Interconnection of Armenian e-Infrastructures with the pan-Euroepan Integrated Environments

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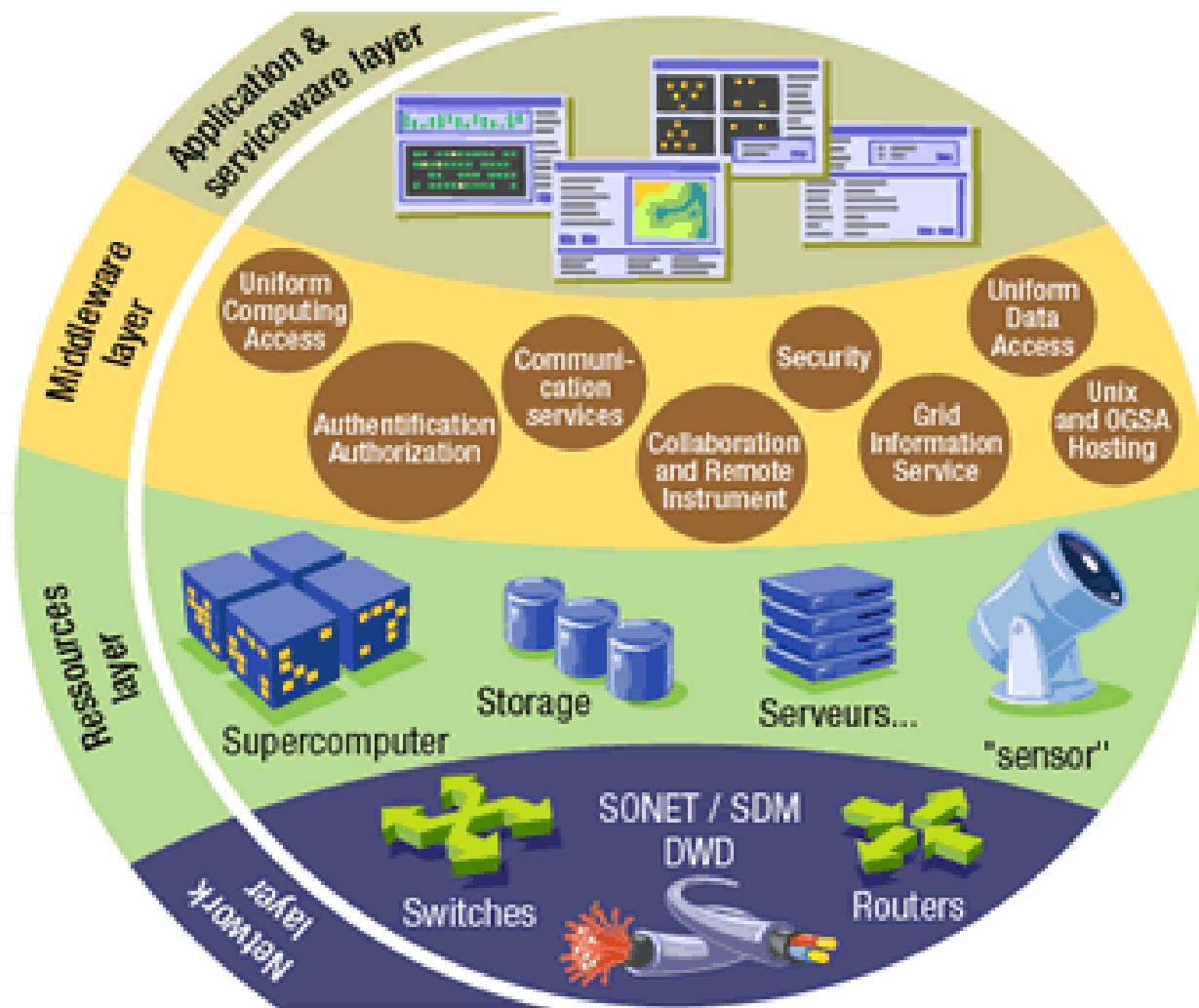
www.grid.am

Europe Shaping 2020's Science:
e-Infrastructures for Scientific Data

9th International Bielefeld Conference
Bielefeld Convention Center, 3 - 5 February 2009

Mário Campolargo
European Commission - DG INFSO
Director, Emerging Technologies and Infrastructures

