e-Infrastructure: current status and plans in FP7

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Roles and some examples of ongoing initiatives

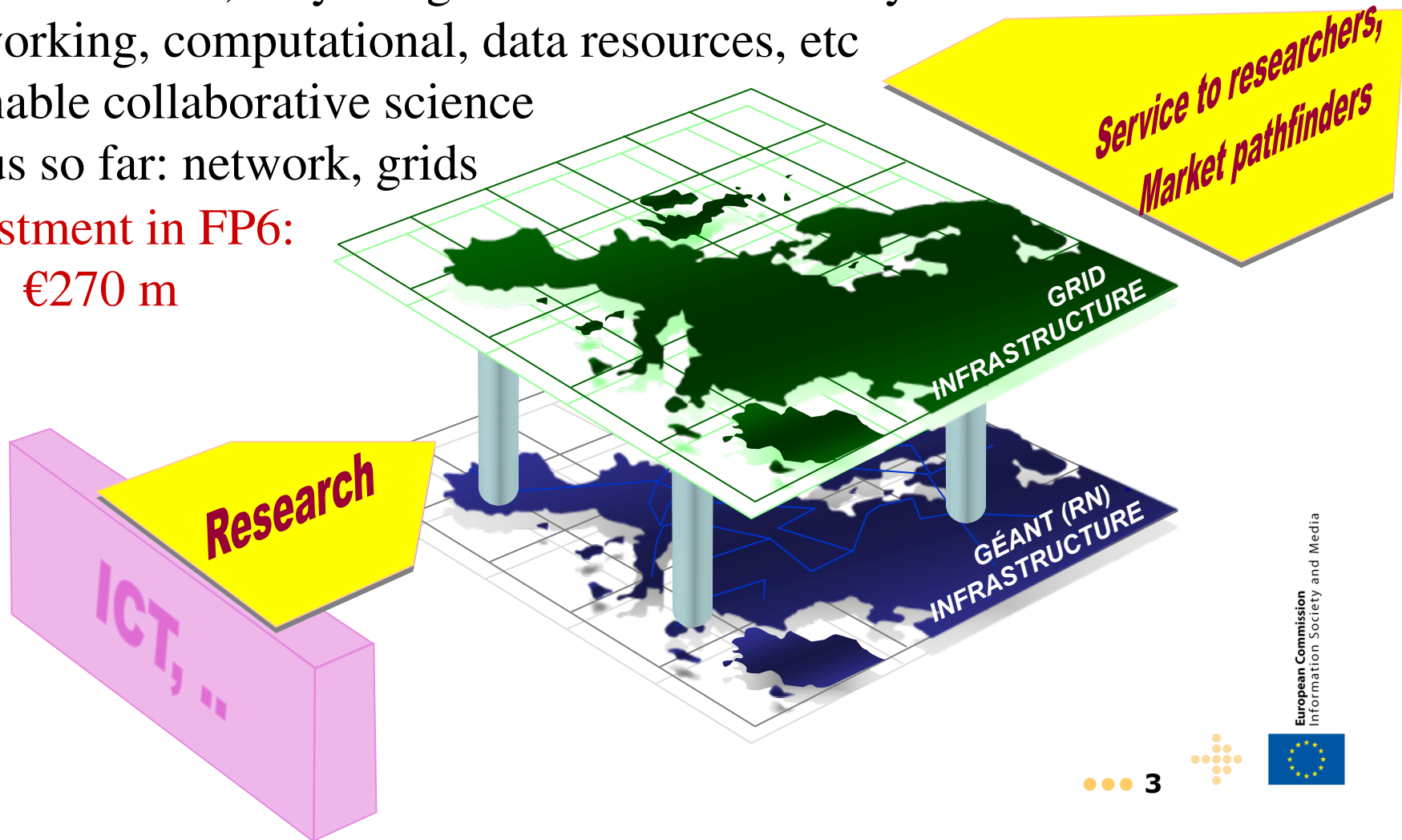European Commission
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e-Infrastructures in the broader European research picture

Domain-independent ICT-based RI designed to support science; they integrate in a seamless way networking, computational, data resources, etc to enable collaborative science

Focus so far: network, grids

Investment in FP6:
€270 m

Service to researchers, Market pathfinders

Research

ICT, ..

GRID INFRASTRUCTURE

GÉANT (RN) INFRASTRUCTURE

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EGEE: global collaborations in science

- ~ 500 sites in 40 countries
- > 60 Virtual Organisations
- ~ 30 000 CPUs
- > 5 PB storage
- > 20 000 concurrent jobs/day

- Scientific communities

High Energy Physics	Biomedics
Astrophysics	Earth Sciences
Computational Chemistry	Finance
Fusion	Geophysics
Life Sciences	Multimedia…

european DEISA services

High bandwidth (up to 10 Gbit/s)

