



**ETP 4 HPC**

**THE EUROPEAN TECHNOLOGY PLATFORM  
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[www.etp4hpc.eu](http://www.etp4hpc.eu)

SRA – update,  
Workprogramme 2018-2020,  
European Cloud Initiative,

cPPP meeting, HPC Summit Prague, May 11<sup>th</sup> 2016



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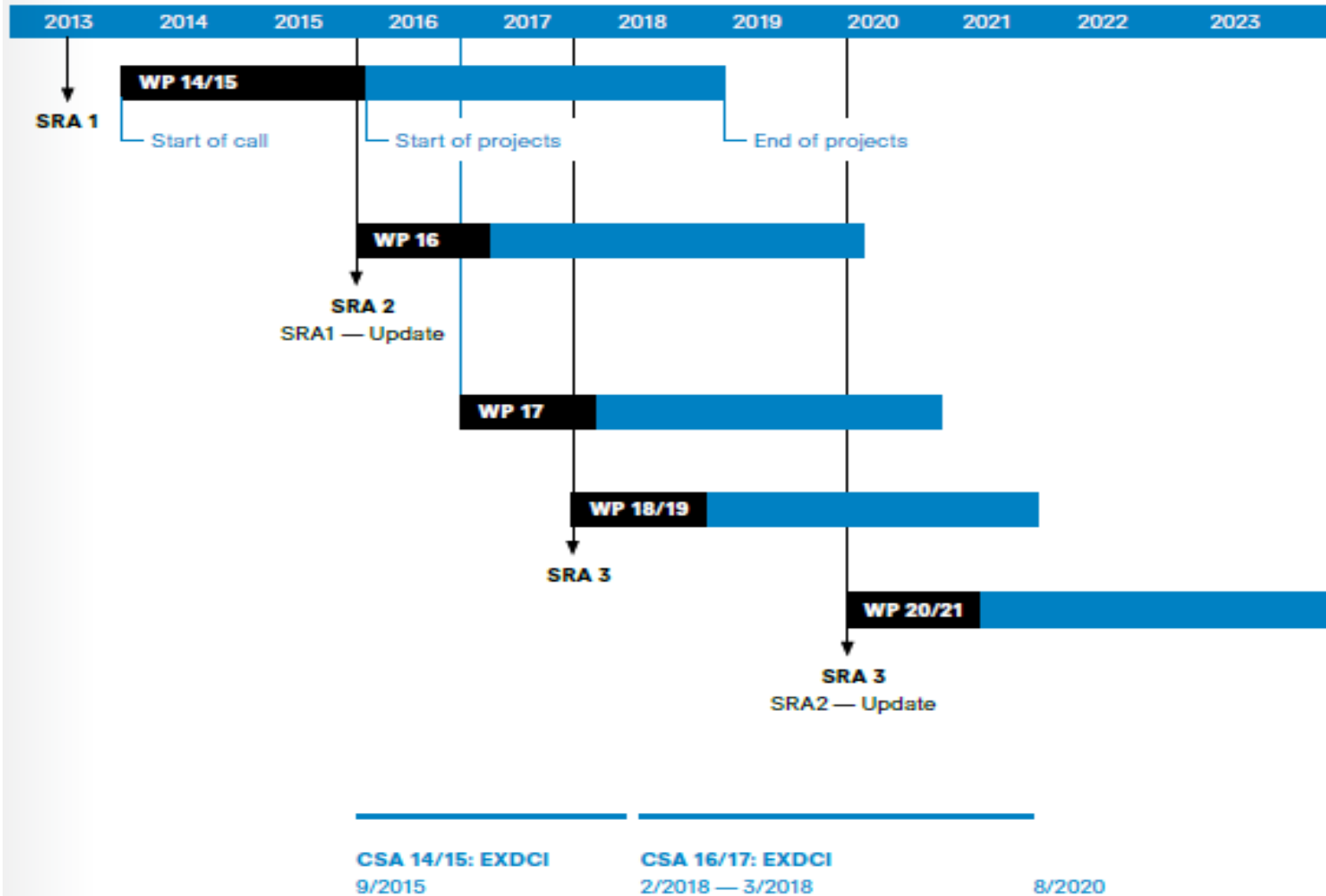
# **Strategic Research Agenda**

