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

Josephine Wood | 6 November 2023

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

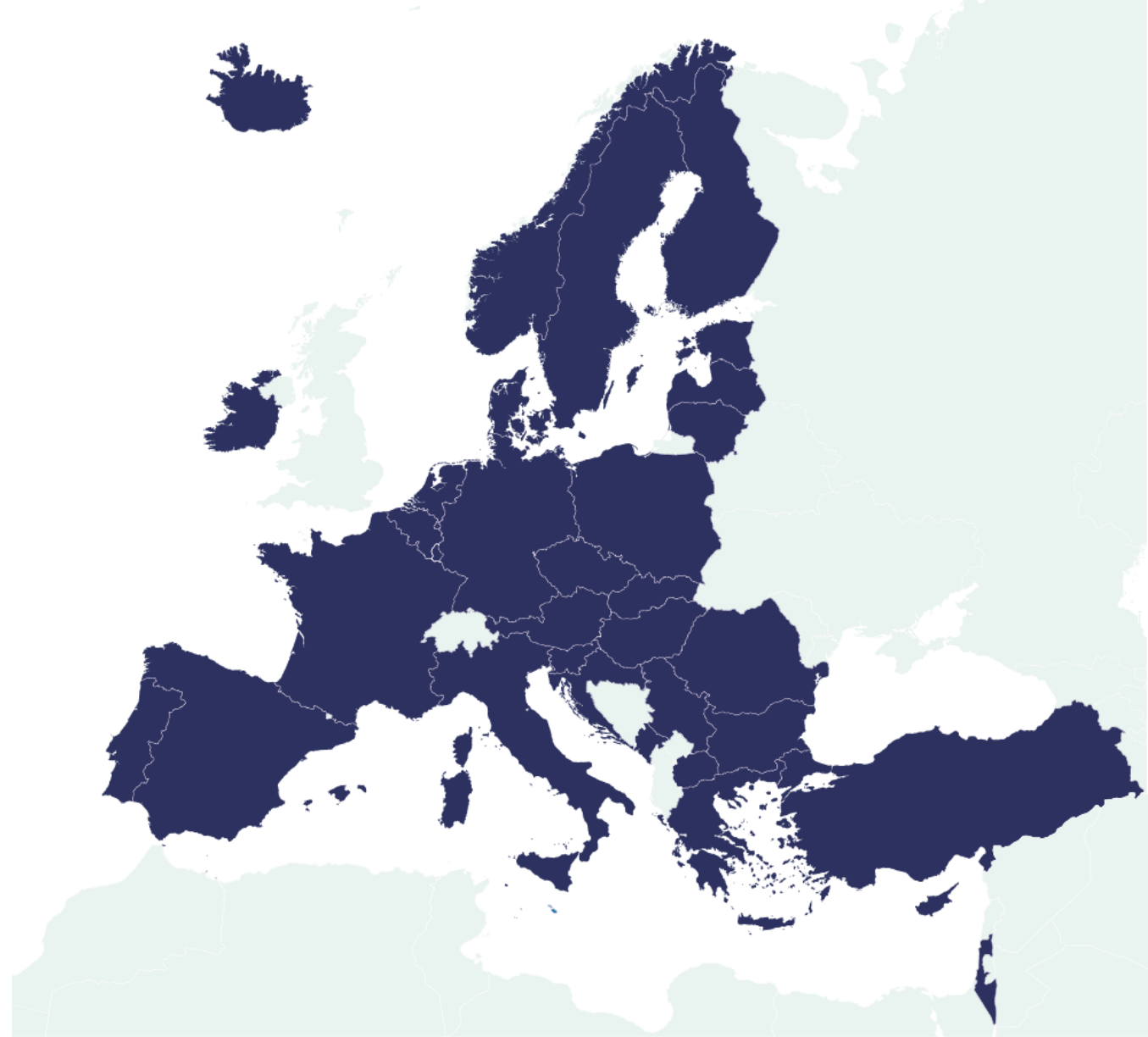The EuroHPC JU pools together the resources of its members to:

➢ 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)

BDV BIG DATA VALUE ASSOCIATION

QuIC European Quantum Industry Consortium

ETP 4 HPC — EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING

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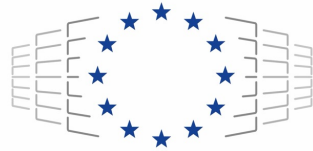
JUNE 2022	TOP500	Green500
LUMI	#3	#7
LEONARDO	#4	#15
MELUXINA	#57	# 26
KAROLINA	#95	#24
DISCOVERER	#134	#219
VEGA	#166	#255

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

- ❑ 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

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
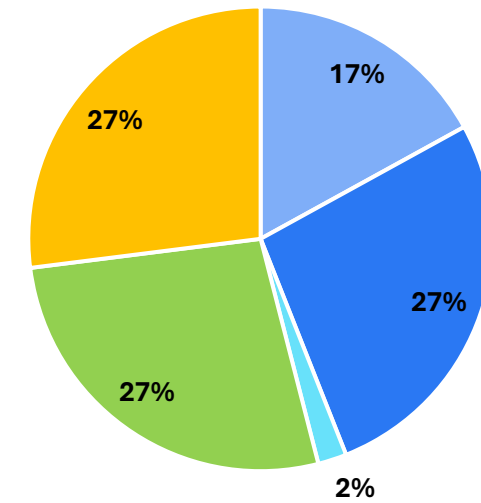(across all cut-offs, up to March 23)

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)

17%
27%
27%
2%
27%

- 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
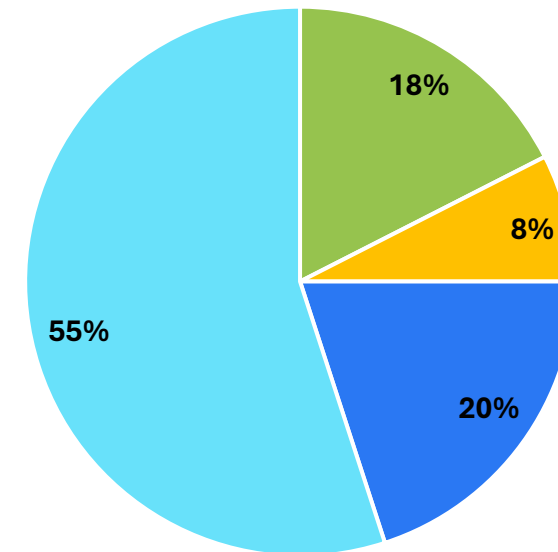- Engineering, Mathematics and Computer Sciences

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

Access to EuroHPC: Belgium

LUMI : National share is 50% of the compute time on LUMI will be distributed via EuroHPC calls. The other 50% is distributed among the participating countries according to their contributions to the consortium.

Belgium as the second largest participant will get 7.4% of the total compute time on LUMI for its own allocation programs.

Projects that got access via EuroHPC:

- Regular Access (up to March 2023 cut-off):
  - o No of awarded projects – 3
  - o No of submitted projects – 5
  - o Computing time granted – 138,000,000 core hours / 1,078,125 node hours

| Regular Access - BE		
System	Core hours	Node hours
Vega CPU	39,000,000	304,688
Discoverer CPU	55,000,000	429,688
LUMI-C	44,000,000	343,750
Total	138,000,000	1,078,125

- Extreme Scale Access (up to May 2023 cut-off):
  - o No of awarded projects – 1
  - o No of submitted projects – 1
  - o Computing time granted – 80,000,000 core hours / 625,000 node hours

Extreme Scale Access - BE		
System	Core hours	Node hours
LUMI-C	80,000,000	625,000