supercomputer

supercomputer

supercomputer
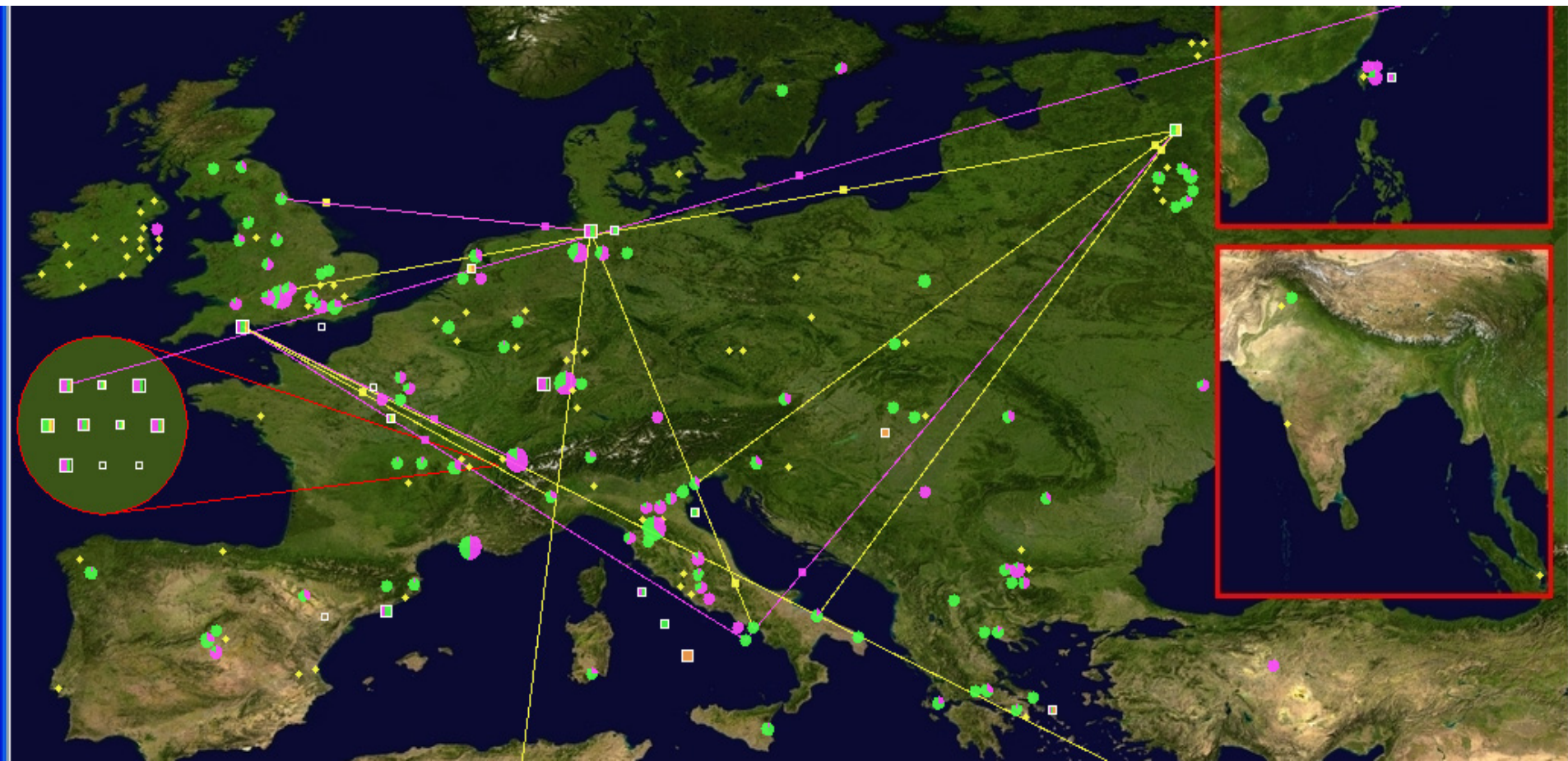
supercomputer

national services

DEISA: High End Computing for next science breakthroughs

≠ Architectures
≠ Operating systems

21.900 processors and 145 TF in 2006, more than 190 TF in 2007

AIX IBM domain

RZG (DE)

IDRIS (FR)

ECMWF (UK)

CSC (FI)

CINECA (IT)

FZJ (DE)

LINUX SGI

SARA (NL)

LRZ (DE)

High Performance Common Global File System

LINUX Power-PC
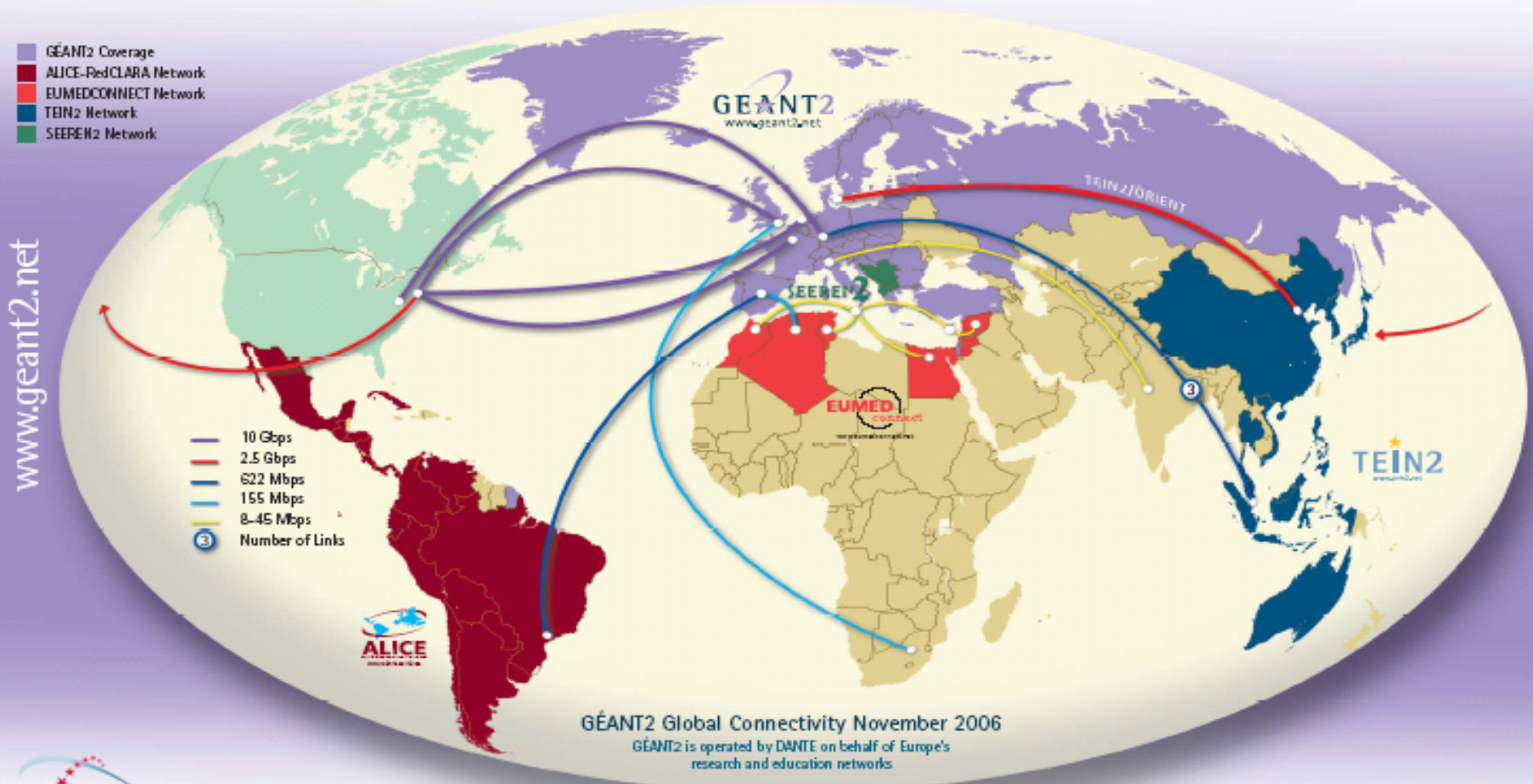
BSC (ES)

Portfolio of projects

Geographical expansion of collaboration

Eastern Europe, NIS, Caucasus	OCCASION, PORTA OPTICA STUDY
Latin America	ALICE, EELA, AUGERACCESS
Asia (China, India etc)	TEIN2, EUChinaGrid, EC-GIN, Orient, EUIndiaGrid
Baltic States	BalticGrid
Mediterranean	EUMedConnect, EUMedGrid, ITHANET
South-Eastern Europe	SEEREN-2, SEEGRID-2

e-Infrastructure

New Applications

Molecular, Clinical	ITHANET
Bioinformatics, Biology	BioInfoGrid
Civil Protection	CYCLOPS
Astronomy	EuroVO-DCA, EXPRES
Earth science	DEGREE
Chemical	Chemomentum
Industrial Applications	SIMDAT
Grids/GÉANT & DLs	DILIGENT, DRIVER
Applications on IPv6	6DISS, IPv6TF

