Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

ICSC
Centro Nazionale di Ricerca in HPC,
Big Data and Quantum Computing

Unleashing Potential: High-Performance Computing, Big Data and Quantum Computing for Innovation

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EGI2024, 2/10/2024

5 National Centers

€1.6B
From the Italian NRRP

1. **ICSC: HPC, Big Data and Quantum Computing**
2. **Agricultural Technology (Agritech)**
3. **Sustainable mobility**
4. **Drugs development with RNA technology and gene therapy**
5. **Bio-diversity**

From 1/9/2022 to 28/2/2026

The #Beginning

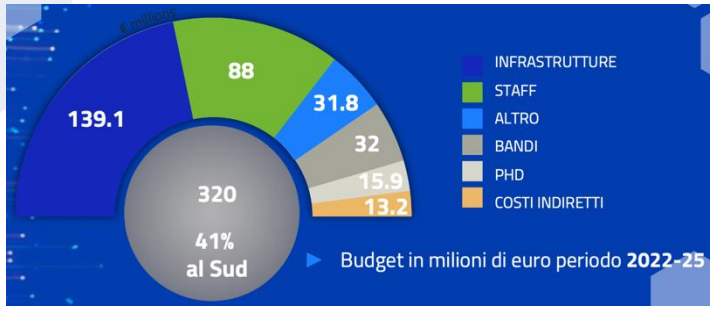
Kick-off Meeting ICSC (Bologna, 25/11/22)

What are the main ICSC objectives?

1. To **create a national computing infrastructure**, boosting and federating the existing HPC, HTC, Big Data and network infrastructures and new targeted resources procured by means of the CN funding, and providing a flexible and uniform Cloud Interface.
2. To **create a globally attractive ecosystem around the infrastructure** supporting academia and enterprises, fostering the exploitation of the computing resources and the development of new computing technologies.

It's remarkable that the Ministry for Education and Research explicitly required to direct all our activities «**From Research to Business**».

12 Istituti di Ricerca



25 Università

Istituti Nazionali

INFN Istituto Nazionale di Fisica Nucleare · CINECA · ENEA · Consiglio Nazionale delle Ricerche · INAF · Istituto Nazionale di Geofisica e Vulcanologia · Consortium GARR

HUBs

UNIMORE Università degli Studi di Modena e Reggio Emilia · Università di Parma · OGS

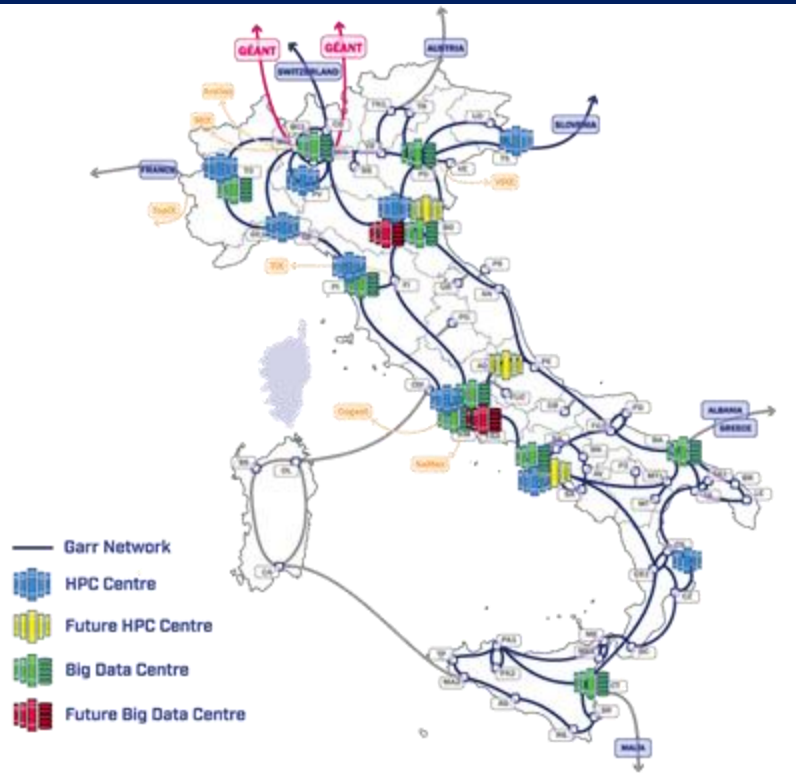
ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