European Commission
Information Society and Media

E-Infrastructures provide a new way of doing research. E-Infrastructures comprise:
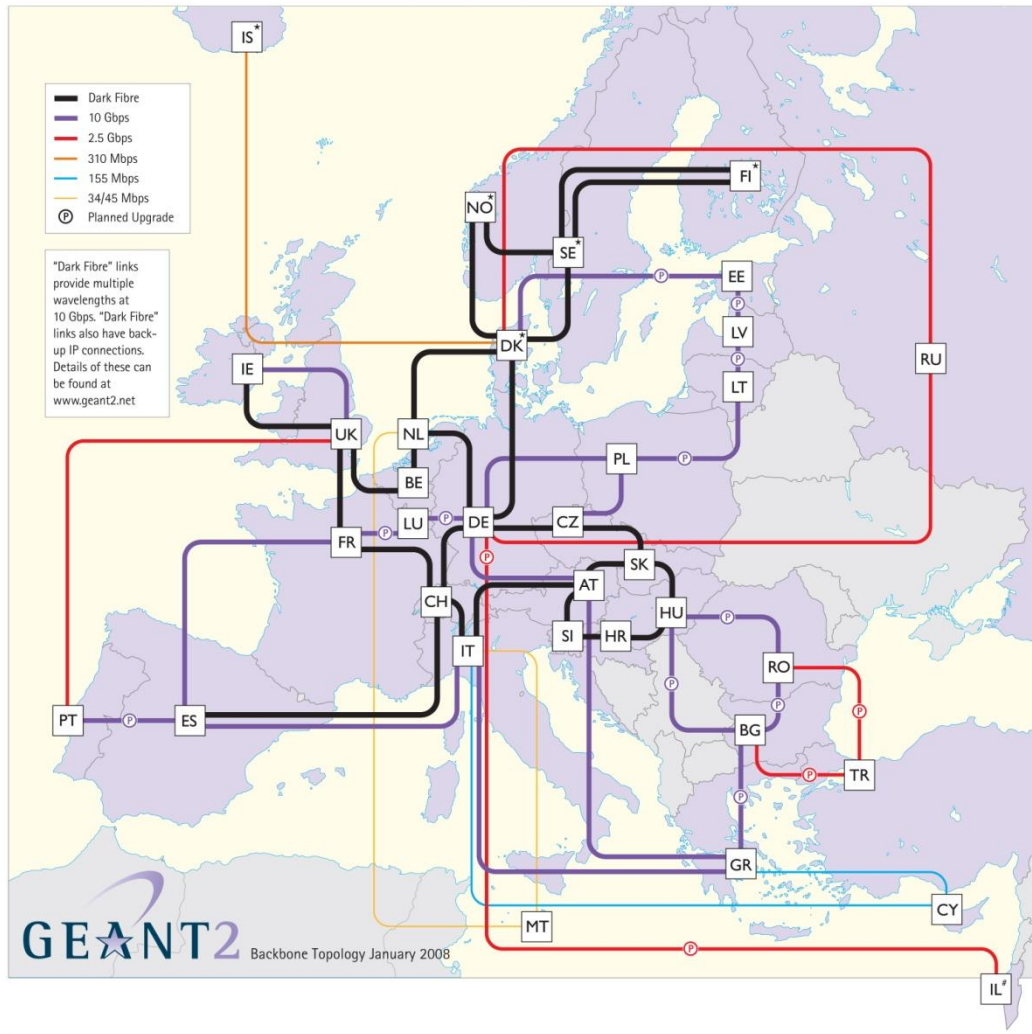
- Connectivity
- Grid computing
- Supercomputing
- Scientific data
- Global Virtual Research Communities
- Standards

- **The Research Network infrastructure provides fast interconnection and advanced services among Research and Education institutes of different countries'**
    - Main Initiative: GEANT
- **The Research Distributed Computing Infrastructure (Grid, HPC) provides a distributed environment for sharing computing power, storage, instruments and databases through the appropriate software (middleware) in order to solve complex application problems**
    - Main Initiatives: EGI, PRACE
- **This integrated environment is called electronic infrastructure (eInfrastructure) allowing new methods of global collaborative research - often referred to as electronic science (eScience)**
- **The creation of the eInfrastructure is a key objective of the European Research Area**

