IMPORTANT PROJECT OF COMMON EUROPEAN INTEREST (IPCEI)

ON
HIGH PERFORMANCE COMPUTING
AND
BIG DATA ENABLED APPLICATIONS
(IPCEI-HPC-BDA)

European Strategic Positioning Paper

Luxembourg, France, Italy (& Spain)

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GLOBAL CONTEXT

There is increasing global recognition of the strategic security and economic impact of HPC enabled applications. Most recently;

- In the U.S., President Obama issued an executive order to establish a National Strategic Computing initiative with an initial allocation of $450 Million from the U.S. Department of Energy (29/07/2015)
- China's President Xi applauded the success of the world's fastest supercomputer Tianhe-2 built by the Chinese National University of Defence Technology (13/07/2015)
- French President François Hollande announced the launch of a French National "Plan Supercalculateur" (07/05/2014)
- Former Vice President of the European Commission Neelie Kroes announced the launch of a contractual Public-Private-Partnership (cPPP) on Big Data (€500M EC funding) and for the development of a European HPC Eco-System (€700M EC funding). (17/12/2013)
- Italian Prime Minister Matteo Renzi announced the creation of a Digital Authority for the creation of a Digital Single Market in Italy and in Europe. (8/7/2014)
- The Luxembourg Government launched "Digital Lëtzebuerg" under the lead of the Ministry of State, the Ministry of Finance and the Ministry of Economy to accelerate the development of the Digital Economy within Luxembourg.

HPC, big data and ultra-fast internet access are enabling technologies for all European industrial sectors. Europe has a unique opportunity to act now and invest in the development and deployment of HPC technology, Big Data and Applications. Failure to do so will seriously undermine European competitiveness and Europe will miss an important opportunity to ensure its industries compete on a global level.

EUROPEAN CHALLENGES

The European Commission has identified five major challenges to the successful implementation of HPC:

- E-infrastructure initiatives tend to be fragmented at the geographical and user-community level.
- European investments are inefficient due to lack of critical mass and rationalisation, lack of financial instruments to pool resources.
- Europe shows a lack of awareness of the innovation potential of High Performance Computing to make the bridge between science, industry and the public sector.
- Europe is lagging behind in the implementation and deployment of world-class e-infrastructure for data exploitation.
- Europe is unable to preserve the long term sustainability of its e-infrastructure

Europa can build on its strengths; i.e. existing European, National and Regional programmes, its skills, its expertise in Key Enabling Technologies (including supercomputers) and others, to implement an appropriate programme addressing the above challenges.

IPCEI ON HIGH PERFORMANCE COMPUTING AND BIG DATA ENABLED APPLICATIONS

In order to address these European e-infrastructure challenges, to provide a springboard for new economic growth, Luxembourg, Italy and France intend to apply for an Important Project of Common European Interest[1] on High Performance Computing and Big Data enabled Applications.

The IPCEI-HPC-BDA will bring Europe forward to achieve its macro-objectives:

- Ensure a European industrial sovereignty on key HPC technologies (necessary in terms of safety and security);
- Support the development of new usages of HPC by the industry;
- Guarantee access to world-class HPC facilities for public and private research.

The IPCEI-HPC-BDA shall be based on three pillars, in support of the above objectives: Technology (pillar 1), Infrastructure (pillar 2) and Large Scale Applications (pillar 3).

The IPCEI-HPC-BDA will support Europe to build a resilient European HPC Supply Chain, support the European Science Cloud Game Changer, and support large-scale pan-European pilots where e-infrastructure meets user, to accelerate European industry solutions onto global markets.

Considering the major investments required, its implementation is expected to leverage regional and national funding with complementary European funding mechanisms including, but not limited to, Horizon2020 programmes, the Connecting Europe Facility (CEF), the European Fund for Strategic Investment (EFSI), and the European Structural Investment Fund (ESIF).

EUROPEAN HPC AND BDA ECO-SYSTEM

PILLAR 1: TECHNOLOGY

The development of high performance computing and data management technology to build a resilient European computing and data infrastructure supply chain shall focus on:

- Hardware for computing systems;
- HPC system architecture and data processing and curation;
- Software development, maintenance, and reliability of operating systems, extreme parallelism, fast and open data access;
- New systems concepts to provide scalable and reliable storage and transport of data;
- Ultra-fast networking.

[1] As defined by the European Commission, an IPCEI is an initiative from at least 3 Member States which contributes to economic growth, jobs and competitiveness for EU industry. An IPCEI brings together various economic actors, knowledge, expertise and funding and can be relevant for all policies. An IPCEI is the appropriate tool to finance this particular large transnational project of strategic importance to Europe in line with the EU state aid rules. It will overcome market failure of private initiatives and will generate benefits for a multitude of European stakeholders. The IPCEI will enable Member States to offer a diversified portfolio of support forms (repayable advances, loans, guarantees, grants) and in justified cases allow public support up to 100% of the funding gap on the basis of a large set of eligible costs. Furthermore it will allow state aid for the first industrial deployment of the selected applications.

