ITU-D Regional Development Forum for the EUR and CIS Region

NGN and Broadband, Opportunities and Challenges

Chisinau, Moldova, 24 – 26 August 2009

Broadband e-infrastructure development in Moldova for e-science and e-learning services

by Veaceslav Sidorenco

Technical University of Moldova, RENAM

CAPACITIES

Important components of Information Society

ICT-enabled e-science and e-learning becomes today emergent and valuable structural components of Information Society

To be a genuinely competitive in the knowledge economy, one must be better prepared

- in producing knowledge through **research**
- in diffusing it through **education**
- in applying it through **innovation.**

Researcher: fast growing needs

Researcher: the most precious capital and the centre of all developments!

Slide: Mário Campolargo

What is e-Infrastructure

e-Infrastructure refers to new research environment in which all researchers - whether working in the context of their home institutions or in national or multinational scientific initiatives - have shared access to unique or distributed scientific facilities (including data, instruments, computing and broadband communications), regardless of their type and location in the world.

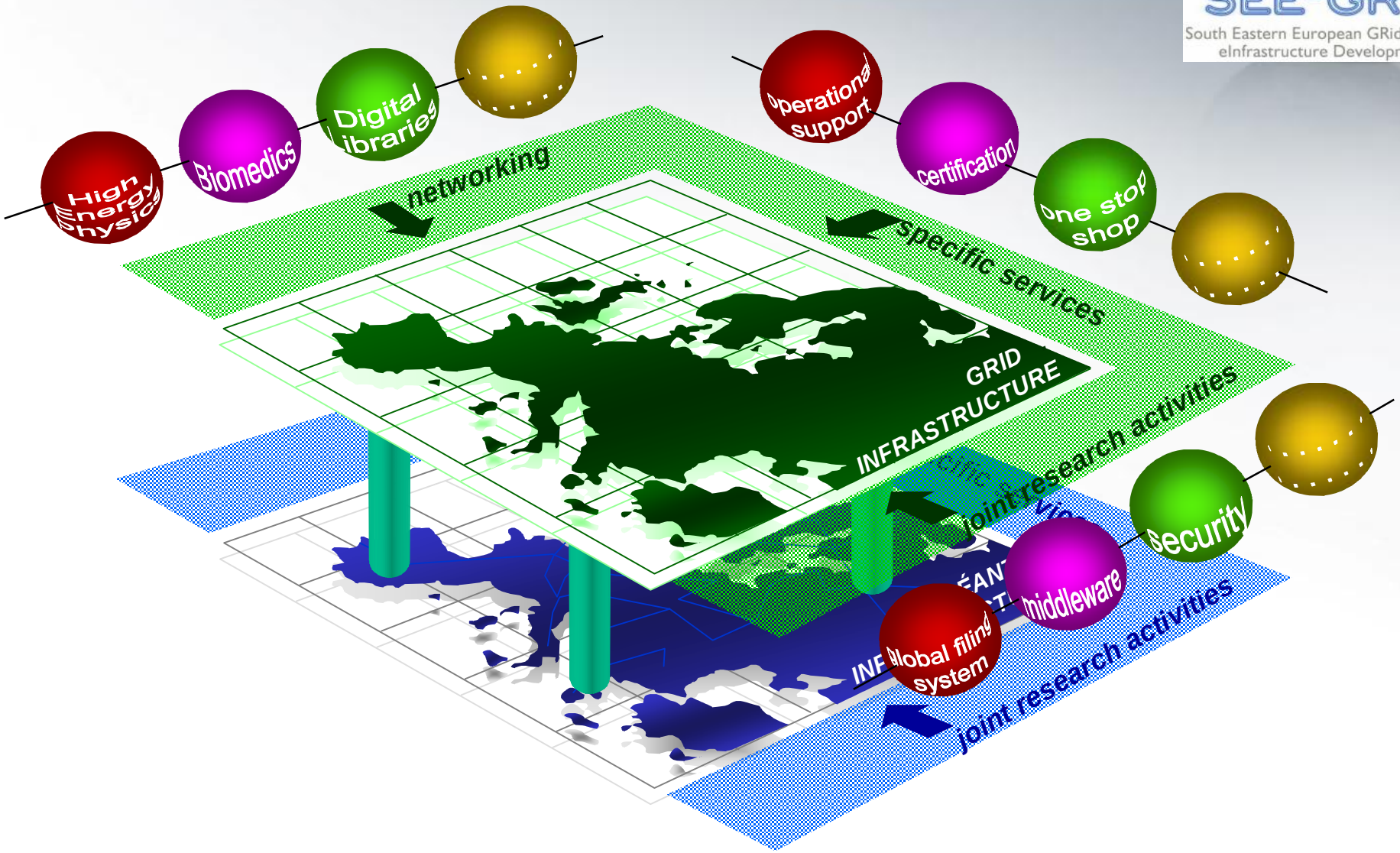
http://cordis.europa.eu/fp7/ict/e-infrastructure/

Importance of e-Infrastructure

e-Infrastructures developing worldwide will provide researchers and economy a common market of electronic resources, accessible on a 24-hour basis and a unique tool for the development of collaborating applications, accessible via Research & Educational Networking infrastructures as Distributed Environment based on **Grid Computing technology**

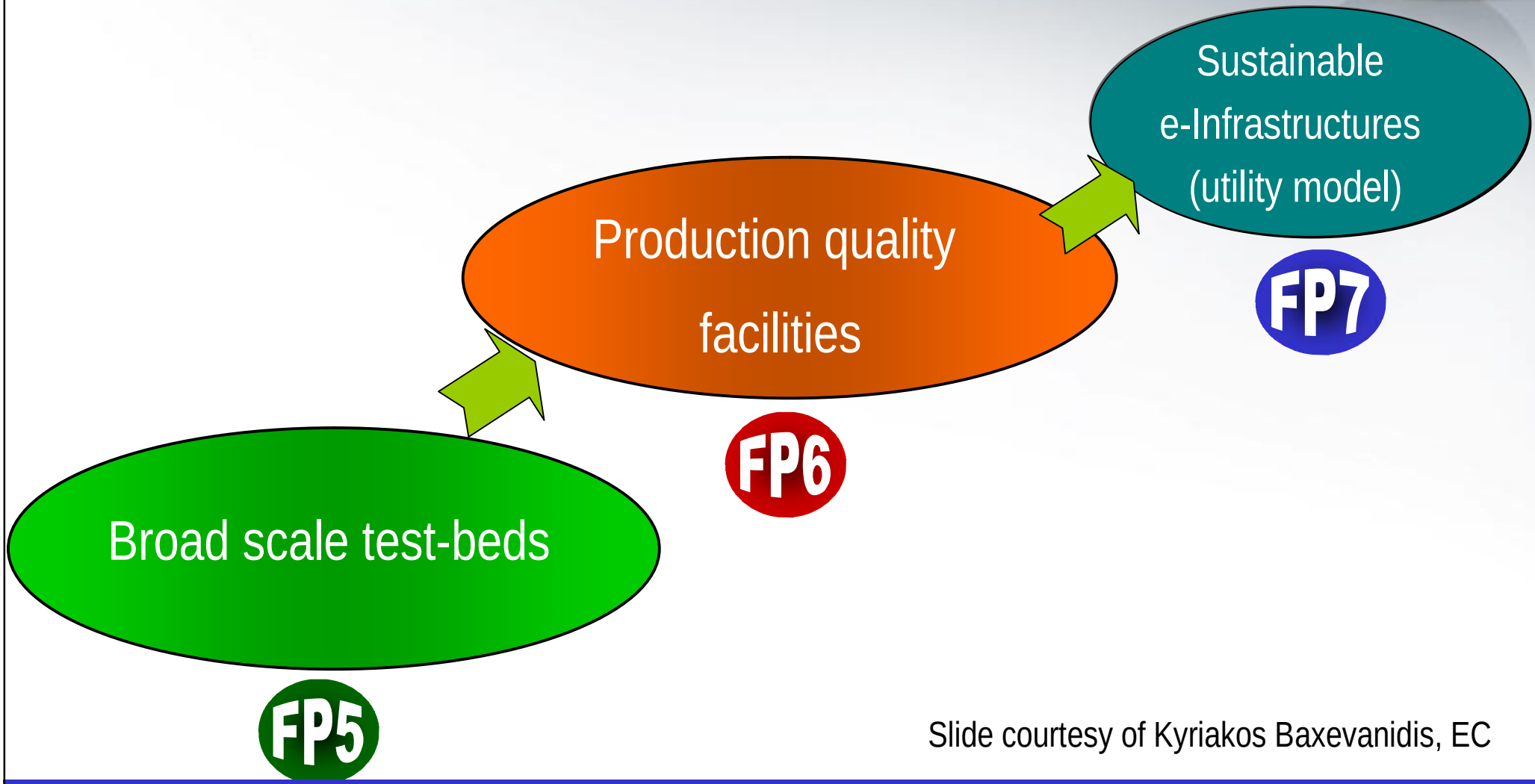
e-Infrastructure - implementation blocks

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



Roadmap to sustainable grid-empowered e-Infrastructures

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



Slide courtesy of Kyriakos Baxevanidis, EC

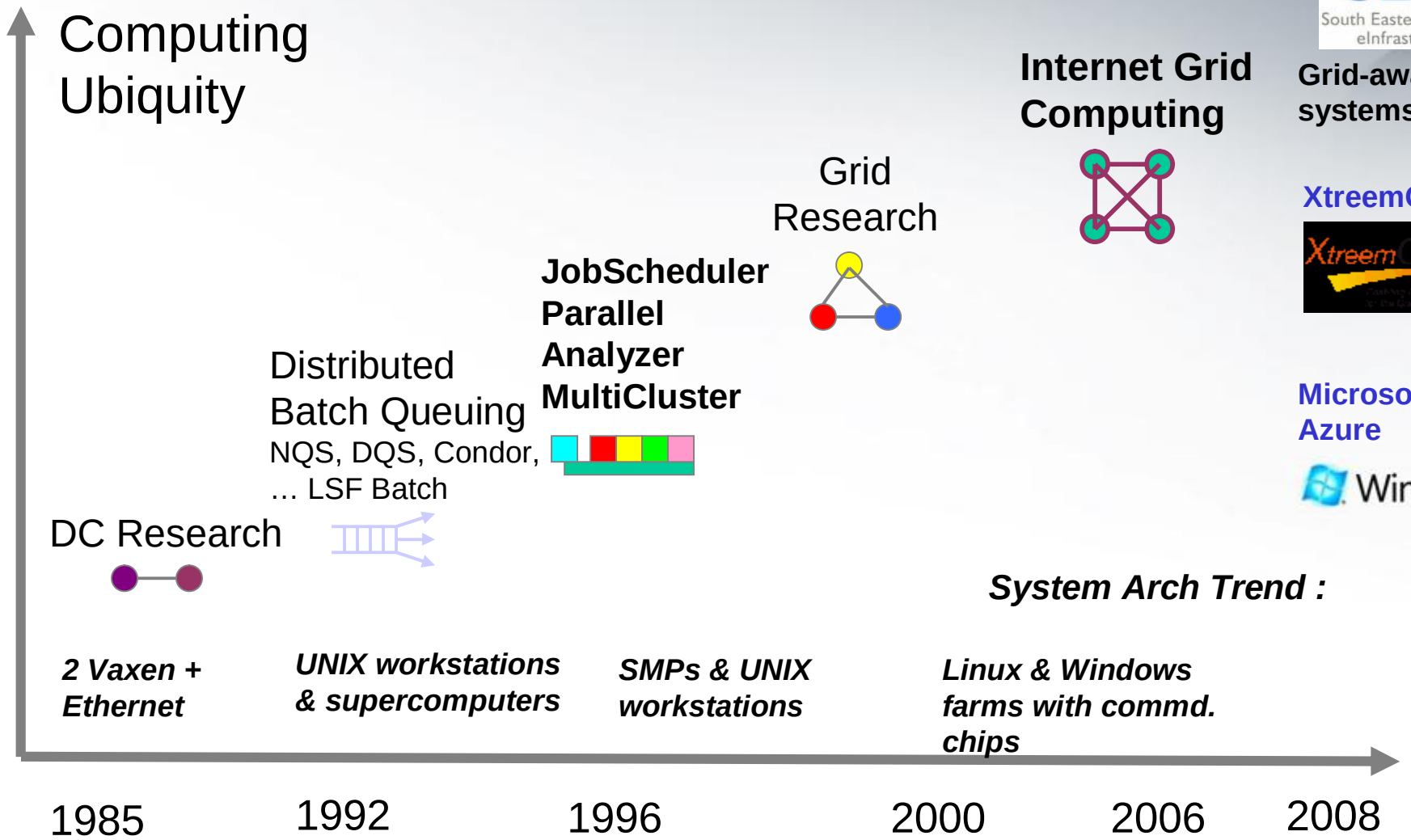
Grid Computing

Grid computing is a technology to build virtual supercomputers by utilizing/sharing unused resources on connected PC's:

Network itself is a virtual supercomputer

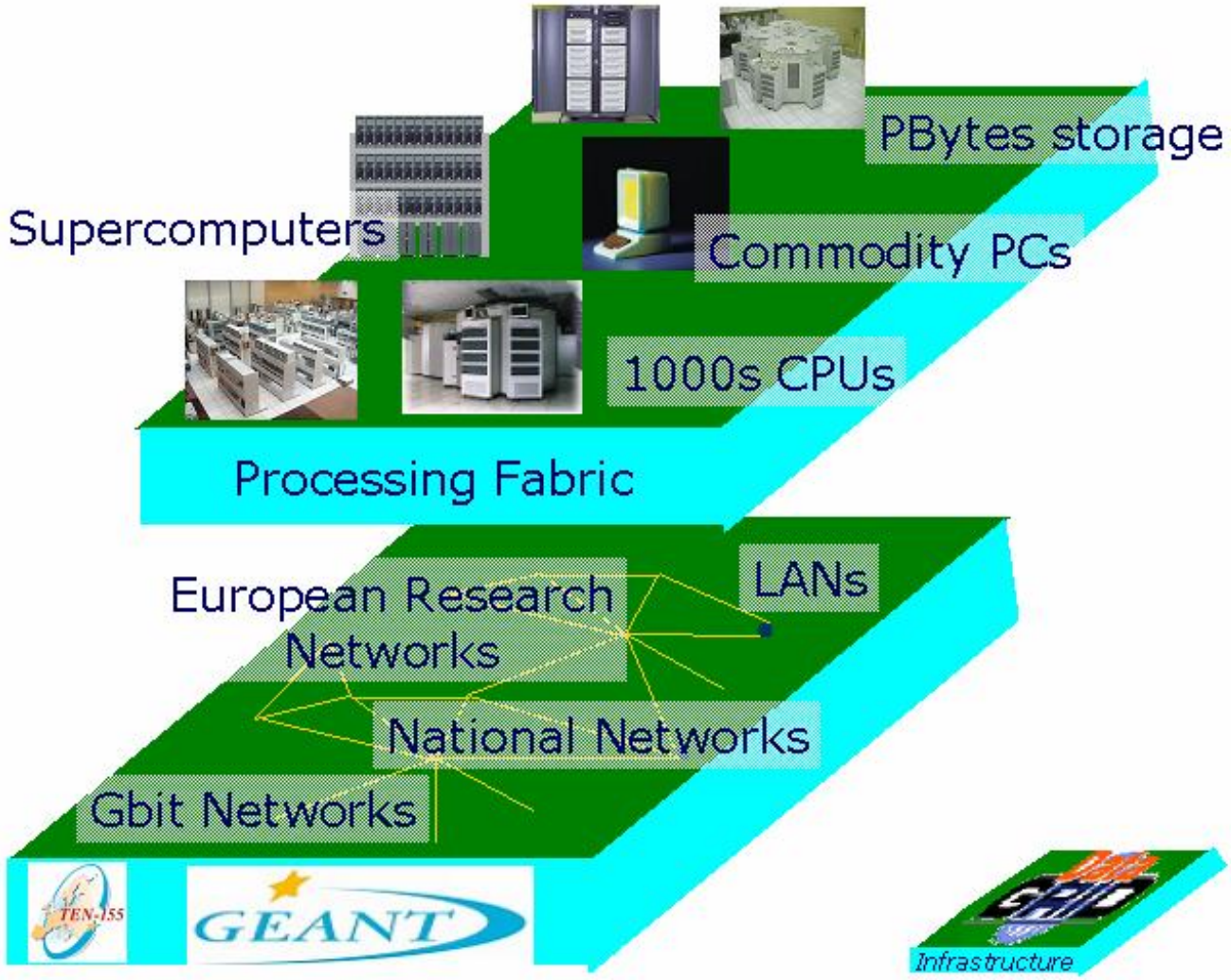
Grid technology has achieved maturity recently and brought a new opportunity for developing countries to build their national distributed computing powers.

Distributed Computing evolution



Grid Computing Architecture

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



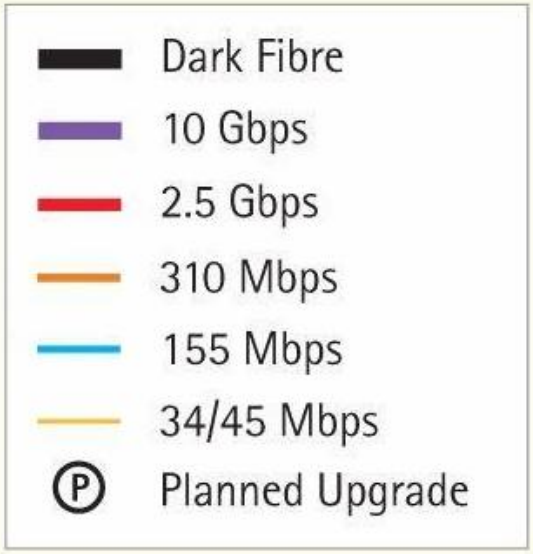
Underlying high speed network is a key enabler!

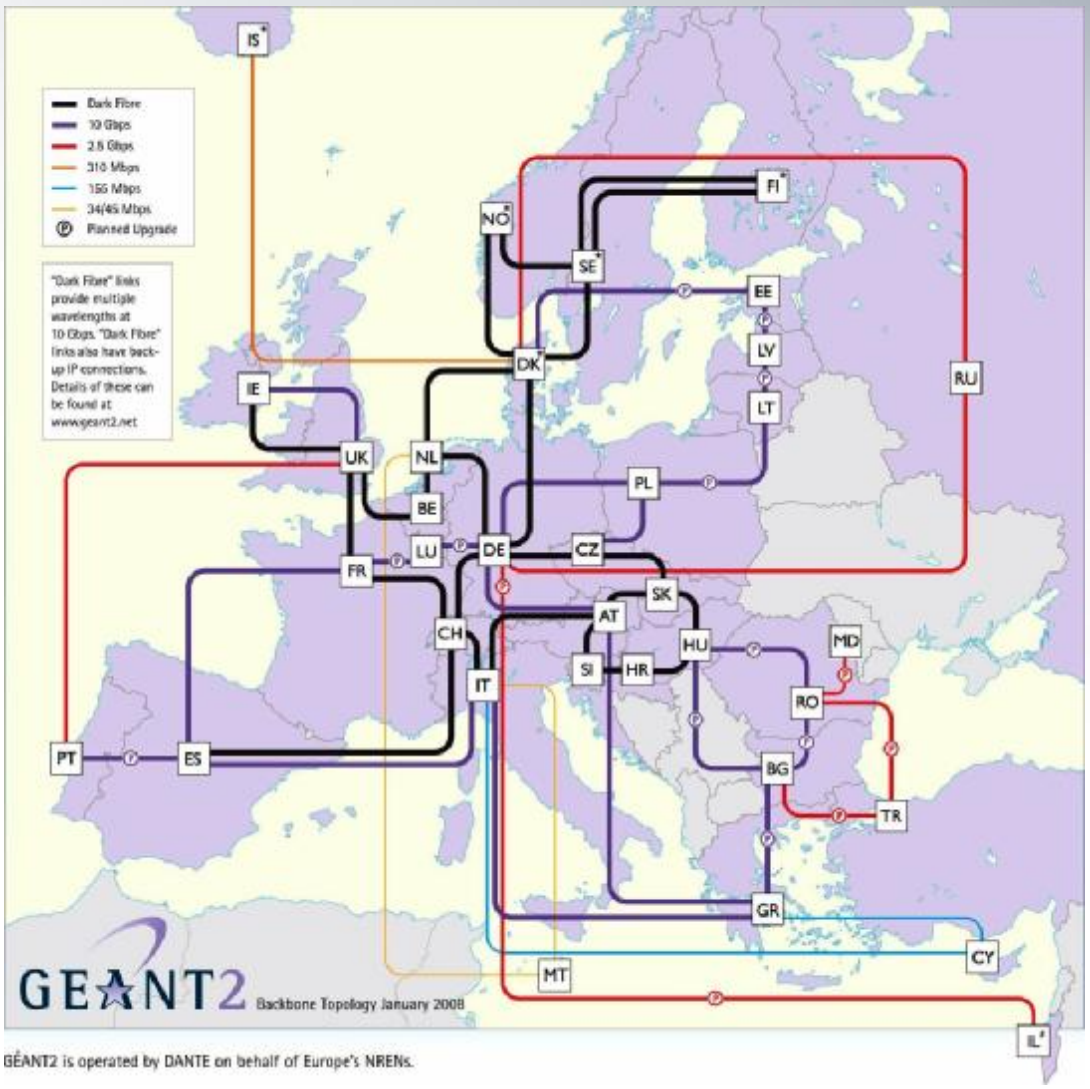
GEANT - 2nd generation European Research Network

- **Super fast networks to link the finest researchers across the world.**
- Europe is the hub of the world's most advanced and fastest research network.
- With European Commission support, a high-tech academic internet – **GEANT 2** – delivers broadband connectivity, ultra high-speed computing power and data resources to 30 million academics and researchers worldwide.
- The network facilitates networking and the pooling of knowledge, allowing 4,000 research institutes in Europe and across the world to effectively work together.

GEANT 2 topology

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development





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

GEANT 2 International links

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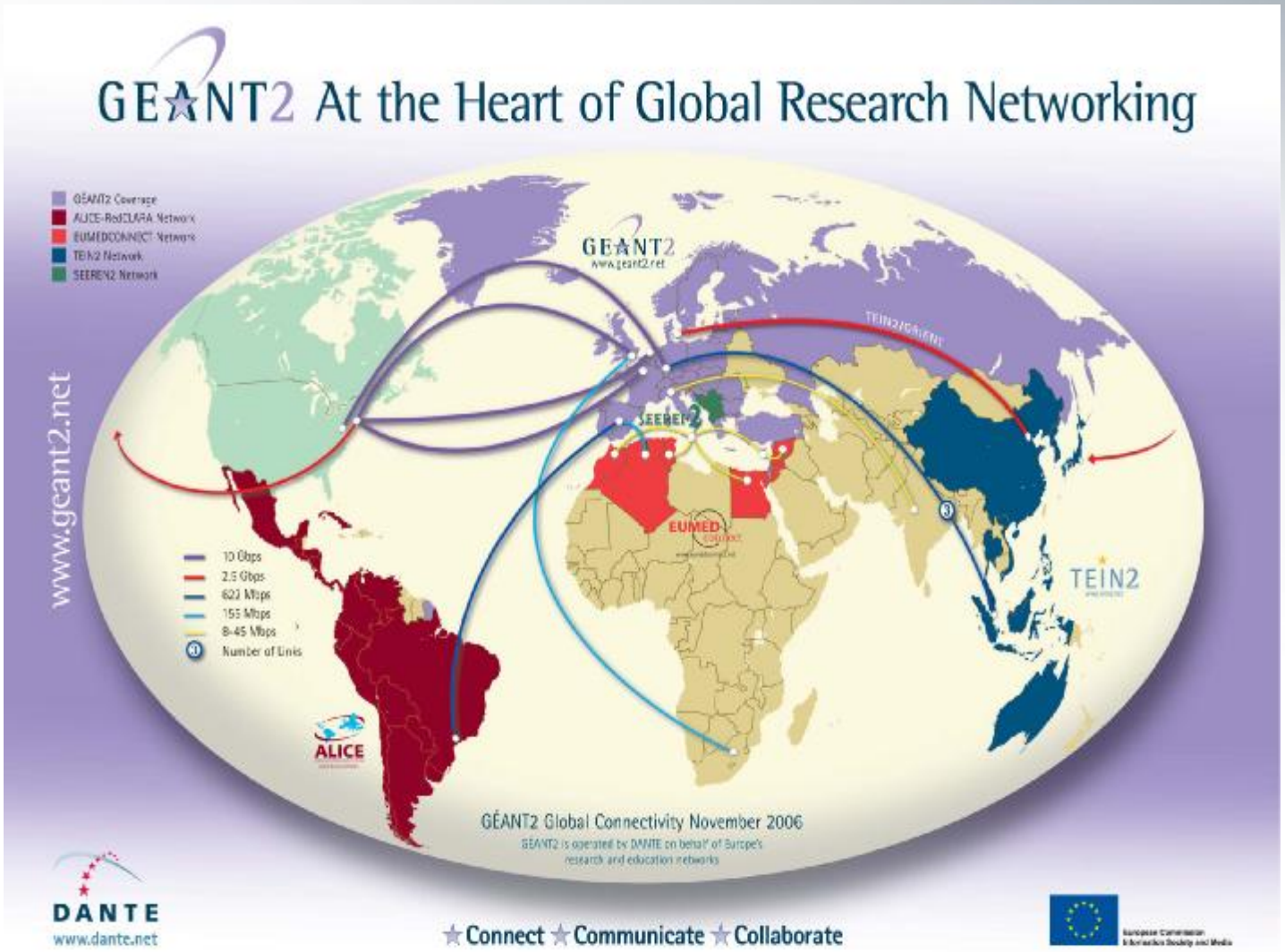
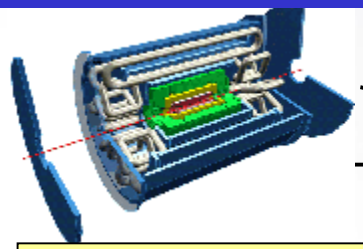


