



Enabling Grids for E-science

Status of EGEE Production Service

Ian Bird, CERN

SA1 Activity Leader

EGEE 1st EU Review

9-11/02/2005

www.eu-egee.org



- **Overview of the Grid Operations Service activities (SA1) – structure, successes, issues, and plans**
- **Strategy has been to**
 - have a robust certification and testing activity,
 - simplify as far as possible what is deployed, and to make that robust and useable.
 - In parallel construct the essential infrastructure needed to operate and maintain a grid infrastructure in a sustainable way.
- **Current service based on work done in LCG – culminating in the current service (“LCG-2”)**
 - Now at the point where in parallel we need to deploy and understand gLite – whilst maintaining a reliable production service.

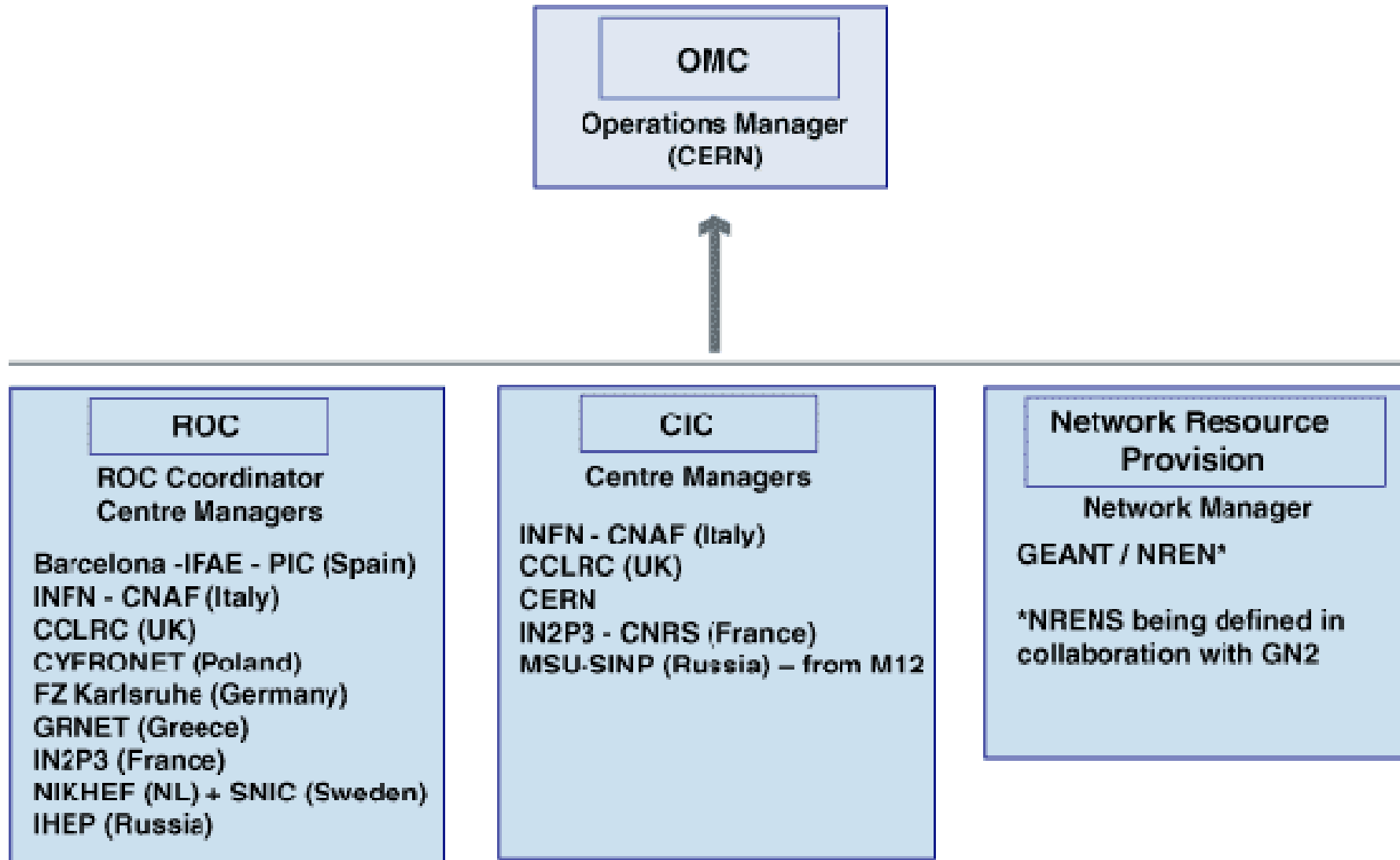
- **Successes:**

- A large operational production grid infrastructure in place and in use
 - Managed certification and deployment process in place
 - Managed grid operations process in place
 - ☞ *Talk by Markus Schulz & Hélène Cordier*
- Have supported extensive and intensive use by the LHC experiments during 2004 data challenges (10 months)
 - ☞ *NA4 talk*
- Now has Bio-medical community using the infrastructure, and others close

