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ISTITUTO NAZIONALE
DI ASTROFISICA

INAF USCVIII - Calcolo Critico

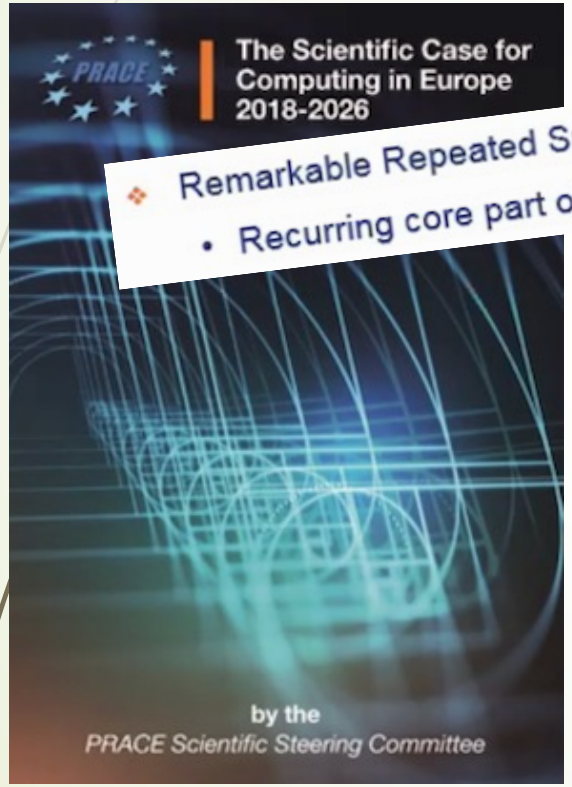
15–16 Jun 2023
Dipartimento di Fisica e Astronomia “Ettore Majorana” Universitá degli Studi di Catania Via S. Sofia, 64,
Europe/Rome timezone

The Central Scientific Unit VIII - ”*Computing*”

ANDREA POSSENTI

Why a USC «*Computing*» in INAF?

The need to process a large amount of data and to have advanced software is becoming **everyday life** even **for astrophysicists**



Simulations and data analysis for the exploitation of modern instruments in **space and on the ground** require increasing computing and data storage capacities (e.g. Gaia, Euclid, CTA, Vera Rubin, etc.)

Controlling and monitoring instruments and experiments also requires advanced computation and software developments

As an extreme case, there is a sector of astrophysics - **radio astronomy** - which requires **calculation capabilities** and **management of large amounts of data** that have always been equal to or **greater** than those of **almost all scientific disciplines**

Why a USC «*Computing*» in INAF?

INAF is involved in many of the largest international observing programs (plus many others that require moderate to intermediate computing and archiving capabilities), **is very active in the field of theoretical modeling**, and often has **leading roles in the design, control and instrumentation monitoring**

Along many years, this has progressively increased awareness among INAF personnel of the need to:

- **national coordination of activities** related to calculation, data archiving and software, with particular emphasis on major projects
- **a significant investment in human capital** to reach a critical mass of researchers with strong skills in computer science, development of innovative software, "porting" of codes on complex infrastructures
- **an investment in** (and management of) **a centralized infrastructure** that can grow over time
- **accompaniment in the growth of local skills** also through support to existing medium or medium-small infrastructures

INAF has picked up and accompanied this need in a **bottom-up process** that has included the acquisition of **opinions** both **from within INAF,** and from an **international commission** of external experts (through an official "report" available to all)

Creation of the USC VIII-*Computing*

In this context, USC VIII-Computing was established with Resolution number 50 of the INAF CdA dated 13 June 2022

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Delibera n. 50/2022

Oggetto: Approvazione della modifica all'assetto organizzativo della Direzione Scientifica e costituzione dell'Unità Scientifica Centrale VIII (USC VIII) denominata "COMPUTING".

