FONDAZIONE BRUNO KESSLER
MAGAZINE

Also FBK and UNITRENTO in the project of the supercomputing center

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The new National Research Center in High Performance Computing, Big Data and Quantum Computing, led by INFN has the participation of Fondazione Bruno Kessler and UniTrento among its 51 founding members spread across the country.

There is a little bit of Trentino in the **National Research Center in High Performance Computing, Big Data and Quantum Computing**, one of the five National Centers to be set up through the PNRR National Plan for Recovery and Resilience that will be built at the Bologna Technopole and will be led by the INFN National Institute of Nuclear Physics.

The Center will count on the contribution of 51 partners from all over Italy, from the public and private sectors, scientific research and industry, and a funding of nearly 320 million euros, to build the largest Italian system dedicated to high-performance computing, big data management and quantum computing, a cross-cutting infrastructure to support the main industries that are strategic for the country today with Hub at the Bologna Technopole.

"***Fondazione Bruno Kessler*** *has established strategic collaborations with many Italian companies and institutions in the field of data analytics and Artificial Intelligence, topics that increasingly require high-performance computing capabilities* – said **Andrea Simon**i, FBK -Secretary General – *For this reason, the participation in the National Research Center in High Performance Computing, Big Data and Quantum Computing, together with many of the companies and institutions mentioned above, represents an important step that will allow to pool the results achieved and to relaunch by increasing the reputation of our institution at the European level*."

Marco Cristoforetti, head of the Data Science for Industry and Physics Unit of the FBK Digital Industry Center, detailed some of the areas that FBK under the new National Center will focus on: "*Digital society, smart cities, climate, predictive medicine and omics data: these are the areas in which high-impact issues for the lives of all of us can be addressed by FBK*

researchers, thanks in part to the collaboration with the other institutes and universities involved and the computational resources made available by the National Center."

FBK will contribute to the work of the new national initiative in particular through the Digital Society and Digital Industry Centers.

"We are extremely proud to be part of the PNRR ICSC initiative," also commented the scientific officer for the University of Trento, Professor Sandro Fiore. "The University of Trento will have the opportunity to work at the frontier of research on High Performance Computing, Big Data and Quantum Computing in a context of national scientific excellence, contributing to cutting-edge topics for the Trentino region, such as climate, smart cities and the materials field. A scientific endeavor that among other things promotes a strong interdisciplinary, innovation and sustainability perspective."

The governing bodies of the ICSC Foundation, which will manage one of the five National Centres to be set up through the PNRR National Recovery and Resilience Plan took offic on July 19. Thus, the National Center for Research in High Performance Computing, Big Data and Quantum Computing was created, which, **proposed by the INFN** National Institute of Nuclear Physics, has 51 founding members spread throughout the country from the public and private sectors, the world of scientific research and industry. The new National Center will be based at Tecnopolo di Bologna, a citadel of innovation promoted by the Emilia-Romagna Region, thanks in part to investments by the Italian government and the European Community, which already houses the Data Center of the European Weather Center (ECMWF) and will soon host the **Leonardo supercomputer** managed by CINECA, and the INFN Computing Center, and will network and systematize the specific knowledge, skills and resources of entities operating throughout Italy in multiple fields, with the aim of building a distributed and cross-cutting infrastructure that supports scientific research and the productive world in the innovation and digitization of the country.
ICSC, consistent with the strategic goals of the PNRR, will achieve its specific objectives by promoting youth careers and initiatives to overcome the gender gap in professional careers and between the North and the South of the country.
To carry out its mission, ICSC will count on funding, on Next Generation EU funds within the Education and Research Mission of the PNRR coordinated by the MUR Ministry of University and Research, amounting to Euro **319,938,979.26**, of which 41% will be invested in the South. In particular, of the total funding, more than 100 million euros will be dedicated to personnel, an investment that is considered a priority, with female participation of at least 40 percent, and with nearly 16 million euros set aside for doctoral fellowships and thus for the higher education and careers of young people.

