

Open Grid Services for Earth Observation



Pedro Gonçalves



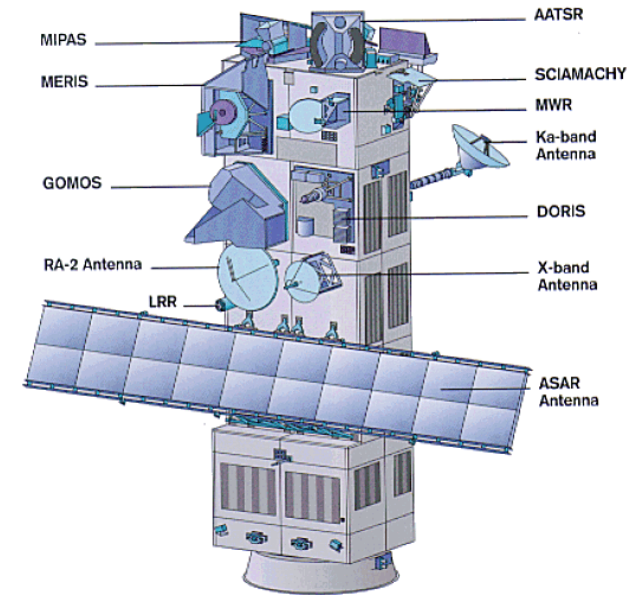
Topics

- Earth observation (EO) applications requirements
- Generic application-grid interface layer (GridEngine)
- Grid portal for EO services
- Possible Future Developments



Requirements

- 100 Gbytes of data per day in ERS missions and 500 Gbytes in ENVISAT
- What do we need :
 - enhance the ability to access high level products
 - allow reprocessing of large historical archives
 - improve Earth science complex applications (data fusion, data mining, modeling ...)



