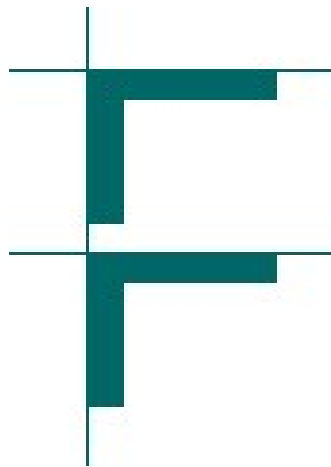


# EGEE: crafting a production quality Grid environment



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Forschungszentrum Karlsruhe / Germany*

*Varna, 16.9.05*

*Some slides contributed by  
EGEE team, FZK members*

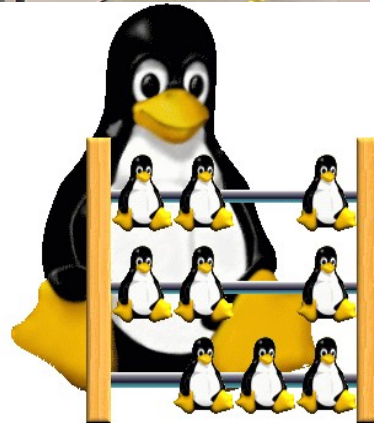
# Forschungszentrum Karlsruhe



Institute for Scientific Computing (IWR)

- Part of the „Helmholtz Gemeinschaft“
- One of the largest independent German research institutions
- Many different research areas ranging from environmental studies over nano technology to Grid Computing

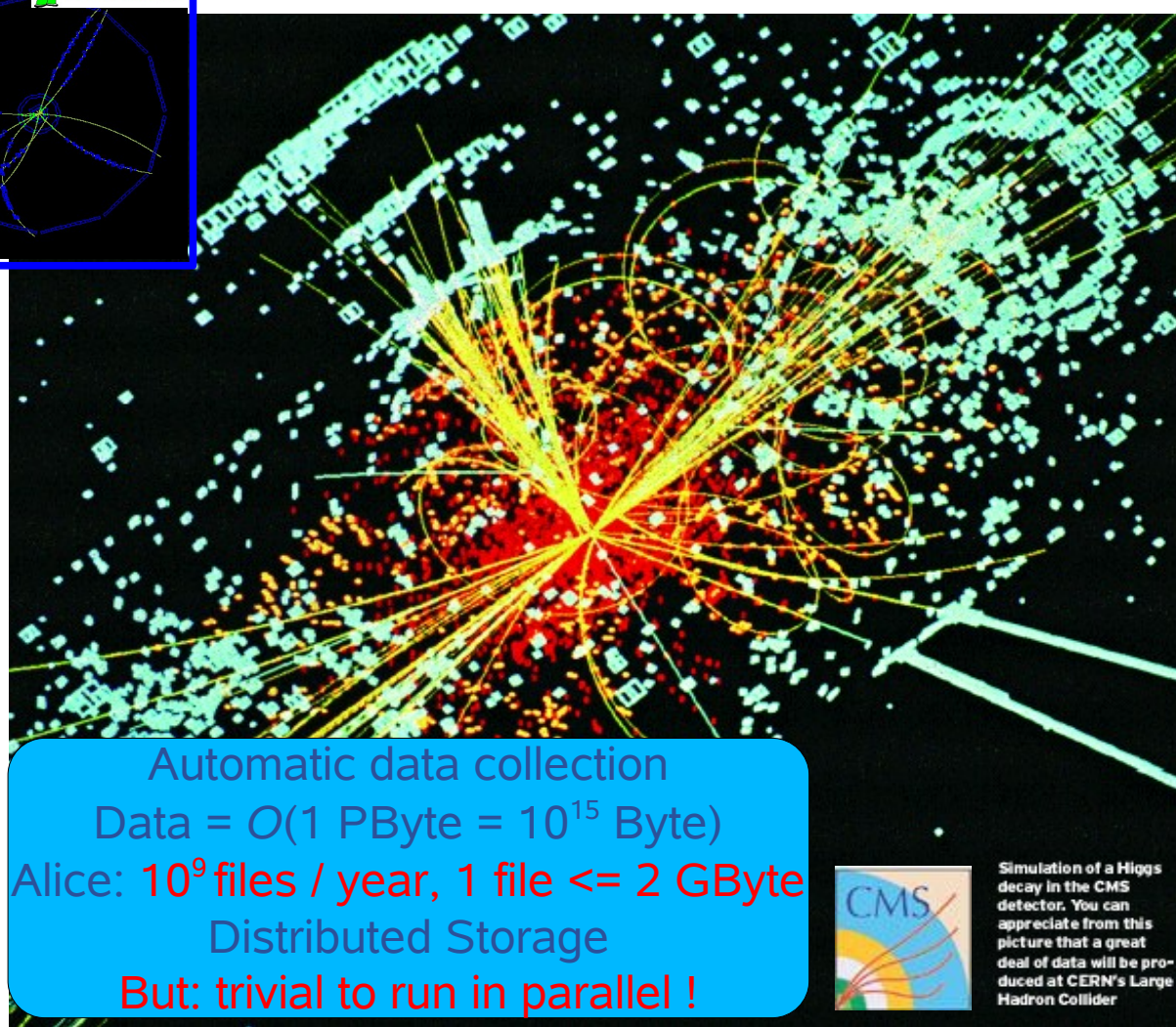
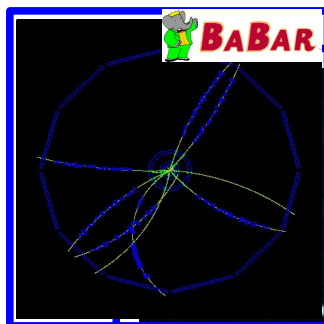
## Tier-1 centre in LCG



 **Scientific Linux**

In LHC:  
Expect data rates of  
10 - 40 Petabytes  
for all experiments  
per year.

But: trivial to  
run in  
parallel ...



Automatic data collection  
Data =  $O(1 \text{ PByte} = 10^{15} \text{ Byte})$   
Alice:  $10^9$  files / year, 1 file  $\leq 2 \text{ GByte}$   
Distributed Storage  
But: trivial to run in parallel !



