Design and Implementation of GEO Grid Security

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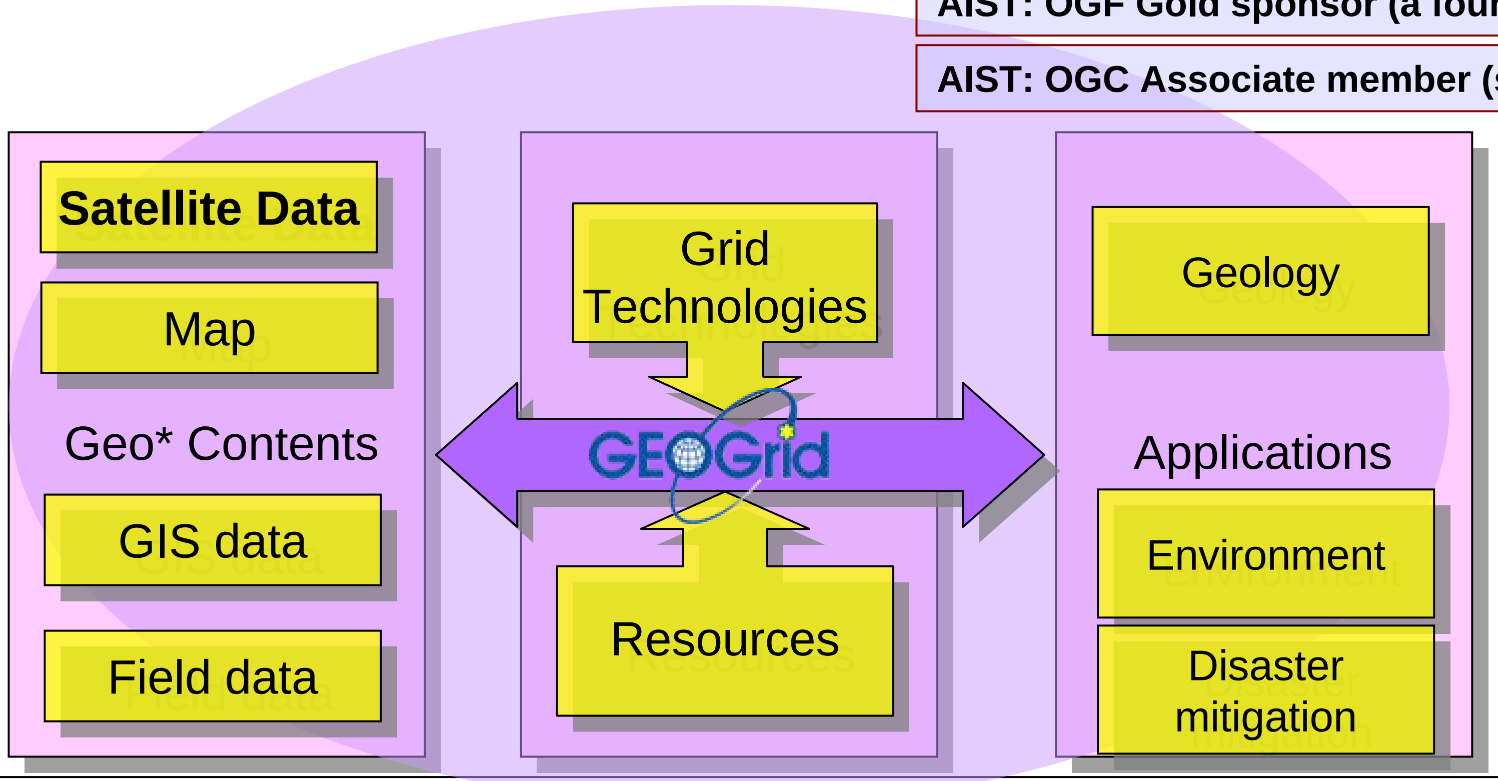
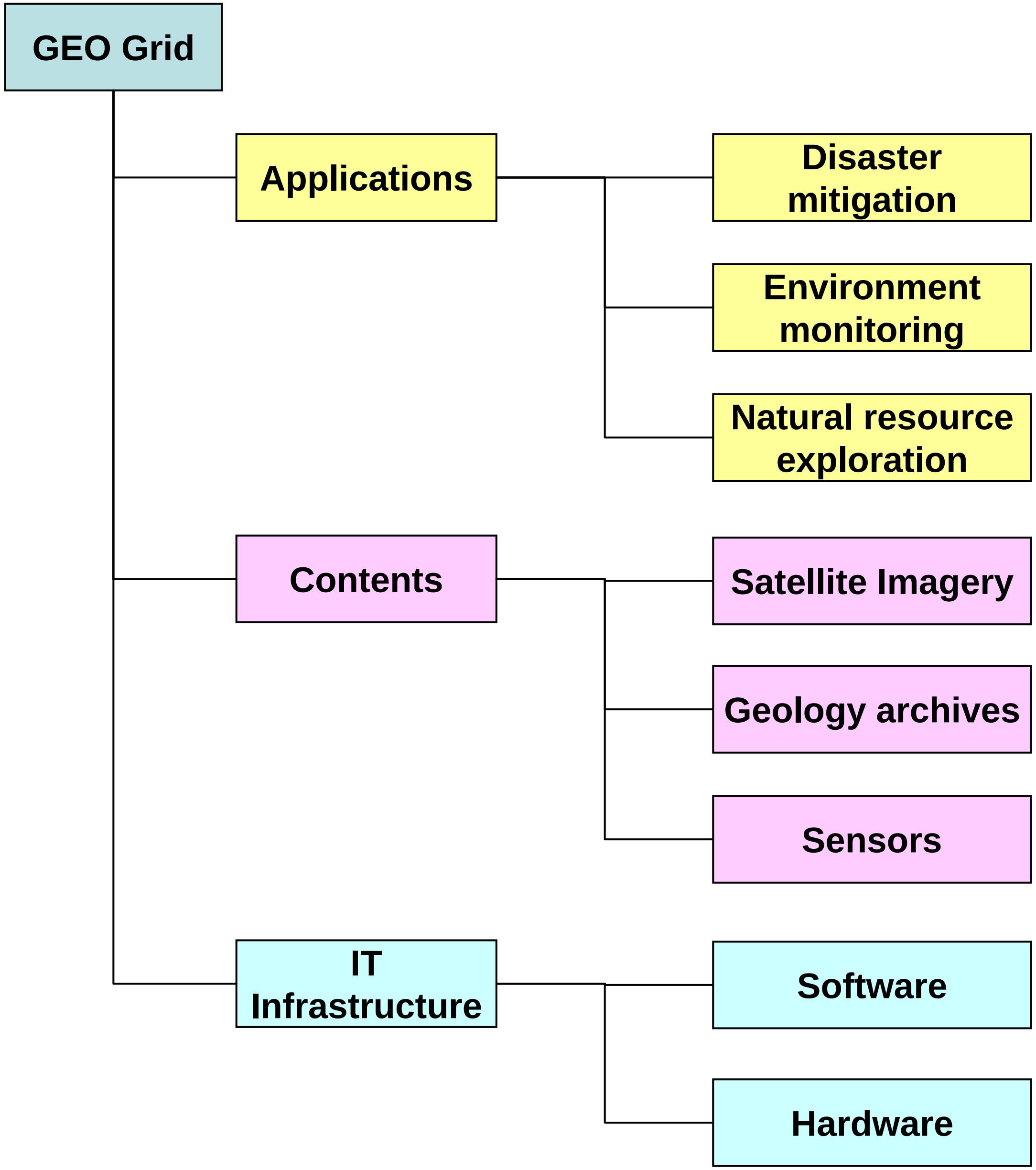
What is the GEO Grid ?

