e-Infrastructures
fostering the building of Global
Virtual Research Communities

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a new vision for Science

- **Global challenges with high societal impact**

- **Data deluge... wet-labs versus virtual-labs**

- **Improved scientific process**

- **Cross-disciplinarity**

- **Virtual Research Communities**

Technology push

networking
grids
instrumentation
computing
data curation...

revolution in science & engineering, research & education

value added of distributed collaborative research (virtual communities)

Application pull

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building Science through collaboration

Research Communities

- common goals, complementary and shared information, tools and knowledge, awareness of research protocols, effective means of collaboration, interest in being part of the community

Virtual research

- from empirical, experimental, theoretical and computational science... to intensive use of data... abstraction... models... simulation... e-Science

Virtual communities

- no geographical, time or institutional boundaries

Globalisation

- Global challenges, global dimension, win-win situation

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Global Virtual Research Communities

Research Community-1	Research Community-2	Research Community-3
Human interaction	Human interaction	Human interaction
Workspace	Workspace	Workspace
Labs	Labs	Labs
Scientific Data	Scientific Data	Scientific Data
Computing, Grid	Computing, Grid	Computing, Grid
Network	Network	Network

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Global Virtual Research Communities

Virtual Community

Human interaction	Human interaction	Human interaction
Workspace	Workspace	Workspace
Virtual Labs	Virtual Labs	Virtual Labs

Economies of Scale

Scientific Data

Grid

Network

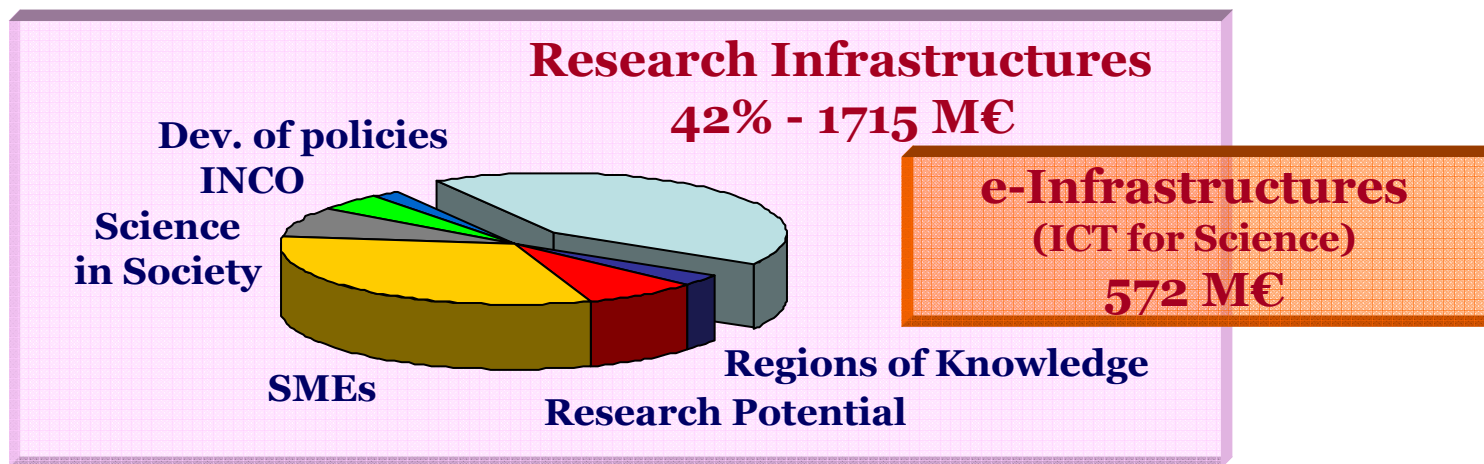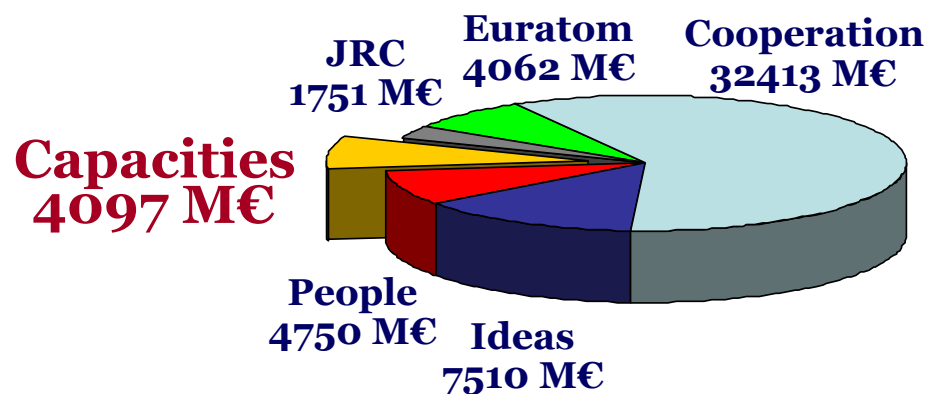Efficiency Gains