Simulation of a Higgs decay in the CMS detector. You can appreciate from this picture that a great deal of data will be produced at CERN's Large Hadron Collider

## Over 6000 LHC Scientists world wide

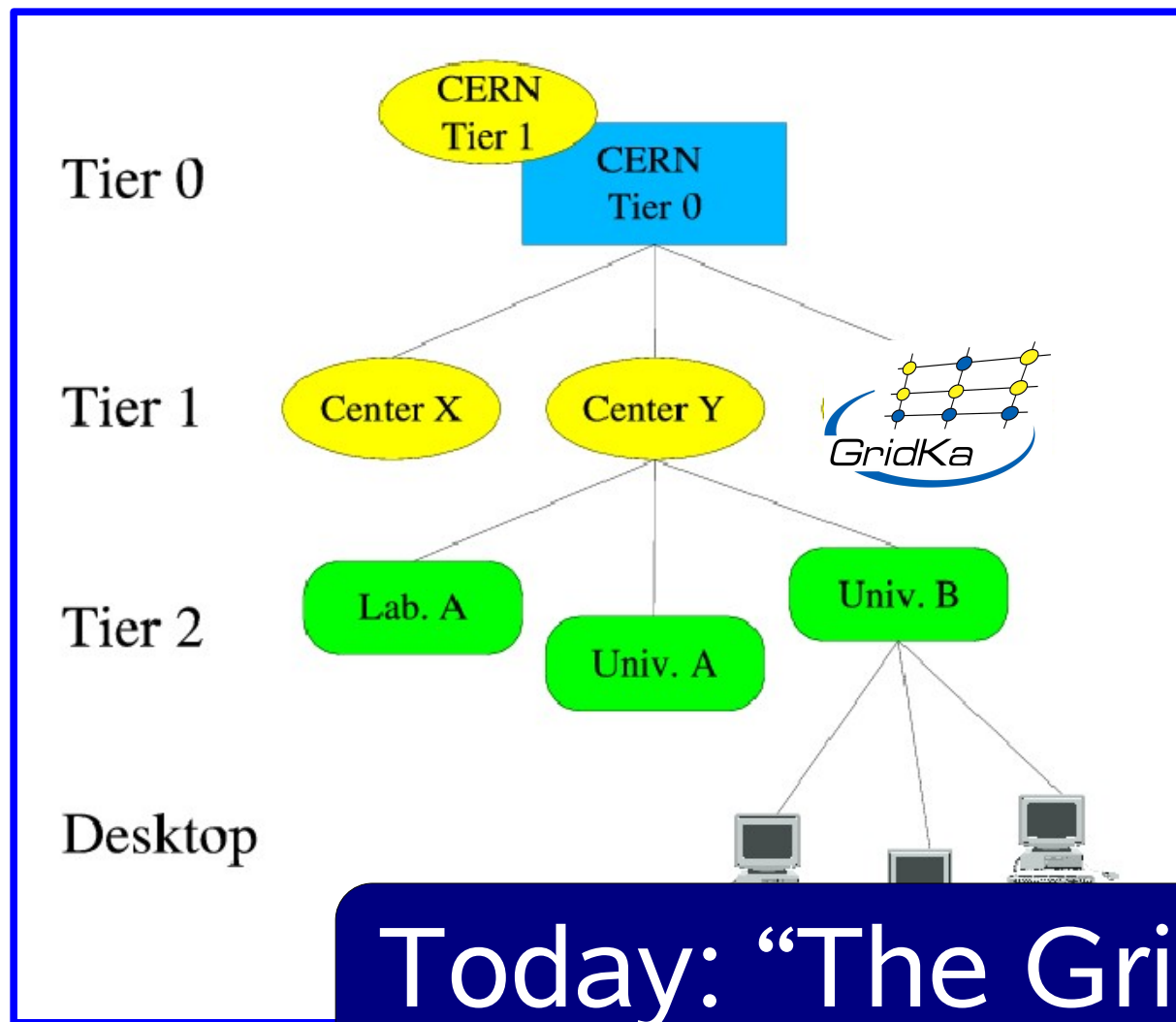


Want transparent and quick access (very rightly so).  
Interested more in physics results, than computing revolutions

Europe: 267 Institutes, 4603 Users  
Other: 208 Institutes, 1632 Users

- Basic idea: hierarchical distribution of tasks
- Idea accepted by the **LHC Computing Grid** (responsible for planning and management of LHC computing)
- Tier-0: Initial reconstruction and storage of raw events, distribution to Tier-1
- Tier-1: Data-heavy analysis, reprocessing of data, regional support
- Tier-2: Managed disk storage, simulation of PP events, computing

