CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

CC-IN2P3

Operating a Global Grid

Lessons learnt from EGEE/LCG

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- Global grid operations issues
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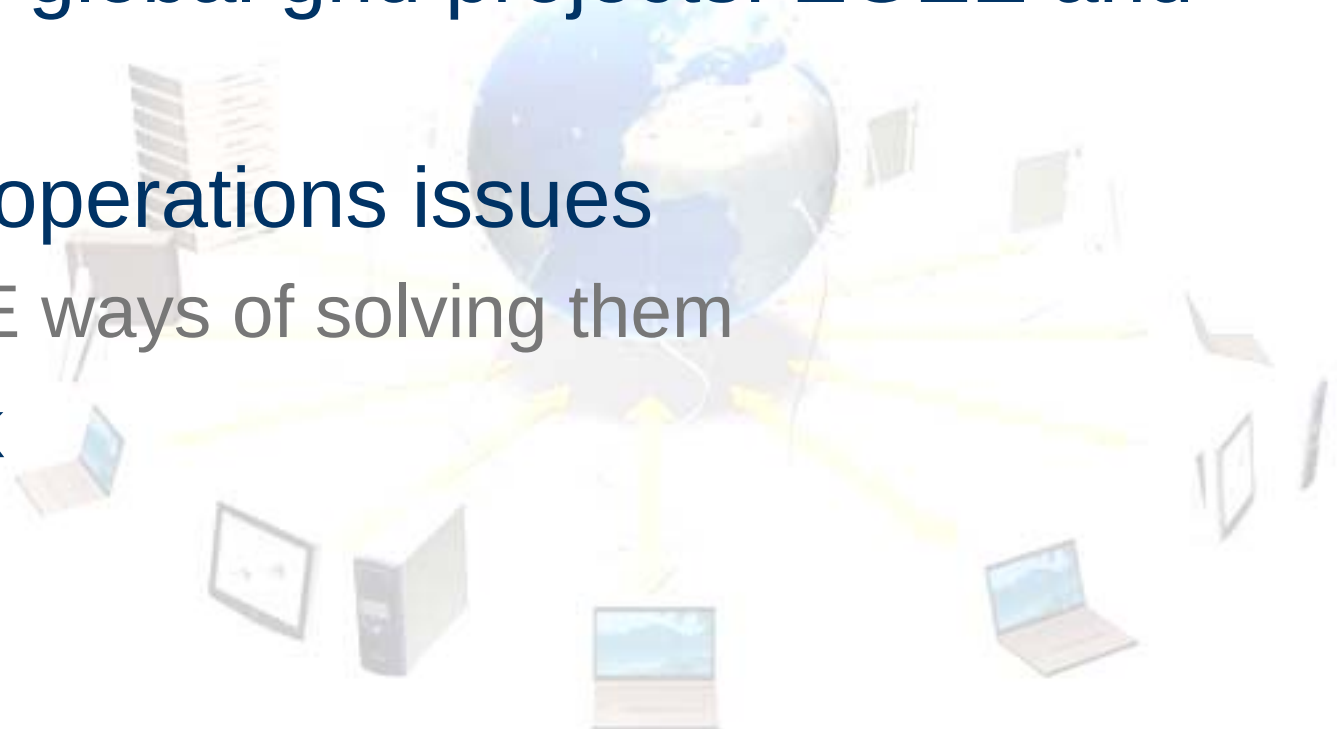
- Questions



IN2P3

- IN2P3: National Institute of Nuclear Physics and Particle Physics
  - An institute of the National Centre for Scientific Research (CNRS)
- Mission: promote and federate research in physics
  - goal: identify elementary constituents of matter, their interactions and their behavior
- 3300+ people of whom 1700+ permanent scientists
- 18 laboratories
- 1 computing centre in Lyon

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IN2P3 Computing Centre

- Data processing facility, not located in an experimental site
- Mission
  - mass storage repository
  - high-throughput computing facilities
  - network services for the whole institute
  - consulting and training services for laboratories
  - web hosting, video-conferencing, e-mail infrastructure, news, …
  - 24x7 service
- Users
  - 1800+ users from IN2P3 and DSM-CEA (Atomic Energy Commission)
  - 35+ international collaborations in nuclear physics, particle physics and astrophysics
  - since 2002 serving also bio-medical applications
- Human resources
  - 60 people

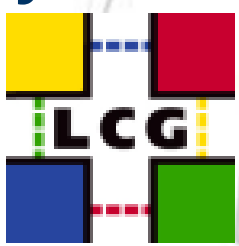
IN2P3 Computing Centre (cont.)

IN2P3 Computing Centre (cont.)

- Compute services
  - 1.3M SpecInt2000 (~1200 CPUs)
  - Linux (most), AIX, SunOS
  - 1800+ simultaneous jobs
  - 15.000+ jobs in queue
- Data storage: disk
  - ~250 TB
  - Not including local disk of compute nodes
- Data storage: tape
  - Main scientific data storage medium
  - 36.000 cartridges on-line (6 silos StorageTek automated tape library)
  - mixture of 20GB and 200 GB cartridges
    - 1000+ TB
  - 150.000 cartridges in the vault

IN2P3 Computing Centre (cont.)

- Involved in grid projects since 2000
  - Regional, national and international level
  - Applications in physics and bio-medical
- Gained great experience with EU DataGRID
- Now actively contributing to LCG and EGEE



