THE NATIONAL INSTITUTE FOR ASTROPHYSICS (INAF)

A.Costa

INAF oact

The roles of the INAF are:

- Defining and coordinating the national research policies in astronomy and astrophysics;

- Representing the Italian astronomical community in all the related international boards;

- Funding and performing world-class research programs in Astrophysics and Space Sciences.

INAF IN ITALY

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National Institute for Astrophysics (INAF)

1. Galaxies and Cosmology
2. Stars, Stellar Populations and Interstellar medium
3. Sun and Solar system
4. Relativistics and Particle Astrophysics
5. Advanced Technologies and Instrumentation

HQ in Rome

16 Institutes and Observatories

2 National facilities
(TNG, Canarias), LBT (AZ, USA)

about 1400 people

INAF IN ITALY

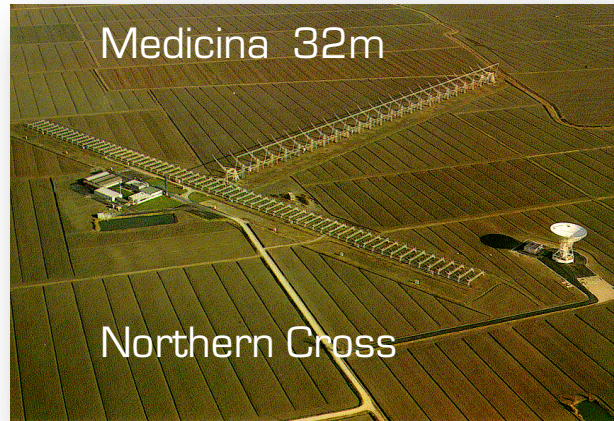TORINO · MILANO · PADOVA · TRIESTE · BOLOGNA · FIRENZE · TERAMO · ROMA · NAPOLI · CAGLIARI · PALERMO · CATANIA

Longtime tradition in Radioastronomy
3 Radio Facilities
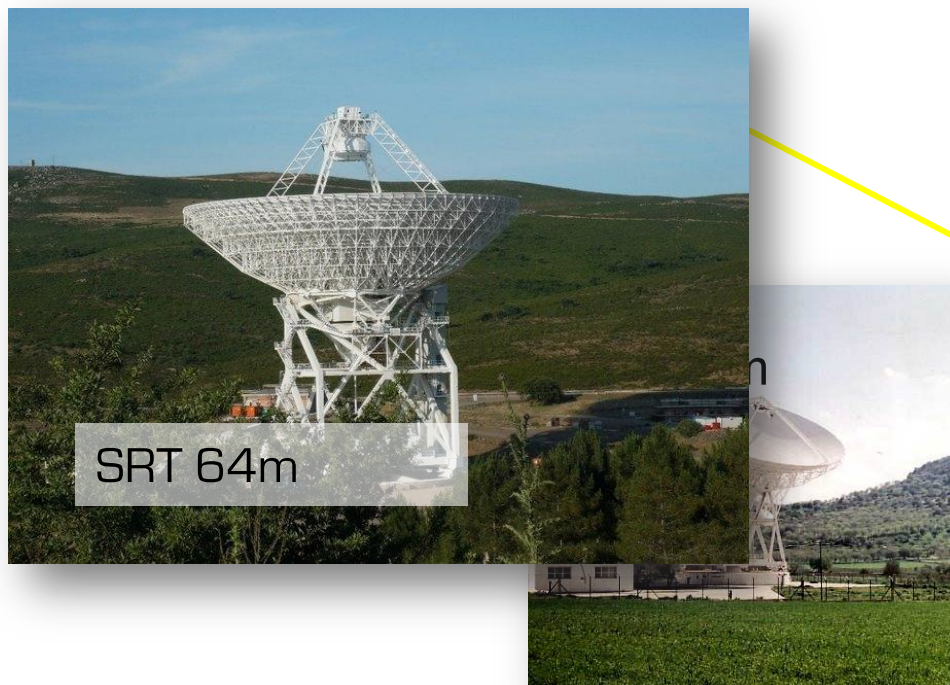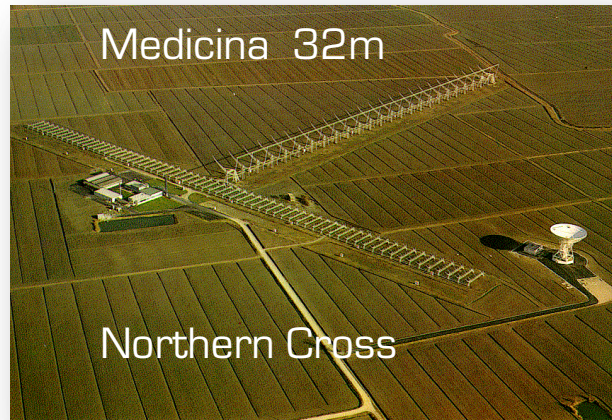
Longtime tradition in Radioastronomy
3 Radio Facilities

