



**HIGH
PERFORMANCE
COMPUTING
FOR EUROPE**

ETP 4
HPC

ETP4HPC

European Technology Platform For High Performance Computing

Webinaire FET HPC 2018
High Performance Computing
26/03/2018

*Maïke Gilliot
Jean-Philippe Nominé*

*ETP4HPC Office
ETP4HPC Office*

<http://www.etp4hpc.eu/>

office@etp4hpc.eu



ETP4HPC ASSOCIATION

“Building a globally competitive European world-class HPC technology value chain”

Industry-led think tank founded in 2012

Private partner of the HPC cPPP with the European Commission – signed in 2013

December 2017:

86 Members

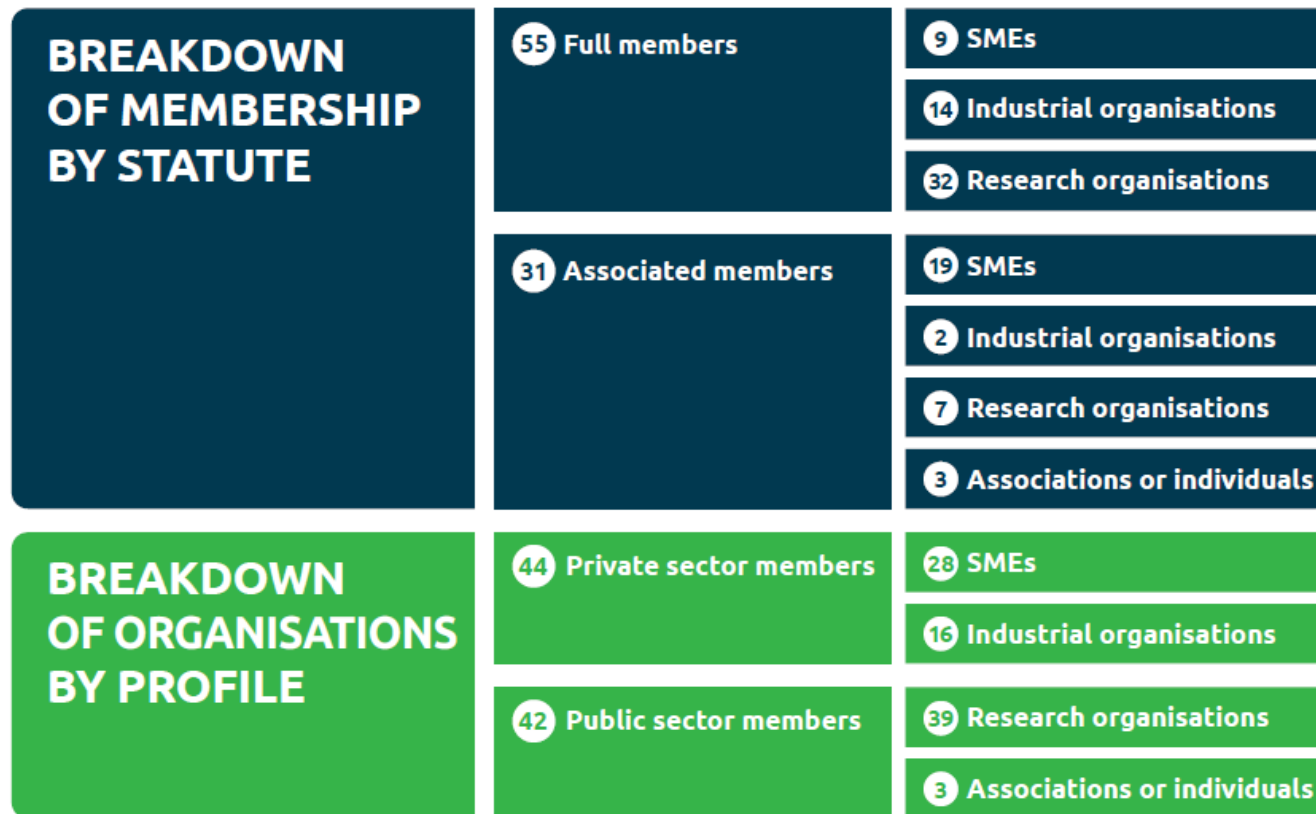
44 Private / 29 SMEs

38 Research organisations



OUR ASSOCIATION (DEC. 2017 SNAPSHOT)

“Building a globally competitive European world-class HPC technology value chain”



DIVERSITY OF OUR MEMBERS

- Technology and solution providers
 - Vendors of whole supercomputing systems hardware+software
From SMEs to large companies
 - Components/building blocks (Hardware- Software)
 - Independent Software Vendors (ISVs)
- Service providers
- Application owners and users
- ETP4HPC public members - research organisations - play different roles:
 - Strong contributions to upfront technology R&D (Hardware + Software)
 - Some are large computing centres (operations and HPC user support competencies + co-design and code optimisation and/or development)
 - Application owners in different domains (many participate in Centres of Excellence for Computing Applications)

SCOPE OF HPC cPPP

EUROPEAN HPC ECO-SYSTEM



ETP4HPC MAIN REMIT

Main remit:

Provide input to define H2020 HPC R&D programmes funded and operated by the EC

Tool = Multi-Annual Roadmap - “Strategic Research Agenda” (SRA)

<http://www.etp4hpc.eu/en/sra.html>

Permanent Working groups:

- SME Working Group
- Software Working Group
- Energy efficiency Working Group
- Industrial Contact Group

Other activities

HPC ecosystem development

European Extreme Data & Computing Initiative <https://exdci.eu/>

EVENTS 2017



7th General Assembly of ETP4HPC @ IBM, Munich

On 21st March 2017, we held our General Assembly in Munich. IBM hosted this event in its new Watson IoT Center. The first focus was on our activities. To this end, our chairman Jean-Pierre Panziera presented an overview of ETP4HPC's past and future activities, as well as the upcoming evolution of the European HPC landscape. Our Work Groups then reported on their activities. Talks by invited guests complemented this part: Gustav Kalbe (DGCNECT) presented and discussed the EC's strategy on HPC with ETP4HPC's members, and Jean-François Lavignon reported on the activities of the international initiative BDEC. Our members and our ecosystem were our second focus: The General Assembly was also a good opportunity for our new members to introduce themselves, Will Schilders (TU Eindhoven) gave a short presentation on the EU-MATHS-IN initiative and possible collaborations with ETP4HPC, and Gordon Wollgam (Roland Berger Consulting) presented a currently running HPC Business case study on behalf of the European Investment Bank (EIB).

