ACID
Astro & Physics
Cloud Interactive Desktop

cta
cherenkov telescope array

ACID
an interactive Desktop for CTA Science Gateway

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- The Astronomical & Physics Cloud Interactive Desktop (ACID) has been developed as a VNC-based User Interface for the CTA Science Gateway to provide scientists with astronomical and physics software suites and allow them to use interactively those tools, on a web based environment, exploiting the native GUIs of the programs

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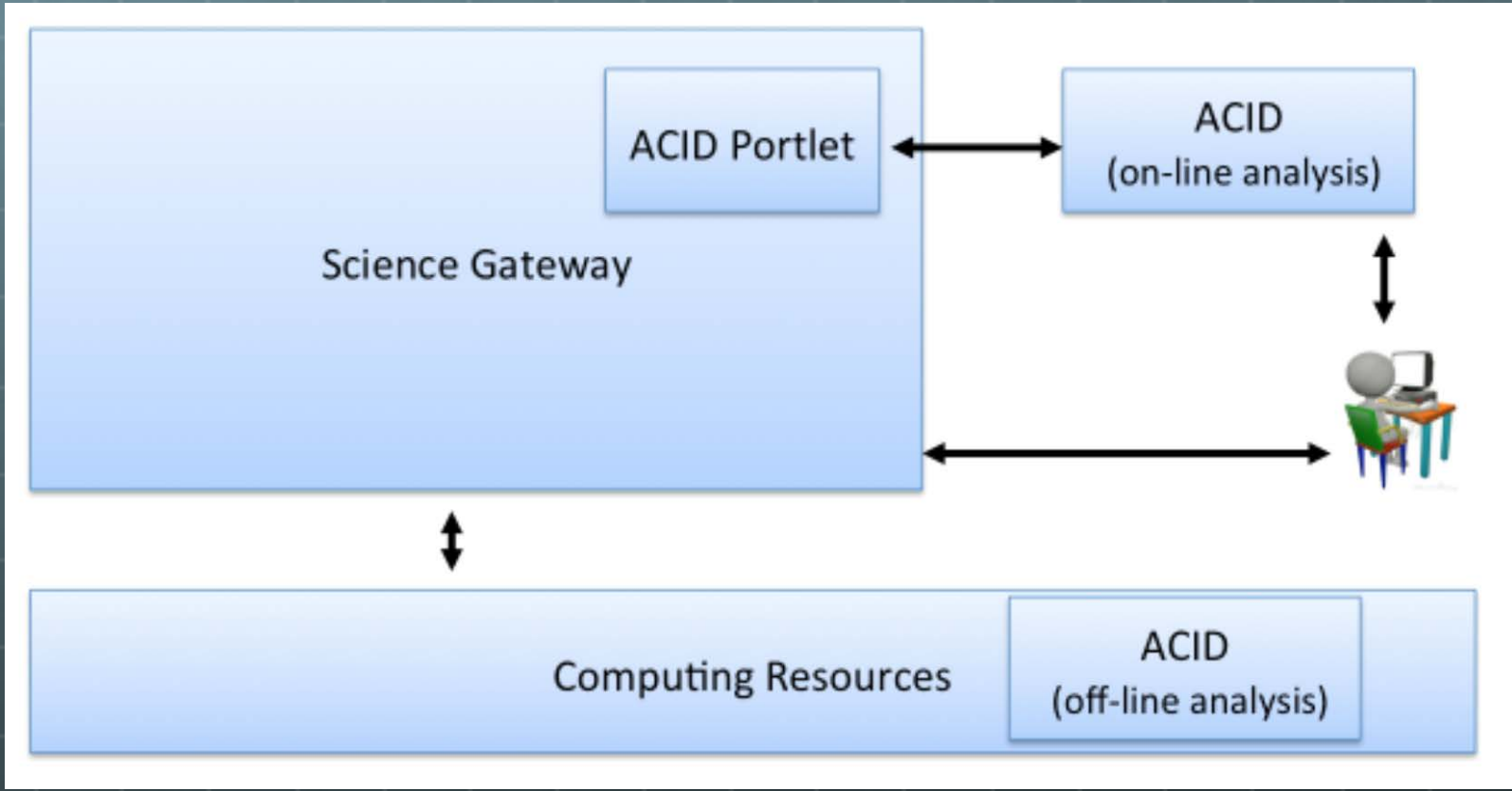
Overall architecture diagram



