



The European High Performance Computing Joint Undertaking

LEADING THE WAY IN EUROPEAN SUPERCOMPUTING

November 2023 | Dr. Lilit Axner

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:

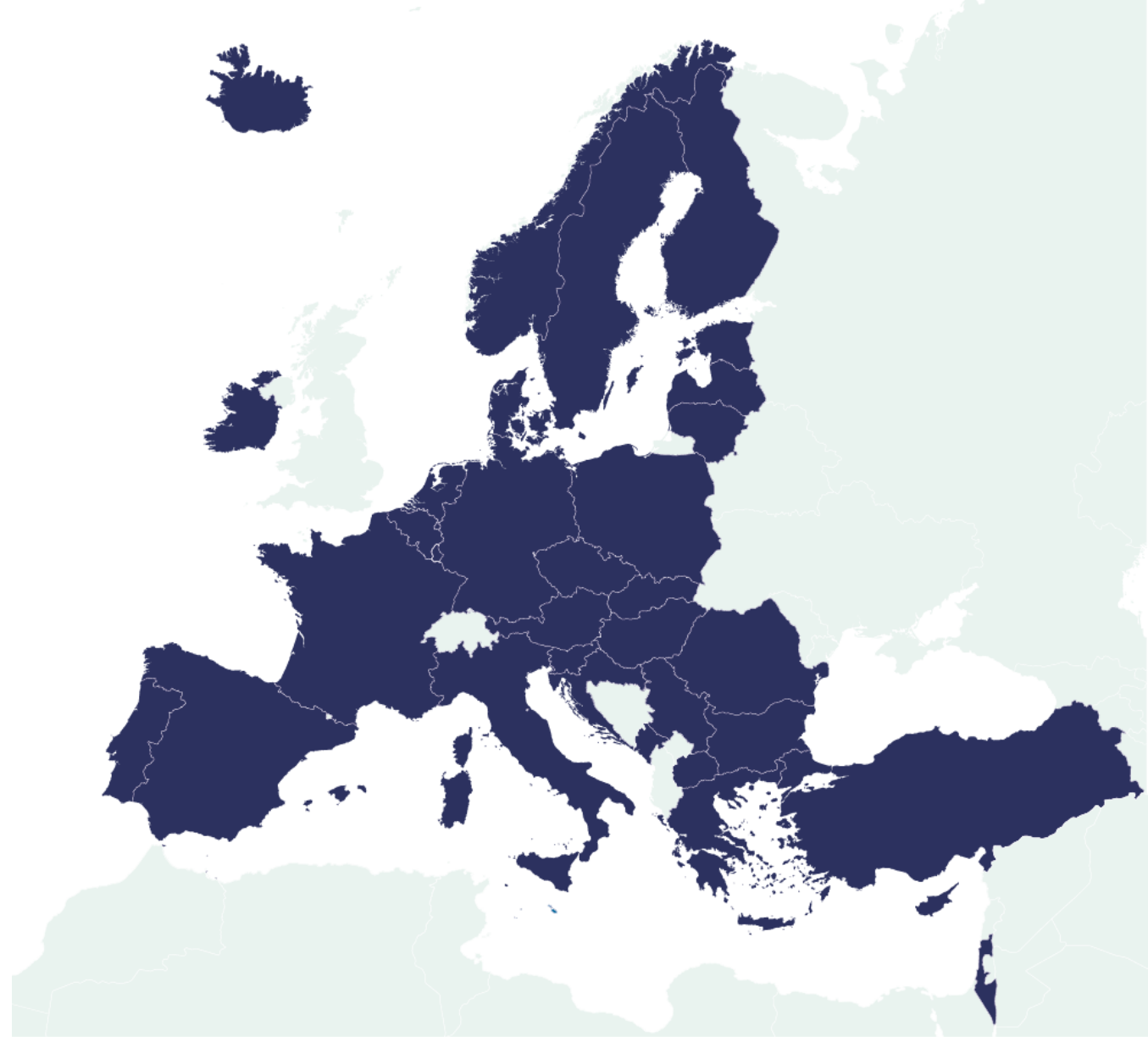
- Develop, deploy, extend & maintain a world-leading supercomputing, quantum computing, service & data infrastructure ecosystem in Europe
- Support the development of innovative supercomputing components, technologies, knowledge & applications to underpin a competitive European supply chain
- Widen the 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)





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 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



