

- 10:30 Welcome (ESA)
- 10:35 GRID: Earth and Space Science Applications Perspectives (ESA)
- 10:50 ESA GRID Infrastructure (ESA)
- 11:00 Introduction to SpaceGRID (DAT)
- 11:10 Project Presentation (DAT)
 - 11:20 Earth Observation (DAT)
 - 11:40 Space Weather (CS-SI)
 - 11:55 Spacecraft - Plasma Interactions (DERA + SSL)
 - 12:10 Radiation Transport Simulation (DERA + SSL)
 - 12:25 Solar System Research (RAL + SSL)
 - 12:45 Mechanical Engineering (ASPI)
- 13:00 Lunch
- 14:00 Visit to Concurrent Design Facility and other labs (ESA)
- 15:00 European Commission present and future GRID actions (EC)
- 15:30 European institutions cooperation on GRID - discussion (all)
- 16:45 Conclusions (ESA)
- 17:00 Adjourn

GRID: Earth and Space Science Applications Perspective

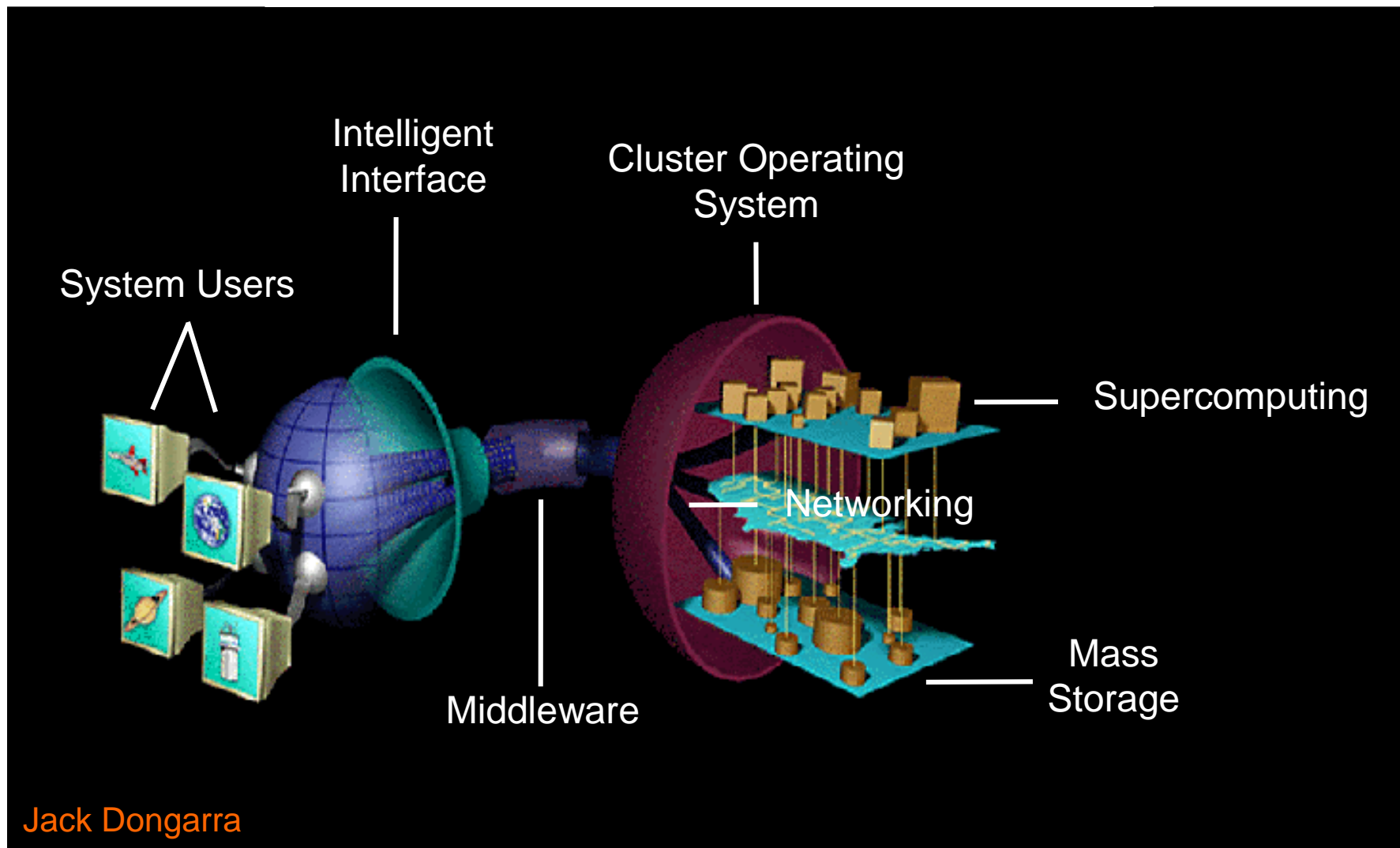
luigi.fusco@esa.int

SpaceGRID KO meeting
ESTEC, 26 September 2001

Summary

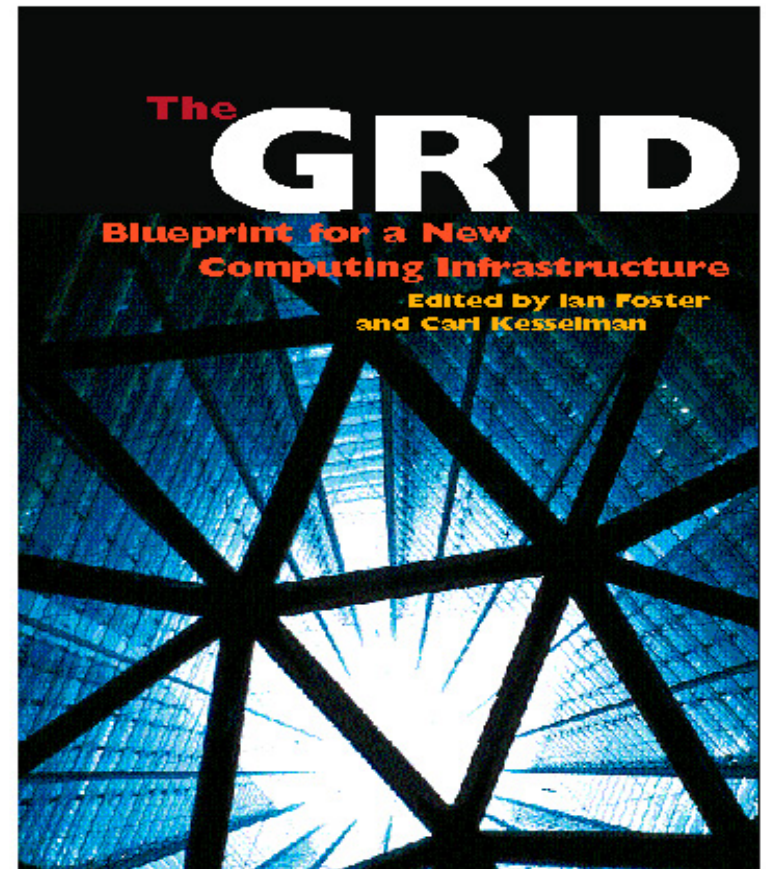
- GRID paradigm - facts
- Earth and Space Science applications framework for GRID
- Future perspectives

GRID vision



Five Emerging Models of Networked Computing

- **Distributed Computing**
 - synchronous processing
- **High-Throughput Computing**
 - asynchronous processing
- **On-Demand Computing**
 - dynamic resources
- **Data-Intensive Computing**
 - databases
- **Collaborative Computing**
 - scientists

