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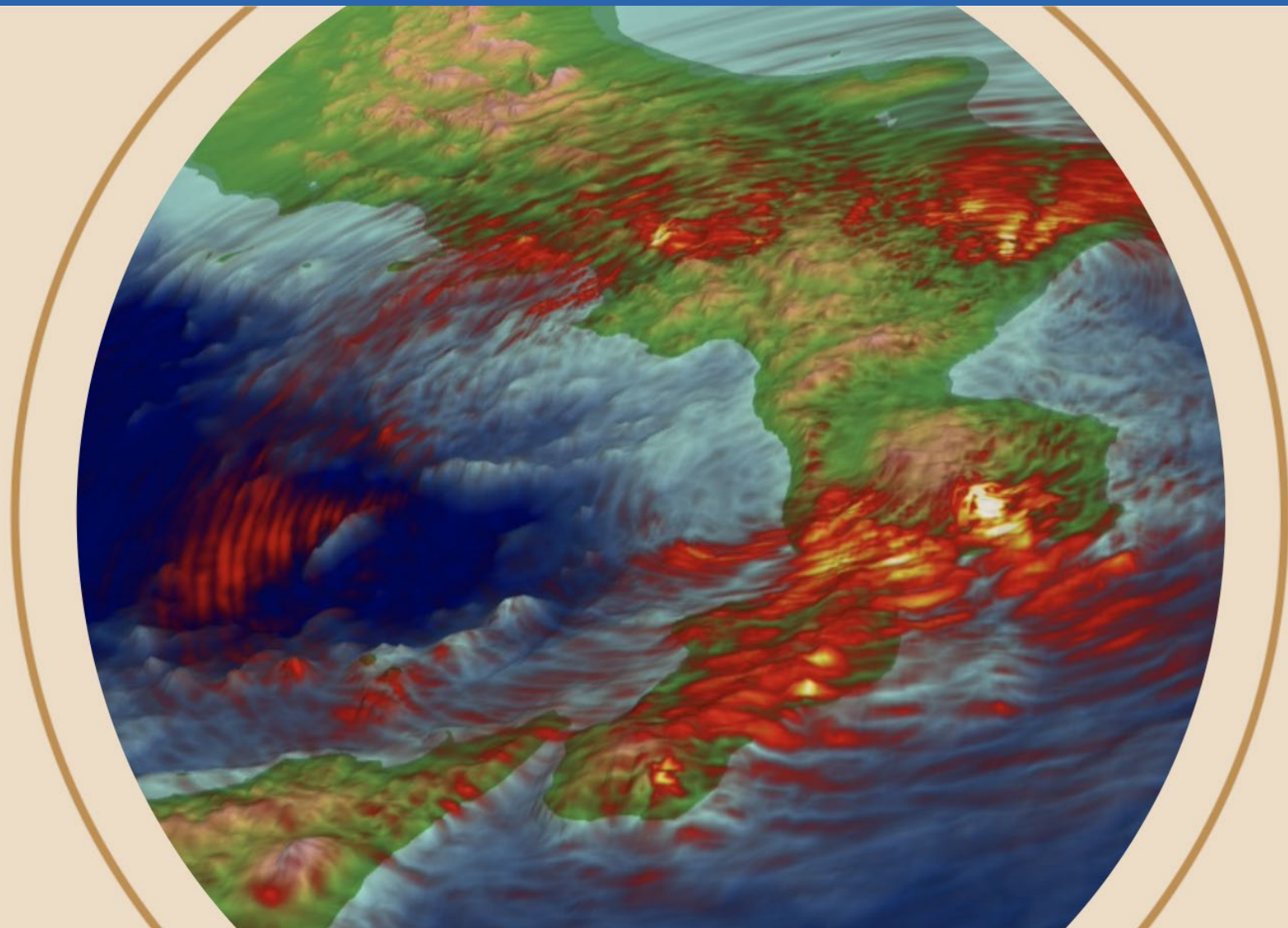
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# WP10