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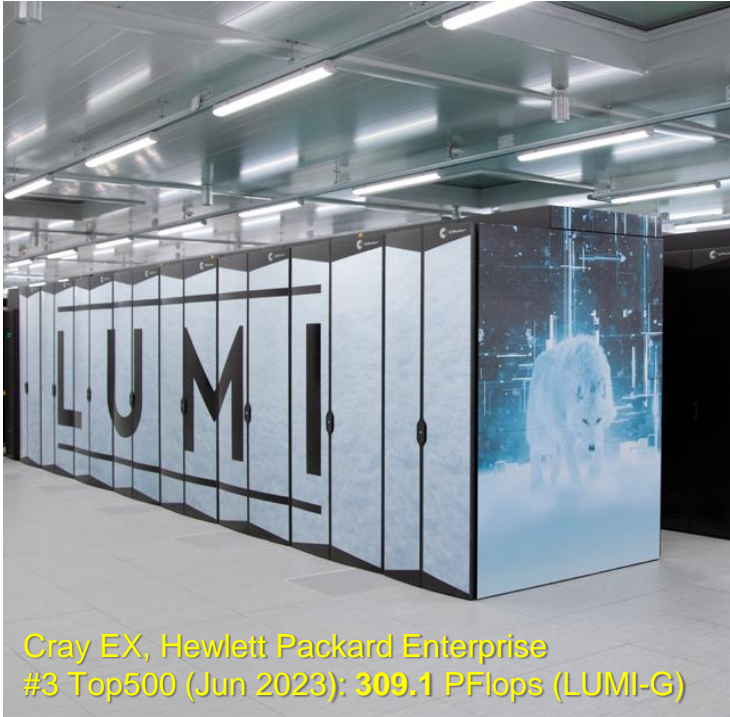
JUNE 2023	TOP500	Green500
LUMI	#5	#7
LEONARDO	#6	#18
MareNostrum5	#8	#6
MELUXINA	#71	# 27
KAROLINA	#113	#94
DISCOVERER	#166	#258
VEGA	#198	#278

Operational systems | Pre-exascale



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LUMI (Lead by CSC) Kayaani, Finland



Cray EX, Hewlett Packard Enterprise
#3 Top500 (Jun 2023): **309.1 PFlops (LUMI-G)**

- 4,976 Nodes (2,928 GPU + 2,048 CPU)
- 11,712 GPUs (AMD MI250X)
- Slingshot Interconnect (200 Gb/s)
- 117 PB Storage (Lustre + Ceph)

AMD platform

- CPU: 64-core AMD EPYC™
- GPU: AMD Instinct™ (MI250X)

Leonardo (Lead by CINECA) Bologna, Italy



Atos BullSequana XH2000
#4 Top500 (June 2023): **238.7 PFlops (BOOSTER)**

- 4,992 Nodes (3,456 GPU + 1,536 CPU)
- 13,842 GPUs (Nvidia A100)
- Quad-rail Infiniband HDR (200 Gb/s)
- 110 PB Storage (Lustre)

Intel/Nvidia platform

- CPU: Intel Sapphire Rapids (56-core), Intel Ice Lake (32-core)
- GPU: Nvidia custom Ampere (A100)

MareNostrum 5 (Lead by BSC) Barcelona, Spain



Atos BullSequana XH3000 / Lenovo Think Systems
205 PFlops (projected sustained - aggregate)

- 7,528 Nodes (1,120 GPU + 6,408 CPU)
- 4,480 GPUs (Nvidia H100)
- Quad-rail Infiniband NDR200
- 250 PB Storage (GPFS)

Intel/Nvidia platform

- CPU: Intel Sapphire Rapids (56-core), Intel Sapphire Rapids (32-core),
- GPU: Nvidia Hopper (H100)

Operational systems | Petascale

Vega



MeluXina



Karolina



Discoverer



Petascale systems in numbers

43.83 Petaflops sustained (54,41 Petaflops R_{peak})

- 14 partitions
- 5533 CPU Nodes
- 365 GPU Nodes
- 24PB Lustre Storage
- 6802 AMD EPYC Rome CPUs / 1632 Fujitsu ARM A64FX CPUs
- 1748 Nvidia A100 GPUs
- Other: FPGA, Visualisation and Cloud capabilities

