The EuroHPC Initiative and its Implementation

DG CONNECT, European Commission

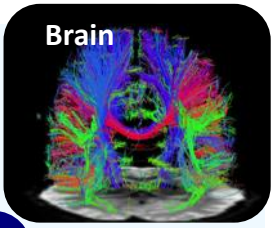
Why Investing on HPC? Reminder

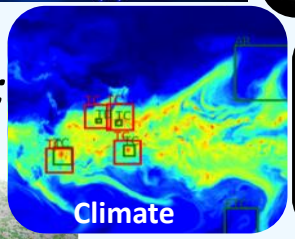
HPC is at the core of major advances and innovations in the digital age

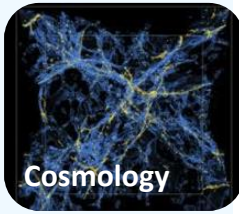
It is a key technology for science, industry, and society at large

Strategic value for science

- ***HPC enables breakthrough science***
  disease treatment; new therapies; brain; climate; chemistry; new materials; cosmology, astrophysics; high-energy physics; environment; transportation, earthquakes, etc.

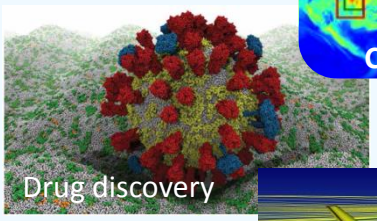


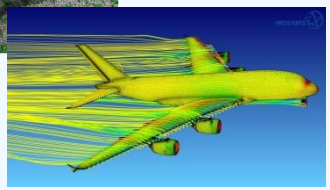


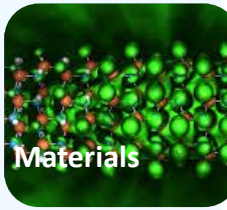


Strategic value for Industry

- *New products, design and production cycles, decision processes, costs, resource efficiency, etc.*

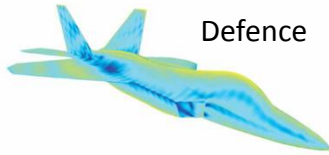






National security and defence

- *complex encryption technologies, terrorism, forensics cyberattacks, nuclear simulations*



HPC: The Logic of investments 2014-2020

Technology development, integration, pilot test-beds and applications

- ➔ Technology development (low-power processor, SW, applications)
- ➔ Integrating and co-designing extreme scale systems

HPC – Cloud – BDA

Ecosystem development

Two pre-exascale

Two exascale

Infrastructure/Services

- ➔ Centres of Excellence in HPC applications
- ➔ Procurement of HPC infrastructures and services (exascale, big data nodes, interconnection) and widening of HPC use

HPC in Horizon2020/CEF Work Programmes

2018-2020

FET ➔ Key components & concepts: preparing next generation & beyond

Future and Emerging Technologies (FET)

extreme scale HPC compute & data technologies and co-designed prototypes

LEIT ➔ Microprocessor, integration, test-beds & demonstration

Leadership in Enabling and Industrial Technologies (LEIT)

Low-power processor design and development

Co-design of extreme scale demonstrators

HPC Large scale test-beds

e-Infraestructures and Connecting Europe Facility (CEF)

CEF 2017 WP

HPC-enabled services supporting decision-making for public authorities

PRACE-2 , Centres of Excellence, widening use

PPI Pre-exascale systems

Data nodes, Interconnectivity

European HPC Strategy!

