Making e-Infrastructures easy: the Science Gateway approach

Roberto Barbera (roberto.barbera@ct.infn.it)
University of Catania and INFN

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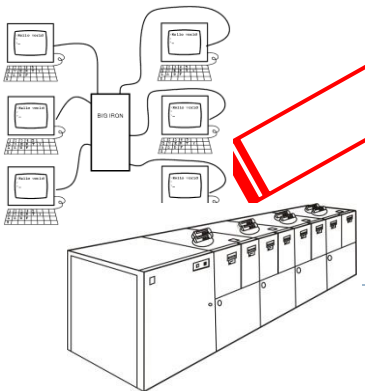
Outline

- Introductory considerations
- The Catania Science Gateway Framework
- Use cases from health:
  - DECIDE
  - IOERT
- Summary and conclusions

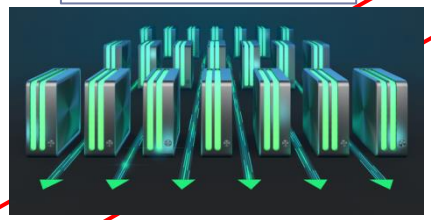
Evolution of distributed computing

Cost of hw
Cost of networks

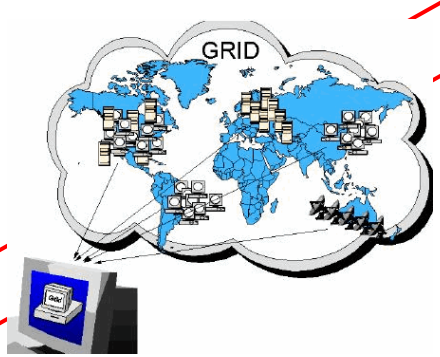
Mainframe Computing



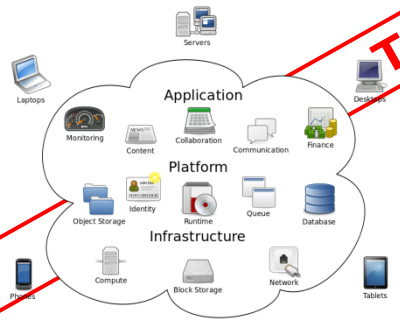
80's-90's Cluster Computing



90's-00's Grid Computing



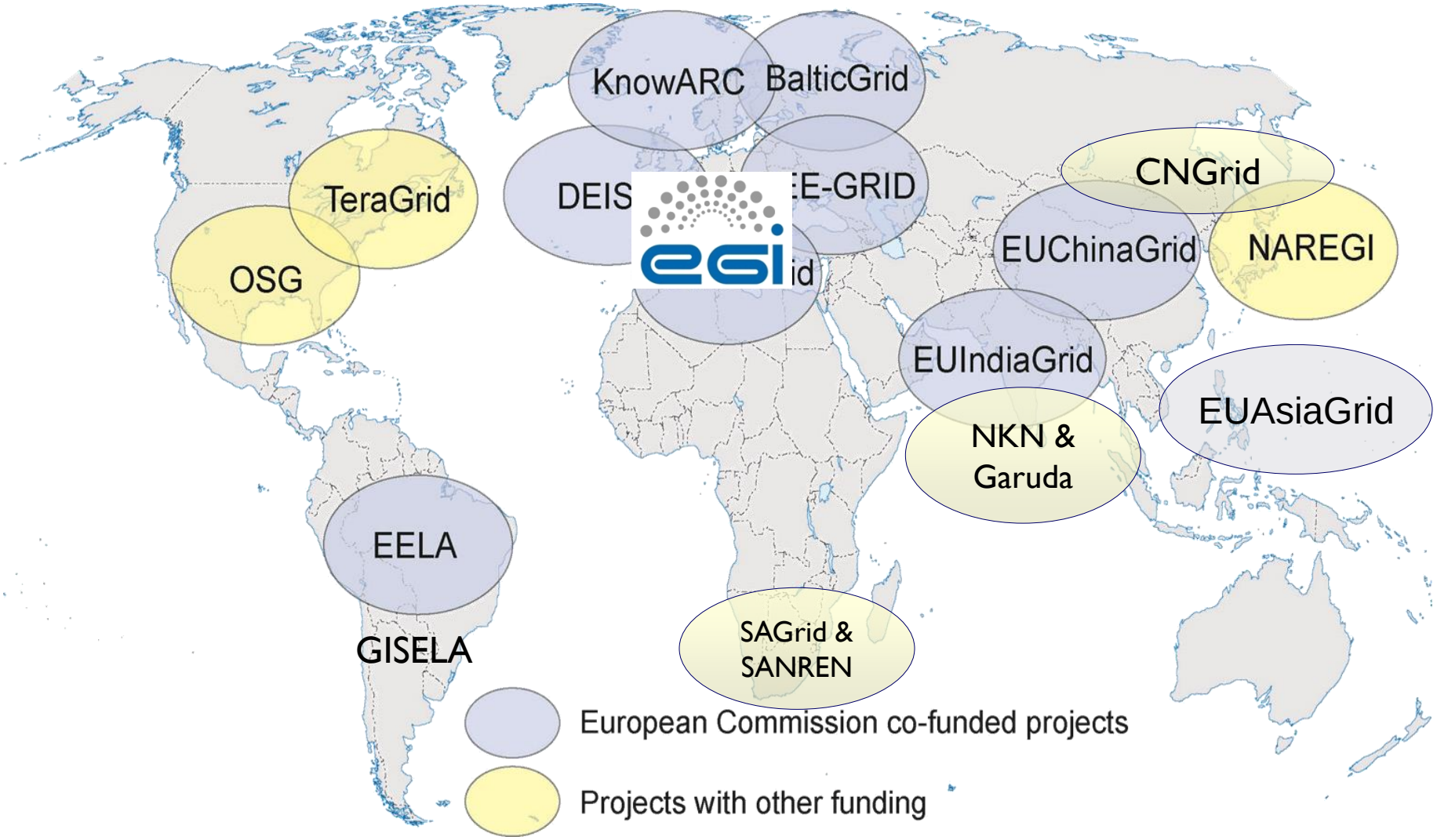
00's-10's Cloud Computing



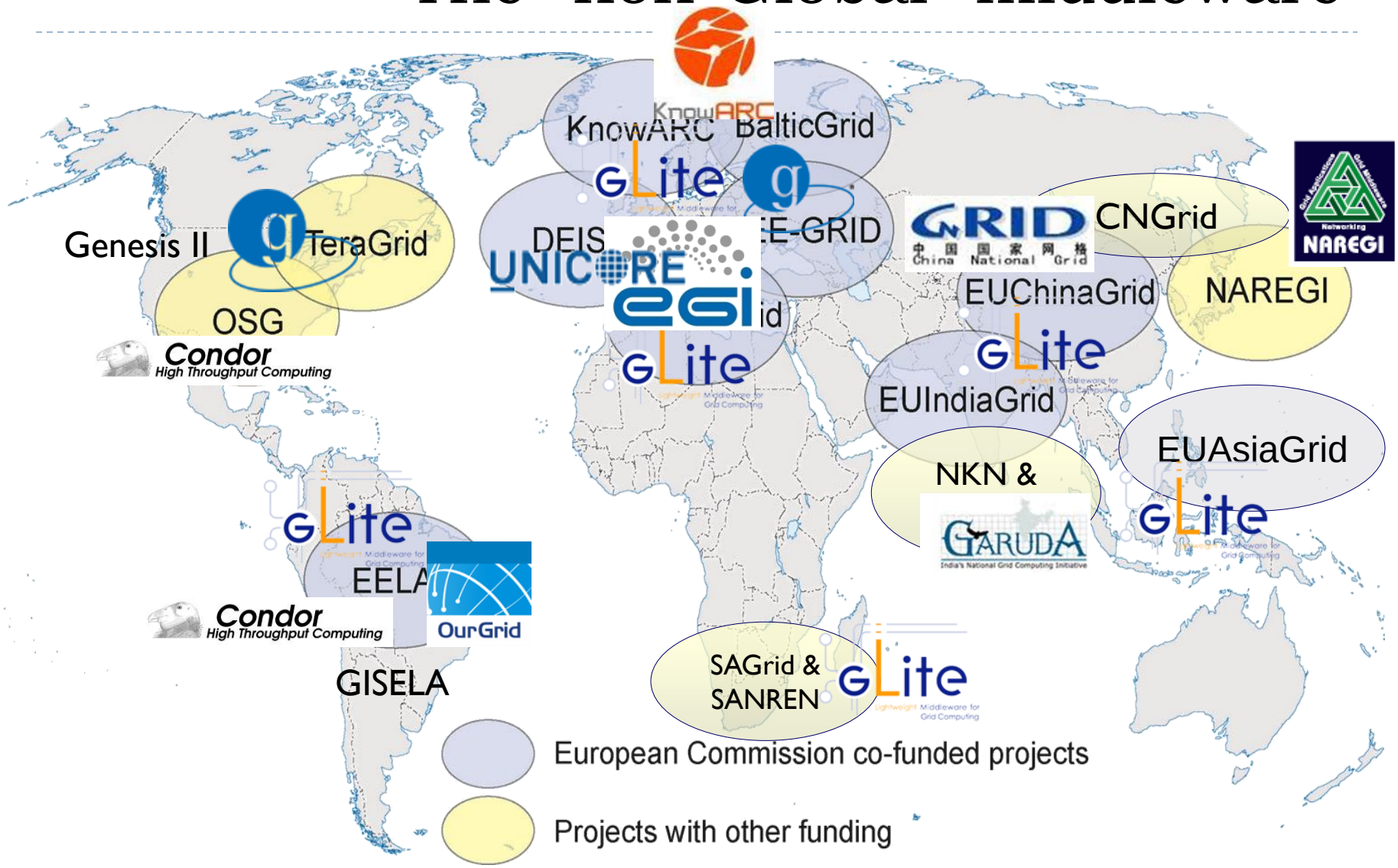
Time

Power of COTS
WAN bandwidth

The “Global” Grid



The “non-Global” middleware



Using Grids is not straightforward ☹

```
Type = "Job";
JobType = "MPICH";
MPIType = "MVAPICH2_PGI706";
CpuNumber = 16;
MPIGranularity = 4;
Executable = "flash2";
StdOutput = "mpi.out";
StdError = "mpi.err";
InputSandbox =
```

JDL

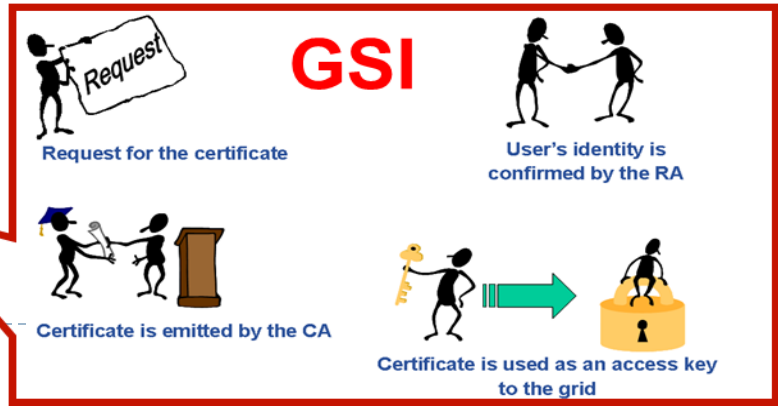
```
echo Staging Input Data \(Courtesy of European Space
Agency\);
#edg-rm --vo=gilda copyFile lfn:$1.N1 file://$PWD/$1.N1;
lcg-cp --vo=gilda lfn:$1.N1 file://$PWD/$1.N1;
echo Staging Application;
gunzip beam20.tar.gz;
tar xvf beam20.tar;
cd beam-2.0/bin;
echo Starting Application;
./pds2jpg-ASAR-run.sh $1;
mv $1-b*.jpg ../..
cd ../..
rm -fr beam-2.0;
```

Script

CLI

```
Exit code:        0
Status Reason:    Job terminated successfully
Destination:      grid010.ct.infn.it:2119/jobmanager-lcgpbs-gilda
Submitted:        Tue Jun 29 15:34:40 2010 CEST
```

