



*Astronomy ESFRI and Research Infrastructure Cluster*

ASTERICS - 653477



# INAF Data integration Services for the Cherenkov Telescope Array

A. Costa, E. Sciacca, F. Vitello



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# Overview

## CTA AUTHENTICATION AND AUTHORIZATION INFRASTRUCTURE

Developer: INAF

As analyses in astronomy, astrophysics and particle astrophysics tend to increase in complexity with the abilities available on modern computer systems, the basic requirement of (short and long term) reproducibility is becoming harder to achieve.

The high number of dependencies makes it non-trivial to be reproduced exactly and

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## CTA SCIENCE GATEWAY

Developer: INAF

In the framework of the CTA Data Management group (CTA-DM), INAF-OACT developed a *science gateway* and an *interactive desktop* connected to the CTA data. The science gateway leverages open source tools and the scientific community.

The figure below shows the INAF-OACT

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## JUPYTER FOR GAMMA (J4G)

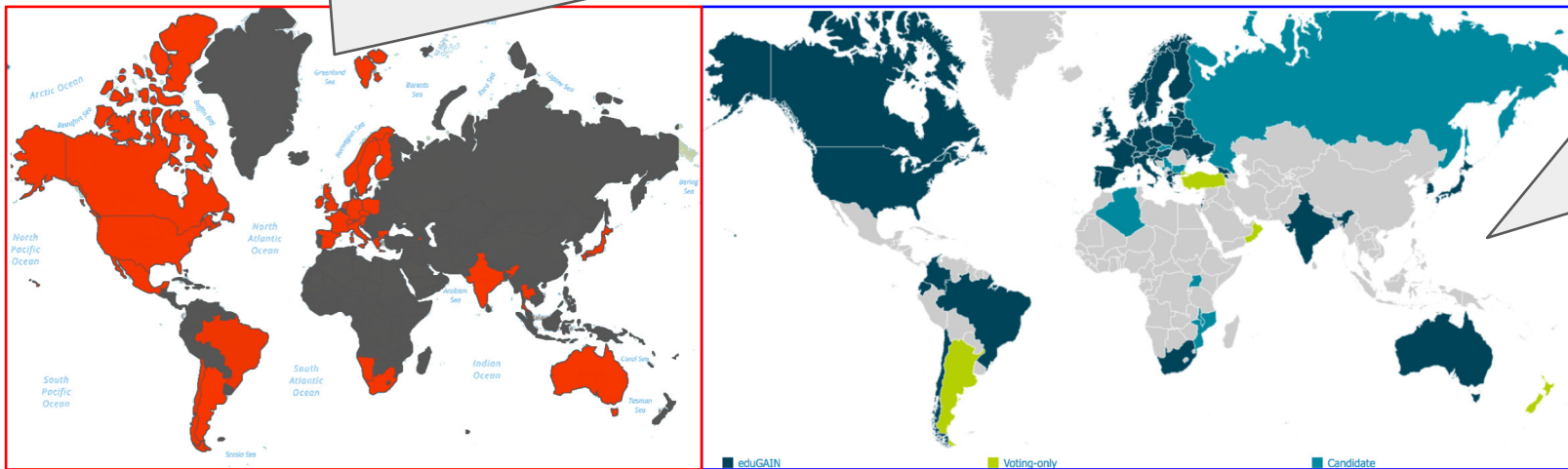
Developer: INAF

J4G combines a multi-user version of notebooks with Gamma Ray Astronomy tools. It provides remote single-user Jupyter notebooks and it is integrated with the INAF-CTA Authentication and Authorization Infrastructure (INAF-CTA AAI). It makes available user data by deploying Jupyter Notebooks in user space close to user's data thanks to an integrated cloud data service environment (based on owncloud). J4G is a user-friendly and reproducible computing in HPC/HTC environments.

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# CTA AAI

The CTA consortium is an experimental scientific collaboration consisting of over 1400 members working in 31 countries from 200, mostly academic, institutes.

