

ANTWERP

# Collaborating on HPC with LATAM

Fabrizio Gagliardi, Dr.  
International cooperation head,  
Barcelona Supercomputing Center  
Barcelona  
Spain



# Experience with EU-LATAM Cooperation

+20 years of EU-LATAM collaboration in digital infrastructures

- EU-funded projects focused on grid and cloud computing ([EELA](#), [EELA-2](#), [GISELA](#), [CHAIN-REDS](#), [EUBrasilCloudFORUM](#)) and HPC ([HPC4E](#), [ENERXICO](#)).
- EU-funded CSAs focused on EU-LATAM cooperation in research infrastructure and policy coordination ([ResInfra EU-LAC](#), [RISC](#), [RISC2](#), and the ongoing project [SPIDER](#)).
- [BELLA Programme](#) to leverage the digital infrastructure enabled by the [ELLALink](#) submarine cable.
- [EU-LAC Digital Alliance](#) under the Global Gateway investment strategy.



# RISC2

The **RISC2** European project (2021-2023) established a network for supporting the coordination of High-Performance Computing research between **Europe** and **Latin America**.

<https://www.risc2-project.eu/>



# RISC2







# The way forward – Conclusion of 3 years of RISC2 activity

## The RISC2 Roadmap recommendations

- Establish **CoEs** at the regional level in LATAM to support scientific applications in priority areas.
- Elaborating on a **regional framework for AI** would allow the region to leverage the countries' resources in terms of AI research-focused expertise.
- The different national HPC systems in LATAM should **federate** together and cooperate to create a solid regional HPC ecosystem.
- Design specific **degrees in HPC** (MSc, joint PhD programmes) in cooperation between LATAM and EU academic partners.
- Promote **bilateral agreements** between EU and LATAM countries (followed by collaborations with EuroHPC JU).



# The case of Brazil

- Brazil is in a good position to foster a **LATAM HPC ecosystem**.
- In Nov 2021, the EC and Brazilian funding agencies CNPq, FINEP, and CONFAP signed an Administrative Arrangement to support Brazilian participation in HE (2021-2027).
- Brazil could follow the example of other countries (Japan, India, South Korea, and Singapore) and pursue a **Digital Partnership Agreement** with the EU.
- **HPC access to Brazilian** and European facilities on a competitive basis for joint EU-BR proposals could be encouraged.
- A **mobility** program for stays and secondments could be initiated.
- New and already established **HPC schools** could be integrated into the ecosystem.





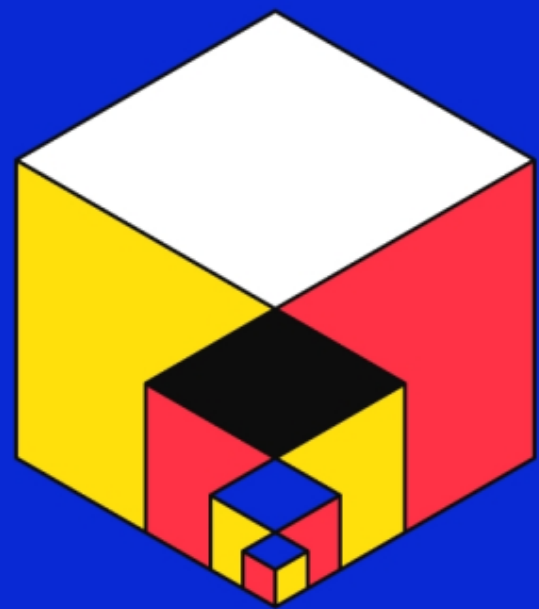
# EU-Brazil HPC collaboration



BSC, ELDORADO Institute, and UNICAMP announced the signing of an MoU to drive research and development in semiconductors and supercomputing.

The collaboration focuses on developing a Matrix Multiplication Acceleration Unit integrated with a RISC-V processor.





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Thank you!

# Some (Post-)Exascale Challenges

## The NumPEx Program and InPEx Project Contributions

EuroHPC Summit, 19 March

Panel « PLENARY: International Cooperation: What's Next? »

JY. Berthou (INRIA)

### Contributors

**Spain-BSC :** Sergi Girona, Rosa M Badia, Fabrizio Gagliardi

**Italy-CINECA :** Sanzio Bassini

**France-NumPEx :** Jean-Yves Berthou (Inria), Thierry Bidot (Neovia), Jérôme Bobin (CEA), Emmanuel Jeannot (Inria), Michael Krajecki (CNRS)

**France-GENCI :** Stéphane Requena

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**Germany-JSC :** Bernd Mohr

