EuroHPC JU supercomputers state-of-play and upcoming systems
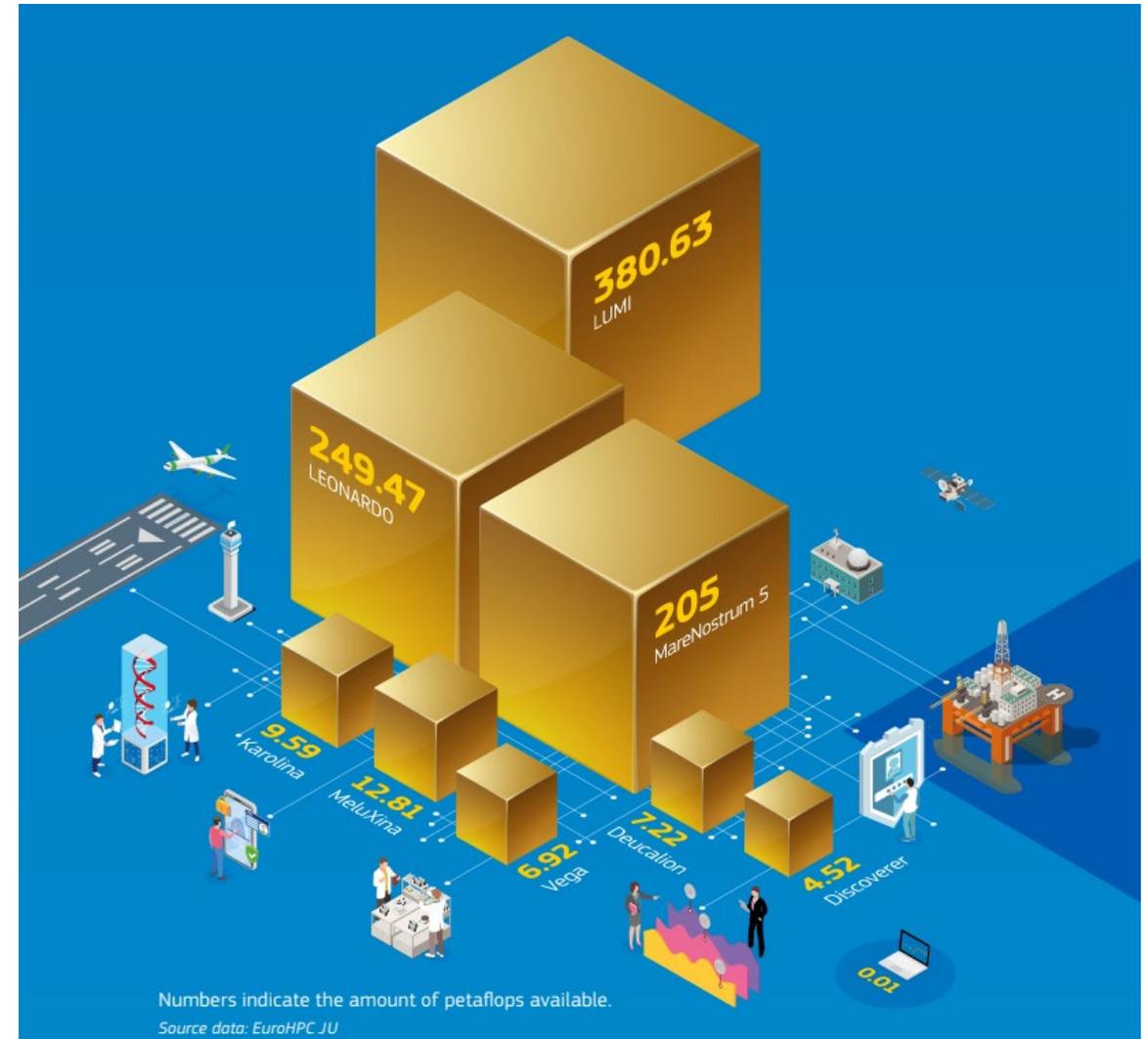
Vangelis Floros, Head of Sector Infrastructure
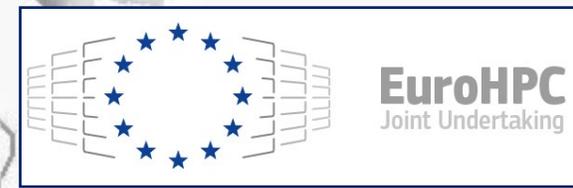**24 March 2023**