14 Aziende private

ENGINEERING The digital transformation company · eni · Ferrovie dello Stato Italiane · Fincantieri · fondazione innovazione urbana · autostrade per l'italia · Humanitas Research Hospital · iFAB International Foundation Big Data and Artificial Intelligence for Human Development · Intesa Sanpaolo · Leonardo · sogei · ThalesAlenia Space · Terna Driving Energy · UnipolSai Assicurazioni

Organization

0 SUPERCOMPUTING CLOUD INFRASTRUCTURE



1 FUTURE HPC & BIG DATA

2 FUNDAMENTAL RESEARCH & SPACE ECONOMY

3 ASTROPHYSICS & COSMOS OBSERVATIONS

4 EARTH & CLIMATE

5 ENVIRONMENT & NATURAL DISASTERS

6 MULTISCALE MODELING & ENGINEERING APPLICATIONS

7 MATERIALS & MOLECULAR SCIENCES

8 IN-SILICO MEDICINE & OMICS DATA

9 DIGITAL SOCIETY & SMART CITIES

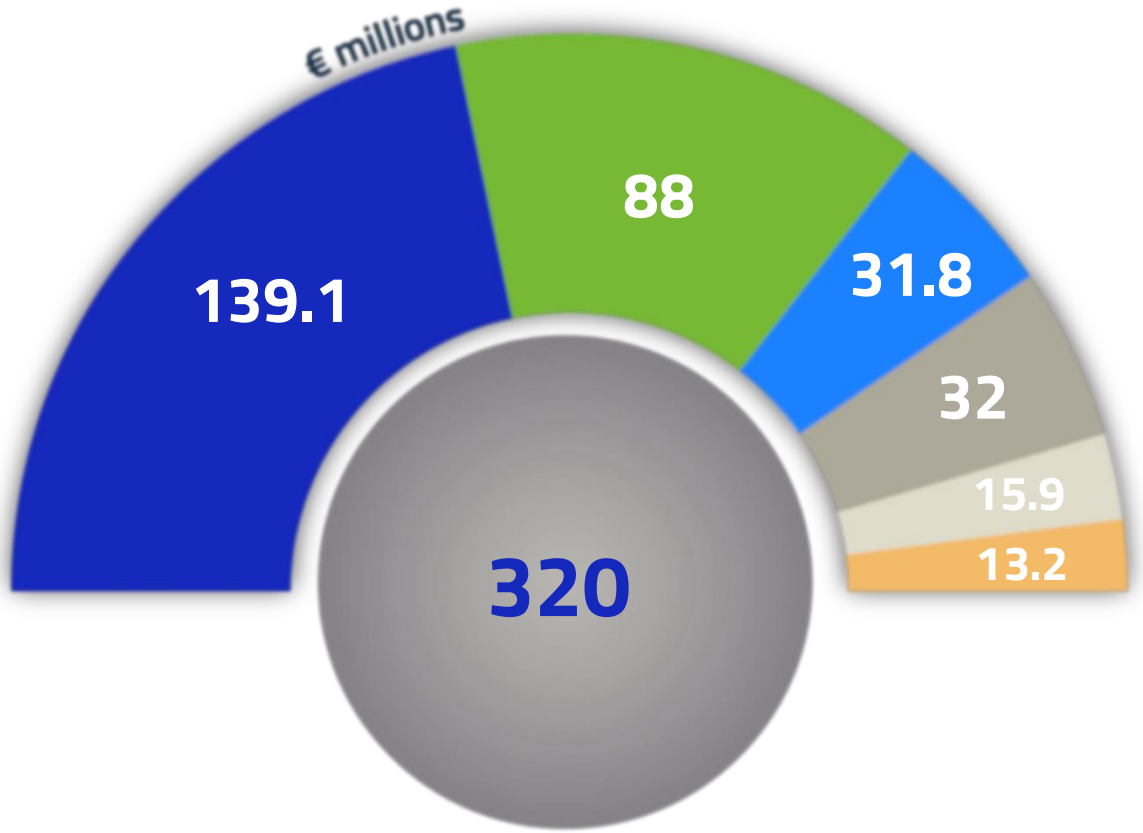
10 QUANTUM COMPUTING

SII TRANSVERSAL RESEARCH GROUP on SOCIETAL IMPLICATIONS AND IMPACT

Budget

~ 270 New Researchers

~ 337 PhD Postdoc Research Grants



6.325 M€ Annual Contribution from ICSC members

ICSC Innovation Themes

1. Act on infrastructures
2. Act on needs
3. Act on know-how
4. Act on opportunities

Within the National and European context

The ICSC Plan

- The ICSC innovation actions are tightly connected to its foundational elements:
  - A publicly funded infrastructure, based on Open Science and FAIR data (no "vendor lock-in")
  - For research and business
  - With a massive ecosystem collecting and empowering the best national expertise
  - That transparently integrates Cloud, Quantum and HPC resources through a continuum of solutions, building a «Supercomputing Cloud Infrastructure»
  - Presenting a uniform, dynamic solution portfolio, production-level (not simply «testbeds» or «playgrounds»)
  - Able to federate other resource providers and to aggregate diverse communities and organizations
- Nothing like this exists at this scale in other Countries
  - This goes **well beyond the 2022-2025 NRRP**. It is a national strategic asset for innovation.

