

e-Infrastructures for e-Science the EU Policy

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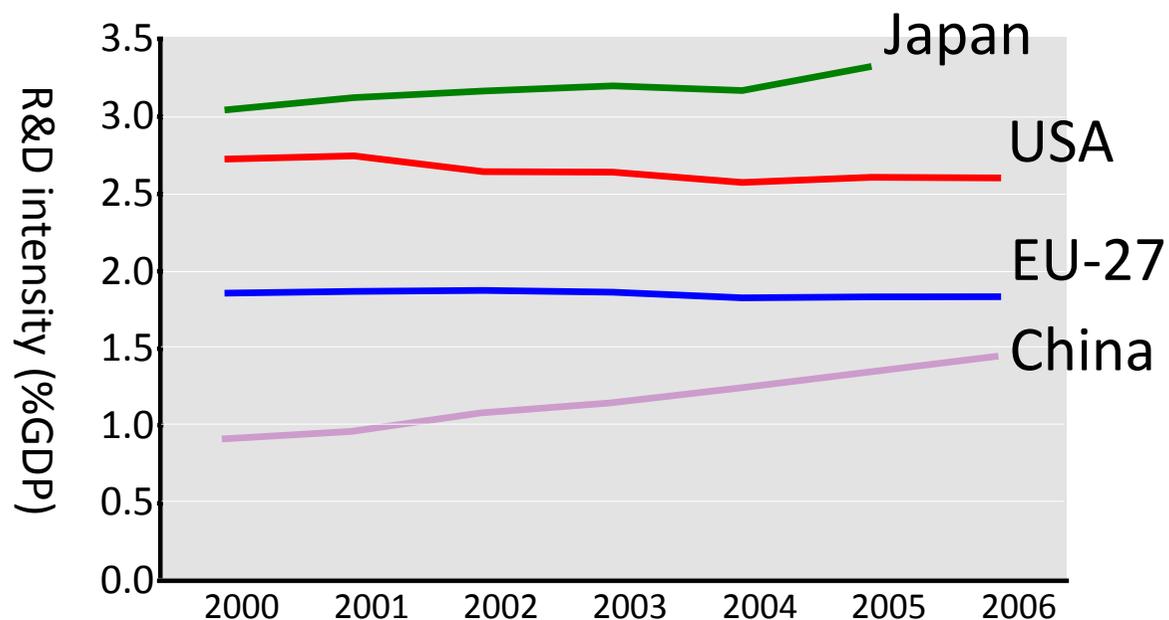
European Commission
Information Society and Media



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

Our global position

	R&D investment (%GDP)	R&D funded by private sector (%)
EU-27	1.8	55
USA	2.6	64
Japan	3.3	75
China	1.4	65



European Research Area building blocks

Excellent research institutions and universities

Well-coordinated research programmes and priorities (joint programming)