EuroHPC Infrastructure

- *Empowering European Scientific Research, Academia, Industry & SMEs*
- *Providing the necessary computing power to accelerate discovery and innovation in Europe*

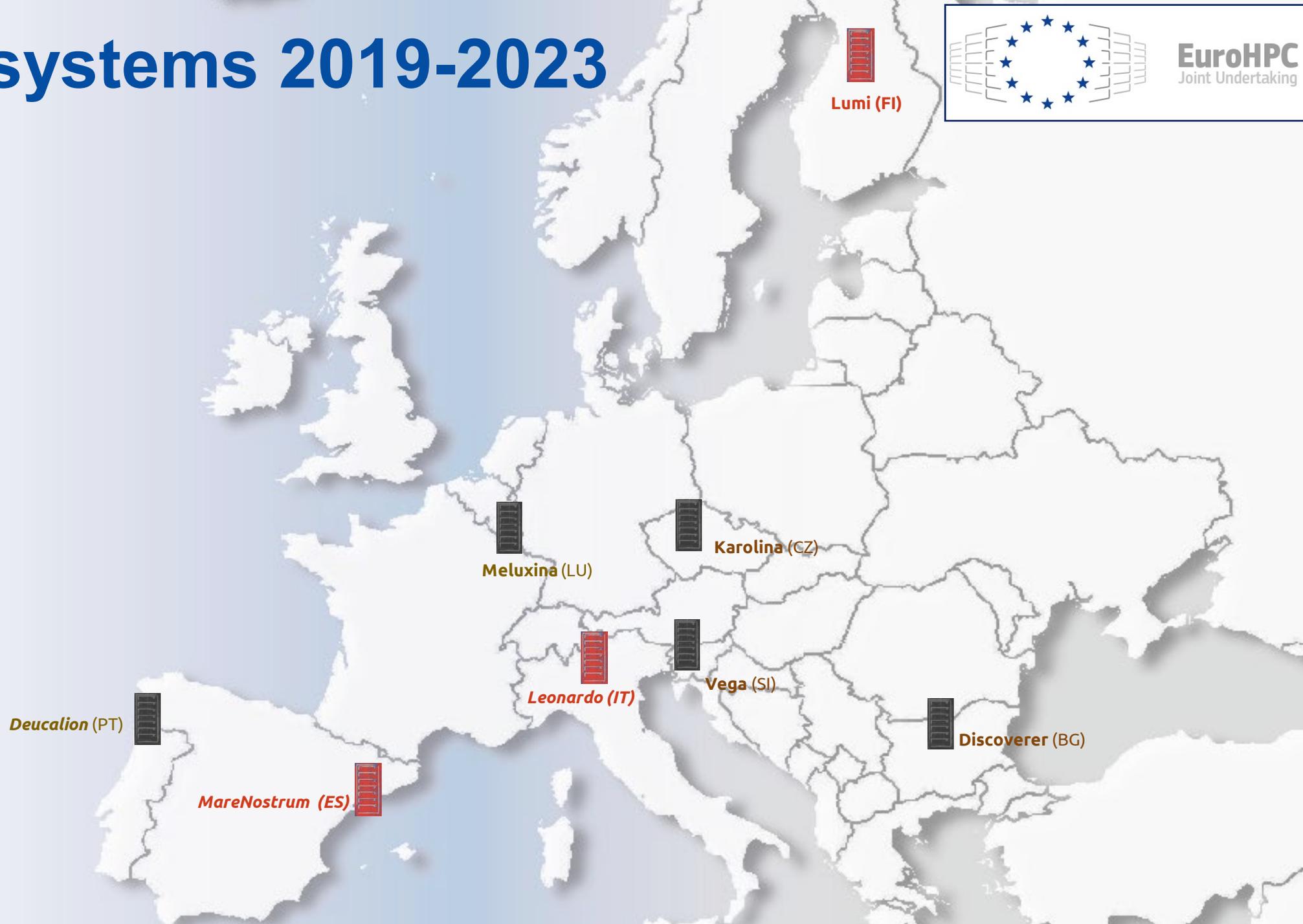**EuroHPC Infrastructure activities**
- Hosting Entity Selection
- System Procurements
- Operation & Monitoring
- Access Time allocation
- Hyperconnectivity
- Federation
- High-Level Application Support