Support, Enhancements

Synergy, Outreach, Training	BELIEF, Go4IT, Iceage
Security, Policy support	ISSeG, E-IRGSP
SW-interoperability, testing	OMII-Europe, ETICS
Grid services (interactive, workflow-centric, quasi-supercomputing,…)	int.eu.grid, KnowARC Chemomentum QosCosGrid
Control remote instruments	GridCC, RINGrid
Traffic Monitoring, e2e QoS	Lobster, Phosphorus
Optical networks	MUPPED
Connected Test-beds/NREN	EUROLabs, WEIRD

e-Infrastructures transforming science: Science as we know it today (application "silos")
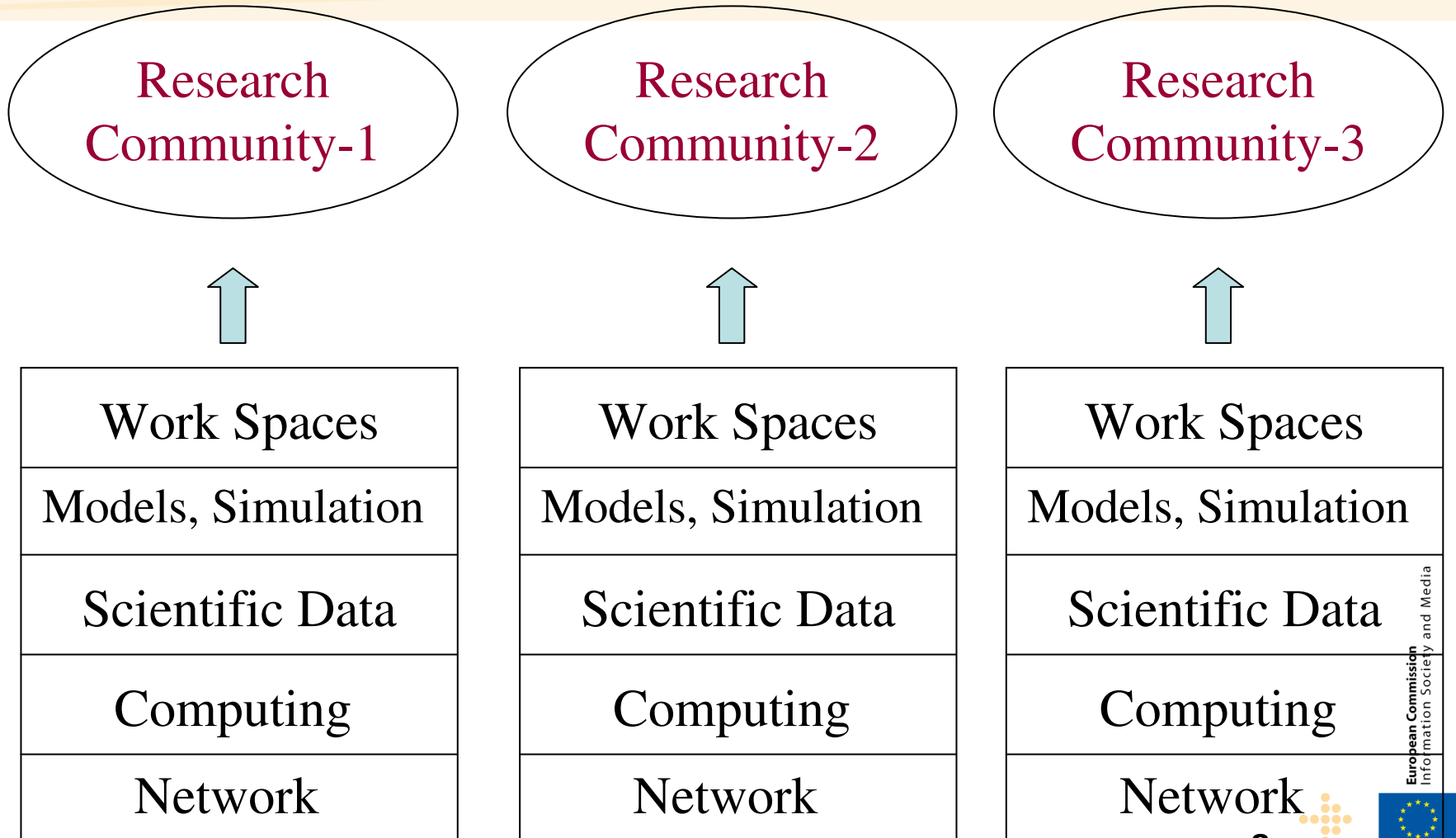
e-Infrastructures transforming science: Science of tomorrow based on *Global Virtual Research Communities*
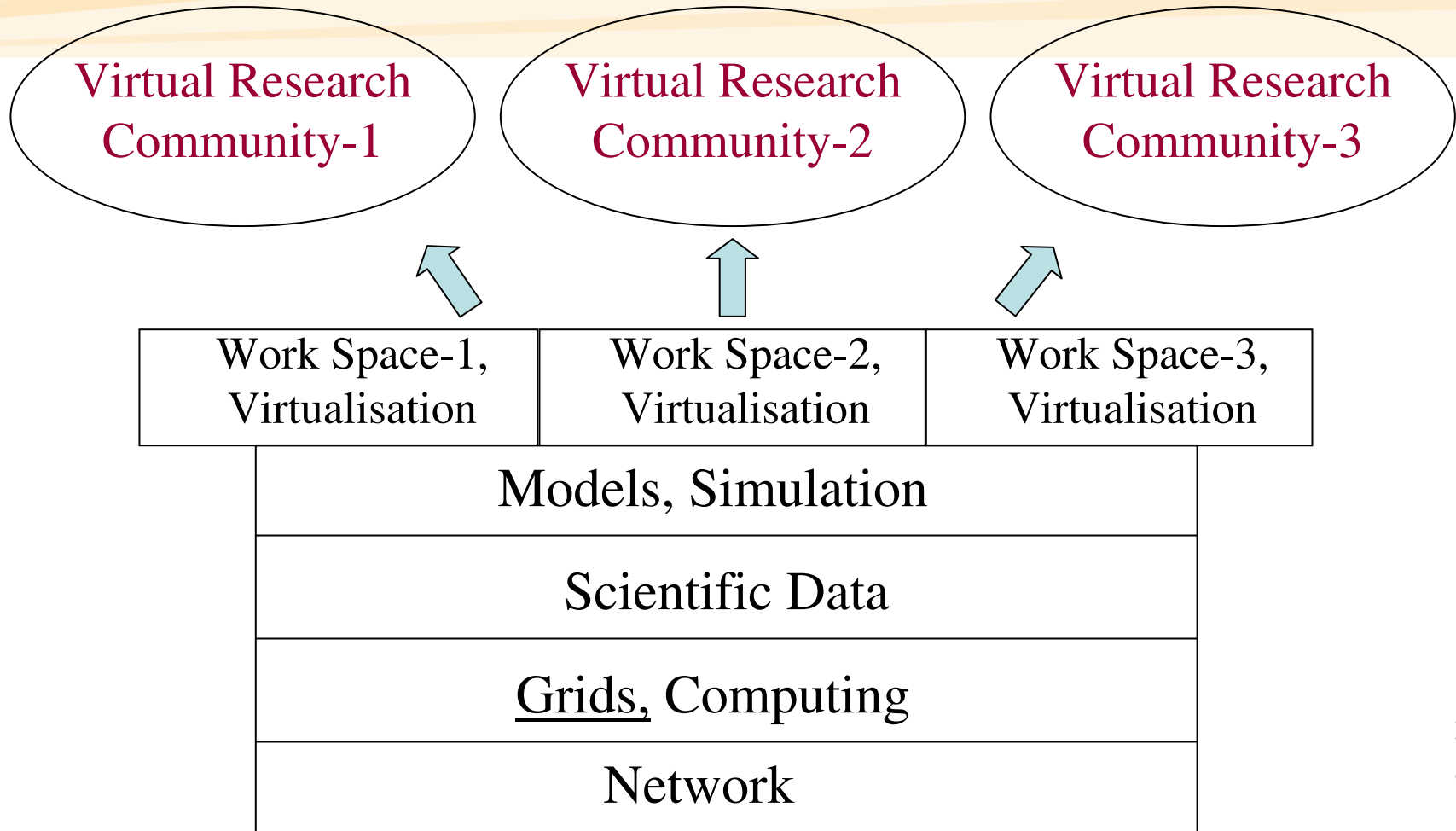
Global Virtual Research Communities are complementary to physical research centres; they are not replacing them