Grid Computing projects Evolution

www.eu-egi.eu

LHC Computing Challenge



~PBytes/sec

Online System

~100 MBytes/sec

1 TIPS = 25,000 SRECInt95

PC (1999) = ~15 SPECInt95

- One bunch crossing per 25 ns
- 100 triggers per second
- Each event is ~1 Mbyte

Offline Farm
~20 TIPS

~100 MBytes/sec

~ Gbits/sec
or Air Freight

CERN Computer
Centre >20 TIPS

Tier 0

Tier 1

US Regional Centre

Italian Regional Centre

French Regional Centre

RAL Regional Centre

ScotGRID++
~1 TIPS

Tier2 Centre
~1 TIPS

Tier 2

~ Gbits/sec

Tier 3

Institute
~0.25TIPS

Physics data cache

100 - 1000 Mbits/sec

Workstations

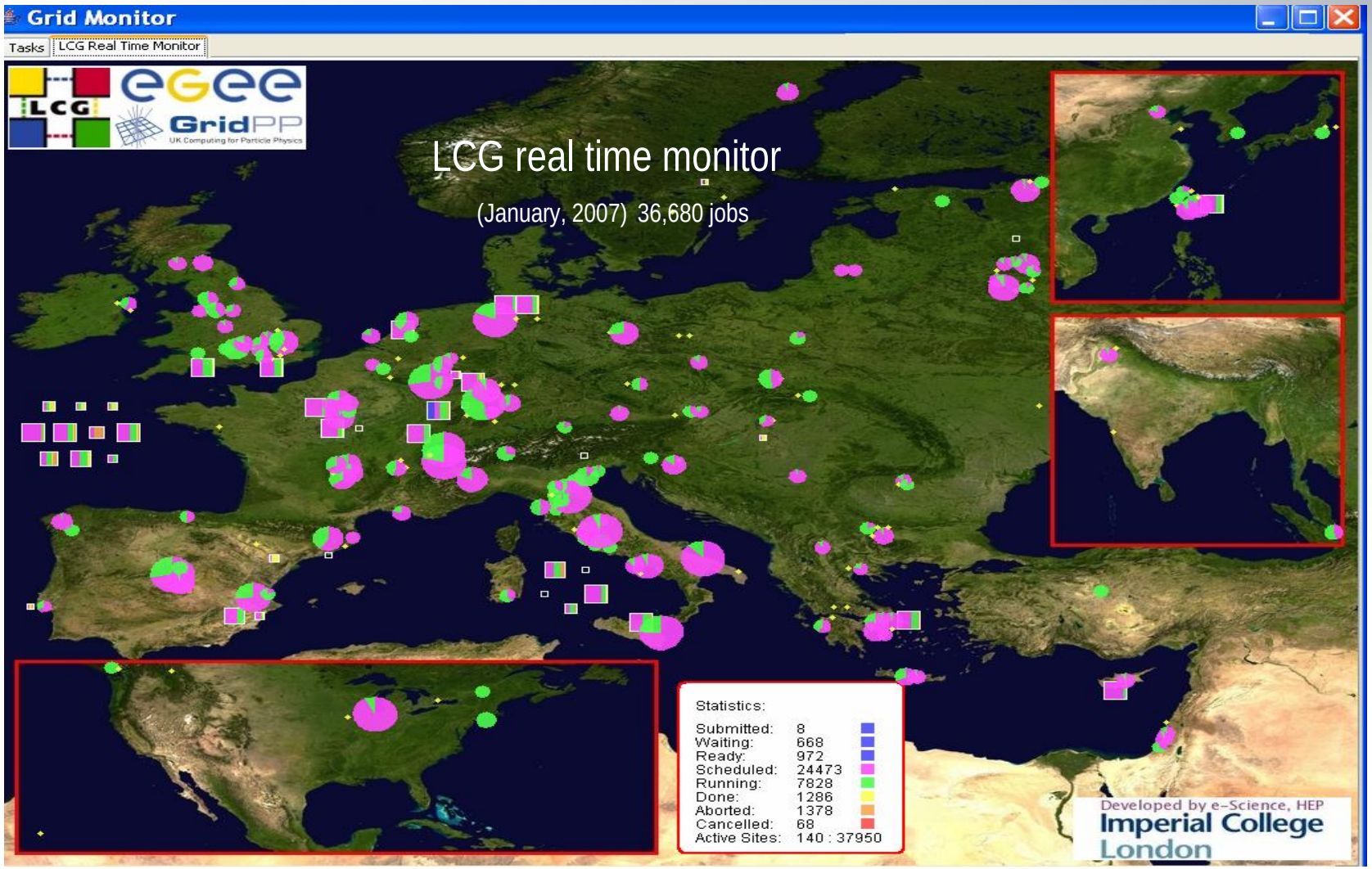
Tier 4

Physicists work on analysis “channels”

Each institute has ~10 physicists working on one or more channels

Data for these channels should be cached by the institute server

LHC computing Grid Service



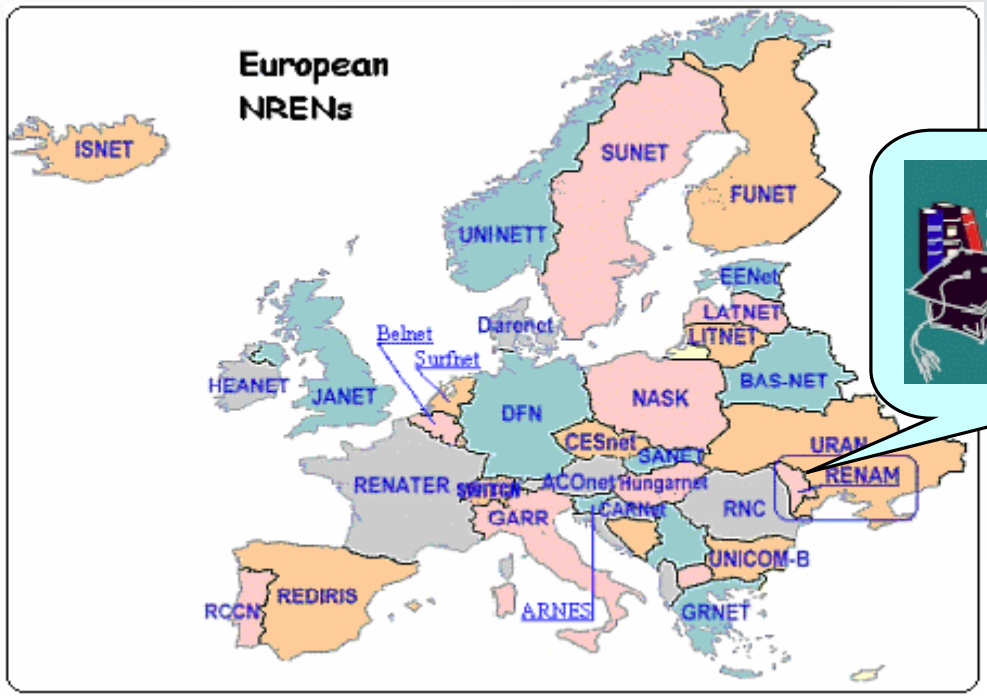
SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

EGEE - Enabling Grids for E-Science

OSG - US Open Science Grid

RENAM: Research and Educational Networking Association of Moldova

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



RENAM

ASM

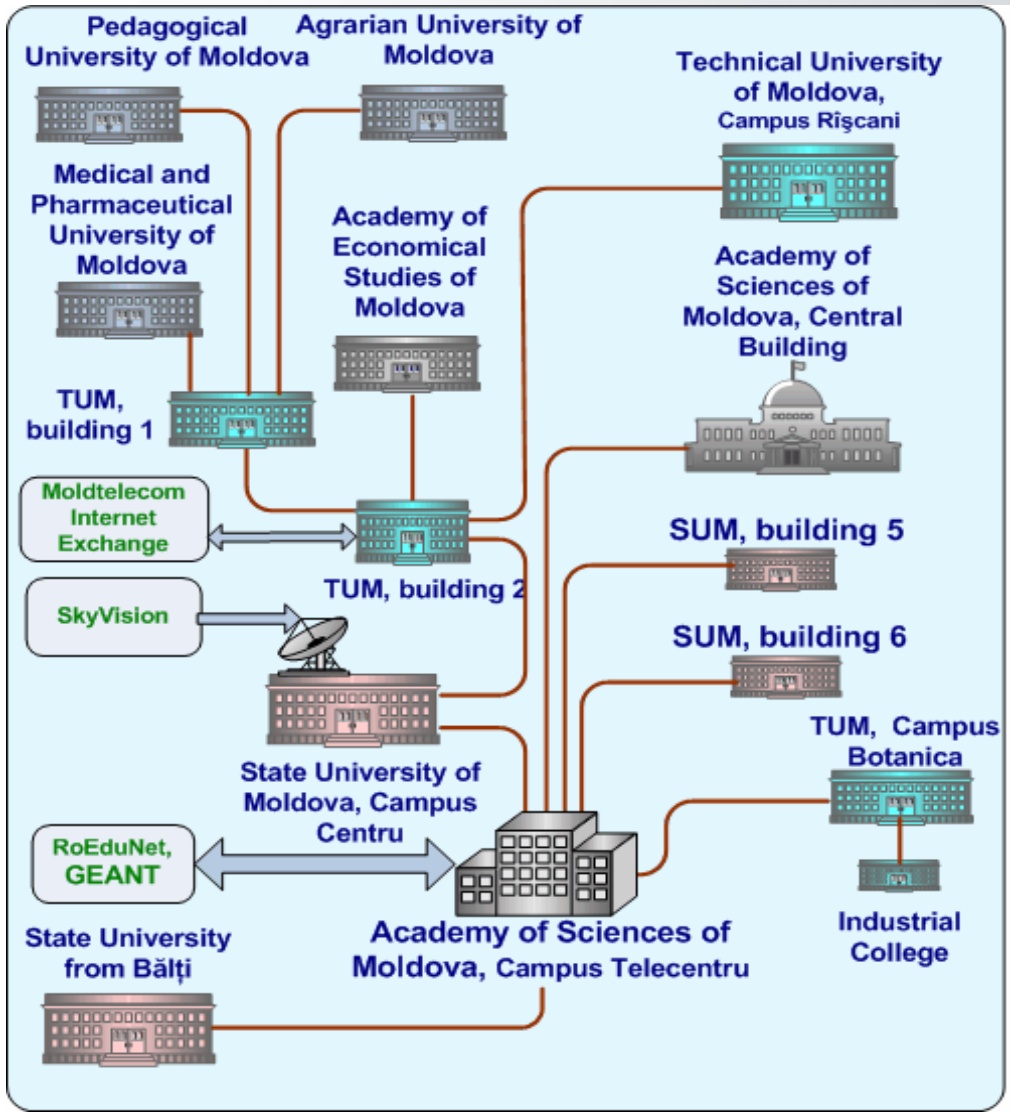
TUM

USM

ASEM
Academia de Studii Economice

NATO Science Programme

RENAM network general information



RENAM infrastructure provides connectivity to the universities and R&E organizations placed in Chisinau and other localities of Moldova.