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

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	University of Luxembourg

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	Ostrava, Czech Republic

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

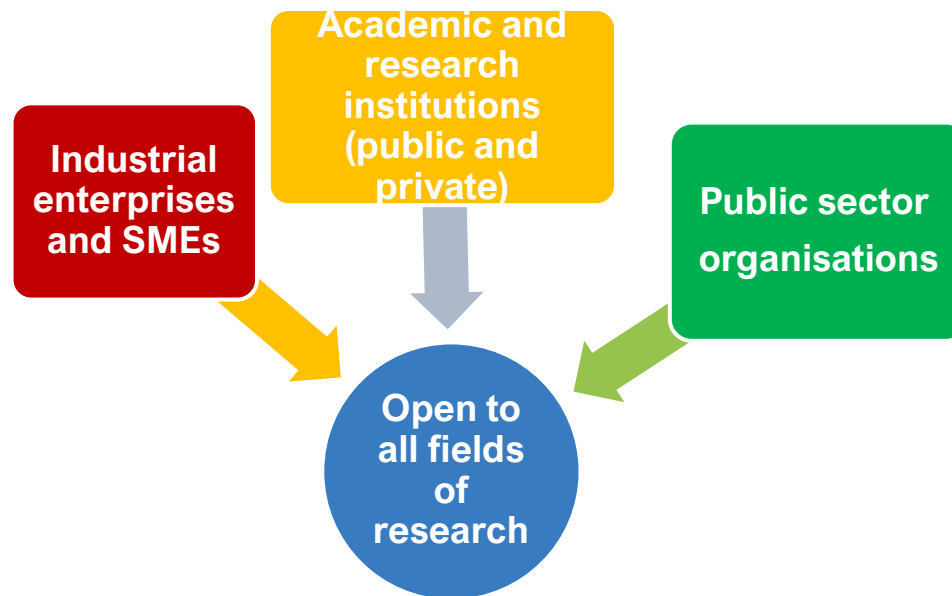
Deucalion



Sustained performance:	7,22 petaflops (projected)
CPU:	Fujitsu ARM A64FX, AMD Epyc Rome
GPU:	Nvidia A100
TOP500 ranking:	(TBC)
Vendor/model	Fujitsu FX700, Atos BullSequana
Operated by	MACC, Univ. Minho, Portugal

Access to EuroHPC Supercomputers

WHO IS ELIGIBLE?



WHICH TYPES OF ACCESS EXIST?



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

GPU Node Hours Provided per Call type



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Access type	GPU Node hours*	Duration
Benchmark access	Between 400 to 3000	3 months
Development access	Between 1000 and 10 000	6 or 12 months
Regular access	Up to 730 000	12 months
Extreme access	Up to 7.7 million	12 or 24 months

Node hours = Number of Nodes x Number of Cores per Node

365 GPUs on Petascale and over 30 000 GPUs on Pre-exascale

Documentation on Current systems with GPU partitions

<https://doc.vega.izum.si/> - VEGA

<https://docs.it4i.cz/karolina/hardware-overview/> -Karolina

<https://docs.lxp.lu/> - Meluxina

<https://docs.lumi-supercomputer.eu/> - Lumi

<https://leonardo-supercomputer.cineca.eu/hpc-system/> - Leonardo

The European High Performance Computing Joint Undertaking (EuroHPC JU)

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Access to Our Supercomputers

EuroHPC Access Calls

List of EuroHPC calls for proposals for access to compute time on EuroHPC supercomputers.

Access Policy and FAQ

How to access our supercomputers?

Awarded Projects

List of projects which have been awarded computing time on the EuroHPC supercomputers.

Share this page



https://eurohpc-ju.europa.eu/access-our-supercomputers/eurohpc-access-calls_en



Film produced by ENCCS

COMING SOON: JUPITER, THE FIRST EUROPEAN EXASCALE

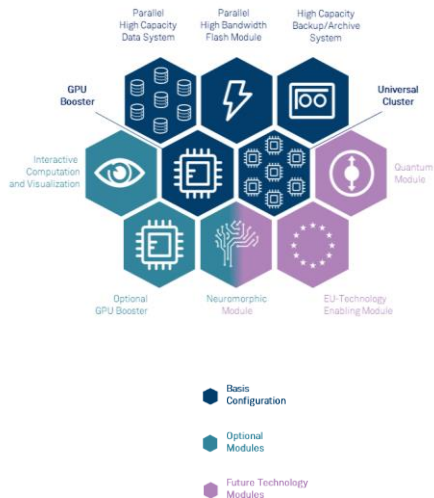


JÜLICH | JÜLICH SUPERCOMPUTING CENTRE
Forschungszentrum

JUPITER THE ARRIVAL OF EXASCALE IN EUROPE

Contact

✉ jupiter@fz-juelich.de | fz-juelich.de/jupiter



- ❑ The first European supercomputer capable of **one billion billion (10^{18}) calculations per second**
- ❑ Based on a **modular supercomputing architecture**
- ❑ Designed to be green, **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
- ❑ Will be installed on the campus of Forschungszentrum Jülich in 2023 and operated by the Jülich Supercomputing Centre

THE EUROHPC QUANTUM COMPUTERS



The EuroHPC JU has signed hosting agreements for six new quantum computers in Europe co-funded by the European Union

-  LUMI-Q - Czechia
-  EuroQCS-France
-  Euro-Q-Exa - Germany
-  EuroQCS-Italy
-  EuroQCS-Poland
-  EuroQCS-Spain

