



Teratec, a European Industrial initiative

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High Performance Computing

High Performance Computing is essential for Science, but also for Industry in all domains and all size of enterprises.

It has become a strategic factor of competitiveness and innovation in most sectors of the economy, with a major impact on employment and national wealth.

- **Industry** needs large computing power to design complex systems and to accelerate the introduction of innovative products.
- **Research** relies more and more on simulations to produce new knowledge.

**HPC is a key element
of our competitiveness and our innovation capacity**



HPC is essential in many domains

- In a domain like **Energy**, HPC is mandatory to progress on more efficient transport systems (car, aircraft), better exploitation of resources (oil industry) and development of new resources.
- In **Health**, development of new drugs, of new and personalized treatments, as well as brain biology or bespoke prosthesis, need supercomputing power.
- The **Services** industries will need more and more computing power to develop new and optimized services (in Finance, risk assessment and new financial services).
- The **Media industry** (movie and video creation and distribution) is redefining itself around HPC, like many other sectors, including national and regional security.

**HPC is becoming an engine of the economy,
with potential major impact on our daily life.**

This is why we have created TERATEC an eco-system regrouping



The diagram illustrates the TERATEC ecosystem components. It features three colored rounded rectangular boxes: a purple box on the left labeled 'Industrial users', a yellow box in the center labeled 'Technology providers', and a green box on the right labeled 'Research centres'. A large, faint 'teratec' logo is visible in the background, with a curved arrow pointing from the 'Industrial users' box towards the 'Research centres' box.

**Industrial
users**

**Technology
providers**

**Research
centres**

on one subject :

How to master HPC technologies and enlarge their usage

Teratec Members

A 3D architectural rendering of a modern technopole or university campus. The scene features several multi-story buildings with glass facades and green spaces. A large, semi-transparent circular arrow logo with a rainbow-to-black gradient is positioned in the upper left, partially overlapping the text. Several grey 3D cubes of varying sizes are scattered in the air to the right of the text. The overall lighting is bright and clean, suggesting a high-tech environment.

Ter@tec

***We are building a technopole
dedicated to
High Performance Computing
for Modeling and Simulation***



A unique place, with active participation of key players of every step of the value chain

TERATEC Campus

 **Business Incubator**

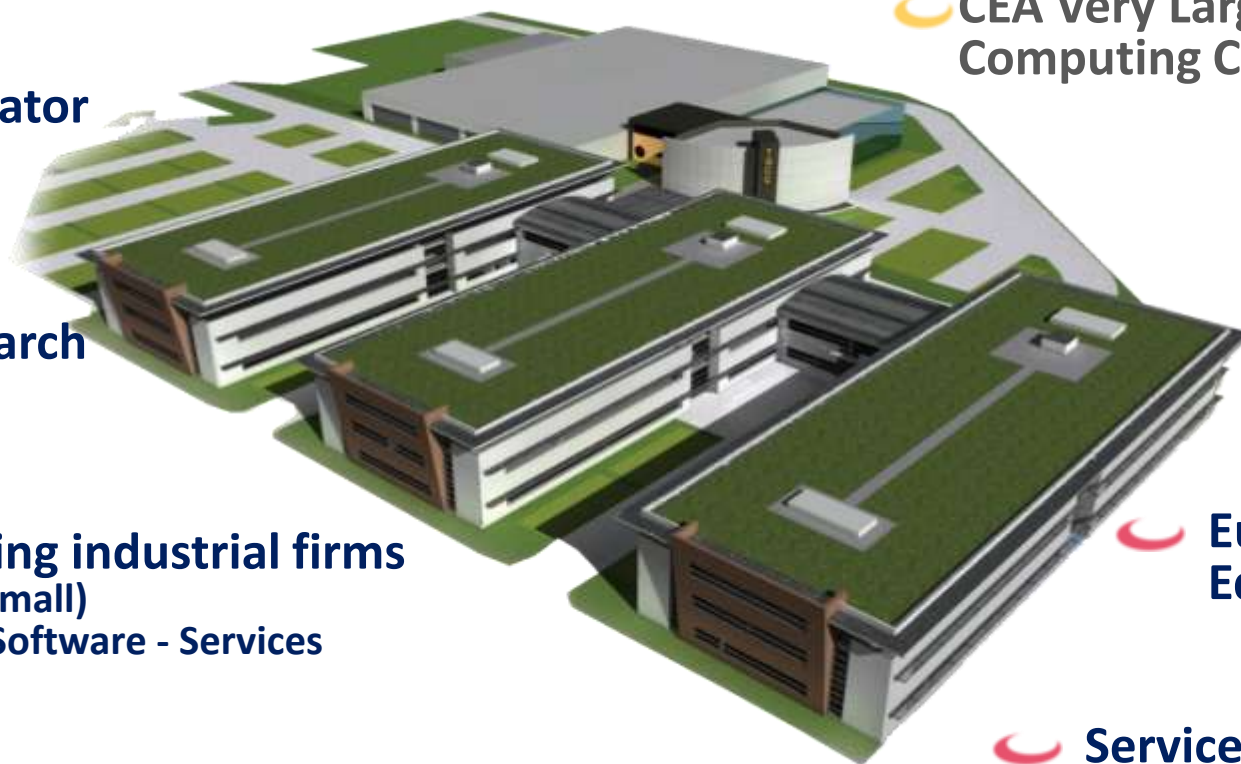
 **Collaborative Industry - Research laboratories**