## Center for computational geosciences

**Coordinators: E. Casarotti  
T. Esposti Ongaro**

WP leaders: G. Scarpato, D. Melini



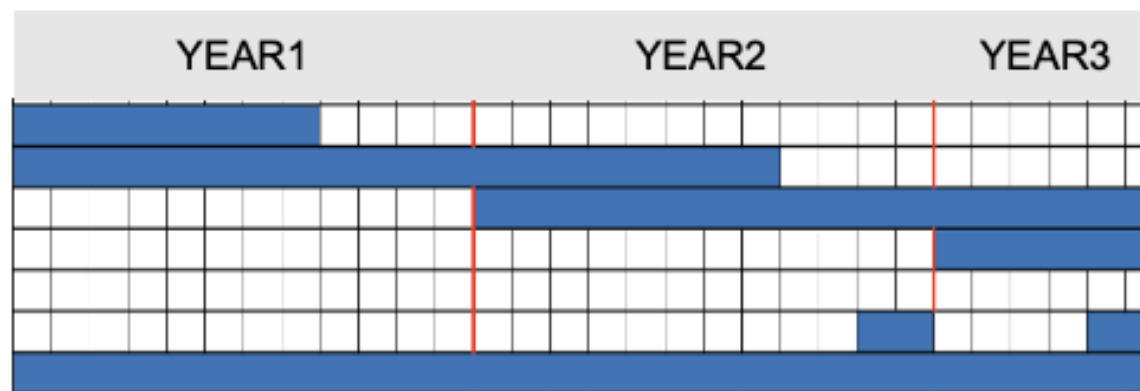


## WP10 Center of computational geoscience

- **Data Center infrastructure design and implementation:** Design a scalable, energy-efficient, sustainable Data Center able to host HPC systems (ROMA)
- **Strengthening, design, acquisition of HPC resources:** Make available to the (enlarged) INGV community a hybrid HPC system close to Tier III category
- **HPC Software and system management:** Provide access to software, scientific workflows and large datasets for HPC, HPDA, AI to the geosciences (INGV and wider EPOS) community, following the FAIR principles.



HIRING: 3 Technologists  
PURCHASES: Hardware and HPC infrastructure  
INSTALLATION  
DATA PRODUCTION  
TRAINING  
CIVIL INFRASTRUCTURES



WP10		Casarotti	PERSONNEL	INSTRUMENTATION, EQUIPMENT, SOFTWARE, PATENT	OPEN ACCESS, TNA, FAIR	CIVIL INFRASTRUCTURES AND RELATED SYSTEMS	TRAINING ACTIVITIES	INDIRECT COSTS	TOTAL
10.1	Data Centre infrastructure design and implementation	Scarpato	113K€	99K€		700K€	2.5K€	64K€	979K€
10.2	Strengthening, design, acquisition of HPC resources	Melini	113K€	600K€			10K€	50.6K€	774K€
10.3	HPC Software and system management	Esposti Ongaro	113K€	25K€	54K€		12.5K€	14K€	219K€



# Personnel



**(10.1) - Technologist**



deserted

**(10.2) - Technologist**



deserted

**(10.3) - Technologist**



Federico Brogi (TD Pisa) – September 2023

Possibility of scrolling INFN's PNRR CN HPC lists for technologists in HPC field (72 eligible) - **pending**





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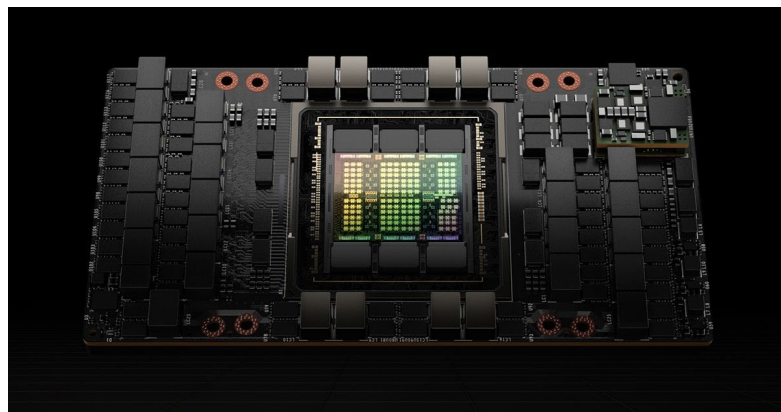