IL CONSIGLIO DI AMMINISTRAZIONE

VISTA la Legge 7 agosto 1990, numero 241, e successive modifiche ed integrazioni, che contiene "*Nuove norme in materia di procedimento amministrativo e di diritto di accesso ai documenti amministrativi*";

VISTO il Decreto Legislativo del 23 luglio 1999, numero 296, pubblicato nella Gazzetta Ufficiale della Repubblica Italiana, Serie Generale, del 26 agosto 1999, numero 200, di "*Istituzione dell'Istituto Nazionale di Astrofisica - INAF, a norma dell'articolo 11 della legge 15 marzo 1997, numero 59*";

VISTO il Decreto Legislativo 30 marzo 2001, numero 165, e successive modificazioni ed integrazioni, che contiene "*Norme generali sull'ordinamento del lavoro alle dipendenze delle amministrazioni pubbliche*";

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Determinazione n. 131/2022

Oggetto: **Nomina del Responsabile *dell'Unità Scientifica Centrale VIII (USC VIII) denominata "COMPUTING" della Direzione Scientifica* dell'Istituto Nazionale di Astrofisica.**

IL DIRETTORE SCIENTIFICO

VISTA la Legge 7 agosto 1990, numero 241, e successive modifiche ed integrazioni, che contiene "*Nuove norme in materia di procedimento amministrativo e di diritto di accesso ai documenti amministrativi*";

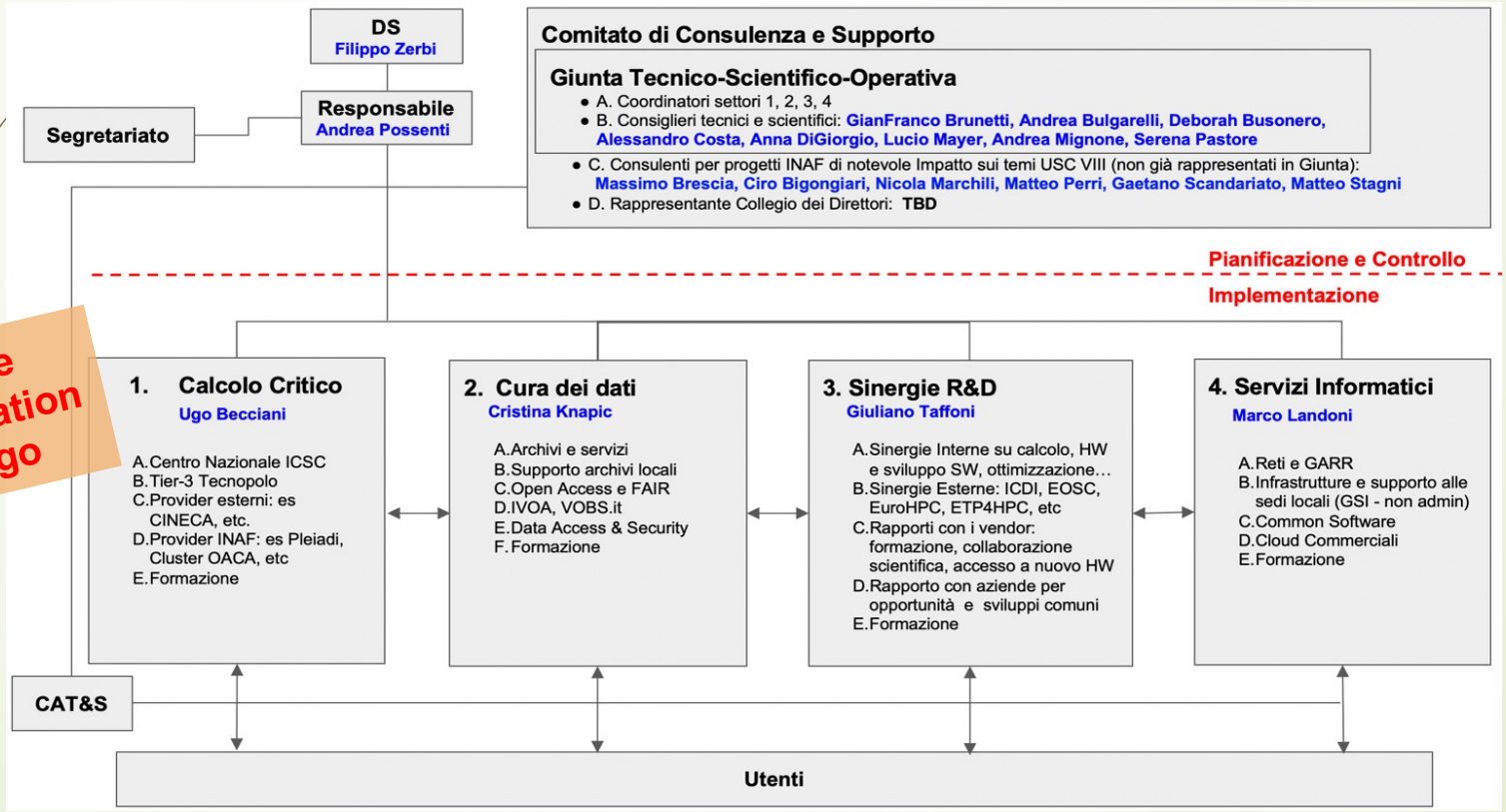
VISTO il Decreto Legislativo del 23 luglio 1999, numero 296, pubblicato nella Gazzetta Ufficiale della Repubblica Italiana, Serie Generale, del 26 agosto 1999, numero 200, che istituisce l'*Istituto Nazionale di Astrofisica (INAF)*;