The technology development will build on existing initiatives. ETP4HPC that promotes Europe's position in the domain of HPC technologies and fosters collaboration among all players in the HPC supply chain. INDIGO-DataCloud, a H2020 project that aims at developing a data/computing platform targeting scientific communities, deployable on multiple hardware and provisioned over hybrid (private or public) e-infrastructures.

It will leverage on Horizon2020 programme: the FETHPC-1-2014 Core Technologies, Programming, Environments and Algorithms for Extreme Parallelism and Extreme Data Applications, the FETHPC-2-2014 HPC Eco-system Development, the INFRADEV-4-2016 – Towards a European Research and Science Cloud, the EINFRA-12-2017 - Data and Distributed Computing e-infrastructures for Open Science and the EINFRA-21-2017: Platform-driven e-infrastructure innovation.

The activities will be in line with the European roadmap in computer science towards exa-scale for computing and data.

The Technologies in Pillar 1 will serve as the basis for European industry to co-design, develop and deploy the e-infrastructure (Pillar 2).

PILLAR 2: INFRASTRUCTURE

The development and implementation / deployment of e-infrastructure shall aim at securing European leadership in computing, storage and secure data transport.

- It shall extend HPC infrastructure to other[2] EU Member States to support research and emerging industrial applications, tackle new challenges and develop strategic sectors;
- It shall develop reliable European storage infrastructure for data in support of public and private research;
- It shall develop reliable European data infrastructure for data processing, open access curation and long term preservation;
- And ensure a secured transport of data via European computing infrastructures (secured networks).

It will help extend the PRACE initiative and build on the Horizon2020 programme EINFRA-4-2014 Pan European High Performance Computing infrastructure and services.

The infrastructure will provide access to world-class supercomputing facilities and services, the computing and data infrastructure for industry, research technology organisations (RTO's) and academia.

PILLAR 3: LARGE-SCALE PAN-EUROPEAN PILOTS

The third pillar will establish European Centres of Excellence (CoE) to develop and test HPC-enabled applications in specific strategic sectors at the regional, national and pan-European scale. The Centres of Excellence shall develop academic excellence in support of European companies towards growth opportunities in strategic domains. They will address the Grand Societal Challenges Europe is facing: climate change, environment, green mobility, security, health, digitization of private companies…

The IPCEI shall deploy pan-European pilots at large-scale in (real-time) application test beds such as "Smart City", "Smart Building", "Smart-Energy", "Smart Water", "Smart Mobility", "Smart-Space", "Smart Agriculture", "Manufacturing 4.0", "FinTech", and others.

[2] The development of new Infrastructure will build on what has been established by the Partnership for Advanced Computing in Europe (PRACE) with six supercomputers in four hosting countries (France, Germany, Italy and Spain).

The IPCEI-HPC-BDA will enable transforming raw big-data in to intelligence, provide calculating power for real time applications and make it particularly accessible to SMEs.

The development of HPC applications can build upon initial initiatives from Horizon2020 programmes:

- FETHPC-2-2014 HPC Eco-system development to boost European research excellence on the key challenges towards the next generations of high-performance computing systems.
- EINFRA-6-2014 Network of HPC Competence Centres for SMEs to promote access to computational expertise anywhere in Europe and enable the dissemination of best practices in HPC industrial use particularly for SMEs.
- EINFRA-5-2015 Centres of Excellence for computing applications to ensure EU competitiveness in the application of HPC for addressing scientific, industrial or societal challenges. (Sectorial e.g. medicine, life science, energy, Transversal e.g. computational science, Challenge-driven e.g. societal or industrial challenges).

STATE OF PLAY

To gather together the critical mass, capacity and capability to address the above European challenges and ensure the successful implementation of a European HPC initiative, Luxembourg has sought collaboration with, initially, two other European Member States, i.e. Italy and France. The IPCEI on HPC will leverage respective Member States strengths and enable alignment of respective implementation strategies.

The IPCEI HPC initiative has obtained full support from the three EU Member States partners and specific European region (see enclosed letters of support):

- The Italian Ministry of Economic Development, the Ministry of Education, University and Research, the Ministry of Public Function, the regional Ministry of Emilia-Romagna, the regional Ministry of Piemonte, the regional Ministry of Trentino, the regional Ministry of Lazio and the regional Ministry of Marche
- The French Ministry of Economy, Industry and the Digital Sector
- The Luxembourg Ministry of the Economy, the Luxembourg Ministry of Higher Education and Research.

In addition, Luxembourg, Italy and France consider Spain an important potential partner in the future IPCEI on HPC and Big Data enabled Applications. Luxembourg is in contact with the Secretary General of Science, Technology and Innovation, and will meet the Spanish Ministry in mid-December to discuss integration in the project.

CONCLUSION

In view of the European strategic and economic context, its alignment with, and importance to the European Digital Economy thrust and considering the significant capital investments that will be required in e-infrastructure, the partners consider an Important Project of Common European Interest (IPCEI) IPCEI on HPC essential for the overall success of the initiative.

Considering the significant investments, the Member States will seek to complement national public investments with private investments (national and international), and financial support from European Institutions and programmes (H2020, CEF, ESIF, EFSI, EIB).

Luxembourg, Italy and France look forward to the announcement by Commissioner Oettinger of the launch of an IPCEI on HPC on November 17th 2015 at the European Data Forum in Luxembourg.