



EuroCC@Greece

<https://eurocc-greece.gr/newsletter/>

<https://www.linkedin.com/company/eurocc-greece>

<https://www.youtube.com/@euroccgreece9501>

https://x.com/EuroCC_Greece



EuroHPC
Joint Undertaking



EuroCC@Greece

The overall objective of the Greek National Competence Center is to enable the efficient uptake of HPC technologies with the 3-fold goal to:

- advance competitiveness in **research**
- improve the effectiveness of **government** services and
- promote innovation in **industry**

The Greek Competence Center for High Performance Computing and Artificial Intelligence

Enhancing innovation capacity in Business, Industry and Science
by utilizing advanced High Performance Computing services



EuroCC@Greece

Services

- Technological Support & Consulting
 - High-Performance Computing,
 - Artificial Intelligence, and
 - High-Performance Data Analytics
- Training and Skills Development
- Access to computational resources

<https://eurocc-greece.gr/>

Fields of Applications

- Artificial Intelligence
- Machine Learning
- Computer Vision
- Large Language Models
- Finite Elements Analyses
- Computational Fluid Dynamics
- Molecular Simulations
- Atmospheric & Oceanic Sciences



Consortium

The Greek National Competence Center “EuroCC@Greece”, is run by a consortium of 5 institutions, namely

1. National Infrastructures for Research and Technology (coordinator) - **GRNET**
2. National Center for Scientific Research - **Demokritos**
3. Institute of Communication and Computer Systems - **NTUA**
4. Aristotle University of Thessaloniki - **AUTH**
5. Foundation for Research and Technology Hellas - **FORTH**



The European High Performance Computing Joint Undertaking (EuroHPC JU)

is a joint initiative between the EU, European countries and private partners to develop a World Class Supercomputing Ecosystem.

https://eurohpc-ju.europa.eu/index_en





8 operational systems, all ranking among the world's most powerful supercomputers:

1. LUMI in Finland #5
2. LEONARDO in Italy #6
3. MARENOSTRUM in Spain
4. VEGA in Slovenia
5. MELUXINA in Luxembourg
6. KAROLINA in Czechia
7. DEUCALION in Portugal
8. DISCOVERER in Bulgaria

Underway:

- JUPITER in Germany
- DAEDALUS in Greece

1	Frontier - HPE Cray EX235a, AMD Optimized 3rd Generation EPYC 64C 2GHz, AMD Instinct MI250X, Slingshot-11, HPE
2	Aurora - HPE Cray EX - Intel Exascale Compute Blade, Xeon CPU Max 9470 52C 2.4GHz, Intel Data Center GPU Max, Slingshot-11, Intel
3	Eagle - Microsoft NDv5, Xeon Platinum 8480C 48C 2GHz, NVIDIA H100, NVIDIA Infiniband NDR, Microsoft
4	Supercomputer Fugaku - Supercomputer Fugaku, A64FX 48C 2.2GHz, Tofu interconnect D, Fujitsu
5	LUMI - HPE Cray EX235a, AMD Optimized 3rd Generation EPYC 64C 2GHz, AMD Instinct MI250X, Slingshot-11, HPE
6	Leonardo - BullSequana XH2000, Xeon Platinum 8358 32C 2.6GHz, NVIDIA A100 SXM4 64 GB, Quad-rail NVIDIA HDR100 Infiniband, EVIDEN
7	Summit - IBM Power System AC922, IBM POWER9 22C 3.07GHz, NVIDIA Volta GV100, Dual-rail Mellanox EDR Infiniband, IBM



LUMI
FINLAND



LEONARDO
ITALY



MELUXINA
LUXEMBOURG



KAROLINA
CZECH REPUBLIC



DISCOVERER
BULGARIA



VEGA
SLOVENIA



DEUCALIO
PORTUGAL



MARENOSTRUM 5
SPAIN

1. LUMI (CSC, Finland)

- LUMI-C: 1536 nodes, 128 cores/node, 256-1024 GB RAM/node
- GPU: 2560 nodes, 64 cores/node, 4 GPUs, 128 GB GPU-RAM
- Visualization: 64 nodes, 1 GPU, 48 GB GPU-RAM
- Peak Performance: 550 petaflops
- URL: <https://www.lumi-supercomputer.eu/lumis-full-system-architecture-revealed/>

2. Leonardo (Cineca, Italy)

- Booster Module: 3456 nodes, 32 cores/node, 512 GB RAM/node, 4 GPUs, 64 GB GPU-RAM
- Data Centric Module: 1536 nodes, 112 cores/node, 512 GB RAM/node
- Peak Performance: 323.4 petaflops
- URL: <https://leonardo-supercomputer.cineca.eu/hpc-system/>

