Conference:
"Cloud computing: Education, Research, Scientific developments"
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The changing world of Distributed Computing Infrastructures (DCI) - role and contributions of EU e-Infrastructure programme

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The world in the midst of a crisis (economic, environmental..) and a social and economic transformation (ICT..)

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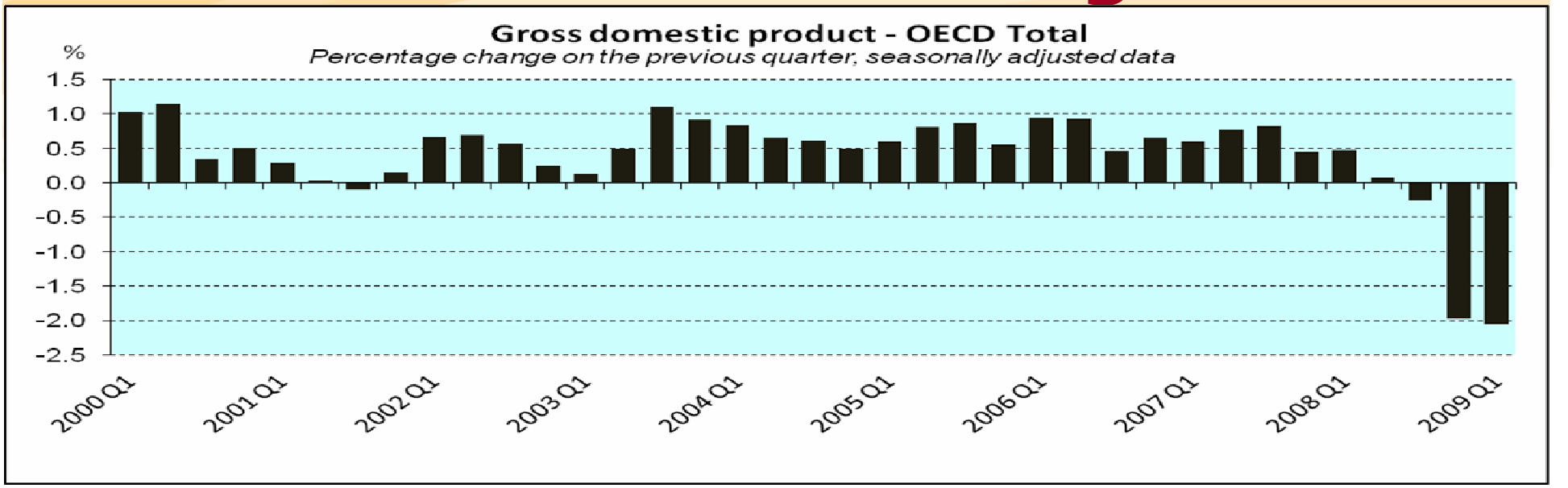
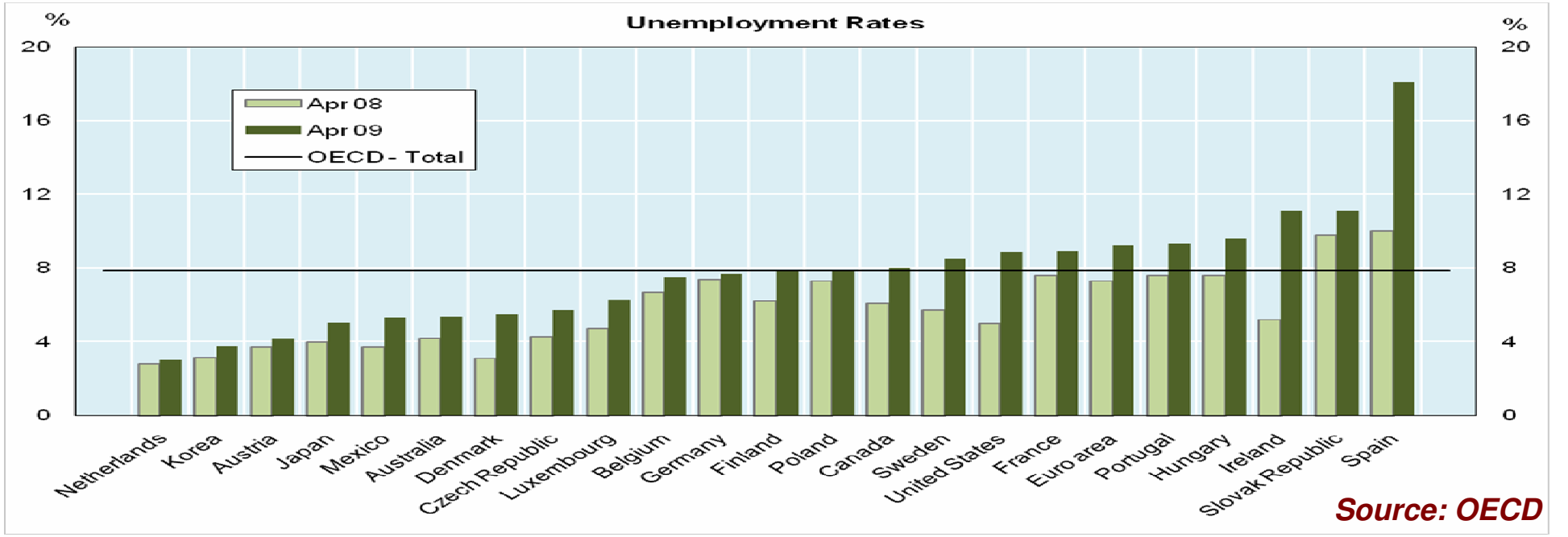
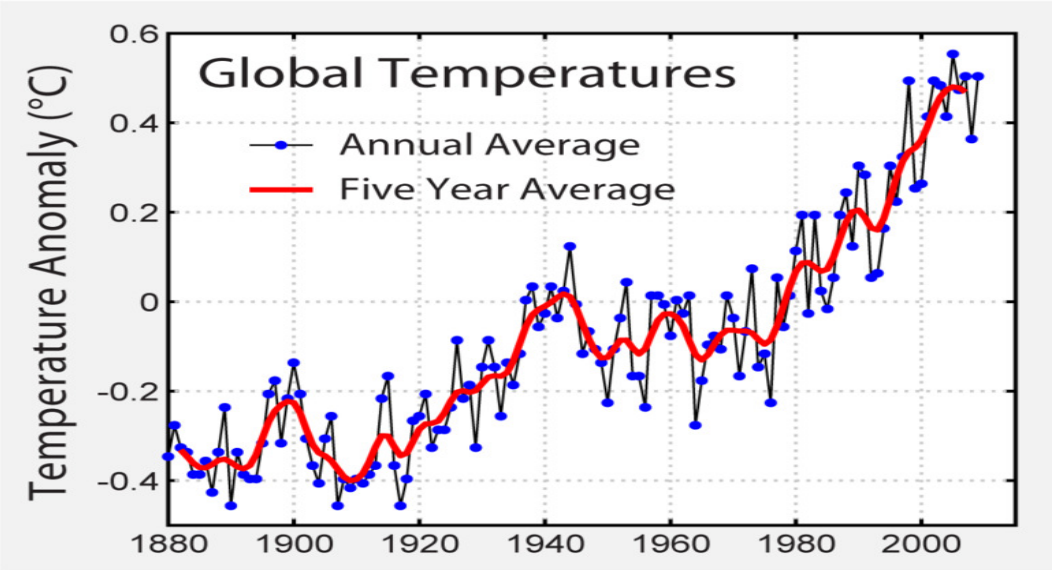
Economic crisis in figures