A new environment for doing science

Technological advances and the availability of a new generation of research infrastructures (based notably on high speed networks and resource sharing technologies) enable new ways of doing science

- Increased *productivity*, decreased *cost* (better use of research facilities, scientific resource to researcher and not the opposite, decreasing costs of modelling and experimentation etc)

- *Cross-disciplinary research*, becoming the norm, dynamic forming of research communities

- Increased *collaboration* (independent of geographical location), connection of *best minds*, ideas linked "at the speed of light"

- Alleviation of brain drain

  Similar developments in education (open universities, distance learning, Internet-based learning etc)

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e-Infrastructures as icebreakers for industry

- Early adoption by industry
- Shorter cycles for new products
- Academia-Industry partnerships
- Innovation

e-Infrastructures

- Technology validation in real world settings (test-beds, production-quality facilities)
- Education, Training
- Skilled workforce
- Pre-commercial procurement

Industry

- Industrial requirements and quality

Standards: catalytic role

Particularly important for smaller and remote EU Member States

Example: four Member States have mainly, up to now, invested in large RIs; the availability of e-Infrastructures is key for these large RI to be remotely accessed

Breakdown of RIs with > 250 MEuros construction costs (56 RIs)

Other Countries 5%

EU12 0%

EU15 less (DE-FR-IT-UK) 23%

DE-FR-IT-UK 72%

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e-Infrastructures in the press

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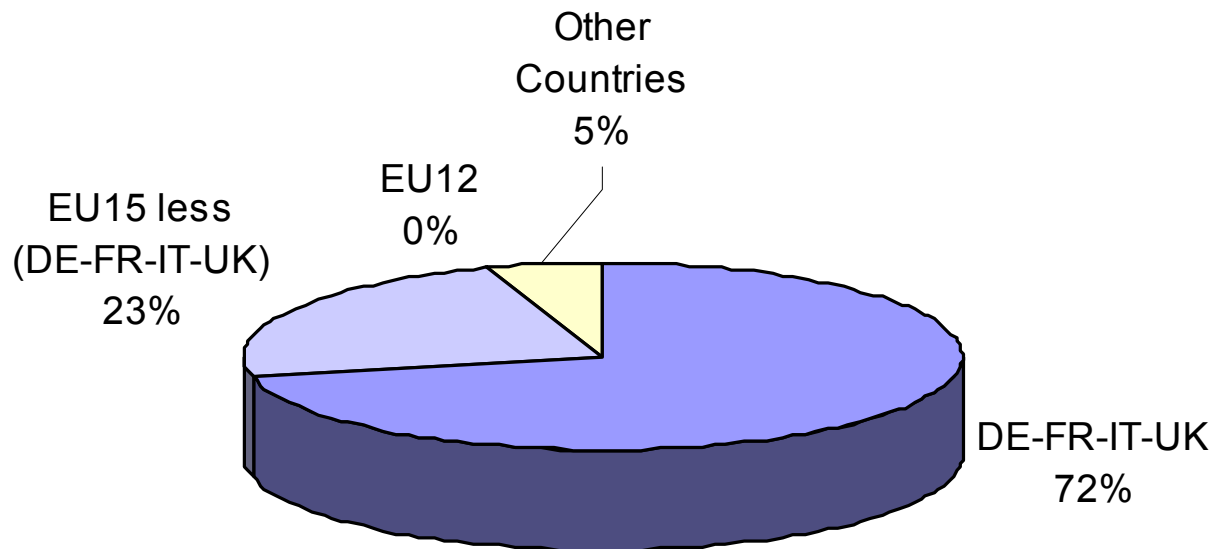
e-Infrastructures in the press

Global weather forecast system uses power of GÉANT to share data and resources (Nov 2005)

The planned Global Interactive Forecasting System (GIFS), to become operational by 2008, aims to improve weather prediction speed and accuracy, reducing the effects of extreme weather on the developed and developing world. GIFS relies on GÉANT2 to transmit as much as 500 Gb of data daily between distributed researchers – the equivalent of over 700 CDs worth of information.

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e-Infrastructures in the press

*EGEE makes rapid earthquake analysis possible (June 2005)*

Using the EGEE grid-infrastructure, researchers at the *Institut de Physique du Globe de Paris* (IPGP), France, were able to analyse the large Indonesian earthquake, which struck on 28 March 2005, within 30 hours of it occurring; such calculation would have taken them at least 100 hours on their local machines, whereas they did it in about 10 hours on the grid

e-Infrastructures in the press

Radio astronomers record moments of spacecraft SMART-1 (Sep 2006)

European radio astronomers monitored radio transmissions from the European spacecraft SMART-1 using a network of interconnected (in real time) radio telescopes located in South America and Australia. The data transfer was made possible through GÉANT and its international links and with the use also of the techniques of the e-Infrastructure project EXPReS.
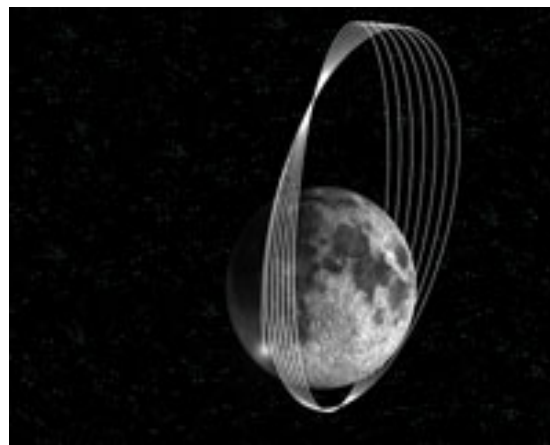
SMART-1 trajectory up to impact.
Photo: ESA

e-Infrastructures in the press

The US TeraGrid and the EU DEISA Supercomputing infrastructures linked by a common wide-area global file system (Dec 2005)

Through this link any scientist, accessing TeraGrid from the US, or accessing DEISA from Europe can directly and transparently create or access data stored in the now common file system of TeraGrid and DEISA with one common file address space.
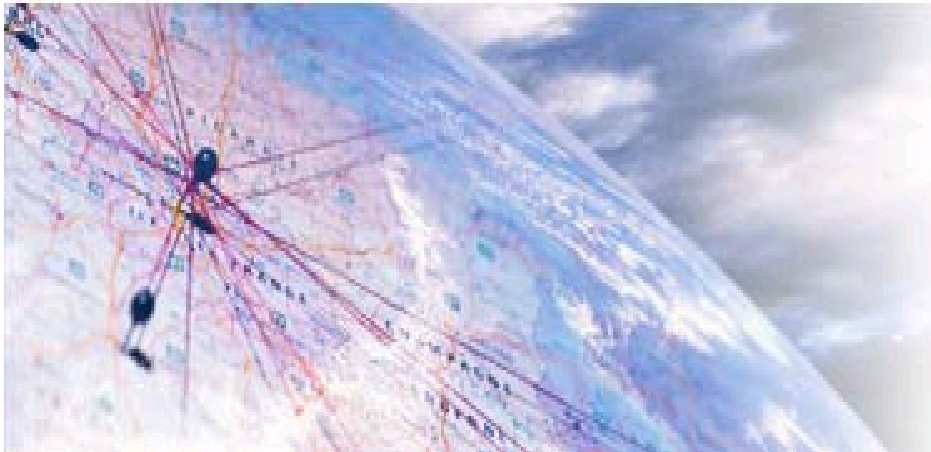
e-Infrastructures in the press

