# Grid @ Forschungszentrum Karlsruhe: GridKa and GGUS

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**http://www.gridka.de**

# The Grid Computing Centre Karlsruhe GridKa

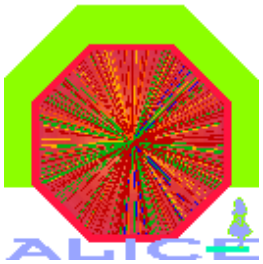
**Requested as a Regional Data and Computing Centre by 41 HEP user groups in 19 German universities and research institutions.**

**Founded in 2001 as part of the computing centre of Forschungszentrum Karlsruhe.**

**Main goals**

- test environment for LHC **(ALICE, ATLAS, CMS, LHCb)**
- LHC Tier-1 in 2007+
- production environment for non-LHC **(BaBar, CDF, D0, Compass)**
- environment for Grid R&D **(CrossGrid, LCG, EGEE, …)**
- user support, services, education & training
- grid environment for other sciences (astrophysics, bio-informatics...)

# High Energy Physics experiments served by GridKa









(SLAC, USA)


(FN

- Committed to Grid Computing
- Have real data already today

(FNAL ,USA)


(CERN)

**LHC experiments**

**non-LHC experiments**

**Other sciences later**

# GridKa Project Organization

**Technical Advisory Board**

- Alice
- Atlas
- CMS
- LHCb
- BaBar
- CDF
- D0
- Compass
- Physics Committees
- DESY
- Project Leader

**GridKa**

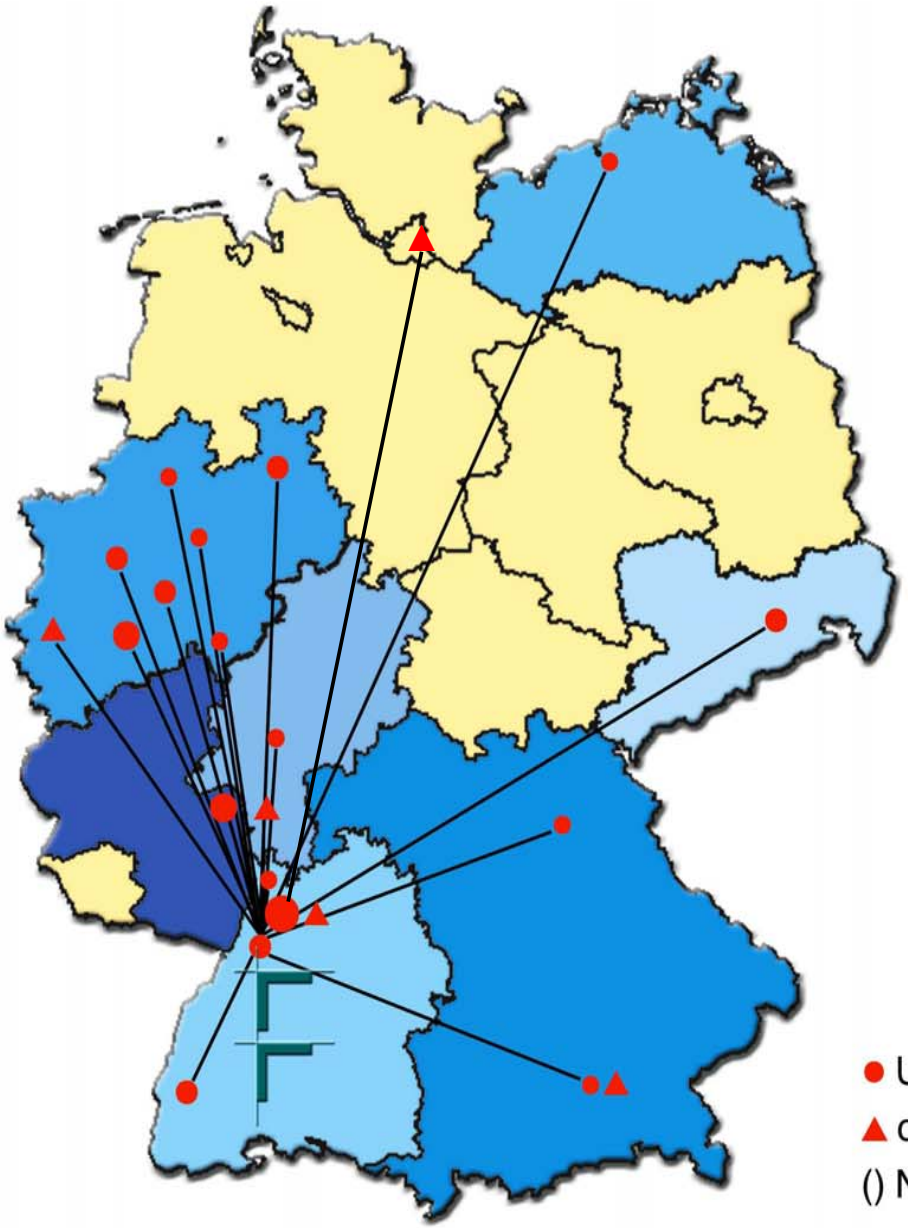
- Planning
- Development
- Technical realization
- Operation

**Overview Board Board**

- BMBF
- Physics Committees
- HEP Experiments
- LCG
- FZK Management
- Head FZK Comp. Centre
- Chairman of TAB
- Project Leader

# German Users of GridKa

Aachen (4)●
Bielefeld (2)●
Bochum (2)●
Bonn (3)●
Darmstadt (1)▲
Dortmund (1)●
Dresden (2)●
Erlangen (1)●
Frankfurt (1)●
Freiburg (2)●
Hamburg (1)▲
Heidelberg (1)▲(6)●
Karlsruhe (2)●
Mainz (3)●
Mannheim (1)●
München (1)●(5)▲
Münster (1)●
Rostock (1)●
Siegen (1)●
Wuppertal (2)●



**22 institutions**

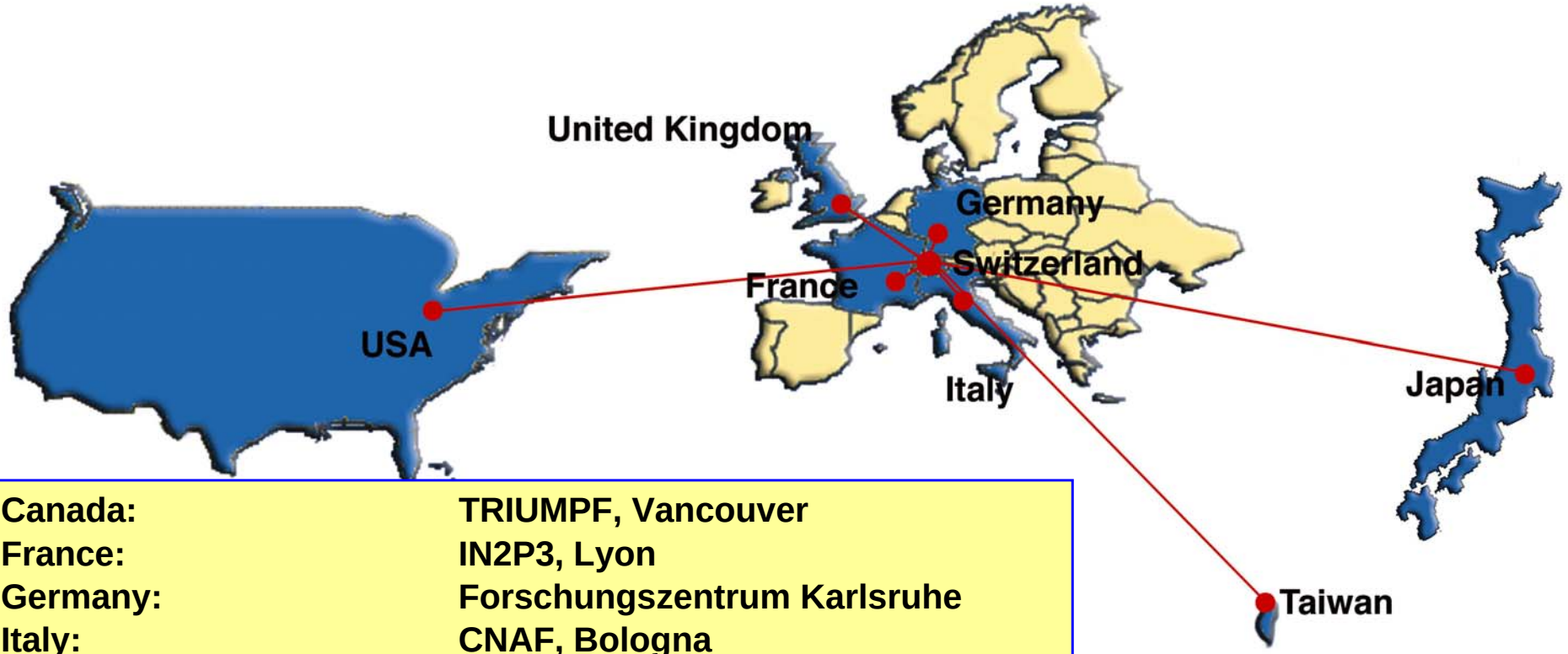
**44 user groups**

**350 scientists**

● University
▲ other research institutions
() Number of working groups

GridKa

# GridKa in the network of international Tier-1 centres




| | |
|---|---|
| **Canada:** | **TRIUMPF, Vancouver** |
| **France:** | **IN2P3, Lyon** |
| **Germany:** | **Forschungszentrum Karlsruhe** |
| **Italy:** | **CNAF, Bologna** |
| **North Europe:** | **NDGF, Nordic DataGrid Facility** |
| **Spain:** | **PIC, Barcelona** |
| **Taiwan:** | **Academia Sinica, Taipei** |
| **The Netherlands:** | **NIKHEF/SARA, Amsterdam** |
| **UK:** | **Rutherford Laboratory, Chilton** |
| **USA:** | **Fermi Laboratory, Batavia, IL** |
| **USA:** | **BNL** |

desktops portables

small centres

Tier-2

RAL

Tier-1

MSU
IC
IFCA
UB
Cambridge
Budapest
Prague
Taipei
TRIUMF
Legnaro
CSCS
Rome
CIEMAT
Krakow
NIKHEF
USC