\* MONARC == Models Of Networked Analysis at Regional Centers



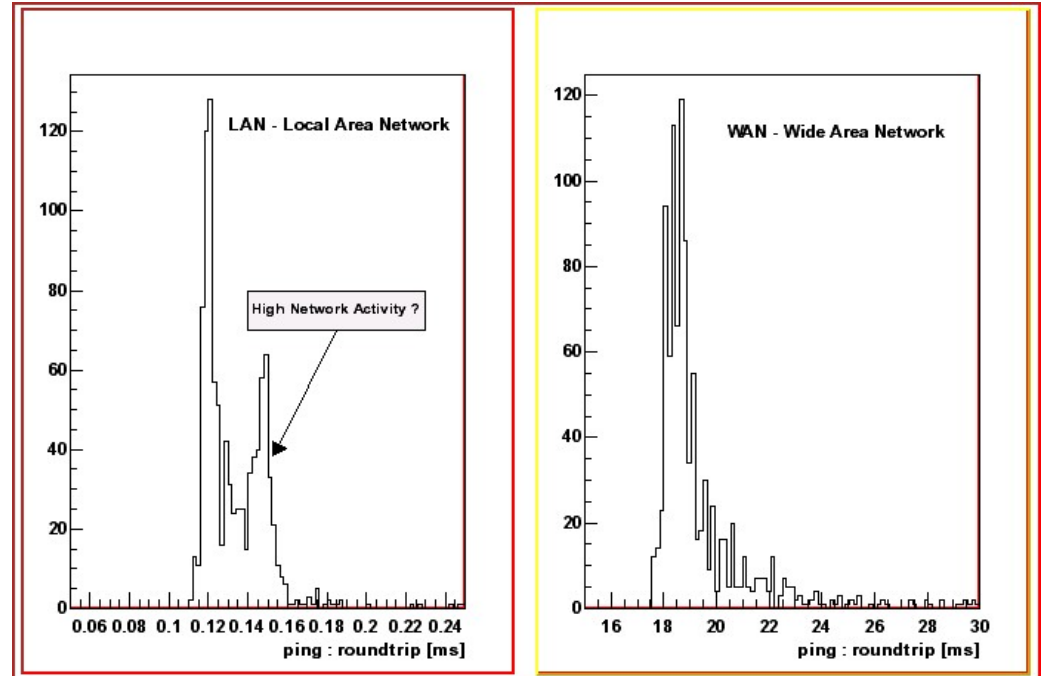
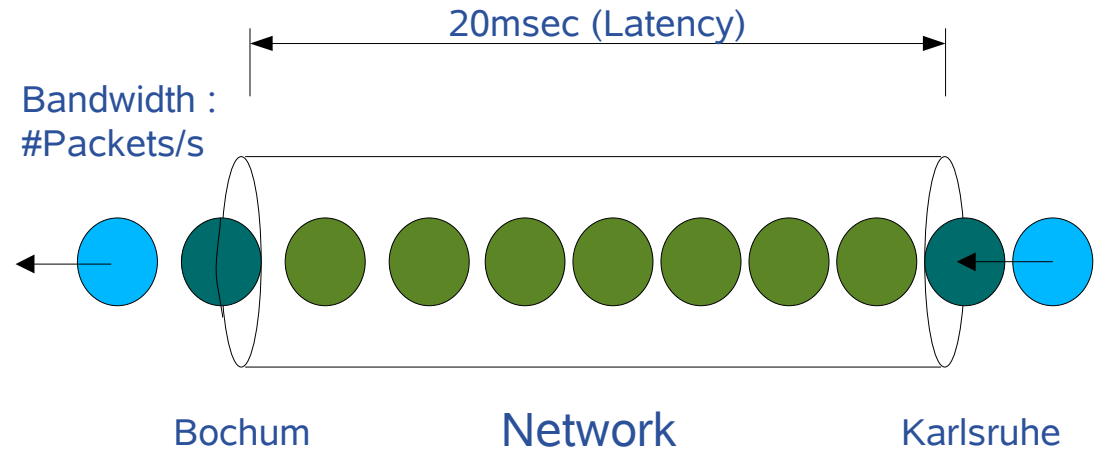
**Today: “The Grid”**  
(with many meanings ...)

Need:

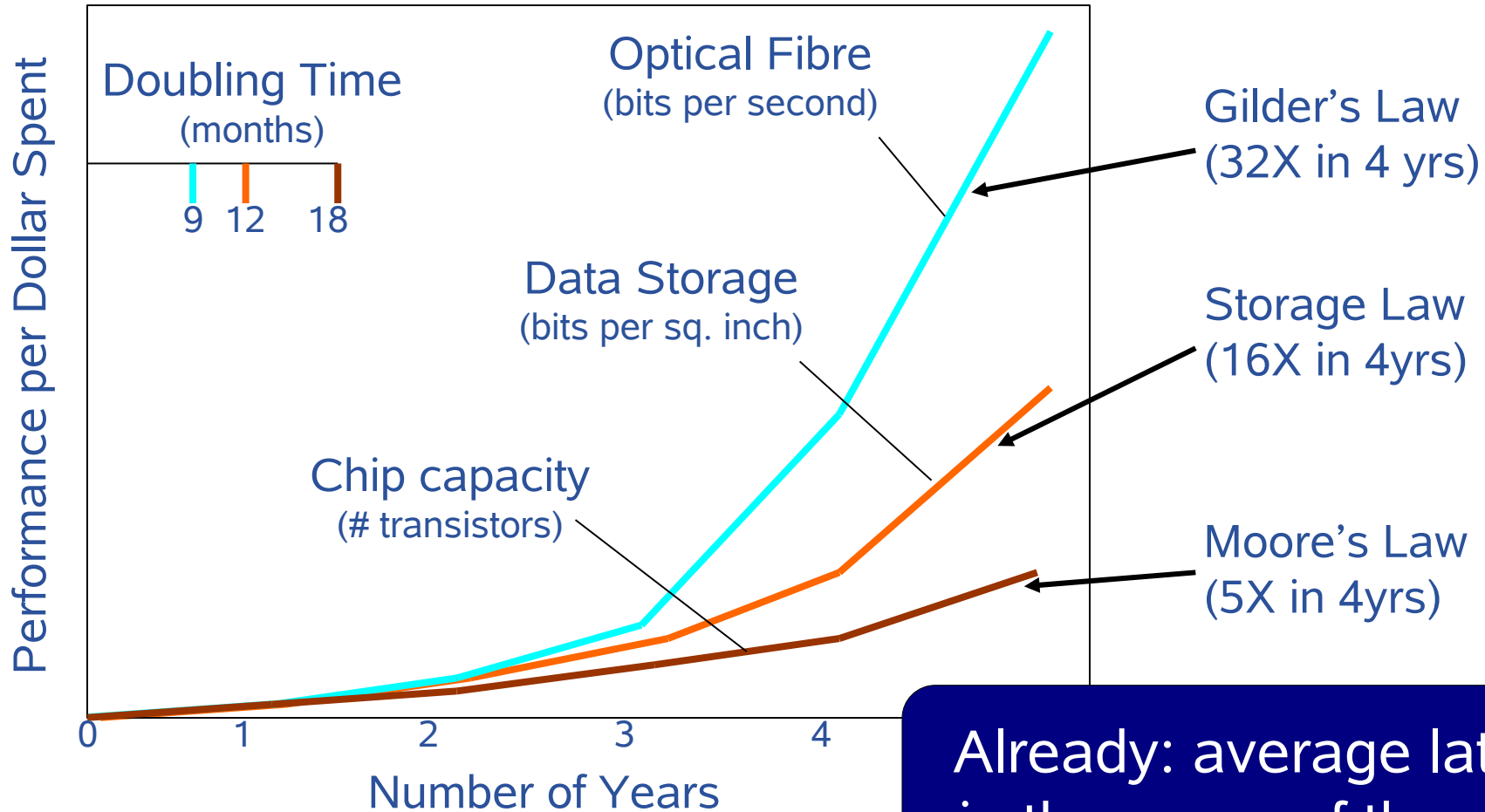
- transparent access to data
  - replication, virtualisation,
  - global filesystems, ...
- secure storage, authentication and authorisation
  - access control (Unix ...), PKI infrastructure, CA, agreed policies, VO
- accounting (computing costs money)
  - not really solved
- training, support
  - GGUS, EGEE Workpackages
- fast networks (low latency, high bandwidth)
  - Geant, DFN, ....

