



European High Performance Computing Strategy and Outlook

Dr Panagiotis Tsarchopoulos
Future and Emerging Technologies
DG CONNECT
European Commission

Key EU developments HPC



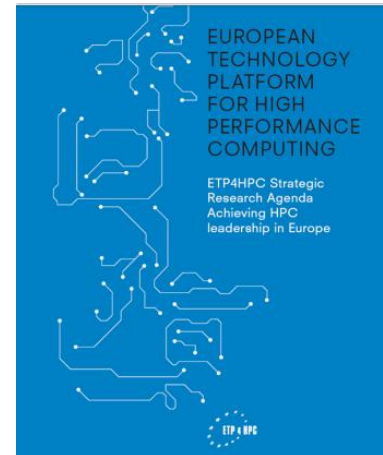
Communication from the EC
"High-Performance Computing:
Europe's place in a global race" (2012)



Council Conclusions on High-Performance
Computing (Competitiveness Council –
2013)



Establishment of the European Technology
Platform on High-Performance Computing
(ETP4HPC - 2012) and Strategic Research
Agenda on HPC (2013)



Horizon 2020 programme including
HPC Calls adopted (end of 2013)



High Performance Computing PPP: Mastering the
next generation of computing technologies for
innovative products and scientific discovery

Public-Private Partnership with ETP4HPC
(1st January 2014)

- HPC to tackle major scientific, societal and competitiveness challenges
- Innovative world-class industrial products and services in a cost effective way
- Underpinning scientific discovery through modelling and simulation





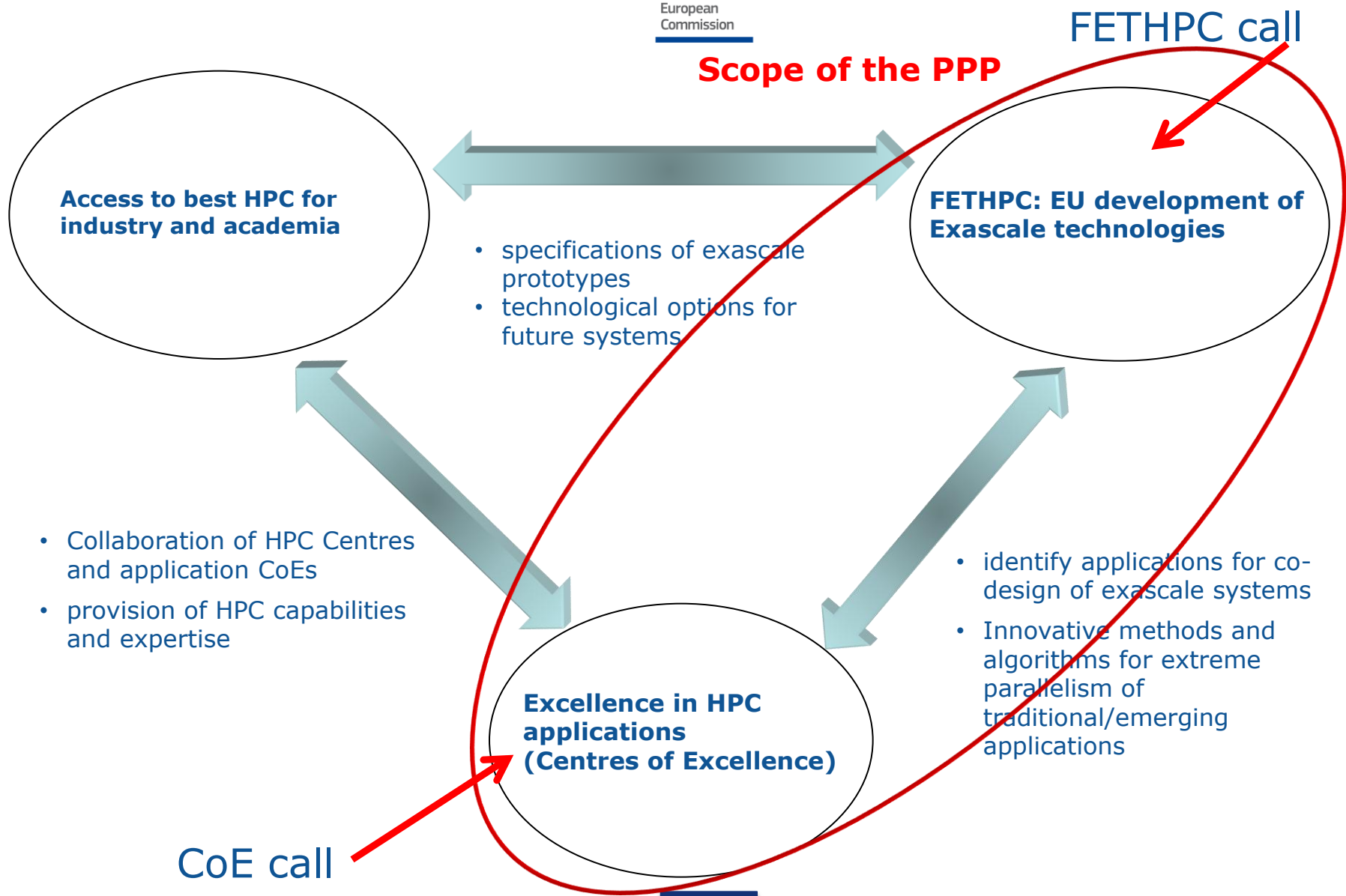
Implementing the HPC strategy in Horizon 2020