IN2P3
FNAL
CNAF
FZK
PIC
BNL
ICEPP

CERN

# The fifth LHC subproject

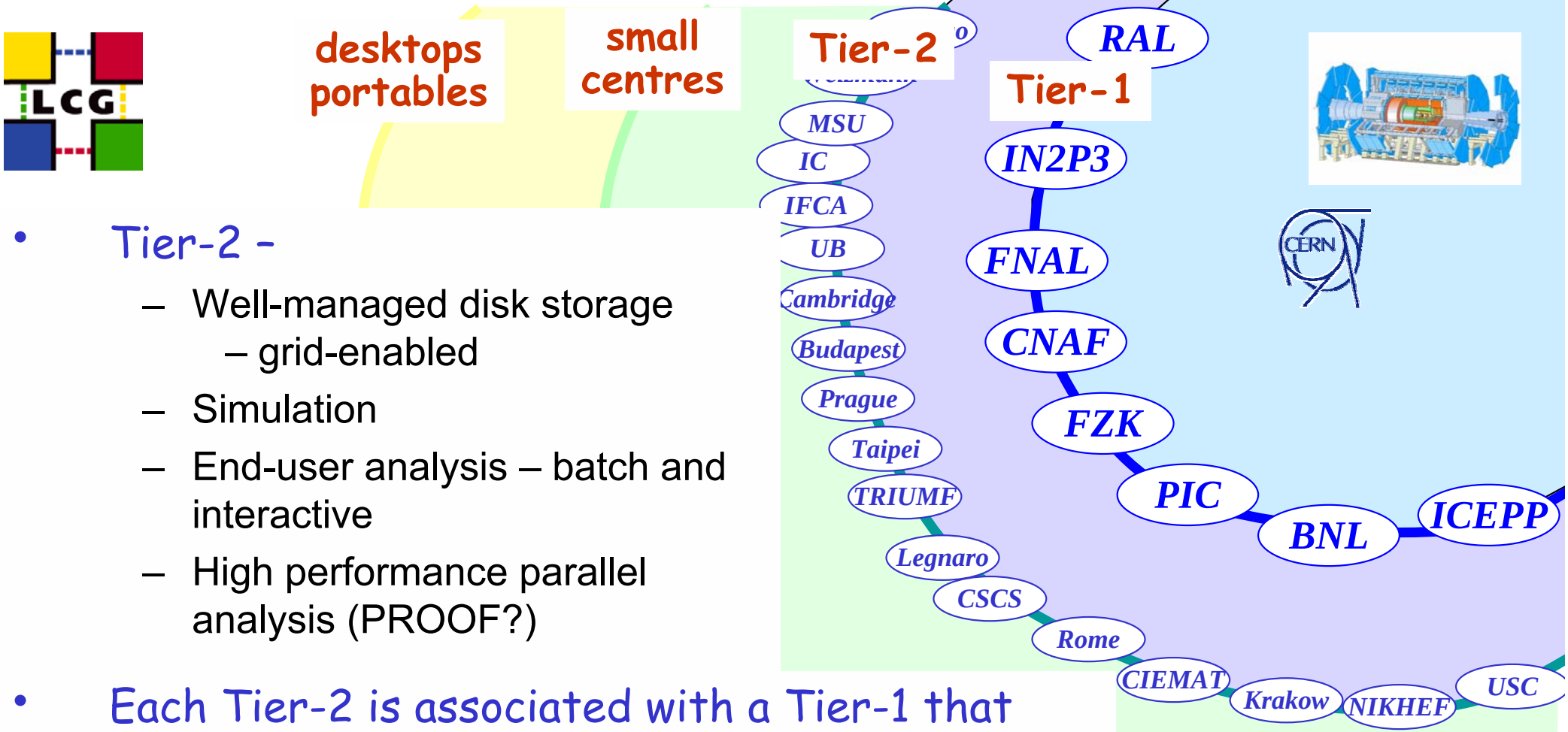
## LHC Computing Model (simplified!!)

- Tier-0 – the accelerator centre
  - Filter → *raw data*
  - Reconstruction → *summary data* (ESD)
  - Record *raw data* and *ESD*
  - Distribute *raw* and *ESD* to Tier-1

- Tier-1 –
  - Permanent storage and **management** of *raw*, *ESD*, calibration data, meta-data, analysis data and databases → **grid-enabled data service**
  - Data-heavy analysis
  - Re-processing raw → ESD
  - National, regional support

"online" to data acquisition process
-- high availability (24h x7d)
-- managed mass storage
-- long-term commitment
-- resources: 50% of "average Tier-1"

Les Robertson, GDB, May 2004




- Tier-2 –
  - Well-managed disk storage
    - grid-enabled
  - Simulation
  - End-user analysis – batch and interactive
  - High performance parallel analysis (PROOF?)
- Each Tier-2 is associated with a Tier-1 that
  - Serves as the primary data source
  - Takes responsibility for long-term storage and management of all of the data generated at the Tier-2 (grid-enables mass storage)
  - May also provide other support services (grid expertise, software distribution, maintenance, …)

Les Robertson, GDB, May 2004

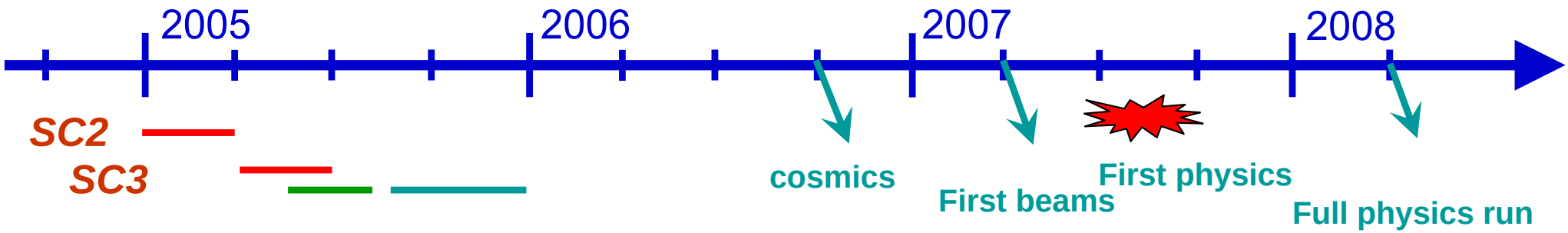
# Stepwise extension of GridKa resources

| | Oct 2004 | Apr 2005 | Oct 2005 | % of 2008 |
|---|---|---|---|---|
| **Processors** | 1070 | 1280 | 1550 | 40 % |
| **Compute power / kSI2k** | 920 | 1200 | 1500 | 18 % |
| **Disk [TB]** | 220 | 270 | 310 | 8 % |
| **Tape [TB]** | 375 | 475 | 500 | 11 % |
| **Internet [Gb/s]** | 10 | 10 | 10 | 50 % |

- extension of resources every 6 months (2001-2005)
- heterogeneous environment, PIII@1,26 GHz, …, PIV@3,06, … Opteron 246
- 310 TB Disk is *usable* disk space, ~2550 disk drives
- installed with SC3.0.4, LCG 2_6_0
- available via Grid together with ~140 other installations in Europe (EGEE)

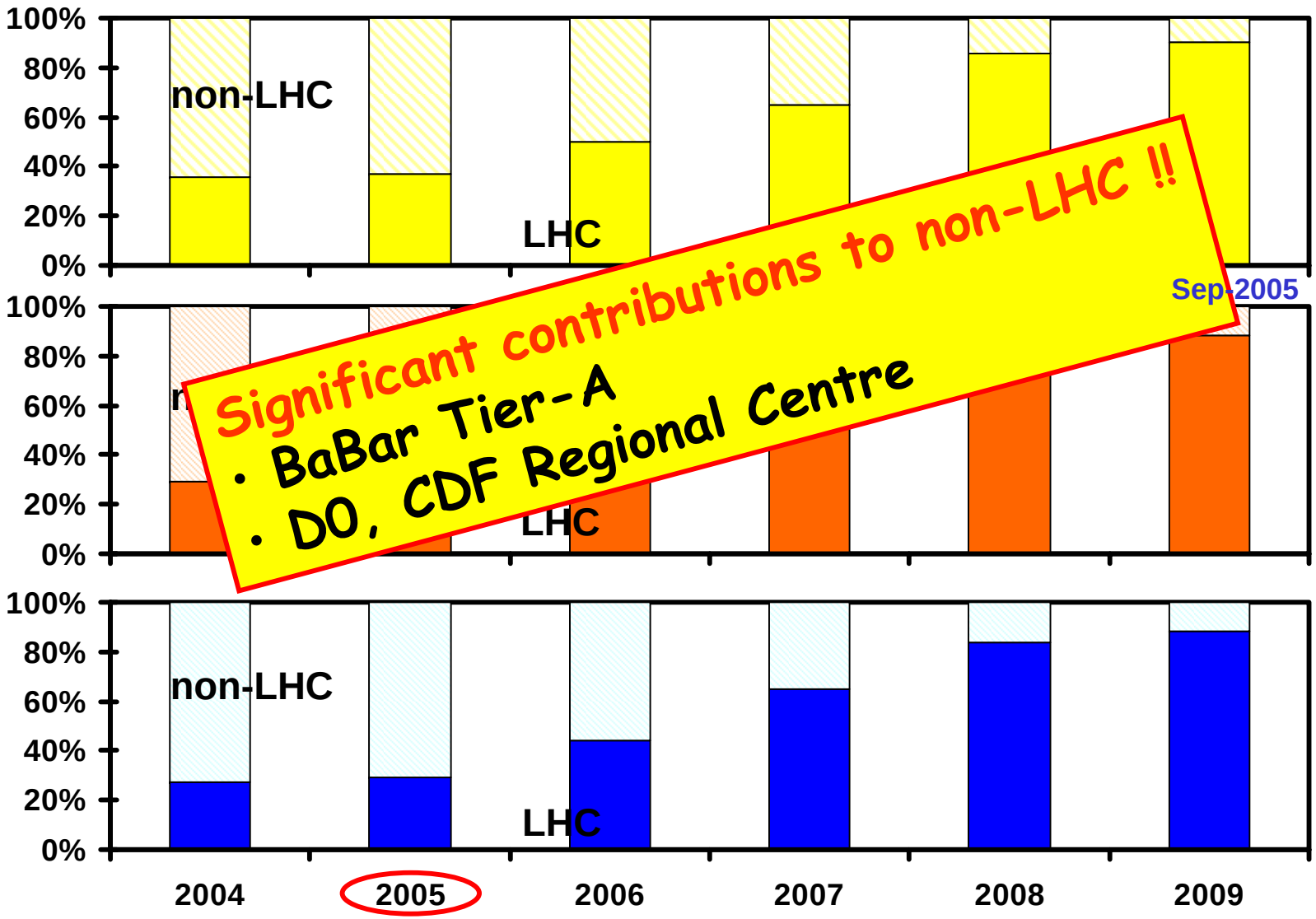
# Requested resources at GridKa (LHC + non-LHC)

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| CPU [kSI2k] | 1440 | 2020 | 3080 | 8300 | 12780 |
| Disk [TB] | 310 | 640 | 1390 | 3860 | 5880 |
| Tape [TB] | 500 | 960 | 1830 | 4460 | 8700 |
| WAN [Gb/s] | 10 | 10 | 10 | 20 | 20 |