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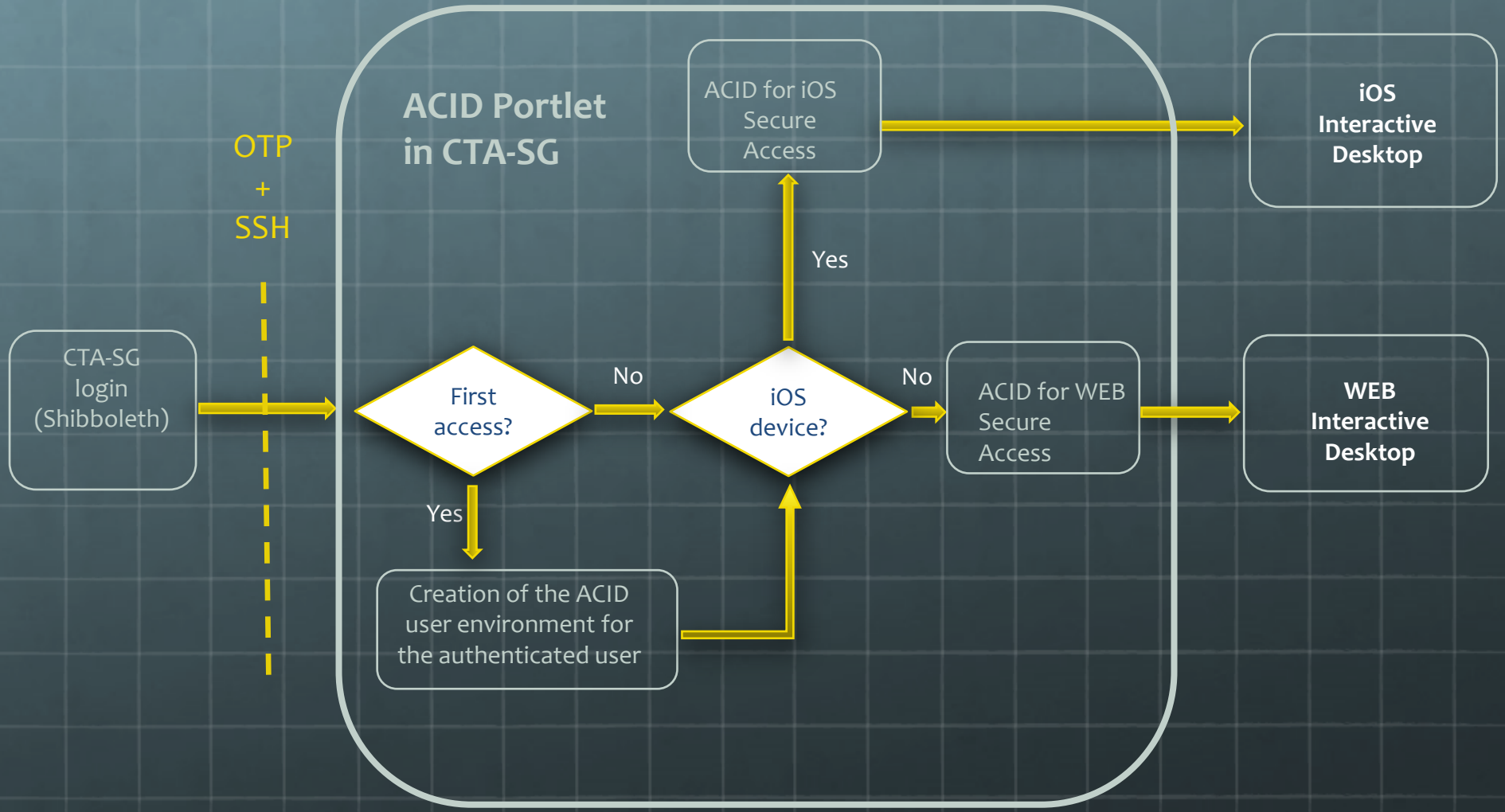
Working flow chart



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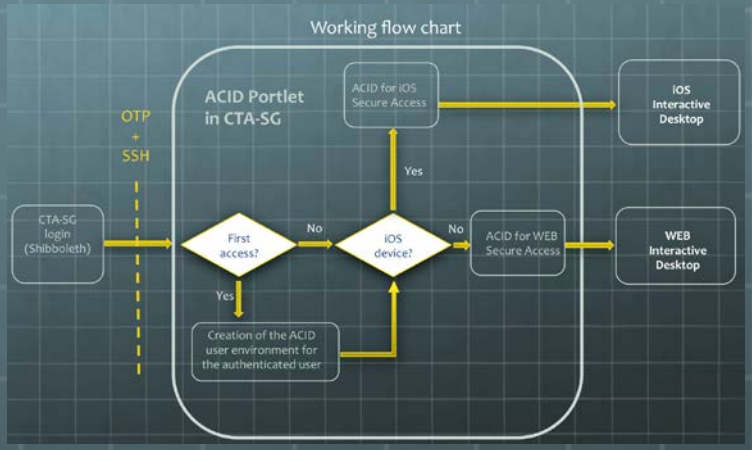
Working flow chart: step by step



The user requests account on CTA Science Gateway server (based on gUse and Liferay)

He will use the *Shibboleth Single Sign-On* credentials to connect to CTA-SG server

When the user wants to use ACID, he will automatically be connected to the ACID server

At the first access the user ACID environment will be created

The communication between the Science Gateway and ACID server is based on *https* protocol and *Terena Certificate Service* moreover it makes use of an OTP (*One-Time Password*)

The connections for submitting shell commands from SG is secured by the SSH protocol using public and private user keys stored on the ACID server