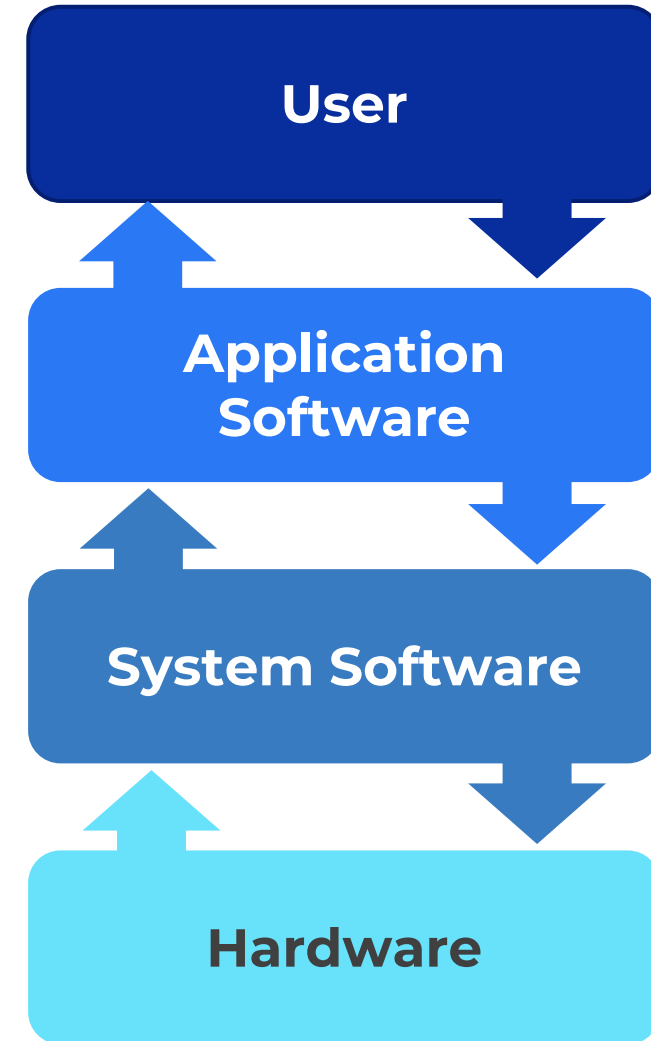


In June 2023, the EuroHPC JU has signed hosting agreements with six sites across Europe to host & operate EuroHPC quantum computers. These quantum computers will allow European users to explore a variety of quantum technologies coupled to leading supercomputers.

