

# HPC in Italy: state of play, new initiatives, applications & collaboration opportunities

Mirko Cestari, Ph. D. – CINECA

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### **CINECA** pillars



#### SUPPORT FOR RESEARCH & INNOVATION

High Performance Computing and Data Analytics, Scientific Visualization, Virtual Interactive Environments, Research and development, Education and Training



#### SERVICES FOR UNIVERSITY & MIUR

Workflow Innovation, Dematerialisation, Security, Services and Solutions for University Administration and Ministry of Education, University and Research



#### **TECHNOLOGY TRASNFER**

Numerical Experiments, Prototyping, Problem Solving, Machine Intelligence, Health and Research Clinics, Numerical Forecasting



Example of human action detection across different frames of a video.



### Equivalent node hours





### Scientific Use-cases e Innovation Objectives



### Partecipation H2020 and HE Current Active Projects



EuroHPC Joint Undertaken



European Declaration on High Performance Computing, Declaration signed in Rome 23/03/2017 by: Italy, France, Germany, Luxembourg, Netherland, Portugal, Spain

# **32 participating countries** (Serbia joined recently)

The European Union (represented by the European Commission)

**Private partners** (represented by industry associations)

### #EuroHPC Joint Undertaking

The European High Performance Computing Joint Undertaking (EuroHPC JU) will pool European resources to develop top-of-the range exascale supercomputers for processing big data, based on competitive European technology.

Member countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden and Turkey.



# EuroHPC JU – Mission, Governance, and Funding

**Mission:** Establish an integrated worldclass supercomputing & data infrastructure and support a highly competitive and innovative HPC and Big Data ecosystem



### **European Supercomputers**

### 3 pre-exascale supercomputers:

- MareNostrum 5, ES
- <u>Leonardo, IT</u>
- LUMI, Nordic Countries

### 1 exascale supercomputers (2024):

• JUPITER, DE



# 5 peta-scale supercomputers: 4 mid-range supercomputers (2023): Discoverer, BG Deucalion, PT Vega, SI Capsir, IR

Ehpcpl, PL

- Meluxina, LU
- Karolina, CZ

### 720 M€ total EU investment

- Peta-scale/Mid-range (5-20 PF)
  - Pre-exascale (200-400PF)
  - Exascale >2024 (1000-2000 PF)
  - Post-Exascale >2027 Italy? (2000-5000 PF)

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# Centro Nazionale HPC, Big Data e Quantum Computing



### The ICSC will include 10 thematic Spokes and one Infrastructure cross spoke





### **Attract SMEs**



# HPC Infrastructure

### **Cineca HPC infrastructure**









### **Post-exascale Projection**







### Manifattura Tabacchi

At the Tecnopolo in Bologna, 1950s structure designed by Pier Luigi Nervi







D LOTTO 2

E

CINECA / INFN

F3

LOTTO 1 (LOTTO A) Face 2 F2

#### Capannone Miscela C2 - LEONARDO







20.2

### Supercomputer Leonardo



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## Leonardo Supercomputer & Quantum Computing





**Quantum Comp.** 200 qubit (2024) 500 qubit (2025)



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### **Quantum Computing**

**CINECA** plans to acquire a Quantum Computer

Initially the QC will be an experimental and dedicated system but the idea is to use QC as an **accelerator of Leonardo** 

Some QC technologies are under investigation

It will be considered **QC European technologies** 

Time frame: installation H2-2024

Total investments will be in the order of





(•) AQT



### Upgrade Galileo100

### CINECA plans to upgrade G100

Leonardo will remain a **conventional** HPC system

# G100 will be upgraded to become an important cloud asset

G100 will stay in the Casalecchio area

Time frame: installation 2024

Most of the investments will be used for the **cloud partition** 

Total **investments** will be in the order of:





### **Cloud HPC relevant use cases**

- Establishe<u>d since</u> 2015 **Real-time data projects** (e.g., data coming from sensors)
  - Acting as computing and data repository backend  $\cap$
  - Leveraging fast IO storage (full flash) for NoSQL DB 0
  - Supporting MQTT publish/subscribe messaging pattern 0
  - Workloads processing sensitive data •
    - Leveraging LUKS volume encryption directly from the dashboard
    - Completely transparent to users (no key managing hurdle)
  - Projects requiring huge amount of data (e.g., coming from HPC • simulations) to be exposed on the web
    - Full stack software can be deployed to address the use case
  - And many other where environment flexibility is key 0
    - Data analysis framework 0
    - Monitoring Ο
    - Backup 0



self provisioning, managed via dashboard or

CLI



# **E4** Meet Monte Cimone – First HPC-like RISC-V Cluster

### Question:

How mature is the RISC-V ecosystem? Is the **RISC-V ecosystem mature** enough to build HPC production clusters?

### This work:

We designed and built **Monte Cimone**, the **first physical prototype** and test-bed of a **complete RISC-V (RV64) compute cluster** integrating **compute**, **interconnect**, *a complete software stack for HPC* and a full-featured system monitoring infrastructure.





### Thank you

Dr. Mirko Cestari

HPC and Cloud Technology team coordinator

CINECA, <u>www.cineca.it</u>

Mail: m.cestari@cineca.it



