European Commission

Advanced computing

EU investment in high performance computing and computing technologies will enable Europe to lead the way in supercomputing in the Digital Decade.

© European Commission - What are supercomputers?
fix-empty

These days, most of you will know what a gigabyte is — it is a measure of data storage, one of which is enough to hold 20 albums of music, or 542 copies of War and Peace.

But, do you know what a gigaflops is? This is a little more complicated. A gigaflops is a measure of computer performance. FLOPS (or flops) are floating point operations per second, and a gigaflops is roughly one billion floating operations per second. The average laptop computer can run at anything between 250 gigaflops and 400 gigaflops — enough to browse the internet, run office software, play games, and run photo-editing software.

However, laptops are not the most powerful computers around. That honour belongs to machines in the category of high performance computing, or HPC for short. HPC systems are measured not in gigaflops, but in petaflops: one million billion operations per second. Soon, they will be measured in exaflops, which carry out one billion billion operations per second — the same as the combined computing power of all the mobile phones in the EU. One example of HPC today is the EU co-funded LUMI supercomputer in Finland, capable of a peak of 550 petaflops. This is the same as the combined power of 1.5 million laptops. If these laptops were stacked on top of each other, it would make a tower over 23 kilometres high.

HPC systems and what they do are already central to our lives. They carry out complex tasks where large amounts of data needs to be analysed and allow us to create models to study and better understand complex challenges, such as simulating drug molecules for medicines, rural and town planning, and designing new materials, cars, and aircraft.

In the near future exciting new EU projects powered by HPC systems will come online to make a digital twin of the Earth, which will better simulate and predict environmental and climate-related changes and help decision makers to better plan and cope with impacts. There are also plans for a digital twin of a human being, theoretically allowing us to tailor medical treatments to each individual.

The EU plans to fund projects that combine quantum mechanics and computing with these HPC systems. Doing so will allow even more complex simulations in areas such as drug discovery, secure and encrypted communication, and ultra-precise clocks.

HPC systems are impressive, but they are complex and expensive. No one European country can go it alone and expect to compete globally in creating HPC systems. That is why the EU created the European High Performance Computing Joint Undertaking (EuroHPC JU). This body brings together resources from the EU, participating countries, and private partners, to strengthen Europe’s position as a leading HPC power, and make such a resource available to European researchers, industry and

smaller businesses.

The EU plans to further invest €7 billion until 2033 in HPC systems. And, to help the EU become a world leader in quantum computing and technologies, it is helping to fund projects that bring together researchers and industry players in quantum.

Two essential technologies to the future of computing and other areas are photonics and electronics.

Photonics and electronics are what makes your phone work, keeps your internet connection fast and transport safe. And, they offer solutions in healthcare, energy and climate change.

The EU has developed a strategy to ensure that Europe is at the forefront in design and manufacturing of photonics and electronics. European leadership in key enabling technologies (KETs) will bring huge benefits to the economy over the Digital Decade, including a boost in productivity, growth and jobs.

In particular, the Commission is working to develop a common approach to photonics with the European Technology Platform Photonics21. By collaborating across industry, science and policy, Europe can accelerate innovation, boost manufacturing and become a leader in photonics.

As KETs become more complex, industry and small and medium-sized enterprises (SMEs) find it harder to fully benefit from the innovation potential they bring. To be able to enjoy this potential, industry and SMEs need access to these technologies and support in developing and testing innovations before they enter the market.

The new industrial strategy harnesses support from the Horizon Europe and Digital Europe programmes, and European Structural investment funds to support industry and SMEs benefit from KETs.

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more sustainable throughout their life cycle are key for the goals of the European Green Deal and contribute to the zero pollution ambition set in it. They promote competitive sustainability and are necessary for green transport, clean energy and to achieve climate neutrality by 2050. The proposal addresses the social, economic and environmental issues related to all types of batteries.

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Photonics

We are on the verge of a new photonics era, and the European Commission is working to ensure citizens and businesses enjoy the full benefits of this technology.

Quantum

To unlock the transformative power of quantum, the EU should develop a solid industrial base that builds on its tradition of excellence in quantum research.

High Performance Computing

High performance computing refers to computing systems with extremely high computational power that are able to solve hugely complex and demanding problems.