STRATEGIC R&I – INTERVENTION AREAS

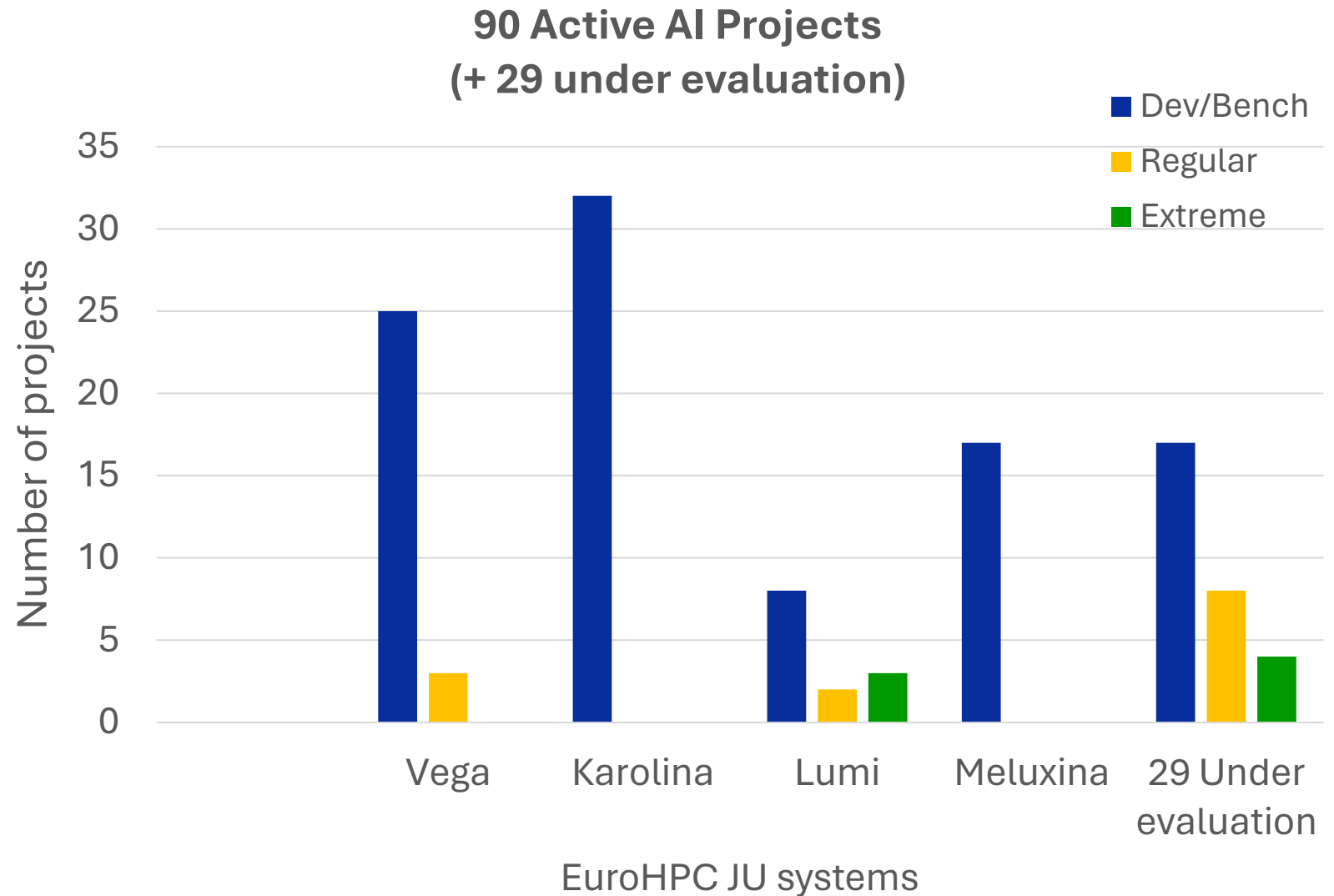
40 Ongoing project

- » **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.



AI Applications per System by August 2023

(42 of 119 are
LLM
applications)



Expert Support

EuroHPC JU Hosting Entities



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IZUM
Institut informacijskih znanosti, Maribor

VSB TECHNICAL UNIVERSITY OF OSTRAVA

IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER

LUX PROVIDE
high-performance computing center

CSC

SOFIA TECHPARK

CINECA

MAACC

Minho Advanced Computing Center

BSC

And more....

