



# EXDCI

## European eXtreme Data and Computing Initiative

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# EXDCI project

- Partners
  - PRACE
  - ETP4HPC
- Duration: 30 months, starting September 2015
- Budget: 2.5 M€



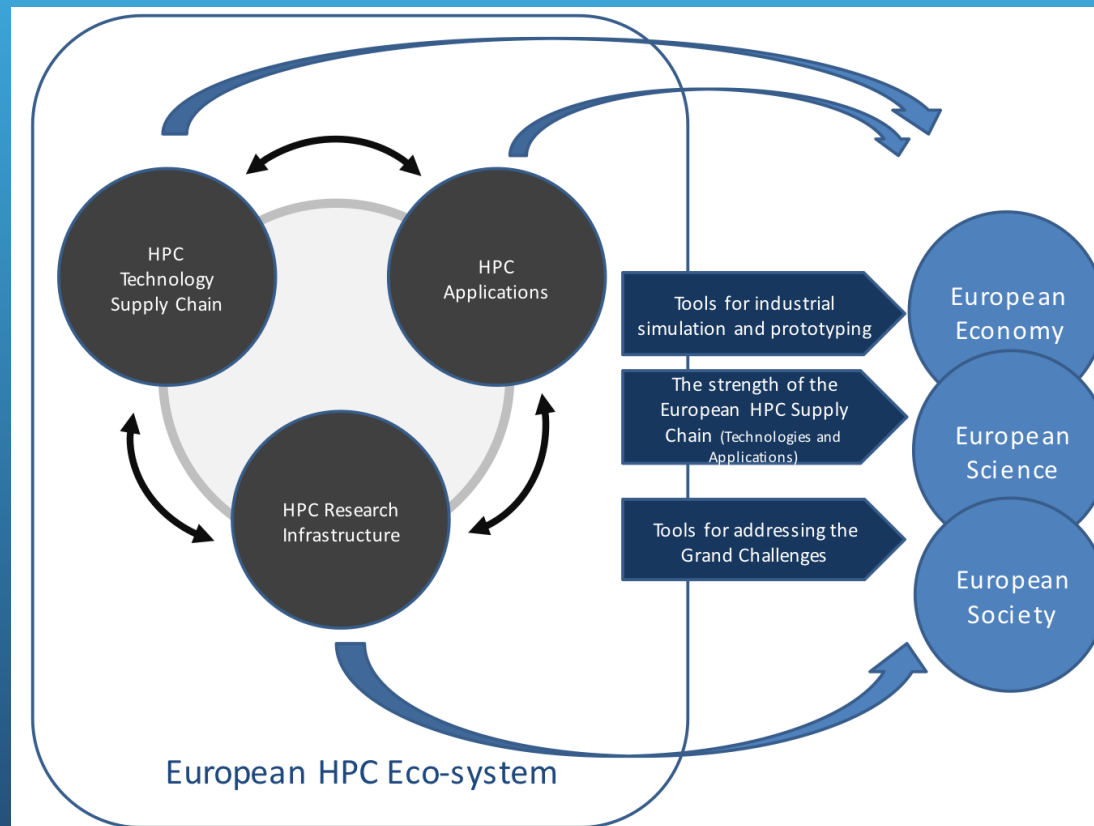
- PRACE
  - Barcelona Supercomputing Center
  - CEA
  - CINECA
  - EPCC
  - GENCI
  - INRIA
  - JSC
  - Neovia
  - SurfSARA
  - Uni. Aachen
  - Uni. Ljubjana
  - Uni. Salento



- ETP4HPC
  - Bull
  - Eurotech
  - Fraunhofer
  - IBM
  - Intel
  - Scapos
  - Seagate
  - Teratec

# Objectives

- Coordinate the development and implementation of a common strategy for the European HPC Ecosystem



