

Some aspect of research and development in ICT in Bulgaria

Authors

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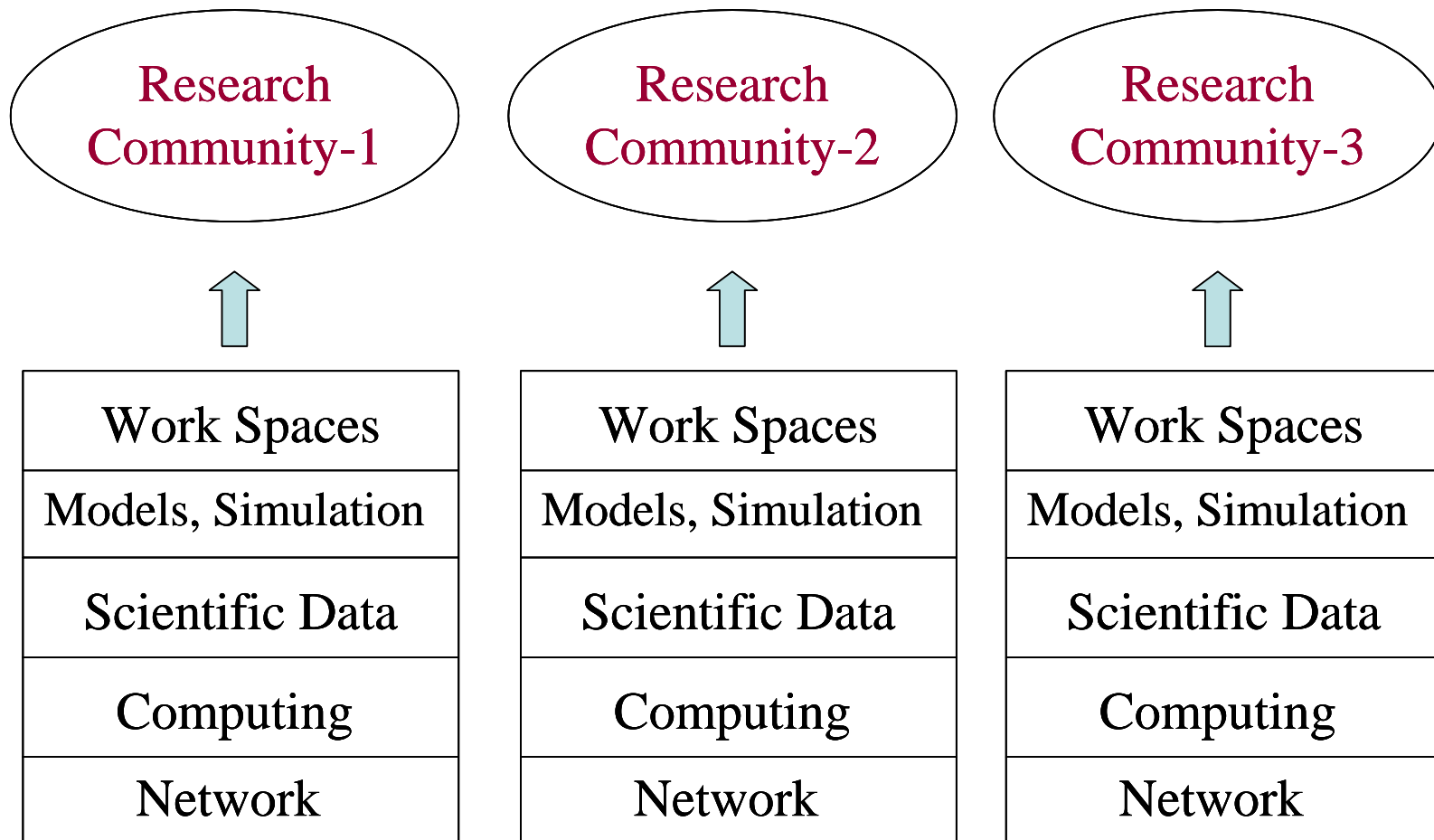
Introduction

The development of economy and research is determined by a number of factors, among which:

