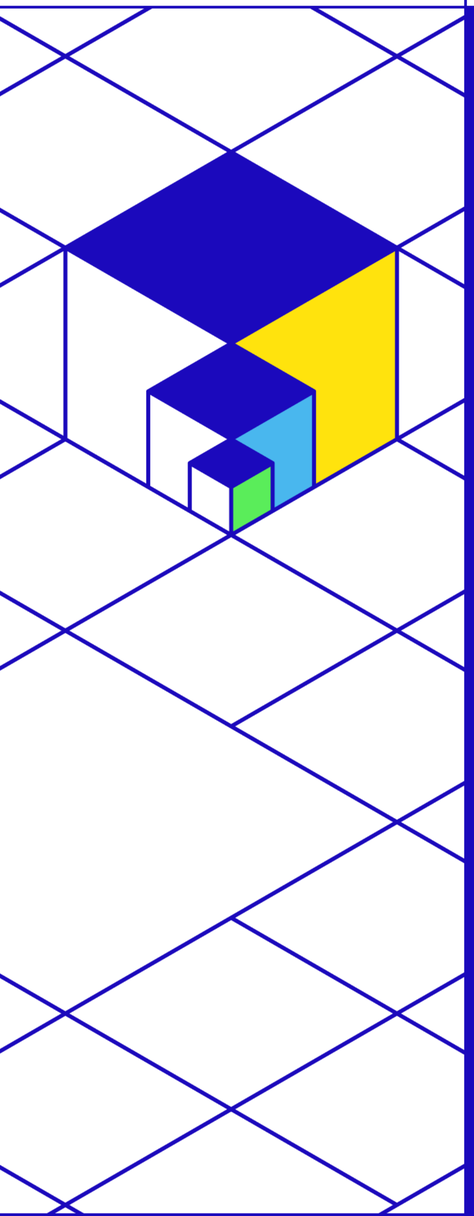
EuroHPC Summit

2023 Göteborg



THE EUROPEAN HIGH PERFORMANCE COMPUTING JOINT UNDERTAKING

Leading the Way in European Supercomputing

Anders Dam Jensen – Executive Director

EuroHPC Joint Undertaking

WHO ARE WE?

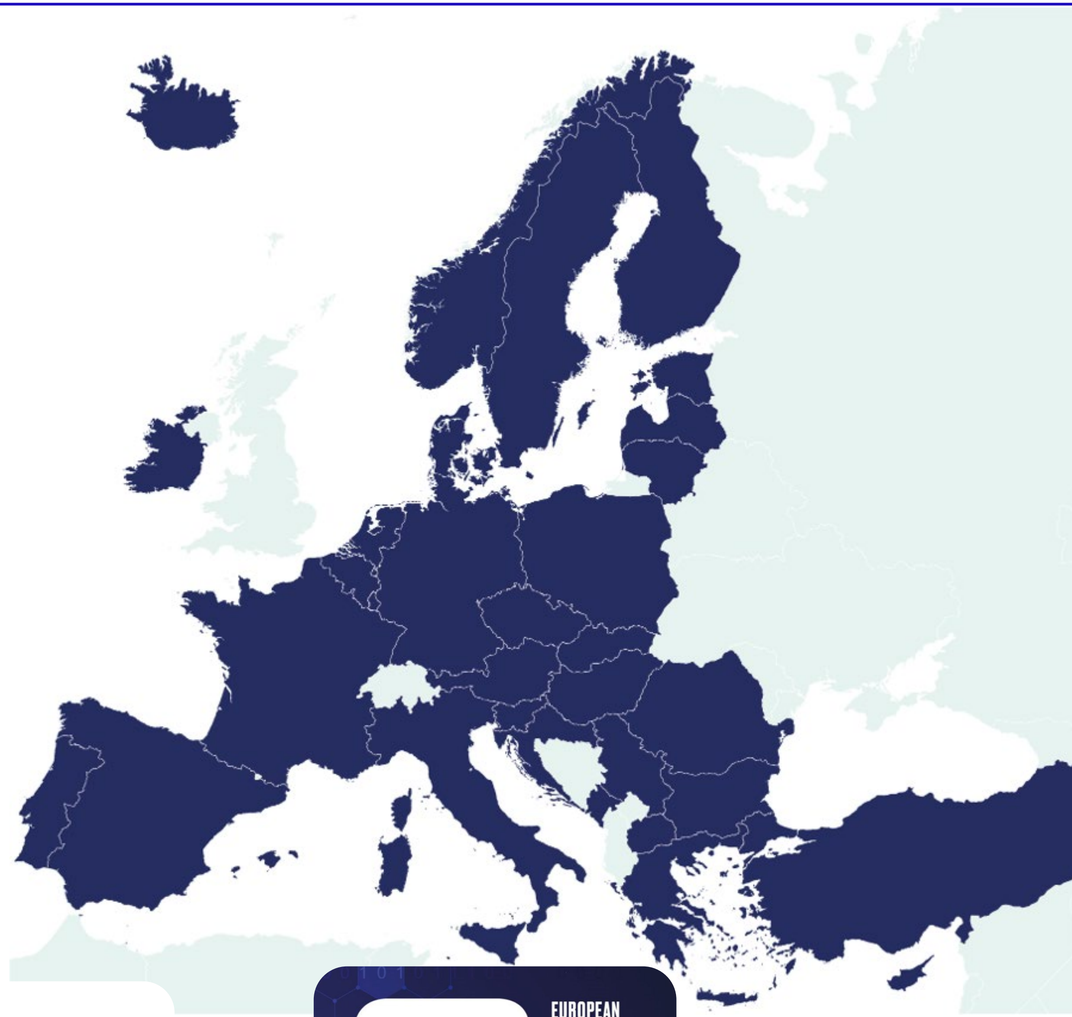
- A legal and funding entity (Art 187 of the Treaty on the Functioning of the European Union -TFEU)
- Created in 2018 and autonomous since September 2020
- Based in Luxembourg
- A team of 30 employees, still in the process of recruiting additional employees throughout 2023

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.

OUR MEMBERS

- 33 participating countries
- The European Union (represented by the European Commission)
- 3 private partners



BDV BIG DATA VALUE ASSOCIATION

QIC 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

EUROHPC JU 2022 ACTIONS IN NUMBERS

- **9** Governing Board meetings in 2022
- **9** Research & Innovation calls launched since January 2022
- **13** new R&I projects launched since January 2022
- **4** calls for expression of interest to host new supercomputers launched in 2022
- **2** hosting agreements to host 2 new EuroHPC supercomputers signed in 2022
- **2** new EuroHPC supercomputers inaugurated in 2022: LUMI and Leonardo
- **2** EuroHPC supercomputers in the global top 5 (Top500 list- Nov 2022): LUMI and Leonardo
- **4** EuroHPC supercomputers in the global top 25 greenest supercomputers (Green500 list- Nov 2022): LUMI, Leonardo, Karolina & Meluxina
- **6** hosting entities selected to host EuroHPC quantum computers

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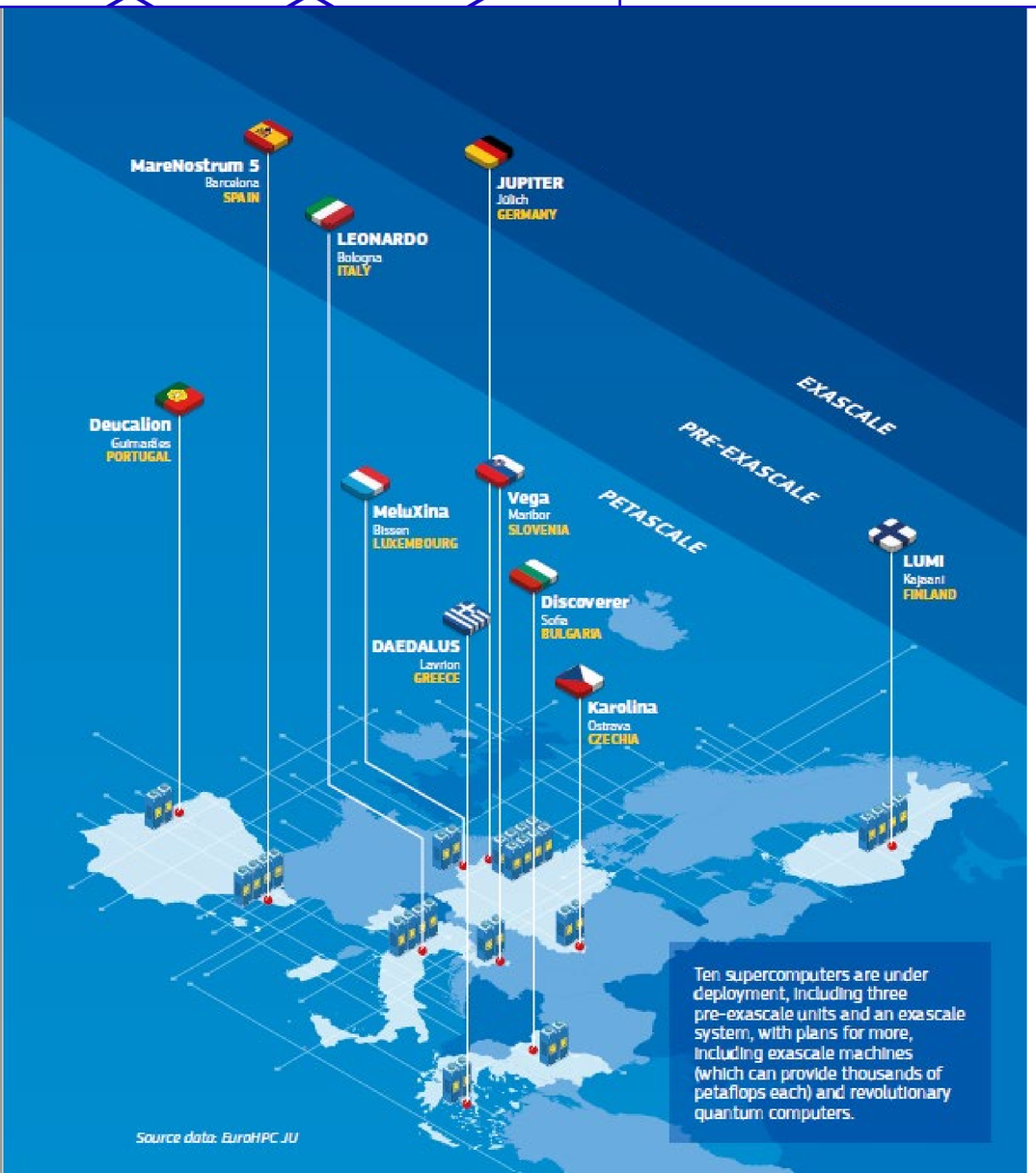
INFRASTRUCTURE