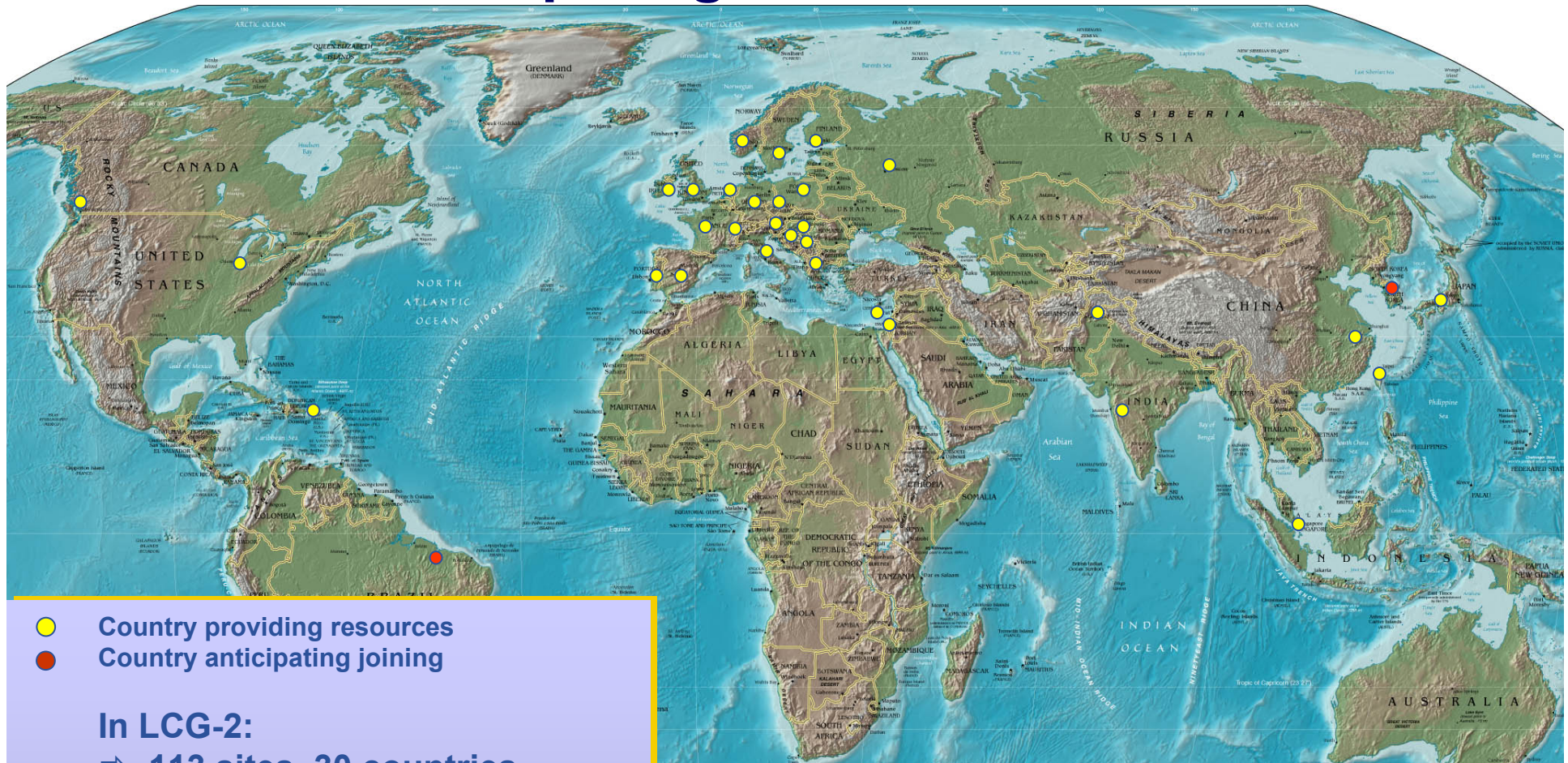
- **Issues:**

- Continue to improve the quality, reliability and efficiency of the operations
 - How to approach "24x7" global operations.
- Continue to develop a trusted, reliable and usable user support infrastructure
- Introducing and deploying new VOs is too heavy weight

- **Grid Management**
 - Coordinate Regional Operations Centres (ROC) and Core Infrastructure Centres (CIC)
 - Manage the relationships with resource providers via service-level agreements
- **Grid Operation**
 - Operate core Infrastructure services
 - Provide grid monitoring and control
- **Support:**
 - Validate, deploy, and support middleware releases
 - Provide user support – helpdesk and call centres
 - Provide support to resource centres
- **International Collaboration**
 - Drive collaboration with peer organisations in the U.S. and in Asia-Pacific
 - Ensure interoperability of grid infrastructures and services for cross-domain VOs
 - Participate in liaison and standards bodies in wider grid community



Month	Deliverable/ Milestone	Item	Lead
M03	DSA1.1	Detailed execution plan for first 15 months of infrastructure operation	CERN
M06	MSA1.1	Initial pilot production grid operational 10 sites	
M06	DSA1.2	Release notes corresponding to the initial pilot Grid infrastructure operational	INFN
M09	DSA1.3	Accounting and reporting web site publicly available	CCLRC
M09	MSA1.2	First review	
M12	DSA1.4	Assessment of initial infrastructure operation and plan for next 12 months	IN2P3
M14	DSA1.5	First release of EGEE Infrastructure Planning Guide ("cook-book"),	CERN
M14	MSA1.3	Full production grid infrastructure operational 20 sites	
M14	DSA1.6	Release notes corresponding to the full production Grid infrastructure operational	CCLRC
M18	MSA1.4	Second review	
M22	DSA1.7	Updated EGEE Infrastructure Planning Guide	CERN
M24	DSA1.8	Assessment of production infrastructure operation and outline of how sustained operation of EGEE might be addressed.	IN2P3
M24	MSA1.5	Third review and expanded production grid operational 50 sites	
M24	DSA1.9	Release notes corresponding to expanded production Grid infrastructure operational	INFN



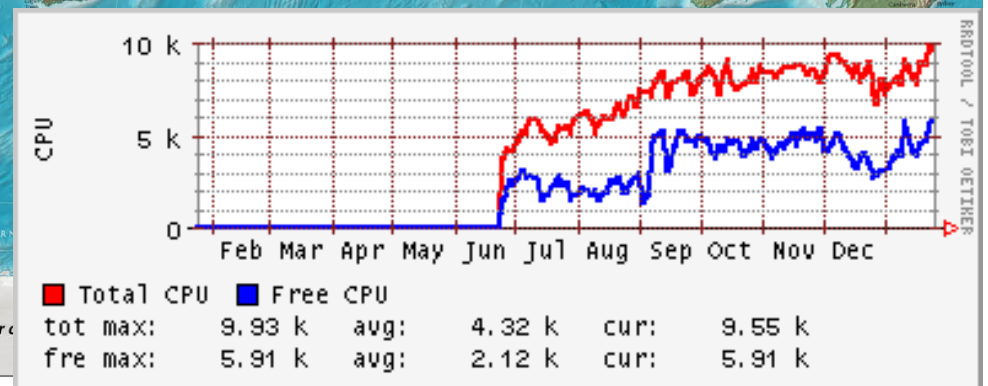
- Country providing resources
- Country anticipating joining

In LCG-2:

- ⇒ 113 sites, 30 countries
- ⇒ >10,000 cpu
- ⇒ ~5 PB storage

Includes non-EGEE sites:

- 9 countries
- 18 sites



<i>Region</i>	<i>coun-tries</i>	<i>sites</i>	<i>cpu M6 (TA)</i>	<i>cpu M15 (TA)</i>	<i>cpu actual</i>
<i>CERN</i>	0	1	900	1800	942
<i>UK/Ireland</i>	2	19	100	2200	2398
<i>France</i>	1	8	400	895	886
<i>Italy</i>	1	20	553	679	1777
<i>South East</i>	5	7	146	322	133
<i>South West</i>	2	12	250	250	498
<i>Central Europe</i>	5	8	385	730	373
<i>Northern Europe</i>	2	4	200	2000	427
<i>Germany/Switzerland</i>	2	10	100	400	1207
<i>Russia</i>	1	6	50	152	238
EGEE-total	21	95	3084	9428	8879
<i>USA</i>	1	3	-	-	458
<i>Canada</i>	1	6	-	-	316
<i>Asia-Pacific</i>	6	8	-	-	394
<i>Hewlett-Packard</i>	1	1	-	-	100
Total other	9	18	-	-	1268
Grand Total	30	113	-	-	10147

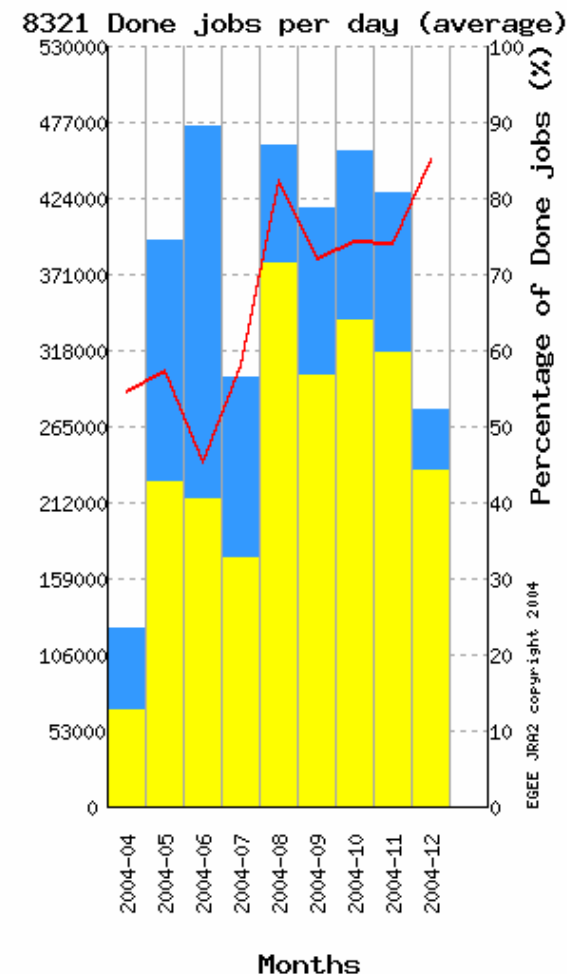
Countries, sites, and CPU available in EGEE production service

EGEE partner regions

Other collaborating sites

- **VOs and users on the production service**
 - Active HEP experiments:
 - 4 LHC, D0, CDF, Zeus, Babar
 - Active other VO:
 - Biomed, ESR (Earth Sciences), Compchem, Magic (Astronomy), EGEODE (Geo-Physics)
 - 6 disciplines
 - Registered users in these VO: 500
 - In addition to these there are many VO that are local to a region, supported by their ROCs, but not yet visible across EGEE

- **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/month

- **Mechanics:**
 - The recipe is straightforward and clear
 - But, this is a heavy weight process and must be improved
 - Requires a lot of configuration changes by a site
 - Often leads to problems
- **Policy:**
 - Joint group of SA1/NA4 (called OAG in the TA)
 - Members are the application representatives and the ROC managers; chaired by NA4
 - Mandate
 - *Understand application resource requirements*
 - *Negotiate those resources within the federations – the ROC manager is responsible to make the negotiation*
 - NB. A site is often funded for specific applications – it is by and large NOT the case that any application is entitled to run anywhere
 - *But let's demonstrate the value of being able to do that ...*

- **Evolution through 2003/2004**

- Focus has been on making these
 - rather than additional functionality
- Respond to needs of users, admin

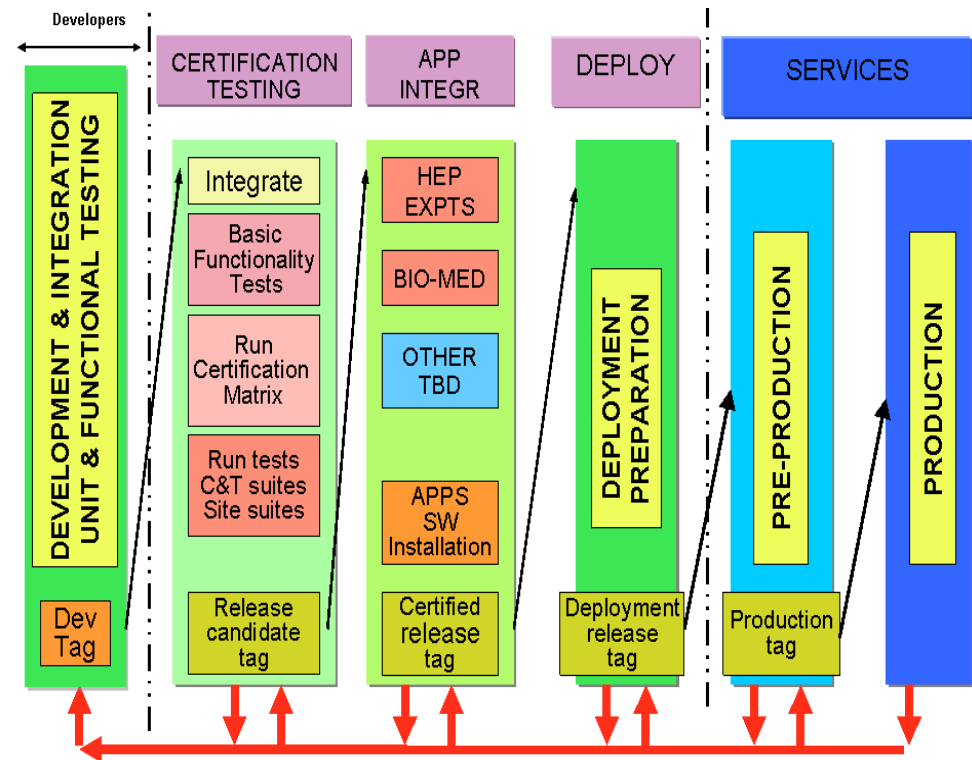
- **The software stack is the following**