33 EuroCC National Competence Centres across Europe

EURO NETHERLANDS

EURO BELGIUM

CCFR
CENTRE DE COMPÉTENCE HPC.HPDAJA

IONCC
NATIONAL COMPETENCE CENTRE IN HPC - HIGH PERFORMANCE COMPUTING

HPC.MK
EuroCC @North Macedonia

EURO CZECHIA

EUROCC PORTUGAL

EUROCC SPAIN

EURO MONTENEGRO

EURO SLOVAKIA

EURO SLOVENIA

EURO GREECE

SLING

EURO LUXEMBOURG

LIETUVA

EURO AUSTRIA

HPC@hu
Competence Centre

EURO IRELAND

ESTONIAN HPC COMPETENCE CENTER

EUROCC ITALY
HPC Competence Center

ENCCS
EuroCC National Competence Center

HRVATSKI CENTAR KOMPETENCIJA ZA HPC

TRUBA
Turkish Science e-Infrastructure

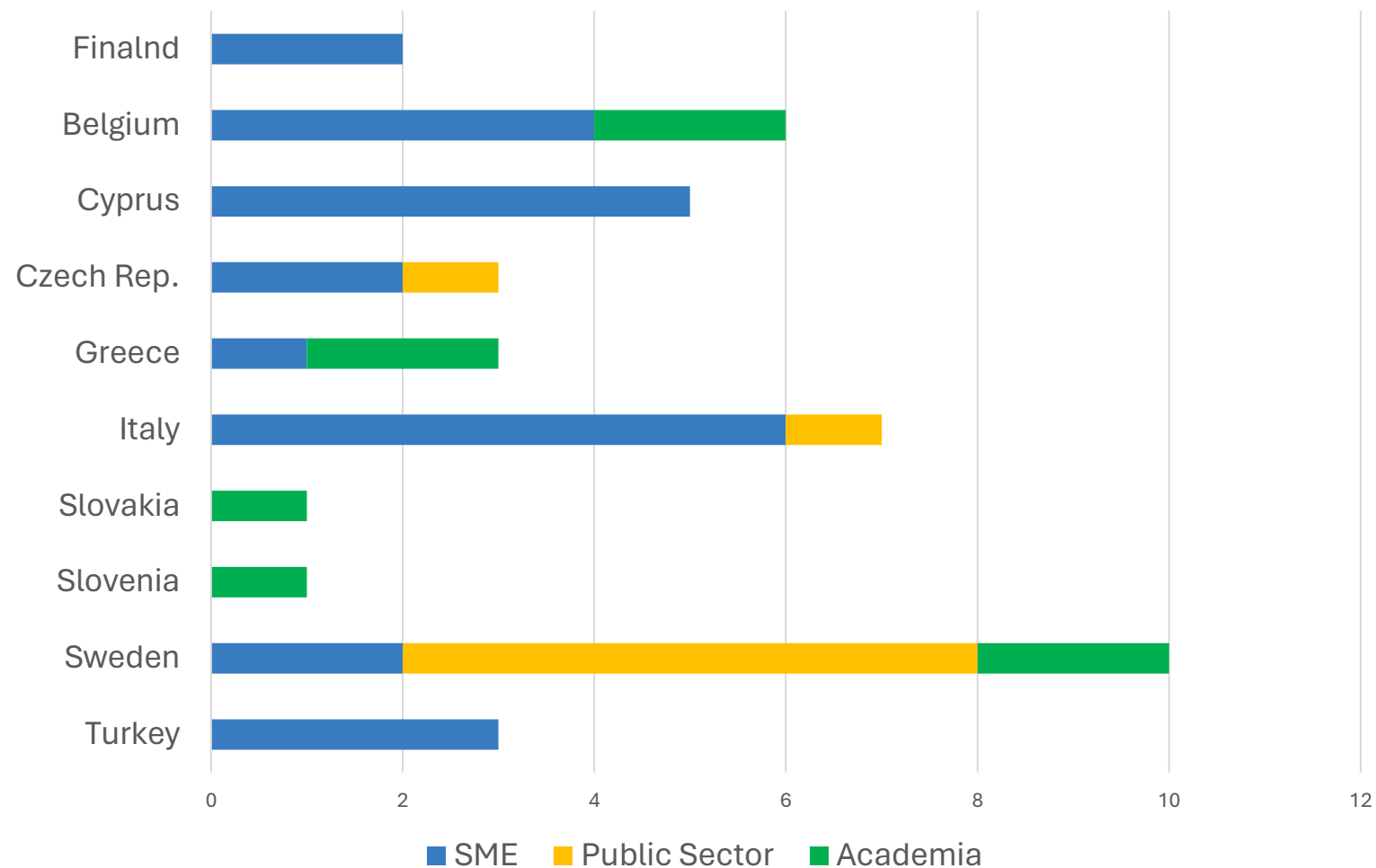
And more....



