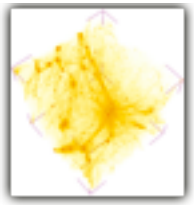
INAF



VisIVO

3D visual analytics systems for ViaLactea project

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- Pula (Ca) -

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Vialactea Project

The aim of the VIALACTEA project is to combine all the new-generation Infared -> Radio surveys of the Galactic Plane, using 3D visual analytics and data mining framework, to build and deliver a quantitative 3D model of our VIALACTEA Galaxy as a star formation engine that will be used as a template for external galaxies and study star formation across the cosmic time.

The main objectives of the project are:

- **developing** new and carefully **image processing tools** to carry out detection and extraction of compact sources and filamentary structures, as well as more complex shape-finding to identify bubble-like features from large scale Galactic Plane imaging surveys both in the infrared continuum and in gas molecular lines.
- To combine in a **VO-compatible** and interoperable way the new-generation Galactic Plane surveys from space-borne missions and ground-based observatories, to obtain a sub-arcminute resolution complete and homogeneous data coverage over the entire Galactic Plane.
- To **build** and **visualize** a new 3D representation of the Milky Way Galaxy.
- To bring to a **common forum** the scientific astronomical expertise and the e-Science technological know-how of european-leading research groups to **develop** the next generation **data analysis tools.**

Vialactea Consortium

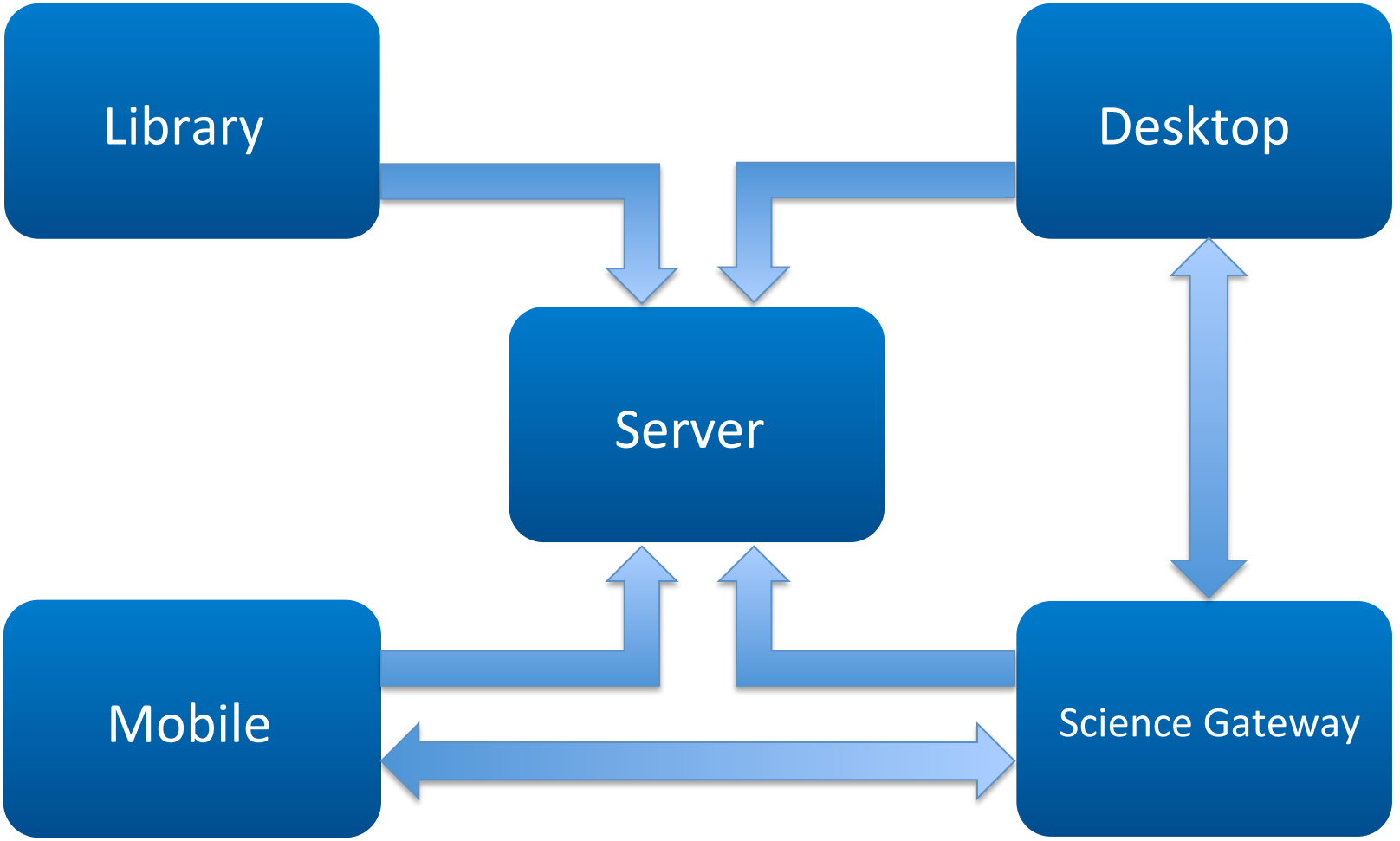
- INAF-Istituto Nazionale di Astrofisica
- University of Leeds
- MPG,Max-Planck Institute fur Astronomie
- MTA SZTAKI
- Cardiff University
- Laboratoire d'Astrophysique de Marseille
- Observatoire de Strasbourg
- Nagoya University
- University of Exeter

Vialactea – INAF CT

INAF-OACT is involved in the implementation of a **3D-aided visual analytics** environment allowing the astronomer to easily conduct research activities using virtual reality methods for multidimensional data and information visualization, real-time data interaction to carry out complex tasks for multi-criteria data/metadata queries for subsample selection and further analysis, or real-time control of data fitting to theoretical models.