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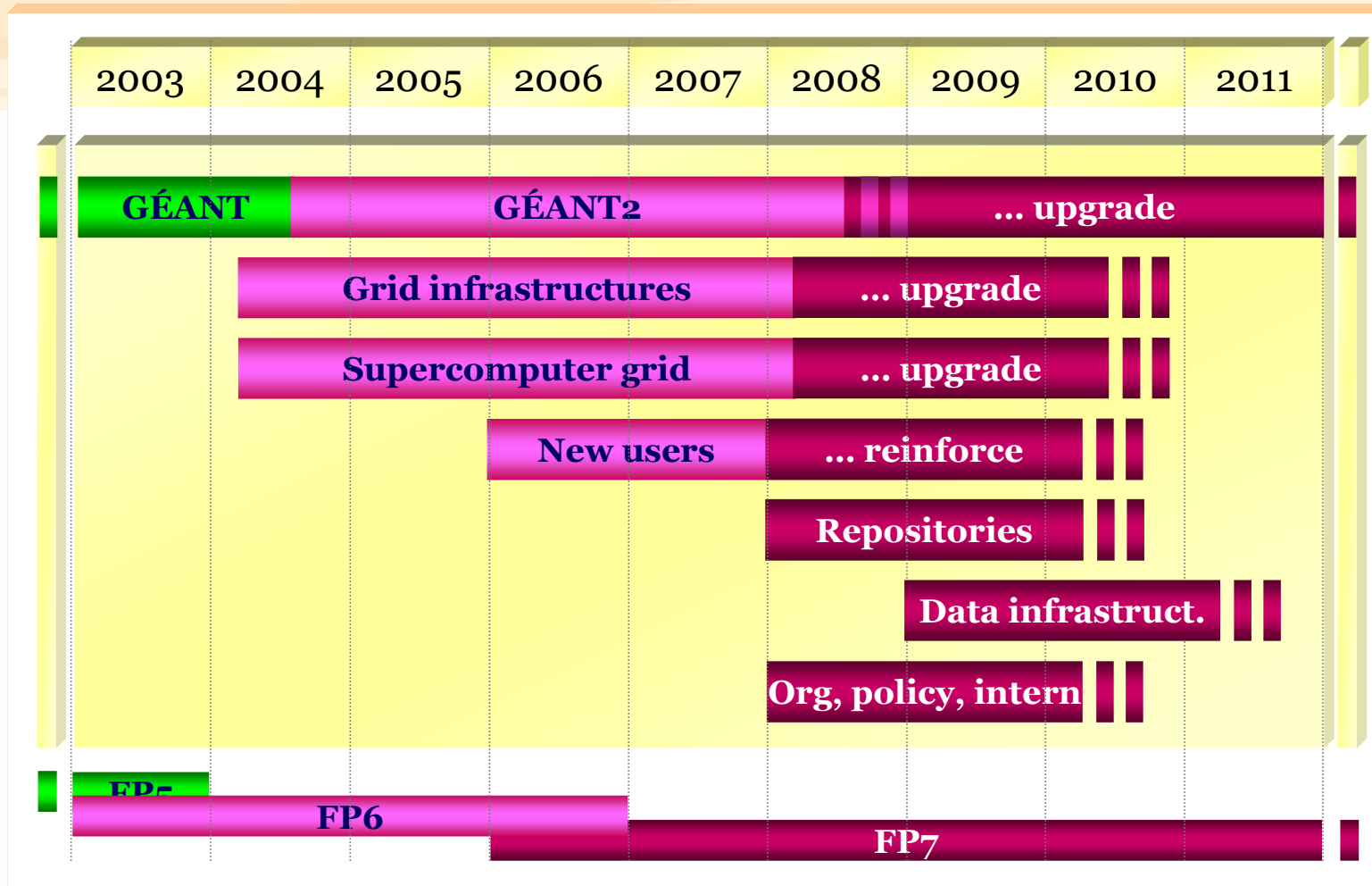Information Society and Media

