European Commission

# e-Infrastructures in Horizon 2020

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**eInfrastructure**

**DG Connect**

**EURESEARCH - EuroRis-Net+**

**High Level Training**

**Geneva, 29 January 2013**

# Characteristics of (e-)infrastructures

**Infrastructure**: "The basic systems and services ... a country or organisation needs to work efficiently"

Cambridge dictionary

- **Maturity**

  - Ubiquity

  - Accessibility

  - Transparency (usability)

  - Trust, reliability

- **Formation**

  - Through connecting isolated systems and networks

  - Transformative, innovative, collaborative

*Notion includes technical, legal and organisational systems, as well as social and cultural dispositions*

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# What we do for Science and Innovation…
European Commission and Member States invest in e-Infrastructures…

Innovating the scientific process, capacity building:
**global virtual research communities**

Accessing knowledge:
**scientific data and publications**

Experimenting *in silico*:
**simulation and visualisation**

Sharing the best computational resources:
**Grid, clouds, HPC**

Linking at the speed of the light:
**GÉANT**

# Staying Competitive in Science

- Large scale collaborations becoming the norm
  - *often global*
  - *virtual research communities*
  - *access to rare/remote resources*
- Data-intensive science and innovation
  - *Use and manage exponentially growing sets of data*
- Experimentation in silico, simulation
  - *Use of high-performance computing*

*Neelie Kroes:*

**"let's make science open"**

ICT transforming science: collaboration and sharing knowledge at unprecedented scale and speed

*How to do it?*

# Open Science

## *Open Scientific Content*

data, computational resources and software resulting from public funded research should be made openly available and preserved, for re-use in research and education activities