At the first plenary meeting, ICSC's founding members elected **Antonio Zoccoli**, president of INFN, as the **Foundation's president**, as well as the ten members of the Board of Directors: Emilio Fortunato Campana from CNR, Paolo Maria Mancarella from the University of Pisa, Francesco Scarcello from the University of Calabria, Donatella Sciuto from the Politecnico di Milano, Simona Tondelli from the University of Bologna, Francesco Ubertini from CINECA, Matteo Laterza from UnipolSai, Elisabetta Oliveri from Autostrade per l'Italia, Andrea Quacivi from Sogei, and Francesca Zarri from Eni. The first meeting of the Board of Directors followed.

Why. The context. Ours is a data society. In more recent years, the increasing digitization of virtually every human activity has produced and made available a huge amount of data and information, and in the near future this trend will increase more and more, already producing unprecedented masses of data in the coming years. Storing, sorting, sharing, processing, and interpreting this data, the so-called **big data**, has become today's great undertaking to make the country competitive, both in scientific research and in the production system, so as to be able to meet the present and future challenges on key issues for our society and our Planet, such as protecting the environment, protecting personal and public health, building smart cities, and sustainable development. The management of big data is therefore a priority, for which massive computing resources, the development of innovative technology solutions, such as **quantum computers,** and increasingly advanced mathematical and statistical algorithms and models are needed. In this context, **supercomputing, numerical simulations, artificial intelligence, machine learning, and frontier technologies** are essential tools for stimulating developments and discoveries of both the industrial world and the world of scientific research, and thus for the economic and cultural growth of our society. ICSC aspires to become an attractive ecosystem at the international level, strengthening Italian competitiveness and contributing to Europe's leadership in the field.
This is the scenario in which the National HPC, Big Data and Quantum Computing Center was created, with the triple purpose of building an **Italian supercomputing infrastructure**, to aggregate research and innovation resources in the most strategic sectors for the country, and to position itself as the national platform to support scientific and industrial initiatives.

What. The Mission. The Center will carry out R&D activities, nationally and internationally, in support of **innovation in the field of high-performance simulations, computation and data analysis**. These activities will be carried out from an internationally cutting-edge infrastructure for high performance computing and big data management, capable of systemizing resources and promoting and integrating emerging technologies. Over the next few years, ICSC will implement solutions that will bring network speeds up to more than 1 Terabit/second, and it will provide users with a cloud infrastructure such that frontier scientific activities and industrial development can be managed.
The new National Supercomputing Center will focus on the one hand on the **maintenance and enhancement of the Italian HPC and big data infrastructure, and on the other hand on the development of advanced numerical methods and applications and software tools**, to integrate the computation, simulation, collection and dat analysis of interest to the research system and the productive and social system, including through cloud and distributed approaches.
ICSC will engage and promote the best interdisciplinary expertise in science and engineering, enabling substantial and sustainable innovations in fields ranging from basic research to computational and experimental sciences for climate, environment, and space, from the study of matter and life to medicine, from materials technologies to information systems and devices.The Center will support higher education and promote the development of policies for responsible data management in **open data and open science** perspectives, combining regulatory, standardization, and compliance profiles. ICSC will be a shared and open cloud/HPC infrastructure, and will be a unique strategic asset for Italy, but also for the international community.

How. The organization. The National Center will aggregate Italian scientific communities of excellence in 10 different areas, will be structured on two equally relevant pillars, infrastructure and thematic areas, and will be organized according to the Hub and Spoke model. The Hub also envisages the involvement of Italian companies to build a synergy between the scientific communities and the industrial world, to the benefit of both the research system and the production system.
The Hub will be responsible for validating and managing research programs, whose activities will be elaborated and implemented by the Spokes and their affiliated entities, including through calls open to research institutions and companies.