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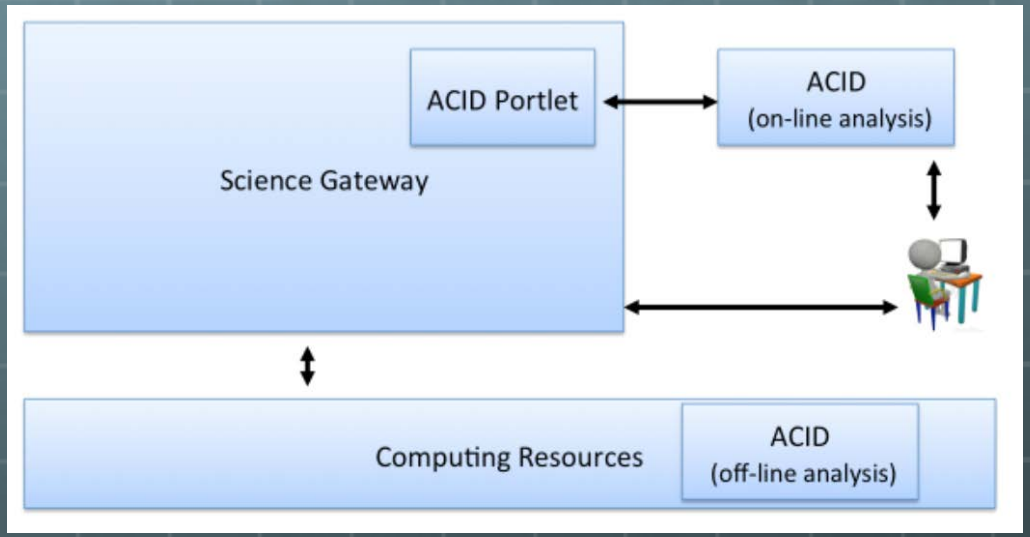
Overall architecture



The CTA Science Gateway prototype offers two modes of usage:

- Interactively to perform an on-line analysis through the VNC desktop and the native GUIs
- *Distributed Computing Infrastructure* (DCI) to perform an off-line analysis through a workflow submission

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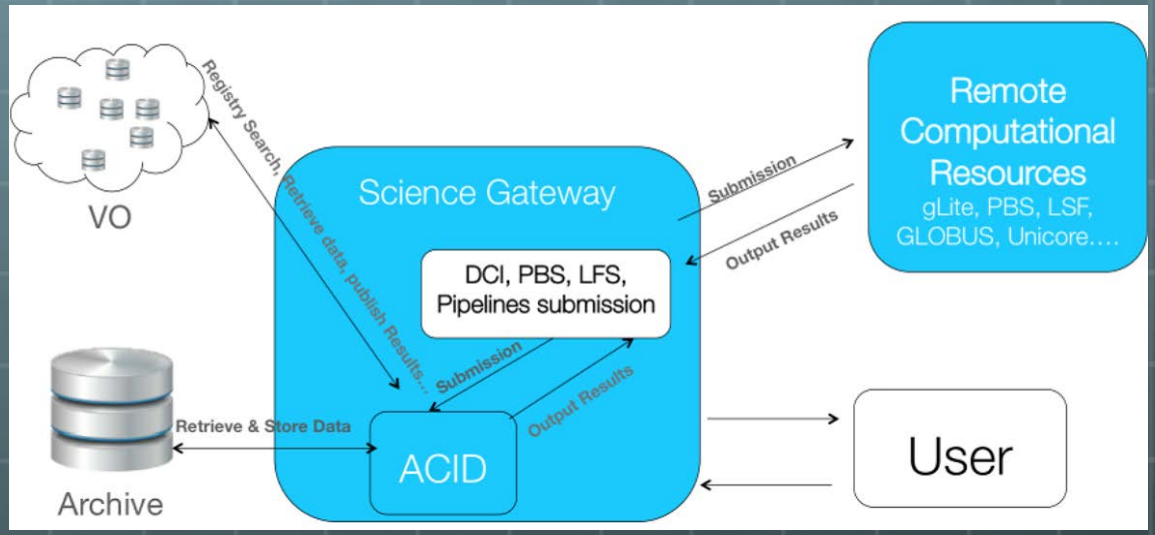
Off-line analysis



Off-line analysis allows submitting jobs to the ACID using this resource as a node of a PBS cluster

The job is submitted as a workflow and it is possible to exploit easily the large number of command line-based software packages available in the environment

There are more than 10 GB of astronomical packages in the ACID installation and the workflow instance can refer to the current position of each software package.