- Virtual Data Toolkit
 - Globus (2.4.x), Condor, etc
- EU DataGrid project developed higher-level components
 - Workload management (RB, L&B, etc)
 - Replica Location Service (single central catalog), replica management tools
 - R-GMA as accounting and monitoring framework
 - VOMS being deployed now
- Operations team re-worked components:
 - Information system: MDS GRIS/GIIS → LCG-BDII
 - edg-rm tools replaced and augmented as lcg-utils
 - Developments on:
 - *Disk pool managers (dCache, DPM)*
 - Not addressed by JRA1
- Other tools as required:
 - e.g. Gridlce – EU DataTag project

- Maintenance agreements with:
 - VDT team (inc Globus support)
 - DESY/FNAL - dCache
 - JRA1 teams:
 - WLM, VOMS, R-GMA, Data Management

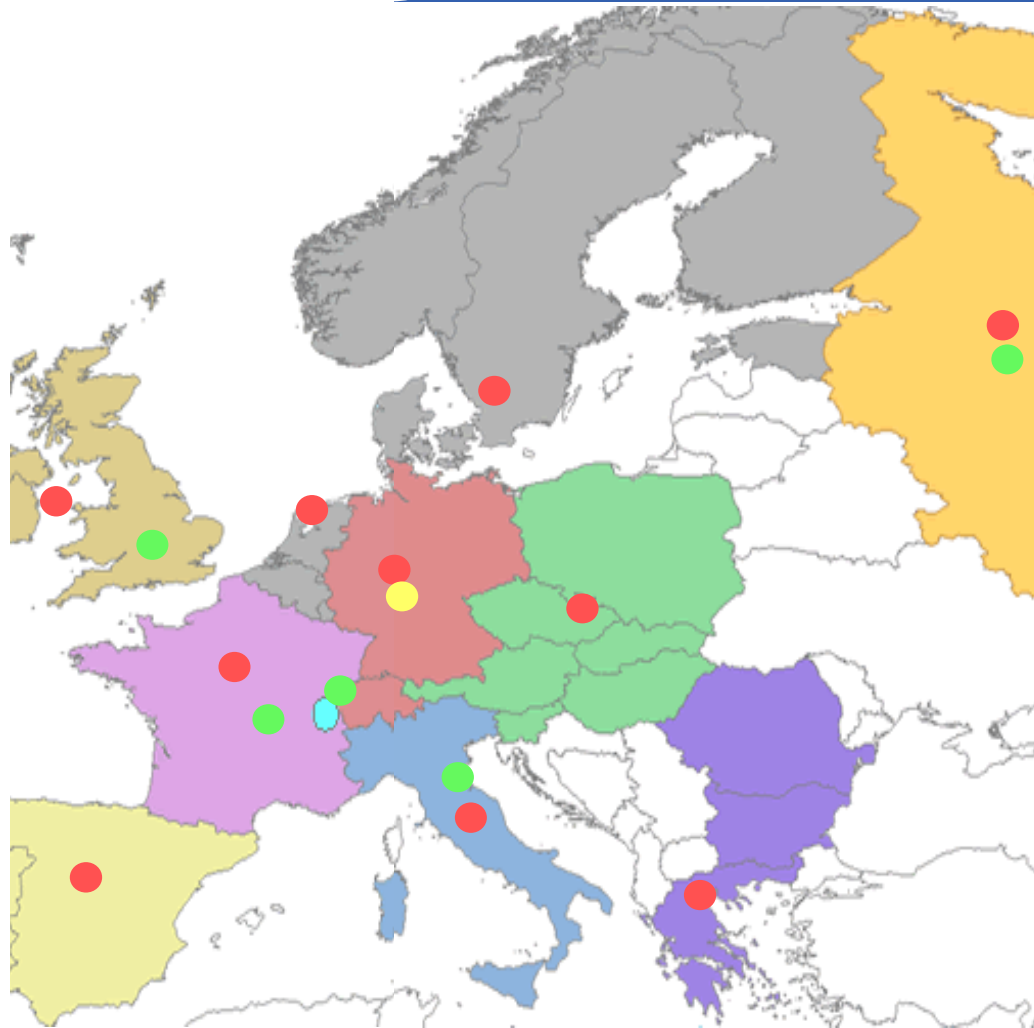
- **Platform support**
 - Was an issue – limited to RedHat 7.3
 - Now ported to: Scientific Linux (RHEL), Fedora, IA64, AIX, SGI
- **Another problem was heaviness of installation**
 - Now much improved and simpler – with simple installation tools, allow integration with existing fabric management tools
 - Very light installation on worker nodes – user level

- **Key point – a certification process is essential**
 - However, it is expensive (people, resources, time)
 - But, this is the only way to deliver production quality services
 - LCG-2 was built from a wide variety of “research” quality code
 - Lots of good ideas, but little attention to the “mundane” needs of production ...
 - Building a reliable distributed system is hard –
 - Must plan for failure, must provide fail-over of services, etc
 - Integrating components from different projects is also difficult
 - Lack of common standards for logging, error recovery, etc
- → **Markus Schulz’ talk**



- **The EGEE production grid service is quite stable**
 - The services are quite reliable
 - Remaining instabilities in the IS are being addressed
 - Sensitivity to site management
 - Problems in underlying services must be addressed
 - Work on stop-gap solutions (e.g. RB maintains state, Globus gridftp → reliable file transfer service)
- **The biggest problem is stability of sites**
 - Configuration problems due to complexity of the middleware
 - Fabric management at less experienced sites
- **Job efficiency is not high, unless**
 - Operations/Applications select stable sites (BDII allows a application-specific view)
 - In large tests, selecting stable sites, achieve >>90% efficiency
- **Operations workshop last November to address this**
 - Fabric management working group – write fabric management cookbook
 - Tighten operations control of the grid – escalation procedures, removing bad sites