# Strategic Goals

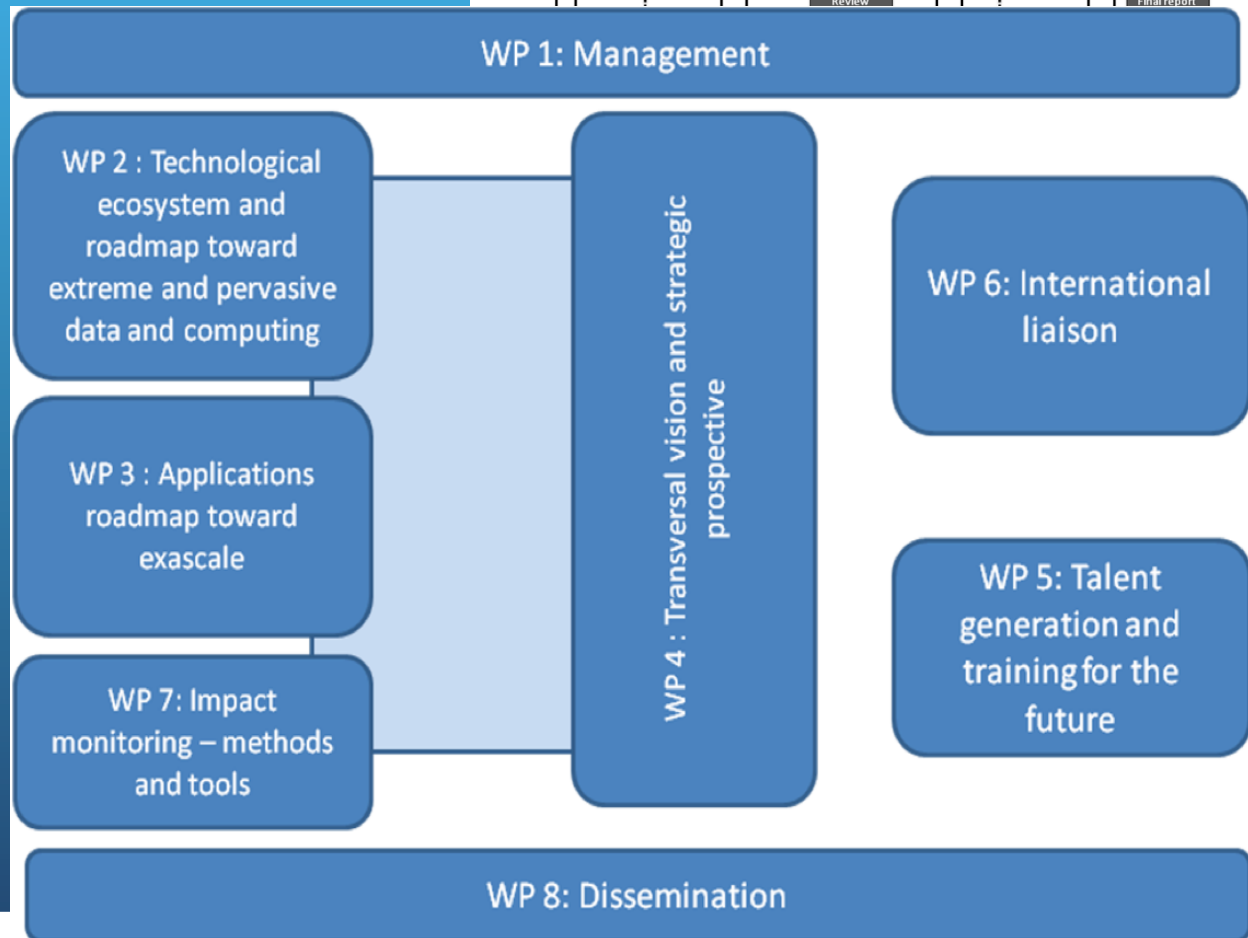
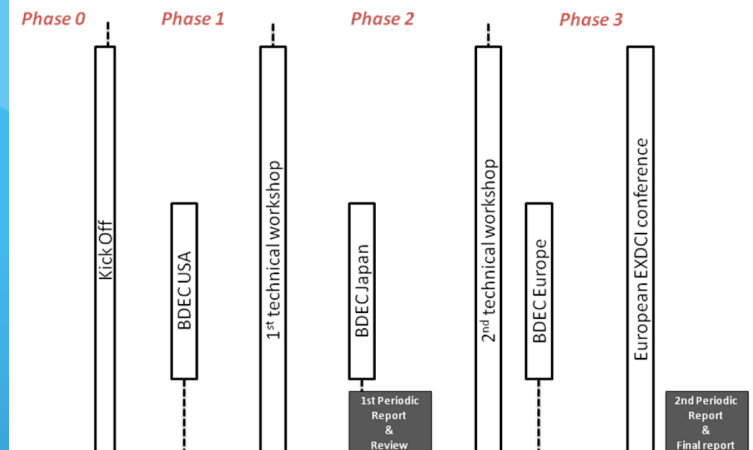
- Development of a common European HPC Strategy
  - Coordination of activities of stakeholders
- Operating a synchronised European HPC Community
  - Joint community structuring and synchronisation

# Overall planning and Work plan structure

Periodic updates of the Strategic Research Agenda (SRA) : leaded by ETP4HPC

Update the PRACE Scientific Case.