- The GEO (Global Earth Observation) Grid is aiming at providing an _E-Science Infrastructure_ for worldwide Earth Sciences communities to accelerate GEO sciences based on the concept that relevant data and computation are _virtually integrated_ with a certain *access control* and ease-of-use interface those are enabled by a set of Grid and Web service technologies.

AIST: OGF Gold sponsor (a founding member)

AIST: OGC Associate member (since 2007)





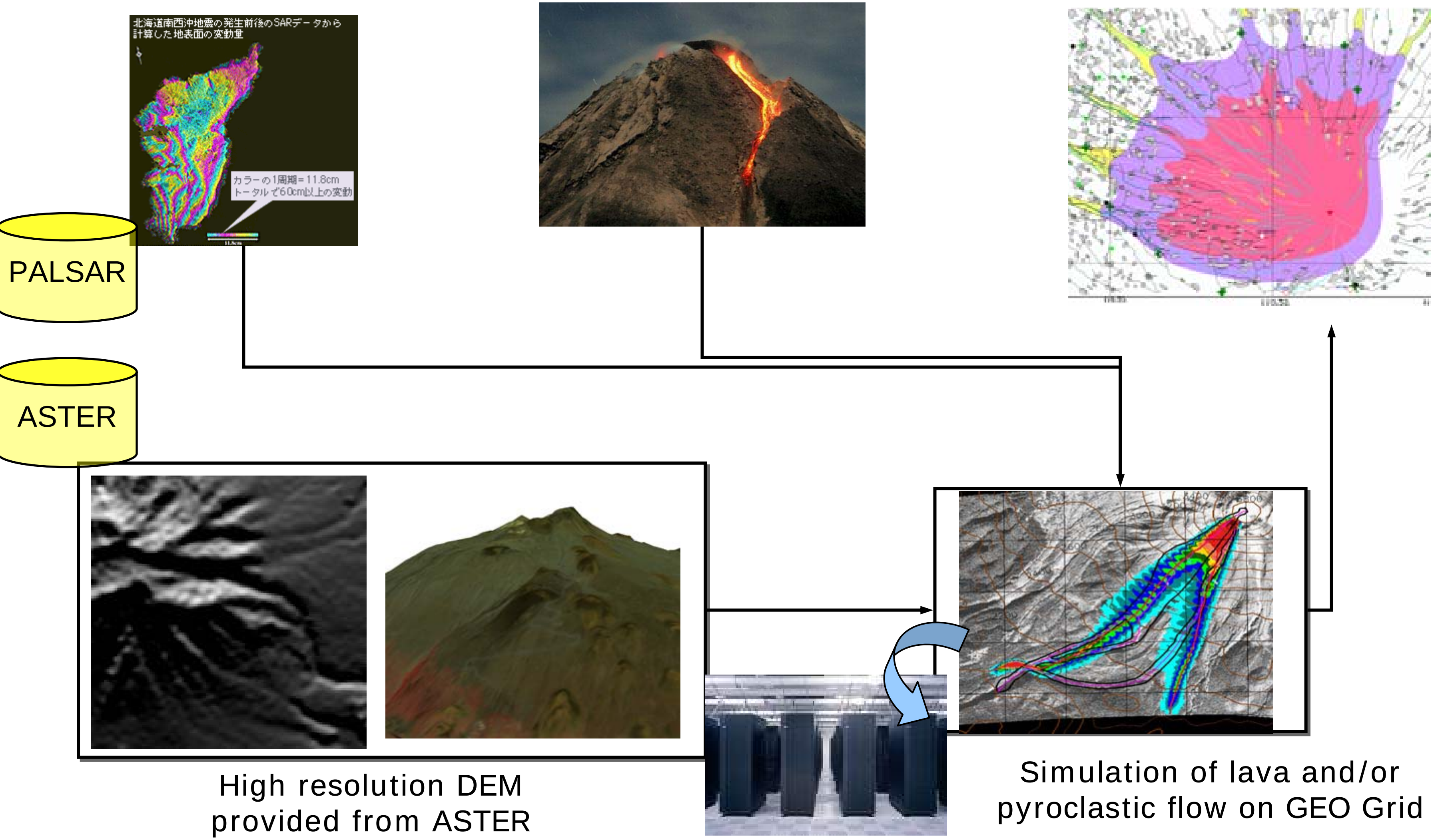
- GEO Grid
  - Applications
    - Disaster mitigation: Land slides, flood
    - Environment monitoring: Global warming, CO_2 flux estimation
    - Natural resource exploration: Oil, Gas
  - Contents
    - Satellite Imagery: Full L0 ASTER on disk; MODIS on disk (East Asia)
    - Geology archives: Japan, SE Asia
    - Sensors: AsiaFlux, Field server
  - IT Infrastructure
    - Software: Security, data access, service registry, resource mgmt., Weg GIS, Workflow, U/I Portal, etc.
    - Hardware: Storage, Servers Cluster computers