 **Complexity is in the number of sites – not number of cpu**

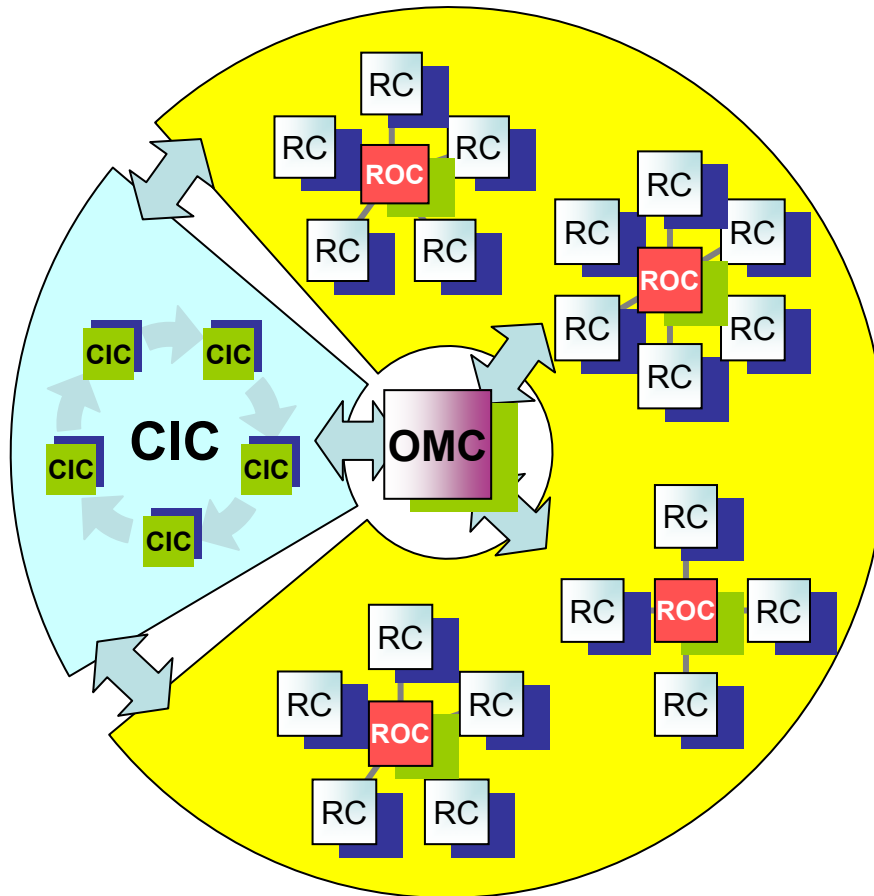


- **Operations Management Centre (OMC):**
 - At CERN – coordination etc
- **Core Infrastructure Centres (CIC)**
 - Manage daily grid operations – oversight, troubleshooting
 - Run essential infrastructure services
 - Provide 2nd level support to ROCs
 - UK/I, Fr, It, CERN, + Russia (M12)
 - Taipei also run a CIC
- **Regional Operations Centres (ROC)**
 - Act as front-line support for user and operations issues
 - Provide local knowledge and adaptations
 - One in each region – many distributed
- **User Support Centre (GGUS)**
 - In FZK – manage PTS – provide single point of contact (service desk)
 - Not foreseen as such in TA, but need is clear

- **Represent a significant investment of the project**
- **Provide the front-line for**
 - User support → local helpdesks
 - Deployment support in the region
 - Coordination, planning and scheduling
 - Negotiate resource access for users
 - Local adaptations of middleware
 - Site certification and operation
 - Negotiate and monitor SLAs in the region
- **The ROC is the first point of contact for all:**
 - New sites joining the grid and support for them
 - New users and user support
- **ROCs were set up early in the project and have been active in several areas**
 - Operations requirements for gLite
 - Provide incident security team members
 - Part of user support task force to build up GGUS and support infrastructure
- **This hierarchy of regional responsibility is essential**
 - Coordinate planning and reporting in the region,

- **Teams:**

- Deployment team
- Support team (answers user and rc problems)
- Operations training at RC's
- Organise tutorials for users



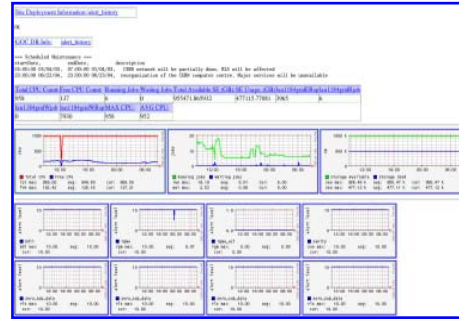
RC = Resource Centre

- The *grid* is flat, but
- **Hierarchy of responsibility**
 - Essential to scale the operation
- **CICs act as a single Operations Centre**
 - Operational oversight (*grid operator*) responsibility
 - rotates weekly between CICs
 - Report problems to ROC/RC
 - ROC is *responsible* for ensuring problem is resolved
 - ROC oversees regional RCs
- **ROCs responsible for organising the operations in a region**
 - Coordinate deployment of middleware, etc
- **CERN coordinates sites not associated with a ROC**

Enabling Grids for E-science

GIIS Monitor

GIIS Monitor



GIIS Monitor graphs

Site Functional Tests report

Site Functional Tests



Variety of monitoring tools are in daily use.

Some of these are shown on the live display monitors.

More details in Grid Operations talk.

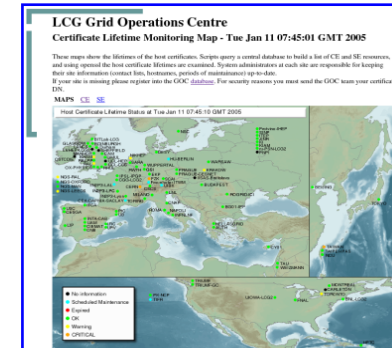


Gridce – VO view

Gridce – VO view

Gridce – fabric view

Gridce – fabric view



Certificate Lifetime Monitor

Note: Those thumbnails are links and are clickable.

