

ITAPA 2021
9 November 2021

**HPC and quantum technologies as drivers of innovation
and the digital transition**

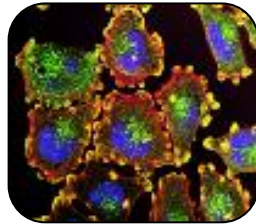
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DG CNECT - European Commission

HPC is strategic: transforming big scientific, industrial and societal challenges into innovation and business opportunities !

Strategic tool for Science

Personalised health



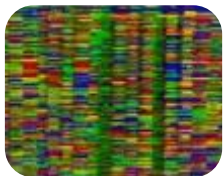
Cancer



Drug discovery



Drug design



Genomics

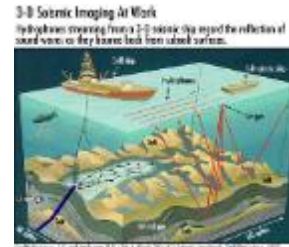


Climate change

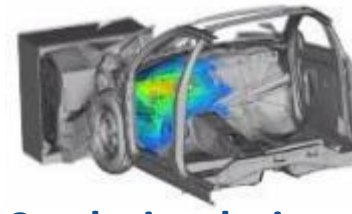
Strategic value for Industry



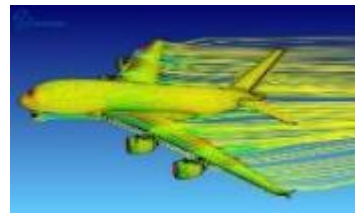
Wind plant modelling



Oil & Gas exploration



Crash simulations



Aerodynamics & structural analysis

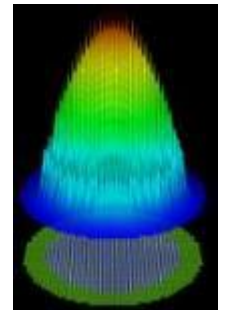


Pharmaceuticals

National security and defence



Cybersecurity



Nuclear reactor simulations



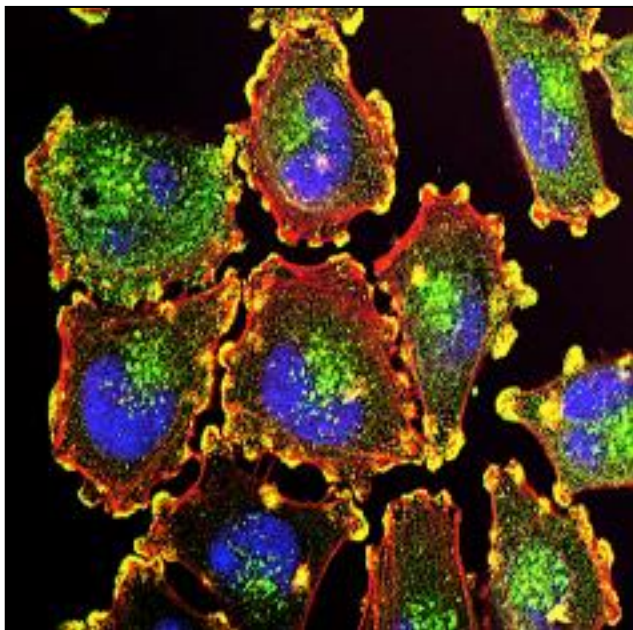
complex encryption technologies

Role of supercomputers in the pandemics

- **Planning and forecasting;** support containment measures with scenario buildings and simulations, evaluate post- epidemic scenarios
- **Dramatically accelerated drug discovery: Excalate4CoV**
 - EU supported powerful supercomputing platform to virtually analyse hundreds of billions of molecules against Covid-19 virus
 - Discovery of generic drug (*Raloxifene*) for earlier stages of Covid 19 disease; now in clinical trials
 - Other promising molecules were identified and are undergoing biological testing
- **Supercomputers in medicine;** cancer, human digital twin, personalised medicine



Why do we need Exascale Performance?