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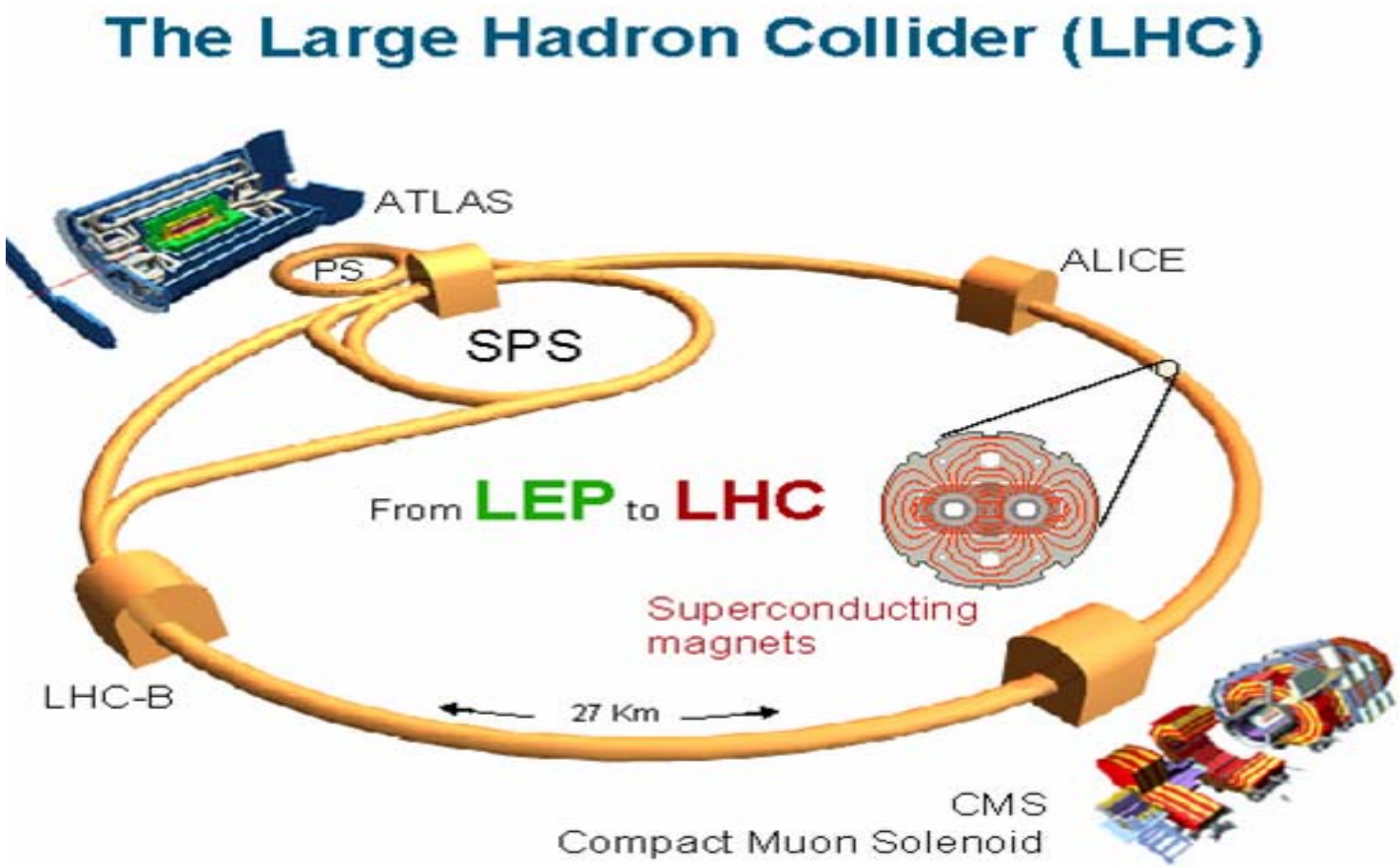
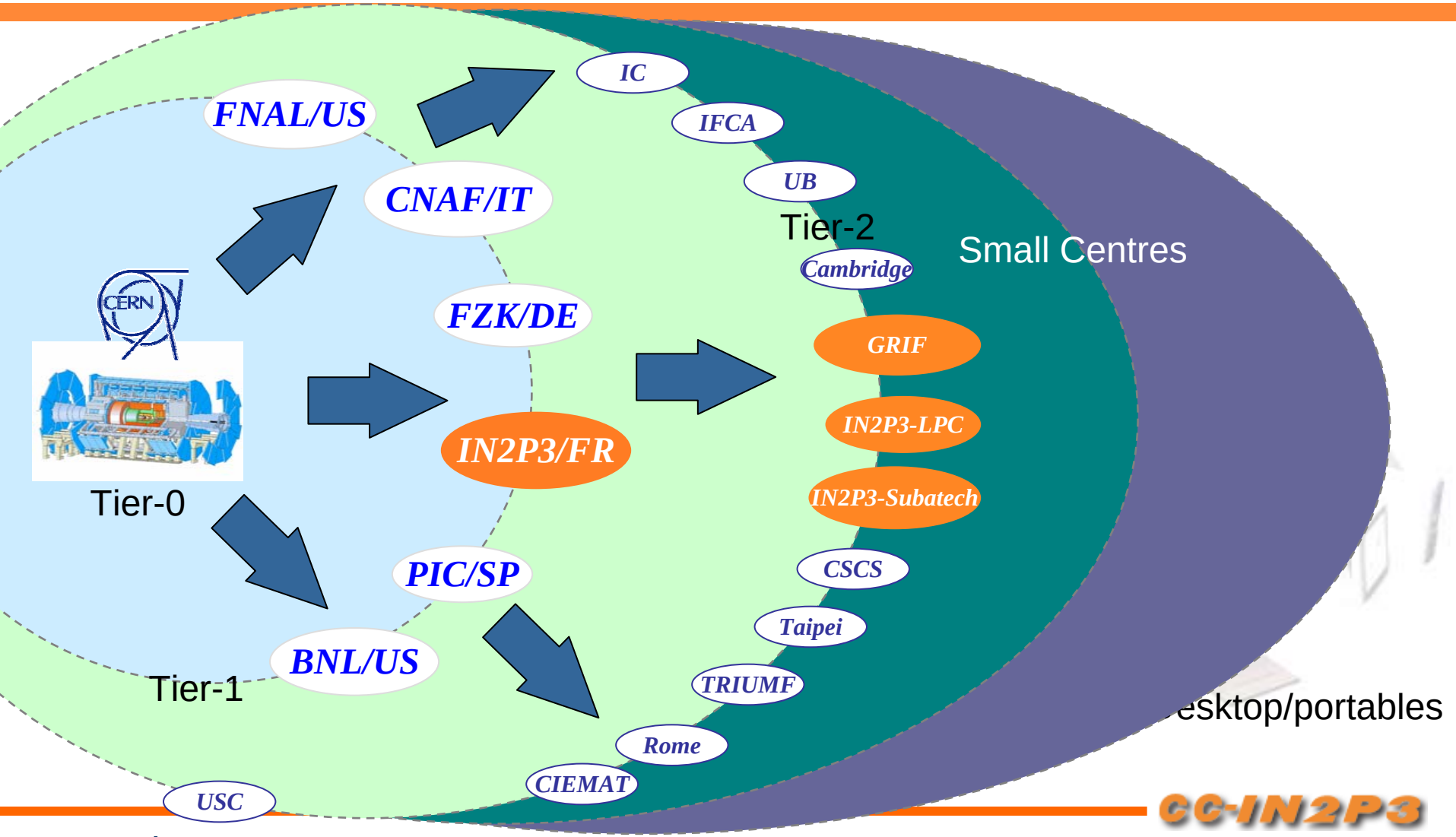
LCG: LHC Computing Grid