 **HPC leading industrial firms (large and small)**
Hardware – Software - Services

 **CEA Very Large Computing Center**

 **European HPC Education Institute**

 **Services Platforms**





TERATEC CAMPUS Open June 2012





Incubator and Business center

Domiciliation

Headquarters domiciliation - Postal domiciliation - Management of mail - Availability of the large meeting room,

Good quality of equipment furniture
Telephone - Internet – Secure access –
Personalized reception and telephone
service - Support and Secretarial

All-inclusive Private Space

Facilities Management

Reprography Services - Management and
maintenance offices - Coaching innovative
projects - Management of Business
Development



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Common space





Collaborative Projects Industry - Research

TERATEC members are key participants in major projects of Advancity, Astech, Cap Digital, Minalogic, Systematic, ANR and ITEA2

- **AGREGATION** - Contrôle commande sûr pour les moyens d'essais
- **AIRCITY** - 3D simulation of air quality in the city with 3m resolution
- **CALLISTO** - Simulation Architecturale Réaliste Immersive
- **DATASCALE** - Big data et Calcul haute performance
- **H4H** - Optimise HPC Applications on Heterogeneous Architectures
- **H4H PERFCLOUD** - Performances pour le cloud
- **ILMAB** - First simulation chain in the construction field.
- **MANYCORELABS** - Software tools for Manycore embedded platforms
- **MECASIF** - Modèles réduits pour la Conception Amont de Systèmes Industriels Fiables
- **MUSICAS** - Méthodologie unifiée pour la simulation de l'intégrité et de la contrôlabilité des assemblages soudés
- **OASIS** - Optimization of Addendum Surfaces In Stamping
- **RICHELIEU** - Accelerate science-oriented programming languages
- **SIMILAN** - SIMulation & Implementation high performance fitted to digital signal processing
- **TERRA X Projets** - Développement d'un ensemble complet d'outils de représentation et de simulations numériques des territoires urbains



Industrial Research Laboratories

The Teratec Campus is home to several research laboratories on topics such as future architectures and exaflop systems, developing and parallelizing simulation software, and designing complex systems.



- **Extreme Computing (CEA/Bull)**



- **Exascale Computing Research Lab (INTEL/CEA/GENCI/UVSQ)**



- **The SystemX Technological Research Institute** also establishes the permanent laboratories for its HPC program on the campus.



Education and Training

Teratec has joined forces with universities and major engineering schools to design programs in initial and continuing education that cover the entire spectrum of high performance simulation and modeling.

These initiatives will be expanded and reinforced to form a European training institute.

- **Master Degree in High-Performance Computing (MIHPS)**

Supported by Université de Versailles Saint-Quentin-en-Yvelines, Ecole Centrale de Paris, l'Ecole Normale Supérieure de Cachan and PRES UniverSud.

- **Continuing education**

Animated by technology companies, systems suppliers, software providers and services companies







2013-2014 : a turning point

A larger scope confirmed

-  From Classical Supercomputing to Systems Design, Big Data, Multimedia Creation, Life science applications....

Program extensions

-  R&D projects : from French collaborative projects to European and international cooperations
-  Education : new initiatives
-  Launch of the HPC European Technology Platform, ETP4HPC
-  Preparation of the French National Supercomputing Plan





TERATEC 2013 Forum

Plenary sessions

The plenary sessions illustrate the increasing impact of HPC in many industrial and research fields and its role in major scientific and technological challenges. With the participation of leading international industrial users, technologies providers and key responsables from the political, economic and academic worlds :

- David ROS, Conseil Général de l'Essonne
- Charbel FARHAT, Stanford University
- Sudip DOSANJH, Division Director, NERSC
- Stefano ODORIZZI, CEO, ENGINSOFT
- Dr David LECOMBER, COO, ALLINEA SOFTWARE
- Jean-François MINSTER, directeur Scientifique, TOTAL
- Régis REAU, directeur Scientifique, AIR LIQUIDE
- Alvis BRAZMA, Senior Team Leader, Functional Genomics, EMBL/EBI
- Marie-Pierre de BAILLIENCOURT, DGA, BULL
- Gérard ROUCAIROL, président, TERATEC
- Louis GALLOIS, Commissaire général à l'investissement





TERATEC 2013 Forum Exhibition

A large exhibition presents products and innovations from the major HPC players : manufacturers and editors, systems integrators and services providers, universities and research centres, competitiveness clusters and public organisations, etc.

- ACTIVEON
- ALINEOS
- ALLIANCE SERVICES PLUS
- ALLINEA SOFTWARE
- ALTAIR ENGINEERING
- ALTRAN
- ALYOTECH
- ANSYS FRance
- BARCO
- BULL
- CAPS ENTREPRISE
- CARRI SYSTEMS
- CCI DE L'ESSONNE
- CEA
- CLUSTERVISION
- COMMUNICATION & SYSTEMES
- DATADIRECT NETWORKS
- DELL
- ECR LABS
- EMC
- ENGIN SOFT
- ESI GROUP
- ESPACE A PROJETS
- EUROTECH
- FUJITSU
- GENCI
- HEWLETT PACKARD
- IBM
- IFPEN
- INRIA
- INTEL
- KALRAY
- NAFEMS
- NETAPP
- NICE SOFTWARE
- NVIDIA
- OPENSIDES
- OXALYA
- PANASAS
- PEPINIERE TERATEC
- QUANTUM
- RITTAL
- ROGUE WAVE
- SCILAB ENTERPRISES
- SGI
- SILKAN
- SOGETI HIGH TECH
- ST MICROELECTRONICS
- SYSFERA
- SYSTEMATIC
- SYSTEMX IRT
- TERATEC
- TOTALINUX
- TRANSTEC



Platinum Sponsors



Gold Sponsors



Silver Sponsors





TERATEC 2013 Forum

Technical workshops

The technical workshops address major technical HPC topics. It gives the possibility to review the most important collaborative projects involving industry and research.

