FETHPC
Calls for Proposals
2016-2017

An integrated HPC approach in H2020

- HPC strategy combining three elements:

(a) Computer Science: towards **exascale** HPC; *A special FET initiative focussing on the next generations of **exascale computing technology** as a key horizontal enabler for advanced modelling, simulation and big-data applications* [HPC in FET]

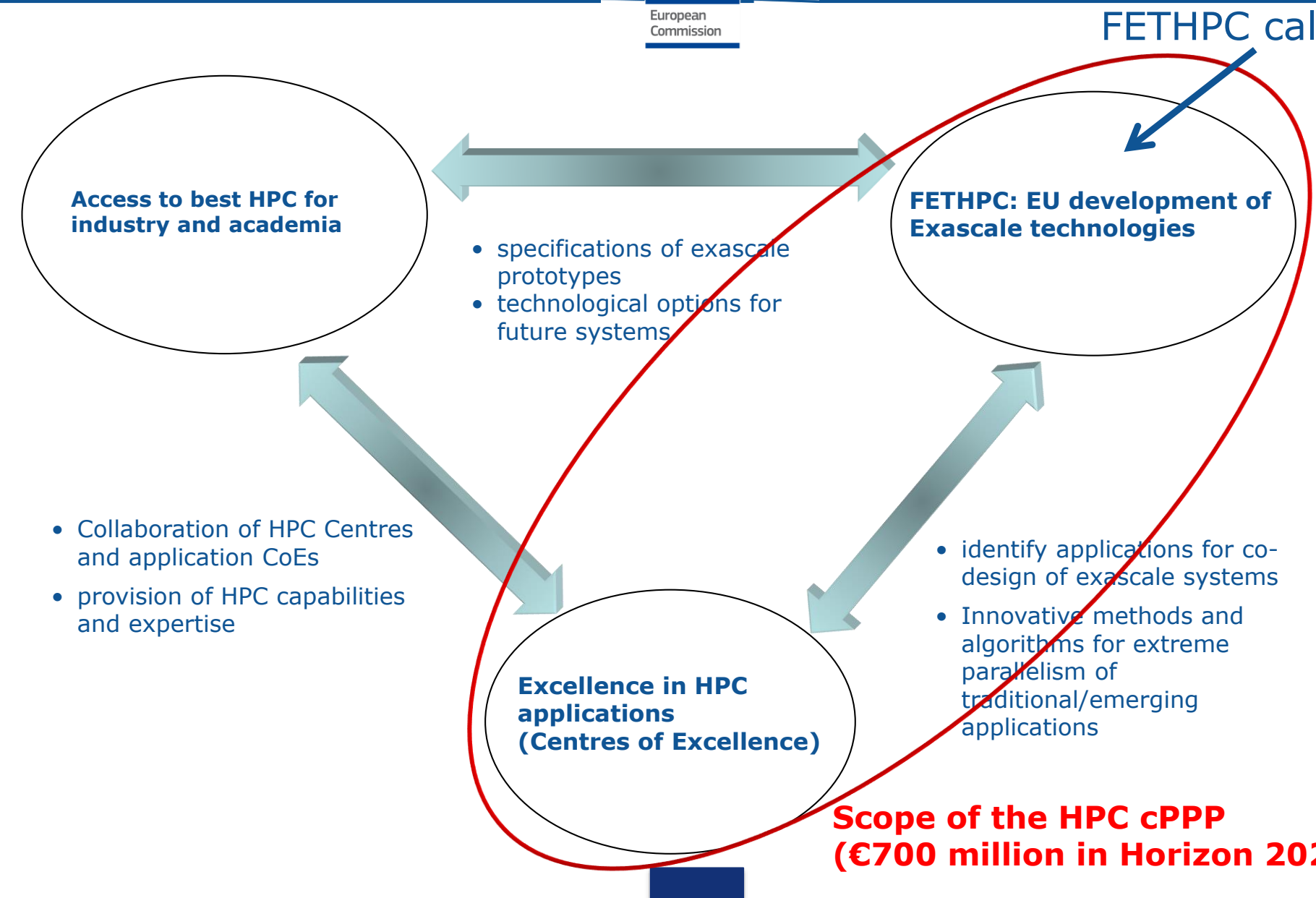
(b) achieving excellence in HPC **applications**; *Centres of Excellence for scientific/industrial HPC applications in (new) domains that are most important for Europe* [e-infrastructures]