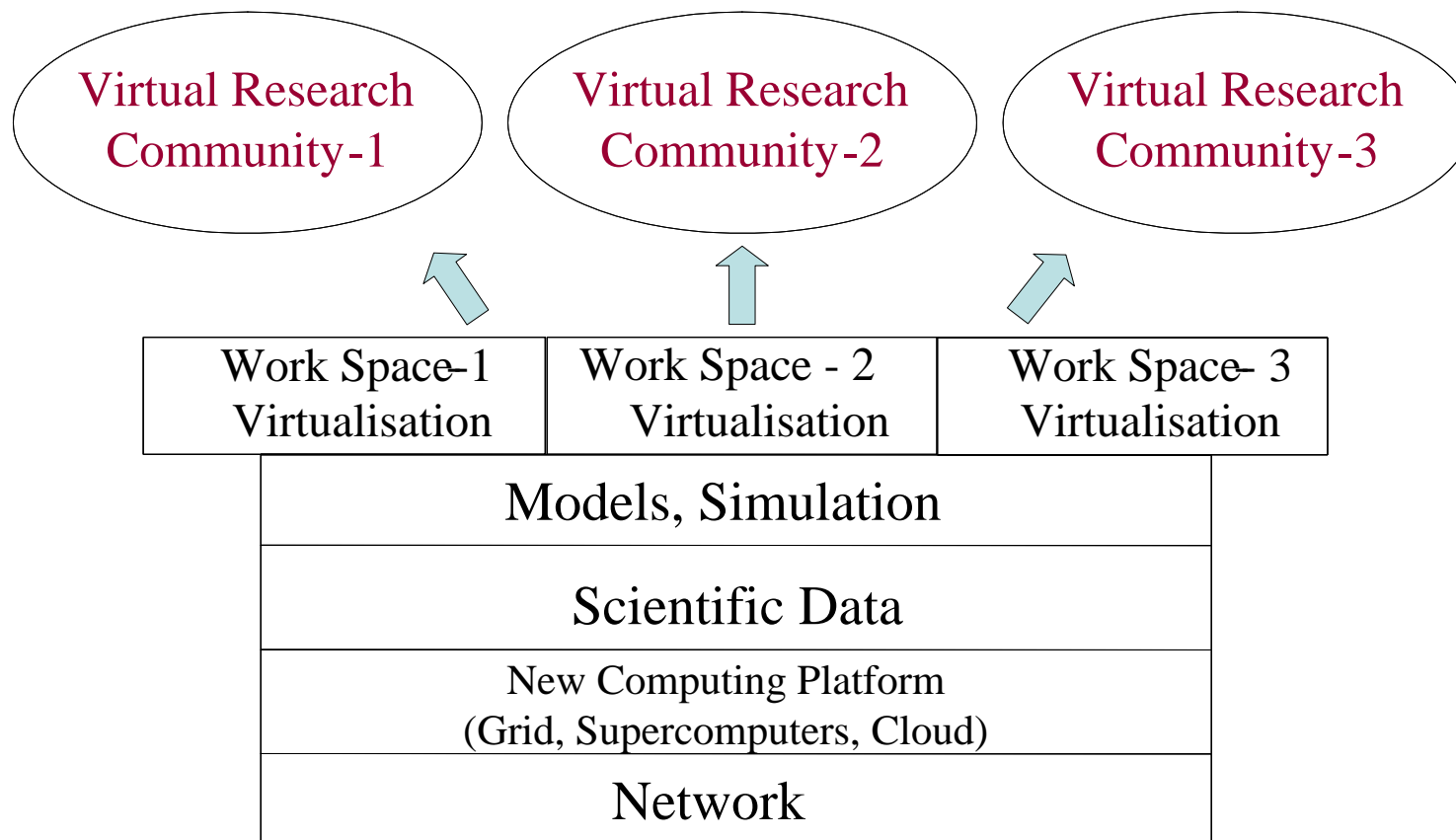
- Large volumes of raw data increasing exponentially
- Strong collaboration among the industrial branches
- The effect and results of scientific research increasingly relies on Information and Communication Technologies (ICT) for discovery, development and application of new technologies;
- The research, education and innovation will play a key role;

The influence of e-Infrastructure is steadily increasing in all fields of economic, social, cultural and research activities.