- **Embedded and Mechatronics Complex Systems** - Chaired by Jacques DUYSENS (SILKAN), Gérard POIRIER (DASSAULT AVIATION) and Christian SAGUEZ (TERATEC)
- **Materials Simulation** - Chaired by Gilles ZERAH (CEA)
- **Big Data & HPC** - Chaired by Ange CARUSO (EDF), Georges HEBRAIL (EDF) and Guillaume COLIN DE VERDIERE (CEA)
- **Energy Efficiency of HPC systems** - Chaired by Marie-Christine SAWLEY (INTEL Exascale Labs)
- **HPC in Biology and Health** - Chaired by François BALLETT (MEDICEN) and Christian SAGUEZ (TERATEC)
- **Modeling and simulation to support sustainable cities** - Chaired by Vincent COUSIN (ADVANCITY) and Etienne DE POMMERY (ESI Group)
- **ScilabTEC, Annual Scilab Users Day**



Join us !

TERATEC 2014 Forum

July 1 & 2, 2014 – Ecole Polytechnique, Paris



**European Reference in
Modeling & Simulation
High Performance Computing**

With permanent industrial objectives



Innovation



Competitiveness



Job creation



ETP 4 HPC

**THE EUROPEAN TECHNOLOGY PLATFORM
FOR HIGH PERFORMANCE COMPUTING**

ETP4HPC Background and Future

**‘Building a Globally Competitive HPC
Technology Industry in Europe’**



What is ETP4HPC?

- ETP4HPC, the **European Technology Platform (ETP)** for High-Performance Computing (HPC) (www.etp4hpc.eu) is an organisation **led by European HPC Technology providers** with an objective **to build a competitive HPC value chain in Europe**.
- ETP4HPC is one of the European Technology Platforms (ETPs) recognised by the European Commission
 - European Technology Platforms (ETPs) are **industry-led** stakeholder fora that develop short to long-term research and innovation agendas and roadmaps for action at EU and national level to be supported by both private and public funding.

Individual ETPs

Bio-based economy	Energy	Environment	ICT	Production and processes	Transport
EATIP	Biofuels	WssTP	ARTEMIS	ECTP	ACARE
ETPGAH	EU PV TP		EUROP	ESTEP	ERRAC
Food for Life	TPWind		ETP4HPC	EuMaT	ERTRAC
Forest-based	RHC		ENIAC	FTC	Logistics
Plants	SmartGrids		EPoSS	SusChem	Waterborne
FABRE TP	SNETP		ISI	Nanomedicine	
TP Organics	ZEP		Net!Works	ETP-SMR	
			NEM	Manufuture	
			NESSI		
			Photonics 21		

What is ETP4HPC?

- **SRA** - a Strategic Research Agenda (SRA) which outlines the research priorities of European HPC on its way to achieve Exascale capabilities within the Horizon 2020 Programme.
- **PPP** - one of the partners of the Contractual **Public-Private Partnership (cPPP) for HPC** (together with the European Commission) the aim of which is **building a competitive HPC Eco-system in Europe** based on the provision of Technologies, Infrastructure and Applications.

ETP4HPC's Objectives

- To build a **European world-class High-Performance Computing (HPC IT) technology value chain that will be globally competitive.**
- To achieve a **critical mass of convergent resources** in order to increase the competitiveness of European HPC vendors and solutions.
- To leverage the transformative power of HPC in **order to boost European competitiveness in science and business.**
- **To expand the HPC user base, especially SMEs** (through facilitating access to HPC resources and technologies) and to open the possibilities for SMEs to participate in the provision of competitive HPC technology solutions.
- To facilitate the provision **of innovative solutions to tackle grand societal challenges in Europe** such as climate change, better healthcare, predicting and managing large scale catastrophes and energy-efficiency.
- To foster **international cooperation** in research and industry



www.etp4hpc.eu

- **Purpose:** R&D roadmap to develop HPC technology in Europe within Horizon 2020

116
Milestones

Deadline	Milestones
2014	M-PROD-AP1-1: Develop benchmarks and mini-apps for new programming models/languages
2015	M-PROD-AP1-2: APIs and annotations for legacy codes*
	M-PROD-AP1-3: Advancements of MPI-4 approaches (beyond current release end)
	M-PROD-DC-5: Data race detection tools with user support for problem resolution
	M-PROD-LIB-7: Self-tuning libraries and components
	M-PROD-RT-1: Scalable trace collector and storage: sampling and filtering
	M-PROD-RT-1: Runtime and compiler support for auto-tuning and self-adapting systems
	M-PROD-RT-2: Management and monitoring of runtime systems in dynamic environments
2016	M-PROD-RT-5: Runtime support for commercial bin optimization: data locality management, caching, and pre-fetching
	M-PROD-AP1-4: APIs for auto-tuning performance or energy
	M-PROD-LIB-3: Compositional library interoperability APIs