(c) providing **access** to the best supercomputing facilities and services for both industry and academia; *PRACE - world-class HPC infrastructure for the best research* [e-infrastructures]

- complemented with training, education and skills development in HPC

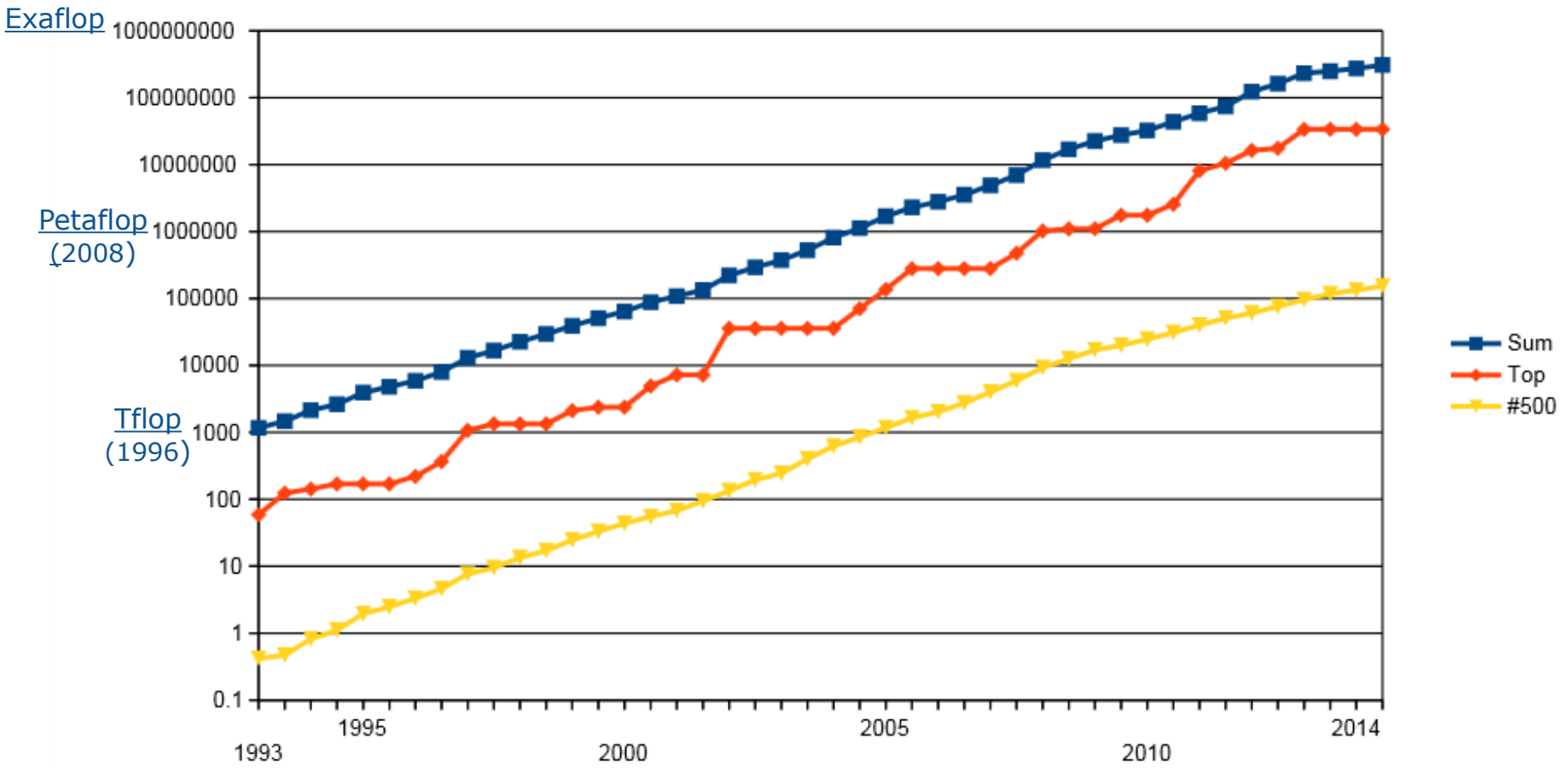
Interrelation between the three elements

