



Enabling Grids for E-sciencE

EGEE Production Grid

Dr. Ognjen Prnjat

*South East Europe Regional Operations Centre Manager
Greek Research and Technology Network, Athens*

**GGF 15 Production Grids Workshop,
Boston, October 2nd 2005**



- EGEE is the largest production Grid in Europe and perhaps the world
- South East Europe Grid is a subset of the EGEE Grid, being one of the 11 regional Grids in the project
- SEE and EGEE have full infrastructure and management compatibility, sharing the user base
- Focus of the talk: EGEE production Grid practices – operations/management
- Different/wider context from Campus Grids, but same principles of sharing and management apply!

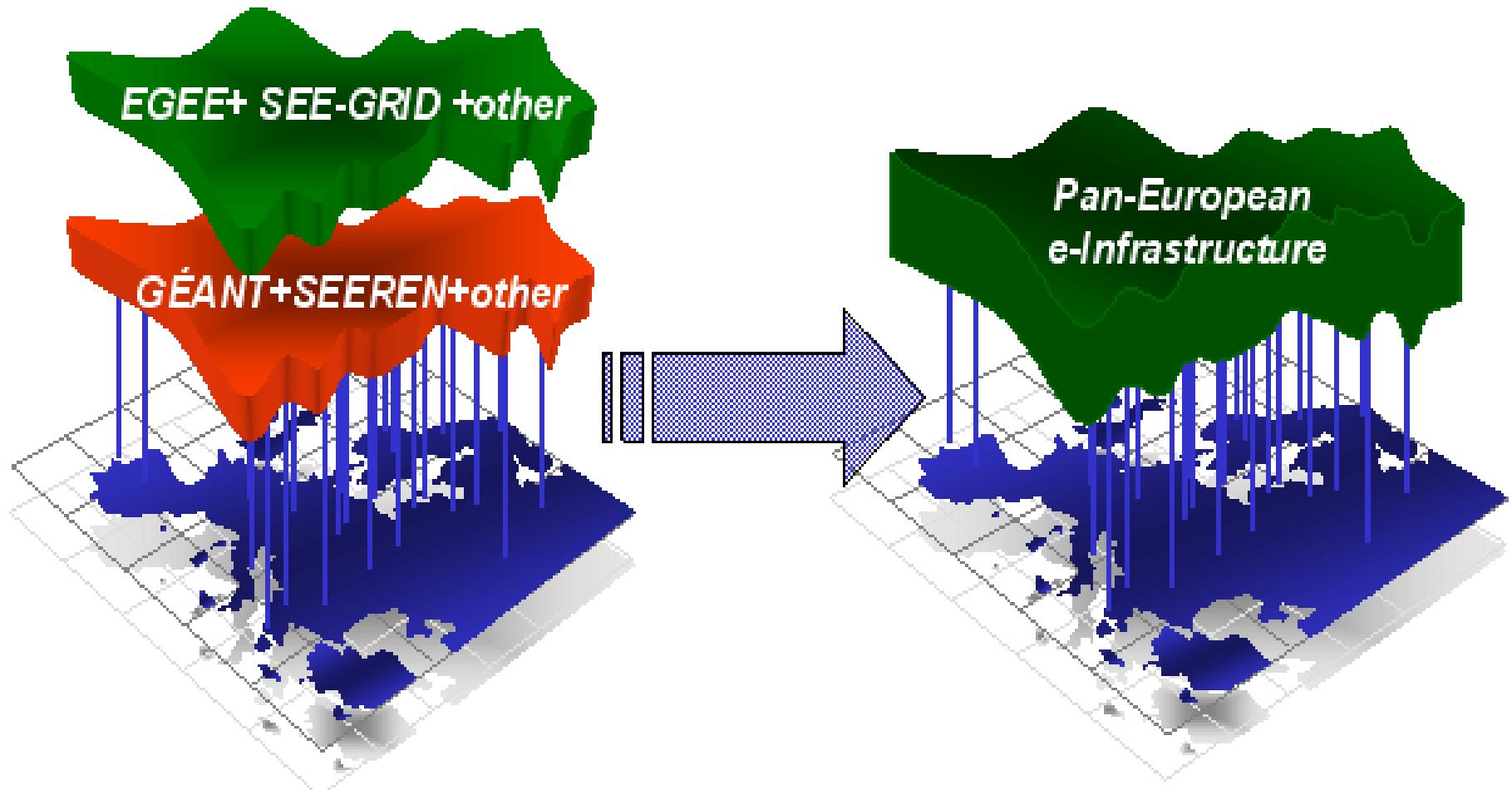
- **Objectives**

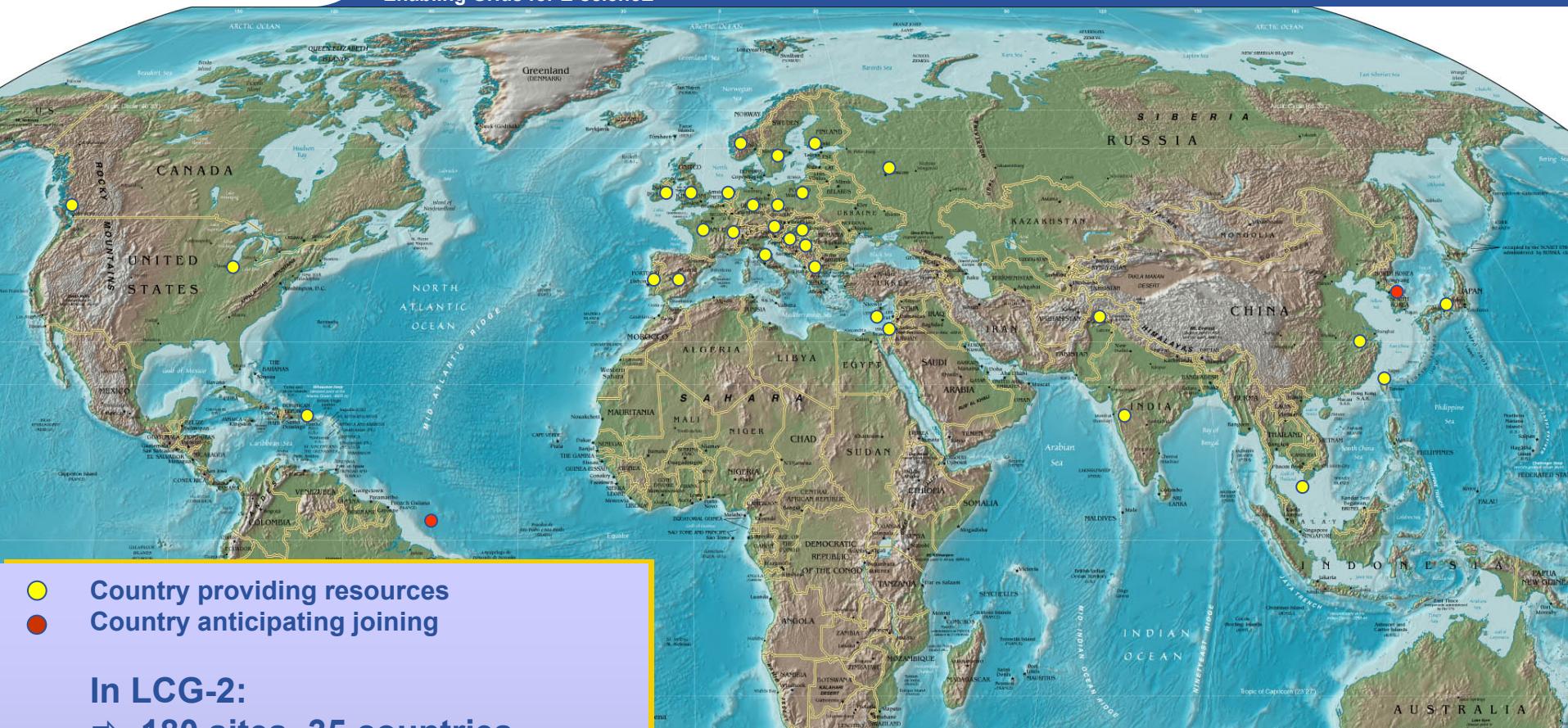
- Provide consistent, robust and secure grid infrastructure
- Improve and maintain the middleware
- Attract new resources and users from industry as well as science
- Cater for a wide range of disciplines

- **Structure**

- 71 leading institutions in 27 countries, federated in regional Grids
- Leveraging national and regional grid activities worldwide
- Funded by the EU with ~32 M Euros for first 2 years starting 1st April 2004





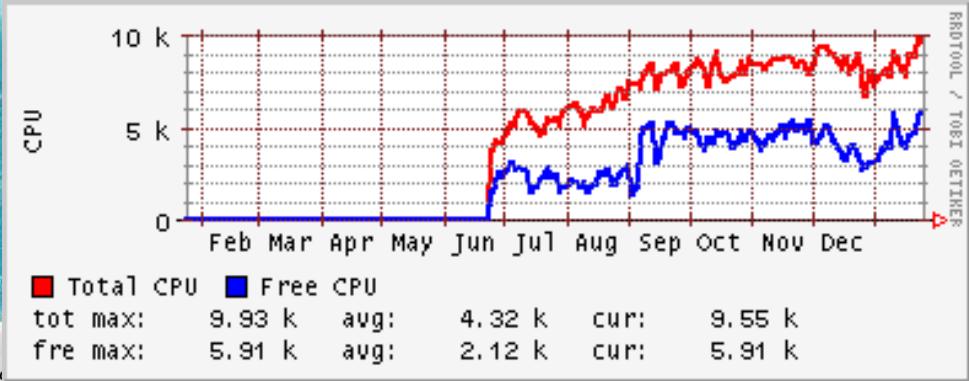


In LCG-2:

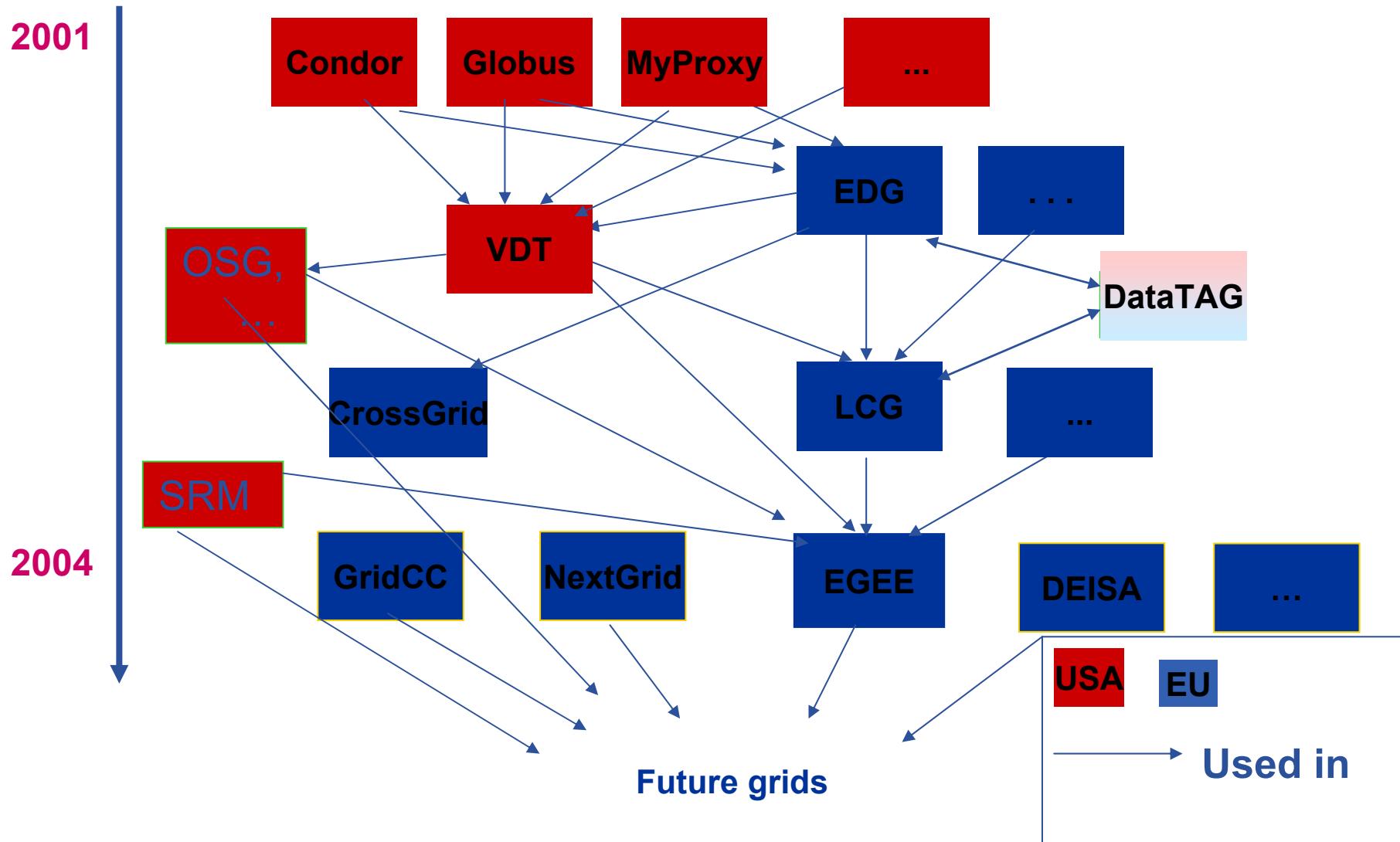
- ⇒ 180 sites, 35 countries
- ⇒ >14,000 cpu
- ⇒ ~5 PB storage

Includes non-EGEE sites:

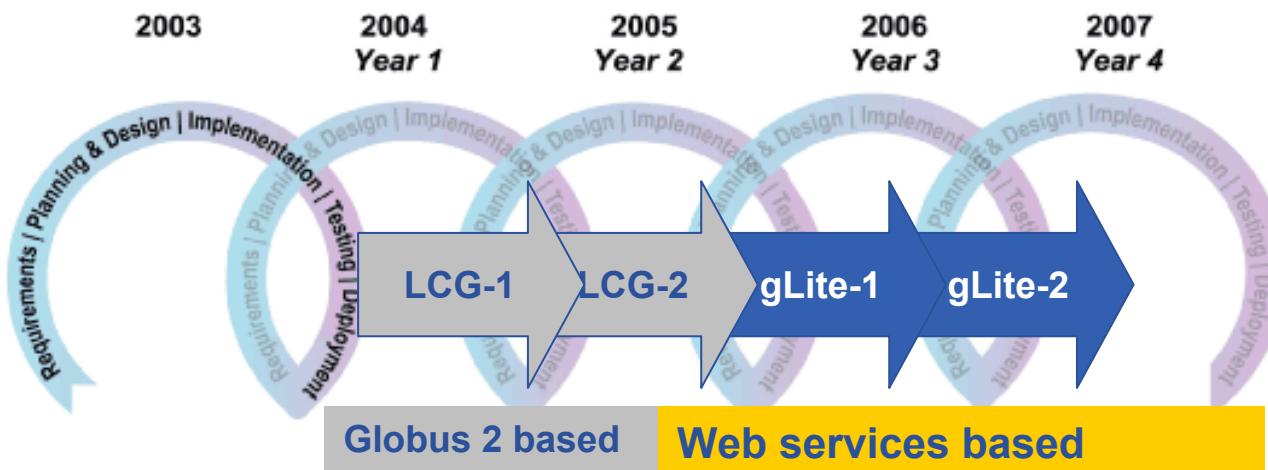
- 9 countries
- 18 sites



Grid m/w “Ecosystem”



- To replace present LCG2 m/w with production quality services
- Developed from existing components
- Aims to address present shortcomings and needs from applications
- Prototyping short development cycles for fast user feedback
- Initial web-services based prototypes being tested
- LCG: Redhat Enterprise 3 / binary compatible – SL, SLC, ports to Debian

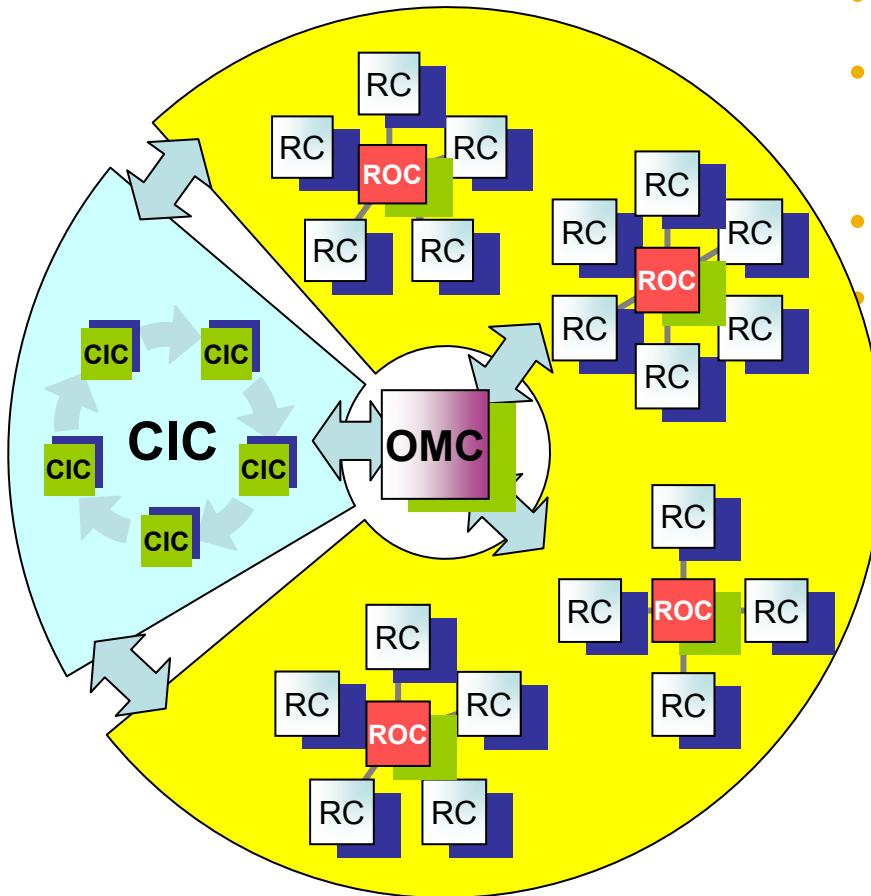


- **First release of gLite end of March 2005**
 - Focus on providing users early access to prototype
 - Release 1.1 in May 05
 - Release 1.2 in July 05
 - Release 1.3 in August 05
 - see www.gLite.org
- **Interoperability & co-existence with deployed infrastructure**
- **Robust: performance & fault tolerance**
- **Service oriented approach**
- **Open source license**



Lightweight Middleware for
Grid Computing

- **Design team includes**
 - Representatives from middleware providers (AliEn, Condor, EDG, Globus...)
 - Colleagues from the Operations activity
 - Partners from related projects (e.g. OSG)
- **gLITE development takes into account input and experiences from applications, operations, related projects**
 - Collaborative, open development frameworks



RC = Resource Centre

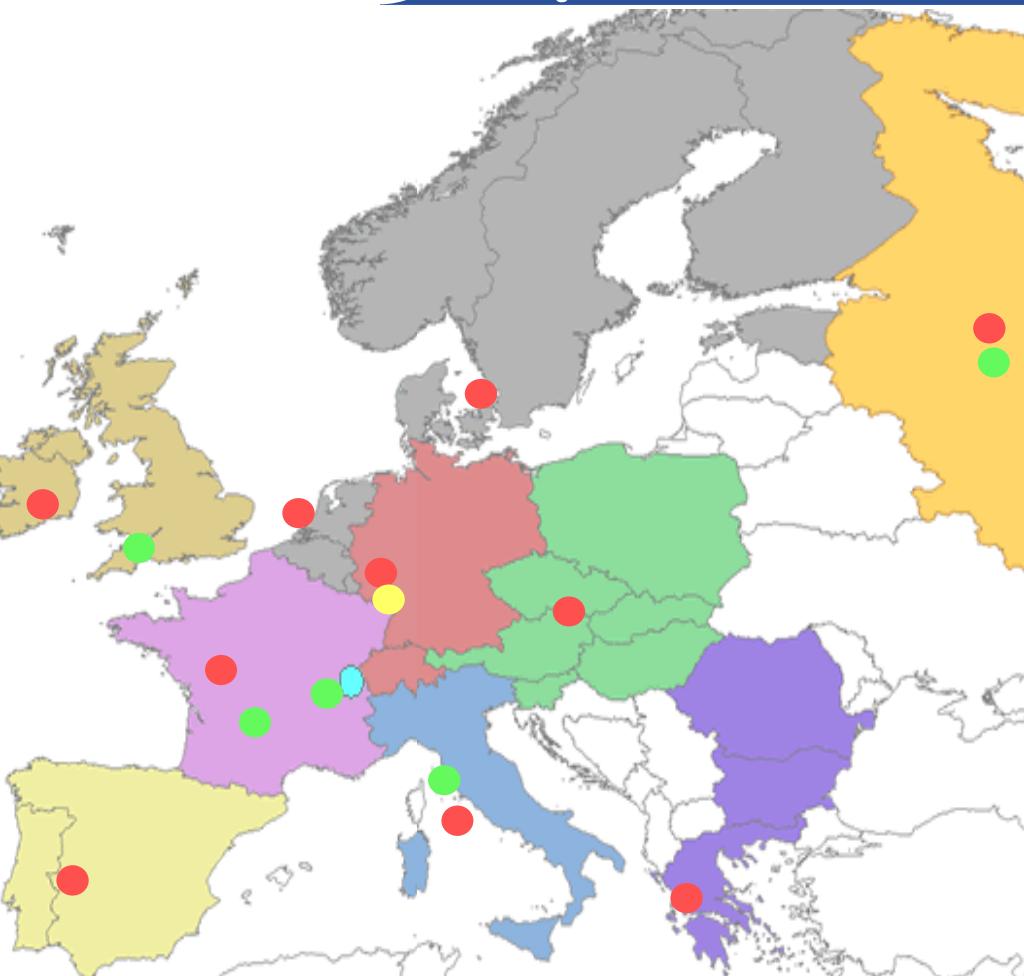
ROC = Regional Operations Centre

CIC = Core Infrastructure Centre

OMC = Operations Management Centre

- The *grid* is flat, but
- **Hierarchy of responsibility**
 - Essential to scale the operation
- **RC provides resources**
- **ROCs responsible for organising the operations in a region**
 - Coordinate m/w deployment, troubleshooting
- CICs act as a single Operations Centre**
 - Operational oversight (*grid operator*) responsibility
 - Rotates weekly between CICs
 - Report problems to ROC/RC
- **OMC provides central coordination**