## **SRA**

a multi-annual roadmap towards  
Exascale High-Performance Computing Capabilities

# Horizon 2020 WPs and SRAs

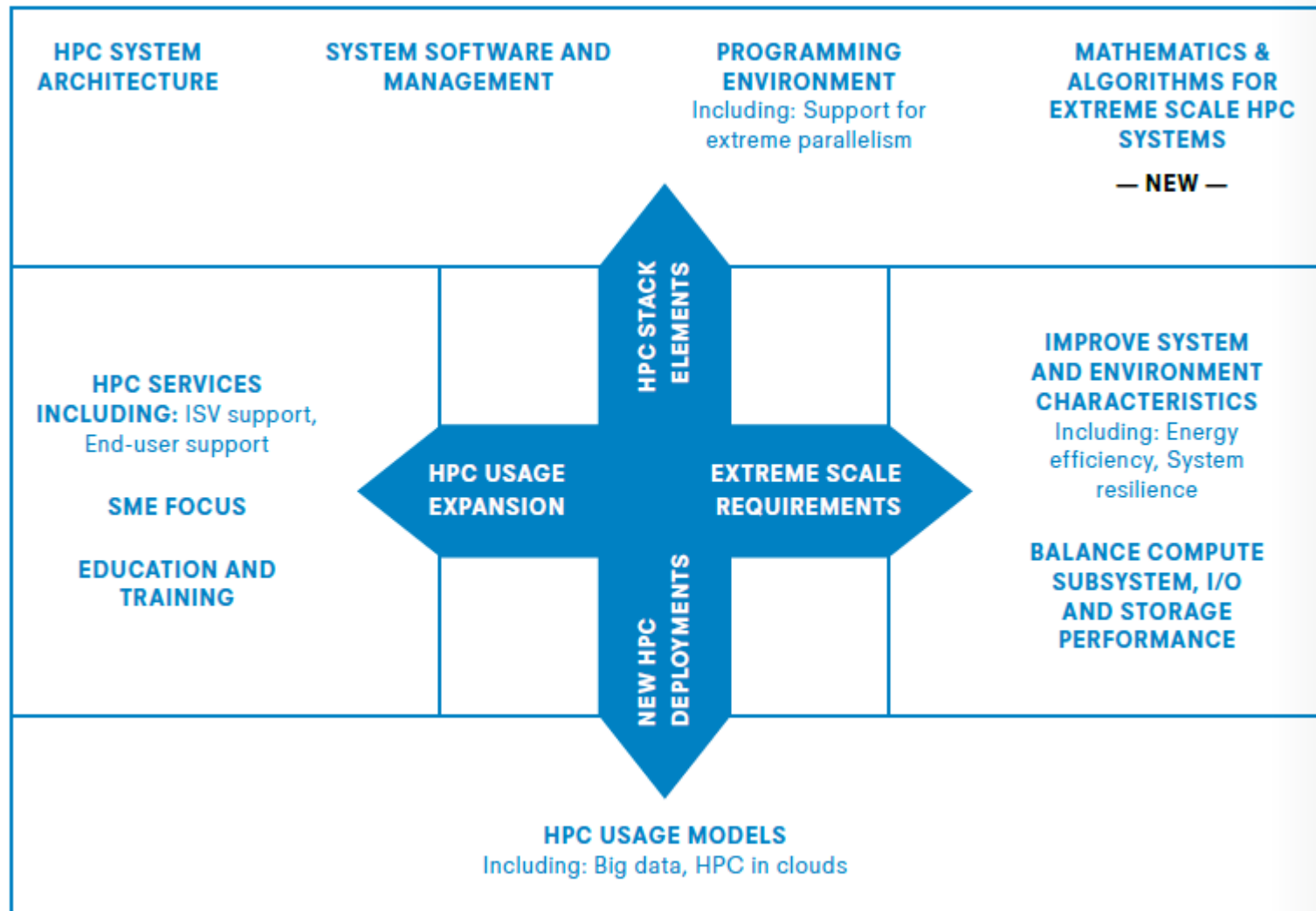
## HPC — HORIZON 2020 ROADMAP



# Priorities

- There is a demand for R&D and innovation in both extreme performance systems and mid-range HPC systems
  - Scientific domain and some industrial users want extreme scale
  - ISVs and part of the industry expect more usability and affordability of mid-range system
- The ETP4HPC HPC technology providers are also convinced that to build a sustainable ecosystem,
  - their R&D investments should target not only the exascale objective (too narrow a market)
  - an approach that aims at developing technologies capable of serving both the extreme-scale requirements and mid-market needs can be successful in strengthening Europe's position.

# 4 dimensions of the SRA



# Transversal issues to be addressed

- Three technical topics:
  - Security in HPC infrastructures to support increasing deployment of HPDA
  - Resource virtualisation to increase flexibility and robustness
  - HPC in clouds to facilitate ease of access
- Two key element for HPC expansion
  - Usability at growing scale and complexity
  - Affordability (focus on TCO)



# How was the SRA been built?

8 Workgroups covering the 8 technical focus areas:

## **SRA 2015 technical focus areas**

- HPC System Architecture and Components
  - Energy and Resiliency
  - Programming Environment
  - System Software and Management
  - Big Data and HPC usage Models
  - Balance Compute, I/O and Storage Performance
  - Mathematics and algorithms for extreme scale HPC systems
  - Extreme scale demonstrators
- 
- 48 ETP4HPC member orgs/companies involved in these workgroups
  - Members named 170 individual experts to contribute, 20-30 per working group

# Other interactions

- Feedback sessions with end-users and ISVs at Teratec Forum