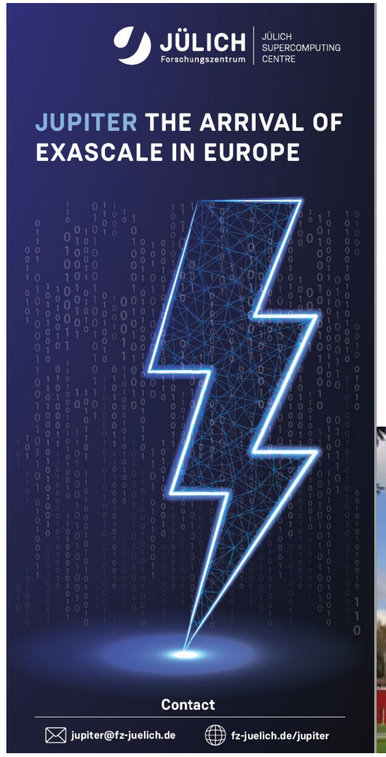
EuroHPC
Joint Undertaking

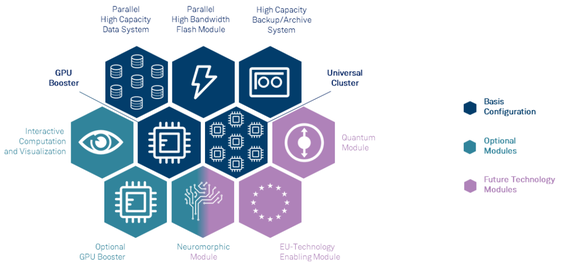


- **6 operational EuroHPC systems,** all ranking among the world's most powerful supercomputers, in:
  - Slovenia
  - Luxembourg
  - Czechia
  - Bulgaria
  - Finland
  - Italy

- **4 EuroHPC systems are underway** in:
  - Spain
  - Portugal
  - Germany
  - Greece

COMING SOON: JUPITER, THE FIRST EUROPEAN EXASCALE





- The 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
- Call for tender closed 17/02/2023 and is currently under evaluation
- Will be installed on the campus of Forschungszentrum Julich in 2023 and operated by the Jülich Supercomputing Centre

EUROHPC AND QUANTUM

HPCQS

- The first EuroHPC initiative exploring quantum computing
- Launched in 2021 and running for 4 years
- HPCQS aims to integrate 2 quantum simulators, each controlling about 100+ qubits, into :
  - **Joliot Curie** (France)
  - **JUWELS** (Germany)
- French startup PASQAL will provide 2 Fresnel analog quantum simulators
- Incubator for **quantum-HPC hybrid computing**, unique in the world

PROCUREMENT OF QUANTUM COMPUTERS

- In October 2022, 6 sites were selected host and operate the first European quantum computers
- The selection includes IT4Innovations in Ostrava, CZ to host & operate LUMI-Q
- A diversity of quantum technologies and architectures is represented in this selection, giving European users access to many different quantum technologies

NOVEMBER 2022 TOP 500 LIST

- **LEONARDO** entered the ranking at 4th place
- **LUMI** retained its 3rd place ranking
- All operational EuroHPC supercomputers ranked among the 140 most powerful in the world
- **LUMI, Leonardo, Karolina** & **MeluXina** ranked among the top 25 greenest supercomputers in the world

NOVEMBER 2022	TOP 500	GREEN 500
LUMI	#3	#7
Leonardo	#4	#14
MELUXINA	#52	#22
KAROLINA	#85	#20
DISCOVERER	#123	#247
VEGA	#140	#288

FREE ACCESS TO 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 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: https://eurohpc-ju.europa.eu/participate/calls_en

ACCESS TO EUROHPC SUPERCOMPUTERS IN NUMBERS

CORE HOURS AWARDED FOR REGULAR ACCESS

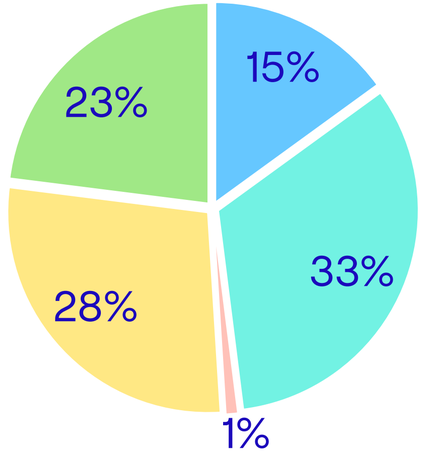
VEGA	383,379,687
KAROLINA	140,900,667
DISCOVERER	151,310,720
MELUXINA	121,207,896
LUMI (CPU only)	765,204,976

Total core hours awarded across all systems:
1,562,003,946

Regular access time is currently being provided to the following fields of research:

- 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

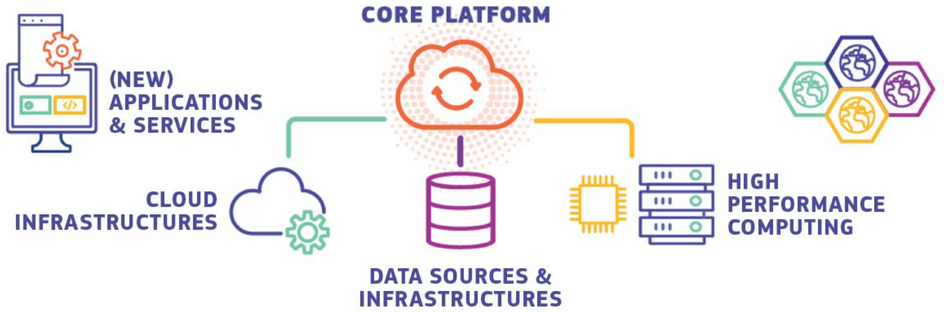
Research domains distribution across all cut-offs

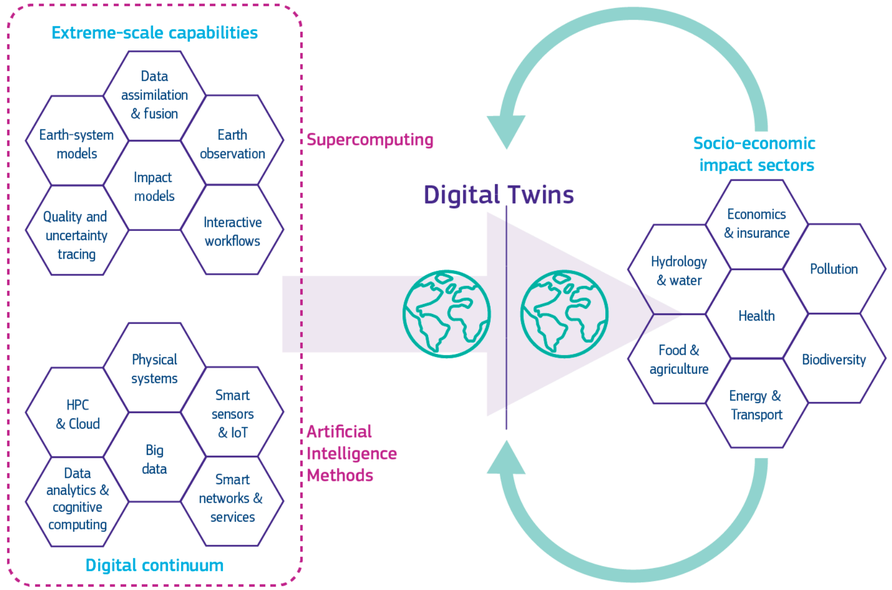


SPECIAL ACCESS – DESTINATION EARTH

- 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

Session on Digital Twins today, 16h30 Drottningporten





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RESEARCH & INNOVATION

EuroHPC
Joint Undertaking

- The EuroHPC JU **R&I** activities aim to develop a **full European supercomputing ecosystem** to reduce Europe's dependency on foreign manufacturers.

- Currently **39** ongoing 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

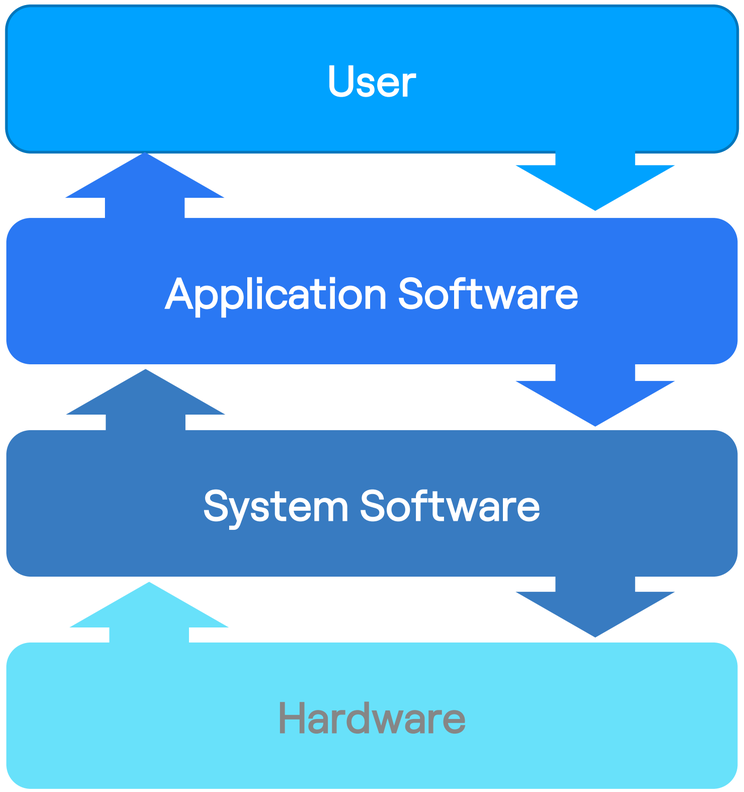
Centres of Excellence for HPC Applications and new algorithms for European exascale technology

❑ 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



SOME PROJECT HIGHLIGHTS

FF4EUROHPC

- Connecting SMEs across Europe with HPC tech
- Second round of experiments have concluded
- A number of Success Stories have come out of the experiments of European SMEs using HPC to improve accuracy and efficiency in their processes
- E.g. A Serbian/Irish SME had access to AI/ML to improve their monitoring of poultry farm to improve boost productivity and animal wellbeing

EUMASTER4HPC

- First cohort are in their second semester of study
- Students from the first cohort have joined us as HPC Ambassadors
- Applications for the second cohort starting Sept 2024 are currently open

EUROCC 2 & CASTIEL 2 – NCCs and CoEs

- Have secured second round of funding for 3 years
- Ensure cooperation and consistent skill levels across Europe
- 32 NCCs and 10 CoEs across Europe