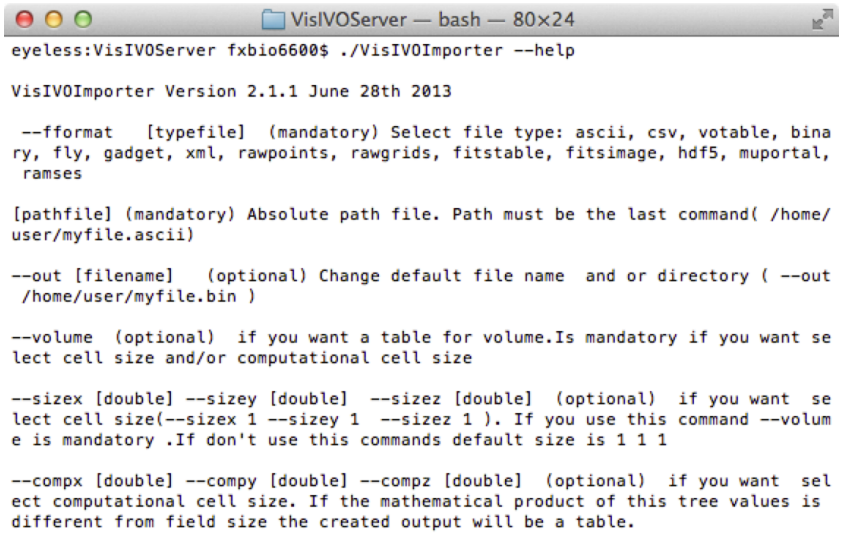
This tool is built on the **VisIVO** backbone to implement a **client-server** application where all data, models, analysis tools, data-mining/machine-learning tools and information will be enclosed in a standardised, homogeneous and interoperable framework handled via a **Science Gateway**.

VisIVO Ecosystem



VisIVO Server

VisIVO Server is a suite of command line tools for creating customised views of 3D renderings from astrophysical data tables.



It consists of three core components:

VisIVO Importer converts user-supplied datasets into an internal data format called VBT.

VisIVO Filters are programs that creates a new table or modify the existing one according to the selected operation.

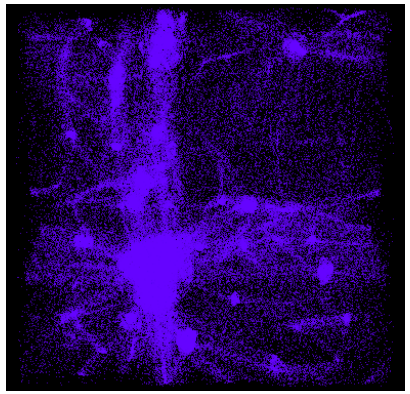
VisIVOViewer creates 3D views from the input data file (in VBT Format).

Rendering Engine

VTK

The **Visualization Toolkit (VTK)** is an open-source, freely available software system for 3D computer graphics, image processing and visualization. VTK consists of a C++ class library.

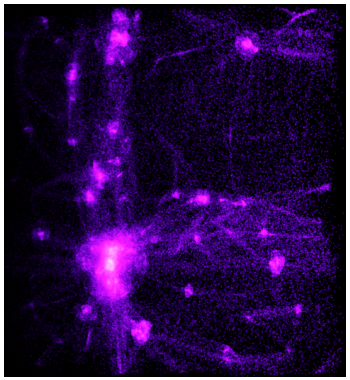
http://www.vtk.org



Splotch

Splotch is a ray tracing rendering tool used to represent several species. The visualization algorithm is a derivative of the volumetric ray casting and uses an approximation of the radiative transfer equation which gives the produced images a very realistic appearanced.

http://www.mpa-garching.mpg.de/~kdolag/Splotch/



VisIVO Library

```
3
4  #include "visivo.h"
5
6  int main(int argc, char*argv[])
7  {
8      VisIVOImporter env1;
9      int errorCode;
10     errorCode=VI_Init(&env1);
11
12     errorCode=VI_SetAtt(&env1,VI_SET_FFORMAT,"votable");
13     errorCode=VI_SetAtt(&env1,VI_SET_FILEPATH,"VOTableUserFilename.xml");
14     errorCode=VI_SetAtt(&env1,VI_SET_OUTFILEVBT,"/home/user/dataNewTable.bin");
15     errorCode=VI_Import(&env1);
16 }
```

