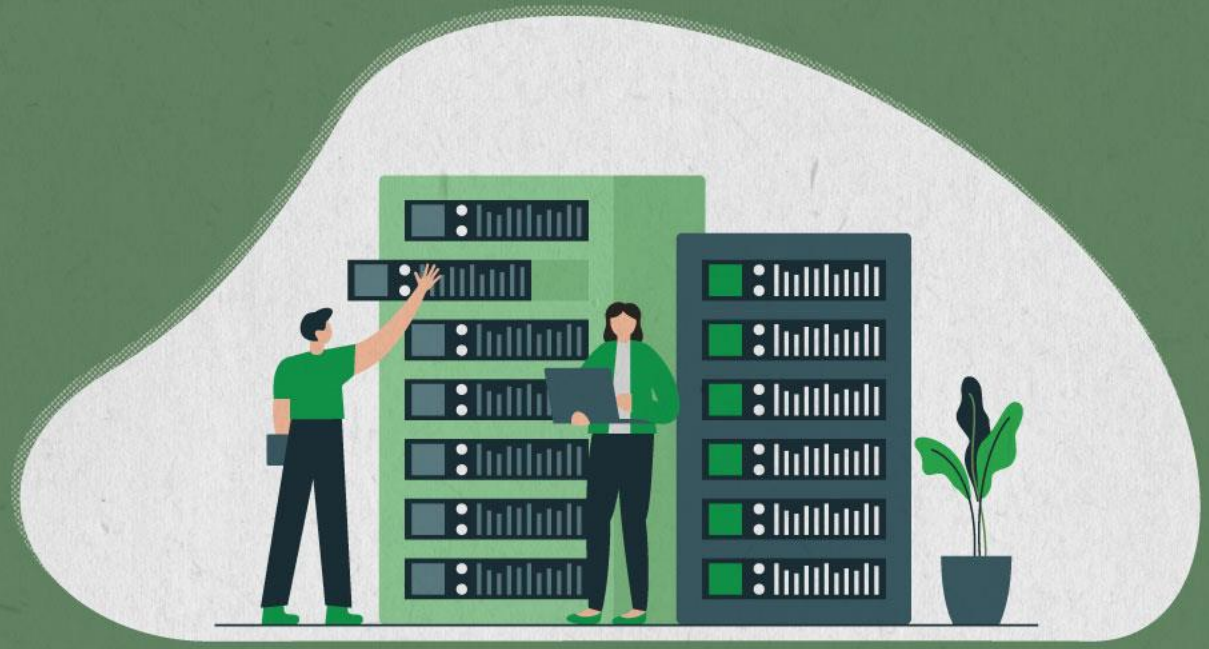
RNCA

REDE NACIONAL DE COMPUTAÇÃO AVANÇADA

Encontro RNCA 2023

07 e 08 de novembro de 2023
UTAD, Vila Real



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EuroHPC Joint Undertaking

European Commission

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Access to MareNostrum5 and other European HPC infrastructures

Oriol Pineda, PhD

Barcelona Supercomputing Center

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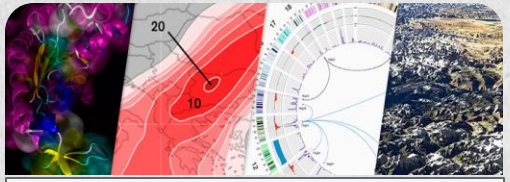

R&D in Computer, Life, Earth and Engineering Sciences

PhD programme, technology transfer, public engagement

Supercomputing and data services to Spanish and EU researchers

BSC-CNS is a consortium that includes

Spanish Government	60%	Gobierno de España · Ministerio de Economía, Industria y Competitividad
Catalan Government	30%	Generalitat de Catalunya Departament d'Empresa i Coneixement
Univ. Politècnica de Catalunya (UPC)	10%	Universitat Politècnica de Catalunya BarcelonaTech

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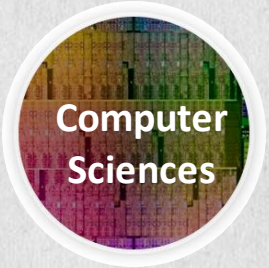

To influence the way machines are built, programmed and used: programming models, performance tools, Big Data, computer architecture, energy efficiency

To develop and implement global and regional state-of-the-art models for short-term air quality forecast and long-term climate applications

To understand living organisms by means of theoretical and computational methods (molecular modeling, genomics, proteomics)

To develop scientific and engineering software to efficiently exploit super-computing capabilities (biomedical, geophysics, atmospheric, energy, social and economic simulations)