- **Running at the side of the auditorium**
 1. GIIS (Information system) monitoring
 - Live state of information system
 - Check on information published
 2. Service test results
 - Checks of services and installations – site validations
 3. Live job status applet
 - Shows jobs queued, dispatching, executing, etc.
 4. Gridlce – views of
 - Remote site fabric management,
 - VO-specific views

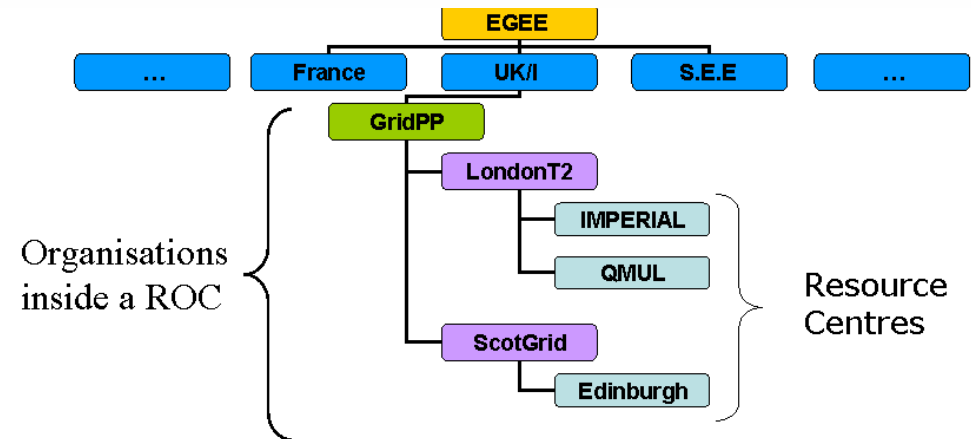
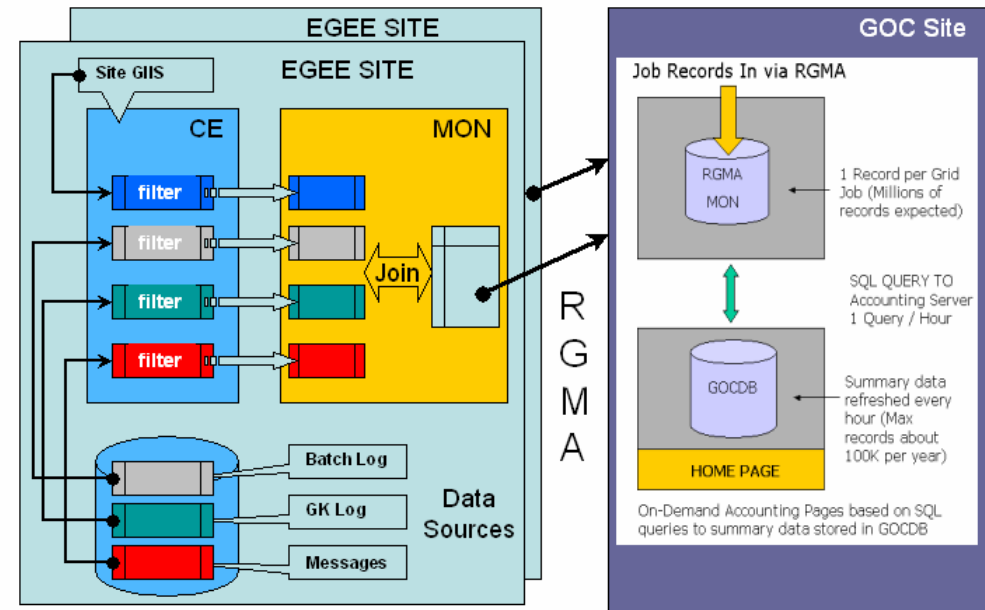
- **See live demos of operations use of the tools in coffee breaks downstairs**

- **Start with service level definitions**
 - What a site supports (apps, software, MPI, compilers, etc)
 - Levels of support (# admins, hrs/day, on-call, operators...)
 - Response time to problems
 - Agreement (or not) that remote control is possible (conditions?)
 - Sites sign-off on these commitments and responsibilities
- **Define metrics to measure compliance**
 - Publish performance of sites relative to their commitments
 - Publish metrics on site stability, availability, etc.
 - Consistently bad sites → escalate to political level (e.g. Project Management Board)
- **Remote management of services**
 - Can be considered for small sites
 - ROCs run grid services, site responsible for fabric only
 - Remote fabric monitoring (GridICE etc)
- **Middleware/services**
 - Should cope with bad sites

- **How to move towards a 24x7-like global support?**
 - Understand what this means
 - Service should be available 24x7
 - Does not mean all sites must be available 24x7
 - In general large centres have best-effort on-call support (no shifts)
 - What is the requirement for 24x7?
 - Specific crucial services that justify cost
 - Loss of capacity – vs damage
 - Classify what are 24x7 problems
 - Classify services according to level of support required
 - Operations tools need to become more and more automated
 - Distributed CIC provides partial coverage by using EGEE, Taipei, (America/Canada?)
- **Having an operating production infrastructure should not mean having staff on shift everywhere**
 - “best-effort” support
 - The infrastructure (and applications) must adapt to failures

- Accounting at the moment is “after the fact”
 - The most important way to determine how many resources were consumed by each VO (and potentially each user)
 - No attempt to establish or impose quotas
 - But of course, each site can and does do so
 - Not a trivial problem – jobs should not go to a site where they have no resource, but a modern batch system cannot give a definitive reply

Accounting Flow Diagram



Accounting

- > Accounting Home
- Accounting Plots**
- > CIC View
- > ROC View
- > Country View
- > Custom Query
- > Site View
- General**
- > Contact the GOC accounting team