Source: OECD

Environmental crisis (facts)



- The **biological diversity** of the Planet is the basis of the life-support system that secures wellbeing for humanity
- Millennium Ecosystem Assessment found that **60%** of the ecosystem services on which people depend are already over-exploited or threatened due to, for example, damage to habitats, invading species, and environmental pollution

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ICT strongly impacting economic, environmental, social processes

- **We are all connected**
  - technically, socially, economically
- **The world is becoming smarter**
  - systems, processes, service delivery
- **Important role in production & use of energy**
  - operation of power plants, electricity transport, modeling & optimization of processes..
- **ICT as energy consumer**
  - 1.5 billion of world's PCs consume 10% of global energy
  - Worldwide consumption for servers doubled from 2000 to 2005

A changing distributed computing landscape

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IT-challenges

(*Public organisation & Enterprise)*

- Data deluge
- Dependence on external services and outsourcing
- Align and sync with the business in a constantly changing environment (always faster product/service cycles)
- IT-capital investment more difficult and riskier (particularly for SMEs, small organisations)
- data-centre (and infrastructure) complexity
- Infrastructure scalability (not enough capacity or low resource utilization..) and upgrade issues
- Increasing management/administration and energy spending

mottos: save costs, be faster!

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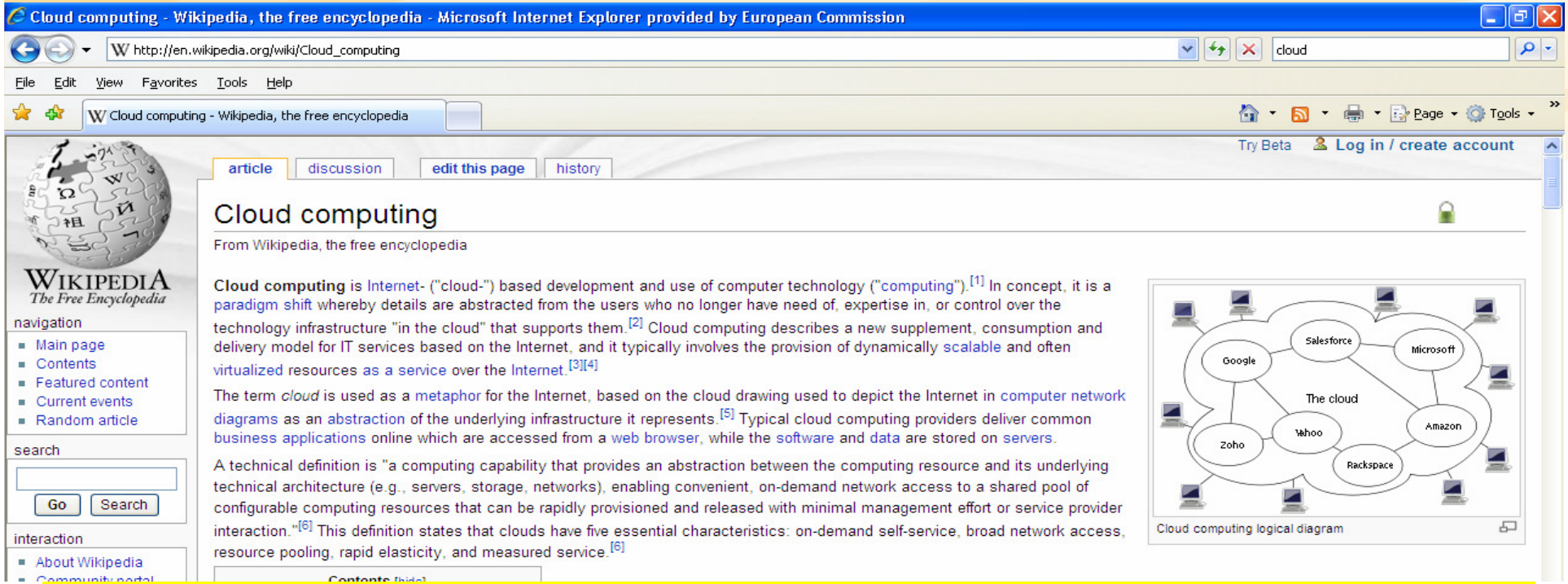
10-years of grid-technology

- **Addresses many of IT "pain points"**
- **Started by science, was developed to mainly address science needs**
  - Large-scale adoption by research community; core technology for a number of science fields (energy, biology, climate etc)
  - Mature technology today – demand by research community for sustainable service
- **Poor adoption by industry**
  - Concerns on complexity, applications that need to be pre-packaged, non-elasticity, lack of virtualisation..

The Cloud promise



key business incentive:

In the fast changing ICT-world, the cost to rent is lower than cost of ownership over long-term (the faster the technology moves, the more incentive there is to rent)

energy saving perspective:

Infrastructure consolidation, better use of it

faster innovation cycles:

Focus on business, not on infrastructure

Cloud issues

- **High-speed Internet access**
  - particularly for large datasets
- **Interoperability**
  - lock-in risks
  - portability of data, security settings;
- **Privacy & Legal**
  - where is my data? whose law applies? who can access it?
- **Governance, control**
  - no control of updates, problem resolution priorities
- **Security**
  - data, outages
- **Operational**
  - inadequate application modelling to the cloud

Where do clouds appear today?

- **Business**
  - 20% of world servers (over 1m annually) being bought by a small handful of companies which include cloud-service provision in their business portfolio ("cloud" giants)
  - US dominance
  - Rapidly increasing commercial interest in Europe – *single market / regulatory issues pose obstacles*
- **Governments**
  - Attractive technology for cutting costs, competition, efficiency
- **Research**
  - Increasing interest; concept proof efforts
- **Standards**
  - (Cloud-Standards Coordination WG, Cloud Security Alliance)

What comes next in science?