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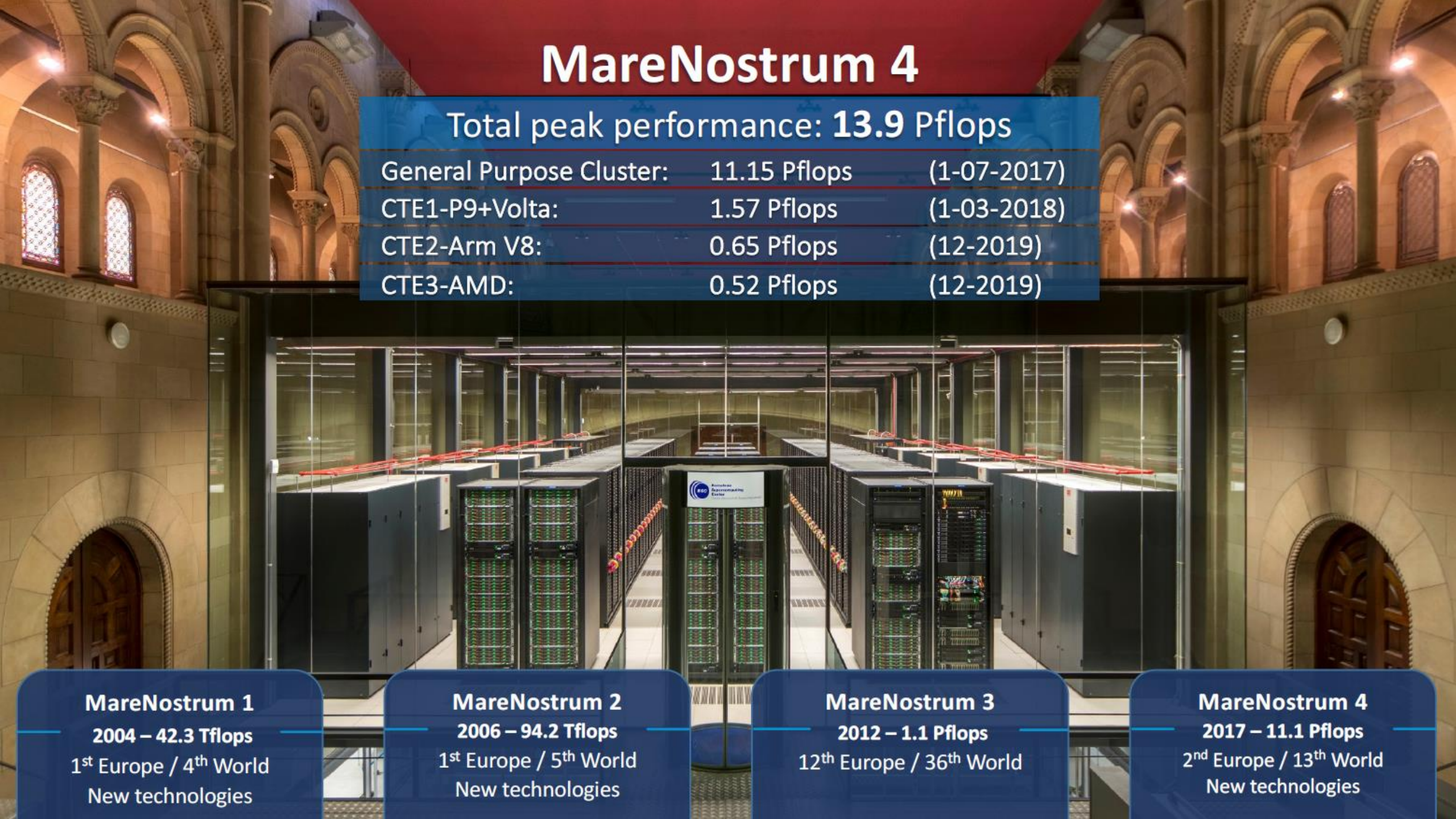
MareNostrum 4

Total peak performance: **13.9** Pflops		
General Purpose Cluster:	11.15 Pflops	(1-07-2017)