**Germany-GCS :** Claus-Axel Mueller,

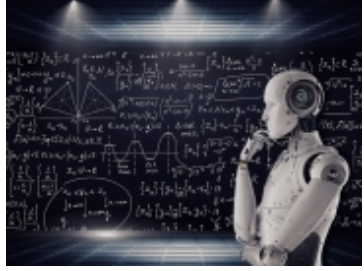
**Germany-LRZ :** Martin Schulz (TUM)

**Germany-HLRs :** Michael Resch



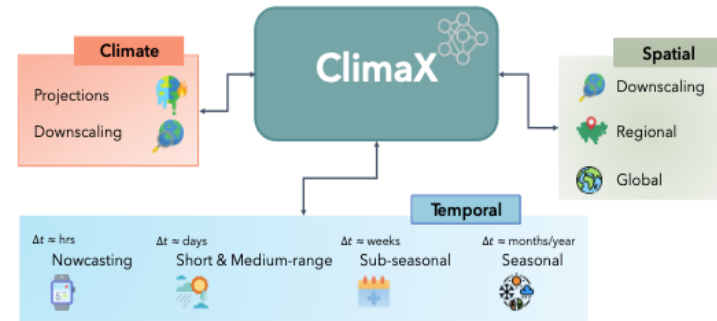
# Some post-exascale challenge

## AI4Science / Science4AI

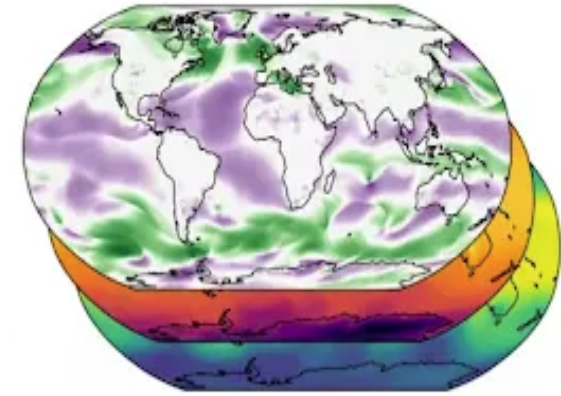


AI everywhere, a game-changer  
at the post-Exascale era

International collaboration is key  
and Gen AI/LLMs are of major  
importance



*CLIMAX: a foundation model for climate science (Microsoft)*



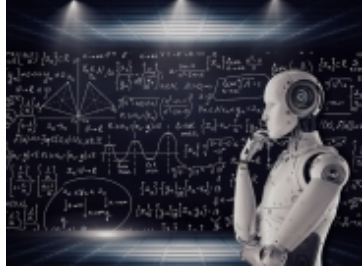
*Graphcast for weather forecasting (Deepmind)*



But ...

# Some post-exascale challenge

## AI4Science / Science4AI



International collaboration is key and Gen AI/LLMs are of major importance, But ...



### **Other scientific and technical challenges need to be addressed:**

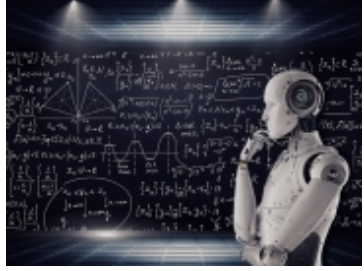
- AI needs in Science is not only large models, also support SLM, domain specific foundation models, ...
- Towards an hybrid HPC/AI software stack (AI4Science and HPC4AI)
- How to go towards validated/robust and trustworthy AI models/services?

=> need for a more holistic program dedicated to AI4Science/Science4AI



# Some post-exascale challenge

## AI4Science / Science4AI



International collaboration is key and Gen AI/LLMs are of major importance, But ...



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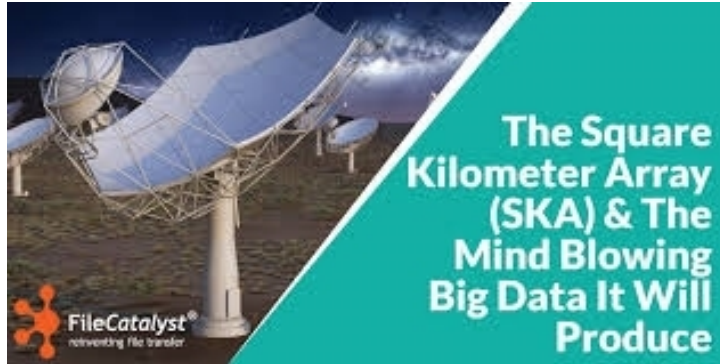
### Some European strategic and sovereignty issues:

- Fuel of AI discoveries, how to manage data stewardship/ownership and sharing ?
- Trends towards AI-centric HW (e.g. AI accelerators), puts huge constraints on the HPC SW stack
- Need for European software, tools, from European academia and **industries**