## *Open Infrastructures*

reliable, high-performance and economically efficient infrastructures

## *Open Culture*

career systems should support and reward those who participate in the culture of sharing. Open science should inspire the young and enable adequate education to benefit from the abundance of technical tools and scientific information
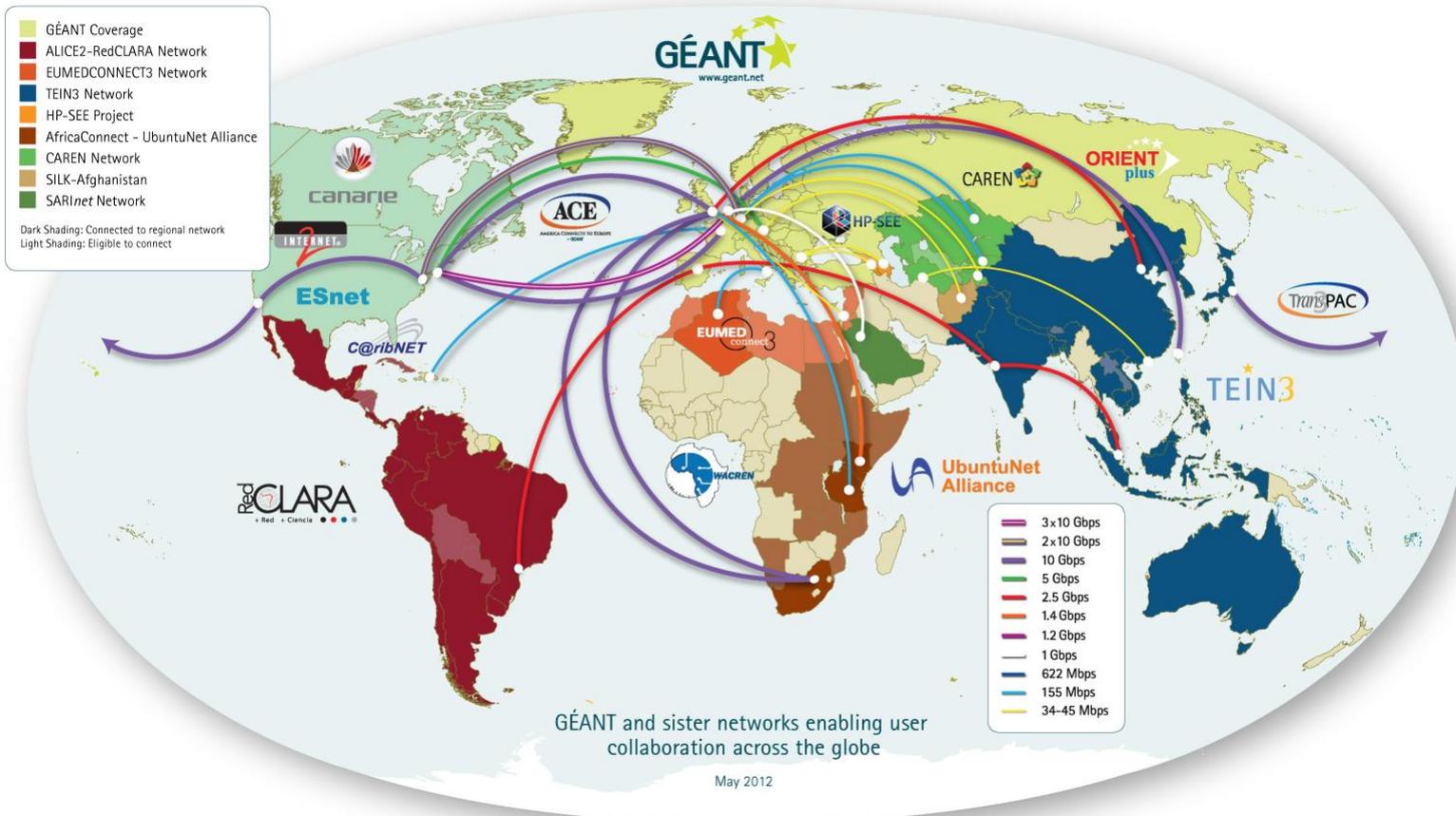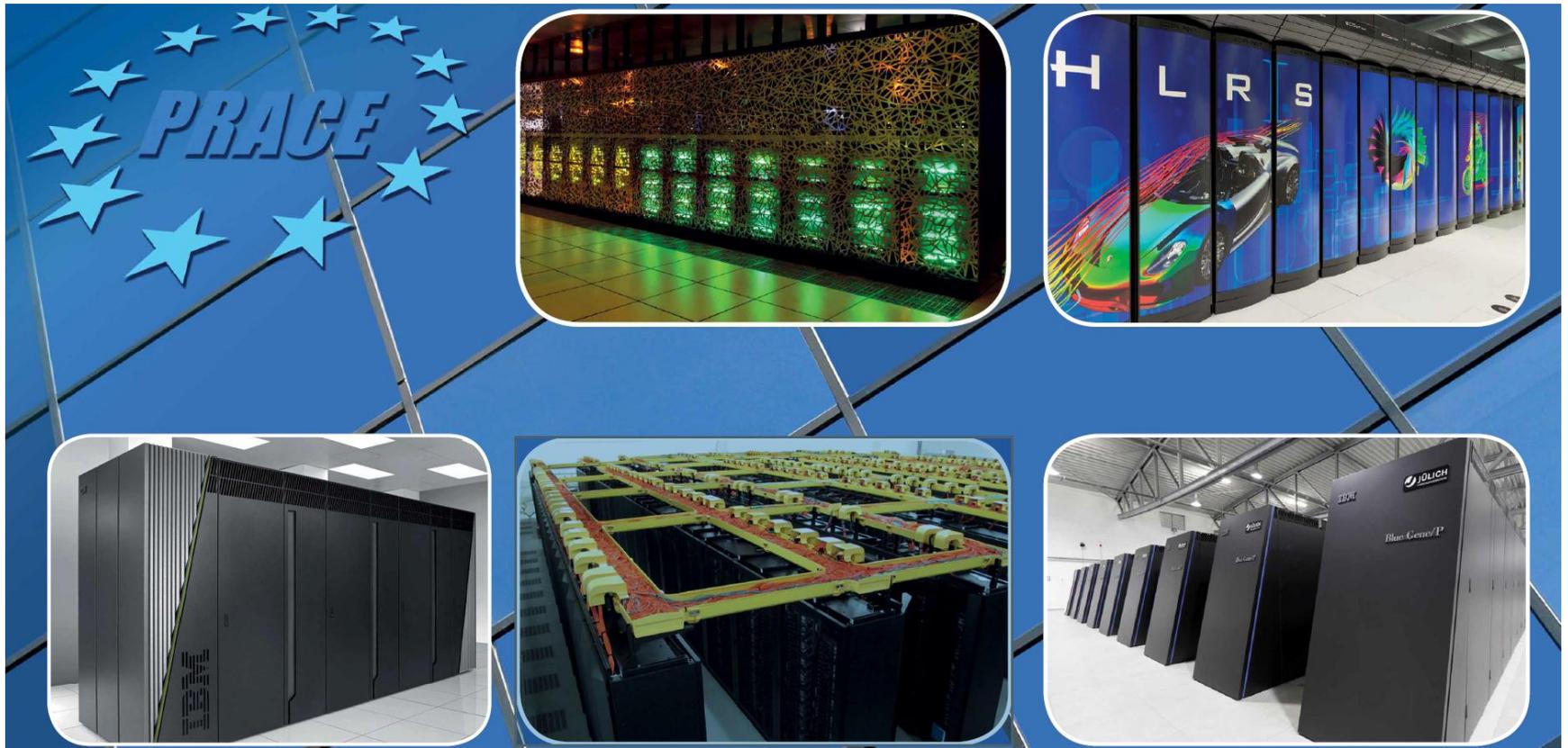
# Simulation and *in silico* experimentation