- **Rationale:** A window of opportunity for a European HPC Technology Value Chain - European strengths meet global opportunities: e.g.: energy efficiency & power, data, concurrency & scale, resiliency
- **Europe’s HPC consuming power is not matched by its share in HPC systems**



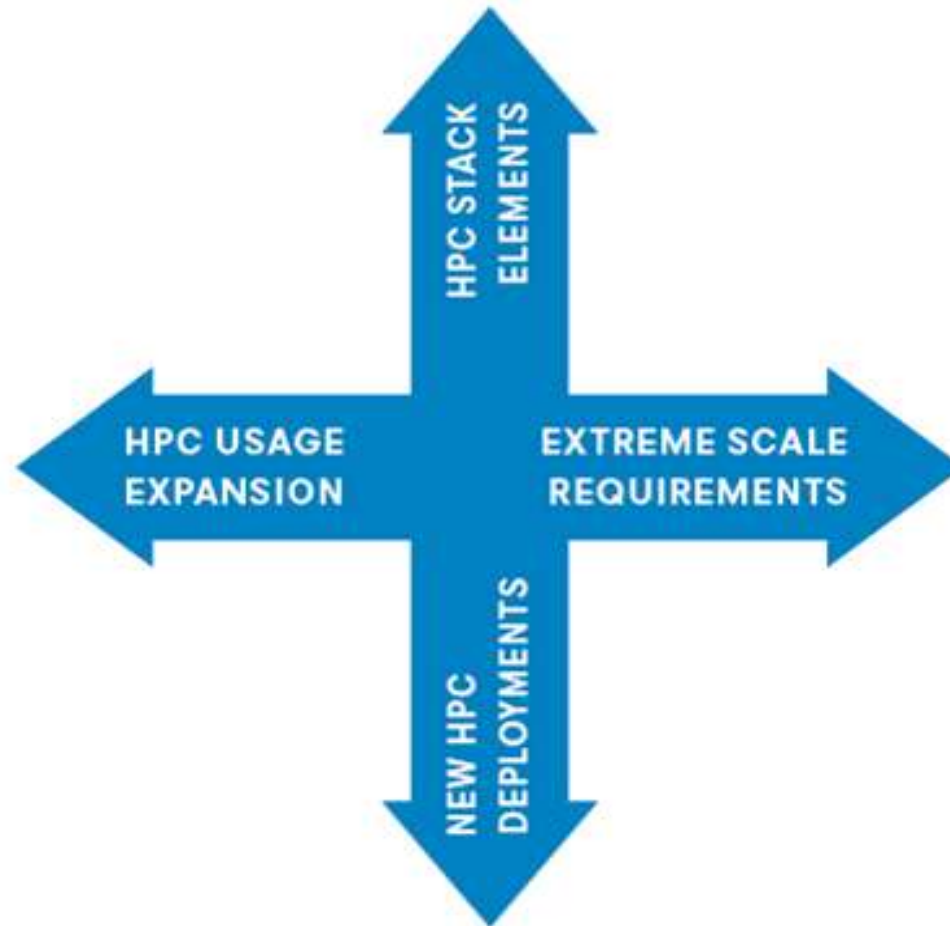
SRA - Impact

The implementation of the recommendations of the SRA will have the following impact:

- Strengthen the European HPC technology provision eco-system and increase its global market share
- Allow Europe to achieve global leadership in HPC-related technological areas, with the possibility of transferring such technologies to other industries
- Address some of the globally recognised grand challenges, such as energy efficiency and the handling of large data volumes
- Design HPC solutions required by European science and industry