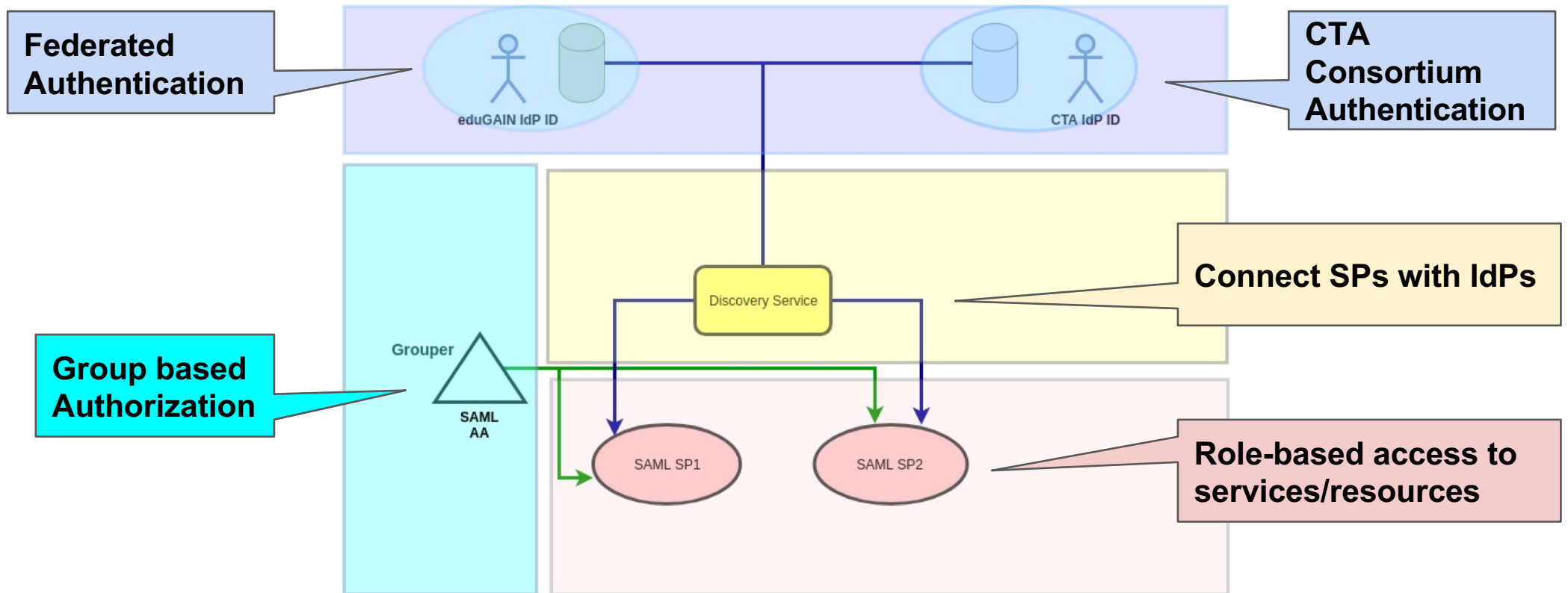


The geographical location of consortium members leads to the need of a pervasive **Federated Identity Management network.**  
→ eduGAIN

# CTA AAI

- The **INAF CTA Authentication and Authorization Infrastructure** (INAF CTA AAI) provides functionalities enforcing the protection of CTA resources and digital assets by means of a **role based authorization**.
- It offers a **federated authentication**, based on eduGAIN inter-federation, or a centralized **CTA SAML authentication service**.
- An **attribute authority** (based on Grouper) is provided in order to allow a **role-based authorization** thanks to a set of attributes managed and agreed at consortium level.

# CTA AAI



# CTA SG

- The INAF CTA science gateway aims at providing a collaborative web environment for high energy astrophysics.
- It leverages open source technologies giving web access to a set of tools and software widely used by the CTA community, such as: XANADU software package, GammaLib & ctools, Fermi Science Tools, Aladin, IRAF.
- The gateway provides a Workflow Management System (WMS) with a customizable graphical web user interface and a web-desktop environment.

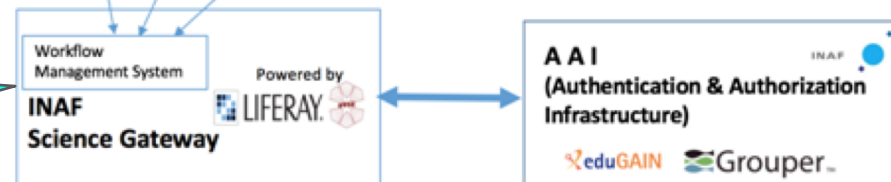
INAF CTA science gateway: <http://cta-sg.oact.inaf.it/>  
ACID: [http://acid.oact.inaf.it/ACID/Home\\_page.html](http://acid.oact.inaf.it/ACID/Home_page.html)  
CTA Help Desk: cta-admin@oact.inaf.it