European Commission
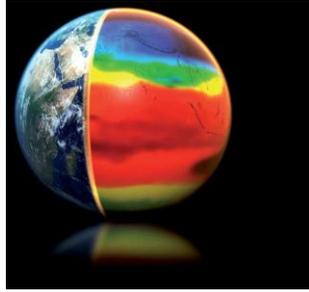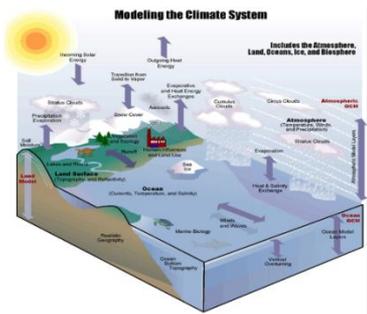
**Weather, Climate & Earth Sciences**
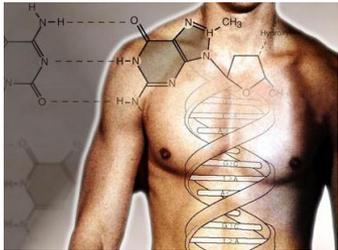
**Life Sciences and Health**
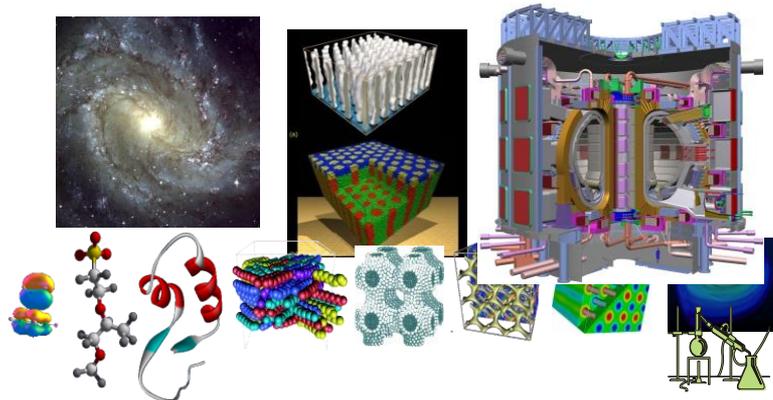
**Fundamental sciences: Physics, Chemistry, Material Sciences, Astrophysics Applications.**
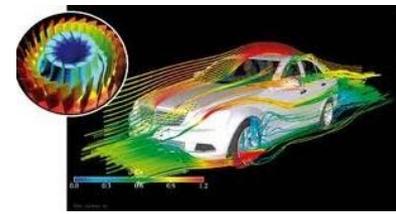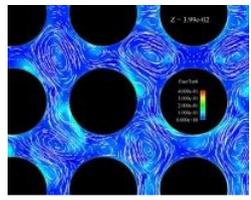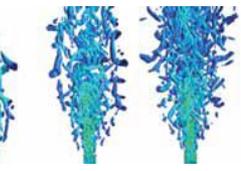
**Industrial & Engineering Application for transport and energy**