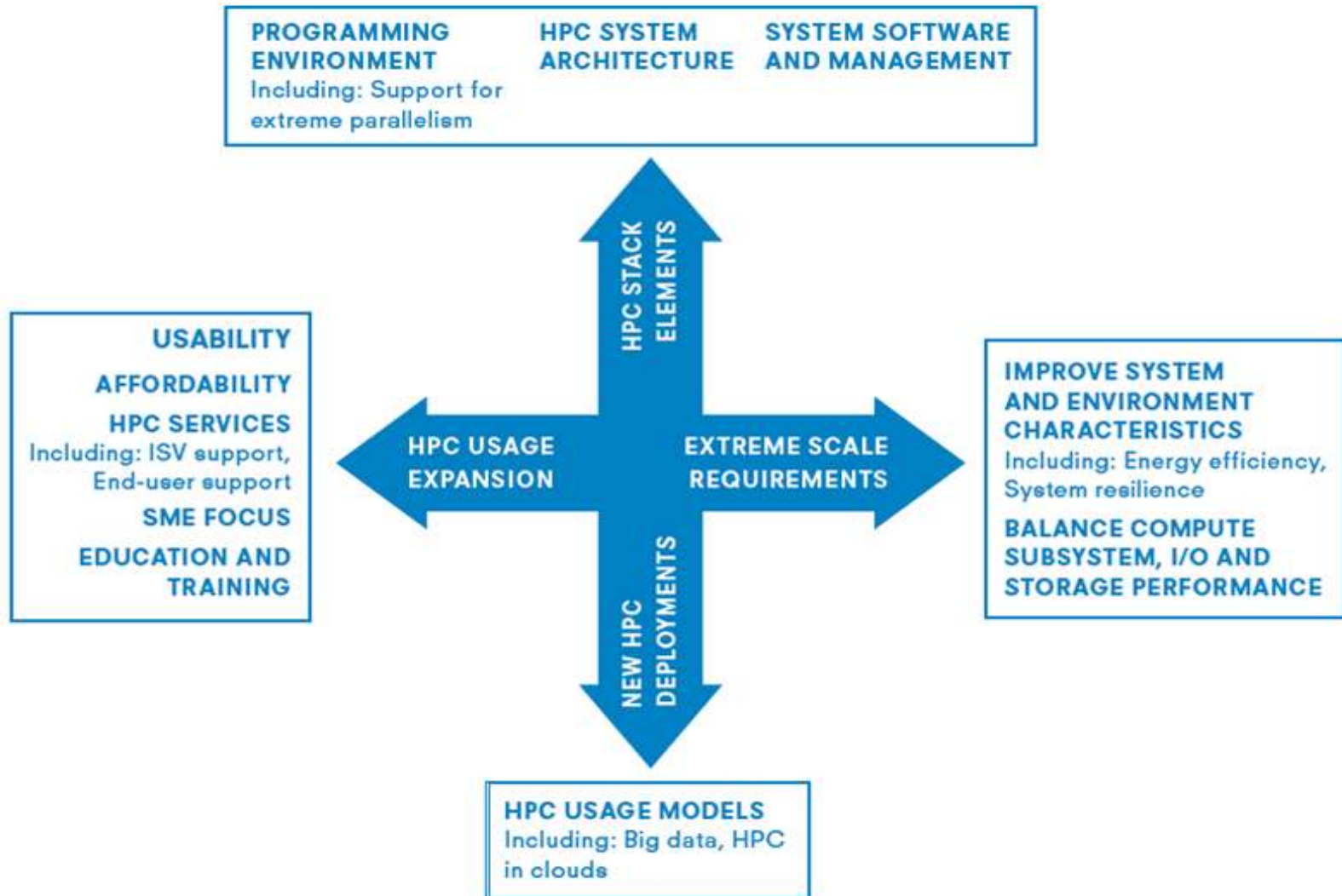
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Strategic multi-dimensional vision