- HPC strategy combining three elements:
 - (a) Computer Science: towards **exascale** HPC; *A special FET initiative focussing on the next generations of exascale computing 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 2104 Call Towards Exascale

FETHPC 2014 CALL

Summary



FETHPC-1-2014: HPC Core Technologies, Programming Environments and Algorithms for Extreme Parallelism and Extreme Data Applications (Research and Innovation Actions)

- a) **HPC core technologies and architectures** (e.g. processors, memory, interconnect and storage) and their optimal integration into HPC systems, platforms and prototypes
- b) **Programming methodologies, environments languages and tools:** new programming models for extreme parallelism and extreme data applications
- c) **Application Programming Interfaces and system software** for future extreme scale systems
- d) **New mathematical and algorithmic approaches** for existing or emerging applications

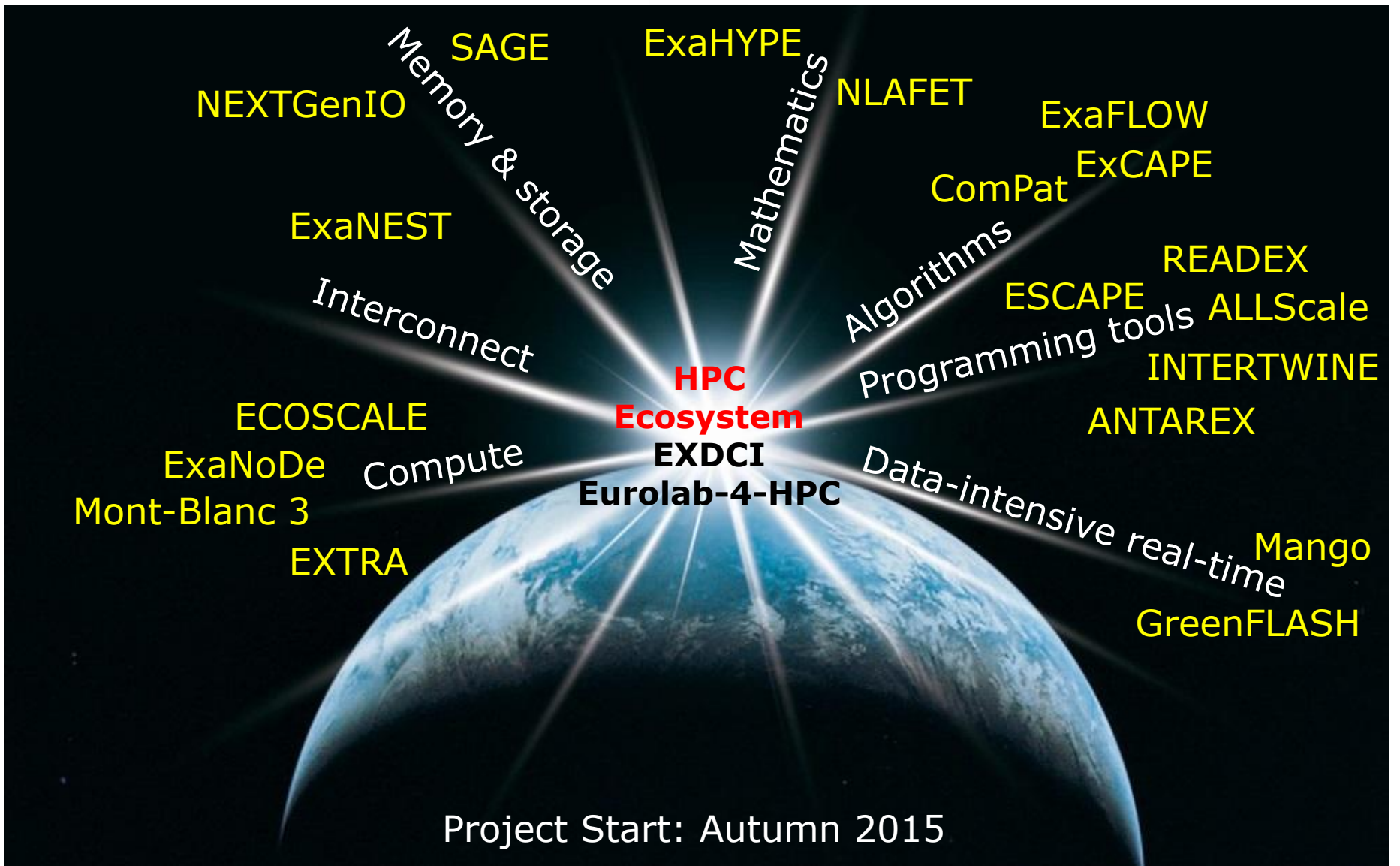
FETHPC-2-2014: HPC Ecosystem Development (Coordination and Support Actions)