Moreover, we began the work on the third edition of our Strategic Research Agenda (SRA3), as guiding reference for the HPC-related calls in the 2018-2020 Work Programme.

© ETP4HPC

European HPC Summit Week in Barcelona

EXDCI coordinates the conference series "European HPC Summit Week". Its aim is to gather all related European HPC stakeholders (institutions, service providers, users, communities, suppliers and consultants) in a single week to foster synergies. Each year, EXDCI opens a call for contributions to all HPC-related players who would like to participate in the week through a workshop. After Prague in 2016, the 2nd edition of the European HPC Summit Week (EHPCSW17) took place from May 15th to 19th in Barcelona on the Campus of the Universitat Politècnica de Catalunya. The event hosted the EXDCI workshop, as well as the fourth edition of the PRACE Scientific and Industrial Conference on "HPC for Innovation: when Science meets Industry" with international keynotes, panel discussions, and many parallel sessions. In addition, EuroLab4HPC held a workshop, as did ETP4HPC with a session on applications for Extreme scale Demonstrators. The workshops organised by the Centres of Excellence (CoE) and the FETHPC projects ranged from application areas including renewable energies, oil & gas, biomedicine, big data, mathematics, climate modelling, computing applications, to HPC future technologies.



European HPC Summit Week in Barcelona (Spain) in June 2017

© EXDCI



ETP4HPC booth at ISC17

© ETP4HPC

ISC17 and Forum Teratec 2017

The 2017 edition of the ISC High Performance (ISC17) was held in Frankfurt (Germany) from June 19th until 22nd 2017. Like in previous years, ETP4HPC took part in different ways: First, we presented our SRA and other activities on our booth and discussed with members and visitors the development of the European HPC ecosystem. Moreover, we hosted a workshop focusing on industrial usage (and users) of the future Extreme scale Demonstrators (EsDs) on Thursday (June 22nd 2017).

Another important event in June is Forum Teratec: On June 27th and 28th, Ecole Polytechnique in Palaiseau (France) hosted the Forum Teratec 2017. This forum is one of the major events in France and Europe, which is gathering top international experts in High Performance Computing, Big Data and simulation. ETP4HPC hosted on its booth EXDCI, and jointly we promoted and explained to visitors the European efforts in HPC.

ETP4HPC and BDVA Joint Workshops

ETP4HPC co-organised two technical exchange workshops with Big Data Value Association (BDVA) with the view of improving a common technical language between their HPC and Big Data platforms and also clarifying the perspective on common subjects such as compute infrastructure and requirements for its next generation.

The main focus of the first workshop in Bologna (July 4th 2017) was on developing a better understanding of the intersections in scope, research directions and priorities for both platforms, with a central discussion on developing a commonly accepted view on the differences between typical HPC compute systems and that of Big Data. Moreover, the participants agreed to identify use cases of common interest, i.e., use cases using both HPC and Big Data technologies. The 2nd workshop brought in representatives from BDEC, HIPEAC and AIOTI – along with BDVA and ETP4HPC. The objective of this workshop was to verify the use cases of common interest and



Joint Workshop with BDVA in Bologna (Italy) in July 2017

© EXDCI

also begin a discussion on preparations for future joint research priorities and roadmaps. The workshop took place on November 20th 2017 in Versailles, organised as part of the European Big Data Value Forum 2017.

EVENTS 2017



EXDCI

EXDCI Final Conference in September 2017 in Barcelona

EXDCI (European extreme Data and Computing Initiative) co-located its Final Conference (September 7th - 8th 2017 in Barcelona, Spain) with the Annual ACM Europe Conference 2017, gathering thus the ACM Europe community, HPC specialists, students and ACM members worldwide. Sergi Girona (BSC) as Project Coordinator and François Bodin (Université Rennes I) as EXDCI Technical Director opened the conference with an overview of EXDCI's activities and achievements. Marcin Ostasz (BSC) and Stéphane Requena (GENCI) reported on upcoming evolutions regarding technologies and applications, respectively. The global trends in HPC and the international competition were sketched by Mark Asch (Université de Picardie), and David Henty (EPCC) presented EXDCI's efforts on Training for the next generation of HPC experts.; Maïke Gilliot (ETP4HPC/Teratec) gave some insight on challenges the SMEs in HPC face and Jean-Philippe Nominé (ETP4HPC/CEA) showed the evolution of the European HPC ecosystem over the last few years. The conference also included a joint session with Eurolab4HPC (H2020 funded coordination and support action) and HiPEAC, represented by Keon De Bosschen, as well as ACM's track on HPC and a Turing Lecture.

Birds-of-a-Feather Session @ SC17 (Nov. 14th 2018, Denver, Colorado)

For the third time, we held a Birds-of-a-Feather session (BoF) at the International Conference for High Performance Computing, Networking, Storage and Analysis (SC). This year's edition was entitled "European Exascale Projects and Their Global Contributions". It was organised by ETPHPC on behalf of the European extreme Data and Computing Initiative (EXDCI). The objective of the BoF was to present an overview of the European HPC landscape and the international potential of the European HPC projects, many of which were present at the event with the aim of starting new collaborations. After a short introduction by Jean-Pierre Panziera, Chairman of ETP4HPC, Eugene Griffiths, (BSC and member of ETP4HPC's Steering Board) presented an overview of "The European HPC Strategy". This was followed by presentations of three selected European HPC Projects: BioExcel (Erwin Laure, KTH), SAGE (Sai Narasimhamurthy, Seagate) and Mont-Blanc (Etienne Walter, Acos).