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
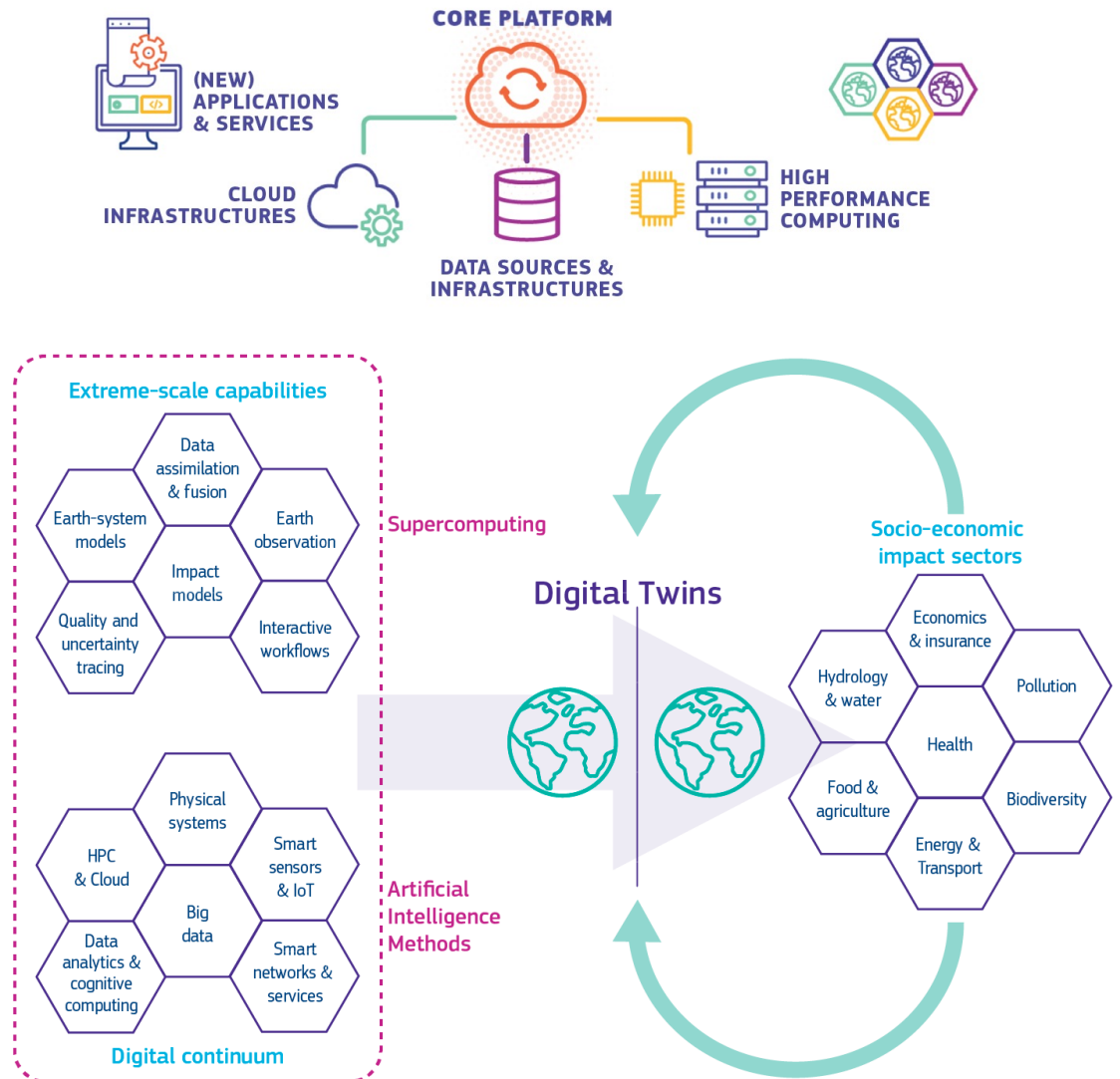
RESEARCH & INNOVATION