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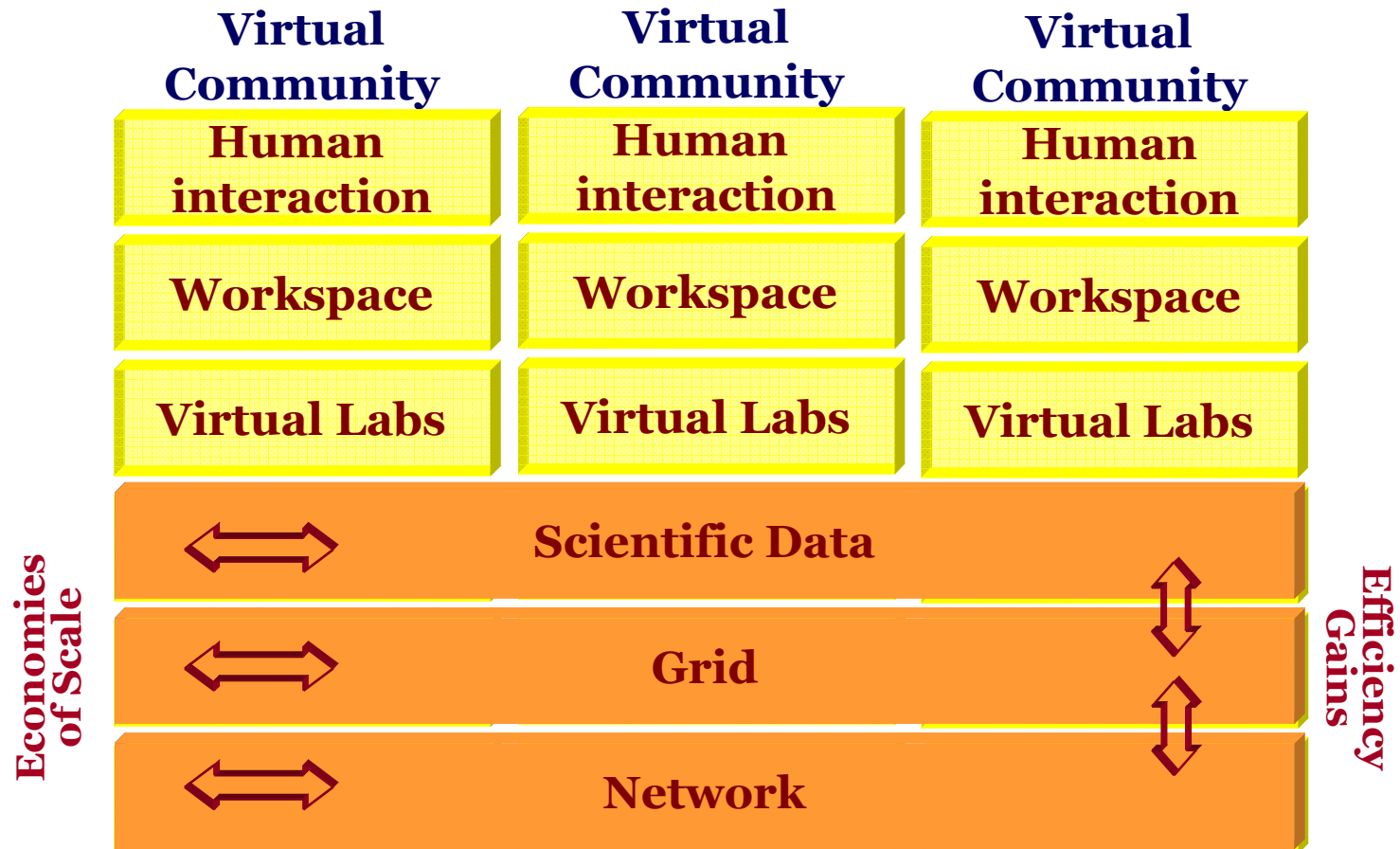
ICT for Science: e-Infrastructures

Connecting the finest minds
Sharing and federating the best scientific resources
Building global virtual communities

Weather Forecast community

Biomedics community

Astrophysics community

Sharing and federating scientific data

Sharing computers, instruments and applications

Linking at the speed of the light

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Framework Programme 7 (2007-13)

JRC
1751 M€

Euratom
4062 M€

Cooperation
32413 M€

Capacities
4097 M€

People
4750 M€

Ideas
7510 M€

Research Infrastructures
42% - 1715 M€

Dev. of policies
INCO

Science
in Society

SMEs

Regions of Knowledge

Research Potential

e-Infrastructures
(ICT for Science)
572 M€

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e-Infrastructure: evolving approach

GÉANT: connecting Europe

- **Pan-European coverage (40+ countries /3900 universities / 30+ million students)**

- **Hybrid architecture:**
  - **connectivity at 10 Gb/s (aggregated traffic)**
  - **dark fiber wavelengths (demanding communities)**

GÉANT2 is operated by DANTE on behalf of Europe's NRENs.