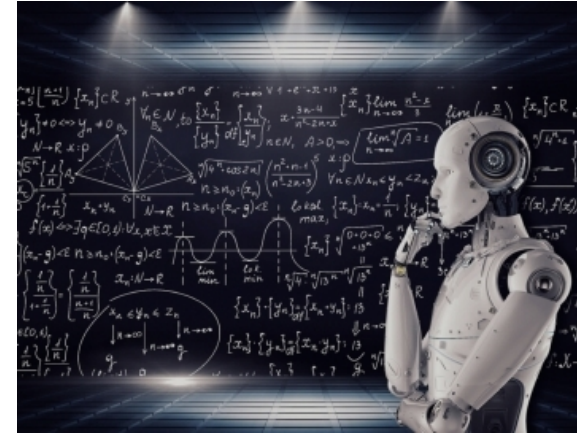
=> need for a proper European agenda

## There are other post-exascale challenges

From edge to HPC systems  
The digital continuum



AI4Science – Science4AI



Software/application co-design



Software, the new frontier



=> Need for international collaborations and a dedicated European agenda



# The International Post-Exascale Project

## InPEX

- Landmark documents largely exploited, worldwide
- Contribute to the **implementation** of an international, shared, high-quality **computing environment based** on the principles and practices of co-design
- Formation of a solid network of exascale computing leaders, all around the globe



Date	(10/2023)	11/2023	06/2024	06/2025
Location	Preparatory phase EU (France)	SC'23 - BOF	Workshop1 EU/BSC	Workshop2 Japan
Date	03/2026	09/2026	06/2027	09/2027
Location	Workshop3 US	Workshop4 EU	Workshop5 Japan	Workshop6 US

# The European Post-Exascale initiative

## InPEX-EU

- Structure, formalize and unify a common European **vision**, including **academia and industry**
  - Operate and speak in a coherent and distinct way in the world-wide international InPEX project
- => Contribute to the foundation to support a healthy, sovereign and sustainable European post-Exascale computing ecosystem

## InPEX-EU

### Proposition for a dedicated European Post-Exascale agenda

#### Contributors (March 2024)

**Spain-BSC** : Sergi Girona, Rosa M Badia, Fabrizio Gagliardi

**Italy-CINECA** : Sanzio Bassini

**France-NumPEX** : Jean-Yves Berthou (Inria), Thierry Bidot (Neovia), Jérôme Bobin (CEA), Emmanuel Jeannot (Inria), Michael Krajecki (CNRS)

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**Germany-HLRs**: Michael Resch

**INPEX-EU, an incubator for a European  
post-exascale project/initiative**

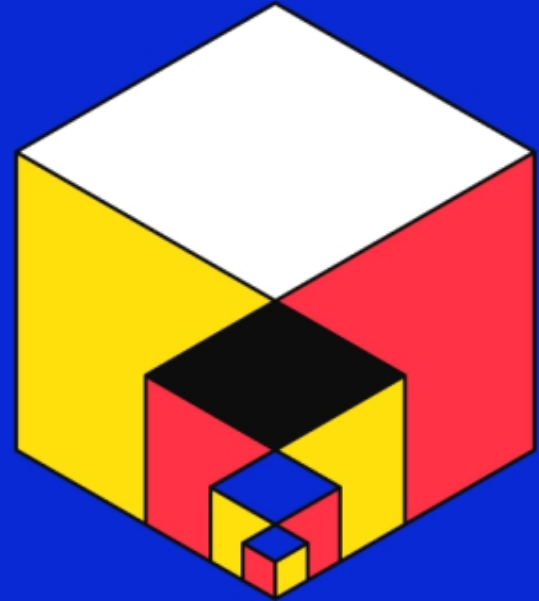
# The International Post-Exascale (InPEX) Project

**Inpex.science**

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**How to contribute?** Send 2 pages white paper to before April 5: [inpex@inpex.science](mailto:inpex@inpex.science)





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# *How do Mediterranean countries benefit from high-performance computing?*