CTE1-P9+Volta:	1.57 Pflops	(1-03-2018)
CTE2-Arm V8:	0.65 Pflops	(12-2019)
CTE3-AMD:	0.52 Pflops	(12-2019)



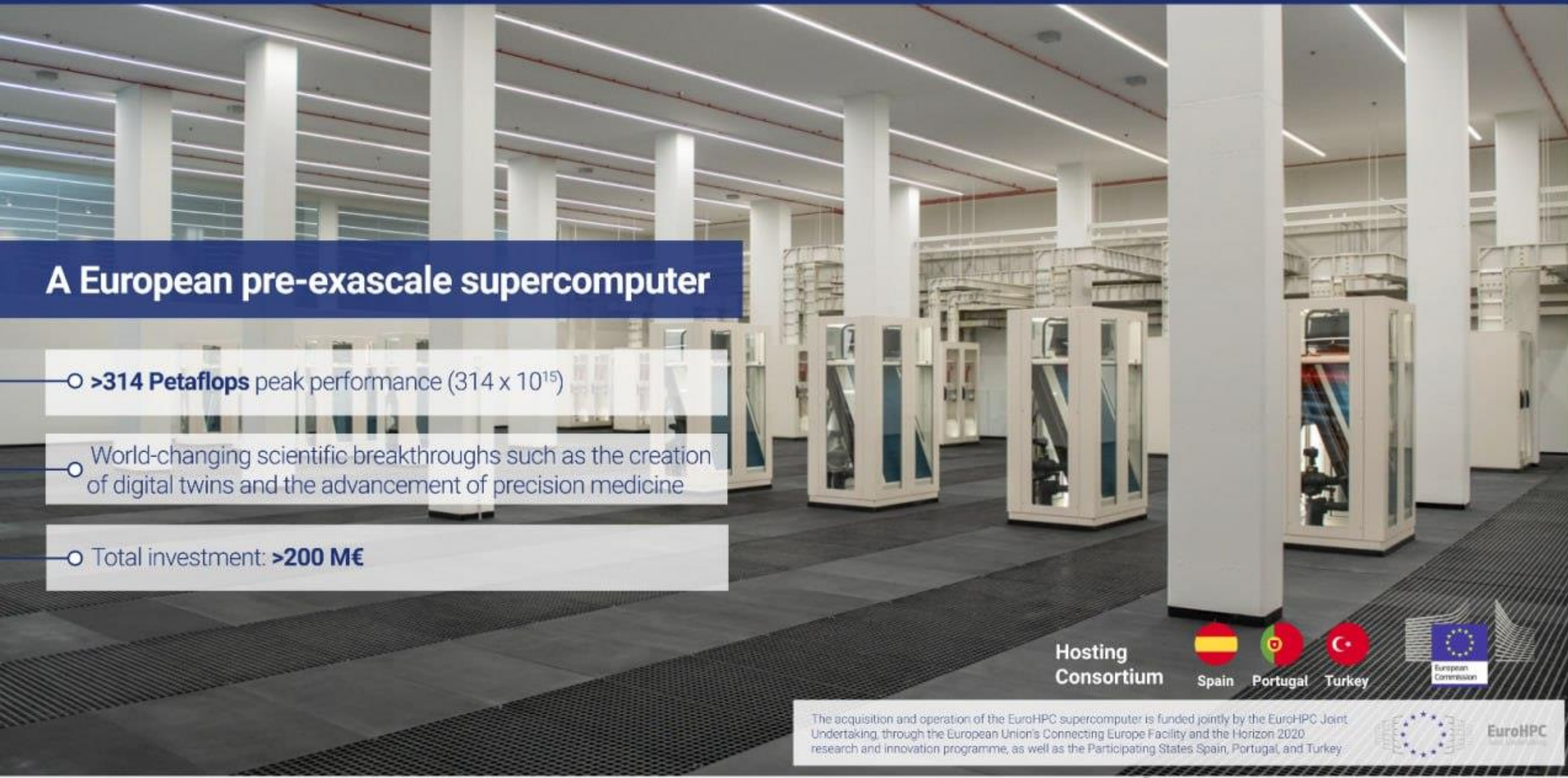
MareNostrum 1
2004 – 42.3 Tflops
1st Europe / 4th World
New technologies