- 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
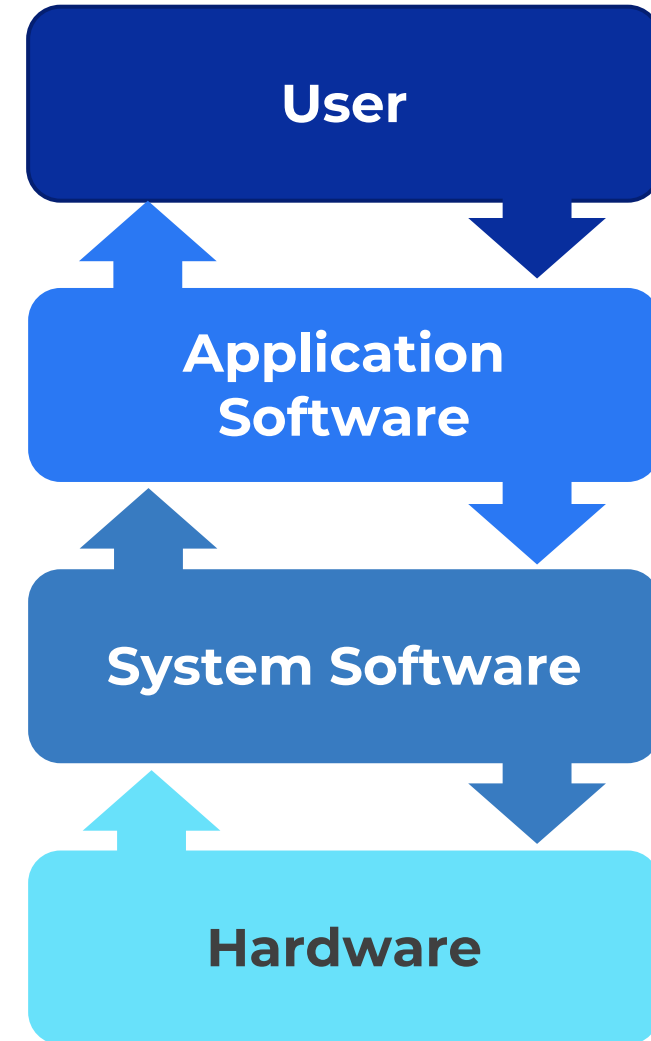
COMING SOON: VIRTUAL HPC ACADEMY

✓ 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
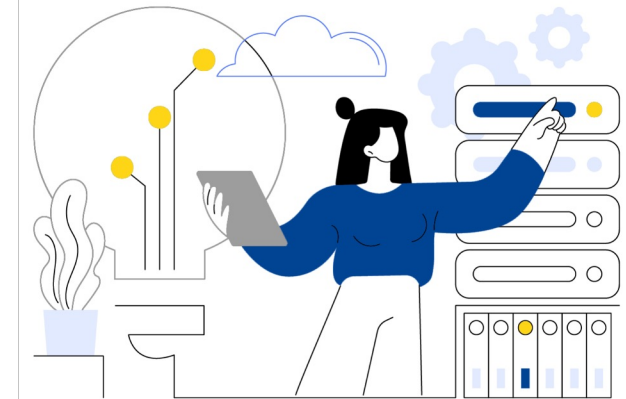
WHAT'S COMING NEXT?
EuroHPC Work Programme 2024

INFRASTRUCTURE

- Procurement of the second exascale hosted by the Jules Vernes consortium
- Call to select a hosting entity and industrial consortium for an indurtrial 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
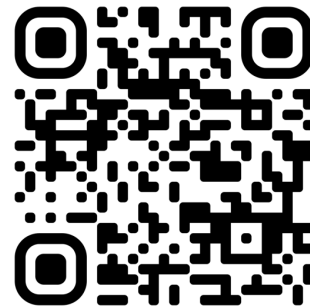
THANK YOU

EuroHPC Joint Undertaking

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

eurohpc-ju.europa.eu

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