Single labour market for researchers

European Research Area

World-class research infrastructures

Opening to the world through international cooperation in S&T

Effective sharing of knowledge

Definition of Research (e)-Infrastructures

Facilities, resources, and related services

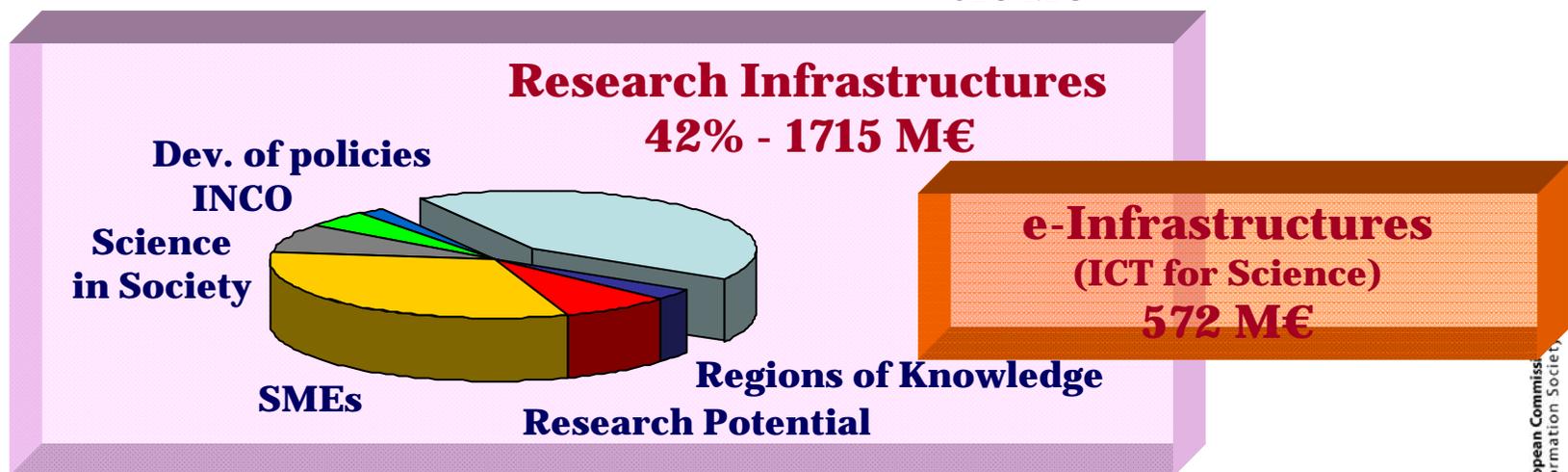
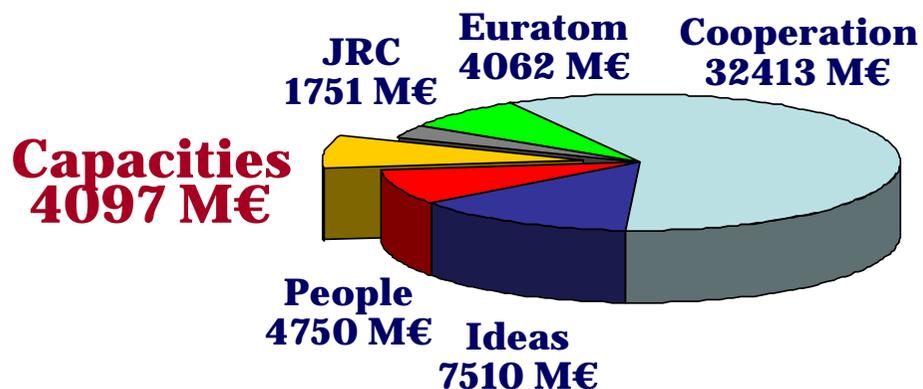
used by the scientific community for

- Conducting leading-edge research
- Knowledge transmission, knowledge exchange and knowledge preservation

They include

- Major scientific equipment
- Scientific collections, archives and structured information
- ICT-based infrastructures “e-Infrastructures”
- Entities of a unique nature, used for research

Budget for Research Infrastructures under FP7 (2007 - 2013)



What is “e-Infrastructure”?

e-Infrastructure is “an environment where research resources (hardware, software and content) can be readily shared and accessed wherever this is necessary to promote better and more effective research”.

Such environment integrates networks, grids and middleware, computational resources, experimental workbenches, data repositories, tools and instruments and the operational support that enable global virtual research collaborations.



ICT infrastructures for e-Science: a Communication to European Institutions

COM(2009) 108

- Highlighting the importance of embracing the **e-Science** paradigm shift
- Highlighting the strategic role of **e-Infrastructures** as a crucial asset underpinning European research and innovation policies
- Calling on Member States and the scientific communities, in cooperation with the European Commission, for a reinforced and coordinated effort to further develop world class e-Infrastructures

e-Infrastructures for science

...ubiquitous research environments for accessing and sharing resources and tools...