3. MareNostrum 5 (Barcelona Supercomputing Center, Spain)

- General Purpose Partition: 6408 nodes, 112 cores/node, 256 GB RAM/node
- Accelerated Partition: 1120 nodes, 64 cores/node, 512 GB RAM/node, 4 GPUs, 64 GB GPU-RAM
- Peak Performance: 314 petaflops
- URL: <https://www.bsc.es/innovation-and-services/marenostrum/marenostrum-5>

4. MeluXina (LuxProvide, Luxembourg)

- Cluster: 573 nodes, 128 cores/node, 512 GB RAM/node
- Accelerator-GPU: 200 nodes, 64 cores/node, 512 GB RAM/node, 4 GPUs, 40 GB GPU-RAM
- Large memory: 20 nodes, 128 cores/node, 4096 GB RAM/node
- Peak Performance: 18.29 petaflops
- URL: <https://docs.lxp.lu/system/overview/>

5. Karolina (IT4I, Czech Republic)

- CPU: 828 nodes, 128 cores/node, 256-24000 GB RAM/node
- GPU: 72 nodes, 8 GPUs, 40 GB GPU-RAM
- Peak Performance: 15.69 petaflops
- URL: <https://www.it4i.cz/en/infrastructure/karolina>

6. Vega (IZUM, Slovenia)

- GPU partition: 60 nodes, 128 cores/node, 512 GB RAM/node, 4 GPUs, 40 GB GPU-RAM
- CPU node Standard: 768 nodes, 128 cores/node, 256 GB RAM/node
- CPU node Large Memory: 192 nodes, 128 cores/node, 1000 GB RAM/node
- Peak Performance: 10.05 petaflops
- URL: <https://doc.vega.izum.si/architecture/>

7. Deucalion (Guimarães, Portugal)

- ARM cluster: 1632 nodes, 48 cores/node
- X86 cluster: 500 nodes, 48+ cores/node
- Accelerated partition: 33 nodes
- Peak Performance: 10 petaflops
- URL: <https://macc.fccn.pt/resources#deucalion>

8. Discoverer (Sofia Tech Park, Bulgaria)

- CPU: 1128 nodes, 128 cores/node, 256 GB RAM/node
- CPU-Fat: 18 nodes, 128 cores/node, 1000 GB RAM/node
- Peak Performance: 5.94 petaflops
- URL: https://docs.discoverer.bg/resource_overview.html

ARIS – HPC Infrastructure in Greece Compute Nodes

The ARIS infrastructure consists of a total of five computing system nodes based on Intel x86 architecture, interconnected into a single InfiniBand FDR14 network offering multiple options and processing architectures. More specifically, the infrastructure consists of:

- **Thin Nodes:** 426 IBM NeXtScale nodes, Intel Xeon E5-2680v2, 8,520 cores.
- **Fat Nodes:** 44 Dell PowerEdge R820, 4 Intel Xeon E5-4650v2, 512 GB memory per node.
- **GPU Nodes:** 44 Dell PowerEdge R730, 2 Intel Xeon E5-2660v3, 64 GB memory, 2 NVIDIA K40 GPUs per node.
- **Xeon Phi Nodes:** 18 Dell PowerEdge R730, 2 Intel Xeon E5-2660v3, 64 GB memory, 2 Xeon Phi 7120P co-processors per node.
- **ML Node:** 1 server, 2 Intel E5-2698v4, 512 GB memory, 8 NVIDIA V100 GPUs.