MareNostrum 2
2006 – 94.2 Tflops
1st Europe / 5th World
New technologies

MareNostrum 3
2012 – 1.1 Pflops
12th Europe / 36th World

MareNostrum 4
2017 – 11.1 Pflops
2nd Europe / 13th World
New technologies

MareNostrum 5



A European pre-exascale supercomputer

- **>314 Petaflops** peak performance (314×10^{15})
- World-changing scientific breakthroughs such as the creation of digital twins and the advancement of precision medicine
- Total investment: **>200 M€**

Hosting Consortium

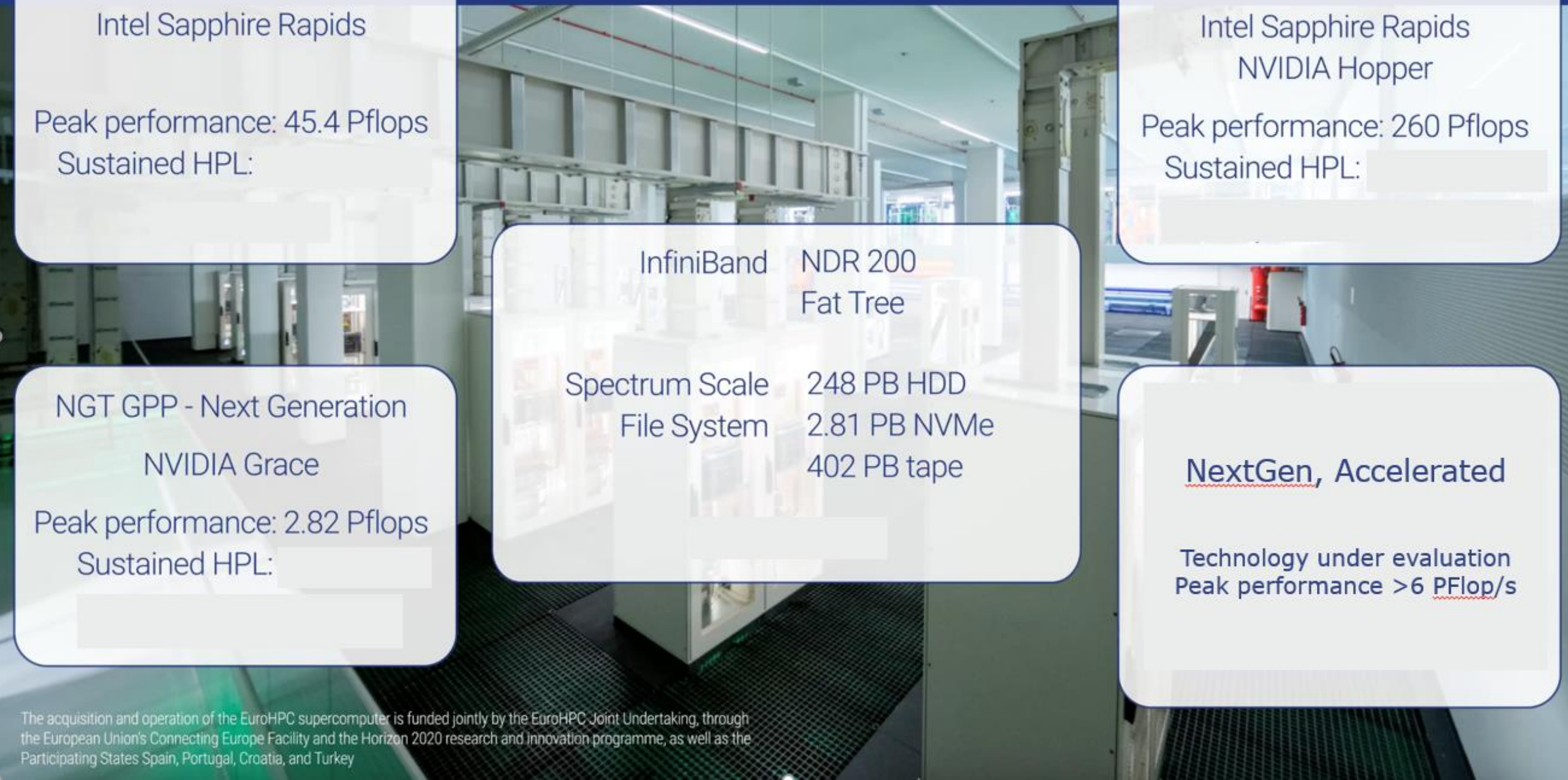
Spain Portugal Turkey

European Commission

The acquisition and operation of the EuroHPC supercomputer is funded jointly by the EuroHPC Joint Undertaking, through the European Union's Connecting Europe Facility and the Horizon 2020 research and innovation programme, as well as the Participating States Spain, Portugal, and Turkey

EuroHPC

MareNostrum 5



GPP - General Purpose

Intel Sapphire Rapids

Peak performance: 45.4 Pflops
Sustained HPL:

ACC – Accelerated

Intel Sapphire Rapids
NVIDIA Hopper

Peak performance: 260 Pflops
Sustained HPL:

InfiniBand	NDR 200 Fat Tree
Spectrum Scale File System	248 PB HDD 2.81 PB NVMe 402 PB tape

NGT GPP - Next Generation

NVIDIA Grace

Peak performance: 2.82 Pflops
Sustained HPL:

NextGen, Accelerated

Technology under evaluation
Peak performance >6 PFlop/s

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MareNostrum5 – General Purpose Partition

90 racks, 72 nodes per rack, 6480 nodes, peak performance 45 PFlop/s
Node configuration:

- 2x Intel Sapphire Rapids 8480+ processors, 56 cores at 2GHz
  - 6192 nodes with 256GB DDR5
  - 216 FAT nodes with 1TB DDR5

- 2x Intel Sapphire Rapids 03H-LC processors, 56 cores at 1.7GHz
  - 72 nodes with 128GB HBM + 32GB DDR5

- All
  - 960GB NVMe local storage
  - NDR200 shared by two nodes
  - DLC and RDHX cooling

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MareNostrum5 – Accelerated Partition

35 racks, 32 nodes per rack, 1120 nodes, peak performance 260 PFlop/s

Node configuration:

- 2x Intel Sapphire Rapids 8460Y+ processors, 32 cores at 2.3GHz
  - 512GB DDR5
  - 480GB NVMe local storage
- 4x NVIDIA Hopper 64GB HBM
- 4x NDR200
- DLC cooling

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MareNostrum5 – NextGen General Purpose

7 racks, 68 nodes per rack, 408 nodes, peak performance 2.8 PFlop/s

Node configuration:

- 2x NVIDIA Grace processors, 72 cores at 2.6GHz
  - 240GB LPDDR5
  - 128GB NVMe local storage
- NDR200
- RDHX cooling

MareNostrum5 - Storage

Hard-drive storage

Spectrum Scale File System. 25 racks with RDHX cooling. In total:

- 20.400 HDDs, 18TB each, 1.6TB/s read, 1.2 TB/s write. Total Net Capacity 248PB
- 20 NVMe Flash, 15TB each, 600GB/s read&write. Total Net Capacity 2.8 PB