Support @ your country by EuroCC NCCs

- <https://www.eurocc-access.eu/about-us/meet-the-nccs/>

AI projects supported by EuroCC NCCs in their countries



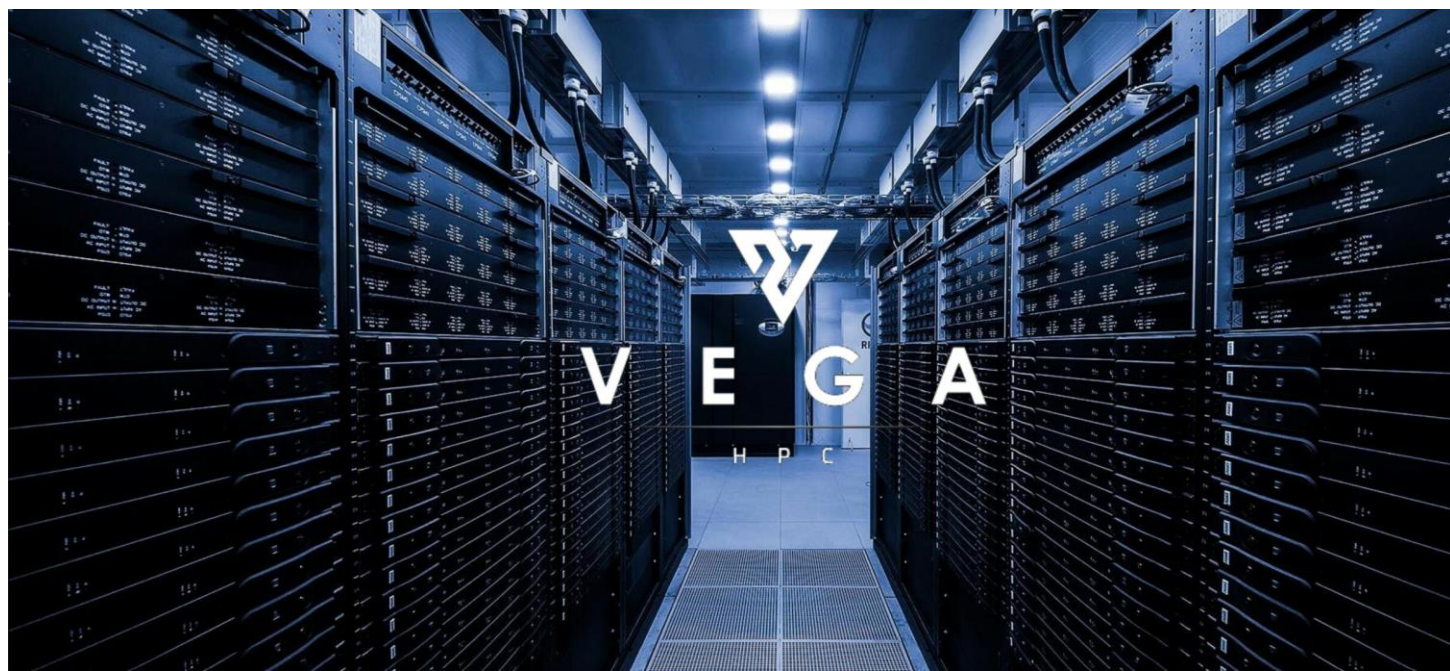


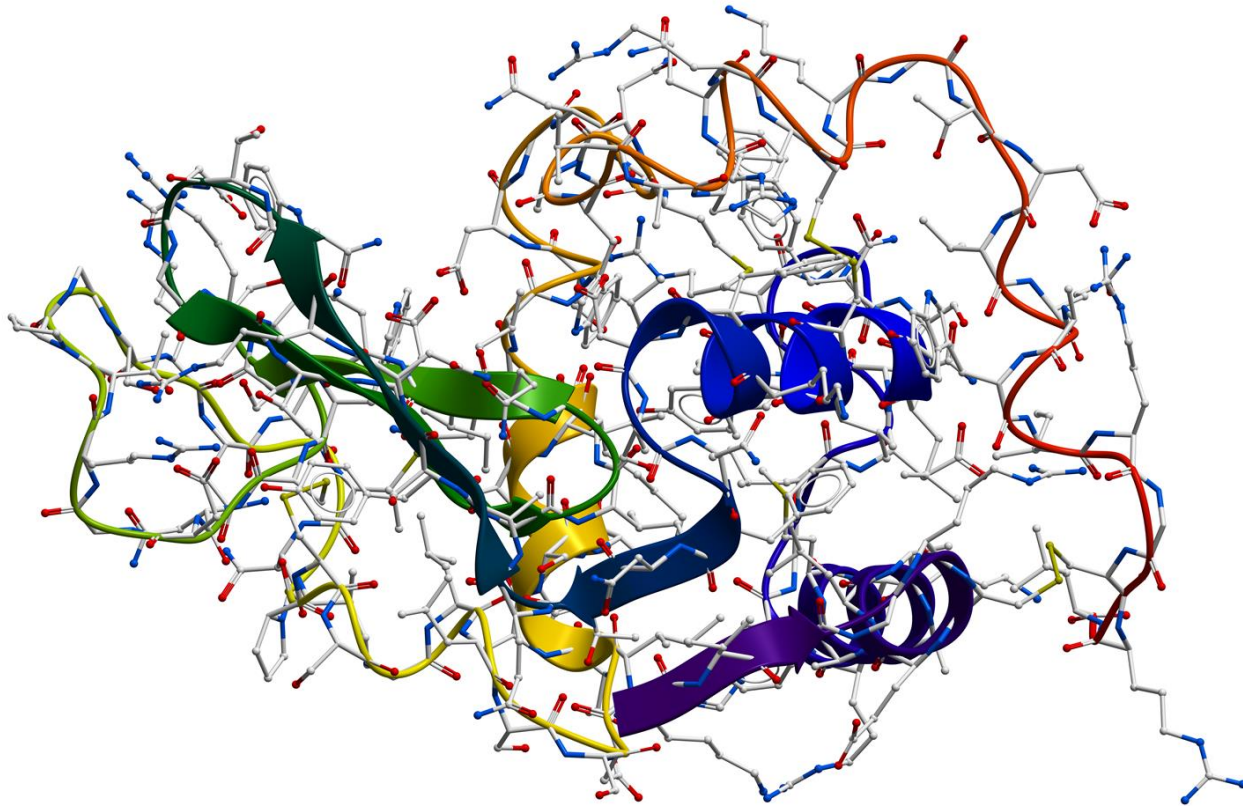
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Simulations of the electrochemistry relevant for battery development

Use of classical and reactive molecular dynamics and quantum chemical simulations to devise bottom-up design strategies for improved batteries.

northvolt





Skin permeability

- Atomistic model of the main barrier in human skin
- Predict drug permeability using molecular dynamics simulations (GROMACS)

1 920 000 CPU Core Hours

384 000 GPU Core hours

Using EuroHPC JU Vega System by the Croatian SME Called TIS



System for **E**arly **N**eurological **D**eviation **D**etection

A unique **AI** solution for assessing the quality of spontaneous movements (fidgeting).

The target:

Children in early infancy (2-3m)

The purpose:

Detecting infants at high risk of neurodevelopmental disorders or expected normal outcome in a group of neuro risky children

Goal: AI system automatically detects neurological risk infants

www.sendd.eu

www.tis.hr



Evropska unija
Zajedno do fondova EU



Operativni program
**KONKURENTNOST
I KOHEZIJA**



**EUROPSKI STRUKTURNI
I INVESTICIJSKI FONDOVI**

FF4EuroHPC: AI/ML COMPUTER VISION FOR THE NEXT GENERATION POULTRY FARMS



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Researchers from this consortium have engaged a large number of poultry farms of different sizes. The main goal of the engagement was to understand their business challenges and to present an IoT based poultry farm management solution, supported by a set of sensors for environmental monitoring. The use of HPC and deep learning AI was used to create prediction models that can be deployed on the edge devices equipped with camera sensors for the use in IoT/AI solutions in the poultry sector.