EuroCC@Greece

Publications

Greek supercomputer ARIS

<https://www.hpc.grnet.gr/en/publications/>

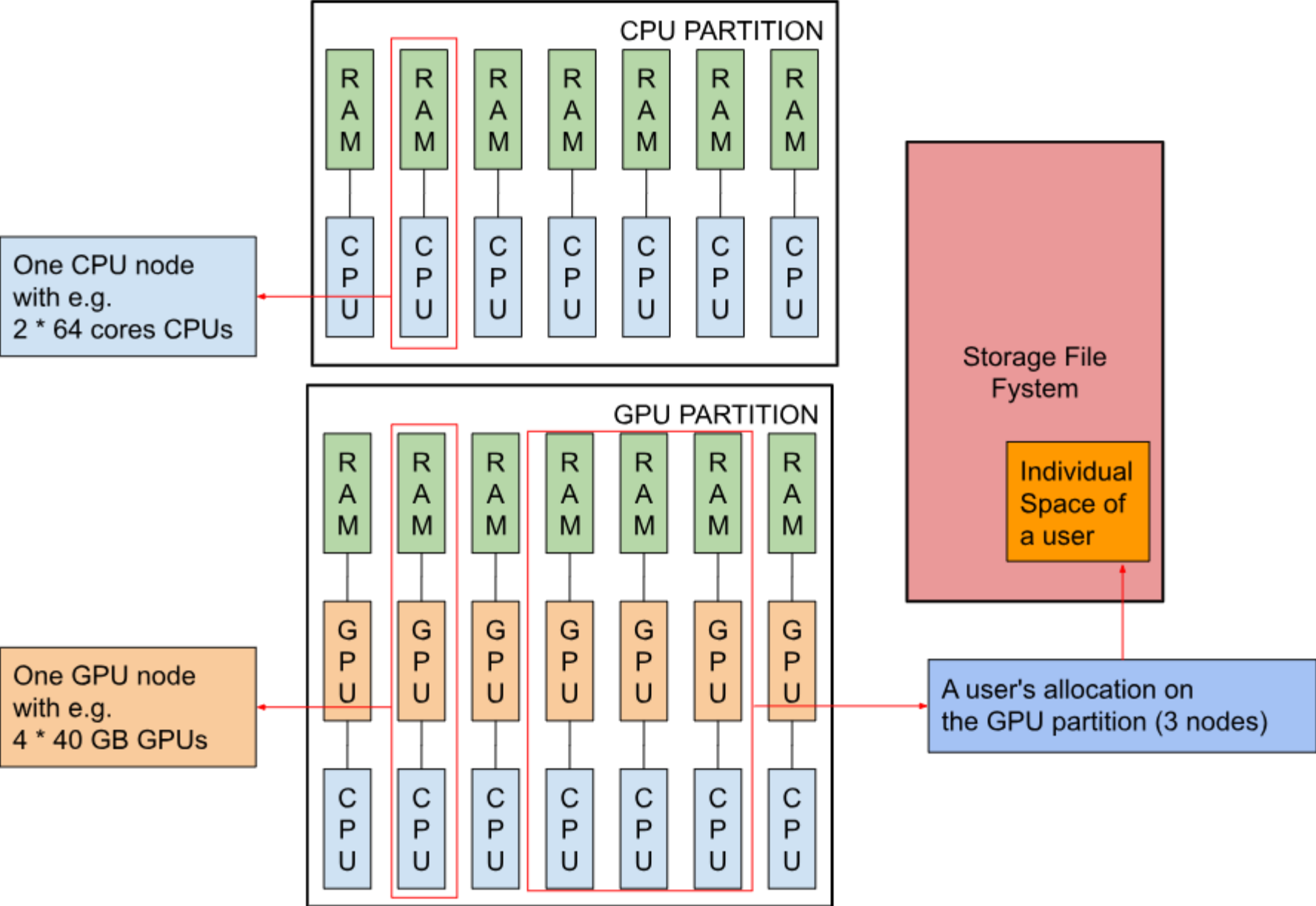
- In **fluid dynamics**, HPC powers deep learning models for super-resolution imaging and **turbulent flow reconstruction**, along with complex **multi-phase flow simulations**.
- **Materials science** benefits from HPC-driven **machine learning** and **molecular dynamics**, refining interatomic potentials for **pharmaceuticals**, and investigating **polymer mechanics**.
- **Computational chemistry** leverages quantum mechanical calculations for **thermoelectric materials**, **electronic structures**, and **drug binding** studies.
- **Astrophysics** research utilizes HPC for **modeling neutron star** thermoelectric effects and pulsar equations.
- **Atmospheric and oceanic sciences** apply HPC to turbulence modeling in **air pollution studies**, **weather forecasting**, and sea surface simulations.
- Additionally, HPC enhances radiation modeling for space applications and **Monte Carlo-based dosimetry** calculations, underscoring its vital role in advancing interdisciplinary research.

The way is open to building a EuroHPC world-class supercomputer in Greece

- A hosting agreement has been signed between the EuroHPC Joint Undertaking and the National Infrastructures for Research and Technology (**GRNET**) in **Greece**, where **DAEDALUS**, a new **EuroHPC supercomputer**, will be located.
- **60 petaflops** or 60 million billion calculations per second
<https://grnet.gr/en/business-directory/grant-for-the-development-of-a-new-national-hpc-system-daedalus/>
- **Lavrion** Technological and Cultural Park (TCPL) https://eurohpc-ju.europa.eu/way-open-building-eurohpc-world-class-supercomputer-greece-2022-11-28_en
- June 11, 2024: GRNET S.A. conducts a Public Consultation on the Open Tender Announcement Issue
<https://grnet.gr/2024/06/11/public-consultation-lavrio-daedalus/>