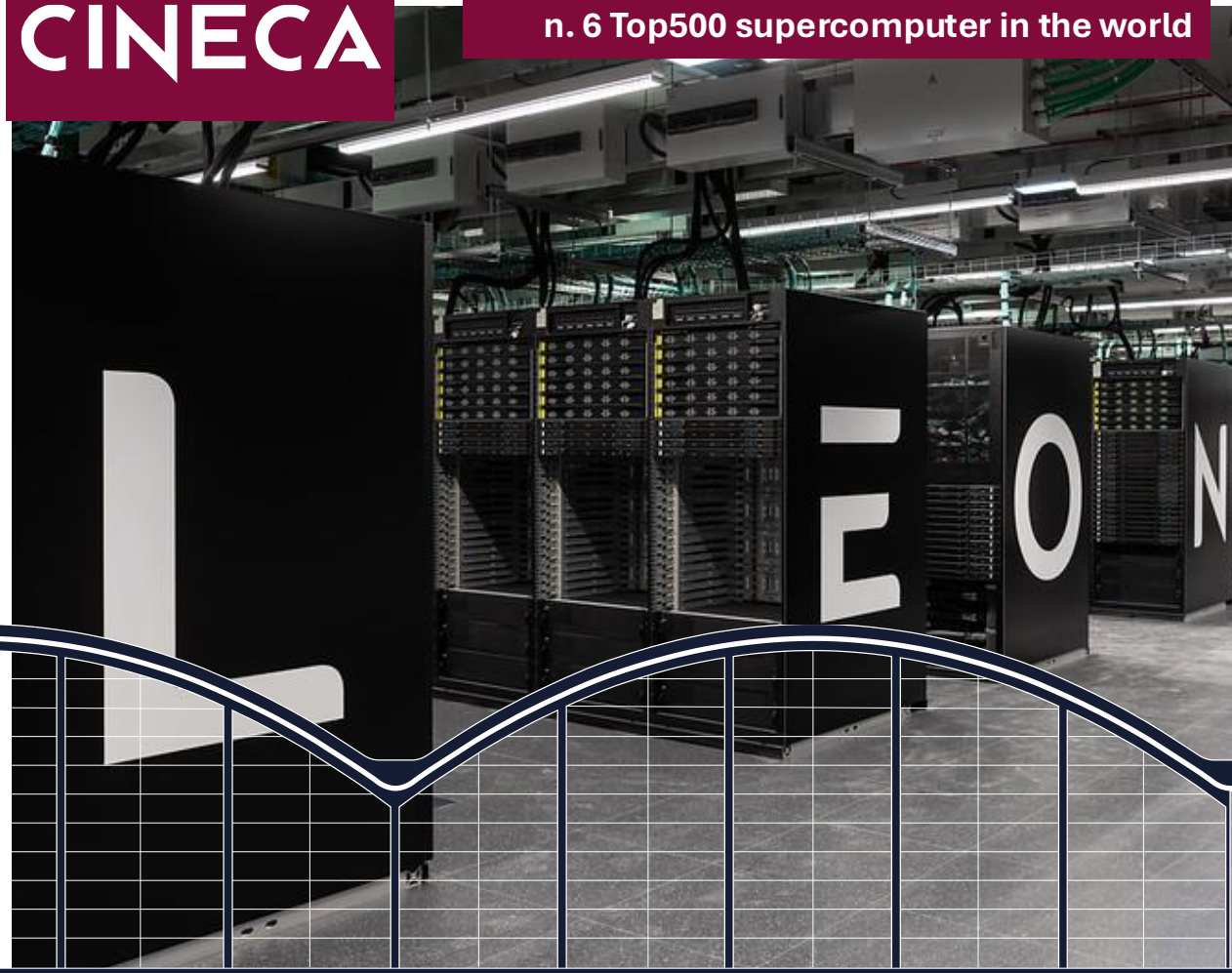
The big Italian data centers

#Tier1
Inaugurato il 10 Maggio 2024

INFN CNAF
Istituto Nazionale di Fisica Nucleare

CINECA

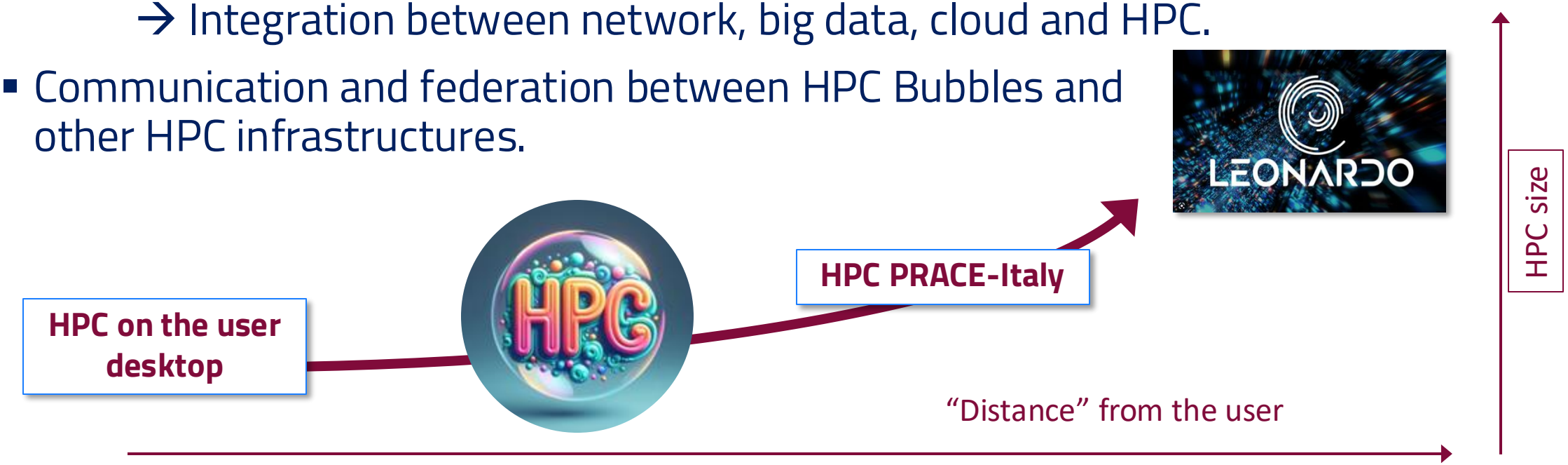
#Leonardo
n. 6 Top500 supercomputer in the world



The "HPC Bubbles"

- Ambition: deliver "HPC at all scales".
- HPC Bubbles: HPC Cloud-native resources and services, made available at the IaaS, PaaS e SaaS levels.

  → Integration between network, big data, cloud and HPC.
- Communication and federation between HPC Bubbles and other HPC infrastructures.



Which resources/services are provided by ICSC?

- "Bare metal" resources: Cloud, Traditional HPC, Quantum Computers
- "Standard" services built upon these resources, for instance:
  - Jupyter notebooks, interactive high-performance computations
  - Cloud systems to store (disk / tape) and analyze sensitive data in ISO-certified regions (e.g., health-related data)
  - Multi-site resource orchestration
  - Data management, with multiple access policies
  - "Sync-and-share" (Dropbox-like), support to VMs, container, etc.
- Soon: consultancy services to customize the ICSC solution portfolio

Who can access the ICSC resources and how?

- **Requests for resources and services** can currently be made by ICSC affiliates, by beneficiaries of cascading calls, by beneficiaries of the I4S initiative (start-ups), or by projects for which there is an agreement with ICSC.
- The allocation of ICSC resources is done through an online application, analyzed by the **ICSC Resource Allocation Committee** (RAC).
- To date, the RAC has evaluated more than 90 requests, assigning about 150 million core-hours on Leonardo, about 13,000 CPU cores on Cloud/Grid, about 3 PB of disk space and about 5 PB of tape space.