Operations Structure



- **Operations Management Centre (OMC):**
 - At CERN – coordination etc
- **Core Infrastructure Centres (CIC)**
 - Manage daily grid operations - monitoring, troubleshooting
 - Run essential infrastructure services
 - Provide 2nd level support to ROCs
 - UK/I, Fr, It, CERN, + Russia (M12)
 - Taipei also run a CIC
- **Regional Operations Centres (ROC)**
 - Act as front-line support for user and operations issues
 - Coordinate m/w deployment
 - Provide local knowledge
 - One in each region – many distributed
- **User Support Centre (GGUS)**
 - In FZK – provide single point of contact (service desk)

- CERN integration and deployment team releases new version of LCG m/w approx every 3 months
 - Deployment testing on the distributed 3-site testbed (Italy, UK, South-east Europe)
 - ROCs responsible for coordination of m/w deployment
-
- In parallel, a pre-production services with next-generation m/w
 - Crucial for admins and users to get the hands-on with new m/w

- Operation of Production Service: real-time display of grid operations
- Accounting Information
- Selection of Monitoring tools

• GIIS Monitor + Monitor Graphs

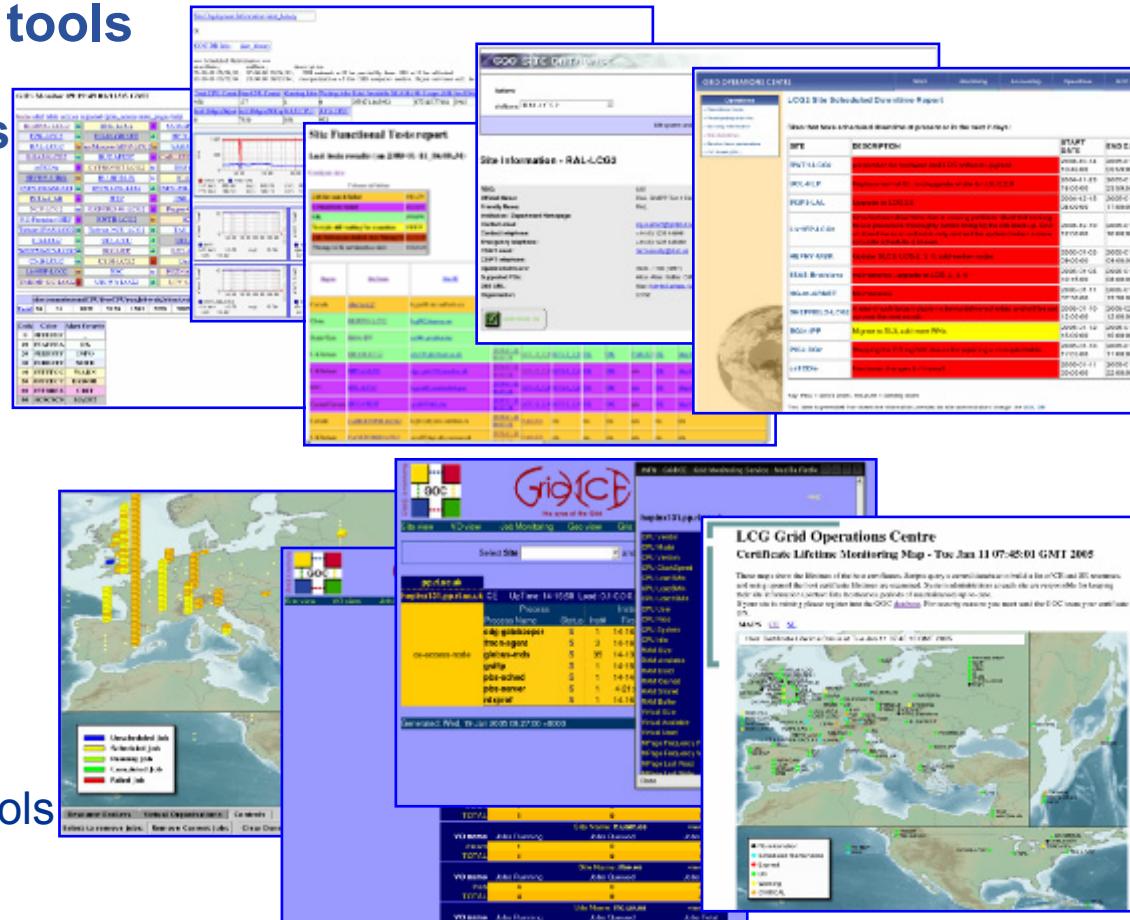
- Sites Functional Tests
- Live Job Monitor
- GridIce – VO + Fabric View
- Certificate Lifetime Monitor
- → work towards common transport system and data schema

