ITAPA 2021
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HPC and quantum technologies as drivers of innovation and the digital transition

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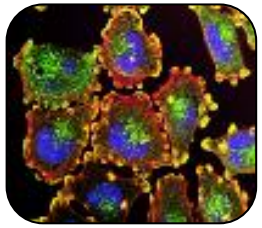
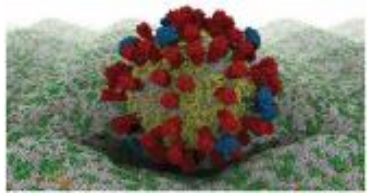
HPC is strategic: transforming big scientific, industrial and societal challenges into innovation and business opportunities !

Strategic tool for Science

Personalised health

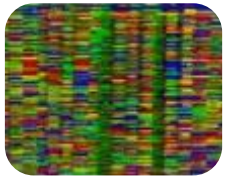


Cancer



Drug discovery

Drug design

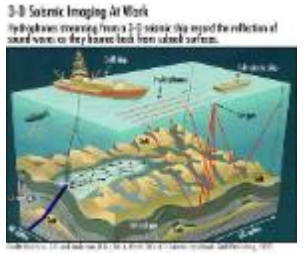


Genomics

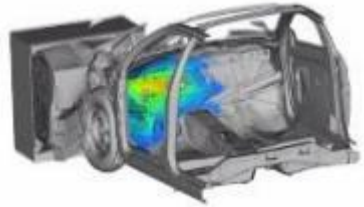
Climate change

Strategic value for Industry

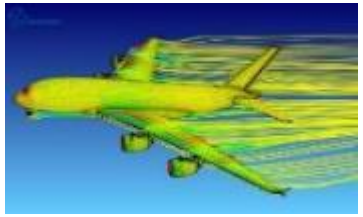
Wind plant modelling



Oil &Gas exploration



Crash simulations

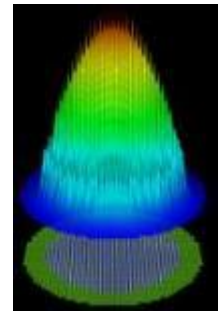


Aerodynamics & structural analysis

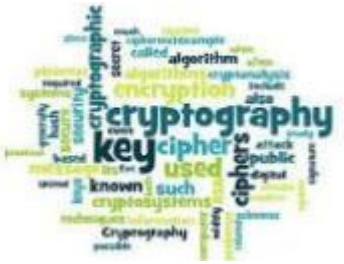
Pharmaceutics

National security and defence

Cybersecurity



Nuclear reactor simulations



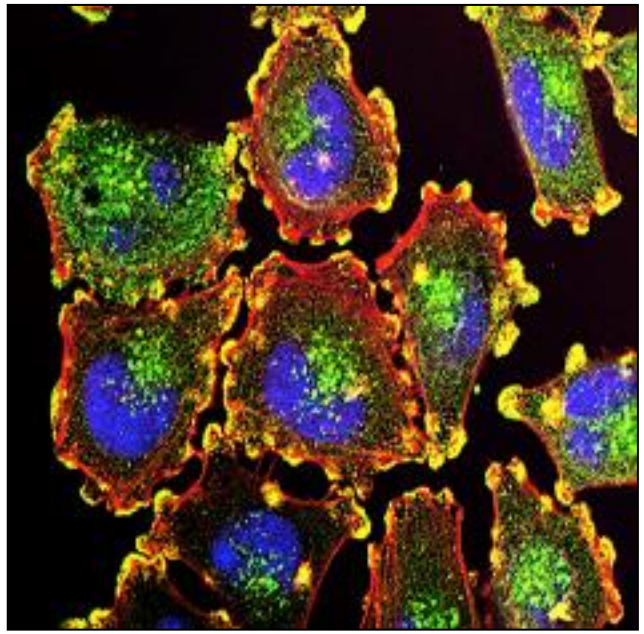
complex encryption technologies

Role of supercomputers in the pandemics

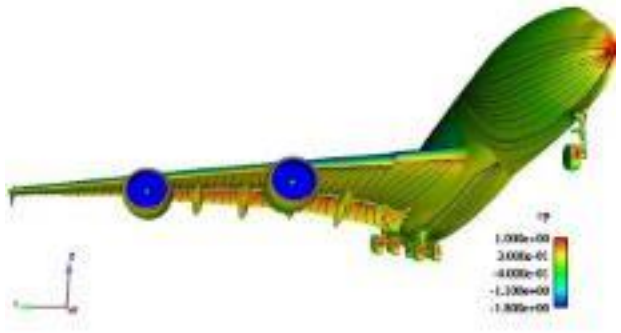
- **Planning and forecasting;** support containment measures with scenario buildings and simulations, evaluate post- epidemic scenarios
- **Dramatically accelerated drug discovery: Excalate4CoV**
    - EU supported powerful supercomputing platform to virtually analyse hundreds of billions of molecules 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