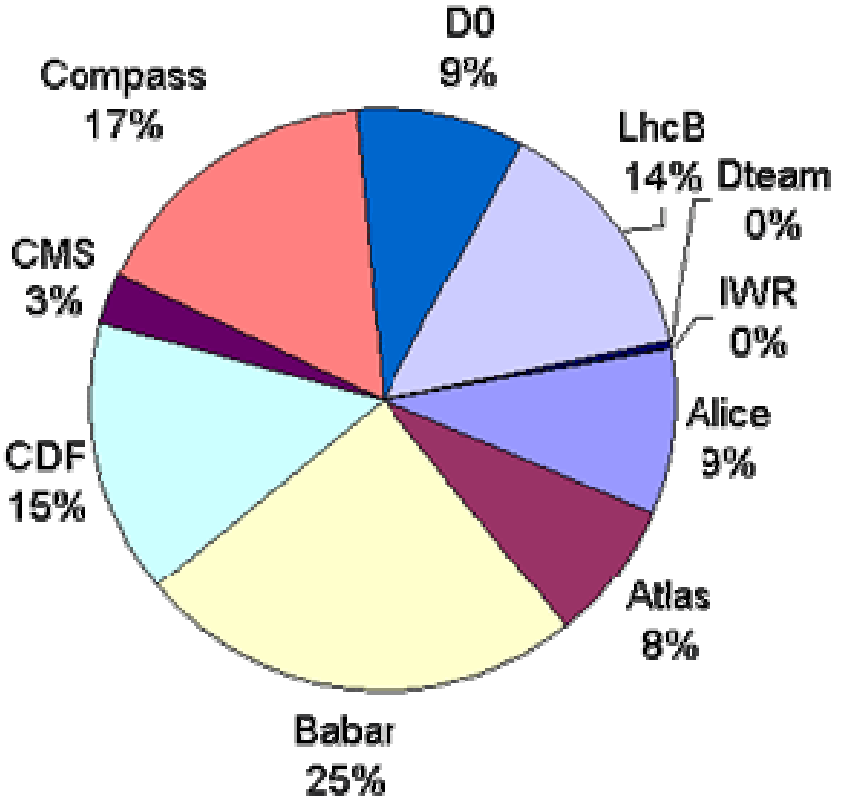



**SC = Service Challenge (between Tier-0/1/2)**

# Distribution of planned resources at GridKa



# Usage of GridKa 2004




| | |
|---|---|
| **LHC** | **34%** |
| **nLHC** | **66%** |

| | |
|---|---|
| **Processor usage [h]** | **4.183.000** |
| **Number of jobs** | **1.442.000** |

# Work done at GridKa as a computing centre

**Infrastructure planning** (floor space, electricity, cooling)

**Resource planning, procurement, installation, exchange**

**Development of tools** (installation, monitoring, inventory db,…)

**Software installation & upgrades** (OS, micro codes, …)

**Connection of disk & tape systems** (TSM, dCache,…)

**Batch system management**

**Security**

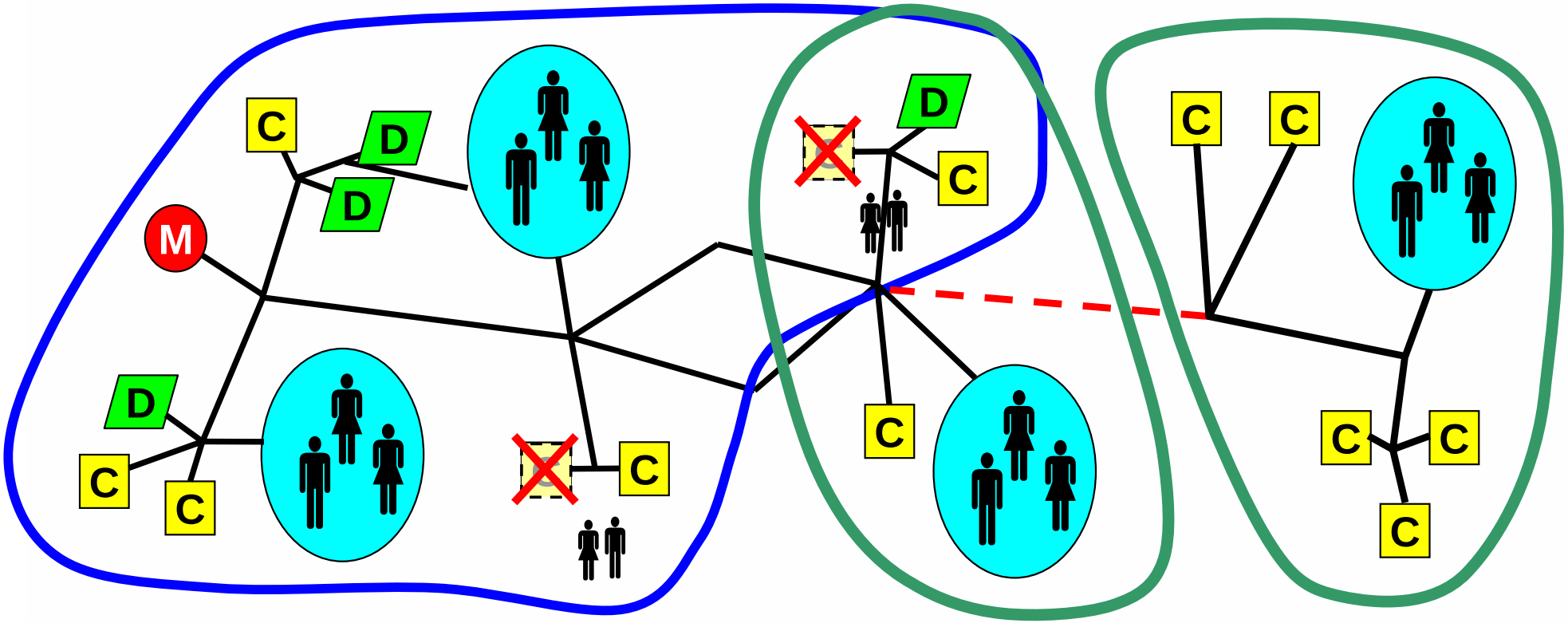
**User support**

**Access & throughput optimization**

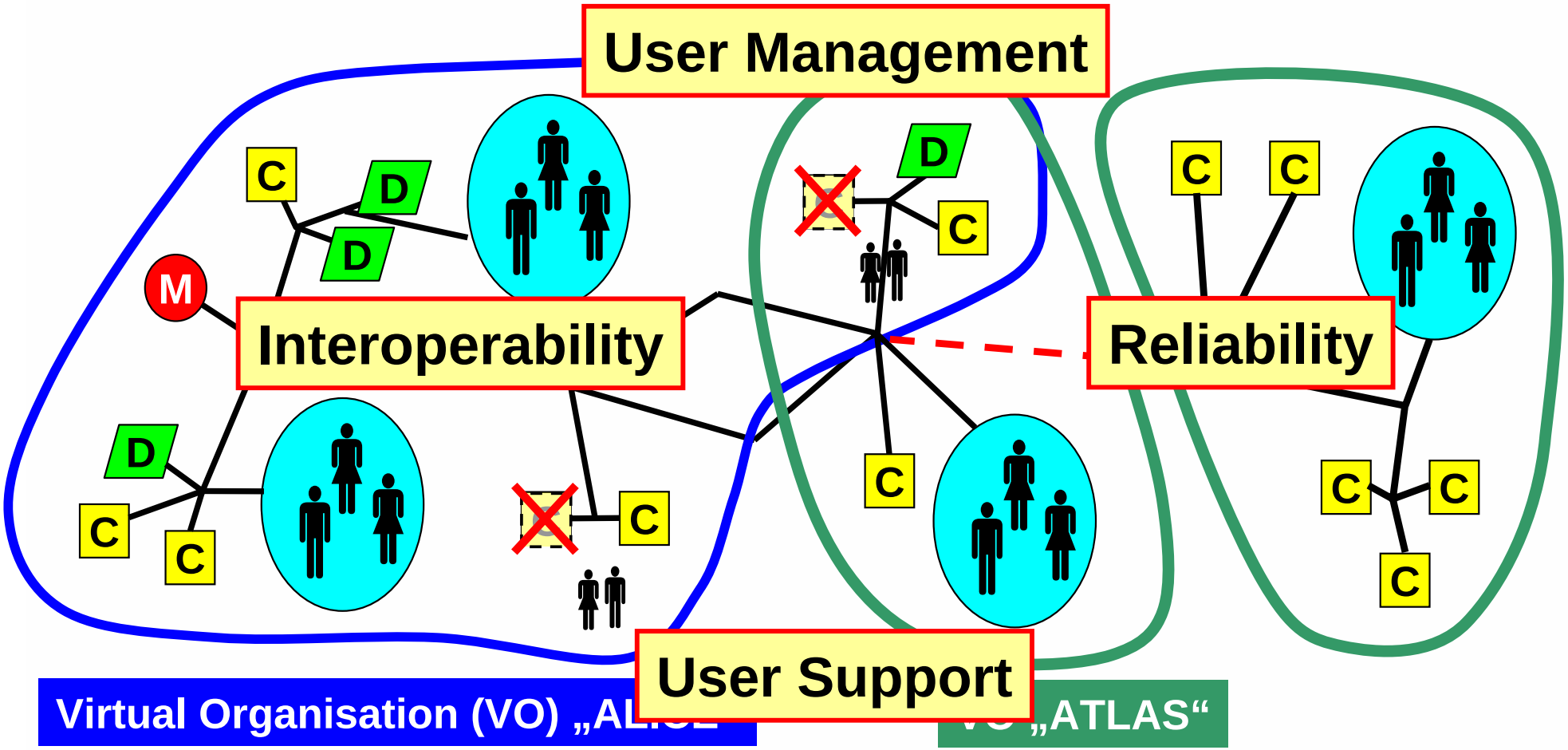
**LCG installations and Service Challenges**