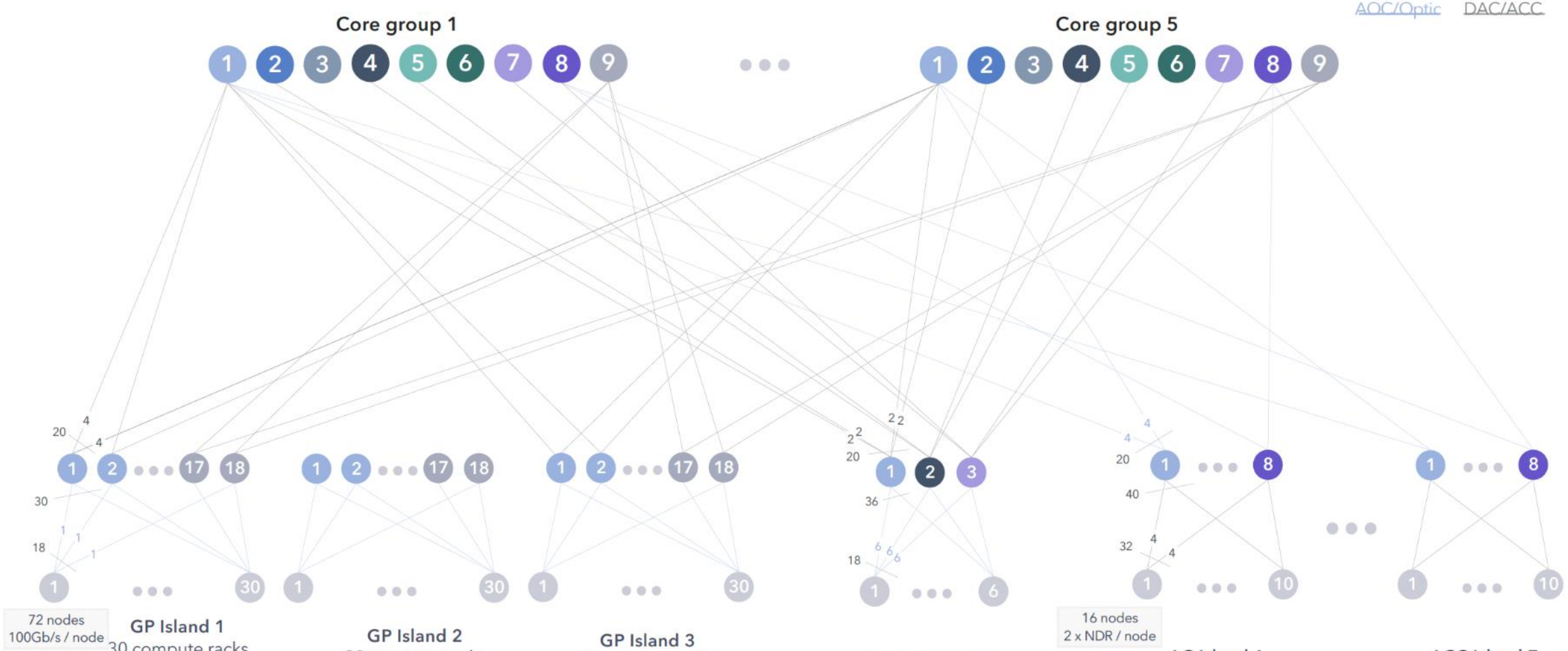
4xNDR200 per module

Tape-based storage

Two tape libraries, 13 racks each library:

- Total 20,100 tapes, 20TB per tape, 402PB Net capacity
- 64 drives, 400MB/s per drive

High performance network



GP Island 1
30 compute racks
2,160 compute nodes

GP Island 2
30 compute racks
2,160 compute nodes

GP Island 3
30 compute racks
2,160 compute nodes

IO partition and management island

AC Island 1
5 compute racks
160 compute nodes

ACC Island 7
5 compute racks
160 compute nodes

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GP
- Island: Full Fat Tree
- Partition: contention 3:2

ACC
- Island: Full Fat Tree
- Partition: contention 2:1

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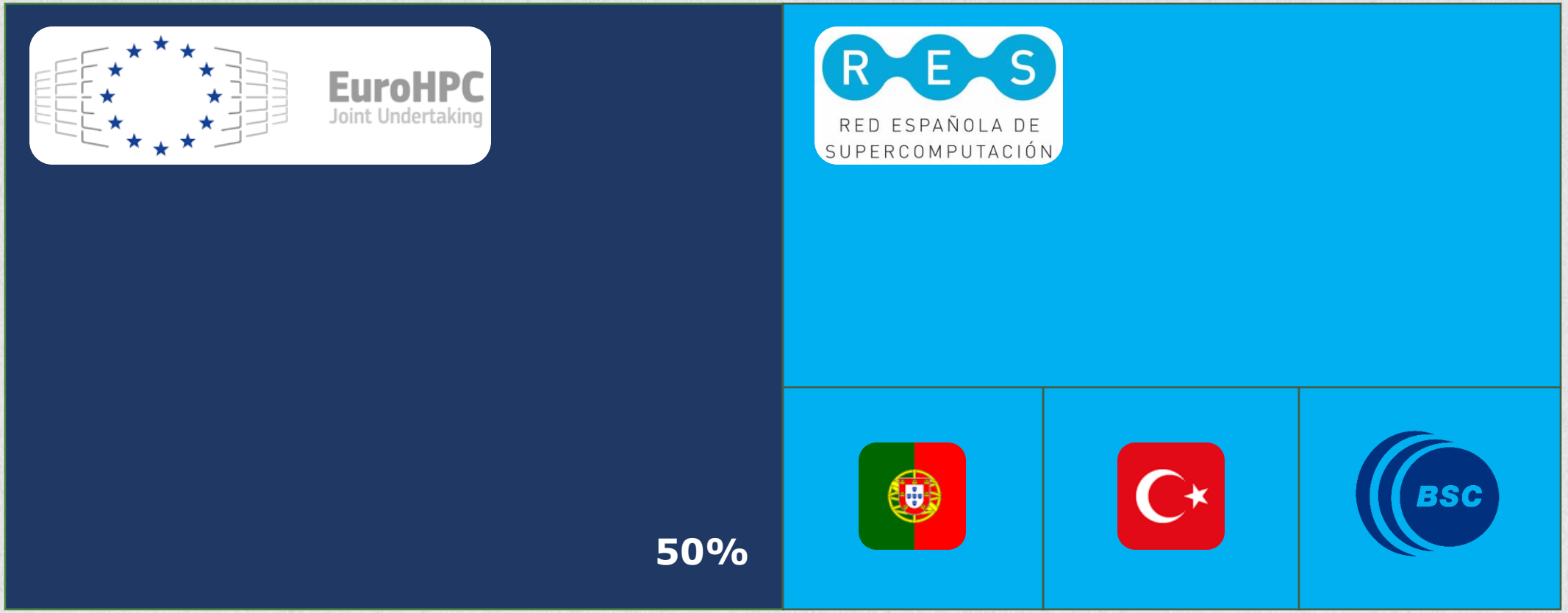
Access to MareNostrum5



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Access to MareNostrum5

EuroHPC JU access programmes
- Extreme Scale Access, 2 calls per year
- Regular Access, 3 calls per year
- Benchmark and Development Access, rolling call