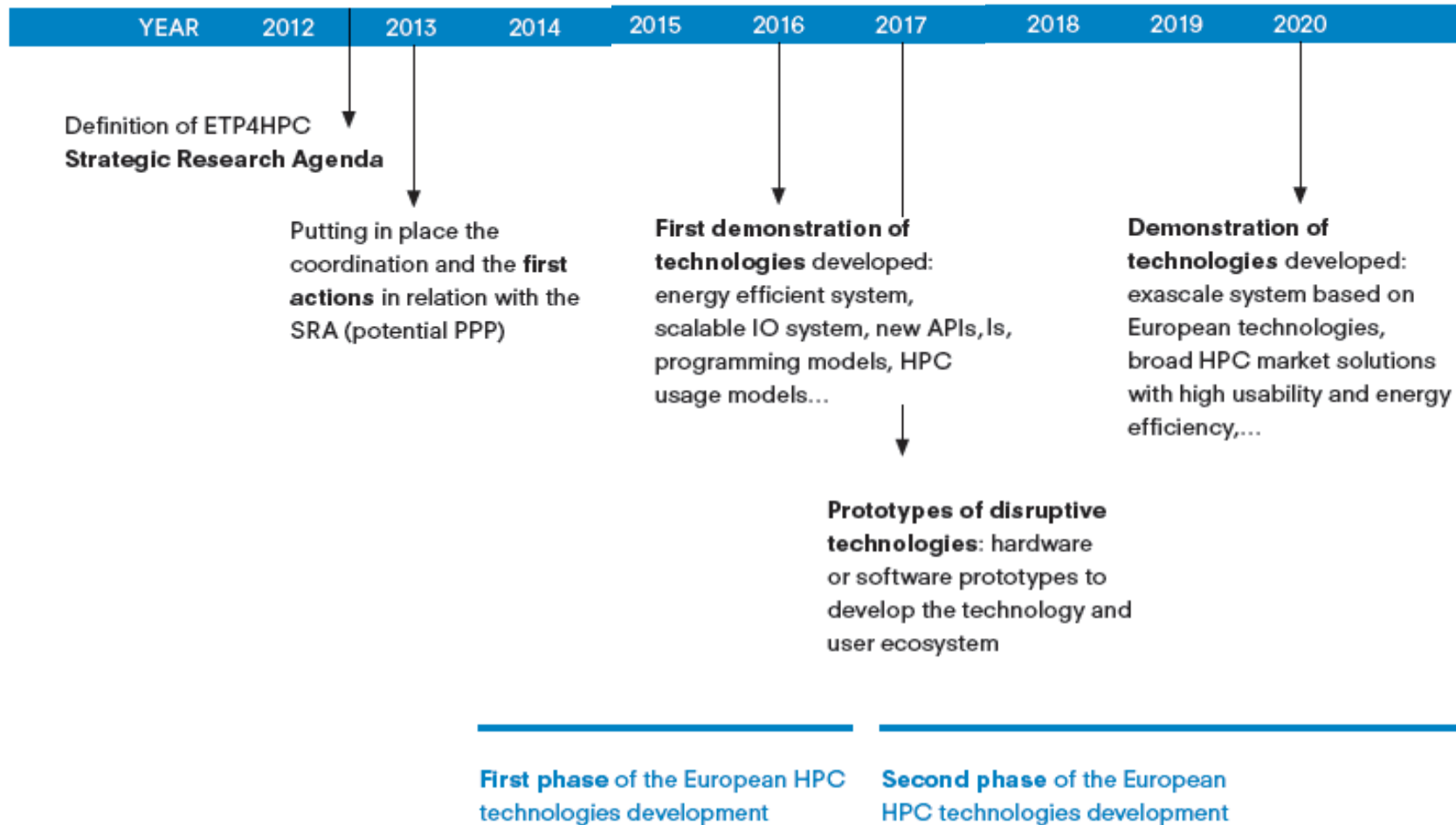


The four dimensions of the
ETP4HPC Strategic Research
Agenda

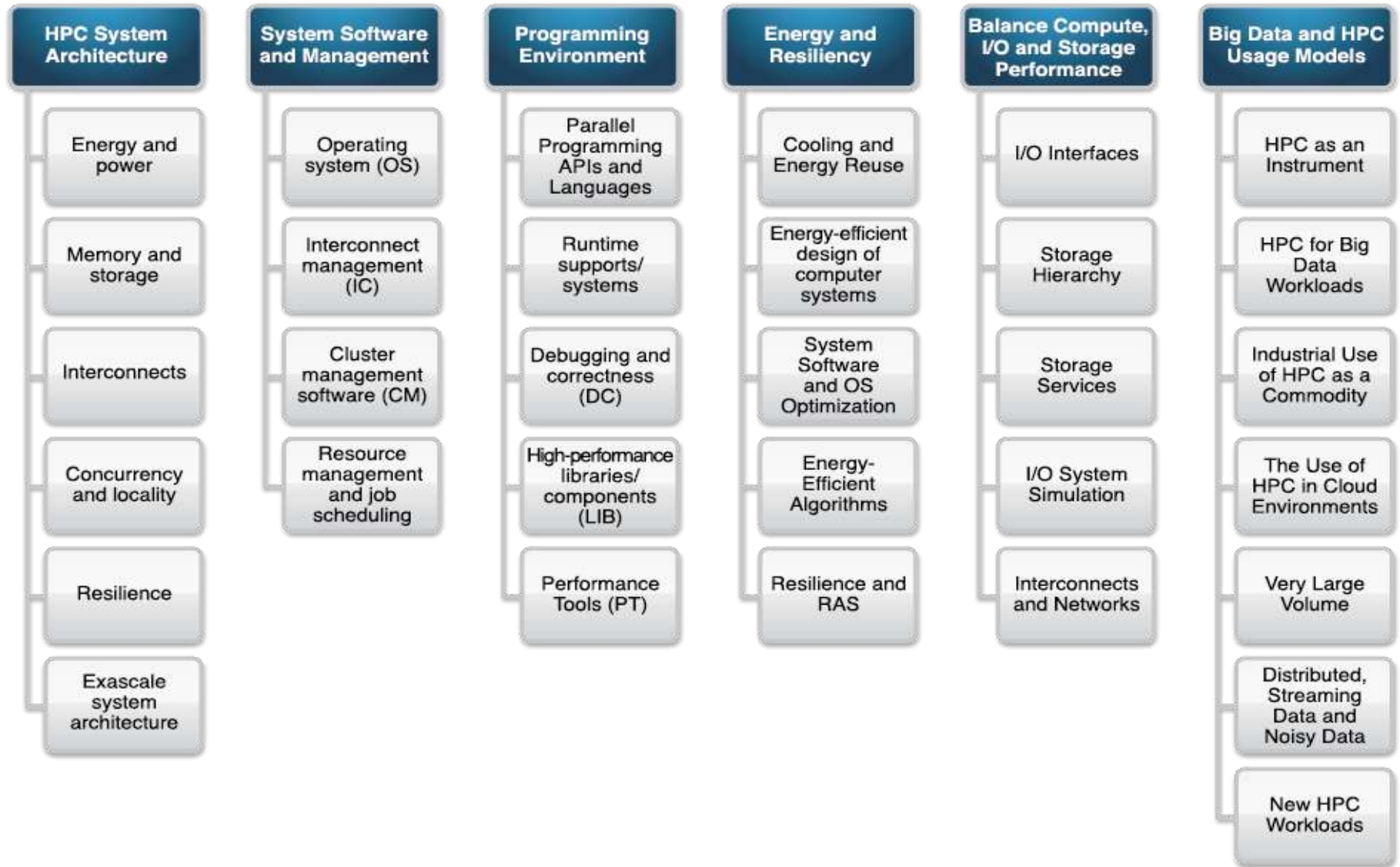
Strategic multi-dimensional vision



The timeline of the R&D program



Research priorities



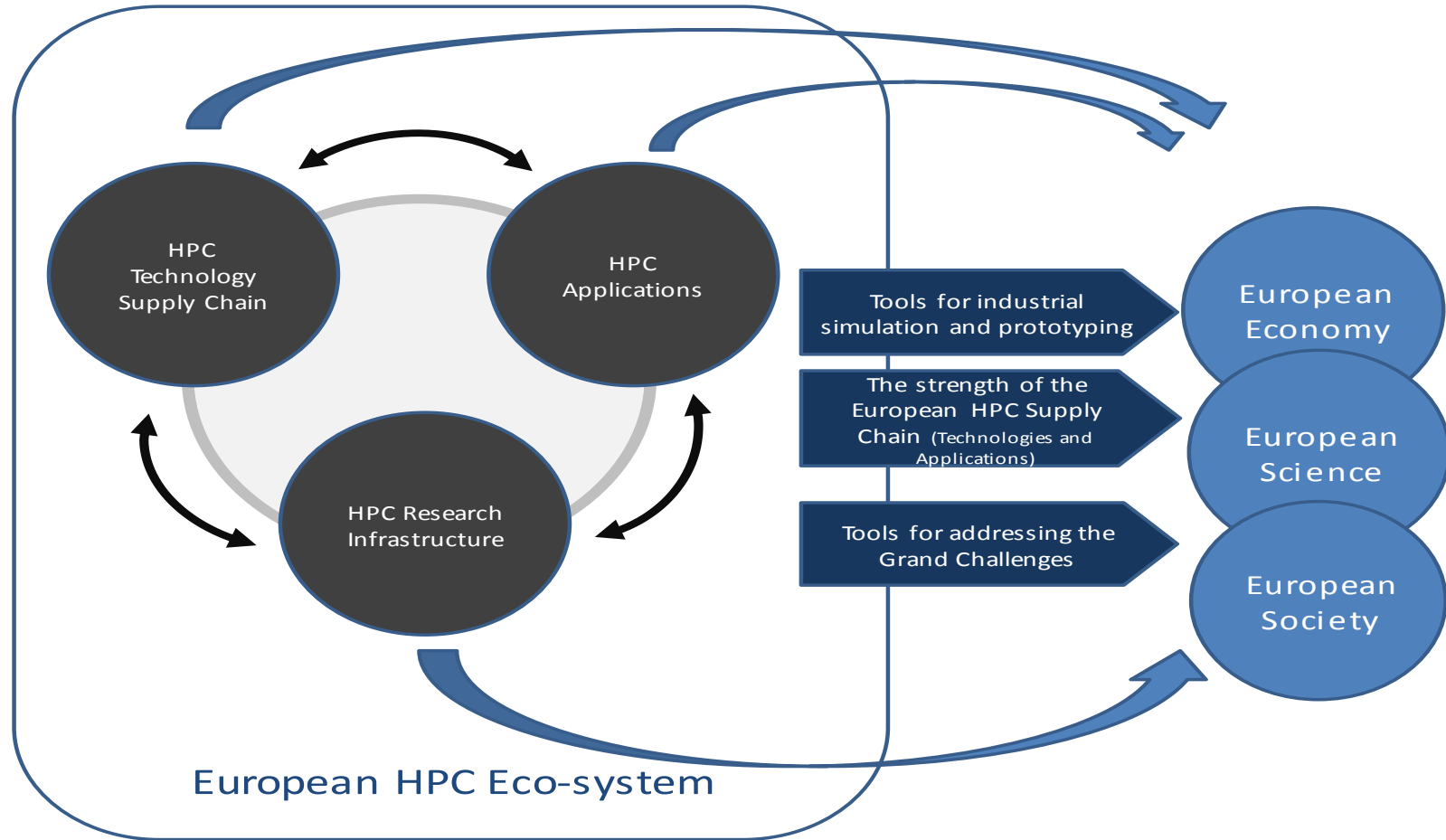
What is in it for European HPC?

cPPP

Contractual Public-Private Partnership



HPC cPPP – Building a European HPC Ecosystem



- **What** is a **contractual Public Private Partnership** ?
 - Contractual agreement signed both by EC and private partner(s)
 - Defining:
 - Objective(s)
 - Governance
 - Commitment of the EC and of the private side
 - Monitoring of the agreement
- **Why** a cPPP for HPC ?
 - To highlight the importance of HPC for Europe
 - To put in place an ambitious plan for HPC development in Europe
 - To increase the coordination of stakeholders



ETP4HPC SIGNS AGREEMENT TO FORM A CONTRACTUAL PUBLIC-PRIVATE PARTNERSHIP FOR EUROPEAN HIGH-PERFORMANCE COMPUTING

Brussels, 17th of December 2013. ETP4HPC, the European Technology Platform (ETP) in the area of High-Performance Computing (HPC) signed an...

cPPP's Objective and Resources

- **To build a European world-class High-Performance Computing (HPC IT) technology value chain that will be globally competitive.**
- **To support a EU leadership and world-wide excellence in key application domains for industry, science and society that are most important for Europe,**
 - facilitating the provision of innovative solutions for grand societal challenges
 - allowing the development of the future applications for the next exascale computing generation
- EC Funds of 700 M€ for the Technology and Application pillars in order to implement the actions of the Strategic Research Agenda of ETP4HPC
- Matched by Industrial Investments

ETP4HPC Members

- 16 Founding Members
- Steering Board = 15 members
- 52 members as of March 2014,
 - Companies
 - SME
 - ISVs
 - Service providers
 - Research Centres...



A 3D wireframe cube is centered on a black background. The cube is composed of white, red, and blue lines. The top and bottom faces are white. The front and back faces are red. The left and right faces are blue. The text "THE NEW FACE OF INDUSTRY IN FRANCE" is written in white, bold, uppercase letters across the center of the cube.