  - 20 end-users outline their deployment of HPC, future plans and technical recommendations
  - Very diverse set of priorities (performance & scale, robustness, ease of access, new workflows etc.)
  - No ‘One size fits all’ – approach possible
- Technical session with Big Data Value Association (BDVA) to understand architectural influences of HPDA
  - Technical dialogue started, much more to be done over next 1-2 years
  - BDVA has issued an update to their SRIA in Jan 2016



# The technical domains and the ESD proposal

Trends and recommended research topics –  
a few examples

# HPC System Architecture, Storage and I/O, Energy and Resiliency

- Major trends - a subset:
  - Increased use of accelerators (e.g. GPUs, many core CPUs) in heterogeneous system architectures
  - Compute node architectures efficiently integrate accelerators, CPUs with high bandwidth memory
  - Non volatile memory types open up new interesting memory and caching hierarchy designs
  - System networks to significantly scale up and cut latencies, introducing virtualisation mechanisms
  - Storage subsystems to become more ‘intelligent’ to better balance compute and I/O
  - Increased activities in object storage technologies with major architectural revamp in the next years
  - Focus on architectural changes to improve energy efficiency and reduce data movement
- Research topics to be addressed (examples)
  - Compute node deep integration with embedded fast memory and memory coherent interfaces
  - Silicon photonics and photonic switching in HPC system networks
  - Global energy efficiency increases with targets of 60kW/PFlops in 2018 and 35 kW in 2020
  - Active storage technologies to enable ‘in situ’ and ‘on the fly’ data processing
  - Research in methods to manage ‘energy to solution’
  - Prediction of failures and fault prediction algorithms