Red Española de Supercomputación
- 3 calls per year, for HPC and IA access

RNCA
- Call for Advanced Computing Projects

All open to Portuguese researchers

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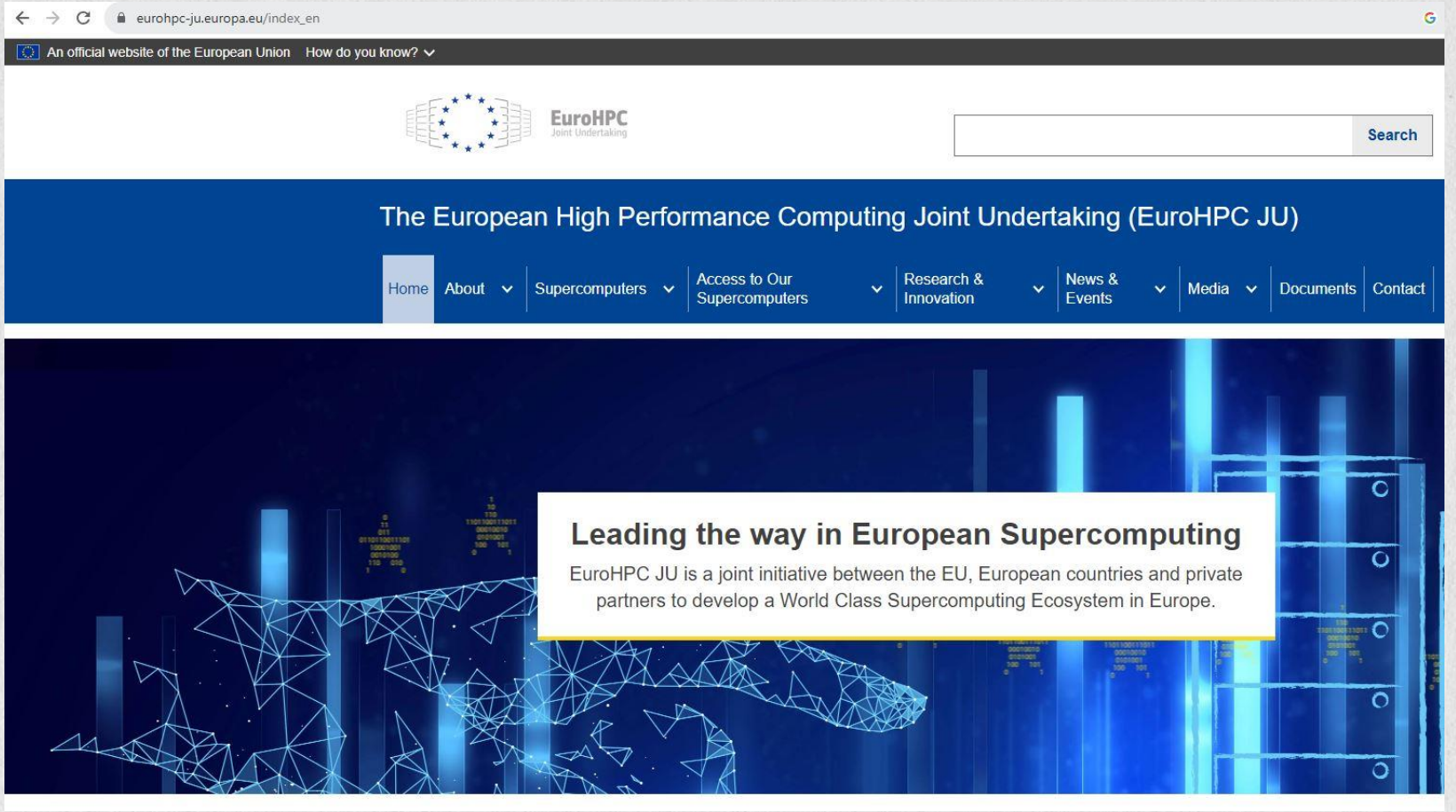
EuroHPC JU – Access



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

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EuroHPC JU – Access Programmes

- Benchmark Access: to test applications on EuroHPC systems prior to applying for an Extreme Scale or Regular Access project
- Development Access: to develop, test and optimise applications on EuroHPC systems
- Regular Access: to serve research domains, industry open R&D and public sector applications that require access to substantial computing and storage resources
- Extreme-scale Access: targets HPC applications with high-impact and high-gain innovative research from academia, industry and public sector

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

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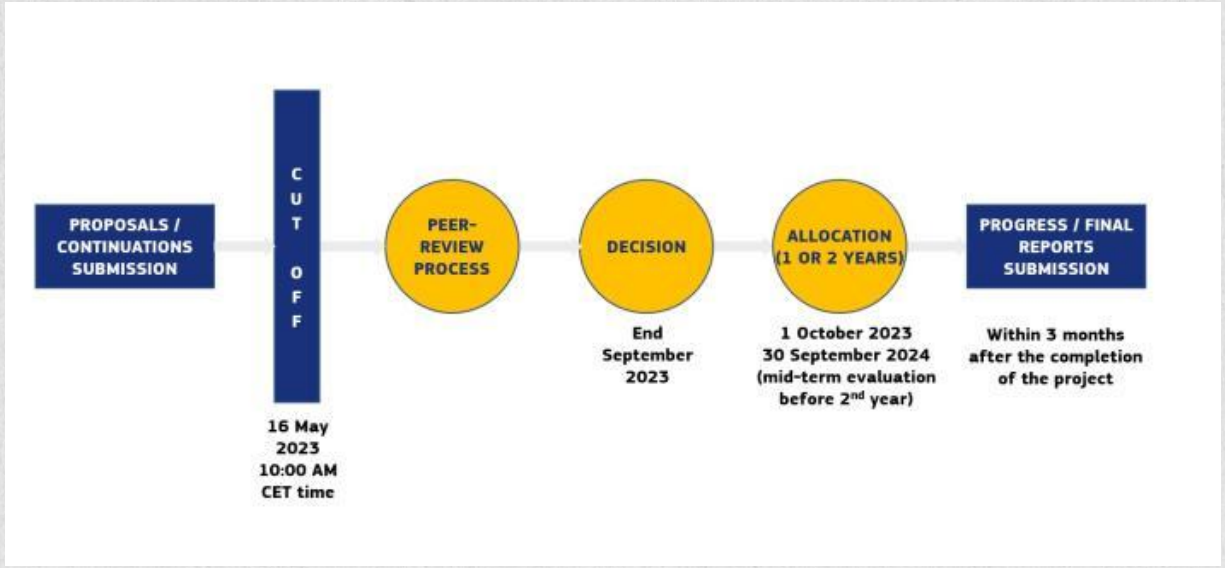
EuroHPC JU – Regular Access