- a) **Coordination of the HPC strategy:** coordination of the activities of stakeholders, development of Strategic Research Agenda, mapping and analysis of national and international R&I programmes, attracting young talents ,...
- b) **Excellence in High Performance Computing Systems:** boosting European research excellence on the key challenges towards the next generations of high-performance computing systems; cutting across all levels.



- *Closed: 25 November 2014*
- *81 eligible proposals were submitted*
 - **FETHPC1 (RIAs): 79 proposals**
 - **FETHPC2 (CSAs): 2 proposals**
- *Total budget requested: 340m*
 - **FETHPC1: 336m**
 - **FETHPC2: 4m**
- *Indicative budget available: 97.4m*
 - **FETHPC1: 93.4m**
 - **FETHPC2: 4m**

Retained proposals FETHPC



Project Start: Autumn 2015



*E-Infrastructures
Centres of Excellence
2015 Call*



Specific Challenge:

Establish a limited number of user-centred Centres of Excellence (CoE) in the application of HPC for addressing scientific, industrial or societal challenges

CoEs may be: Thematic, Transversal, Challenge-driven, or a combination

Proposals (*Research and Innovation Actions*) **will address:**

- a) Pan-European services
- b) Exascale R&D
- c) Sustainability
- d) New communities
- e) Governance structure



- *Closed: 14 January 2015*
- *20 eligible proposals submitted*
- *Projects start: end 2015*
- *Examples of areas covered by projects:*

Renewable Energy, Materials, Molecular & Atomic Modelling, Weather & Climate Change Modelling, Performance Optimisation, Global System Science, Biomolecular research



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Looking ahead



HPC Server Forecasts



*Forecasting a 7.4% yearly growth from 2013 to 2018
2018 should reach \$14.7 billion*

Worldwide Total Technical Computer Market			
	2013	2018	CAGR 13-18
Supercomputer	3,994,740	5,661,830	7.2%
Divisional	1,355,097	1,845,090	6.4%
Departmental	3,363,263	4,657,390	6.7%
Workgroup	1,585,666	2,545,416	9.9%
Total	10,298,766	14,709,726	7.4%
Source: IDC 2014			

The Broader HPC Market



Worldwide

Revenues by the Broader HPC Market Areas

	2013	2018	CAGR 13-18
Server	10,298,766	14,709,726	7.4%
Storage	3,841,141	5,898,600	9.0%
Middleware	1,122,052	1,587,179	7.2%
Applications	3,305,216	4,854,210	8.0%
Service	1,690,499	2,235,878	5.8%
Total Revenue	20,257,674	29,285,594	7.6%
Source: IDC 2014			

The Projected HPC Market In EMEA: Beyond The Base Servers



EMEA

Revenues by the Broader HPC Market Areas			
	2013	2018	CAGR 13-18
Server	3,101,954	4,433,856	7.4%
Storage	1,164,773	1,727,754	8.2%
Middleware	355,157	488,013	6.6%
Applications	1,039,935	1,419,563	6.4%
Service	550,568	669,118	4.0%
Total Revenue	6,212,388	8,738,305	7.1%
Source: IDC 2014			

Headline research challenges FETHPC 2016/2017 Calls*

- **Co-design** of HPC systems and applications (big projects)
- **Transition to exascale computing** (smaller focused projects)
 - 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** (CSAs)

*Disclaimer: subject to change - under discussion with member and associated states

HPC Overall strategy



Horizon 2020 Calls 2014-2017

WP2014-15 ~155 M€
(~144 in the cPPP)

WP2016-17 ~151 M€ (*)
(85 in the cPPP)

**HIGH PERFORMANCE
COMPUTING**

Pan-European HPC Infrastructure

HPC Capability
HPC Services
Support to innovation

Exascale technologies

Architectures, programming.
environments, tools...
Exascale Prototypes

PRACE-4IP
(15 m€)

PRACE (15 m€)
PPI for HPC (26 m€)