- LHC Computing Grid Goal: to setup the global infrastructure for simulation and processing of data for the LHC (Large Hadron Collider) experiments
  - Prepare, deploy and operate the computing environment for experiments to analyze the data from the LHC detectors
  - Data acquisition starts on 2007
- Strategy
  - Integrate thousands of computers at dozens of participating institutes worldwide into a global computing resource
  - Rely on software being developed in advanced grid technology projects, both in Europe and in the USA
- Global needs
  - 37 PB/year (disk)
  - 43 PB/year (mass storage)
  - 105 M SpecInt2000
    - ~70.000 today's fastest CPUs
- LCG : A data handling problem
  - 40 millions collisions per second
  - After filtering ~100 collisions per second
  - 1 to 10 MB of digitised data per collision
    - Data rate: 0.1 to 1 GB/sec
  - 10^{10} recorded collisions per year

LCG (cont.)


The Large Hadron Collider (LHC)
ATLAS
PS
SPS
ALICE
From LEP to LHC
Superconducting magnets
LHC-B
27 Km
CMS
Compact Muon Solenoid
© CERN

LCG: data distribution model



- *Enabling Grids for E-science*
- Goal
  - create a wide European Grid production quality infrastructure on top of present and future EU regional networks infrastructure
  - Provide services on top of this infrastructure 24x7
- Funded by EU (FP6)
  - 30 M€
  - 2 years from April 2004 (4 years program)
  - 70 leading institutions in 27 countries, federated in regional grids
- EGEE-II submitted to European Commission
  - 2006-2008

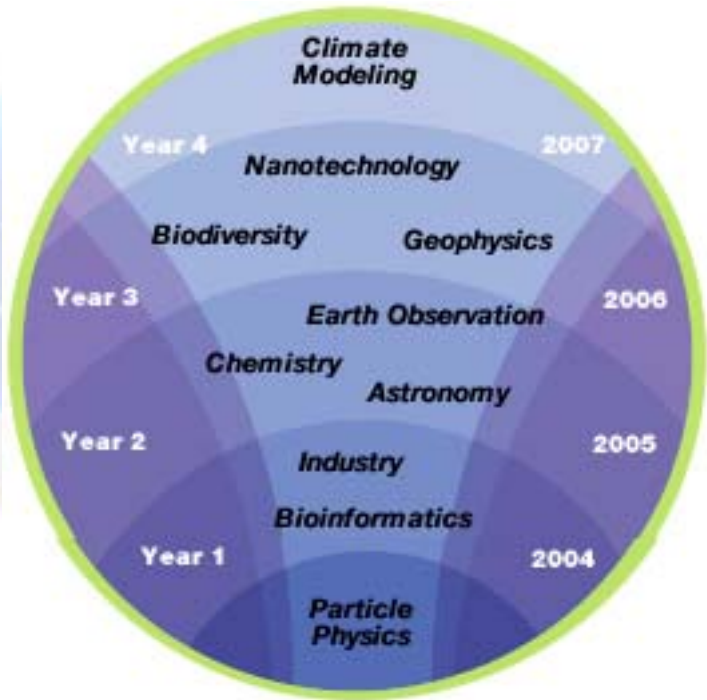
EGEE (cont.)

- Partners organized in federations

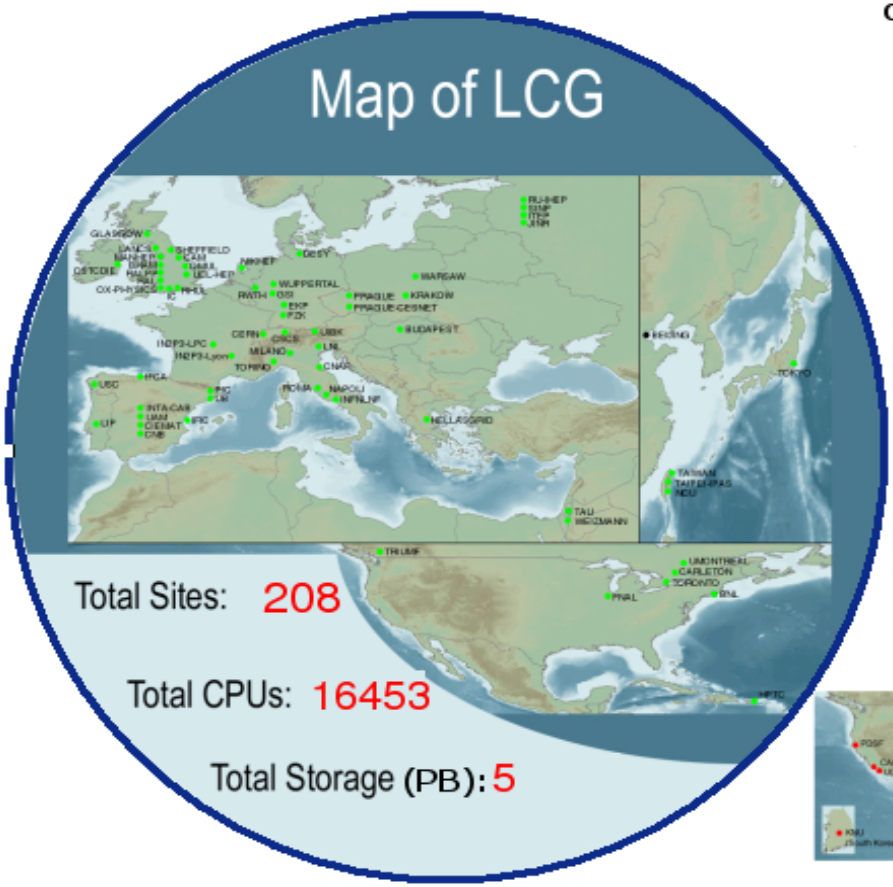
- CERN
- Central Europe (Austria, Czech Republic, Hungary, Poland, Slovakia, Slovenia)
- France
- Germany and Switzerland
- Ireland and UK
- Italy
- Northern Europe (Belgium, Denmark, Estonia, Finland, The Netherlands, Norway, Sweden)
- Russia
- South-East Europe (Bulgaria, Cyprus, Greece, Israel, Romania)
- South-West Europe (Portugal, Spain)