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GÉANT: global reach

GÉANT2 Global Connectivity November 2006
GÉANT2 is operated by DANTE on behalf of Europe's research and education networks
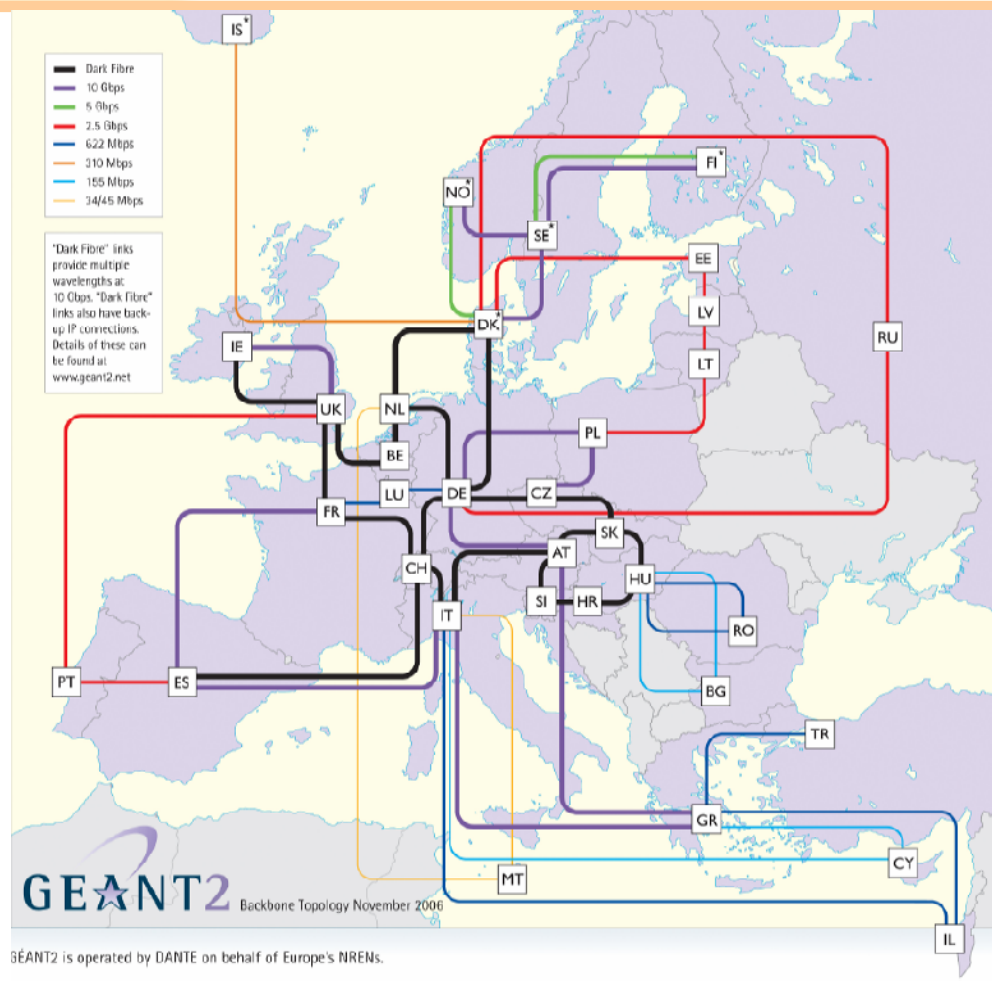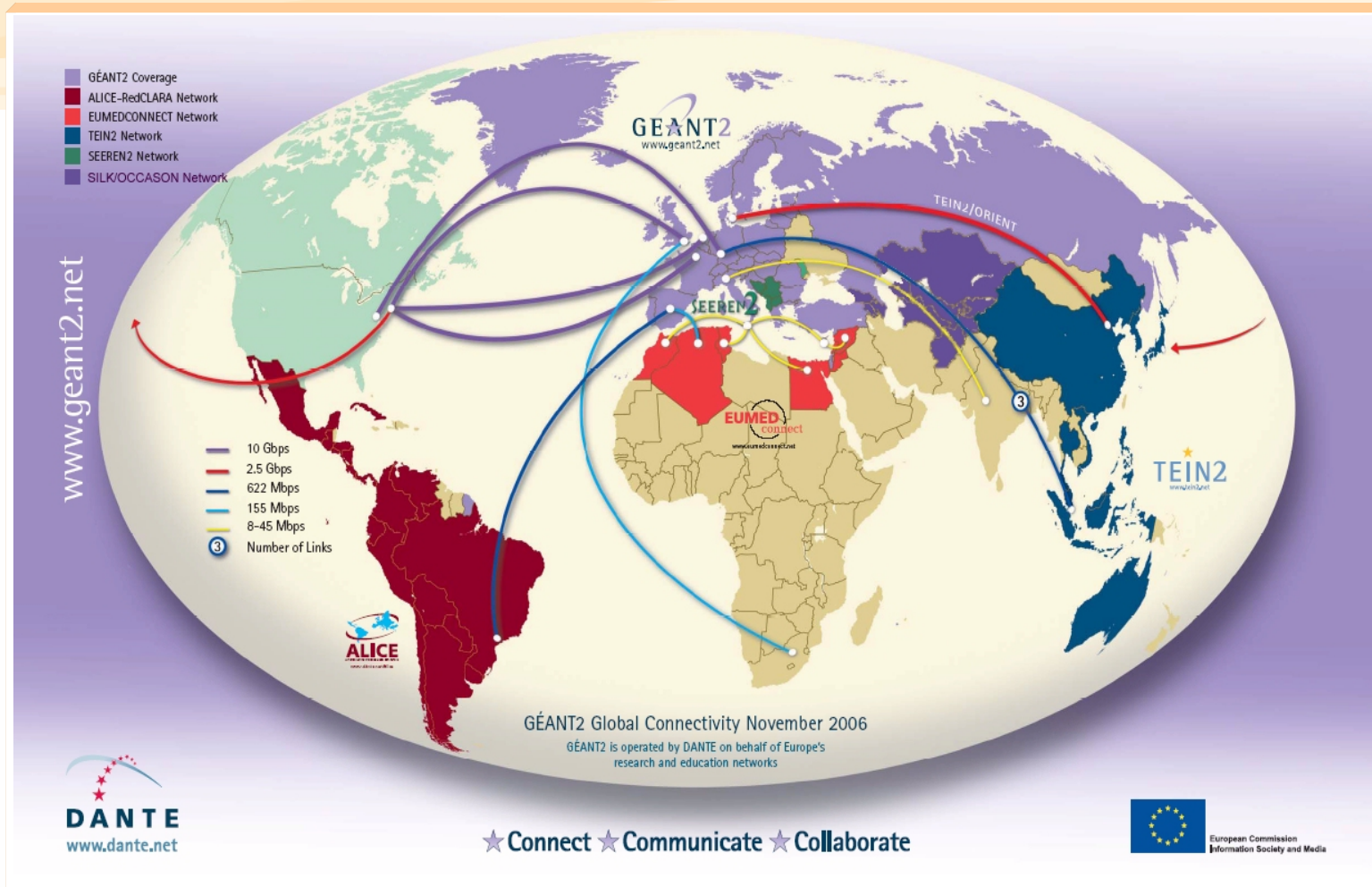
EGEE: large multi-science grids