**… plus huge effort for grid operation**

# Global (Grid) operation



# Global (Grid) operation




This thing should be global, dynamic and virtual

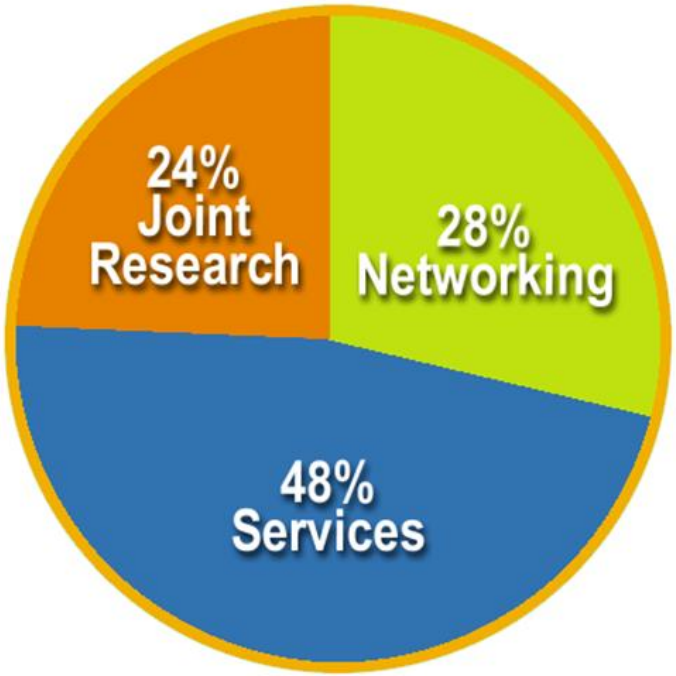
# Project Goals

**Within a four year programme (started in April 2004):**

- **Build, deploy and operate a consistent, robust and secure grid that attracts new computing resources**
- **Improve and maintain the middleware in order to deliver a reliable service to users**
- **Attract new users from science and industry and ensure training and support for them**

# Activities Definition

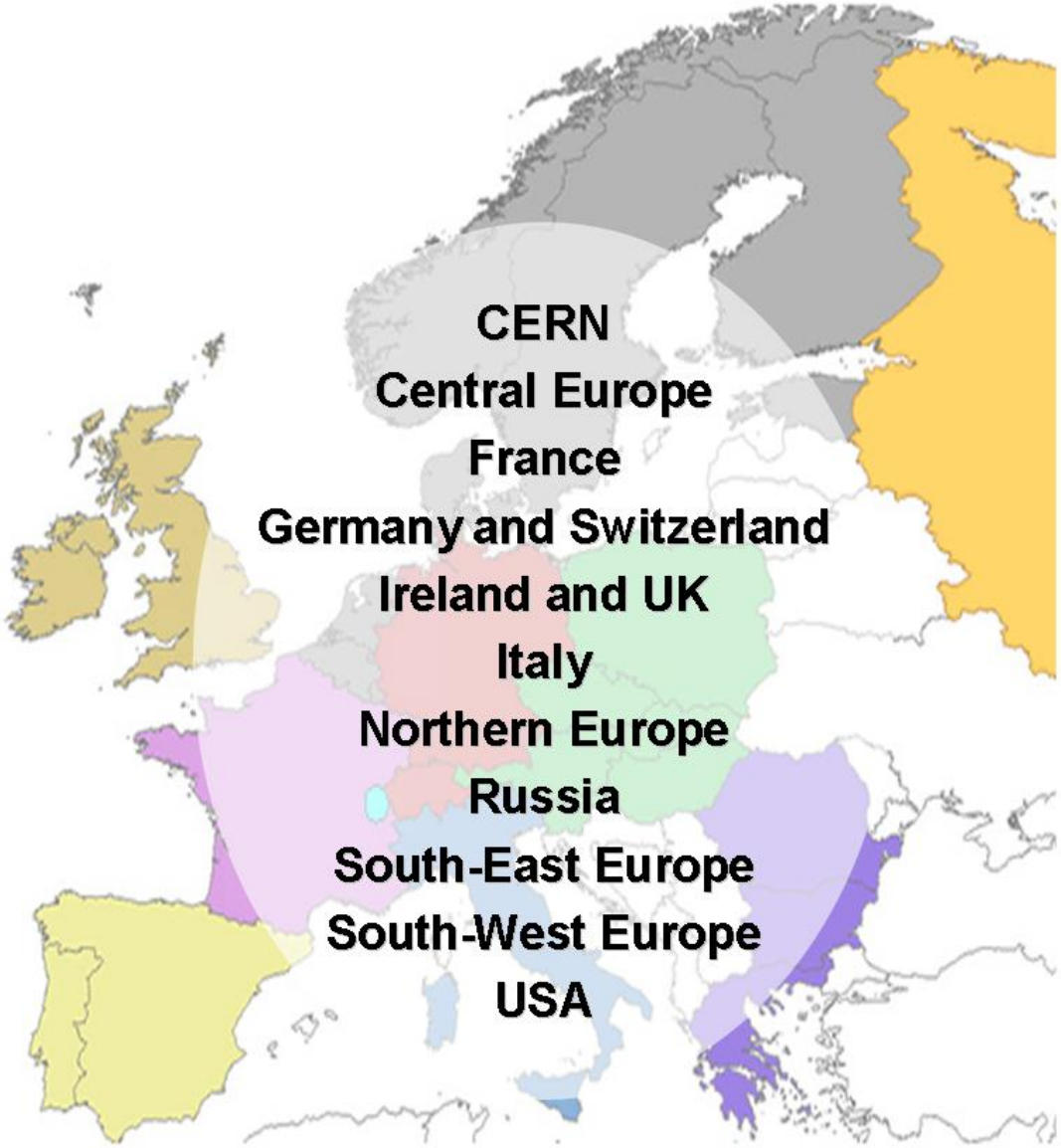
- **Network Activities**
  - NA1: **Project Management**
  - NA2: **Dissemination and Outreach ***
  - NA3: **User Training and Induction ***
  - NA4: **Application Identification and Support**
  - NA5: **Policy and International Cooperation ***
- **Service Activities**
  - SA1: **Grid Support, Operation and Management ***
  - SA2: **Network Resource Provision**
- **Joint Research Activities**
  - JRA1: **Middleware Reengineering + Integration**
  - JRA2: **Quality Assurance**
  - JRA3: **Security ***
  - JRA4: **Network Services Development**




* Forschungszentrum Karlsruhe involved

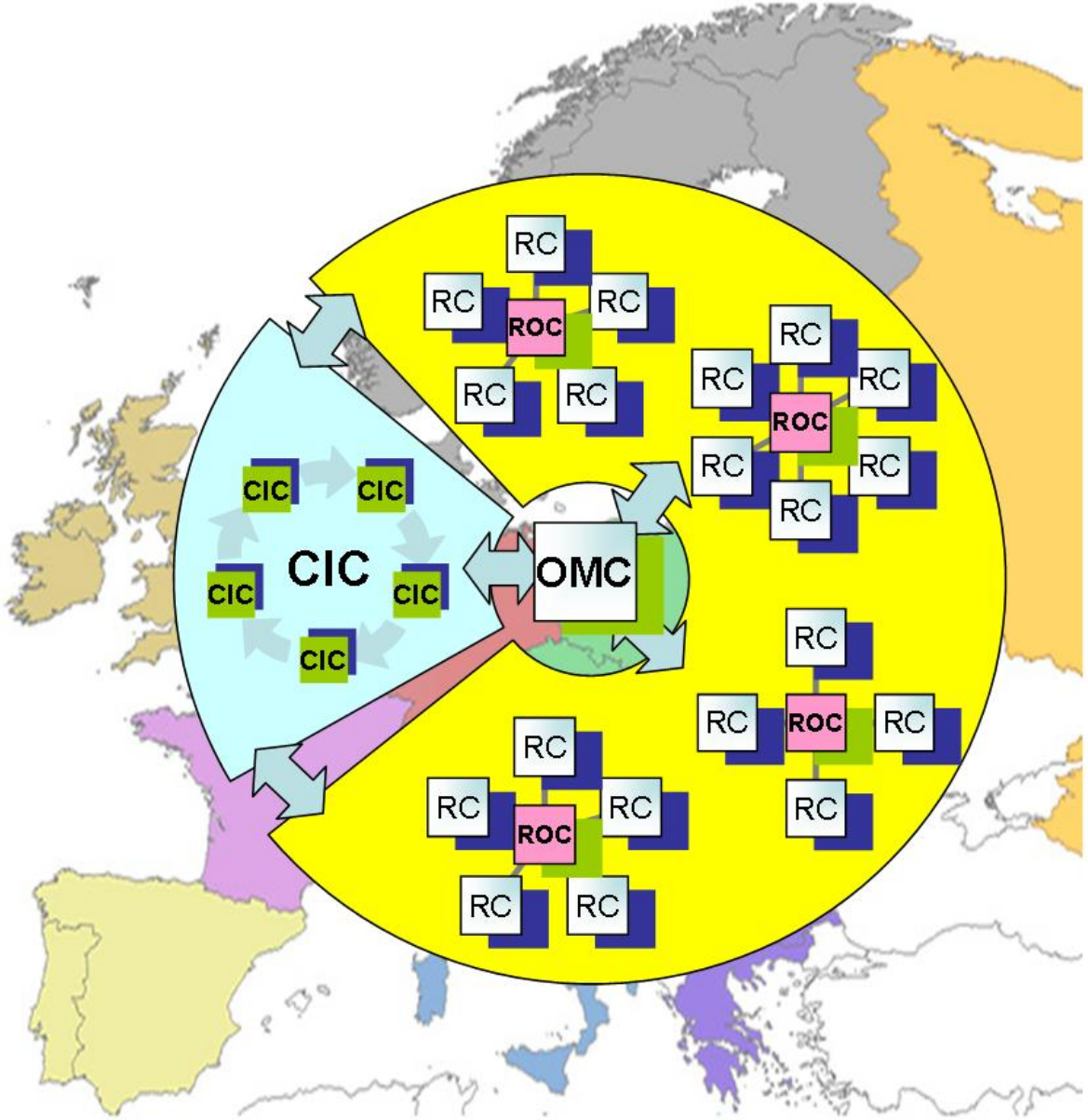
**Emphasis in EGEE is on operating a production grid and supporting the end-users**

# EGEE Organisation




- 70 leading institutions in 27 countries, federated in regional Grids
- ~32 M Euros EU funding for first 2 years starting 1st April 2004
- Leveraging national and regional grid activities
- Promoting scientific partnership outside EU