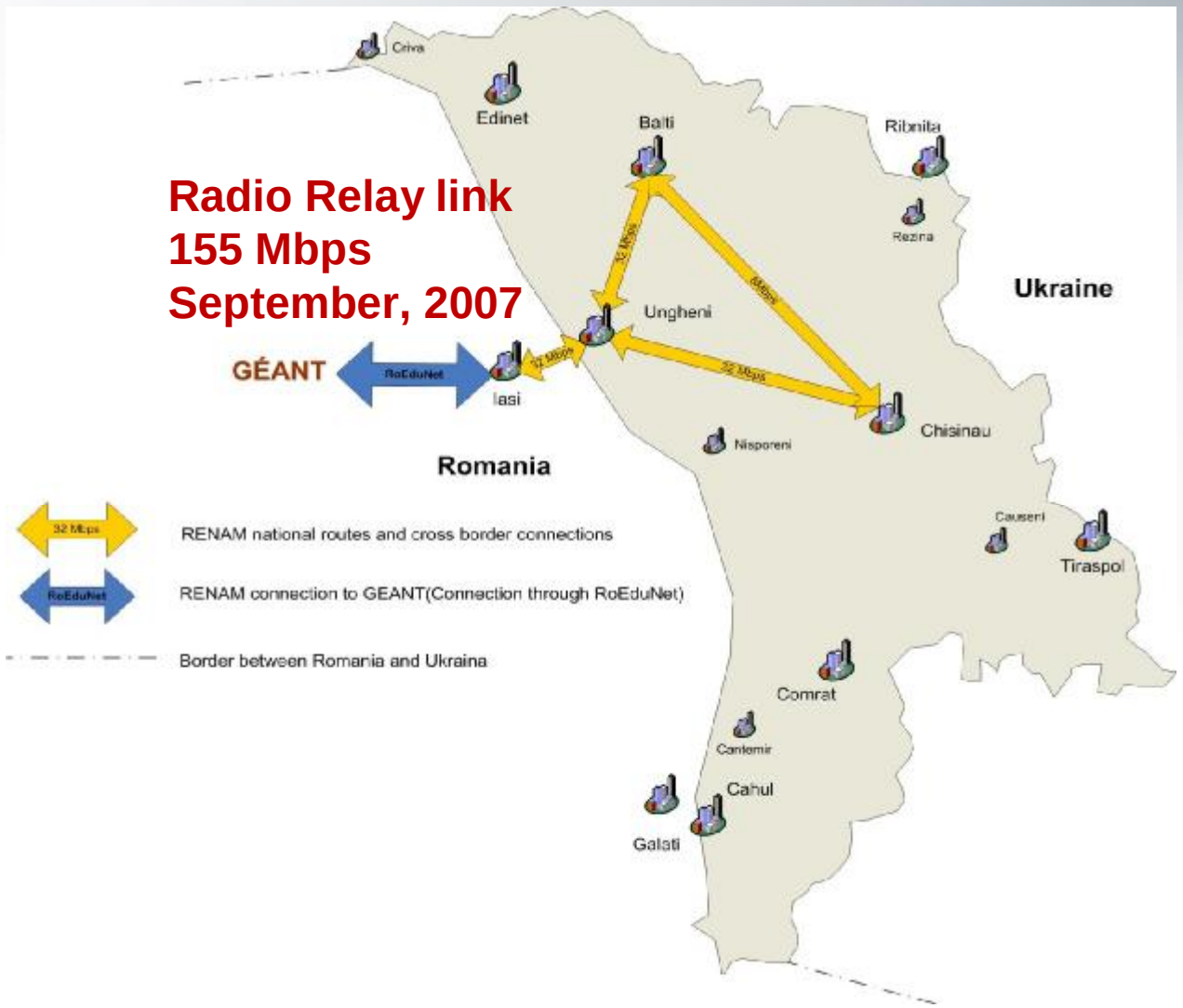
RENAM networking infrastructure joins:

- 40 research institutes,
- 10 universities and
- 5 colleges.
- about 5000 scientists and professors,
- 1000 Ph.D. students and
- more than 80 000 university students.

The network node was realized in Balti State University, which joins also 4 technical colleges from Balti City.

http://www.renam.md/

Territorial and external connections of RENAM network



Advancing the Information Society in Eastern and South-East Europe

In the past 5 years a number of targeted initiatives funded by the European Commission programs have contributed to ameliorating the state of eInfrastructures in the Eastern Europe and in SEE region:

- **Porta Optica Study project**
- **SEE-GRID, SEE-GRID2 and SEE-GRID-SCI projects**
- **SEEREN**
- **SEE-LIGHT**

The aims of above initiatives are:

- **to improve connectivity and provide wide access** to modern infrastructures and services,
- **to activate** new user communities and
- **to enable** collaborative research activities**.**

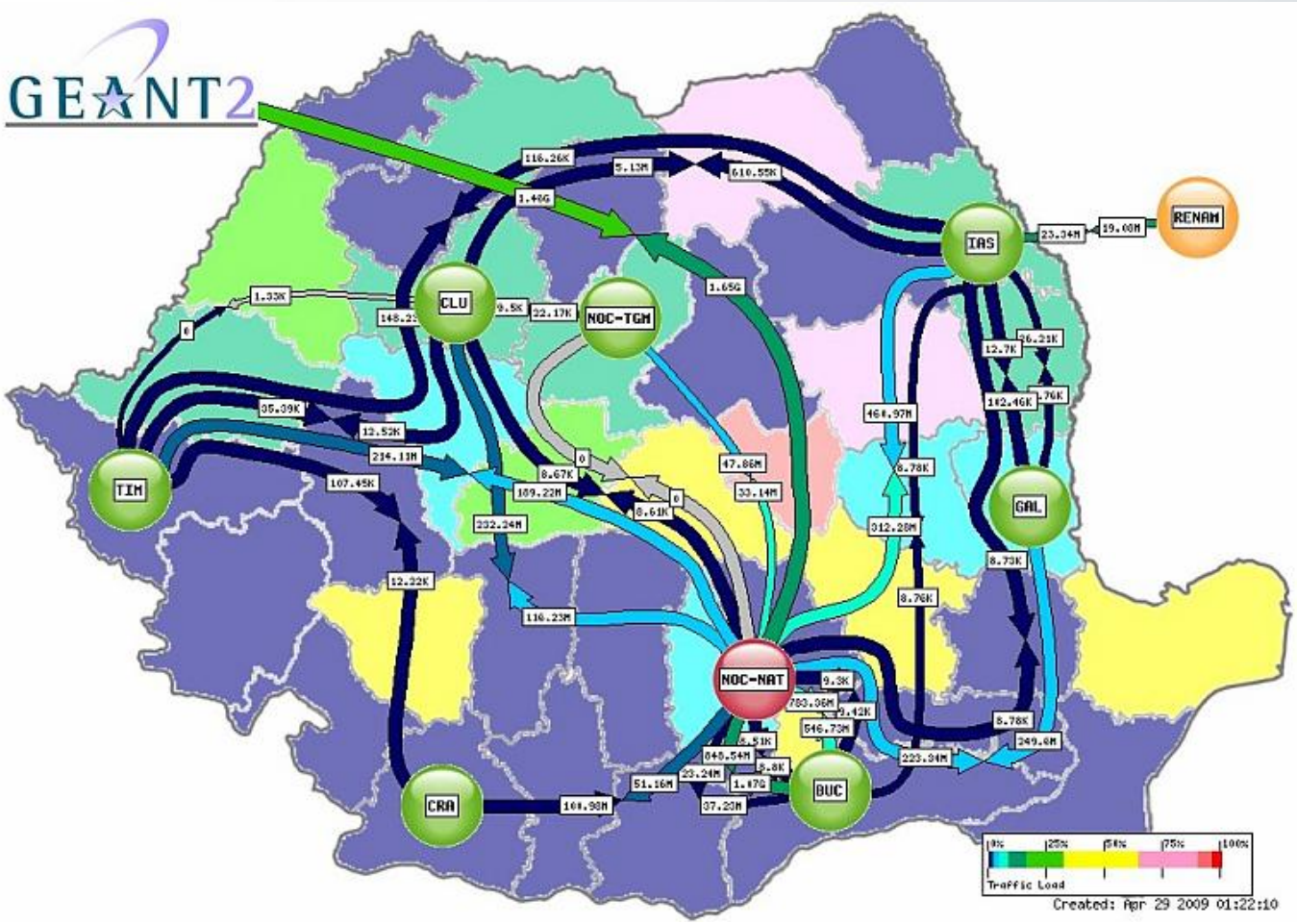
Projects of RENAM – RoEduNet - GEANT fiber connection

Prospects of regional cross-border fiber infrastructure development for research and education support:

- EC FP6 **Porta Optica** Study project - Distributed Optical Gateway to Eastern Europe
- EC FP7 **Black Sea Initiative**
- EC FP7 **SEE-GRID-SCI** project – SA1 activity, task SA1.3 - Network Resource Provision
- **NATO NIG project** - new RENAM-ROEDUNET gateway based on xWDM technologies implementation

RoEduNet extension to RENAM

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



FP6 EC “Porta Optica Study” project

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

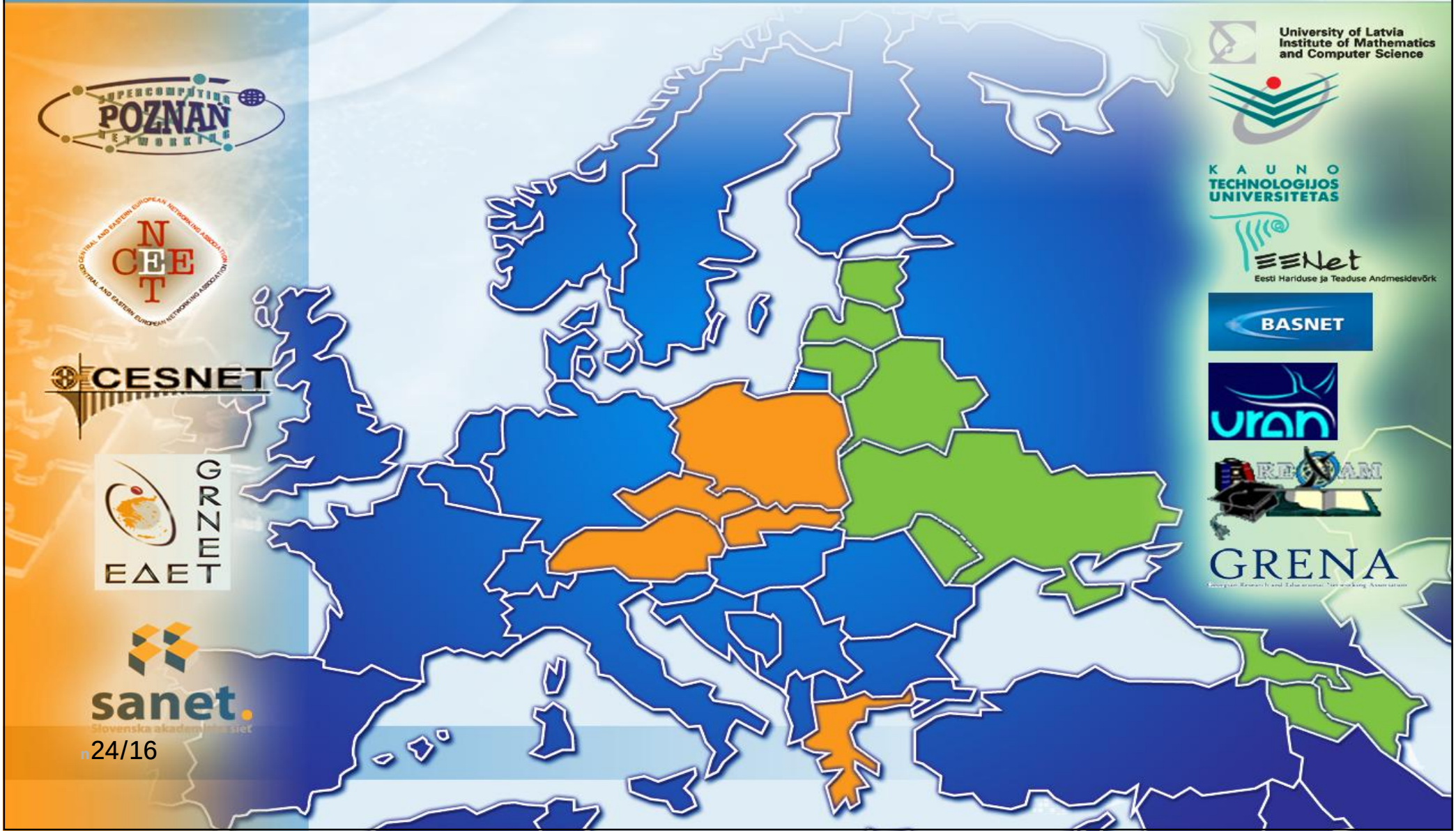
- “Porta Optica Study” is an European Commission co-funded Specific Support Activity Project.
- Its ultimate goal was stimulation and consolidation of initiatives to ensure the successful, dark-fiber based research network deployment in the Eastern Europe, including Republic of Moldova, Baltic states and Southern Caucasus regions.

http://www.porta-optica.org

PORTA OPTICA
distributed optical gateway to Eastern Europe

PORTA OPTICA
distributed optical gateway to Eastern Europe

Target and Partners



Moldova NREN backbone – parameters of the network development

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

2.5 - 10 Gbps GÉANT connectivity required for 2009
1 Gbps main backbone planned
Leasing lambda channel
About 1400 km of leased lambda lines
Possible construction of DF

- **Potential Impact**
- **7 cities**
- **50 scientific institutions**
- **35 higher education institutions**
- **78 500 university students**

PORTA OPTICA
distributed optical gateway to Eastern Europe

Black Sea Interconnection initiative

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

- BSI (Black Sea Interconnection) project intends bridging the digital divide that exists between the South Caucasus countries and Europe by establishing a regional research and education network in the South Caucasus and connecting it to GÉANT2.
- The aim of the BSI is interconnection of NRENs in countries of Black Sea region with fiber optic.
- NRENs from Armenia, Azerbaijan, Belarus, Bulgaria, Moldova, Georgia, Greece, Poland, Romania, Russia, Turkey and Ukraine expressed interest to participate in BSI.