A Workflow example “Disaster prevention and mitigation (Volcano)”

Monitoring of crustal deformation by PALSAR

In-situ observations e.g. growth of a lava dome

Hazard Map for Evacuation planning



High resolution DEM provided from ASTER

Simulation of lava and/or pyroclastic flow on GEO Grid

Functional requirements for the IT infrastructure

- Size scalability in near-real-time data handling and distribution
  - Need to manage hundreds tera-bytes to peta-byte of data.
  - Such data will be made available with minimum time delay and at minimum cost.
- Handling wide diversification of data types, associated metadata, products and services.
  - Research communities wish to integrate various data according to their interests.
  - IT infrastructure must support
    - the creation of user groups which represent various types of virtual research/business communities
    - Federation of distributed and heterogeneous data resources which is shared in such communities

Functional requirements for the IT infrastructure (cont'd)

- Respecting data owner's publication policies
  - Some data are not freely accessible.
    - E.g. commercial data.
  - IT infrastructure must provide a security infrastructure which supports flexible publication policies for both data and computing service providers.
- Smooth interaction and loose coupling between data services and computing services
  - A desirable IT architectural style would achieve loose coupling among interacting software agents to allow users both to create services independently, and to produce new application from them.
  - IT infrastructure must support sharing, coordination, and configuration of environments for application programs and resources, depending on the user's requirements.

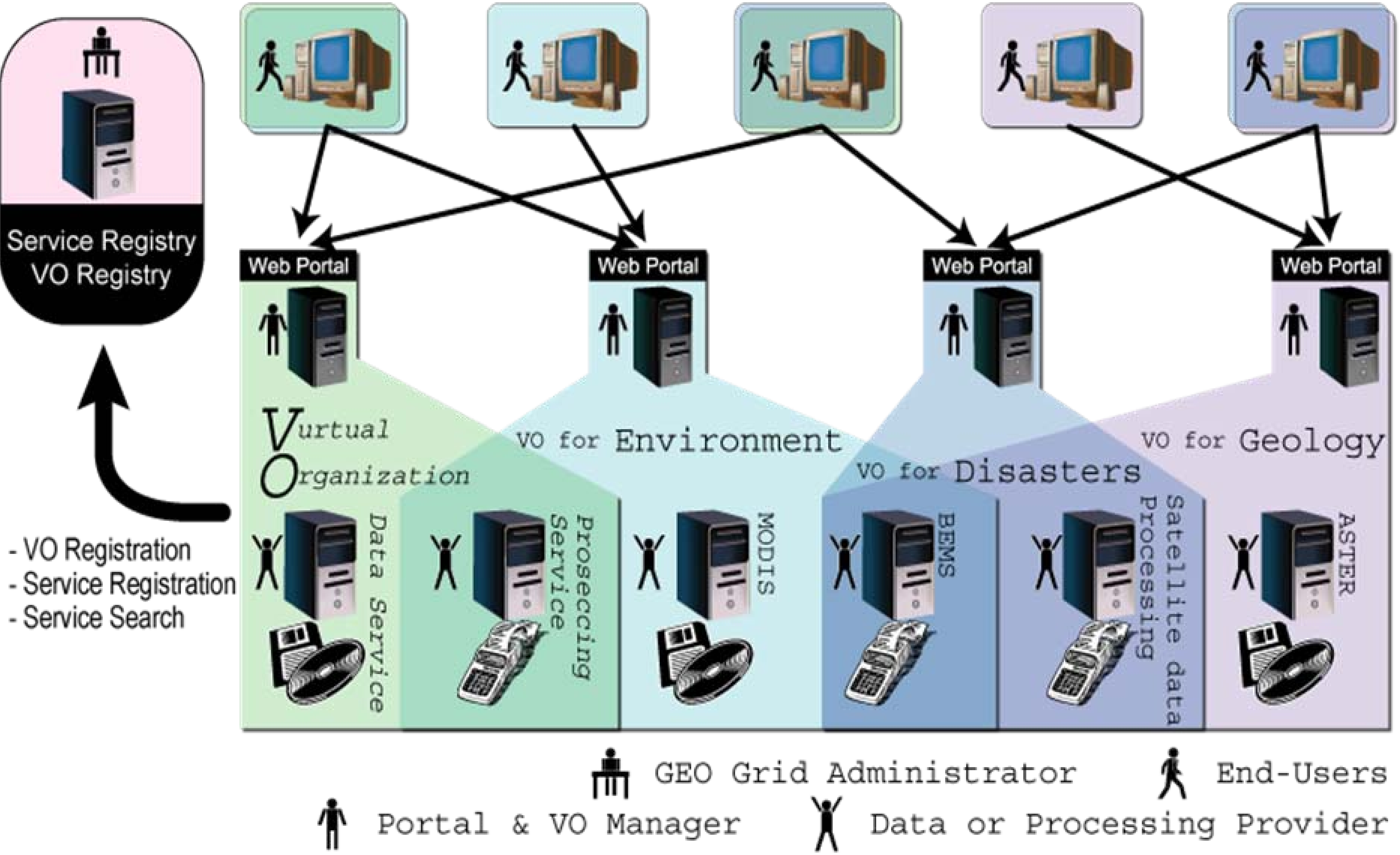
Functional requirements for the IT infrastructure (cont'd)