APPLICATION-BASED PROJECTS

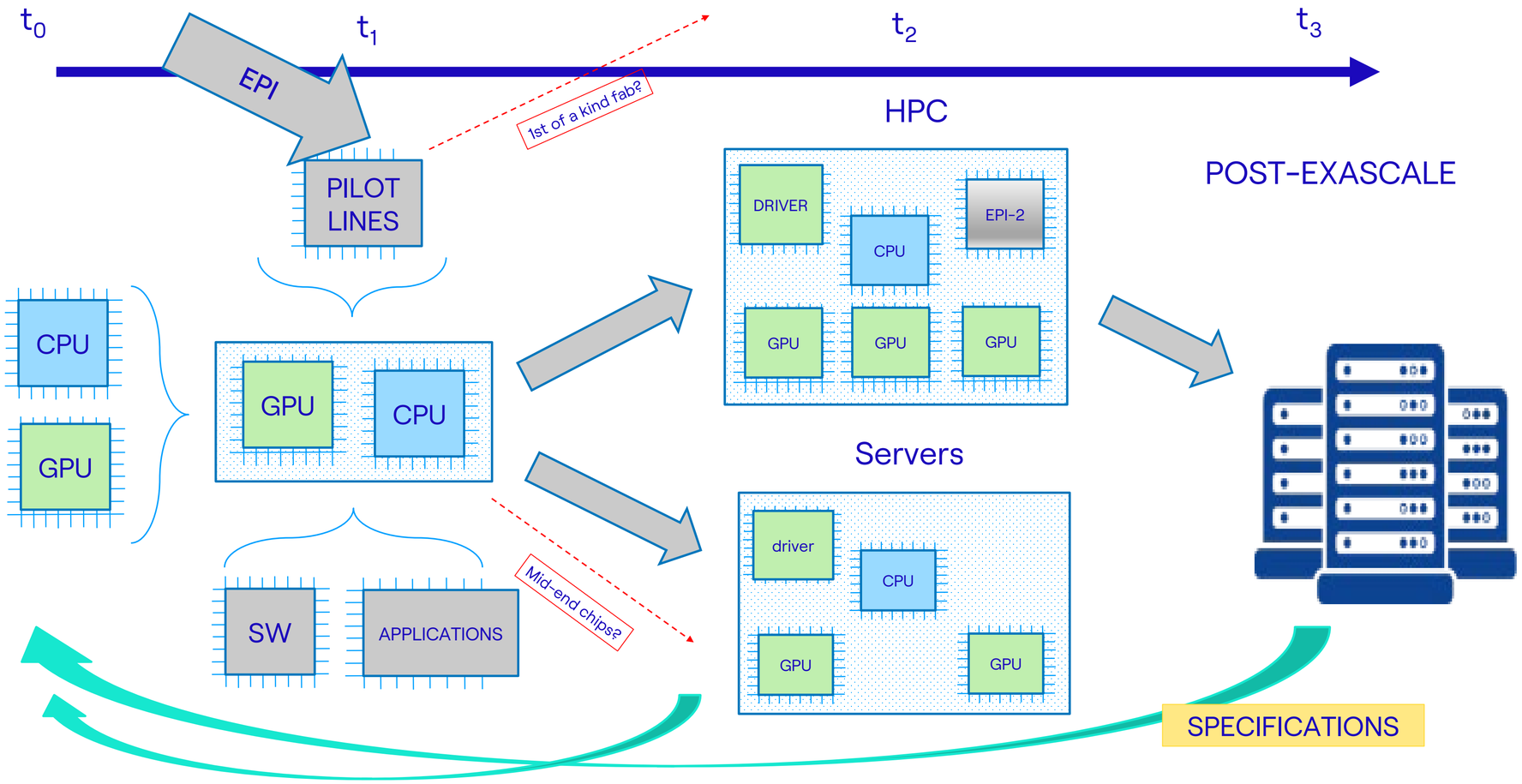
- **NextSim**: Supporting aerospace engineering by increasing the capabilities of current CFD tools for aeronautical design
- **Ligate**: Improving the drug design process with higher speed and accuracy, combining exascale capability, machine learning, extreme scale computer simulations & big data analytics,
- **Microcard**: Supporting disease modelling by using HPC to simulate the electrical behaviour of the heart

EUROPEAN PROCESSOR INITIATIVE 2

- Second phase of EPI
- Aim of developing a competitive European microprocessor and accelerator
- Involvement in the EuroHPC RISC-V initiative

OPEN RISC-V INITIATIVE

- Contribute to the development of an EU Open-RISC-V ecosystem
- Focus on high-end (HPC) Open-RISC-V pillar
- Correspondence with CHIPS Act objectives
- Complementarity/synergies with KDT/Chips JU



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WHAT NEXT FOR THE JU?

EuroHPC
Joint Undertaking

WHAT'S NEXT FOR THE EUROHPC JU?

The JU has launched a number of calls for upcoming initiatives:

- EU–JAPAN partnership in HPC
- Initiative for an HPC ecosystem based on RISC-V
- Call for CoEs for exascale applications
- Training activities

Upcoming EuroHPC infrastructure:

- Two recent calls for new mid-range and high-end supercomputers
- Ongoing procurement processes
- Upcoming quantum computers
- Hyperconnectivity and user requirements studies

Building up the EuroHPC user forum

- Establish effective feedback mechanisms between JU and users
- Support a demand-oriented and user-driven HPC ecosystem
- Ensure user requirements are met by EuroHPC infrastructure
- Include new and underrepresented user communities to address their requirements and support HPC uptake

EuroHPC Summit

2023 Göteborg

THANK YOU!

Keep up to date with all EuroHPC JU news!

https://eurohpc-ju.europa.eu

@EuroHPC_JU

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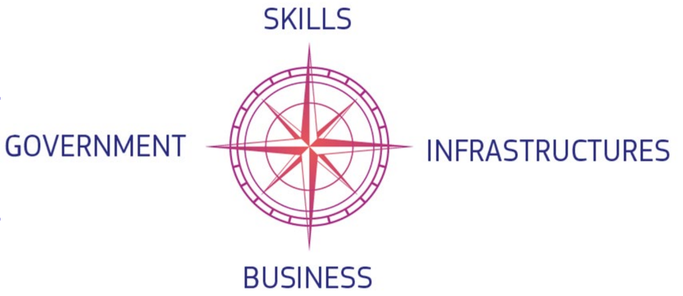
THE EUROPEAN HIGH PERFORMANCE COMPUTING JOINT UNDERTAKING

Next Challenges for the EuroHPC JU:

What's Next in R&I?

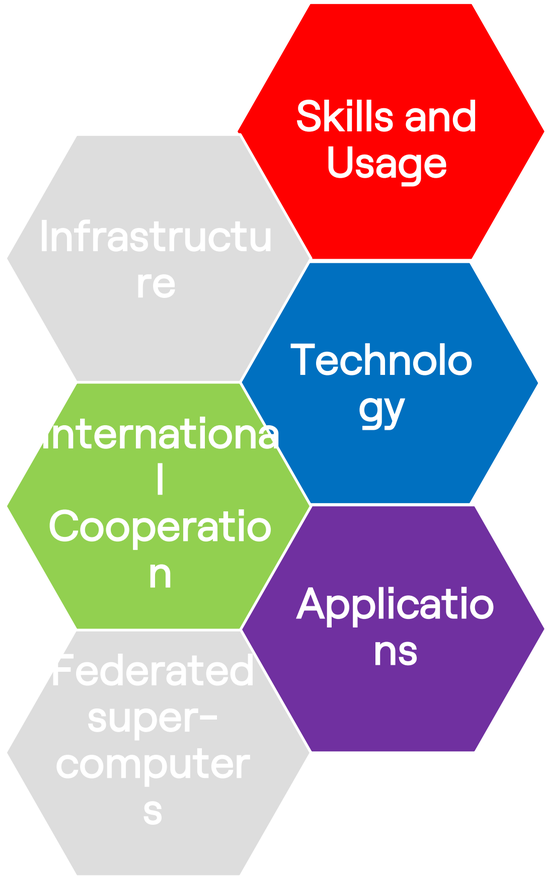
Daniel Opalka – Head of Sector, Research & Innovation

EuroHPC Joint Undertaking



2030 Digital Compass: the European way for the Digital Decade

EUROHPC JU MISSION[1] AND RESEARCH & INNOVATION PILLARS OF ACTIVITY



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**

[1]http://data.europa.eu/eli/reg/2021/1173/oj

EUROHPC JU FUNDING FOR RESEARCH & INNOVATION

Digital Europe
1.98 B€
- Infrastructure
- Federation of HPC services
- Widening usage and skil

Horizon Europe
900 M€
- Technology
- Applications
- International cooperation

Connecting Europe Facility
200 M€
- Hyperconnectivity
- Data connectivity

EuroHPC Joint Undertaking

Total budget
1.5 B€ in 2019-2020

350 M€ in 2019-2020
≈ 2 B€ in 2021-

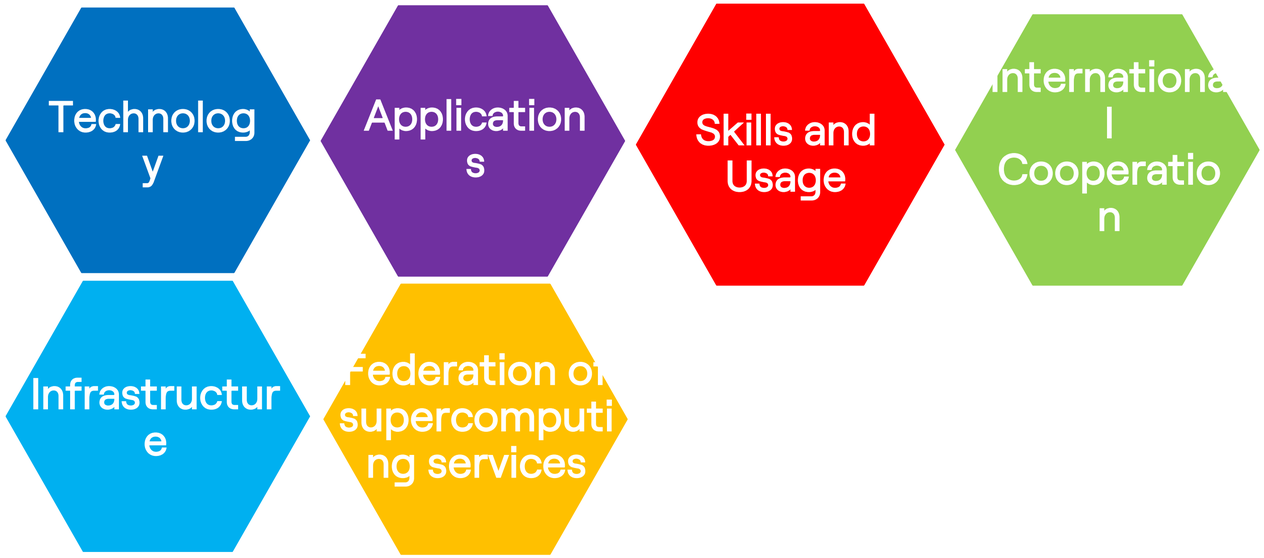
BDV BIG DATA VALUE ASSOCIATION
EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING
ETP 4 HPC
QuIC European Quantum Industry Consortium