SYSTEM*	SITE (&COUNTRY)	ARCHITECTURE	PARTITION	TOTAL RESOURCES**	MINIMUM REQUEST
MN5 MARENOSTRUM	BSC (ES)	Lenovo ThinkSystems SD650	MN5 GPP	376 719	38 000
		Atos BullSequana XH3000	MN5 ACC	300 563	20 000
LEONARDO CINECA	CINECA (IT)	Atos BullSequana XH2000	Leonardo DCGP	132 347	13 000
			Leonardo Booster	300 563	20 000
LUMI	CSC (FI)	HPE Cray EX	LUMI-C	376 719	37 000
			LUMI-G	738 665	50 000
DISCOVERER	Sofia Tech Park (BG)	Atos BullSequana XH2000	Discoverer CPU	812 500	80 000
MELUXINA	LuxProvide (LU)	Atos BullSequana XH2000	MeluXina CPU	511 719	80 000
			MeluXina GPU	173 438	30 000
KAROLINA	IT4I VSB-TUO (CZ)	HPE Apollo 2000 Gen10 Plus x86_64Atos	Karolina CPU	468 750	80 000
		HPE Apollo 6500	Karolina GPU	46 875	8 000

- Three calls per year
- Four months from deadline to allocation

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

EuroHPC JU – Extreme-scale Access



SYSTEM*	SITE (COUNTRY)	ARCHITECTURE	PARTITION	TOTAL RESOURCES**	MINIMUM REQUEST
MN5 MARENOSTRUM	BSC (ES)	Lenovo ThinkSystems SD650	MN5 GPP	3 955 550	400 000
		Atos BullSequana XH3000	MN5 ACC	4 207 883	420 000
LEONARDO CINECA	CINECA (IT)	Atos BullSequana XH2000	Leonardo DCGP	1 852 863	185 000
			Leonardo Booster	4 207 883	420 000
LUMI	CSC (FI)	HPE Cray EX	LUMI-C	3 955 550	390 000
			LUMI-G	7 755 983	775 000

- Two calls per year
- Five months from deadline to allocation

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

EuroHPC JU – Awarded projects

Home > Access to Our Supercomputers > Awarded Projects

Awarded Projects

Filter by

Keywords

Access Mode

Select

Call Cut-off

Select

Country

Portugal

Domain

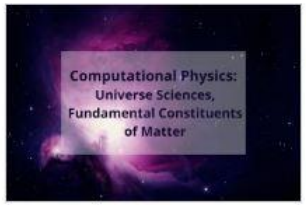
Select

Awarded Projects (6)

RSS

Showing results 1 to 6

COUNTRY Portugal



Coherent Radiation Mechanisms in Extreme Plasma Physics

Astrophysical observations reveal that disorganised plasmas around compact objects produce coherent radiation. How orderly processes can arise from such conditions and give place to coherent dynamics still eludes us. Several mechanisms have been proposed to explain these phenomena.

EVPCC- ElastoViscoPlastic fluids flow Past Confined Cylinder

Complex fluids which simultaneously have elastic and plastic behaviors are ubiquitous in every day life (ketchup, chocolate), nature (fluids and materials in the human body), andvarious industries such as food, process, chemical and pharmaceutical.

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Red Española de Supercomputación

Red Española de Supercomputación (RES), created in 2007

- Member of the Spanish Unique Scientific and Technical Infrastructures network (**ICTS**)
- Composed of 14 members, offering access to:
  - 16 High-Performance Computing systems
  - 9 Data Management facilities

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Centro Nacional de Supercomputación
Instituto de Astrofísica de Canarias
UC Universidad de Cantabria
Universidad de Málaga
Instituto Universitario de Investigación Biocomputación y Física de Sistemas Complejos
Universidad Zaragoza
CSUC Consorci de Serveis Universitaris de Catalunya
SCAYLE Supercomputación Castilla y León
CénitS
Vniversitat de València
CESGA Centro de Supercomputación de Galicia
UAM Universidad Autónoma de Madrid
nasertic
PIC port d'informació científica
Gobierno de España
Ministerio de Ciencia e Innovación
Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

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Red Española de Supercomputación

R E S

RES in numbers

- Combined computing capacity above 22 PFlop/s
- Combined storage capacity above 180 PBytes
- High-speed network (RedIRIS)
- Periodic competitive calls for access

>20% through RES

Annual statistics (2023)

- Nearly 1.000 million core hours distributed
- ~400 activities/experiments enabled
- ~240 scientific papers acknowledging RES
- More than 1.000 regular users