Numbers indicate the amount of petaflops available.
Source data: EuroHPC JU

EuroHPC systems 2019-2023

Pre-exascale

Petascale

Lumi (FI)

Meluxina (LU)

Karolina (CZ)

Leonardo (IT)

Vega (SI)

Deucalion (PT)

Discoverer (BG)

MareNostrum (ES)

3

EuroHPC systems 2023-2025

Exascale

Pre-exascale

Petascale / Mid-range

Lumi (FI)

Jupiter - Jülich (DE)

Karolina (CZ)

Meluxina (LU)

Leonardo (IT)

Vega (SI)

Deucalion (PT)

Discoverer (BG)

MareNostrum (ES)

Daedalus (GR)

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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**

EuroHPC
Joint Undertaking

Lumi (FI)

Jupiter - Jülich (DE)

Karolina (CZ)

Meluxina (LU)

Vega (SI)

Leonardo (IT)

Deucalion (PT)

Discoverer (BG)

MareNostrum (ES)

Daedalus (GR)

Operational systems | Pre-exascale

LUMI Consortium (Coordinator CSC)
Kayaani, Finland

Leonardo Consortium (Coordinator CINECA)
Bologna, Italy

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

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

Atos BullSequana XH2000
#4 Top500 (Nov 2022): **238.7** PFlops (BOOSTER)

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

Operational systems | Petascale

EuroHPC Joint Undertaking

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	

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

GPP - General Purpose

Intel Sapphire Rapids
Peak performance: 45,4 Pflops

65 Kw/rack (201 x 60 x 160)
DLC + Rear Door

May 2023

MareNostrum5

InfiniBand NDR 200
4 IB racks + 4 Eth racks
22 Kw/rack + 11 Kw/rack
Rear Door

Spectrum Scale File System
248 PB HDD + 2,81 PB NVMe
402 PB tape

25 x 22 Kw/rack, Rear door
26 x 1,4 Kw/rack, ambient

January 2023 / March 2023

ACC – Accelerated

Intel Sapphire Rapids
NVIDIA Hopper
Peak performance: 260 Pflops

100 kw/rack (225 x 90 x 135)
DLC (3,86 kw to ambient)

June 2023 / September 2023

NGT GPP - Next Generation

NVIDIA Grace

Peak performance: 2,82 Pflops
Sustained HPL: 2 Pflops

October 2023

NGT ACC - Next Generation

Intel Emerald Rapids
Intel Rialto Bridge

CANCELLED

MORE
Coming Soon

Peak performance: 6 Pflops
Sustained HPL: 4,24 Pflops

December 2023

BSC Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Compute partitions overview

		Racks	Cooling	Nodes		Provider	Processor/Accelerator		Memory	PFlops (HPL)		Local Drive	High-Perf. Network
				Total	per rack								
Main	**General Purpose**	89	DLC +RDHX	6192	72 (6x6x2)	Lenovo	2x Intel Sapphire R. 8480+	56c @ 2GHz	>2GB/core 256GB DDR5	35.43	>205	960GB NVMe	1x NDR200 Shared by 2 nodes
				216					>8GB/core 1024GB DDR5				
		1		72			2x Intel Sapphire R. 03H-LC	56c @ 1.7GHz	> 0.5GB HBM/core 128GB HBM + 32GB DDR5	0.34			
	Accelerated	35	DLC	1120	32	Atos	2x Intel Sapphire R. 8460Y+	32c @ 2.3GHz	512GB	163		480GB NVMe	4x NDR200
							4x Nvidia Hopper 64GB HBM						
Next Gen	**General Purpose**	7	AC +RDHX	408	68	Atos	2x Nvidia Grace	72c @ 2.6GHz	240GB LPDDR5	2		128GB NVMe	1x NDR200
	Accelerated	1	DLC +RDHX	24	24	Lenovo	~~2x Intel Emerald R.~~	~~48c~~	~~512GB DDR5~~	4.24		960GB NVMe	2x NDR
							~~4x Intel Rialto Bridge 128GB HBM2E~~						