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# Hardware and HPC infrastructure



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PNC  
Piano nazionale per gli investimenti  
complementari al PNRR  
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<b>G00740</b>	<b>FORNITURA DI HARDWARE PER IL POTENZIAMENTO DEL SISTEMA DI SUPERCALCOLO GALILEO 100 E RELATIVI SERVIZI CONNESSI</b>	
Procedura aperta ai sensi dell'art. 71 del d.lgs. 36/2023	Critério di aggiudicazione:	Prezzo fisso (art. 108, comma 5, del Codice)
RUP: Sanzio Bassini	CIG A01FB86326  CUP: D56G22000380006 (CINECA SPOKE0 CNHPC); I53C21000370006 (OGS); D53C22001400005 (INGV); B53C22005960001 (CINECA AFFILIATO SPOKE 2/4 D34HEALTH)	
CUI CINECA F00317740371202300021 CUI OGS F00055590327202300052 CUI INGV AC06838821004202300112  NUTS ITH55 Casalecchio di Reno (BO); ITE43 Roma		



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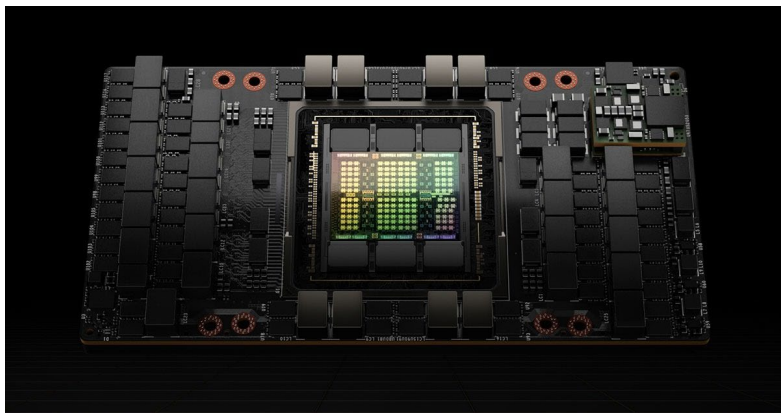


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# Hardware and HPC infrastructure



Title : FORNITURA DI HARDWARE PER IL POTENZIAMENTO DEL SISTEMA DI SUPERCALCOLO GALILEO 100 E RELATIVI SERVIZI CONNESSI - CIG : A01FB86326 - CUP : D56G22000380006