ICT infrastructures for e-Science

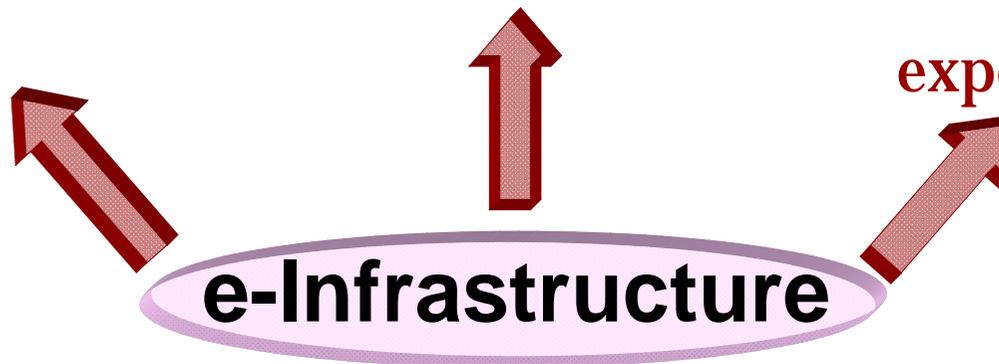
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Three vectors of a renewed European Research strategy 2020:

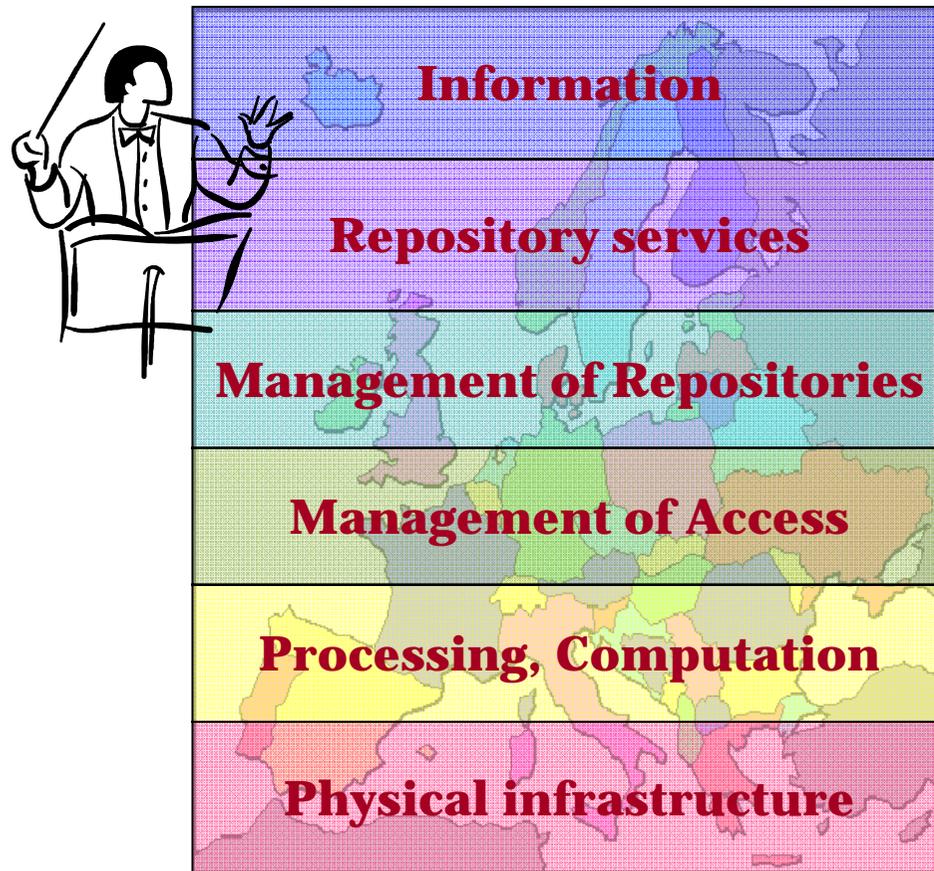
Europe as hub
of excellence in
e-Science

**Sustainable and
continuous services**
of production quality
24/7

Innovation by
exploiting know-how
beyond science
(public services,
large scale
experimentation,...)