http://www.blacksea-net.org/

BSI
Black Sea Interconnections

Black Sea Area Ring

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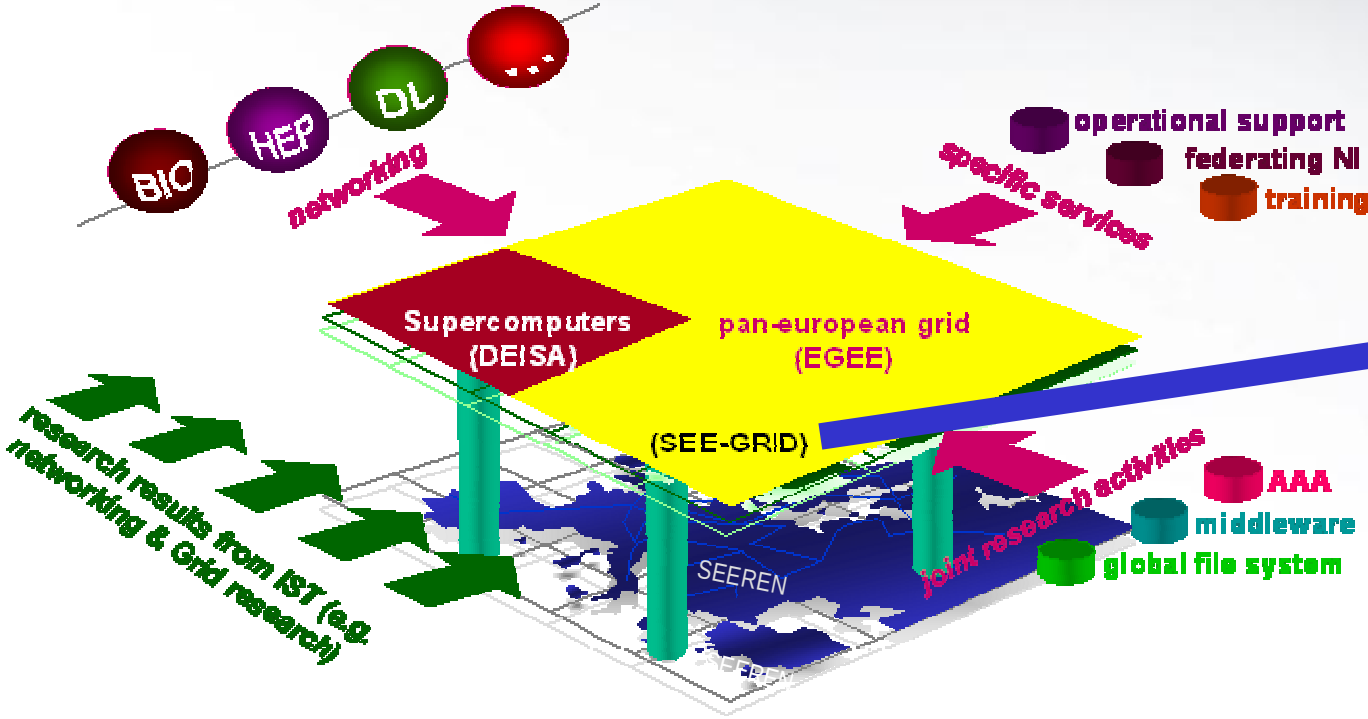
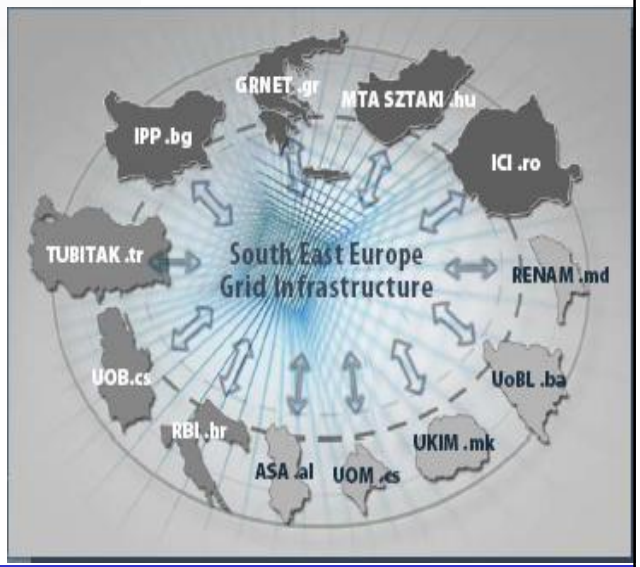
The SEE-GRID initiative

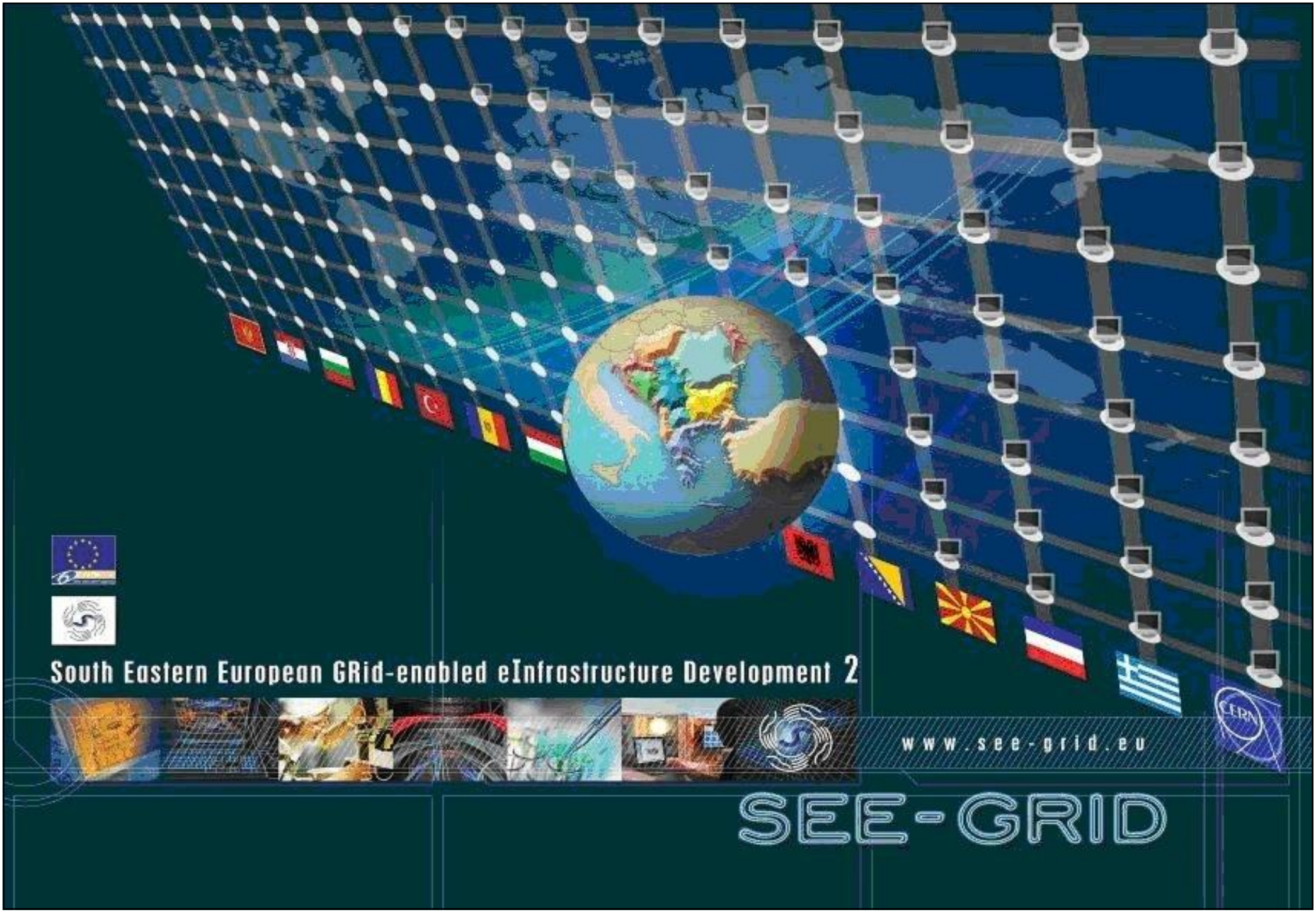
SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

Contribute to building a worldwide Infrastructure by expanding the "eInfrastructure inclusion" into South-East Europe





http://www.see-grid.eu

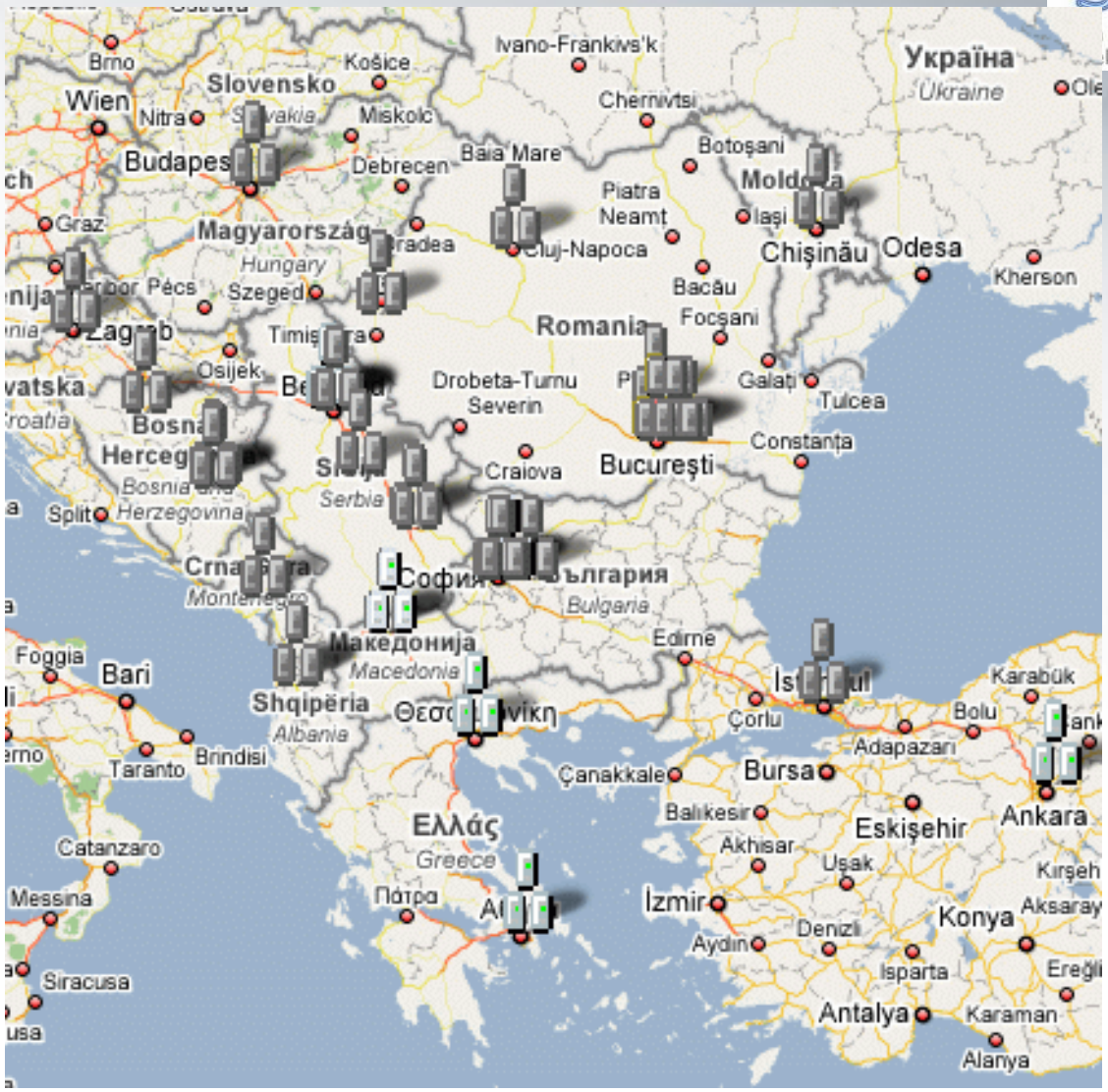

South Eastern European GRid-enabled eInfrastructure Development 2
www.see-grid.eu
SEE-GRID

SEE-GRID e-Infrastructure

SEE-GRID
Eastern European GRid-enabled Infrastructure Development

- Number of Countries: 11
- Number of Sites: 31
- Number of CPUs: 540
- TBs of Storage: 80