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- If we want to use the native sophisticated GUIs of the programs we need to install the whole software package in the computer where we work (if the O.S. is compatible)
- Web-based User Interfaces (WUI) often do not offer neither full control nor an interactive mode like the specific native GUIs
- ACID exploits an *ad-hoc* VNC-based User Interface (VUI)
- ACID groups many sophisticated and complexes astronomical and physics software suites
- ACID is able to ensure the network access security
- ACID is independent of the O.S. and does not require any VNC client installation on user desktop

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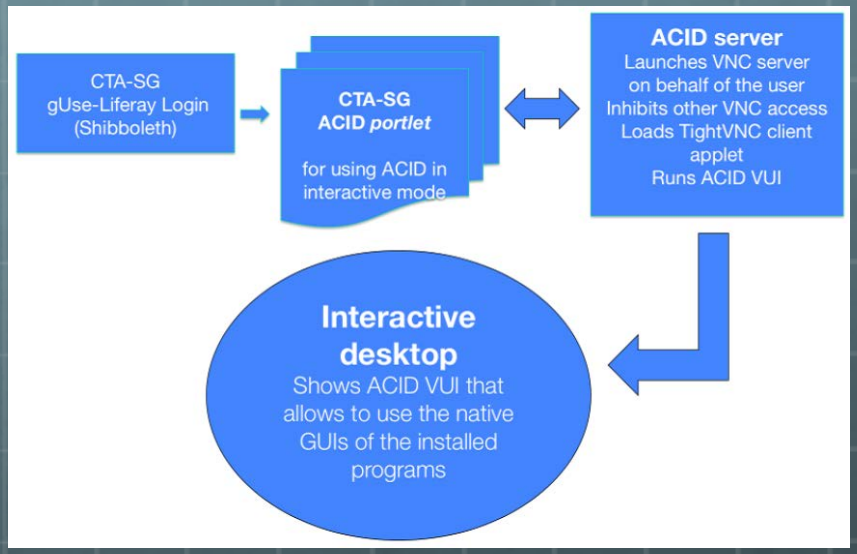
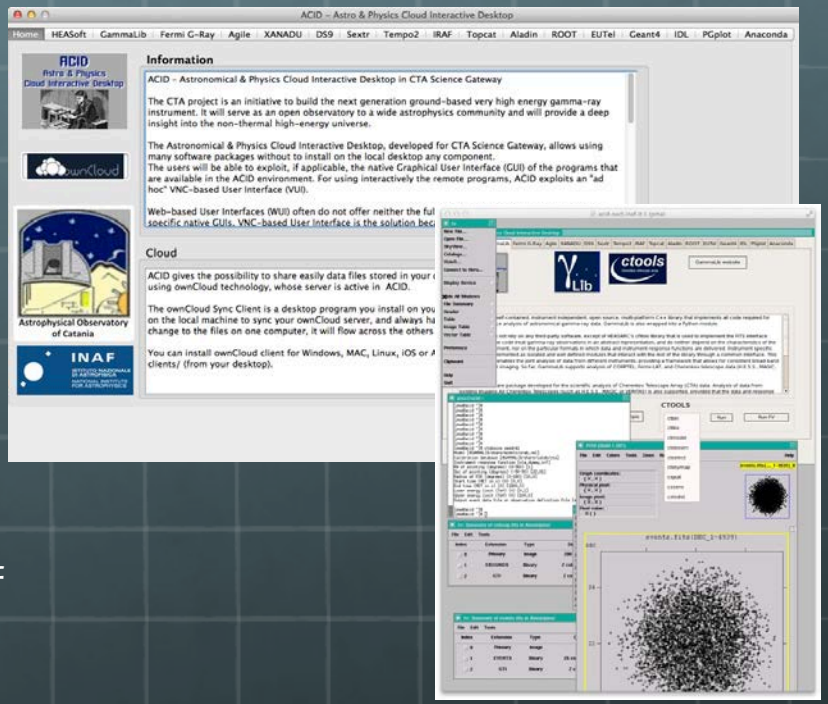
On-line analysis





On-line analysis allows to fully exploit the potential of the operating environment

The main graphic interface groups all available software package in ACID

All data files to analyse or data files produced as output by other programs and pipelines can be visualized through the use of the native *Graphical User Interfaces* devoted to that specific dataset as *GammaLib*, *Fermi Tools*, *CTA ctools etc*

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- ACID runs VNC server on behalf of the user (standard low-level Linux privileges), generating a random VNC password, valid only for that session
- It loads in the user browser (MAC, Linux, Windows) the TightVNC Java applet client. On iOS and Android devices the user has to exploit a web link based on a *URL Scheme*, for automatically running the VNC client previously installed on board of the device and opening an interactive desktop
- It establishes the connection and changes the password
- Any other VNC connection for the same user will be inhibited
- The Shibboleth authentication data are the only credentials needed to operate in this technology

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- The ACID server is behind a firewall and it has a public IP address. A range of TCP ports is allocated for VNC connections and each user has a different VNC channel.
- The latest implementation of ACID server is a virtual machine. This paradigm best fits the new WS-PGRADE Direct Cloud Access feature that, in the near future, will allow the system to forward asynchronous ACID jobs to an *Open Nebula* cloud and, for the interactive on-line analysis, to perform a load-balancing mechanism

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- ACID uses *ownCloud* technology to share easily data between the user desktop and ACID server
- Data sharing between ACID server and multiple servers (e.g. STARnet) is achieved using *Unison File Synchronizer* into a "*star topology*"

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- Each user, once he has been enabled to use the ACID server, finds in own disk area the directory “ownCloud” whose data will be automatically synchronized with those of his desktop. For allowing the synchronization of data between server and desktop, the user must install the client ownCloud in his desktop and use our ownCloud server.
- If the Scientific Gateway is a node of a cluster, ACID server will synchronize all “owncloud” directories of the user present in each node by using Unison File Synchronizer.