• GOC Data Base

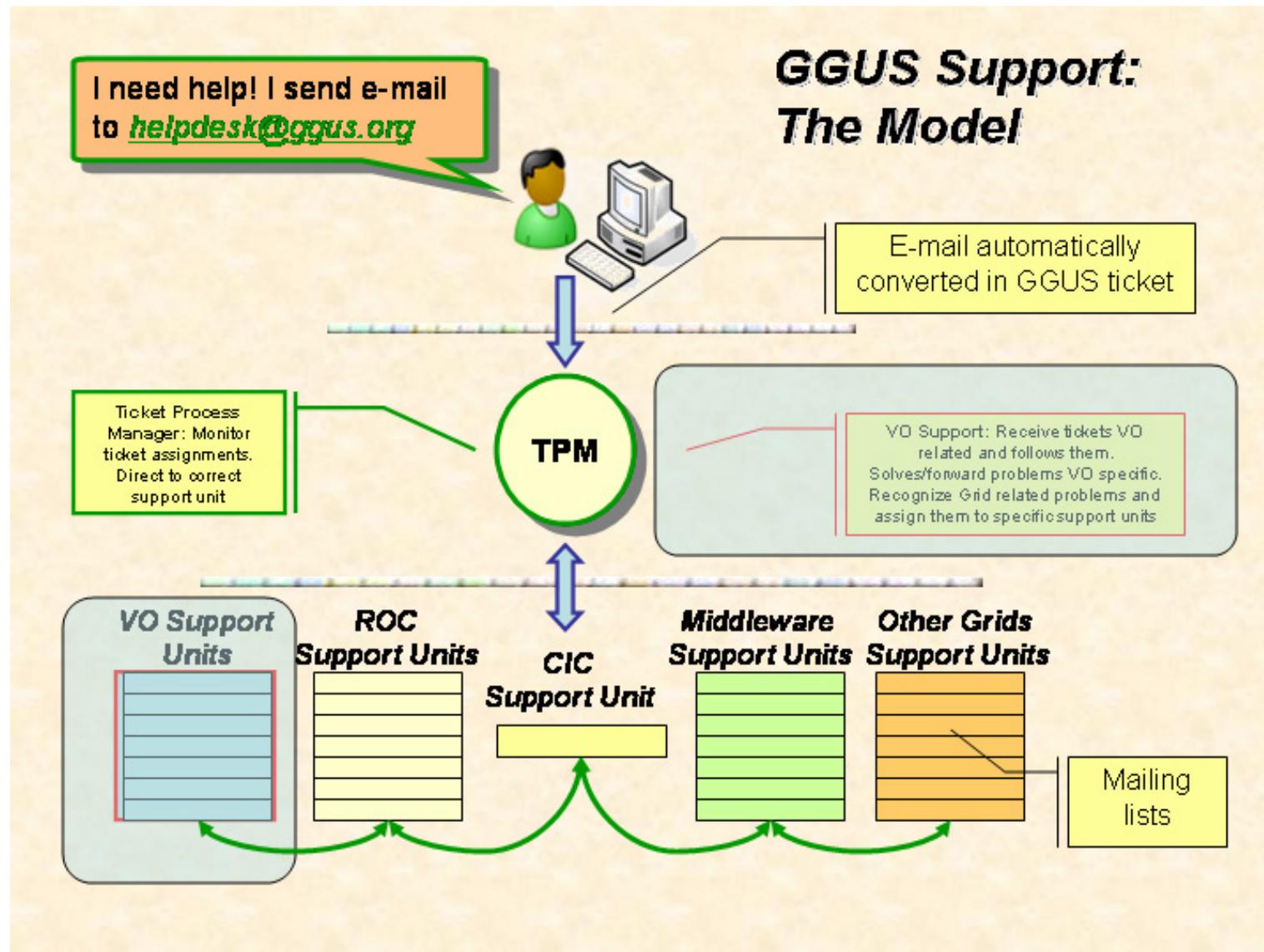
- Centralized site info: static

• CIC dashboard

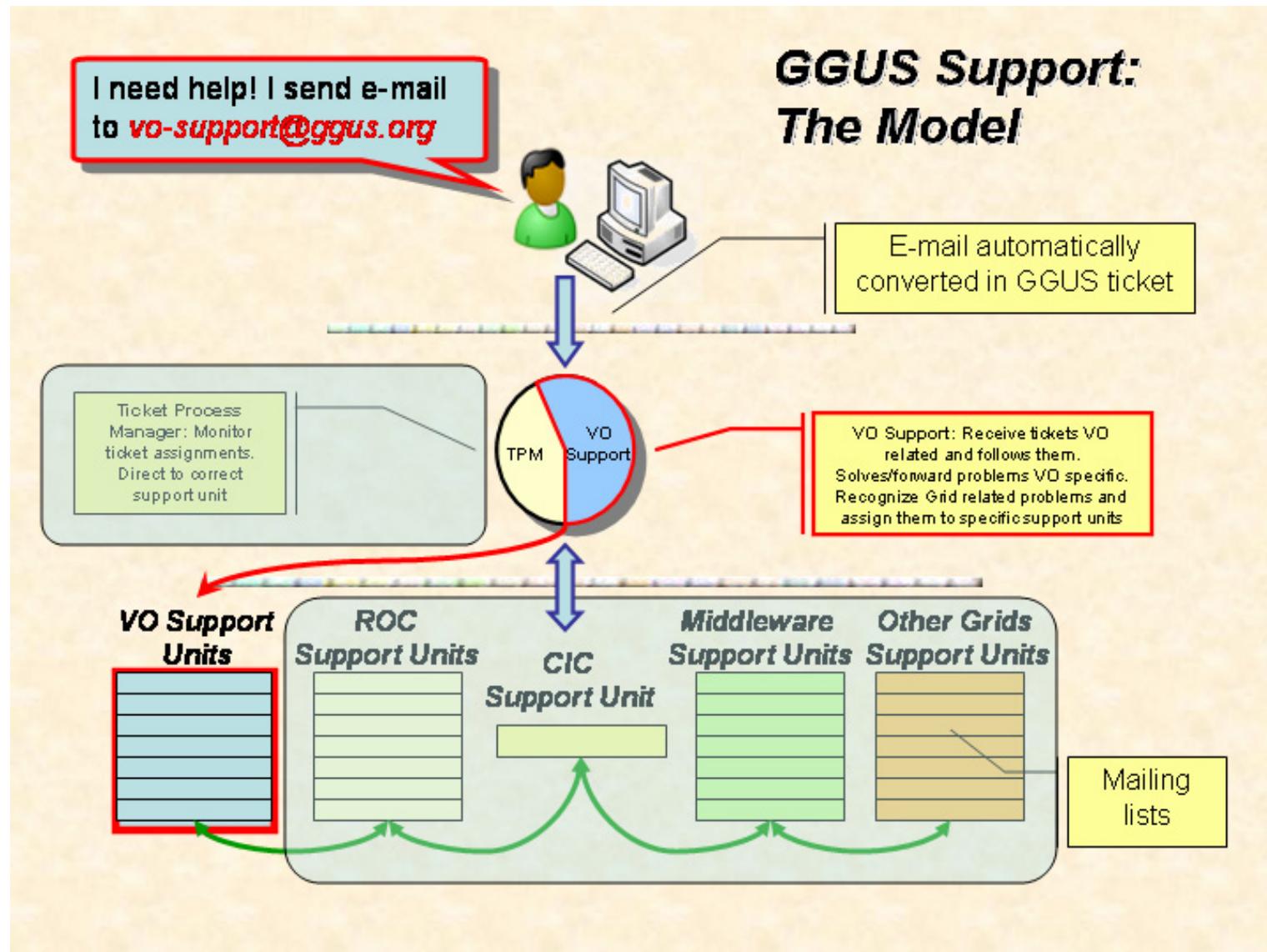
- Integrated info from MON tools

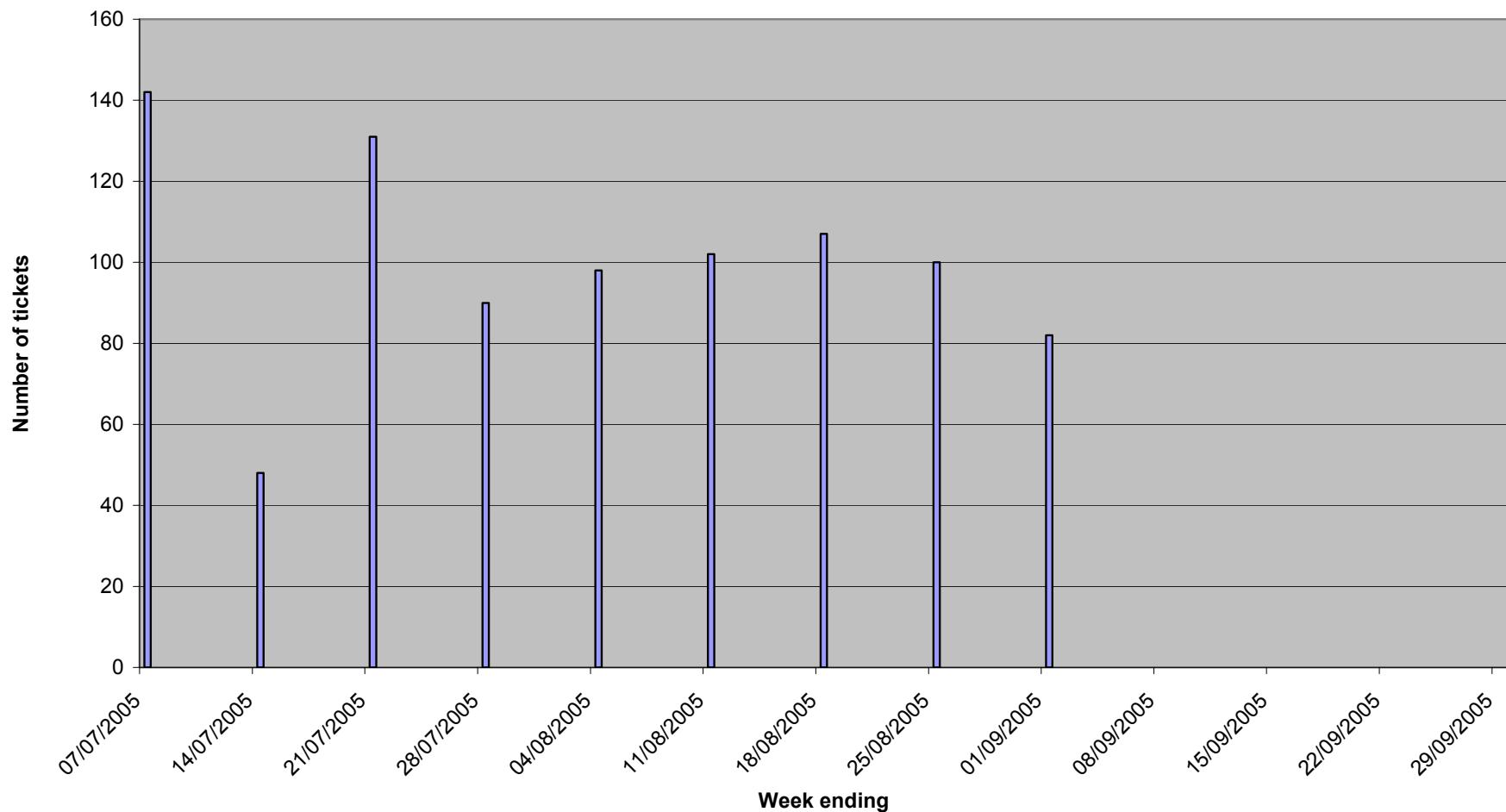


Helpdesk and Troubleshooting: TPM

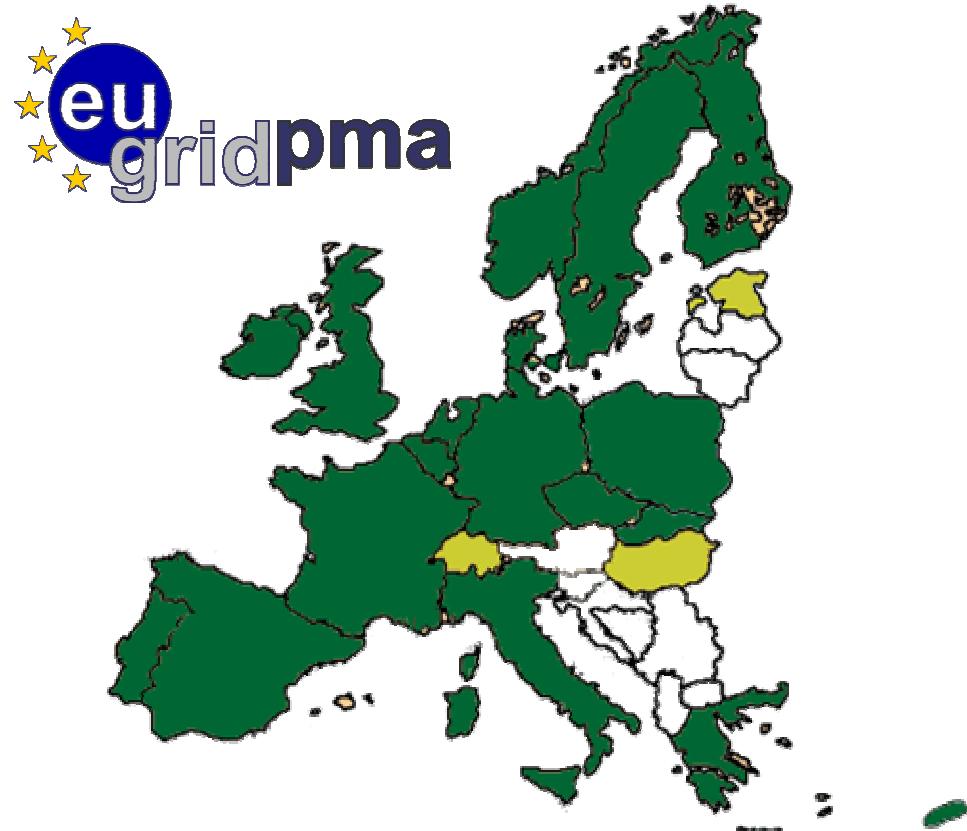


Helpdesk and Troubleshooting: VO



GGUS- Tickets

- **Policy Management Authority:** “Club” of trusted Certification Authority managers www.eugridpma.org