KPIs



# Next/firsts actions

- KoM, September 2-3, 2015. Brussels
- European HPC Summit, May 9-13, Prague
- Coordination initial workshop, Rome 29-30 September
  - EXDCI organized
  - Participants: PRACE, ETP4HPC, CoE, FETHPC projects
  - For all
    - to understand the whole HPC ecosystem
    - Build together the new HPC vision

# EXDCI Technical Overview

- HPC is strategic for economical growth and industry competitiveness
- The road to Exascale requires a continuing, global, mid-term, coherent and large R&D effort
- Need an effort with a critical mass
- Large world wide challenge

# HPC Critical for Economical Growth

- HPC (and corresponding data analysis) is a key enabler for the high tech industry
  - On the critical path of innovation, no HPC no innovations in oil and gas, climate modeling, astrophysics, molecular simulations, finance, transportation, environment, ...
- Today's HPC capability innovations will be tomorrow capacity solutions
  - Exascale / low energy HPC is key for future HPC efficient systems
- EESI / IDC HPC ROI study shows\*
  - \$1 HPC investment allows to generate a ~\$850 generated revenue with a ~\$50 benefit
  - HPC based innovation has a particularly strong economical impact

\*EESI 2 / IDC Report: Special Study To Measure And Model How Investments In HPC Can Create Financial ROI And Scientific Innovation In Europe



# HPC Challenges

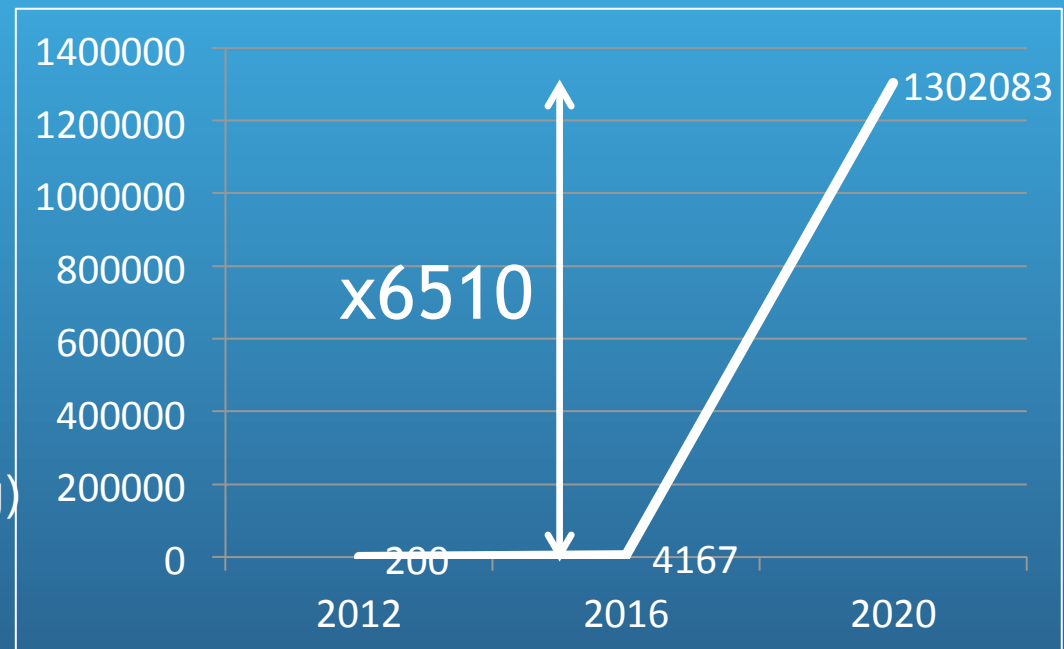
- Propose paths to Exascale solution while considering
  - Parallelism
  - Fault tolerance
  - Energy efficiency
  - Heterogeneity
  - (Big) Data management and exploration
- An *exaflop* also means a *petaflop* in a box and 20 KW/PF
  - The road to Exascale is not to build one of a kind system but to design the new generation low energy HPC technology
- In a context of technological disruptions
  - Photonics, new memories, many-core CPU, ...