SECTOR: Agriculture

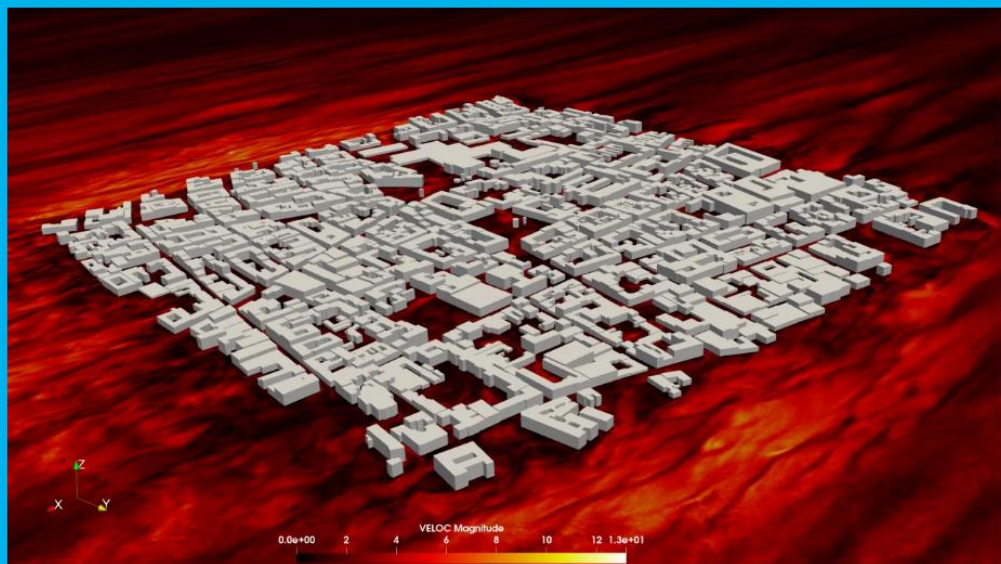
TECHNOLOGY USED: HPC, Machine Learning, Edge Computing

COUNTRY: Montenegro

 [1003_Success Story Flyer](#)



AI-AIDED WIND FLOW AND GAS DISPERSION SIMULATIONS IN CITIES



Nowadays, the distribution of pollutants at street and urban level is not completely understood because the sources of the emissions of the gas concentrations may change fast at a given location and between nearby sites. In this context, HPC and Computational Fluid Dynamics (CFD) are key tools for tracking the dispersion of pollutants with high resolution. The goal of this experiment is to train Generative Adversarial Networks that mimic the output of HPC-CFD simulations at an affordable cost and to add them to Bettair's map generation pipeline.

SECTOR: Environmental

TECHNOLOGY USED: CFD Simulations

COUNTRY: Spain

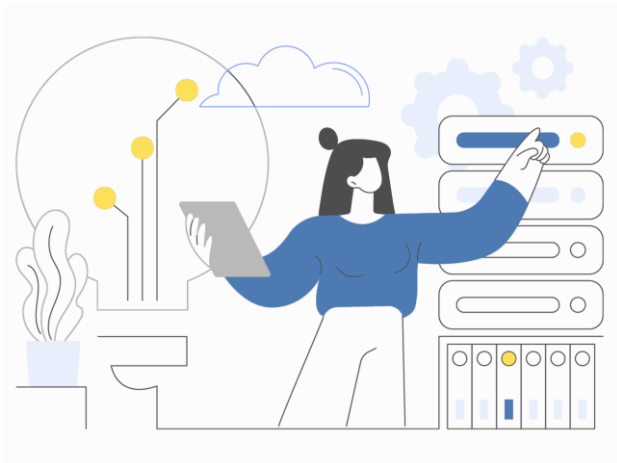


1012_Success Story Flyer

WHAT'S NEXT?

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
- Initiative to boost the competitiveness and innovation of SMEs
- Innovation action in Interconnects



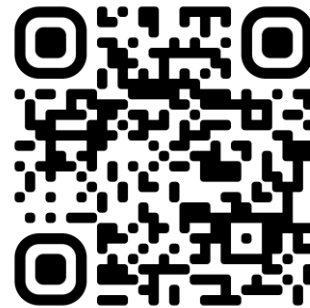
Building up the EuroHPC user forum

- 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

THANK YOU



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



eurohpc-ju.europa.eu



[@euroHPC_JU](https://twitter.com/euroHPC_JU)



[eurohpc-ju](https://www.linkedin.com/company/eurohpc-ju)



[@eurohpc-ju](https://www.youtube.com/@eurohpc-ju)