EGEE (cont.)

- Target applications
  - both academic (mainly) and industrial
- Pilot applications
  - Physics and biomedical
  - Selected to guide the implementation and certify the performance and functionality of the evolving infrastructure
- Users
  - 5000 users (3000 at the end of year 2) from at least 5 disciplines



LCG/EGEE status



Collaborating with LCG

NorduGrid

Grid3

Grid Operations

- Characteristics of EGEE/LCG impacting operations
  - Support of many applications of several scientific domains
  - 70+ institutions
    - 200+ **autonomous** sites
    - Not dedicated to EGEE/LCG (also providing services to local users)
  - Highly distributed
    - Federations of sites, sometimes across several countries
    - Language and local time issues
  - EGEE users will also use other grids (like OSG in the USA)
    - Interoperability issues

Grid Operations Issues

- Middleware deployment
- Obtaining information on the resources, sites, services
- Monitoring grid services
- Accounting for resource utilization
- Sharing operation responsibility
- Supporting end-users and site operators
- Putting all together

Middleware deployment

- Testing and certifying grid middleware for a highly heterogeneous grid is a difficult task
  - Heterogeneity in hardware, operating system, installation tools at the site-level, resource management systems, etc.
  - A lot of human resources and hardware is required
- Goal
  - Maintain backward compatibility between releases
  - Gently introduce new functionalities/services
    - provide the means for users to benefit of them
- Balance between the number of releases per year and the time needed to deploy a given release on all sites
  - Several weeks (~8) in the case of LCG
- Well designed information system is fundamental for enabling a grid running several releases of the middleware
- LCG/EGEE: middleware release management and certification is performed at CERN
  - In close cooperation with 3 sites

Obtaining site information

- Keep a central repository of information on the components of the grid
  - Site registry (name, location, contact information, administrator contact, security contact, …)
  - Site status (candidate, uncertified, production, suspended, …)
  - History of scheduled unavailability of the site
  - Grid services operated by the site: computing elements, storage elements, file catalogue services, virtual organization management services, resource brokers, etc.
  - Services that sites want to be monitored by the grid operators
- Keeping this information up to date is a shared responsibility between the site operator and the regional operator manager
- LCG/EGEE
  - central repository of site information (a.k.a. Grid Operations Centre) developed and operated by Rutherford Appleton Laboratory (RAL) in the UK
  - http://goc.grid-support.ac.uk/gridsite/gocdb
- This repository is used by the grid monitoring services (more on this later)

Monitoring services

- Grid operators need to have a global view of the status of the infrastructure
  - Grid information is highly dynamic
- Tools required to collect information on the grid component state
  - Availability of resources and services, based on the static information stored in the central site repository
  - Collection of metrics on availability of resources and services
    - e.g. % of downtime, metrics for capacity planning, number of sites in operation, jnumber of jobs submitted/completed/failed, job efficiency per VO/site, etc.
    - Ways to measure the quality of the service as a whole and of individual services
- LCG/EGEE
  - Service of probes sent to every site to check it on a regular basis
  - Service for regularly testing the consistency of the dynamic information published by the site in the grid information system
  - Information on the result of those tests is available to grid operators, site managers and end-users
  - Virtual Organization managers can use this information to select a set of sites they intend to use
    - VO-specific site/service certification, based on the information provided by the grid operators
  - Monitoring services developed and operated by CERN, Academia Sinica (Taiwan) and GridPP (UK)

Issues: Monitoring Services (cont.)

GStat: 21:20:05 10/19/05 GMT

home alert table service regional service metrics links prod test seegrid

AsiaPacific	BNL	CERN	Canada	CentralEurope	China	FNAL	France	GermanySwitzerland	HP
Italy	NorthernEurope	OSG	Pakistan	Russia	SouthEasternEurope	SouthWesternEurope	UKI		