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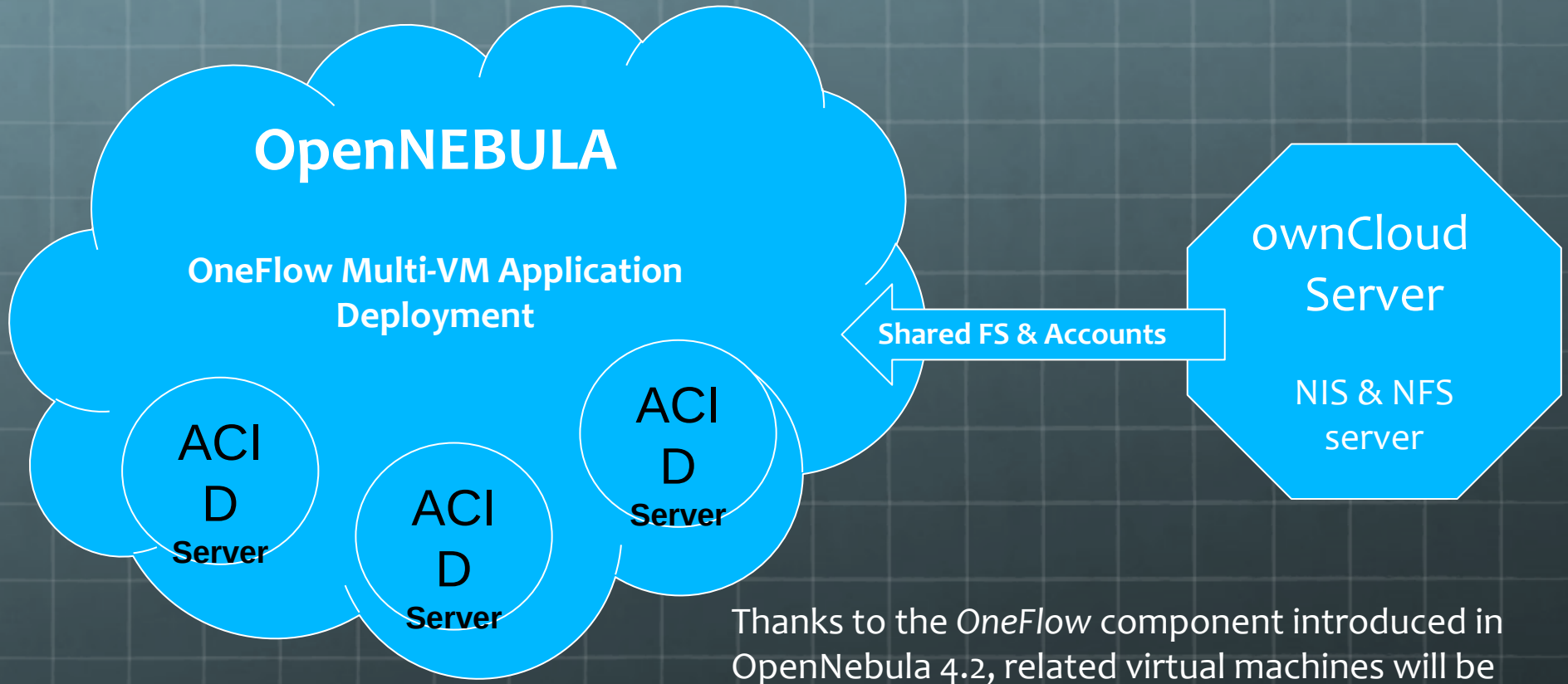

Thanks to the *OneFlow* component introduced in OpenNebula 4.2, related virtual machines will be able to be grouped into a Service