- Ease of use
  - End users should be able to access data and computing resources without the burden of installing special software and taking care of security issues (e.g. certificate mgmt.).
  - Data and service providers should be able to easily make their resources available as services with desired access control.
  - Administrators and leaders of communities should be able to create virtual communities easily by configuring appropriate access control.
  - We must provide an ease-of-use framework for publishing services and user interfaces.

Design Policy

- Introduces a concept of VO (Virtual Organization)
- Data and computation are provided as “services” via standard protocols and APIs.
- A VO is created dynamically by integrating available services and resources according to the interests and requirements of the VO.
- User-level Authentication and VO-level Authorization
    - User’s right is managed (assigned) by an administrator of his belonging VO.
    - Access control to a service is configured by the service provider according to the publication policy. There are some options of the access control
        - VO-level, Group/Role-based, User-level, etc.
    - Scalable architecture for the number of users.

Overview and usage model of the GEO Grid system



Key Technologies: GSI and VOMS

- Grid Security Infrastructure (GSI) is standard security technology used in the current Grid communities.
  - Based on Public Key Infrastructure (PKI) and X.509 Certificates.
- Virtual Organization Membership Services (VOMS) is a software for creating/managing VOs.
  - Developed by European Communities
  - Based on GSI

End users of GEO Grid may not be required to understand GSI, VOMS, etc, but project (VO) admin should understand these technologies correctly.

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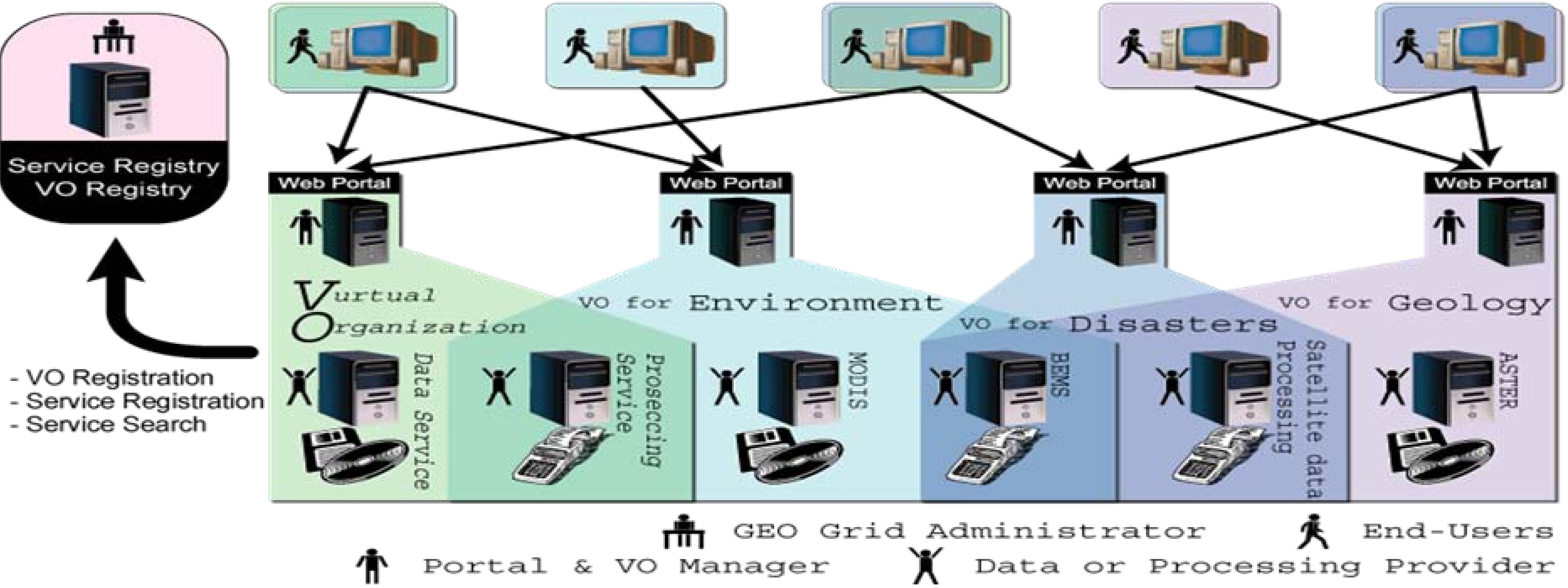