François Bodin (Scientific Director, EXDCI), Paul Messina (Exascale Computing Project, USA) and Yutaka Ishikawa (Riken, Japan) presented an update of the HPC ecosystem in Europe, the US and Japan respectively.



BUILDING A SUSTAINABLE HPC ECO SYSTEM

“Exascale” target seen as driver for technology excellence in:

- scalability
 - resiliency
 - energy efficiency
 - programmability
 - usability
-
- ETP4HPC’s roadmap covers research for entire performance spectrum
Extreme scale only does not make up a market

 - Incentive for Europe’s HPC technology providers (HW/SW), incl. many SMEs

STRATEGIC RESEARCH AGENDA 2017

European Multi-annual
HPC Technology Roadmap

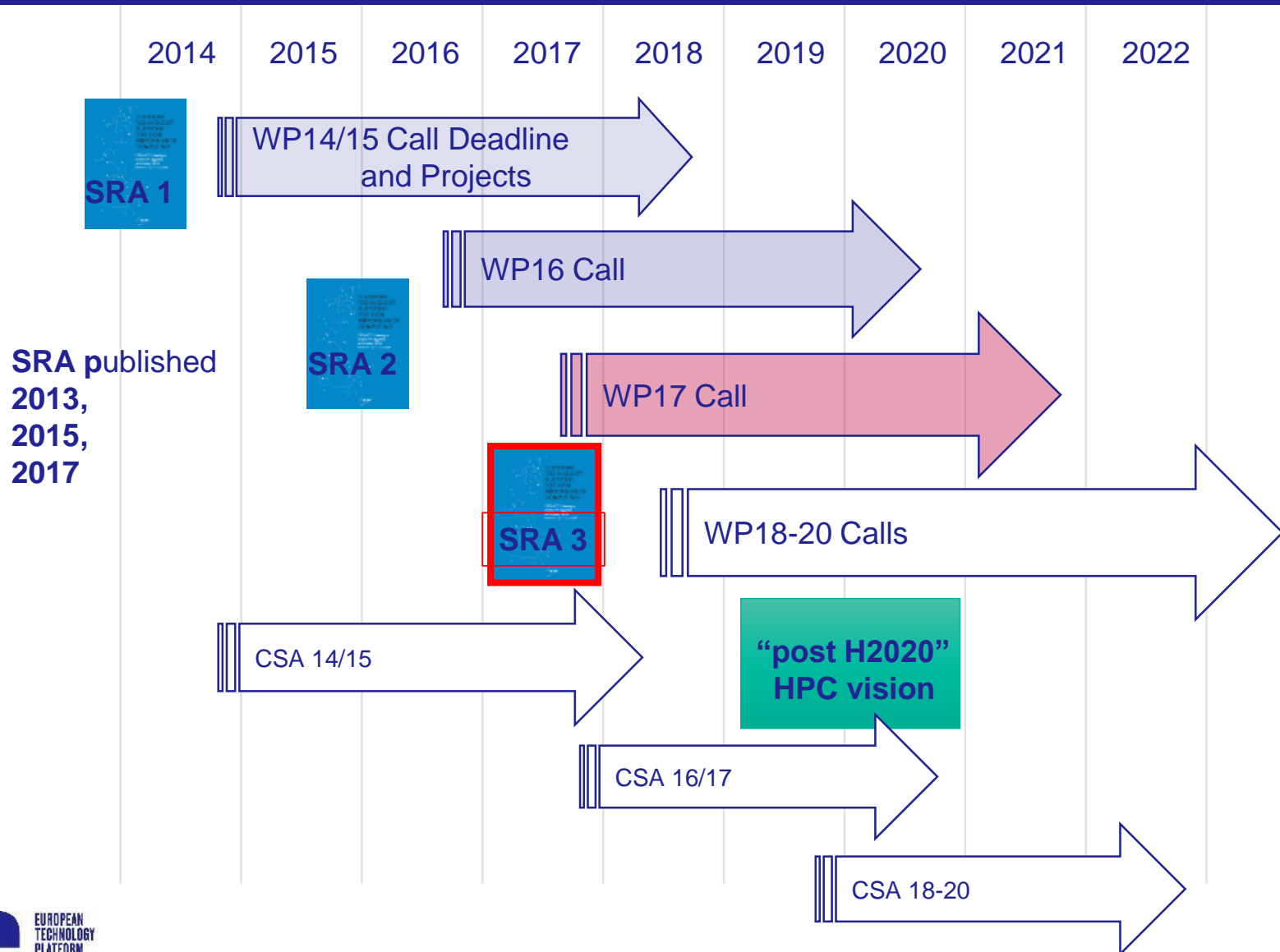


CONTENTS

A. GLOSSARY OF TERMS	5
B. FOREWORD	7
C. EXECUTIVE SUMMARY	8
D. HOW TO USE THIS DOCUMENT	9
1. INTRODUCTION AND CONTEXT	10
1.1 The Process of Preparing SRA 3	14
2. THE CASE FOR EUROPEAN HPC TECHNOLOGY	16
2.1 The Value of HPC	18
2.2 The current European HPC Strategy	19
3. THE EUROPEAN HPC ECOSYSTEM - WHERE WE ARE AND WHERE WE SHOULD GO	22
3.1 The evolution of the European HPC Ecosystem (2012-17)	24
3.2 A Holistic view of European HPC	29
3.3 The International Context of European HPC Technology	30
4. DIMENSIONS AND DRIVERS OF HPC RESEARCH	34
4.1 The ETP4HPC SRA Model	35
4.2 An emerging deployment context for HPC	37
4.3 Application Requirements	42
5. NEW TRENDS IN HPC CHALLENGES, USE AND TECHNOLOGY	54
6. TECHNICAL RESEARCH PRIORITIES	62
6.1 HPC System Architecture and Components	63
6.2 System Software and Management	67
6.3 Programming Environment	70
6.4 Energy and Resiliency	73
6.5 Balance Compute, I/O and Storage Performance	77
6.6 Big Data and HPC usage Models	83
6.7 Mathematics and Algorithms for extreme scale HPC systems	84
7. RESEARCH MILESTONES	90
7.1 HPC System Architecture and Components	92
7.2 System Software and Management	93
7.3 Programming Environment	94
7.4 Energy and Resiliency	95
7.5 Balance Compute, I/O and Storage Performance	96
7.6 Big Data and HPC usage Models	97
7.7 Mathematics and Algorithms for extreme scale HPC systems	98
8. EXTREME-SCALE DEMONSTRATORS	100
8.1 Phases of EsD projects	102
8.2 Scope of EsD projects	103
8.3 ETP4HPC's Proposal for EsD project structure	105
9. NON-TECHNICAL RECOMMENDATIONS AND PRIORITIES	108
9.1 Ecosystem-Level Holistic Recommendations	109
9.2 SMEs and Start-ups	110
9.3 Education and Training	112
10. CONCLUSIONS AND OUTLOOK	114
11. REFERENCES	116
12. APPENDIX	119
12.1 ETP4HPC SWOT Analysis (May 2017)	120
13. CONTRIBUTORS	123