# In a Complex and Fast Moving Landscape

- The Laws that are reaching limits
  - Moore's Law on transistor density
  - Dennard's Law on constant energy density
  - Kryder's Law on storage density
  
- The Laws that remain
  - Rock's Law on foundries cost
  - Amdahl's law on speedup
  - Gustafson's Law on « weak scaling »

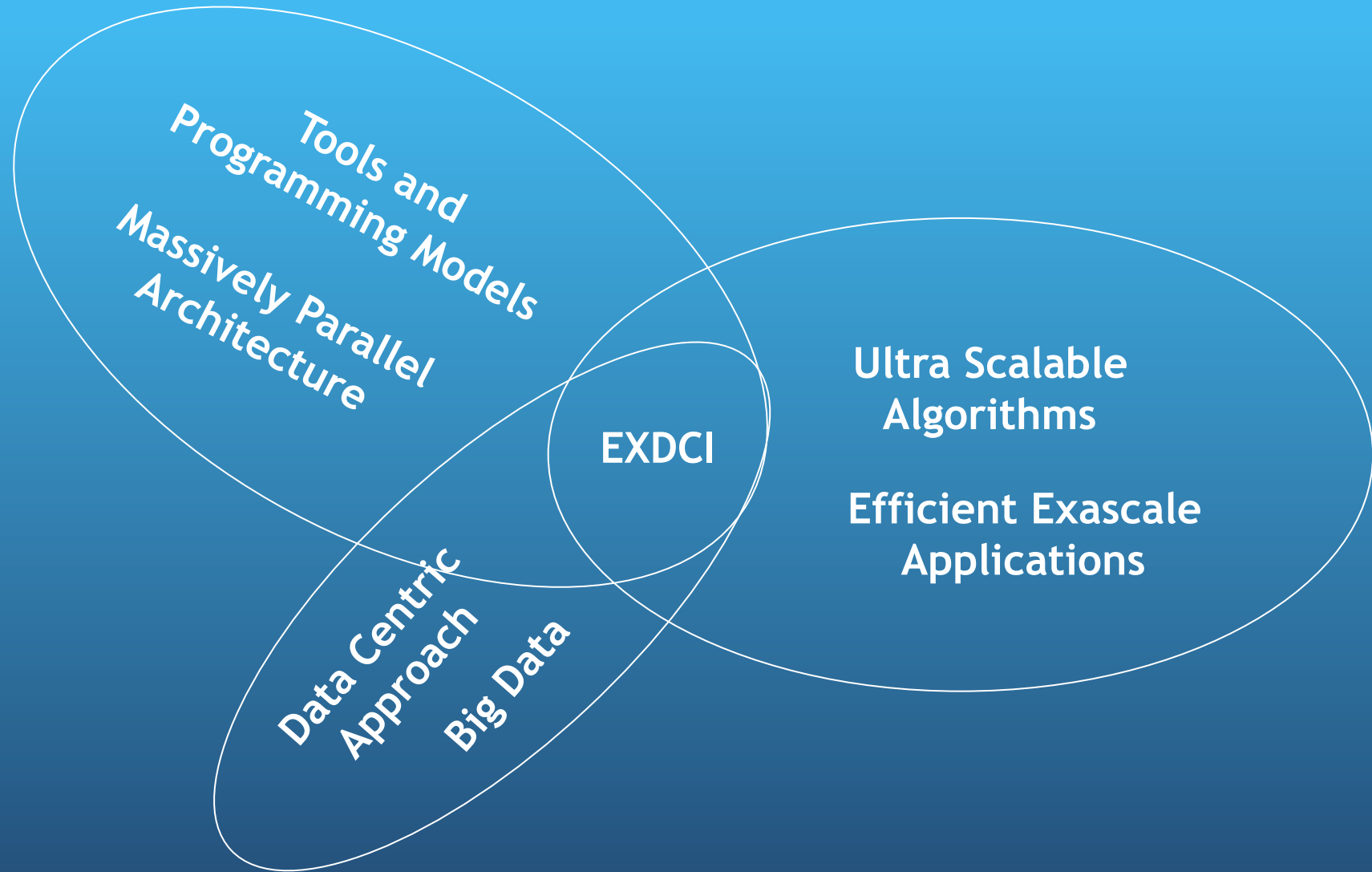
# With Many Constraints and other Walls

- Energy consumption dominated by data movements
  - Massively parallel multicore processors
  - Accelerator technologies (e.g., GPU, FPGA)
- Memory wall
- Data explosion
- Diminishing MTBF
- **Economical constraints**
  - Code efficiency (i.e. scaling)
  - Time to solution



Climate Earth System Modeling  
Data produced in total in Gbytes/month-of-simulation  
PRACE Scientific for High Performance Computing in Europe