- **Clouds for science? *(which business models?)***
  - Big science? Small science? both?
  - Computation? Data storage/sharing? all?
  - Secondary tasks? Core tasks? (security?)
  - Public / private cloud services? Incentives? Sustainability?
- **Grids-Clouds:** converging? diverging? Hybrid solutions?
- **Link of clouds to existing investments?**

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Role of public funding agencies

- Broadband everywhere
- Sustainable service provision for researchers
- Coherent framework for data flow, access and protection (regional, international)
- Privacy and security regime
- Promote open solutions and standards
- Energy (green) aspects
- Public procurement lever

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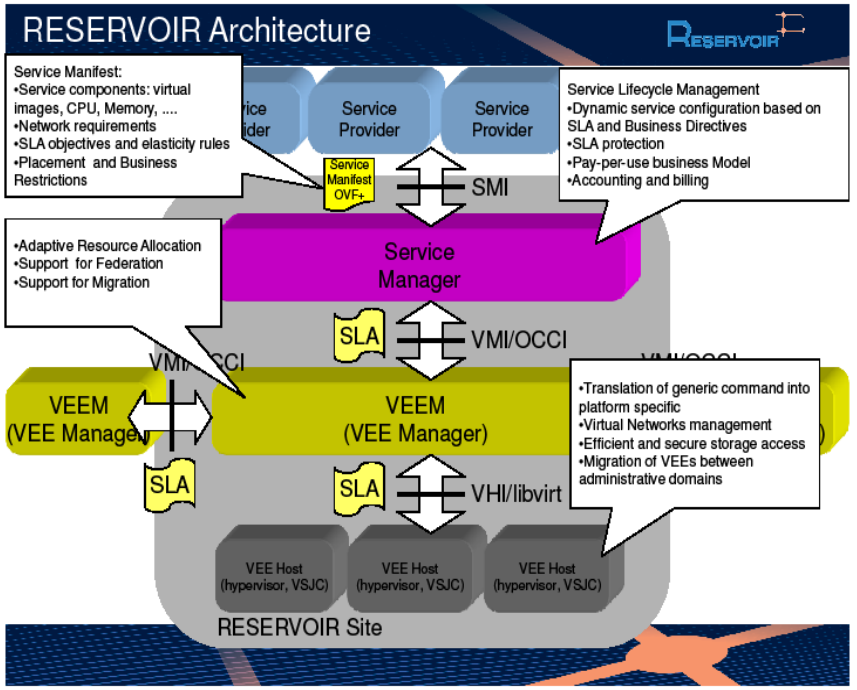
European research efforts on Clouds

Research project

RESERVOIR develops a system and service technologies that serve as the infrastructure for Cloud Computing. It achieves this goal by creative coupling of virtualization, grid computing, and business service management techniques



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Expert group on Cloud Computing

- Set-up in Spring 2009 by DG INFSO/D3
- Acts as an advisory body
- Prepared a Cloud Computing strategic vision and research directions
- Produced a report: http://cordis.europa.eu/fp7/ict/ssai/docs/cloud-report-final.pdf

Expert group: key factors & opportunities for Europe

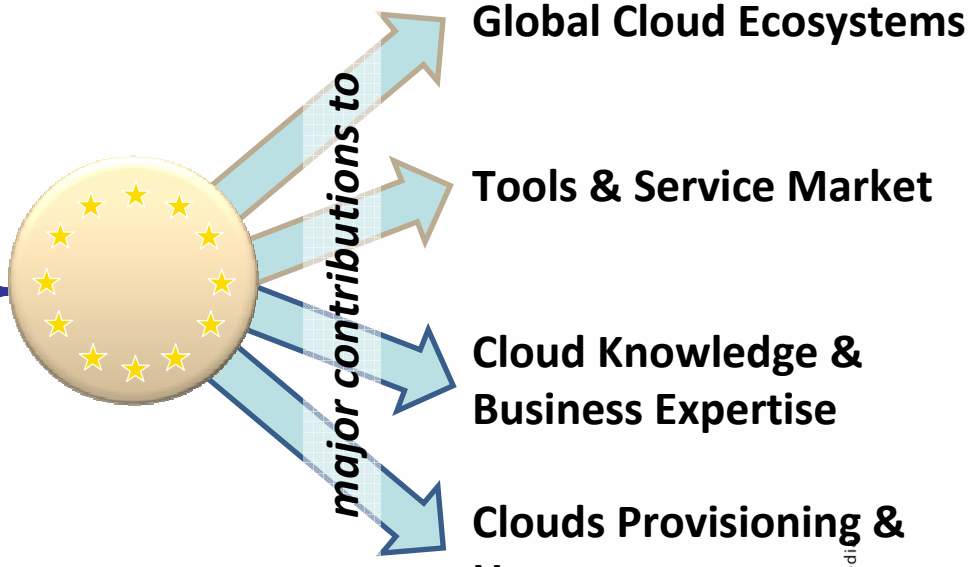
Telecommunication industry

Selling enhanced products (rather than new technologies)

Particular focus on provisioning of professional services (as opposed to consumer market focus)

Synergies between research and industry

Ongoing research background and expertise in related areas (Grids, SoA, Future Internet)



Expert group recommendations

1. Build large scale **test beds**
2. Develop **joint programmes** involving both public stakeholders and industry
3. Encourage development and production of :
   (a) CLOUD interoperation **standards**;
   (b) an **open source reference implementation**
4. Promote leadership position in SW through commercially relevant open source solutions
5. Set up (EC, Member States) a regulatory framework to facilitate uptake of Clouds

The European e-Infrastructure programme

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e-Infrastructure Vision

empower research communities through ubiquitous, trusted and easy access to services for data, computation, communication and collaborative work