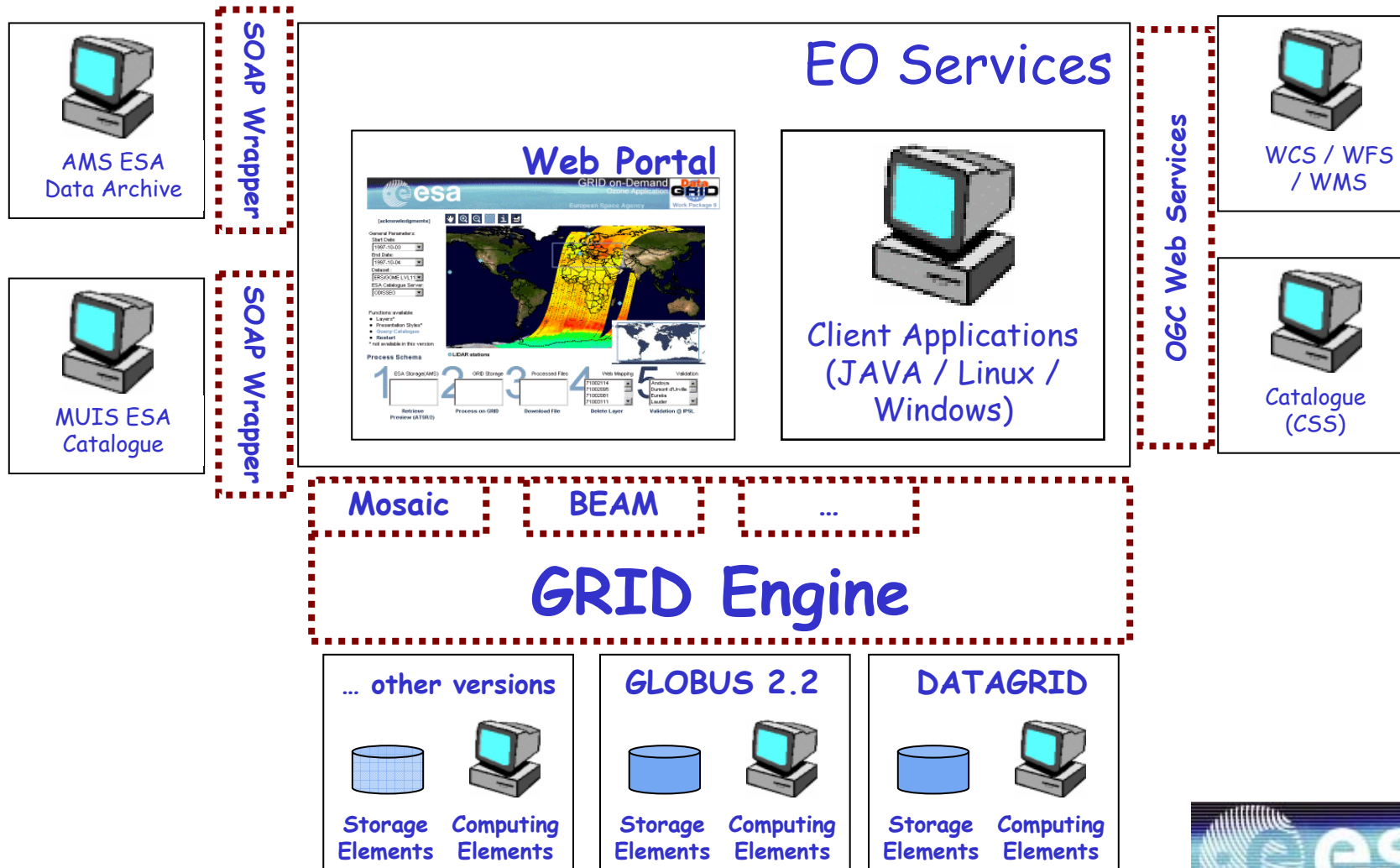
ESA/ESRIN Current Resources

- European Project DataGRID underlined infrastructure
 - Complex middleware (system environment) developed by CERN, PPARC, CNRS, INFN...
 - Middleware for Earth Observation Applications (Grid Engine) developed by us
- Local infrastructure
 - Dedicated Computing Element (cluster), Storage Element (with enough tera for a rolling archive)
 - Interface to operational infrastructure: MUIS (catalogue), AMS (archive)
- Infrastructure extensions with ENEA, Tor Vergata, CNR, and the CEOS GRID project (NASA and USGS)



EO end-to-end Application Environment ...

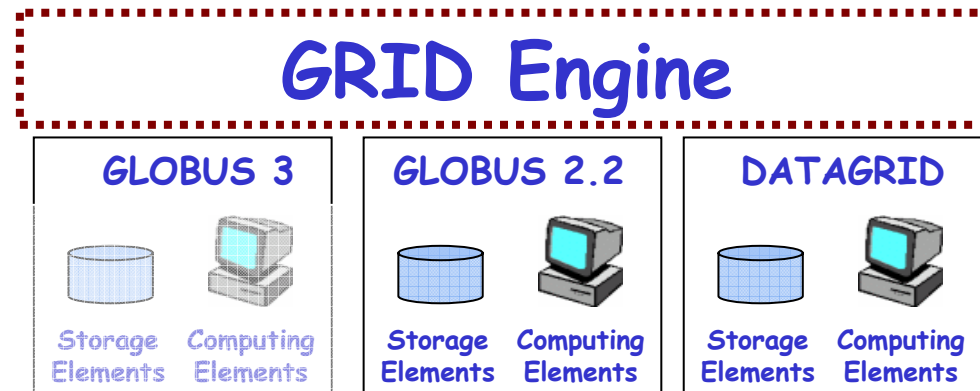
Joining the services



GRID Engine

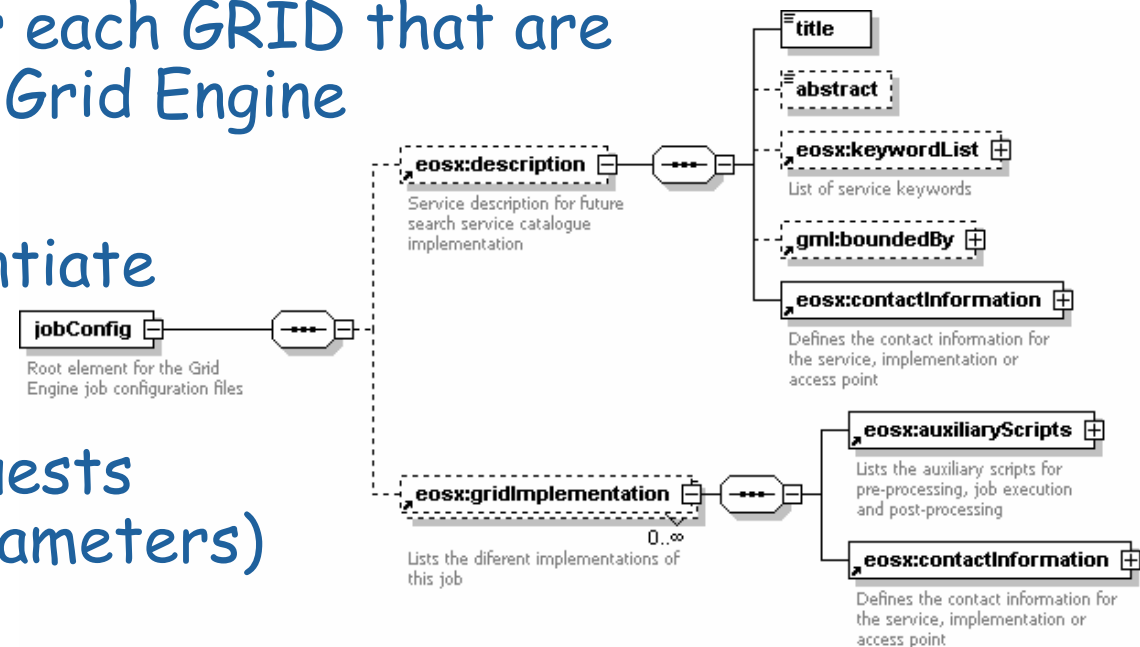
Status : Compatible with DataGrid and GLOBUS 2.2