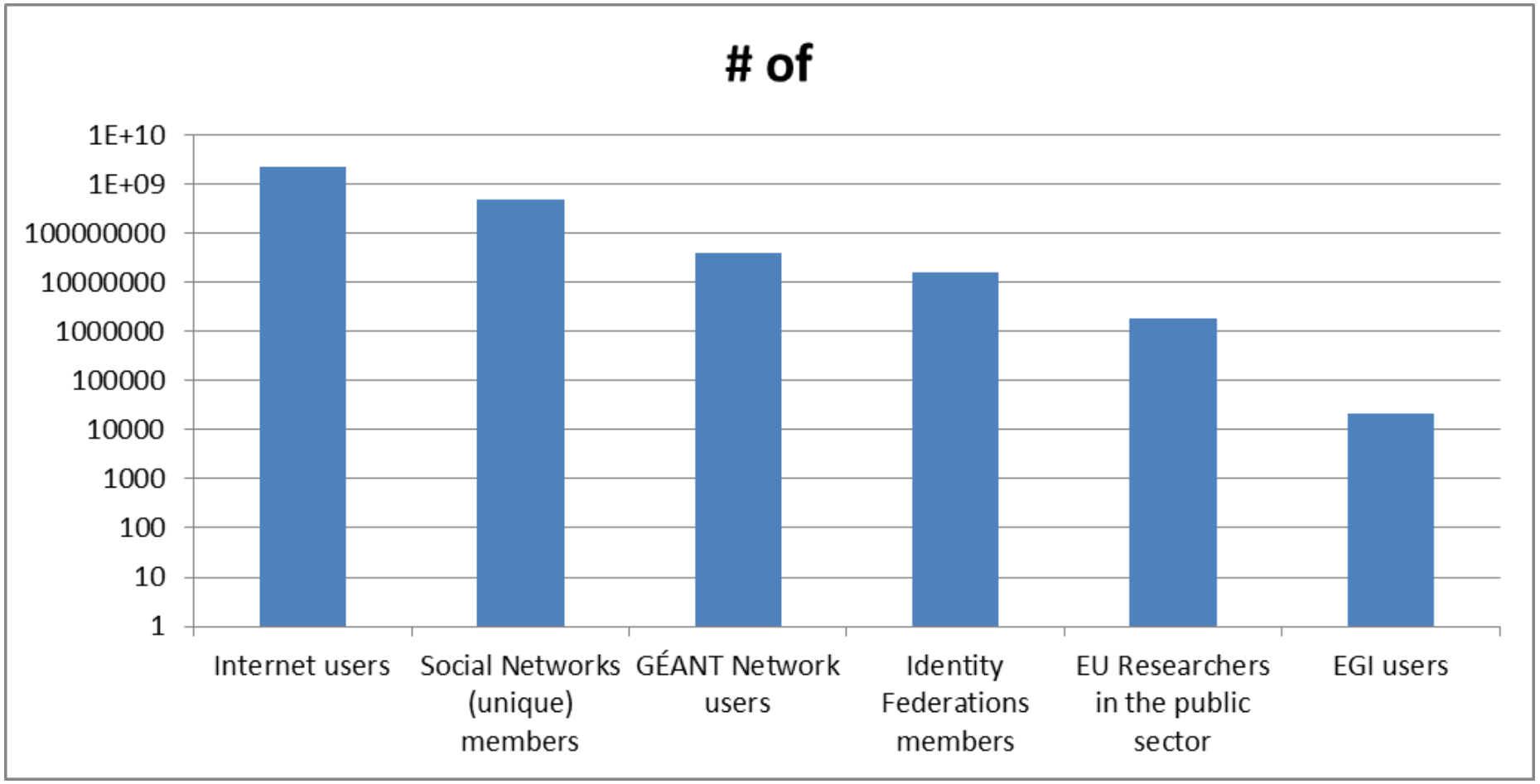
Users have to cope with complex security procedures, execution scripts, job description languages, command line based interfaces and lack of standards.
This makes the learning curve very steep and keeps non IT-experts away.



The eResearch2020 report
(http://www.eresearch2020.eu/eResearch%20Brochure%20EN.pdf)

- Some barriers in the adoption of Grids:
  - **Changes on Grids means changes on applications**
  - Time required to adapt usual workflows
  - Lack of structure to support anonymous access
  - Download and installation of applications
  - **Interface**
  - Slow to get to compared to other resources
  - **Difficult to use in the beginning**
  - **Time spent to get the application compiled and running**

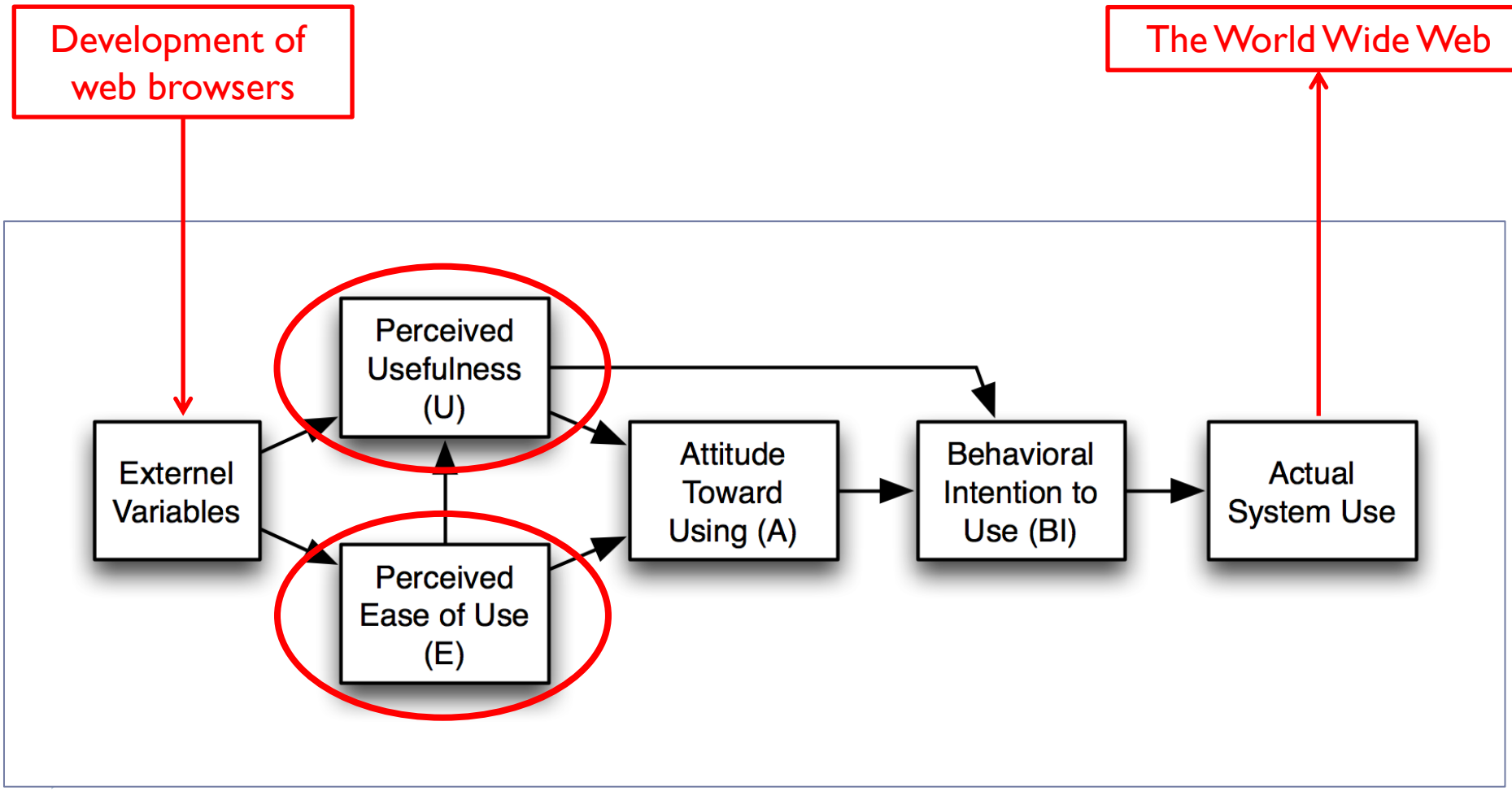
Some figures…



The path to technology uptake – Where are we with e-Infrastructures ?

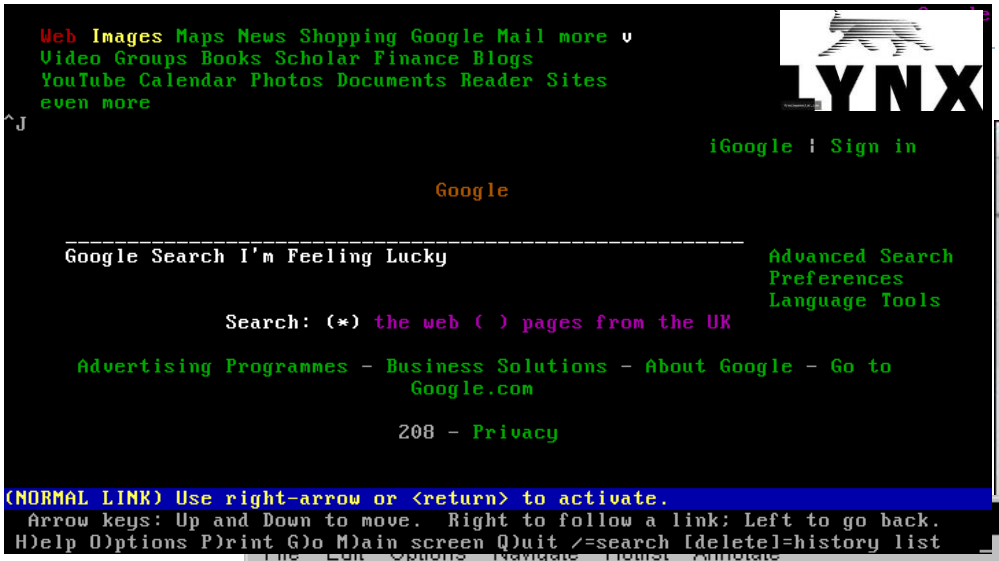
The Rogers "bell-shape" curve - Rogers, E. M. (1962), "Diffusion of Innovations", Glencoe: Free Press.

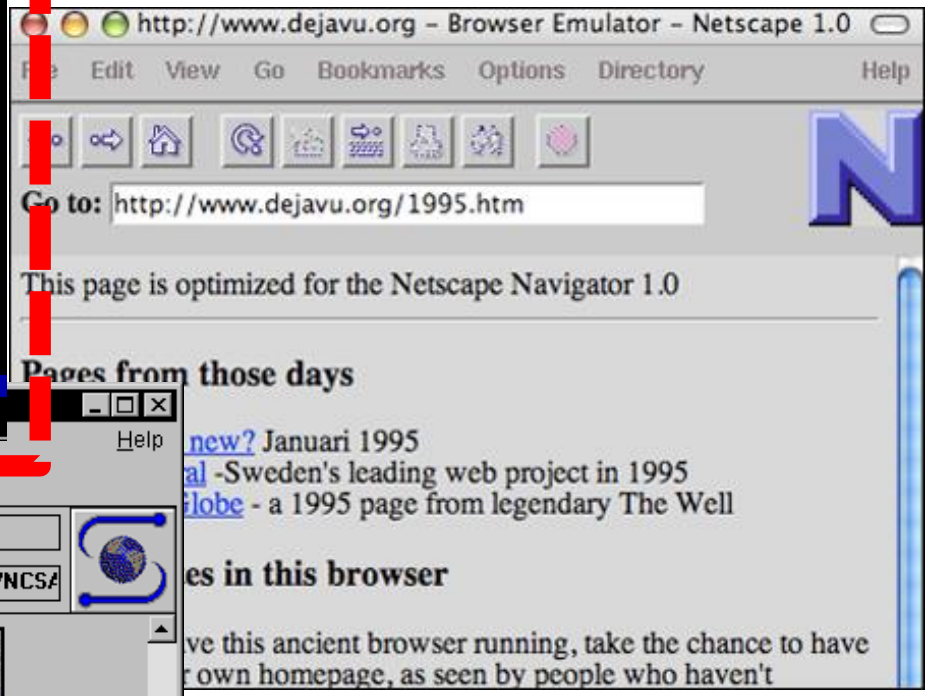
IT acceptance model – **the Web**

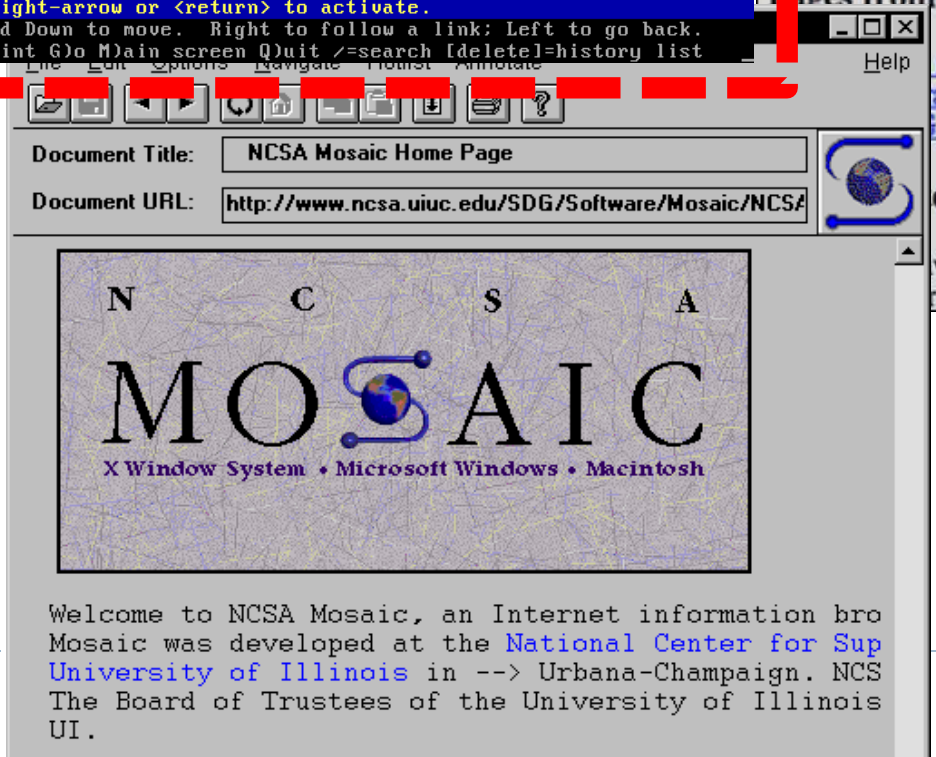


Davis, F. D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly* 13(3): 319–340

The evolution leap in web browsers







evolution leap

Community-driven web portals have started to integrate Grid Tools and Applications

