



# The European DataGRID Production Testbed

Franck Bonnassieux

CNRS/UREC

ENS-Lyon France

DataGrid Network Work Package Manager

[Franck.Bonnassieux@ens-lyon.fr](mailto:Franck.Bonnassieux@ens-lyon.fr)

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# Presentation outline

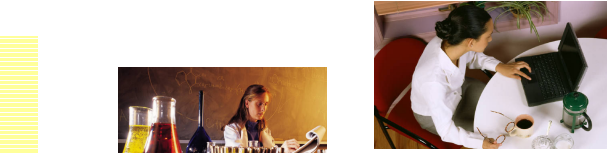
- General DataGrid project status
  - Numbers and assets
  - Testbeds and Applications
  - Quality and validation
  - Summary and last year project
- Network activities
  - Monitoring
  - Transports and Services
    - High Speed Transfers
    - QOS
    - NetworkCost Suite
- Perspectives



# DataGrid in Numbers

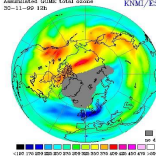
## People

- >350 registered users
- 12 Virtual Organisations
- 16 Certificate Authorities
- >200 people trained
- 278 man-years of effort
- 100 years funded



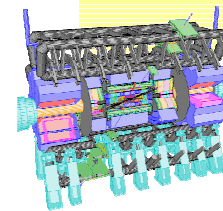
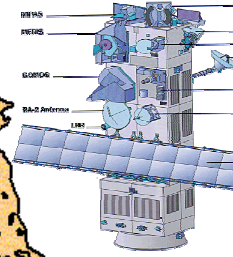
## Software

- 50 use cases
- 18 software releases
- >300K lines of code



## Testbeds

- >15 regular sites
- >40'000s jobs submitted
- >1000 CPUs
- >5 TeraBytes disk
- 3 Mass Storage Systems

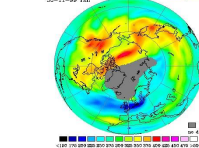


## Scientific applications

- 5 Earth Obs institutes
- 9 bio-informatics apps
- 6 HEP experiments



International GEM Total count 20-11-2003 KNM/ESA





## Current Project Status

- EDG currently provides a set of middleware services
  - Job & Data Management
  - GRID & Network monitoring
  - Security, Authentication & Authorization tools
  - Fabric Management
- EDG release 1 currently deployed to the EDG-Testbeds
  - ~15 sites in application testbed actively used by application groups
    - Core sites CERN(CH), RAL(UK), NIKHEF(NL), CNAF(I), CC-Lyon(F)
  - EDG sw also deployed at total of ~40 sites via CrossGrid, DataTAG and national grid projects
- Many applications ported to EDG testbeds and actively being used
- Intense middleware development continuously going-on



# DataGrid Assets

- Testbeds available through-out the year
  - Have gone further than any other project in providing a continuous, large-scale grid facility
- Innovative middleware
  - Resource Broker
  - Replica Location Service (joint development with Globus) and layered data management tools (Replica Manager & Optimizer)
  - R-GMA Information and Monitoring System
  - Automated configuration and installation tools
  - Access to diverse mass storage systems
  - VOMS security model
- Distributed team of people across Europe that can work together effectively to produce concrete results
- Application groups are an integral part of the project contributing to all aspects of the work

# Testbeds

## Application Testbed: End-user Applications

- Software: Stable, certified release (EDG 1.4.3)

## Certification Testbed: Extended, Detailed Testing

- Software: release candidate
- Collaboration with Testing Group/LCG.

## Development Testbed: Integration & Evaluation of SW

- Software: alpha & beta release.
- Active use; 5 sites involved.

## Development Machines: Testing of Middleware in Isolation

- Software: development release
- Under control of middleware work packages.



# Application Testbed Resources

## Since Last Year:

- Improved software (EDG 1.4.3).
- Doubled sites. More waiting...
  - Australia, Taiwan, USA (U. Wisc.), UK Sites, INFN, French sites, CrossGrid, ...
- Significantly more CPU/Storage.

