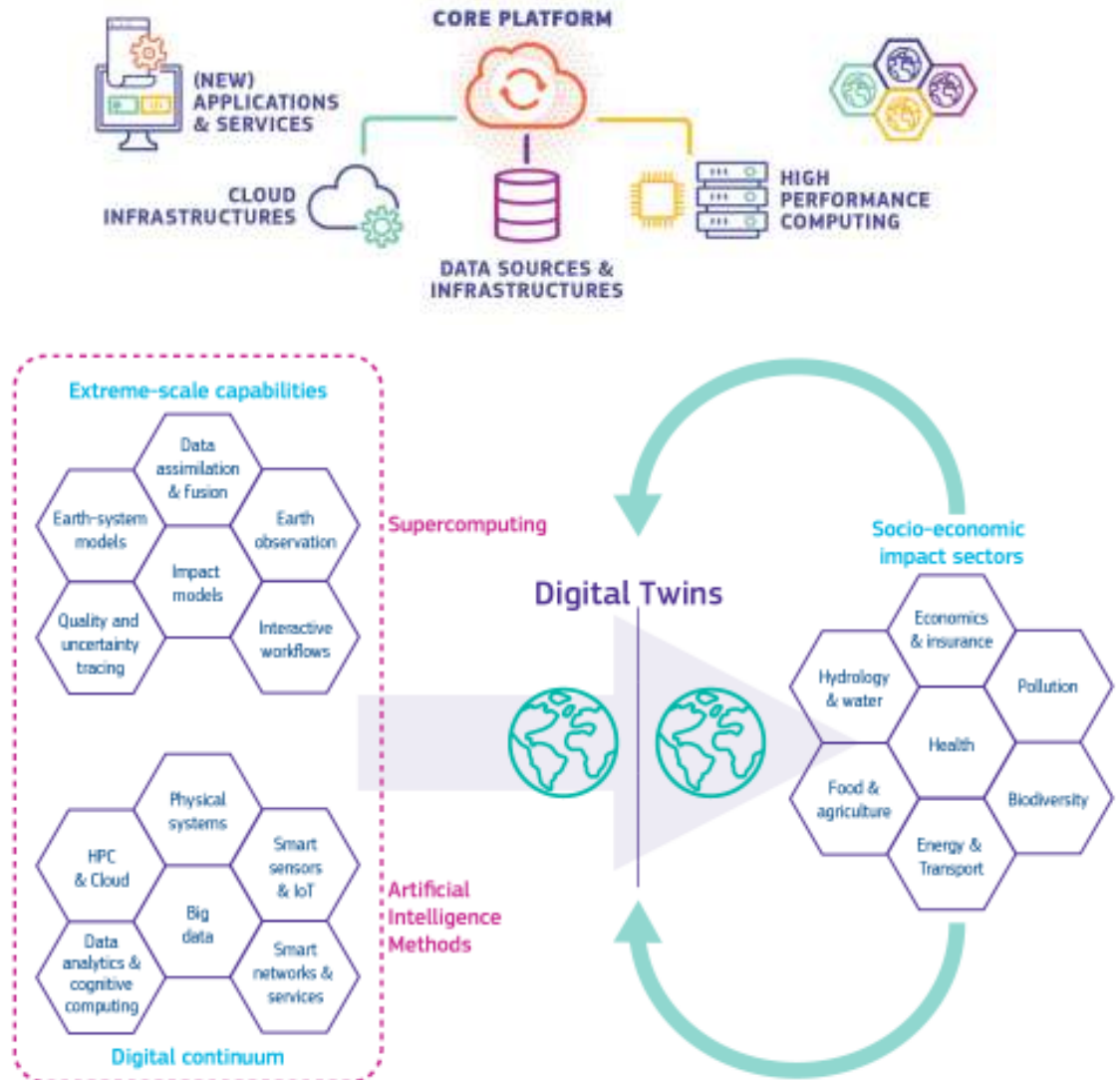
EUROHPC AI INITIATIVES

- **Several AI projects have already successfully used EuroHPC JU supercomputers**

- The newly published call for a **Support Centre for HPC-powered AI Applications** has been launched to provide services for AI users and developers, supporting their uptake and utilisation of HPC resources, providing essential training in HPC skills, and divulging key knowledge on HPC architectures and requirements for training large-scale AI models.