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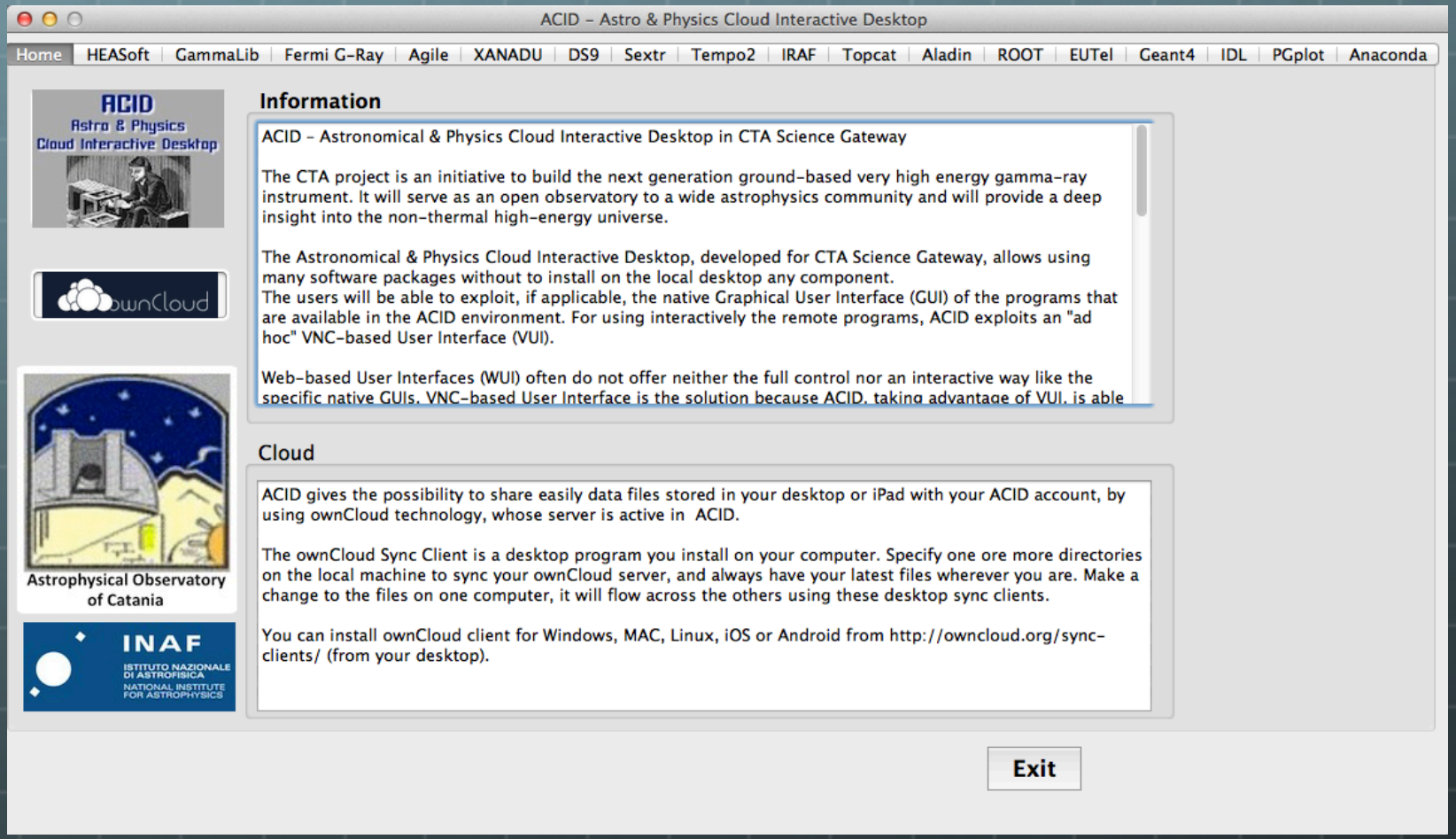

Developed by XOJO, native multi-platoforms (Linux, Mac, Windows)

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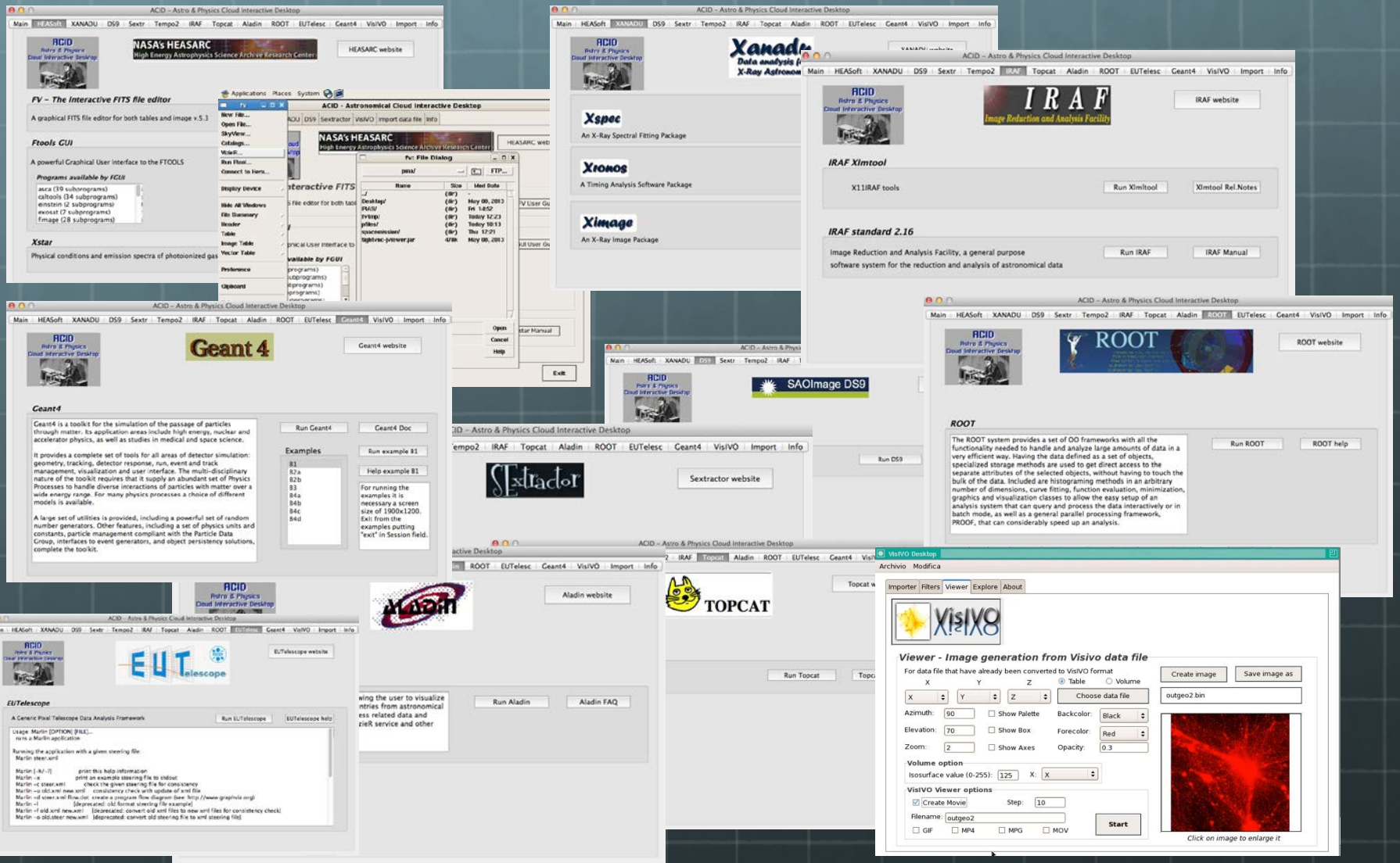