eGee
Enabling Grids
for E-sciencE

Scheduled = 17356
Running = 18359

- >240 sites
- >37 000 CPUs, 15 Pbyte of storage
- ~100 000 jobs successfully completed per day
- 200 Virtual Organisations
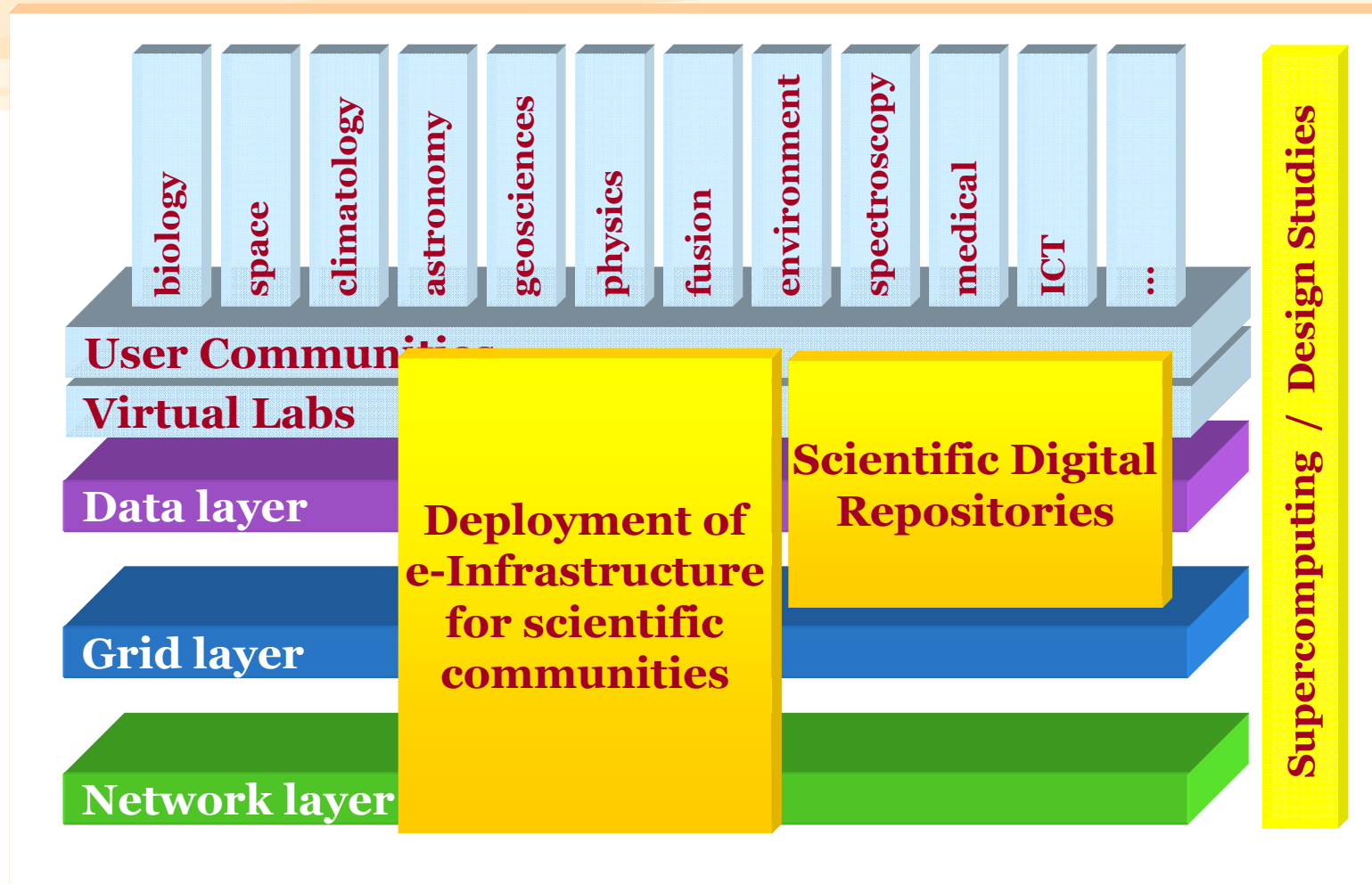- >2000 registered users, representing 1000s of scientists