# The Collaborative Data Infrastructure - a framework for the future



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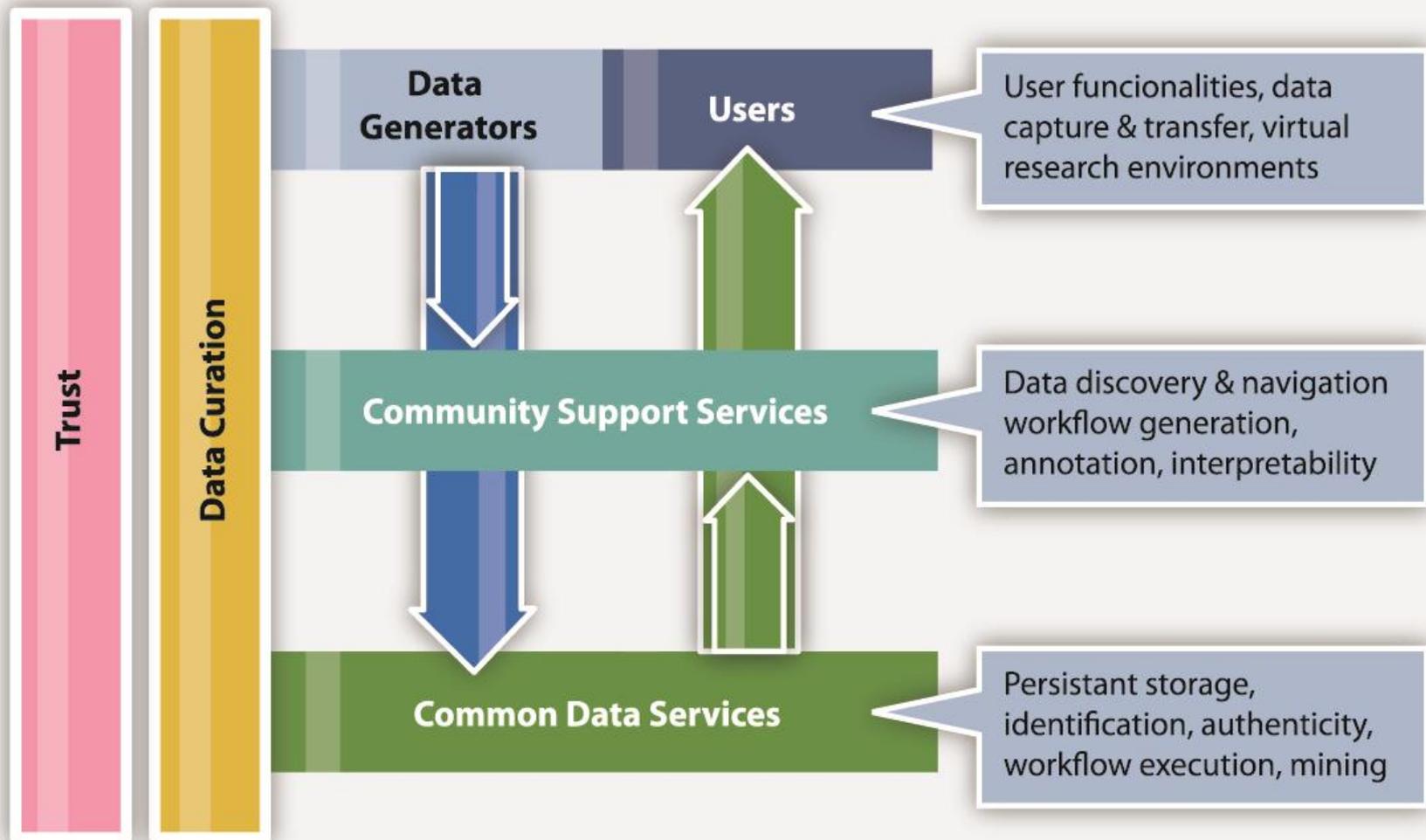
# Data explosion



Evolution of ESA's EO Data Archives between 1986-2007 and future estimates (up to 2020)
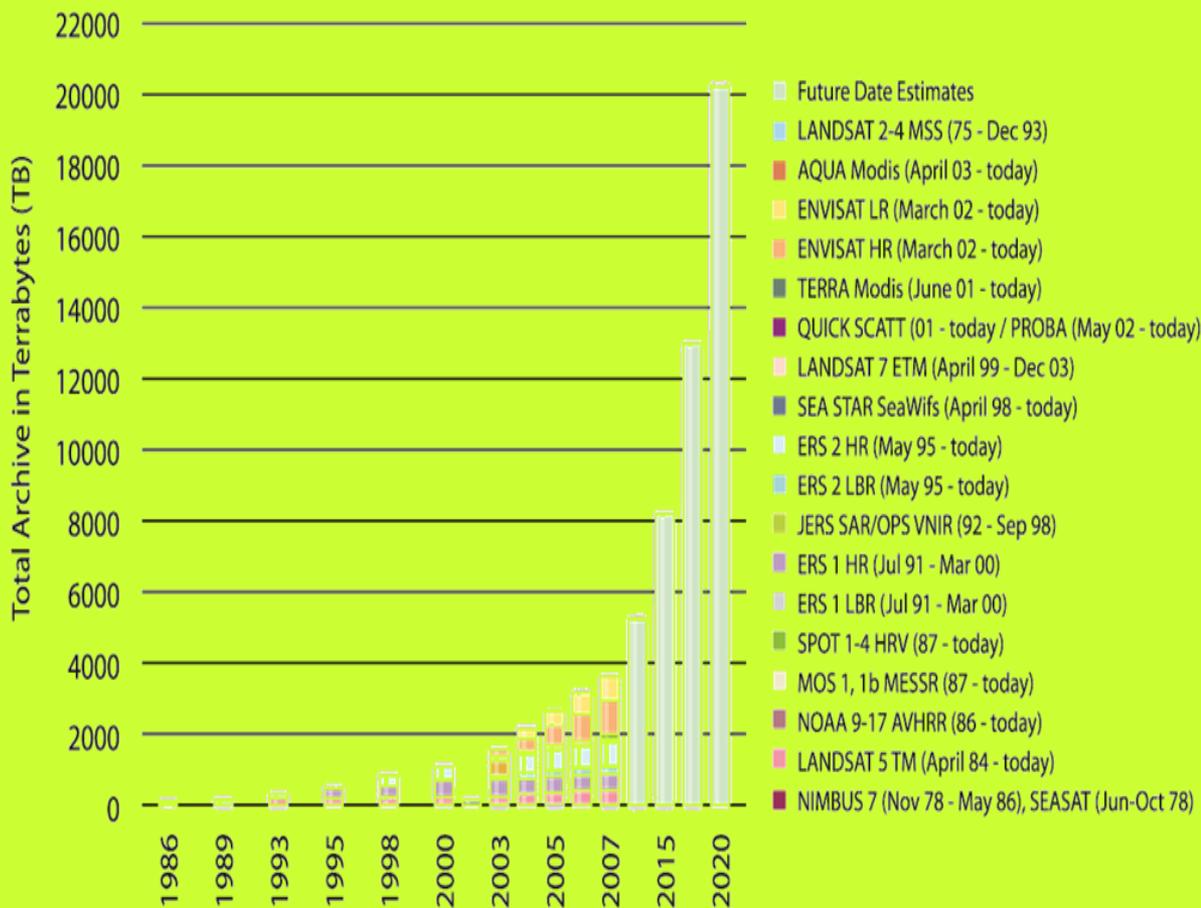
Yearly Data Creation on NICE