900 M€ in-kind contributions from Private Members

3 B€ from Participating States

FINANCIAL INSTRUMENTS

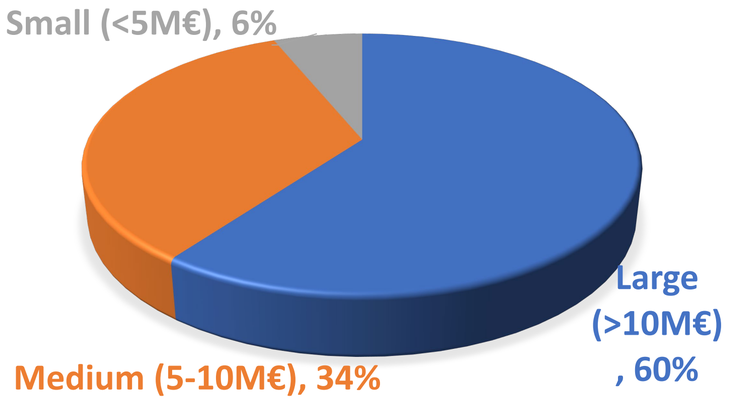
- **Grants**
  - Calls for Proposals
  - Synergy grants
- **Procurements**
  - Calls for Tender
  - Co-financing through ESIF, RRF



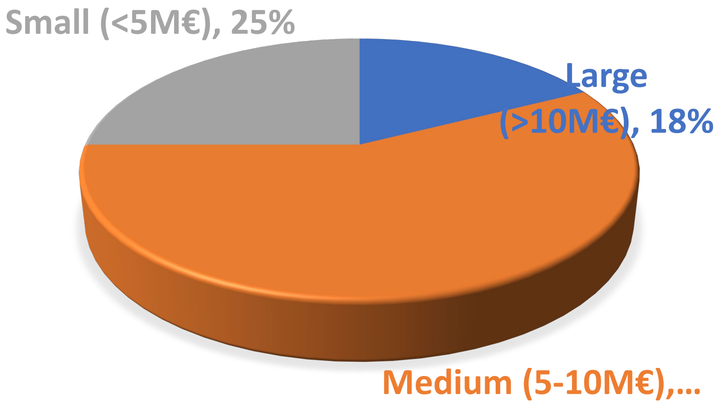
- **Equity & debt financing**
  - Not provided by the JU but could be used in combination with grants and procurements
  - The European Innovation Council offers equity, also blended with grants (SMEs)
  - The European Investment Bank offers loans

R&I ACTIVITIES IN NUMBERS

Grant Budget
(>490M € total)



No of Grants
(40 actions funded)



EuroHPC JU pools European resources to fund large strategic projects

- HPC hardware including advanced processors, accelerators, high-speed interconnect
- Software stack including programming models, resource management software, HPC services
- Applications for R&I covering many scientific domains and topics, engineering
- Skills, usage and HPC adoption supported by a pan-European network of Competence Centres

EUROHPC R&I: TECHNOLOGY FOR HPC

Towards an Autonomous European HPC Supply Chain: Showcasing EuroHPC Projects

Wed, 22/03/2023, 16:30-18:00h
Brevsorterarsalen 3
Parallel Session 01

European Processor Initiative

- A cornerstone of th European initiative towards **strategic autonomy in HPC & chip technologies**.
- General-Purpose Processor (GPP) & proof-of-concept implementation of European accelerator technology.
- Developing industrialisation & commercialisation paths.

THE EUPILOT

- Demonstrating a European accelerator, designed in Europe
- Based on the RISC-V instruction set architecture
- Integrating accelerators into a pilot HPC system with liquid immersion cooling technologies.

EUPEX
European Pilot for Exascale

- Integrate GPP and other technologies from EU funded projects
- Provide early access to European HPC technology for the exascale era

EUROHPC R&I: TECHNOLOGY FOR HPC

Framework Partnership Agreement for developing a large-scale European initiative for HPC ecosystem based on RISC-V

- Strategic R&I roadmap to design and deliver energy efficient HPC technology
- Strong participation of the European HPC and server/cloud supplier industry
- Deliver at least one pilot integrating the developed components

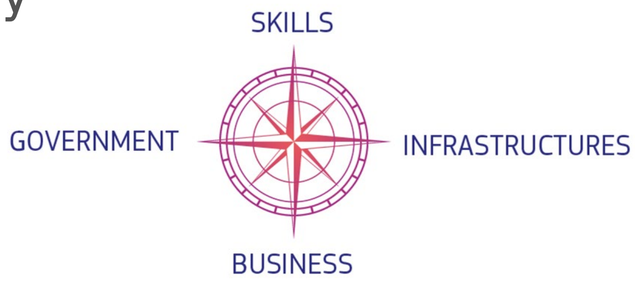
2019	2023	2030(?)
EuroHPC Petascale and Pre-exascale Supercomputers *Procurement of off-the-shelf technology available on the market*	EuroHPC Exascale Supercomputers *Integration of European technology*	EuroHPC Post-exascale Supercomputers *Significant parts developed in European R&I initiatives and produced in Europe*

THE EUPILOT

EUPEX European Pilot for Exascale

European Processor Initiative epi

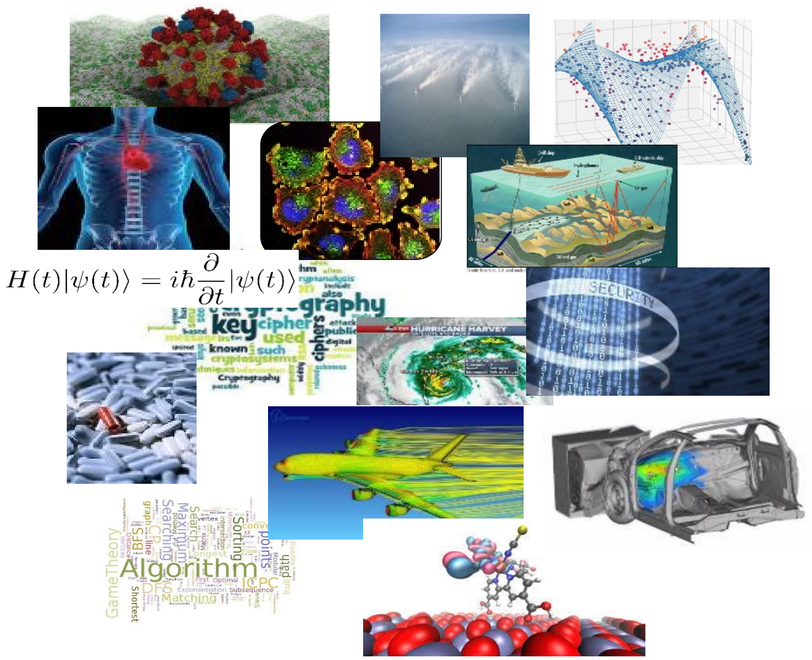
RISC-V Pilot(s)



„It is our proposed level of ambition that by 2030

The production of cutting-edge and sustainable semiconductors in Europe including processors is at least 20% of world production in value (meaning manufacturing capacities below 5nm nodes aiming at 2nm and 10 times more energy efficient than today)“

APPLICATIONS



OPEN CALL

HORIZON-EUROHPC-JU-2023-COE-01
Call on Centres Of Excellence For Exascale HPC Applications
Closing date: 08/06/2023

Centres of Excellence for HPC Applications

Project launch: 01/01/2023

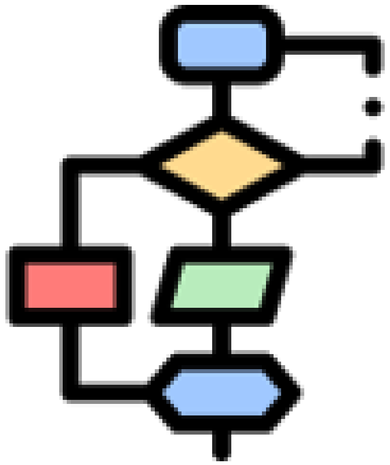
MaX	Materials / Quantum Chemistry
SPACE	Astrophysics & Cosmology
Plasma-PEPSC	Plasma science
CEEC	Engineering, Aeronautics
ChEESE-2p	Earth Sciences
BioExcel-3	Bioinformatics, biomolecular
EXCELLERAT P2	Multidomain engineering
ESiWACE3	Meteorology and Climate change
HiDALGO2	Multidomain environmental challenges
MultiXscale	Tools for performance, productivity

Open Workshop:
Centres of Excellence & Competence Centres

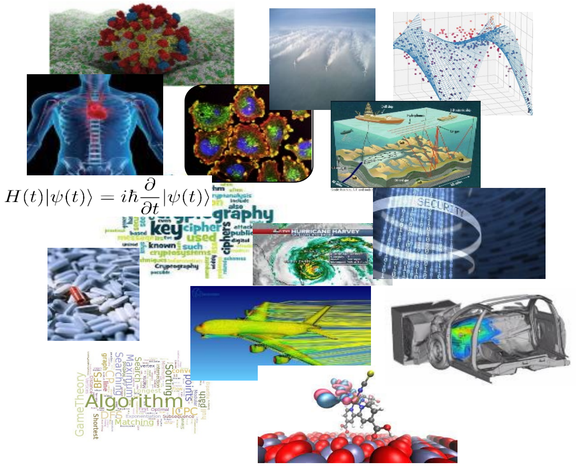
Thu, 23/03/2023, 10:30-13:00h
Brevsorterarsalen 3

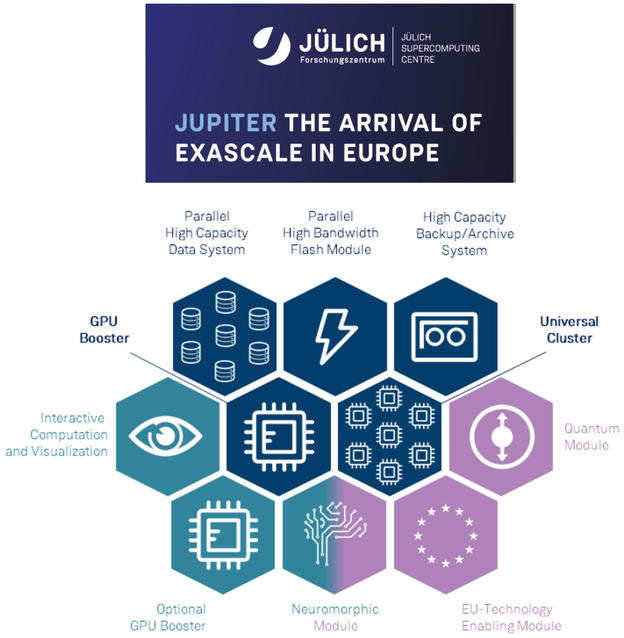
APPLICATIONS

INNOVATIVE ALGORITHMS FOR APPLICATIONS ON EUROPEAN EXASCALE SUPERCOMPUTERS



INNO4 SCALE





New algorithms for applications on European exascale supercomputers

- Cascaded grant – selected consortium will provide small grants for algorithm develop
- Bottom-up: open topic, focus on impact