- Connects and manages jobs sessions in multiple GRID environments - (WSDL description and SOAP encoding)
- Publish jobs availability and current processing status to external services in XML
- Retrieves and translates job results



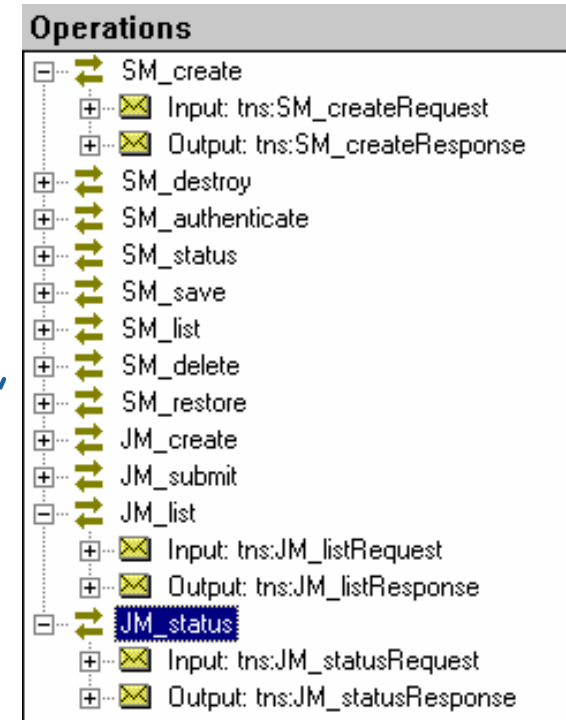
GRID Engine

- Services are pre-defined applications managed by templates for each GRID that are plugged into the Grid Engine
- Templates instantiate the necessary scripts for the specific job requests (files names, parameters)
- Defined by XML schema for future implementation of discovery services



GRID Engine - Operations

- SOAP Services using HTTP(S)
 - Session Manager (SM)
 - Session and Certificates management
 - SM_open, SM_authenticate, SM_quit,
 - Job Manager (JM)
 - Job commands and status information
 - JM_submit, JM_list, JM_create, ...
 - Storage Explorer (SE)
 - Storage access
 - SE_query, SE_move and SE_transfer methods.
- TBD : the use of SOAP w/ Attachments (W3C sub.)

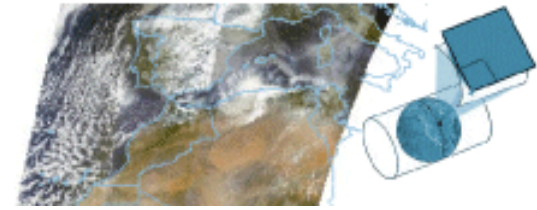


EO specialized Services

- On-demand geographical orbit projection (using ESA's EnviProj)



- On-demand orbit projection and mosaicking (using OSSIM, BEAM and BEST)



- Format Conversion Services: Envisat standard, GeoTiff, HDF-EOS ...
- GOMOS/GOME level 1-2 processing and validation (ESA/ACRI and external validation tools)



EO data Search and Storage Services

- Temporal/spatial selection of data (ESA catalogue - MUIS) with automatic browse projection
- Data transfer from data warehouses (AMS)
- Data transfer to and from the GRID storage elements

The screenshot displays the ESA MUIS search interface. At the top, there is a map of North Africa with several colored rectangular overlays (green, blue, pink) representing search areas. To the right of the map is a control panel with the following sections:

- Geographical Selection:** Includes a globe icon, a dropdown menu set to "North Africa", and input fields for "Top Right" (57, 42) and "Bottom Left" (25, 21).
- Date Selection:** Includes a calendar icon, "Start Date" (2003, May, 14) and "End Date" (2003, May, 20) dropdowns, and a "Query" button.
- Mosaic Parameters:** Includes a "Description" field (Mosaic), an "Output File" field (Mosaic), an "Execution type" dropdown (Multi noded), a "Mosaic type" dropdown (Minimum value), a "Save Task" button, and a "Bands" dropdown (Band 1, Band 2, Band 3, Band 4).