VisIVOLibrary is a **C/C++ library.**

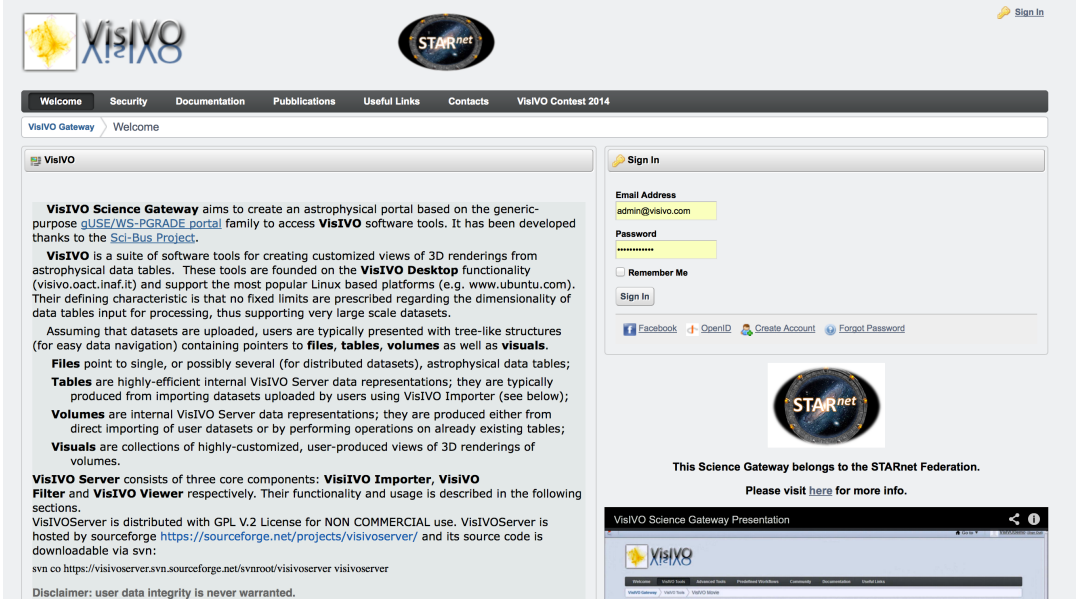
The Library can create images directly from the **binary arrays** of the user program **without having the output files.**
The Library also allows the user program to open **local**, **remote** (URL) or **grid catalogue** data files.

VisIVO Library is organized with *environments* that are represented with a variable.

More than one environment may exist for each section. Typically to set the environment the user must declare the variable (e.g. *VisIVOViewer env3;)* and initialize it (*VV_Init(&env3*)).

The variable contains all settings for the operation.

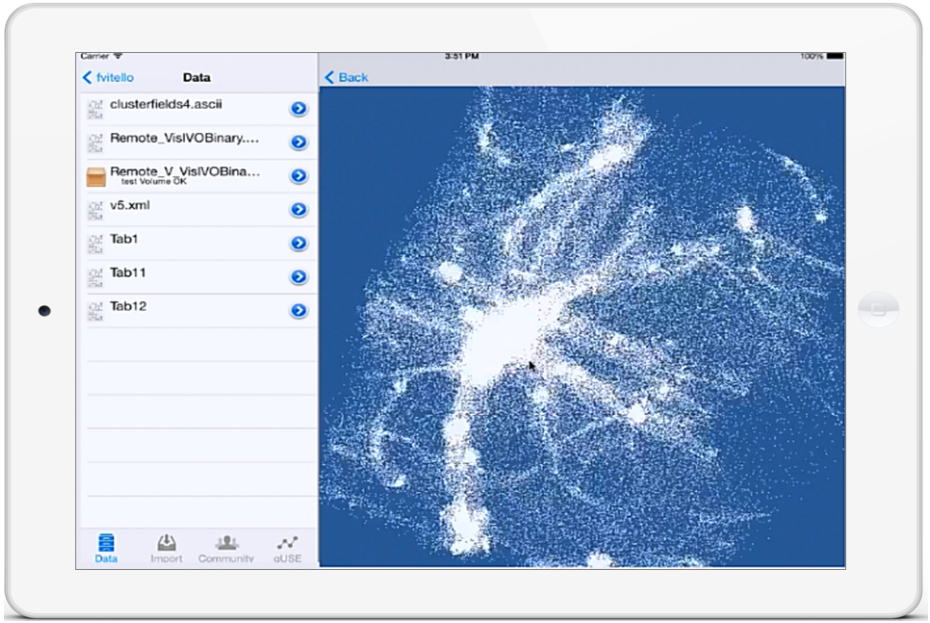
VisIVO Science Gateway



The **VisIVO Science Gateway** is designed as a workflow enabled grid portal that is wrapped around **WS-PGRADE/gUSE** framework providing visualization and data management services to the scientific community by means of an easy-to-use graphical environment for accessing the full functionality of VisIVO Server.