Support for innovation

32 M€
Cascade Grants

31 M€
Innovation Funds

I4S

- **Publication of 13 Cascade Grants, reserved to public and private institutions that are *not* already ICSC members**
- **76 high-TRL innovative public-private research projects funded, proposed and led by private companies**
- **I4S: support program for innovative startups and SMEs**

The "Cascading Grants"

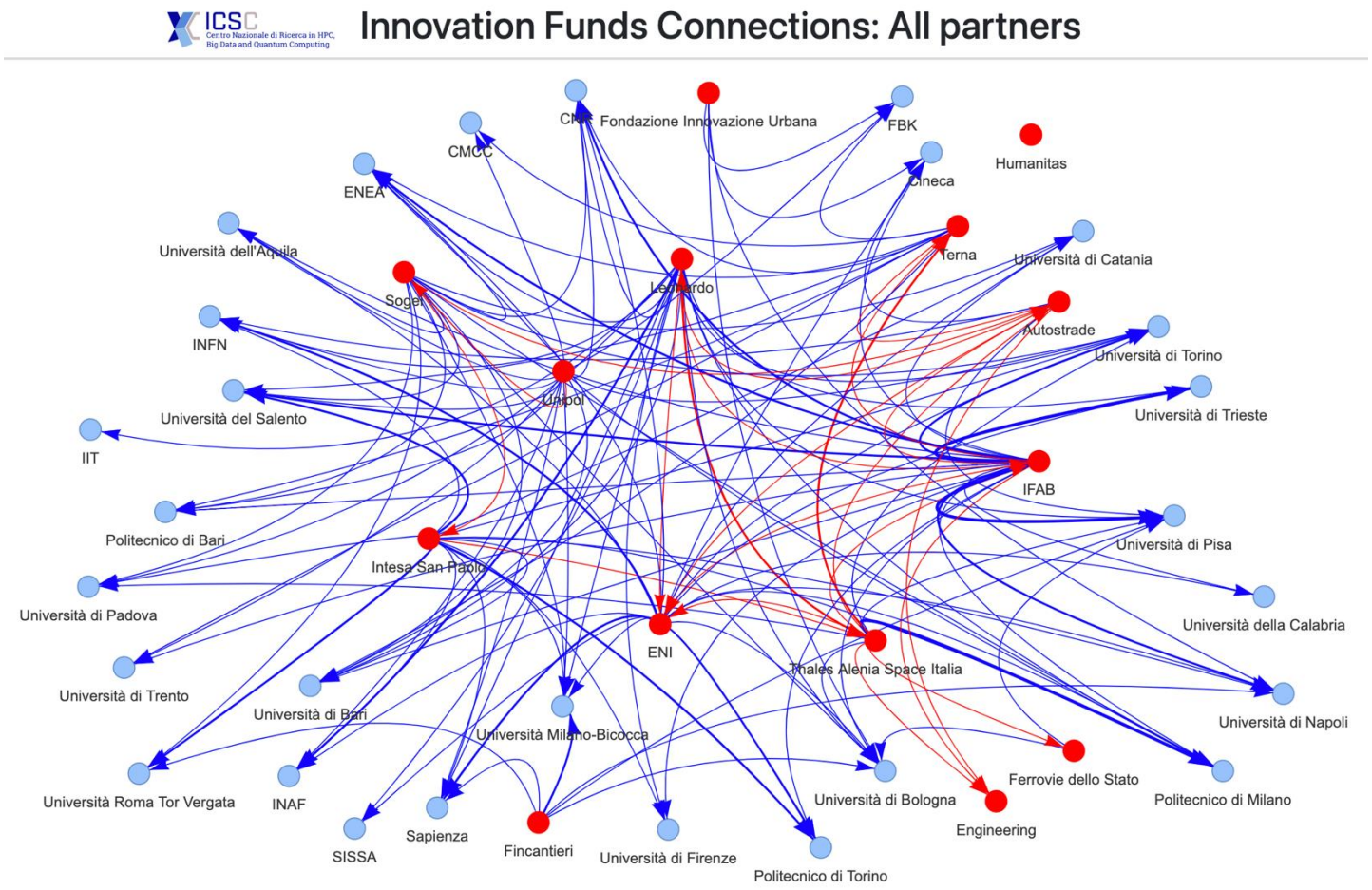
- Calls issued by the ICSC Spokes 1-10, aimed at institutions that are not part of the ICSC consortium, for the implementation of projects related to activities taking place in each Spoke.
- 13 calls published and closed, total cost ~32 M€ (the results of the calls are being evaluated right now)

https://www.supercomputing-icsc.it/bandi-a-cascata/

The Innovation Projects

Through 3 "Innovation Funds" calls, we have approved **76 projects** of industrial interest reserved to ICSC affiliates. All projects are coordinated by a private institution and may also involve other ICSC partners, be they public or private.

The total cost of the approved innovation projects is ~31M€, with an allocated subsidy of ~26M€.



What are the innovation projects about?