<http://www.etp4hpc.eu/sra.html>

SRAs – WORK PROGRAMMES IN HORIZON 2020 TIMELINE

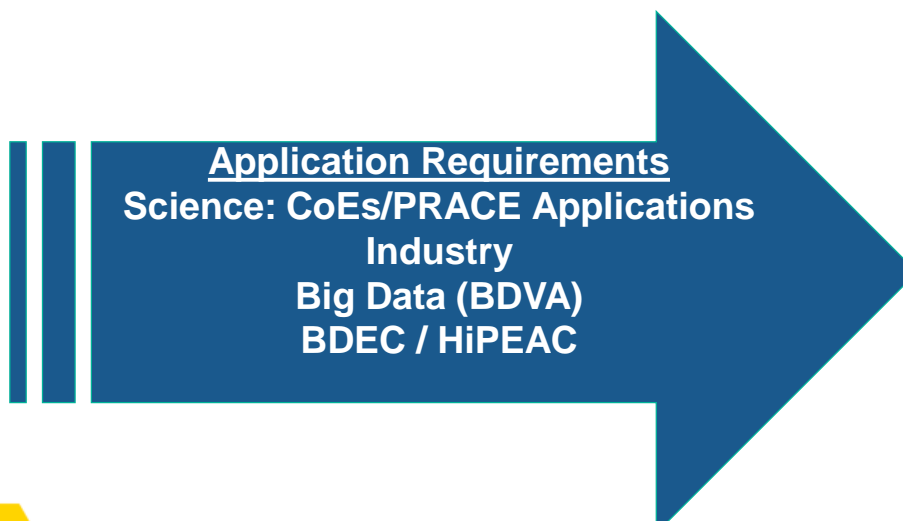


INPUT SOURCES FOR THE SRA3/2017

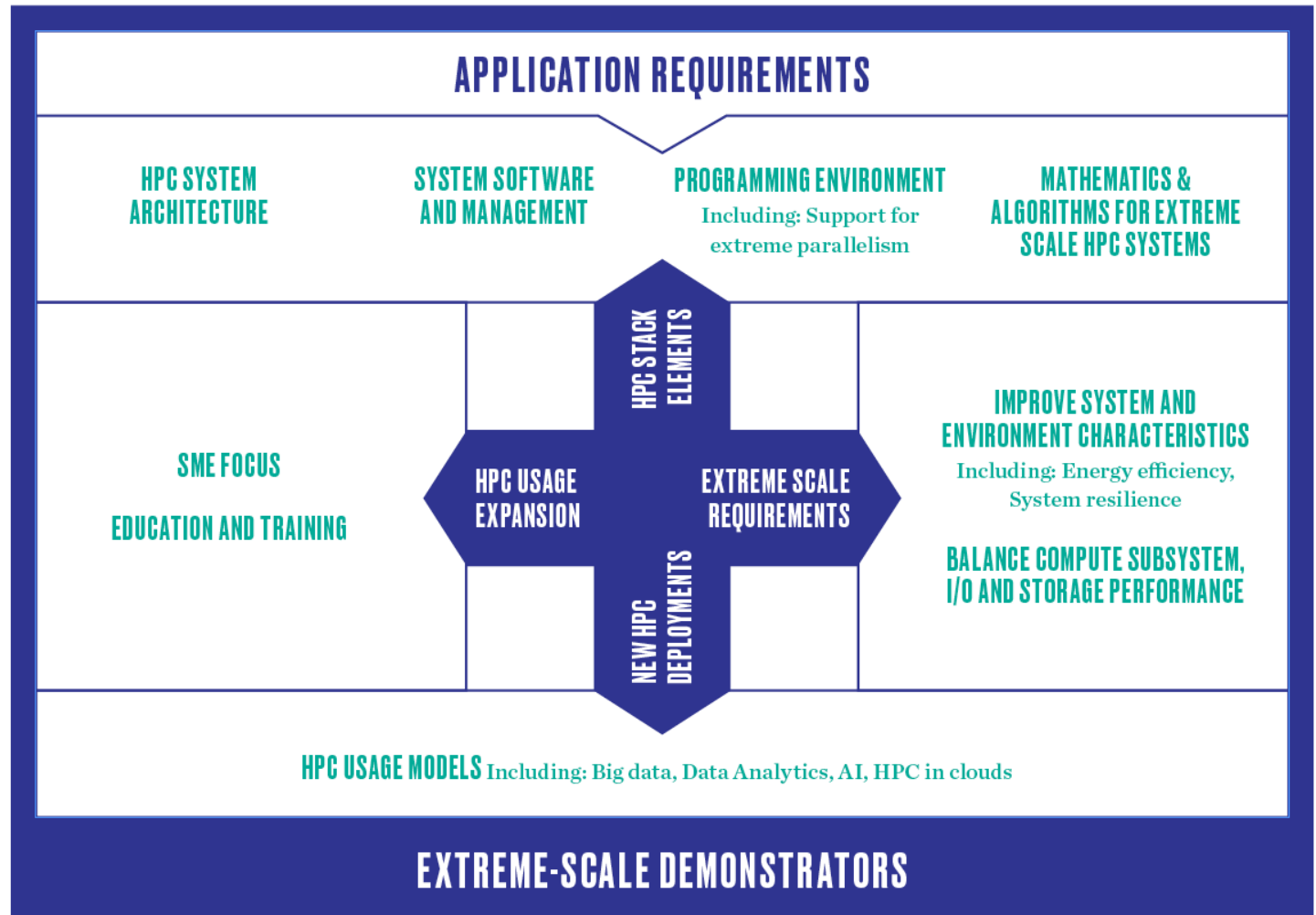


	Material sciences: Materials design at the eXascale
	Material sciences: The Novel Materials Discovery Laboratory
	Material sciences: An e-infrastructure for software, training and consultancy in simulation and modelling
	Energy: Energy oriented Centre of Excellence for computer applications
	Climate: Excellence in Simulation of Weather and Climate in Europe
	Global Systems Science: Center of Excellence for Global Systems Science
	Bioscience: Centre of Excellence for Biomolecular Research
	Biomedicine: A Centre of Excellence in Computational Biomedicine
	Performance: Performance Optimisation and Productivity

+ input from 150 ETP4HPC experts



MULTI-DIMENSIONAL SRA HPC MODEL



CURRENT PORTFOLIO

PROJECTS FUNDED IN 2015-2017 UNDER HPC cPPP UMBRELLA