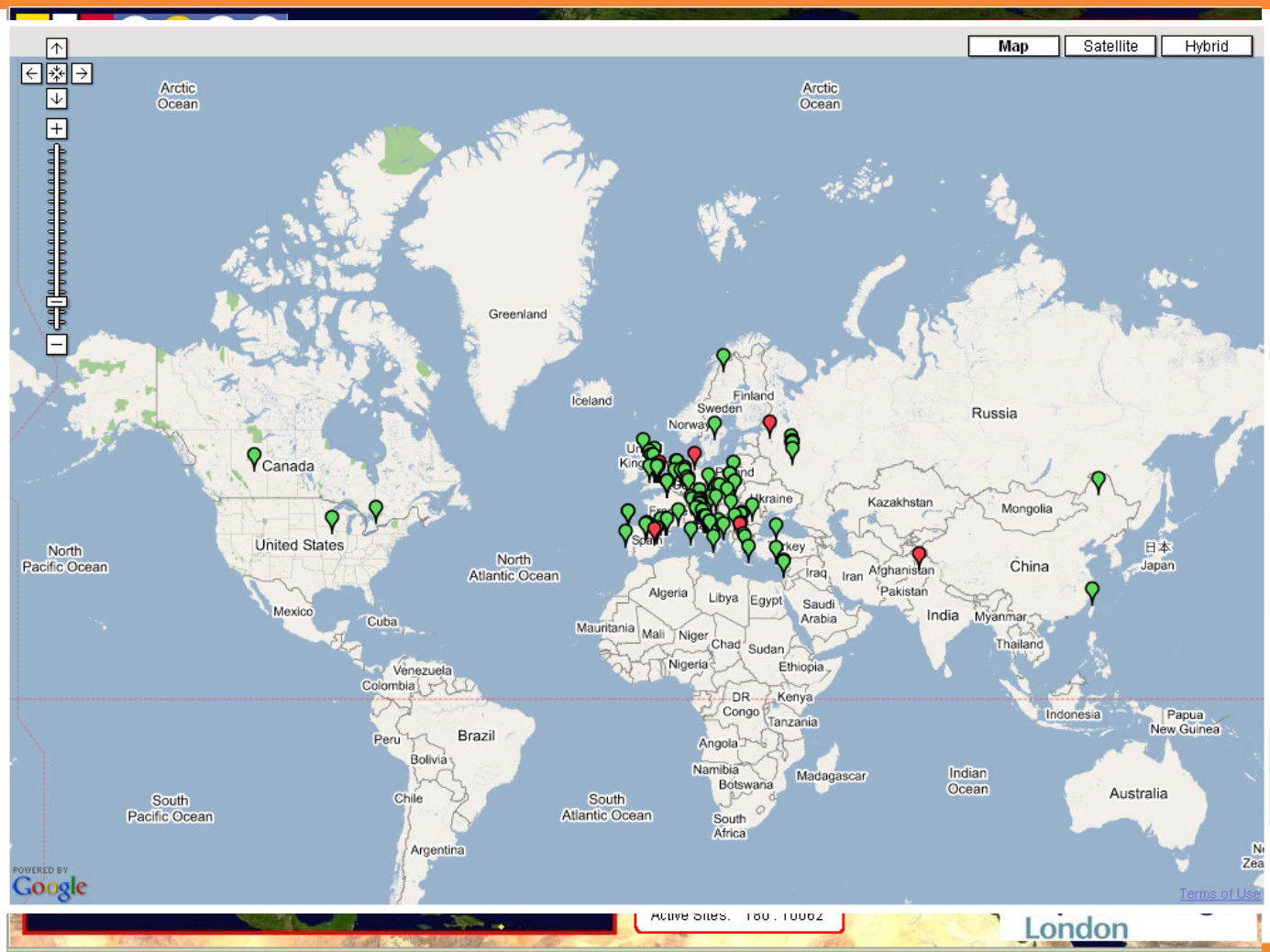
IN2P3-CC	OK	IN2P3-LAPP		IN2P3-LPC	OK	OK	CEA-DAPNIA-SACLAY	CT	CGG-LCG2	OK	GRIF	OK	OK
IN2P3-CPPM	OK	IPSL-IPGP-LCG2	OK										

Color Legend									
GSTAT		OK	INFO	NOTE	WARN	ERROR	CRIT	MAINT	OFF
SFT	OK	NonCrit	Crit	JobSub	JobListMatch	SchedDown			

No	Site Reports	GIIS Host	bnode	cernse	gperf	sanity	serv	version	totalCPU	freeCPU	runJob	waitJob	seAvail TB	seUsed TB	maxCPU	avgCPU	DI	gic
1	CGG-LCG2	ce1.egee.fr.cgg.com	ok	ok	ok	ok	ok	LCG-2_6_0	56	4	52	15	0.03	0.01	56	49	OK	ok
2	CEA-DAPNIA-SACLAY	node03.datagrid.cea.fr	.	.	ok	ok	ok	LCG-2_6_0	3	1	2	1	0.01	0.00	3	2	CT	ok
3	GRIF	bdii.grif.fr	ok	ok	ok	ok	ok	LCG-2_6_0	28	16	12	1	0.94	0.15	28	21	OK	OK
4	IN2P3-CC	cclcgip01.in2p3.fr	.	.	ok	warn	ok	LCG-2_6_0	1927	1867	60	254	10.66	0.00	1933	1373	OK	info
5	IN2P3-CPPM	marseillece01.mrs.grid.cnrs.fr	.	.	ok	ok	ok	LCG-2_6_0	28	3	25	0	0.41	0.92	28	27	OK	ok
6	IN2P3-LAPP	lappgrid05.in2p3.fr	ok	ok	ok	ok	ok								0	0	info	
7	IN2P3-LPC	clrlcgce02.in2p3.fr	.	.	ok	ok	ok	LCG-2_6_0	170	136	35	4	2.21	0.36	192	170	OK	OK
8	IPSL-IPGP-LCG2	hudson.datagrid.jussieu.fr	.	.	ok	ok	ok	LCG-2_6_0	4	2	2	0	0.34	0.11	4	3	OK	ok

	sites	countries	totalCPU	freeCPU	runJob	waitJob	seAvail TB	seUsed TB	maxCPU	avgC
Total	8	2	2216	2029	188	275	14.63	1.58	2244	164