# CTA SG

Support for multiple computing resources



Collaborative CMS and WMS portal



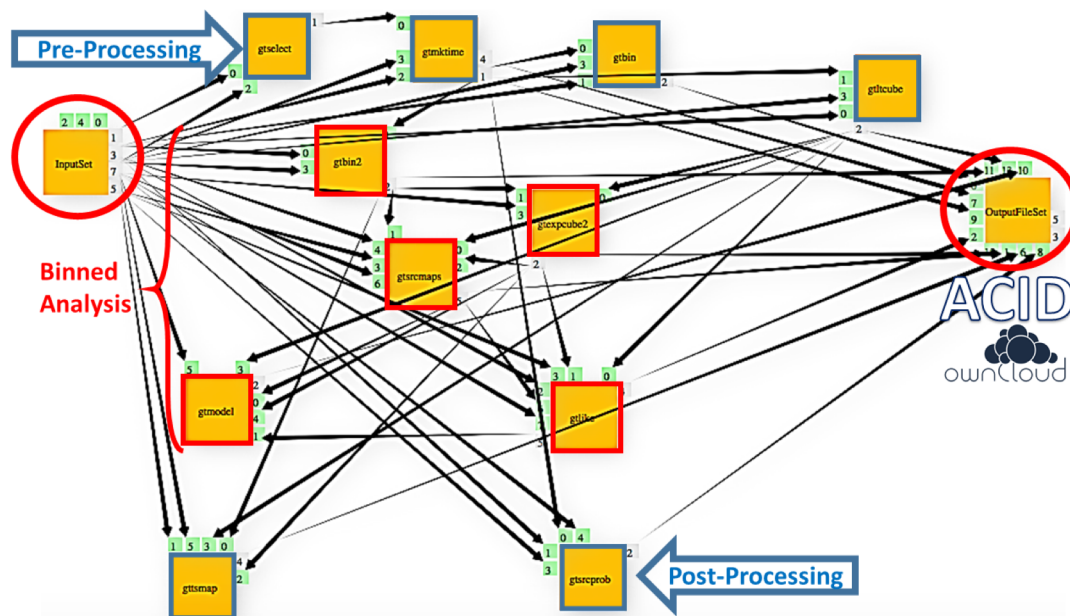
Full integration with the CTA AAI

Interactive VNC-based environment



# CTA SG

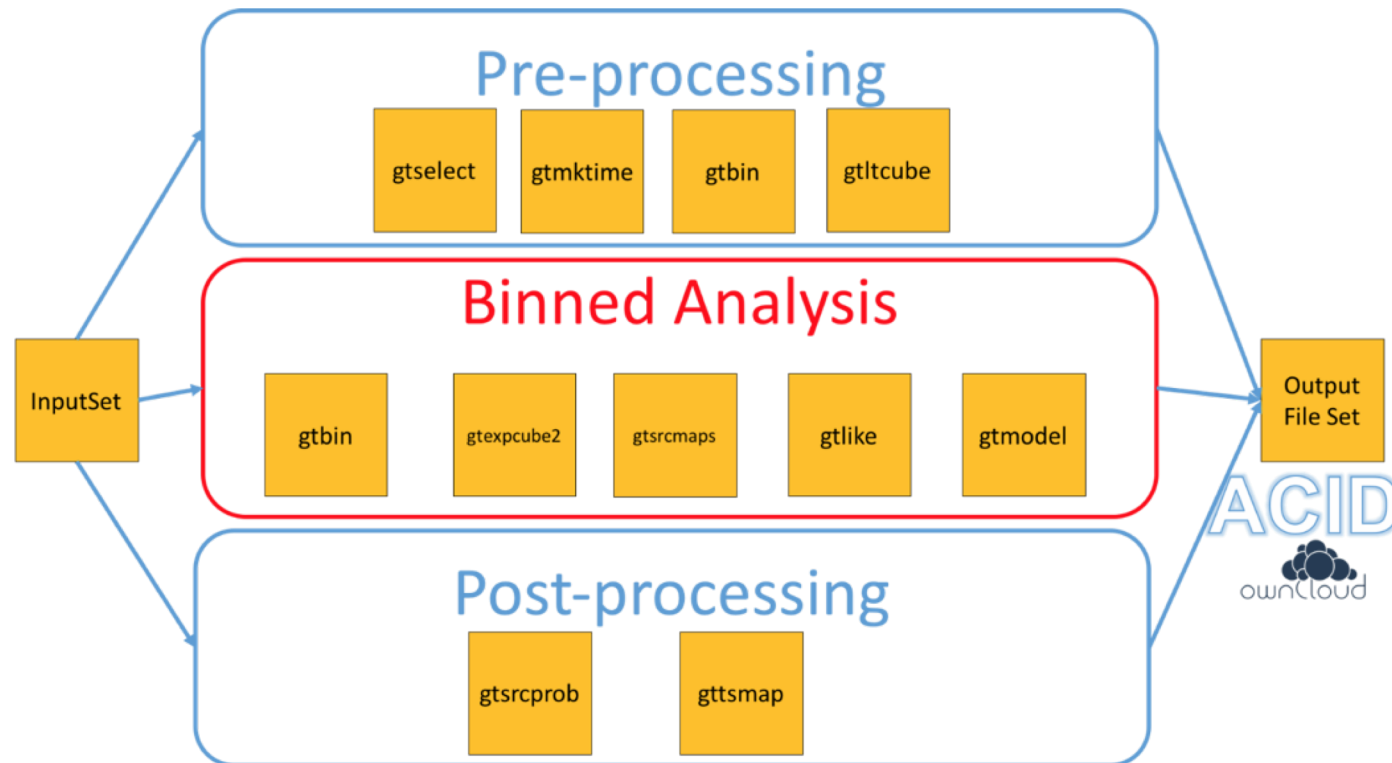
A workflow demonstrator has been implemented following a typical CTA analysis (performed with the Fermi Science Tools).