http://visivo.oact.inaf.it

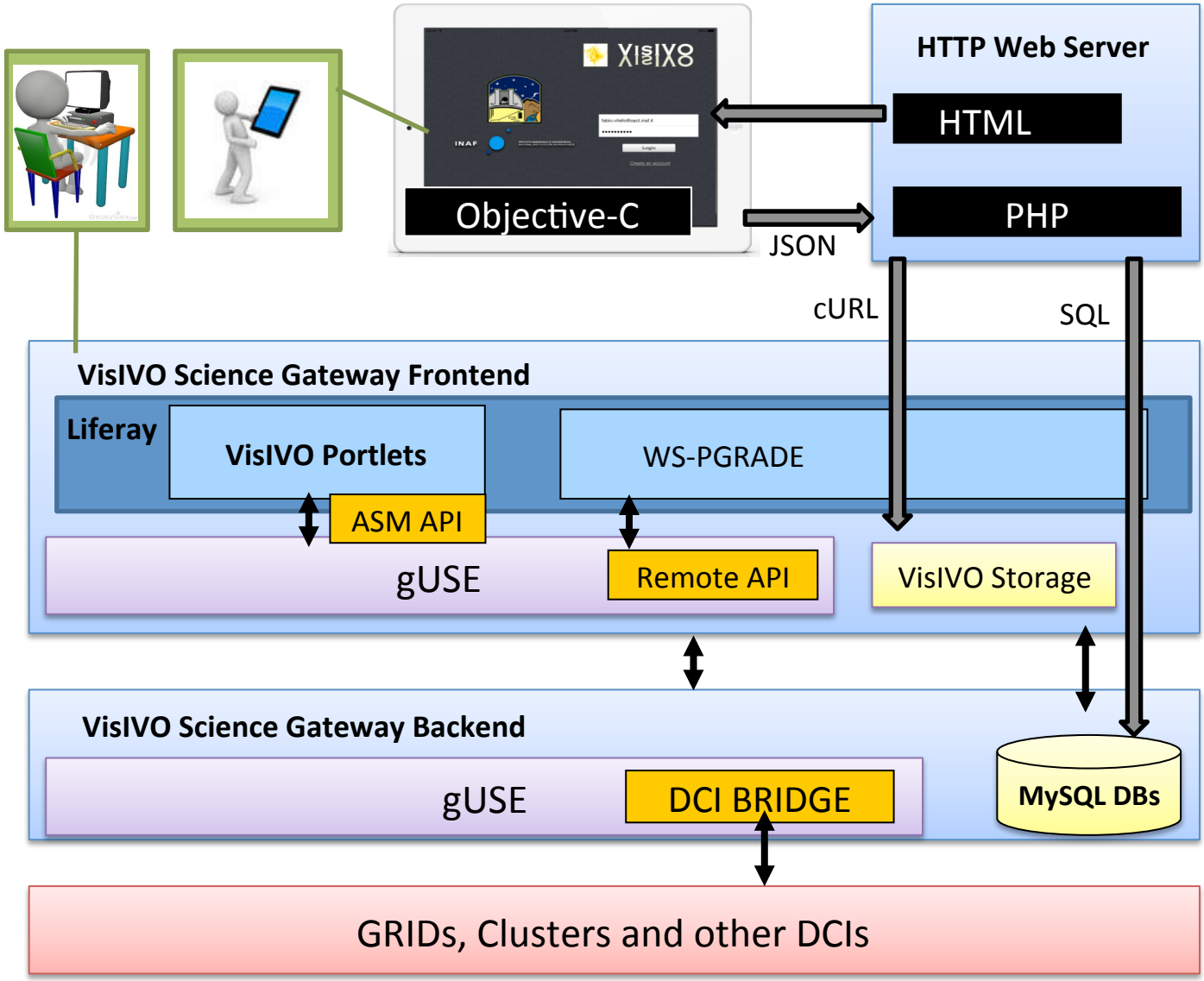
VisIVO Mobile



Available on the App Store

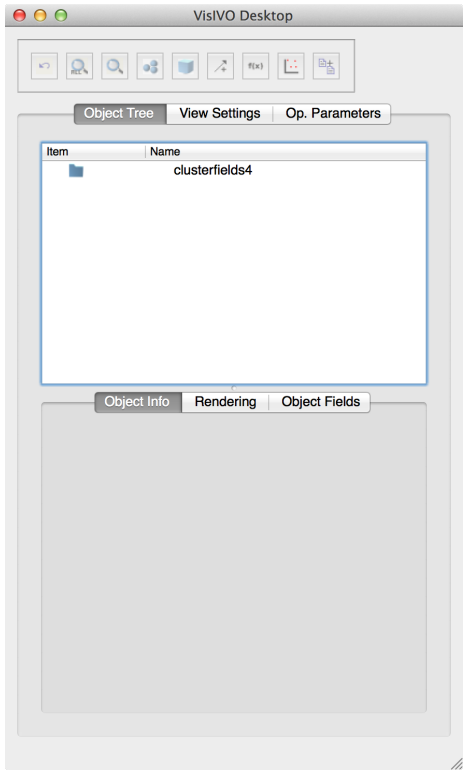
The **VisIVO Mobile** application allows Apple iPad devices to exploit **VisIVO Science Gateway** functionalities to access large-scale astrophysical datasets residing on a server repository for analysis and visual discovery operations.