*Octavi Quintana*  
*PRIMA Director*

UNLEASHING THE  
POWER OF EUROPEAN  
HPC AND QUANTUM  
COMPUTING

ANNOTATION



**PRIMA**  
PARTNERSHIP FOR RESEARCH AND INNOVATION  
IN THE MEDITERRANEAN AREA



# Content

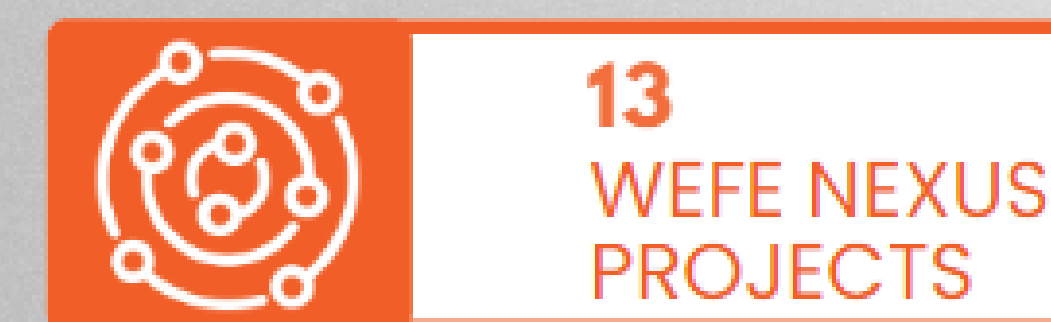
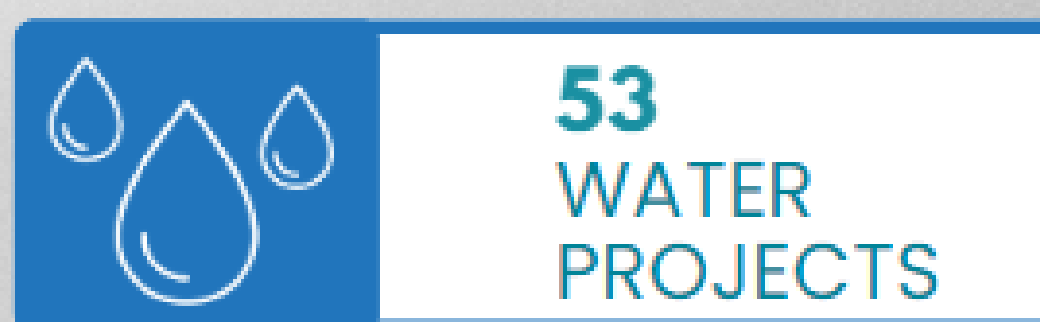
- **PRIMA Main Achievements**
- **Why HPC is important for the Mediterranean region?**
- **Conclusion**



## PRIMA ACHIEVEMENTS BOARD (2018-2023)

**21K+**# of participating  
entities**2310+**

# of Total Beneficiaries

**ALL**PRIMA PS  
received funds**239**# of funded projects (16  
MPC coordinators)**352** M€Total Budget  
Allocated**30%**MPC Total Budget  
Share**20%**Budget Share of  
Private Sector



**Need for data exchange, collaboration and access to resources and expertise between Southern and Northern Mediterranean countries**



**Southern Mediterranean countries can benefit from access to GÉANT's high-speed network infrastructure, advanced services, and international research collaborations.**

GÉANT signs **EUR 40 million** agreement with the European Commission, the European Investment Bank and AFR-IX Telecom on **MEDUSA** submarine cable project to boost trans-Mediterranean R&E connectivity





## HPC is important for the Mediterranean



- ✓ **Enhanced Connectivity**: GEANT provides **high-speed and reliable internet connectivity**, allowing **Southern Mediterranean** countries to seamlessly collaborate with European partners
- ✓ **Facilitate collaboration** : fosters knowledge exchange, joint research initiatives, and the development of innovative solutions to common challenges
- ✓ **Access to Advanced Resources**: **Southern Mediterranean countries** can leverage GEANT to access advanced computing resources, data repositories, and scientific instruments hosted in European research facilities
- ✓ **International Collaboration**: Opportunities for funding and collaboration with European partners







## HPC is important for PRIMA funded projects



- **Complex Modeling:** HPC provide the necessary computational power to run these intricate models with high resolution and accuracy
- **Data Processing:** Climate and food security research rely on massive datasets. HPC excel at processing, managing, and analyzing these vast datasets, enabling researchers to extract valuable insights and trends.
- **High-Resolution Simulations:** HPC facilities allow for high-resolution climate simulations
- **Crop Modeling:** HPC resources are essential for running sophisticated crop models that simulate how climate variables impact crop growth and yields





# A Coordination and Support action is required



## 1. Strategic Research and Innovation Agenda Development:

The strategic priorities, goals, and roadmaps for advancing HPC research, development, and deployment in the Euro-Mediterranean region