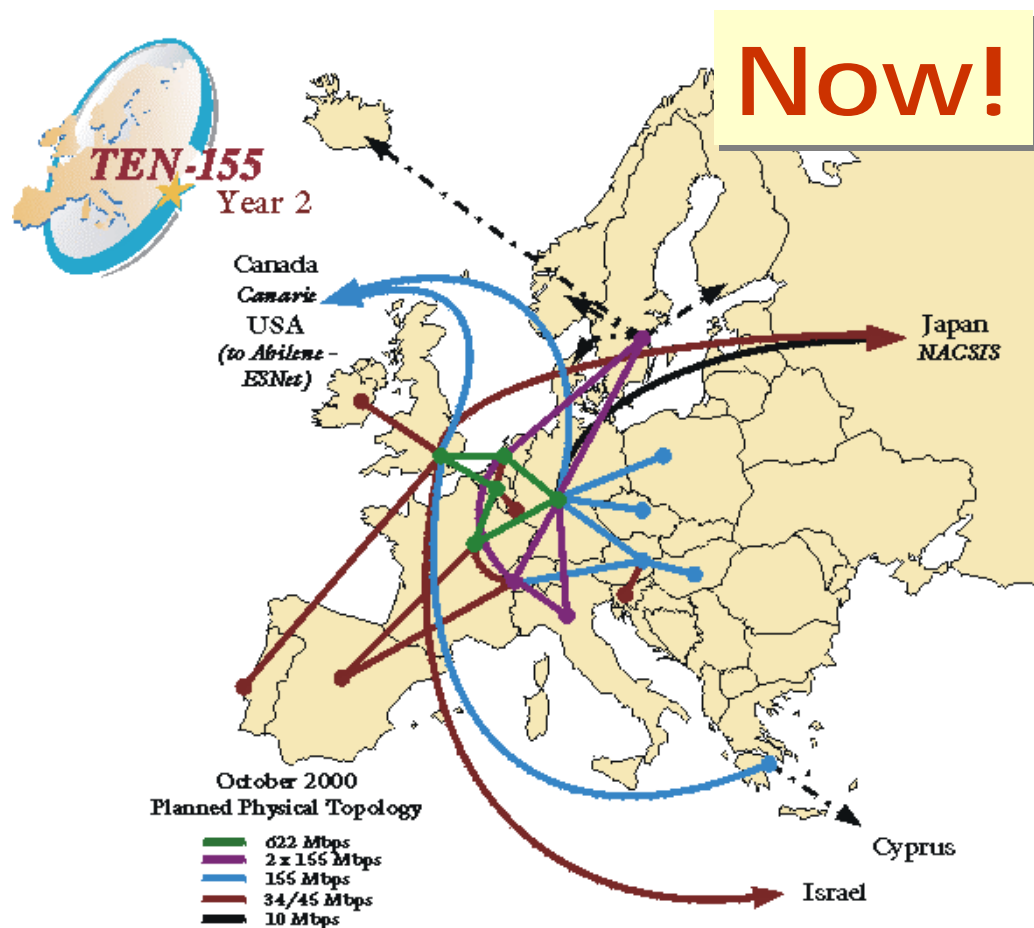


Ian Foster and Carl Kesselman, editors, "The Grid: Blueprint for a New Computing Infrastructure," Morgan Kaufmann, 1999

The GRID metaphor

- Unlimited ubiquitous distributed computing
- Transparent access to multipetabyte distributed data bases
- Easy to plug in
- Hidden complexity of the infrastructure
- Analogy with the electrical power GRID

EU Geant - Trans European Research Network



- up to 2.5/10 Gbps in coming 2 years
- 80 MEu financed Prj
- Multi-Gigabit shared core
- QoS and VPN
- Bandw. to be negotiated
- Test Nw and Production Nw