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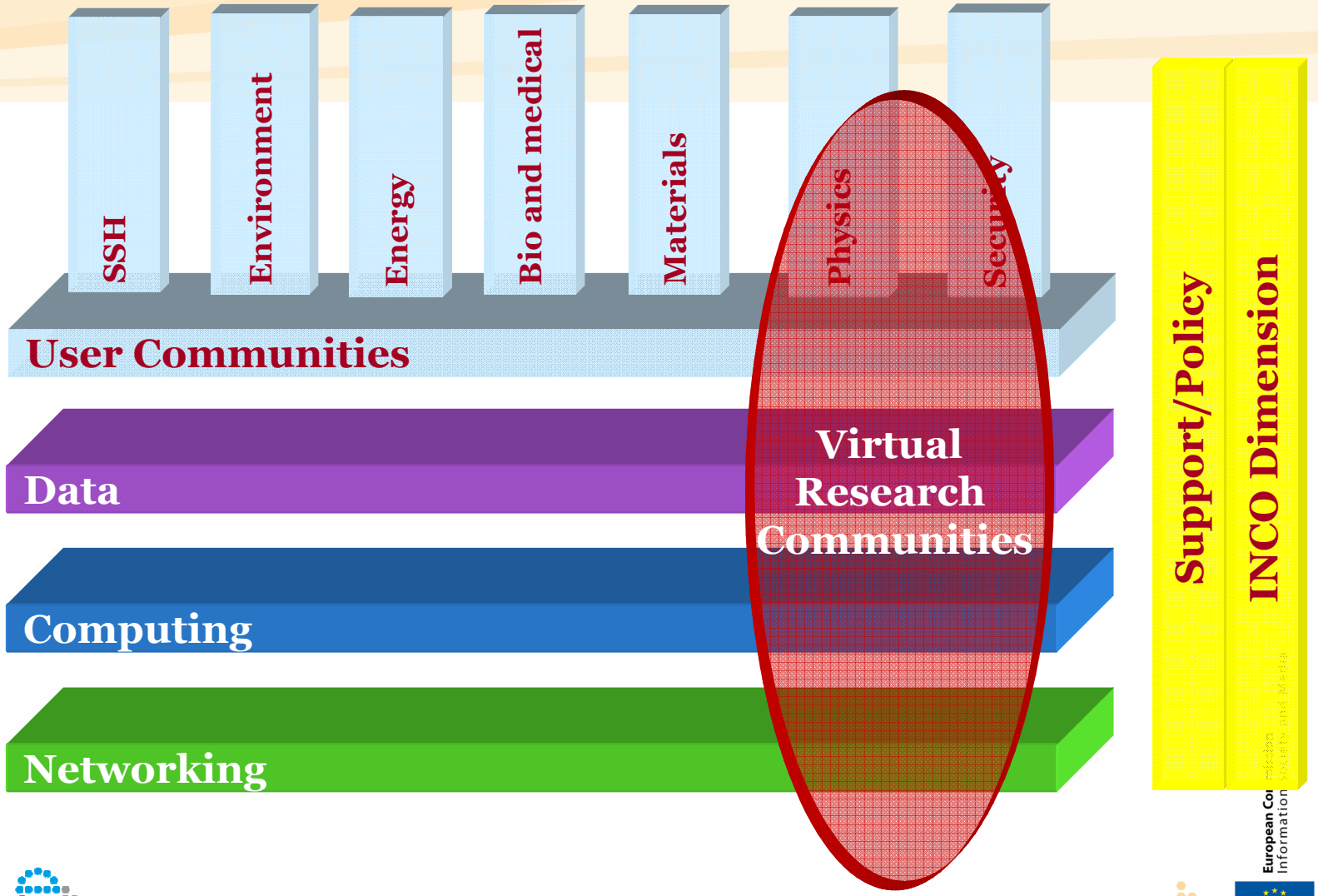
Main areas of activity



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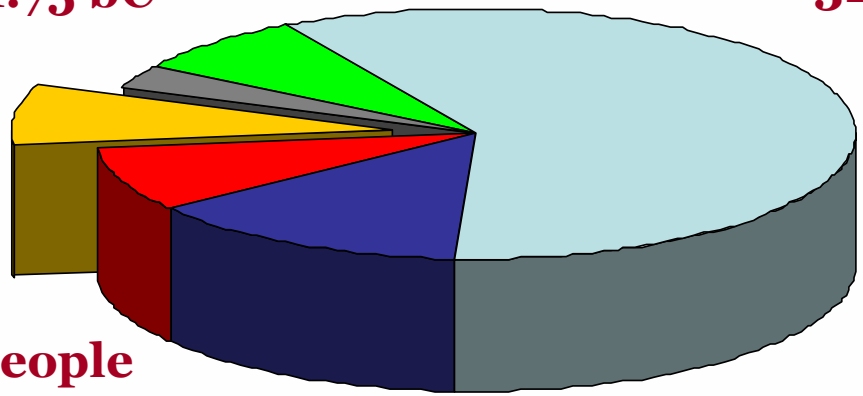
Budget overview (FP7 - 2007-13)



e-Infrastructures
0.6 b€

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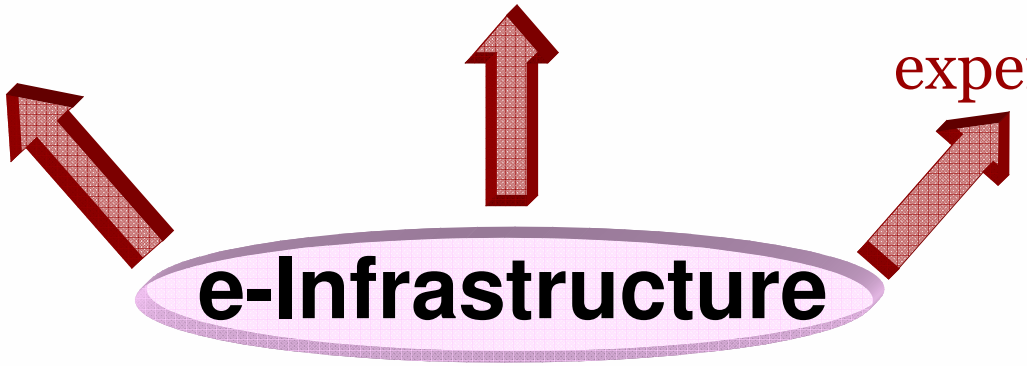
Main orientations of a renewed strategy

Three vectors of a renewed European strategy:

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,...)



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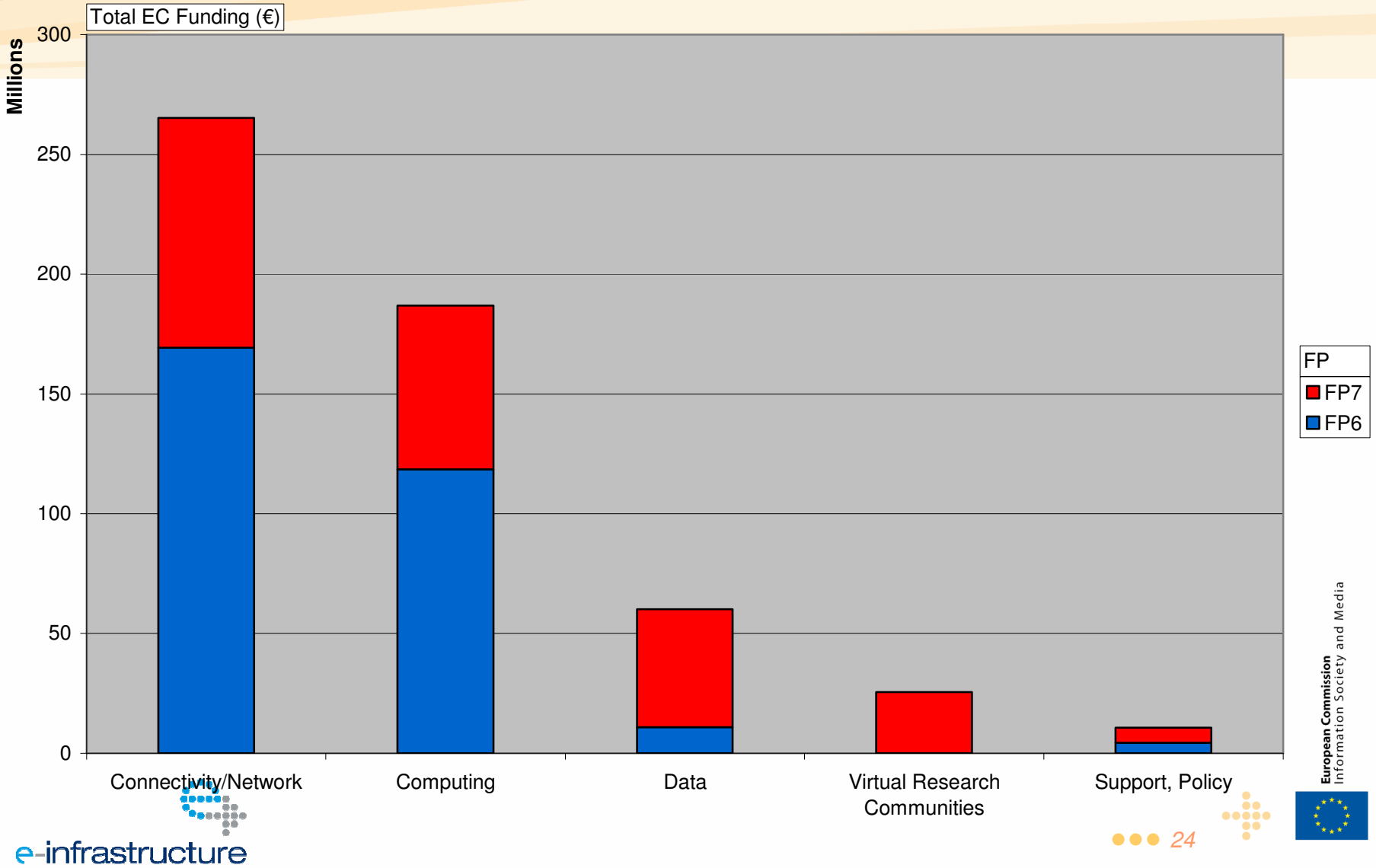
Funding per topic (2003-2009)