## Hidden Infrastructure

- MDS Hierarchy
- Resource Brokers
- User Interfaces
- VO Replica Catalogs
- VO Membership Servers
- Certification Authorities

Site	Country	CPUs	Storage
CC-IN2P3*	FR	620	192 GB
CERN*	CH	138	1321 GB
CNAF*	IT	48	1300 GB
Ecole Poly.	FR	6	220 GB
Imperial Coll.	UK	92	450 GB
Liverpool	UK	2	10 GB
Manchester	UK	9	15 GB
NIKHEF*	NL	142	433 GB
Oxford	UK	1	30 GB
Padova	IT	11	666 GB
RAL*	UK	6	332 GB
SARA	NL	0	10000+ GB
<b>TOTAL</b>	<b>5</b>	<b>1075</b>	<b>14969 GB</b>

\*also Dev. TB; +200 TB including tape



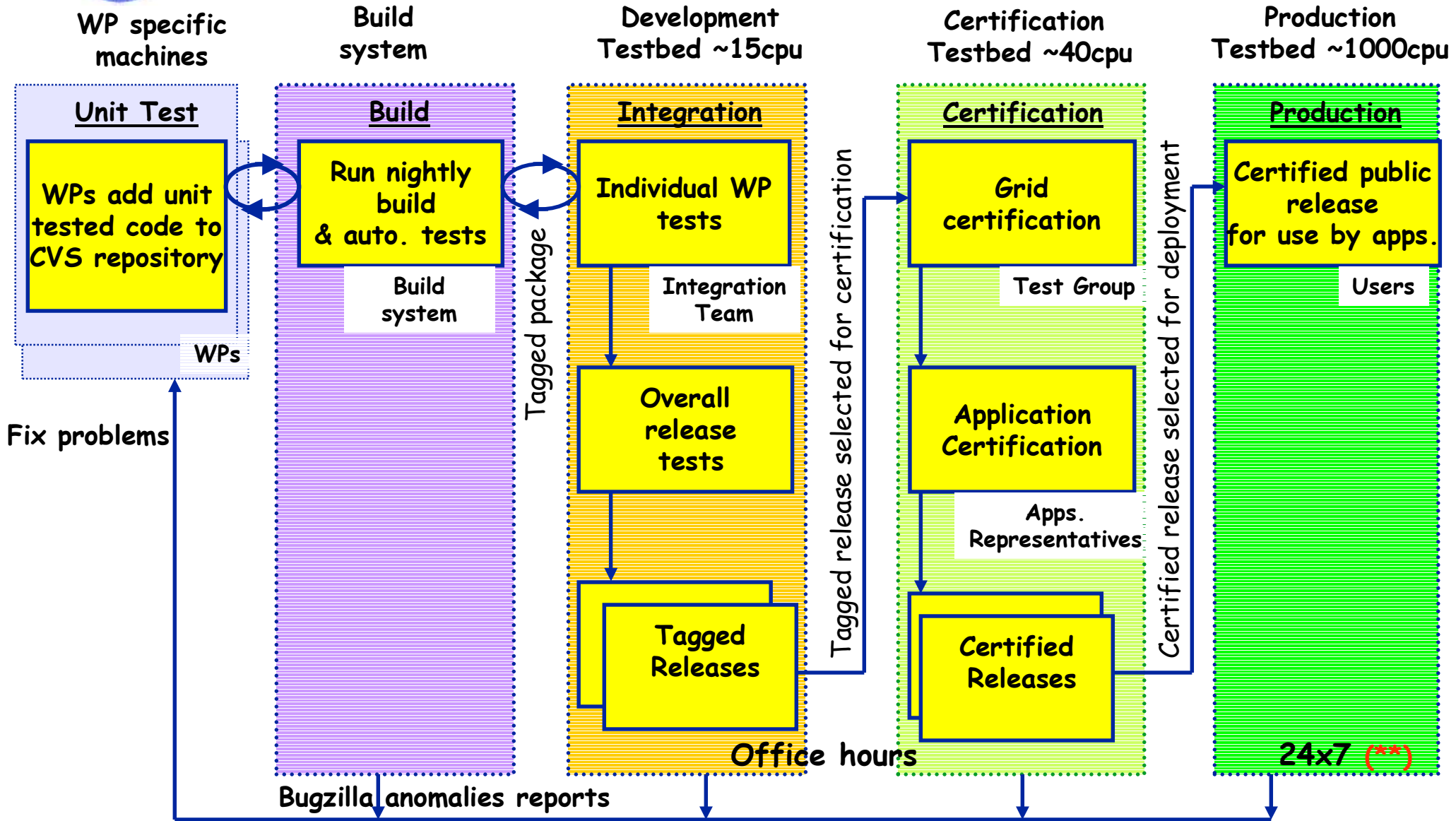
## Refocus on quality objectives

- Year 1 - Focus on:
  - Quality of the deliverables - Deliverable procedure - Document management
  - Project monitoring and reporting
  - Software infrastructure: Software release procedure - Central repository - Bug reporting and tracking - Standards and tools
- Year 2 - Focus on:
  - Quality of the software production - Stability of the system - User support - Software distribution and Testbed infrastructure
  - Supported by the "Project Quality Statement"
- Year 3 - Focus on:
  - Global provisioning of Quality of Services (QoS)





# Test and Validation process





## A few statistics

Since mid-November 2002

Virtual Org.	SE Data (Gb)
ATLAS	3258.300
CMS	388.934
DØ	148.000
Earth Obs.	83.000
Biomedical	8.186
LHCb	7.400
Integ. Team	2.800
WP6	0.311
Alice	0.156
BaBar	0.001

Virtual Org.	# jobs	CPU hrs
CMS	12869	33841
ATLAS	6930	11583
<b>Local Users</b>	<b>2151</b>	<b>8906</b>
WP6	1627	973
LHCb	810	444
EarthOb	1462	365
Biomedical	6821	195
Alice	1819	136
Tutorial	1651	2
Iteam	7207	1
BaBar	1	0
DØ	1	0
<b>Totals</b>	<b>43349</b>	<b>56445</b>
Failed	3159	