# HPC System Architecture, Storage and I/O: milestones

M-ARCH-1: New HPC processing units enable wide-range of HPC applications.	2018
M-ARCH-2: Faster memory integrated with HPC processors.	2018
M-ARCH-3: New compute nodes and storage architecture use NVRAM.	2017
M-ARCH-4: Faster network components with 2x signalling rate (rel. to 2015) and lower latency available.	2018
M-ARCH-5: HPC networks efficiency improved.	2018
M-ARCH-6: New programming languages support in place.	2018
M-ARCH-7: Exascale system energy efficiency goals (35kW/PFlops in 2020 or 20 kW/Pflops in 2023) reached.	2020-2023
M-ARCH-8: Virtualisation at all levels of HPC systems.	2018
M-ARCH-10: New components / disruptive architectures for HPC available.	2019

M-BIO-1: Tightly coupled Storage Class Memory IO systems demo.	2017
M-BIO-2: Common I/O system simulation framework established.	2017
M-BIO-3: Multi-tiered heterogeneous storage system demo.	2018
M-BIO-4: Advanced IO API released: optimised for multi-tier IO and object storage.	2018
M-BIO-5: Big Data analytics tools developed for HPC use.	2018
M-BIO-6: 'Active Storage' capability demonstrated.	2018
M-BIO-7: I/O quality-of-Service capability.	2019
M-BIO-8: Extreme scale multi-tier data management tools available.	2019
M-BIO-9: Meta-Data + Quality of Service exascale file i/o demo.	2020
M-BIO-10: IO system resiliency proven for exascale capable systems.	2021

# Energy and resiliency: milestones

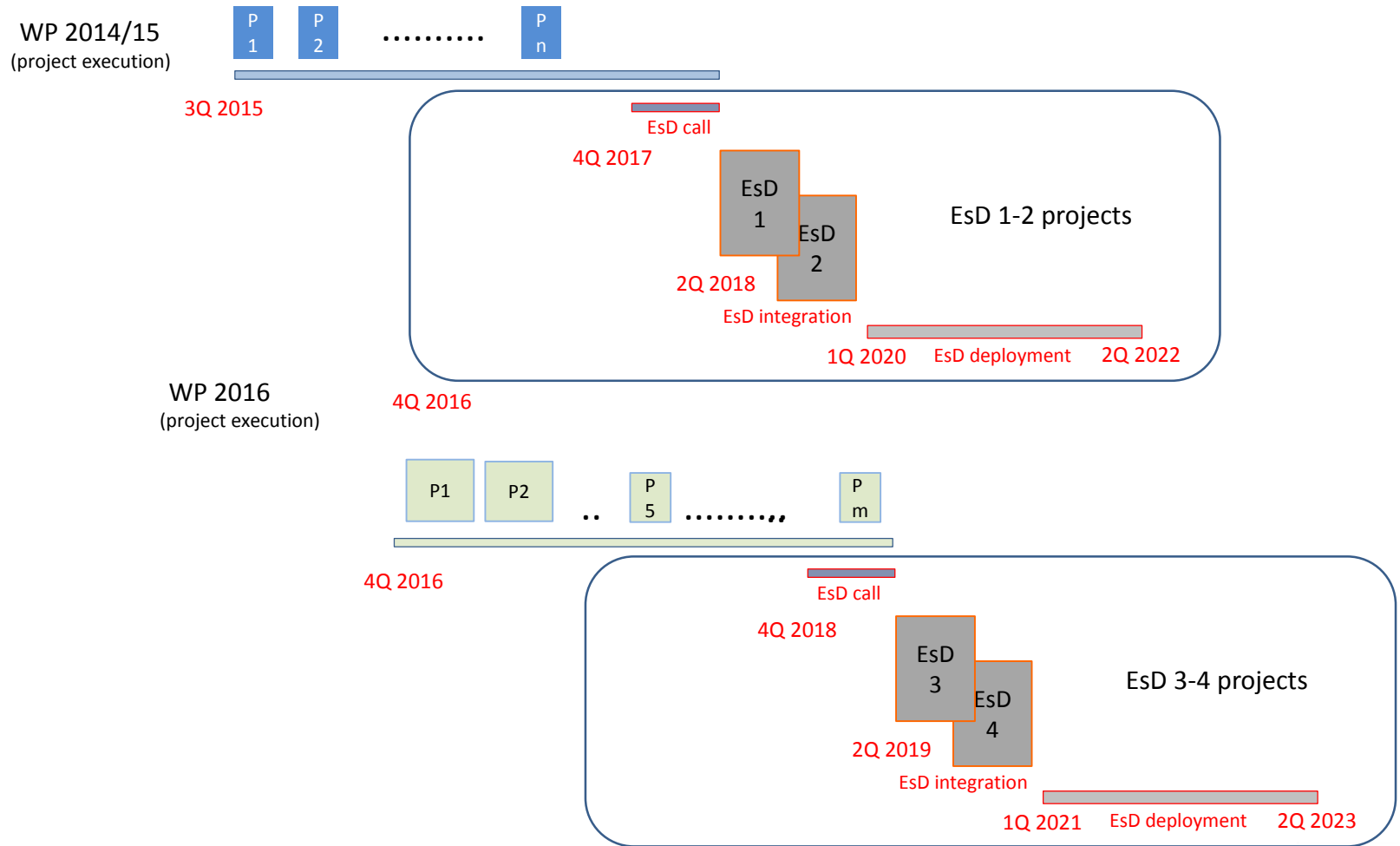
<b>M-ENR-MS-1: Quantification of computational advance and energy spent on it.</b>	2017
<b>M-ENR-MS-2: Methods to steer the energy spent.</b>	2017
<b>M-ENR-MS-3: Use of idle time to increase efficiency.</b>	2018
<b>M-ENR-AR-4: New levels of memory hierarchy to increase resiliency of computation.</b>	2017
<b>M-ENR-FT-5: Collection and Analysis of statistics related to failures.</b>	2018
<b>M-ENR-FT-6: Prediction of failures and fault prediction algorithms.</b>	2019

