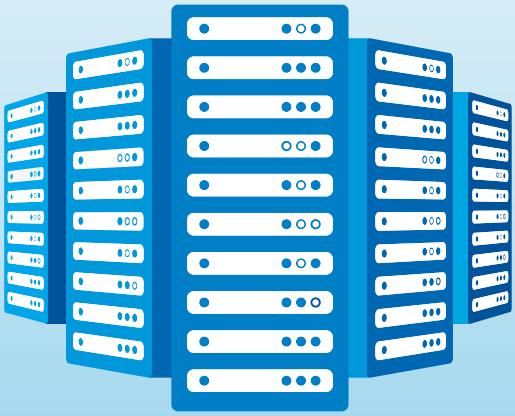
European Commission

# High Performance Computing (HPC)



## What is HPC?

HPC refers to computing systems having extremely high computational capabilities. Today these systems are able to perform more than $10^{15}$ operations per second (petascale) and are expected in a few years to reach $10^{18}$ operations per second (exascale), a computing power level comparable to aggregating all computing capabilities of the cell phones of the entire population in the European Union.

## Use of HPC

HPC is used to solve scientific and engineering problems computationally so complex and demanding that simulations cannot be performed using general-purpose computers.

**Societal challenges:** DNA sequencing, research and early detection and treatment of diseases, deciphering the human brain, forecasting climate evolution, space observation, preventing and managing large-scale natural disasters, designing renewable energy parks

**Science**: HPC and Big Data analysis provide scientist with deeper insights into previously unexplored areas and systems of the highest complexity, driving the innovation and discovery of almost all scientific disciplines, from earth sciences (climate modelling, weather forecast) to high-energy physics and to astrophysics and space exploration

**Industry**: significantly reduce R&D costs and development cycles, producing higher quality products and services, reducing the time of product development cycles.

Health | Automotive | Aerospace | Energy

**Example:** HPC has enabled automakers to reduce the time for developing new vehicle platforms from an average of 60 to 24 months, saving EUR 40 billion while improving crashworthiness, environmental friendliness, and passenger comfort.

High return on investment in HPC: each Euro invested in HPC on average returned EUR 867 in increased revenue and EUR 69 in profits.

**National security and defense**: increase safety and security, by simulating nuclear reactions, designing new aircraft fighters, developing strong encryption technologies or helping security authorities to access encrypted communications and perform large-scale suspicious pattern detection or face recognitions to secure sensitive areas

## EU and HPC

- EU is leader in the use of HPC applications but it owns no supercomputer in global top 10.
- EU industry provides about 5% of HPC resources worldwide, while it consumes one third of it.

## Biggest EU issues in HPC

- Lack of high-reaching and sufficient computing capacity in line with its human and economic power;
- Not competitive enough European supply industry;
- Risk of getting technologically deprived or delayed of strategic know-how for innovation and competitiveness;
- Risk of having the data produced by EU research and industry processed elsewhere for lack of corresponding capabilities in Europe;
- Lack of coordination and synchronised innovation procurement policies between the Member States;
- No Member State can develop the necessary HPC ecosystem on its own in a competitive timeframe with respect to the USA, China or Japan.

## EU HPC strategy

Upraise Europe's scientific capabilities and industrial competitiveness: converging HPC, Big Data and Cloud Computing technologies; building a competitive European HPC ecosystem.

Rank in global top 3: realising and procuring extreme scale supercomputers in 2020/2021 and in 2022/2023 based on EU technology.

## How EU is getting there

**EuroHPC Declaration:** a multi-government agreement in which the signatories Member States committed to work together and with the Commission to build and deploy state-of-the-art HPC and data infrastructures in Europe, available for scientific communities, public and private partners, upraising Europe's scientific capabilities and industrial competitiveness.

**EuroHPC Joint Undertaking:** a legal instrument providing a procurement framework for an integrated pan-European exascale supercomputing and data infrastructure will be proposed by end of 2017.

## Next steps:

- Establishing the legal instrument and have it operational in 2019 and 2020.
- Financing this instrument in the next multi-annual financial framework.