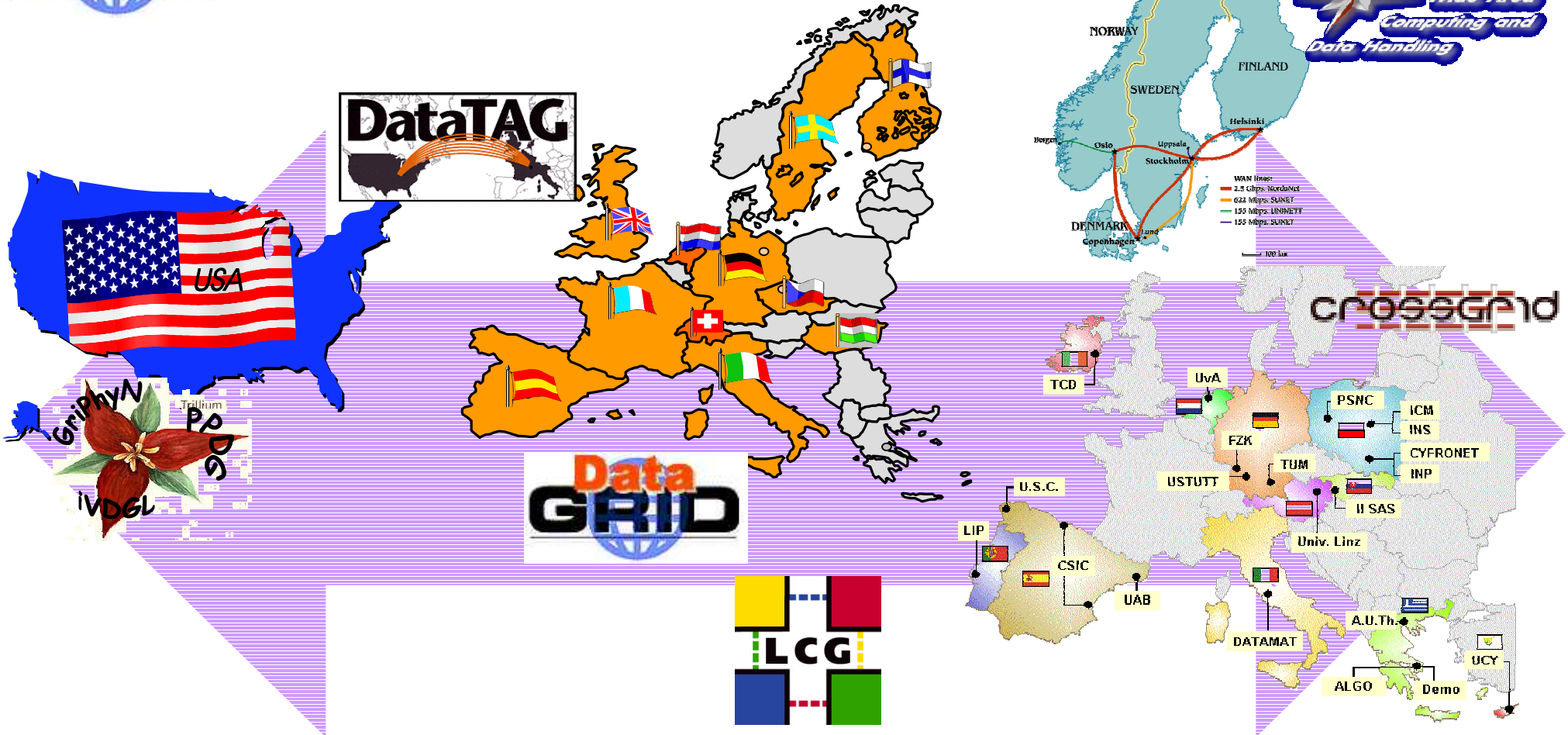


## General Status Summary

- Successful deployment of M/W for use by real applications
  - Periodic releases
  - Testbed available throughout the year
- Applications heavily involved in all phases of the project
  - Many applications ported to EDG testbed
  - Extensive testing and usage
  - Feedback to drive the project development
- Improved international network support
  - Many upgrades within the NRN area
  - Strong collaboration with Geant is key to success
- Active participation in international standard bodies (GGF etc.)
- High-level coordination with related Grid projects
- Open source license developed and adopted
- Major dissemination success with tutorial and road-shows



# Related Grid Projects



Through links with sister projects, there is the potential for a truly global scientific applications grid  
 Demonstrated at IST2002 and SC2002 in November



# Overview of planned activities for 2003

- More software releases
  - Release EDG 2.0 to be deployed on application testbed in May 2003
    - Subsequent updates expected based on application feedback and availability of new mware modules
  - Further improve testing and verification
    - Would like to go even further but resources are already fully stretched
- Applications
  - More HEP experiments, EO projects, bio-informatics applications will use EDG facilities
  - Expand on task force initiatives to provide active support for applications
- Extend cooperation and coordination with related grid projects
- Explore migration paths for EDG software to Open Grid Services Architecture
- More dissemination activities
  - Participation at many events already planned
  - Further sessions of the tutorial road-show