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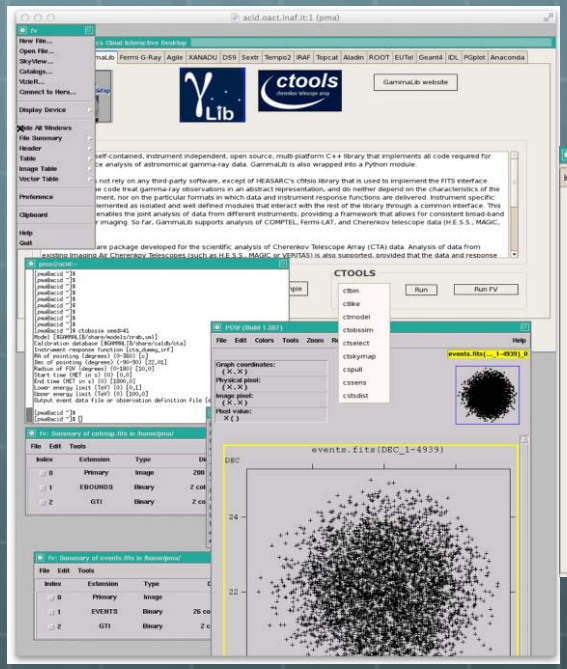
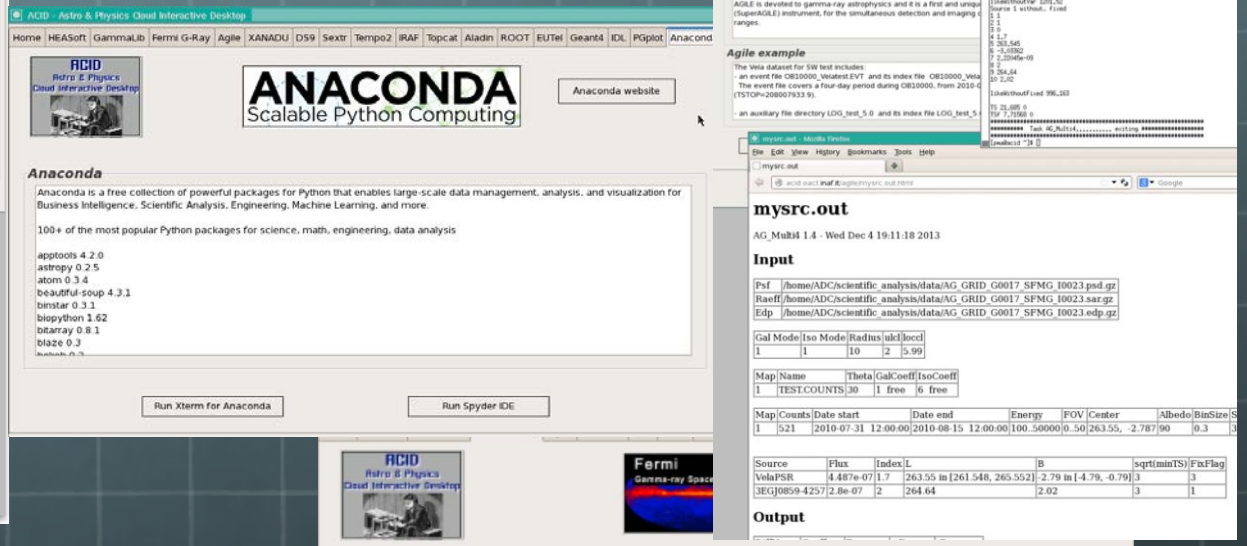
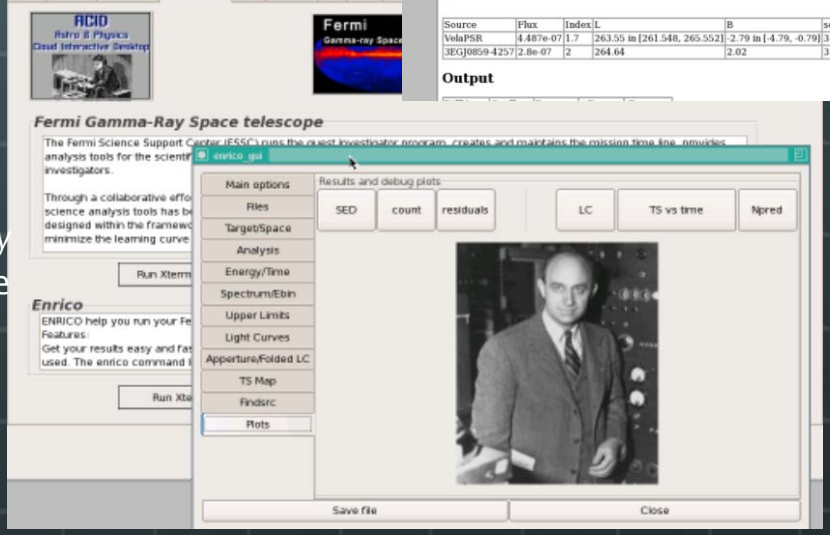