Orchestration within the e-Infrastructure: need for coordination all the elements and layers



- In the Communication to the Council and EP, the Commission asks the involvement of Member States and key stakeholders to build robust, dynamic and innovative e-Infrastructures for scientific data
- This cooperation started already by launching 15 projects, including the FP7 Open Access Pilot (40 Mio Euro)
- There is still a long way to go...

e-Infrastructures in action today



Innovating the scientific process:
global virtual research communities



Accessing knowledge:
scientific data



Experimenting *in silico*:
simulation and visualisation

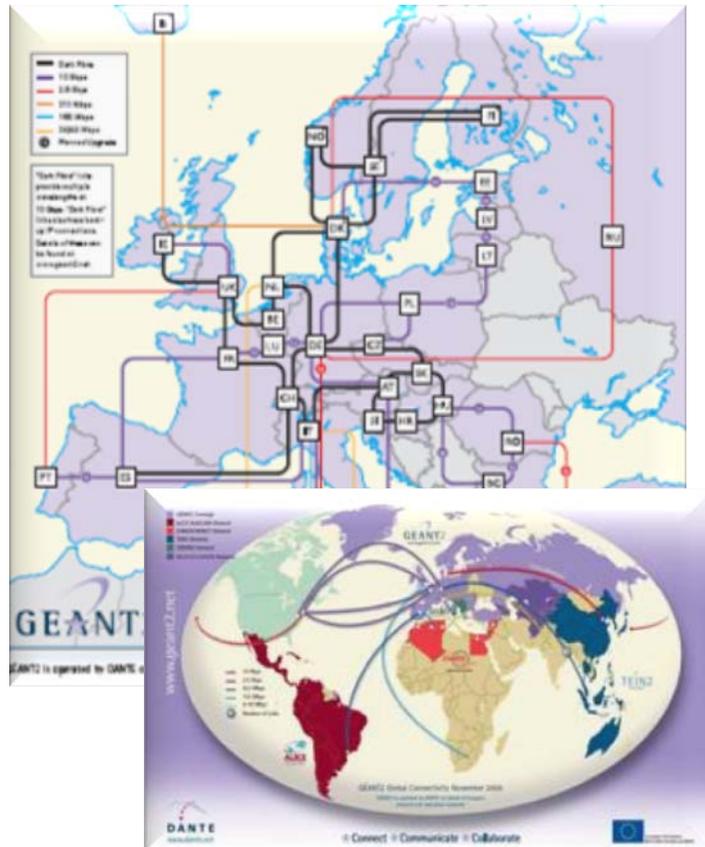


Sharing the best computational resources:
e-Science grid, supercomputing



Linking at the speed of the light:
GÉANT

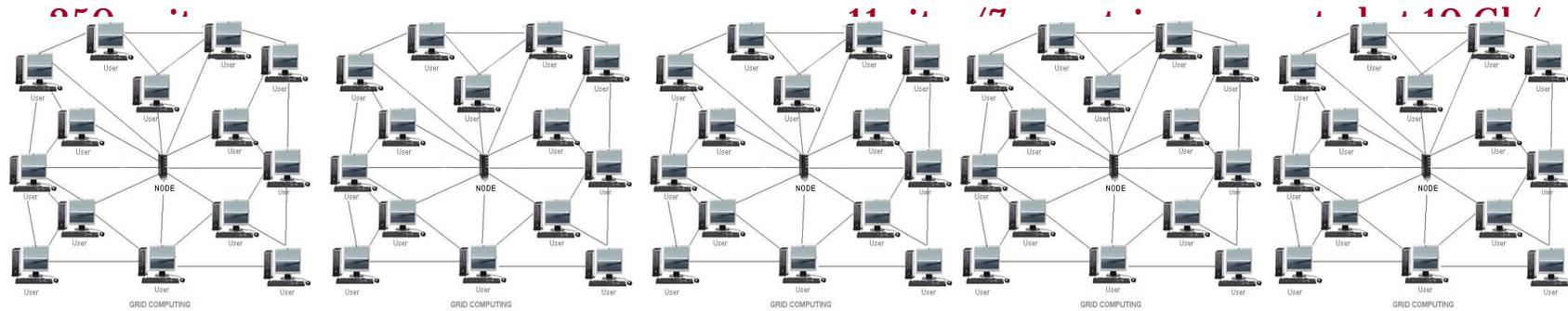
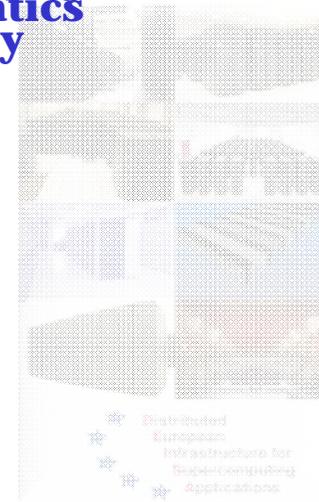
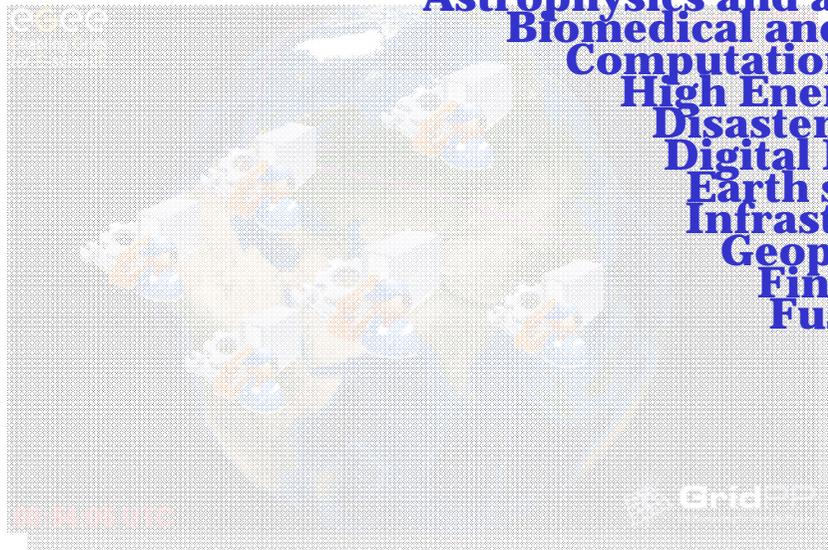
GÉANT: connecting Europe