Example of an HPC cluster



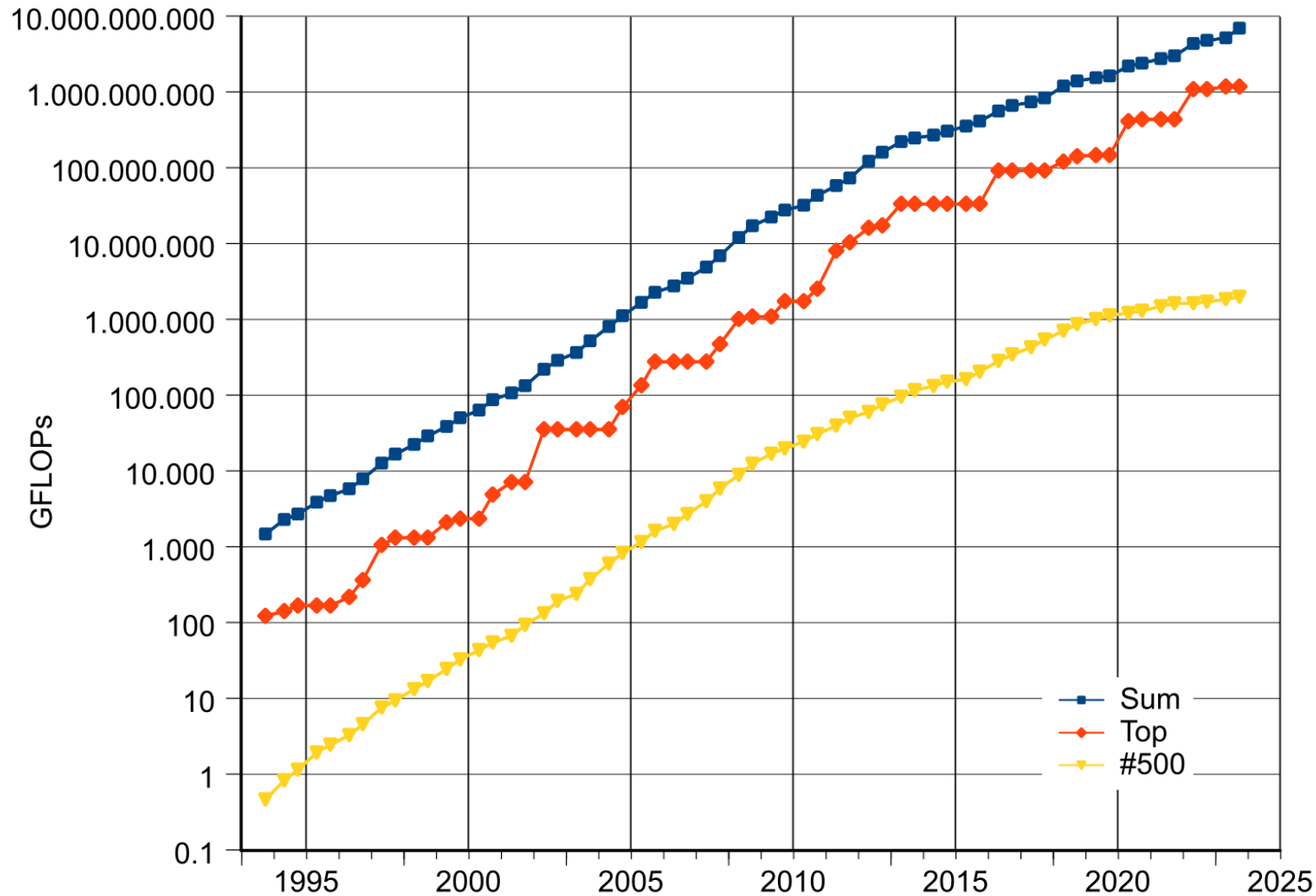
Threads on 1 node of MeluXina supercomputer

<https://docs.lxp.lu/system/overview/>

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Mem[|||||] 15.9G/503G Tasks: 43, 293 thr, 2911 kthr; 227 running
Swp[ ] 0K/0K Load average: 1.97 60.10 121.57
Uptime: 89 days, 01:38:08