<b>M-ENR-FT-10: Application survival on unreliable hardware.</b>	2019
<b>M-ENR-AR-7: Quantification of savings from trade between energy and accuracy.</b>	2018
<b>M-ENR-AR-8: Power efficient numerical libraries.</b>	2019
<b>M-ENR-MS-9: Demonstration of a sizable HPC installation with explicit efficiency targets.</b>	2019

# Extreme-Scale Demonstrators

- **Characteristics**
  - Complete prototype HPC systems
  - high enough TRL to support stable production
  - using technologies developed in the previous projects
  - based on application – system co-design approach
  - large enough to address scalability issues (at least 5% of top performance systems at that time)
- **Two project phases:**
  - phase A : development, integration (of results from R&D projects) and testing
  - phase B : deployment and use, code optimisation, assessment of the new technologies

# Extreme scale Demonstrators call-integration-deployment schedule







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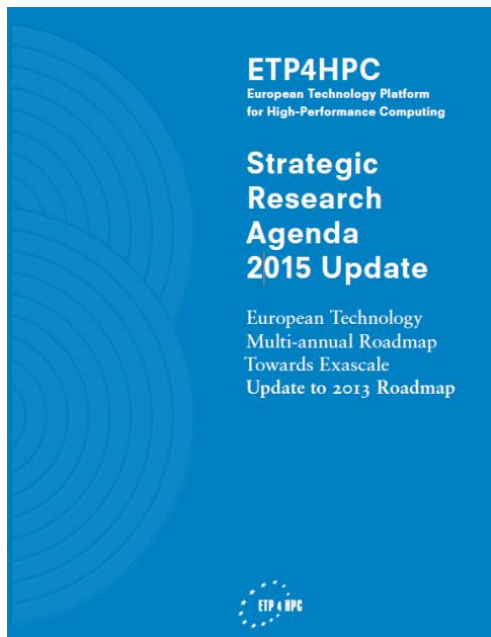
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# SRA – next actions



# Google

« Public Call for comments on SRA »



We will welcome your comments on the current SRA

<http://www.etp4hpc.eu/strategic-research-agenda/>

## Strategic Research Agenda | ETP4HPC

[www.etp4hpc.eu/strategic-research-agenda/](http://www.etp4hpc.eu/strategic-research-agenda/)

6 days ago - Public Call for Comments on ETP4HPC Strategic Research Agenda. Our organisation would like to receive feedback on this document from the ...