Medicina 32m

Northern Cross

INAF IN ITALY

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INAF: Radioastronomy in Italy

Longtime tradition in Radioastronomy
3 Radio Facilities

Medicina 32m

Northern Cross

Noto 32m

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INAF: Radioastronomy in Italy

Longtime tradition in Radioastronomy
3 Radio Facilities

Medicina 32m

Northern Cross

SRT 64m

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One of the 16 INAF Structures

HQs in Catania, inside University of Catania Campus

Synergy with UNICT

Staff: 62 (researchs/technicians/amministratives)
30 non-staff (Students, PdD students, post-doc......)

EOSCPilot VisIVO Science Demonstrator


Main Achievements

- Integration of visual analytics tools with EOSC services;

- Optimization of the archiving of multi-wavelength surveys;

- Increase of computing resources for analysis (e.g. for calculation of spectral energy distributions);

- A federated virtual environment enabling collaboration and re-use of data and knowledge.

https://eoscpilot.eu/astro-sciences-visivo-data-knowledge-visual-analytics-framework-astrophysics
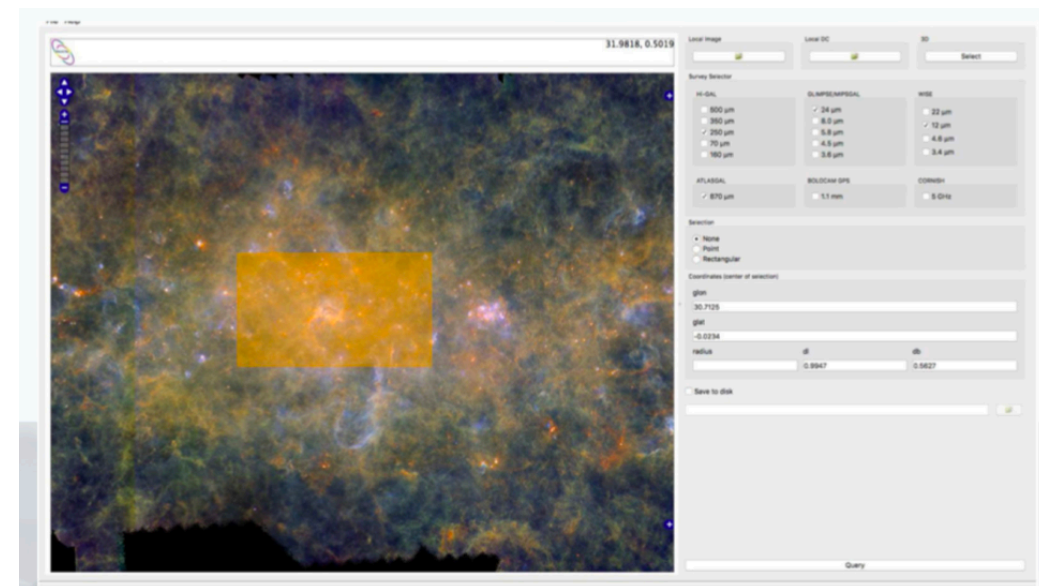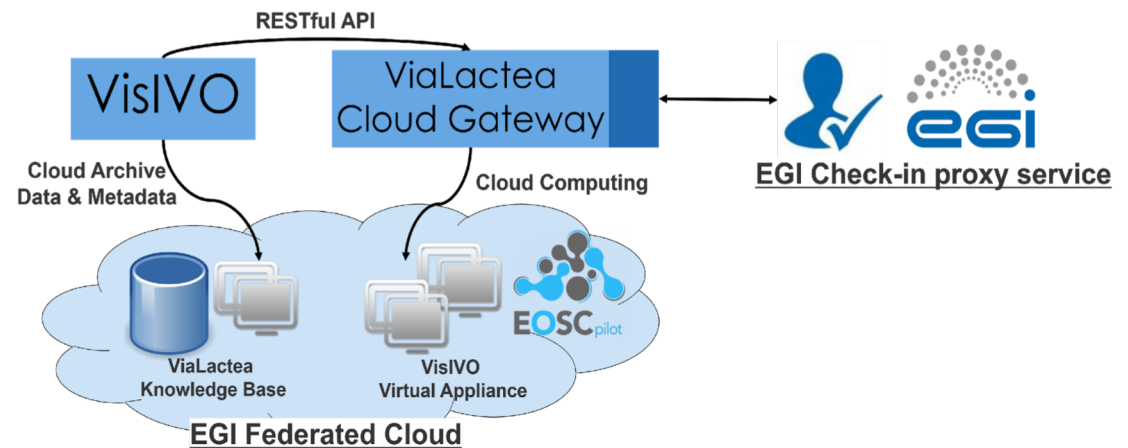
- **ESCAPE** project (European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures) European H2020 project to integrate IVOA compliant Virtual Observatory (VO) services within the EOSC hybrid cloud scenario and to test containerization of VO aware applications.
  - The INAF computing facilityies will be used as an integration testbed in the scope of WP4 (Connecting ESFRI projects to EOSC through VO framework) and WP5 (ESFRI Science Analysis Platform).
- **EGI-Engage** offered researchers from all disciplines an easy and open access to innovative digital services, data, knowledge and expertise. EGI-Cloud is composed of a federation of 21 cloud providers and hundreds of data centres, spread across Europe and worldwide.
  - INAF participate to the project for building a federated cloud with Canadian Astronomy infrastructure offered by CADC.