Legend:
- Future Date Estimates
- LANDSAT 2-4 MSS (75 - Dec 93)
- AQUA Modis (April 03 - today)
- ENVISAT LR (March 02 - today)
- ENVISAT HR (March 02 - today)
- TERRA Modis (June 01 - today)
- QUICK SCATT (01 - today / PROBA (May 02 - today)
- LANDSAT 7 ETM (April 99 - Dec 03)
- SEA STAR SeaWifs (April 98 - today)
- ERS 2 HR (May 95 - today)
- ERS 2 LBR (May 95 - today)
- JERS SAR/OPS VNIR (92 - Sep 98)
- ERS 1 HR (Jul 91 - Mar 00)
- ERS 1 LBR (Jul 91 - Mar 00)
- SPOT 1-4 HRV (87 - today)
- MOS 1, 1b MESSR (87 - today)
- NOAA 9-17 AVHRR (86 - today)
- LANDSAT 5 TM (April 84 - today)
- NIMBUS 7 (Nov 78 - May 86), SEASAT (Jun-Oct 78)

**e-Infrastructures Vision**
*to make every researcher digital, through the development and deployment of e-infrastructures – achieve the digital ERA*

physics community    biomedics community    astronomy community

Data-centric science and engineering

Computational infrastructure (HPC, clouds, grids, SW)

Research networks – GÉANT
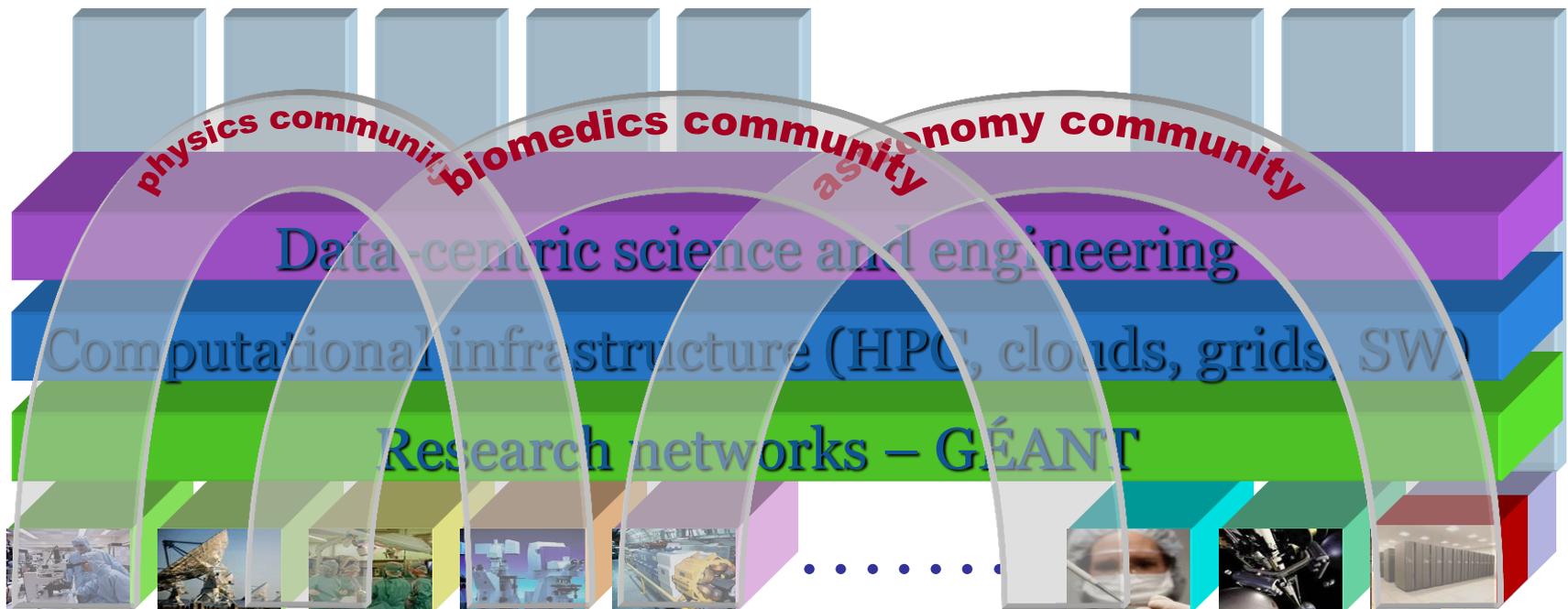
Virtual research communities and e-science environments