European Commission President Jean-Claude Juncker

Our ambition is that by 2020, Europe ranks in the top 3 HPC powers worldwide

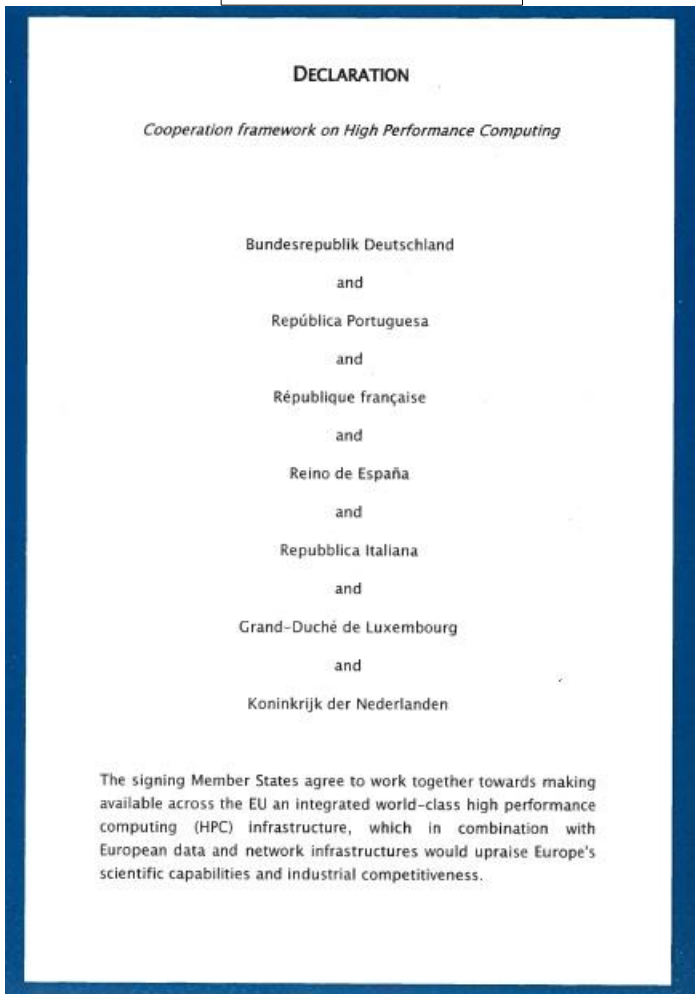
- **04/2016: European Cloud Initiative** COM(2016) 178

  a world-class HPC, data & network infrastructure and a leading HPC and Big Data ecosystem

- **05/2017: Mid-Term Review of the Digital Single Market Strategy** COM(2017) 228

  *by end-2017, propose a **legal instrument** providing a procurement framework for an exascale supercomputing & data infrastructure*

the EuroHPC Declaration



DECLARATION

Cooperation framework on High Performance Computing

Bundesrepublik Deutschland

and

República Portuguesa

and

République française

and

Reino de España

and

Repubblica Italiana

and

Grand-Duché de Luxembourg

and

Koninkrijk der Nederlanden

The signing Member States agree to work together towards making available across the EU an integrated world-class high performance computing (HPC) infrastructure, which in combination with European data and network infrastructures would upraise Europe's scientific capabilities and industrial competitiveness.

12 countries joined EuroHPC,

The EuroHPC Instrument

DG CONNECT, European Commission

Europe's Weaknesses in HPC implementation today

EU has no top ranked supercomputers and depends on non-EU technology

Funding Gap wrt USA, JP, CN

Weak EU supply chain

Weak integration of EU technology in HPC machines

HPC strategy implementation by EC is insufficient

Insufficient coordination of national investments

Demand is not met

How to be again in world top HPC powers?

Co-invest on a leading HPC and data infrastructure
for our scientists, industry and the public sector and support the development of technologies and applications across a wide range of fields

- **Coordinate EC/MS activities**
- **Pool public and private resources at EU level**
- **Procure world-class infrastructure**
- **Close the chain from R&D to procurement**
- **Become lead Users**
- **Create a competitive supply industry**
- **Lead in Applications**

A world-class European HPC, Big Data and Cloud Ecosystem

A new Instrument – Requirements

EuroHPC Instrument

Pooling funds

Public Procurement

Research & Innovation

Openness - New Partnership

VAT & State Aid

EuroHPC : The Objectives

Overall objective: Provide European scientists, industry and the public sector with the latest HPC and data infrastructure and support the development of its technologies and applications across a wide range of fields

- Provide a ***procurement framework*** for an integrated world-class exascale supercomputing and data infrastructure in Europe.
- Provide ***EU level coordination and adequate financial resources to support the development and procurement of such infrastructure.***
  Such infrastructure will be accessible to public and private users for research purposes; paying services to industry may also be provided (under conditions TBD)
- Support the development of an ***integrated European HPC and Big Data infrastructure ecosystem*** covering all scientific and industrial value chain segments (hardware, software, applications, services, interconnections, and skills)

Enabling a strong European HPC ecosystem!