Below the map is a "Catalogue Results (MUIS-C)" section with a list of search results:

Date	Orbit	Start Time	End Time
2003-05-14	Orbit 6287	07:32:55.54	07:36:11.54
2003-05-14	Orbit 6287	07:35:43.20	07:38:59.20
2003-05-14	Orbit 6288	09:07:56.13	09:11:12.13
2003-05-14	Orbit 6288	09:10:43.80	09:13:59.80
2003-05-15	Orbit 6301	06:55:42.17	06:58:58.17
2003-05-15	Orbit 6301	06:58:29.84	07:01:45.84
2003-05-15	Orbit 6301	07:01:17.50	07:04:33.50
2003-05-15	Orbit 6301	07:04:05.16	07:07:21.16
2003-05-15	Orbit 6302	08:36:18.10	08:39:34.10
2003-05-15	Orbit 6302	08:39:05.76	08:42:21.76
2003-05-15	Orbit 6302	08:41:53.43	08:45:09.43

Below the list, there is a checkbox for "Show FootPrint" (checked), and "Preview" and "Delete" buttons.



Web Portal Services

- Job selection, launching and status information
- Result visualization on the web page
- Data folder accessible w/ Web Map Spec.

Open GRID Services - Netscape
http://giserver.esrin.esa.int/grid/service/task.main.asp

Grid on-Demand

ESA User: Pedro Goncalves Last Updated: 29-Aug-2003

My Folder is a briefcase of the your services, created, running or completed on the ESA Earth Observation GRID infrastructure. Each time you leave the session, your job will be saved in this briefcase. There are three levels of services: Not Submitted, Submitted and Concluded. In each of these three levels, there are specific sets of tools to perform the operations on those services. Click on the top level of each one to know more.

Grid On Demand

- Logout
- Services
- My folder
- Demos
 - Meris band combination
 - Europe Mosaic
- Administration
 - Add user
 - Edit user
 - Delete user
- Contact Us

Name: Mosaic Medio Oriente
Grid Portal ID: 193817

Red Band 3
Green Band 5
Blue Band 7

Orbits Processed:
06272
06273
06286

Delete Resubmit

Open GRID Services - Netscape
http://giserver.esrin.esa.int/grid/service/task.main.asp

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Name: Mosaic Amazonas
Grid Portal ID: 121359

Job	Status	Message
		by another node: 0, in cache: 3 4:4
Geocode06434	!	Running,_ACTIVE () File not in cache, geocoding... 4:5
Geocode06448	✓	Terminated,_DONE () Geocoding done... processed: 0, processed by another node: 0, in cache: 0 5:6
Geocode06476	✓	Running,_DONE () Geocoding done... processed: 0, processed by another node: 0, in cache: 0 6:7
Geocode06506	✓	Running,_DONE () Geocoding done... processed: 0, processed by another node: 0, in cache: 0 7:8
MosaicBand3	!	Running,_ACTIVE ()

Refresh Delete Resubmit



Conclusion

- The Web Portal Integrates several components of the EO Infrastructure
- The EO GRID Engine provides a standard way for Web Clients to request GRID operations
- The Web Portal and the EO Grid Engine allow the complexity of the underlying components to be hidden from the user
- This Framework can be adapted to provide new tools for the satellite end-users (e.g. integration of ENVISAT specific tools, such as BEAT, BEST, BEAM ...)



Possible Future Developments... in 1 year

- Demonstrate sharing of processing in other 1-2 sites (Kiruna, DLR, ...) where data are locally archived
- Consolidate generic application service environment
 - "Application manager" to define processing code version independently from GRID infrastructure
- Extend applications cases (data types, processing modules, ...)
 - Systematic on-demand processing of selected ENVISAT steps (e.g. GOMOS 0-1, validation; MERIS, ASAR...) with new algorithms



Possible Future Developments... in 2 years

- Each Acquisition/Archiving facility has a dedicated generic "GRID on Demand processing node"
 - Future evolution of a generic G/S
- Integration with local operational facilities
- Transfer to operation of full infrastructure
 - High bandwidth availability
 - Agreement with facilities ...



More information

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<http://giserver.esrin.esa.int/grid>