NEANIAS Space thematic Services in EOSC
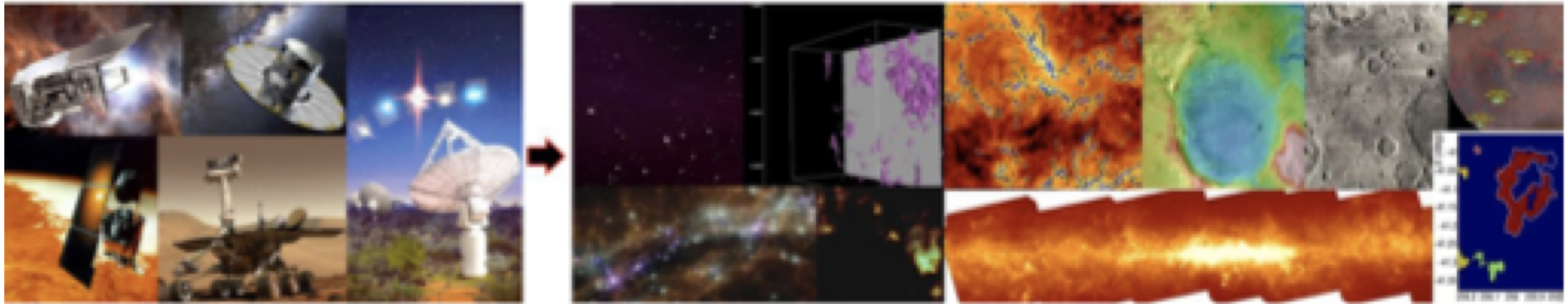
From Space data to Space products developing the following services:

S1 FAIR Data Management and Visualization service.

S2 Map Making and Mosaicing of Multidimensional Space Images service.

S3 Structure Detection on Large Scale Maps with Machine Learning service.

deployed on **EOSC Hub**.

9 Proof of concepts (PoCs) proposed by INAF

Google Cloud Platform

1. **HTC** computing and software containerisation for **DIAMONDS** (M. Landoni)

2. **HTC** computing for **DIAMONDS** with Kubernetes (M. Landoni)

3. **GPU** computing for **Adaptive Optics** (M. Landoni in collaboration with OA Arcetri)

4. **HPC** computing for **GADGET** (G. Taffoni)

5. **HPC** computing for **Exoclimates** (G. Taffoni)

6. **HTC** computing for **LOFAR** (E. Sciacca, S. Riggi, F. Vitello)

7. Computing for **ALMA** (M. Massardi, A. Giannetti, S. Burkutean)

8. Workflow execution for **GIANO@TNG** pipeline (A. Bignamini)

9. **Euclid** LE3 software in the Google Cloud Platform (D. Tavagnacco)

AENEAS ESRC Use Cases @ GCP

Google Cloud Platform

Tested AENEAS use cases for the ESRC, taken from LOFAR pathfinder:

- data calibration: pre-factor pipeline
- data post-processing: pulsar re-folding, rotation measure synthesis, object detection and classification

Computing architecture & run strategy

- LOFAR pipelines running on Singularity containers
- Max data size: 300 GB
- Single instances (40 vCPU) used in GCE
- Storage: local disk, GC storage bucket (mounted with FUSE)

Results

- Easy porting thanks to Singularity & GC dashboard & doc
- Good scalability, usability and reasonable costs of the platform
- Significant impact on the computing times (x 2) observed with data accessed in the GC storage