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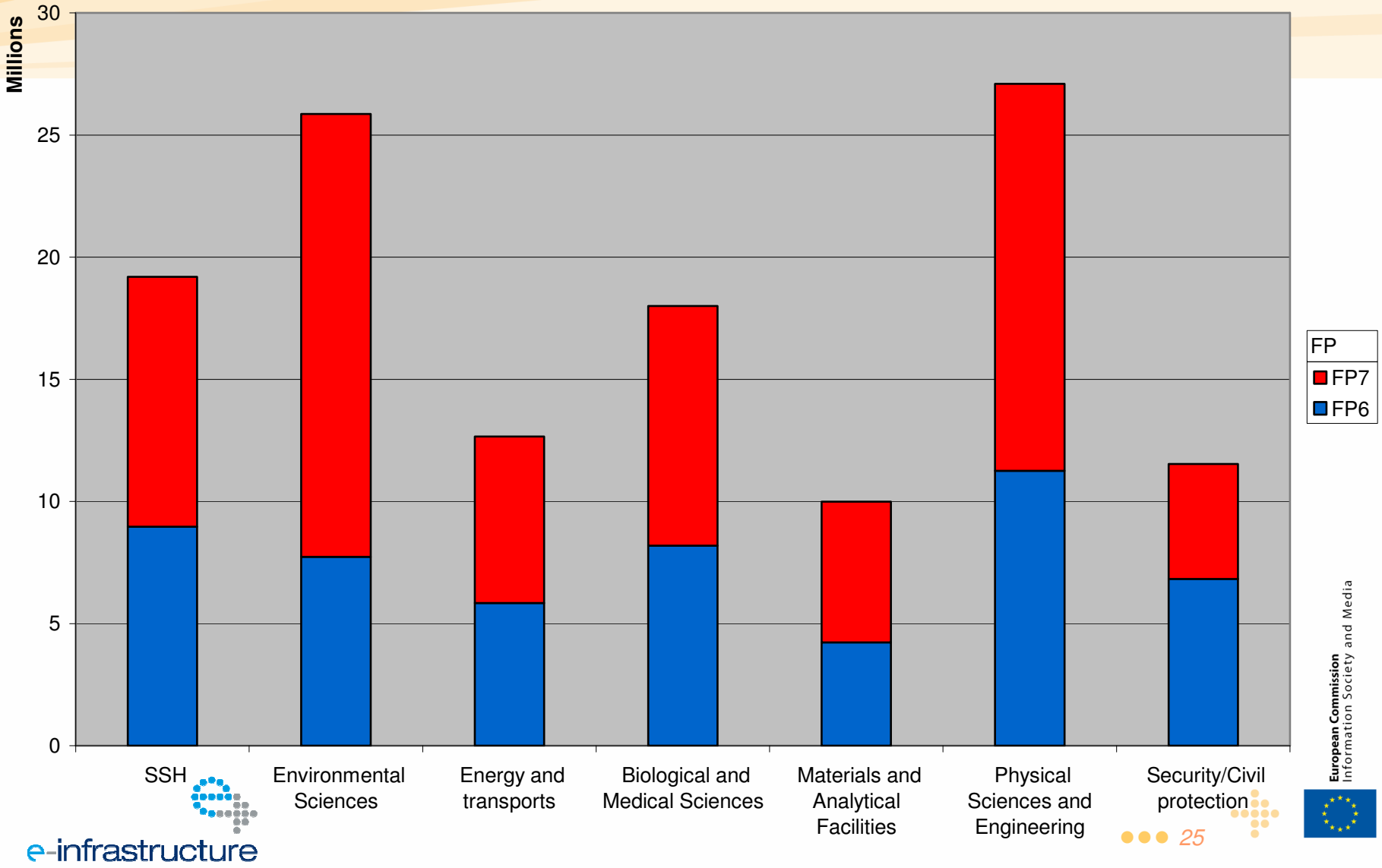
Main user communities supported