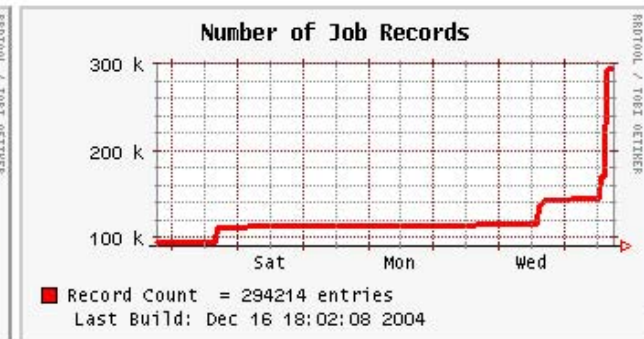
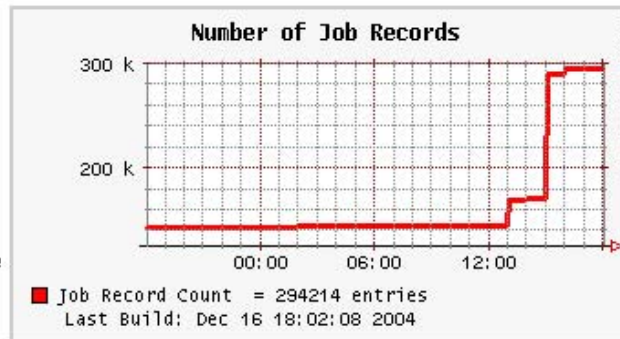
GOC Accounting Services

Latest News

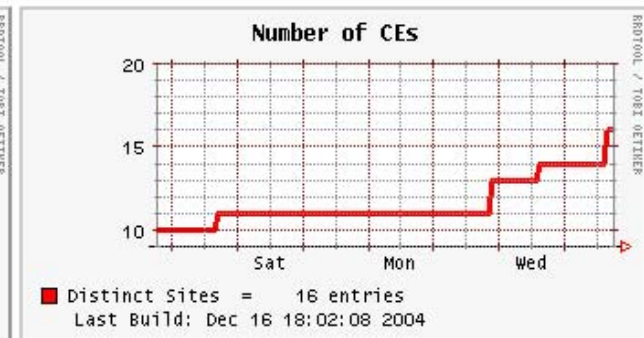
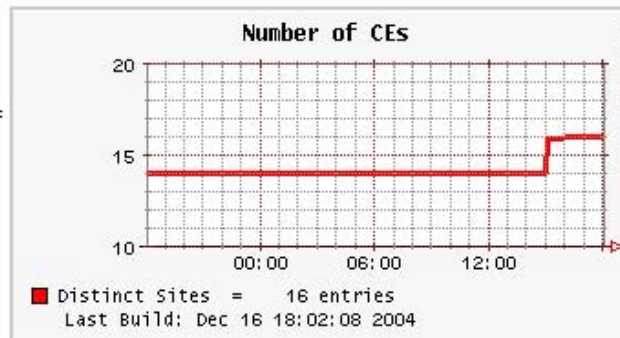
- **Dec-08-2004:**
The accounting RPMs packaged in LCG 2_3_0 (version 3.4.37) have been recently updated! The latest release (3.4.38) is found [here](#).
- **Dec-02-2004:**
The Accounting Service is live.