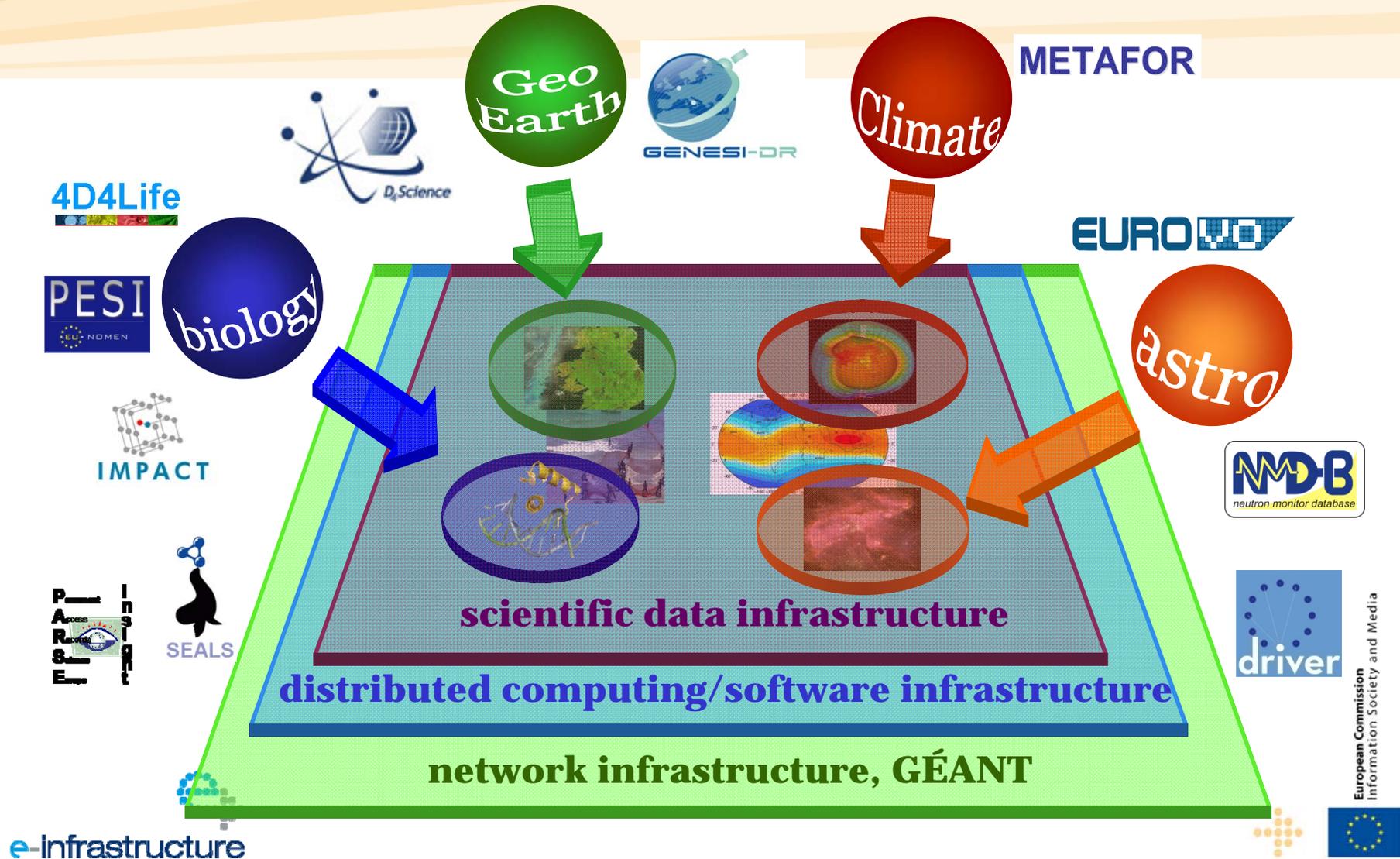
- **Pan-European coverage**
(40+ countries / 3900+ universities / 30+ million students)
- **Hybrid architecture:**
 - connectivity at 10 - 40 Gb/s (aggregated traffic)
 - dark fiber wavelengths (for demanding communities)
- **Global reach**