Organization of Research activity till recently

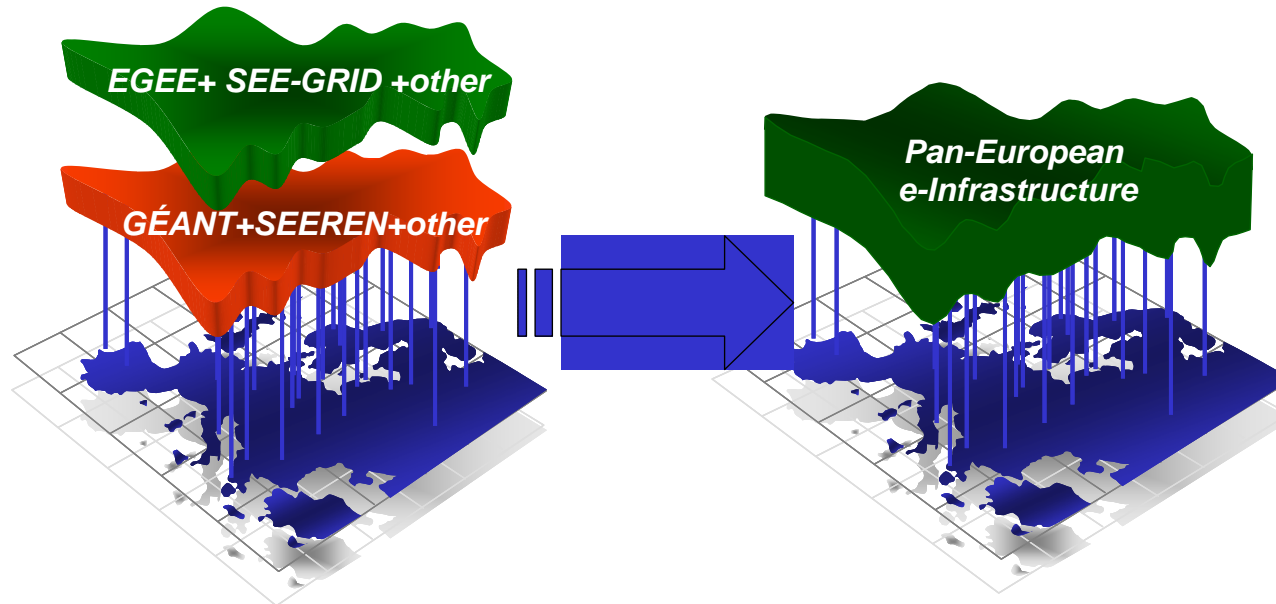


Organization of Research activity in the near future



Emerging of global virtual research communities

What happens in Europe?