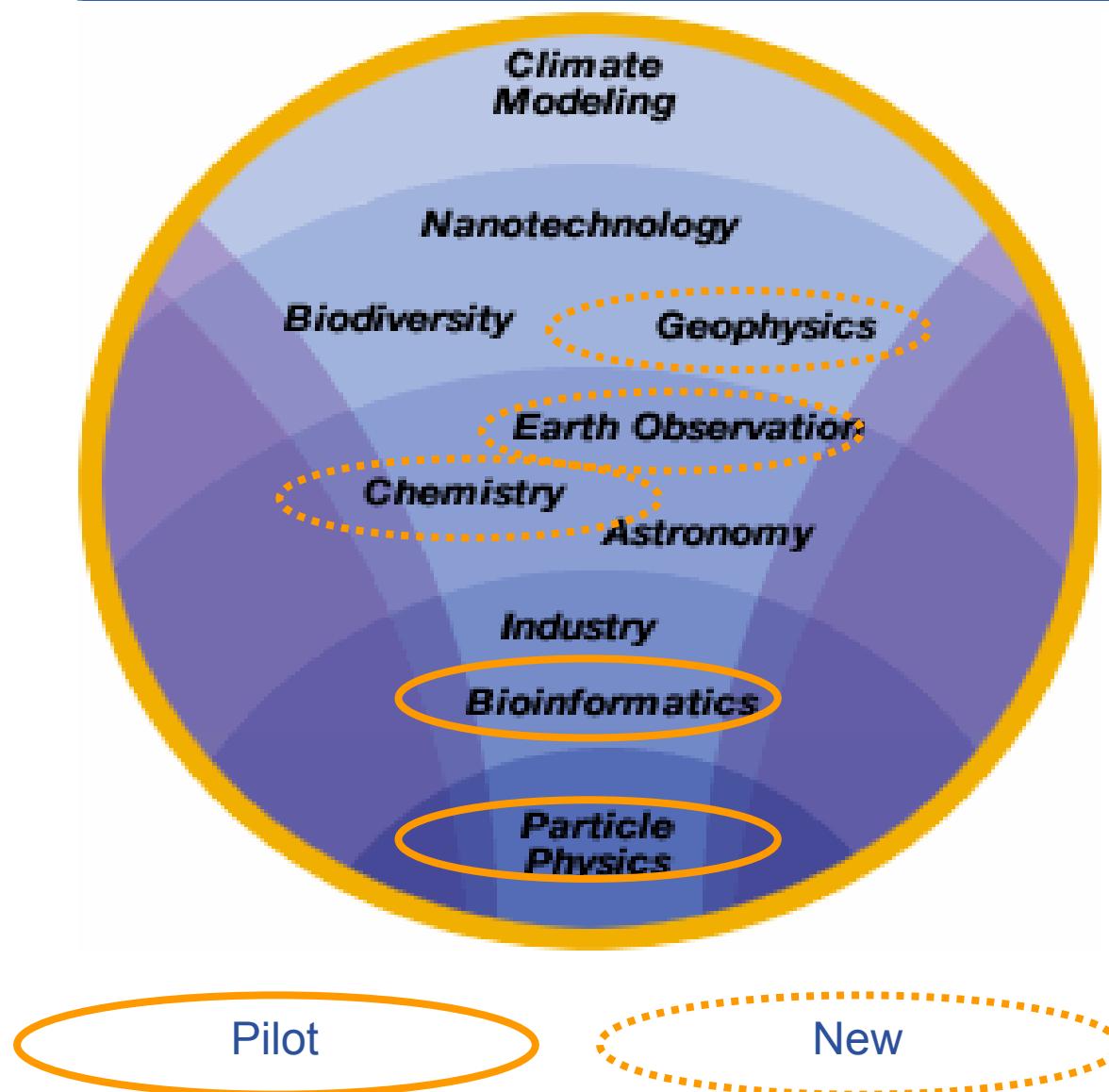


- Green: CA Accredited
- Yellow: being discussed

Other Accredited CAs:

- DoEGrids (US)
- GridCanada
- ASCCG (Taiwan)
- CERN
- Russia (*HEP*)
- FNAL Service CA (US)
- Israel
- Pakistan

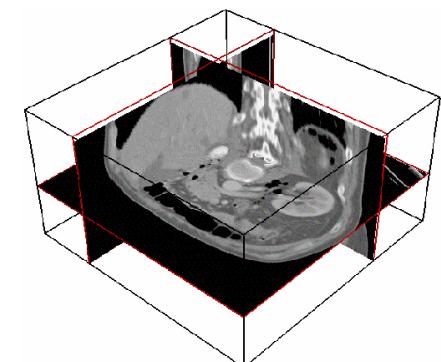
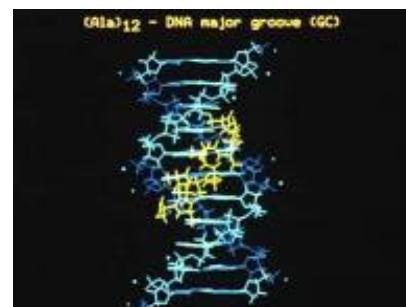
- **Each VO should bring in the resources it is envisaging to use**
- **Each site supports VOs with certain % dictated by its funding sources / NGI**
- **Each site has appel accounting clients reporting usage per VO to the appel central accounting server, over R-GMA**
- **Appel: accounting processor for event logs**



- **High-Energy Physics (HEP)**
 - Provides computing infrastructure (LCG)
 - Challenging:
 - thousands of processors world-wide
 - generating petabytes of data
 - ‘chaotic’ use of grid with individual user analysis (thousands of users interactively operating within experiment VOs)



- **Biomedical Applications**
 - Similar computing and data storage requirements



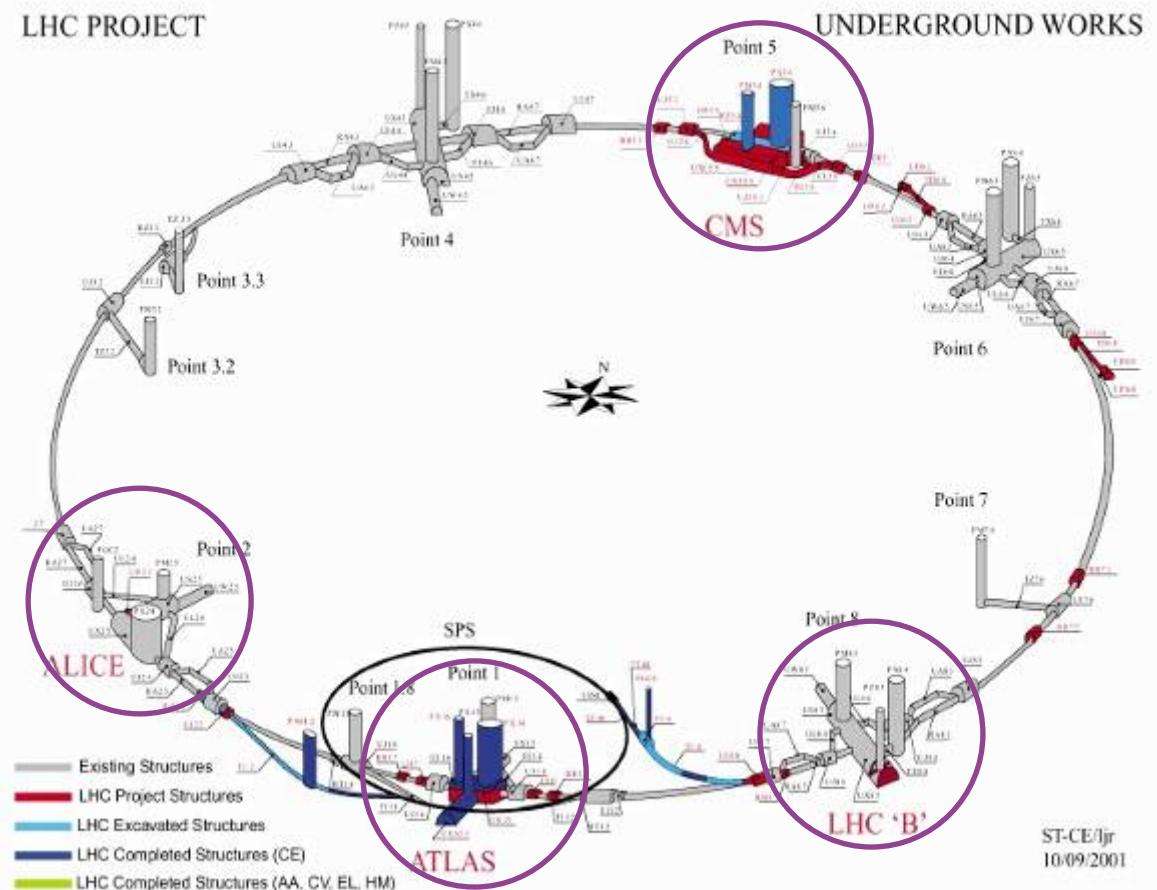
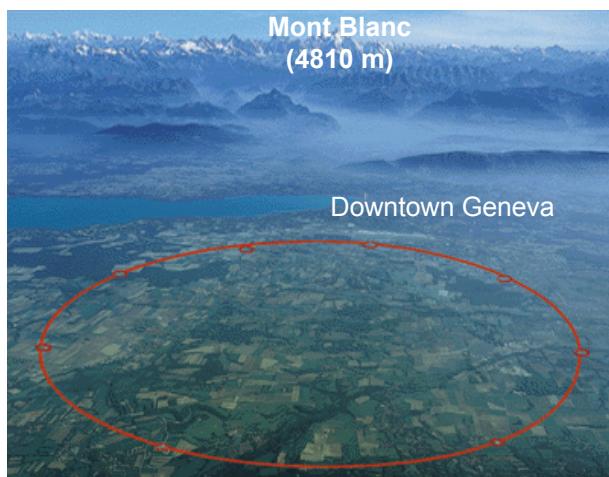
- Large Hadron Collider (LHC):