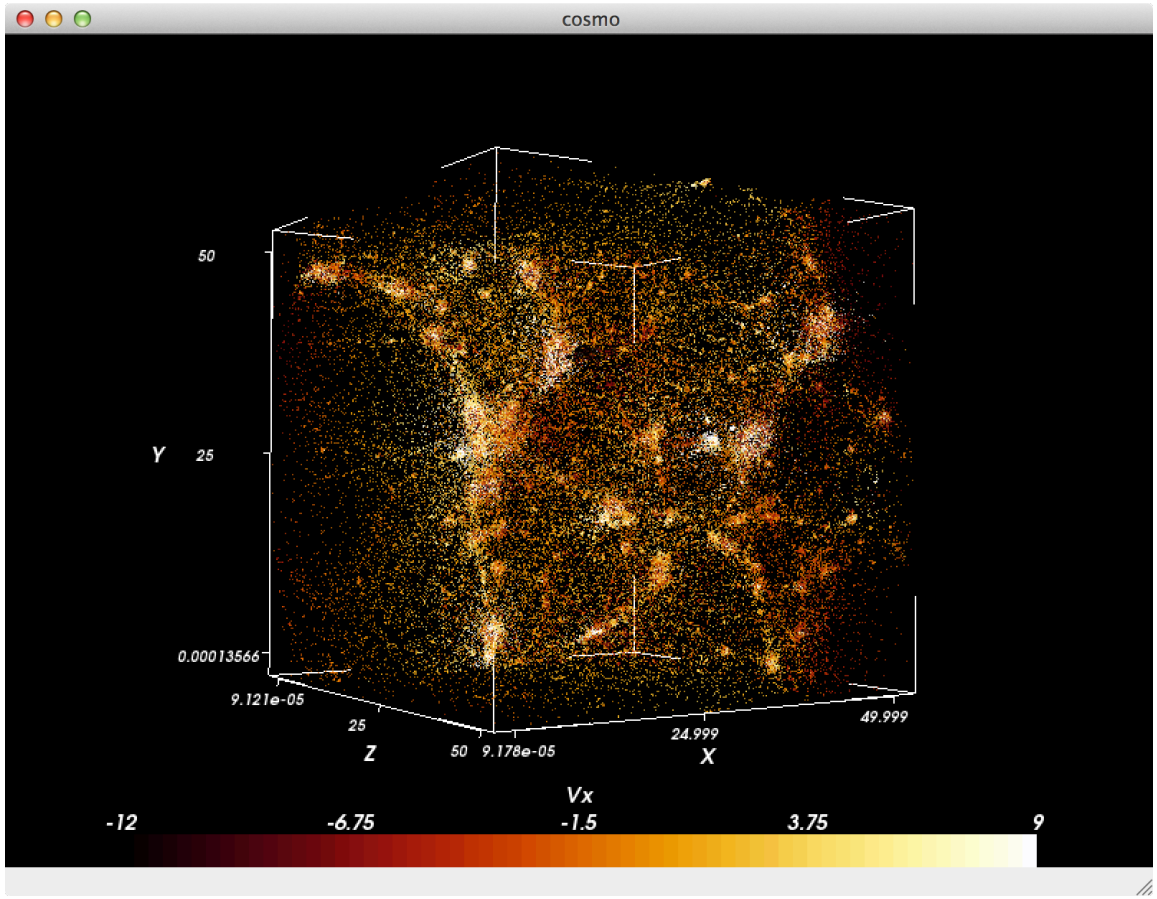
VisIVO Science Gateway and Mobile Architecture



