International Bielefeld Conference
9 February 2006

**e-Infrastructure**
for the
European Research Area
A roadmap

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Research Infrastructure

"The views expressed in this presentation are those of the author and do not necessarily reflect the views of the European Commission"
Contents

- Current achievements – GÉANT and Grids
- eInfrastructures – vision WHY WHAT and HOW
- Preparations for FP7
- Current state of ‘play’
Developments and achievements

- Deployment of the pan-European GÉANT Research Network (including a global perspective)
- Promotion of large scale IPv6 validation testbeds
- Grid concept proven in eScience application pilots
- Strengthening of Europe’s position in Grid middleware development and Grid research
- First steps taken towards maturing Grid technologies for industrial use
- Contribution to standardisation
- Grid deployment side by side with networking deployment - eInfrastructue
• World leading Research Network
• Connecting more than 3900 Universities and R&D centers
• Over 34 countries across Europe >30 million users
• Connectivity to NA, Japan, ...
• Speeds of up to 10 Gbps + Hybrid Networking (light paths)
• Serves millions of end-users + eScience Projects
• The model: A 3-tier Federal Architecture
• Many european schools are also connected (dependent on country)
Researchers: Fast growing Needs

Enabler – eInfrastructures

- Unlimited access to knowledge
- Unlimited access to resources (ICT, instrumentation, people...)
- Unlimited access to information and needs (mobility, security, ...)
- R&D environment dynamically adapted to needs

Researcher: the most precious capital and the centre of all developments!
A new way of doing Science

**e-Science**

**Technology push**
- networking
- grids
- instrumentation
- computing
- data curation...

**Revolution in science & engineering, research & education**

**Application pull**
- value added of distributed collaborative research (virtual organisations)

A new way for all scientists to work on research challenges that would otherwise be difficult to address
Global collaboration in Science
Sharing of resources

- Resources can be physical, virtual, single or multiple sited
- Resources can be distributed world-wide
- Resources can be of any information type (storage, computing, networking, instrumentation, etc)
- Access to them needs to be provided in a secure, coordinated, seamless, dynamic and inexpensive way

e-Infrastructure
Virtual research organisations

- Cluster / High Performance Computation
- Broadband Network Connectivity
- People Training Support
- Databases Digital Libraries
- Small / Large Scale Instruments

Why
Advanced Grid infrastructures

Human Society  Grid system

Sharing of resources, production efficiency

Basic elements
repeated assembling of basic elements into organisations

people / computers

environment resources / ICT based resources
e-Infrastructure – essential for Europe

Global knowledge infrastructure

- e-Science
- e-Health
- e-Learning
- aeronautics
- genomics
- environment
- astronomy

e-Infrastructure (Grids empowered)

- security
- semantic web
- broadband
- Grid
- management
- mobility
- automatic

European Commission
set of persistent services and processes bringing the power of distributed ICT based resources to a virtual community
Fostering **communities of practice** which lead to **evolution**, shaping and stabilisation of new scientific and technological paradigms (virtuous cycle of innovation)

Exploiting mutual benefits: **research organisations shape technology**, as much as **technology shapes research organisations and research practices**

Huge amounts of data are required to store enduring knowledge to be able to access it ‘anywhere, anytime’

From: Meteorology, bio-informatics, radio-astronomy (=storage, transfer and processing of data) to Large scale GRID based testbeds beyond eScience: eLearning eBusiness. eCulture eHealth.
How to address e-Infrastructures

Fostering coordination and synergies with national initiatives, fighting digital divide

Virtual collaboration, virtual presence, virtual labs, simulations, gaming and role playing to share knowledge and skills. Lifelong learning.

