

Leveraging High Performance Computing: EU Supercomputers and AI Factories

Lighthouse Europe

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ANALYSIS

EU High Performance Computing

In today's world, **high performance computing** plays a pivotal role in driving innovation and scientific advancement. Enhancing computing power is considered **strategically important for the EU** to maintain its **competitiveness** in the global arena and achieve **technological sovereignty**. Additionally, having the edge on the computing advancement would ensure a position for the EU in shaping **the global digital landscape**. For this reason, already in 2018, the EU launched [the EuroHPC Joint Undertaking initiative](#) with the aim to develop a world-class supercomputing infrastructure in Europe. The initiative seems to be well under way as the EU already acquired **5 peta-scale supercomputers** (capable of at least 10^{15}) and **3 pre-exascale supercomputers** (capable of performing 10^{17}) all of them being fully operational. The latest addition MareNostrum 5 supercomputer launched just a couple of months ago in December 2023.

AI Factories

Representing a significant leap in computational power, for quite a while these supercomputers were accessible only to researchers tackling complex scientific and technological challenges that were previously beyond reach. However, in January 2024 with the launch of the [AI Innovation Package](#) the Commission introduced **measures widening the access to the EU supercomputing capacity** to support the European SMEs developing generative AI.

According to the communication, it is foreseen to establish [AI Factories](#) which should work as the "one stop-shop". It means that together with the access to the computational power to **train their AI models**, SMEs and startups will also be able to receive services such as **assistance with building algorithms** or **support in development of AI applications**. The deployment of these factories is planned to be around the EU supercomputing facilities with each of the "factory" being connected to a data centre which would give access to the Common European Data Spaces.

Even though the establishment of AI Factories is still under way, the European Commission already launched a [call inviting European businesses](#) to apply for yearly access to use the EU supercomputer facilities. Currently **on the offer are 6 supercomputers**, including the most powerful one in Europe and 5th globally – LUMI supercomputer in Finland. The call is open on a rolling basis, but has a several cut-off dates with the first deadline already passed in April. The **upcoming deadline to apply is June 14** and three more dates are foreseen later in the 2024.

Tapping into the potential of supercomputing

Range scope of application

EU's supercomputing power supports various wide range of applications. First and foremost, supercomputers enable **complex simulations and calculations** that are essential for scientific research and technological development. They facilitate the modeling of systems such as climate patterns, molecular structures, and astrophysical phenomena. In fields like weather forecasting, drug discovery, genomics, and materials science, supercomputers accelerate research by analyzing **vast amounts of data** and **simulating scenarios** that would be impossible with traditional computing methods. For example, while EU supercomputers themselves did not directly develop the vaccines, they played a crucial role in successful research of **COVID-19 vaccine** back in 2020. Supercomputing resources helped to analyze vast amounts of genomic data, model protein structures and simulate viral interactions.

In addition to its economic and scientific significance, supercomputing power is essential for **enhancing Europe's position** in the global AI landscape. Development and training the AI models requires massive **computational power** and **extensive datasets**. Supercomputers are capable of handling these computationally intensive tasks, enabling researchers and developers to train **larger and more sophisticated** AI systems. As the technological advancement accelerates, countries and regions with robust supercomputing infrastructure will gain **a competitive edge** in areas like **machine learning and big data analytics**.

Benefits for SMEs developing AI

In sectors such as aerospace, automotive, energy, and finance, businesses rely on high performance computing to design and optimize products, streamline operations, and gain insights from large datasets. Supercomputers might provide SMEs with access to immense computational power, enabling them to **train complex AI models** more efficiently. Also, their **storage capacity** might allow SMEs to process **large datasets** and **validate sophisticated algorithms** with high accuracy. Therefore, by tapping into the power of supercomputing, companies can experiment with advanced algorithms and develop novel AI applications. The beneficial outcome not only for the developers themselves, but also the EU - the more **innovative European SMEs** can stay ahead of the competition the more Union might **leverage the technological advancement**.