**BINNED** analysis workflow  
The computing flow goes from the *InputSet* job, to the **pre-processing jobs**. Then the binned analysis is performed and the **post-processing jobs**. Finally, the *OutputFileSet* job collects all the jobs output files and send them to the ownCloud server which is synchronized with the user account hosted into the ACID environment.



# CTA SG



# CTA J4G

- J4G combines a multi-user version of notebooks with Gamma Ray Astronomy tools.
- It provides remote single-user Jupyter notebooks and it is integrated with the INAF-CTA Authentication and Authorization Infrastructure (INAF-CTA AAI).
- It makes available user data by deploying Jupyter Notebooks in user space close to user's data thanks to an integrated cloud data service environment (based on owncloud).
- Under testing by the ASTRI/CTA Data Challenge project.

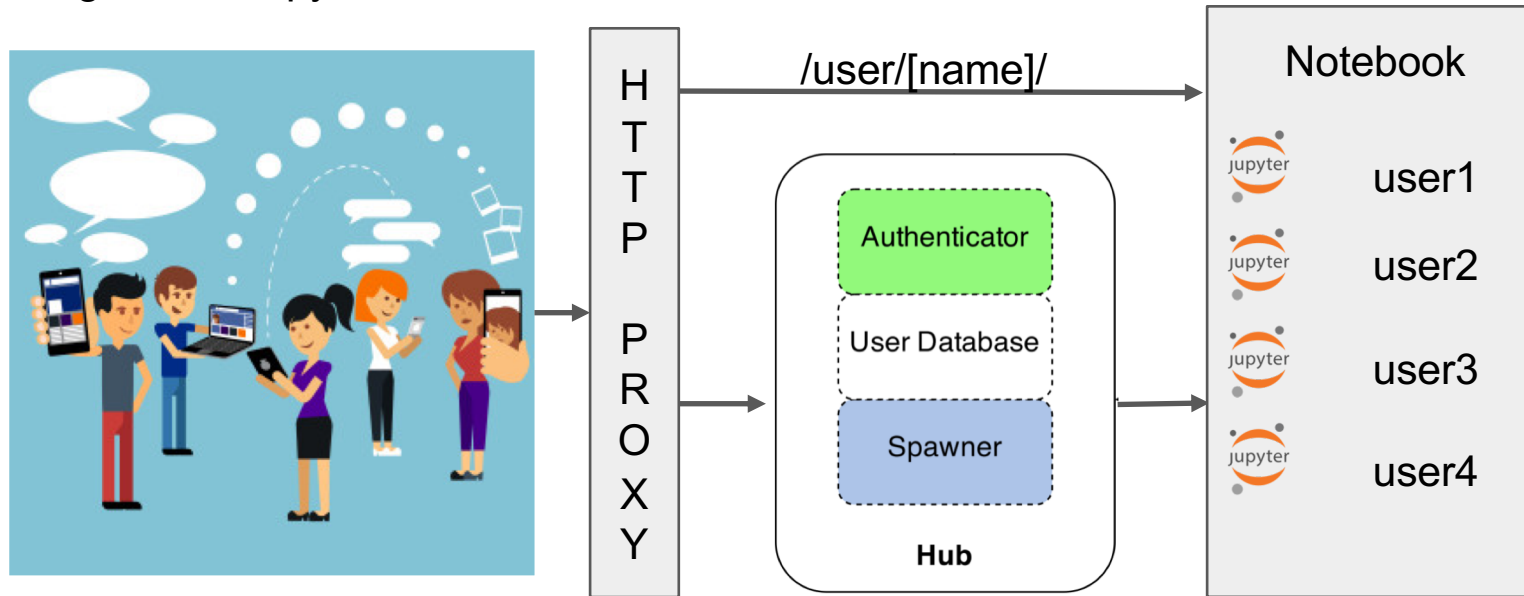
Jupyter Notebook Service: <https://j4g.oact.inaf.it>

