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-Infrastructures 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
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
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
- Weak EU supply chain
  Weak integration of EU technology in HPC machines
- Funding Gap wrt USA, JP, CN
- 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

- Pooling funds
- Public Procurement
- Research & Innovation
- Openness - New Partnership
- VAT & State Aid

EuroHPC Instrument
**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).

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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
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+
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
Procurement is done by the JU under EU rules with the help of national experts in procurement

Rationale:

- 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
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.)

Further Selection Principles for the hosting entity
- At max one hosting site will be selected per country per call
- Hosting sites to be located in MS
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
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 $\rightarrow$ In proportion to their financial contribution to the procurement and/or maintenance costs of the JU machines
- JU $\rightarrow$ 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]*)

- ...
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

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)

Governing Board
[Member States (MS) + EC + Associated Countries (AC)]
1 Covers all the JU pillars

Research & Innovation Board
[academia & industry]
2 Covers only JU pillars 2&3

Infrastructure Advisory Board
[academia & industry]
3 Covers only JU pillars 1&4

Intelligence gathering
Advice & Decision making
Implementation

- R&I activities
- JU funded
- HPC machines
- MS-funded activities
- PRACE activities
- IPCEI activities
- ...
Composition: representatives of the JU Participating States and the EC

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;

...
**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
**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
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**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
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
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
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!

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