VISTO in particolare, l'articolo 1, comma 1 del predetto Decreto Legislativo del 23 luglio 1999, numero 296, il quale definisce l'*Istituto Nazionale di Astrofisica (INAF)* come "*…Ente di Ricerca non strumentale ad ordinamento speciale, con sede in Roma e con strutture operative distribuite sul territorio, nel quale confluiscono gli osservatori astronomici ed astrofisici…*";

Following an investigation initiated by the DS on July 25, 2022, Andrea Possenti was appointed by the Scientific Director as Head of USC VIII-Computing with Resolution dated September 28, 2022, number 131

Initial organizational structure

The appointed manager, Andrea Possenti, in agreement with the Scientific Director, defined, on Dec 7, 2022, the "**governance**" structure of USC VIII-Computing according to the required principles (decree 50/2022 of the CdA) of ***scientific leadership and solid technical skills, community representation, adaptation to changings of the field, and focus on major infrastructures and major projects***



Ample presentation by Ugo

Always reviewable with experience and with a not too long turn-over

Main Aims of USC VIII-*Computing*

In light of the above, the main medium-long term objective of USC VIII-Computing is the creation of a computing ecosystem for INAF, capable of supporting, for the next few decades, the current very high competitiveness of the members of INAF in the international arena

This can be progressively achieved through:

The coordination and synergy of the work of the excellent skills in the field already present in the various INAF Structures, **as well as the existing computing and archiving infrastructures** (distributed and centralized)

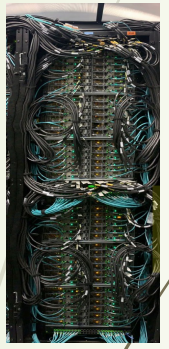
The planning and implementation of adequate (mainly, but not exclusively, centralized) **investments in hardware**, both available to the community in general and optimized to support the large international projects in which INAF is involved

The preparation of **actions for the training of personnel** already in INAF and for the inclusion of new personnel distributed among the Structures, but operating in a way aimed at the needs of the overall ecosystem

Available opportunities

and the Committee for the Assignment of Time of calculus & Space for long-term data preservation

Already available opportunities for the INAF people



- ✓ "Pleaidi" system: 20-25 Million cores/hour on over 7000 cores. Intel Broadwell board 2x Intel Xeon E5- 2697 @2.3GHz, 18 cores/socket (36 cores x node), 128/256 GB Ram
- ✓ resources linked to the agreement between INAF and CINECA: 4.7 million cores/hour
- ✓ Cloud resources acquired by INAF: 1.5-2 million cores/hour
- ✓ Space allocation for the "long-term" preservation of scientific data

Resources will be allocated after evaluation by the **CAT&S,** which comprises **7 members** nominated by the Head of the USC VIII:
Claudio Gheller (chair), *Elena Amato* (deputy chair), *Andrea Bignamini, Elena Rasia, Serena Pastore, Paolo Serra, Alberto Vecchiato*

The **six-monthly calls** will be issued by the Head of USC VIII: **the first** was **released on April 27** with an **expiration on May 31, 2023**

A **small fraction of the resources** will be allocatable at any time, through **on demand requests** (**starting from 1 June 2023**) evaluated by USC VIII

Available opportunities

The Commercial Cloud Computing

The USC-VIII will maintain within its perimeter the Access Service to computational resources based on Cloud Computing (currently Amazon) which, **starting from 1 June 2023**, will continue to be offered on demand by completing a request (to be submitted to review) at the following link

https://forms.gle/VQJgrv929rDu96iH6

This type of access to Computing will allow researchers to respond to small/medium-sized computing needs, typically HTC and embarassingly parallel, without the need to purchase dedicated hardware.