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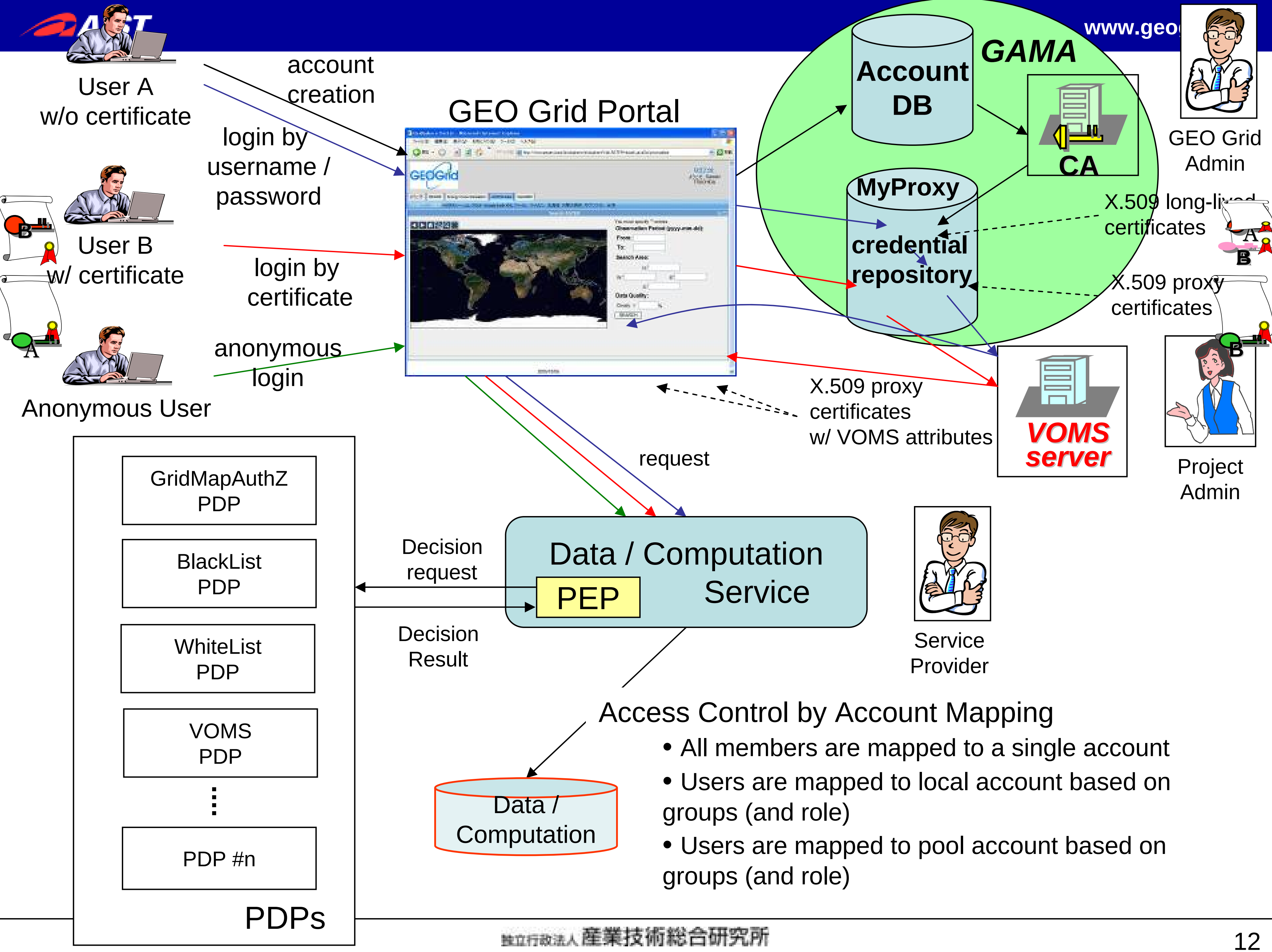
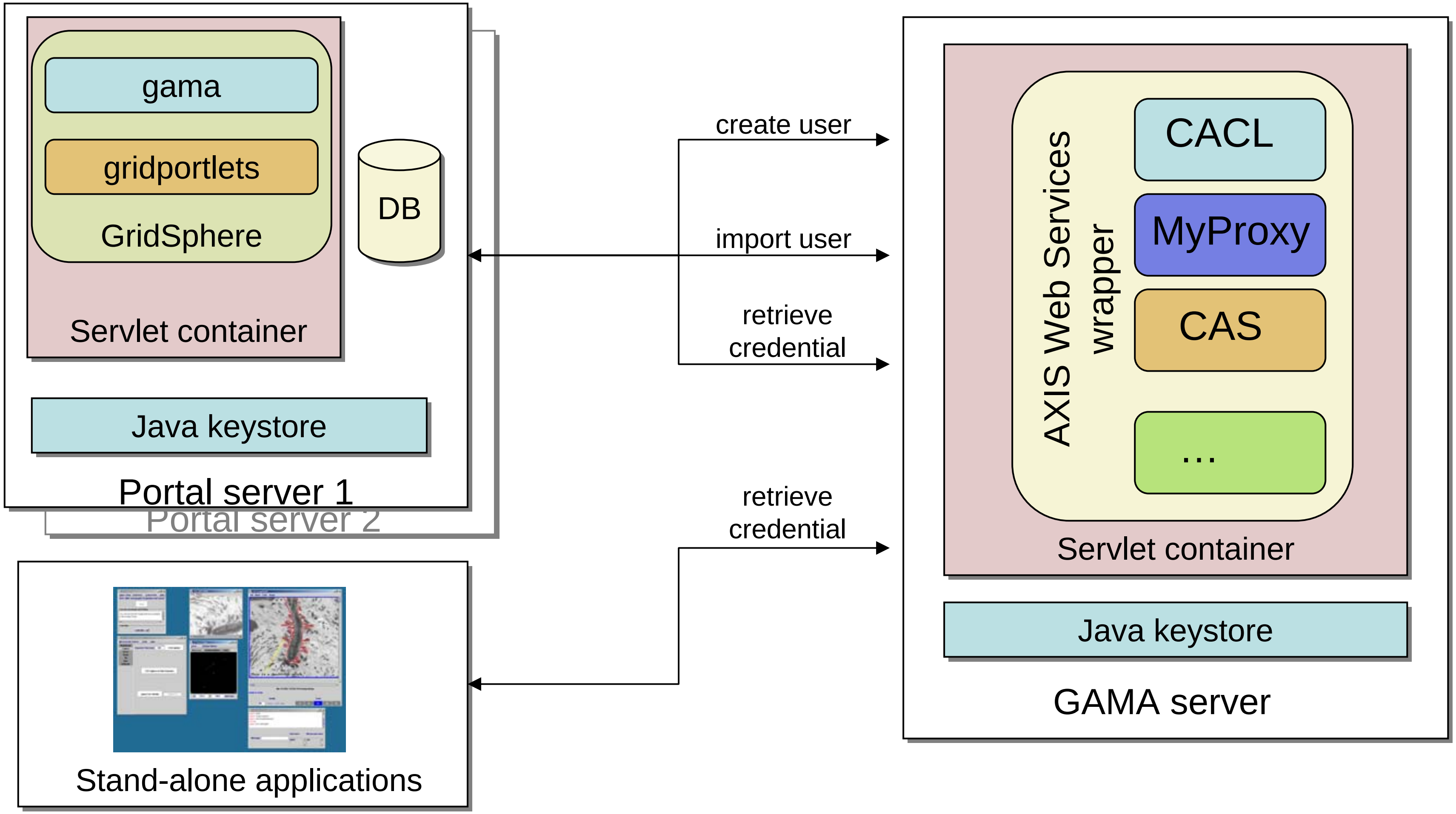