## 2. Data Standardization Framework Development

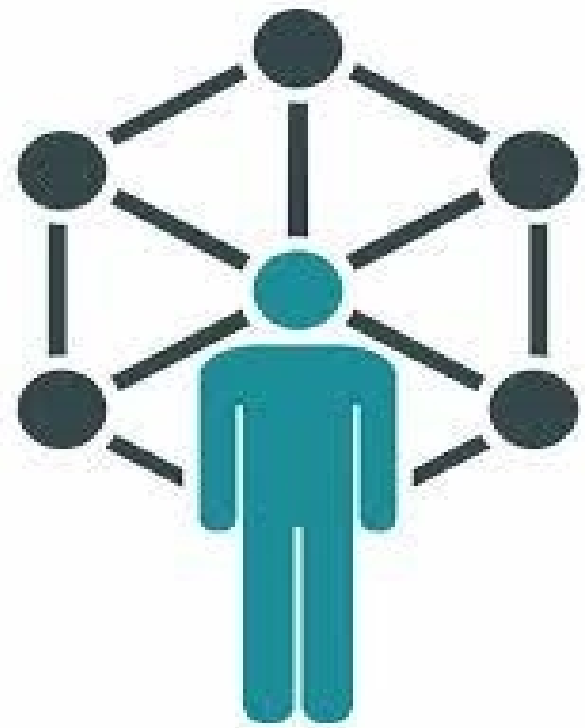
- Data standardization in HPC, including guidelines, principles, and methodologies for data standards.
- Governance structure to oversee the development, maintenance, and evolution of HPC data standards.



**3. Policy Development and Advocacy:** Advocate for favorable policies and regulations to support the development and adoption of HPC technologies.



## A Coordination and Support action is required

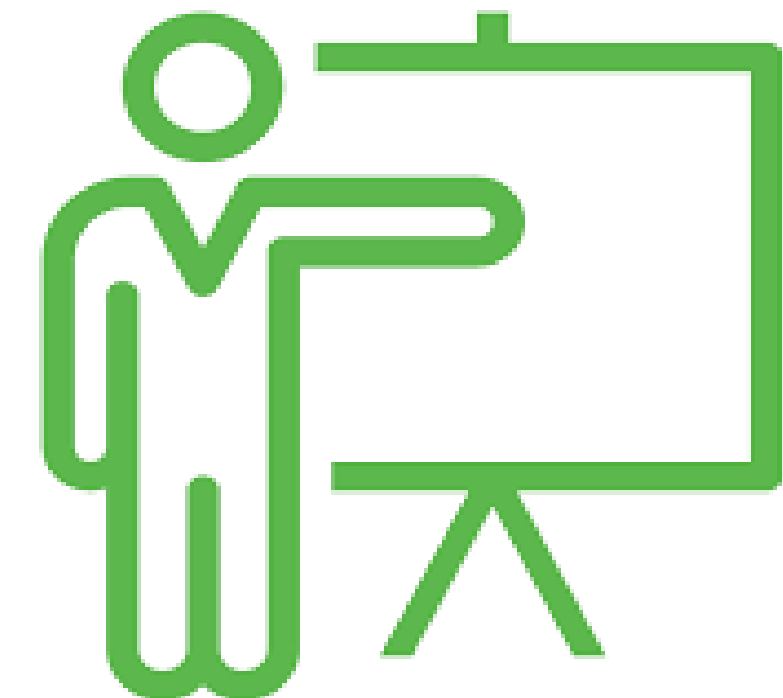


**4. Community Building and Networking:** Foster collaboration and networking among HPC researchers, practitioners, and organizations

- networking events,
- conferences,
- hackathons

## 5. Capacity Building for High-Performance Computing

- Strengthen the capacity of researchers, practitioners, and institutions to effectively use and advance HPC technologies and practices





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Thank you

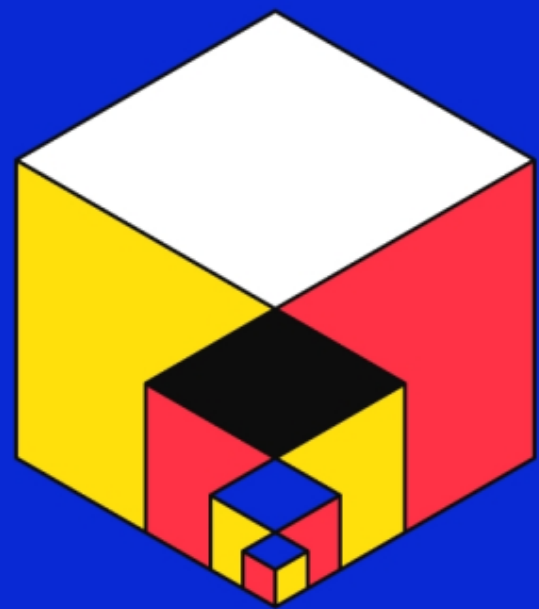
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# International Cooperation: What's Next?