e-Science Collaborations

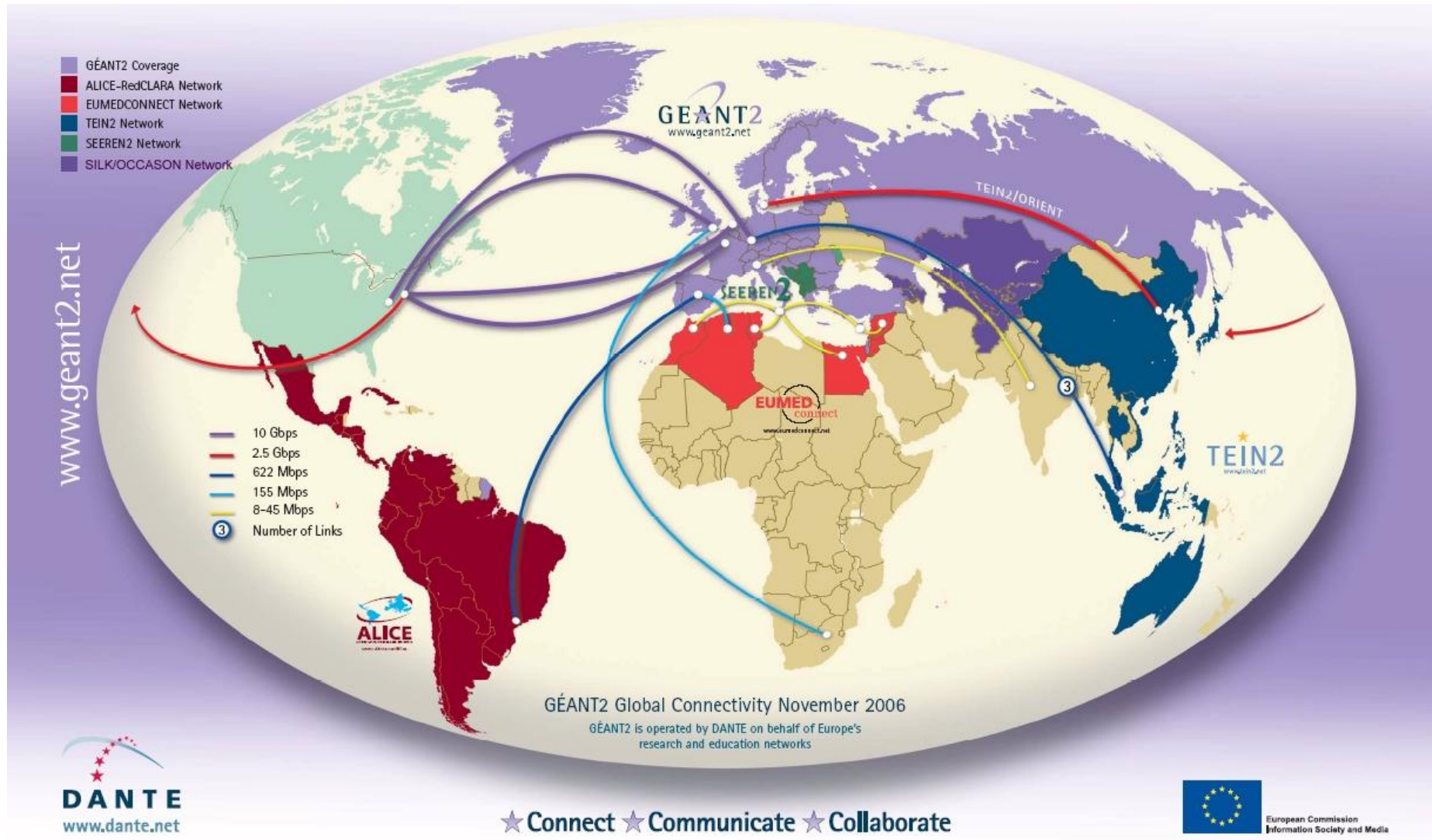DCI Infrastructure

Network Infrastructure
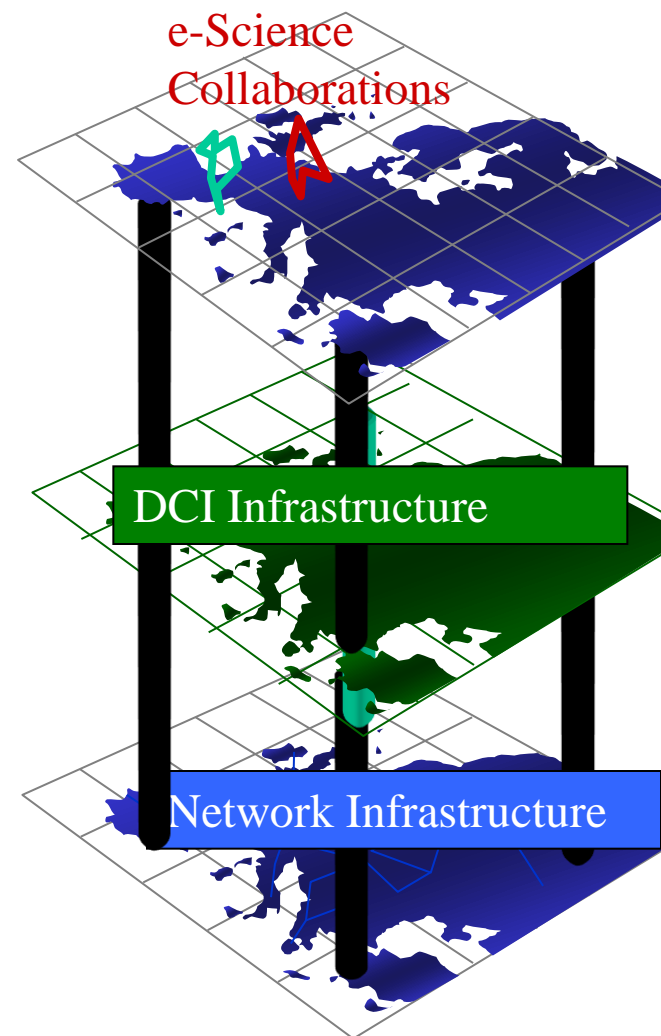
A European R&E Networking Model:

- **GÉANT2 is the high-bandwidth, academic Internet serving Europe's research and education community. Connecting over 30 million researchers with a multi-domain topology spanning 34 European countries and links to a number of other world regions, GÉANT2 is at the heart of global research networking. GÉANT2 is co-funded by the European Commission and Europe's national research and education networks, and is managed by DANTE.**

Dark Fibre
10 Gbps
2.5 Gbps
310 Mbps
155 Mbps
34/45 Mbps
Ⓟ Planned Upgrade

"Dark Fibre" links provide multiple wavelengths at 10 Gbps. "Dark Fibre" links also have back-up IP connections. Details of these can be found at www.geant2.net

GEANT2 Backbone Topology January 2008

A few Facts & Figures…

- **29 POPs**
- **serving 34 NRENs**
- **~12000 km of fibre**
- **>120 (own) 10G lambdas**
- **22 (leased) 10G lambdas**
- **+ some lower speed links**
- **NREN accesses at up to 10Gbps (+ backup) + P2P**
- **4 x 10G to North America**
- **POP in NY**
- **connections to other R&E networks…**
  Abilene (Internet2), ESnet, CA*net4, SINET, TENET, EUMEDCONNECT, RedCLARA, TEIN2,

GÉANT2 Global Connectivity November 2006

GÉANT2 is operated by DANTE on behalf of Europe's research and education networks