Need: (a) software layer “middleware”, (b) fast networks, (c) common policies and (d) services

- „Speed“ of a network consists of two components
- Bandwidth (scales to any number)
- Latency (doesn't scale)
- Possible application types in a Grid are limited by latency
- But PP is not a problem
- However: applicability of our approaches not given for some Grid types !





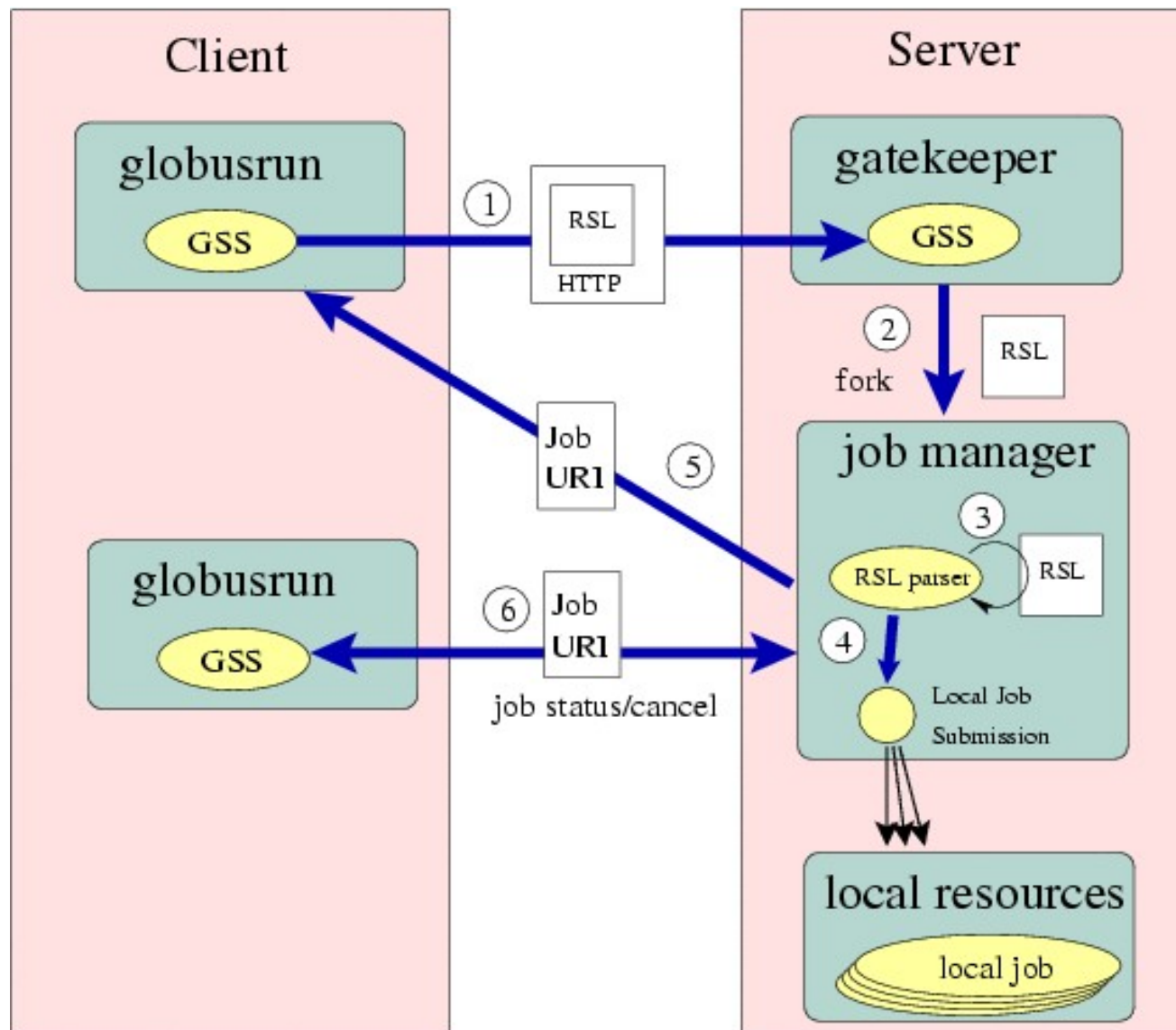


Triumph of Light – *Scientific American*. George Stix,

Already: average latency in the range of the mean access times of an old MFM harddrive !!!

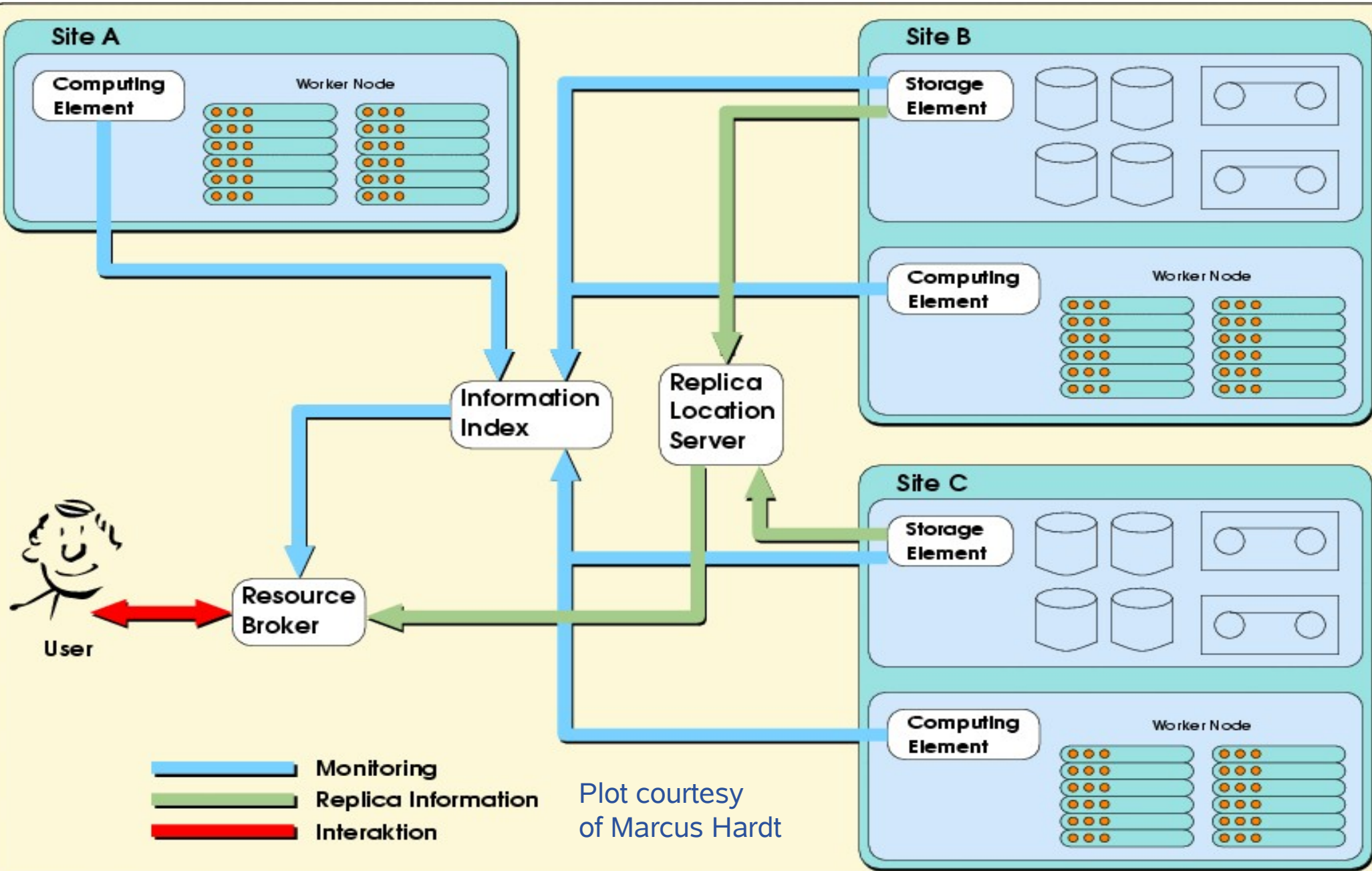
## Globus (Version 2)