- four experiments /

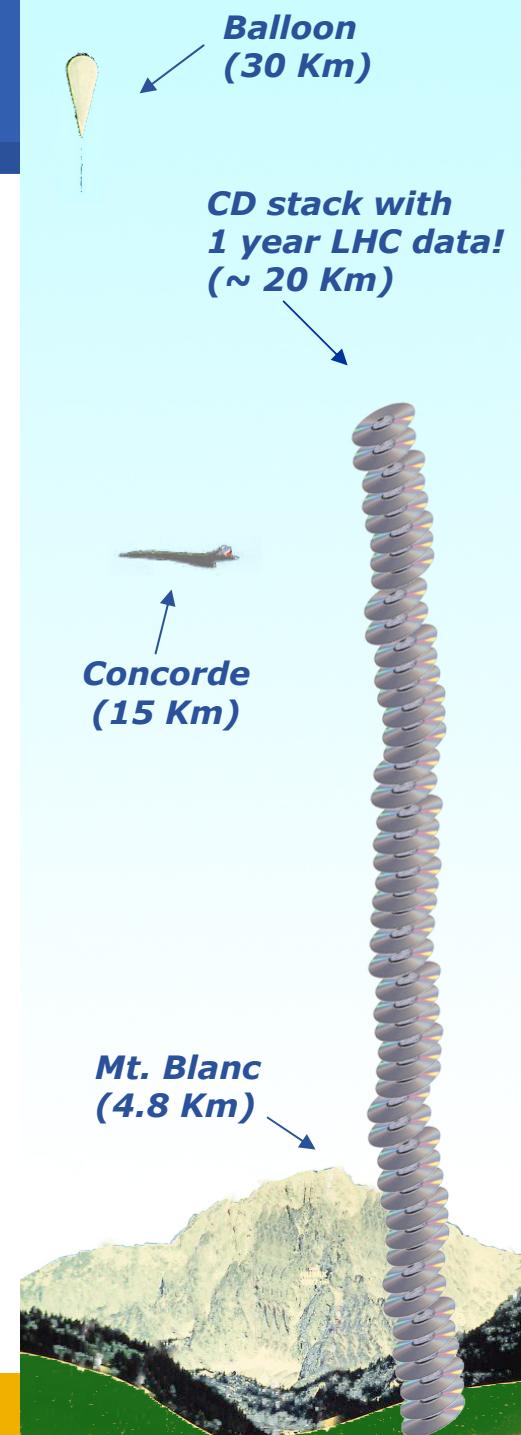
- ALICE
- ATLAS
- CMS
- LHCb

- 27 km tunnel

- Start-up in 2007



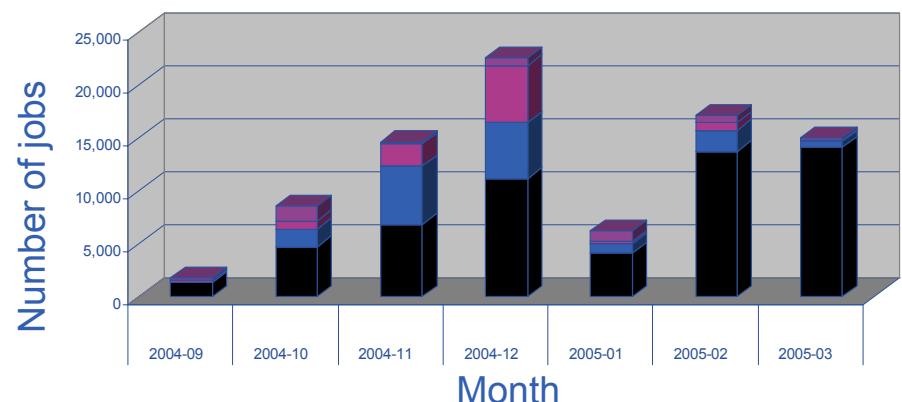
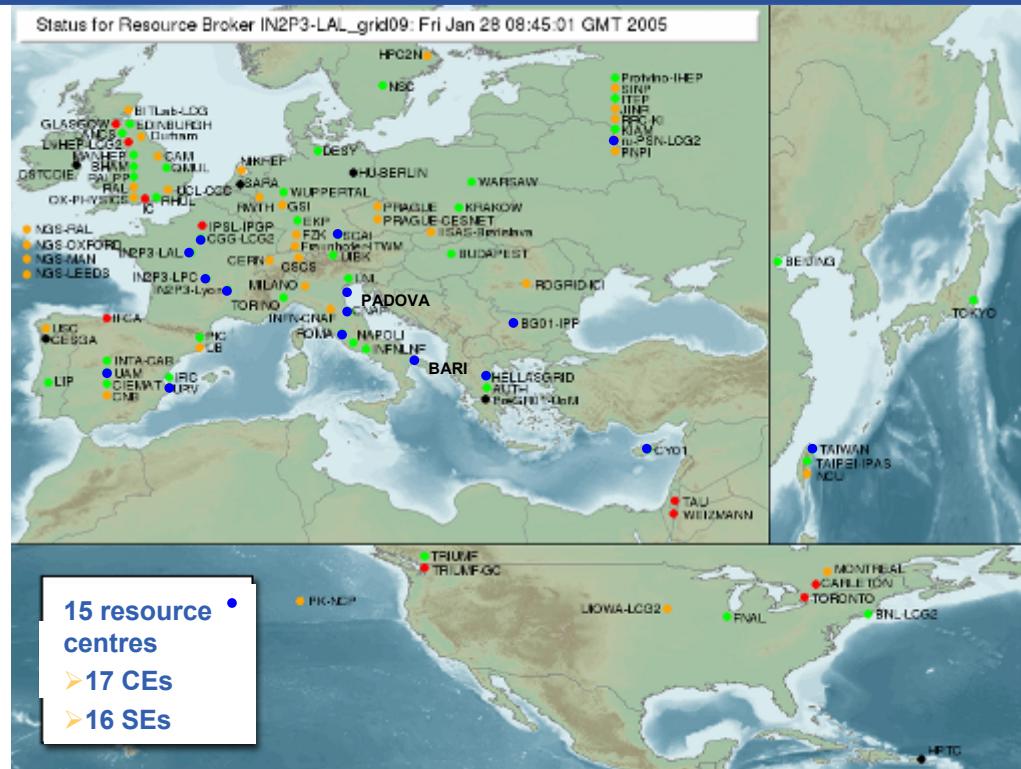
- **40 million collisions per second**
- **After filtering, 100 collisions of interest per second**
- **A Megabyte of data for each collision**
= recording rate of **0.1 Gigabytes/sec**
- **10^{10} collisions recorded each year**
- **~ 10 Petabytes/year of data**
- **LHC data correspond to about 20 million CDs each year!**



- **Infrastructure**
 - ~2.000 CPUs
 - ~21 TB of disk
 - in 12 countries

- **>50 users in 7 countries working with 12 applications**
- **18 research labs**

- **~80.000 jobs launched since 04/2004**
- **~10 CPU years**



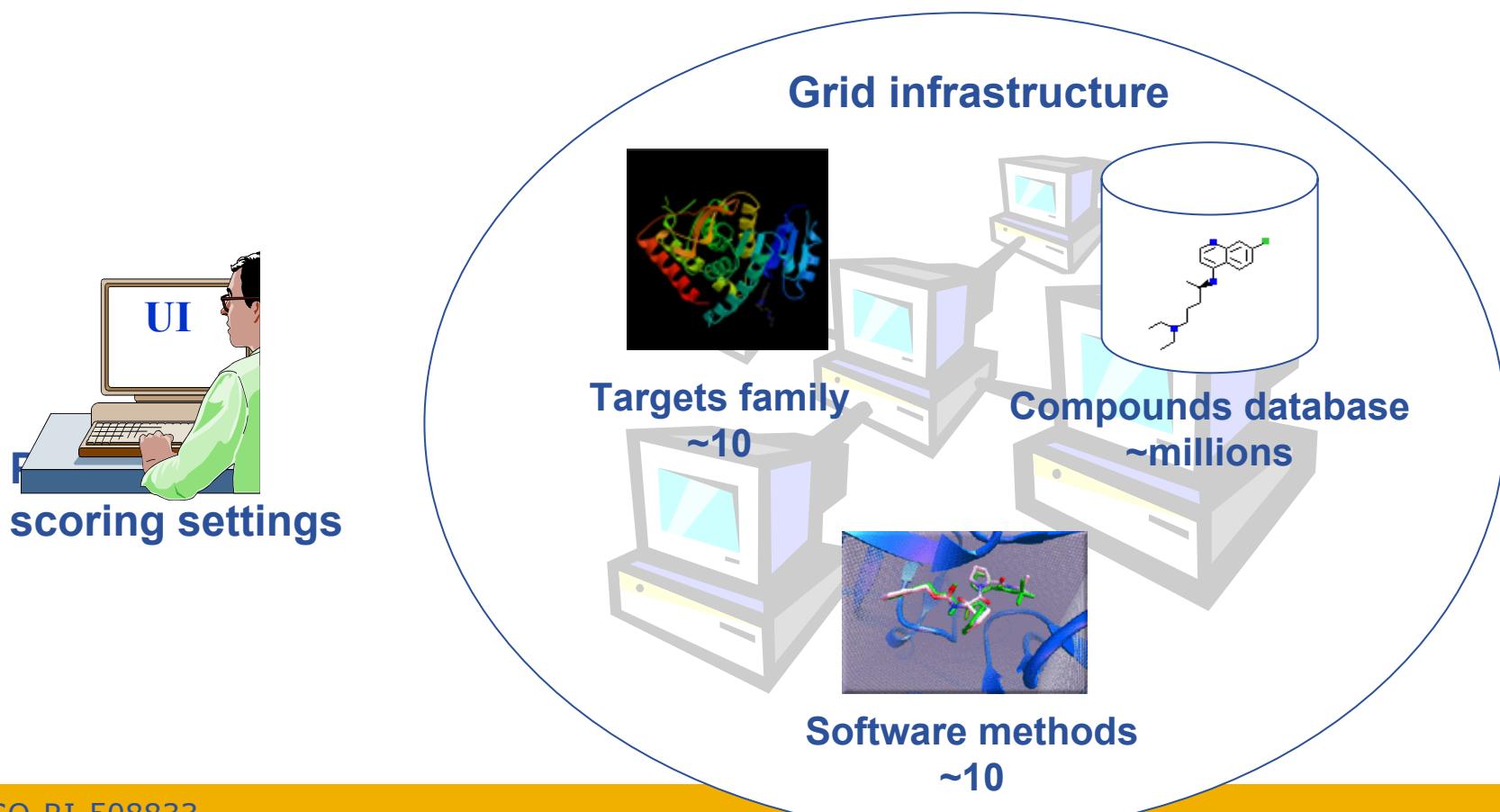


Institut de Biologie et
Chimie des Protéines

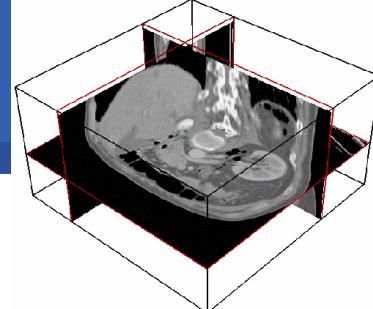


- **GPS@: Grid Protein Sequence Analysis**
 - **Gridified version of NPSA web portal**
 - Offering proteins databases and sequence analysis algorithms to the bioinformaticians (3000 hits per day)
 - Need for large databases and big number of short jobs
 - **Objective:** increased computing power
 - **Status:** 9 bioinformatic softwares gridified
 - **Grid added value:** open to a wider community with larger bioinformatic computations
- **xmipp_MLrefine**
 - **3D structure analysis of macromolecules**
 - From (very noisy) electron microscopy images
 - Maximum likelihood approach to find the optimal model
 - **Objective:** study molecule interaction and chem. properties
 - **Status:** algorithm being optimised and ported to 3D
 - **Grid added value:** parallel computation on different resources of independent jobs

- Demonstrate the relevance and the impact of the grid approach to address Drug Discovery for neglected diseases
- Predict how small molecules, such as substrates or drug candidates, bind to a receptor of known 3D structure



- **4 July – 26 August 2005, incl. testing**
 - A. 2 weeks using commercial docking software
 - B. 3 weeks using free (but slower) docking software
- **Phase A:**
 - 90 packets launched (~ 12900 jobs; 5 to >25 hours each)
 - **~ 20 CPU years** (800 to >1000 CPUs concurrently used)
 - 5800 correct results collected
 - 500 GB of data produced
- **Phase B:**
 - 60 packets launched (~30000 jobs; 10 to >25 hours each)
 - **~ 40 CPU years**
 - 1 TB will be produced
- **Final data production: 1,5 TB**

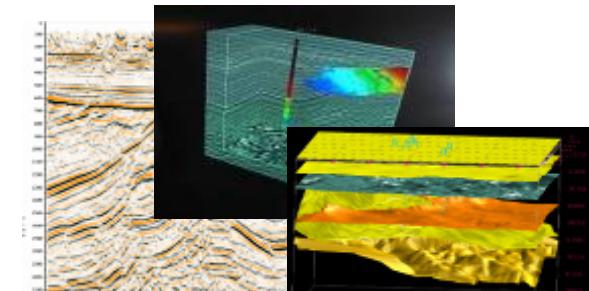
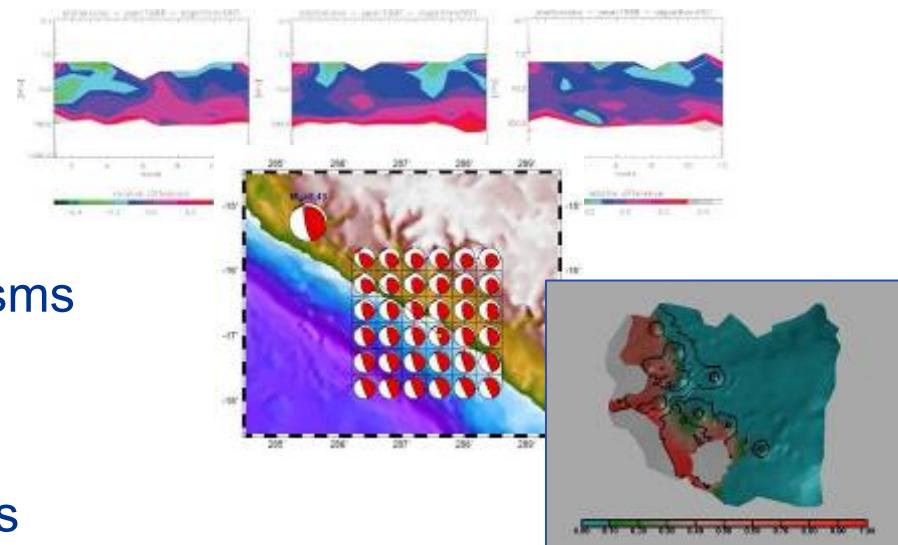