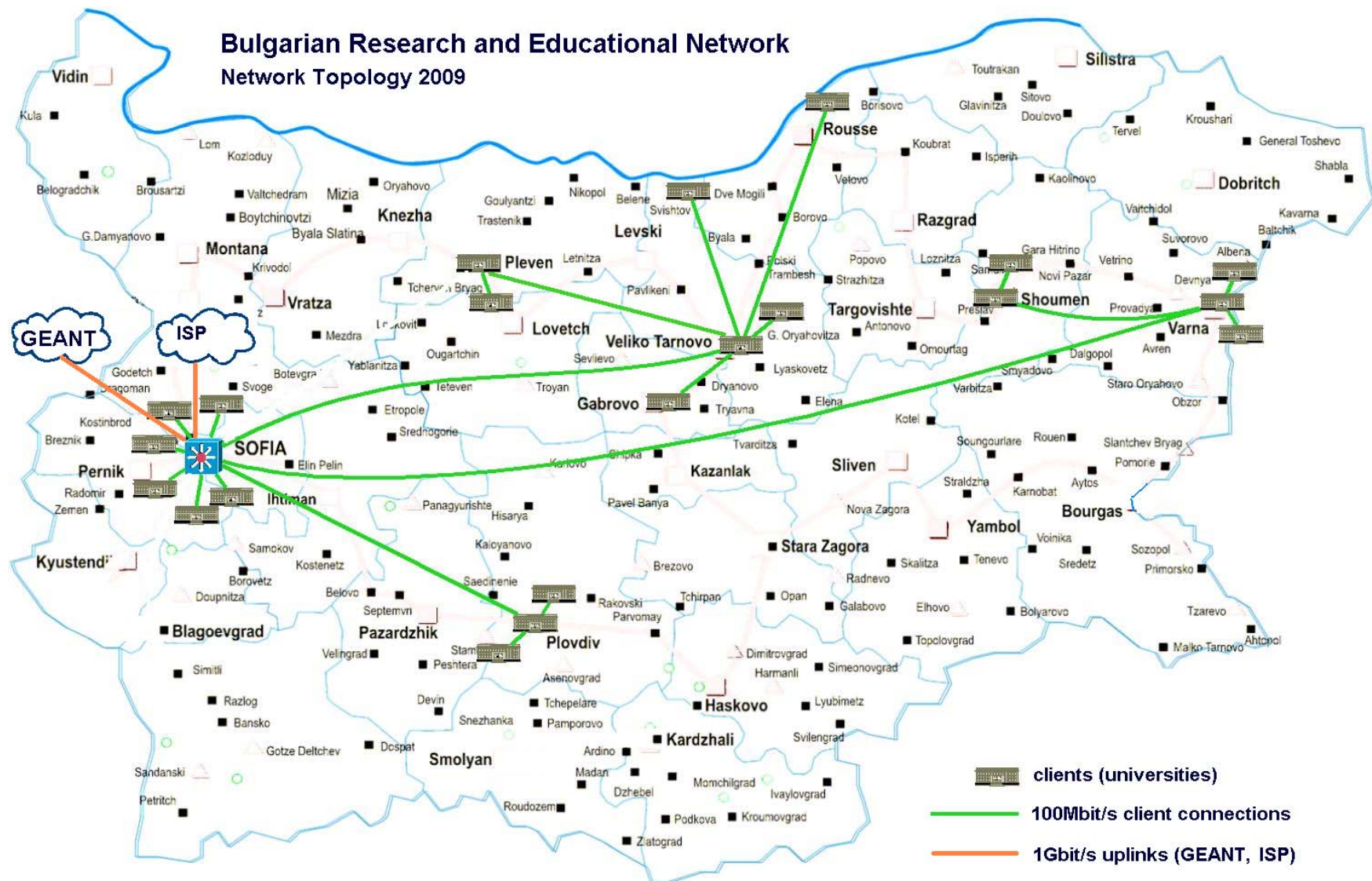


- The European vision for e-Infrastructure is focused on the computer networks and the new technologies above them, which provide new platforms and a complex of services

State-of-the-art of Bulgarian Network infrastructure for Scientific Research

- **The Bulgarian Research and Educational Network (BREN)** is linked to the build up and development of high speed communicational network infrastructure for
 - The BAS institutes
 - The universities
 - The schools in Bulgaria
- In 2008, as part of the GÉANT2 project, IICT-BAS deployed a GEANT backbone Point of Presence (PoP)
 - This PoP is connected by 10 Gbps communication lines with Athens, Bucharest and Budapest and by 2.5 Gbps communication line with Istanbul and 155 Mb/s with Skopie
 - The line speed to the BREN is 1 Gbps which is 10 times below the speed of other European Research and Educational Networks
- The BREN speed to Bulgarian universities and BAS Institutes is 1 Gb/s and is tens of times lower than the speed of scientific organisations in Europe