<http://www.etp4hpc.eu/en/european-hpc-handbook.html>



2017 EUROPEAN HPC HANDBOOK

Our 2017 European HPC Handbook is available. This professional publication details the HPC Technology and Applications Projects within the European HPC ecosystem. It will be distributed at our Supercomputing 2017 Birds-of-a-Feather Session in Denver (14th Nov 2017, 5.15pm).

If you wish to receive a hard copy, please contact the Office.

OPERATIONAL STATISTICS

H2020 PROJECT STATISTICS

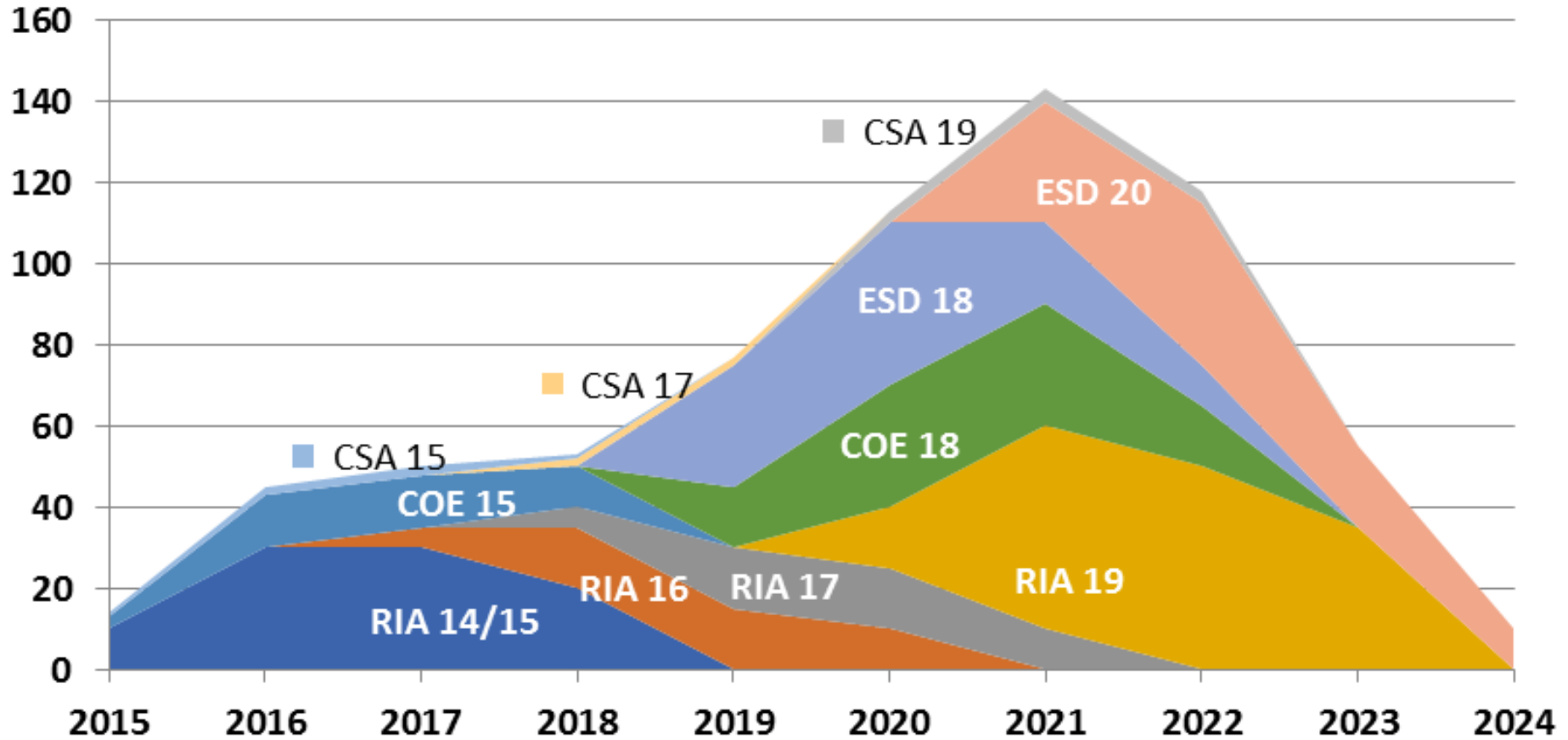
	2014- 2018 (Q1)
# of H2020 calls implemented	4
Avg. time-to-grant	7 months
Total H2020 funding committed	€219.5 million
# of running projects	32
# of new projects to start during the year 2018	11 (RIA) + 2 (CSA)
Projects coordinated by ETP members	19
Participating organisations	429
Unique participations	221
non-ETP members participations	62%
Industry (non-SME) participations	Not processed yet Ca. 20%
SME participations	Not processed yet Ca. 10%