Type of contract : Supplies

Tender procedure : Open procedure

Award criterion : Most economically advantageous offer

Tender amount : **19,000,000.00 € (1,007,413.85 + IVA for MEET)**

Involved Entities : **CINECA, OGS, INGV**

Publication Date : 25/10/2023

Due date : **12/12/2023** by 18:00

Object (only MEET): **hybrid HPC system (CPU 200 Tflops + GPU 1700 Tflops)**

# Data Center infrastructure design and implementation

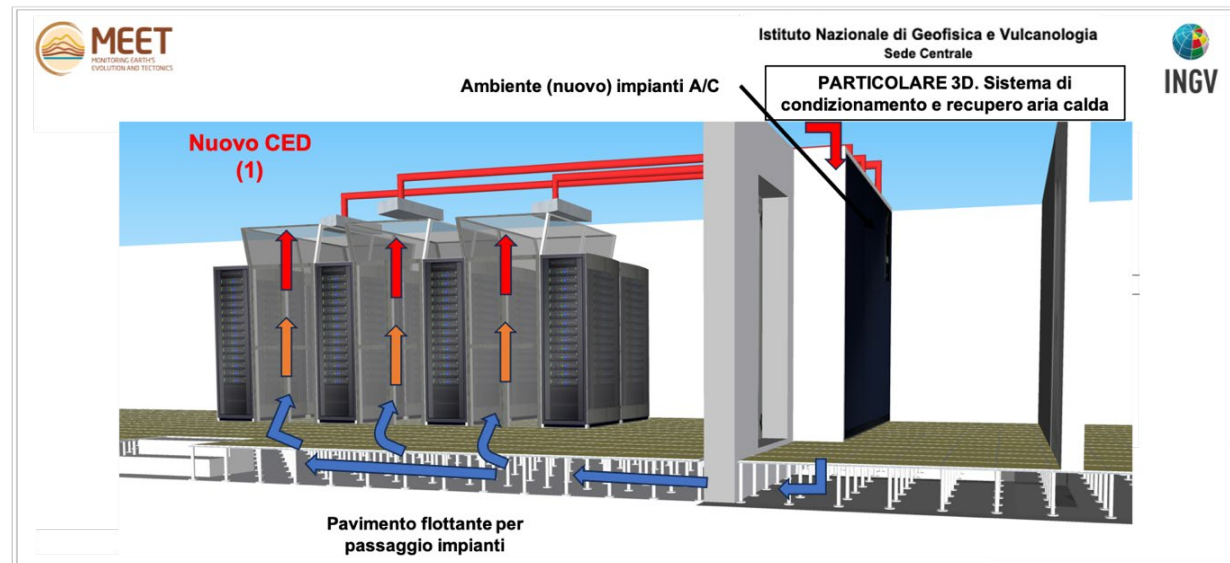


Exigency Framework?

**Quadro Esigenziale** (Sepede, Casarotti, Melini, Zanolin, Ficeli, Scarpato, Ongaro) - November 2023

To be Tendered: December 2023  
Executive design and implementation

Target: Operational on Summer 2024







# Data Center infrastructure design and implementation



Voce	Sintesi voci	Importo lavorazione e servizio (già ivato)	Incidenza percentuale sui lavori [%]	Somma Parziale
1	Progettazione e direzione dei lavori, computo metrico di dettaglio, cronoprogramma e collaudo	57.369,3 €	9.75 %	57.369 €
2	Realizzazione BIM e Analisi termica	5.000 €	0.85 %	62.369 €
3	Oneri del RUP e assistente al RUP	11.764 €	1.96 %	74.134 €
4	Oneri per la sicurezza sicurezza (10 %)	47.806 €	8.12 % (10% sulle lavorazioni)	121.940 €
5	Opere edili per la realizzazione degli ambienti	58.060 €	9.87 %	180.000 €
6	Opere necessarie alimentazione elettrica della strumentazione	120.000 €	20.40 %	300.000 €
7	Realizzazione delle opere di connessione CED con i nuovi impianti di sicurezza ed eventuali modifiche	30.000 €	5.10 %	330.000 €
8	Fornitura attrezzature, realizzazione e messa in servizio degli impianti tecnologici	120.000 €	20.40%	450.000 €
9	Opere per recupero e riutilizzo calore dal CED	80.000 €	13.60 %	530.000 €
10	Acquisto, fornitura e messa in servizio strumentazione per realizzazione della rete data network	70.000 €	11.90 %	600.000 €
<b>Totale</b>				<b>600.000 €</b>





# Accessibility

- Developing High Performance Computing (HPC), High Performance Data Analytics (HPDA) e Artificial Intelligence (AI) resources in a perspective of **scalability** and both **economic/ecological sustainability**.
- Hosting a **Tier 3 computing system**, to provide access to an increasing number of researchers/technologists to high performance computational resources.
- Promoting the **optimization** and **harmonization** of the distributed computational resources inside INGV.
- Providing **TransNational & Virtual Access** to HPC/HPDA/AI software and hardware resources.