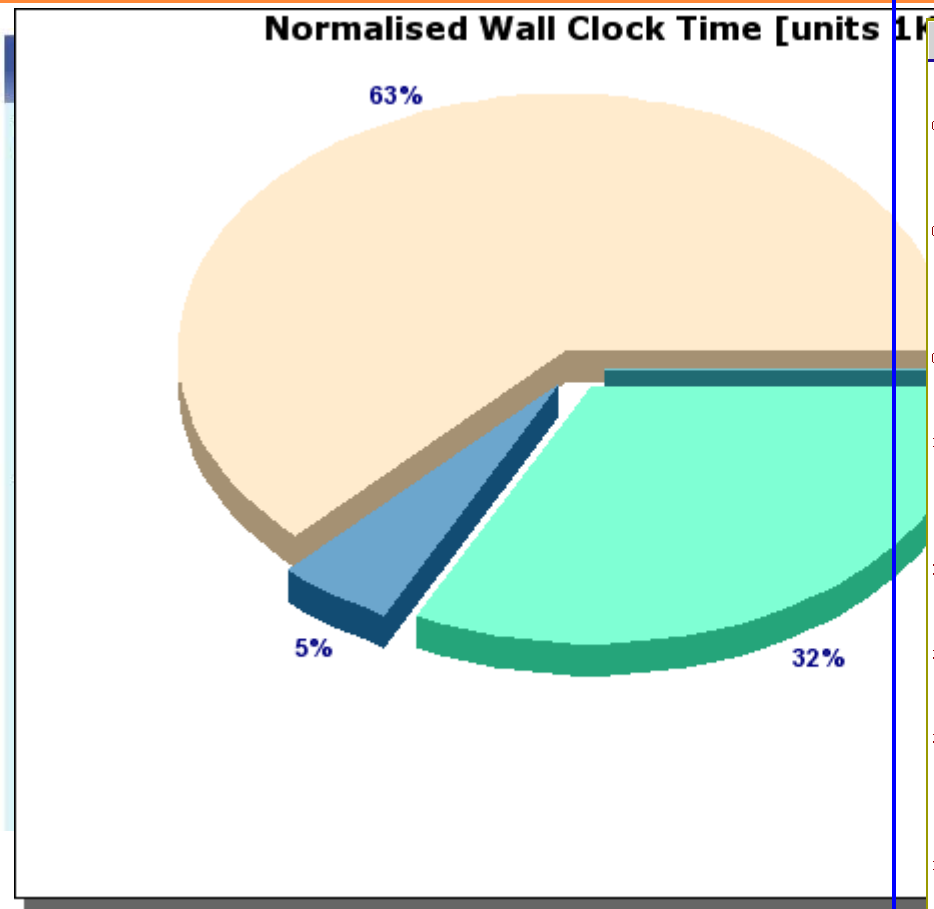
Issues: Monitoring Services (cont.)

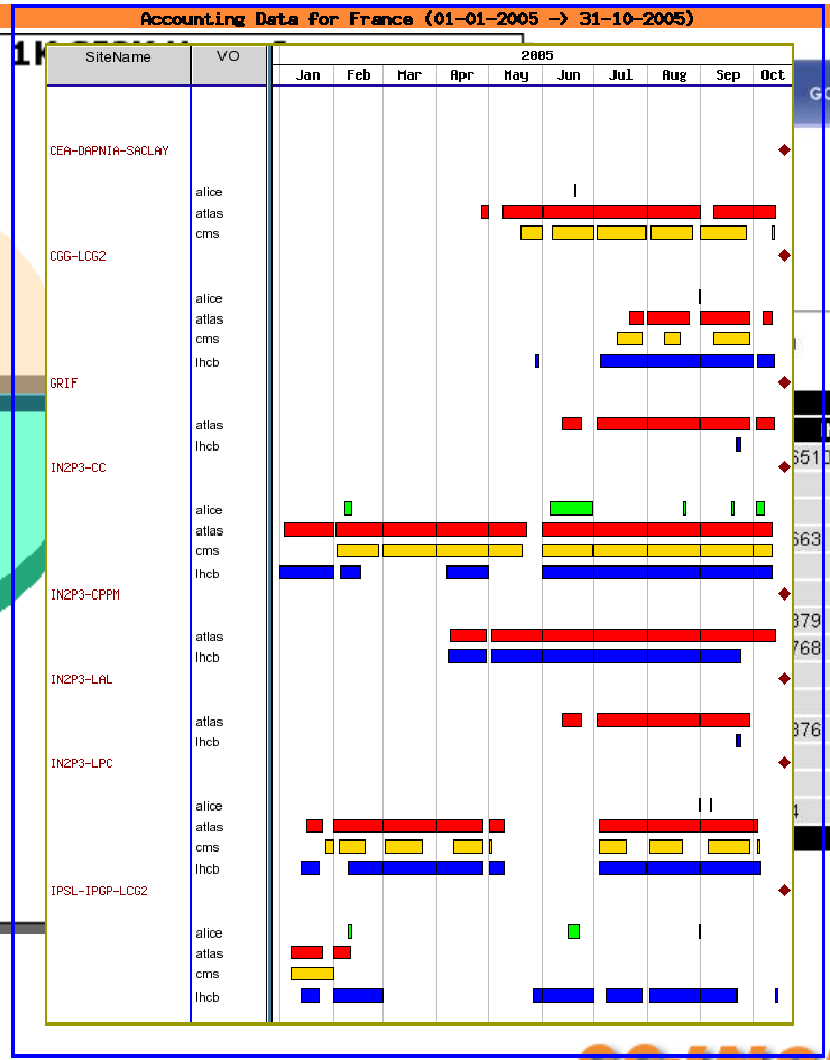


Accounting

- Tools needed to collect and report information on resource utilization
  - Intended audience: site managers, virtual organization managers, grid operators, funding agencies,…
  - Need to define common ways of measuring resource consumption
    - Including usage of same units
- LCG/EGEE
  - CPU usage information (per user or per VO) provided by each site and stored in a central repository
    - Reports (charts and numeric data) available through a web interface
  - Next step: collect information on storage utilization
  - Developed and operated by Grid Operations Centre (UK)

Accounting (cont.)