Cancer Analytics

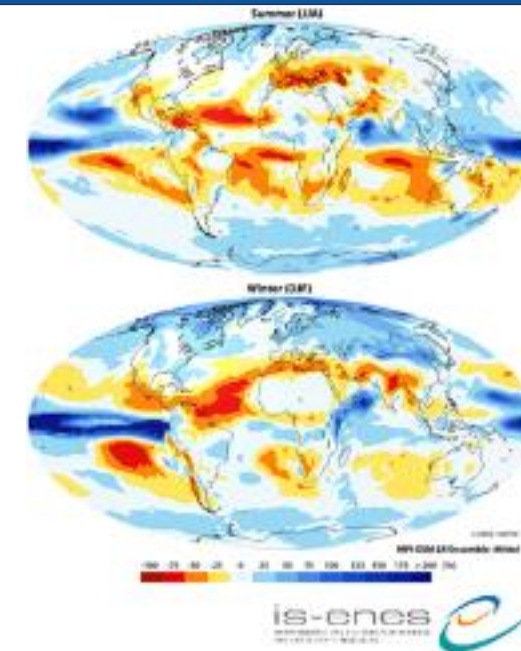
cell-specific interventions: Mapping genetic susceptibility to cancer and its outcomes; intracellular molecular signaling in complex mutational backgrounds; combine genetic, genomic, and clinical data

Full aircraft: real time virtual assembling and testing of millions of components from thousands of suppliers

Earth models: next challenge is to simulate at the 1 km² scale to accurate predictions of climate change



full aircraft simulation



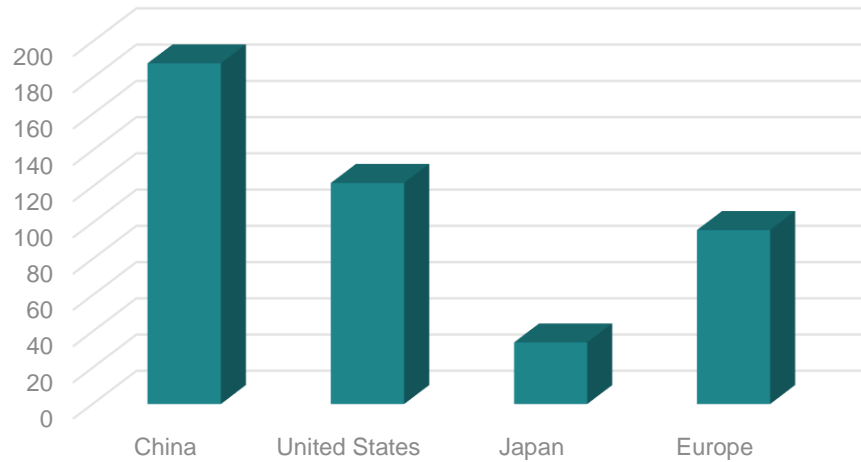
Earth models

Main drivers for HPC strategy in the EU

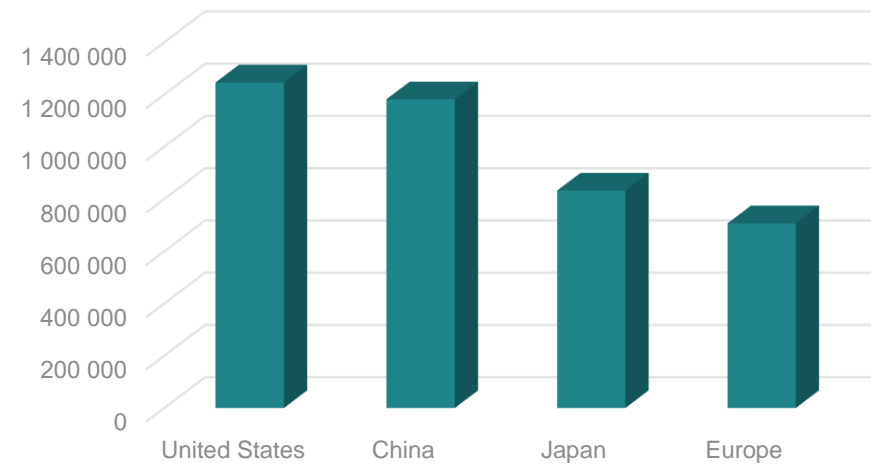
- EU investments are not at the level of its economic importance
- HPC applications are key contributors to the digitisation of industrial sectors (~53% of the Union's GDP)
- Exponential growth of data and computing
- Exascale performance and convergence in computing continuum
- Quantum computing technologies
- No EU processor technology in the top 500 supercomputers