- 1.) Job transmission to server via HTTP as an RSL document
- 2.) Server forks jobmanager, hands over RSL document
- 3.) jobmanager parses RSL, checks the job requirements
- 4.) jobmanager distributes the job to local resources in cluster
- 5.) jobmanager sends a unique job id (URI) to the client
- 6.) The client can use the URI to cancel the job, when needed, or gain status information



Plot courtesy of Marcus Hardt

Plot courtesy Dr. Harald Kornmayer



<http://www.cordis.lu/ist/grids/projects.htm>

The screenshot shows a web browser window displaying a list of grid projects. The browser's address bar shows the URL <http://www.cordis.lu/ist/grids/projects.htm>. The page content includes a table of projects with columns for Project Acronym, Focus of project, Contract type, Commission project officer, Start date, End date, and Project website. A large red text overlay reads: "Many brilliant people with many brilliant (but often totally incompatible) ideas".

Project Acronym	Focus of project	Contract type (*)	Commission project officer	Start date	End date	Project website
FLOWGRID (fact sheet)	On-demand CFD (Computational Fluids Dynamics) simulation and visualisation using Grid computing.	RTD	Vincent Obozinski	2002-09-01	2004-08-31	website
GRACE (fact sheet)	Development of a search and categorisation engine for flexible allocation of computational and data storage resources in Grid environments.	RTD	Maria Tsakali	2002-09-01	2005-02-28	website
GRASP (fact sheet)	Development of architecture and business models for delivering ASP services over the Grid-enabled networks.	RTD	Eoghan O'Neill	2002-04-01	2004-09-30	website
GRIA (fact sheet)	Development of business models and processes that make it feasible and cost-effective to offer and use computational services securely in an open Grid marketplace.	RTD	Vincent Obozinski	2001-12-01	2004-05-31	website
GRIDLAB (fact sheet)	Development of software capable of fully exploiting dynamic resources.	RTD	Franco Accordino	2002-09-01	2004-08-31	website
GRIDNET (fact sheet)	Development of a measurement and monitoring framework for the EU-wide Grid and related services.	RTD	Max Leves	2002-09-01	2005-08-31	website
GRIP (fact sheet)	Interoperability of Globus and NRE two independent packages central to the operation of the Grid.	RTD	Vincent Obozinski	2002-09-01	2004-08-31	website
OPENMOLGRID (fact sheet)	Development of tools for molecular design based on UNICORE enabled distributed computing environments.	RTD	Franco Accordino	2002-09-01	2004-11-30	website
SEL (fact sheet)	Identification of technologies for managing, syndicating and personalising online education resources.	AM	Eoghan O'Neill	2002-11-02	2003-10-31	website
WEL (fact sheet)	Development of a central services interface and control framework for any number of ASP-based business applications.	RTD	Franco Accordino	2002-09-01	2004-04-30	website

The following on-going Grid-related projects are being monitored by other services in the European Commission's DG Information Society:

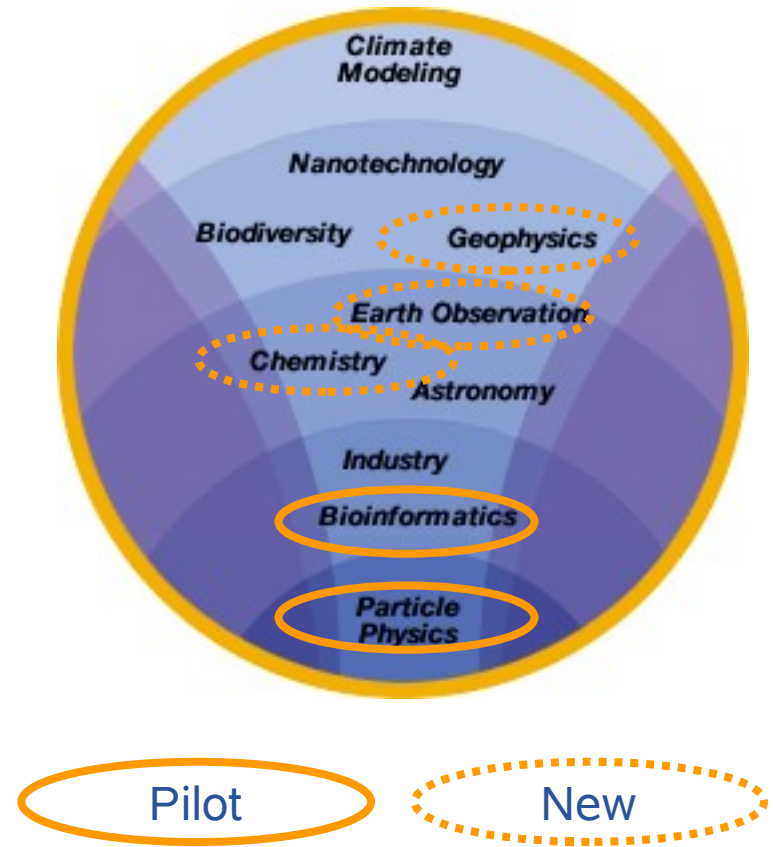
Project Acronym	Focus of project	Contract type (*)	Commission project officer	Start date	End date	Project website
DAMIEN (fact sheet)	Development of e-infrastructure services for the infrastructure.	RTD	TBC	2001-01-01	2003-06-30	website
DATAGRID (fact sheet)	Development of techniques supporting the processing and data-storage requirements of next generation scientific research.	RTD	Kyriakos Baxevanidis (DG INFOSO 'Research Infrastructures')	2001-01-01	2003-12-31	website
DATATAG (fact sheet)	Development of techniques to support reliable and high-speed collaboration across widely distributed networks.	RTD	Kyriakos Baxevanidis (DG INFOSO 'Research Infrastructures')	2002-01-01	2003-12-31	website
EUROGRID (fact sheet)	Development of core Grid software components.	RTD	Kyriakos Baxevanidis (DG INFOSO 'Research Infrastructures')	2000-11-01	2003-10-31	website
MAMMOGRID (fact sheet)	Application of Grid technology to develop a European-wide database of mammograms and to support effective co-working between EU healthcare professionals.	RTD	Sofie Nerager (DG INFOSO 'eHealth')	2002-09-01	2005-08-31	-