*Juan Pelegrin*

*DG CNECT  
European Commission*



# PANEL



- **JAPAN/ EU HPC Collaboration**

Dr. ICHIOKA TOSHIYASU— DIRECTOR RIKEN EUROPE OFFICE



- **TRILLION BILLION PARAMETER CONSORTIUM**

Dr. GABRIELLA SCIPIONE - HEAD OF HPC DATA MANAGEMENT & ANALYTICS - CINECA



- **The International Post-Exascale Project (InPEX)**

Dr. JEAN-YVES BERTHOU— DIRECTOR - INRIA SACLAY RESEARCH CENTER



- **BRAZIL / RISC 2 / LATAM Collaboration**

Dr. FABRIZIO GAGLIARDI- INTERNATIONAL RELATIONS DIRECTOR (BSC)



- **HPC SouthMED**

Dr. OCTAVI QUINTANA— DIRECTOR - PRIMA FOUNDATION



# ***INCO EUROHPC ACTIVITIES***



- **Pillar of activity: EUROHPC JU Regulation**
  - Aligned with Union's external policy objectives and international commitments
  - Aim: Address global scientific and societal challenges
  - Promote competitiveness of European High Performance Computing (HPC) supply and users
- **Rationale:**
  - User/application side:
    - Target countries identified for intl. collaborations offer unique expertise and competences
    - Strengthens respective scientific communities and applications
  - Technology perspective:
    - Enlarges market potential for technology, solutions, and know-how
    - Benefits both sides of collaboration





# INCO HPC ACTIVITIES

## • Digital Partnerships

- EU Strategy on Indo-Pacific: Digital Partnerships with Japan, Korea, Singapore, and Canada
- Non-Binding Cooperation on: Infrastructures, Skills development, Digital transformation of businesses
- Concrete Deliverables: Collaboration on R&I, Standards, Pilot projects in AI, quantum/HPC
- EuroHPC INCO Call with Japan



## • Trade and Technology Council

- EU/US TTC (2021) & INDIA - EU TTC (2022)
- DG CONNECT – MeitY Intent for Cooperation on HPC
- EuroHPC INCO Call with INDIA



## • Other initiatives

- Latin America - RISC 2 Will deliver an EU & Latin America HPC Roadmap
- EC Joint Call on Quantum Computing with Canada



**Many Thanks !!!**



# Trillion Parameter Consortium

# Generative AI for Science

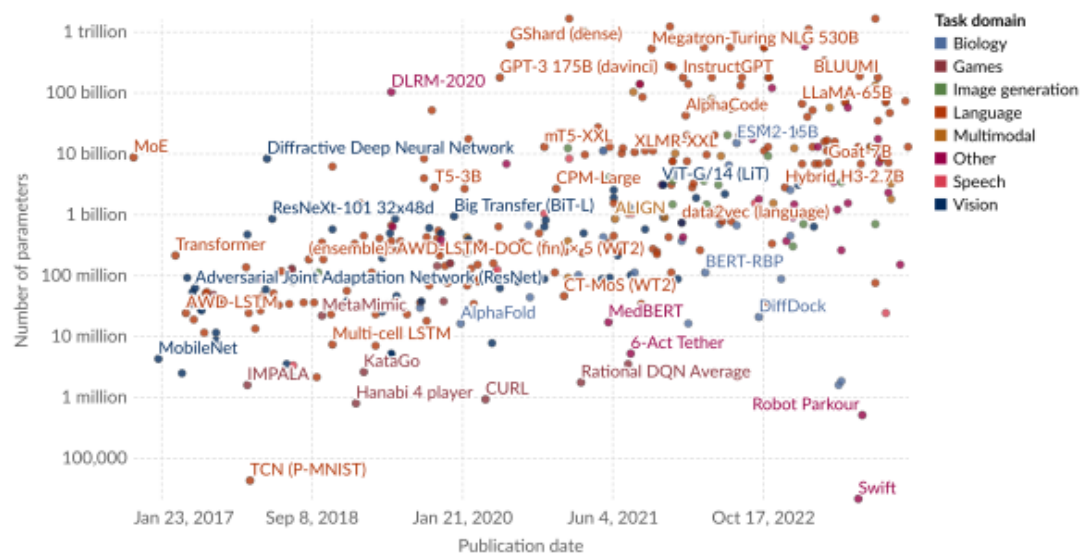
EUROHPC SUMMIT 2024, ANTWERP 18-21 MARCH

Gabriella Scipione (CINECA)



## Parameters in notable artificial intelligence systems

Parameters are variables in an AI system whose values are adjusted during training to establish how input data gets transformed into the desired output; for example, the connection weights in an artificial neural network.