"Excellent Science" part of H2020



FETHPC Calls 2016-2017

Towards exascale computing



Supercomputers performance, based on data from top500.org site. The logarithmic y-axis shows performance in GFLOPS. (source: wikipedia)

Headline research challenges FETHPC 2016/2017 Calls

- ***Co-design of HPC systems and applications***: *bigger projects with 10-20m indicative funding per project. Deadline: 27-Sept-2016*

- ***Transition to exascale computing*** *: smaller focused projects with 2-4m indicative funding per project. Deadline: 26-Sept-2017*
  - **High productivity programming environments for exascale**
  - **Exascale system software and management**
  - **Exascale I/O and storage in the presence of multiple tiers of data storage:**
  - **Supercomputing for Extreme Data and emerging HPC use modes**
  - **Mathematics and algorithms for extreme scale HPC systems and applications working with extreme data**

- *Exascale* ***Ecosystem Development*** *:* Coordination and Support Actions *with 1-2m indicative funding per project Deadline: 26-Sept-2017*

FETHPC-01-2016

European Commission

Co-design of HPC systems and applications

Key points:

- *Co-design driven by a mix of ambitious applications*
- *Innovative / ground-breaking system architectures*
- *Extreme data processing*
- *Reduce energy-to-solution for the selected applications*
- *Resilience, reliability, holistic detection/recover approaches, fault prediction algorithms*
- *Applications aspects impacting underlying system design are included (e.g. APIs and interface between application and system)*
- *Pre-exascale prototypes*
- *Must show scaling to at least 100PFLOPS*
- *2019 target power envelope for compute-centric workloads: 15MW for 250PFLOPS peak*
- ***Large ambitious projects with 10-20m EC funding***

Research and Innovation Actions

Total budget 41m

Expected Impact:

- Contribution to the realisation of the ETP4HPC Strategic Research Agenda, thus strengthened European research and industrial leadership in HPC technologies.
- Proof-of-concept through integrated pre-exascale prototypes for future energy-efficient exascale-class HPC systems and optimal co-design driven by ambitious applications.
- Covering important segments of the broader and/or emerging HPC markets, especially extreme-scale HPC systems.
- Impact on standards bodies and other relevant international research programmes and frameworks.

FETHPC-02-2017

Transition to Exascale Computing

European Commission

Subtopics:

a) **High productivity programming environments for exascale**
b) **Exascale system software and management**
c) **Exascale I/O and storage in the presence of multiple tiers of data storage**
d) **Supercomputing for Extreme Data and emerging HPC use modes**
e) **Mathematics and algorithms for extreme scale HPC systems and applications working with extreme data**

- *Small projects with 2-4 M EC funding*
- ***Proposals should clearly indicate the subtopic which is their main focus***
- *At least one project per subtopic will be funded*

Research and Innovation Actions

Total budget 40m

a) High productivity programming environments for exascale

Key points:

- *Simplify application software development for large- and extreme- scale systems*
- *Managing data transfers, data locality, memory*
- *Support for heterogeneous and reconfigurable systems*
- *Unified performance tools*
- *Auto-tuning for performance and energy optimization*
- *Automated support for debugging*
- *Domain Specific Languages which target a general-purpose stable programming model and runtime*
- *Interoperability and standardization of programming model, API and runtime*
- *Composability of programming models (building new programming models out of existing programming model elements)*

b) Exascale system software and management

Key points:

- *Targeting drastically more complex node architectures*
- *Hardware abstraction through run-time handling of all types of resources and controls*
- *For applications, multi-criteria resource allocation capabilities and interaction during task execution*
- *On-the-fly analysis methods to cope with extreme data (beyond sequential analysis)*
- *Real-time features for graphical simulation interaction*
- *Evolution of configuration and deployment tools*

c) Exascale I/O and storage in the presence of multiple tiers of data storage

Key points:

- *I/O with multiple tiers of storage including non-volatile memory*
- *Fine-grain data access prioritization*
- *Data replication and data layout transformations*
- *Adaptively provide optimal performance and reliability in the presence of millions of simultaneous I/O processes*
- *Interoperability and standardized APIs*
- *On-the-fly data management supporting data processing in multi-tiered storage with real-time in-situ / in-transit processing*

d) Supercomputing for Extreme Data and emerging HPC use modes

Key points:

- *HPC architectures for real-time and in-situ data analytics*
- *Real-time in-memory analysis and direct processing of compressed data*
- *Interactive 3-D visualisation of large scale data*
- *Interactive supercomputing for complex workflows to support urgent decision making*
- *Adapting operational procedures of HPC infrastructures*
- *Efficient co-scheduling techniques*
- *Improving checkpoint/restart*

e) Mathematics and algorithms for extreme scale HPC systems and applications working with extreme data

Key points:

- *Quantification of uncertainties and noise, multi-scale, multi-physics, extreme data*
- *Mathematics, numerical analysis, algorithms, software engineering for extreme parallelism*
- *Minimise data movement and number of communication/ synchronization instances*
- *Parallel in-time methods*
- *Unified European Verification, Validation and Uncertainty Quantification framework*

Expected Impact:

- *Contribution to the realisation of the ETP4HPC Strategic Research Agenda, thus strengthened European research and industrial leadership in HPC technologies.*
- *Successful transition to practical exascale computing for the addressed specific element of the HPC stack.*
- *Covering important segments of the broader and/or emerging HPC markets, especially extreme-computing, emerging use modes and extreme-data HPC systems.*
- *Impact on standards bodies and other relevant international research programmes and frameworks.*
- *European excellence in mathematics and algorithms for extreme parallelism and extreme data applications to boost research and innovation in scientific areas such as physics, chemistry, biology, life sciences, materials, climate, geosciences, etc.*

Subtopics:

a) Coordination of the Exascale HPC strategy and International Collaboration

b) Excellence in Exascale Computing Systems

Coordination and Support Actions with 1-2m EC funding

Separate proposals per subtopic

Total Budget 4m

a) Coordination of the Exascale HPC strategy and International Collaboration

- joint community structuring and synchronisation
- further development and update of the Strategic Research Agenda for High Performance Computing as well as the application and applied mathematics exascale roadmaps;
- prepare the ground for targeted international research collaboration on specific aspects of the exascale challenges.
- create synergies with other HPC-related activities in H2020

b) Excellence in Exascale Computing Systems

- boost European HPC academic research excellence in future exascale-class computing cutting across all levels – hardware, architectures, programming, applications
- include specific actions to better structure the European academic HPC research
- create stronger links with HPC providers and HPC users
- attract venture capital
- promote entrepreneurship
- foster industry take-up

Expected Impact:

- *Strengthened European research and industrial leadership in the supply, operation and use of HPC systems.*
- *Contribution to the realisation of the ETP4HPC Strategic Research Agenda.*
- *Development of a competitive European ecosystem for building and exploiting a wide range of next-generation extreme performance computing systems.*
- *Structuring the efforts of stakeholders for implementing the European HPC strategy.*
- *Reinforced cooperation in international endeavours on HPC software and systems towards exascale.*
- *European Excellence in Exascale Computing systems.*

Headline research challenges (recap)

European Commission

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Thank you for your attention!

Single point of access to all information about the EC HPC strategy, work programmes and HPC related news:

ec.europa.eu/horizon2020-hpc