Many brilliant people with many brilliant (but often totally incompatible) ideas

## Over 2 years EGEE wanted:

- To establish **production quality sustained Grid environment**
  - 3000 users from at least 5 disciplines
  - over 8,000 CPU's, 50 sites
  - over 5 Petabytes ( $10^{15}$ ) storage
- To demonstrate a viable general process to bring other scientific communities on board
- To propose a second phase in mid 2005 to take over EGEE in early 2006

**EGEE does the important step from Grid research to Grid deployment !**



Pilot

New

32 Million Euros EU funding over 2 years starting 1<sup>st</sup> April 2004

- **48 % service activities (Grid Operations, Support and Management, Network Resource Provision)**
- **24 % middleware re-engineering (Quality Assurance, Security, Network Services Development)**
- **28 % networking (Management, Dissemination and Outreach, User Training and Education, Application Identification and Support, Policy and International Cooperation)**

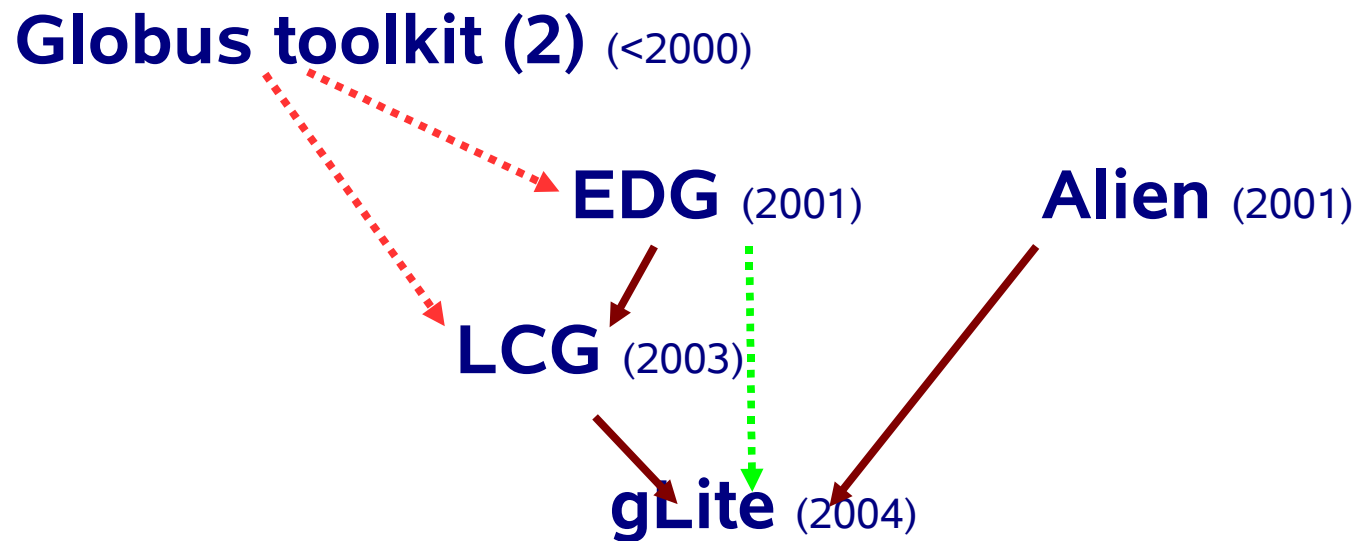


Emphasis in EGEE is on operating a production grid and supporting the end-users

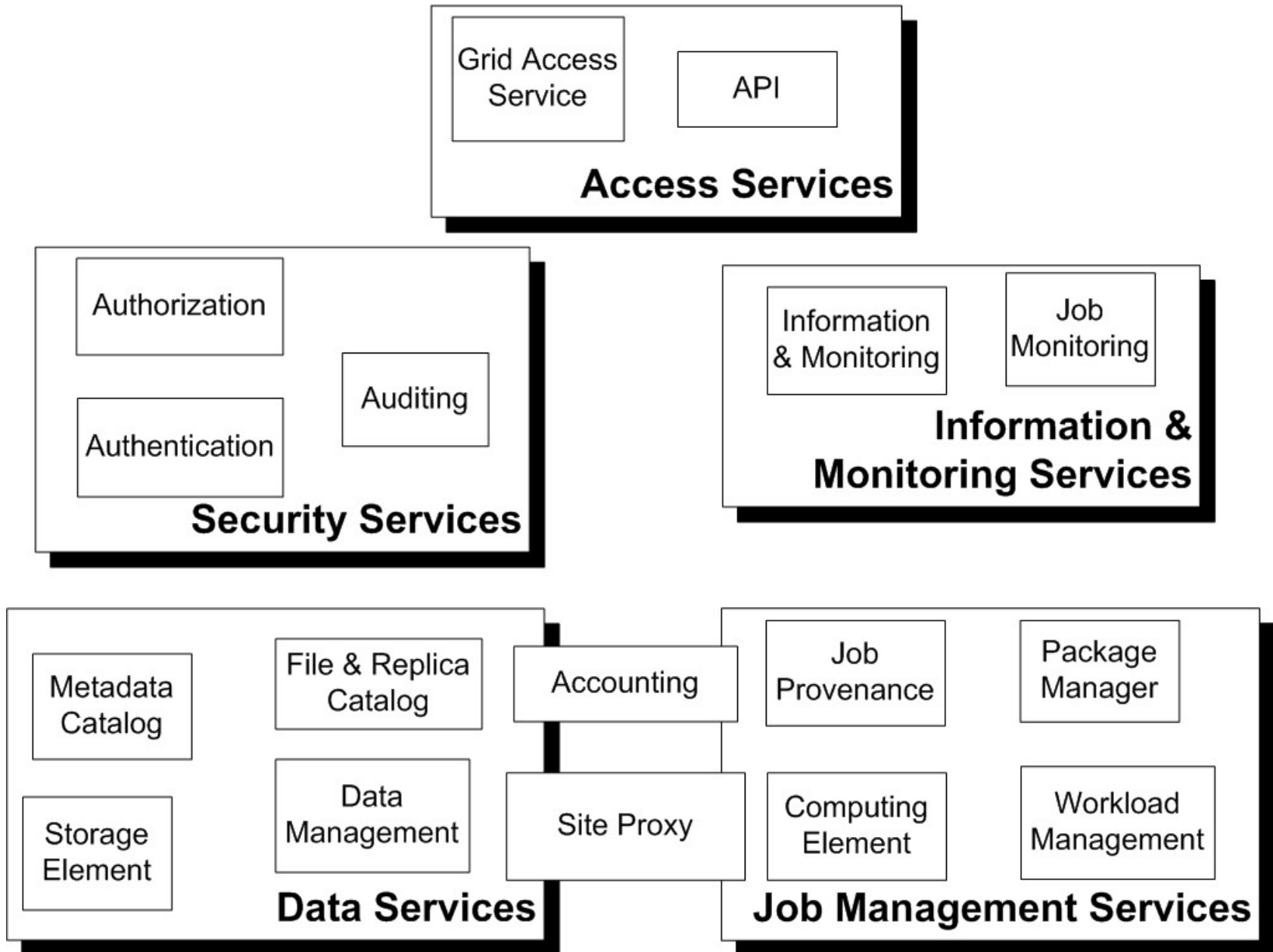
- **Lightweight (existing) services**
  - Easily and quickly deployable
  - Use existing services where possible as basis for re-engineering