# EXDCI is an Interdisciplinary CSA



# WP4 Transversal Vision and Strategic Prospective

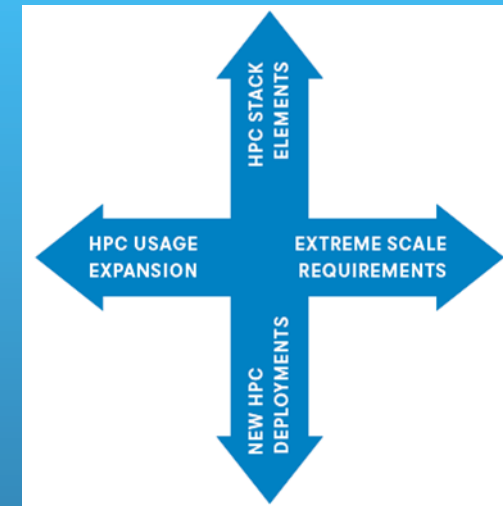
- Objectives
  - Building a global vision of the roadmaps, towards a shared European e-infrastructure roadmap (with DG-CNECT, DG-RTD, ESFRI, e-IRG)
  - Identifying synergies to lead to a co-design approach
- Ecosystem transversal relationships
  - Centres of Excellence
  - FET HPC Projects
  - Eurolab4HPC
- SME
  - Help building a framework for supporting start-ups / SMEs and see how to accelerate the creation of new start-ups
- Survey recommendations continuity (e.g. from EESI)

# Eurolab4HPC / EXDCI Collaboration

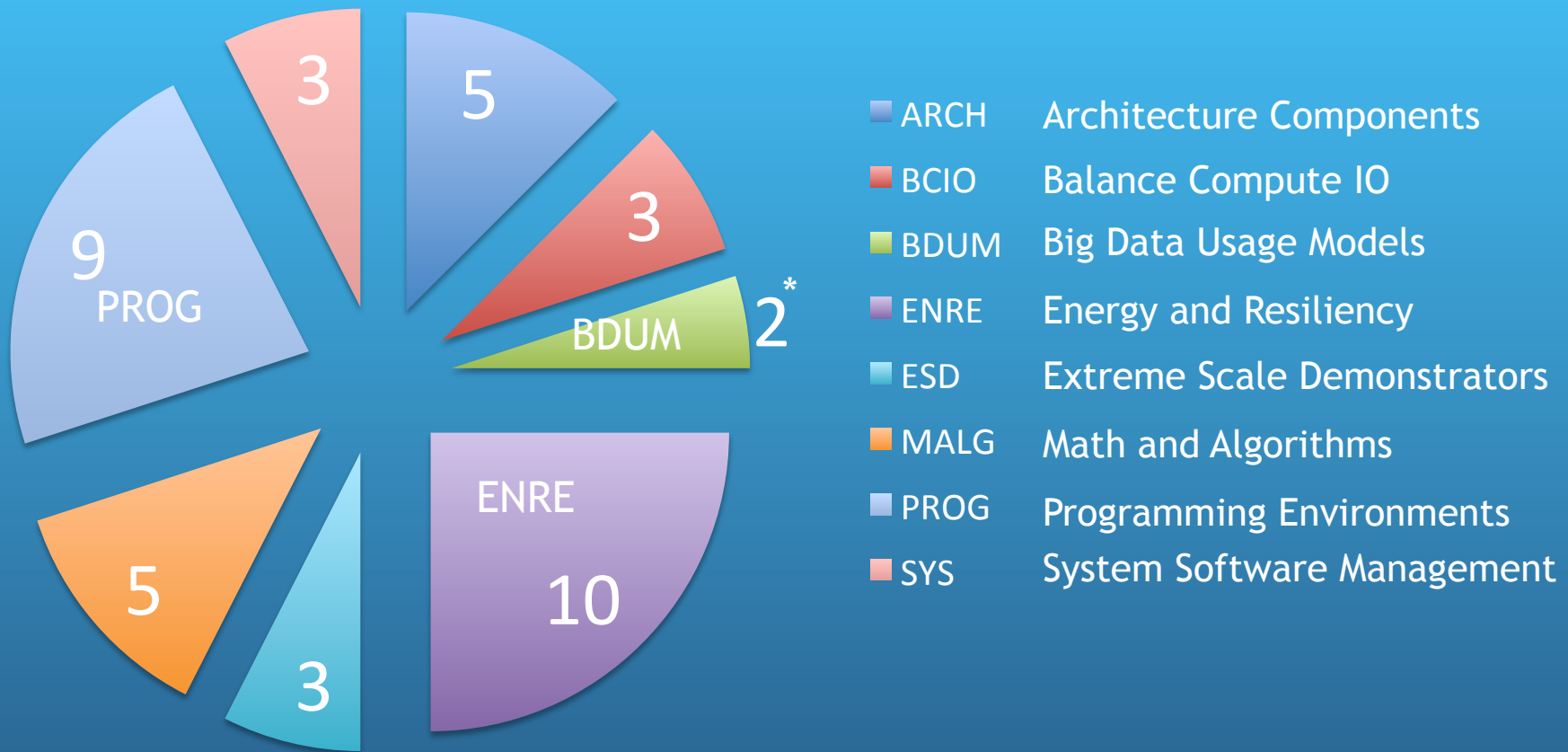
- Roadmapping collaboration and coherence
  - Eurolab4HPC: Long term research, beyond Exascale oriented
  - ETP4HPC: Industry oriented
  - PRACE: Application oriented
- Trainings
  - EXDCI aims at providing Eurolab4HPC inputs to help defining an HPC Curriculum
- Innovation
  - Building synergies between the EXDCI job centers and Eurolab4HPC business prototyping (among others)