# e-infrastructure: From FP7 to Horizon 2020

Building the "digital ERA" for all researchers

- Data-centric science and engineering

- Computational infrastructure (HPC, grids, clouds, software)

- Research and education networks

- Virtual research communities and e-science

*New approaches for:*

Innovation (including through PCP)

Developing human resources and skills

Services to industry, especially SMEs

Commission-wide governance

# Research Infrastructures in H2020

Developing the European research infrastructures for 2020 and beyond

Developing new world-class RI

Integrating and opening existing national RI of pan-European interest

Development, deployment & operation of ICT-based e-Infrastructures

Fostering the innovation potential of Ris and their human capital

Reinforcing European RI policy and international cooperation

Matrix approach to implementation

# Horizon 2020 main lines of RI activities

1. *Developing the European Research Infrastructures for 2020 and beyond*
   - Developing new world-class RIs
   - Integrating and opening existing national RIs of pan-European interest
   - **Development, deployment and operation of ICT based e-Infrastructures**

2. *Fostering the innovation potential of Research Infrastructures & their human capital*
   - Exploiting the innovation potential of RIs
   - Strengthening the human capital of RIs

3. *Reinforcing European Research Infrastructures policy and international cooperation*
   - Reinforcing European policy for RIs
   - Facilitating strategic international cooperation

In complementarity with Cohesion, Structural & Social Funds

# Development, deployment and operation of ICT based e-Infrastructures

- **Objective:** To achieve by 2020 a single and **open European space** for online research

- **Priorities:**

  Data-centric science and engineering

  - ✓ Interoperable, open and rich scientific data infrastructure (services for data access, storage, discovery, integration, curation and analytics)

  Computational infrastructure

  - ✓ Ecosystem of supercomputing facilities progressing towards exa-scale
  - ✓ Grid and cloud infrastructures
  - ✓ Software and service infrastructure for visualisation and simulation

  Research Networks - GÉANT

  - ✓ Global research and education networks (GÉANT as the European "communications commons" for research, education and public service)