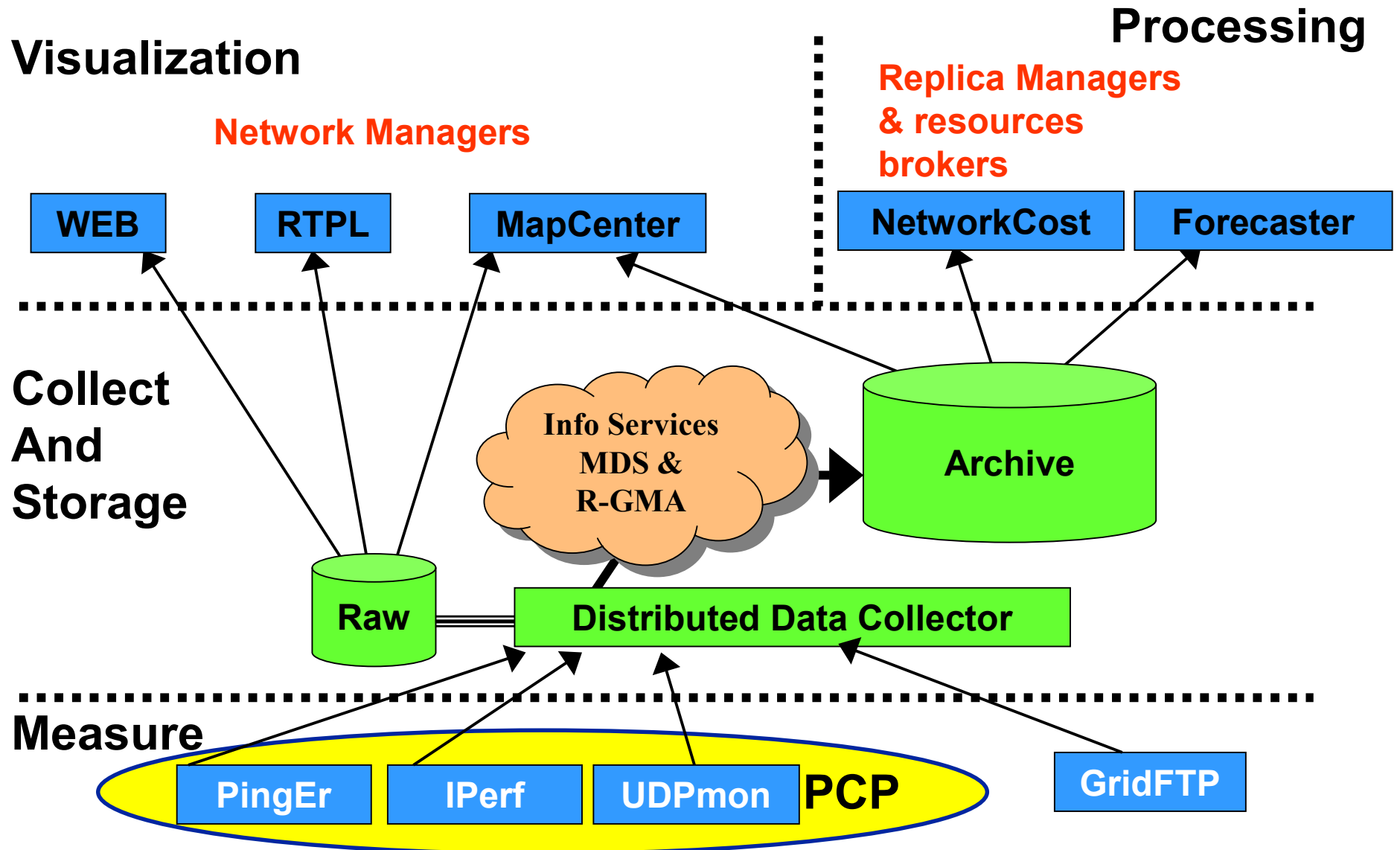
## WP7 (Network) : Generalities

- **Planning for provisioning of infrastructure for testbed operation**
  - **D7.1 (M9) [Report]: Report on Network infrastructure for Testbed-1**
  - **D7.4 (M36) [Report]: Final report on network infrastructure and services**
- **Network and Transport Services**
  - **D7.3 (M9) [Report]: Network Services: requirements, deployment and use in testbeds**
- **Network and Grid traffic monitoring**
  - **D7.2 (M12) [Prototype] : Demonstration and deployment of monitoring tools**
- **Grid Security**
  - **D7.5 (M15) [Report] : Security requirements and report on first project release**
  - **D7.6 (M25) [Report] : Security Design Report**
  - **D7.7 (M36) [Report] : Final security report**

## WP7 Network Monitoring

- Standard and ad-hoc developed **tools** to measure **network metrics**
  - One Way Delay => **Ripe Boxes**
  - Round Trip Delay => **PinGEr**
  - Packet Loss => **PinGEr**
  - TCP throughput => **IPerfEr**
  - UDP throughput => **UDPMon**
  - Jitter => **UDPMon**
  - Routers traffic => **NetLoad Agent**
- **PCP** (Probe Coordination Protocol, dev. by WP7) schedules all active network measurements and avoids conflicts.
- Dedicated **MDS Schema** and **R-GMA infrastructure** stores all network metrics and GridFTP logging.