## WP2 Technological Ecosystem and Roadmap Toward Extreme and Pervasive Data and Computing

- Objectives
  - Produce periodic updates of the **Strategic Research Agenda (SRA)**
  - Derived from these updates, propose research focus topics for the upcoming HPC work programs within H2020
  - Synchronize and coordinate both actions with WP3 (Application roadmap toward Exascale)
- The SRA outlines a roadmap for the **implementation** of a research program for a European HPC technology



# SRA Themes Coverage by New FETHPC RIA



Energy and programming environments are the dominating themes, data under-represented.

\* Number of projects addressing the SRA themes



# WP3 Applications Roadmap Toward Exascale

- Objectives
  - Provide updated roadmaps of needs and expectations of scientific applications
  - Provide inputs to the update the **PRACE Scientific Case** in order to support PRACE in the
  - Deployment of its (Pre)Exascale pan European HPC research infrastructure
- Initiative to create an update of the Scientific Case and capture the current and expected future needs of the scientific communities
  - Weather, Climatology and solid Earth Sciences
  - Astrophysics, HEP and Plasma Physics
  - Materials Science, Chemistry and Nanoscience
  - Life Sciences and Medicine
  - Engineering Sciences and Industrial Applications

## WP5 Talent Generation and Training for the Future

- Objectives
  - Promote HPC and HPC skills to young people
  - Support employers in job specification and in recruitment
  - Undertake training gap analysis across the whole of the HPC Ecosystem
  - Support the development of a community of HPC training providers
- Facilitating HPC staff recruitment by setting up a “Job Centre”
- Identifying and meeting future training needs

# WP6 International Liaison

- Objectives
  - Mapping and analysis of national and international R&I programs/ activities/research agendas in HPC towards exascale
  - Coordination with and participation in relevant international activities
  - Establish and maintain a global network of expertise and funding bodies in the area of exascale computing
  - Act as a proactive European voice and representative into the International Exascale Software Community
- Coordination with SPPEXA (Germany-France-Japan), Belmont Forum CRA on e-infrastructures and data (14 countries), Coordinated Research on E-infrastructures (CRE) (DG-CNCT, RDA)

## WP7&8 Impact Monitoring - Methods and Tools & Dissemination

- WP7 Objectives
  - Determine Key Performance Indicators (KPI) reflecting the progress of the Ecosystem
  - Measure the progresses
  - Building on the HPC cPPP and PRACE KPI
    - Indicators for Industrial Competitiveness and Socio-Economy Impact
    - Indicators for the operational aspects of the programme
    - Indicators for management aspects of the programme
    - Implementing data collection and processing
    - Delivering periodic score cards (incl. for cPPP mid-term review of 2017)
- WP8 Objectives
  - Disseminate the project inputs to the community
  - Organize a European EXDCI Conference

# EXDCI in a Nutshell

- Increasing ecosystem synergies
- Economical dimension taken into account
- Eurolab4HPC – EXDCI collaboration
- Strong world wide dimension, Big Data and Extreme-scale Computing (BDEC) representative
- FETHPC RIA projects and CoE collaborations
- Interdisciplinary / co-design at the core of the roadmaps



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