EGEE and DEISA: European multi-science grids with global footprint

Astrophysics and astroparticle physics
Biomedical and bioinformatics
Computational chemistry
High Energy Physics
Disaster recovery
Digital Libraries
Earth sciences
Infrastructure
Geophysics
Finance
Fusion



Scientific Data Infrastructure



Scientific data e-infrastructure



We need to exploit the growing sensor/effector layer to make the world itself a real-time database.

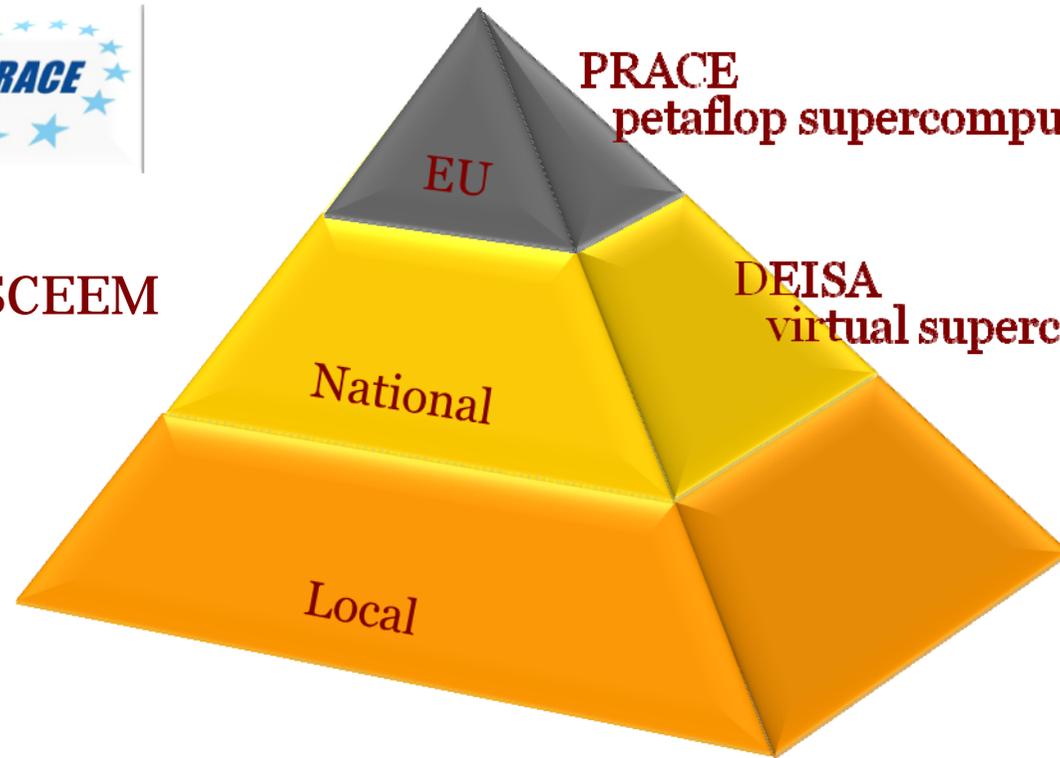
(from the creativity machine, V. Vinge)