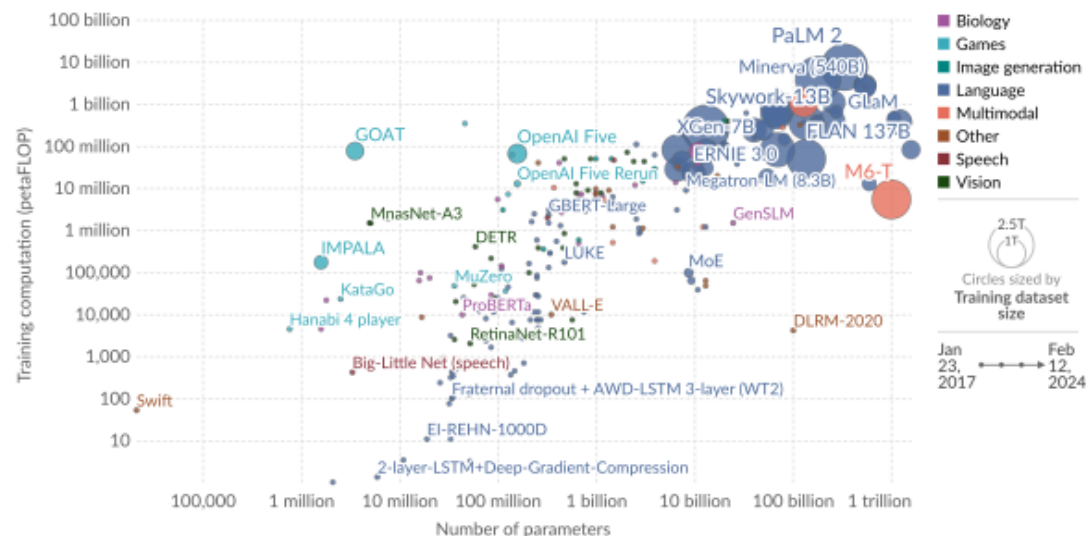
Data source: Epoch (2024)

[OurWorldInData.org/artificial-intelligence](https://OurWorldInData.org/artificial-intelligence) | CC BY

Note: Parameters are estimated based on published results in the AI literature and come with some uncertainty. The authors expect the estimates to be correct within a factor of 10.

## Training computation vs. parameters in notable AI systems, by domain

Computation is measured in total petaFLOP, which is  $10^{15}$  floating-point operations<sup>1</sup> estimated from AI literature, albeit with some uncertainty. Parameters are variables in an AI system whose values are adjusted during training to establish how input data gets transformed into the desired output.



Data source: Epoch (2024)

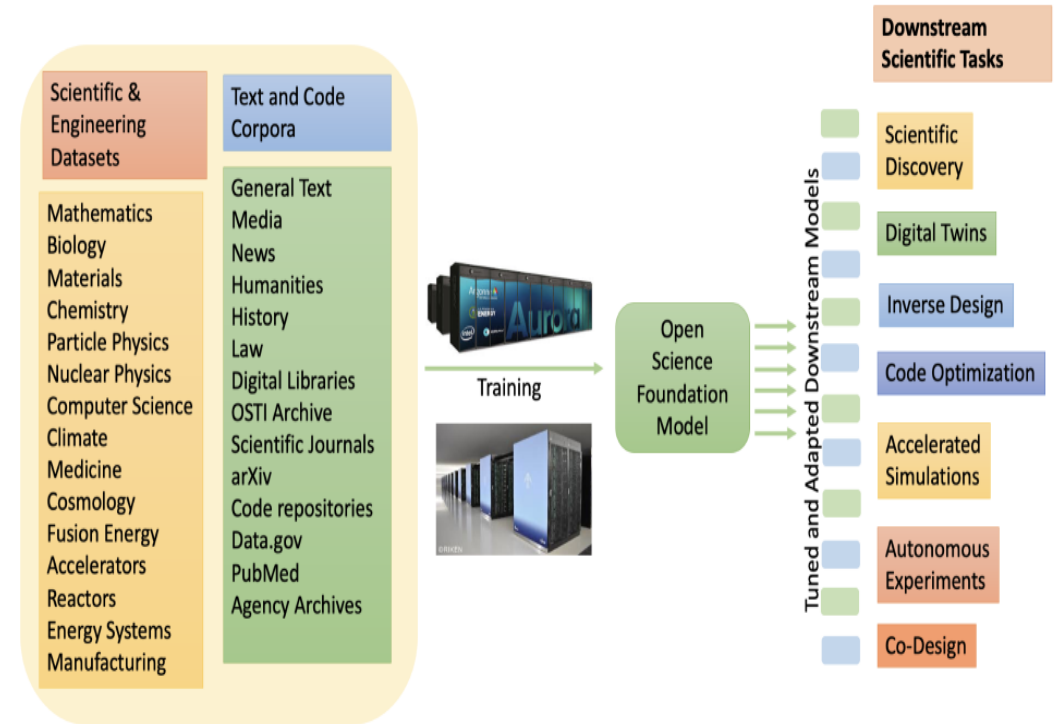
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1. **Floating-point operation:** A floating-point operation (FLOP) is a type of computer operation. One FLOP represents a single arithmetic operation involving floating-point numbers, such as addition, subtraction, multiplication, or division.