Training
Education
Skills

Core technologies (93,4 m€)
Ecosystem development (4 m€)

Flagship
Applications
(HBP)

HBP - HPC (25 m€)

Applications

Societal challenges
Scientific strategic applications
Emerging domains (Big Data)
New methods and algorithms

Co-design (41 m€)
Transition to exascale (40 m€)
Ecosystem development (4 m€)

Centres of Excellence
(40 m€)

**ADVANCED
COMPUTING**

Clouds for
Science

SMEs

Services, Competence
Centres

Network of SME
competence centres
(2 m€)

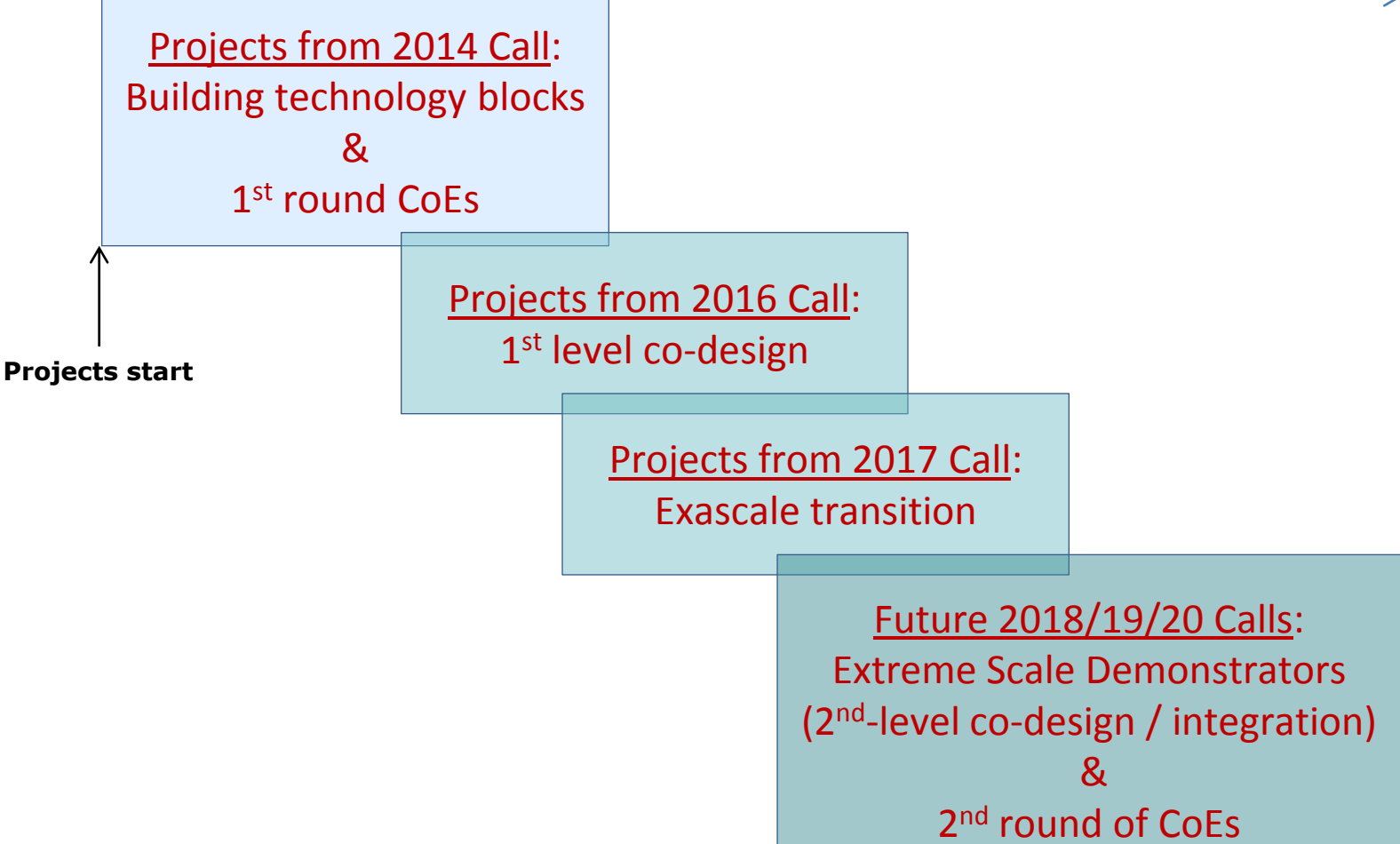
CLOUDS

(*) pending formal approval

HPC cPPP Indicative timeline in H2020



2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023



HPC Ecosystem development →



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Thank you for your attention!

Email: Panagiotis.Tsarchopoulos@ec.europa.eu