- **GATE**
 - **Radiotherapy planning**
 - **Grid Added Value:** parallelisation reduces computing time
- **CDSS**
 - **Clinical Decision Support System**
 - **Grid Added Value:** ubiquitous, managed access to distributed databases and engines
- **SiMRI3D**
 - **3D Magnetic Resonance Image Simulator**
 - **Grid Added Value:** enables simulation of high-res images
- **gPTM3D**
 - **Interactive tool to segment and analyse medical images**
 - Need for very fast scheduling of interactive tasks
 - **Grid Added Value:** permanent availability of resources

- **EGEE Generic Applications Advisory Panel (EGAAP)**
- **UNIQUE entry point for “external” applications**
- **Reviews proposals and make recommendations to EGEE management**
 - Deals with “scientific” aspects, not with technical details
 - Generic Applications group in charge of introducing selected applications to the EGEE infrastructure
- **6 applications selected so far:**
 - Earth sciences (earth observation, geophysics, hydrology, seismology)
 - MAGIC (astrophysics)
 - Computational Chemistry
 - PLANCK (astrophysics and cosmology)
 - Drug Discovery
 - E-GRID (e-finance and e-business)
 - GRACE (grid search engine, ended Feb 2005)

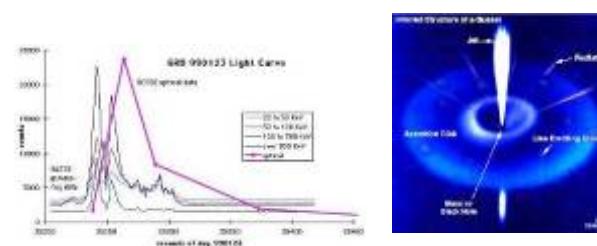
Earth Sciences Applications

- **Earth Observations by Satellite**
 - Ozone profiles
- **Solid Earth Physics**
 - Fast Determination of mechanisms of important earthquakes
- **Hydrology**
 - Management of water resources in Mediterranean area (SWIMED)
- **Geology**
 - Geocluster: R&D initiative of the Compagnie Générale de Géophysique

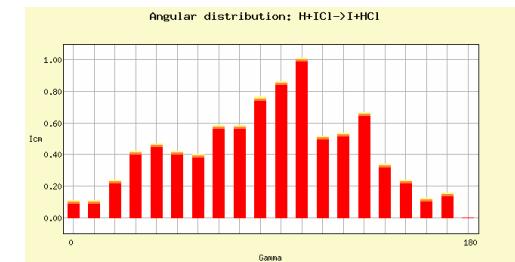
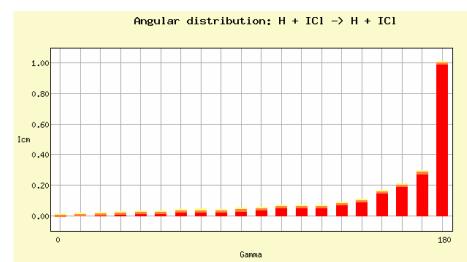
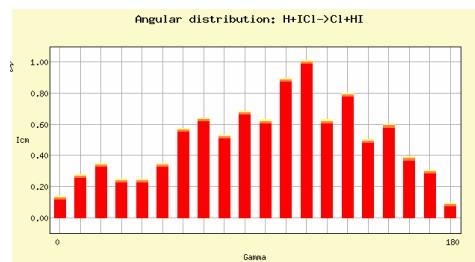
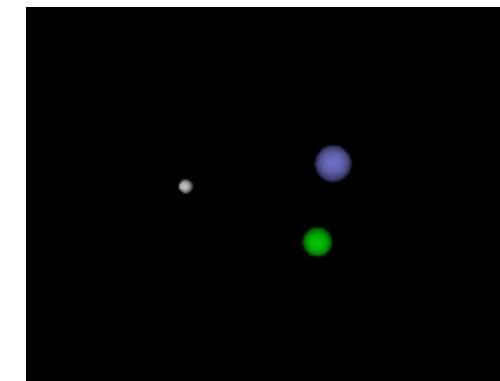


➤ **A large variety of applications ported on EGEE which incites new users**

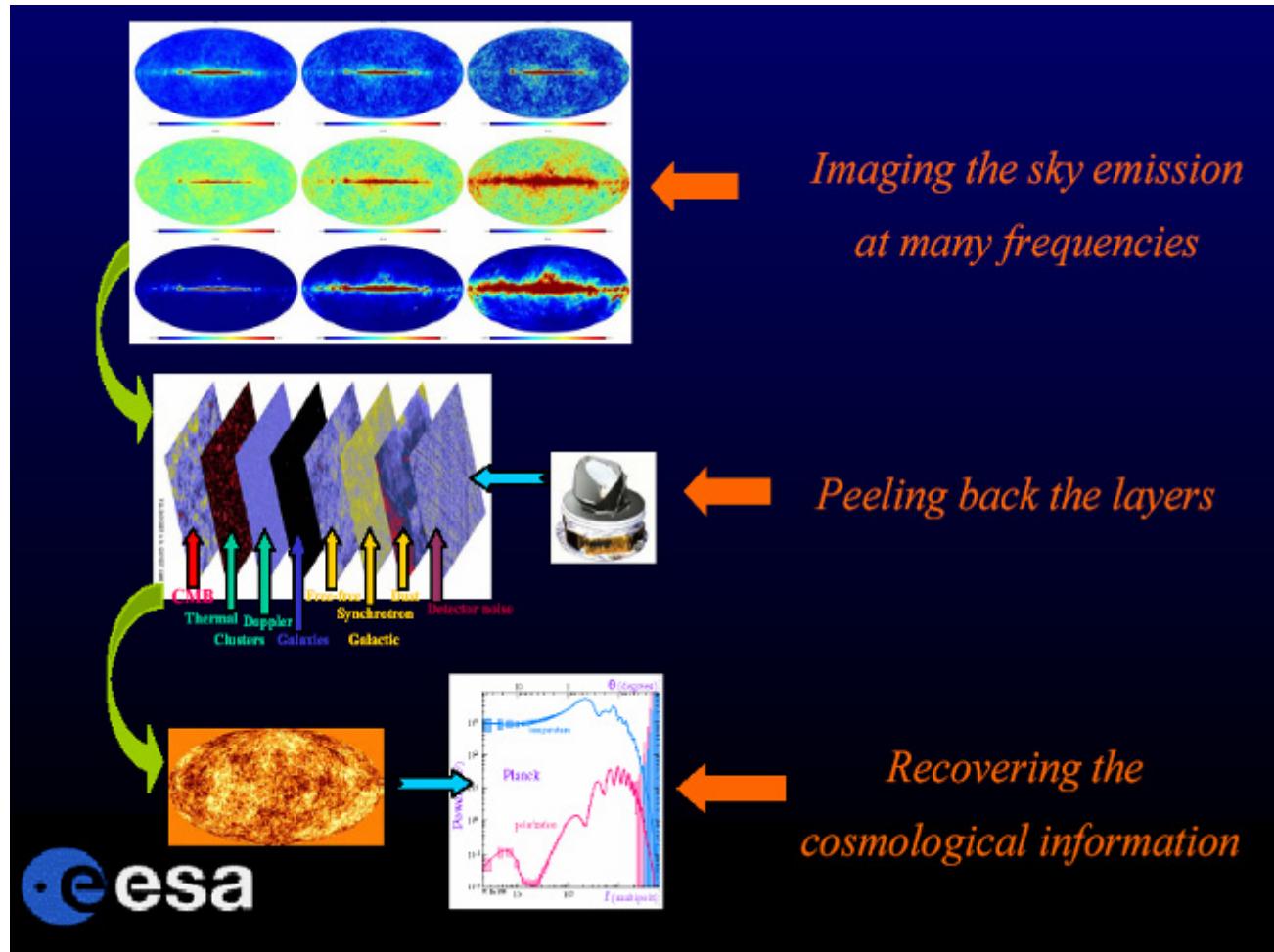
- **Ground based Air Cerenkov Telescope 17 m diameter**
- **Physics Goals:**
 - Origin of VHE Gamma rays
 - Active Galactic Nuclei
 - Supernova Remnants
 - Unidentified EGRET sources
 - Gamma Ray Burst
- **MAGIC II will come 2007**
- **Grid added value**
 - Enable “(e-)scientific” collaboration between partners
 - Enable the cooperation between different experiments
 - Enable the participation on Virtual Observatories



- The Grid Enabled Molecular Simulator (GEMS)
 - Motivation:
 - Modern computer simulations of biomolecular systems produce an abundance of data, which could be reused several times by different researchers.
→ data must be catalogued and searchable
 - GEMS database and toolkit:
 - autonomous storage resources
 - metadata specification
 - automatic storage allocation and replication policies
 - interface for distributed computation

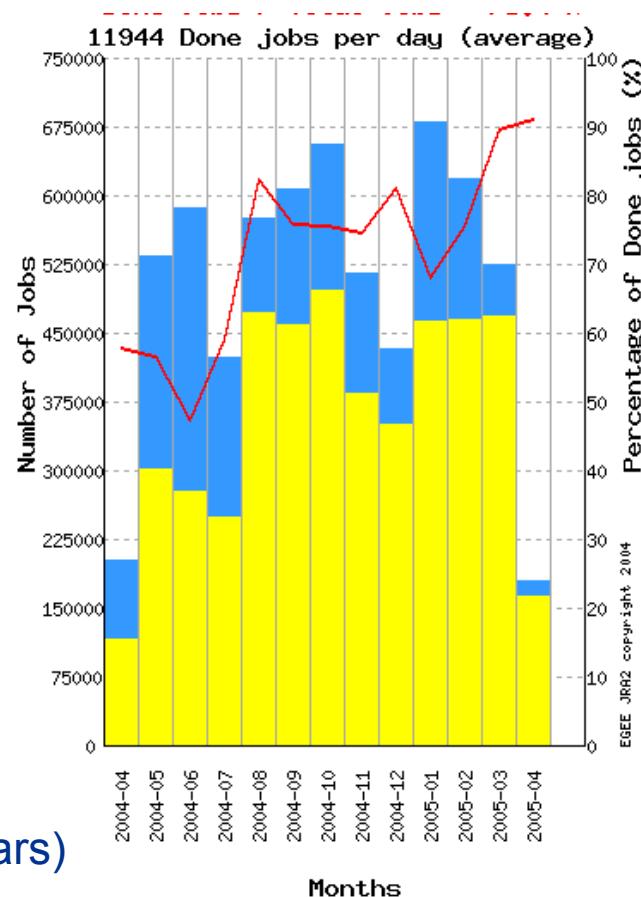


- **On the Grid:**
 - > 12 time faster
(but ~5% failures)
- **Complex data structure**
 - data handling important
- **The Grid as**
 - collaboration tool
 - common user-interface
 - flexible environment
 - new approach to data and S/W sharing