Database Statistics

Total Number of Records in Database

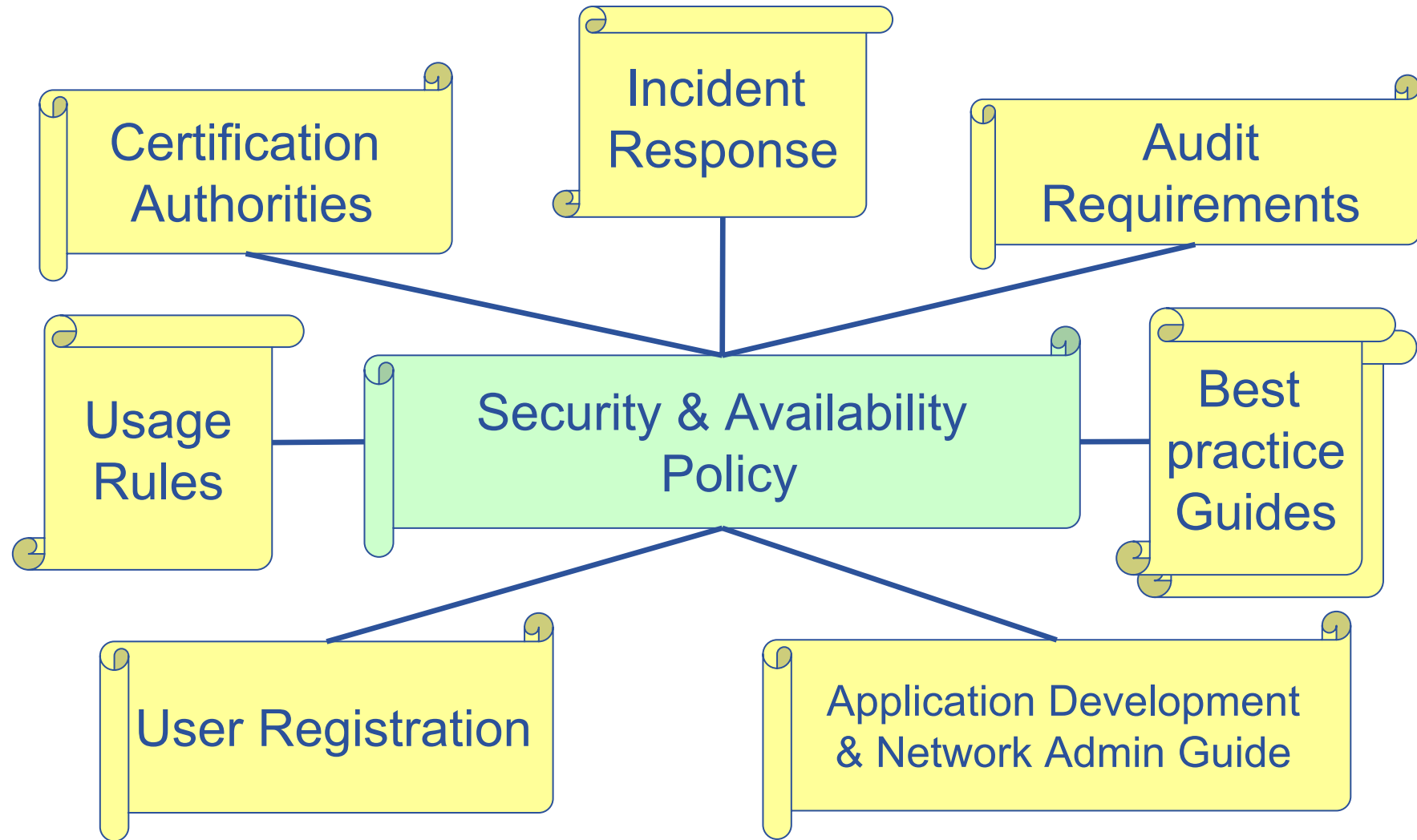


Total number of distinct sites reporting to GOC



Accounting menu may be used to select different views of the data

- **Operational Security team in place**
 - EGEE security officer, ROC security contacts
 - Concentrate on 3 activities:
 - Incident response
 - Best practice advice for Grid Admins – creating dedicated web
- **Security group and work was started in LCG – was from the start a cross-grid activity.**
- **Much already in place at start of EGEE: usage policy, registration process and infrastructure, etc.**
- **We regard it as crucial that this activity remains broader than just EGEE**
 - Handling and response to cyber security incidents on Grids
 - Basic framework for incident definition and handling
- **Site registration process in draft**
 - Part of basic SLA
- **CA Operations**
 - EUGridPMA – best practice, minimum standards, etc.
 - More and more CAs appearing



<http://cern.ch/proj-lcg-security/documents.html>

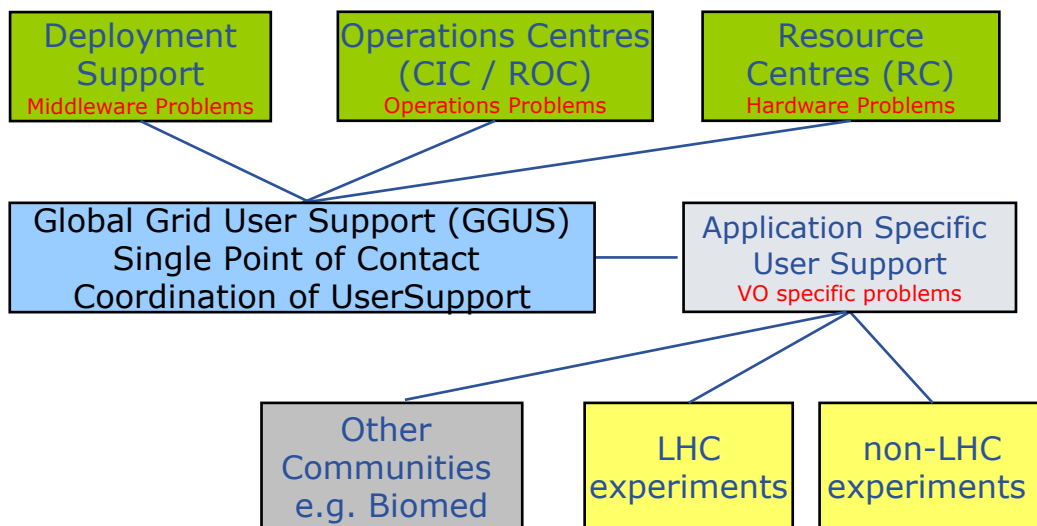
We have found that user support has 2 distinct aspects:

- User support –**

- Call centre/helpdesk
- Coordinated through GGUS
- ROCs as front-line
- Task force in place to improve the service

- VO Support**

- Was an oversight in the project and is not really provisioned
- In LCG there is a team (5 FTE):
 - Help apps integrate with m/w
 - Direct 1:1 support
 - Understanding of needs
 - Act as advocate for app
- This is really missing for the other apps – adaptation to the grid environment takes expertise



- **National Grids within EGEE**

- The large national grid infrastructures in EGEE regions are becoming integrated into the overall service:
 - Italy – Grid.IT sites are part of EGEE
 - UK/I – National Grid Service sites are part of EGEE
 - Nordic countries – Some sites run EGEE in parallel with NorduGrid, others still to be integrated
 - SA1 supports SEE-Grid directly (1 FTE at CERN funded by SEE-Grid)
 - Looking at similar arrangement with Brazil (EELA project)

- **Strong relationship with Asia-Pacific**

- Taipei acts as CIC and hopefully will become a ROC

- **External Grids**

- Most important are Grid3 (→ Open Science Grid) in USA and the Canadian Grid efforts (WestGrid and GridCanada)
 - OSG and EGEE use same base sw stack – we have demonstrated job interoperability in both directions
 - *Operations and security teams have much in common – proposing specific joint activities*
 - Canada – at Triumf a gateway from EGEE to Canadian resources has been built and used in production

- **This momentum has to be maintained as we move to the next generation of middleware**

- **Milestones**

- MSA1.3 (M14) Full production grid infrastructure operational
 - 20 sites, using re-engineered middleware
- MSA1.4 (M18) Second project review
- MSA1.5 (M24) Expanded production grid operational
 - 50 sites

- **Deliverables**

- DSA1.4 (M12) Assessment of operation of 1st 12 months
- DSA1.5 (M14) First release of “cook-book”
- DSA1.6 (M14) Release notes corresponding to MSA1.3
- DSA1.7 (M22) Second edition of “cook-book”
- DSA1.8 (M24) Assessment of production operation
 - Include thoughts on how to make the infrastructure sustainable
- DSA1.9 (M24) Release notes corresponding to MSA1.5

- **Changes wrt TA**

- No significant change

- **Production grid is operational and in use**
 - Larger scale than foreseen, use in 2004 probably the first time such a set of large scale grid productions has been done
 - Leveraged work done in LCG over previous 18 months
 - Modest growth in resources foreseen over next year
- **Operational infrastructure in place and working**
 - Need to improve reliability of service
 - Need to improve user support
- **Support for applications and VOs**
 - VO deployment should become simpler and more routine
 - Application support needs more resources than foreseen
- **Strong collaboration with projects outside of Europe**
- **Deployment and migration to gLite is now a major focus**

⇒ **We have come a long way in the last few months**
⇒ **There is still much to be done**

Infrastructure terms

- **GOC – Grid Operations Centre**
 - Generic reference to:
 - a) **CIC – Core Infrastructure Centre**
 - b) **ROC – Regional Operations Centre**

- **OMC – Operations Management Centre**
- **RC – Resource Centre**
- **GGUS – Global Grid User Support**

General terms

- **VO – Virtual Organisation**
- **HEP – High Energy Physics**
- **LCG – LHC Computing Grid project**
- **BDII – basic component of information system**