Open call for proposals for proof-of-concept implementations of new algorithms expected in 2023

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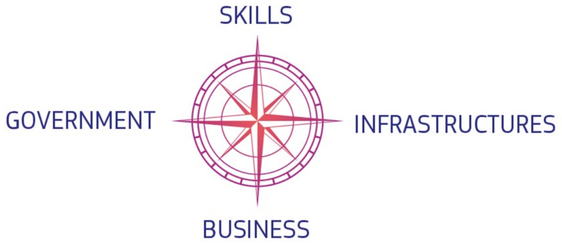
EUROHPC QUANTUM COMPUTER



„It is our proposed level of ambition that

By 2025, Europe will have its first computer with quantum acceleration paving the way for Europe to be at the cutting edge of quantum capabilities by 2030.“

Advances in Quantum Computing in Europe: Showcasing EuroHPC Projects

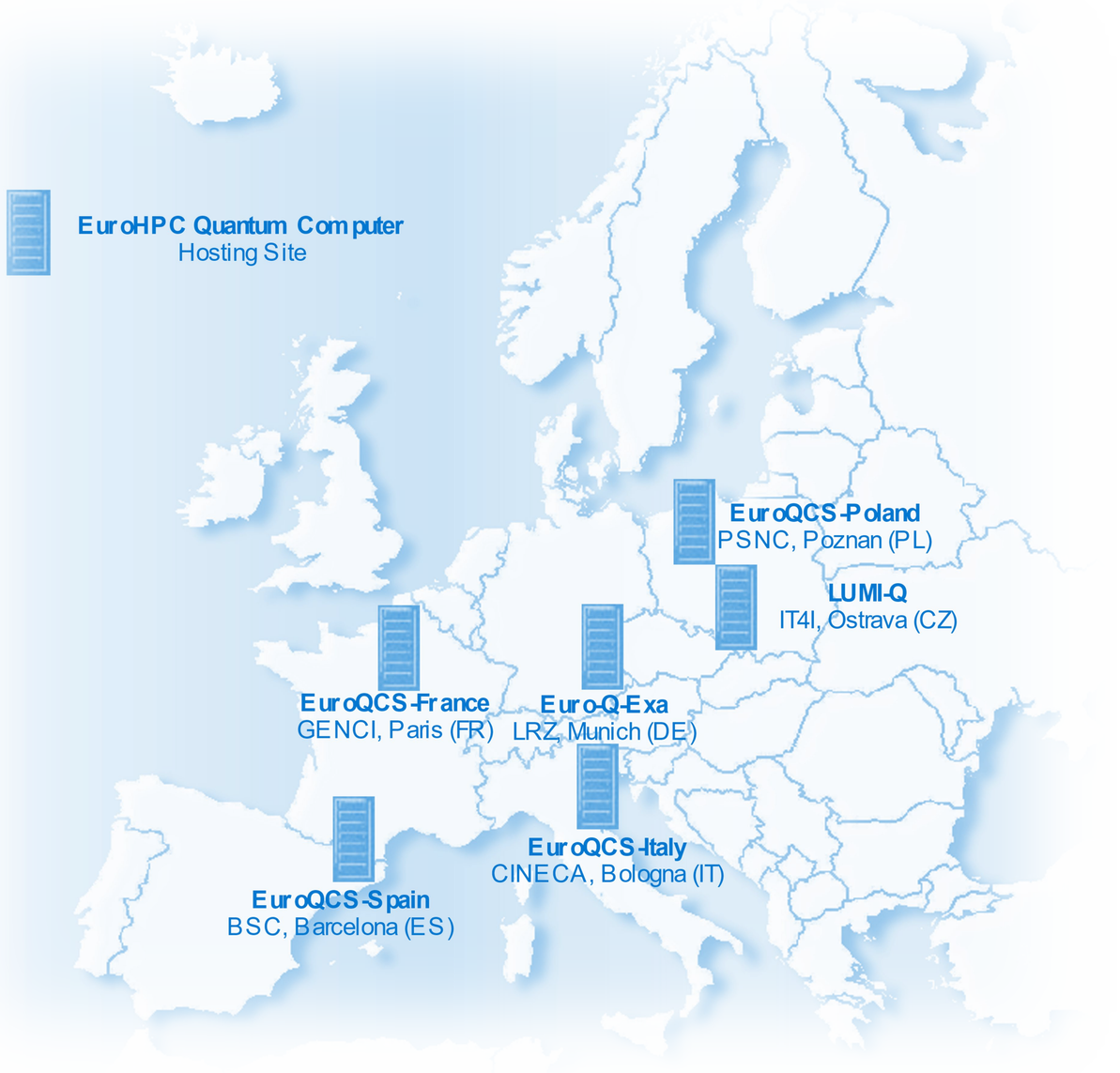
Wed, 22/03/2023, 16:30-18:00h
Drottningporten
Parallel Session 02

⟨HPC|QS⟩

- **quantum simulators**, each controlling about 100+ qubits in :
  - the GENCI supercomputer Joliot Curie (France);
  - the JSC supercomputer JUWELS (Germany).

- Incubator for **quantum-HPC hybrid computing**.
- Enabling research entities & industries to exploit new quantum technologies and find solutions to complex challenges in many areas.

EUROHPC QUANTUM COMPUTER



Selected Hosting Entities/Consortia

- Euro-Q-Exa (DE)
- EuroQCS-Spain (ES)
- LUMI-Q (CZ)
- EuroQCS-Italy (IT)
- EUROQCS-POLAND (PL)
- EuroQCS-France (FR)

- More than 100 M€ total investment
- 17 participating countries

+2 quantum simulators in Paris (FR) and Jülich (DE) in the HPCQS project

APPLICATIONS FOR QUANTUM COMPUTERS

EuroHPC Annual Work Programme 2023

European Quantum Excellence Centres for applications in science and industry

- Development of an ecosystem of quantum computing applications and software libraries, including the integration of quantum computing in existing HPC applications
- Discovery of new applications for quantum computers, fostering knowledge and uptake of new technologies
- Develop technology-agnostic applications for quantum computers with focus on end users

EuroHPC Inducement Prize for Quantum Computing and Simulation Applications

- Incentivise young researchers, inventors and entrepreneurs – two stage selection process:

1. Develop a reference implementation on an HPC system for the solution of a specific challenge
2. Solutions must be implemented on a quantum computer and quantum advantage must be independently validated/reproduced

Skills and Usage

Expertise and HPC resources

EURO

- European network of NCCs in 32 countries to **widen the use of HPC** in Europe.
- Support **SMEs, public services** and **private businesses**
- **Gateway for** users to access **European HPC** resources

Financial support for HPC uptake

- Boost **innovation** and **business opportunities for SMEs**
- **Solve business problems with HPC,** financial support and expertise from European HPC leaders

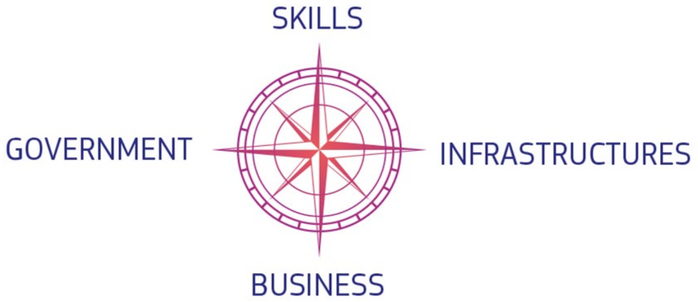
EuroHPC

Talent development

EUMaster4HPC

generation of HPC experts in Europe

- 1st **pan-European MSc** Programme in HPC including 19 countries
- **Connect academic education with HPC industry**



„ It is our proposed level of ambition that by 2030:

- *75% of European enterprises have taken up cloud computing services, big data and Artificial Intelligence*
- *More than 90% of European SMEs reach at least a basic level of digital intensity “*

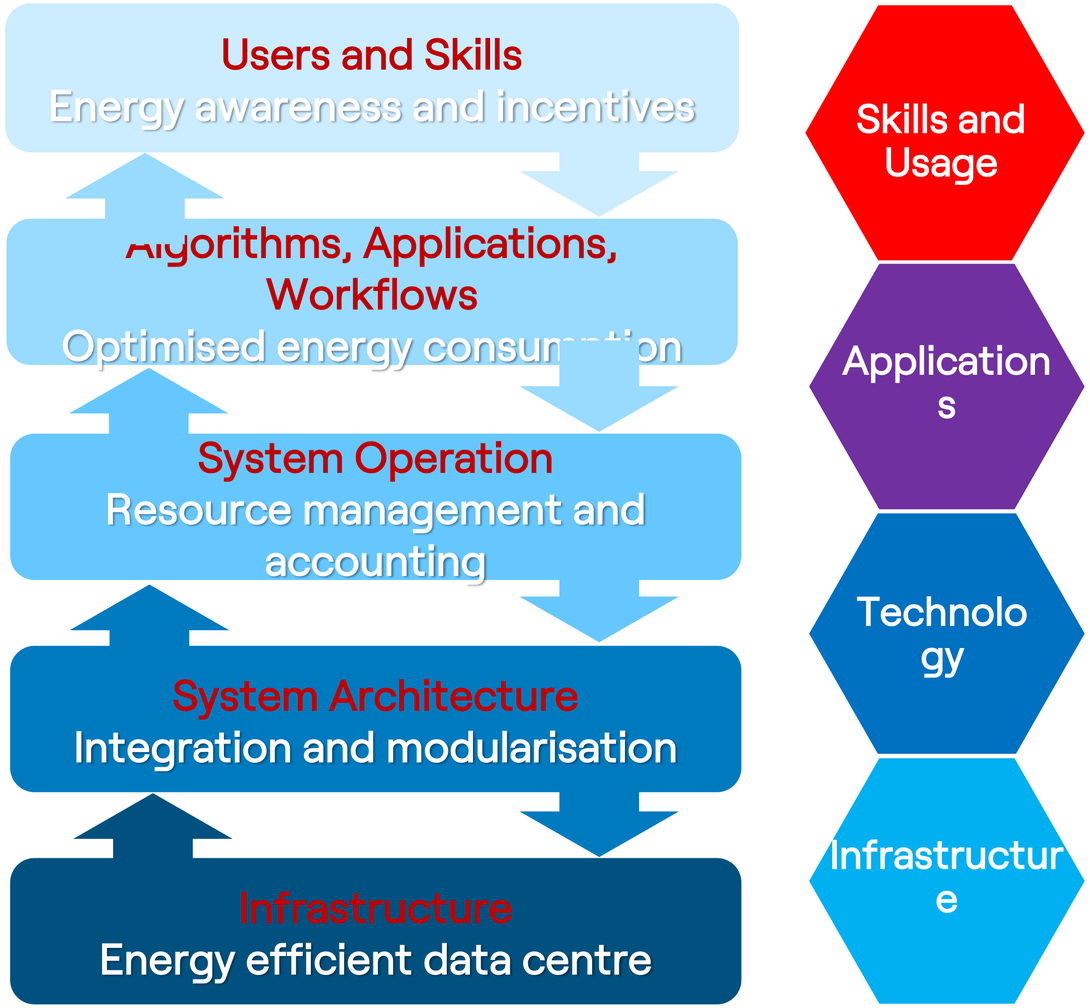
Education in HPC: A Lifelong Effort: Showcasing EuroHPC Projects
Wed, 22/03/2023, 16:30-18:00h
Brevsorterarsalen 2
Parallel Session 03