Deucalion
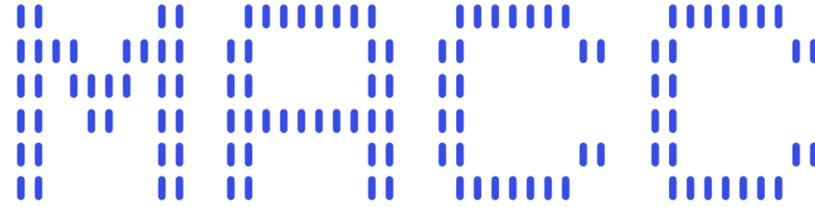
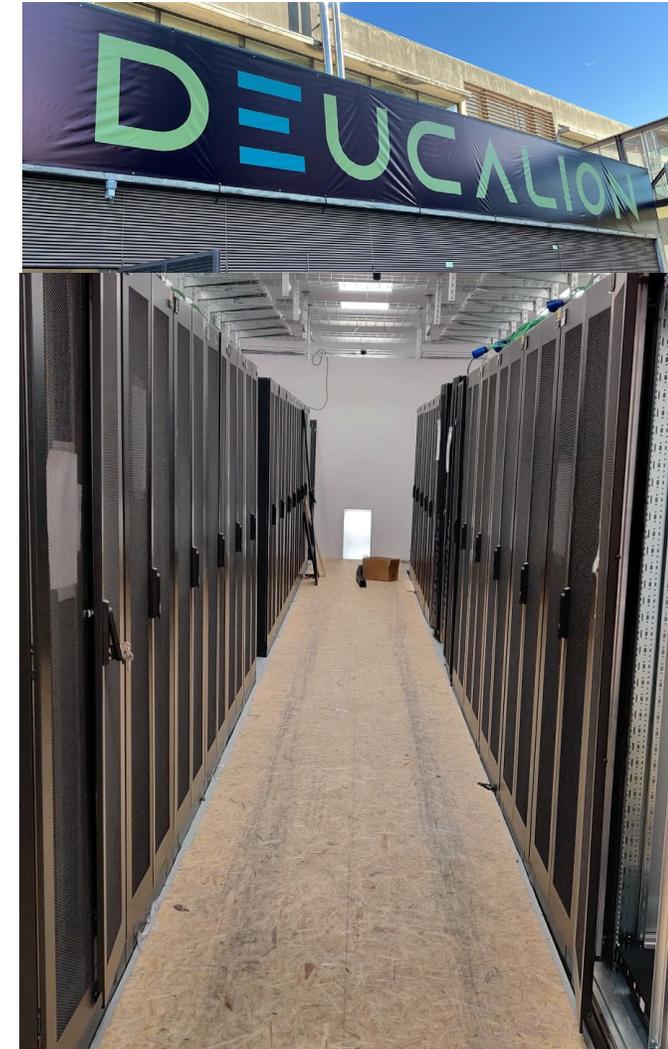|	
Compute partitions:	ARM Partition: 1632 nodes, 3.8 PFLops ; x86 Partition: 500 nodes, 1,62 PFLops ; Accelerated: 33 nodes, 1,72 PFLops
Central Processing Unit (CPU):	A64FX (ARM partition), AMD EPYC (x86 partitions)
Graphics Processing Unit (GPU):	NVidia Ampere
Storage capacity:	430 TB High-speed NVMe partition, 10.6 PB high-speed based Parallel File System partition.