Projects funded between 2015 and 2017 under 3 FETHPC and 1 CoE calls – scope of Work Programmes 2014-2015 and beginning of Work Programme 2018-2020

Call	Projects	Starting
FETHPC 2014	19 RIA + 2 CSA	2015
CoE 2014	9 RIA	2015 (1 in 2016)
FETHPC 2016	2 RIA	2017
FETHPC 2017	11 RIA 2 CSA	2018

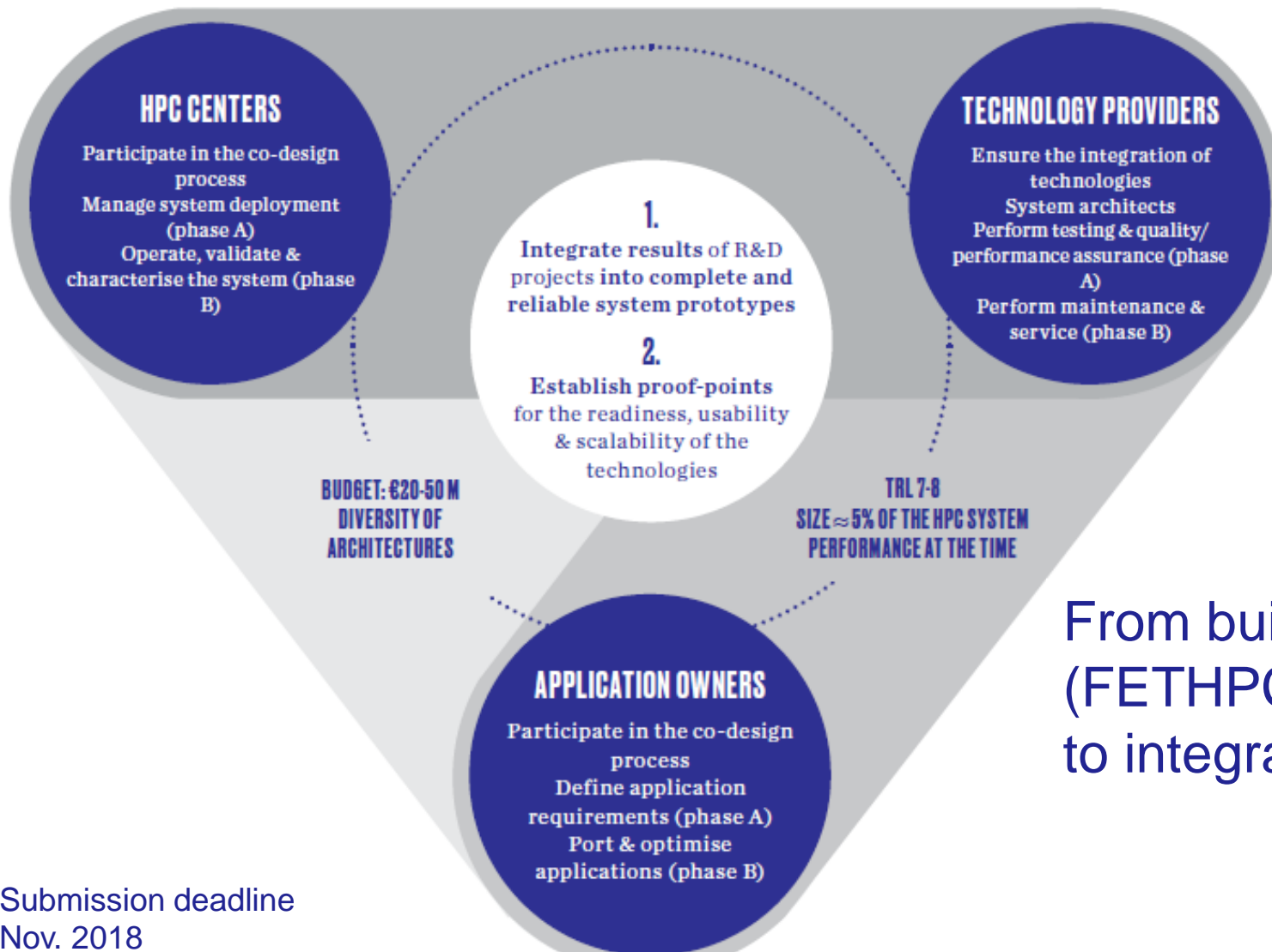
H2020 HPC WORK PROGRAMME – DURATION/VALUES (EURO Ms)

Funding WP 14-20



ETP4HPC Recommendation

CO-DESIGNING EXTREME SCALE DEMONSTRATORS (ESD)