ENERGY EFFICIENT HPC

- Energy-to-solution: involves entire value chain from location of infrastructure to user skills
- Policies and performance metrics required
- R&I activities of JU address the ecosystem from HPC hardware to skills and usage
- Several actions on energy efficiency in EuroHPC JU

Scientific Developments in HPC & Energy Efficiency: Showcasing the Latest Scientific Innovation in HPC and Energy Technologies

Tue, 21/03/2023, 9:00-10:45h



INTERNATIONAL COOPERATION

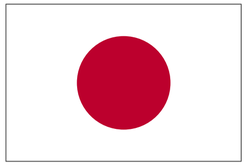
SKILLS
GOVERNMENT INFRASTRUCTURES
BUSINESS

International Partnerships for the Digital Decade

- International Cooperation on the basis of EU Digital Partnerships (existing EU Partnership Agreements with Japan, Korea, Singapore)
- Intent of Cooperation on High Performance Computing (HPC) with India on Weather Extremes & Climate Modeling and Quantum Technologies

Open Call: EU-Japan Partnership

Closing date: 4 April 2023



International Cooperation with Japan on identified priority domains

- Application development and co-design
- Reciprocal access to infrastructure

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Next Challenges for the EuroHPC JU

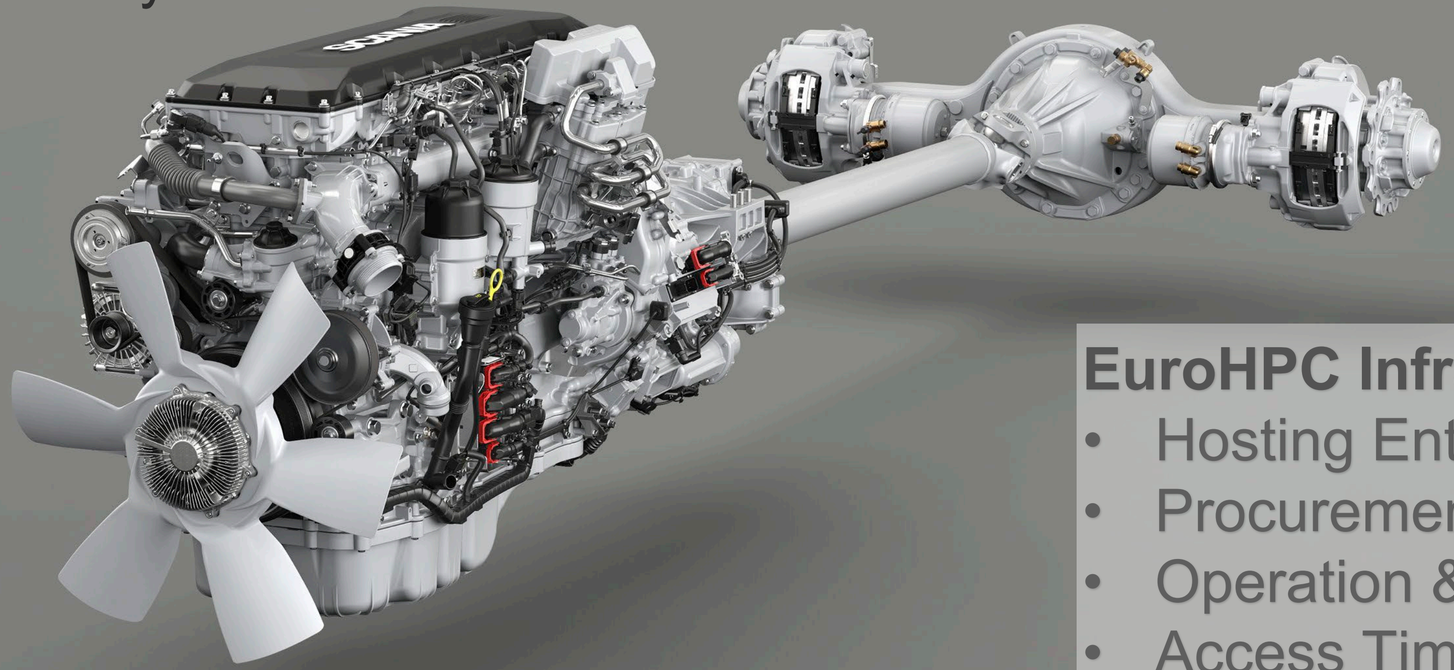
What’s next for the HPC Infrastructure

Vangelis Floros - 21 March 2023

Supercomputing Infrastructure

The powertrain of EuroHPC

- Empowering European Scientific Research, Academia, Industry & SMEs
- Accelerating discovery and innovation

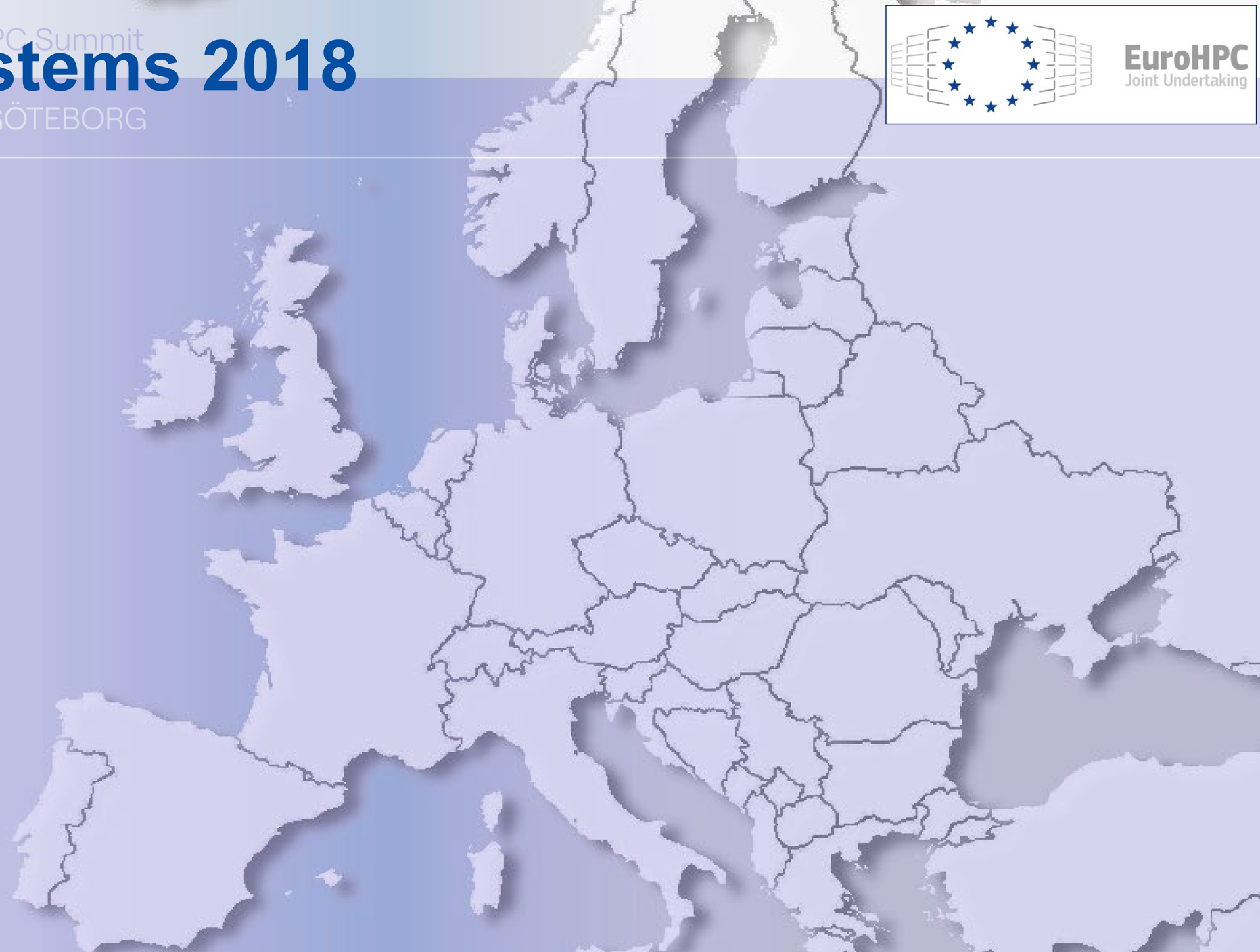


EuroHPC Infrastructure Pillar

- Hosting Entity Selection
- Procurements
- Operation & Monitoring
- Access Time allocation
- Hyperconnectivity
- Federation
- High-Level Application Support