# SA1 Operations Structure




## 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

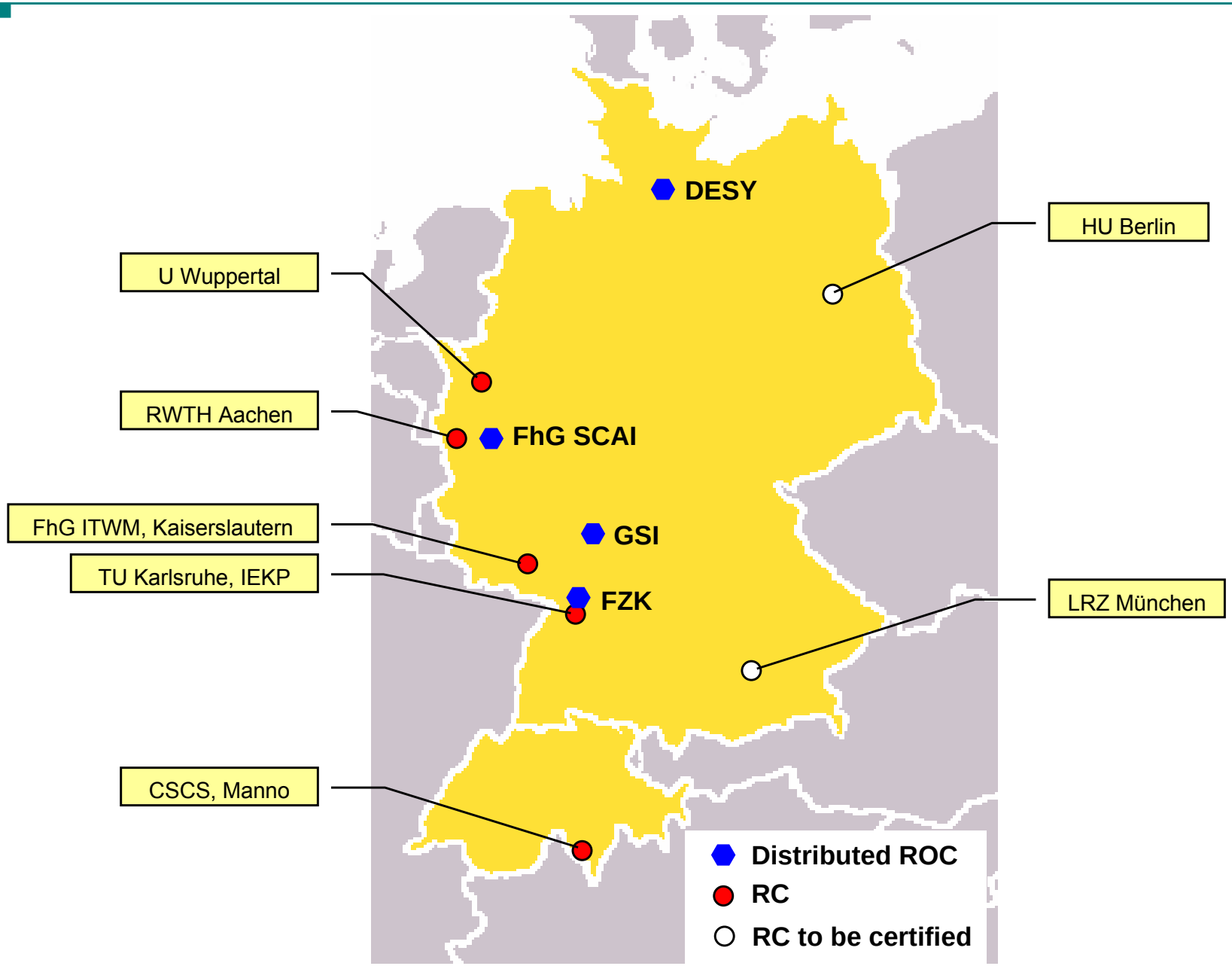
## Resource Centres (RC)

- The sites providing resources

## User Support Centre (GGUS)

- In FZK – manage PTS – provide single point of contact (service desk)

# Centres in D/CH contributing to the EGEE infrastructure



# Resource allocation policy in D/CH

ROC management

| | CSCS | DESY | FZK | GSI | FhG SCAI | FhG ITWM |
|---|---|---|---|---|---|---|
| HEP | yes | yes | yes | yes | | On demand |
| Bio Medicine | | | | | yes | |
| Earth Science | | | | | yes | |
| Computational Chemistry | | | | | | |
| Astrophysics | | | yes (MAGIC) | | | |
| Others | | Synchrotron XFEL | | | | |
| CPUs | 20 | 88 | 1550 | 336 | 30 | 48 |

- 19 supported global and regional VOs
- about 97% of resources for HEP

# Tasks for Grid Operations in the federation

Enabling Grids for E-science in Europe

**Development of policies for**

- User registration
- Registration and certification of new sites
- Resource allocation
- Grid security & incident response
- …

**Development of methods and tools**

- Implement the above policies and refine them
- Middleware roll-out
- Site functional tests
- Resource monitoring
- User & Operations Support
- Weekly operations meetings
- …



GridKa

# Site Functional Tests report

*2005-09-25 -- latest reports*

Help page

Configure view

### Test abbreviations

| | |
|---|---|
| csh | CSH test |
| swdir | VO software directory |
| rgma | R-GMA |
| wn | WN host name |
| ver | Software Version (WN) |
| ca | CA certs version |
| rm | Replica Management |
| votag | VO Tag management |
| js | Job submission |
| bi | BrokerInfo |
| apel | Apel test |

### Colours definition

| | | |
|---|---|---|
| SD | Scheduled downtime | #a3a3a3 |
| JL | Job list match failed | #aab3ff |
| JS | Job submission failed | #f4876b |
| CT | Critical tests failed | #f9d48e |
| NT | Non-critical tests failed | #f2f98e |
| OK | OK | #b2f98e |

### Test summary

| | SD | JL | JS | CT | OK | total |
|---|---|---|---|---|---|---|
| dteam | 22 | 7 | 8 | 11 | 120 | 168 |

| | St. | Region | Site Name | Site CE | VO dteam | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | St. | js | wn | ver | ca | rgma | bi | csh | rm | apel | votag | swdir |
| 1. | OK | SouthEasternEurope | AEGIS01-PHY-SCL | ce.phy.bg.ac.yu | OK | O | I | O | O | O | O | O | O | W | O | O |
| 2. | JS | Canada | ALBERTA-LCG2 | lcgce01.nic.ualberta.ca | JS | X | I | O | O | O | O | O | O | W | W | O |
| 3. | OK | China | BEIJING-LCG2 | lcg002.ihep.ac.cn | OK | O | I | O | O | X | O | O | O | W | O | O |
| 4. | OK | SouthEasternEurope | BG-INRNE | ce1.inrne.bas.bg | OK | O | I | O | O | O | O | O | O | W | O | O |
| 5. | OK | SouthEasternEurope | BG01-IPP | ce001.grid.acad.bg | OK | O | I | O | O | O | O | O | O | W | O | O |

