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

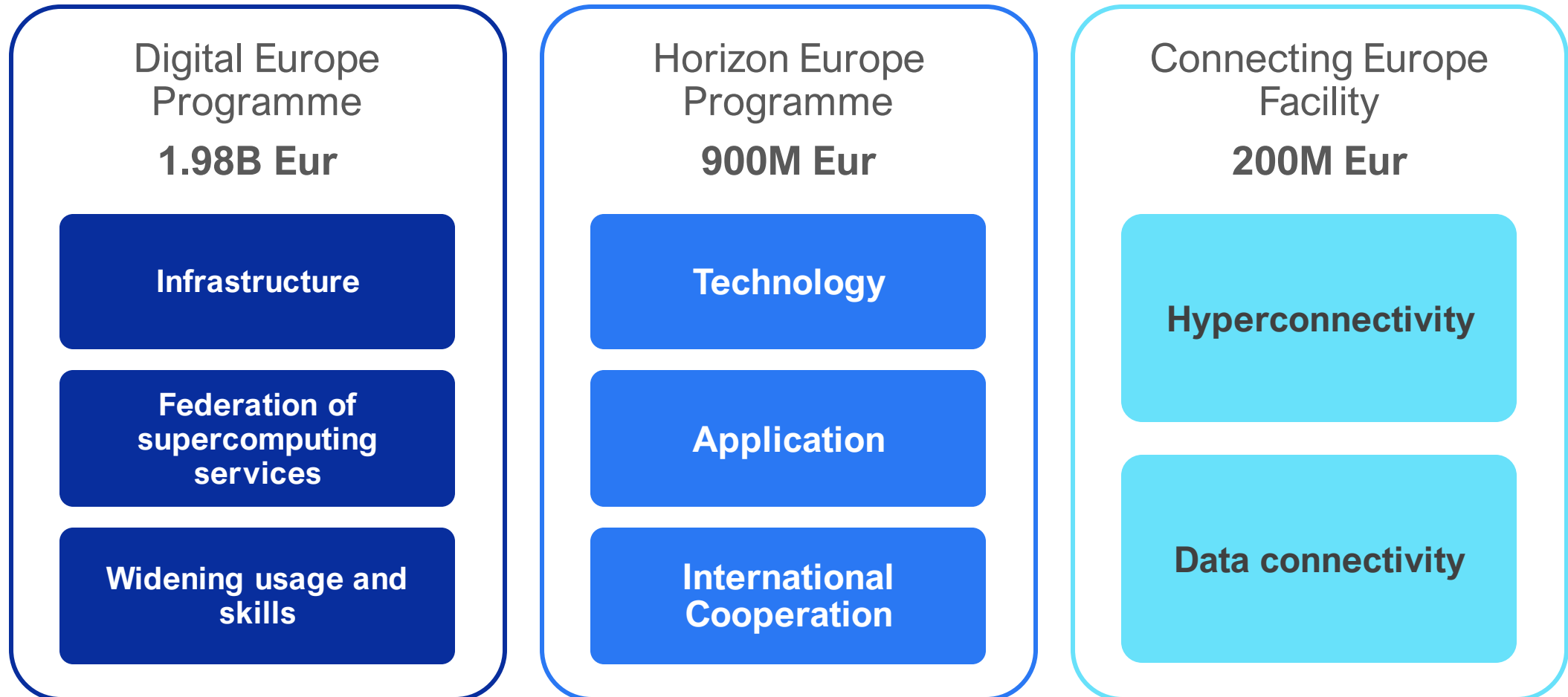Anders Dam Jensen | 7 November 2023 | DeiC