EuroHPC systems 2018

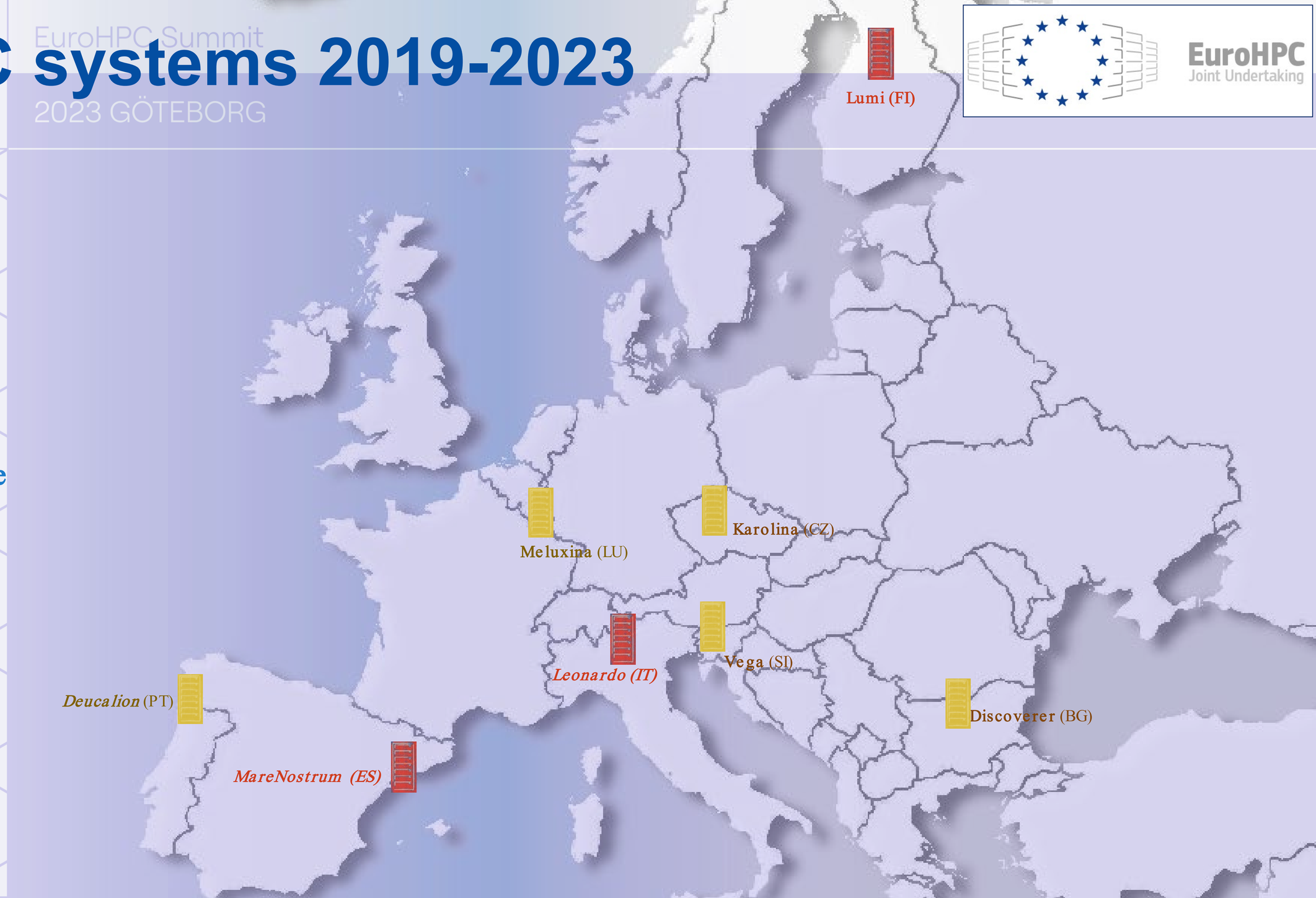
EuroHPC Summit
2023 GÖTEBORG



EuroHPC
Joint Undertaking

EuroHPC systems 2019-2023

EuroHPC
Joint Undertaking



Pre-exascale

Petascale

EuroHPC systems 2023-2025

Hyperconnectivity 2023 - …

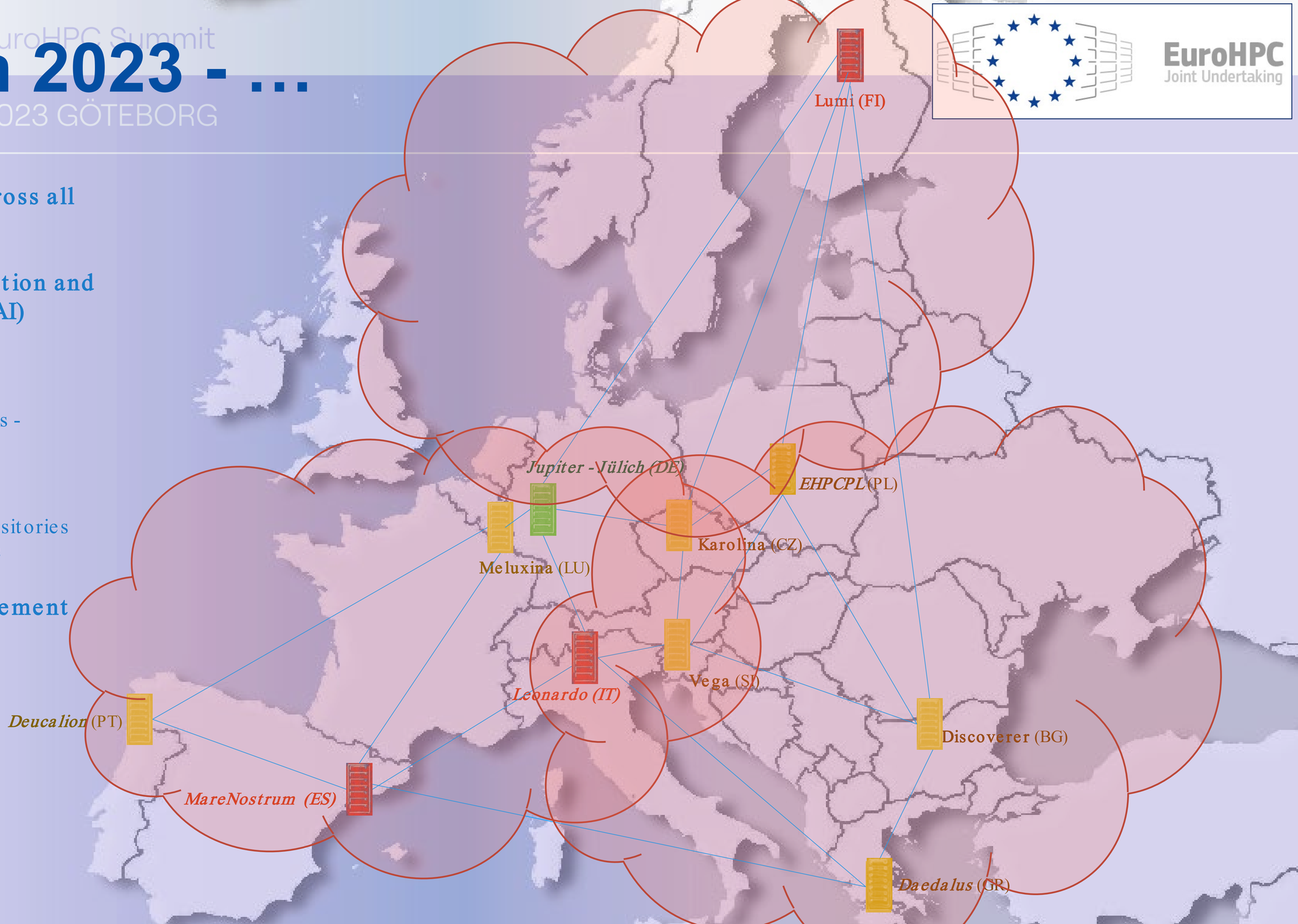
Study in Hyperconnectivity (2023)

- Survey the state of the art
- Understand current and future connectivity requirements
- Design a next generation HPC connectivity solution

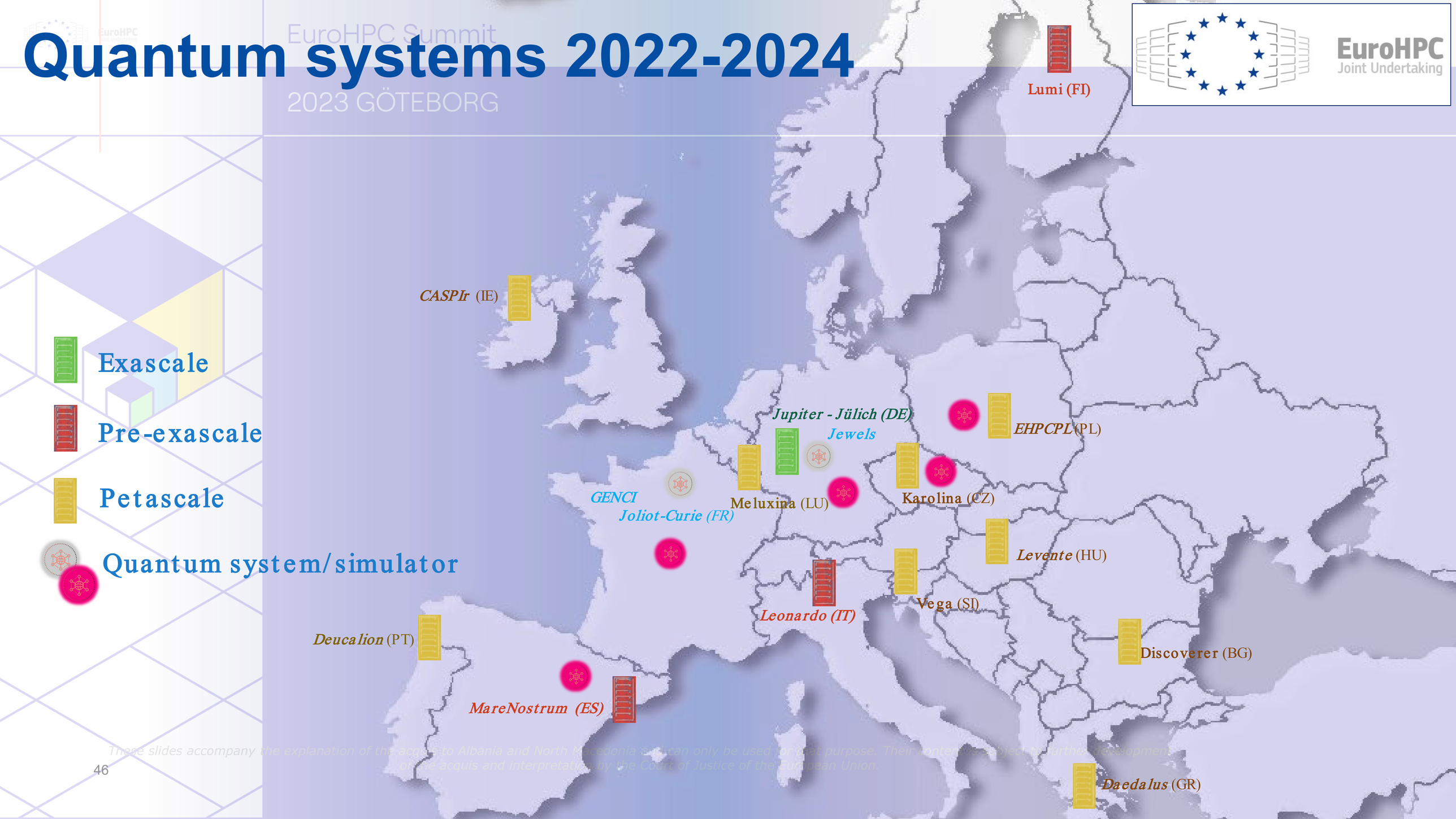
Federation 2023 - …

Federate HPC resources accross all EuroHPC systems

- **Authentication, Authorization and Identification services (AAI)**
- **Computing services**
  - Interactive Computing
  - Cloud access – Virtual Machines - Containers
- **Data services**
  - Archival Services and Data repositories
  - Data mover / transport services
- **User and Resource management**