# The Trillion Parameter Consortium

- an international initiative that focuses on sharing expertise, data and foster collaborations towards **building large foundational models for scientific and engineering applications**
- these models need to be examples of **responsible AI**
- in 2020 started exploring the feasibility of **Trillion Parameter Foundation Models for Science...**
- **established in mid-2023** building on collaborations among several institutions (Argonne, BSC, RIKEN)



«...to create models analogous to largescale instruments, enabling many individual teams to work together with many other teams to contribute data and expertise to build, and then incrementally train, a shared foundation model for their downstream tasks.»

Citation taken from AI FOUNDATION MODELS FOR SCIENTIFIC KNOWLEDGE DISCOVERY, INTEGRATION, AND SYNTHESIS, DoE

# Trillion Parameter Consortium: Goals

## **Goal 1. Build an open community**

of researchers that are interested in creating state-of-the-art large-scale generative AI models (FMs/LLMs) aimed broadly at advancing progress on scientific and engineering problems, by sharing methods, approaches, tools, insights, and workflows.

## **Goal 2. Incubate, launch, and loosely (voluntarily) coordinate specific projects**

to build specific models at specific sites and attempt to avoid unnecessary duplication of effort and to maximize the impact of the projects in the broader AI and scientific community. Where possible we will work out what we can do together for maximum leverage vs. what needs to be done in smaller groups.

## **Goal 3. Create a global network of resources and expertise**

that can help facilitate teaming and training the next generation of AI and related researchers interested in the development and use of large-scale AI in advancing science and engineering.



# Many Founding European Organizations

AI Singapore

**Allen Institute For AI**

AMD

Argonne National Laboratory

**Barcelona Supercomputing Center**

Brookhaven National Laboratory

CalTech

**CEA**

Cerebras Systems

**CINECA**

**CSC – IT Center for Science**

CSIRO

**ETH Zürich / CSCS**

Fermilab National Accelerator Laboratory

Flinders University

Fujitsu Limited

HPE

Indiana University

Intel

**Juelich Supercomputing Center**

Kotoba Technologies, Inc.

**LAION**

Lawrence Berkeley National Laboratory

Lawrence Livermore National Laboratory

**Leibniz Supercomputing Centre**

Los Alamos National Laboratory

Microsoft

National Center for Supercomputing Applications

National Energy Technology Laboratory

National Institute of Advanced Industrial Science  
& Technology (AIST)

National Renewable Energy Laboratory

National Supercomputing Centre, Singapore

NCI Australia

New Zealand eScience Infrastructure

Northwestern University

NVIDIA

Oak Ridge National Laboratory

Pacific Northwest National Laboratory

Pawsey Institute

Princeton Plasma Physics Laboratory

*(this list continues to expand)*

RIKEN

Rutgers University

SambaNova

Sandia National Laboratories

Seoul National University

SLAC National Accelerator Laboratory

Stanford University

**STFC Rutherford Appleton Laboratory, UKRI**

Texas Advanced Computing Center

Thomas Jefferson National Accelerator Facility

Together AI

Tokyo Institute of Technology

Université de Montréal

University of Chicago

University of Delaware

University of Illinois Chicago

University of Illinois Urbana-Champaign

University of Michigan

University of New South Wales

University of Tokyo

University of Utah

University of Virginia

[https:// tpc.dev](https://tpc.dev)



# The added value

## The added value for EU

As AI continues to evolve rapidly, EU needs to:

- keep up with non-EU and world technologies,
- close the gap and keep up to date with U.S., China, Japan, etc...
- share projects and action where we grow together.

## The added value that EU can bring in:

- European scientific excellence (medicine, astrophysics, weather/climate, etc..)
- EuroHPC supercomputing assets and skills
- Always very attentive to ethical aspects : trustworthy safety and trust
- AI Act: the first-ever legal framework on AI

# Upcoming TPC Events

- Half- day TPC Workshop at ISC24
  - 16-May 2024
  - Co-organizers from Europe, Japan, and the U.S.
  - Led by BSC, Argonne, and Allen Institute for AI
- TPC European Kick-Off
  - Hosted by the Barcelona Supercomputing Center
  - 19-21 June 2024
  - Agenda
    - 18-19-June: 1.5d Hands-On Tutorial on LLMs for Science and Engineering
    - 20-June: Keynotes from EU government and research leaders; Invited speakers and panels
    - 20-21-June: Topical meetups of TPC working groups.



“It is a field of fields ... it holds the secrets which will  
reorganize the life of the world.”  
Thomas Edison said of electricity

Thank You

EUROHPC SUMMIT 2024, ANTWERP 18-21 MARCH

Gabriella Scipione (CINECA)