- The emergence of "big data science" has a global dimension as it reflects the increasing value of raw observational and experimental data in virtually all fields of science. Europe has to pay particular attention to the aspects of accessibility to key data collections, its quality assurance and preservation.
- The objective of scientific data e-infrastructure is to develop an ecosystem of European Digital Repositories, federating and adding value to national and discipline based repositories so as to respond to Member States request to improve the access to scientific information.

PRACE: a “peta” race



LinkSCEEM



Novel European e-Infrastructures



In 15 years, we are likely to have processing power that is 1000 times greater than today, and an even larger increase in the number of networked-connected devices (such as tiny sensors and effectors).

(from the creativity machine, V. Vinge)

- Supercomputing has been identified as a key priority to boost Europe's scientific performance. This requires a new strategy for industrial involvement and coordination amongst funding authorities.
- By addressing strategic, policy, technical, financial and governance issues related to supercomputing, PRACE is creating an important momentum in mobilising significant national funds to deploy an ecosystem of Petascale machines in Europe aiming at the exa-scale performance by 2020.

Global Virtual Research Communities



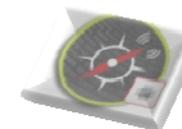
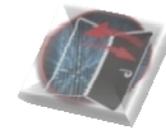
[...] we need to devise and experiment with large scale architectures for collaboration... [...] and forge links between unrelated specialities [...]

(from the creativity machine, V. Vinge)

- Europe needs to continue developing world-class e-Infrastructures capable to support new "participative" paradigms.
- Issues need to be addressed like the clash of cultures between different disciplines, the need to rethink organisational models, the setting up of quality assurance mechanisms etc.
- New strategies for technological development of e-Infrastructures are also fundamental to ensure 'future-proof' solutions, based on open standards, that can be maintained and further improved .