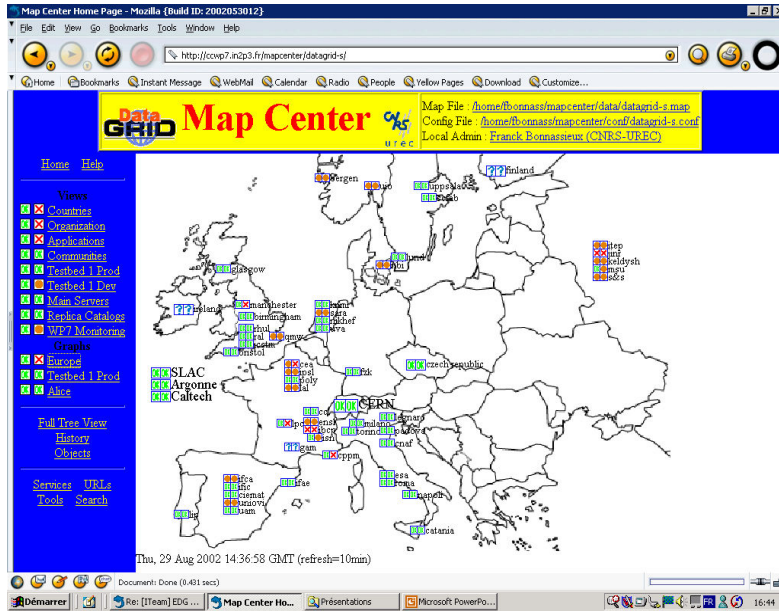
# WP7 Network Monitoring Architecture



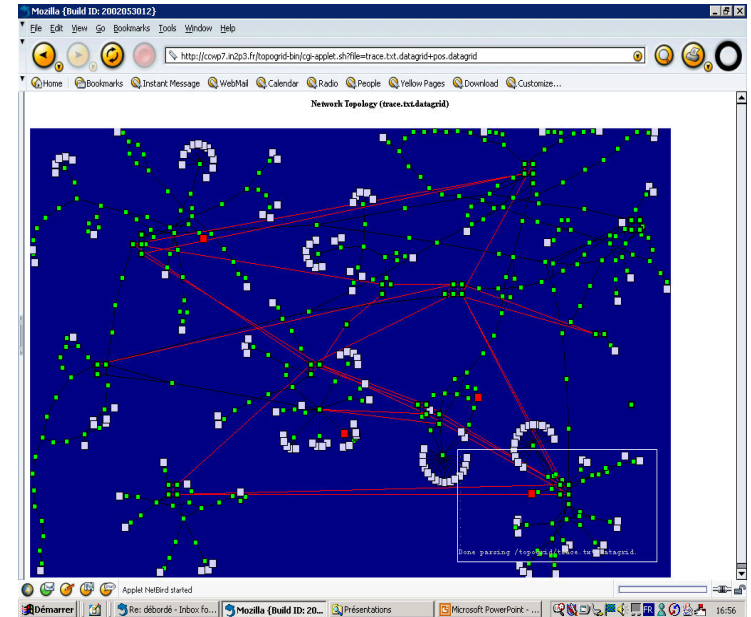




# WP7 Monitoring : Visualization Tools



MapCenter



TopoGrid

Ping Min [ms]  
(row >> column)

	<a href="#">CLRC</a>	<a href="#">CNRS</a>	<a href="#">CERN</a>	<a href="#">SARA</a>
<a href="#">CLRC</a>	---	19.969	19.975	9.974
<a href="#">CNRS</a>	22.900	---	28.100	30.200
<a href="#">CERN</a>	26.000	28.000	---	30.000
<a href="#">SARA</a>	16.000	30.000	30.000	---

rTPL

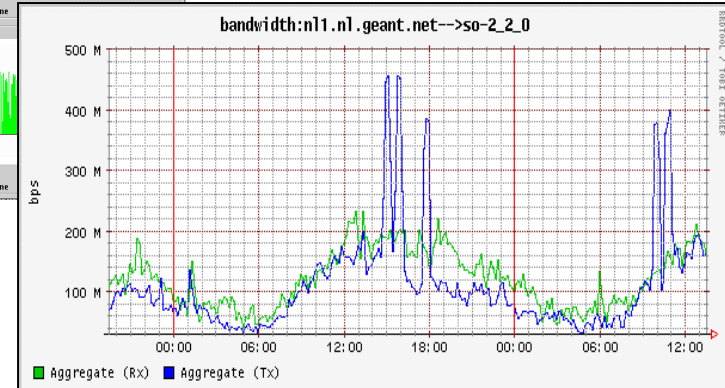
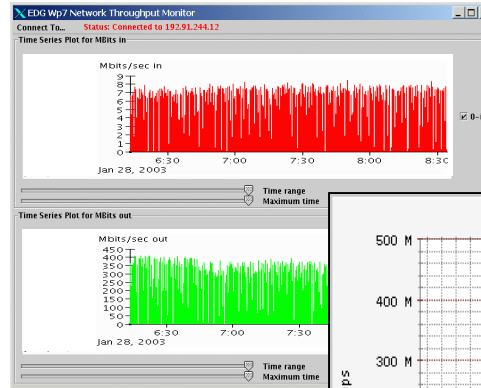