## Public Call for Comments for ETP4HPC Strategic Research ...

<https://www.surveymonkey.com/.../ETP4HPC-SRA2-PUBLIC-CALL4C...>

The updated Strategic Research Agenda (SRA) of ETP4HPC is now available at the following location: <http://www.etp4hpc.eu/strategic-research-agenda/>

## Public Call for Comments on ETP4HPC Strategic Research ...

[primeurmagazine.com/flash/AE-PF-12-15-16.html](http://primeurmagazine.com/flash/AE-PF-12-15-16.html)

2 days ago - Public Call for Comments on ETP4HPC Strategic Research Agenda for exascale supercomputing in Europe December 2015. 13 Dec 2015 ...

## Primeurflash 20151213 - Primeur Magazine

[primeurmagazine.com/contentsflash20151213.html](http://primeurmagazine.com/contentsflash20151213.html)

2 days ago - Public Call for Comments on ETP4HPC Strategic Research Agenda for ... Agenda on November 24th 2015, the ETP4HPC organisation would ...

## ETP4HPC, EXDCI and SESAME Net - new HPC initiatives in ...

[e-irg.eu/.../etp4hpc-exdci-and-sesame-net-new-hpc-initiatives-in-europe-...](http://e-irg.eu/.../etp4hpc-exdci-and-sesame-net-new-hpc-initiatives-in-europe-...)

Apr 9, 2015 - The HPC Centres of Excellence Call amounts to 14 million euro. ... will require an investment of 15 million euro; the Public Procurement of innovative HPC systems has been estimated at 26 million; .... 698 Views, 0 Comments.  
You visited this page on 12/2/15.

## Catherine Gleeson | LinkedIn

<https://www.linkedin.com/in/catherine-gleeson-151229b7>

Amsterdam Area, Netherlands - ETP4HPC - European Technology Platform for HPC - ETP4HPC

Catherine Gleeson. ETP4HPC - European Technology Platform for HPC ... Public Call for Comments on ETP4HPC Strategic Research Agenda. December 11 ...

## eInfrastructures (@eInfraEU) | Twitter

<https://twitter.com/einfraeu>

"Public Call for Comments on ETP4HPC Strategic Research Agenda" by @Etp4H on ... New #H2020 #einfrastructures call for support to policy and international ...

## Images for etp4hpc public call for comments

Report images



# Next SRA-related events in 1H2016

- HPC summit – Extreme scale Demonstrator workshop - May 12th
  - focussed on the EsD definition (engage potential players, further implementation details)
  - at this event the three pillars for the EsD mission ( CoE, HPC centres and the FETHPC1 project speakers ) are invited . **More than 80 registered participants!**
- Participation in BDEC conference - June 16 & 17
- ISC16 – June 23rd
  - Scope: Feedback session on SRA directions, content and value to shape the next update (Invited are: End-users, ISVs and International HPC experts)
  - 2<sup>nd</sup> EsD workshop (follow-on to May 12<sup>th</sup> workshop)
- Level set with HPC application experts (EXDCI WP3) – September 21 & 22
- Technical workshop with Big Data Value Association (BDVA) June/July



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# Workprogramme 2018-2020, European Cloud Initiative

# Workprogramme 2018 – 2020 discussion - topics

From “ETP4HPC – Recommendations for Work Programme 2018-2019-2020”:

- European Exascale: timing mismatch between expectations and investment so far
- ETP4HPC recommendation based on:
  - Diversity of System Architectures
  - Top priority: European system architectural leadership: Grow basic “know-how” and expertise
  - SME and start-ups require support for entry and participation in larger H2020 research projects
- Workprogramme elements:
  - Research in HPC Technology
  - Extreme-scale Demonstrators
  - Centres of Excellence for Computing Applications (CoEs)
  - Continuation and extension of support actions