- **Interoperability**
  - Allow for multiple implementations
- **Resilience and Fault Tolerance**
- **Co-existence with deployed infrastructure**
  - Reduce requirements on site components
  - Co-existence (and convergence) with LCG-2 and Grid3 are essential for the EGEE Grid service
- **Service oriented approach**
  - Follow WSRF standardization
  - No mature WSRF implementations exist to date so start with plain WS (WS-I)
  - Provide framework to others so higher-level services can be developed quickly

**Architecture: <https://edms.cern.ch/document/476451>**



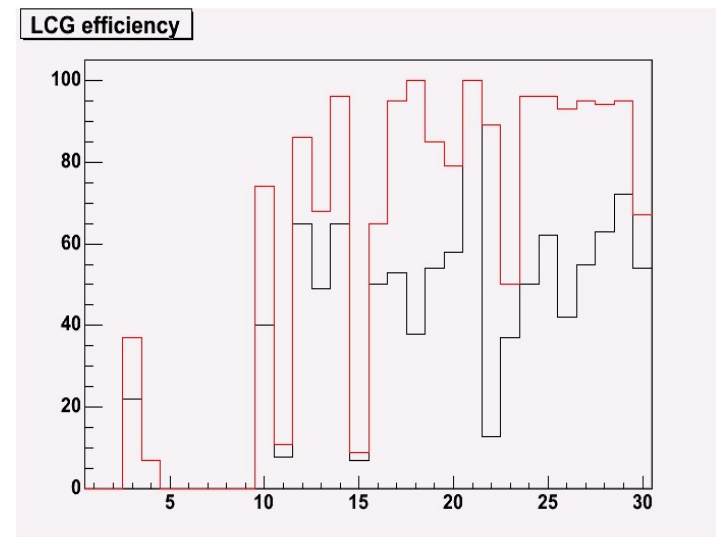
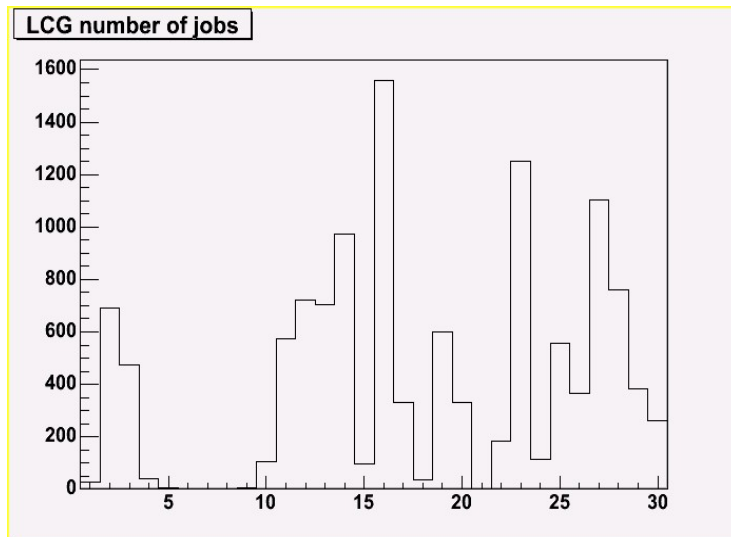






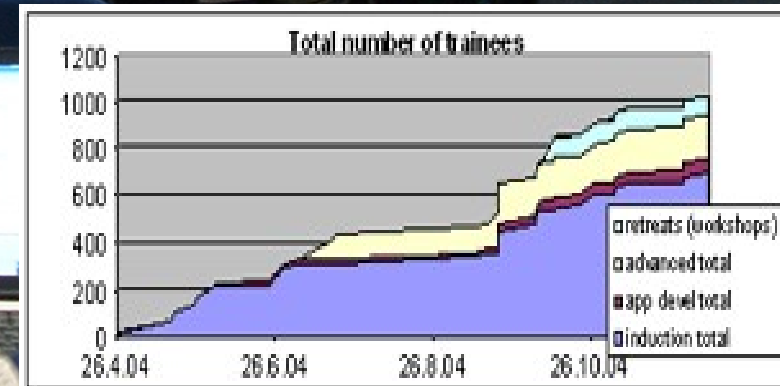
- Hardware / Software issues
  - Heterogeneous hardware, software, OS are a BIG problems !
  - Example: User Interface
  - Example: floating point accuracy
  - Example: dynamic libraries
  - Example: distributed application across different platforms
  - Revival of the interpreter, JIT ?
  - Security and accounting – IntraGrid vs. InterGrid
  - Submission times ???
- Political Issues
  - Different communities – different agendas / hidden agendas
  - coordination between partners
  - typical problems of large, heterogeneous organisations
  - small and dynamic vs. large and powerful organisations