# GermanGrid CA (GridKa-CA)

**Delivers X.509 certificates for German users, hosts & applications**

**2001: supported / connected to DataGrid**

**2002: continued within CrossGrid**

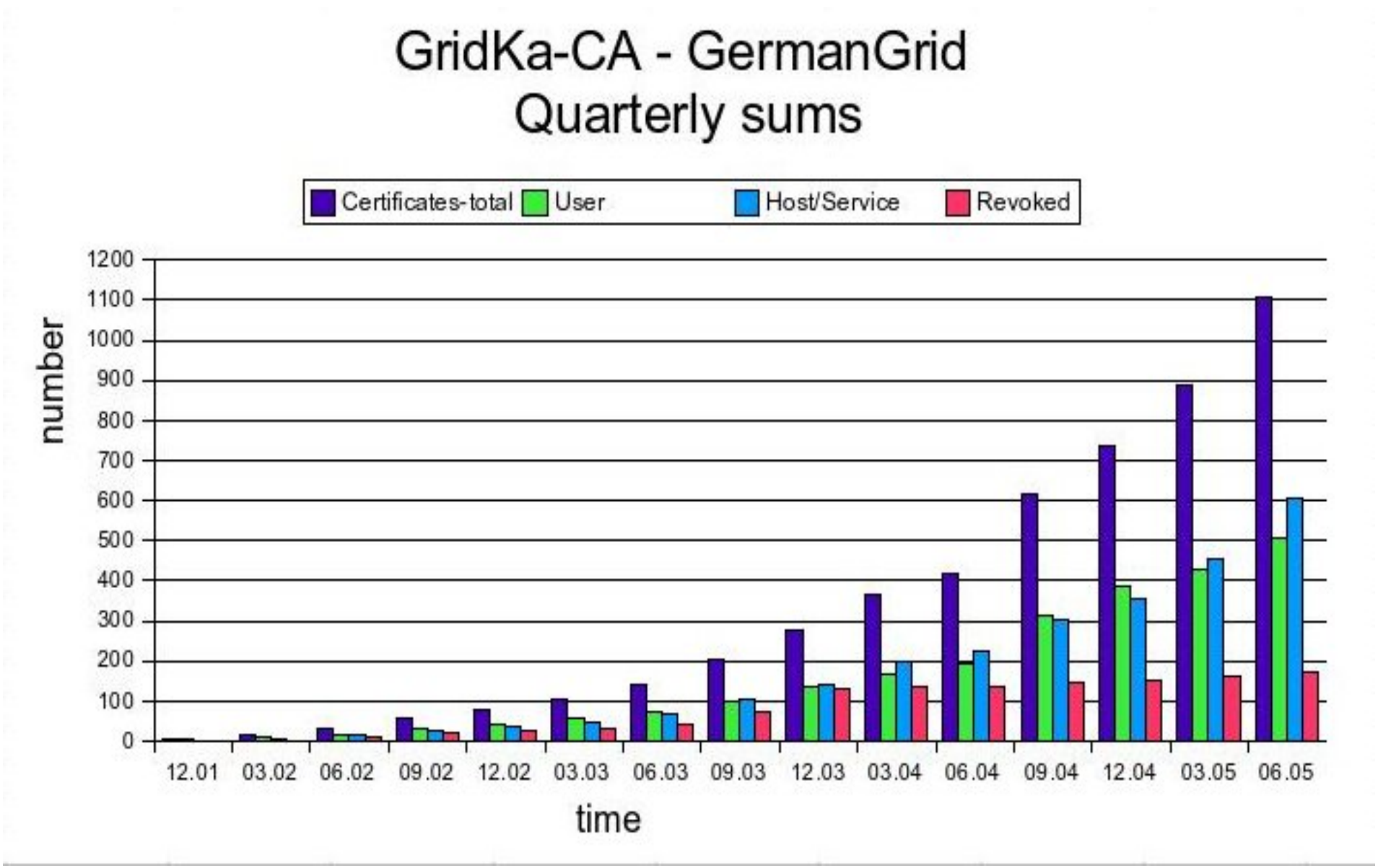
**2004: contributes to EGEE**

**Became member of EUGridPMA**

**EUGridPMA – European Grid Policy Management Authority**

***"Coordinates the European Public Key Infrastructure (PKI) for use with grid authentication middleware"***

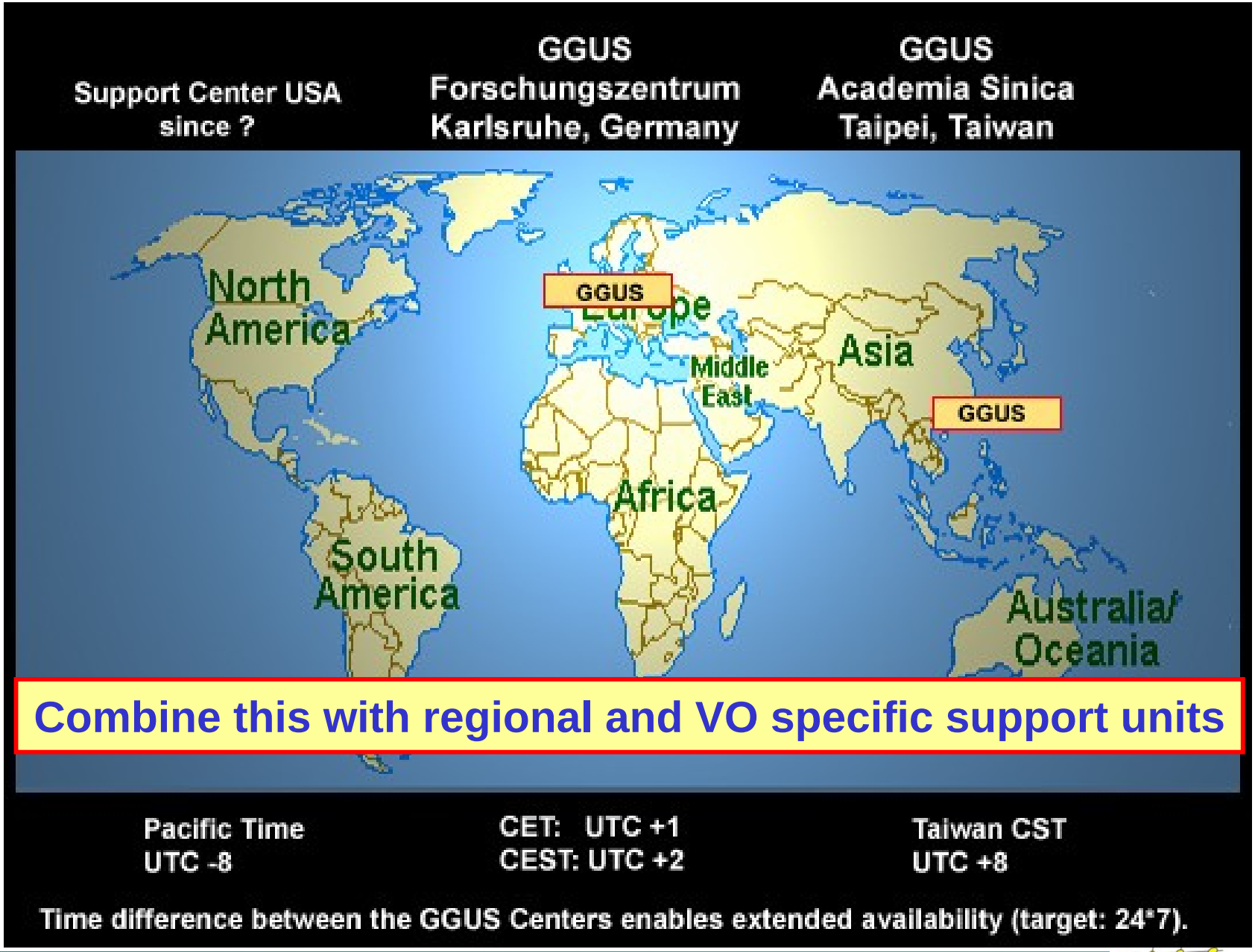
- **develops PKI and CA policies; provides root CAs**
- **>35 member CAs in Europe**
- **collaborates with APGridPMA (Asia-Pacific) and TAGPMA (America)**


GridKa-CA - GermanGrid
Quarterly sums
Certificates-total
User
Host/Service
Revoked
number
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
12.01
03.02
06.02
09.02
12.02
03.03
06.03
09.03
12.03
03.04
06.04
09.04
12.04
03.05
06.05
time

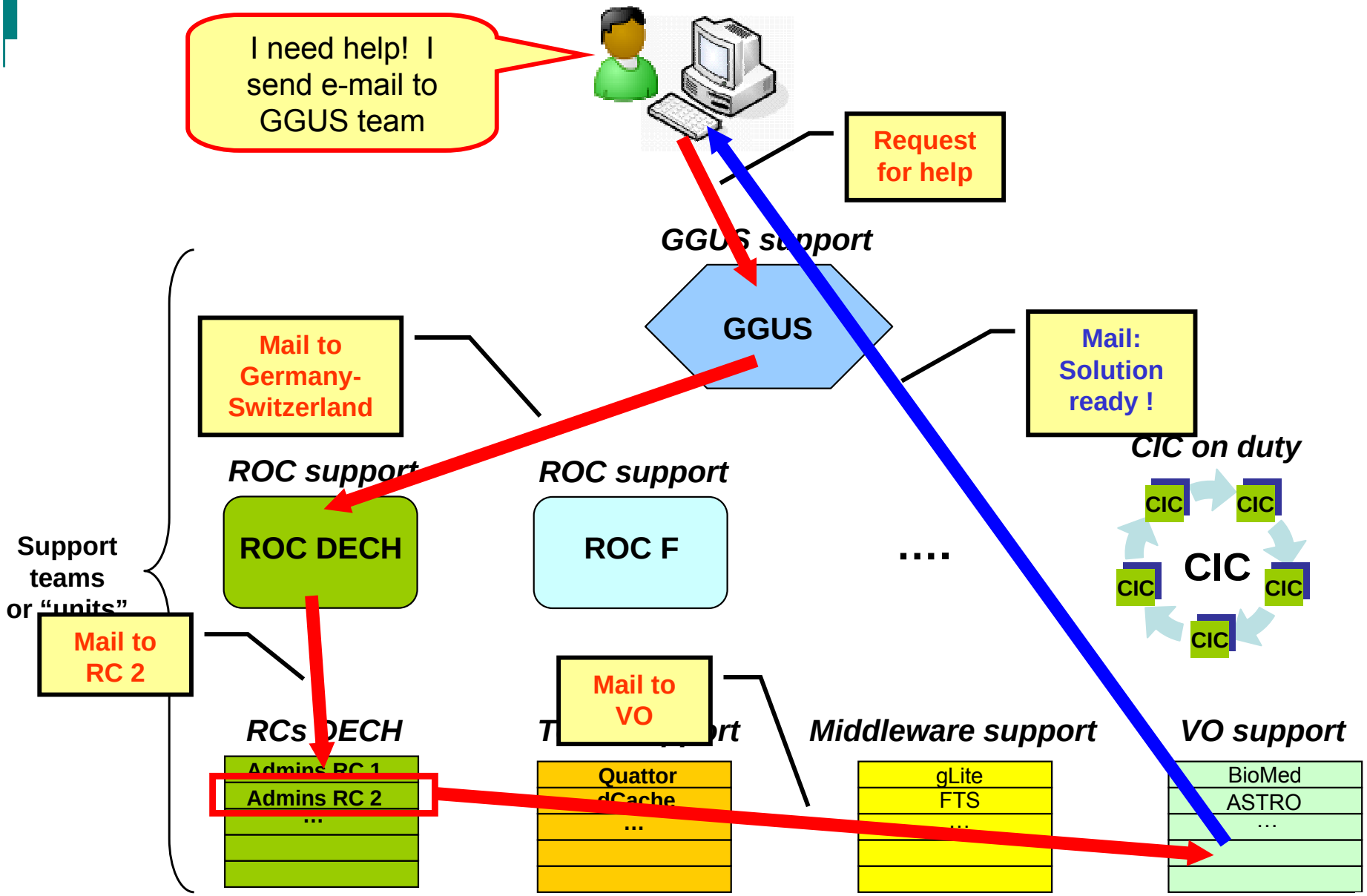
# GGUS

(Global Grid User Support)