The use of these resources is optimal in the context of projects that require **sporadic and immediately available access to small/medium-sized computing resources** (e.g. 512 cores for two or three days for an analysis necessary for the conclusion of an instrument PDR).

The plan: hardware

Acquisition of **≈1.5 PetaFlop/s** (with a combination CPU and GPU) **and ≈11 PBy** (combined between fast disks for computing and disks for long-term preservation) **Tier-3** computing system, to be installed inside of one of the CINECA areas at the Bologna Technopole

The Technopole already hosts the European weather center ECMWF, the Leonardo super-computer and will host the United Nations University on Climate Change

Use of **a Tier-2 sizing system** integrated into a Tier-1 sizing system and becoming the kernel of the Italian node of the SKA Regional Center. Investment of the CN-PNRR for the needs of INAF and CNR (7 million euros), owned by CINECA, with guaranteed (non-exclusive) use for INAF. Expected for INAF: **about 4 PetaFlop/s** (Data Centric Nodes and Booster Nodes) and **≈2 PBy** high speed storage

The plan: Training

It is an activity **transversal to all 4 implementation sectors**

It will be based on a series of initiatives

- ✓ **Schools** for students, contractors and structured on individual specific topics: eg. porting of codes to HPC, methodologies for Machine Learning, exploitation of GPUs, use of containerization, continuous integration etc…
- ✓ Certified **refresher courses** for structured staff (on institutional funds for training)
- ✓ **Scholarships for existing Masters** at other Organizations and Institutions, and **for Doctorates at Universities** (to be confirmed)

The plan: INAF Events

It is planned to organize:

- ✓ **Recurring National Meetings for INAF (and external) members** on individual specific issues. Objectives: knowledge of reciprocal activities, development of new opportunities for synergy, team-up. Indicatively **at least 2 meetings of this type per year** with a duration of **2-3 days each**

- ✓ **USC VIII General Congress,** taking up the fruitful example of the ICT meetings, interrupted in the pandemic phase. **(Semi-)annual cadence** with a **duration of one week**

Support for events

In addition to the events directly organized by USC VIII, an online form will be available from **June 1, 2023**

https://forms.gle/jMbceGveHoeGfn9LA

to request support (economic or practical) at USC VIII in organizing events that have to do with USC activities.

The above link will be a "**channel with multiple deadlines during the year**" with evaluation, and possible approval, of the proposals within 30 days of each deadline.

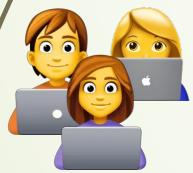
It can be applied in parallel to the general channel of the Scientific Direction for the support of events, but obviously **double funding will not normally be possible**

The plan: catalog of the expertise

There is a lot of know-how in INAF on the issues of calculation and archiving

We want to create a catalog of the expertise

- to avoid «reinventing the wheel» when some colleagues have already faced a problem



- to optimize the planning of human resources to be deployed within the projects

- to encourage discussion between colleagues (and the creation of a critical mass) around common themes

The plan: survey to build the catalog of the expertise

Your information:

Nome:

Cognome:

Email:

Next

Select one or more expertises:

- [ ] Programming languages and development
- [ ] BigData, Databases
- [ ] Networking
- [ ] Sysadmin
- [ ] Machine Learning
- [ ] Numerical Simulations
- [ ] Virtual machines and virtual environments
- [ ] Containers (e.g. Docker)
- [ ] Code Versioning
- [ ] Codes for data visualisation
- [ ] GPU coding, hardware accelerated code
- [ ] Extreme programming
- [ ] Code testing
- [ ] Real Time Computing
- [ ] Parallel Computing
- [ ] noSQL Databases
- [ ] Cloud Computing
- [ ] IoT
- [ ] MCMC, montecarlo simulations
- [ ] Software for Ambient and Instrumentation Monitoring
- [ ] Software for Operating and Control Instrumentation
- [ ] FPGA programming
- [ ] Altro

Microsoft Excel

Thanks !