## TERABIT?

## Centro di Geoscienze Computazionali

ACTION:

Activities for the DATA CENTER.  
Acquisition of a 2 PFLOPS computing system.  
Staff recruitment

Coordination activities with CSI and GRI (INGV Symposium).  
Coordination activities with WP9 and WP11



# Capacity building

- Coordinating INGV personnel **training**, knowledge sharing.
- Facilitating the **technological development** in HPC/HPDA/AI sector, the *porting and enabling* of HPC applications. Improving scientific production related to Computational Geosciences.
- Facilitating the access to HPC/HPDA/AI resources of higher level (Tiers2-1-0) in the Regional, National and European context, towards the **Exascale Computing** strategic objective.
- Developing HPC/HPDA/AI services for geophysical hazards, including **Urgent Computing, Early Warning, e Probabilistic Hazard Assessment**.
- Develop a **synergy with INGV centres**: Centro Allerta Tsunami, Centro Pericolosità Sismica, Centro di Pericolosità Vulcanica, Centro di Monitoraggio delle Eolie, Centro per il Monitoraggio del Sottosuolo, Centro Osservazioni Spaziali della Terra.

## Centro di Geoscienze Computazionali

### ACTION:

Technology and knowledge transfer from HPC projects (in particular, ChEASE-2p)

Scheduling of HPC/HPDA/AI training.



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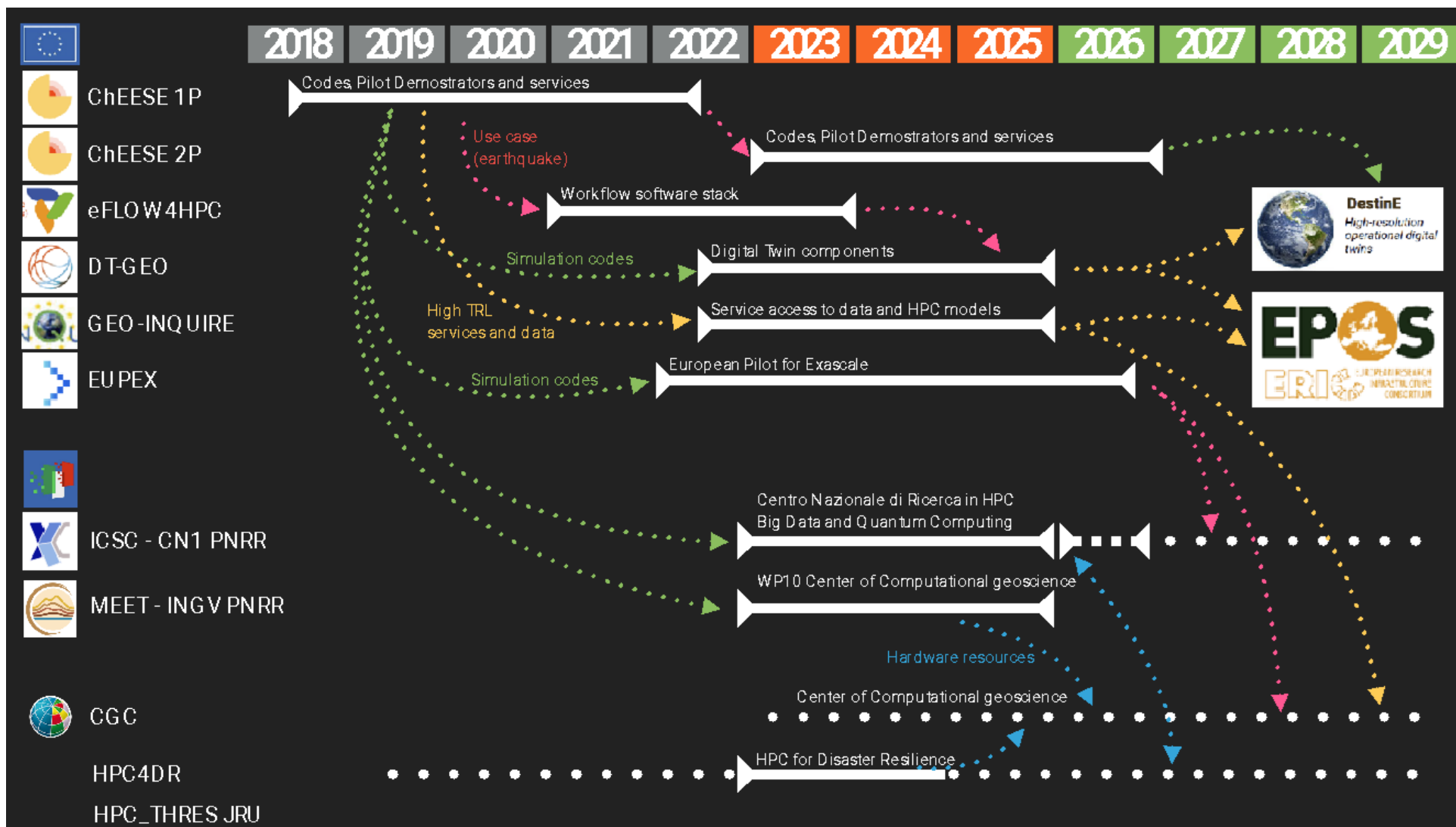
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# Is High Performance Computing (HPC) for everyone?