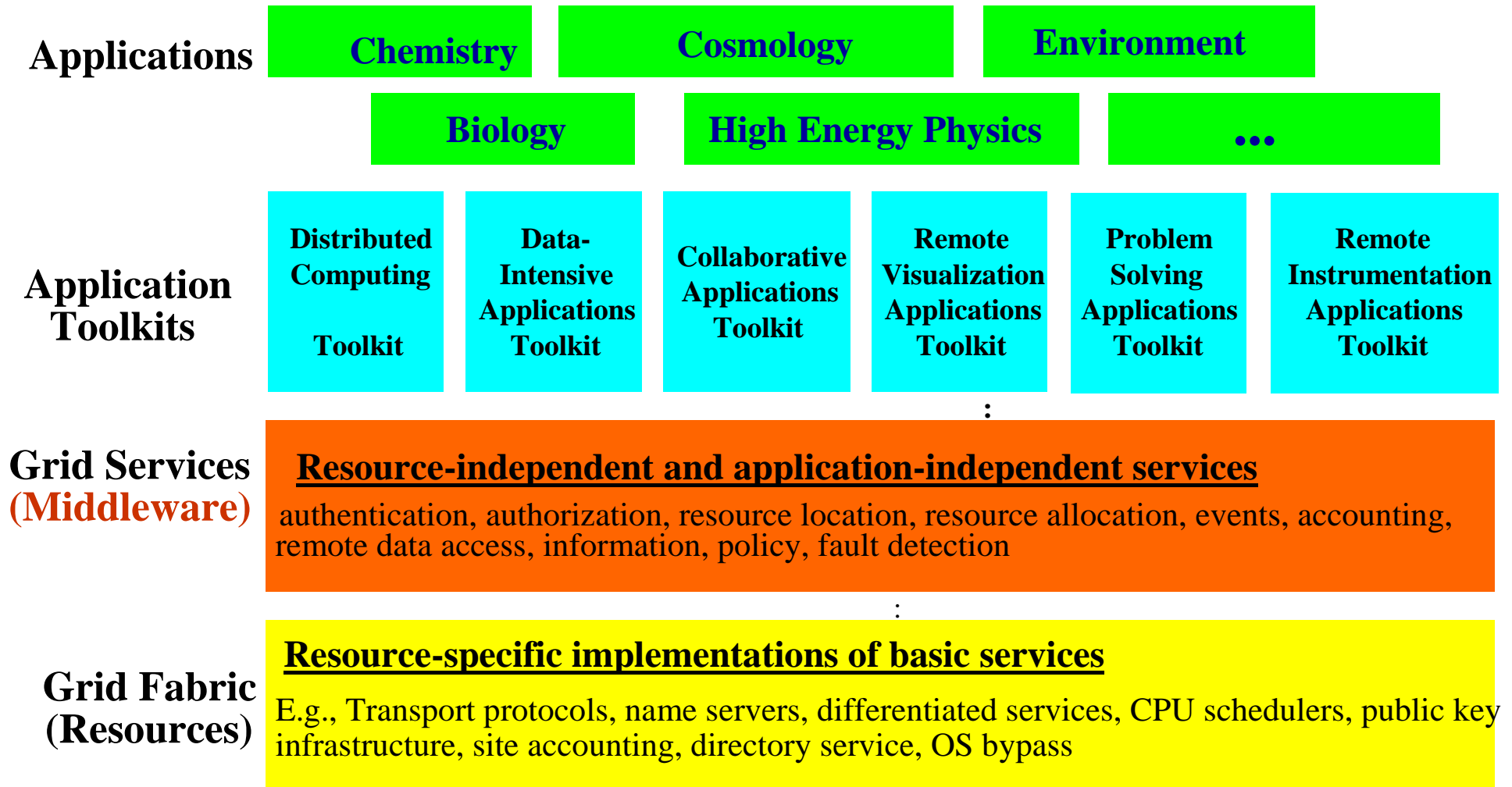
e-Science

e-Science is the global collaboration in key area of **science** and the next generation of **infrastructure** that will enable it

GRID can be the technological infrastructure of **eScience**:

- co-ordinates resource sharing
- support multi-institutional virtual communities
- process and analyse huge amounts of data.

The Grid from a Services View



The DataGrid Project



The European DataGrid is a project funded by
the **European Union** to set up a
computational and data-intensive **grid** of
resources for the analysis of data from
scientific exploration.



DataGrid Goals

- Develop an **open source middleware** for fabric & grid management
- Deploy a large scale **multi-application testbed**
- Production quality **demonstrations**
- **Collaborate** with and complement other European and US projects
- Involve **industries** to create the critical mass of interest for the success of the project
- foster the **World Wide Grid** technology as the basis for the European Research Area

The DataGrid numbers

- 6 main contractors, 15 assistant contractors
- 9.8 millions € funded by EU
- 150 Full Time Equivalent over 3 years
- Flagship project of the EU IST GRID program
- Project started Jan 2001, duration 3 years

DataGrid Applications

- The DataGrid Project affords real and challenging scientific applications:
 - **High Energy Physics**
 - process the huge amount of data from LHC experiments
 - **Biology**
 - sharing of genomic databases for the benefit of international cooperation
 - **Earth Observations**
 - access and analysis of atmospheric ozone data collected by environmental satellites