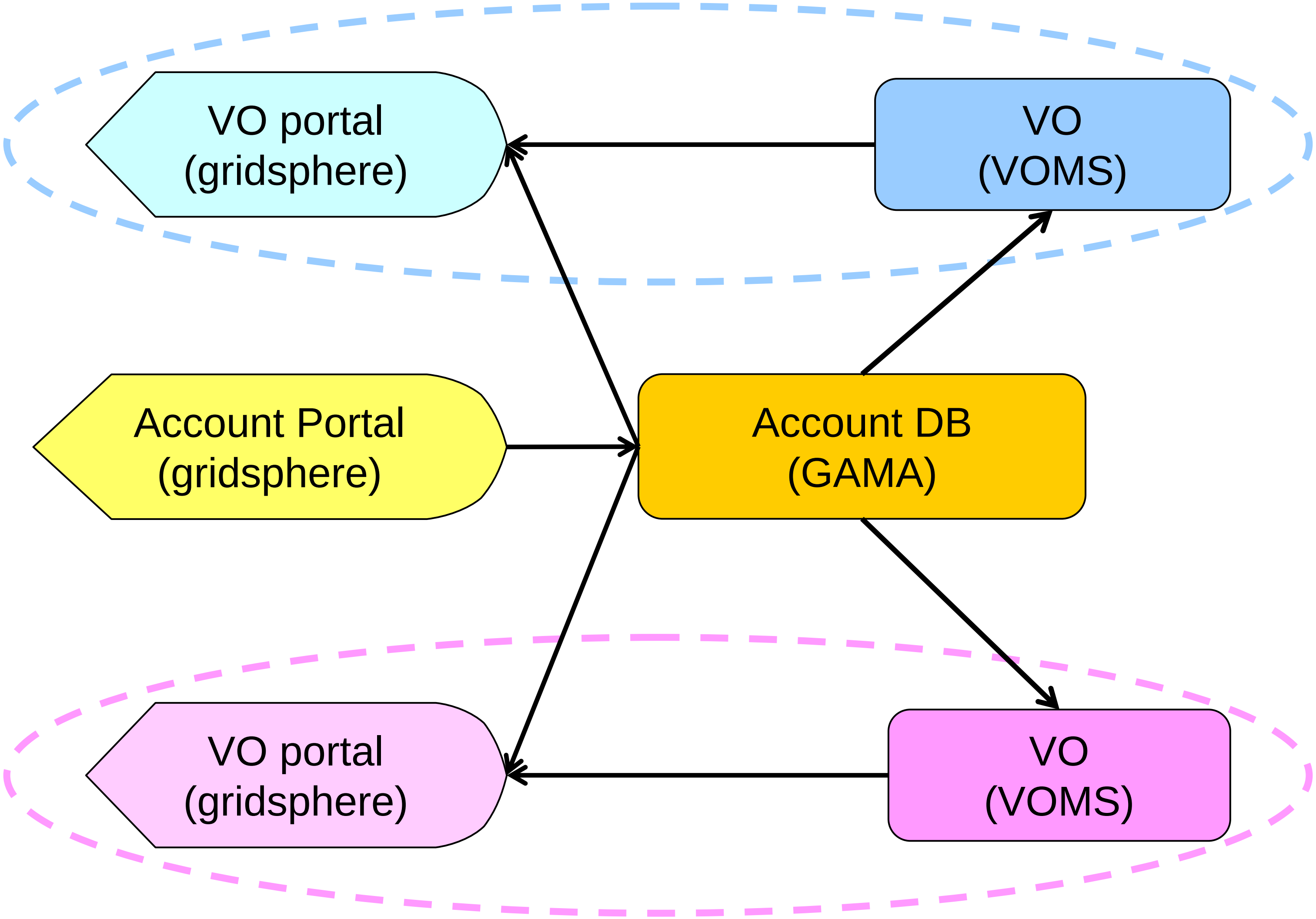
Access Control by Account Mapping

- All members are mapped to a single account
- Users are mapped to local account based on groups (and role)
- Users are mapped to pool account based on groups (and role)