However, accessing high performance computing services offered on the market is often **too costly** for small businesses and startups who just started developing AI. Shared supercomputing facilities such as offered in the framework of AI Factories might be a **cost-effective alternative** as the yearly access is free of charge. Instead of bearing the high expenses SMEs can allocate resources more effectively and focus their investments on core business activities such as building algorithms and applications. This creates a **more favorable environment** for SMEs wanting to enter the AI market. Coupled with the possibility for collaboration with other stakeholders in the supercomputing ecosystem, SMEs might also exchange domain-specific knowledge and **foster new business collaborations**.

Challenges ahead

Regulatory burden

The introduction of AI Package offering incentives for SMEs came just after the political agreement **on the AI Act**. Being a breakthrough first in the world legislative framework on AI it comes with the **stringent regulatory requirements** for the companies developing or implementing AI. Thus, the establishment of the AI Factories might be seen as an effort of the Commission to find the right **balance between regulating and promoting innovation**. However, application to access the supercomputers, as it is often the case with the EU funding programs, comes with a list of conditions and intricate submission procedure.

SMEs often have limited resources making it difficult for them to allocate time, money, and personnel to navigate **complex requirements** of applications as such. **Compliance with the rules** may require expertise and administrative consulting which often SMEs and startups do not have. Navigating **bureaucratic processes** and fulfilling reporting obligations can divert valuable time and attention away from core business activities such as developing AI itself and hinder companies from simply applying at all. Understandably the intricate process of application, in this case to tap into the supercomputing capabilities, is in place to allow access only to the most excellent companies. However, from the business point of view **the regulatory burden** might sometimes look as not worth the additional cost. One of the possible solutions might be to offer **administrative assistance** for the SMEs and startups next to the planned technological and algorithmic support in the AI Factories.

The call for the access to supercomputers invites to apply companies who are "developing **trustworthy** cutting-edge **generative AI** models." It is no surprise as the AI Package stems from the AI Act and the EU's **ethical AI** concept embedded in it. However, consequently the requirements for the businesses to be considered fit to participate are entangled in the still quite ambiguous concept of "**trustworthy AI**". Fear of **regulatory non-compliance** can discourage SMEs from even wanting to get involved in the initiative. This might also create huge discrepancies between SMEs for whom it is already difficult to apply and big companies having extensive legal consulting resources. Certainly, the involvement in collaborative opportunities as such should always be on voluntary basis, nevertheless the responsible EU institutions

should create **favourable conditions** for companies to participate. This might include as simple as conveying the information in a simpler manner or having representatives who can speak the **“language” understandable to engineers and developers**. Otherwise, lack of such guidance could lead to a gap between tech companies and the central administration further demotivating business from willingness to collaborate.

Cloud Computing

Relying solely on supercomputers may not be sufficient to meet all high performance computing needs. While supercomputers offer impressive computational power, they may face **limitations in terms of flexibility**. Supercomputers may not be well-suited for highly dynamic or unpredictable workloads that require **rapid scaling and diverse computing tasks**. Additionally, many AI models involve processing vast amounts of data in addition to computational tasks. Supercomputers may not always provide the **necessary storage and data processing capabilities** to handle these data-intensive workloads effectively. Alternative **cloud based computing platforms** may offer more accessible and affordable options for businesses.

To address the diverse computing needs of entities, be it private or public, a hybrid approach may be required. This entails combining the strengths of supercomputers with **cloud and edge computing** to create a more versatile **high performance computing ecosystem**. Already in 2020, the Member States signed a **Joint Declaration on EU Cloud** agreeing on the promise to build the next generation of cloud in Europe. However, at the moment the development of EU's cloud computing capabilities is still in process, making the EU to lag behind the other regions of the world. **The market fragmentation**, the EU's **reliance on non-European cloud providers** for critical infrastructure and digital services, and on top of that **strict GDPR compliance** raise challenges for developing unified and competitive European cloud. This hinders the EU's ability to harness even more high performance computing power than it has right now to foster the innovation and technological advancement.

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