[Main] [I/O]
PID USER PRI NI VIRT RES SHR S CPU%MEM% TIME+ Command
7131 u100425 20 0 6754M 244M 8424 R 2430.9 0.0 0:48.33 python __mult_proc_loop__.py
F1Help F2Setup F3Search F4Filter F5Tree F6SortBy F7Nice -F8Nice +F9Kill F10Quit
```

Growth of HPC systems



The new **El Capitan** system at the **Lawrence Livermore National Laboratory** in California, U.S.A., has debuted as the most powerful system on the list with an HPL score of 1.742 EFlop/s.
<https://top500.org/>

<https://creativecommons.org/licenses/by-sa/3.0/>

<https://en.Wikipedia.org/wiki/TOP500#/media/File:Supercomputers-history.svg>

X 200,000



0.05 km/h



1 km/h



100 km/h



1,000 km/h



10,000 km/h



1,000,000,000 km/h



1 TFlop

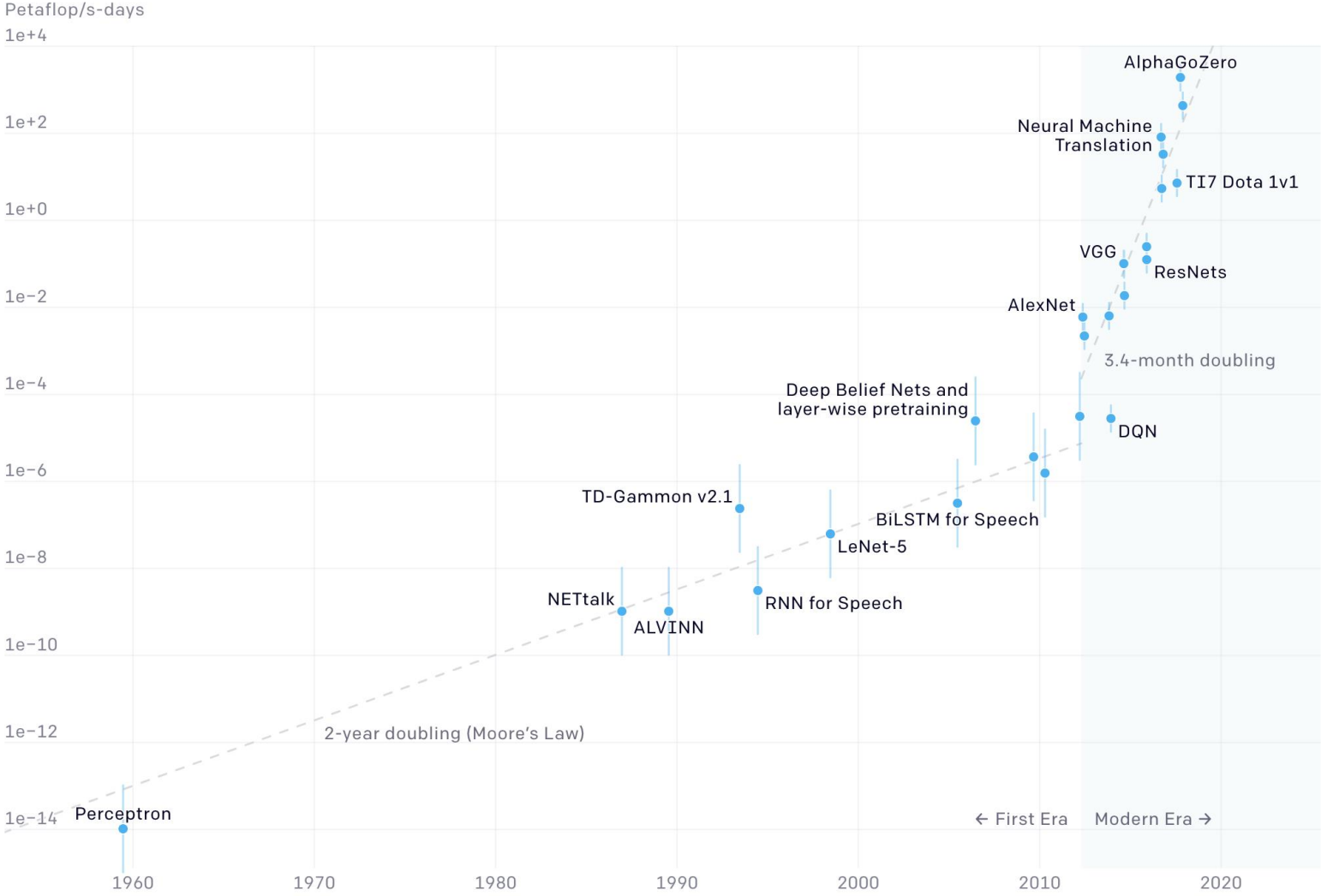
X 1,000,000



1 EFlop

Since 2102 we observe a 3.4-month doubling in computing power used to train AI models.

Two Distinct Eras of Compute Usage in Training AI Systems



Large Language Models on HPC

Estimated GPU Hours for Training:

1. Small LLM (~8B):

- ~1.3M GPU hours (LLAMA 3 8B).

2. Medium LLM (~70B):

- ~6.4M-7.0M GPU hours (LLAMA 3/3.1 70B).

3. Large LLM (~405B):

- ~30.84M GPU hours (LLAMA 3.1 405B).
- Falcon 180B (slightly smaller): ~7M GPU hours.

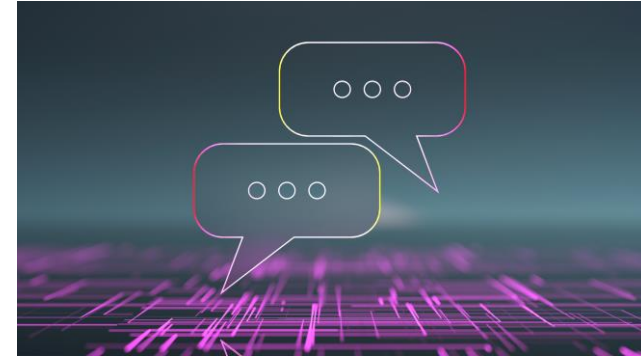
<https://huggingface.co/meta-llama/Meta-Llama-3-8B-Instruct>

<https://huggingface.co/meta-llama/Llama-3.3-70B-Instruct>

<https://huggingface.co/meta-llama/Llama-3.1-405B-Instruct>

<https://docs.lxp.lu/howto/llama3-vllm/>

<https://huggingface.co/blog/falcon-180b>



Estimated GPU Requirements for Inference:

• **Small LLM (~8B):** ~80GB GPU RAM (LLAMA 3.1 8B).

• **Medium LLM (~70B):** ~320GB GPU RAM (GPTQ/int4 on Falcon).

Large LLM (~405B): ~800GB GPU RAM (FP8 on LLAMA 3.1).

EuroHPC Access Modes

[EuroHPC JU Call for Proposals – Extreme Scale Access Mode](#)

For applications with high-impact, high-gain innovative research

[EuroHPC JU Call for Proposals – Regular Access Mode](#)

The expected impact in the application's domain should justify the need for large allocations

[EuroHPC JU Call for Proposals – AI and Data-Intensive Applications Access Mode](#)

To support ethical artificial intelligence & machine learning

[EuroHPC JU Call for Proposals – Development Access Modes](#)

To develop, test and optimise applications

[EuroHPC JU Call for Proposals – Benchmark Access Modes](#)

To test or benchmark applications

https://eurohpc-ju.europa.eu/access-our-supercomputers/access-policy-and-faq_en