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DEISA: virtual HPC services

Distributed European Infrastructure for Supercomputing Applications

- **11 sites in 7 countries connected at 10 Gb/s**

- **Over 22,000 CPUs sporting 200 TFlop**

- **Running larger parallel applications in individual sites**

- **Enabling workflow applications with grid technologies**

- **Providing a global data management service**
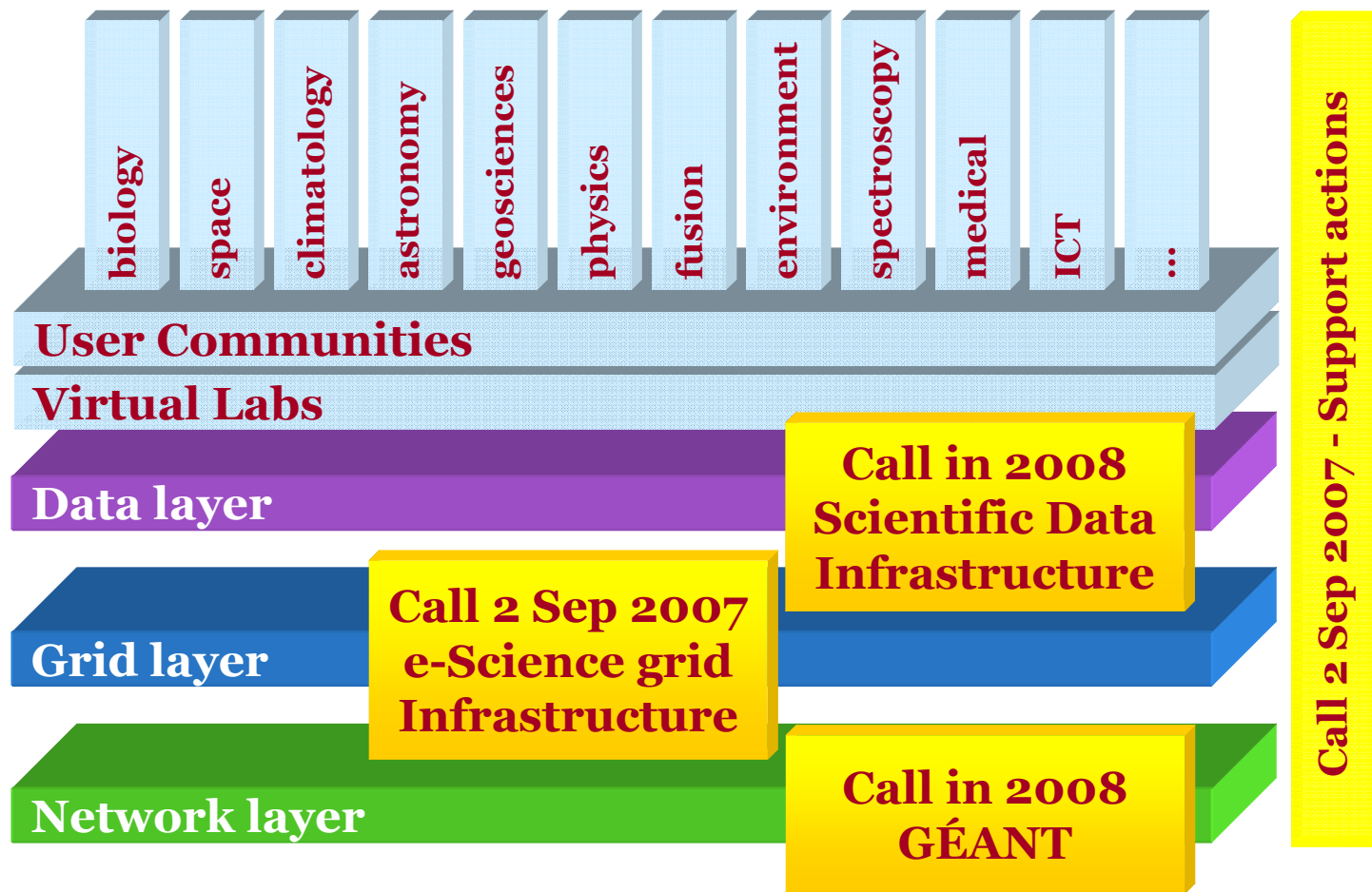
- **Extreme Computing Initiative**

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e-Infrastructure Call 1 (May 2007, €58m)

biology · space · climatology · astronomy · geosciences · physics · fusion · environment · spectroscopy · medical · ICT · …

User Communities

Virtual Labs

Data layer

Grid layer

Network layer

Deployment of e-Infrastructure for scientific communities

Scientific Digital Repositories

Supercomputing / Design Studies

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e-Infrastructure Call 2 (Sep 2007, €64m) and new Call in 2008

Call 1: digital repositories

IMPACT	bio-informatics
NMDB	space physics
METAFOR	climatology
EuroVO-AIDA	astronomy
GENESI-DR	geosciences
DRIVER II	federated digital repositories

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Call 1: user communities

EUFORIA	magnetic fusion
neuGRID	medical e-Support
ETSF	spectroscopy
e-NMR	data analysis - biology
DORII	environmental science, seismology
D4Science	environment - e-Infrastructure
EVALSO	astronomy (intercontinental)
SEE-GRID-SCI	seismology (regional)
FEDERICA	ICT communities
EDGeS	ICT communities

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digital repositories & user communities

DRIVER

(EGEE, DEISA)

(GÉANT)

data

grids

network

IMPACT
METAFOR
EuroVO-AIDA
GENESI-DR
NMDB

neuGRID
e-NMR
EUFORIA
D4SCIENCE
DORII, ETSF

FEDERICA
EVALSO
EDGeS

generic e-Infrastructure...   user communities involvement

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Call 1: new infrastructures

PRACE	**european supercomputing initiative**
EGI - DS	**european grid infrastructure**
DIESIS	**critical infrastructures**

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new "petaflop" supercomputers