JUPITER Exascale System

Hosted by Julich Supercomputing Center (Germany)

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**

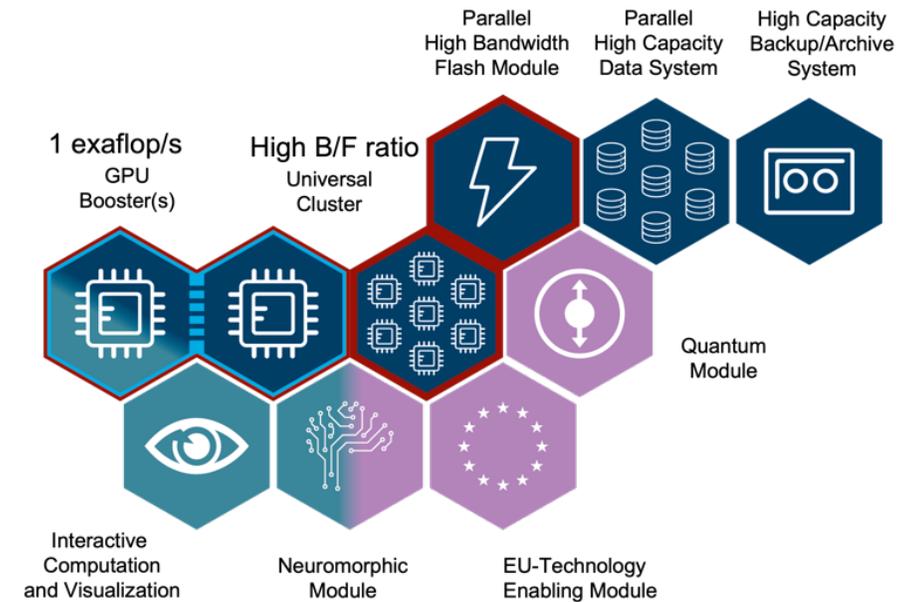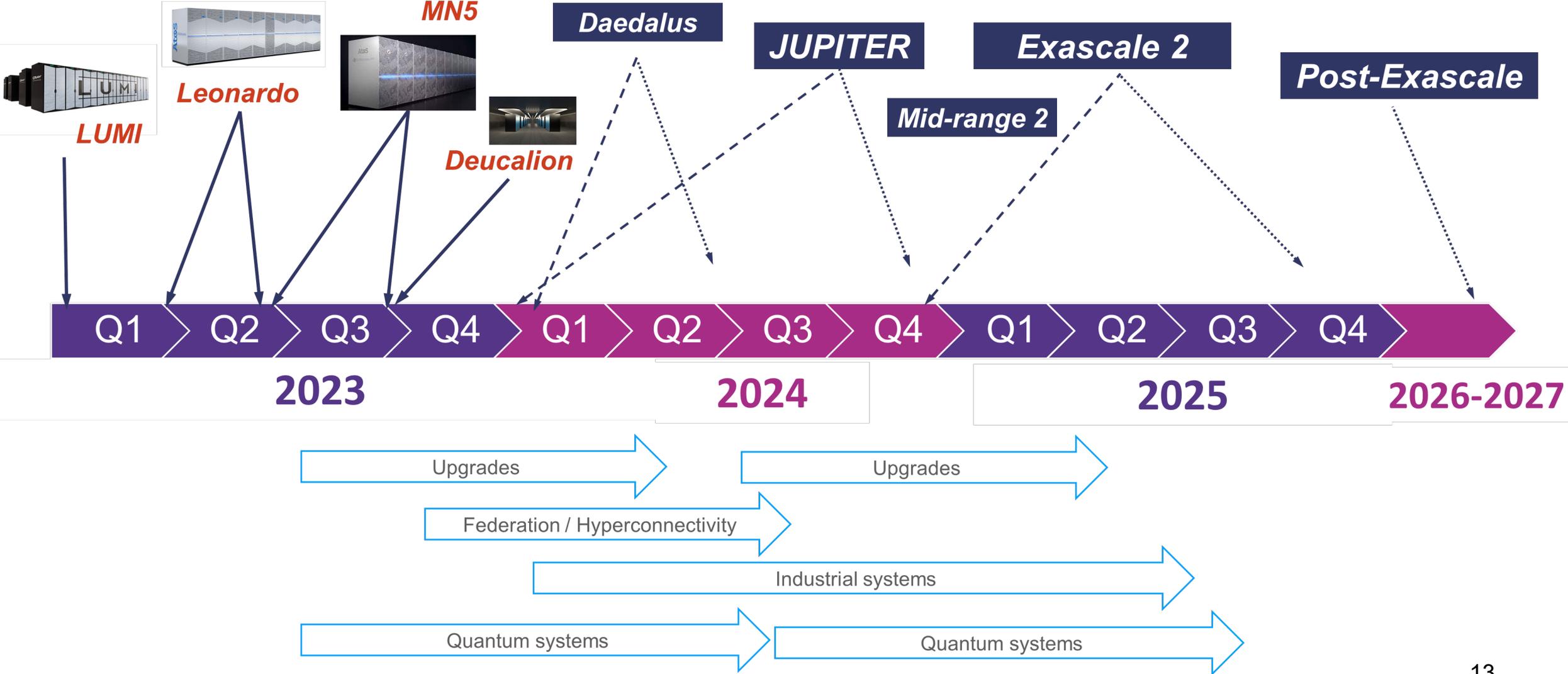Acceptance (Phase 1): **Q4 2024**