- **VOs and users on the production service**
 - Active VOs:
 - HEP: 4 LHC, D0, CDF, Zeus, Babar
 - Biomed
 - ESR (Earth Sciences)
 - Computational chemistry
 - Magic (Astronomy)
 - EGEODE (Geo-Physics)
 - Registered users in these VO: 1000
 - + Many local VOs, supported by their ROCs

- **Scale of work performed:**
 - LHC Data challenges 2004:
 - >1 M SI2K years of CPU time (~1000 CPU years)
 - 400 TB of data generated, moved and stored
 - 1 VO achieved ~4000 simultaneous jobs (~4 times CERN grid capacity)

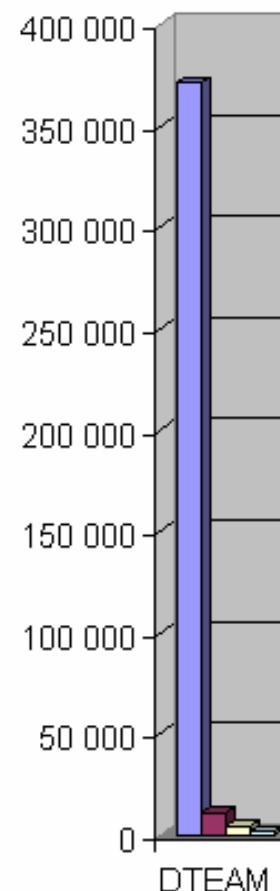
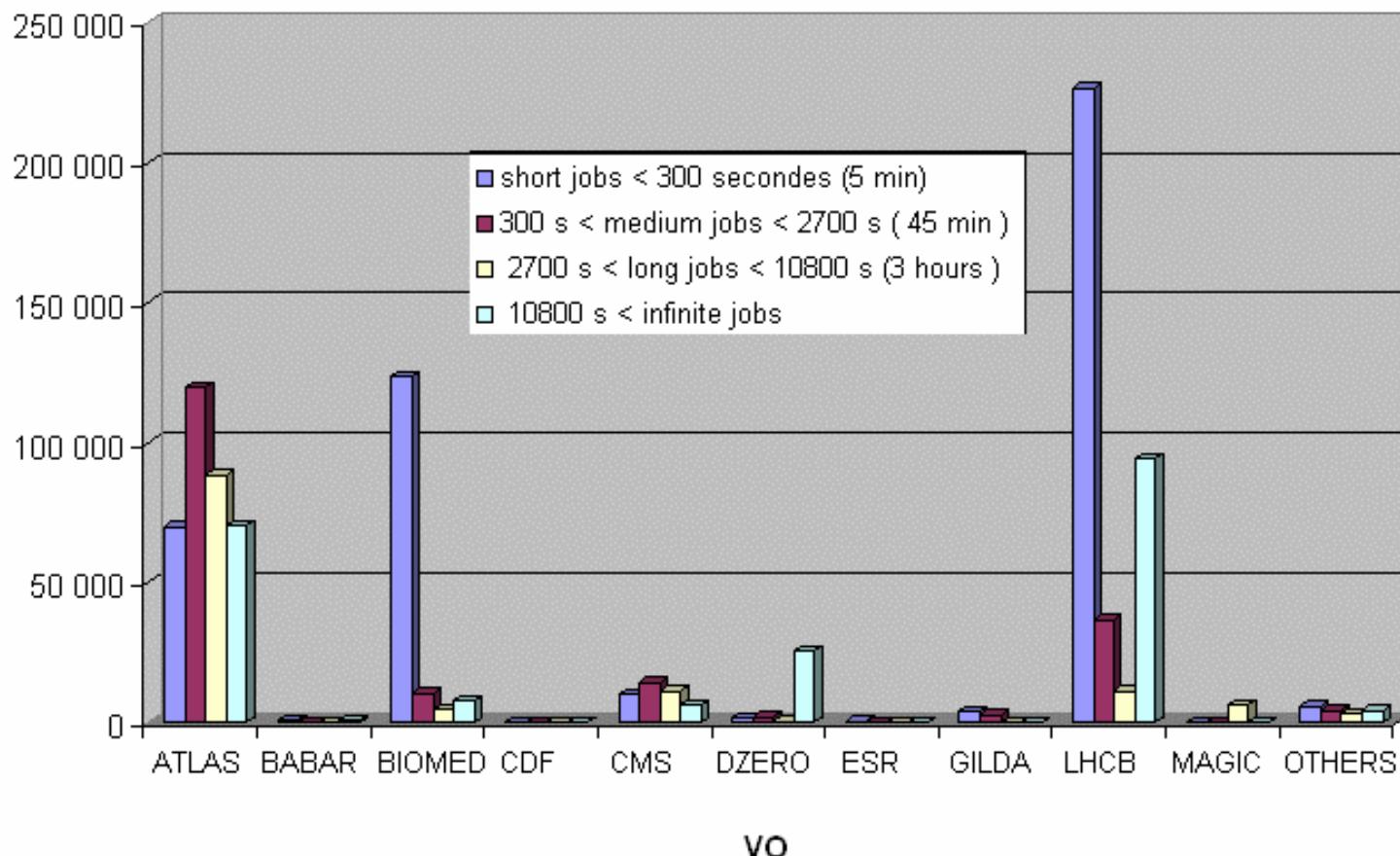


Number of jobs processed per month (April 2004-April 2005)

Name	Discipline	Users
Atlas	Physics	400
Alice	Physics	50
LHCb	Physics	58
CMS	Physics	350
ESR	Earth Sciences	33
Biomed	Biomed	67
Comp Chem	Chemistry	5
Magic	Astronomy	10
dteam	Infrastructure testing	424
EGEODE	Geo-Physics	3
Planck	Satellites	0
	Total	1400

- Average job duration January 2005 – June 2005 for the main VOs

Number of jobs



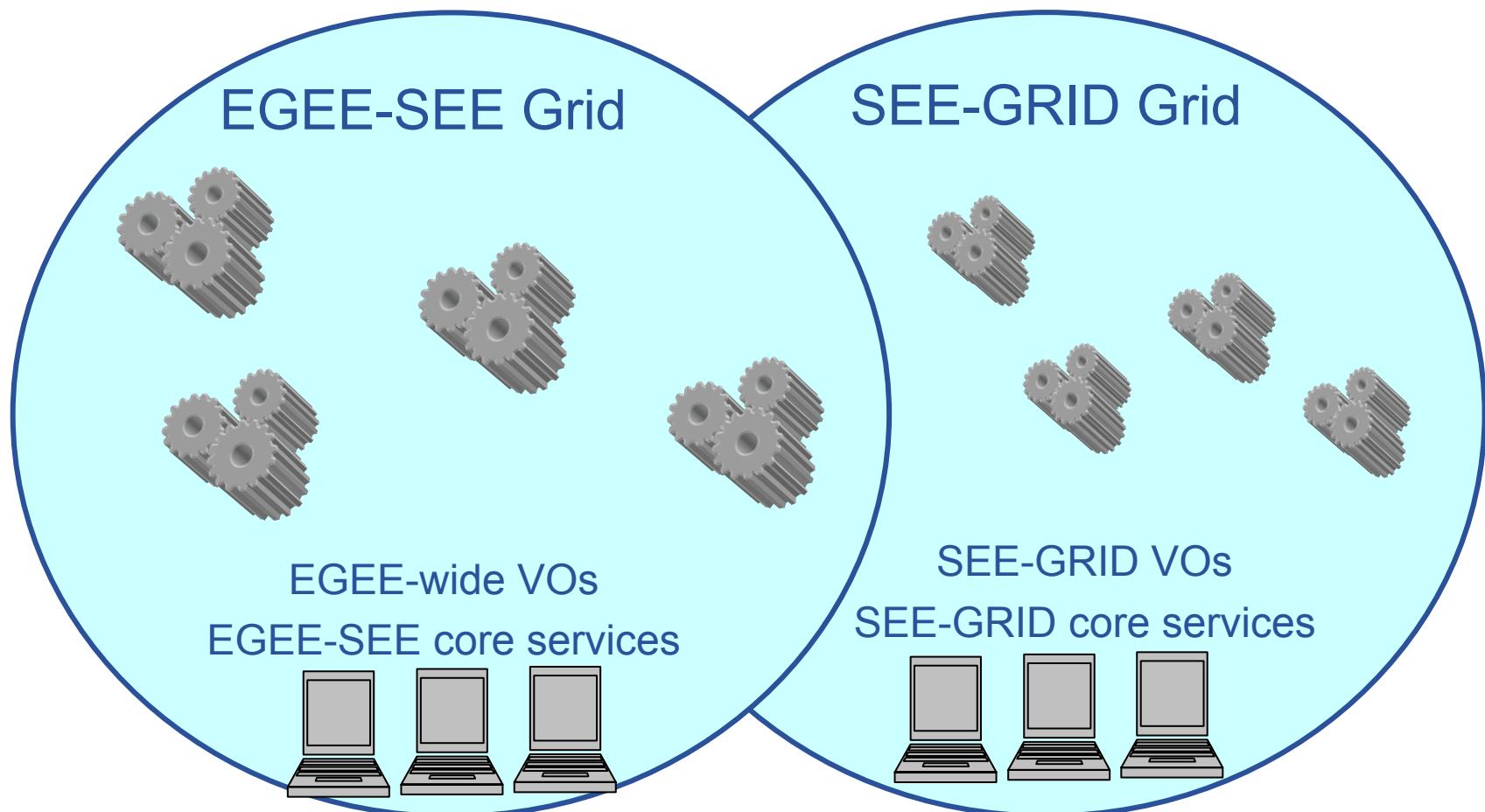
- More than 140 training events across many countries
 - >2000 people trained
induction; application developer; advanced; retreats
 - Material archive online with >200 presentations
- Public and technical websites constantly evolving to expand information available and keep it up to date
- 3 conferences organized
 - ~ 300 @ Cork
 - ~ 400 @ Den Haag
 - ~ 450 @ Athens
- Pisa: 4th project conference 24-28 October '05



- A number of **regional infrastructure support projects**
- **SEE-GRID** the flagship regional project, stimulating **regional NGI establishment** and bring the region up to speed with **GRID** developments
- “**Start with a clean sheet**” approach was important to objectively assess the approach to moving into production



- Strategy: as sites mature → EGEE production, adopt operational procedures



- **Collaboration across national and international programmes is very important:**
 - Grids are above all about collaboration at a large scale
 - Science is international and therefore requires an international computing infrastructure
- **EGEE I and II are always open to further collaboration**

- **EGEE Website**
<http://www.eu-egee.org>
- **How to join**
<http://public.eu-egee.org/join/>