★ Connect ★ Communicate ★ Collaborate

- Need to prepare permanent, common Grid infrastructure
- Ensure the long-term sustainability of the European e-Infrastructure independent of short project funding cycles
- Coordinate the integration and interaction between National Grid Infrastructures (NGIs)
- Operate the production Grid infrastructure on a European level for a wide range of scientific disciplines
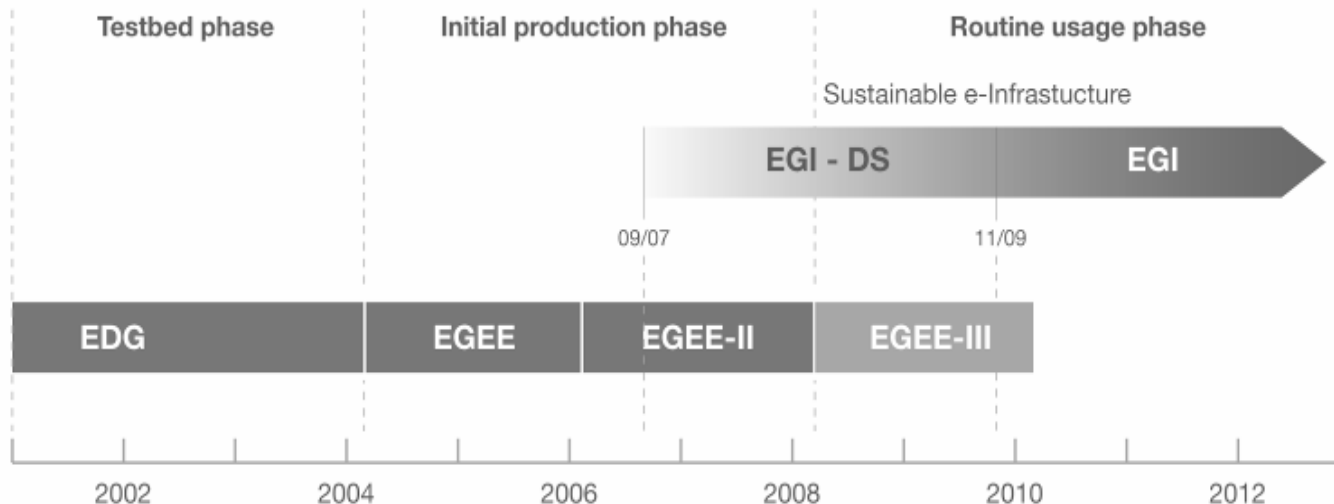
Central to this proposal and key to coordinating an Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (InSPIRE) is a new legal organisation EGI.eu which will be the lead partner in the EGI-InSPIRE project.

Currently, being established in Amsterdam, EGI.eu's focus is coordinating the continued operation and expansion of today's production grid infrastructure that supports over 13,000 researchers, many of them already heavy users of the infrastructure, across diverse disciplines such as Earth Science, Astronomy & Astrophysics, Fusion research, Computational Chemistry, Materials Science, Life Sciences and High Energy Physics.

Coordinator: Participants:

Nikhef , Netherlands   39 EU countries + CERN
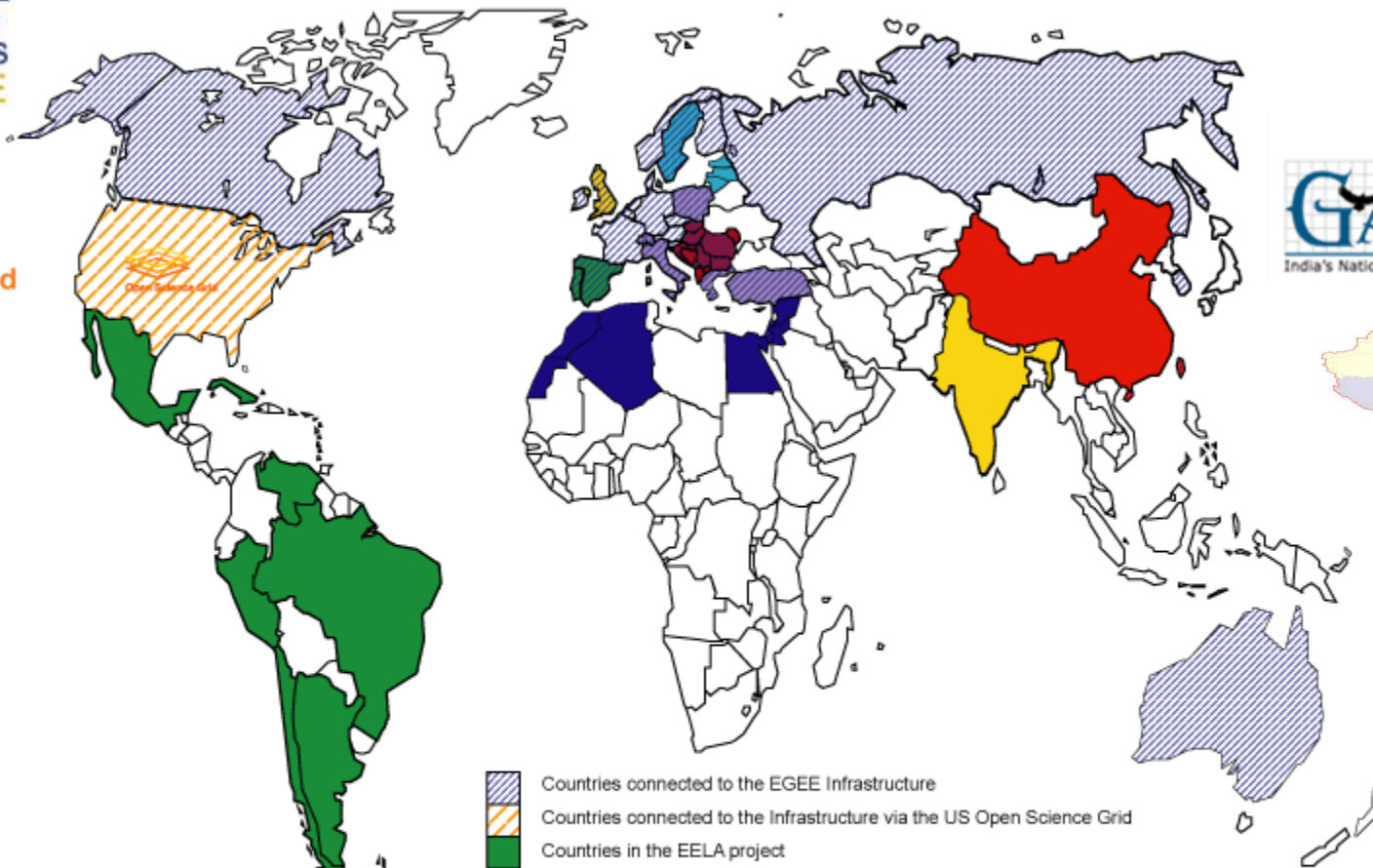
Countries connected to the EGEE Infrastructure
Countries connected to the Infrastructure via the US Open Science Grid
Countries in the EELA project
Countries in the EUMedGrid project
Countries in the BalticGrid project
Countries in the SEE-GRID project
Countries in the EUIndiaGrid project
Countries in the EUChinaGrid project
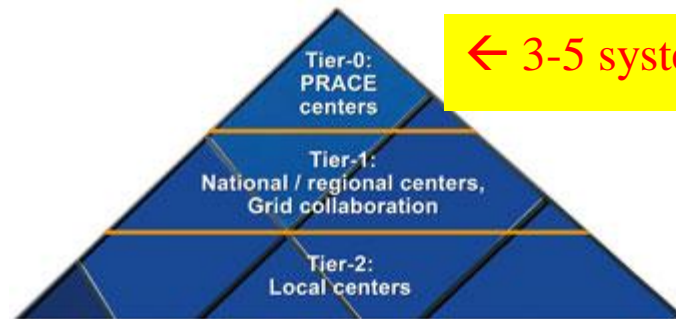Countries in several regional projects

Principal Partners

- **France, Germany**
- **The Netherlands**
- **Spain, UK**

General Partners

- **Austria, Finland**
- **Greece, Italy**
- **Norway, Poland**
- **Portugal, Sweden**
- **Switzerland**

Additional General Partners

- **Bulgaria, Czech Republic**
- **Cyprus, Ireland**
- **Serbia, Turkey**

← 3-5 systems

- The first production system, a one Petaflop/s IBM Blue Gene/P (JUGENE) is installed at Forschungszentrum Jülich, Germany, a Gauss Centre for Supercomputing member site.

- The second production system, a 1.6 Petaflop/s BULL system called CURIE will be located near Paris and operated in a new computing center, the Très Grand Centre de Calcul, funded by Commissariat à l'énergie atomique et aux énergies alternatives.

Tier-0:
PRACE centers

Tier-1:
National / regional centers, Grid collaboration

Tier-2:
Local centers

Welcome to PRACE — Partnership for Advanced Computing in Europe - Mozi...

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Welcome to PRACE

The Partnership for Advanced Computing in Europe prepares the creation of a persistent pan-European HPC service, consisting of several tier-0 centres providing European researchers with access to capability computers and forming the top level of the European HPC ecosystem. PRACE is a project funded in part by the EU's 7th Framework Programme.

Supercomputers are indispensable tools for solving the most challenging and complex scientific and technological problems through simulations. To remain internationally competitive, European scientists and engineers must be provided with leadership-class supercomputer systems. PRACE, the Partnership for Advanced Computing in Europe will create a persistent pan-European high performance computing (HPC) service and infrastructure. This infrastructure will be managed as a single European entity. European scientists and technologists will be provided world-class leadership supercomputers with capabilities equal to or better than those available in the USA and Japan. The service will comprise three to five superior HPC centers strengthened by regional and national supercomputing centers working in tight collaboration through grid

News
» Bulgaria and Czech Republic joined PRACE 2009-09-09
» PRACE HPC Training Video Material Available 2009-09-04
» BSC arranges a PRACE code porting and optimization workshop 2009-08-11
» First projects granted access to the PRACE Prototype systems - 4.4 Million Core hours to 3 projects 2009-07-22
» Presentations and pictures from ISC'09 2009-06-29
more...

Events
» PRACE industry seminar, September 7-8, Toulouse, France
» PPAM 2009, September 13-16, Wroclaw, Poland

Done

HP-SEE focuses on a number of strategic actions. First, it will link existing and upcoming HPC facilities in the region in a common infrastructure, and provide operational solutions for it.