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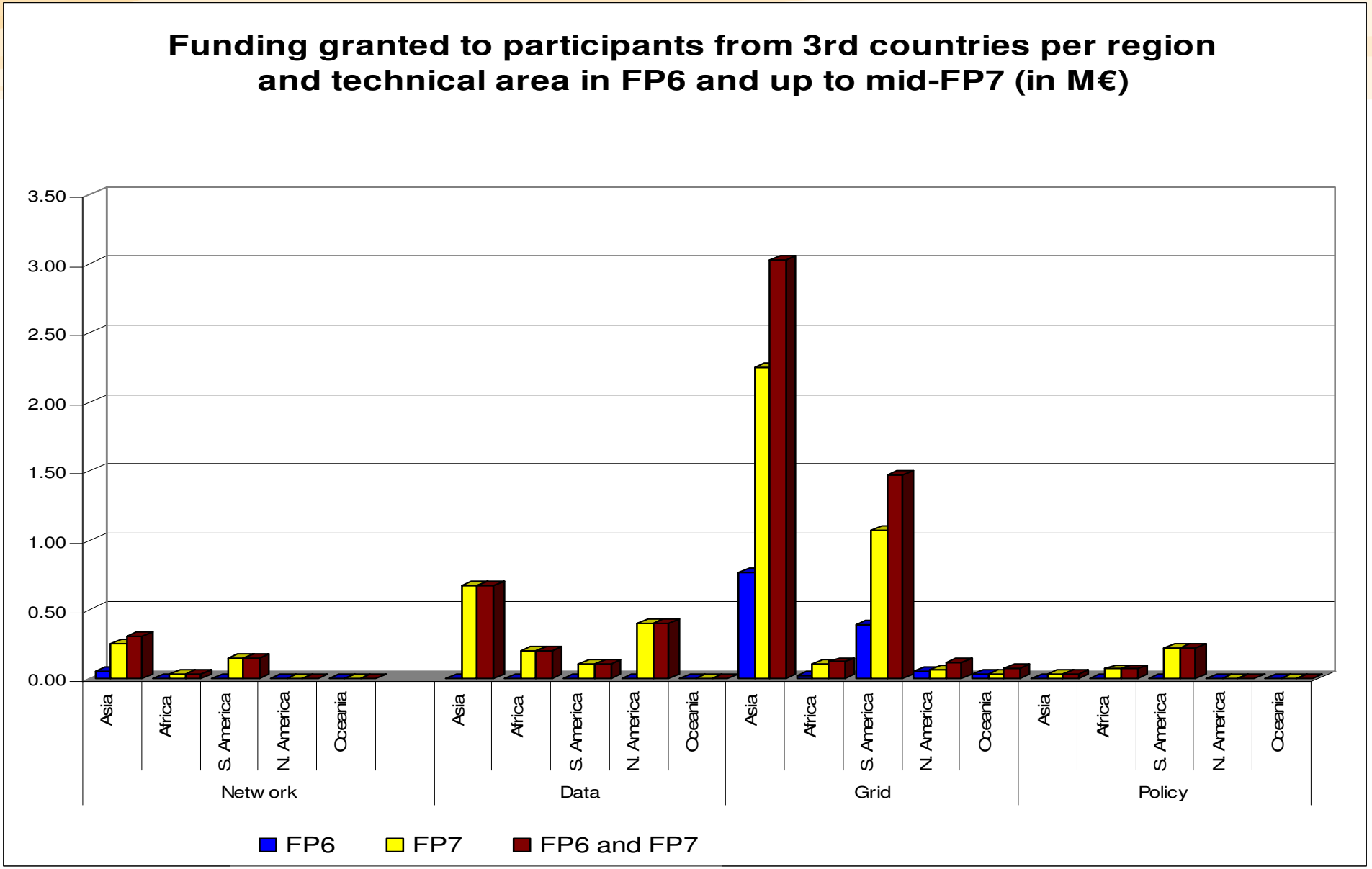
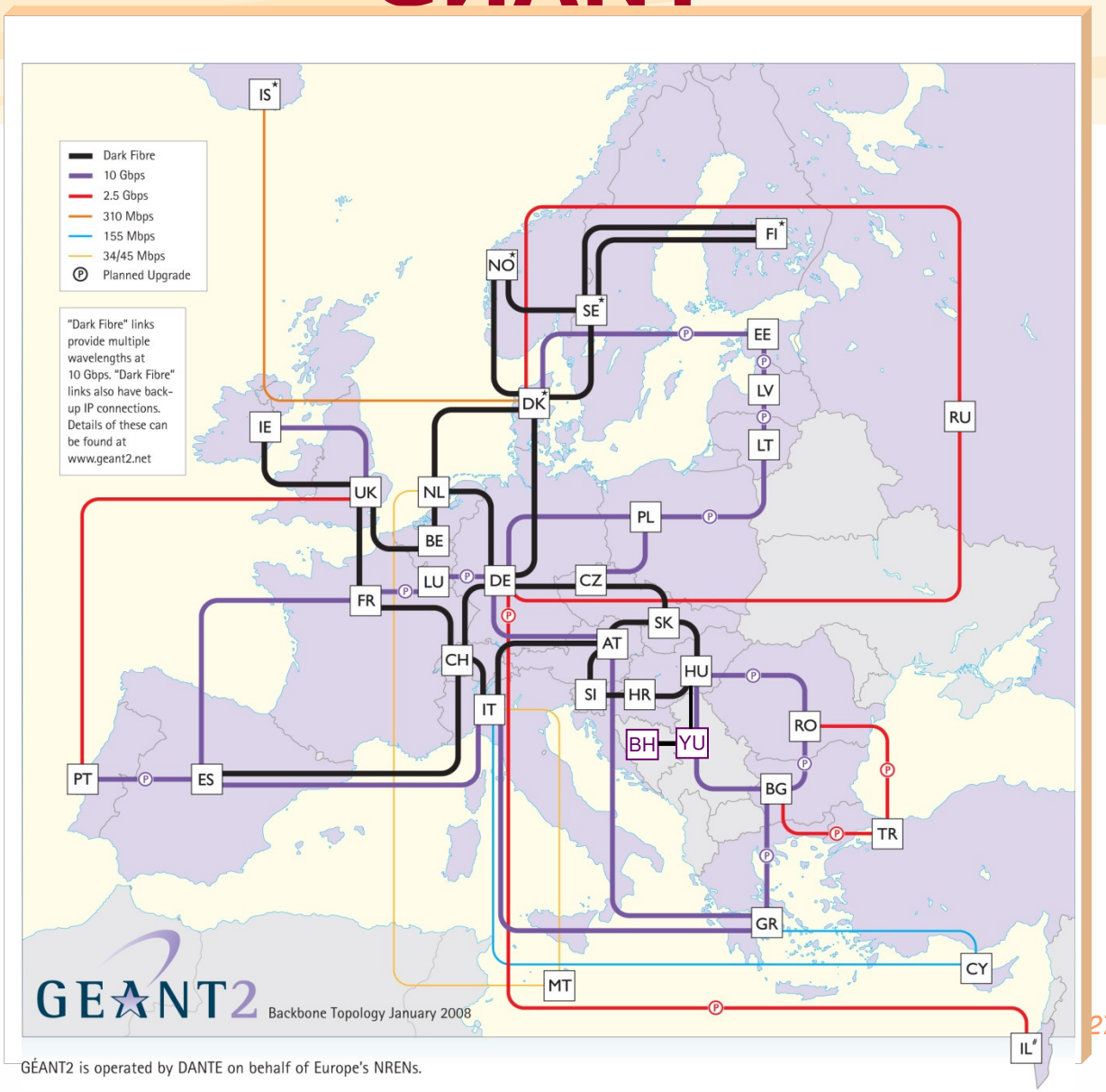
International Dimension