- Together with the European Commission, the EuroHPC JU launched the **AI Grand Challenge** to foster innovation and excellence in large-scale AI models and provide successful applicants with access to the EuroHPC supercomputers LUMI and Leonardo to research, innovate and development novel AI solutions.

- A call was launched to provide HPC support to develop the competitiveness and innovation potential of **SMEs**

- The **EuroHPC JU access policy** will be updated to improve evaluation steps to provide access to AI projects and ethical evaluation procedures

- A new EuroHPC JU call on **AI software stack** will soon be published

RESEARCH & INNOVATION

- EuroHPC JU funds an R&I programme to develop a full European supercomputing ecosystem

- Aiming to support European digital autonomy and reduce Europe's dependency on foreign manufacturers

- Currently around **40** projects focusing on a number of areas including **technologies, applications and skills**

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.

User

Application Software

System Software

Hardware
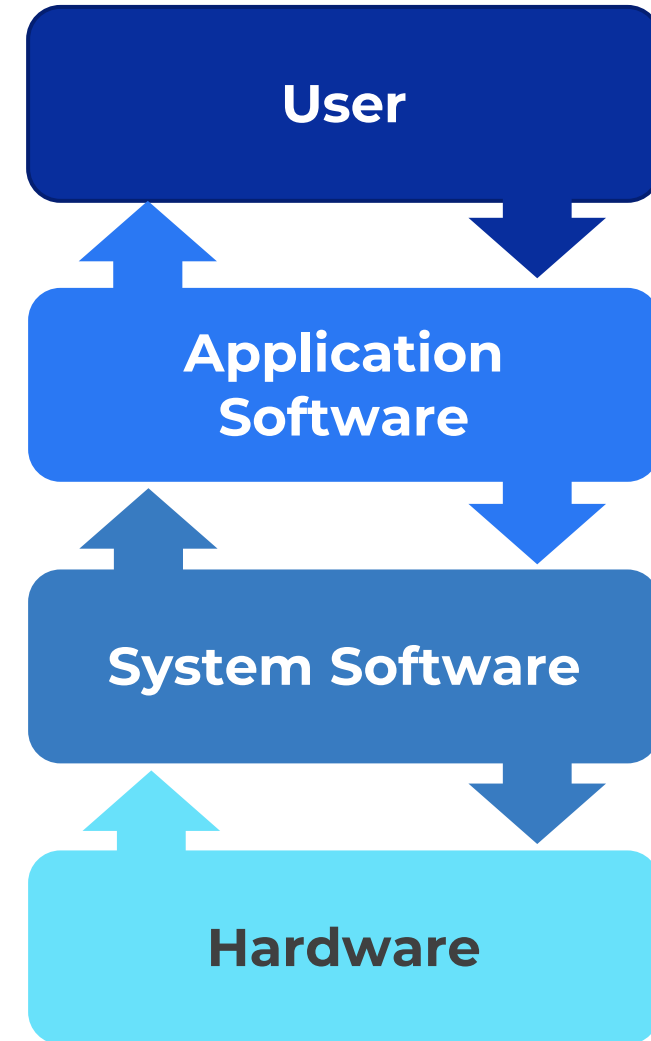
WHAT'S COMING NEXT?

INFRASTRUCTURE

- Procurement of the second EuroHPC exascale hosted by the Jules Verne consortium
- Call to select a hosting entity and industrial consortium for an industrial supercomputer for AI and other applications
- Second call to select hosting entities for quantum computers.
- Call to select hosting entities for further midrange systems

RESEARCH & INNOVATION

- Second phase of the EUMaster4HPC project
- Call targeting quantum middleware
- Continuous integration and deployment platform
- Further calls for applications in areas not yet covered
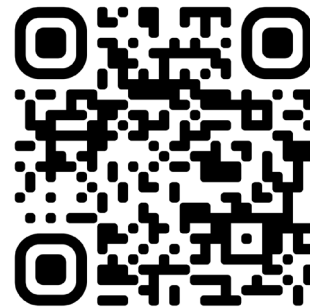
CONNECTIVITY & FEDERATION

- Implementation action based on the recently procured hyperconnectivity study
- Procurement of services to deploy a platform for federating EuroHPC resources

THANK YOU

EuroHPC Joint Undertaking

For more information, feel free to visit our website and social media:

eurohpc-ju.europa.eu

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