# 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

# 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

# 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)
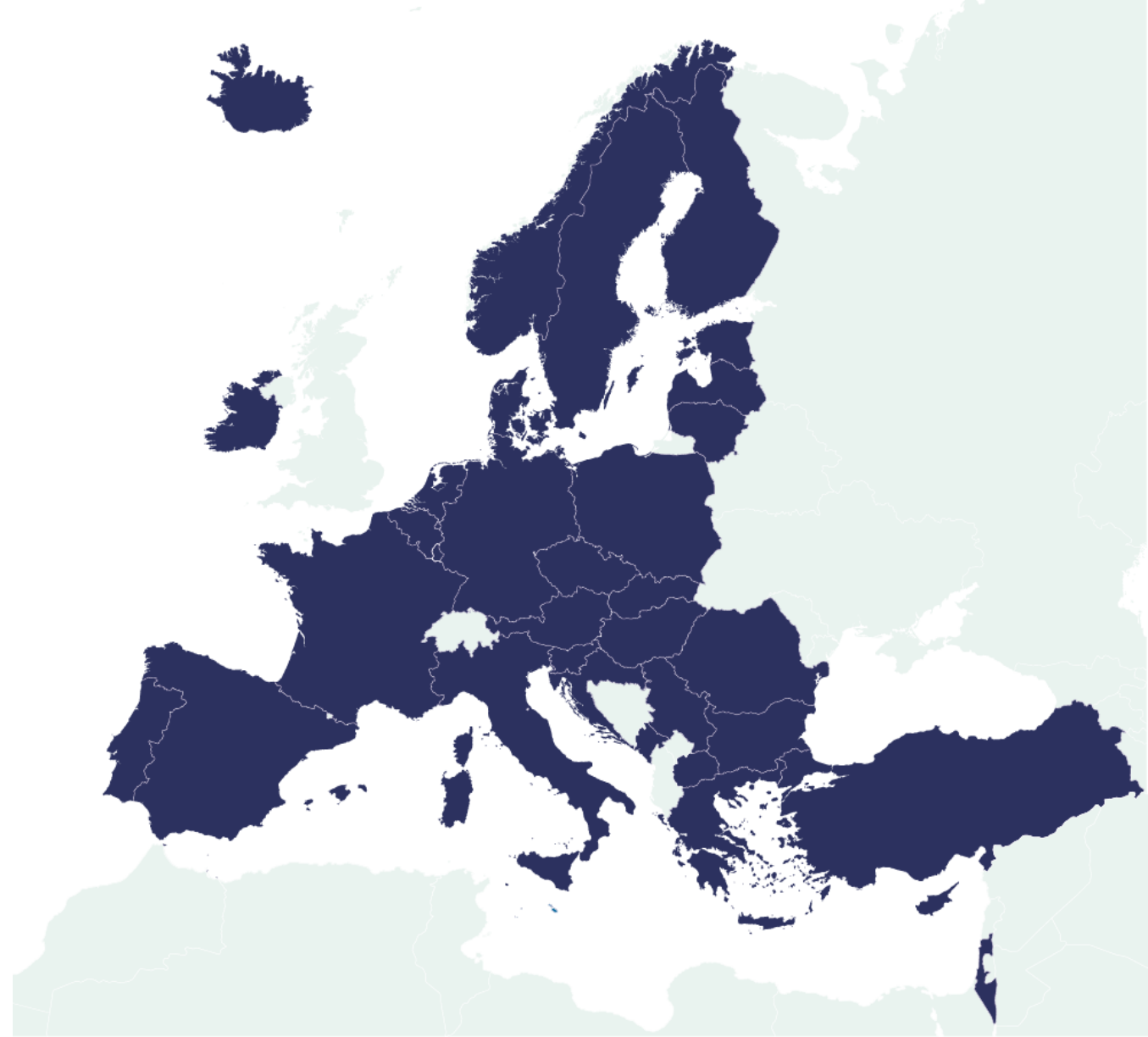
# INDUSTRIAL AND SCIENTIFIC ADVISORY BOARD

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**
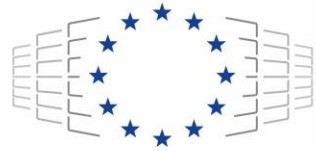
# THE EUROHPC SUPERCOMPUTERS

**7 operational 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

**3 systems underway:**

- MareNostrum5, a pre-exascale system in Spain
- Jupiter, the 1st European Exascale supercomputer in Germany
- Daedalus, a mid-range system in Greece

# GLOBAL STANDING OF EUROHPC SUPERCOMPUTERS

| JUNE 2022 | TOP500 | Green500 |
|---|---|---|
| LUMI | #3 | #7 |
| LEONARDO | #4 | #15 |
| MELUXINA | #57 | # 26 |
| KAROLINA | #95 | #24 |
| DISCOVERER | #134 | #219 |
| VEGA | #166 | #255 |

* As of the June 2023 Edition of the TOP500 and Green500 lists

# 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)
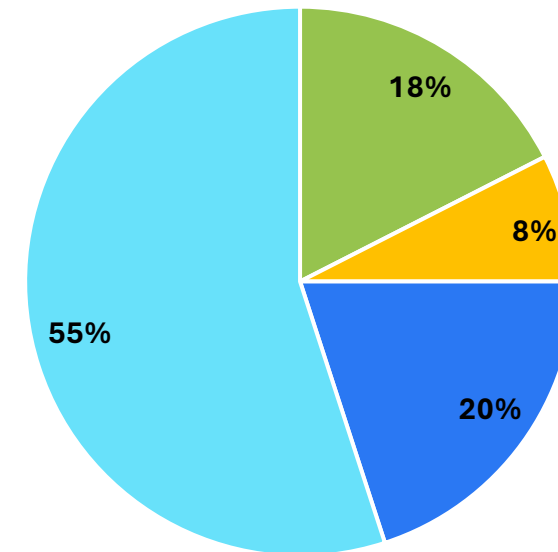
# ACCESS TO EUROHPC SUPERCOMPUTERS IN NUMBERS
## EXTREME SCALE ACCESS