- Areas of industrial interest on several topics. For instance:
  - Predictive Maintenance
  - Weather & Energy
  - AI-Optimized Fuel Efficiency
  - Digital Twins for Precision Agriculture
  - Hazard Mapping & Vulnerability Monitoring
  - Reactive and Adaptive Earth Observation Space Distributed Constellations Systems
  - …

https://igdb.supercomputing-icsc.cloud/

Support to Start-up (I4S)

I4S (**ICSC for Start-up**) is an initiative launched just before summer 2024 aimed at innovative start-ups and SMEs, with an initial funding of €500,000, **through ICSC's non-NRRP money** (it was not an initiative of the official ICSC program).

Requirement: we expect the proposal of a highly innovative project related to HPC/big data. It is an "open-end call" with 3 non-mutually exclusive participation options:

- Limited financial support
- Access to ICSC compute or storage resources
- Support, to be provided by ICSC affiliates, related to the implementation of the proposed project

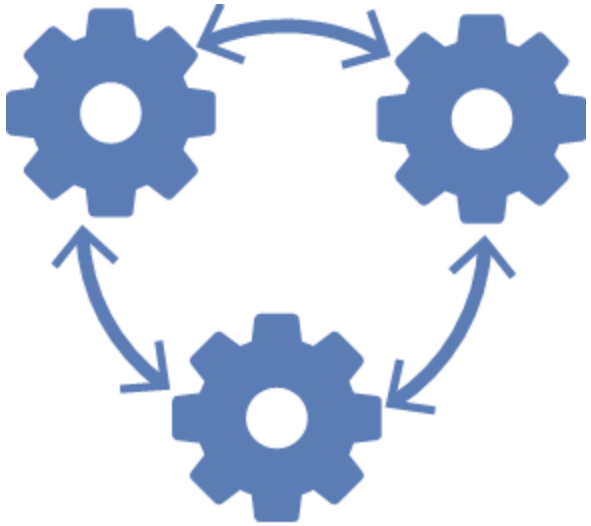
We are currently examining the first applications. The goal is to sign the implementation agreements for the selected Start-ups/SMEs by December 2024.

https://www.supercomputing-icsc.it/icsc-4-startup-i4s/

Agreements with/for enterprises

Accordo	Oggetto
Uptown Basel / Quantum Basel, Switzerland	Exchange of staff, students, training programs; use of mutual resources in the field of Quantum Computing, scientific collaborations
SPRIN-D, Germany	Agreement for the submission of highly innovative projects by European companies, funded by SPRIN-D and which will be able to use ICSC computing resources and data
Call EUROHPC-2024-CEI-IND-01	Expression of interest for the selection of EuroHPC Hosting Entities to provide Industrial-grade supercomputers
ICSC support to Start-Ups I4S	Non-repayable offer of funds and computing resources, aimed at start-ups and innovative SMEs

The ICSC Observatory



OS
Osservatorio sulle tendenze e le applicazioni del Supercalcolo

Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

Kick-off meeting of the Observatory on Supercomputing trends and application (Bologna, 19/01/2024) and first meetings with stakeholders (Naples, 6/03/2024 – Turin, 18/06/2024)

https://osservatorio.supercomputing-icsc.it/

Planned events of the ICSC Observatory

9 **Eventi sul territorio**

- 19 gennaio 2024 – Bologna
- 6 marzo 2024 – Napoli
- 18 giugno 2024 – Torino
- 24 ottobre 2024 – Catania
- Gennaio 2025 – Firenze
- 5 marzo 2025 – Milano
- Aprile 2025 – Bari
- Giugno 2025 – Roma
- Luglio 2025 – Padova / Venezia

16 **Webinar tematici**

4 realizzati
tra aprile e settembre 2024

12 in calendario
tra settembre 2024 e luglio 2025

OS Osservatorio sulle tendenze e le applicazioni del Supercalcolo

Ethics & Data Governance

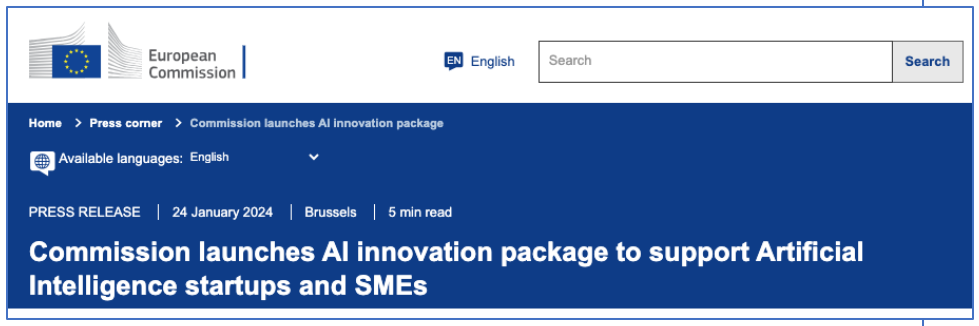
- Ethical review of all research projects ongoing; it is now part of the overall ICSC activity process
- Definition of a global Data Management Plan
- Implementation of guidelines and policies defined together with the Ethics Governance Board
- Activation of European projects in collaboration with Ethics Governance board members