THE NEW FACE OF INDUSTRY IN FRANCE

FRANCE REINVENTED

◆ France is a country of inventors, pioneers, entrepreneurs and captains of industry. Every time it has faced adversity, it has found the strength to reinvent itself. ◆ Today, France is once again undergoing a metamorphosis. Its aim is to regain its place among the major industrial powers, and to play its role in both the environmental, energy and digital transitions. France's industrial policy priorities are outlined in this document. They are the fruit of several months' work to identify France's key advantages in a globalized world, and the growth markets on which our efforts should be focused, our means aligned, our funding targeted and our industrial sectors united. We want to build a new industrial offering that is competitive; one that can recover lost markets and win new ones. ◆ These priorities are in the form of 34 sector-based initiatives that will be the focal point of France's efforts, the meeting point of its productive forces, researchers, engineers, designers, workers and entrepreneurs, and the starting point of its industrial renewal. ◆ France's aim is not simply to have technological performances and demonstrators for display cases. Neither can we leave to other nations the task of mass-producing our inventions conceived by French researchers and financed by French taxes. We want to see tall buildings made of timber in French cities and not just in the foyers of architectural firms, we want to see second-generation biofuels in French petrolstations and not just in test tubes, we want to see 3D printers and robots in French factories and not just in those of our competitors. ◆ Rediscovering a taste for industry and innovation and defending the "Made in France" label will require us above all to regain faith in ourselves. It will also require us to take a resolutely optimistic view of France's capacity for renewal. ◆ A nation without industry is a nation doomed to decline. France's growth and employment prospects, along with its social model, are dependent on its ability to reinvent its industry and build a more productive, green and digital society, in which food, transport, housing, heating, healthcare, education and production have been recast. ◆ This society will be a reflection of the new face of industry in France.

◆ Arnaud Montebourg



THE 34 SECTOR-BASED INITIATIVES

- ▶ RENEWABLE ENERGIES
- ▶ UNIVERSAL CARS CONSUMING LESS THAN 2 LITERS PER 100 KM
- ▶ ELECTRIC CHARGING STATIONS
- ▶ BATTERY LIFE AND POWER
- ▶ DRIVERLESS VEHICLES
- ▶ ELECTRIC PLANES AND NEXT-GENERATION, AIRCRAFT
- ▶ HEAVY-LIFT AIRSHIPS
- ▶ EMBEDDED SOFTWARE AND SYSTEMS
- ▶ ELECTRIC-PROPULSION SATELLITES
- ▶ HIGH-SPEED TRAIN OF THE FUTURE
- ▶ ENVIRONMENTALLY FRIENDLY SHIPS
- ▶ TECHNICAL AND SMART TEXTILES
- ▶ WOOD INDUSTRY
- ▶ RECYCLING AND GREEN MATERIALS
- ▶ THERMAL RENOVATION OF BUILDINGS
- ▶ SMART GRIDS
- ▶ WATER QUALITY AND SCARCITY MANAGEMENT
- ▶ GREEN CHEMICALS AND BIOFUELS
- ▶ MEDICAL BIOTECHNOLOGIES
- ▶ DIGITAL HEALTHCARE
- ▶ MEDICAL DEVICES AND NEW HEALTHCARE EQUIPMENT
- ▶ INNOVATIVE PRODUCTS FOR SAFE, HEALTHY AND SUSTAINABLE FOOD
- ▶ BIG DATA
- ▶ CLOUD COMPUTING
- ▶ E-LEARNING
- ▶ TELECOM SOVEREIGNTY
- ▶ NANO-ELECTRONICS
- ▶ CONNECTED DEVICES
- ▶ AUGMENTED REALITY
- ▶ CONTACTLESS SERVICES
- ▶ SUPERCOMPUTERS
- ▶ ROBOTICS
- ▶ CYBERSECURITY
- ▶ INDUSTRIAL PLANT OF THE FUTURE



SUPERCOMPUTERS

◆ **We want to build a France of computing power and digital simulation.** ◆ **France's stellar** expertise in mathematics, especially applied mathematics, is acknowledged worldwide. France has long positioned itself as a leader in high-performance computing and digital simulation. The global race to build the most powerful supercomputers is primarily a question of innovation: modeling the most complex innovations and forecasting through computing power. ◆ France is one of the few countries in the world to have national players that cover the entire value chain in digital simulation. Bull can lay claim to front-ranking expertise in the design of computing systems ("supercomputers"), while Dassault Systèmes is the world leader in simulation and computer-aided design. Players in supercomputing are structured within efficient ecosystems, such as innovation clusters and the **Teratec association**, enabling them to work hand-in-hand with industrial users. ◆ Used in many high-tech industries such as the aerospace, automotive, energy, health and multimedia sectors, high-performance computing (HPC) simulation is a key component in innovation and the industrial processes of large groups and SMEs. The ever-increasing use of modeling and digital simulation has resulted in significant performance gains and shortened development times, and has facilitated the management of hyper-complex projects such as nuclear power plants, the A380 or space launch vehicles. ◆ Many other examples could be highlighted, in view of the importance of this activity to modern industry: high-performance computing enhances the competitiveness of oil and gas exploration and production, and the modeling of CO2 geological storage projects. Earthquakes and car crash tests can also be simulated and modeled so as to improve safety and save the cost of physical testing. In a very different field, film-makers can now use the HPC capabilities of supercomputers to produce images and special effects. ◆ The impact of simulation using supercomputers will continue to drive corporate performance and competitiveness: it is generally estimated that mastery of HPC technologies would boost European GDP by 2-3%.





Thank you for your attention

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www.teratec.eu