Basic Configuration

Optional Modules

Future Technology Modules

1 exaflop/s GPU Booster(s)

High B/F ratio Universal Cluster

Parallel High Bandwidth Flash Module

Parallel High Capacity Data System

High Capacity Backup/Archive System

Quantum Module

Interactive Computation and Visualization

Neuromorphic Module

EU-Technology Enabling Module

Next systems Timeline

EuroHPC
Joint Undertaking

LUMI

Leonardo

MN5

Deucalion

Daedalus

JUPITER

Mid-range 2

Exascale 2

Post-Exascale

| 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

ACCESS TO EUROHPC SUPERCOMPUTERS

WHO IS ELIGIBLE?

- Academic and research institutions (public and private)
- Public sector organisations
- Industrial enterprises and SMEs
- Established in the EU or H2020 affiliated country
  → Open to all fields of research

WHICH TYPES OF ACCESS EXIST?

- Regular access
- Extreme scale access
- Benchmark access
- Special access

…

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:

- use computing resources primarily for research and innovation
- 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

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Access Policy

Access Policy v1.1 as adopted by the EuroHPC GB

- **6 Access Modes offering resources on a continuously open call basis with periodic cut-off dates.**
  - **Extreme scale:** Large applications, 2xYear. <u>Peer-reviewed</u>. Separate track for industry.
  - **Regular:** Medium to large applications, 3xYear. <u>Peer-reviewed.</u> Separate track for industry.
  - **Development.** All systems. Up to 1 year access. Monthly cut-offs
  - **Benchmark.** All systems. Up to 3 months access. Monthly cut-offs
  - **Fast track for Industry & Academia.** Quick access to previously completed applications

Commercial Access (*)

- **Pay-per-use model**
- **No restrictions for open research – applications for civilian purpose**

- **PRACE supports EuroHPC** in the implementation of the Access Policy!

Visit https://pracecalls.eu/ and https://prace-ri.eu/hpc-access/eurohpc-access/

Current and upcoming offering of resources

By end 2023: **64.5 Million** node hours across **8 systems** (**15 partitions, 22.596 nodes**).

- **CPU, GPU, FPGA resources**
- **Variety of platforms: AMD (x86, Instinct), Intel (x86), Nvidia (A100, H100), Fujitsu ARM (A64FX)**
- **~870 PFlops aggregated performance**

To reach **91.3 Million** node hours by end of 2024 (full systems capacity)

Industry/SMEs

- Up to 20% of total resources available for Commercial Access (*)
- 2023-2024: EuroHPC to procure Industry specific supercomputer in collaboration with industrial partner

Thank you!

Keep up with EuroHPC news:

https://eurohpc-ju.europa.eu   @EuroHPC_JU   EuroHPC Joint Undertaking