The **Spokes will be 10** and will be engaged in as many thematic areas: **Future HPC & Big Data, Fundamental Research & Space Economy, Astrophysics & Cosmos Observations, Earth & Climate, Enviroment & Natural Disaster, Multiscale Modeling & Engineering Applications, Materials & Molecular Sciences, In-Silico Madicine & Omics Data, Digital Society & Smart Cities,** Quantum ComputingThe Future HPC & Big Data and Quantum Computing Spokes will be technology-driven and will have as its frontier focus the development of advanced chips and microchips and emerging technologies such as those for quantum computing.
The National Center has also equipped itself with an Ethics and Data Governance Board (EDGB) and a data management unit, as well as a supercomputing resource access committee that will be instrumental in enabling the research agenda of thematic spokes with computational capabilities and power. Finally, to optimize and evaluate the socio-economic impact of its activities, ICSC has established a dedicated research group that will work across Spokes.

Who. The members of the ICSC Foundation. INFN National Institute of Nuclear Physics, CINECA, GARR, CNR National Research Council, INAF National Institute of Astrophysics, INGV National Institute of Geophysics and Volcanology, IIT Italian Institute of Technology, CMCC Euro-Mediterranean Center on Climate Change, FBK Fondazione Bruno Kessler, ENEA National Agency for New Technologies, Energy and Sustainable Economic Development, CRS4 Center for Research and Development and Advanced Studies in Sardinia, OGS National Institute of Oceanography and Experimental Geophysics, University of Bologna, University of Ferrara, University of Bari, University of Milano Bicocca, Sapienza University of Rome, University of Rome Tor Vergata, University of Trieste, University of Padua, University of Pavia, University of Trento, University of Turin, University of L'Aquila, University Federico II of Naples, University of Pisa, University of Florence, University of Catania, University of Calabria, University of Salento, University of Modena and Reggio Emilia, University of Parma, Politecnico di Bari, Politecnico di Milano, Politecnico di Torino, SNS Scuola Normale Superiore, SISSA International School for Advanced Studies, Autostrade per l'Italia, Engineering Ingegneria Informatica, Eni, Ferrovie dello Stato, Fincantieri, Urban Innovation Foundation, IRCCS Istituto Clinico Humanitas, IFAB International Foundation Big Data and Artificial Intelligence for Human Development, Intesa Sanpaolo, Leonardo, SOGEI, Thales Alenia Space Italia, Terna, UnipolSai Assicurazioni.

When. Timescales and long-term sustainability. The National Center will become fully operational on **September 1**. Among its first initiatives, there will be the publication **by 2022** of the first **doctoral and researcher recruitment calls** and followed by the first open call to engage others in innovation activities. In terms of technology and infrastructure, however, major milestones include **the upgrade of the Leonardo supercomputer at CINECA and the**

INFN computing center, the purchase of a **quantum computer to be placed at the Tecnopolo**, the **completion of the GARR-T (Terabit) network** and some interventions for the creation of thematic Satellite Centers in other Italian locations. Meanwhile, in 2024, the enhanced cloud infrastructure will be made available to users ICSC will become a unique, frontier ecosystem with a strategic role for the country because it will provide its partners with resources and tools that they could not realize and support individually. Based on this vision, a guiding, coordinating and supporting function will be carried out centrally, while research and innovation activities will be entrusted to the Spokes, which will be eligible for funding directly or through the Center. In view of this, the Spokes and their affiliates will commit when fully operational (from 2026 onward) to support from their regular budgets some measures funded in the start-up phase by NRP 2022-2025 funds, and to fund the Center with an annual contribution from 2022 onward. During the first year of operation, a reward mechanism will be identified to incentivize the most active and dynamic partners and researchers. The Center intends to fulfill its strategic role by multiplying opportunities for partners and stakeholders, maximizing socio-economic impact in a competitive environment, implementing something that does not exist today, without overlapping or competing with existing individual research institutions, but instead creating added value for its partners and society. And the key to the success of the initiative lies in the ability to create these conditions early in the start-up phase.

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