EGEE Grid attacks Avian Flu (May 2006)

During April 2006, a collaboration of Asian and EU laboratories has analysed 300,000 possible drug components against the avian flu virus H5N1 using the EGEE Grid infrastructure (for the docking of 300,000 compounds against 8 different target structures of Influenza A neuraminidases, 2000 computers were used during 4 weeks – the equivalent of 100 years on a single computer)

H5   N1

Credit:
Y-T Wu

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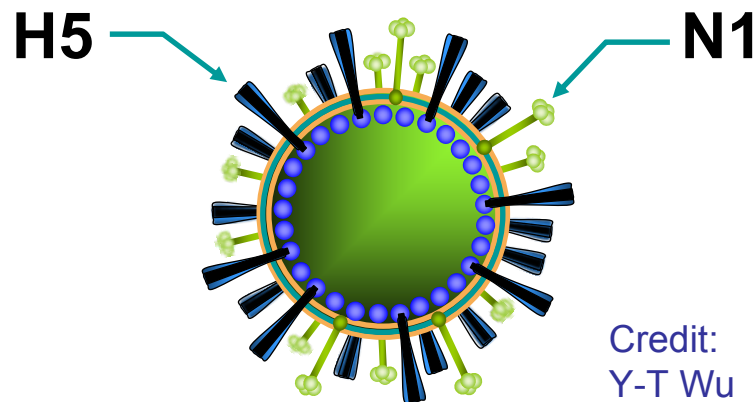
e-Infrastructures in the press

EGEE battles Malaria with Grid Wisdom (Feb 2007)

Using the EGEE grid infrastructure, scientists of the WISDOM project analysed an average of 80,000 possible drug compounds against malaria every hour. In total, the challenge processed over 140 million compounds. Up to 5000 computers were used simultaneously across more than 15 countries, generating a total of 2000 GB (2,000,000,000,000 bytes) of useful data.

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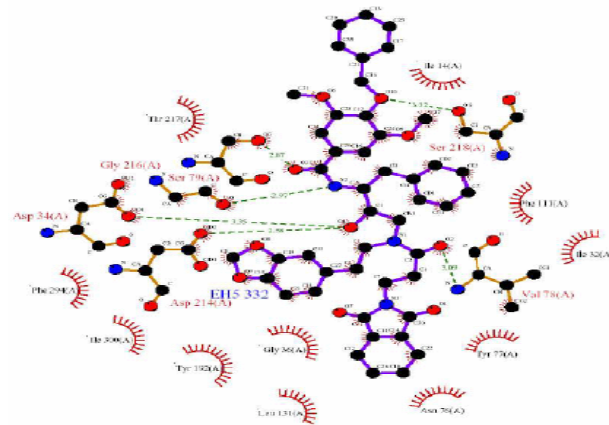
Grid project *SIMDAT*

Grid Solutions for Complex Problems in Industry

1. Grid-enabled data integration across administrative domains

2. Grid-powered collaboration across manufacturers and suppliers

3. Novel analysis and knowledge discovery services exploiting Grid connectivity
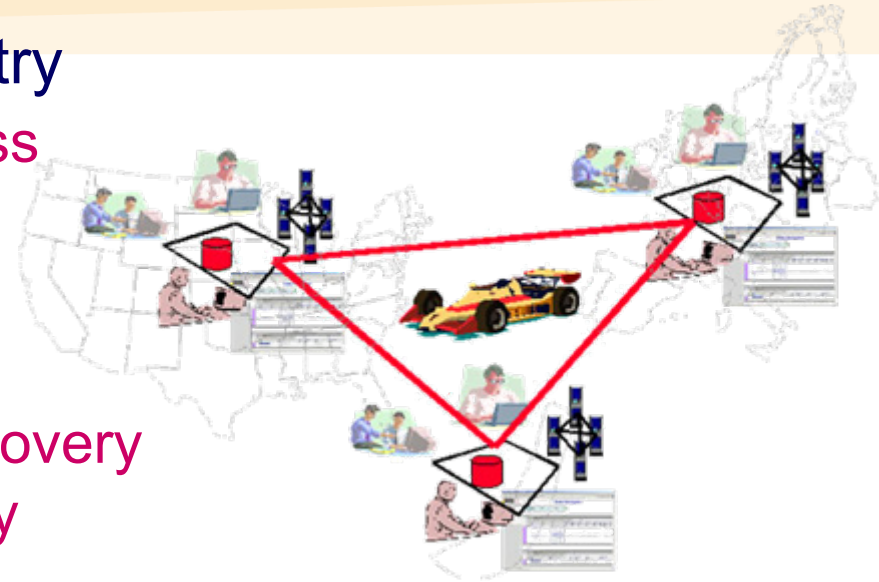
Grid Technologists
FhG · NEC intel · iT innovation · IBM · ORACLE
Universität Karlsruhe (TH)

Capability Providers
ESI GROUP · InforSense · MSC SOFTWARE · lms · LION · ontoprise

Automotive Pharmaceutical Aerospace Meteorology

End Users
gsk · Audi · EADS · Met Office · RENAULT · EUMETSAT · METEO FRANCE · BAE SYSTEMS · DWD

Successful installation of Grids including integrated access to distributed data repositories in seven industrially led prototypes

1. Grid technology development on collaboration to be deployed in the next phase prototypes

2. One prototype already fed into a new product:
   Grid-based integration environment for the automotive industry decided to be deployed at AUDI and SEAT in 2007
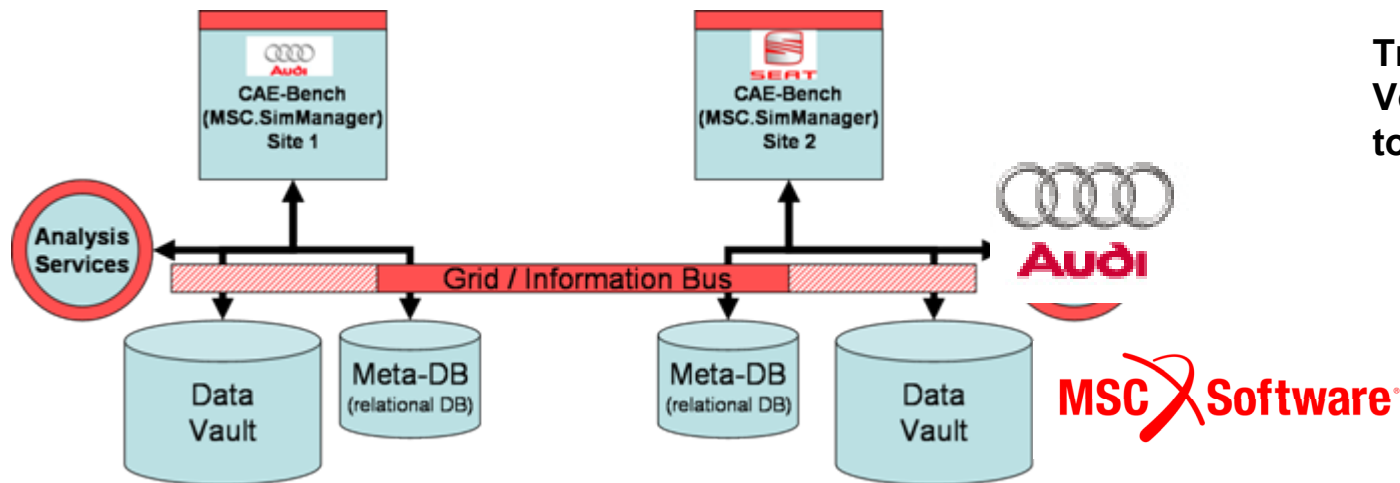
Transferred within Volkswagen Group to SEAT Spain

e-Infrastructures in the press

Industrial application running on EGEE (Mar 2005)