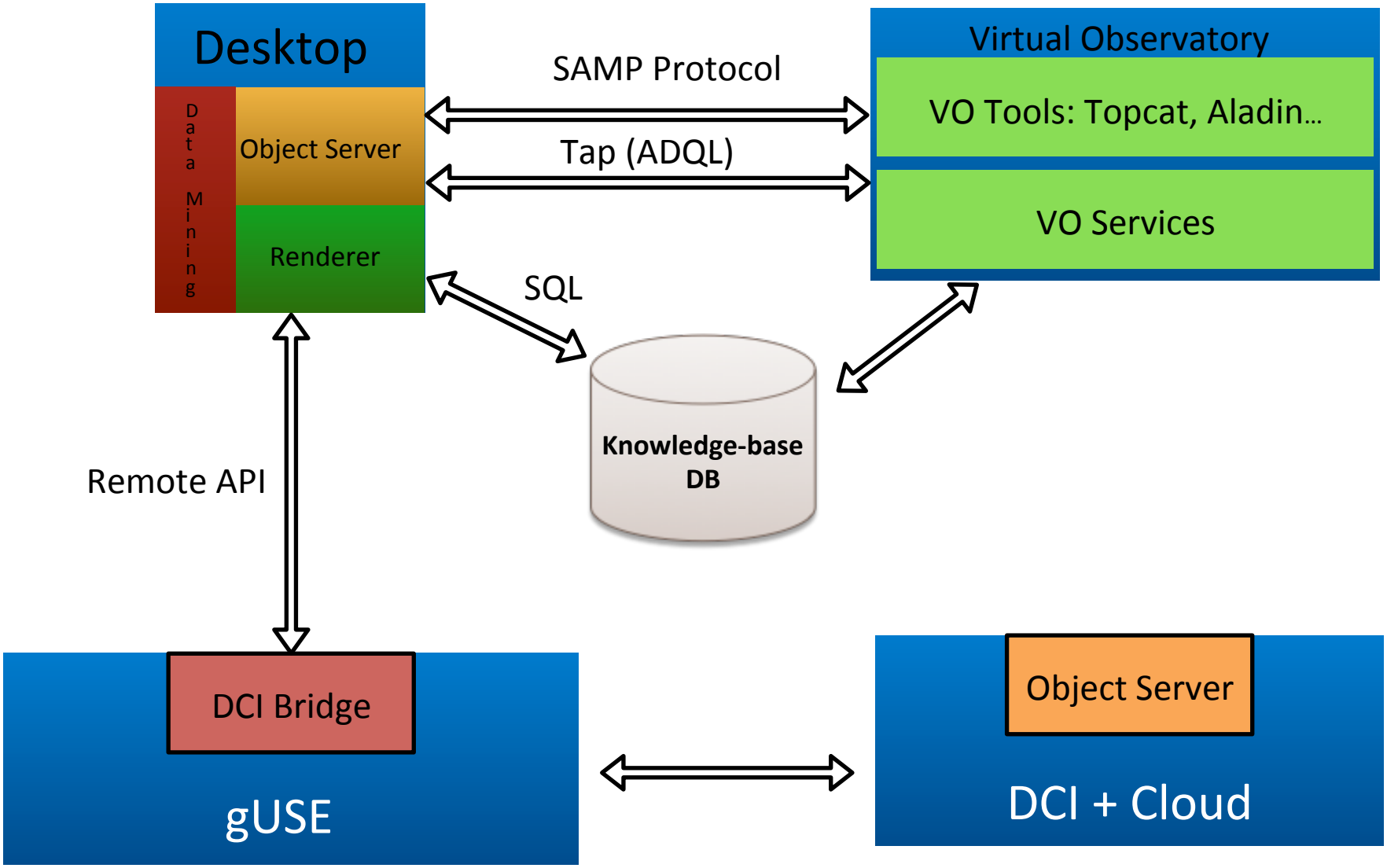
VisIVO Desktop

VisIVO Desktop is an open source visualisation environment specifically designed for exploration of astrophysical (either real-world or numerical simulation) datasets.