This all requires an ambitious cross-discipline collaboration (by researchers and Commission)

Patience, spirit, mutual understanding and recognition, joint development
e-Infrastructure - Implementation blocks

- networking
- joint research activities
- specific services
- GRID INFRASTRUCTURE
- research results
- EU policies
- federated test-beds
- IPv6 Lambda
- High Energy Physics
- Biomedics
- Digital libraries
- Technology testbeds
- astronomy bio-tech earth observations
- User testbeds
- security
e-Infrastructure - Strategic building blocks
World leading GÉANT / Grid infrastructures

Striving for world leadership


GÉANT is acknowledged as leading the world. Europe is a pioneer in Grid empowered infrastructures. ICT based infrastructure, namely GÉANT and GRID, need reinforcement and expansion in FP7.
Workshop on Scientific repositories

Conclusions:

- There is a large, but by no means comprehensive, deployment of Digital Repositories in Europe and elsewhere.
- They currently contain several million objects, of many types, such as indexes, articles, books, theses, audio-visual materials, original scientific data, e-learning materials etc.
- A large fraction of these objects is Open Access (i.e. can be accessed without copyright restrictions).
- For other items, such as journal articles, access may be subject to conditions applied by the publisher.
- Most Digital Repositories today are based at institutions, with searches carried out on a single repository.
- In some countries there are initiatives to federate these Institutional Repositories and enable searches to be carried out over the combined holdings.
Conclusions

- There is an internationally accepted standard (OAI-PMH) for metadata.
- Whilst there are already a number of successful examples of Digital Repository systems, the architecture, middleware and metadata standards to support Digital Repositories are under continual development.
- Digital Repositories are expected to form an integral part of the e-Infrastructure for research in the future.
**Recommendations**

1. A co-ordinated set of strategic studies should be undertaken.
2. The majority of content will be sourced at the institutional level. Institutions should be encouraged to set up Institutional Repositories and to encourage their researchers and authors to deposit their material.
3. Consideration should be given to making the depositing of research results (publications, datasets, images, models or simulations) in accordance with the principles of Open Access publishing mandatory.
4. All countries in Europe should be encouraged to set up national programmes.
5. In the short to medium term, some demonstrator/testbed projects should be undertaken to demonstrate trans-national access.
## Recommendations

6. At the pan-European level, it is essential to plan now for a knowledge infrastructure as an integral component of the e-infrastructures under FP7.

7. The use of widely-adopted metadata standards should be encouraged in order to enable inter-operability.

8. The technology, middleware, content and organisational methods developed for the support of Digital Repositories for research will be of value in other sectors, for example, e-learning, e-health, e-government and e-commerce.

9. The workshop was asked to consider GÉANT as a possible model for a pan-European DR infrastructure (both at organisational level and exploiting the benefits of a layered infrastructure - network/grid/knowledge layer).
From FP5 to FP7 in e-Infrastructures
FP7 plans

- Continuation and further development of current actions → Current Instruments
  - GÉANT
    - Grid infrastructure
    - Digital libraries
  - Supercomputing
- New Infrastructures → New instruments
  - ESFRI
  - Strategic roadmaps

Reinforce the budget for Research Infrastructures!
Reinforce liaison with Thematic Priorities!
Specific Programme

...to support in a coordinated way digital libraries, archives, data storage, data curation and the necessary pooling of resources, at European level, to organise the data repositories for the scientific community and future generations of scientists. The aspects of enhanced trust and confidence of e-Infrastructures will be addressed.

...fostering the further development and evolution of high-capacity and high-performance communication (GÉANT) and grid empowered infrastructures as well as of European high-end computing capabilities stressing the need to support the reinforcement of world class distributed supercomputing facilities, data storage and advanced visualisation facilities. The activities also aim at fostering the adoption by user communities,
e-Infrastructure in FP7

GRID MIDDLEWARE
RESOURCES
GÉANT
FP5
FP6
FP7
Digital Libraries

Digital Libraries

eIRG White Paper
... grids and e-matter...

European Commission
The Capacities Specific Programme of FP7
(Commission proposal)

Research infrastructures: 3987 M€ (54%)
International cooperation: 359 M€ (5%)
Research for benefit of SMEs: 1914 M€ (25%)
Regions of knowledge: 160 M€ (2%)
Science in society: 558 M€ (7%)

http://europa.eu.int/comm/research/future/documents_en.cfm
Discussions on FP7 financial resources are on-going

- Total proposed FP7 financial resources by Commission: ~73 €B
- European Council Dec 2005 meeting on EU financial perspectives suggested FP7 financial resources to adjust to ~50 €B
Conclusion

Connect ★ Communicate ★ Collaborate

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Further info on e-Infrastructures

Web page
www.cordis.lu/ist/rn/

Newsletter

Workshops

Brochures