Geocluster (industry seismic processing solution developed and marketed by the Companie Générale de Géophysique in France, a supplier of products and services to the worldwide Oil and Gas, Mining and Environmental industries) is running as an application on EGEE

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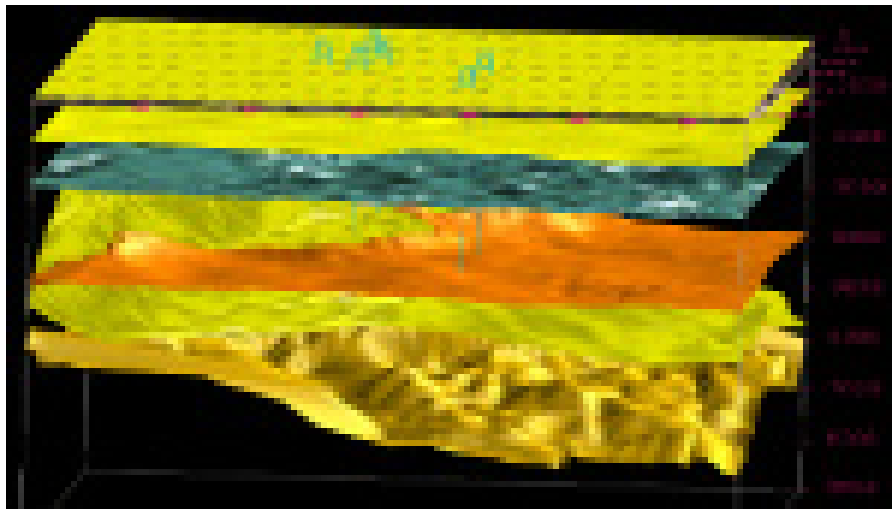
e-Infrastructures in FP7

FP7 Capacities Programme 2007-2013

Total: 50582 m€

Cooperation: 32.4 b€
(8.8 b€ for ICT)

Ideas: 7.5 b€

to enhance research and innovation capacity throughout Europe
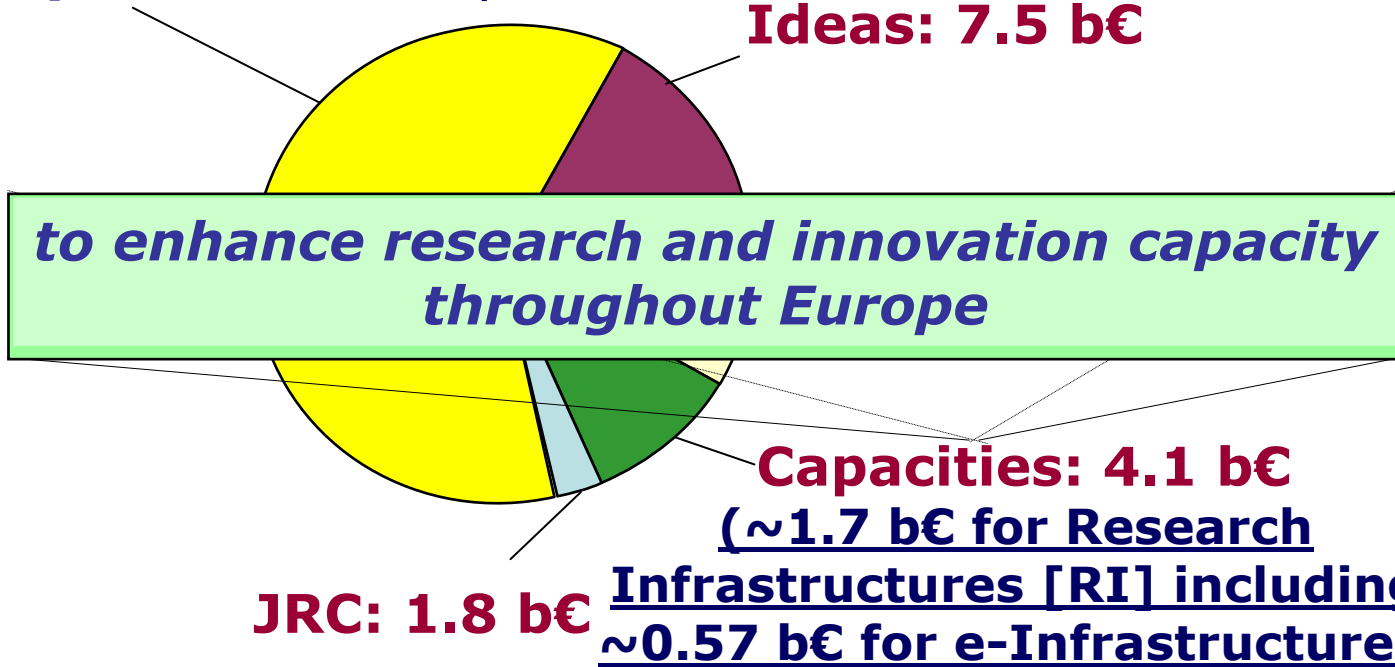
Capacities: 4.1 b€
(~1.7 b€ for Research Infrastructures [RI] including ~0.57 b€ for e-Infrastructures)

JRC: 1.8 b€

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Research Infrastructures lines of action in FP7

- Optimise use & development of best existing RI in Europe

- Help to create in all fields of S&T new RI of pan-European interest needed by the scientific community (Design Studies, Construction of new RI - *preparatory phase, implementation phase*)

- Support programme implementation and policy development

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Existing Infrastructures	New Infrastructures
Integrating activities	Design studies
e-infrastructures	Construction (preparatory phase; construction phase)

Policy Development and Programme Implementation

ESFRI Roadmap (incl. e-IRG input)