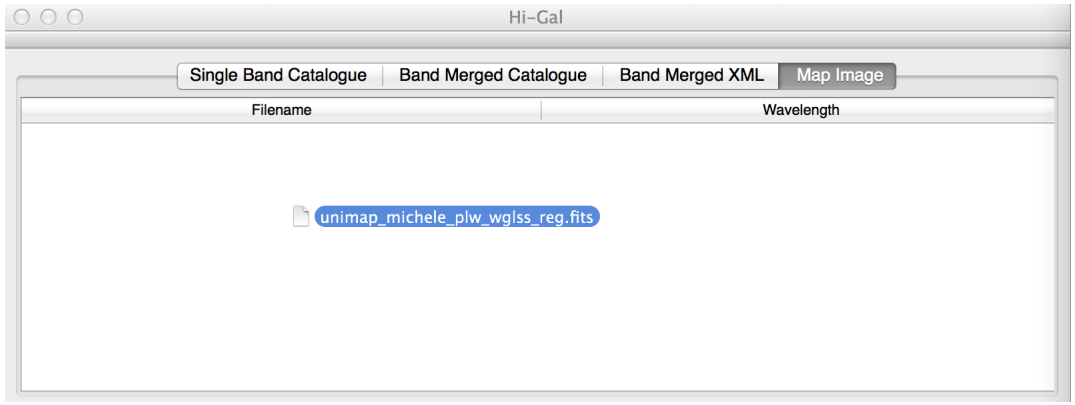




VisIVO Desktop Architecture

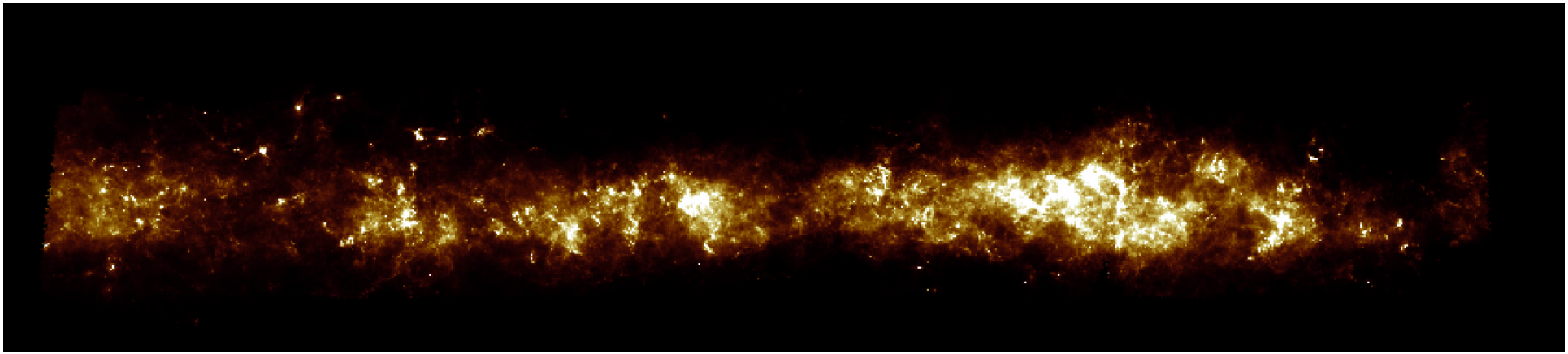


VisIVO Desktop – Vialactea tool

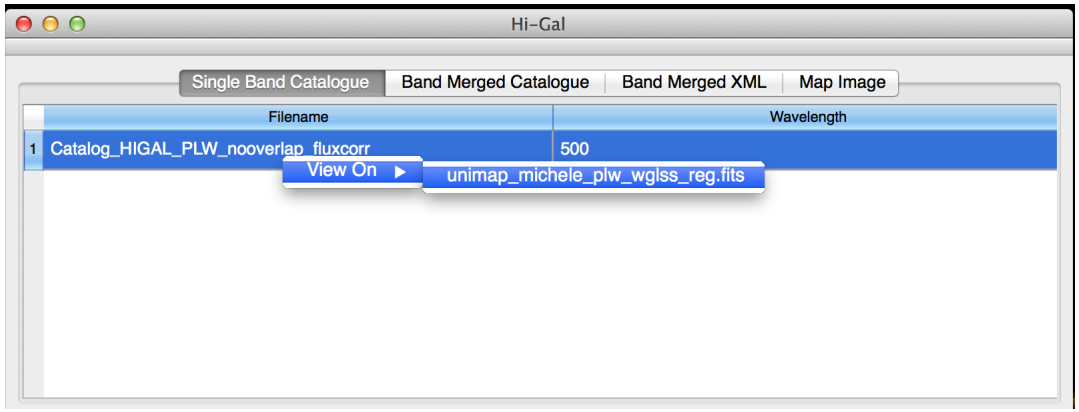


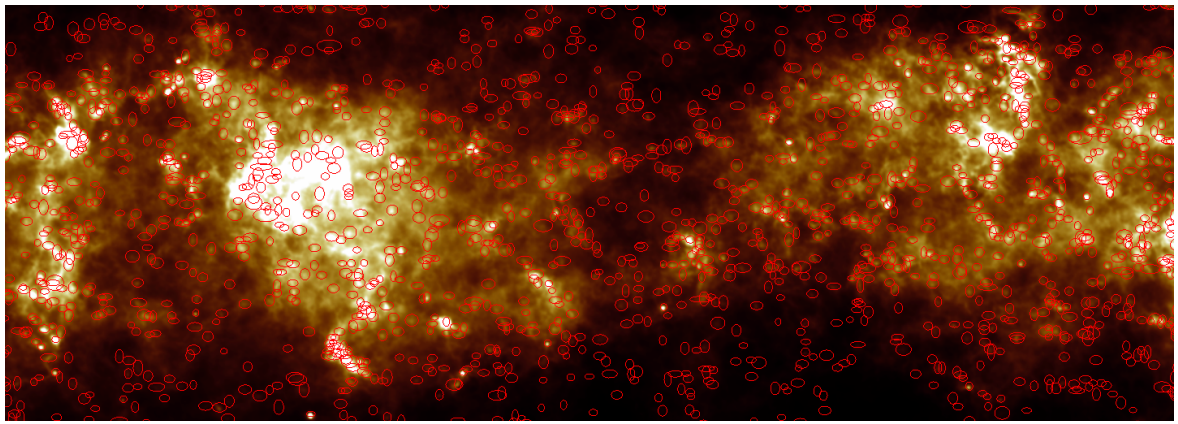
How to load Map images and catalog:

- **Drag and drop** for **local data**;
- SQL Query to Knowledge base DB;
- Query to TAP services;