  e-Infrastructures for virtual research communities and e-Science environments

  - ✓ Real-time collaborative tools for virtual research communities

# Relationship of the supplier and user industry to the e-Infrastructure services

Spin-offs

Technology transfer

**Suppliers / Providers** (of technology, equipment, networks, etc)

**Operators / e-Infrastructure Services** (Géant, HPC, Grids/Clouds, scientific data, software etc)

**Users** (companies in all domains)
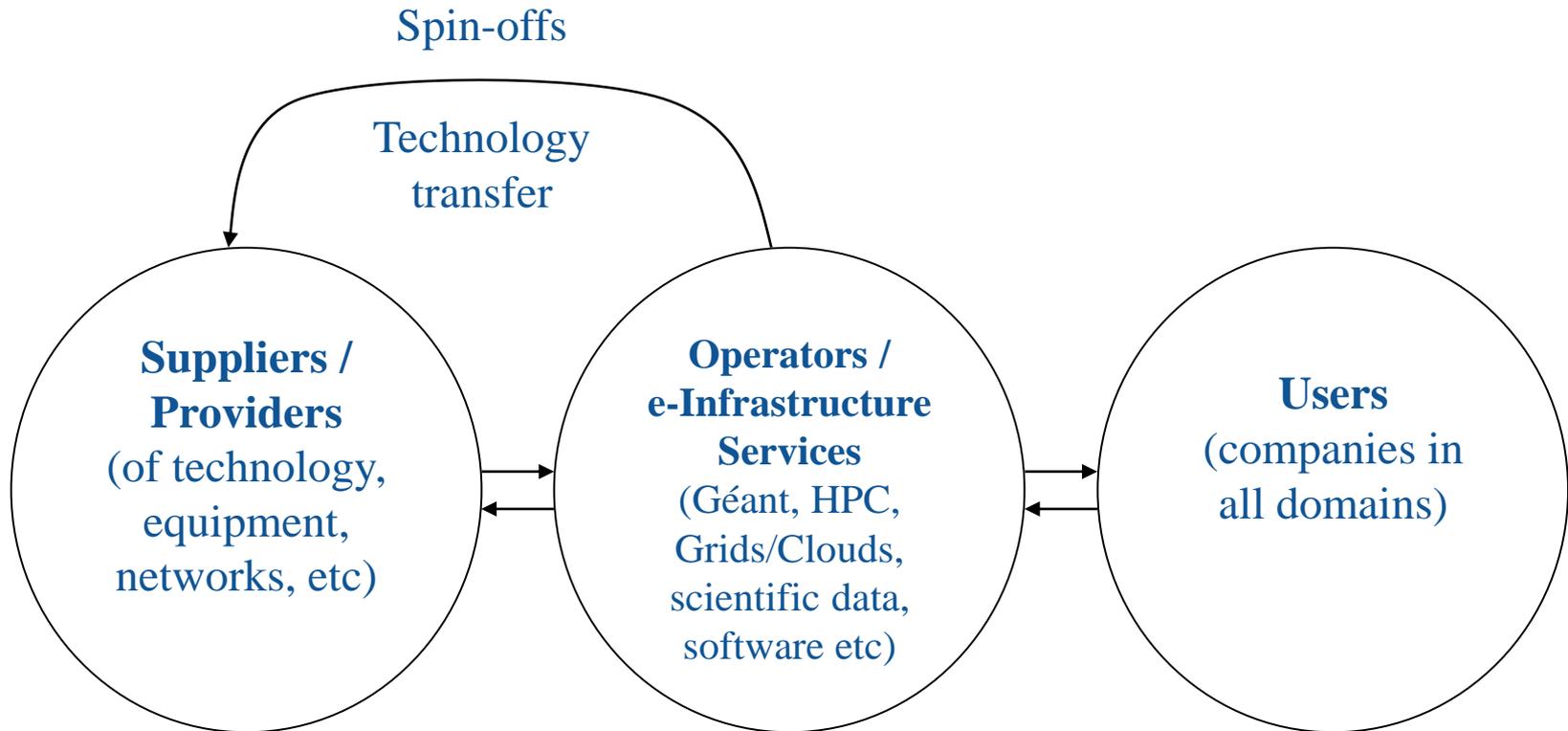
# Open access policy

*Publications, data, e-infrastructure*

*all outputs of Horizon 2020 to be openly accessible*

*Communication to European Parliament and Council*

*Recommendation to Member States*

**Thank you!**

# Additional slides

# e-Infrastructures characteristics
**(adapted from Prof. Sulston Presentation in the European Parliament on October 2011)**

*Distributed and participatory architectures; robust networks of people and institutions*

*Discoverability, Access and Interoperability of Data*

*Access to Storage and Computing Resources*

*High-speed Connectivity to enable international collaborations*

***Geography largely irrelevant!***



Node:

*"Domain Specific hub"*

*"National hub"*

General Hub

**Aggregated Data Sets**
(Temporary or Permanent)

**Other Data**

**Scientific Data**
(Discipline Specific)

**Workflows**

**Aggregation Path**

Environment

Atmosphere/Space Physics

Astronomy

...

Biology Medicine

VRE

Social Sciences

VRE

**Researcher 2**

**Scientific World**

**Researcher 1**

Tools for virtual research environments

**Open Access:**
participatory, distributed infrastructure

Tools for virtual research environments

**Generic services:**
preservation, curation, storage and computation

**Non Scientific World**

**global virtual brain imaging laboratory**

*outGRID* brings together NeuGRID (EU), CBRAIN (Canada) and LONI-ADNI (US)

**chemical safety & toxicogenomics:**

non-animal tests for predicting chemical safety
*diXa*
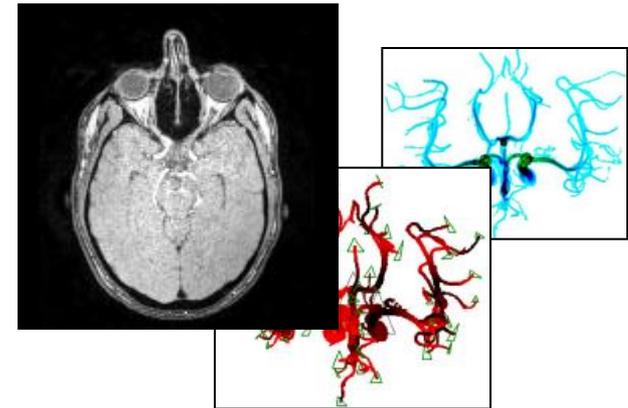
**hydrometeorology**
for natural disasters prediction
*DRIHM*

**Astrophysics**
**Particle and high energy physics**
**Biomedicine**
**Toxicology**
**Earth sciences**
**Seismology**
**Geophysics**
**Meteorology**
**Computational Chemistry**
**Material sciences**

.......