HPC in Top500 (June 2021)

Number of supercomputers



Computing Power [Pflops]

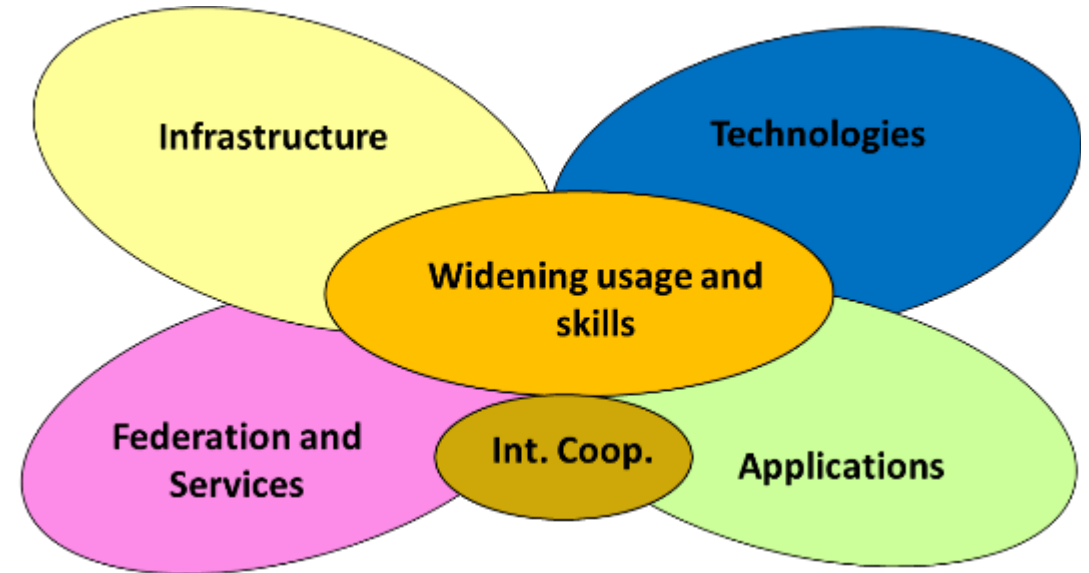


EuroHPC renewed mission 2021-2027



A legal and funding agency

- 29 Participating States (MS + NO, IS) + EU + 2 Private Members (ETP4HPC & BDVA)
- Budget: 7 B€ (EU + PS + In-kind Private Members)



- **Infrastructure** - HPC, quantum / Federation – hyperconnected
- **Technologies** – systems and its supply chain
- **Applications** – optimised for the systems
- **Widening** – support climate neutrality and digital leadership transitions

Infrastructure - HPC & Quantum



- (pre- and post-) Exascale supercomputers
- Quantum Computing
- Industrial-grade supercomputers

indicative

	2019 & 2020	2021	2022	2023	2024	2025	2026	2027
HPC Infrastructure	3 pre-exascale + 5 petascale systems	Several mid-range, pre-exascale and 2 exascale systems			exascale and post-exascale HPC systems			
Quantum Infrastructure	Pilot Quantum simulators interfacing with HPC systems (100+ Quantum units)		QComputer/ QSimulators (NISQ) with Basic HPC integration	QComputer/ QSimulators (NISQ) with Full HPC integration - HPC Accelerators		Prototype QComputers fitted with Error Correction and robust Qbits		

Strengthening the HPC Ecosystem

Technologies, Applications, Widening

Technologies for EU's strategic autonomy

- HW and SW and system integration, energy-efficiency
- Low-power (EPI/ARM, RISC-V), OpenSW Stack
- Algorithms, software technologies and tools
- Emerging computing paradigms and interconnection/integration with HPC systems