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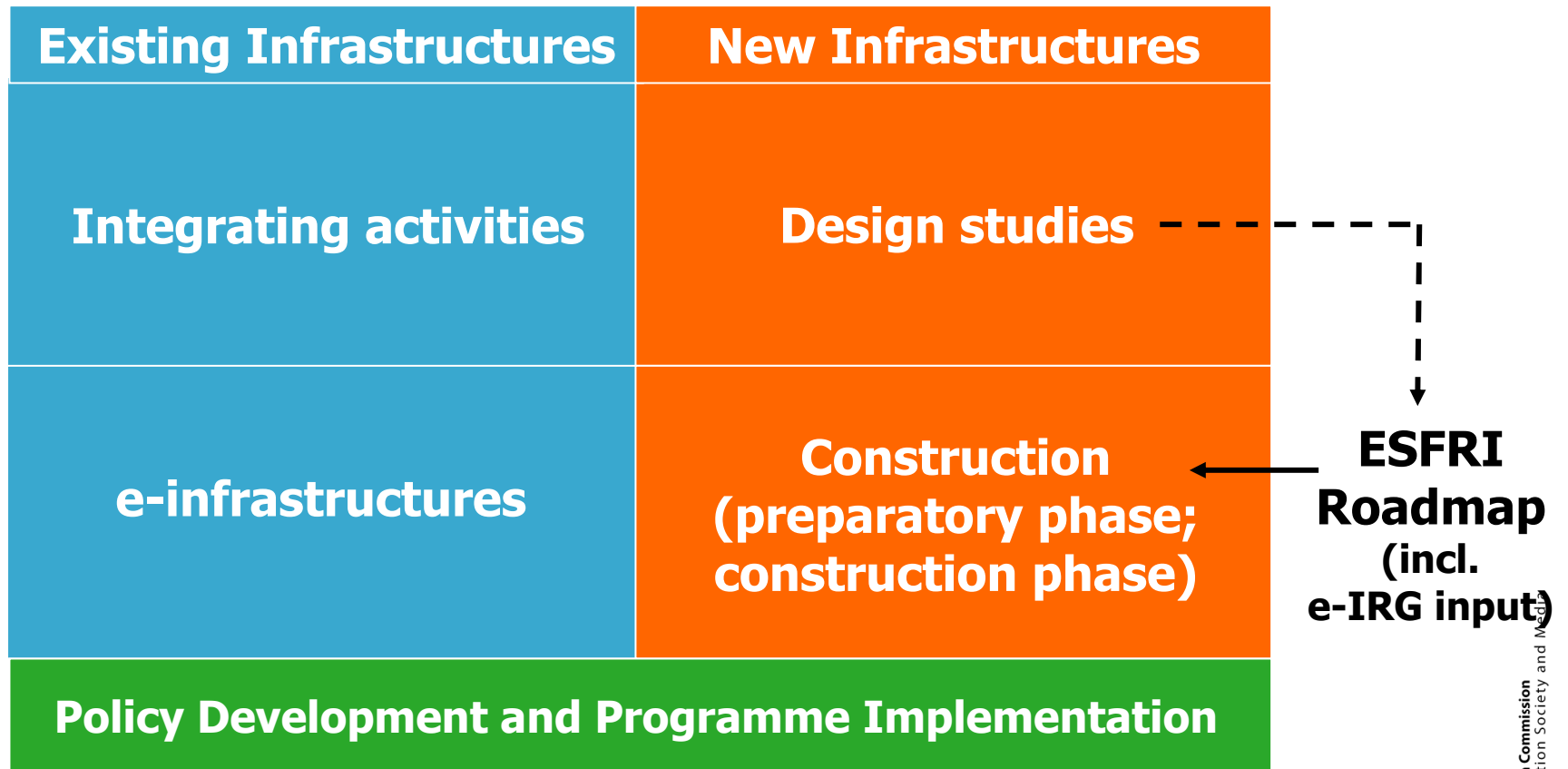
Support to existing Research Infrastructures

Integrating Activities to promote the coherent use and development of research infrastructures in a given field, *implemented through:*

➔ **A bottom-up** approach for proposals open to all fields of science

➔ **Targeted** approach with topics defined in cooperation with the FP7 thematic areas

e-infrastructures – use of ICT based infrastructures in support of a new scientific process

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Support to new research infrastructures

Support to the Construction of new infrastructures and major upgrades to existing ones

➔ **the list of projects to be supported will be based on the work conducted by the European Strategy Forum on Research Infrastructures (ESFRI roadmap) with the support of the e-Infrastructures Reflection Group (e-IRG)**

Design studies: to support the conceptual design for new facilities or major upgrades, of clear European dimension and interest

➔ **through bottom-up calls**

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Objectives of e-Infrastructure activity

- **Promote an ICT-based environment, in which all researchers have an easy-to-use controlled access to unique or distributed scientific facilities, regardless of their type and location in the world**

- **Strengthen collaboration between research centres and their researchers in virtual research communities, enabling worldwide sustainable partnerships in all e-Science fields**

- **Infrastructure layer more transparent and adequately serving cross-disciplinary needs**

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e-Infrastructure: main orientations in FP7

Support the further evolution and deployment of grid and networking infrastructures

Foster the creation of a new generation of HPC facilities in Europe (petaflop scale)
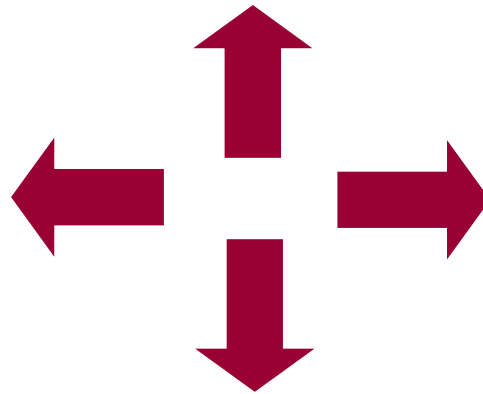
Promote a coordinated and federated approach in the deployment of data infrastructures to enable researchers to effectively aggregate and combine information to generate and share knowledge

Support emergence of new organisational models for service provisioning in domain of grid & data infrastructures (application & resource provider neutral)

Foster adoption of e-Infrastructures by user communities

Support resource sharing policy initiatives (e-IRG…)

Promote international cooperation

e-Infrastructure: from FP6 to FP7
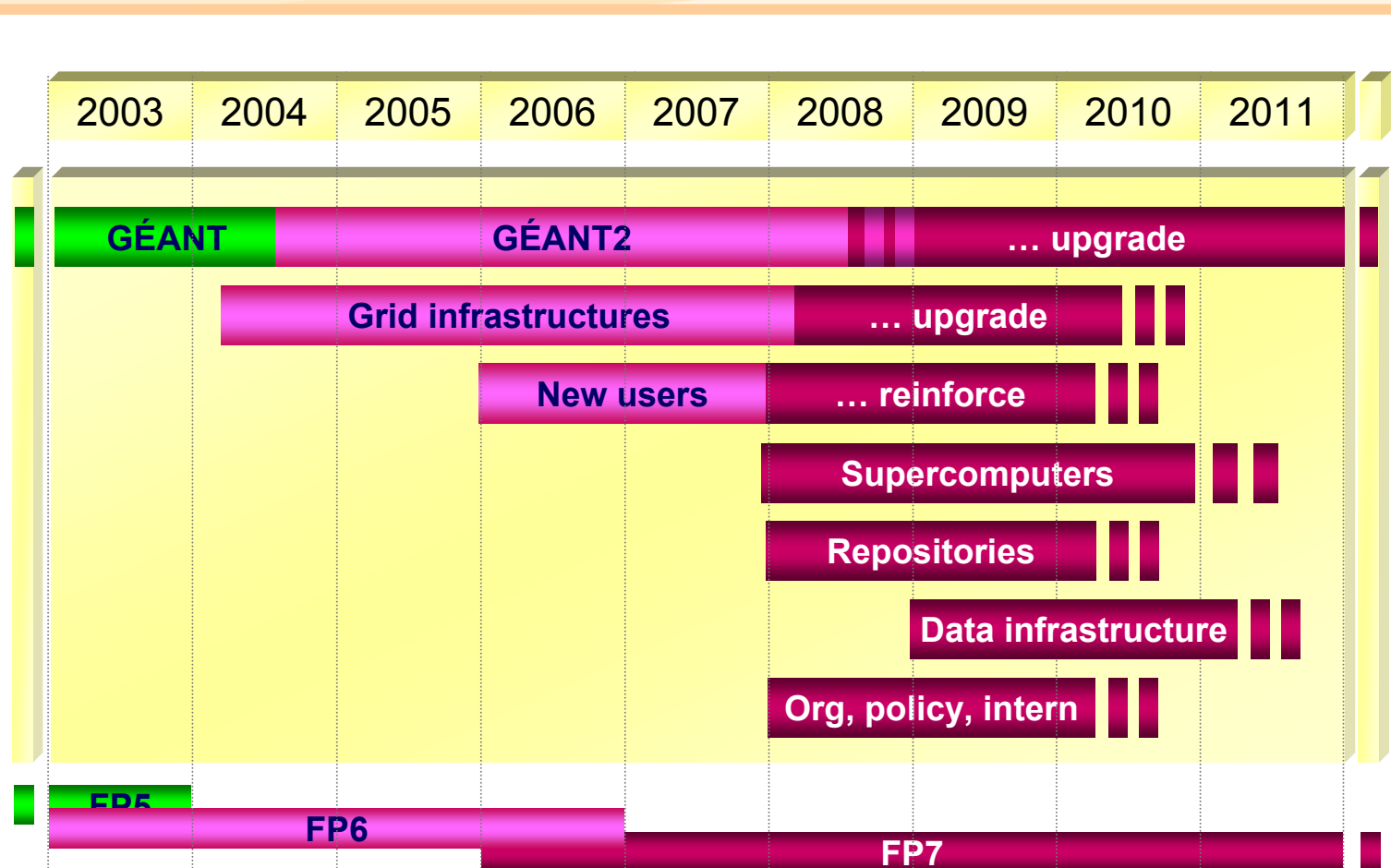
2003	2004	2005	2006	2007	2008	2009	2010	2011