Some specific DataGRID aspects

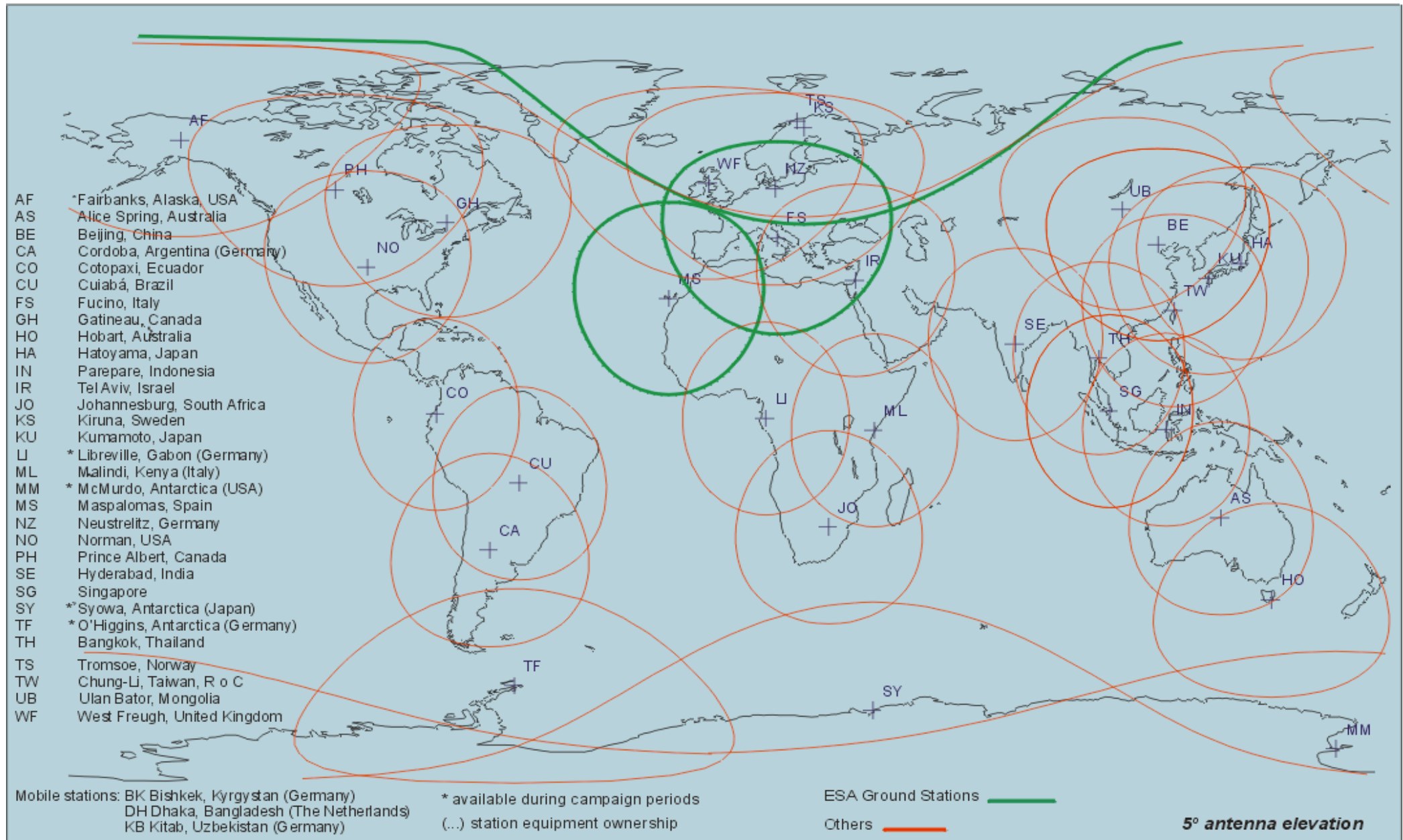
- Foster the **Industrial Deployment** (Industry and Research Forum)
- Support the **Open Source adoption** by researcher and individuals
- Inter-projects collaboration:
 - **GEANT** - Trans European Network
 - main contacts with the **Globus** development team
 - strong participation to the **GGF**
 - coordination with other GRID projects

Recent GRID facts

- New projects funded by EC
 - ...
 - **EC 6th FWP**
- Many initiative at Internat'l & National level
 - EIROFORUM
 - CEOS GRID actions
 - UK e-science, Italy GRID, ...
- International fora:
 - GGF (next conference in Frascati 7-10 October, includes **Industrial FORUM**), ParCo ...