Quantum systems 2022-2024



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EuroHPC Supercomputers

Pre-exascale systems (operational)

LUMI Consortium (Coordinator CSC)

Kayaani, Finland

Cray EX, Hewlett Packard Enterprise
#3 Top500 (Nov 2022): **309.1** PFlops (LUMI-G)

AMD platform
- CPU: 64-core next-generation AMD EPYC™
- GPU: AMD Instinct™ (MI250X),

Leonardo Consortium (Coordinator CINECA)

Bologna, Italy

Atos BullSequana XH2000
#4 Top500 (Nov 2022): **174.7** PFlops (BOOSTER)

Intel/NVidia platform
- CPU: Intel Sapphire Rapids
- GPU: Nvidia custom Ambere (A100)

EuroHPC Supercomputers

Petascale systems (operational)

Vega

Sustained performance:	**6,9 petaflops**
CPU:	AMD Epyc Rome
GPU:	Nvidia A100
TOP500 ranking:	#32 in EU; #106 globally (June 2021)
Vendor/model	Atos BullSequana XH2000
Operated by	IZUM, Maribor, Slovenia

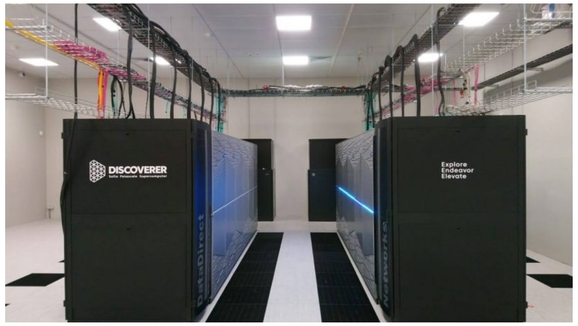
MeluXina

Sustained performance:	**12,8 petaflops**
CPU:	AMD Epyc Rome
GPU:	Nvidia A100
TOP500 ranking:	#10 in EU; #36 globally (June 2021)
Vendor/model	Atos BullSequana XH2000
Operated by	LuxProvide, Bissen, Luxembourg

Karolina

Sustained performance:	**9,13 petaflops**
CPU:	AMD Epyc Rome
GPU:	Nvidia A100
TOP500 ranking:	#20 in EU; #69 globally (June 2021)
Vendor/model	HPE Apollo 2000Gen10 Plus and Apollo 6500
Operated by	IT4I, Ostrava, Czech Republic

Discoverer



Sustained performance:	**4,45 petaflops**
CPU:	AMD Epyc Rome
GPU:	-
TOP500 ranking:	#27 in EU; #91 globally (June 2021)
Vendor/model	Atos BullSequana XH2000
Operated by	PSB consortium, Sofia, Bulgaria

Petascale systems in numbers

33.83 Petaflops sustained (47.19 Petaflops Rpeak)

- **11** partitions
- **3401** CPU Nodes
- **332** GPU Nodes
- FPGA, Visualisation and Cloud capabilities
- **24PB** Lustre Storage
- **6802** AMD EPYC Rome CPUs
- **1616** Nvidia A100 GPUs

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MareNostrum 5

LOADING...

Hosted in Barcelona Supercomputing Center

- Aggregated **205 PFlops** sustained performance
- Modular architecture (GPP, ACC, NG-ACC and NG-GPP partitions)
- To provide one of the largest CPU partitions in the world:
  90 racks | **6480** CPUs | **36** PFlops

Installation status

- Storage, network, management (**Phase 0 and 1**)
- **Phase 2** installation ongoing (GPP)
  - Target acceptance **June 2023**
- **Phase 3** acceptance (ACC): **Q3 2023**

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JUPITER

The 1st exascale supercomputer in Europe

Hosted by Julich Supercomputing Center (Germany)

JÜLICH Forschungszentrum

- Sustained **1 EFlops** performance
- Implementing a dynamic **Modular Supercomputing Architecture (MSA)**
- Hosted in **containerised** data center
- Integration of European hardware

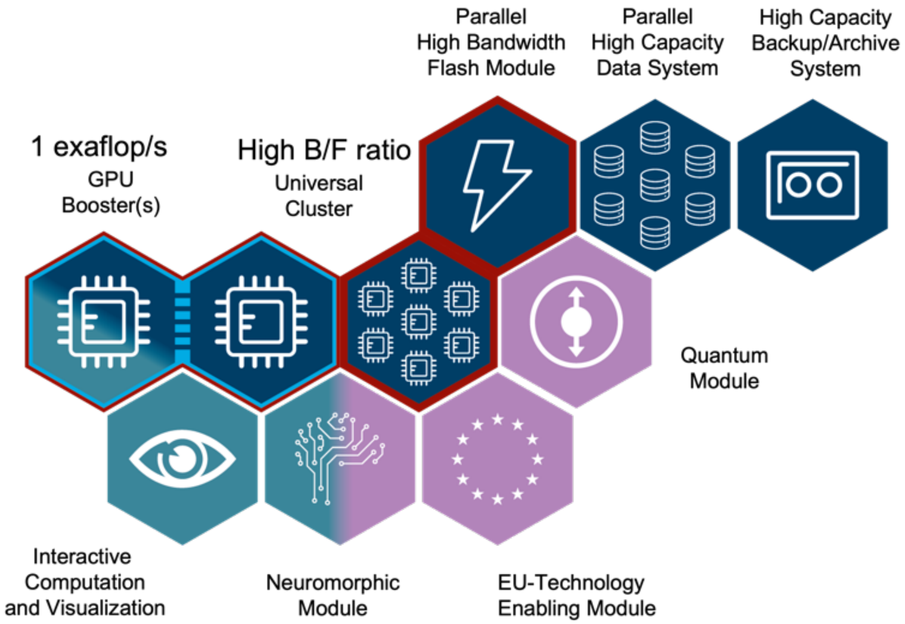
Procurement status

- Competitive dialogue (now in Dialogue Phase).
- Total budget: **273 Million Euro** (including options)
- Contract signature target: **Q4 2023**
- Start of installation: **Q1 2024**
- Acceptance (Phase 1): **Q4 2024**

Basic Configuration

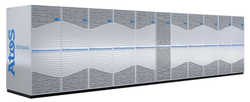
Optional Modules

Future Technology Modules



Estimated timeline

LUMI



Leonardo

MN5

Deucalion

Daedalus EHPCPL

JUPITER

Exascale 2

Post-Exascale

Mid-range 2

Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4

2023 2024 2025 2026-2027

Upgrades

Upgrades

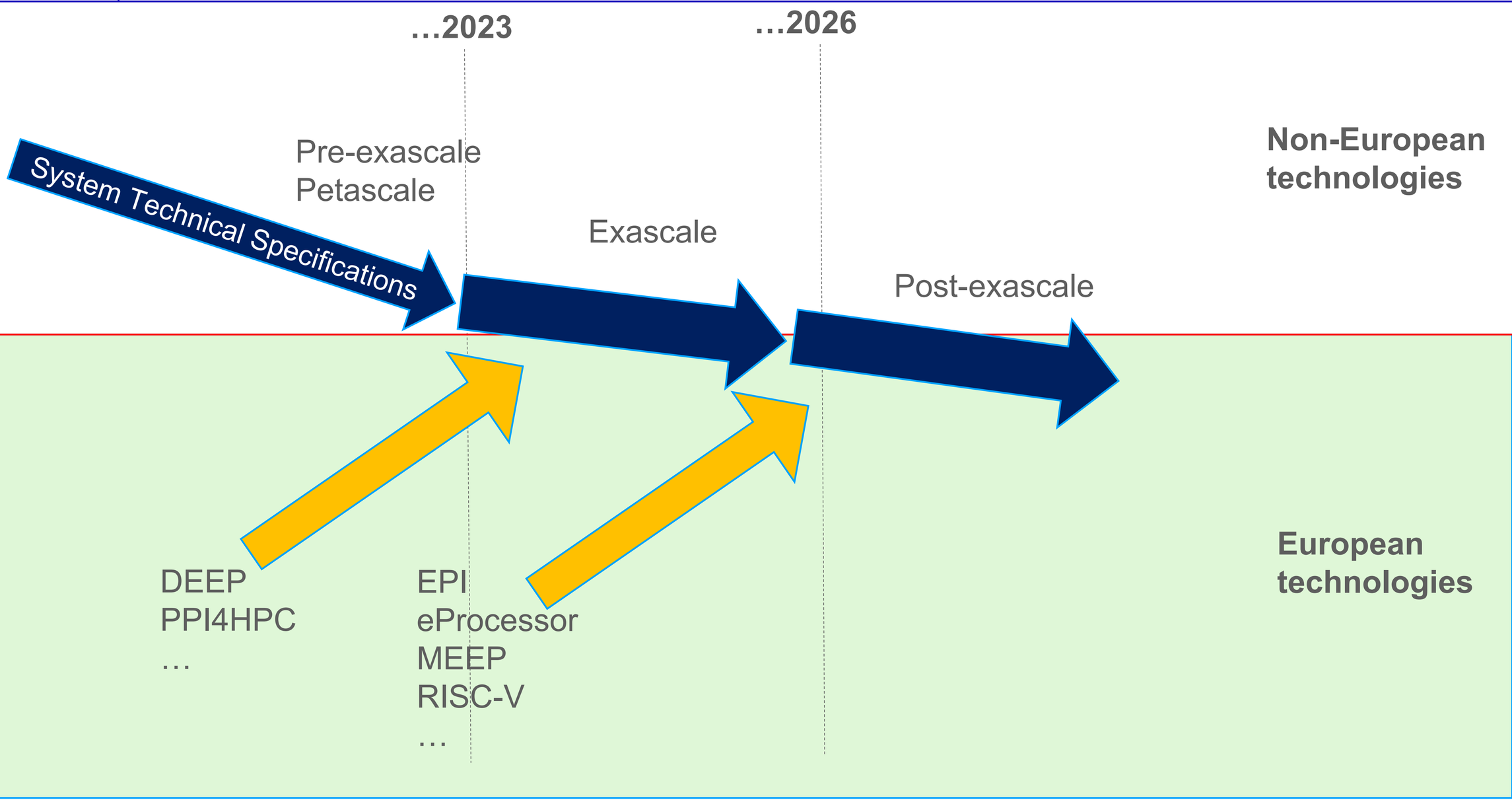
Federation / Hyperconnectivity

Industrial systems

Quantum systems

Quantum systems

Integration of R&I EU technologies



Tack!