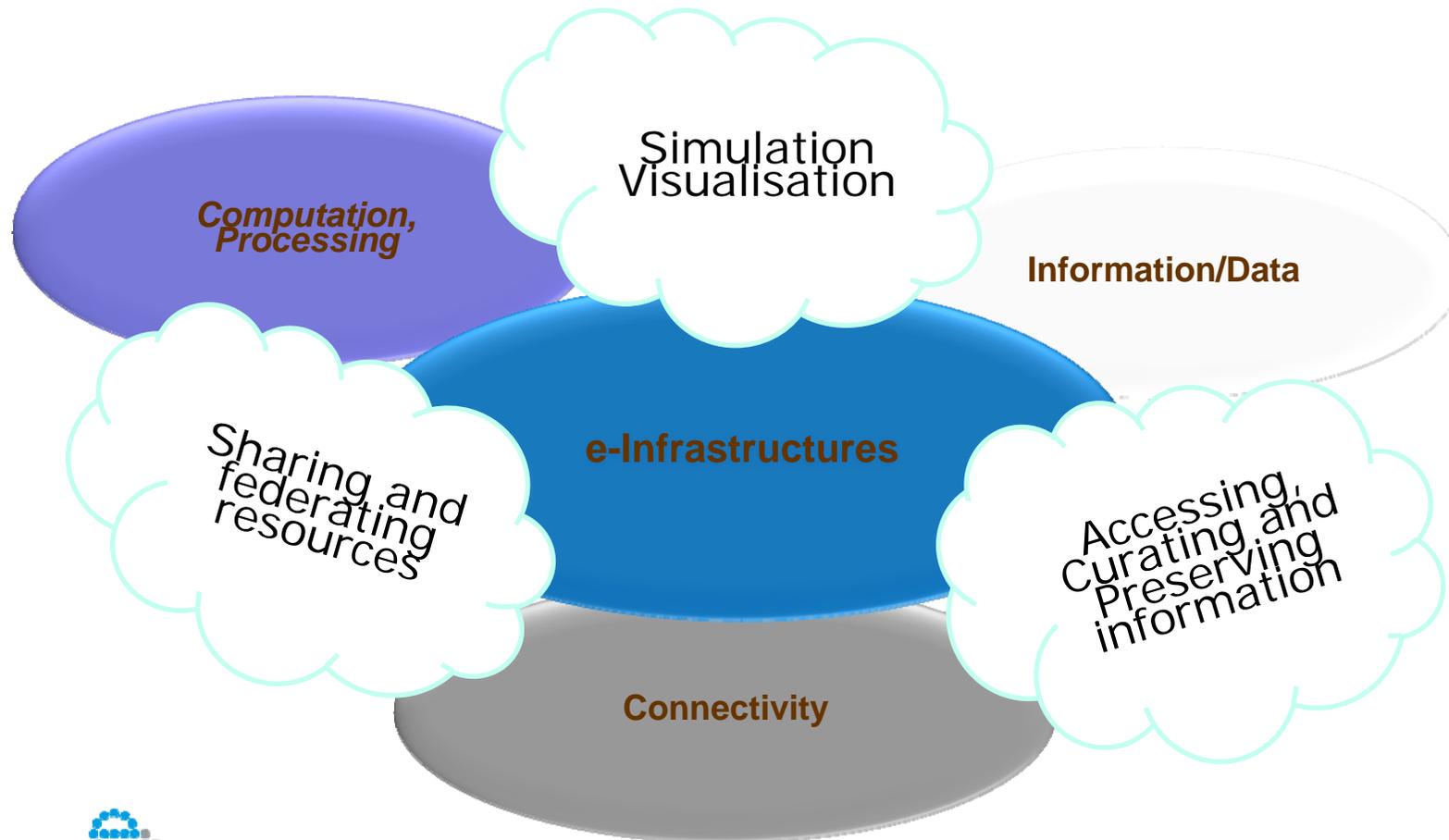
e-Infrastructure

- **Virtualization**
 - connectivity, processing, information management
- **EU footprint**
 - Complementarity between National and European Policies for Research and
- **Cost-effectiveness**
 - By providing common responses to different user requirements, e-Infrastructures are crucial to foster scientific excellence, promote global scientific partnerships and stimulate the development of high-quality human capital, while ensuring economies of scale.



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e-Infrastructures: Europe as Hub of Scientific Excellence



Fostering Global Virtual Research Communities

Push & Pull

Scientific Communities

- Geographically spread
- Culture heterogeneity
- Problem Complexity
- Volumes of information
- Quality of information
- Incentives to share
- Organisational barriers

e-Infrastructures

- Connectivity
- Collaboration
- Processing, Simulation
- Repositories of data
- Curation/Review
- Trust
- Knowledge advantage

Scientific Data - Looking ahead



We need to exploit the growing sensor/effector layer to make the world itself a real-time database.

(from the creativity machine, V. Vinge)

- “Big, complex data-intensive science” of global dimension is here to stay; hence the increasing value of observational and experimental data in virtually all fields of science
- Europe pays particular attention to the aspects of accessibility to scientific information, its quality assurance and preservation
- Developing an ecosystem of European Digital Repositories, federating and adding value to national or discipline-based repositories will be necessary
- Multi-disciplinary approaches, new participative paradigms and global research communities are an essential part and driver of the strategy
 - ...but organisational, governance and financing models need reconsideration, informed by sociological, political and cultural considerations
- Upcoming Calls of e-Infrastructures programme to provide support to the e-Science transition

For further information



www.cordis.europa.eu/fp7/ict/e-infrastructure/