European Commission

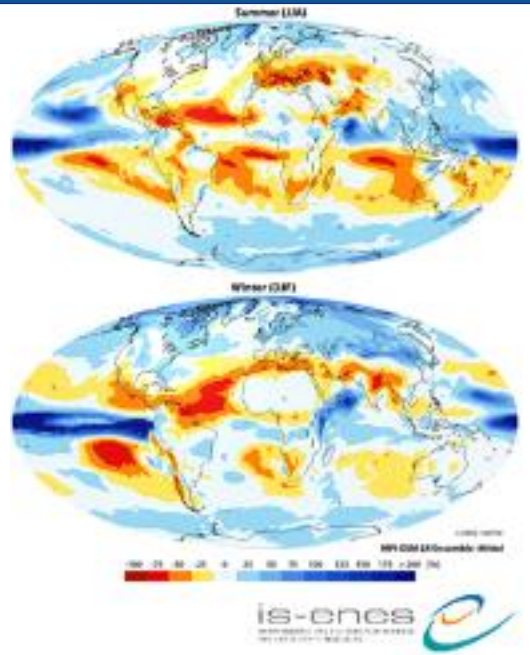
Why do we need Exascale Performance?



Cancer Analytics



full aircraft simulation



Earth models

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

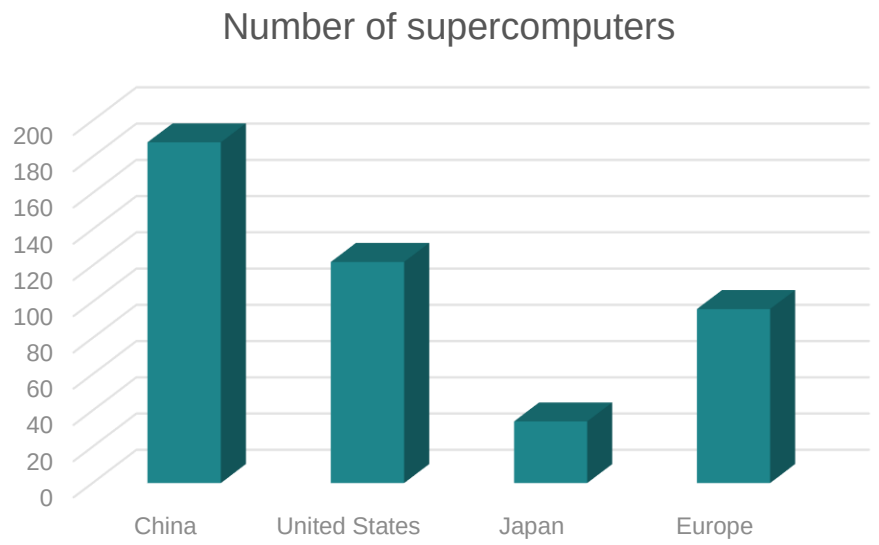
Full aircraft: real time virtual assembling and testing of millions of components from thousands of suppliers

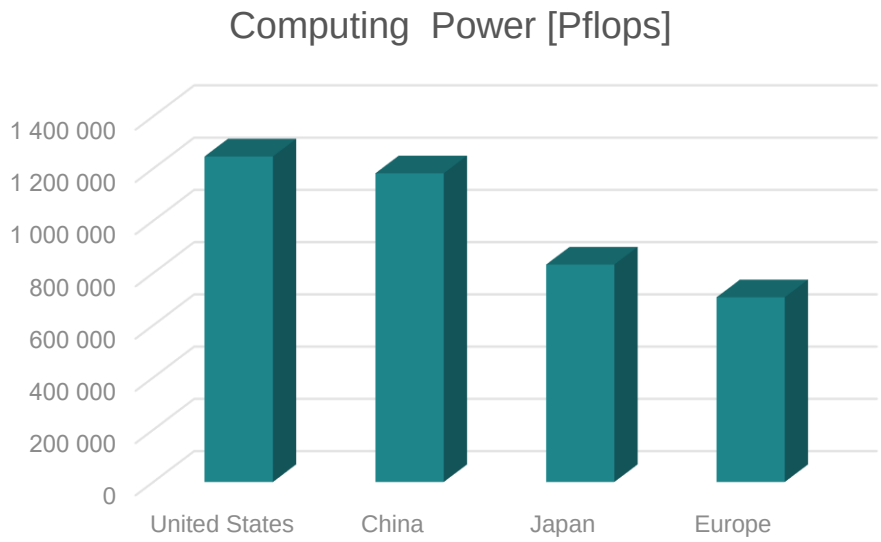
Earth models: next challenge is to simulate at the 1 km^2 scale to accurate predictions of climate change