Applications for Excellence & Leadership

- HPC codes & applications for extreme computing and data (AI, HPDA, cloud, etc.) – Digital twins
- Centres of Excellence in HPC applications
- Code Industrialisation and deployment
- Large-scale HPC-enabled industrial pilots and test-beds

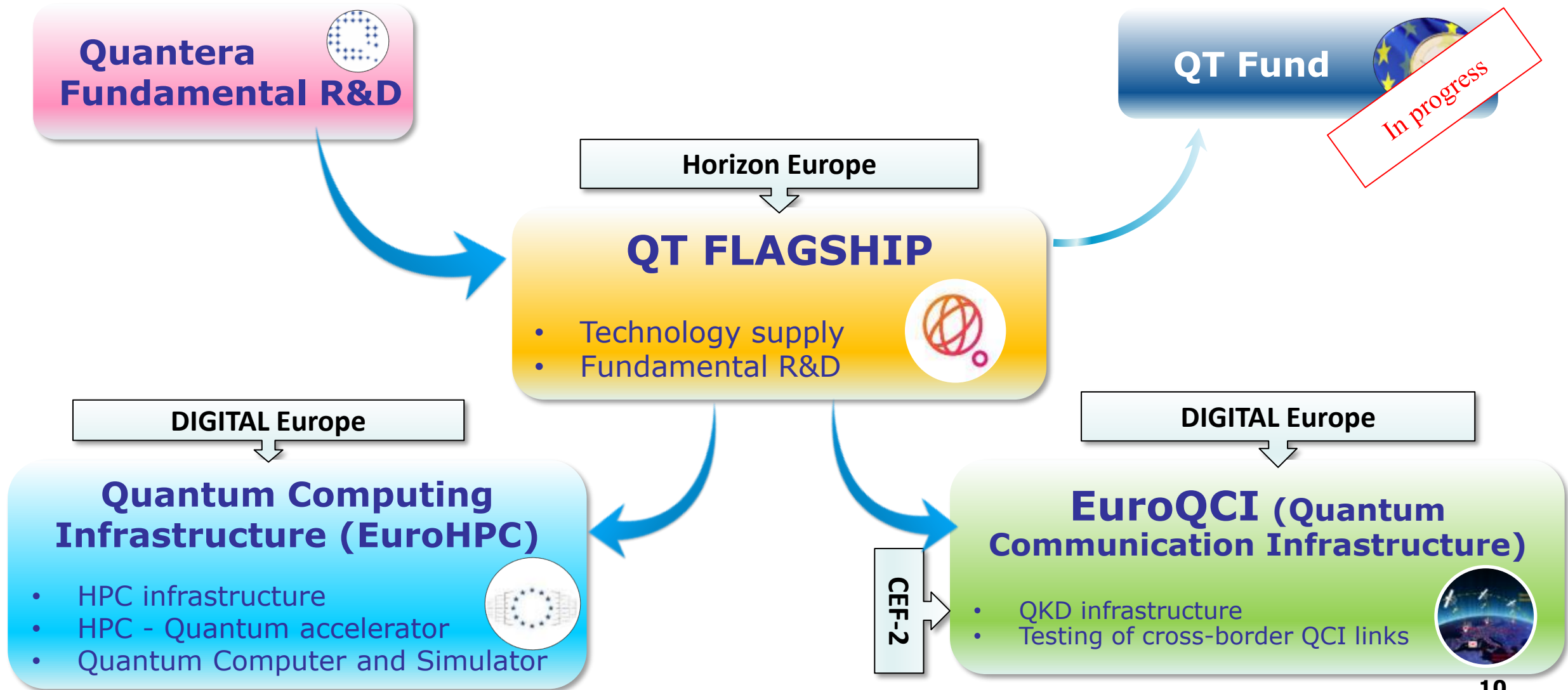


Widening use and skills

- Industrial access and use of HPC infrastructure
- Capabilities and skills in HPC/Quantum/Data
- National Competence Centres
- EU industrial users in HPC

indicative

QT Initiatives of the Union



Thank you!

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