Sustainable connectivity service: GÉANT



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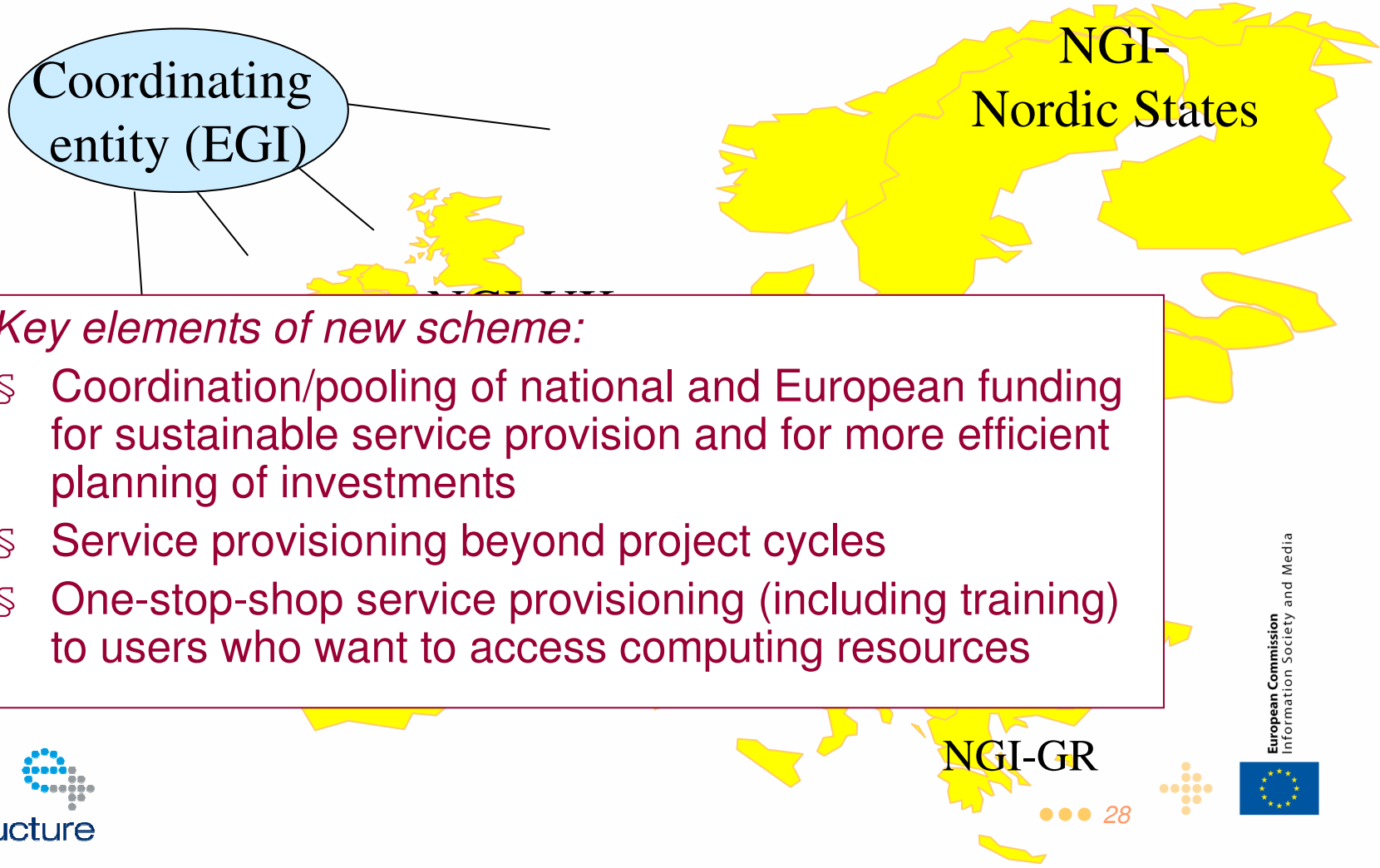
Sustainable grid service: EGI
(currently in negotiation)



Key elements of new scheme:

- § Coordination/pooling of national and European funding for sustainable service provision and for more efficient planning of investments
- § Service provisioning beyond project cycles
- § One-stop-shop service provisioning (including training) to users who want to access computing resources

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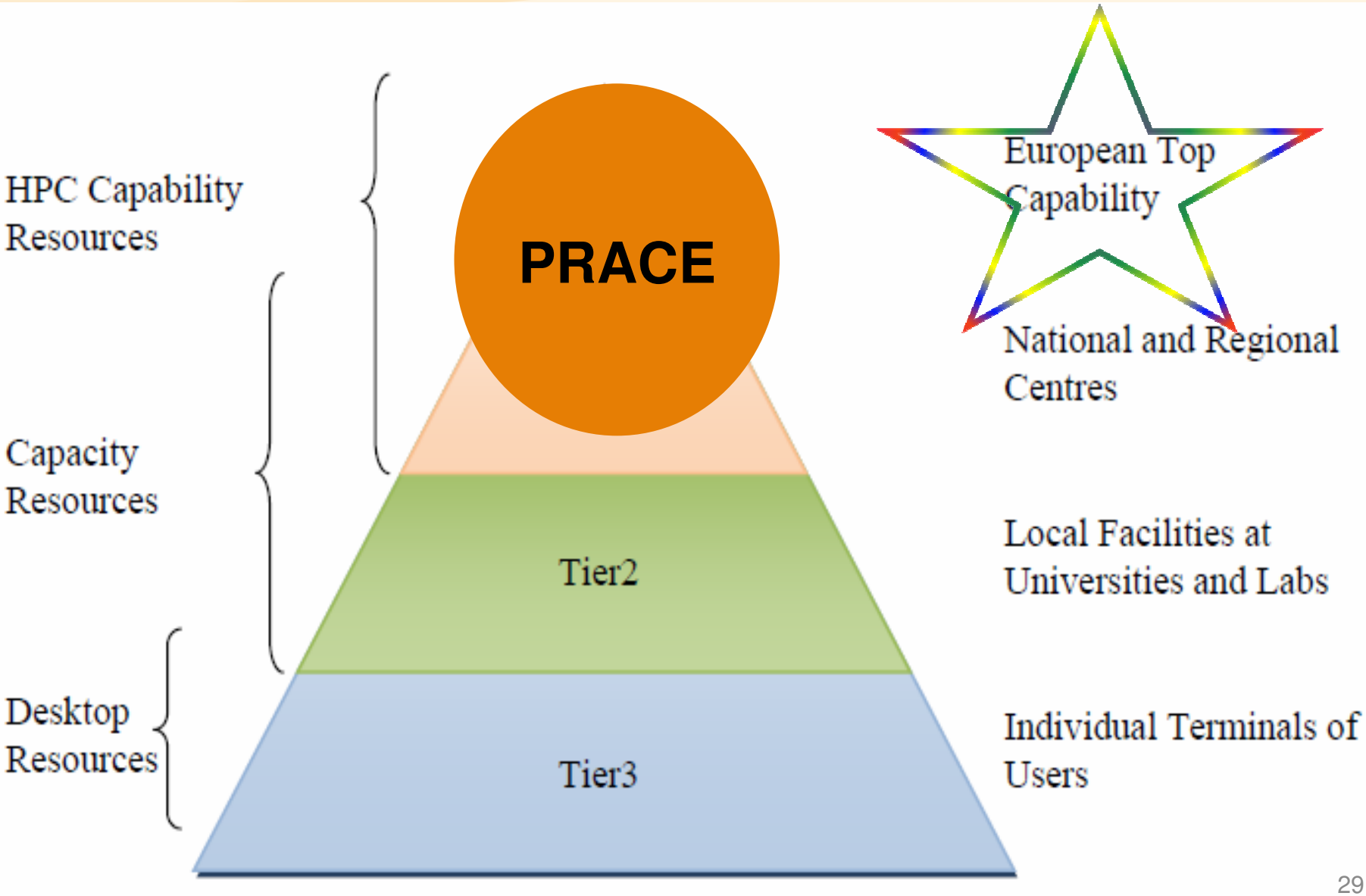
European HPC Ecosystem