As a complementary action, the project will establish and maintain GEANT link for Caucasus. Second, it will open this HPC infrastructure to a wide range of new user communities, including those of less resourced countries, fostering collaboration and providing advanced capabilities to researchers, with an emphasis on strategic groups in computational physics, chemistry and life sciences.

Finally, it will ensure establishment of national HPC initiatives, and act as a SEE bridge for PRACE.
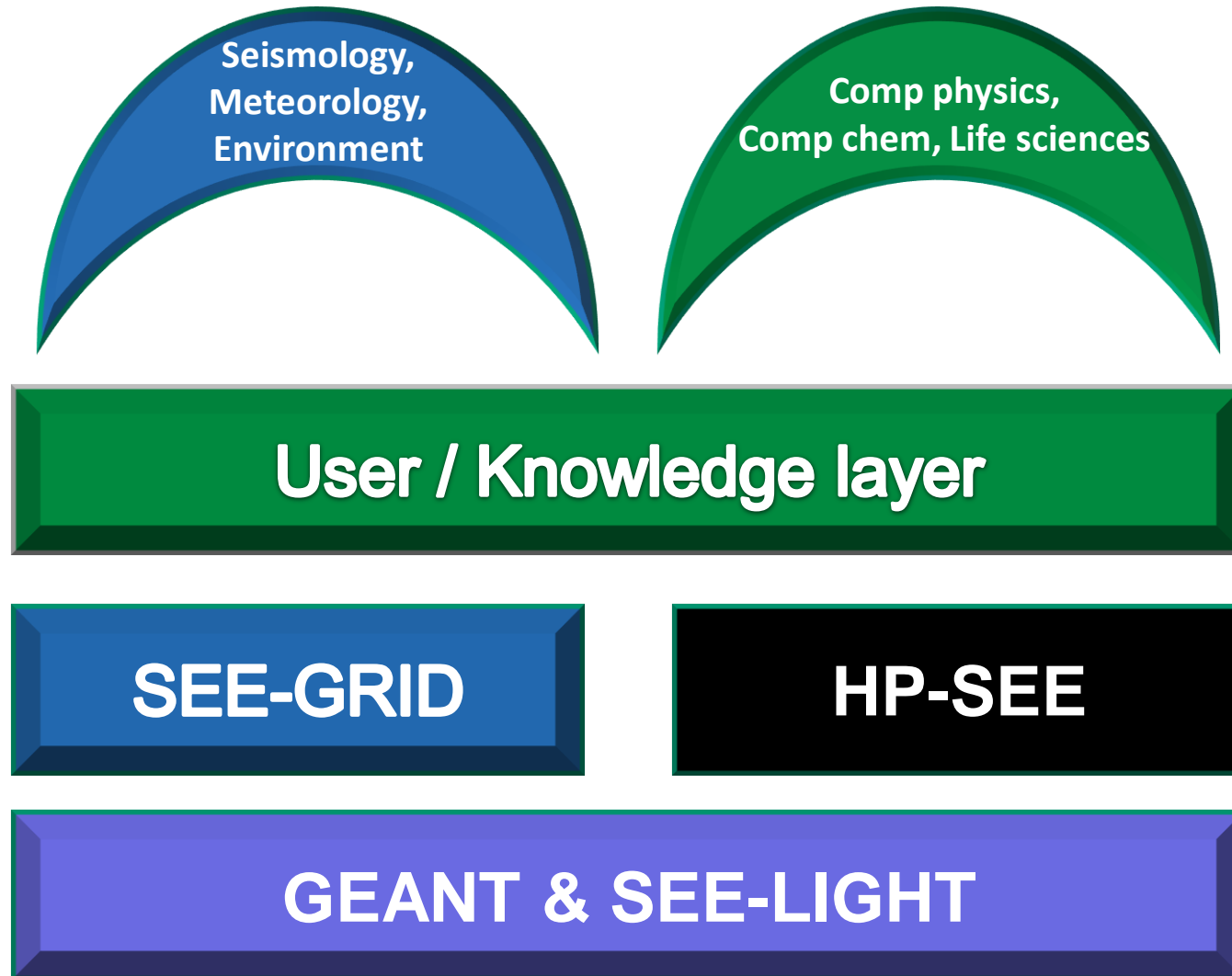
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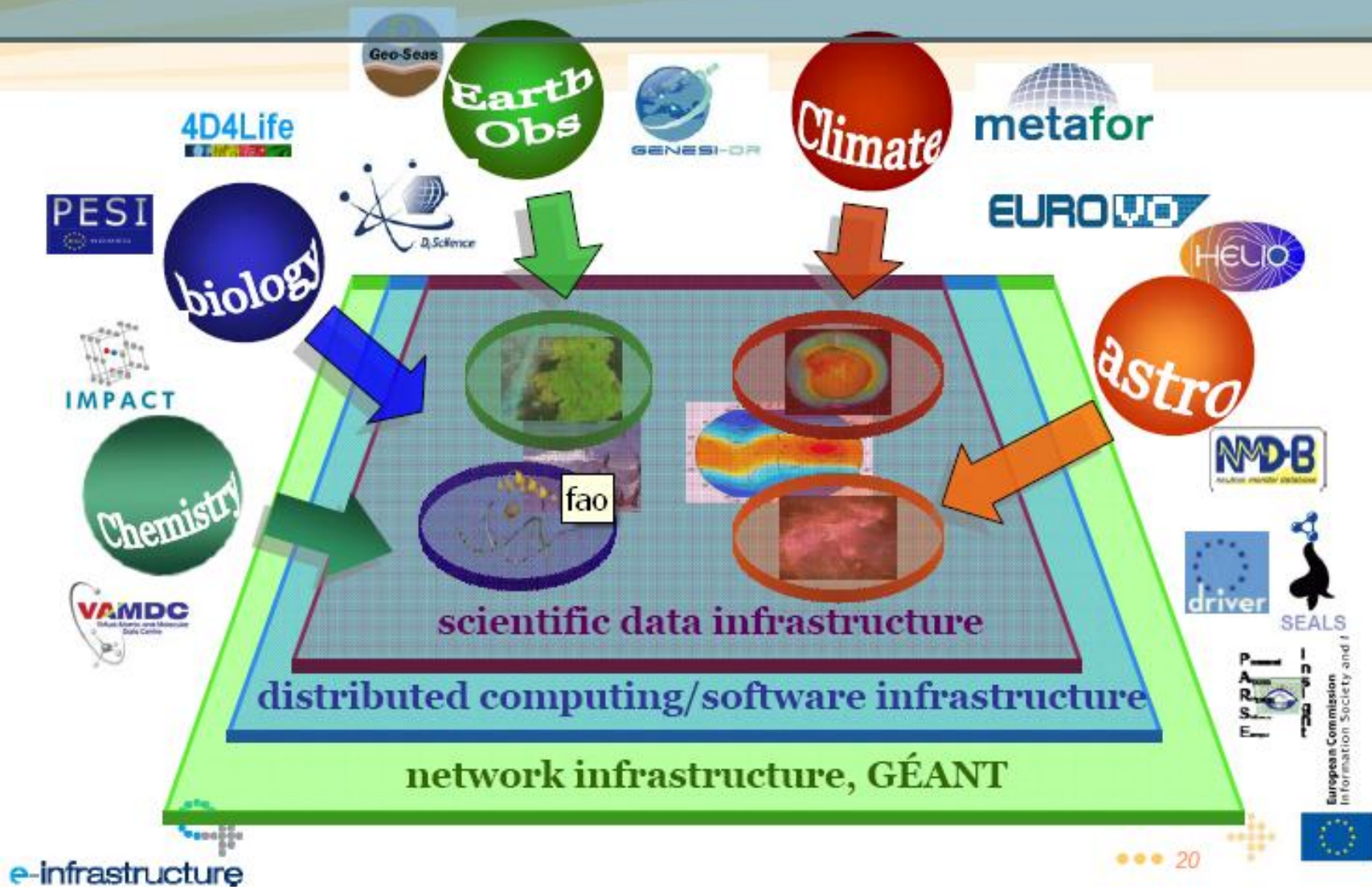
GRNET, Greece   14 countries