# WP7 Transport and Services

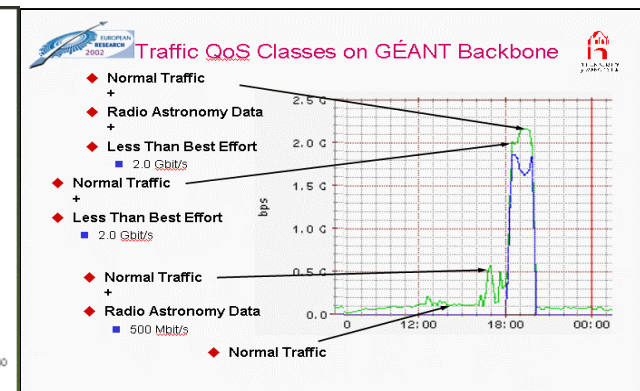
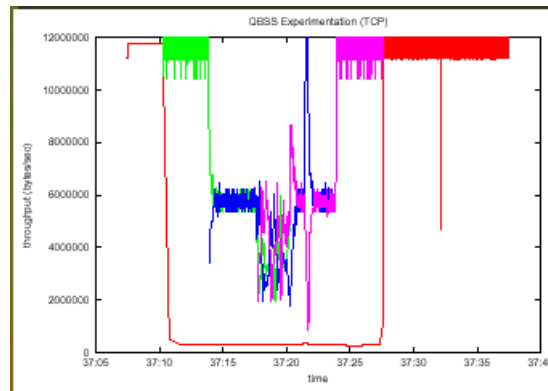
➤ Close technical collaboration with DANTE on :

➤ High Throughput transfer

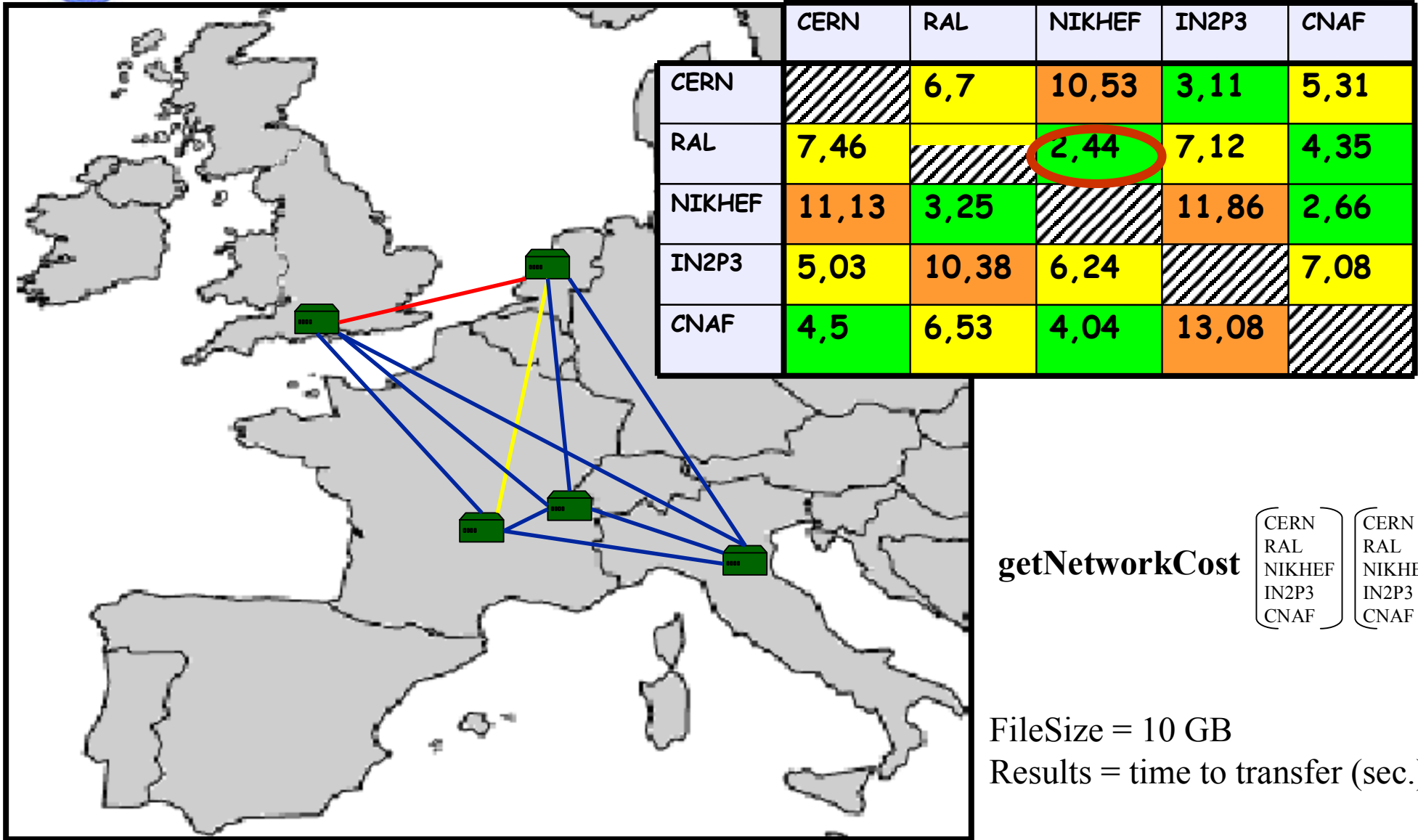
- Parallel streams
- High-speed & Scalable TCP
- More than 350 Mbit/s single stream between DataGRID Storage Elements (CERN and SARA)