GAMA architecture

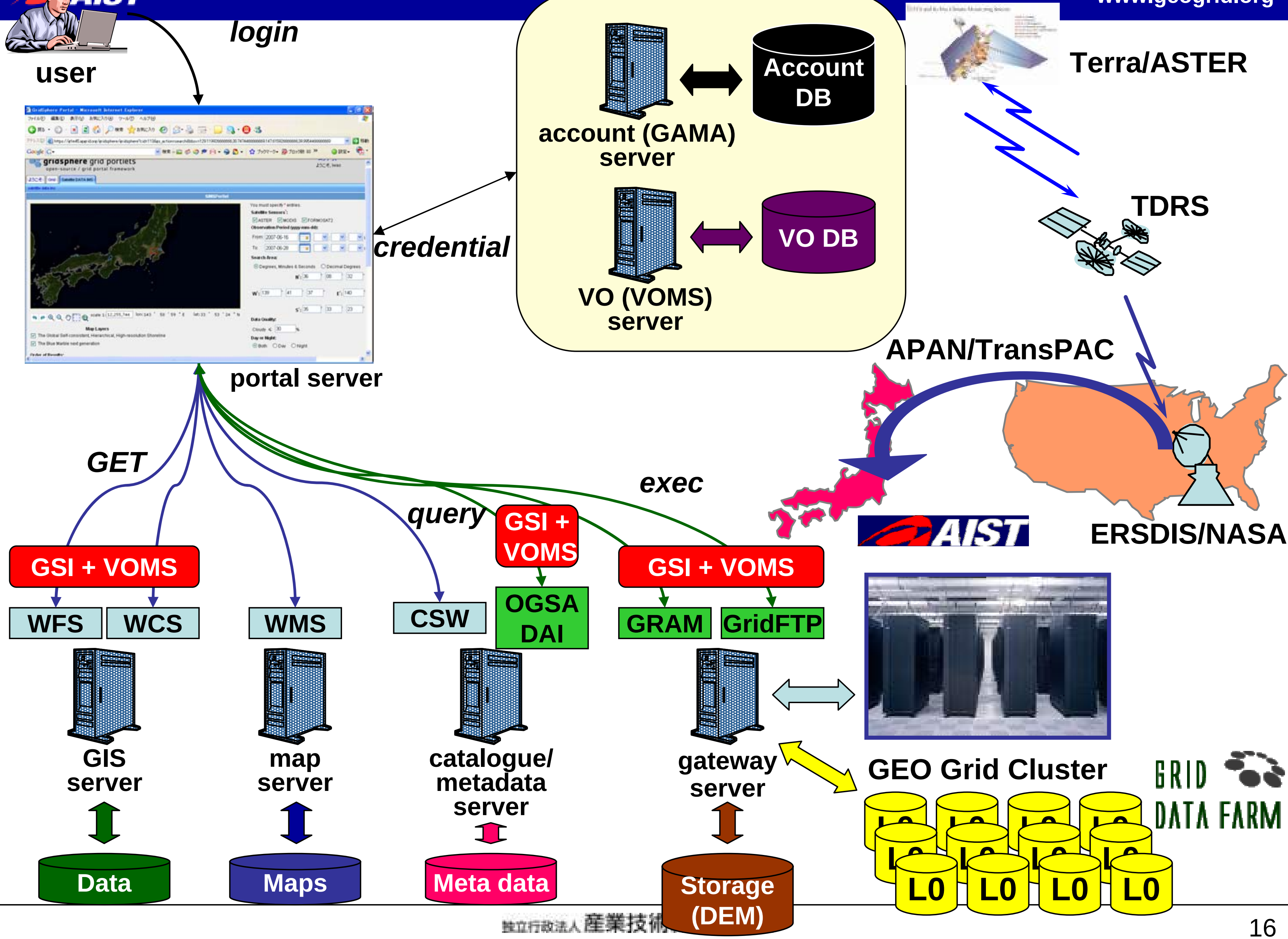


Portal v.s. Accounts v.s. VO

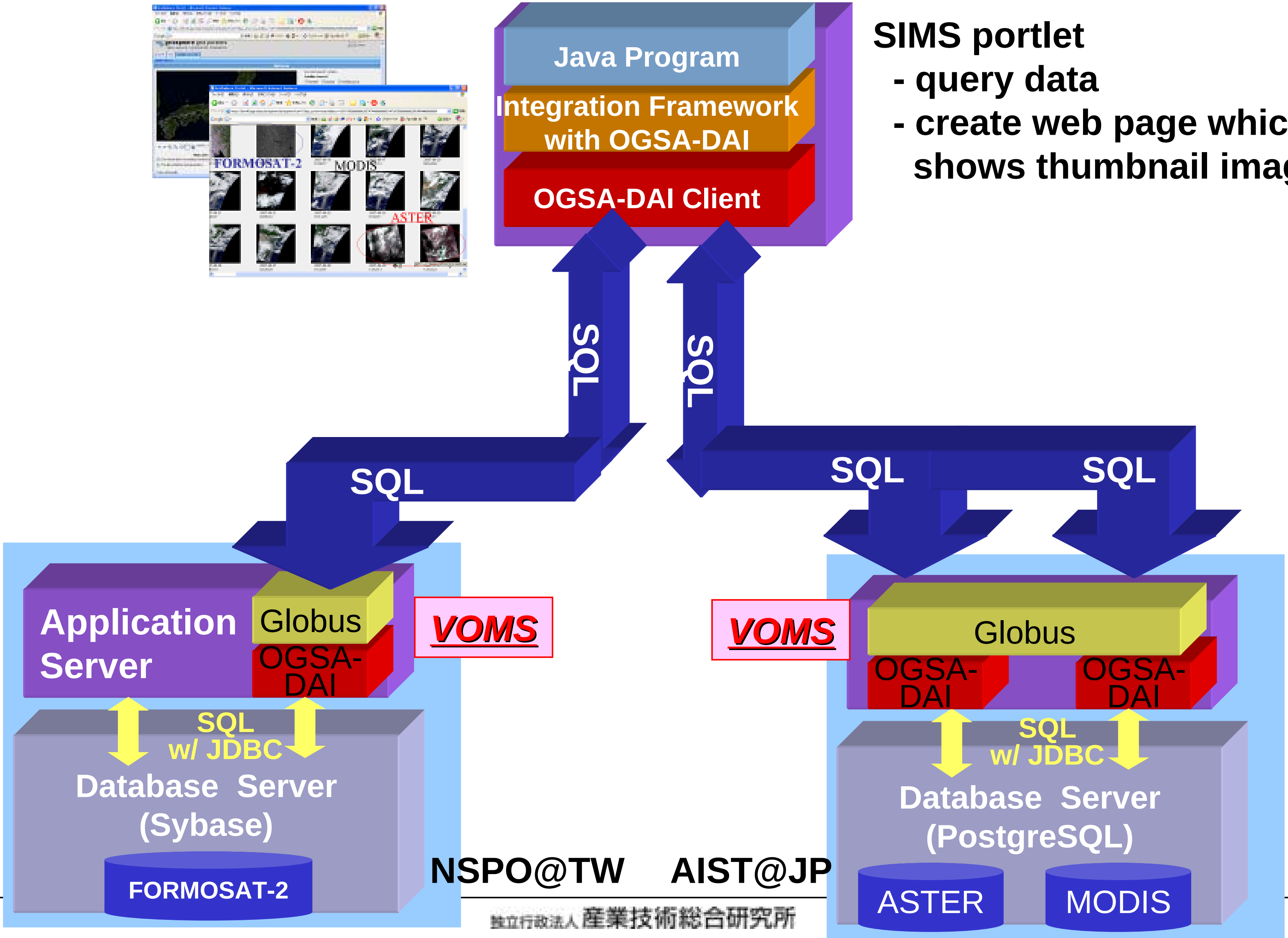


Current status of evaluation, integration, and developments

- Deployed and tested
  - GAMA, VOMS server
  - Pre-WS GRAM w/ VOMS
  - WS GRAM w/ VOMS
  - GridFTP w/ VOMS
  - Apache w/ VOMS
  - OGSA-DAI w/ VOMS
- Authorization using VOMS
  - Different levels of AuthZ
    - VO, Group, Role, User
  - Different method for account mapping
    - Single account, pool account, account for individual user
- Developed two functions for integrating GAMA and VOMS
  - GAMA Portal accesses VOMRS (VO Management Registration Service) to register a new user with the VO when the account is activated.
  - GAMA Portal generate a VOMS proxy from a proxy credential from the MyProxy server.
  - Credential Portlet


user
login
GridSphere Portal - Microsoft Internet Explorer
gridsphere grid portlets
open-source / grid portal framework
You must specify * entries.
Satellite Sensors*:
☑ASTER ☑MODIS ☑FORMOSAT2
Observation Period (yyyy-mm-dd):
From: 2007-06-16
To: 2007-06-28
Search Area:
● Degrees, Minutes & Seconds ○ Decimal Degrees
Data Quality:
Cloudy < 30 %
Day or Night:
● Both ○ Day ○ Night
Map Layers
☑ The Global Self-consistent, Hierarchical, High-resolution Shoreline
☑ The Blue Marble next generation
portal server
credential
account (GAMA) server
Account DB
VO (VOMS) server
VO DB
Terra/ASTER
TDRS
APAN/TransPAC
AIST
ERSDIS/NASA
GET
query
exec
GSI + VOMS
WFS
WCS
GIS server
Data
WMS
map server
Maps
CSW
GSI + VOMS
OGSA DAI
catalogue/ metadata server
Meta data
GSI + VOMS
GRAM
GridFTP
gateway server
Storage (DEM)
GEO Grid Cluster
L0
L0
L0
L0
GRID DATA FARM

Demo Environments - SIMS (ASTER+MODIS+Formsat2)



SIMS portlet

- query data
- create web page which shows thumbnail images