HIGH PERFORMANCE PLATFORMS

- **IBM Blue Gene/P - two racks:**

- **• 2048 PowerPC 450 processors (32 bits, 850 MHz); total of 8192 cores;**

- **16 I/O nodes (to be expanded to 32 I/O nodes in the near future);**

- **System Storage DS3400: dual controller, 4 Gb/s FC, 2 TB disk space (to be installed in the near future)**

Seismology, Meteorology, Environment

Comp physics, Comp chem, Life sciences

User / Knowledge layer

SEE-GRID

HP-SEE

GEANT & SEE-LIGHT

# Overview: scientific data e-Infrastructure

- **Creation of Armenian Grid Joint Research Unit. Agreement signed in September 2007**

- **Armenian National Grid Initiative Foundation, Kick-off meeting 31 October 2008. Juridical Status is in process**

♦State Scientific Committee of the Ministry of Education and Science
♦National Academy of Sciences
♦State Engineering University of Armenia
♦Yerevan State University
♦Yerevan Physics Institute after A. Alikhanian
♦Institute for Informatics and Automation Problems of the National Academy of Sciences
♦Armenian e-Science Foundation

Armenian National Grid Initiative
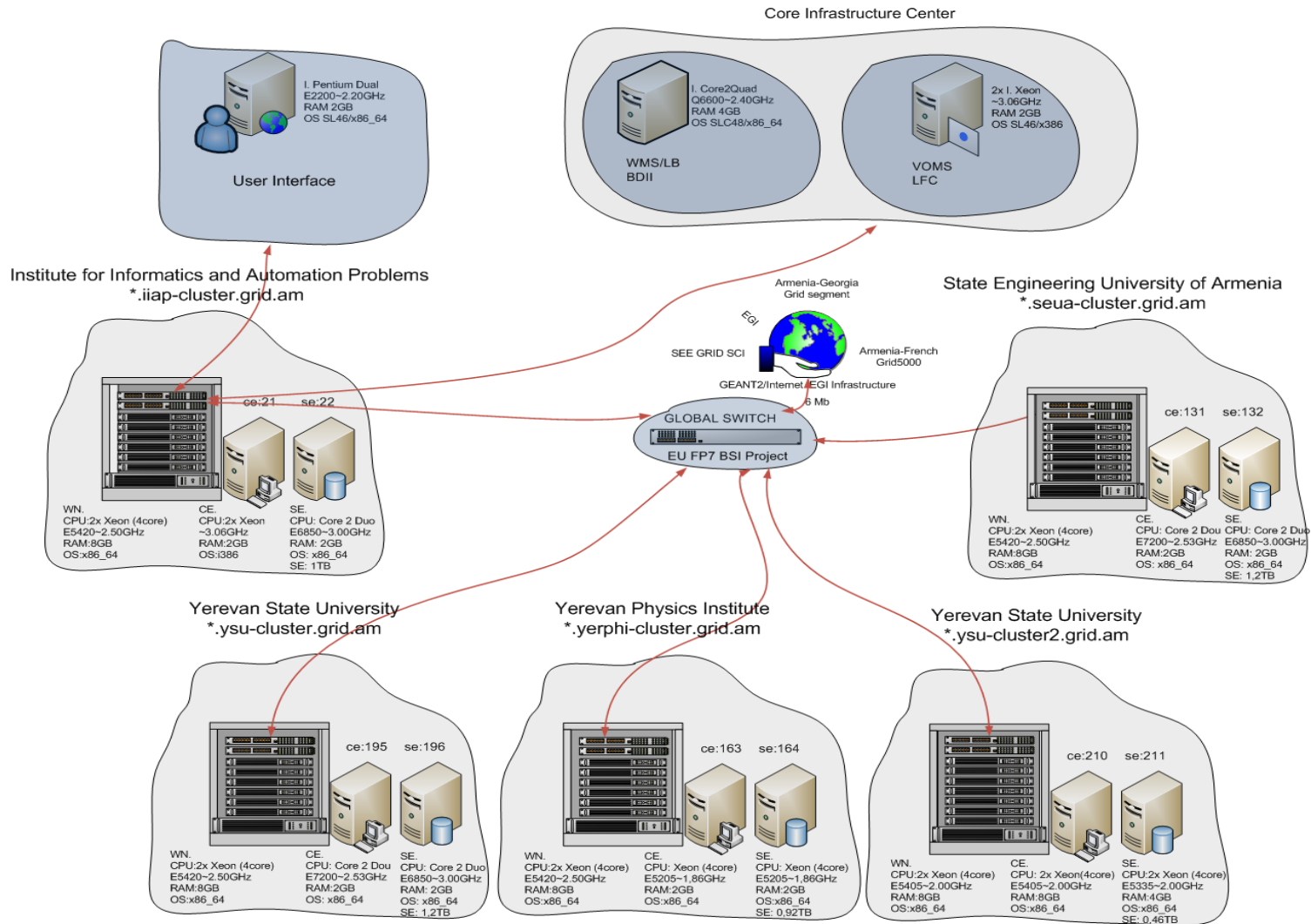
The Tesla C1060 is based on the massively parallel, many-core Tesla processor, which is coupled with the standard CUDA C programming environment to simplify many-core programming. The Tesla C1060 allows you to keep pace with the increasing demands of the toughest computing challenges including drug research, oil and gas exploration, and computational finance and its many-core architecture meets the computational demands of applications whose complexity has outstripped the CPU's ability to solve them.
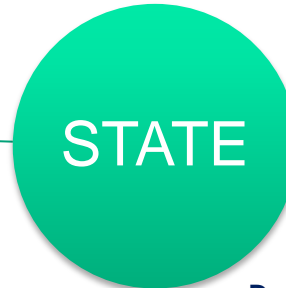
FP7

- **European Grid Initiative: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (39 EU countries + CERN) (2010-2014)**
- **High-Performance Computing Infrastructure for South East Europe's Research Communities (14 countries) (2010-2012)**
- **South Eastern European Grid eInfrastructure for regional eScience**
- **BSI (Black Sea Interconnection)**

PROJECTS

STATE

- **State Target Project entitled Deployment of Armenian National Grid Infrastructure (2010-2012)**
- **Creation of Armenian State Experimental Computing System (2005-2006)**

ISTC

- **Development of Armenian-Georgian Grid Infrastructure and applications in the Fields of High Energy Physics, Astrophysics and Quantum Physics (2008-2010)**
- **Development of Scientific Computing Grid on the Base of Armcluster for South Caucasus Region (2007-2009)**
- **Creation of High-Performance Computation Cluster and Databases in Armenia (2003-2006)**

More Information (www.grid.am)

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Welcome to the Official web-site of the Armenian National Grid Initiative Foundation

The grid infrastructure is recognized today in Europe and worldwide, together with the highspeed networking, as one of the basic components of the e-Infrastructure of research and education and soon of the entire knowledge-based society. The starting point of such perception of the grid infrastructure is the paradigm of the grid itself, which offers a flexible organization of geographically distributed resources (computing, data and information resources as well as, for instance, laboratory and experimental devices and equipment), with a consistent and simple access option and possibility to co-ordinately share them within collaborating virtual teams and organizations.

The Armenian National Grid Initiative (ArmNGI) represents an effort to establish a sustainable grid infrastructure in Armenia. The establishment of ArmNGI foundation is in process. Main aims of the initiative are;

- create a national GRID development policy
- to build up the national grid infrastructure
- to expand the high performance computing resources with collaboration of academic and commercial participants
- to give the information to the national user community about high performance computing, grid infrastructure and international grid projects
- to improve national applications
- to take place the international grid projects actively

ArmNGI Partners

- State Scientific Committe of the Ministry of Education and Science of the Republic of Armenia
- National Academy of Sciences of the Republic of Armenia
- State Engineering University of Armenia
- Yerevan State University
- Yerevan Physics Institute after A. Alikhanian
- Institute for Informatics and Automation Problems of the National Academy of Sciences of the Republic of Armenia
- Armenian e-Science Foundation

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