Dedicated cloud service: <https://j4g.oact.inaf.it/owncloud/>

J4G Help Desk: [j4g-helpdesk@oact.inaf.it](mailto:j4g-helpdesk@oact.inaf.it)

# CTA J4G

J4G is implemented on **Jupyter Hub** that spawns, manages, and proxies multiple instances of the single-user Jupyter notebook server.

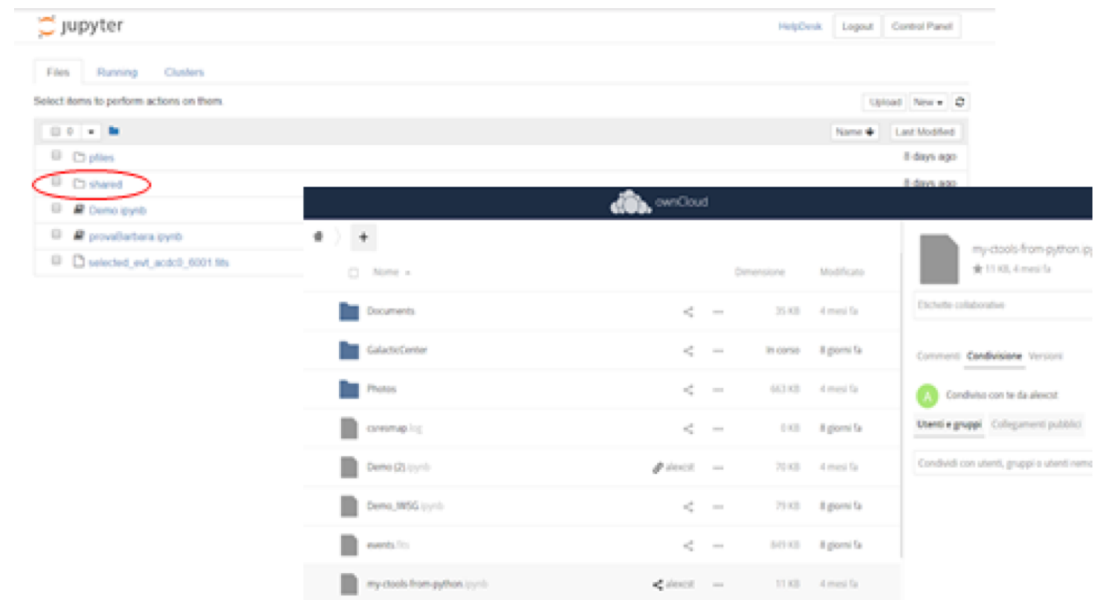


- Manages authentication;
- Spawns single-user notebook servers on-demand;
- Gives each user a complete notebook server;

# CTA J4G

J4G integrate a cloud service to allow:

- Easy sharing of notebooks and files:
  - Public link with password/expire
  - “direct share” to a user
- Enables collaboration
- All-platform access
- CTA Consortium users already have an Owncloud account;



# Conclusions

- We are focusing on the development of a **workspace** tailored to the requirements of the CTA community.
- The CTA workspace consists of a **science gateway module** endowed of a **workflow management system** and embedding a **web-desktop environment** (ACID) and an **interactive notebook environment** connected to an **authentication and authorization infrastructure**.
- Wide adopted **standards** (such as SAML 2.0 and Shibboleth 2.0) and **open-source** technologies (such as WSPGRADE/gUSE and Grouper) have been adopted. This aims at enlarging the developer community and improving the sustainability of the workspace during the whole CTA lifetime.
- The developed services provide an highly **flexible ecosystem** in order to tailor a product suitable to the present and future requirements of the CTA community.

# Acknowledgement

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