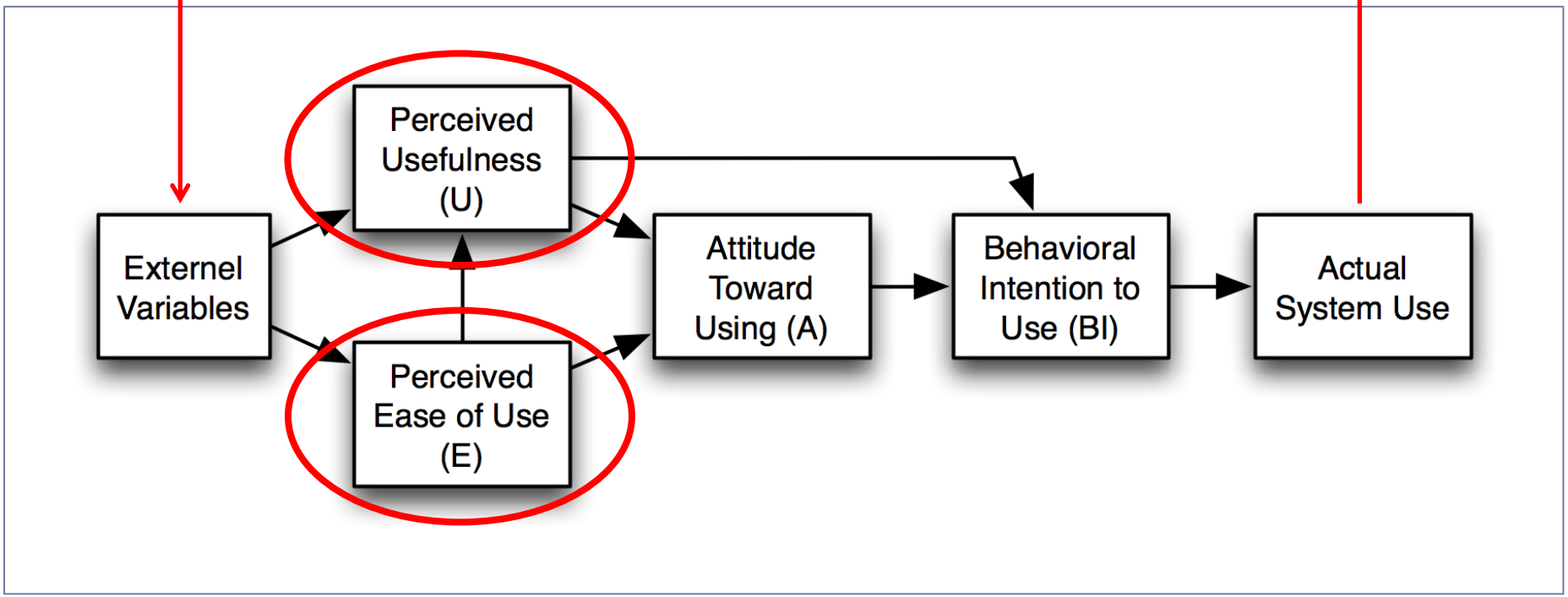
"A Science Gateway is a community-developed set of tools, applications, and data that is integrated via a portal or a suite of applications, usually in a graphical user interface, that is further customized to meet the needs of a specific community."

Teragrid/XSEDE

IT acceptance model – **the Grid**

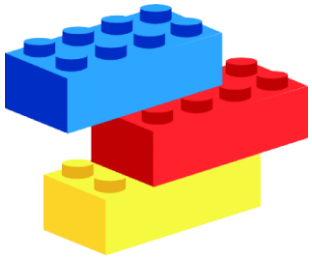
Development of Science Gateways

Requirement for sustainability

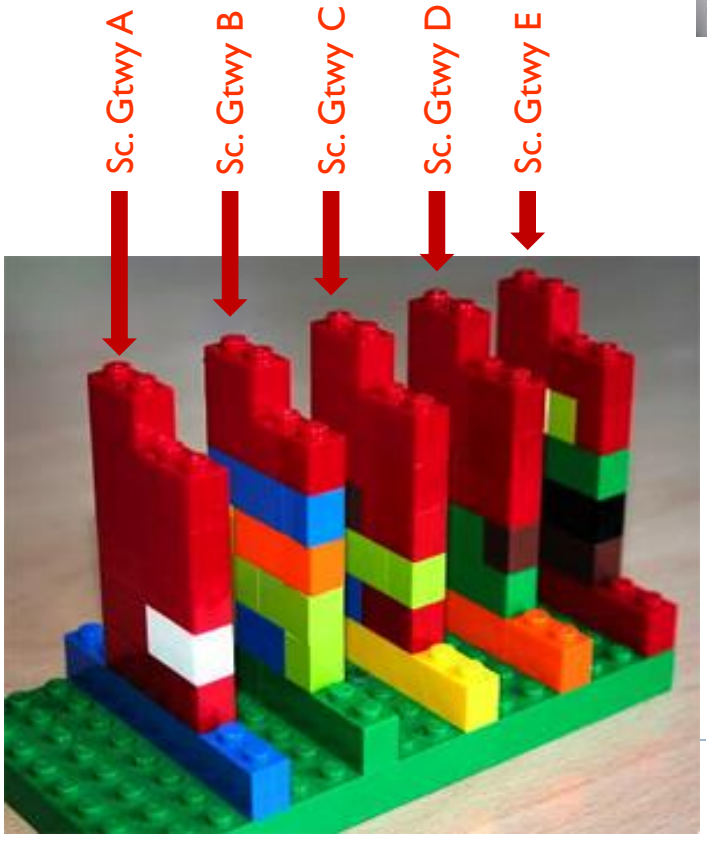


Davis, F. D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly* 13(3): 319–340

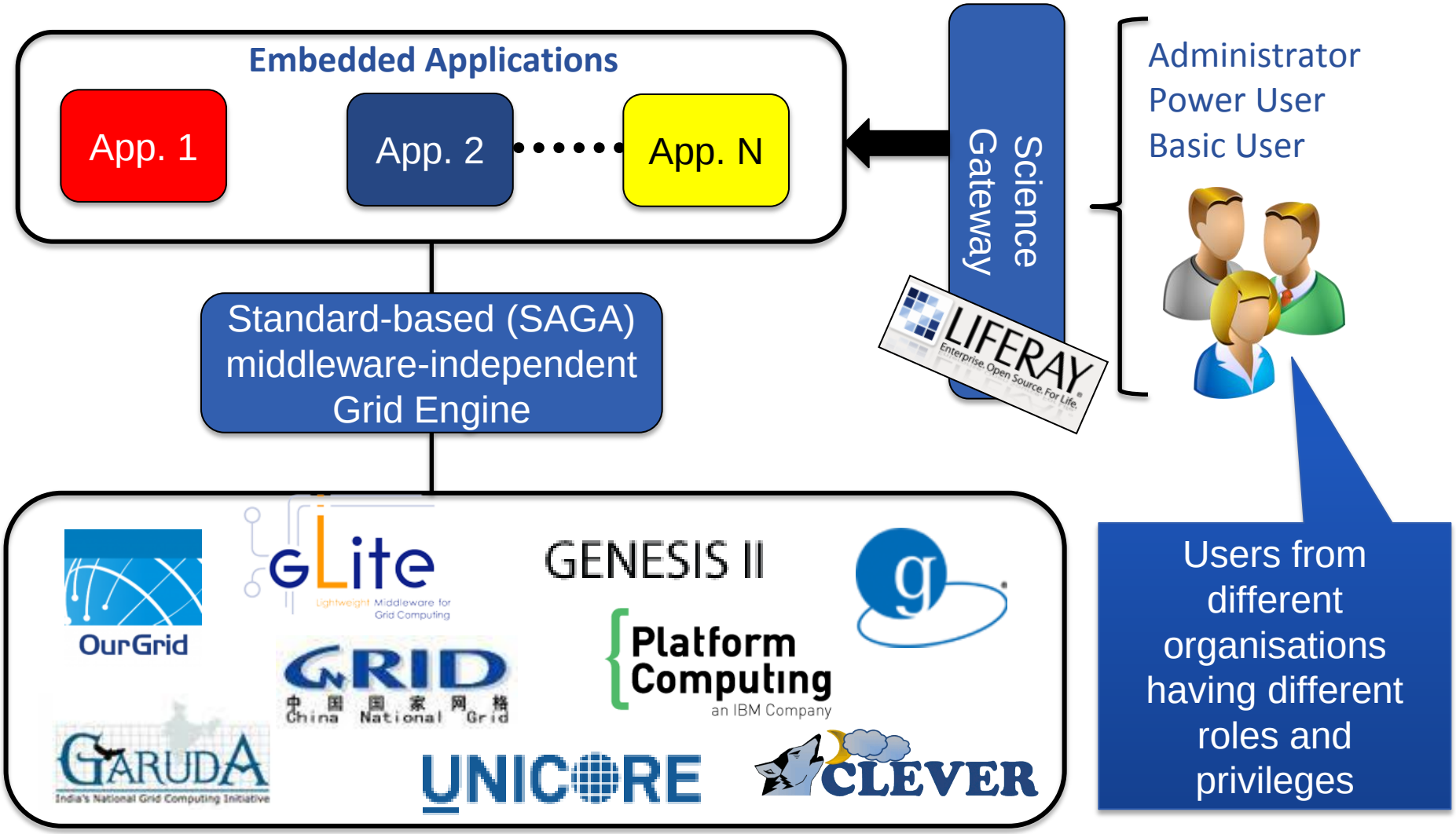
Primary requirement: building Science Gateways should be like playing with LEGO