- Migrating from LCG to gLite



SEE-GRID-SCI: e-Infrastructure for regional e-science

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

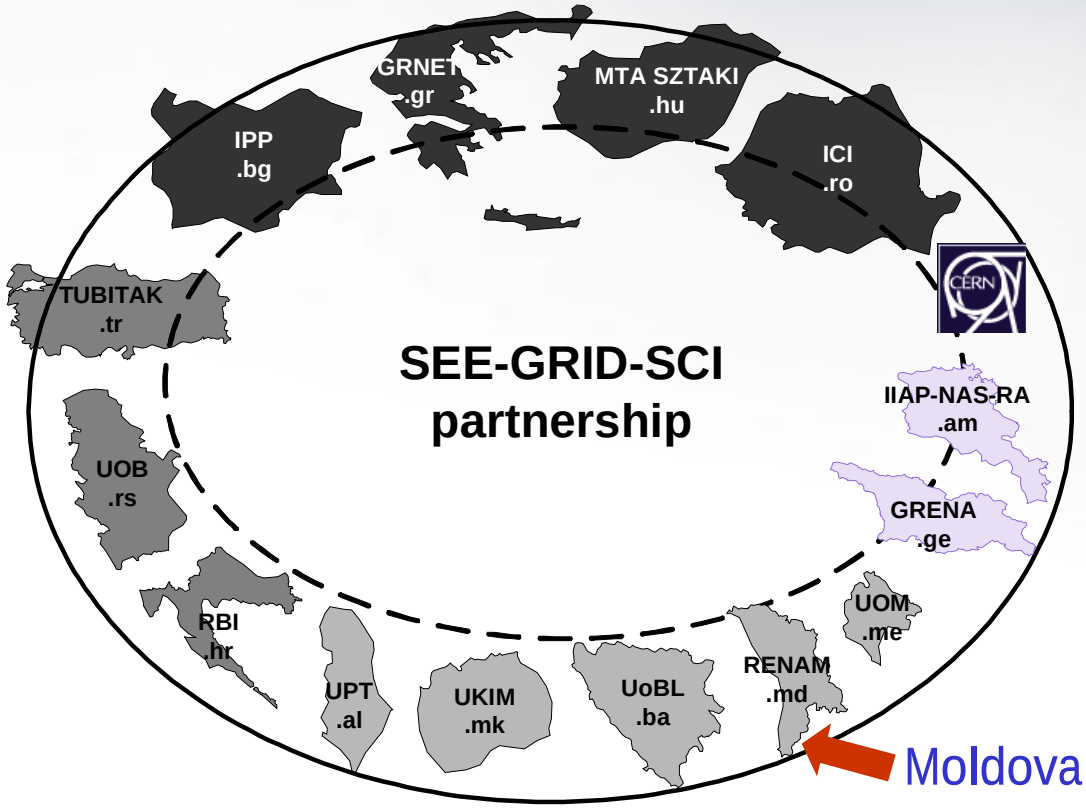
SEE-GRID-SCI project partners

SEE-GRID
South Eastern European GRid-enabled e-Science Development

Start date:	01/05/2008
Duration:	24 months
Total Budget:	2,499,969 €

Contractors

GRNET	Greece
CERN	Switzerland
SZTAKI	Hungary
IPP-BAS	Bulgaria
ICI	Romania
TUBITAK	Turkey
ASA/INIMA	Albania
UoBL	Bosnia-Herzegovina
UKIM	FYR of Macedonia
UOB	Serbia
UoM	Montenegro
RENAM	Moldova
RBI	Croatia
IIAP-NAS-RA	Armenia *- new*
GRENA	Georgia *- new*



Third Parties

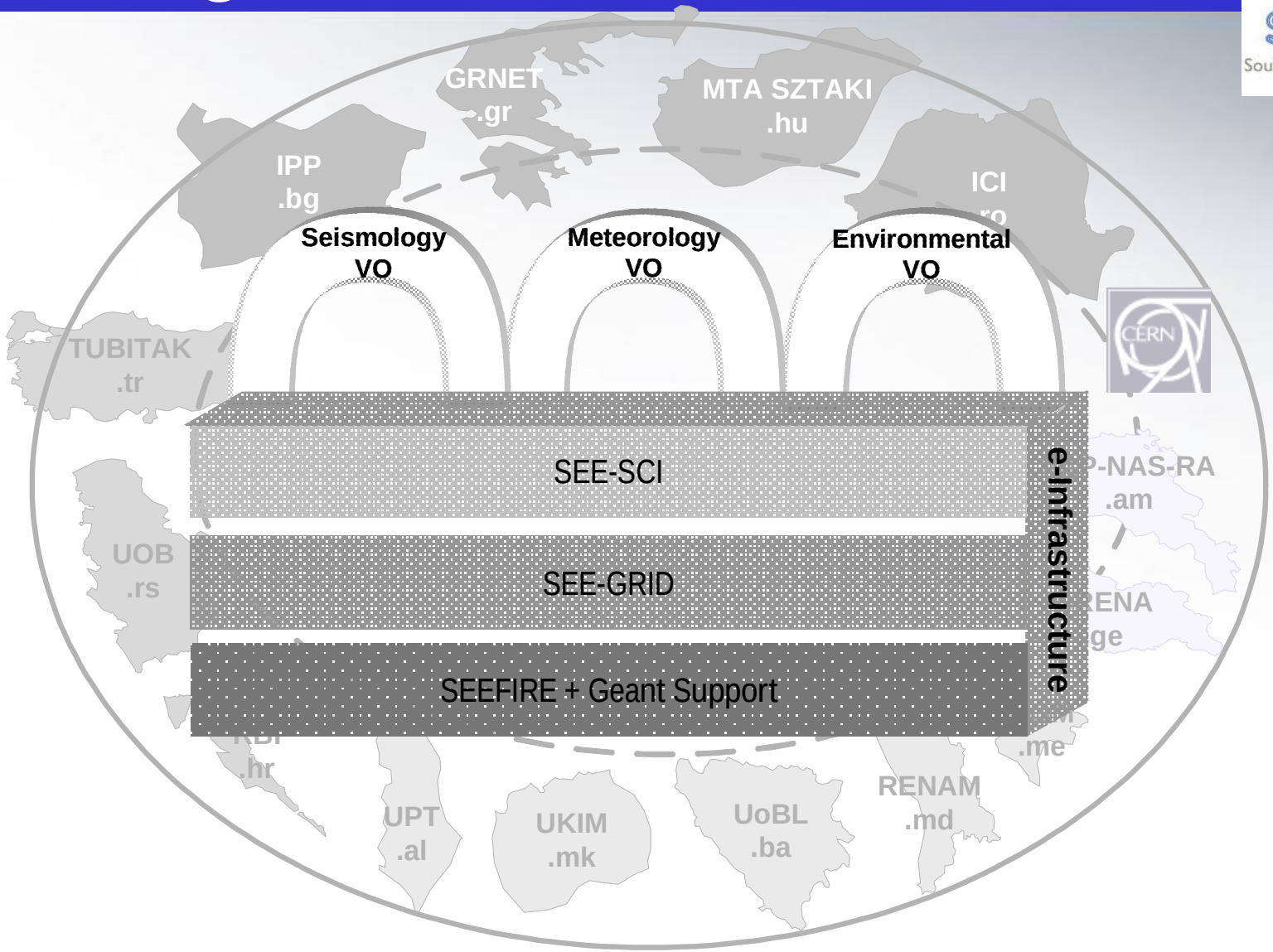
30 universities / research centres

SEE-GRID-SCI Main Objectives

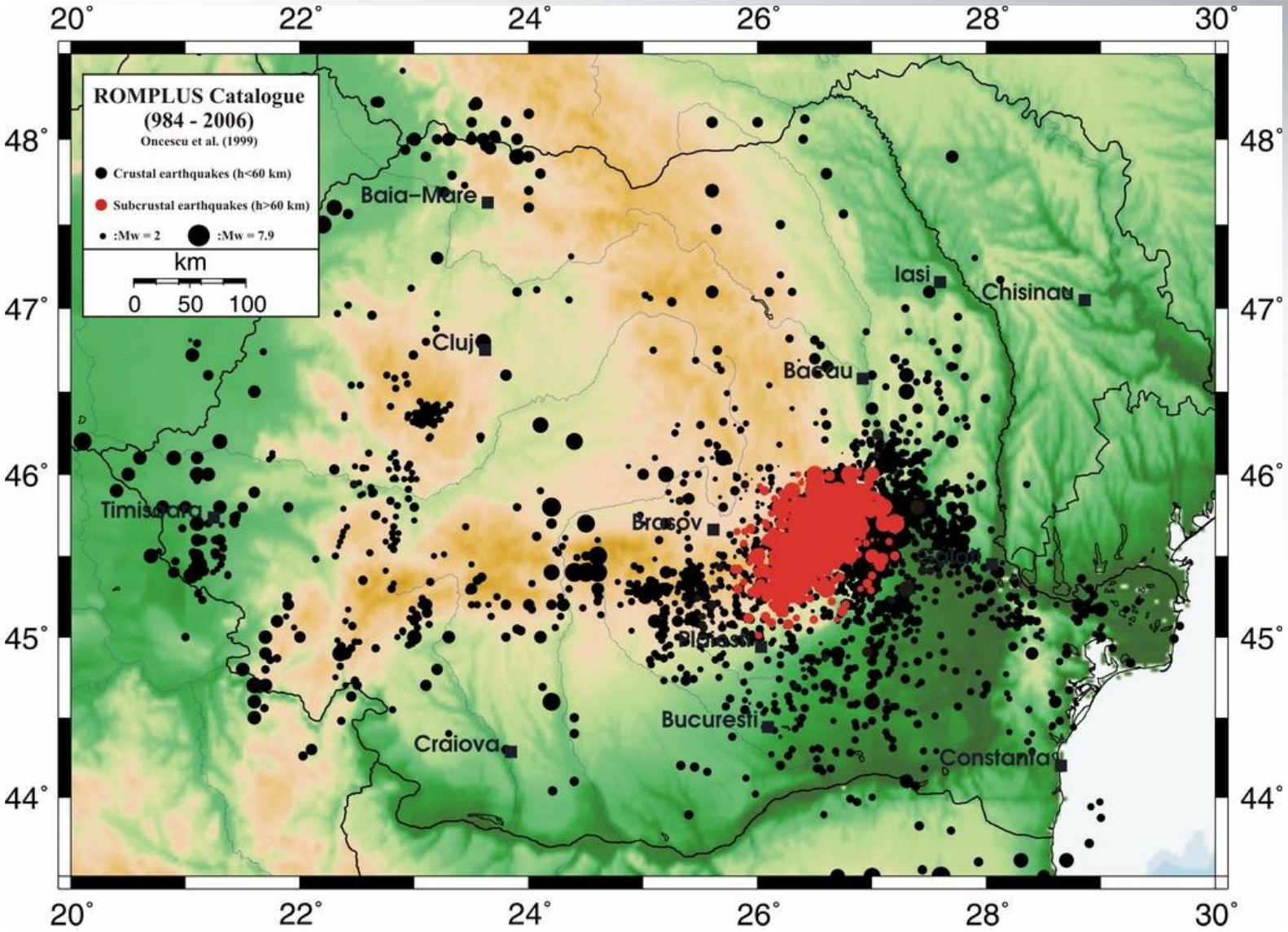
- **Engaging** international user communities and providing application-specific service extensions
- **Providing** infrastructure for new communities. This objective has a special sub-objective:
  - provision of the network link to Moldova, so as to cater for immediate connection to Romania and thus to the rest of the region and Europe. The link is to be co-funded by NATO and local entities.
- **Consolidating** actions toward long-term sustain-ability and EGI inclusion
- **Strengthening** the regional and national human network