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)



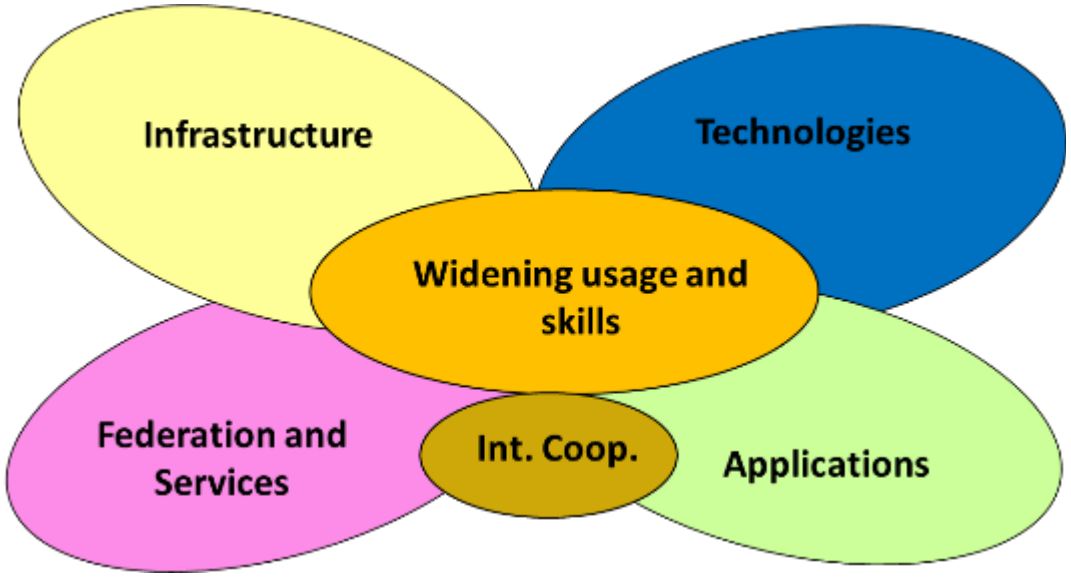


European Commission

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	

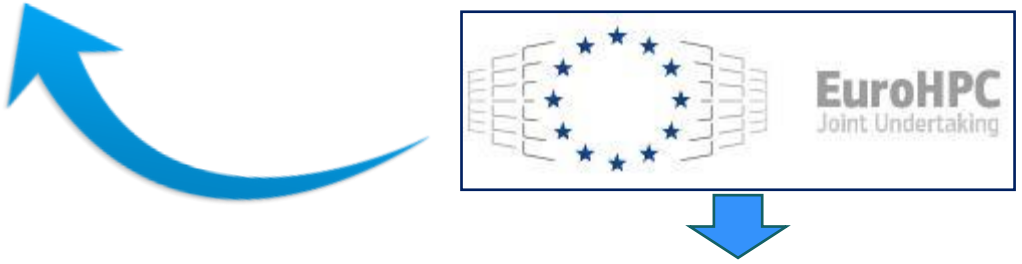
Strengthening the HPC Ecosystem Technologies, Applications, Widening

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

European Commission

QT Initiatives of the Union

Quantera Fundamental R&D

QT Fund

In progress

Horizon Europe

QT FLAGSHIP

- Technology supply
- Fundamental R&D

DIGITAL Europe

Quantum Computing Infrastructure (EuroHPC)

- HPC infrastructure
- HPC - Quantum accelerator
- Quantum Computer and Simulator

CEF-2

DIGITAL Europe

EuroQCI (Quantum Communication Infrastructure)

- QKD infrastructure
- Testing of cross-border QCI links

Thank you!

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