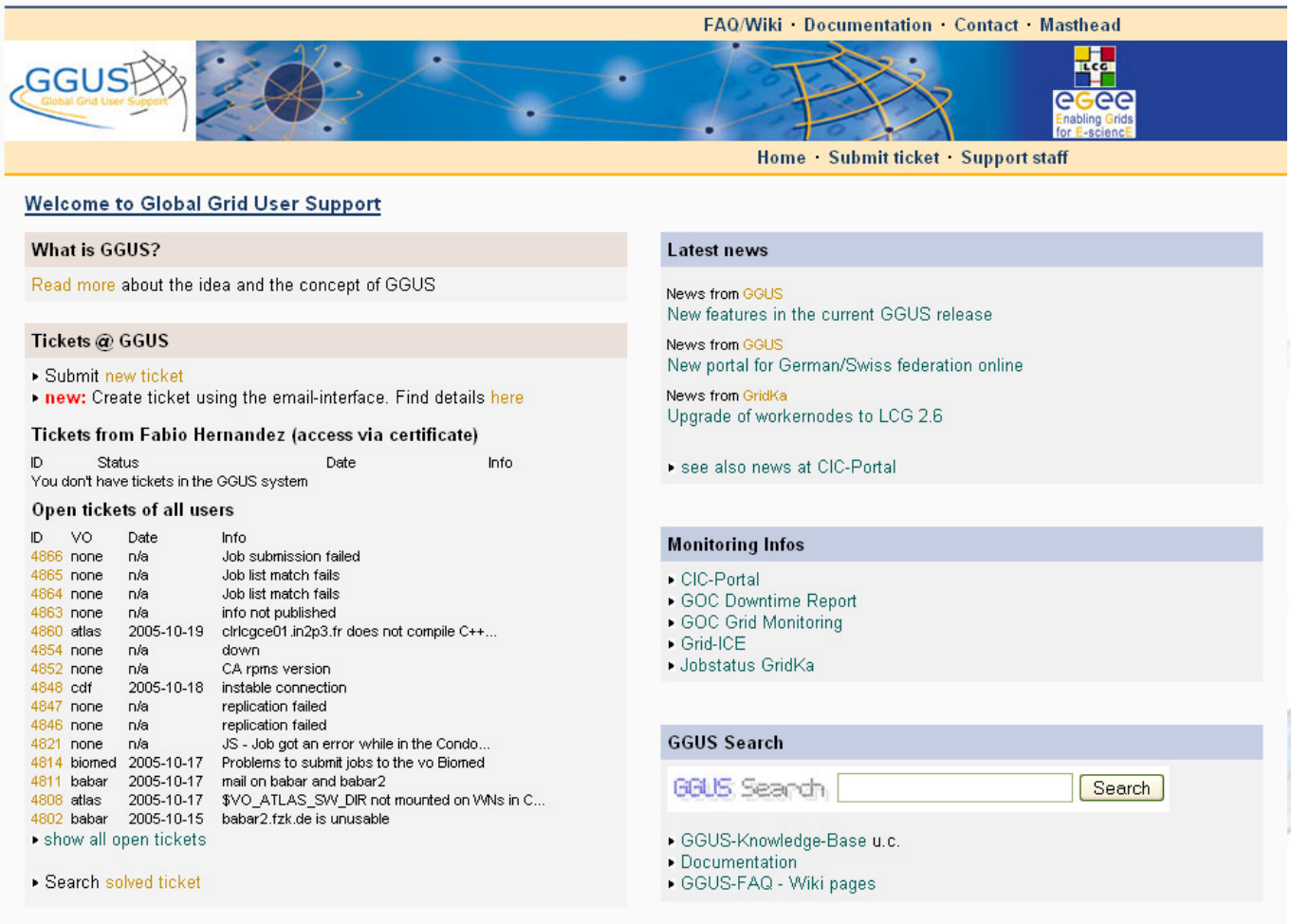
Operator on duty

- Global operation of LCG/EGEE is (also) distributed
- Operation model
  - One site has responsibility for the operation of the whole grid by weekly shifts
    - *Operator-on-duty*
  - Involving at the moment 5 (FR, UK, IT, RU, CERN) out of the 10 existing federations
    - ~ 20 people
    - Taiwan is joining from October 2005
- Responsibilities of operator on duty
  - Oversight the health status of the whole infrastructure
  - Diagnose the causes of the sites and services failures
    - Based on the results of the monitoring services
  - Open operations-related tickets using the problem tracking tool (more on this later)
    - Perform escalation procedures if needed
- Mechanisms
  - Weekly operations meeting (by phone)
  - Hand-over logs available through the operator-on-duty portal (more on this later)
- Quarterly face-to-face meetings
  - For improving procedures and tracking progress on the on-going development of the operations-oriented tools

Tracking incidents

- Incident tracking model
  - Unique channel for opening tickets
  - Classification and assignment done by the ticket process manager
    - Each federation has to provide one
  - Tickets are assigned to *support units*
  - One support unit per domain of expertise
    - Grid operator on duty, virtual organization, regional operations centre, middleware experts, …
- LCG/EGEE
  - Central incident tracking tool developed and operated by Forschungszentrum Karlsruhe (DE)
    - https://gus.fzk.de/
  - Same tool used by grid operators and end users
    - e-mail and web interface
  - Sites failing the tests receive an opened ticket
    - Escalation procedure for solving site-related problems
    - Involves the regional operator and the site operator
- Interface with ticket handling tools used by sites/federations (if needed)
- Tools for collecting metrics on the responsiveness of support units

Tracking incidents (cont.)



FAQ/Wiki · Documentation · Contact · Masthead

GGUS Global Grid User Support

Home · Submit ticket · Support staff

Welcome to Global Grid User Support

What is GGUS?

Read more about the idea and the concept of GGUS

Tickets @ GGUS

- Submit new ticket
- **new:** Create ticket using the email-interface. Find details here

Tickets from Fabio Hernandez (access via certificate)

ID	Status	Date	Info

You don't have tickets in the GGUS system

Open tickets of all users

ID	VO	Date	Info
4866	none	n/a	Job submission failed
4865	none	n/a	Job list match fails
4864	none	n/a	Job list match fails
4863	none	n/a	info not published
4860	atlas	2005-10-19	clrlcgce01.in2p3.fr does not compile C++...
4854	none	n/a	down
4852	none	n/a	CA rpms version
4848	cdf	2005-10-18	instable connection
4847	none	n/a	replication failed
4846	none	n/a	replication failed
4821	none	n/a	JS - Job got an error while in the Condo...
4814	biomed	2005-10-17	Problems to submit jobs to the vo Biomed
4811	babar	2005-10-17	mail on babar and babar2
4808	atlas	2005-10-17	$VO_ATLAS_SW_DIR not mounted on WNs in C...
4802	babar	2005-10-15	babar2.fzk.de is unusable