New communities integration in the regional eInfastructure

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



Cumulative Seismic Activity in Romania and Moldova

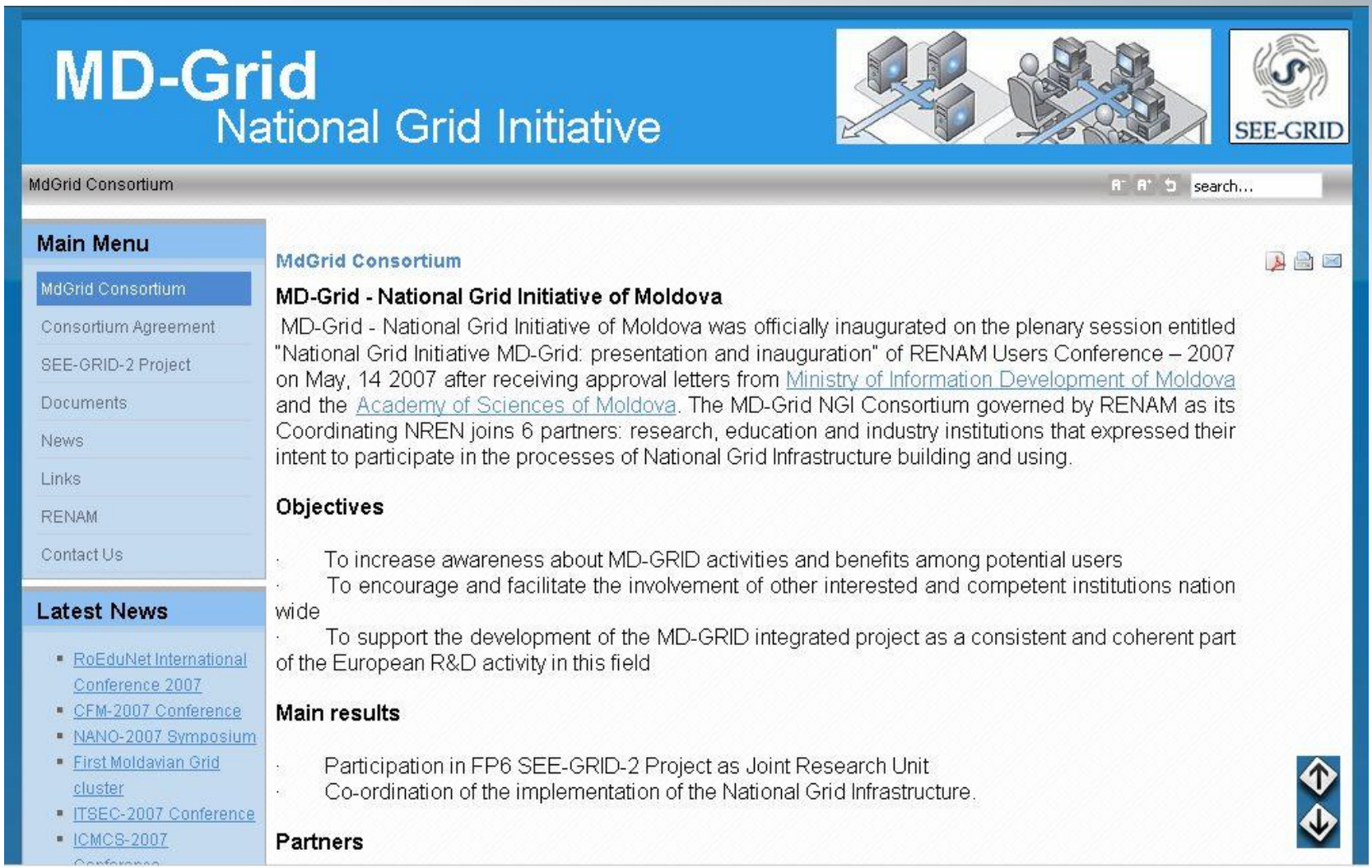


SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

eInfrastructures strategic priority: NGI

- **Formation of stable National Grid Initiatives** is the key to long-term sustainability
- NGI concentrates efforts at National level in order to deploy, operate, and expand grid infrastructures in a coherent and coordinated way
- NGI involves interoperation of Academic and Research resource centers under an umbrella of national programs aiming to integrate the available resources in order to establish an e-Infrastructure for the benefit of the R&E communities, and in the long-term - for the society at large
- **EGI – European Grid Initiative:** will join and harmonize the experience of almost all European NGIs

MD-Grid – NGI of Moldova



http://www.grid.md/

MD-Grid NGI / JRU actual Members

- **RENAM -** Coordinator
- **FRT -** Faculty of Radioelectronics and Telecommunications of Technical University of Moldova
- **IMI/IMCS -** Institute of Mathematics and Computer Science of Academy of Sciences of Moldova
- **IGS -** Institute of Geophysics and Seismology of ASM
- **SHMS -** State Hydrometeorological Service
- **SPH -** School of Public Health. State Medical and Pharmacy University of Moldova
- **IAPh -** Institute of Applied Physics of ASM

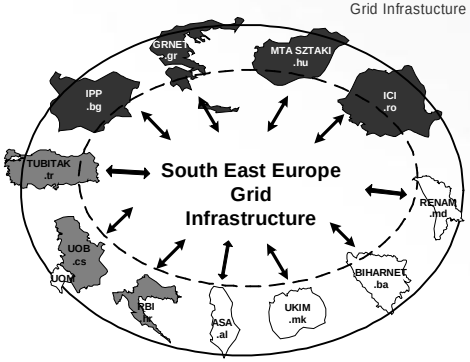
MD-GRID eInfrastructure

MD-GRID NGI site	Available CPU	Available storage	Network
Certificated sites			
MD-01-TUM	5 Intel P-IV 3,0 GHz CPUs	5 120 Gb equals to 500 Gb of storage	1 Gbit Ethernet
MD-04-REN	5 Dual Core Xeon 5130 CPUs	3 250GB SATAII Drives in RAID 5, equals to 500 Gb of storage	1 Gbit Ethernet
Installed cluster's equipment (not certificated yet)			
MD-02-IMI	9 Dual Core Xeon 5130 CPUs	5 250GB Drives in RAID 5, equals to 1 TB of storage	1 Gbit Ethernet
Plan to be integrated in MD-NGI			
MD-05-USM	4x2xAMD 275 Dual-Core 2.2GHz and 3x2xAMD 280 Dual-Core 2.4GHz CPUs	2x500GB 7.2k SATA and 4x80 GB 7.2k SATA	1 Gbit Ethernet
Planned to be installed till the end of year 2010			
MD-03-SPH	5 x CPU AMD Athlon 64 X2 6000+ (3.0GHz, 2x1MB, 1000MHz)	4*160 GB + 1*320 GB SATAII Drives	100 Mbps Ethernet

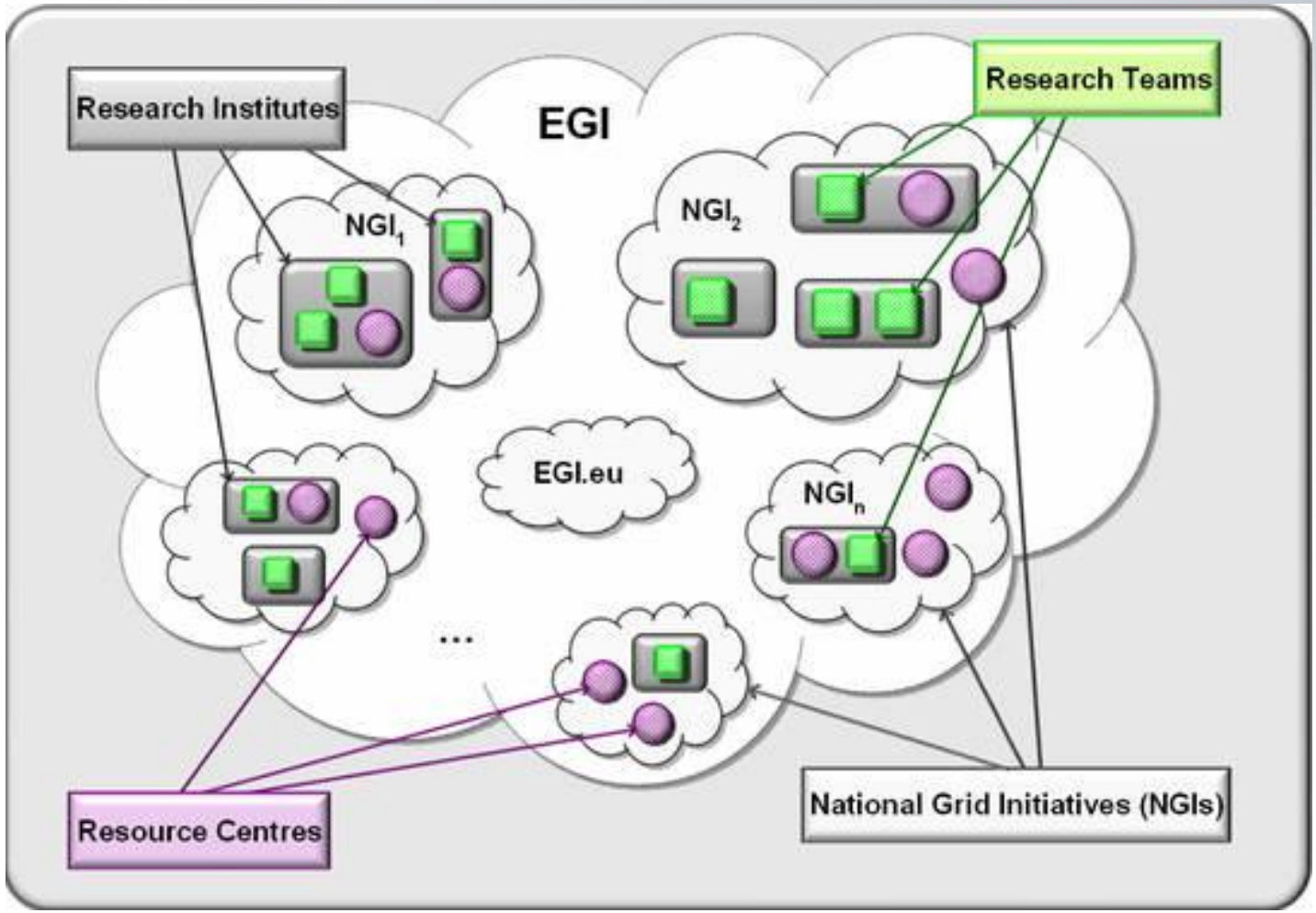
First GRID cluster in Moldova mounted at FRT TUM in April 2006

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

Pan-European Production-level Grid Infrastucture



EGI – European Grid Initiative

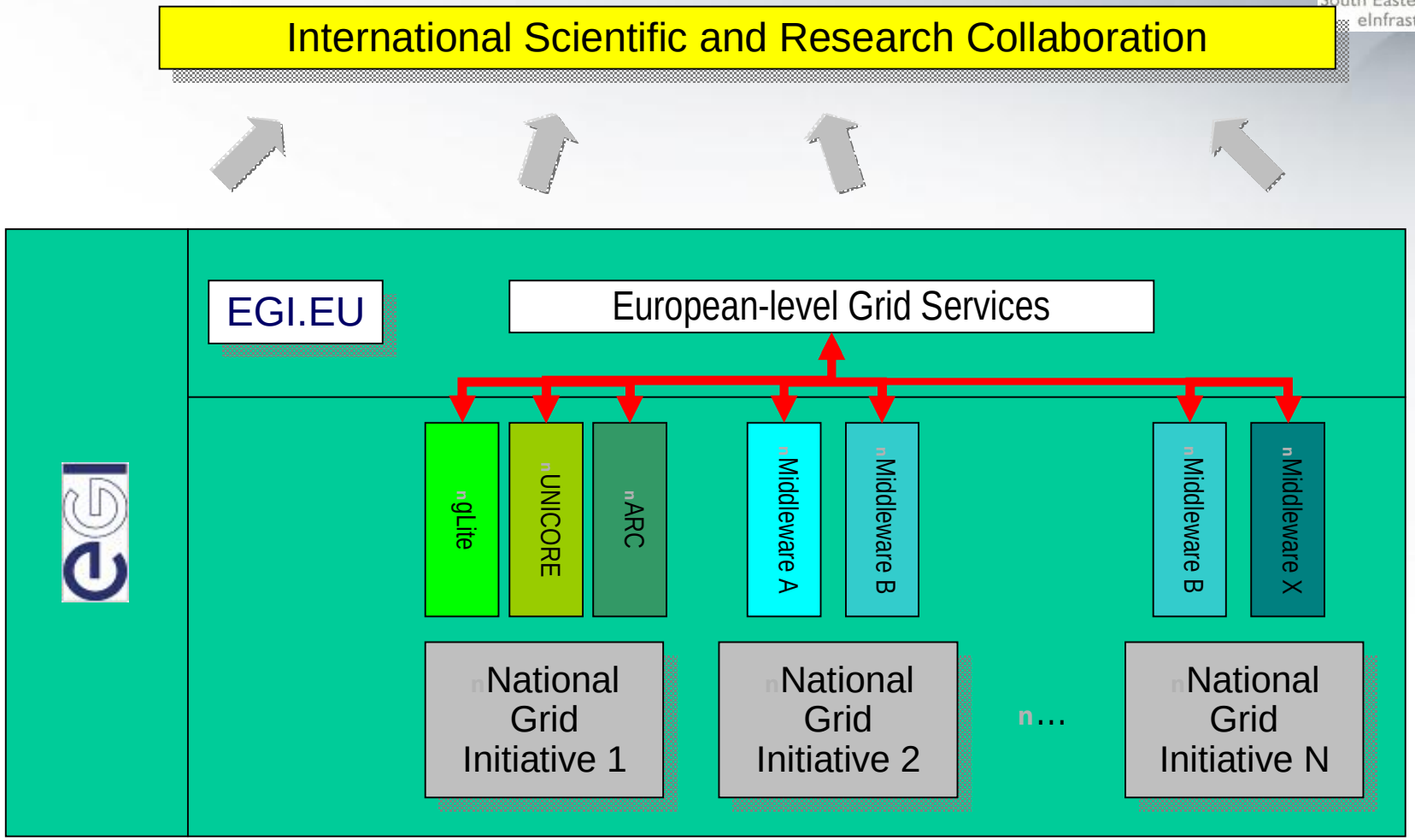


EGI is a partnership between NGIs and a coordinating body, the EGI Organisation (EGI.eu).