European Open Science Cloud

- EOSC is an initiative of the European Commission born in 2015 to promote a cloud infrastructure that bases its services on the principles of open science
- EOSC aims to give the EU a global lead in research data management and ensure that European scientists reap the full benefits of data-driven science

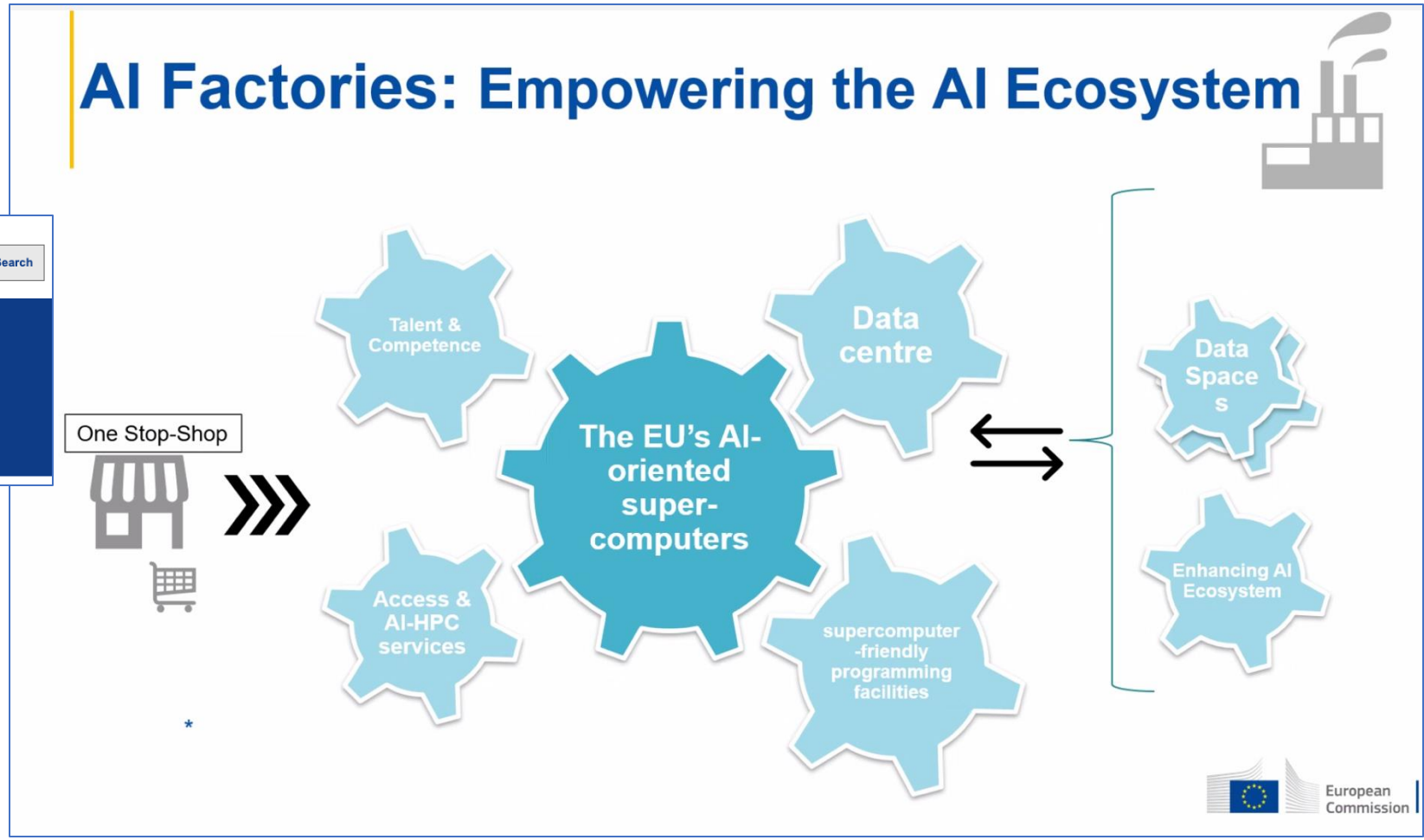
- **ICSC has applied to become a national node of the European EOSC network. Italian institutions that are not already part of the ICSC Consortium are welcome to join the national node.**