Satellite Payload Data Handling is an ideal GRID environment

ERS SAR Image Mode Ground Station Coverage



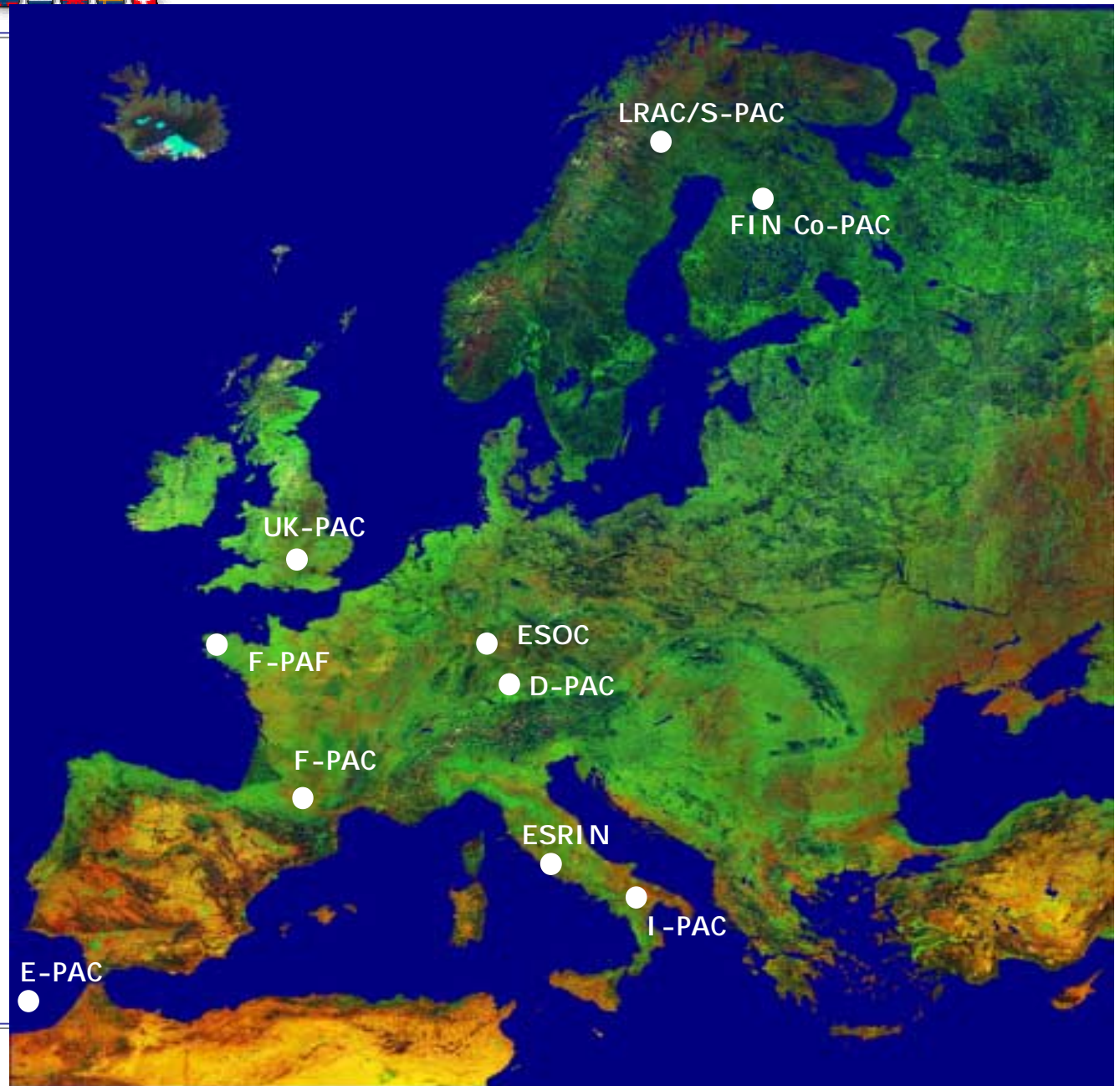
A photograph of the Earth Radiation Budget Experiment (ERBE) satellite, also known as Earth Radiation Budget Satellite (ERBS), in orbit above Earth. The satellite is a complex of gold-colored instruments and solar panels, with a large rectangular solar panel extended to the right. The Earth's surface is visible below, showing blue oceans and white clouds. The word "ENVISAT" is overlaid in large yellow letters on the left side of the image.