Within the EGI partnership, NGIs and EGI.eu will work together to operate and further develop a sustainable pan-European grid infrastructure, enabling optimal sharing of computing and data resources.

www.eu-egi.eu

EGI – European Grid Initiative

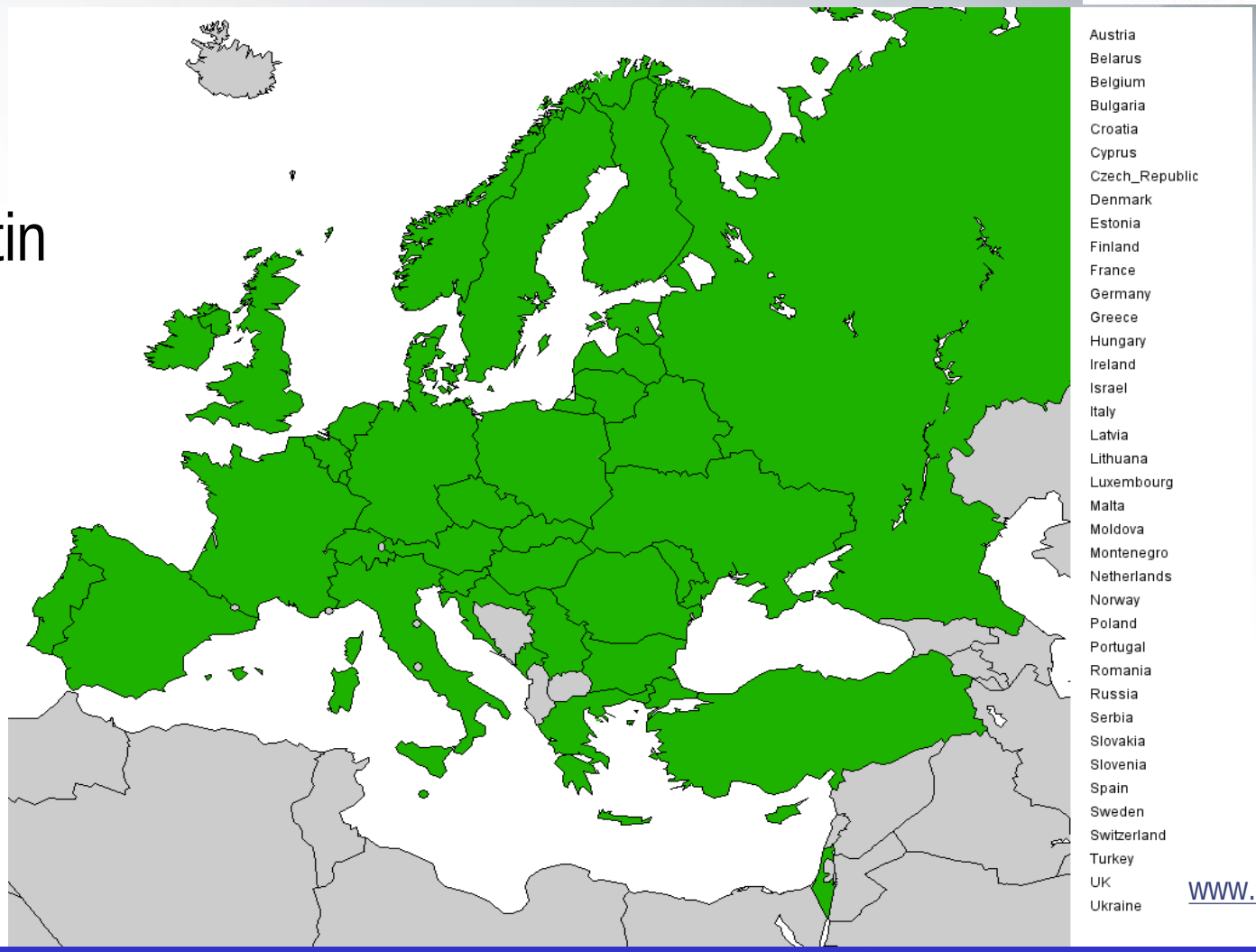


www.eu-egi.eu

EGI – European Grid Initiative

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

- 38 European NGIs
- + Asia, US, Latin America
- + PRACE
- + OGF-Europe
- + …



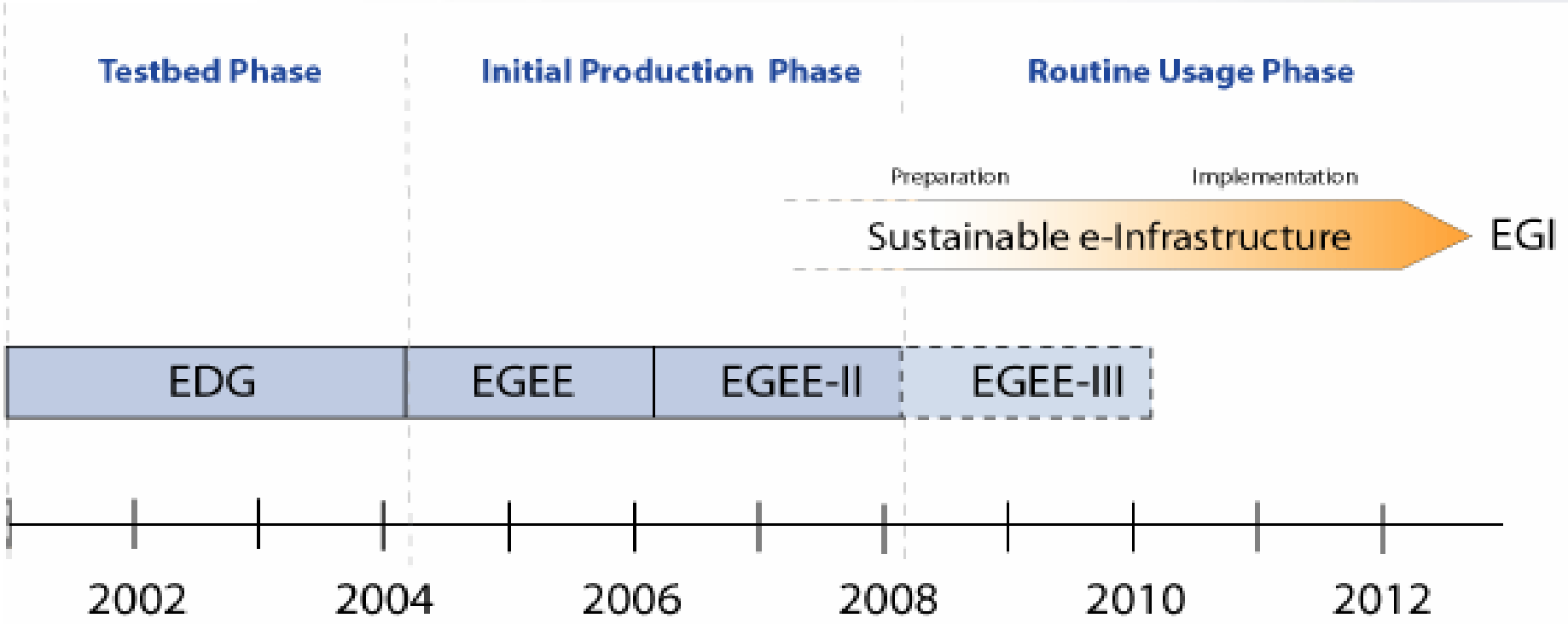
www.eu-egi.eu

Sustainability

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

Need to prepare permanent Common Grid infrastructure

- High quality of service for all user communities
- Independent of short project funding cycles
- Managed in collaboration with National Grid Initiatives (NGIs)



SEE Research Area for eInfrastructures

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

New SEERA-EI project "South East European Research Area for eInfrastructures" - was elaborated and started in April 2009.

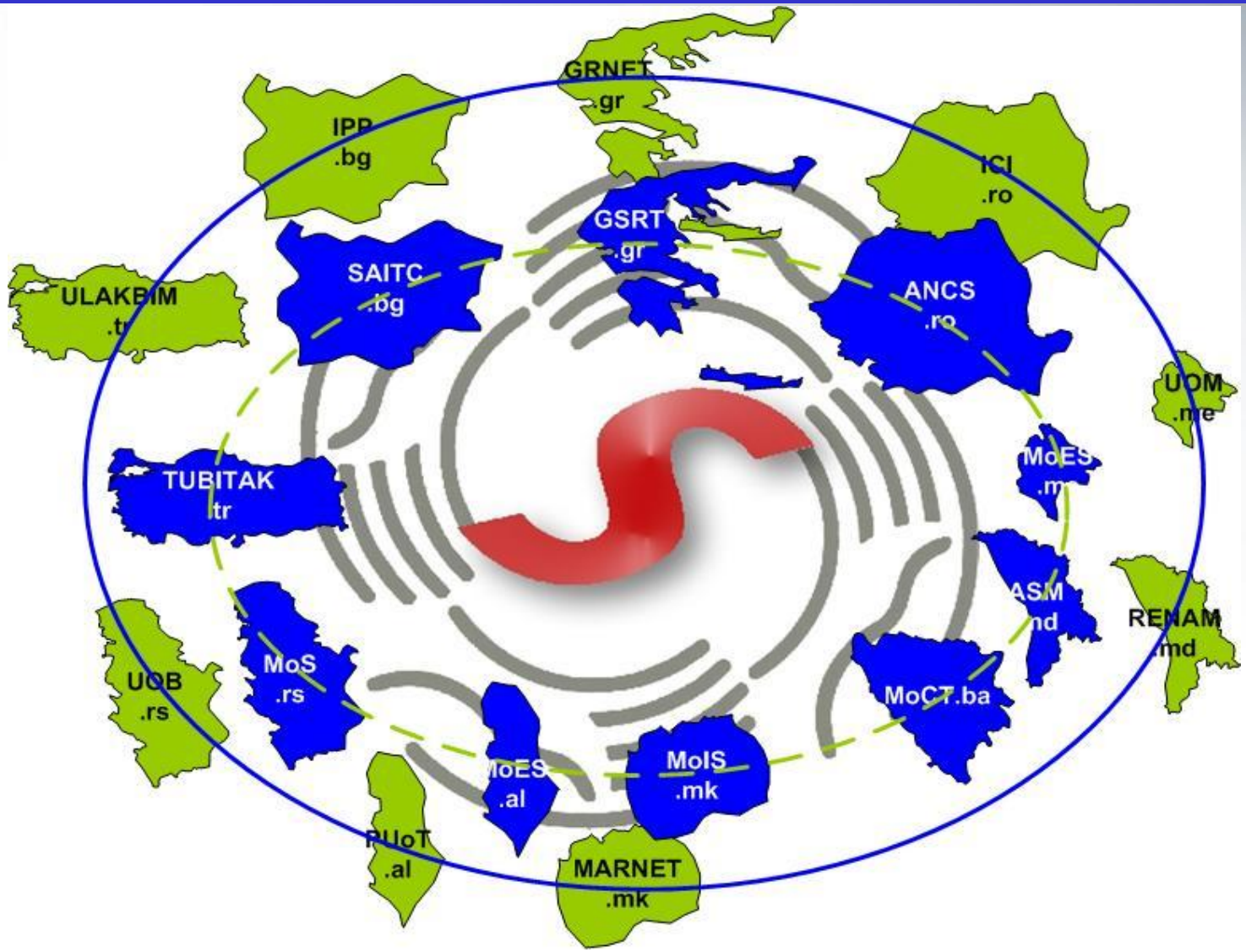
General Information:

- Integrating Activities – Support for policy development and programme implementation – ERA-NET supporting cooperation for research infrastructures in S&T fields
- 10 participating countries representing SEE region, including Republic of Moldova (RENAM and ASM)
- Every country is represented in the project by National eInfrastructure programmes owner – respective ministry or governmental agency and national eInfrastracture implementation partner – NREN and/or NGI
- Duration - 3 years

http://www.seera-ei.eu/

SEERA-EI project partnership

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development



SEERA-EI Project objectives

- Engaging national program owners in common dialogue and planning
- Analyze the state of the art of national eInfrastructure activities and identify commonalities and complementarities
- Structuring and harmonizing national policies and producing related guidelines
- Identifying areas for potential joint activities and implementing pilot activities
- Promotion of international collaboration

Conclusions

- Regional and National e-Infrastructures deployment projects have a significant impact on R&E communities of Moldova and the SEE region by helping the participating countries to join eEurope and align their national priorities with the EU recommendations and guidelines.
- SEE-GRID projects help to deploy a fast, powerful and sustainable Grid infrastructure, which, coupled with human networking activities will be of particular societal, educational, and political importance to the SEE region and to Moldova especially.
- Such modernization is a key goal of eEurope - which aims on accelerating the development of the Information Society in Europe and ensuring its availability to everyone.

Thank you!

SEE-GRID
South Eastern European GRid-enabled eInfrastructure Development

Questions?

Contact: Dr.Veaceslav Sidorenco
svv@renam.md

WWW.UTM.MD
WW.RENAM.MD