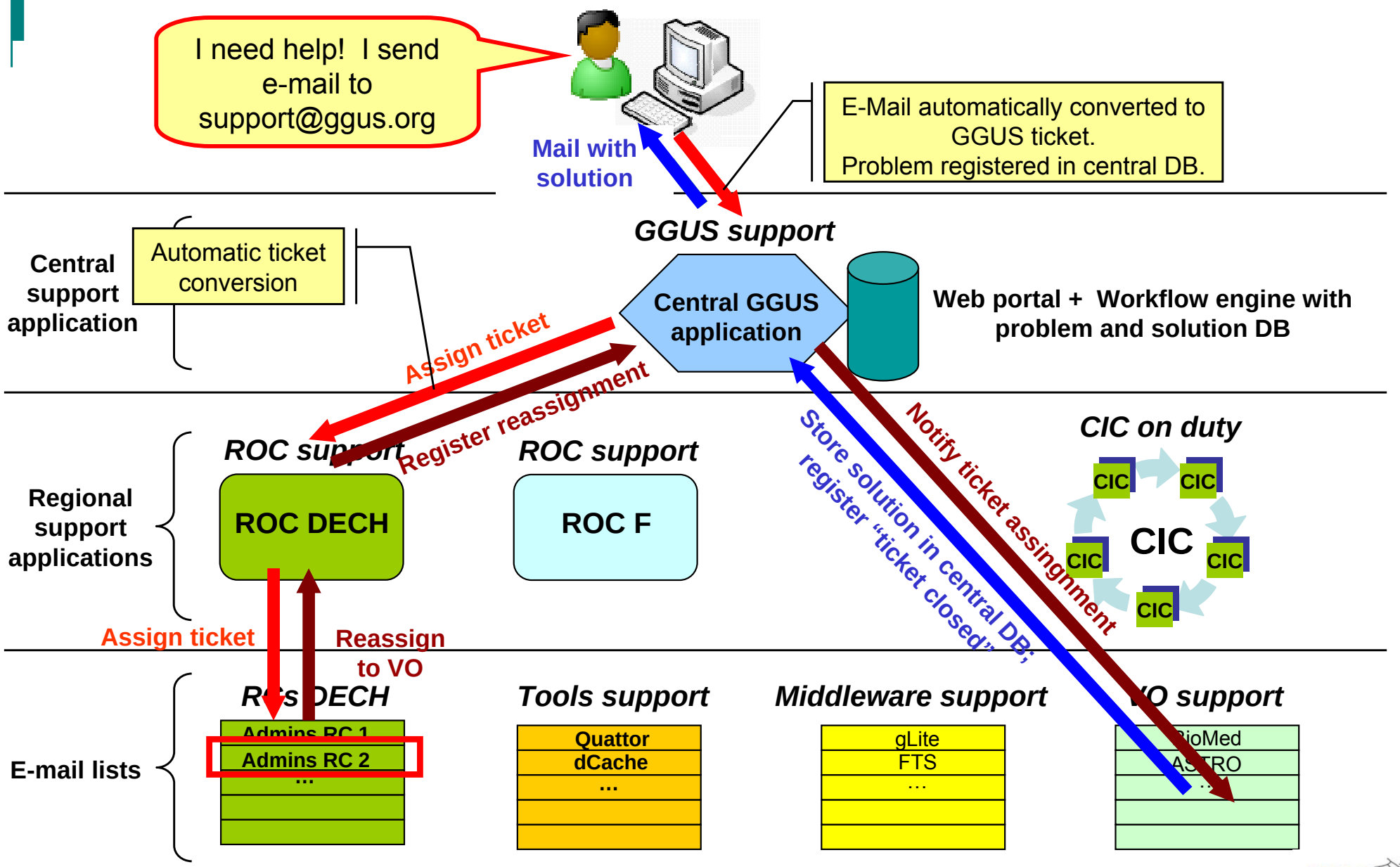
www.ggus.org



# User support: "classical" communication model



# User support: GGUS application model



# Advantages and challenges of the GGUS appl. model

Enabling Grids for E-science in Europe

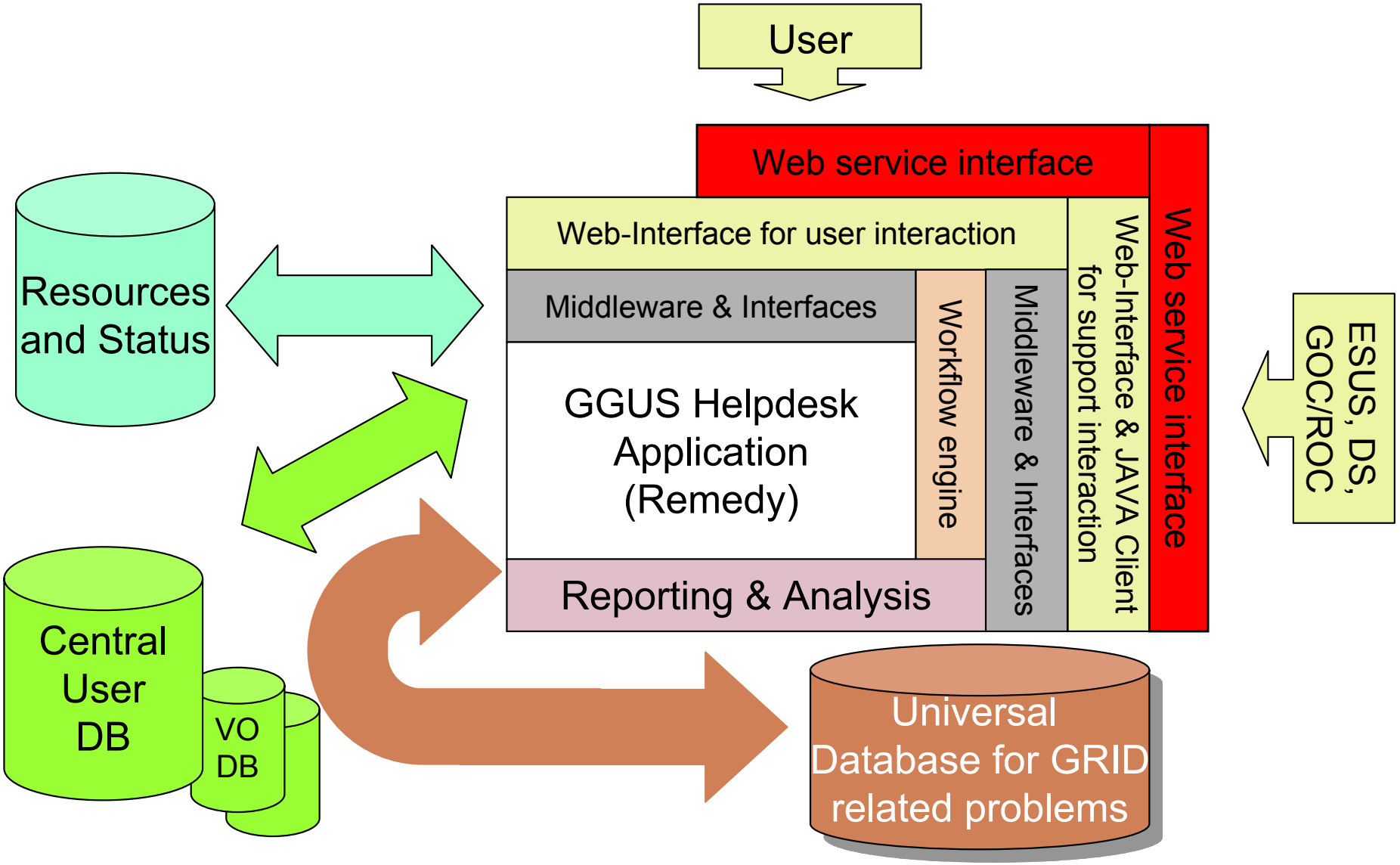
## Advantages

- All steps of the support process are registered centrally
- User and all involved units can monitor the support process
  - ⇨ communication always synchronised
- Workflow can be optimised (automatised)
- Problems and solutions stored for re-use (solution DB)

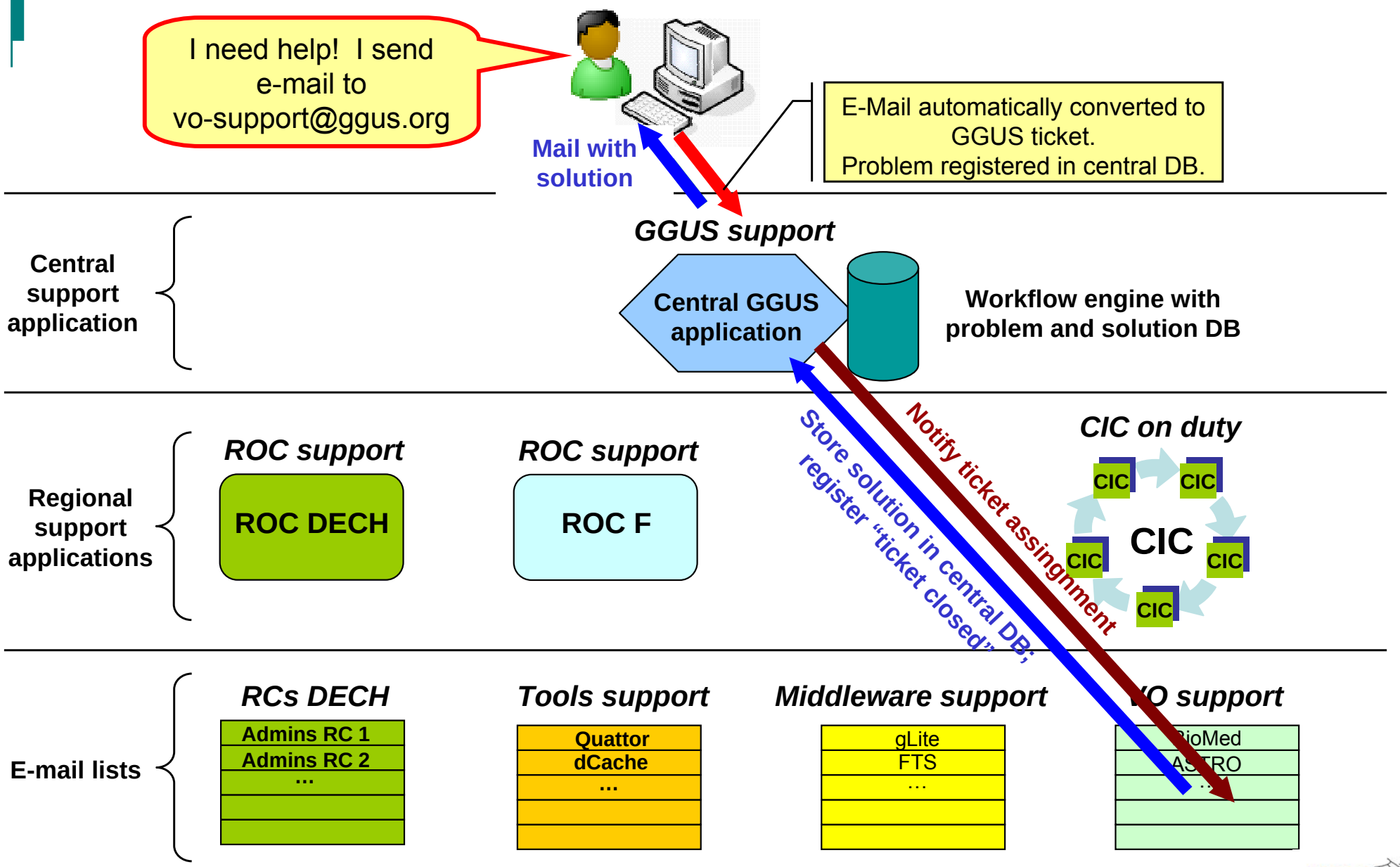
## Challenges

- to define the support units (find the people)
- to develop and implement the workflow
- to develop the central GGUS application
- to develop interfaces between the GGUS application and those applications used by the ROCs, CICs, VOs, ...