<https://access.eurohpc-ju.europa.eu/>

2025 Cut off dates for EuroHPC Access Calls

BENCHMARK ACCESS:

- 1st day of each month

DEVELOPMENT ACCESS:

- 1st day of each month

AI AND DATA INTENSIVE APPLICATIONS ACCESS:

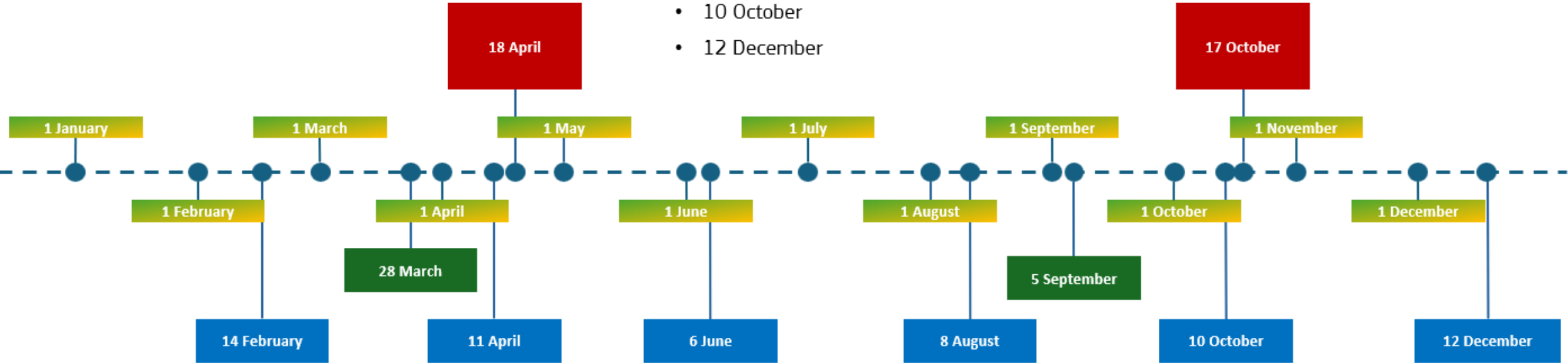
- 14 February
- 11 April
- 6 June
- 8 August
- 10 October
- 12 December

REGULAR ACCESS:

- 28 March
- 5 September

EXTREME SCALE ACCESS:

- 18 April
- 17 October



Open Calls for Proposals



Cut-off ends in

3 hours

EuroHPC Benchmark Access Call

● Open

The EuroHPC Benchmark call is designed for code scalability test...



Cut-off ends in

6 days

EuroHPC Extreme Scale Access C...

● Open

The Extreme Scale Access mode is designed to serve research...



Cut-off ends in

7 days


EuroHPC AI and Data-Intensive A...

● Open

The EuroHPC JU AI and Data-Intensive Applications Access cal...



<https://access.eurohpc-ju.europa.eu/>

Proposal for civilian purposes* 

Is any part of the project confidential?*


Yes No 

Research fields

Research field title*

PE6 Computer Science and Informatics 

Research field sub-title*

PE6_7 Artificial intelligence, intelligent systems, natural language processing 

Research field share (%)*

50

The sum of all research fields should not exceed the total of 100%



Cut-off ends in

3 hours

EuroHPC Development Access Call

● Open

The EuroHPC Development call is designed for projects focusing on...

<https://access.eurohpc-ju.europa.eu/>

Research fields #2

Research field title*

PE6 Computer Science and Informatics

Research field sub-title*

PE6_11 Machine learning, statistical data processing and applications using signal

Research field share (%)*

50

The sum of all research fields should not exceed the total of 100%

Remove

+ Research fields

AI set of technologies selection

Machine Learning

Natural Language Processing

Deep Learning

If applicable, please select used AI technologies. This is a multi-select field so you are able to choose more than one option.

<https://access.eurohpc-ju.europa.eu/>

Partitions

Partition name*

Code(s) used*

This field is a multi-text field, for adding another code separate it with a comma

Requested amount of resources (node hours)*

Average number of processes/threads*

Average job memory (total usage over all nodes in GB)*

Maximum amount of memory per process/thread (MB)*

Total amount of data to transfer to/from (GB)*

<https://access.eurohpc-ju.europa.eu/>