- **Standards**
- **Simplicity**
- **Easiness of use**
- **Re-usability**

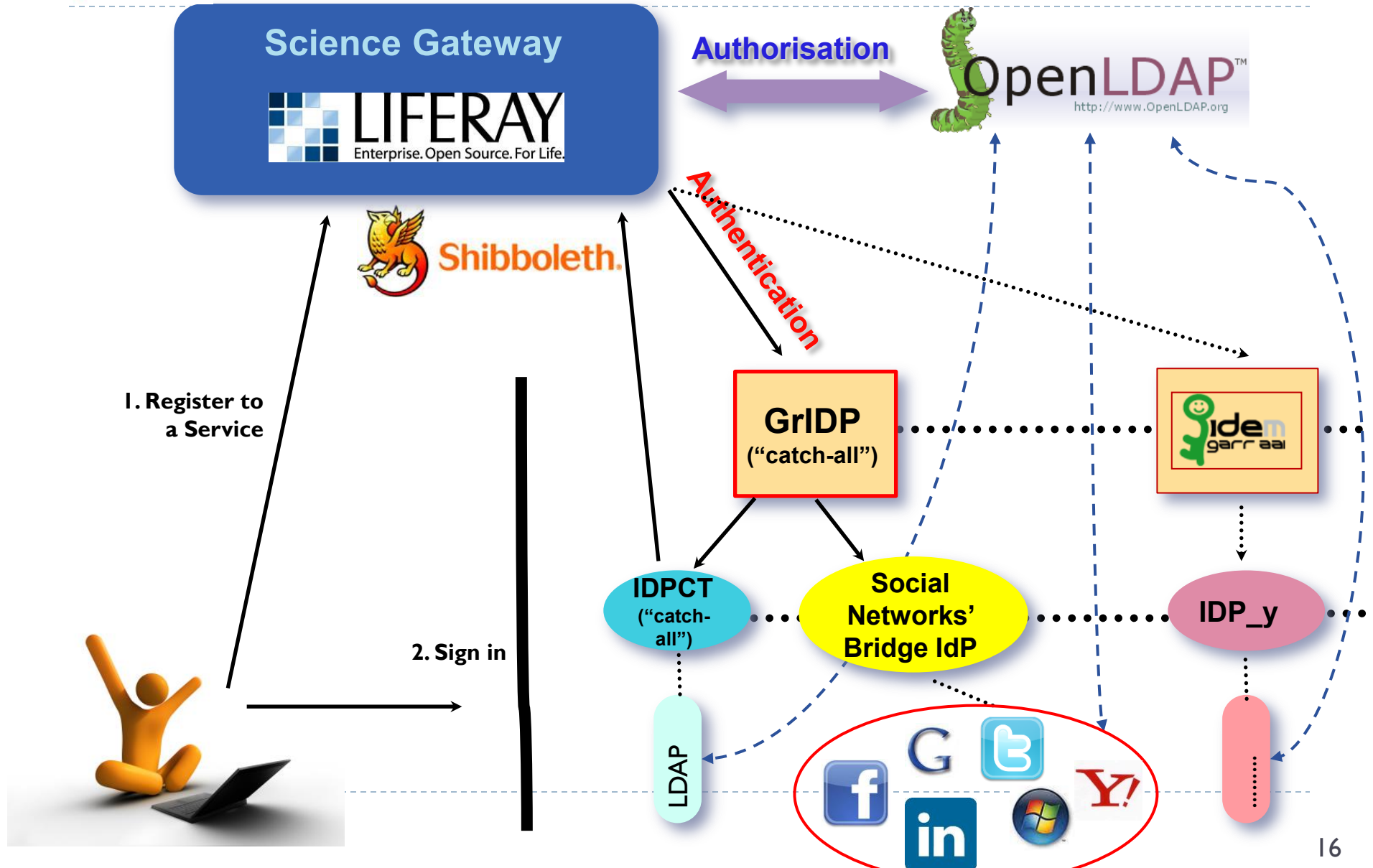


The Catania Science Gateway framework



Middleware supported so far

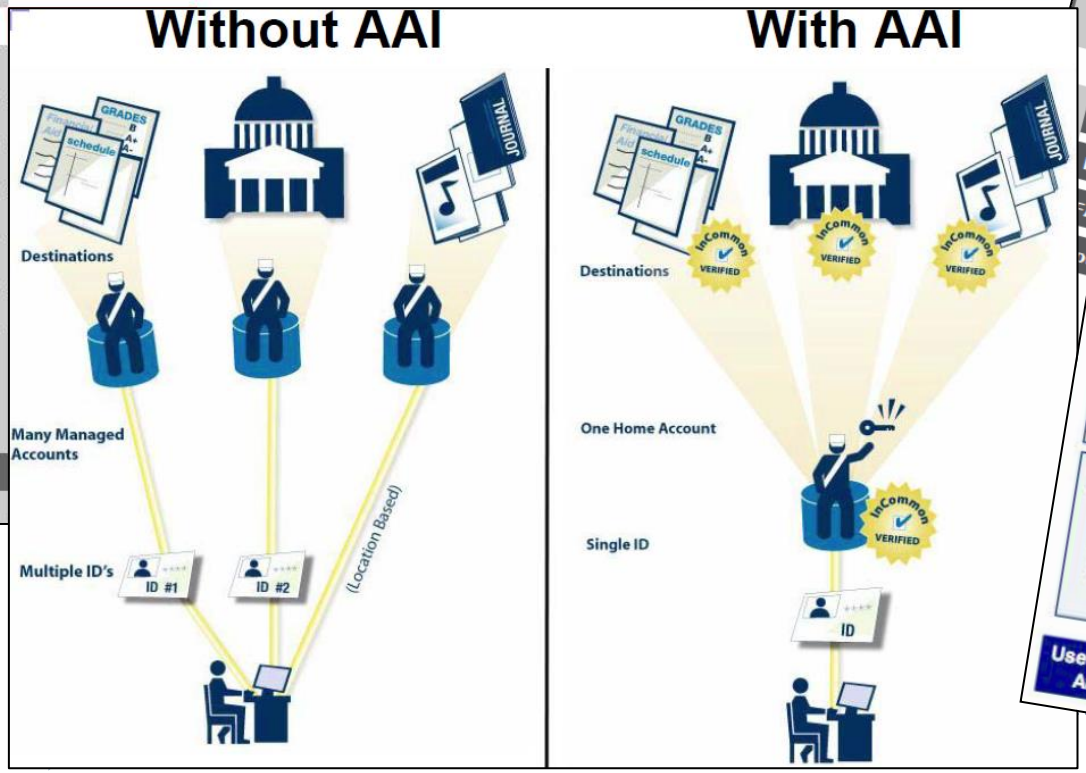
AuthN & AuthZ Schema

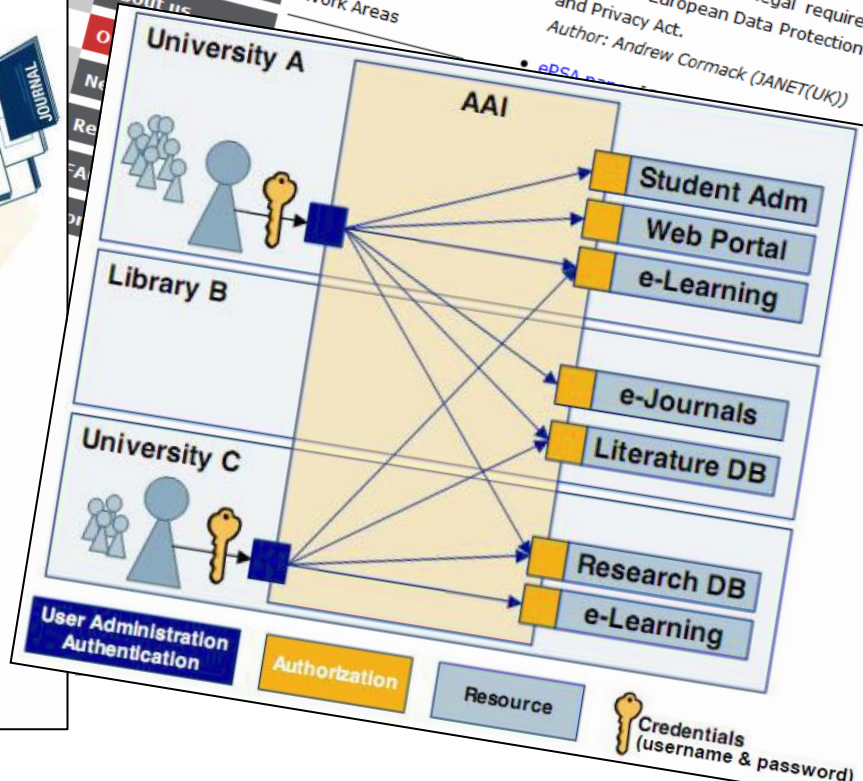


Identity Federations (https://refeds.org)

An Identity Federation consists of *"[…] the agreements, standards, and technologies that make identity and entitlements portable across autonomous domains."*

Burton Group





Official Identity Federations currently supported by Catania Science Gateways

cafe

CARSI

COFRe
Comunidad Federada REUNA

grnet

idem garr aai

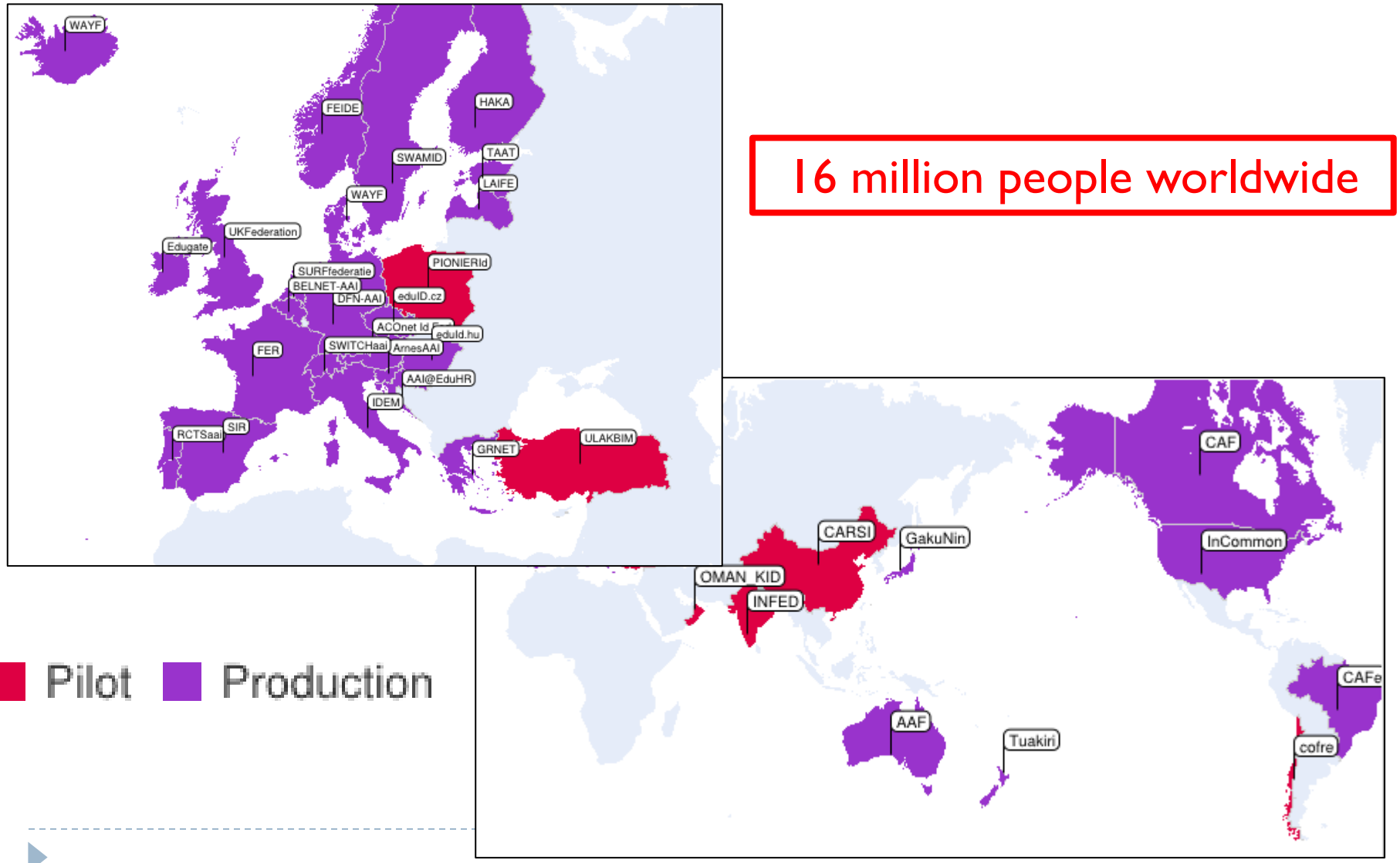
RCTSaai
REDE CIÊNCIA, TECNOLOGIA E SOCIEDADE

SIR

FIdMex
Federación de Identidades

In progress

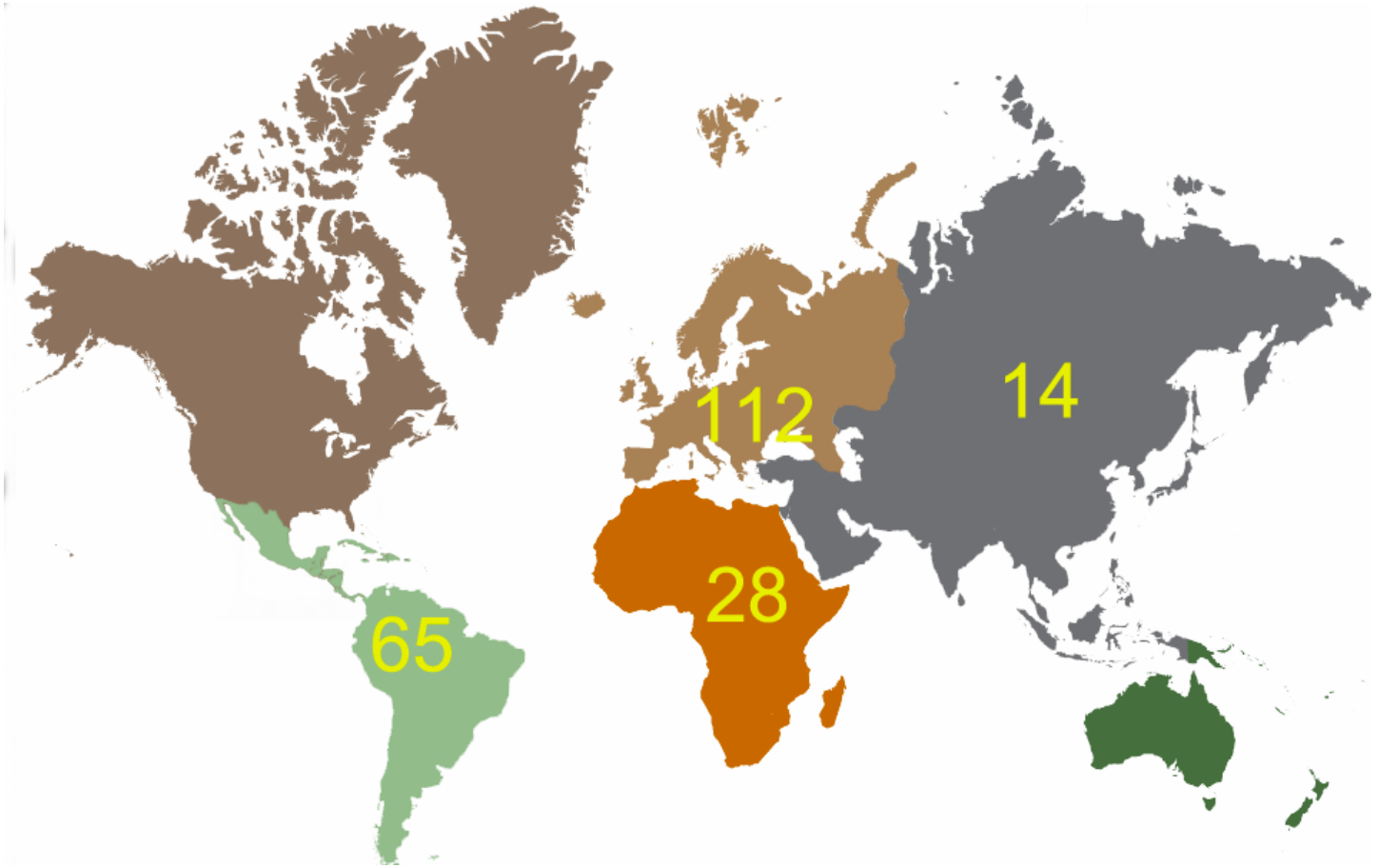
Identity Federations in the world
(https://refeds.org)



16 million people worldwide

Uptake of Catania Science Gateways
(as of the end of 2012)

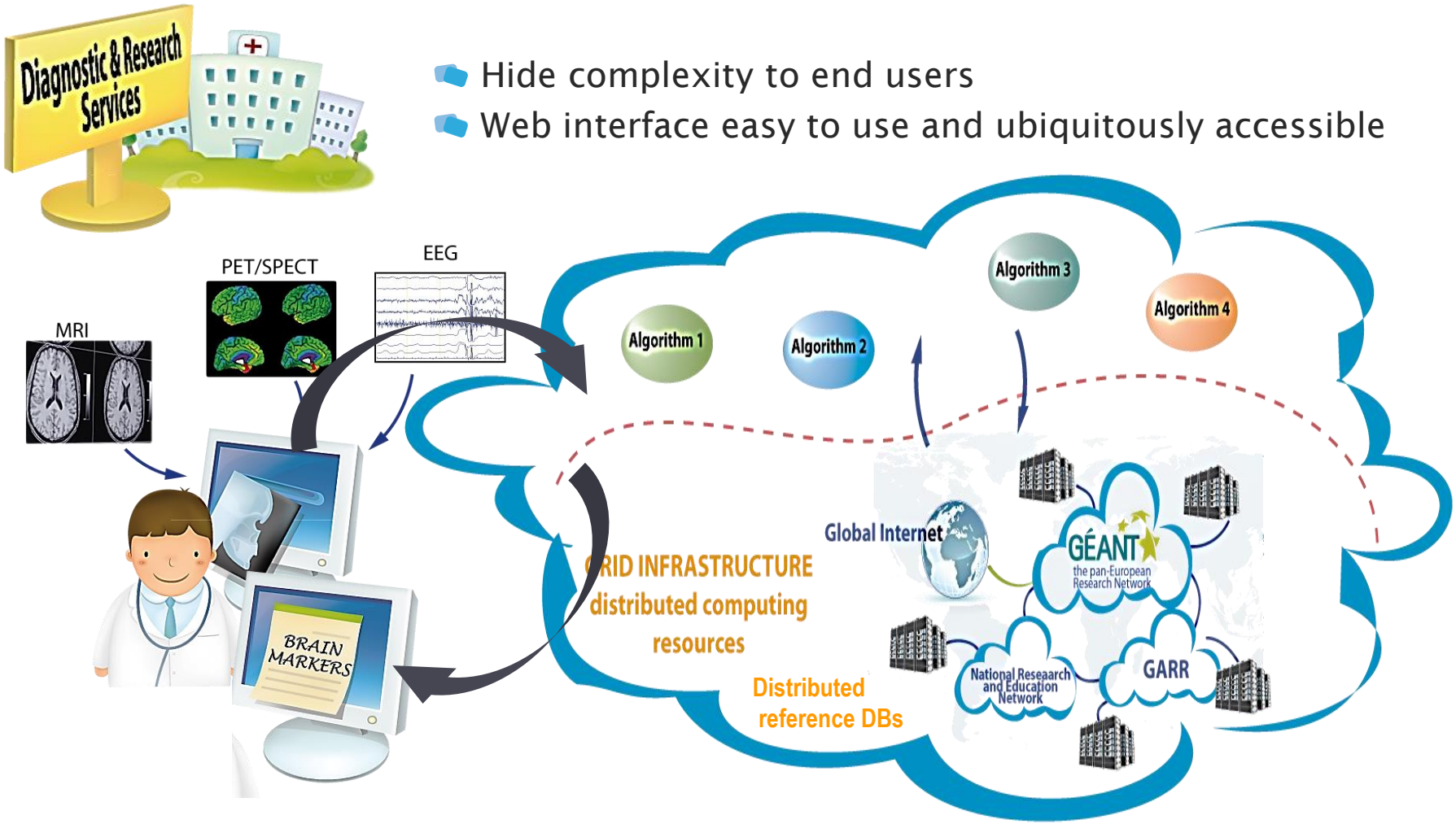
Users from 219 Organisations in 47 Countries