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EuroCC SPAIN

Infraestructuras Científicas y Técnicas Singulares

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RES Competitive Services

Computing SERVICES

- Quarterly calls and allocations
- Submissions by Jan, May, Sept
- Up to 30M core hours per year

Data Management SERVICES

- Yearly call
- Open from November to January
- Duration 3 to 5 years
- From 200TB to 1PB
  - + VMs

Artificial Intelligence SERVICES

- Quarterly calls and allocations
- Submissions by Jan, May, Sept
- Mentored activities
- Test activities

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RES Past awards

Home > List of application activities

List of application activities

All Areas | 2023-3 (November 1st - February 29th) | Search

Search Results

Area: Astronomy, Space and Earth Sciences
Title: Modelling the impacts of green infrastructure on air quality and climate change at the urban scale.
Leader: Gara Villalba Méndez
Institution: Associate professor at the Dept. of Chemical, Biological, and Environmental Engineering, Universitat Autònoma de Barcelona and senior researcher at the Institute of Environmental Science and Technology

Assigned machine(s): Picasso (UMA)
Assigned khours with priority: 700

Abstract:
The computational activity proposed takes place in the context of the ERC Consolidator project URBAG: Integrated System Analysis of Urban Vegetation and Agriculture 2019-2025). Given the need of cities to increment green areas and local agriculture to promote urban sustainability, URBAG aims to provide the knowledge and tools to evaluate which combinations of urban/peri-urban agriculture and green spaces result in the best performance in terms of air quality, heat wave and climate change mitigation, as well as ecosystem services provided to urban dwellers. To do so, URBAG uses, develops, and improves atmospheric transport models at the urban scale with the aim to evaluate 1) the efficacy of green areas on heat wave episodes using WRF and 2) how urban and peri-urban agriculture and vegetation affect air quality and climate change using WRF

https://www.bsc.es/res-intranet/abstracts

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Access to MareNostrum 5

Up to 1Mh	1Mh to 10Mh	10Mh to 100Mh	More than 100Mh

RES

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EuroHPC

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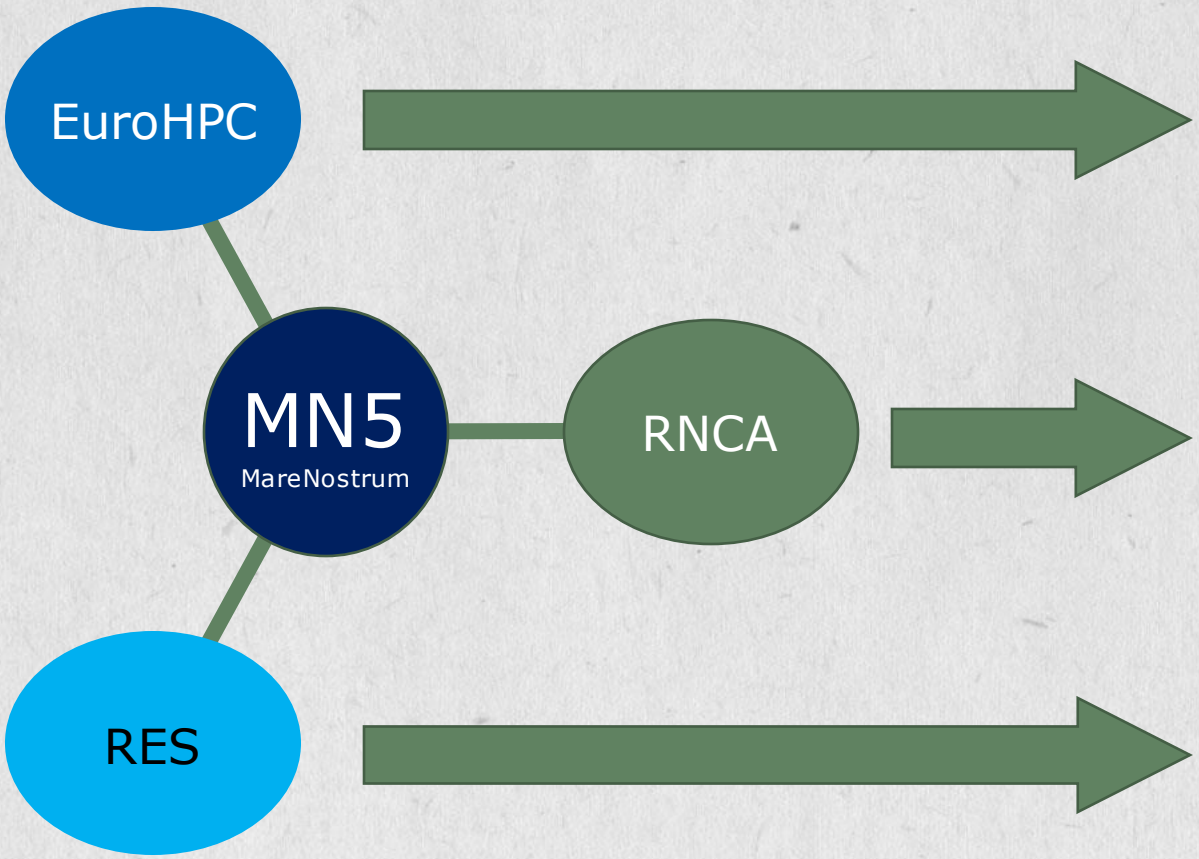
Access to European HPC systems



EuroHPC Exascale (2), pre-exascale (3), mid-range (3) and petascale systems (5)

Portuguese HPC systems, including **Deucalion**

Spanish HPC systems (17) and Data Management centres (9)