A&A Piloting activities in AENEAS
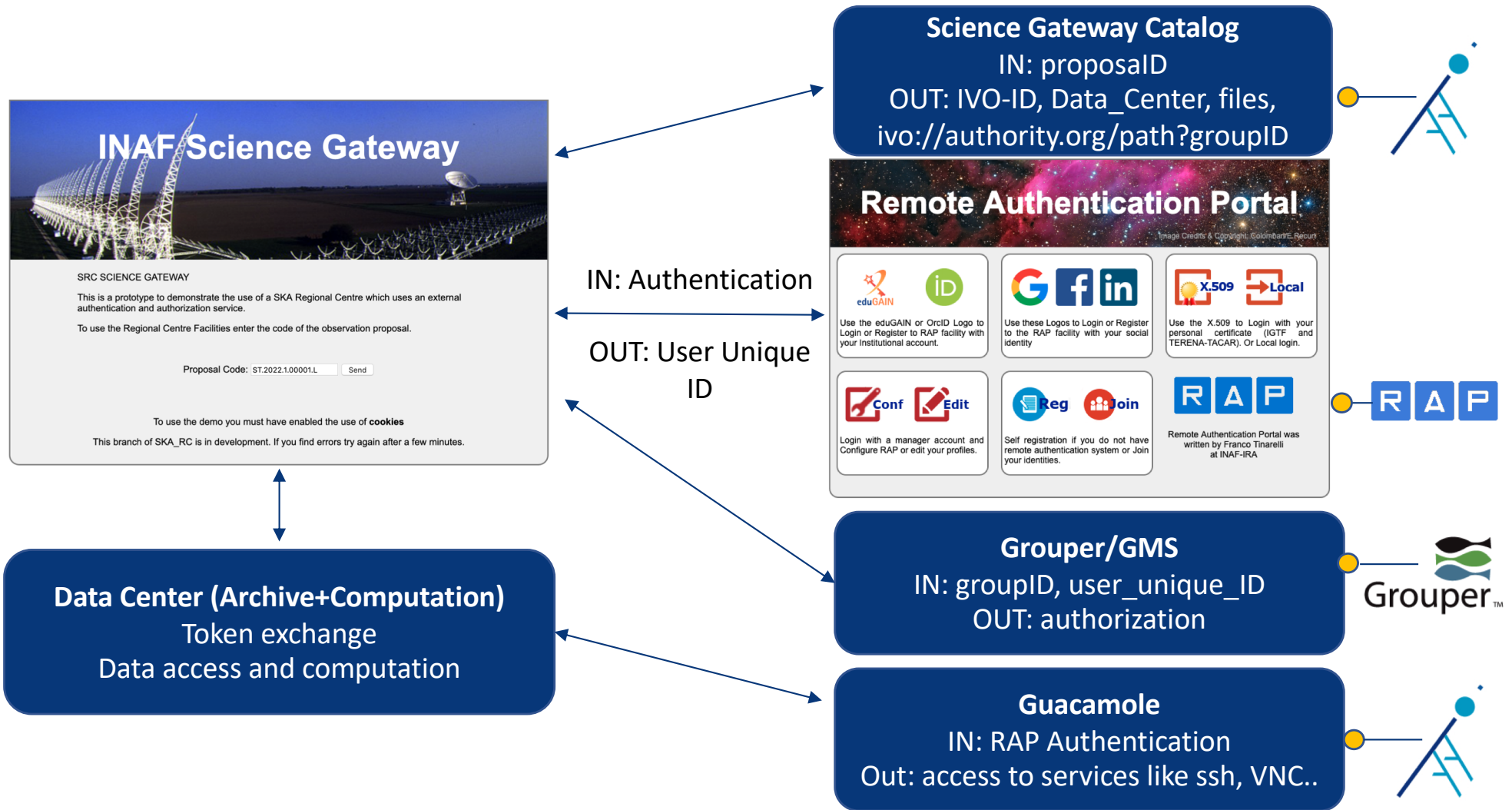
- EUCLID satellite distributed private cloud.
  - Federation of 8 European + 1 US SDCs (Science Data Centers) + SOC (Science Operation Center)
  - Heavy simulations needed before the mission
  - Heavy (re)processing needed from raw data to science products (volume multiplied by dozens),
  - Large amount of external data needed (ground based observations)
  - Amount of data that the mission will generate per full release
  - 26 PBytes of data (including external data) => ~175 PB grand total
- Not achievable with classical architecture
- Accuracy and quality control required at each step

- INAF distributed HPC/HTC infrastructure that involves different sites in Italy and offers a computing resource for ~ 25 TFLOPS and HPC storage for about 500TB (CHIPP).

- INAF cloud service offers a EOSC compatible cloud access to computing and storage resources based on OpenStack. It is hosted by INAF – OATs and it is now used to provide virtual computing desktops to Astronomers.

- LOFAR.IT distributed infrastructure based on 4 sites in Italy to offer HTC resources for LOFAR data reduction and analysis