- show all open tickets
- Search solved ticket

Latest news

News from GGUS
New features in the current GGUS release

News from GGUS
New portal for German/Swiss federation online

News from GridKa
Upgrade of workernodes to LCG 2.6

- see also news at CIC-Portal

Monitoring Infos

- CIC-Portal
- GOC Downtime Report
- GOC Grid Monitoring
- Grid-ICE
- Jobstatus GridKa

GGUS Search

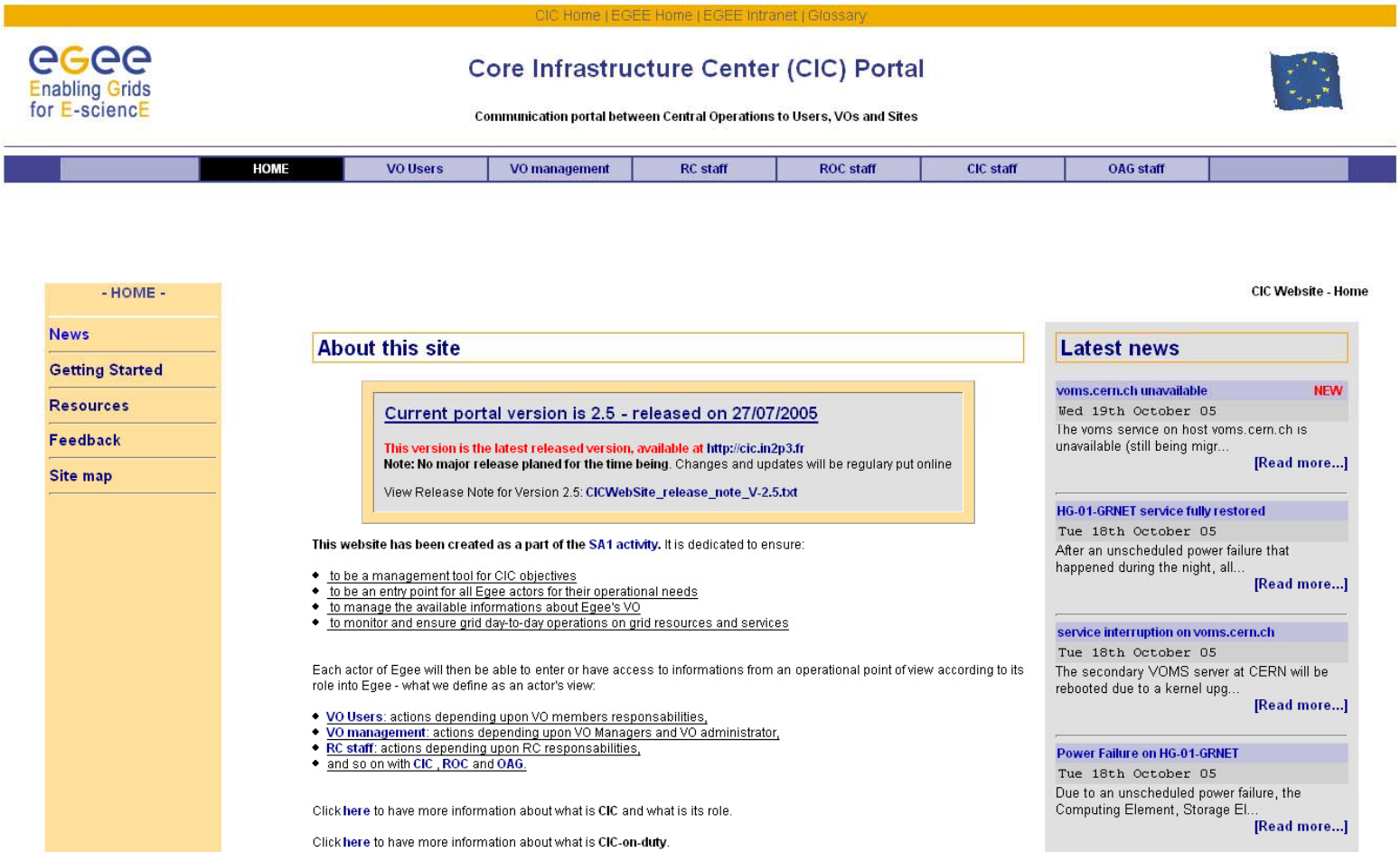
GGUS Search Search

- GGUS-Knowledge-Base u.c.
- Documentation
- GGUS-FAQ - Wiki pages

Putting all together: the grid operator portal

- Web portal for integrating all the tools and sources of operations-related information into one single place
  - Main intended audience: the grid operator on duty
    - But also, virtual organization managers, site managers, regional operator manager, …
  - Single entry point for relevant operations information
- Developed and operated by CC-IN2P3
  - http://cic.in2p3.fr/
  - Provides and maintains an integrated operations dashboard for grid on duty operator
    - Integrating ticket handling, grid monitoring information, services status, etc.
  - Provides mechanisms for keeping information needed for appropriate hand over between operators on duty
  - Easy access to appropriate contact information on every actor involved in the operations of the grid
  - Provides an effective communication tool for reaching all the relevant actors of the project
    - Selectively broadcasting information to federations, sites, VO managers, ...
- Other contributions of CC-IN2P3 for the grid operations
  - Actively participates in the development of operators on duty‘s tools and procedures
  - Chairs the quarterly grid-operators meetings

Putting all together: the grid operator portal (cont.)



Interoperability

- How to cope with operations problems when users simultaneously use cross-grid services?
  - Need to understand what and where the problems are
  - Who is responsible for handling cross-grid incidents?
    - How to handle cross-grid incidents?
- Grid operators may need to define common procedures (and tools?) for handling operations problems
- Interoperability issues will be addressed in EGEE-II

Future Work

- Achieve a real 24x7 production quality service
- Improve monitoring of core services for reaching target levels for LHC production
  - Will benefit other scientific domains
- Increase diversity in applications and scientific domains
- Integrate other regions
  - Latin-America, south-east Europe, China, Baltic countries, Mediterranean countries…
- Address the grid interoperability issues

To know more…

- CC-IN2P3 http://cc.in2p3.fr
- EGEE http://www.eu-egee.org
- LCG http://www.cern.ch/lcg
- LCG/EGEE Operations Portal http://cic.in2p3.fr/

Questions