# GGUS application system architecture



# User support: GGUS application model



# User support: alternative path


**Central support application**

***GGUS support***

**Central GGUS application**

**Workflow engine with problem and solution DB**

**Regional support applications**

***ROC support***

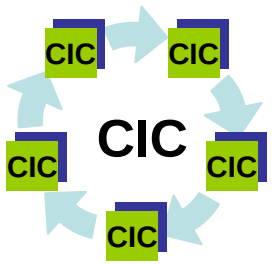
**ROC DECH**

***ROC support***

**ROC F**

Interfaces among applications

***CIC on duty***




**E-mail lists**

***RCs DECH***

- Admins RC 1
- Admins RC 2
- …

***Tools support***

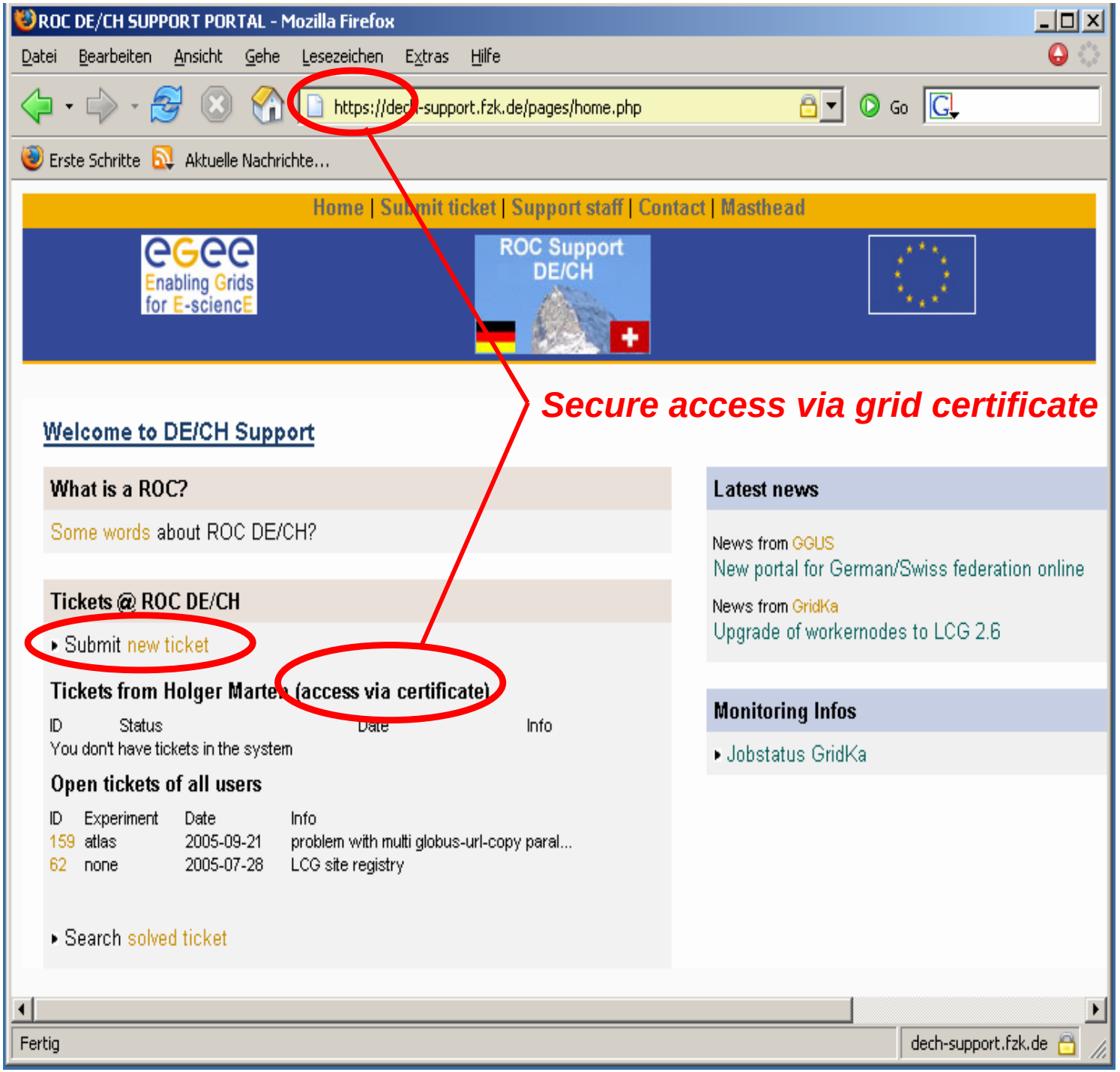
- Quattor
- dCache
- …

***Middleware support***

- gLite
- FTS
- …

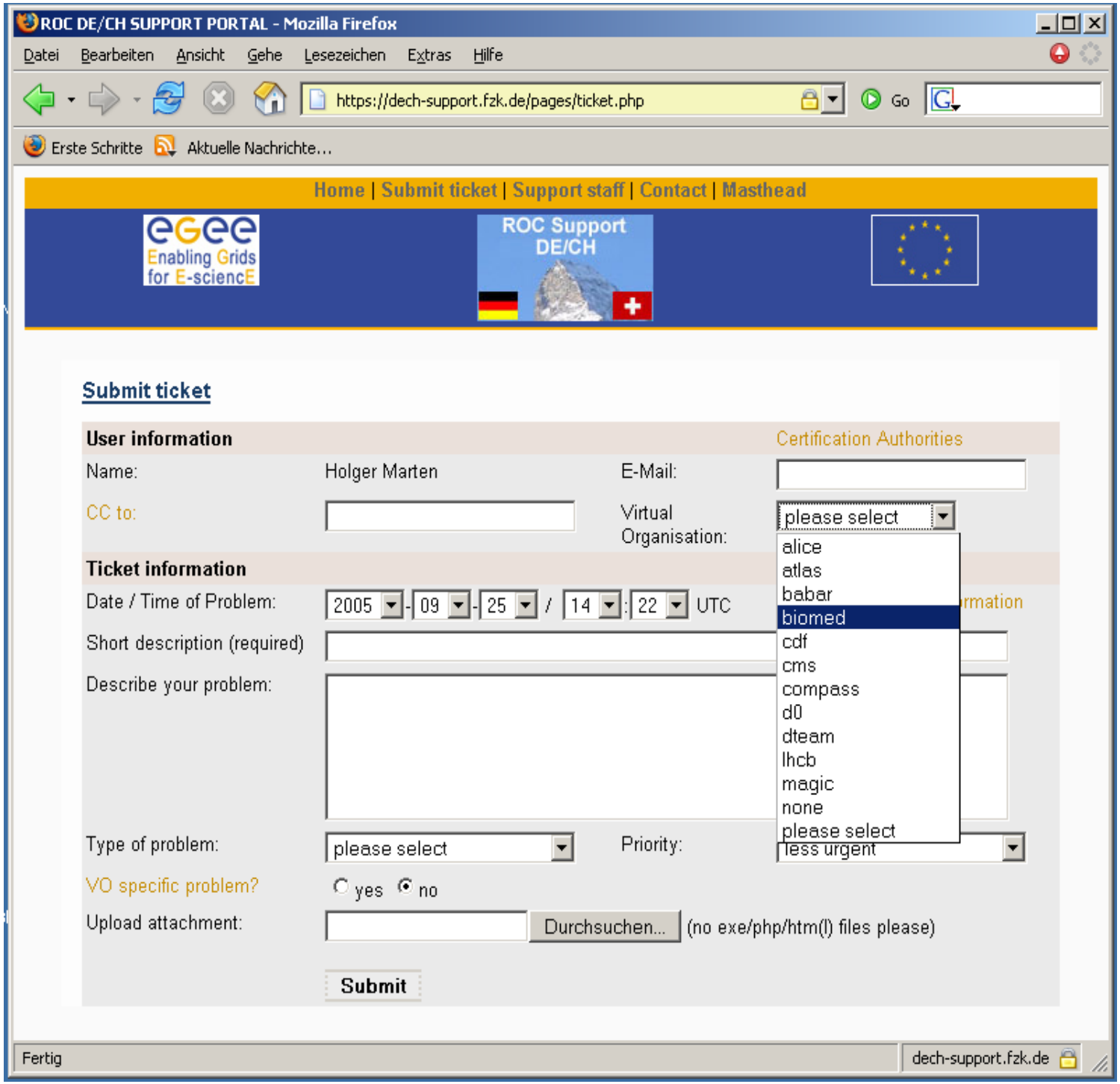
***VO support***

- BioMed
- ASTRO
- …




# User view

**http://dech-support.fzk.de**



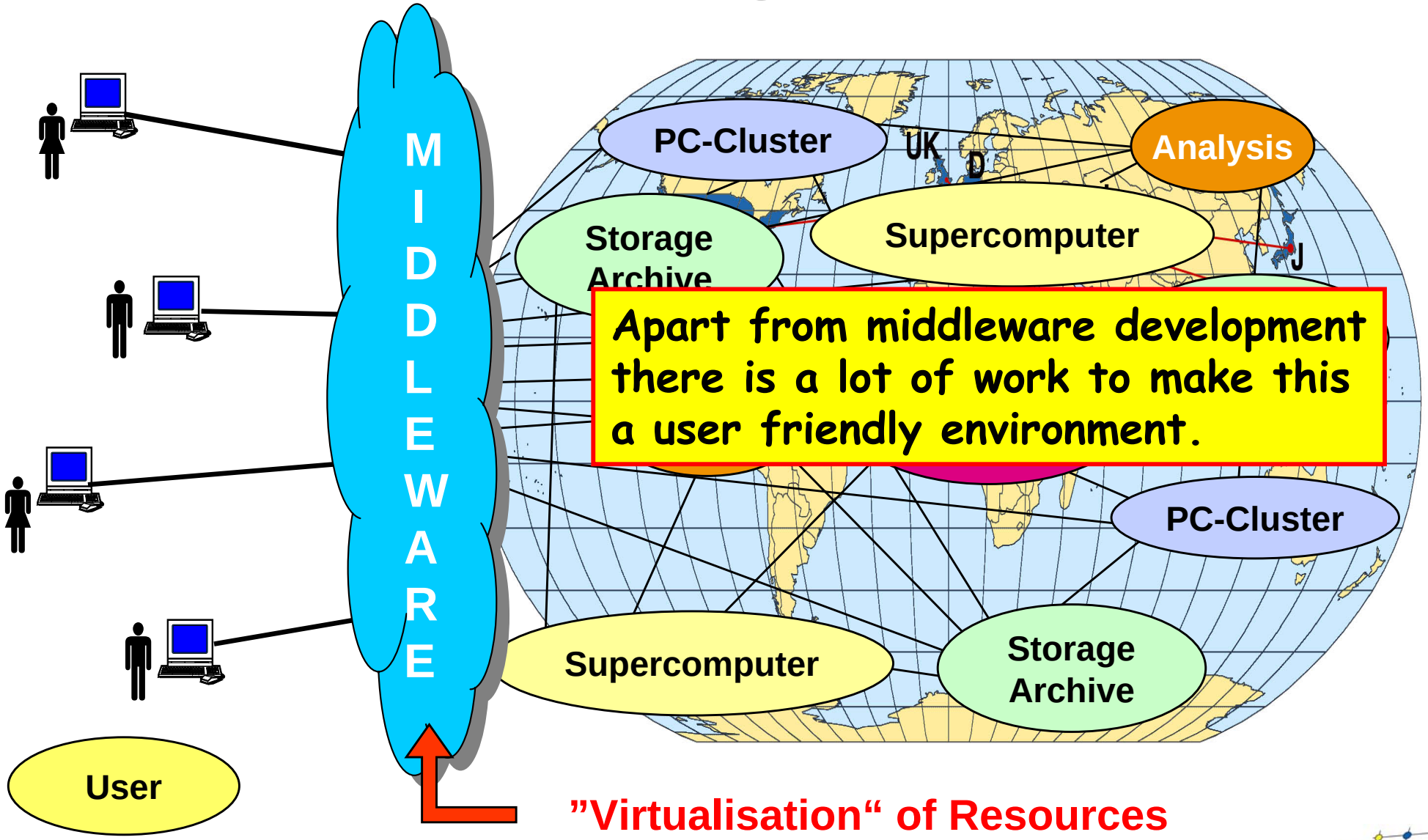

Enabling Grids for E-science in Europe

# User view

## "submit ticket"

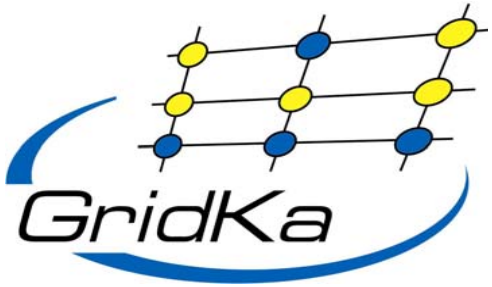
**http://dech-support.fzk.de**

# Concluding remarks




**”Virtualisation“ of Resources**

# Concluding remarks





## Thank you !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Bundesministerium
für Bildung
und Forschung