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

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

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



- 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**

# Awarded projects with DK lead or participation

8 successful projects out of 11 submissions

5 successful projects out of 5 submissions

| Regular Access – DK | | |
| --- | --- | --- |
| System | Core hours | Node hours |
| Vega CPU | 10,000,000 | 78,125 |
| Vega GPU | 11,326,080 | 88,485 |
| Karolina CPU | 13,000,000 | 101,563 |
| Karolina GPU | 800,000 | 6,250 |
| Discoverer CPU | 21,324,586 | 166,598 |
| LUMI-C | 24,000,000 | 187,500 |
| TOTAL | 80,450,666 | 628,521 |

| Extreme Scale Access - DK | | |
| --- | --- | --- |
| System | Core hours | Node hours |
| Leonardo Booster | 14,807,200 | 462,725 |
| LUMI-C | 527,059,904 | 4,117,656 |
| MareNostrum5 ACC | 7,600,000 | 237,500 |
| TOTAL | 549,467,104 | 4,817,881 |

- 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**

# EUROHPC 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.

- **EuroQCS-Poland**

A call for tender has now been launched for the installation of EuroQCS-Poland.

- Located at Poznan Supercomputing and Networking Center (PSNC)

- A digital, gate-based quantum computer based on trapped-ions and offering 20-plus physical qubits.

- Further procurements to be launched soon

⟨HPC|S⟩

*Call for Quantum Excellence Centres*

- 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)

- Launched today

- 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

# THE EUROHPC QUANTUM APPROACH

## HARDWARE

- HPCQS project: integrating quantum simulators into supercomputers

- Procurement of quantum computers, integrated into existing supercomputers

## MIDDLEWARE

- Upcoming call targeting hybrid HPC-QC middleware technologies

## SOFTWARE

- Upcoming call targeting hybrid algorithms and applications

## USERS & SKILLS

- Quantum Excellence Centres for science and Industry

# 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**
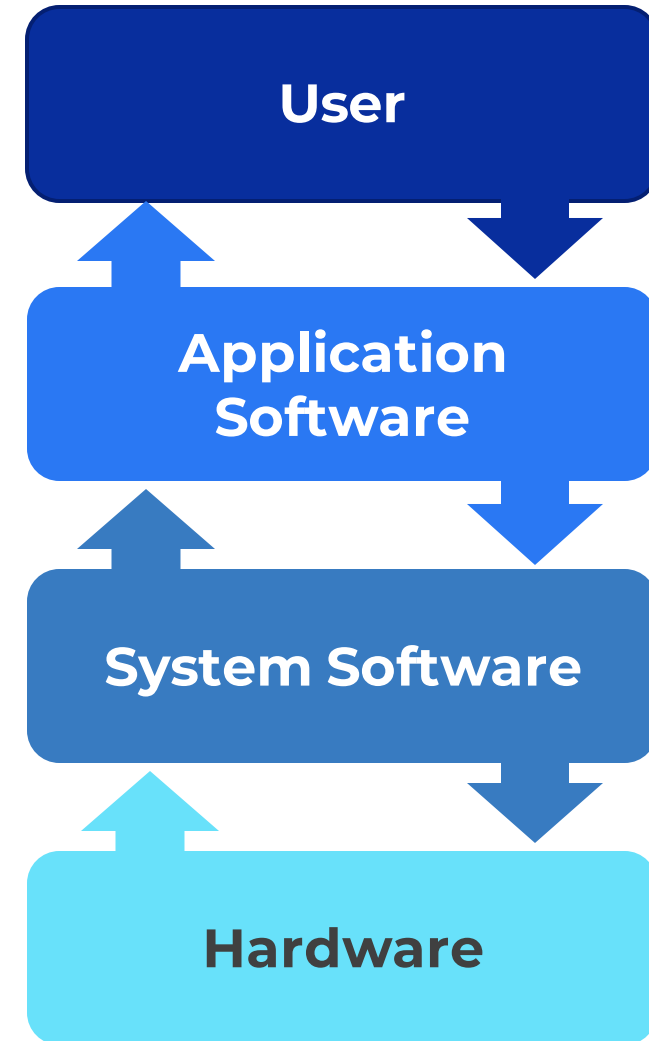
# COMING SOON: VIRTUAL HPC ACADEMY

✓ Call launched today

✓ Part of the EuroHPC's skills and usage pillar

✓ Establish the EuroHPC Academy covering the multidisciplinary field of HPC including related fields, emerging technologies and cross-cutting dimensions

✓ Based on a modular skills tree of competences and learning objectives, bridging the gap between basic digital skills and specialist, domain-specific knowledge

✓ Ensure common quality and qualification standards in HPC and support the uptake of standardisation of training and education in European HPC

✓ Will support a more skilled and knowledgeable HPC workforce, enhancing the competitiveness and innovation potential of European companies and research institutions

# WHAT'S COMING NEXT?
## *EuroHPC Work Programme 2024*

**INFRASTRUCTURE**

- Procurement of the second exascale hosted by the Jules Vernes 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



## See you at the EuroHPC User Day, 11 December in Brussels

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