➤ LBE and IP Premium



# WP7 Services : NetworkCost functionality





## WP7 Services : NetworkCost Suite

- **getNetworkCost** functions assist **replica managers** and **resource brokering**
- Based on **various back-ends** for flexibility:
  - CGI, and Globus MDS back-ends in release 1
  - R-GMA back-end in release 2
  - Web Services back-end also under development
- Based on **regular TCP throughput measurement**. (release 1)  
Parameters to be added for enhanced precision:
  - GridFTP logging information : the more the grid is used, the more precise are the results.
  - historical data stored in R-GMA Archiver
  - other network metrics (RTT, Jitter...)
  - forecasting methods will be also tested.



# WP7 Summary & perspectives

## ➤ Major accomplishments

- Follow-up of network infrastructure evolutions (GEANT and NRENs)
- Close technical collaboration with DANTE
  - tests and prove of network QOS benefits
    - Less than Best Effort for bulk transfers
    - IP Premium for more interactive applications
  - Achievement of high throughput transfers between EDG sites
- Deployment of Network Monitoring Infrastructure
  - Installation of network sensors on main EDG sites and storage of metrics in Globus MDS.
  - Delivery of first release of NetworkCost function, built upon this infrastructure

## ➤ Major goals for next year

- Deployment of R-GMA Archives to store all historical network metrics
- Enhancement of monitoring and of NetworkCost functions suite (GridFTP logging, RTT, Jitter, scheduling of measurements ...)
- Continue close collaboration with DANTE on network QOS and performance to
  - Understand the behavior of GEANT backbone
  - Learn the benefits of QoS deployment



## General DataGrid Project Perspectives

- Third year activities will build on the assets from the first two years of the project (European-wide testbeds, software and highly motivated groups)
  - Third year of the project will be at least as stimulating and challenging as the first two years
- Advances are planned for all aspects of the EDG middleware and testbeds
  - Providing more functionality, computing resources and higher levels of service
- The project is following the development of OGSA and sees it as the future for grids
- Established relationships with related projects will ensure that DataGrid developments will live on after the project has run to completion
  - DataGrid partners will participate in a proposal (EGEE [www.cern.ch/egee-ei](http://www.cern.ch/egee-ei)) of the EU FP6 to further develop the production aspects of the project