

General Information	
Preliminary title of the European Partnerships	European High Performance Computing (EuroHPC)
Short description of the partnership	The EuroHPC Partnership has as its mission to establish an integrated world-class supercomputing & data infrastructure and support a highly competitive and innovative HPC and Big Data ecosystem.
Services directly involved	Lead service: CONNECT/C2, High Performance Computing and Quantum Technologies, CNECT-C2@ec.europa.eu
Context and problem definition	<p>On 28 September 2018, the Council adopted Regulation 2018/1488 to establish the European High Performance Computing Joint Undertaking (EuroHPC). The Regulation entered into force on 28 October 2018. EuroHPC enables the Union and the 28 participating states to coordinate their supercomputing strategies and research agendas and pool together investments from public and private funds.</p> <p>Its mission is to develop, deploy, extend and maintain in the EU an integrated world-class exascale supercomputing and data infrastructure, and to develop and support a highly competitive and innovative High Performance Computing (HPC) ecosystem. The EuroHPC JU plans include activities under the current Multi Annual Financial Framework (MFF) – 2014-2020 – with a co-Investment of ~EUR 1 billion (50% EU budget and 50% budget from the Participating States), in addition to EUR 420 million of private investments. To achieve its long-term mission, further funds from the next MFF will be necessary.</p> <p>Supercomputing and data infrastructures are a critical and strategic resource for the EU for understanding and responding to the increasing challenges such as personalised health, or climate change that European citizens will be facing in the years to come, as well as for the future of European industry, SMEs, and the creation of new jobs. They are also key to ensuring that European scientists reap the full benefits of data-driven science and lead the path to grand scientific discoveries. Currently however, only two of the ten fastest supercomputers in the world are situated in Europe, and the ones available in Europe are built largely using non-European technologies. The EU risks getting technology deprived of strategic know-how for scientific excellence, innovation and competitiveness. Europe's scientific capabilities, industrial competitiveness and sovereignty depend critically on continuous access to world-leading HPC and data technologies and infrastructures to keep pace with the growing demands and complexity of the problems to be solved.</p> <p>Under the current Multi Annual Financial Framework (MFF), the EuroHPC JU, will acquire at least two world-class precursors to exascale supercomputers and few petascale supercomputers by pooling European and national resources. In addition, through Research and Innovation activities the EuroHPC JU will support the development of exascale HPC technologies and systems, HPC applications, and widening of HPC use by supporting competence and skills developments in Europe.</p> <p>The EuroHPC JU is conceived and designed with the long-term mission presented above for achieving a highly competitive and innovative HPC ecosystem in Europe. In order to enable the EuroHPC JU to continue its operations and implement its long-term objectives of achieving world-class European exascale and post-exascale HPC technologies and systems and their wide deployment all over Europe, further funds are required.</p>
Objectives and expected impacts	In the next MFF (2021-2027), the EuroHPC aims to achieve a world-class exascale and post-exascale supercomputing infrastructure and innovation

ecosystem in Europe by pooling resources of its Participating States and coordinating their efforts in a common public procurement and research and innovation agenda. Compared to the recently terminated cPPP on HPC, EuroHPC does not only address the development of hardware and software technologies and innovative applications at R&D. It expands the scope of the cPPP, providing a procurement framework at European level to harness the R&D results into operational world-class HPC systems based on European technologies.

The main objectives to be achieved in the new MFF include:

- From a Research & Innovation perspective (Horizon Europe Framework Programme), the Partnership aims to create a leading innovation ecosystem in Europe that covers the full chain from research to prototyping, piloting and demonstration accelerating wider market uptake and deployment. By developing and pooling the fragmented knowledge, expertise and skills, Europe can build the full supply chain for exascale systems: from technology components, processor technologies and systems to full machines. These will become essential technologies in a variety of other mass markets (such as automotive, consumer electronics, servers, etc.).

In addition, the Partnership will ensure and consolidate Europe's world leadership in supercomputing applications. This is of critical importance to industry and particularly SMEs without in-house capabilities that will benefit from easy to use HPC resources, applications and analytics tools to create new innovative applications, products and processes.

- The capacity building objectives for the Partnership will be implemented by the Digital Europe Programme (DEP) which aims to deploy a world-class exascale and post-exascale supercomputing Infrastructure and will include the acquisition of two exascale systems (of which at least one with European technology) and post-exascale systems incl. the deployment of a first hybrid HPC/Quantum computing infrastructure in Europe. The DEP will support large-scale HPC capacity building and widening HPC use (e.g., by supporting and coordinating the activities of a network of HPC competence centres serving large industry users and SMEs; large scale training and skills building, etc.)
- The Partnership will ensure terabit connectivity between existing and future supercomputing centres through the Connecting Europe Facility-2 Programme, so that the EuroHPC infrastructure will be accessible for HPC services to researchers, public administrations and industry across Europe.

The impact will be in the creation of a highly competitive and innovative HPC and Big Data European public and private ecosystem, strengthening the European HPC supply chain and user base. The transition towards exascale and post exascale computing, supported by joint EU/Participating States investments acting as lead market users, would provide an opportunity for the independent European supply industry to leverage on such investments and get access to new markets estimated to EUR 1 trillion and affect directly the competitiveness of European industry. Technologies developed through the EuroHPC Partnership will benefit HPC applications in several scientific, industrial and societal areas such as personalized health, climate, new material and drugs discovery, energy, cybersecurity. The expected timeframe to achieve the above objectives potentially extends to 2030.

