High-Performance Computing (HPC)

HPC (High-Performance Computing) is a strategic resource for Europe's future as it allows researchers to study and understand complex phenomena while allowing policy makers to make better decisions and enabling industry to innovate in products and services. The European Commission funds projects to address these needs.

The challenges

Societal, scientific and economic needs are the drivers for the next generation of HPC - computing with exascale performance (computers capable of performing 10 to the power of 18 floating point operations per second).

- All scientific disciplines are becoming "computational" today. Modern scientific discovery requires very high computing power and capability to deal with huge volumes of data.
- Industry and SMEs are increasingly relying on the power of supercomputers to invent innovative solutions, reduce cost and decrease time to market for products and services.
- HPC is part of a global race. Many countries (USA, Japan, Russia, China, Brazil, India) have announced ambitious plans for building the next generation of HPC with exascale performance and deploying state-of-the-art supercomputers.

The European HPC Strategy and its implementation

The European Commission recognised the need for an EU-level policy in HPC to optimise national and European investments, addressing the entire HPC ecosystem and adopted its HPC Strategy [1] on 15 February 2012.

The implementation of the European HPC strategy in Horizon 2020 is supported through three pillars working in synergy:

1. Developing the next generation of HPC technologies, applications and systems towards exascale: this will engage a European-wide effort to develop autonomous technology to build exascale systems and novel applications within ~10 years. The scope is R&D of HPC technology covering the whole spectrum from processors and system architectures to high-level software and tools to delivering prototype exascale systems and associated applications according to specifications. This pillar is supported by the Future and Emerging Technologies [2] (FET) programme.
2. Providing access to the best supercomputing facilities and services for both industry including SMEs and academia: this includes support to PRACE [3] as well as to support actions to facilitate HPC take-up by industry (including SMEs). PRACE will plan and manage the eco-system of Tier-0 resources at the EU level and its articulation with national (Tier-1) HPC
resources and their evolution in time. This pillar is supported by the e-infrastructures [4] programme.

3. **Achieving excellence in HPC application delivery and use**: this will support the establishment of Centres of Excellence (CoEs) to focus and coordinate support to the application of HPC in scientific or industrial domains that are most important for Europe. This pillar is supported by the e-infrastructures [4] programme.

These pillars are complemented with awareness raising, training, education and skills development in HPC.

A strong cooperation with the HPC stakeholders is key for the success of the HPC strategy. A **contractual Public-Private Partnership on HPC** (cPPP on HPC [5]) was established in January 2014 between the Commission and the European Technology Platform for HPC [6] (ETP4HPC) to develop an ambitious R&I strategy. The cPPP covers the pillars (1) and (3) above.

Check the applications of High-Performance Computing and what the EC does within its HPC strategy in this infographic [7].

**Implementation in WP2014-2015**

HPC-related actions were called under 2 different domains of the "Excellent Science" pillar of Horizon 2020:

- Under FET [8], the 'Towards Exascale High-Performance Computing' [9] call (total budget of **97.4 M€**) aims to deliver a broad spectrum of extreme scale High Performance Computing (HPC) systems and to develop a sustainable European HPC Ecosystem. 21 projects [10] have been selected and started in autumn 2015.

- The e-infrastructures programme [11] addresses in particular the provision of services, the infrastructure for computing applications (Centres of Excellence, CoEs) and a network of HPC Competence Centres for SMEs (SESAME-NET [12]). Nine CoEs [13] have been launched. The grant agreement for the 4th implementation phase of PRACE [14] (PRACE-4IP) has been established.

**Implementation in WP2016-2017**

- Under the FET Proactive HPC topic, **three topics** [15] are called (total budget of 85 M€)

**Links:**
- [e-Infrastructures](https://ec.europa.eu/programmes/horizon2020/en/h2020-section/e-infrastructures)
- [European Technology Platform for HPC](http://www.etp4hp.eu/)
- [PRACE-4IP](https://www.prace-ri.eu/)