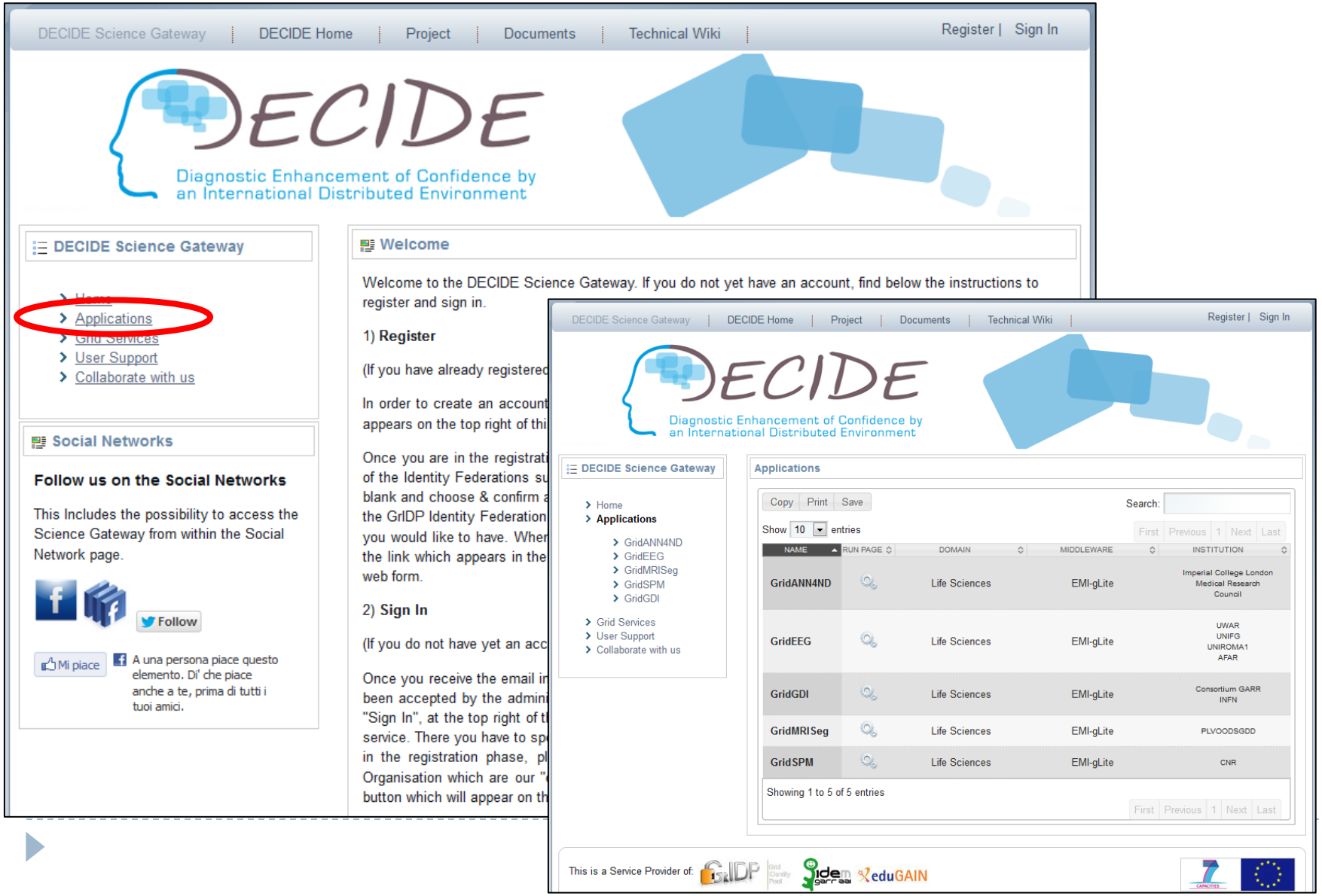
12 Science Gateways in production; 4 in preparation

The DECIDE Use Case

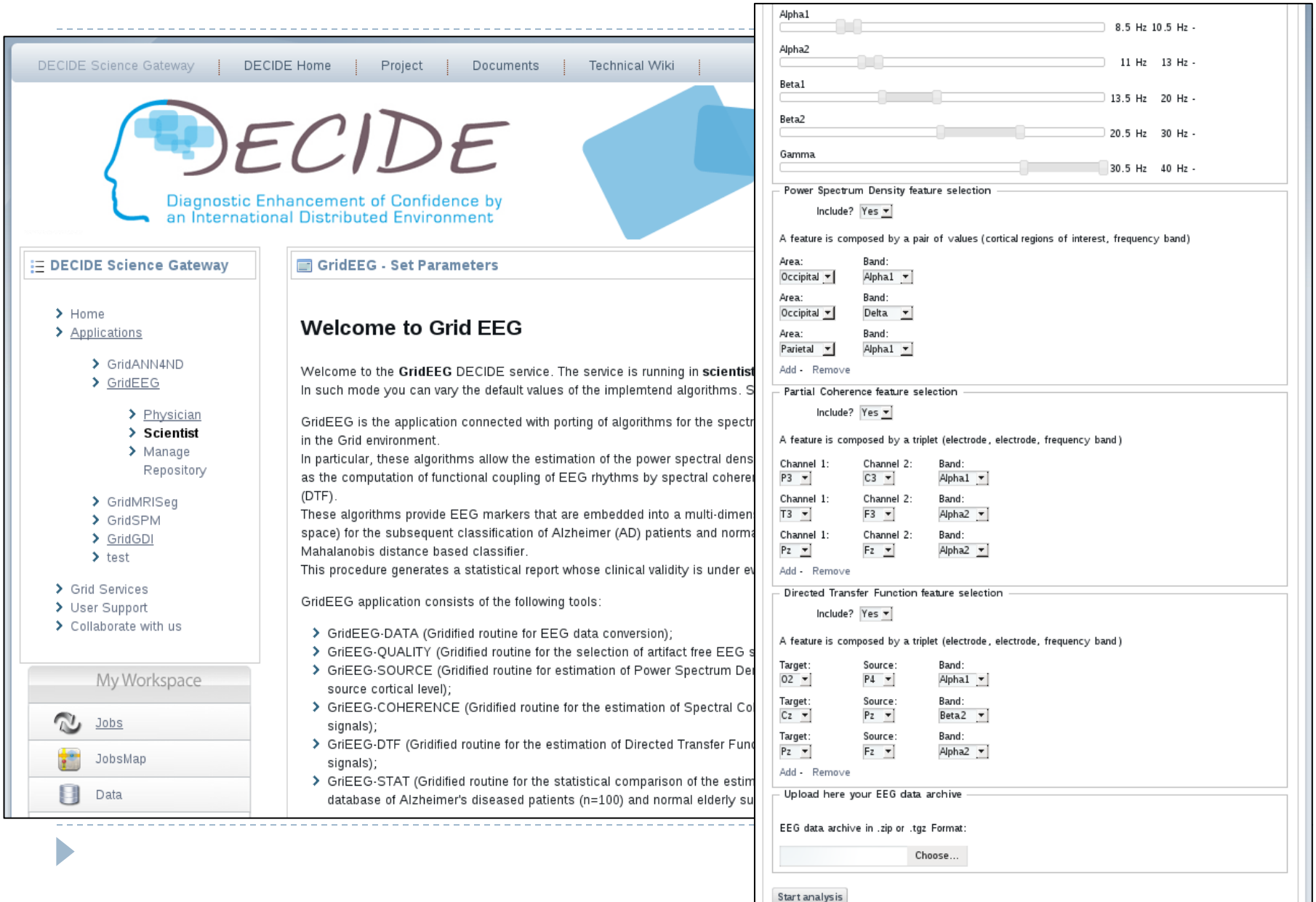
- Hide complexity to end users
- Web interface easy to use and ubiquitously accessible



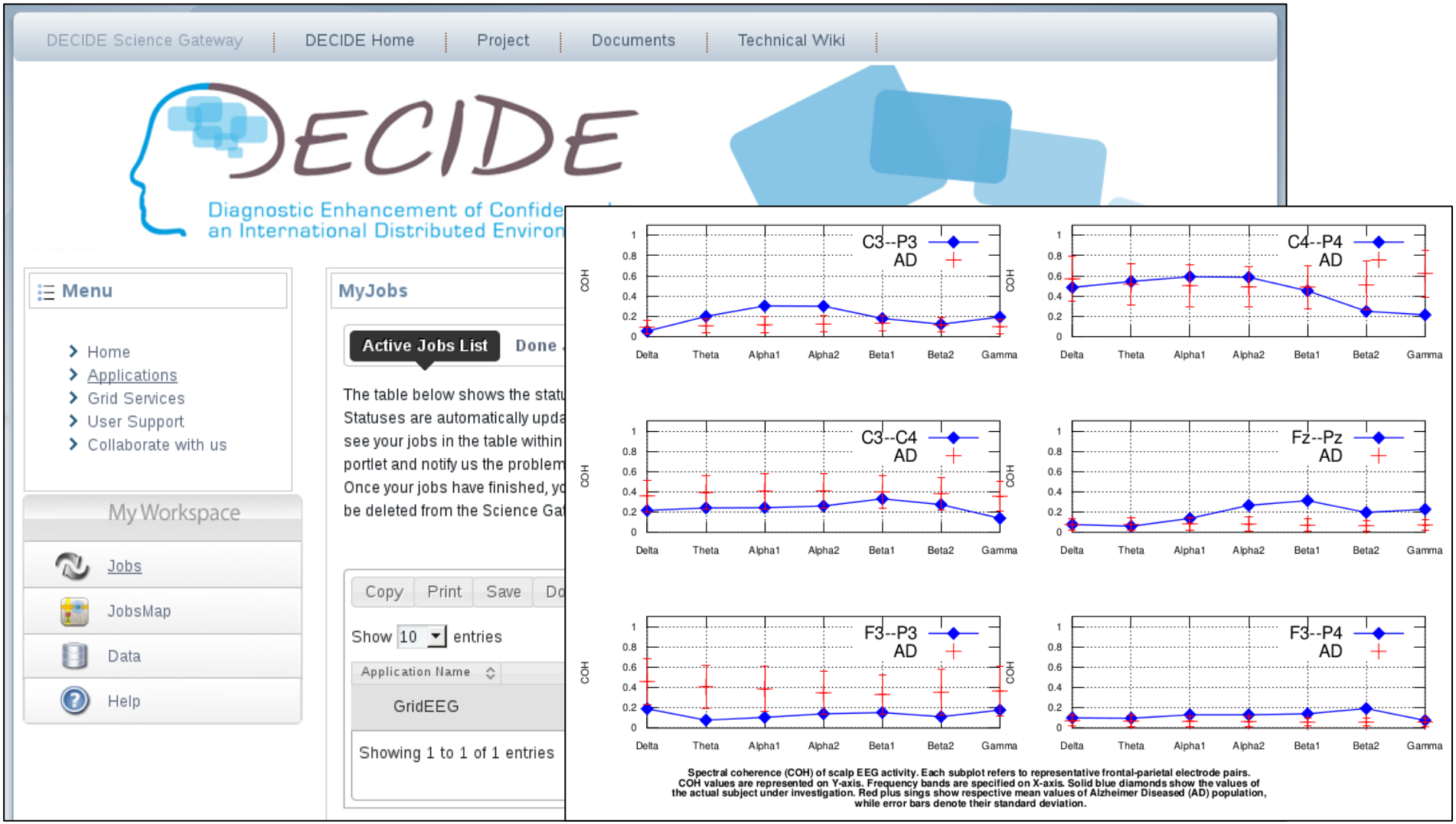
The DECIDE Science Gateway
(http://applications.eu-decide.eu)