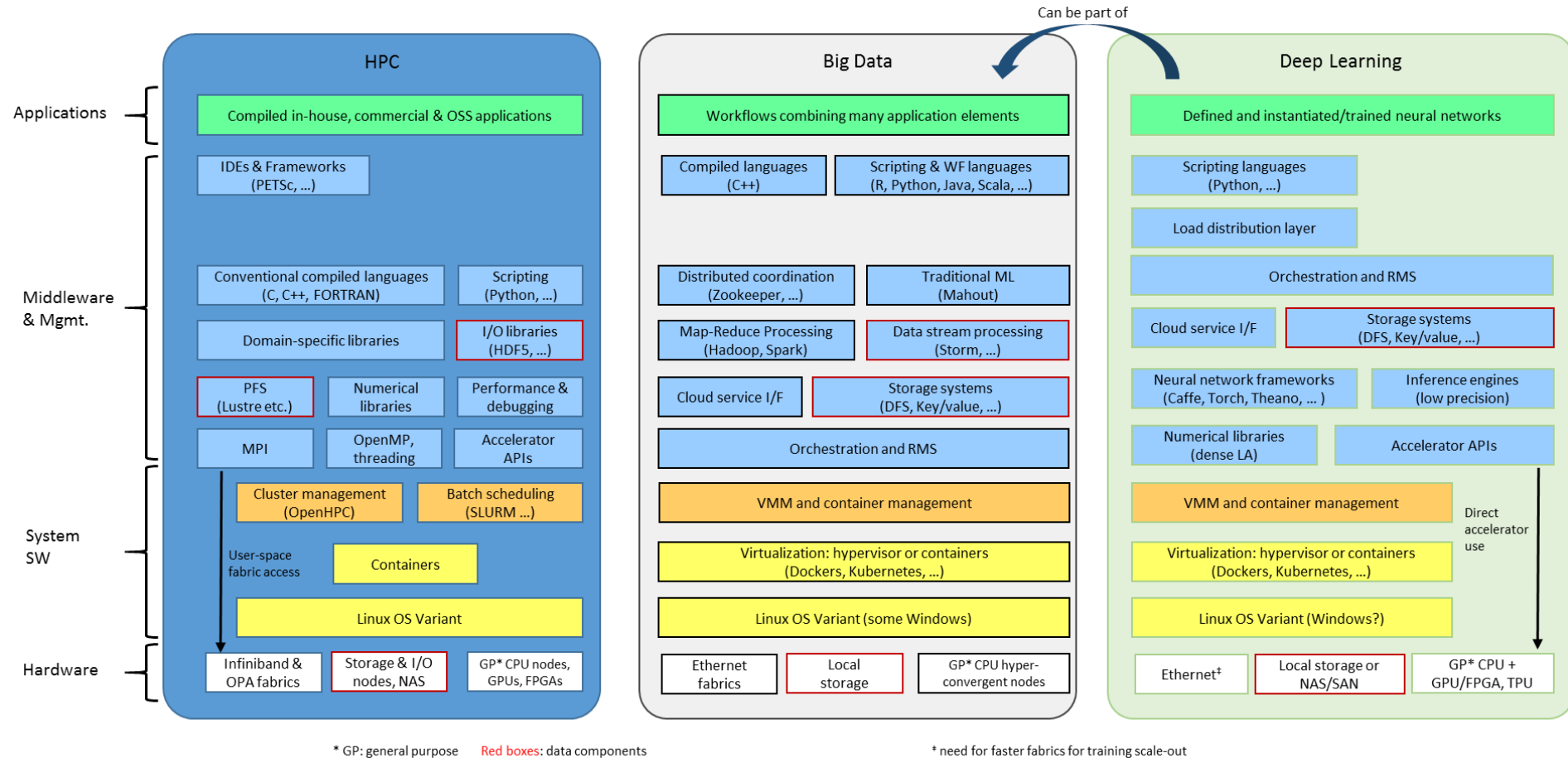


From building blocks
(FETHPC 2014/16/17)
to integrated solutions

Submission deadline
Nov. 2018

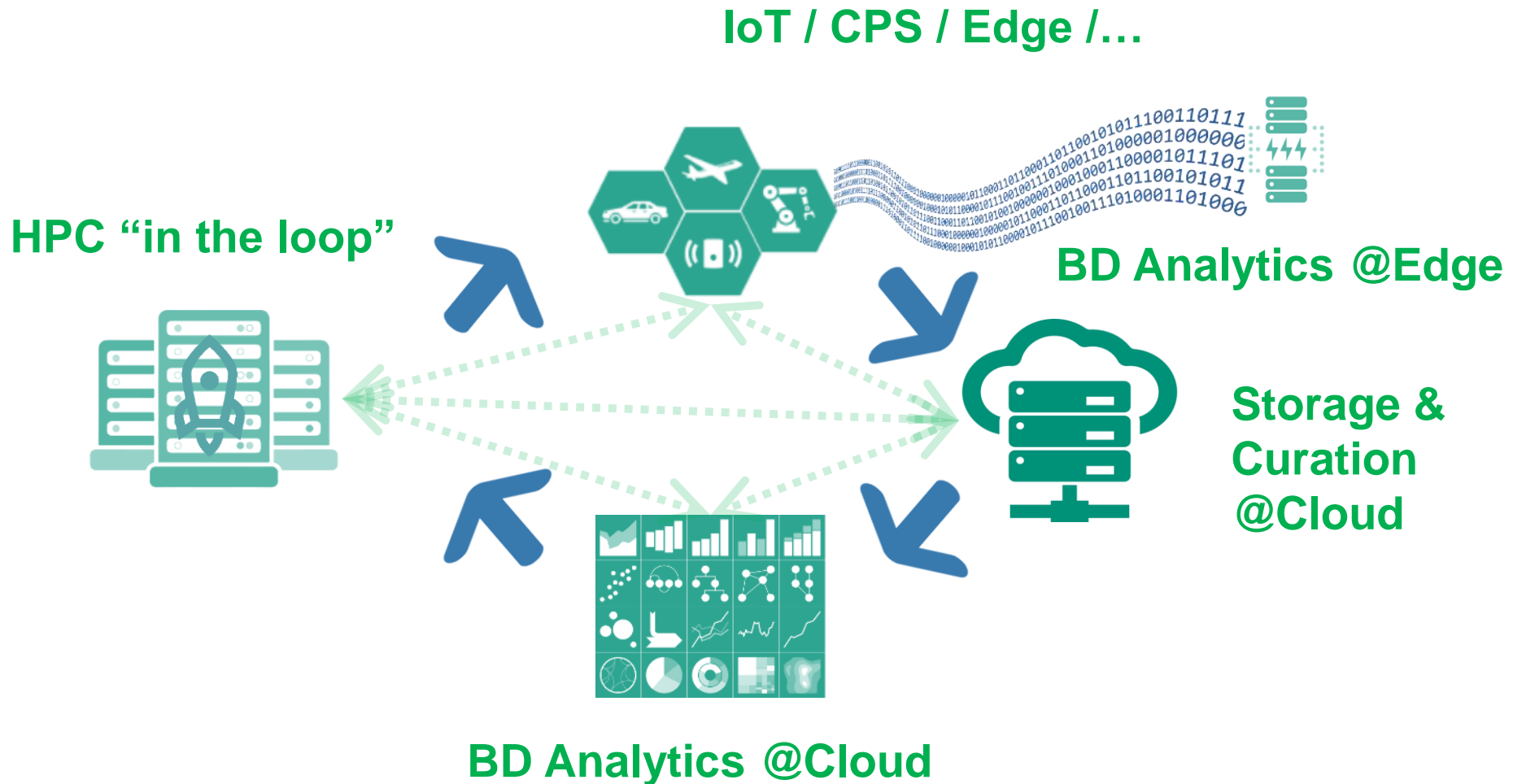
<http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/ict-14-2019.html>

ETP4HPCs EXTENSION TO HPC, BIG DATA AND DEEP LEARNING



This is the structural foundation of the technical roadmap work ahead

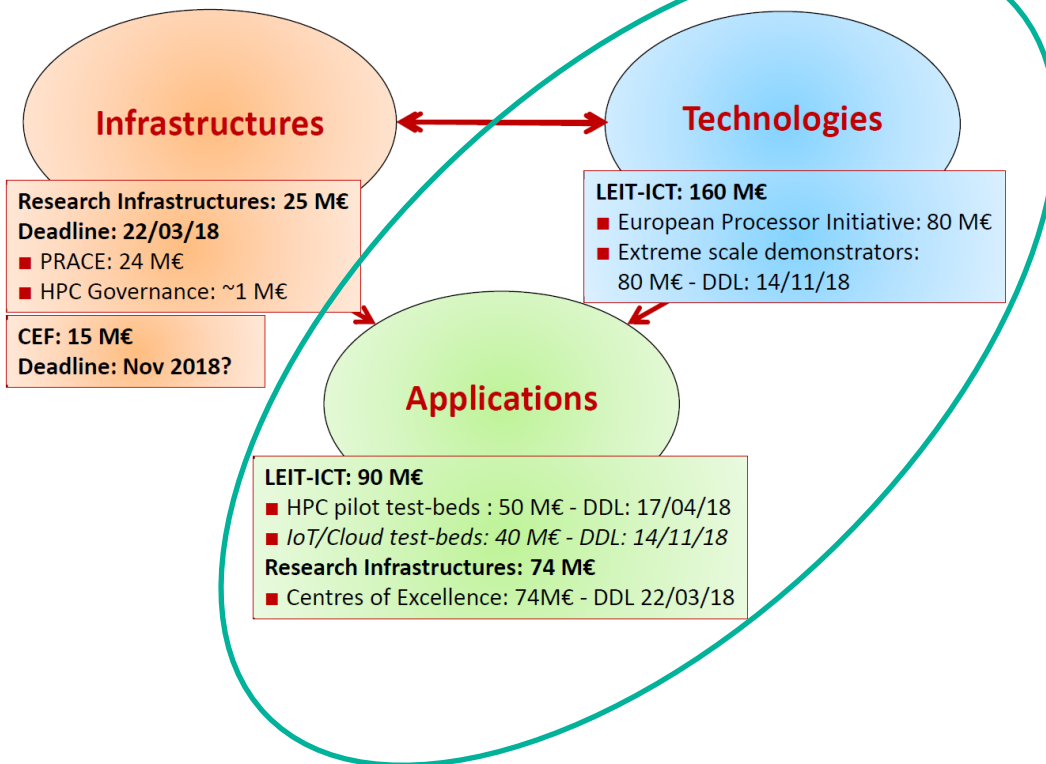
HPC IN THE LARGER PICTURE



WORK PROGRAMME 2018-2020



Agenda for 2018 HPC Calls for proposals in 2018



Then 2019-2020:
EuroHPC coming

	H2020 FET	H2020 LEIT-ICT
WP 2019	FETHPC-02-2019 : HPC - Extreme scale computing technologies, methods and algorithms for key applications and support to the HPC ecosystem 68 M€	
WP 2020	FETHPC-03-2020 : Co-design of extreme scale HPC systems and applications 100 M€	Framework Partnership Agreement in European low-power microprocessor technologies (Phase 2) 40 M€

ETP4HPC

- Industry-led think tank founded in 2012
- HPC ecosystem development
- Private partner of the HPC cPPP with the European Commission
- Edit and maintain HPC multi-annual roadmap
→ Strategic Research Agenda (SRA)
- HPC Work Programme Progress Monitoring
- Supporting EuroHPC Joint Undertaking initiative
- Getting prepared to play an active role in EuroHPC for H2020 and FP9



EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING

www.etp4hpc.eu • office@etp4hpc.eu