New DCI (Grid & Cloud) initiatives in negotiation phase (1)

- **EGI-InSPIRE:** integrated, sustainable pan-European grid production infrastructure for research – potential integration of cloud services
- **EMI (European Middleware Initiative):** middleware environment of consolidated, interoperable middleware components (gLite, UNICO, ARC) for deployment in EGI, PRACE..
- **StratusLab:** incorporate cloud & virtualization technology & services into existing Grid infrastructure

New DCI (Grid & Cloud) initiatives in negotiation phase (2)

- **VENUS-C:** industrial-quality service-oriented platform based on virtualisation/cloud technology to serve research & industrial users
- **SIENA:** accelerate & co-ordinate adoption & evolution of interoperable DCIs through reinforcement of Open Standards deployment; grid-clouds roadmap on standards
- **EDGI:** middleware for extension of Service Grids with Desktop Grids; bridge also to cloud resources
- **IGE:** development, customisation, provisioning, support, and maintenance of components of Globus Toolkit for Europe

EU - RU cooperation in e-Infrastructure & ICT

Solid cooperation

- Important participation of RU organisations in ICT and e-Infrastructure projects; EU-funding
- RU part of pan-European Research Networking (GÉANT) and Grid (EGI) infrastructures
- Increasing collaboration on HPC (DEISA)
- EU-RU (high level) Dialogue on Information Society
  - Research and Regulatory matters (Internet, Security etc)
  - 2 Working Groups (ICT, e-Infrastructures), Expert meetings
- New opportunities: joint EU-RU Call on ICT (in plan)
  - 4M€ EU + 2M€ RU (draft)
  - Topics: Programming models & runtime support; Performance analysis tools for HPC; Optimisation, scalability & porting of codes (draft)

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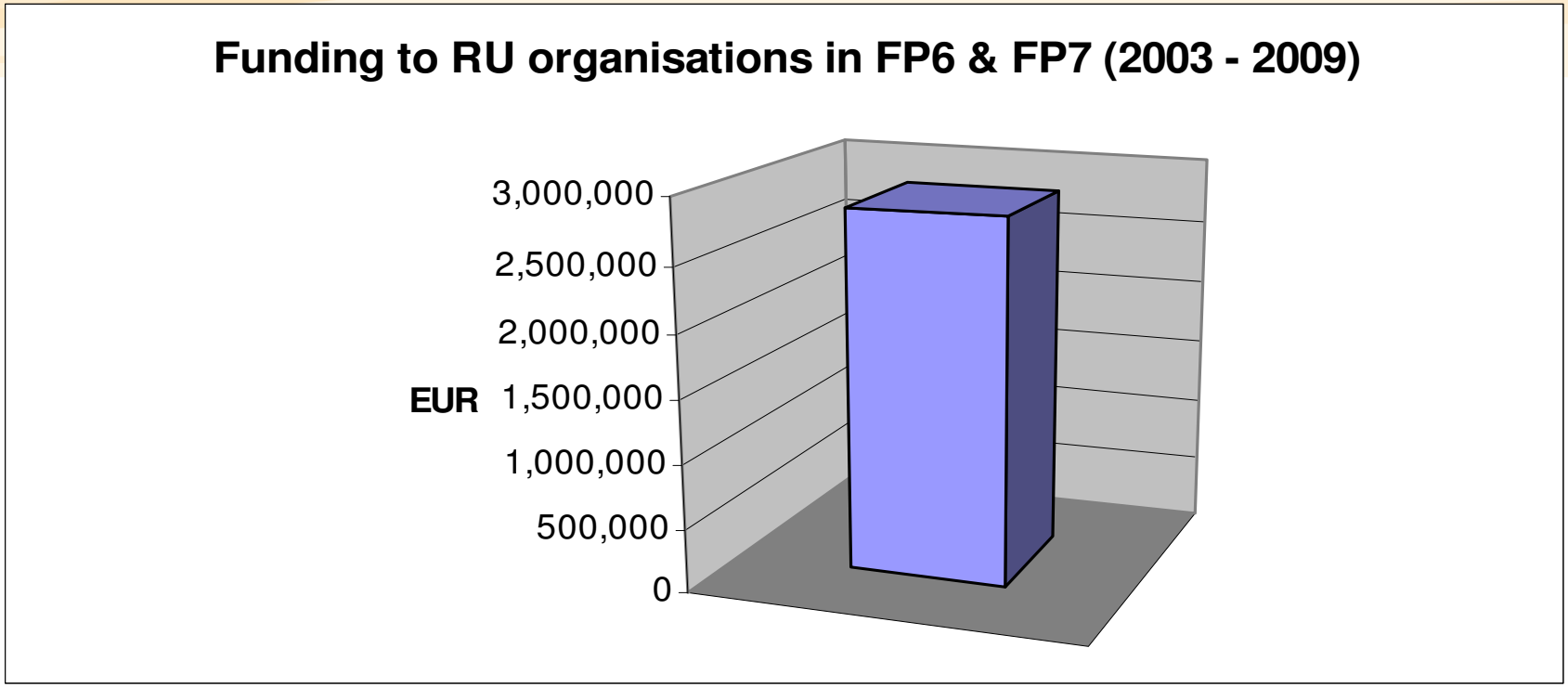
Example: RU participation in e-Infrastructure Programme



- 25 RU participating organisations in 9 projects
- Opportunity to increase cooperation through clouds (data regulatory framework, security, roadmap for standards..)

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Conclusions, next steps

Some conclusions

- **Global crisis**: global economies highly interlinked (important spill-overs between national economies)
- The **Cloud promise**
  - a business rather than a technological concept
  - main challenges non-technical
- **Clouds for science?**
- **Increasing importance** of clouds in European research and business agenda
- Opportunity to further **increase EU – RU cooperation**

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Next steps in Europe

- **Overall ICT policy framework: The European Digital Agenda** *(in preparation)*
  - Establish an EU cloud computing strategy to bring high performance computing systems to governments & science
  - Very fast Internet access; Trust & Security..
- **Research**
  - ICT, RI (e-Infrastructure) Work-programmes 2011-12 *(in preparation)*
- **Data flow/protection, Trust and Security**
  - Directives: Data Protection *(currently in review)*, e-Privacy
  - Enhancement of cross-border security (including cyber-crime) through Lisbon Treaty
  - Opportunity for Europe to drive international initiatives based on internal experiences

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There's no better time to innovate than right now, anticipating the eventual upturn in the economy and laying the intellectual foundation for new products and services

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

Thank you!

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