

International Cooperation



1 ETP4HPC global vision on international cooperation

To achieve HPC leadership, Europe must engage in international cooperation. This cooperation should target two objectives:

1. Develop synergies with the most active areas in HPC technologies research and their optimal usage. Priority should be given to developing links with Japan and the US, which demonstrate the longest experience in HPC and the most structured and mature related programmes;
2. Collaborate with some of the countries developing their HPC strategies in order to utilise the expertise and capabilities of the European HPC ecosystem.

This cooperation should not only focus on HPC technologies but also on policies to develop wider use of HPC within the scientific and industrial communities.

1.1 Cooperation with Japan and the United States

These two countries have undertaken a long-term, structured and sustained effort to develop HPC Exa-scale system technologies. The objectives of ETP4HPC in this cooperation would be to:

- Analyse the complementarity of the research and investment programs to identify the technologies and capabilities that could be competitively developed and offered within Europe and for use by the ROW in HPC and other markets;
- Identify common efforts in Exa-scale software stack development and in programming models with view to establish common vision leading to the establishment of new standards and APIs that should be widely used in Exa-scale HPC systems and applications to facilitate interoperability and exchange of HPC components (hardware, software and tools);
- Exchange experience in Exa-scale application development and technology assessment
- Share the strategic visions and determine whether joint communication is needed.

The EC could establish two bilateral MoU's or Agreements with respectively DoE and MEXT following the example set by the current arrangement between DoE and MEXT. These frameworks would serve as a basis for regular meetings and interactions to implement the goals presented above. This cooperation would deal with the following topics:

- None of the three major regions (Japan, US and Europe) claims that it is in a position to develop all the relevant technologies for Exa-scale on their own. Even if there is competition and if each region takes its own path to reach the next generation of HPC, there will be some room for complementary actions. The cooperation could focus on exchanging information on

the results of demonstrator assessment and establishing links between research projects that could benefit from mutual integration of technologies.

- To foster the development of Exa-scale, new standards and APIs are needed. These elements are key to establish a sound basis for the interaction between projects working on different levels of the HPC system and application stack. One of the main subjects are programming models that will be needed for productive development of ultra-scale parallel applications. The programming model standards will also drive the efforts toward new development, tuning and optimising tools. Besides these topics, there are different domains for which the emergence of APIs will be mandatory to organise the research efforts and increase the impact of the projects. Some of the APIs fit between the different levels of the software stack as runtime APIs, communication APIs, IO API's, etc. Some APIs are also needed to implement mandatory Exa-scale features as resilience and power management. In all these domains international cooperation can accelerate the adoption of new frameworks facilitating the interaction of research projects.
- Each region has undertaken efforts in developing new Exa-scale applications. Interaction could be beneficial to share best practices and experience. Common assessment methods could also be put in place to facilitate the assessment of the research results and exchange information about the outcomes of the different programs.
- The cooperation should also target selected strategic interactions. The topics could include technology vision and also ecosystem-related subjects such as the impact of HPC on research and industry, the development of education programs, the democratisation of HPC, etc. If needed, joint communication could be organised to increase the impact of the common messages.

1.2 Cooperation with HPC emerging countries

More and more countries recognise the importance of HPC and its impact on the development of research and economy first as a key and enabling capacity in many different application areas, secondly as a vivid ICT technological area and thirdly as a critical economic contributor in itself. Their objective is to foster HPC development and to implement a plan with several key components: a state of the art HPC infrastructure, HPC applications targeting strong domains of their economy and an ICT research plan focused on HPC topics.

Cooperation with these countries could lead to mutual benefits. On the one hand, the HPC emerging countries could take advantage of the experience of Europe and obtain access to the skills needed develop their plans. On the other hand, Europe could focus its research on top-priority topics, develop relationships that would facilitate the export of European products and services, and attract high-potential people to its education system.

This kind of cooperation could be established with countries that are increasingly active in HPC and willing to develop their relationship with Europe. Today, it seems that Algeria, Morocco, South Africa, Brazil and Mexico, India and Singapore are legitimate candidates.

To implement such cooperation, at least two instruments should be considered:

- Joint call in Horizon 2020: this instrument (already in place with Brazil) can increase the research effort on the topics of common interest and establish relationships that could be

developed further toward economic exchanges. The topics of the joint call would have to be selected after the first phase of bilateral discussions between these countries and the EC.

- Centres of Excellence (that will soon be created in Europe) could establish relationships with academic and industrial partners in their domains in selected countries. HPC emerging countries usually need to show the rapid impact of HPC. The CoE's could help introduce new use patterns and accelerate the exploitation of HPC in these countries. The CoE's could benefit from some resources provided by those countries in return.

In addition, with these instruments some exchanges should be organised to cover other strategic topics for the development of a strong HPC ecosystem. These exchanges should include education, the democratisation of HPC access and interaction between academy and industry.