Last but not least…





GammaLib (high-level science analysis of astronomical gamma-ray data), *ctools* (for the scientific analysis of Cherenkov Telescope Array CTA data), *Fermi Gamma-Ray* (analysis tools for Fermi data) and *Enrico* (command line tools for Fermi data), *Agile* (for gamma-ray and X-ray astrophysics data), *Anaconda* (powerful packages for Python that enables large-scale data management, analysis and visualization).

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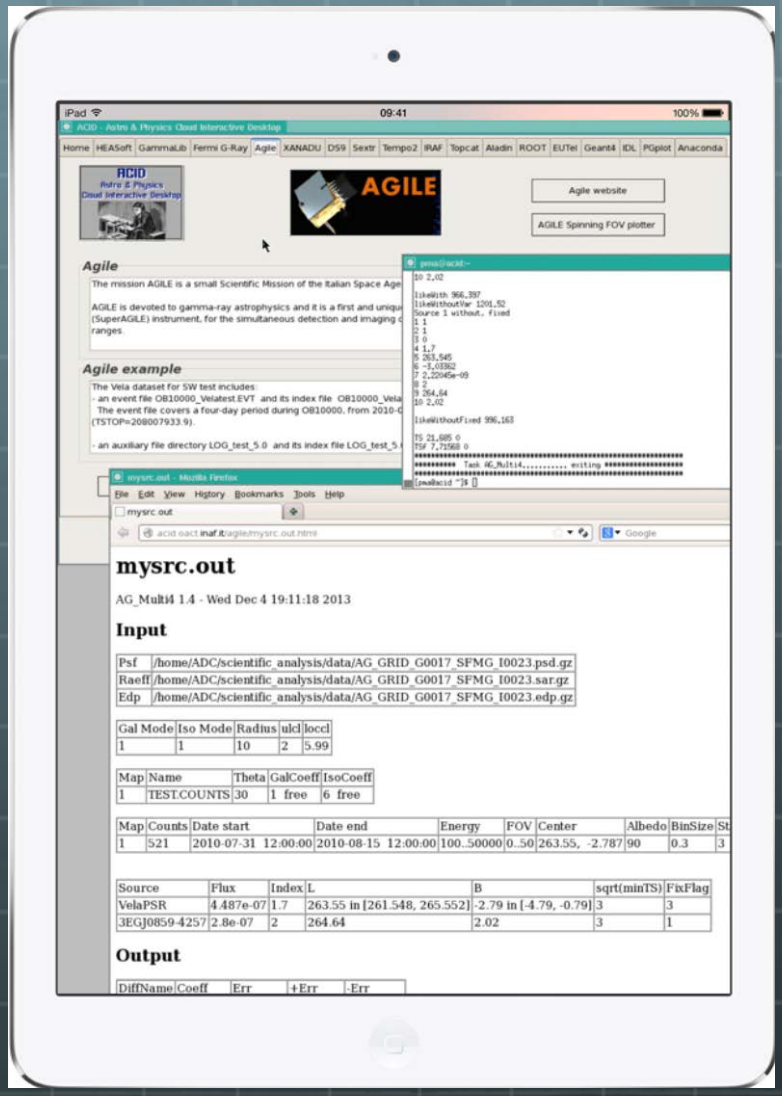

iPad screenshot

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