# Big vs. "long tail" science

# Questions for an e-infrastructures policy
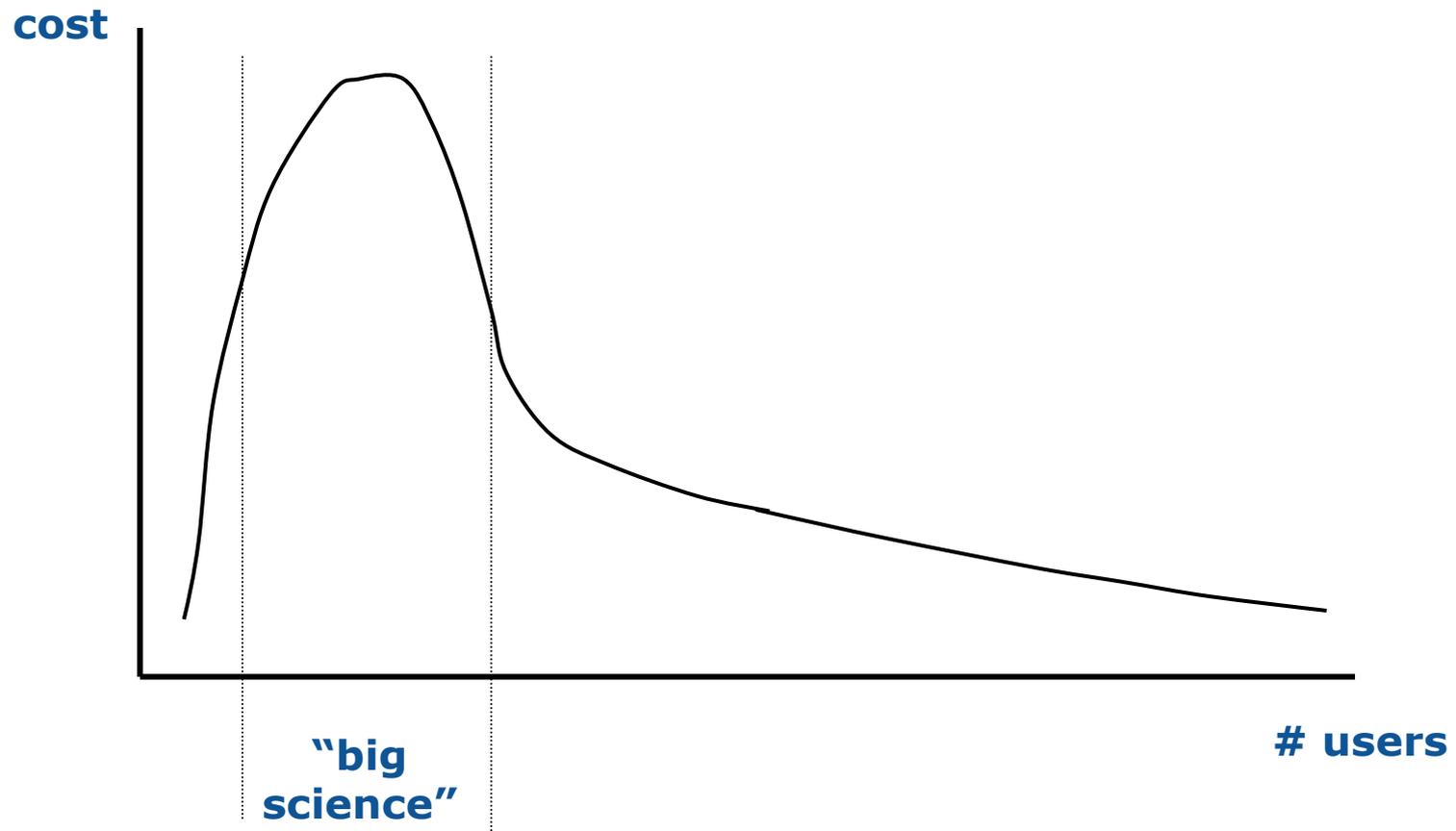
*What mix of top-down vs. bottom up?*

*How to encourage openness?*

*What drives e-infrastructures investment priorities?*

- Big vs. long tail science

*How to deploy a user-centred e-infrastructure?*

- Connectivity, (national) clouds, HPC services, data access, information management, AAA, service federation,…
- What support from cohesion policy funds?
- Who pays? Who decides?
- What level is most appropriate? (regional vs. national vs. European vs. global)
- What model? (federated vs. centralised vs. network-like)

*What priority to innovation, education and skills?*