## Users

- complex access/interaction (command line, ssh connections, scheduler partitions)
- time consuming installations (e.g. compilation issues)
- select appropriate hardware and amount of resources?
- complex workflows and reproducibility of results?

## Developers

- HPC application peculiarities (parallel efficiency, memory bandwidth usage)
- lack of knowledge of HPC profiling tools
- no appropriate versioning and development workflow strategies (collaboration and reproducibility)

## Software Administrators (no OS management)

- on large machines many user help requests (typically installation issues)
- large number of software installations
- manage complex queue systems and partitions, multiple machines with heterogeneous hardware in different places

Is High Performance  
Computing (HPC) for  
everyone?





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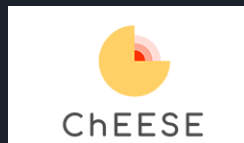
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# Bringing our HPC expertise from CoEs to CGC-INGV

How to better exploit the current and future advanced computing capabilities

Is High Performance Computing (HPC) for everyone?

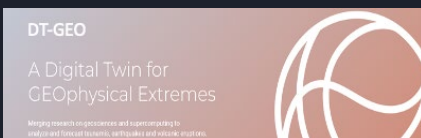
## CoEs and Projects



Preparation of Community flagship codes for the current and next generation of supercomputers.



Integrate HPC workflows



Build virtual replica of physical systems (volcanoes, earthquakes)

## EU Leading Computing Centers



## Computing systems



LUMI #5



LEONARDO #6



MARENOSTRUM 5 #8

3 EuroHPC SUPERCOMPUTERS RANKED AMONG THE WORLD'S TOP 10 SUPERCOMPUTERS





# Empower users and developers of all skill levels INGV Center for Computational Geosciences

## Users

- **Organise and promote courses**
- **Web page** -> one place for relevant informations (machines, software, help documentation)
- **Web and graphical interface** -> easy access, use, interact with computational resources
- **Containers for HPC** to help avoid installation issues and improve portability

## Developers

- **Guiding application performance assessment for HPC** (scalability and profiling)
- **Favor git usage** -> appropriate workflow strategies and versioning (reproducibility)

## Software Administrators (no OS management)

- **Automatic Software installation frameworks** (Easybuild, Spack, Modules) -> users can install most of the software easily
- **Web/Modern scheduling system to manage resources** (e.g. multiple heterogeneous machines)

Is High Performance  
Computing (HPC) for  
everyone?