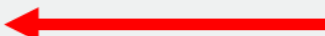
Partitions #2 

Partition name*

Code(s) used*

This field is a multi-text field, for adding another code separate it with a comma

Requested amount of resources (node hours)*

Average number of processes/threads*

Average job memory (total usage over all nodes in GB)*

Maximum amount of memory per process/thread (MB)*

<https://access.eurohpc-ju.europa.eu/>

Frequently Asked Questions (FAQ)

https://eurohpc-ju.europa.eu/access-our-supercomputers/access-policy-and-faq_en

- **How can I gain access to computation time on EuroHPC machines?**
 - You will need to **apply** to one of the open **access calls** that **EuroHPC** provides. The list of available calls can be found here.
- **Which organisations are eligible for access to EuroHPC machines?**
 - Any European organisation is eligible for access to perform Open Science research (the **results** of the work are made available for **open access**). This includes **public and private** academic and research institutions, public sector organisations, industrial enterprises and SMEs
- **What is the cost?**
 - Currently access is **free of charge**.
- **What are the participation conditions?**
 - Participation conditions depend on the specific access call that a research group has applied. 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 participation conditions can be found in the call's Documents section.

Our Training Events <https://eurocc-greece.gr/events-2/>



EURO Greece

HPC Training Series

Course 1

HPC for beginners: basic concepts, MPI and OpenMP

| PRESENTATION LANGUAGE: GREEK |

MARCH 29 | 09:45 EET | ONLINE



EURO Greece

HPC Training Series

Course 2

Introduction to accelerators: GPUs / CUDA

| PRESENTATION LANGUAGE: GREEK |

APRIL 19, 2024 | 10:00 EET | ONLINE



EURO Greece

it.auth

HPC Training Series

Course 3

Large Language Models (LLMs) on High Performance Computing (HPC) Systems

| PRESENTATION LANGUAGE: GREEK |

APRIL 24, 2024 | 10:00 EET | ONLINE



EURO Greece

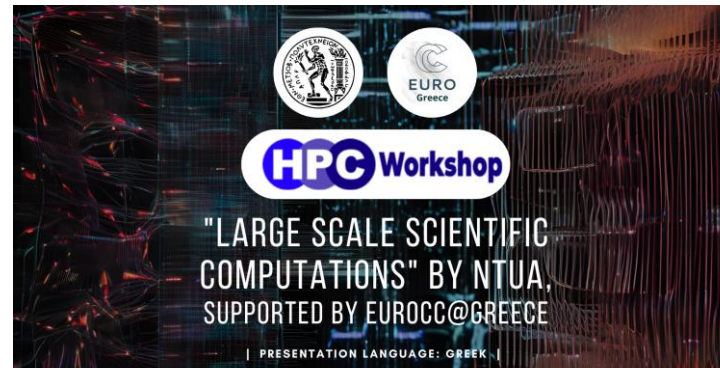
HPC Training Series

Course 4

Intermediate-level Programming for HPC using Python

| PRESENTATION LANGUAGE: ENGLISH |

MAY 29, 2024 | 10:00 EET | HYBRID



EURO Greece

HPC Workshop

"LARGE SCALE SCIENTIFIC COMPUTATIONS" BY NTUA
SUPPORTED BY EUROCC@GREECE

| PRESENTATION LANGUAGE: GREEK |

JULY 11-14, 2024 | 10:00 - 16:00 EET | ON-SITE



EURO Greece

HPC Training Series

Course 5