The European Context



Call **EuroHPC AI-Factory**:

- Due 4/11/2024
- 200+200 M€ budget



https://ec.europa.eu/commission/presscorner/detail/en/ip_24_383

AI Factories & AI Ecosystem

Up to 1.6 B€

EU strategy on AI Factories

(Networked) AI Ecosystems
- AI supercomputers (new)
- Upgrades of (AI-) supercomputers
- Dedicated HPC/AI services
- Application support
- Access policy to supercomputers
- Access to data / common EU data spaces
- Support to AI EDIC (ALT-EDIC)
- Human talent and skills
- Collaboration with AI Office – EU values

National strategy on AI Factories

Invest in an AI ecosystem
- AI-supercomputer
- Data centre(s)
- Access to data + open gov. data
- Dedicated services
- Human talent and skills, incl. investing in housing facilities
- Cooperation with Universities
- Local GPU clusters
- Digital Innovation Hubs
- AI start-up policy (access to capital, tax incentives, etc.)

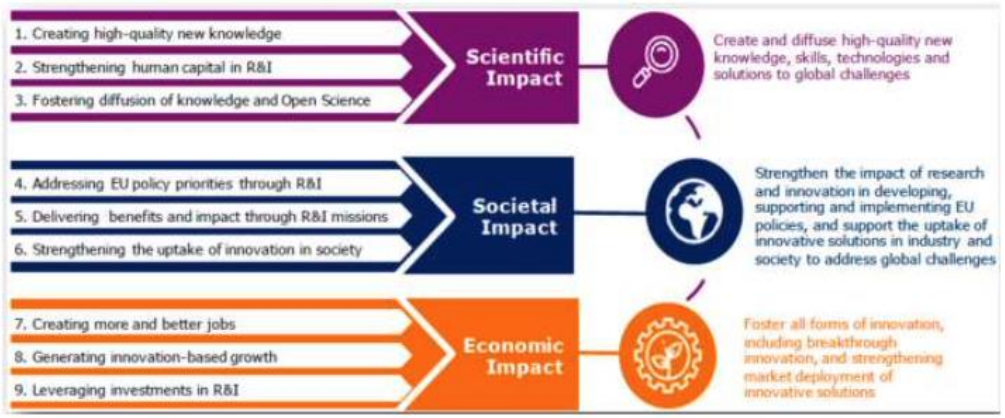
ICSC

Data spaces | Access to supercomputers | HPC for AI services | TEFs for AI

Data centre | Talent | Cooperation with universities | Digital Innovation Hubs for AI

Some final words about innovation and impact

- The **impact** of ICSC's activities is **scientific, economic and social**. For example:
  - *Scientific*, for the fundamental and applied science results that take place in our 11 Spokes.
  - *Economic*, for the expected outputs of many innovation projects, from cascading calls, from support to start-ups.
  - *Social*, for applications of both these components, e.g. as in the health, environment or mobility sector.



(Source: European Commission)

From goods to knowledge

August 24

- We are globally and very rapidly moving from an economy based on the **production of material goods** to an economy based on **knowledge**.
- A concise definition of what an HPC system (or, in ICSC parlance, a "Supercomputing Cloud Infrastructure") is, is simply that it is a knowledge accelerator.
- This is for us closely linked to the creation of a **portfolio of educational services**, which we are actively working on.

Education Area – Main lines

- **Bridge the gap** between professionals with strong vertical skills and professionals with IT skills in the HPC, Big Data, Cloud, Quantum domains.
  To this end, we have already launched the first initiatives in different disciplinary areas such as, for example, bio-informatics.
- **Train new professionals** in areas where the demand for professionals exceeds the supply.
- **Define one or more job profiles** for supercomputing and data management professional.

#Some significant events

Napoli 29-30/05/2024 ‘Inauguration of the UNINA Superconducting Quantum Computing Center’

#Some significant events

Bologna 10/05/2024
‘Bologna Technopole, the factory of Future’

#Some significant events

Bologna 12/06/2024

Conference and show, '**Science 4.0: Research and knowledge in the age of artificial intelligence and quantum computing**'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Supercomputing
shaping the future
https://www.supercomputing-icsc.it/