PRACE
petaflop supercomputers

DEISA
virtual supercomputer

EU

National

Local

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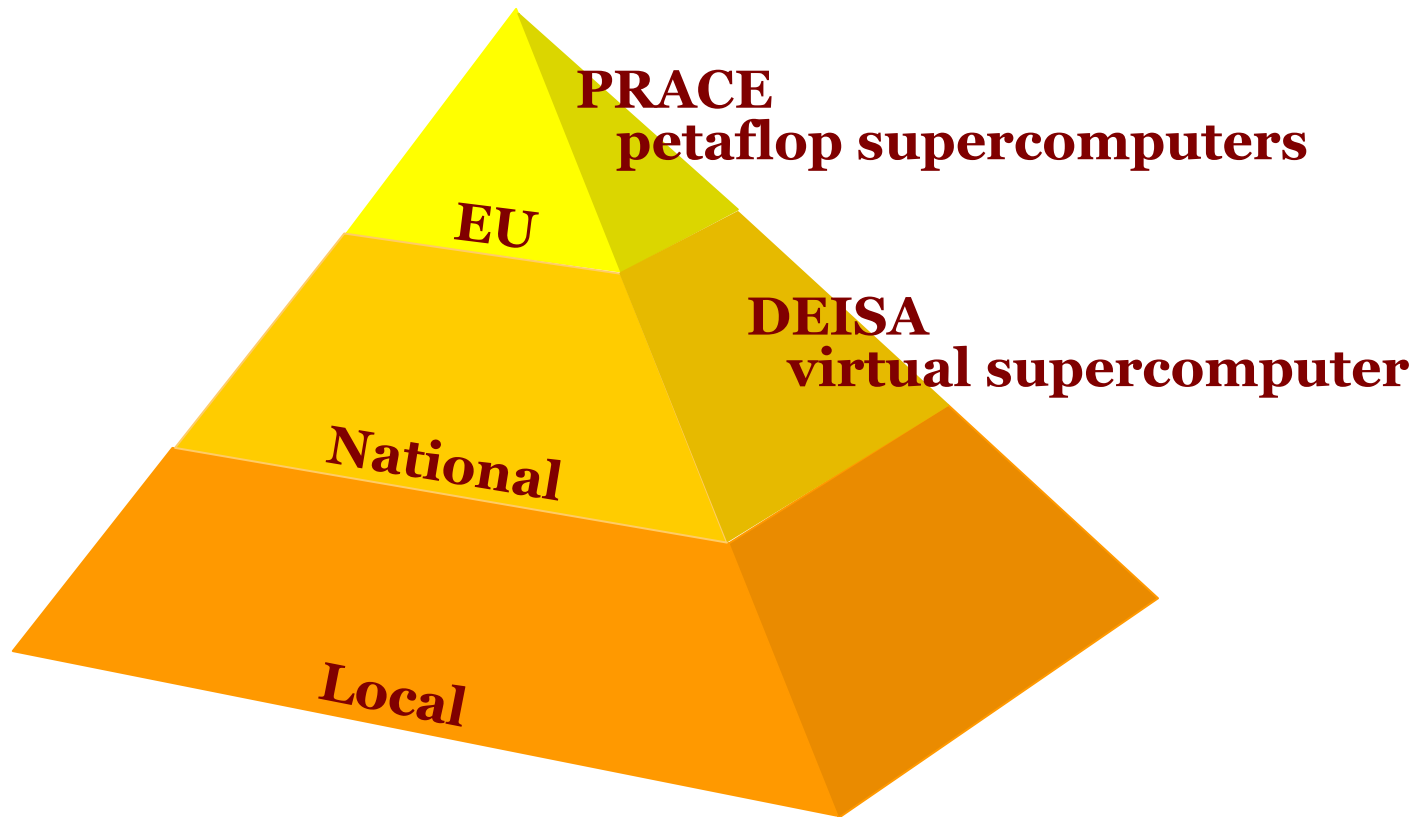
new resource-provisioning model

Service entry point for basic services provided by a national entity called National Grid Initiative (NGI)

User
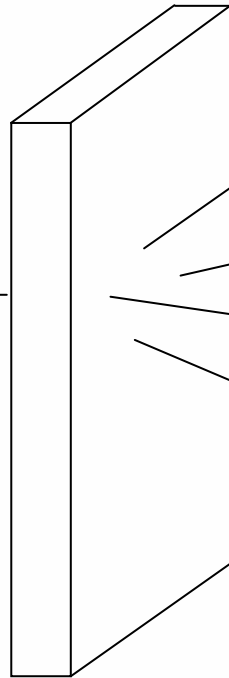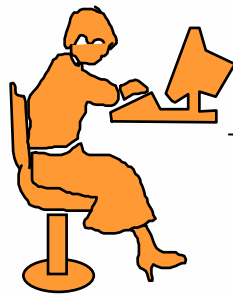
Pool of