The DECIDE Science Gateway in action



The DECIDE Science Gateway in action



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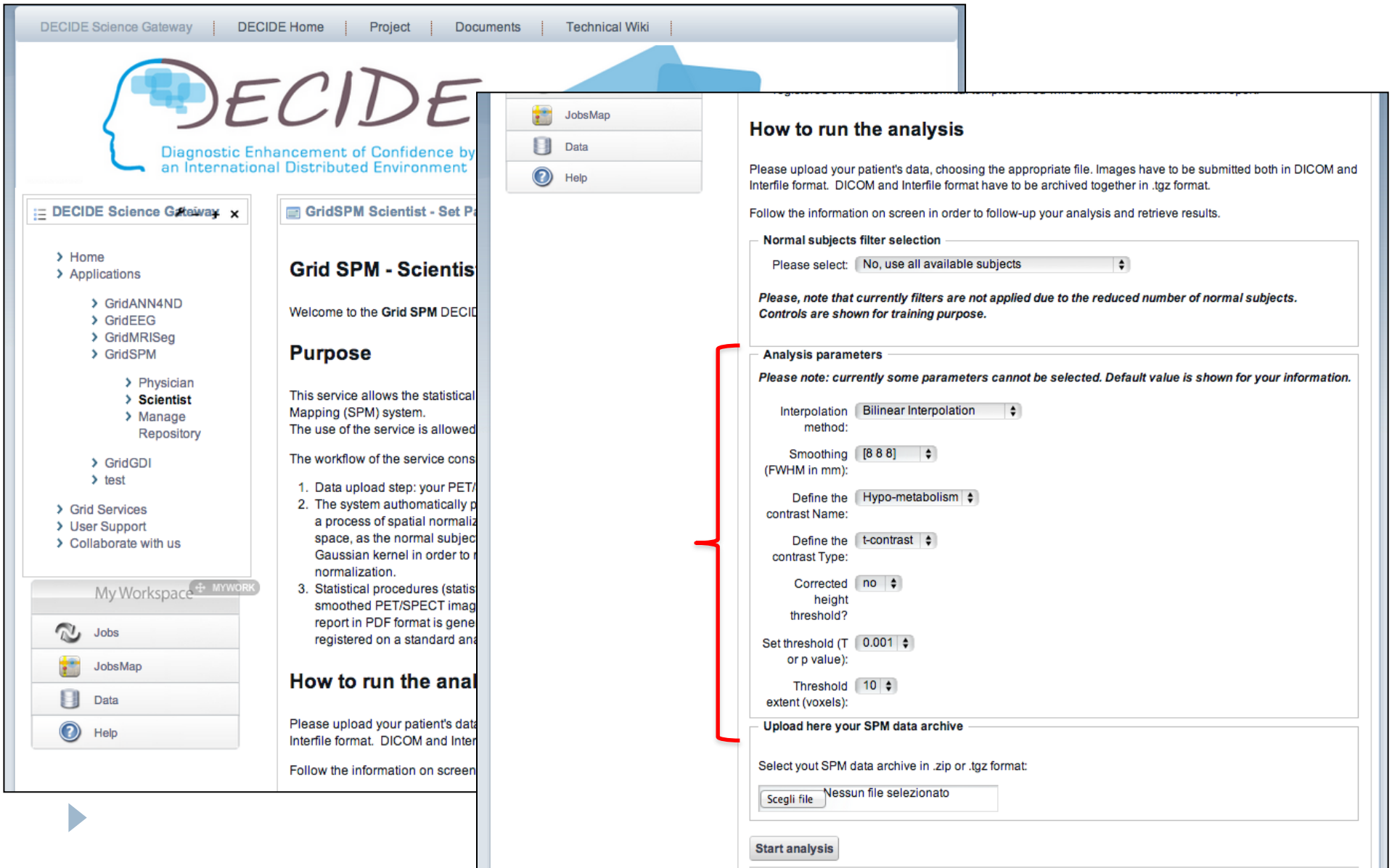
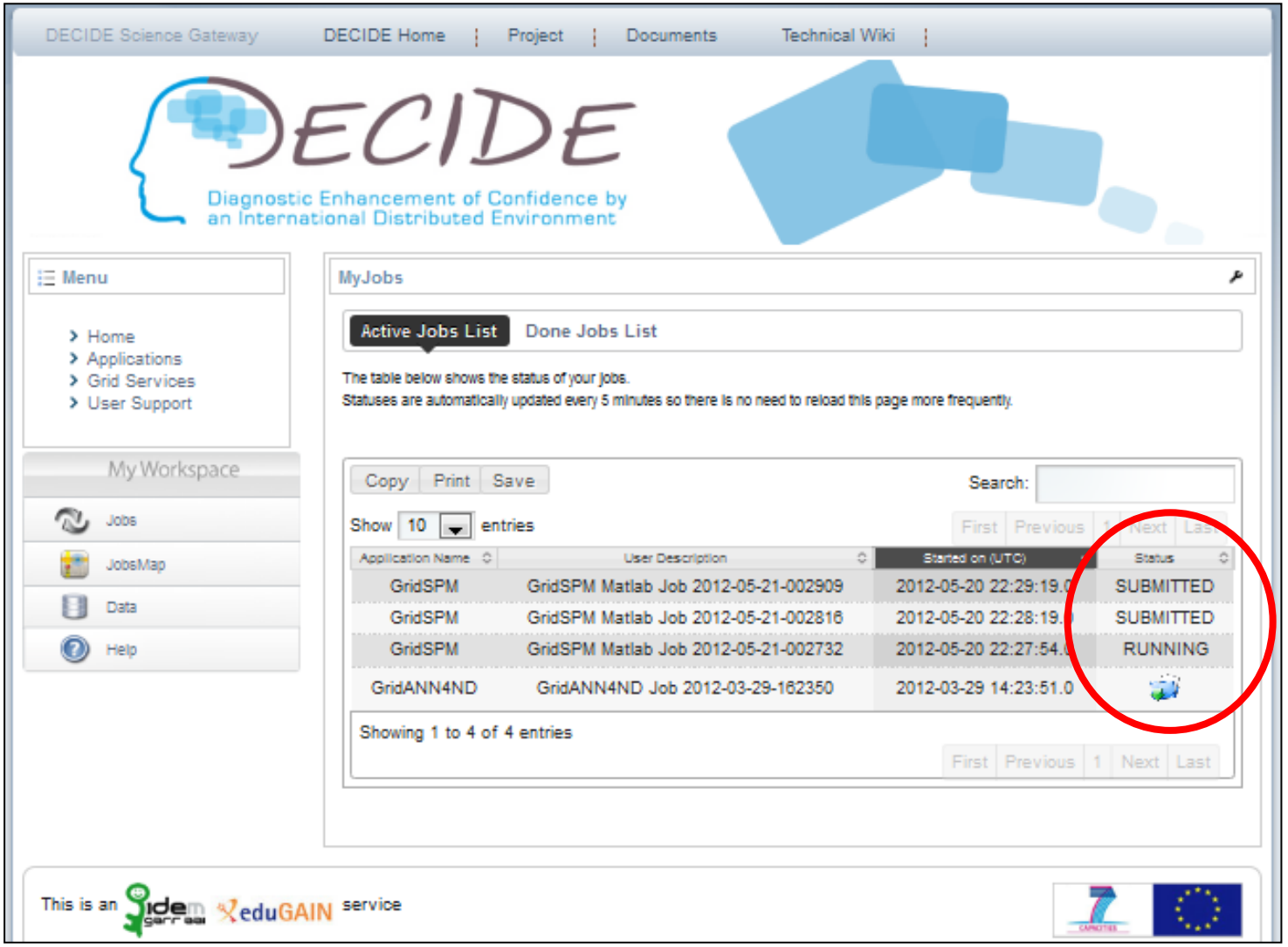
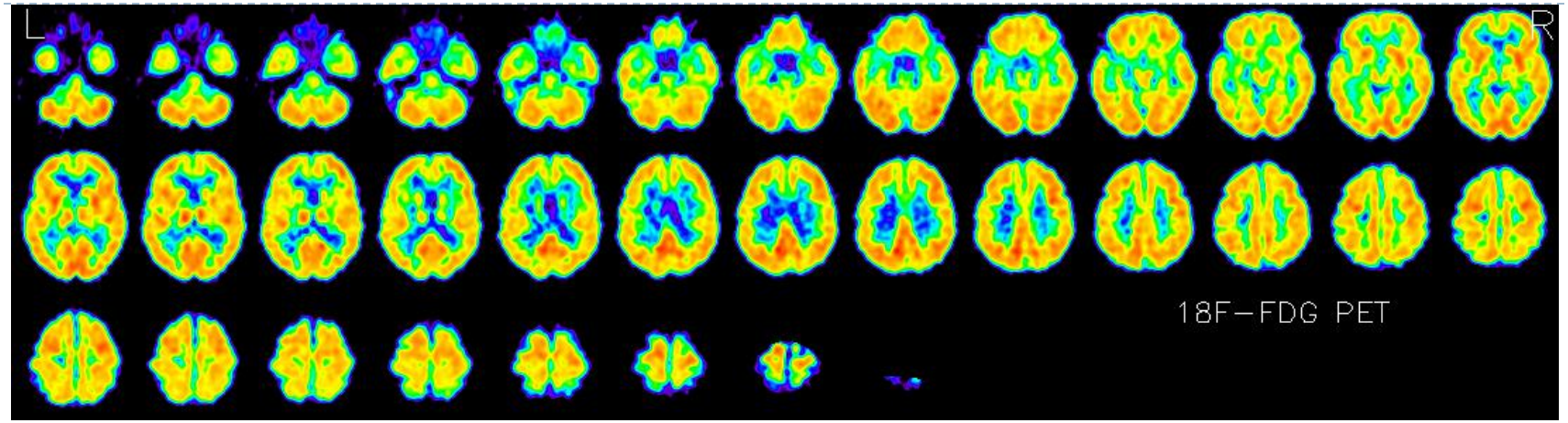


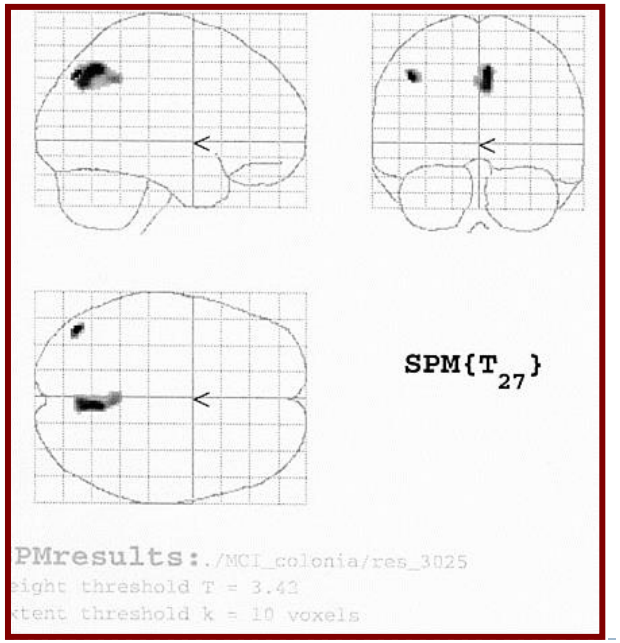
The DECIDE Science Gateway in action



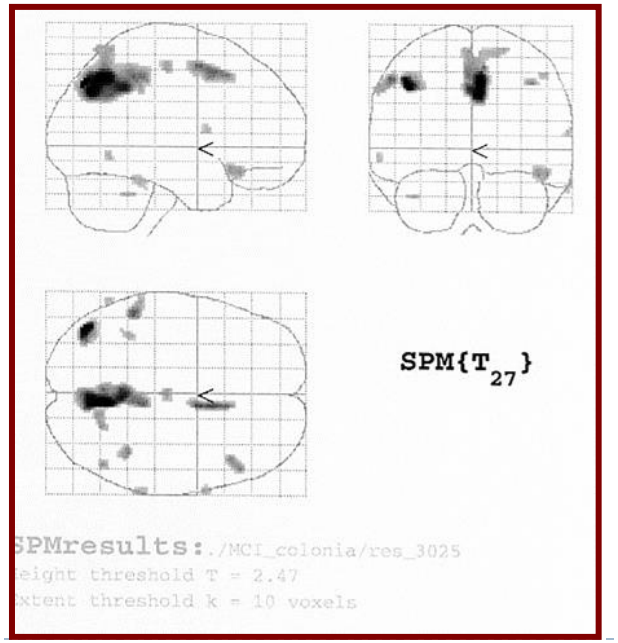
The DECIDE Science Gateway in action



GridSPM report



p = 0.001



p = 0.01

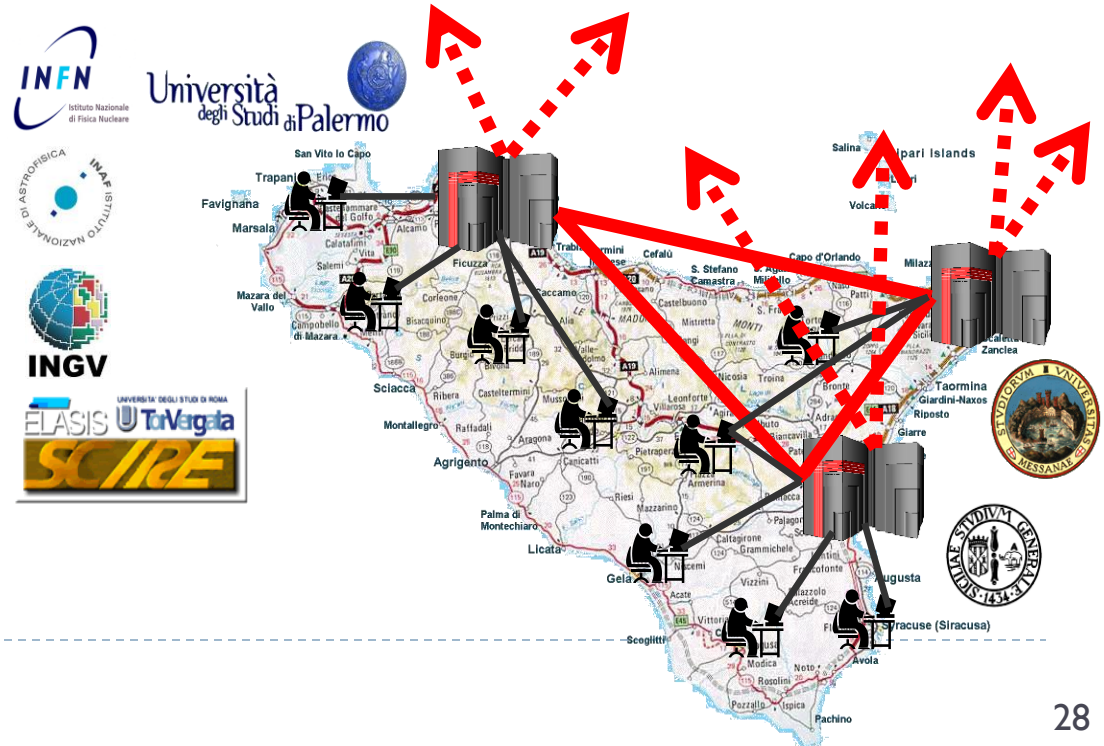
ID: C03025 | Age: 82 | MMSE: 25 | CVLT: 4

aMCI

The IOERT Use Case

LAboratorio di Tecnologie Oncologiche (LATO)
@ HSR Giglio - Cefalù (PA)