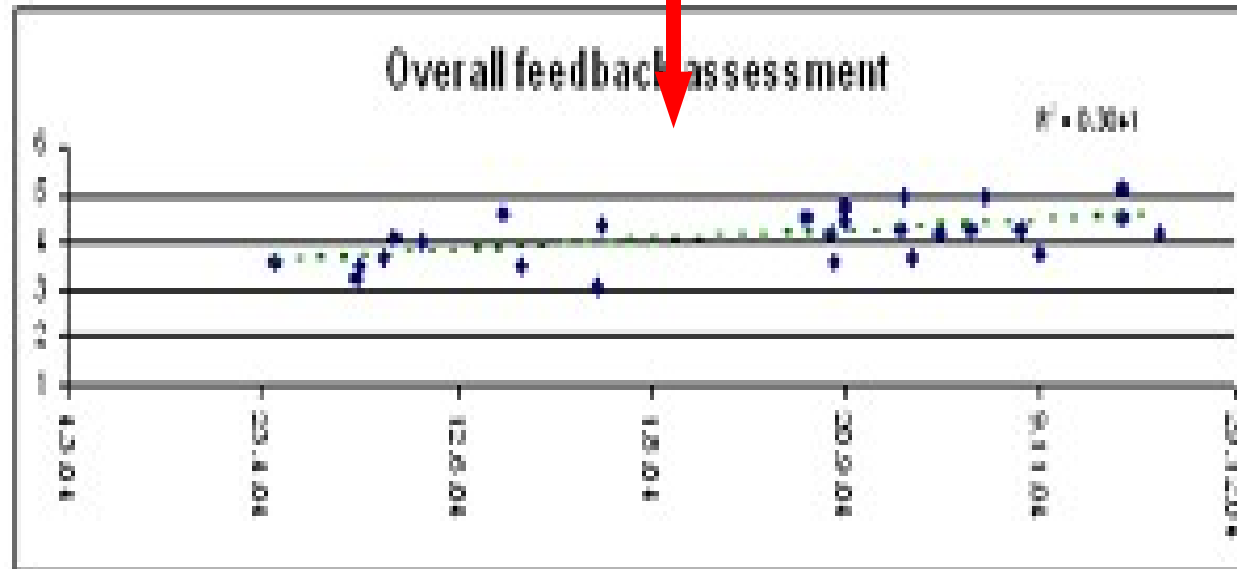
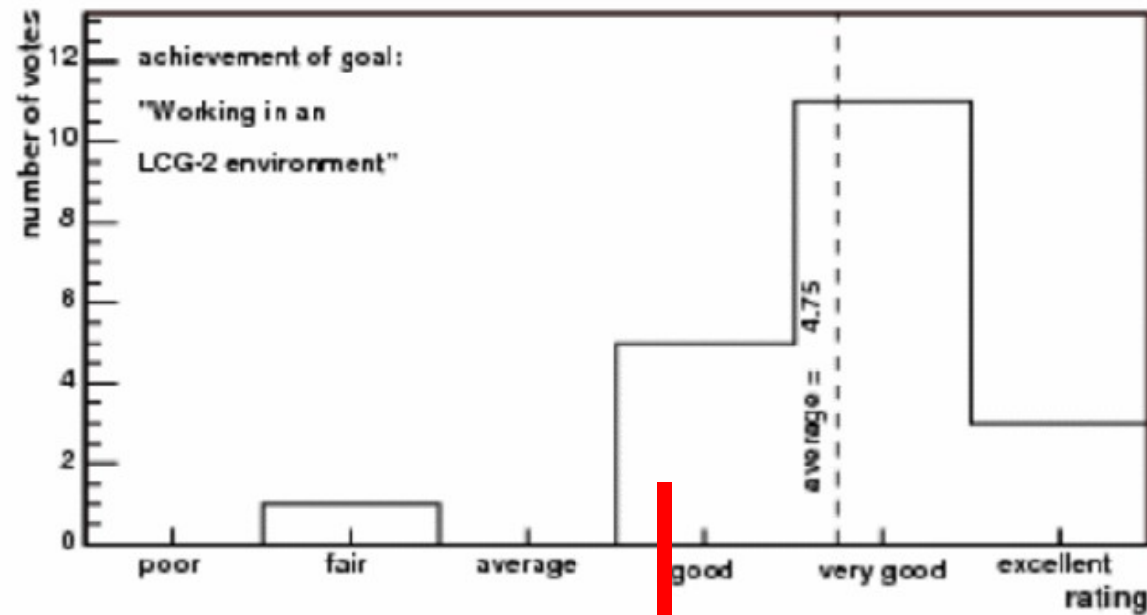
- Standardisation is an important goal but cannot always be achieved. Thus **interoperability** of different solutions is equally important.
- Alongside sophisticated features, a **user-friendly behaviour** of Grid components is important to end-users
- Research collaborations must find the **right balance** between development flexibility and man-power.
- **Support and Training play crucial role** in generating critical mass of users.
- **Quality of existing solutions must be ensured** by extensive testing, e.g. using **data and service challenges** at regular intervals in context of the LCG project.



# Impression from Grid Training

Picture taken at  
GridKa School 2004.  
Check out GridKa School  
2005 at <http://gks05.fzk.de>





- The Grid is not history, but there is quite a bit of history in Grid Computing
- Standardisation is an ongoing process
- Following standards might be a better approach than inventing them
- The ultimate meaning of „The Grid“ will be defined by the applications that run on it
- **EGEE is a major step in the creation of a production quality Grid infrastructure for science and industry**

**We'd like to thank the German Federal Ministry of Education and Research, BMB+F, the EGEE project and its representatives as well as Forschungszentrum Karlsruhe / Germany for their continuous interest and support !**



**bmb+f** - Förderschwerpunkt  
Hadronen -  
und Kernphysik  
Großgeräte der physikalischen  
Grundlagenforschung