ENVISAT

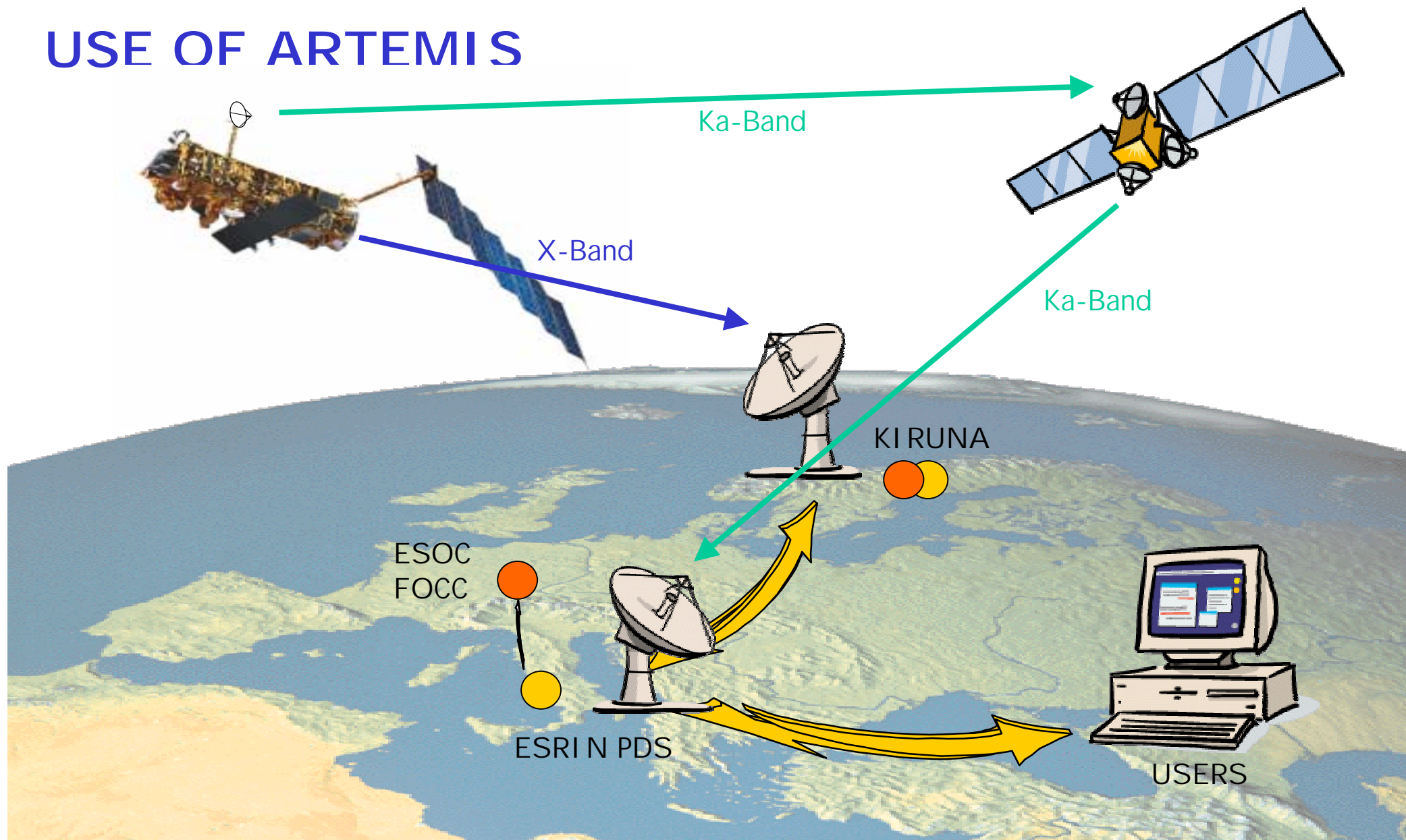
- 3500 MEuro programme cost
- 10 instruments on board
- 200 Mbps data rate to ground
- 400 Tbytes data archived/year
- ~100 "standard" products
- 10+ dedicated facilities in Europe
- ~700 approved science user projects

PRINCIPLES

- ❑ Decentralised architecture, central co-ordination and supervision.
- ❑ National facilities put at ESA's disposal via MOUs and contracts.
- ❑ Direct dealing with scientific users.
- ❑ Co-operation with value added industry in E.O. promotion and in technology transfer from research to applications.