VisIVO Desktop – Vialactea tool

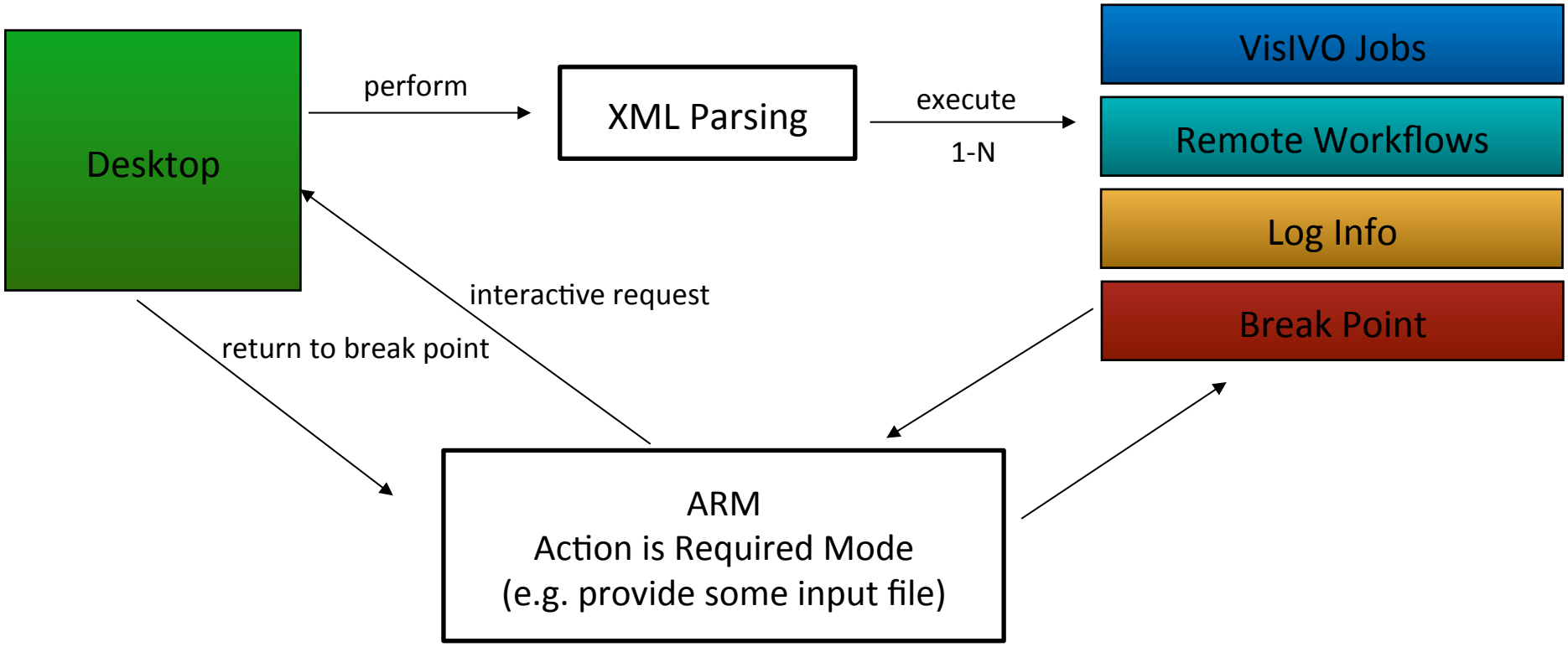




Fits map visualisation with overlapping compact sources

VisIVO Desktop – Scenario Work flow

Predefined and customisable sequence of actions in XML format



STAR^{net} Gateway Federation

http://www.oact.inaf.it/STARnet

INAF

- Astrophysical Obs. of Catania

VisIVO: Scientific Visualization and data exploration

- Astronomical Obs. of Trieste ***Cosmic Microwave Background: Esa's Plank space telescope***
- Astronomical Obs. of Teramo

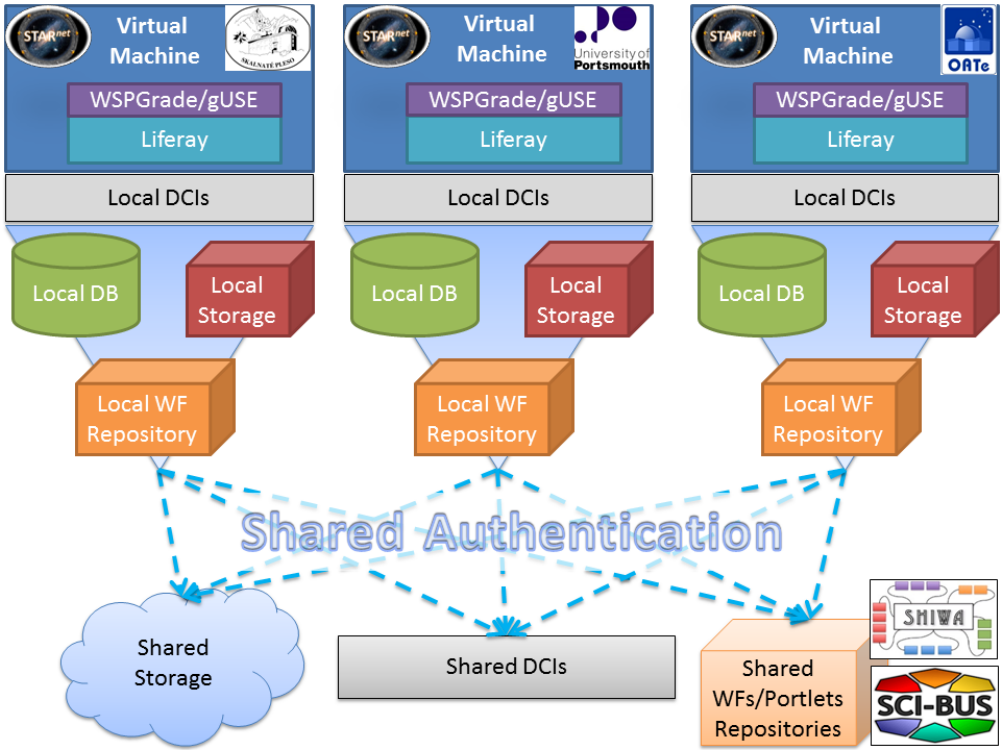
Stellar astrophysics evolutionary model

University of Portsmouth (UoP)

- ***Large scale Cosmological Simulations***

Astronomical Instutute of the Slovak Academy of Sciences (SAS)

- ***Interstellar Comets***



Technology

Liferay, WS-PGRADE/gUse

Maintenance

Master Virtual Machine with local customization

Shared services

- Single Sign On (SSO based on LDAP)
- Workflows and Portlets sharing
- Shared Storage based on ownCloud