GÉANT — **GÉANT2** — **… upgrade**

Grid infrastructures — **… upgrade**

New users — **… reinforce**

Supercomputers

Repositories

Data infrastructure

Org, policy, intern

FP5 — **FP6** — **FP7**

Call for proposals No1 launched 22 Dec 2006, closing 02 May 2007

Topics:

- **Scientific Digital Repositories (€15m)**
- **Deployment of e-Infrastructures for scientific communities (€27m)**
- **Design studies for e-Infrastructures (€6m)**
- **Preparatory phase for "Computer and Data Treatment" research infrastructures in the 2006 ESFRI roadmap (€10m)**

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Call for proposals No1
launched 22 Dec 2006, closing 02 May 2007

Topics:

- **Scientific Digital Repositories (€15m)**

- •Support deployment of digital repositories for scientific communities by pooling existing resources at European level and supporting data storage, archiving, access, interpretation, interoperability, management & curation activities

- •Enable scientists to effectively aggregate and combine information to generate and share knowledge, profiting from a transparent underlying data infrastructure across communities, institutions & geographic boundaries

Call for proposals No1 launched 22 Dec 2006, closing 02 May 2007

Topics:

- **Scientific Digital Repositories (€15m)**
- **Deployment of e-Infrastructures for scientific communities (€27m)**

- •Reinforce impact, adoption and global relevance of e-Infrastructure across various areas of science & engineering;

- •Support continuous consolidation & expansion of e-Infrastr.

- •Provide advanced applications and capabilities to more researchers, capturing commonalities, fostering interoperability, promoting open standards and federating approaches across disciplines

Topics:

- **Scientific Digital Repositories (€15m)**
- **Deployment of e-Infrastructures for scientific communities (€27m)**
- **Design studies for e-Infrastructures (€6m)**

- Foster emergence of new organisational models to consolidate a sustainable approach to e-Infrastructures in the domain, in particular, of grids and data repositories
- Facilitate in this context new service provisioning schemes, more application neutral and open to all user communities and resource providers

- Strategic work (integrate in European fabric, centres of excellence, identify site[s] of facility[-ies], plan research services to be provided)

- Technical work (engineering plans, prototypes, transfer of knowledge from prototypes to infrastructures, exploit highest efficiency, new processes or software)

- Governance & logistical work (decision-making, management structure, advisory body, IPRs, access rules for researchers, staff plans, logistic support)

- Financial work (financial arrangements for construction; operation and decommission; use complementarities of national/Community instruments - e.g. structural funds, EIB; use new mechanisms - e.g. pre-commercial procurement of innovation)

- Legal work (for the construction and operation, prepare "signature-ready" agreement for the actual construction)

- **Preparatory phase for "Computer and Data Treatment" research infrastructures in the 2006 ESFRI roadmap (€10m)**

Call for proposals No2
to be launched May-June 2007

Topics:

- **e-Science Grid infrastructures**

- **Studies, conferences and coordination actions supporting policy development, including international cooperation, for e-Infrastructures**

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Call for proposals No2
to be launched May-June 2007

Topics:

- **e-Science Grid infrastructures**

•Support the further evolution and deployment of grid infrastructures and foster the pooling of more resources (across multiple scientific disciplines) in the grid

•Emphasize on provision of persistent, cross-disciplinary services with increased levels of interoperability, trust and security

Call for proposals No2
to be launched May-June 2007

Topics:

- **e-Science Grid infrastructures**

- **Studies, conferences and coordination actions supporting policy development, including international cooperation, for e-Infrastructures**

- Encourage coordination between National and pan-European e-Infrastructure initiatives, namely through support to e-IRG

- Support specific studies and conferences on e-Infrastructure related topics

- Promote international cooperation

Topics:

- **GÉANT**
- **Scientific Data Infrastructure**

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Topics:

- **GÉANT**

  - Support the further development and evolution of GÉANT in close articulation with the National Research and Education Networks (NRENs)

  - Reinforce the provision of end-to-end connectivity and services (user-to-user)

  - GÉANT to represent an instantiation of the "Internet of the future" by making timely use of state-of-the-art communication technologies

Topics:

- **GÉANT**

- **Scientific Data Infrastructure**

  - Support the deployment of standardised mechanisms to store, archive, authenticate, access, transfer, preserve, curate, certify, interpret scientific data

  - Provide an integrated set of services exploiting the middleware and grid capabilities to federate data in an ecosystem of digital resources

  - Support the deployment of a broad European multidisciplinary scientific data infrastructure able to be easily federated with knowledge infrastructures in other parts of the world

Collaborative projects (CP)

- *Support to research projects carried out by consortia with participants from different countries, aiming at developing new knowledge, new technology, products,* demonstration activities *or common resources for research. The size, scope and internal organisation of projects can vary from field to field and from topic to topic.*

•*Support to activities aimed at coordinating or supporting research activities and policies (networking, exchanges, trans-national access to research infrastructures, studies, conferences, etc)*

Coordination and Support actions (CSA)

Funding schemes

Collaborative projects (CP)

Coordination and Support actions (CSA)

Combination of two (called Integrated Infrastructure Initiative in the case of existing RI)

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Combination of Collaborative Projects & Coordination and Support Actions

The Integrated Infrastructure Initiative (I3) model combines:

- **Networking activities;**
- **Trans-national access and/or service activities;**
- **Joint Research activities**

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Further information

Information on calls: www.cordis.europa.eu

GÉANT & e-Infrastructure Unit: www.cordis.europa.eu/ist/rn/

e-Infrastucture logo

- **Connecting the finest minds**
  Linking ideas at the speed of light

- **Sharing the best scientific resources**
  Harnessing the unlimited power of computers, instruments and data

- **Building virtual global research communities**
  Innovating the scientific process