Grid-based

Resources

and Services

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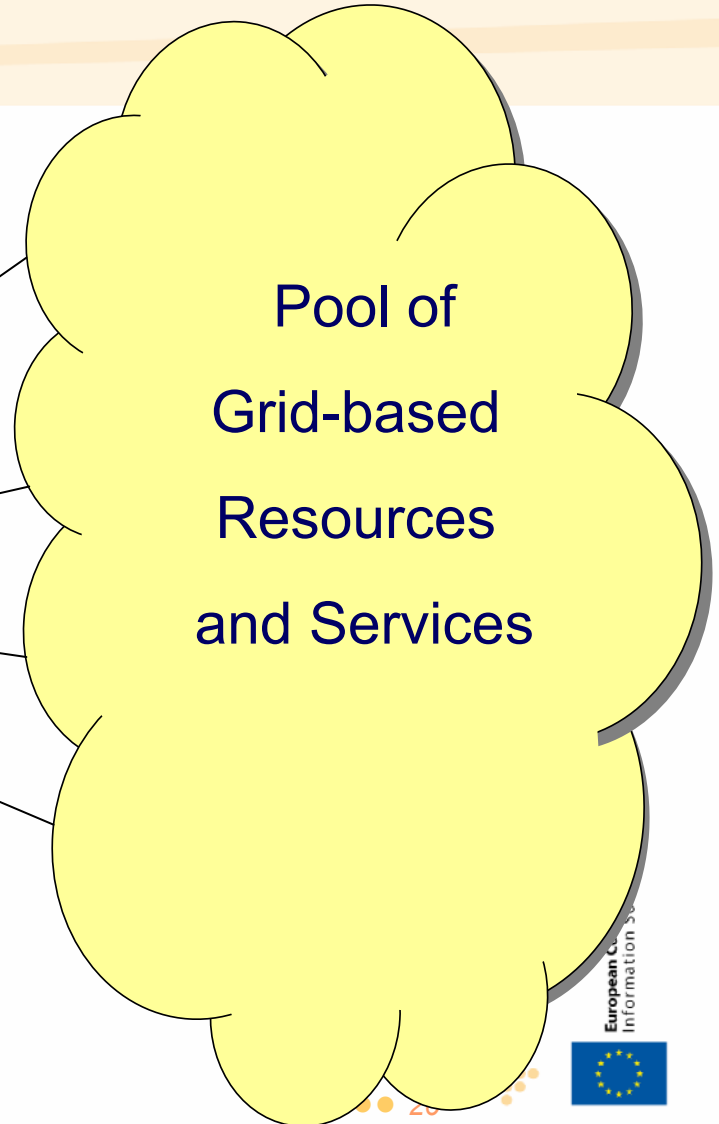
new resource-provisioning model

EGI_DS (Design study)

Coordinating entity (EGI)

NGI- Nordic States

Key elements of new scheme:

- One-stop-shop service (including training) to users who want to access grid-based and data resources
- Service provisioning beyond project cycles
- More efficient use of resources on the national/regional level
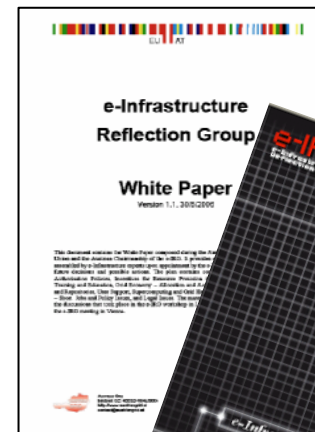- Better planning of new investments, economies of scale

NGI-GR

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policy aspects

Standards: essential strategy element

- Standards ensure interoperability of products and services
    - Benefit for industry & research: level playing field, lower risk that innovation may be heading to technological "dead ends"
    - Benefit for consumers: better products & services, lower investment risks
- Work on standardisation: essential element of European strategy to simplify regulation at EU / national level so as to ease burden on business

- Standardisation particularly important in ICT (ICT de facto a global market, technological convergence) – *ICT Standardisation Work-Programme (2006), Study*

- e-Infrastructures: validation of standards in novel application scenarios – *opportunities to increase contributions / benefit*

ETSI: one of the cornerstones of EU standardisation process

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Some conclusions

- Global challenges in science, the data deluge

- e-Science: virtual research, global virtual research communities

- A multi-dimensional e-Infrastructure programme responding to the challenge

- Standards: an essential EU strategy element *(impact of e-Infrastructure fragmented and limited when insufficient emphasis is put on standards)*

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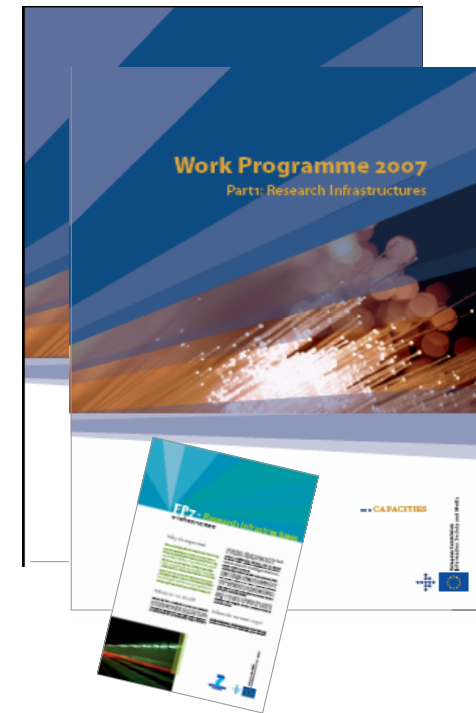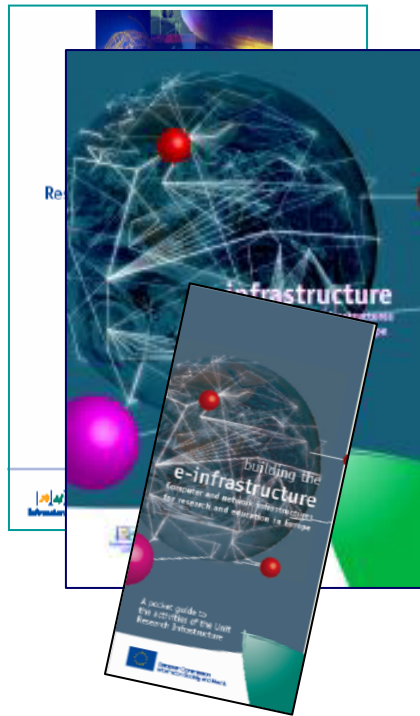
www.cordis.europa.eu/fp7/ict/e-infrastructure/