EuroHPC: Four Pillars

- **Pillar 1: Infrastructure**
  - Acquisition of infrastructure (linked to Research and Innovation) and providing and managing access to research users
- **Pillar 2: Applications & Skills**
  - Excellence in HPC applications; Supporting Industry (incl. SMEs); Training and Outreach
- **Pillar 3: Research and Innovation**
  - Technologies and systems developed in Europe
- **Pillar 4: Operating the Machines**
  - Installation, deployment and operation via hosting entities

EuroHPC: Pillar 1
Infrastructure Development & Acquisition

- ***Procurement of HPC machines:***
  - **Top-class**: 2 pre-exascale [2020]; 2 exascale [2022] and 2 post-exascale machines [2025+]
  - **Mid-class**: minimum 2 petascale
- ***Interconnection*** (and possible federation) to regional, national and European HPC resources
- ***Providing and managing access*** to HPC based infrastructures and services to public and private users
- Building first ***hybrid HPC / Quantum Computing infrastructures*** in Europe

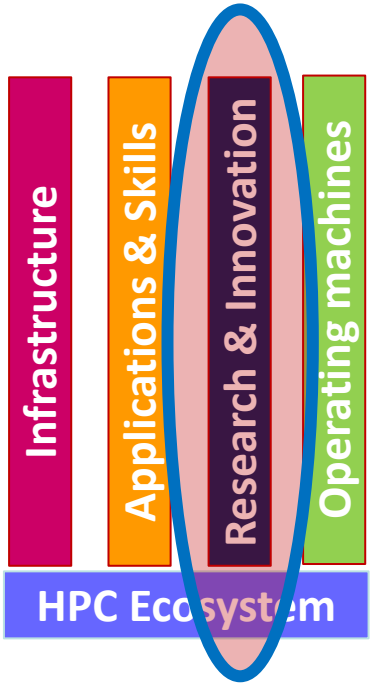
- Financing from EU + MS/ACs
- Financing from industry could be possible (e.g. for dedicated access)

EuroHPC : Pillar 2
Applications and Skills Development

- Achieve excellence in **HPC applications** for exascale and post-exascale performance – support large-scale ***HPC-enabled pilot demonstrators and test-beds*** for big data applications and services in a wide range of scientific and industrial areas.
- Support ***Centres of Excellence*** in HPC applications, and increase the innovation potential of ***industry (incl. SMEs)***
- Actions for ***outreach*** and for increasing ***training and skills***

- Financing from EU + MS/ACs + Industry

EuroHPC: Pillar 3
Research and Innovation Agenda



- Develop the ***next generation HPC technologies and systems: exascale and post-exascale***
  (low-power processors; SW; algorithms; programming models and tools; novel architectures and their system integration through co-design, etc.)

- Financing from EU + MS/ACs + Industry

EuroHPC: Pillar 4
Operating the Machines

- ***Delegate machine operations*** to a hosting entity
- ***Support*** (through service contracts) the hosting entity for ***machine operation & maintenance***

- Financing from EU + MSs
- Possible financing from Industry + Public Administrations

EuroHPC: The two phases

Phase 1: 2019-2020 (Present Multi-annual Financial Framework)

- **[Pillars 1 & 4]** Procure and operate pre-exascale machines; Link them to regional, national and European HPC resources; provide and manage access;
- **[Pillar 3]** Develop technologies for exascale (low-power processor; co-design exascale systems)

  To be noted: Pillar 2 (Applications) is called in H2020 WP 2018
- JU operates until 2026 [end of lifetime of procured pre-exascale machines]

Phase 2: 2021-2028 (Next Multi-annual Financial Framework)?

- **[Pillars 1 & 4]** Procure exascale and post-exascale machines; Link them to regional, national and European HPC resources; provide and manage access; Building first hybrid HPC / Quantum Computing infrastructures
- **[Pillars 2 & 3]** Develop applications for exascale and technologies for post-exascale; skills & outreach
- JU operates until 2030+

EuroHPC
Membership and Contributions

Members

- The Union (represented by the European Commission)
- Member States (MS) and Associated Countries (AC)
- Industry [under specific conditions]
- New members (acceptance of statutes, financial contribution)

Financial Contributions

- ***EC:*** procurement, R&D, administrative costs
- ***Participating States:*** procurement, R&D, administrative costs
  Industry: R&D (H2020)

Voting rights

- **EC, MS, AC*:*** based on financial contributions

Ownership & Procurement

DG CONNECT, European Commission

EuroHPC
The Procurement Policy [1]

Preferred Option of the Commission

- **Procurement is done by the JU under EU rules with the help of national experts in procurement**
- **<u>Rationale</u>:**
  - JU is a joint ownership by MS/ACs and acts as a trusted manager of the procurement process on behalf of all participating countries
  - Application of EU procurement rules
  - VAT exemption
  - Opening the possibility of cooperation of hosting entities in the procurement process

EuroHPC
The Procurement Policy [2]