<p>Necessity test: rationale for a European Partnership</p>	<p>The increasing costs of building and maintaining a world-class computing infrastructure and a leading HPC ecosystem requires stronger coordination between EU and national procurement processes and the coordination between of EU and national strategies and investment plans through a strong governance at EU level and the rationalisation of HPC resources.</p> <p>A Partnership can put in place a coordinated approach and the pooling of financial resources in a joint public procurement for acquiring world-class supercomputers. This enables the rationalisation of financial resources, while permitting at the same time the acquisition of a diversity of supercomputers serving a large range of different application needs.</p> <p>No single Member State has the means to develop the necessary full world-class HPC ecosystem on its own and in competitive periods with respect to the USA, China or Japan. To be able to implement the European HPC strategy, a Partnership is necessary to coordinate and pool national and European efforts, because the scale of the resources that are needed to realise a sustainable exascale and post-exascale level HPC infrastructure and ecosystem is beyond what national governments can nowadays afford to invest.</p> <p>A Partnership can combine EU budget with other sources of funding (national, private, etc.), allowing the implementation of research, technological development, pilot application and demonstration programmes in an integrated way. It can ensure coordination with national programmes and will permit to plan and synchronise the different calls and activities towards the achievement of the overall goal of the Partnership. Each subsequent call would build on the results of previous calls ensuring continuity. In addition, calls for innovation procurement may be planned that make the participation to the procurement conditional to the successful conclusion of prior European R&D projects and/or specify a preference for the integration of R&D results previously developed by the European R&D programmes. The Partnership can thus become a very effective instrument to achieve excellence in applications, and for technology and innovation development that would be integrated in world class HPC machines based on European technology.</p> <p>Without coordinated action at EU level, fragmentation of public HPC services across the EU and within MS would lead to inefficient use of resources and only partial cross-border exchange of expertise, with negative societal and economic impacts.</p>
<p>Relevant for the following parts of Horizon Europe</p>	<p>Pillar II 'Global Challenges and European Industrial Competitiveness'</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Cluster Health <input type="checkbox"/> Cluster Culture, creativity and inclusive society <input type="checkbox"/> Cluster Civil Security for Society <input checked="" type="checkbox"/> Cluster Digital, Industry and Space <input checked="" type="checkbox"/> Cluster Climate, Energy and Mobility <input checked="" type="checkbox"/> Cluster Food, Bioeconomy Natural Resources, Agriculture and Environment <input type="checkbox"/> Cross-cluster <input type="checkbox"/> Pillar III 'Innovative Europe'
<p>Currently identified links with other partnership candidates / Union programmes</p>	<p>The core activity will be under cluster Digital, Industry and Space, but due to the transversal nature of HPC as a key enabler and backbone for other critical technologies it is expected to contribute to many other activities of Horizon Europe, such as artificial intelligence (AI), big data, cybersecurity or blockchain-based services. Clearly defined boundaries and interaction with the planned successor of ECSEL and with the Partnership on AI, data and robotics will be established to maximise efficiency of cooperation and</p>

	<p>avoid duplication.</p> <p>Similarly, as the development of HPC technologies matures through Horizon Europe, these will progressively be taken up and deployed by DEP. Therefore synergies are expected to be created as DEP capacities and infrastructures will be made available to a large number of public and private users, including for activities supported through Horizon Europe. This deployment may leverage European structural and investment funds (ESIF).</p>
Does the proposed partnership build on currently active ones?	The EuroHPC Partnership was established in September 2018. It expands and builds on the activities of the previous cPPP on HPC. The private associations ETP4HPC and BDVA are Private Partners in the Partnership. Following the set-up of the EuroHPC Partnership, the respective cPPPs have been discontinued in 2019.
Expected type and composition of partners	The EuroHPC partnership has the strong commitment of 28 Participating States (all Member States except for Cyprus, Malta and the UK, plus Switzerland, Norway and Turkey), the European Commission and the ETP4HPC and BDVA industry associations, as well as a firm governance structure. One of the policy priorities is to widen the use of HPC technologies for new actors, such as SMEs and the public sector and to provide training and skills to professionals, engineers and scientists.
Contributions and commitments expected from partners	EuroHPC is a Partnership between the EU and 28 Participating States are expected to contribute financially on R&I priorities and joint public procurement activities for acquiring world class supercomputers and collectively match the Union contribution. Private members will contribute in-kind to implement the R&I actions and financially to support the administrative costs of the EuroHPC office.
Currently envisaged implementation mode(s).	<input type="checkbox"/> Co-programmed European Partnership <input type="checkbox"/> Co-funded European Partnership <input type="checkbox"/> Institutionalised European Partnership <input type="checkbox"/> Article 185 <input checked="" type="checkbox"/> Article 187 <input type="checkbox"/> EIT-KIC
Justification of the implementation mode	<p>The Partnership is considered the only instrument that allows to effectively and efficiently combine joint public procurement and ownership of supercomputers, as well as joint investment in the development of technology.</p> <p>The implementation by a Partnership was chosen following the Impact Assessment that was made for the Commission proposal for establishing the EuroHPC Partnership (available at https://ec.europa.eu/digital-single-market/en/news/proposal-council-regulation-establishing-eurohpc-joint-undertaking-impact-assessment). Those arguments are still valid.</p> <p>In summary, the different options analysed were Business-As-Usual, European Research Infrastructure Consortium, Partnership, European Economic Interest Grouping, Galileo-type program and intergovernmental organisation. The Partnership was considered the preferred option.</p>
Proposed starting year	2021 (for contributions from the new MFF and related partners contributions)