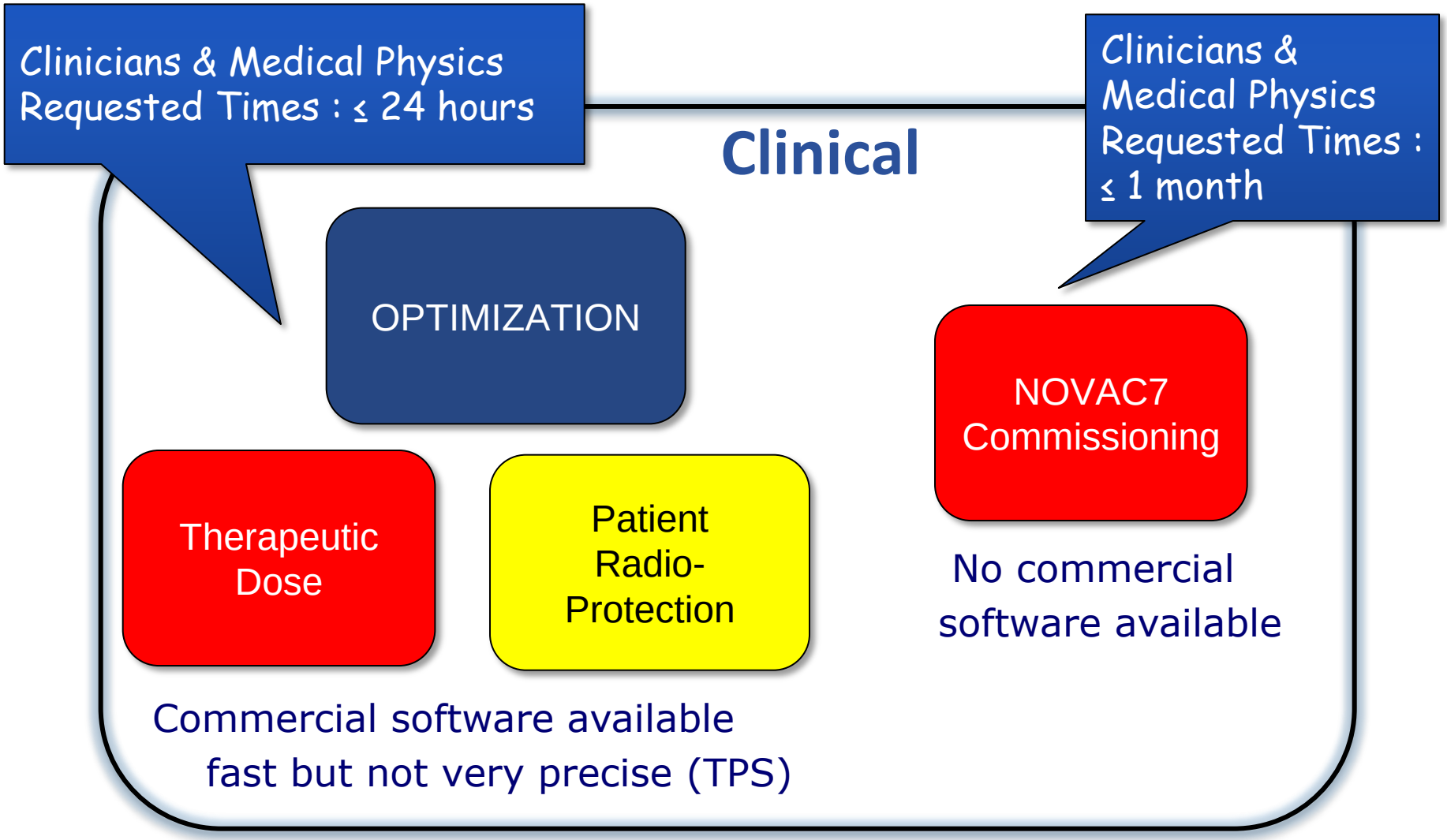
Consorzio COMETA- Catania



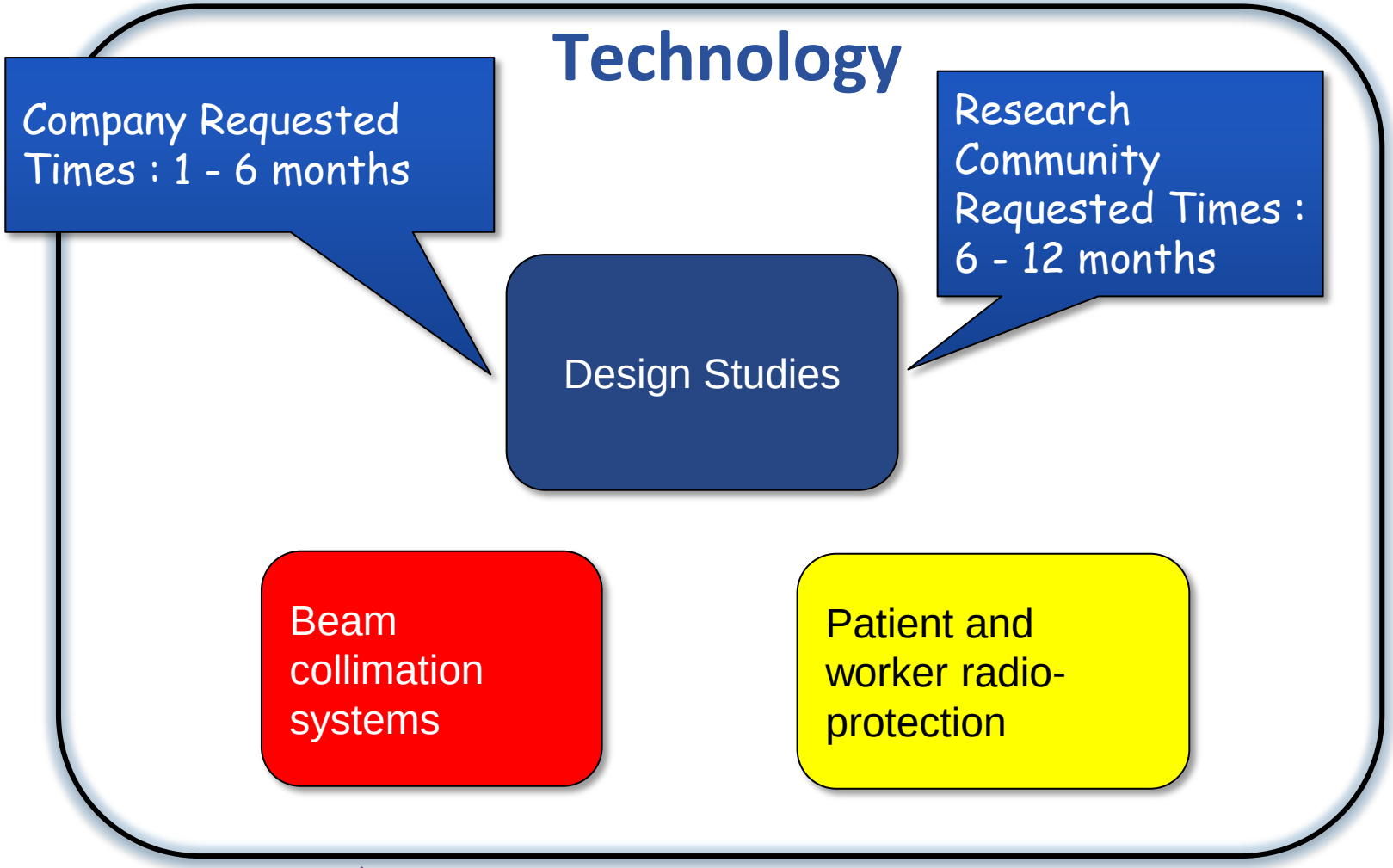
The Intra-Operative Electron Radio-Therapy (IOERT) technique in a nutshell

- **Intra-Operative Electron Radiotherapy (IOERT)** is an advanced radiation therapy technique that allows treatment of tumors after surgery, directly in the surgery room, delivering a high dose to the target *(Veronesi et al., 2001)*;
- Treatment of breast, stomach, prostate cancers;
- The electron beam is produced through dedicated and mobile accelerators, such as **NOVAC7** (NRT, Aprilia - Italy);
  - ✓ Electron beams of 4, 6, 8 e 10 MeV with different diameters (from 3 to 10 cm) and slant angles collimators (0°, 15°, 22.5°, 30° and 45°)