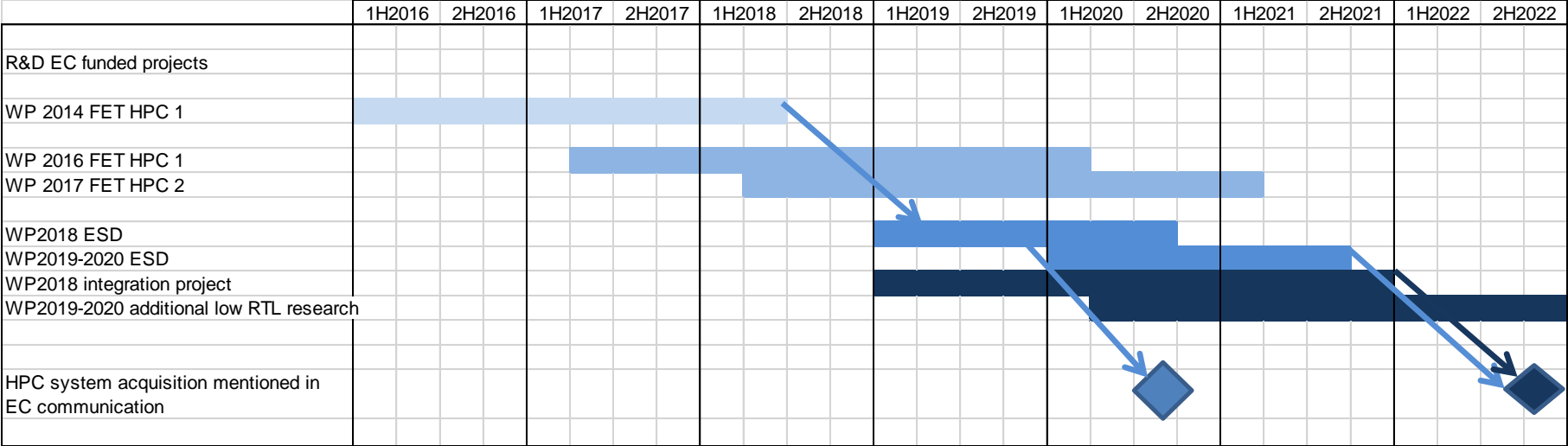
# Workprogramme 2018-2020 budget recommendations

Workprogramme 2018 – 2020: budget recommendations	
Area	Suggested funding volume (m€)
<b>Technology</b>	<b>170 - 270</b>
Focussed projects high TRL	130-180
Focussed projects low TRL	40 - 90
<b>Extreme scale Demonstrators</b>	<b>100 - 200</b>
Two asap, two incl. WP16 results	
<b>Centres of Excellence</b>	<b>70</b>
Existing (after merge)	45
New	25
<b>Support actions</b>	<b>8</b>
HPC eco system development incl. Joint actions with Big Data and Cloud Computing	6
International cooperation	2

## “European Cloud Initiative” discussion - topics

- From *“European Cloud Initiative - Building a competitive data and knowledge economy in Europe”*
- *“.....realising exascale supercomputers around 2022, based on EU technology, which would rank in the first 3 places of the world (p8)*
- *foster an HPC ecosystem capable of developing new European technology such as **low power HPC chips** (p9)*
- *The Commission and participating Member States should develop and deploy a large scale European HPC, data and network infrastructure, including (p10):*
  - *the acquisition of two co-designed, prototype exascale supercomputers and two operational systems which will rank in the top three of the world – as of 2018*
  - *the establishment of a European Big Data centre – as of 2016*

# Potential paths to commercial systems







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**THANK YOU!**

For more information visit

**[www.etp4hpc.eu](http://www.etp4hpc.eu)**

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