- **Call for Expression of Interest (CEoI) for selecting the hosting entity**
- **Preference for CEoI proposals submitted by a Consortium (rather than individual MS)**
- **Selection (Evaluation) Criteria for CEoI Proposals:**
  - Compliance of the proposal to the general machine specifications provided in the CEoI call (see next slide)
  - Total Cost of Ownership/Share of CAPEX and OPEX
  - Experience of the hosting entity in installing and operating the machine
  - Quality of the hosting facility, its physical and IT infrastructure and its connectivity links (i.e., the quality of the network interconnection links in terms of bandwidth capacity, etc. with the rest of Europe)
  - Quality of service to the users (e.g., compliance to SLA specified in CEoI call, security, etc.)
- **<u>Further Selection Principles for the hosting entity</u>**
  - At max one hosting site will be selected per country per call
  - Hosting sites to be located in MS

EuroHPC JU
Ownership of Machines

Preferred Option of the Commission

The JU is the owner of the procured machines

- *How will the acquisition of the JU machines be financed:*

  ➔ The JU purchases the machines and hosting entity becomes prime contractor for the operation and maintenance of the JU machines

  ➔ Contract between the JU and the hosting entity will define the period of ownership (this could be the end of lifetime of the JU machine, typically of the order of ~5 years)
  After that period, ownership is transferred to the hosting entity

- *How will the operation and maintenance costs of the JU machines be financed:*
  The JU pays the hosting entity with a service contract

  ➔ The delegation rules will be decided by the JU Governing Board

EuroHPC
Access Rights to Machines [1]

- **JU machines accessible to public and private users for research purposes**
- Access and use rules are defined by the JU Governing Board
  Specific rules can apply for the access to the JU machines.

  For example:
  - MS/AC → In proportion to their financial contribution to the procurement and/or maintenance costs of the JU machines
  - JU → rules TBD for the use of the part funded by the Union
    (Example: use PRACE rules or any other guiding principle which is based on fair conditions and fit for purpose like scientific excellence, training, etc.)
  - Access outside Europe: TBD
    (Possible principle: Access will be granted to stakeholders outside Europe if endorsed by a Researcher or Research team located in Europe [as in PRACE])
  - …

EuroHPC
Industry Access Rights to Machines [2]

- **For public-funded research actions**
  - Same rules as for the scientific and public sector users
  - Reserve access time for industry users participating in R&I funded actions
- **For private purposes**
  - Paying service; max share of access time in EuroHPC machines TBD
  - Possible agreement with industry users for financial contribution in exchange of access rights

Governance Structure

DG CONNECT, European Commission

Governance of EuroHPC

Intelligence gathering

Stakeholders

[academia, industry]

(a) Users forum

- Science Users (EDI users from EOSC)
- Users of PRACE and HPC CoEs
- Industry Users

(b) Technology forum

- PRACE, GEANT
- Tier-0 supercomputing centres
- Industry (ETP4HPC, BDVA PPP, IPCEI)

Advice & Decision making

Governing Board[1]

[Member States (MS) + EC + Associated Countries (AC)]

[1] Covers all the JU pillars

Research & Innovation Board[2]

[academia & industry]

[2] Covers only JU pillars 2&3

Infrastructure Advisory Board[3]

[academia & industry]

[3] Covers only JU pillars 1&4

Implementation

R&I activities

JU funded

HPC machines

MS-funded activities

PRACE activities

IPCEI activities

…

EuroHPC
The Governing Board

The main decision making body of the JU

Composition: representatives of the JU Participating States and the EC

Governing Board
[Member States (MS) + EC + Associated Countries (AC)]

Mission:

- Establishes the rules of the JU cooperation framework (strategic orientations and operations of the JU; synergies with MS)
- Decides on the implementation roadmap for acquiring and deploying an integrated exascale supercomputing infrastructure and the creation of an HPC and Big Data ecosystem in Europe

Scope of action:

- ***General JU operations:*** Annual budget; multi-annual strategic plan; JU work plan & the corresponding expenditures; communication policy; internal audit; annual activity reports; advisory groups and their members; Membership of the Infrastructure Advisory Board; New membership applications; termination of membership; etc.
- ***Pillar 1 & 4:*** Procurement procedures (tender calls, evaluation, selection and monitoring of procurement; financing procedures for the purchase of the JU machines and their operation and maintenance costs; hosting site; delegating rules); Access and use rules of the JU machines
- ***Pillars 2 & 3 (Indirect R&I actions)***: Prepares the R&I Calls for proposals; Ensures fairness & transparency on allocation of public funds to participants; evaluation, selection and monitoring of actions;
- …

EuroHPC
The Research and Innovation Board

Advisory Board

Research & Innovation Board
[academia & industry]