Computational Fluid Dynamics (CFD) using OpenFOAM on High Performance Computing (HPC)

| PRESENTATION LANGUAGE: GREEK |

JUNE 14, 2024 | 09:30 EET | ONLINE



EURO Greece

gnet

DCoMEX

Workshop

Data-driven Applications for Exascale Supercomputers

SEPTEMBER 2-3, 2024 | 09:00 - 17:00 EET | ATHENS, GREECE



EURO Greece

HPC Training Series

Course 6

Gradient-based & gradient-free Optimization, with applications to CFD & beyond

| PRESENTATION LANGUAGE: GREEK |

OCTOBER 4, 2024 | 10:00 EET | ONLINE



EURO Greece

HPC Training Series

Course 7

AI for Life Sciences

Vol. 1: Deep Learning for Health and Life Sciences

| PRESENTATION LANGUAGE: GREEK |

NOVEMBER 1, 2024 | 10:00 EET | ONLINE

Our Training Events <https://eurocc-greece.gr/events-2/>



EURO Greece 

HPC Training Series

Course 8
Computational Chemistry and High Performance Computing (HPC)

| PRESENTATION LANGUAGE: GREEK |

DECEMBER 9, 2024 | 10:00 EET | ONLINE



EURO Greece

HPC Training Series

Course 9
Running LLMs on HPC: Transformers, Inference & Deployment

| PRESENTATION LANGUAGE: GREEK & ENGLISH |

JANUARY 17, 2025 | 10:00 EET | ONLINE



EURO Greece 

HPC Training Series

Course 10
Introduction to Computational Fluid Dynamics and OpenFOAM, using HPC

| PRESENTATION LANGUAGES: GREEK & ENGLISH |

FEBRUARY 17, 2025 | 09:30 EET | ONLINE



EURO Greece

HPC Training Series

Course 11
HPC for Beginners: Basic Concepts, MPI and OpenMP

| PRESENTATION LANGUAGE: GREEK |

MARCH 7, 2025 | 09:45 EET | ONLINE

HPC Training Series - Course 11

HPC for Beginners

- Basic Concepts
- OpenMP
- MPI



09:45

→ 10:00

Introduction to EuroCC & the training events

Speaker: Dr Nikolaos Bakas (GRNET)

10:00

→ 10:15

How to access the EuroHPC-JU supercomputers

Speaker: Dr Nikolaos Bakas (GRNET)

10:15

→ 10:30

How to access the Greek HPC Infrastructure ARIS

Speaker: Mr Nikolaos Triantafyllis (GRNET)

10:30

→ 11:00

How to submit a job via Slurm on an HPC cluster

Speaker: Mr Nikolaos Triantafyllis (GRNET)

11:00

→ 12:30

Introduction to OpenMP

Speaker: Dr Georgios Goumas (NTUA)

12:30

→ 14:00

Introduction to MPI (Message Passing Interface)

Speaker: Dr Antony Spyropoulos (NTUA)

14:00

→ 14:05

Wrap Up

Speaker: Dr Nikolaos Bakas (GRNET)



EuroCC@Greece

<https://eurocc-greece.gr/newsletter/>

<https://www.linkedin.com/company/eurocc-greece>

<https://www.youtube.com/@euroccgreece9501>

https://twitter.com/EuroCC_Greece



EuroHPC
Joint Undertaking

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