Clinical Activities



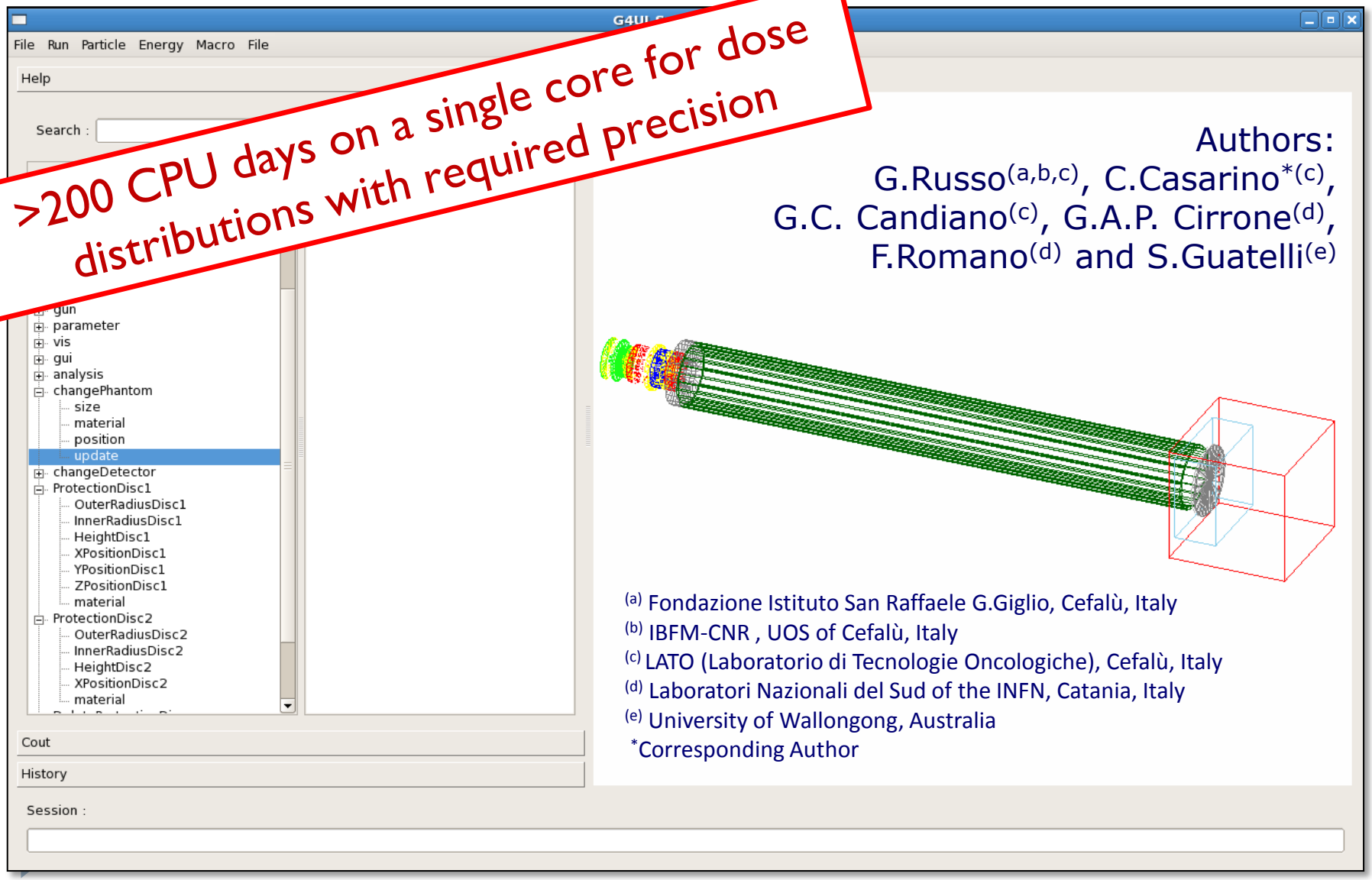
Technological Activities



- No commercial software available

The IOERT simulator with Geant4

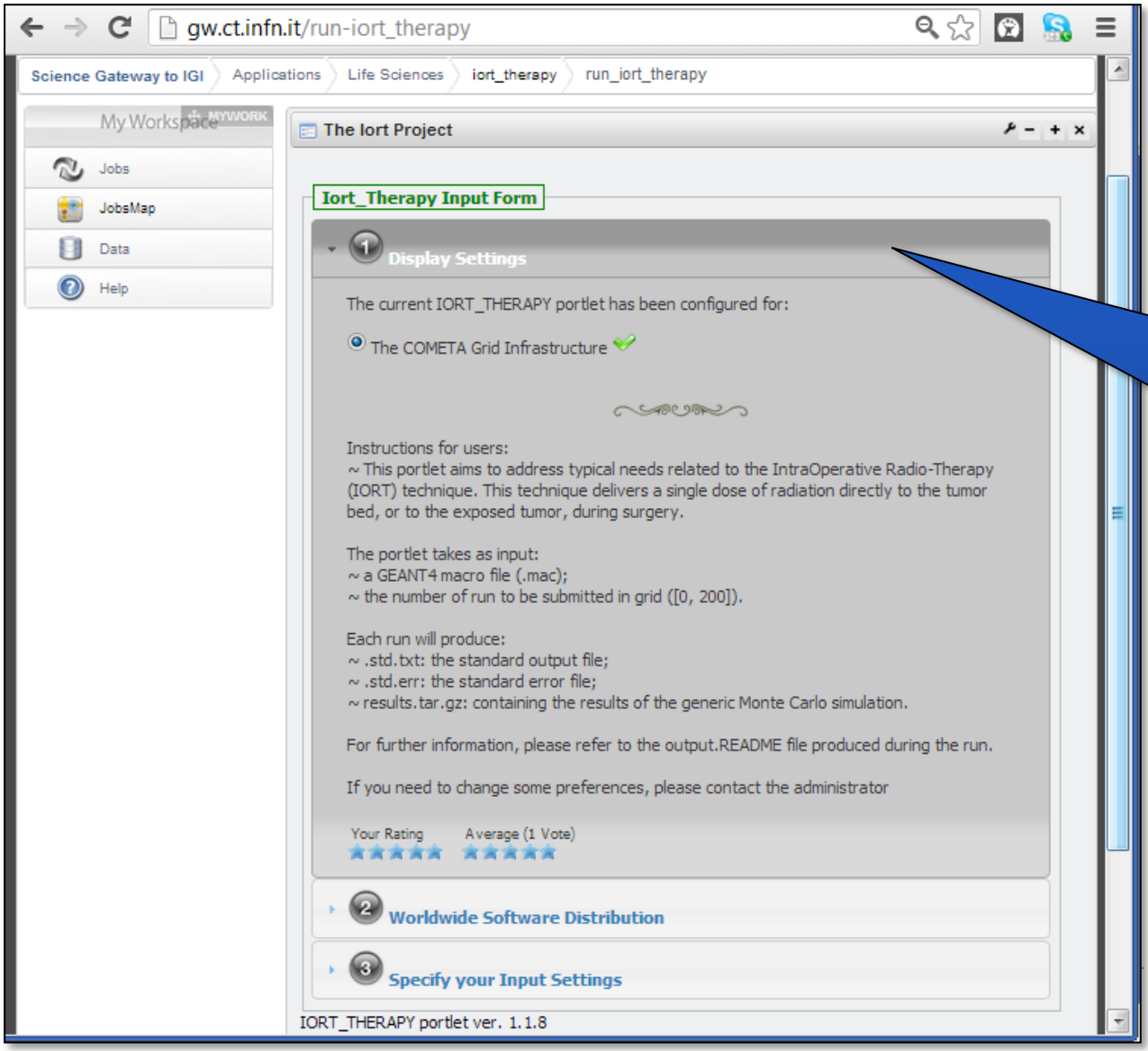
>200 CPU days on a single core for dose distributions with required precision



Authors:
G.Russo[a,b,c], C.Casarino*[c], G.C. Candiano[c], G.A.P. Cirrone[d], F.Romano[d] and S.Guatelli[e]

[a] Fondazione Istituto San Raffaele G.Giglio, Cefalù, Italy
[b] IBFM-CNR , UOS of Cefalù, Italy
[c] LATO (Laboratorio di Tecnologie Oncologiche), Cefalù, Italy
[d] Laboratori Nazionali del Sud of the INFN, Catania, Italy
[e] University of Wallongong, Australia
*Corresponding Author

The IOERT Science Gateway in action



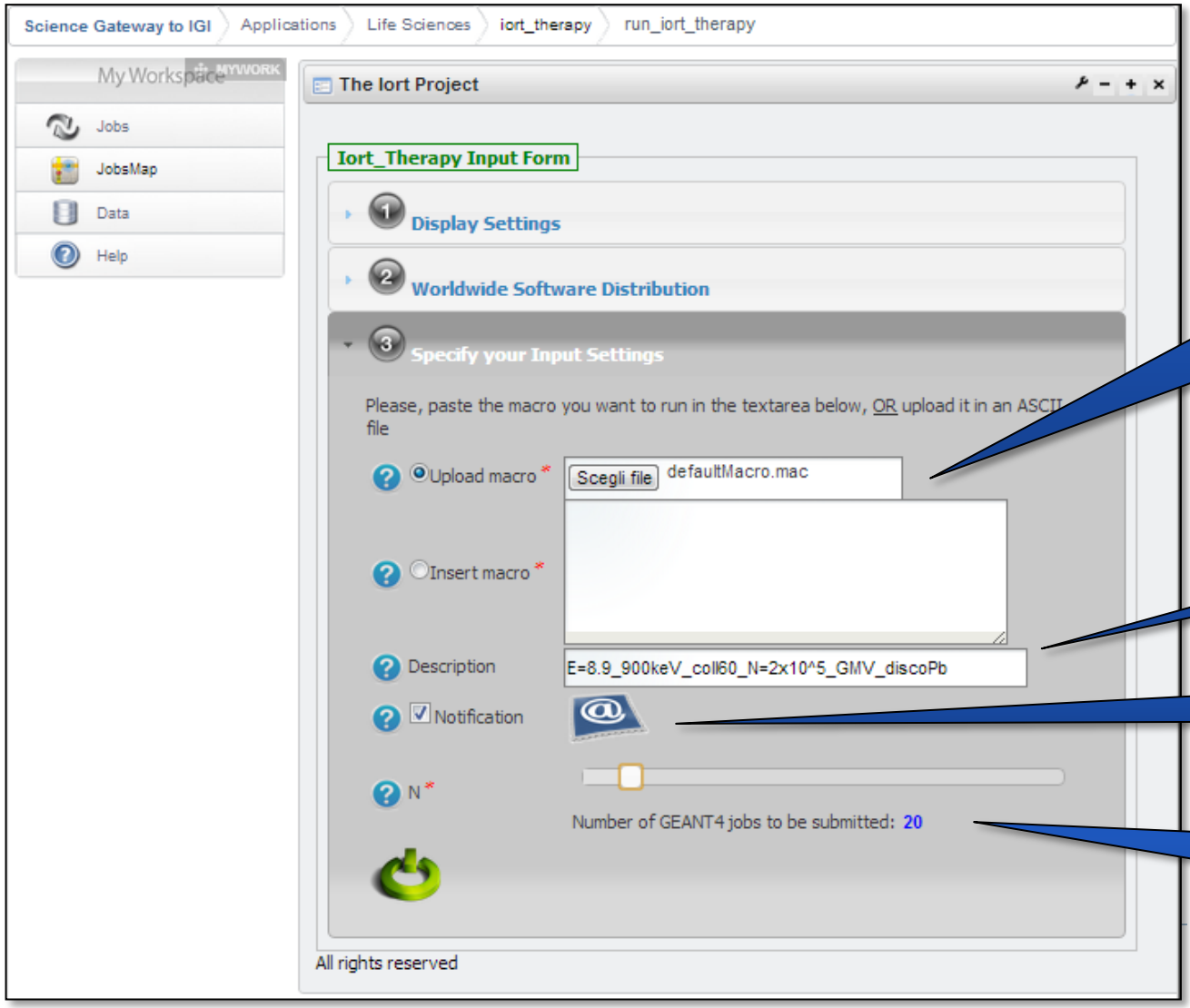
Science Gateway
running on http://gw.ct.infn.it

1

It provides some explanation about the application

The IOERT Science Gateway in action

Science Gateway
running on http://gw.ct.infn.it



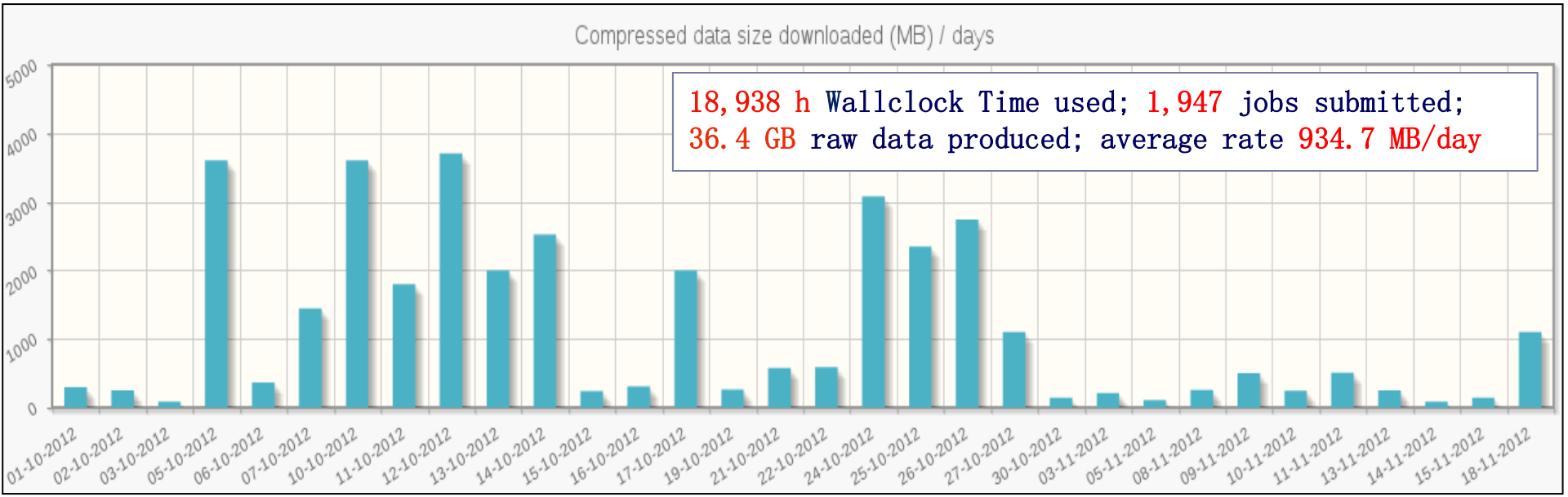
3 Uploading a GEANT4 macro as ASCII file or via the text-area

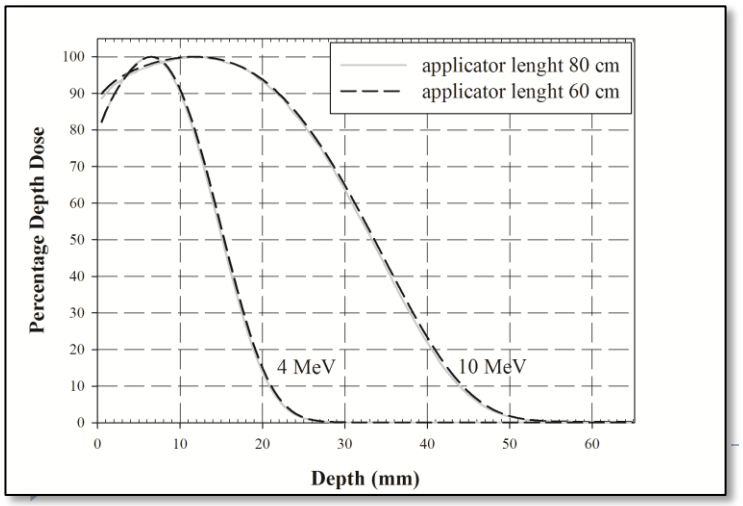
Job description

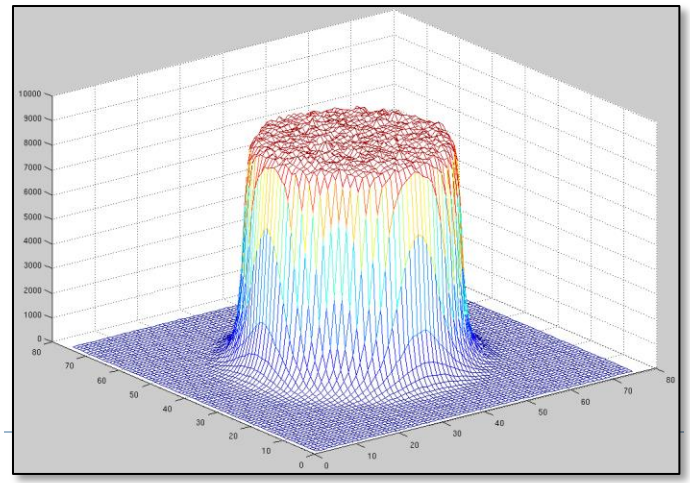
Enable e-mail notification

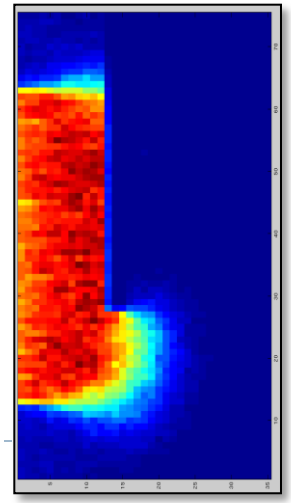
# of Monte Carlo jobs to submit

The IOERT Science Gateway in action









Summary and conclusions

- e-Infrastructures can be very beneficial platforms for many users, provided they are really «easy to use» and users are at their centre
- The Catania Science Gateway framework, with support for Identity Federations, changes the way e-Infrastructures can be used, hugely widening their potential user base across continents and organisations, especially non-IT experts
- The adoption of standards (JSR 286, SAGA, SAML, etc.) represents a concrete investment towards sustainability
- Concrete use cases demonstrate the usefulness of the Science Gateway paradigm for next generation e-health

Thank you !