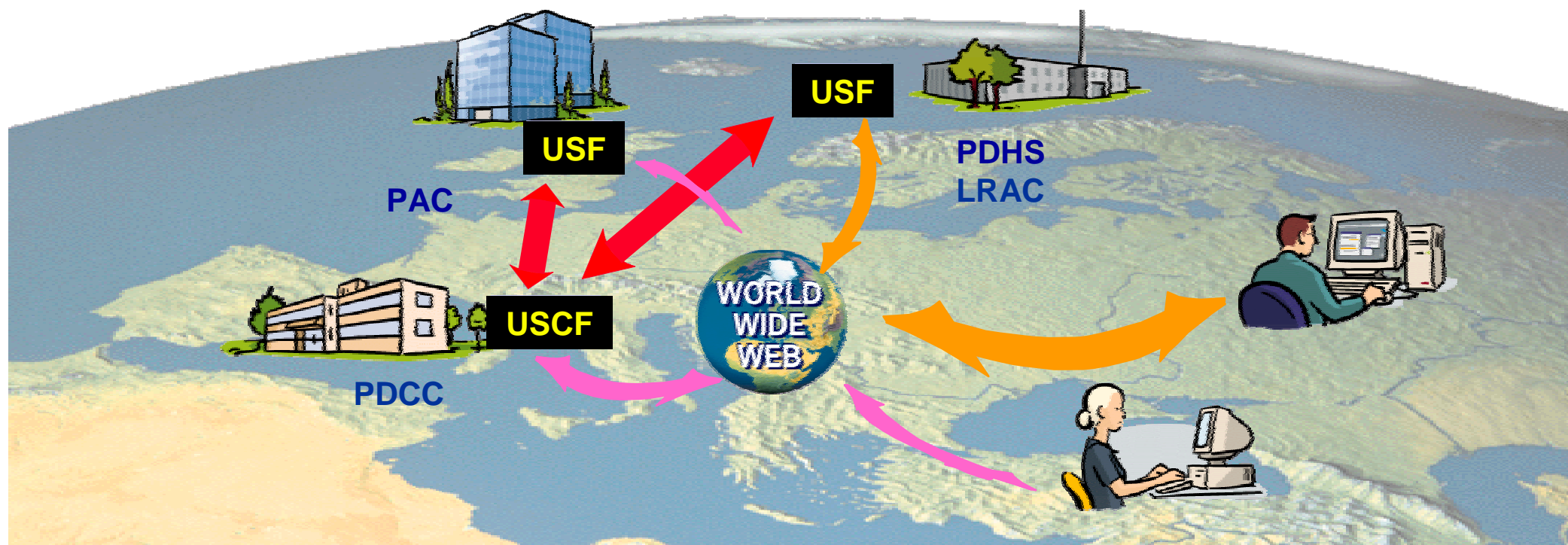


USE OF ARTEMIS



User services for data/products access

- at ESA and selected national facilities
- Science utilisation not part of key ESA infrastructure (many users)



ESA and GRID initiatives

- Considered as a **priority** technology to be used across space applications
- An ESA interest Group established (<http://esagrid.esa.int>)
- ESA-wide initial GRID **infrastructure** being established
- Co-operation with other initiatives (**duplication of funding** to be avoided)
- New ESA contractual actions under discussion

Science requirements for GRID

- Metadata and data access
- intensive and distributed data processing
- e-science (collaboration)
- data fusion, mining, visualisation
- services for Value Adding and commercial use
(security, application development environment, ...)

SpaceGRID Goals

- Assess how GRID technology can serve requirements across a large variety of space disciplines
- Foster collaboration and enable shared efforts across space applications
- Sketch the design of an ESA-wide (and common) GRID infrastructure
- Proof of concept through prototyping
- Involve both industry and research centres

Keep Europe up with GRID efforts

The way forward

- ✓ **Earth and Space Science application user infrastructure to become GRID-aware**
- ✓ **Extend GRID access Space applications**
 - ✓ to **large science** communities
 - ✓ to **value adding and commercial** communities, ...
 - ✓ to federate Earth and Space Science dedicated Networks
- ✓ **Build proper collaborative environments**
- ✓ **More presence in European level initiative**

Science Application GRID Framework