***Composition*:** representatives of industry (supply and use industry) and academia

Mission: Elaborates a medium to long-term R&I agenda (technology & applications) covering pillars 2&3

***Scope of action*:**

- Draws and regularly updates the multiannual strategic R&I agenda: consults widely academic and industry stakeholders (the User Forum and the Technology Forum) for preparing this agenda
- Prepares each year a proposal for the governing board of the draft R&I activities plan for the next year. It will be used as a basis for the JU governing board to prepare the JU calls of proposals for R&I activities

Organisation of work: Functioning, Meetings, rules of procedures, etc. TBD

EuroHPC
The Infrastructure Advisory Board

Advisory Board

Infrastructure Advisory Board
[academia & industry]

***Composition*:** A few members selected by the JU Governing Board; selection rules TBD

***Mission*:** Acts as a Strategic Advisory Board to the JU Governing Board from where it receives the relevant information for its work in Pillars 1 &4

***Scope of action*:** Provides advice on the infrastructure implementation options of the JU

- Prepares and proposes the specifications for the procurement of the JU machines after extensive consultation with the relevant stakeholders
- Monitors the operations of the JU machines (incl. access compliance by academic and industrial users)

Organisation of work: Functioning, Meetings, rules of procedures, etc. TBD

JU Governance
The Stakeholders

They are consulted by the R&I Board and the Infrastructure Advisory Board

Stakeholders

[academia, industry]

(a) Users forum

- **Science Users (EDI users from EOSC)**
- **Users of PRACE and HPC CoEs**
- **Industry Users**

(b) Technology forum

- **PRACE, GEANT**
- **Tier-0 supercomputing centres**
- **Industry (ETP4HPC, BDVA PPP, IPCEI)**

- **Users Forum**
  - Provides views and requirements from the scientific and industrial user communities to shape the EuroHPC strategic R&I agenda
- **Technology Forum**
  - Provides views and requirements from HPC and Big data infrastructure technology and infrastructure developers and operators on state of the art technology relevant to HPC and Big data systems, infrastructures, applications and services
  - Provides inputs on architectural options for infrastructure implementation

Next Steps

- **OCT 2017:** Validation of the EuroHPC Instrument
- **DEC 2017:** EC proposal to the Council for the EuroHPC Instrument
- **DEC 2017 & JAN 2018:** EuroHPC Workshops
- **2018:** Council Decision on the EuroHPC Instrument
- **2019-2020:** Setting up and operating the EuroHPC Instrument [JU Phase 1]
- **2021 onwards:** Next Financial Budget Framework [JU Phase 2]?

Workshops

DG CONNECT, European Commission

Workshops for the EuroHPC roadmap [1]

Purpose: gather information to draft the EuroHPC implementation roadmap

- Bring together experts from relevant fields in their roles as users (from science and industry), technology providers (of HPC and data resources) including data managers and cloud service providers, and network providers to discuss enabling mechanisms to deploy the European HPC and Data Infrastructure

3 workshops are planned in Brussels:

- ***05 December 2017***: requirements from users and technology offer for next generation HPC
- ***16 January 2018***: requirements from users and technology offer for next generation HPC (continuation of 05 Dec. workshop)
- ***31 January 2018***: Technology specification and operational deployment

Workshops for the EuroHPC roadmap [2]

- **5 December 2017 workshop to explore requirements from users and technology offer for next generation HPC**
  - What are the exascale User requirements in different disciplines?
  - How do these translate into hardware & software requirements?
  - How do they match to technology supplier roadmaps and trends?
  - What HPC services are needed?

  Invite participants: suggestions from Member States

  Rapporteur: TBD

- **16 January 2018 (continuation of 05 DEC 2017 workshop)**

  Invite participants: suggestions from Member States

  Rapporteur: TBD

Workshops for the EuroHPC roadmap [3]

- **31 January 2018: Workshop on Technology specification and operational deployment**
  - Architectural aspects of HPC & Data Infrastructures (PRACE, GEANT)
  - Procurement timeframes and processes, incl. best practices / challenges in procedures at national level; and defining a European approach to integrate / improve on national procedures (PRACE, Supercomputing Centres, and GEANT)
  - Additional measures needed to "provide seamless, high-speed, reliable and secure connectivity to make HPC accessible across the EU"
  - Pan-European HPC, Data and Networking ecosystem (PRACE, GEANT)

Invite participants: suggestions from Member States

Rapporteur: TBD

THANK YOU!

Contact: CNECT-C2@ec.europa.eu

High Performance Computing (HPC)