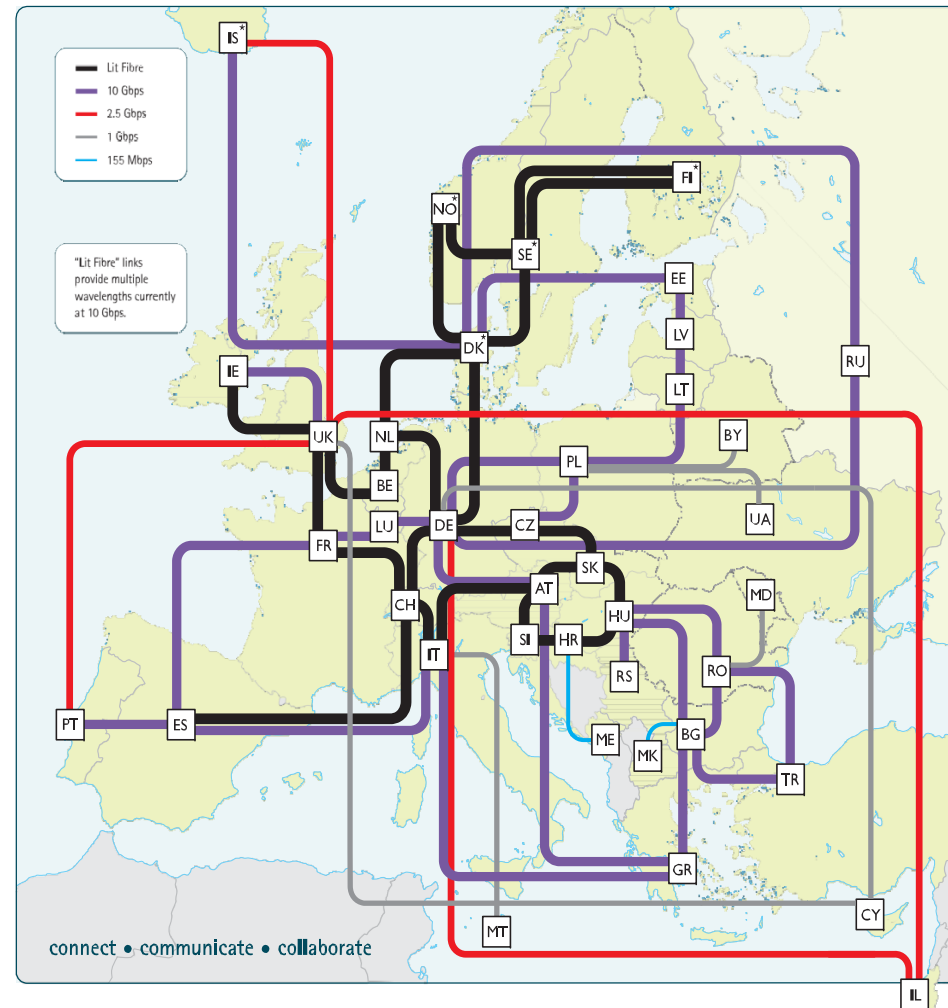
Bulgarian REN



Some significant European infrastructure initiatives and projects - GEANT

GEANT is a multi-gigabit research and education network which

- Provides data communications with leading-edge standards of reliability and innovation and the most advanced services to the European research and education community
- The project partners are 32 European NRENs, DANTE and TERENA; plus an additional four Associate NRENs.
- Operates at data transfer speeds of up to 10 Gbps across 50,000 km of network infrastructure, of which 12,000 km is based on our own lit fibre.
- Comprises 25 Points of Presence (PoPs), 44 routes and 18 dark fibre routes
- Multiple 10Gbps wavelengths are employed in the network's core with an ongoing trial of 40Gbps over 1,400 km of fibre between Frankfurt and Milan, via Geneva.



Supercomputing in Bulgaria – state-of-the-art and perspectives

- an IBM Blue Gene/P supercomputer was deployed in the State Agency for Information Technology and Communications (SAITC) in Sofia in 2008
- IBM Blue Gene/P is used for scientific research the field of medicine, drug discovery, financial simulations, education etc.
- The performance of the supercomputer is 23.42 TFLOPS which and is achieved by
 - 8192 processor cores
 - 4 TB random access memory
 - 12 TB disk storage will be deployed in the near future
 - At the present the connectivity to the BREN is 1 Gbps but it will be increased in the near future

Some significant European infrastructure initiatives and projects - PRACE-2IP

- PRACE-2IP (<http://www.prace-project.eu/>) supports the accelerated implementation of the pan-European High Performance Computing (HPC) Research Infrastructure
 - created in April 2010 as the result of the preparatory phase PRACE project
 - complements and extends the work of the PRACE-1IP project that was started in July 2010.
 - addresses the computational and simulation needs of European scientific communities to keep them at the forefront of discovery.
 - The project vision is the formation of an integrated HPC ecosystem of facilities and services enabling researchers to realise the full potential of computational science within the supportive environment of the European Research Area.
- Building on the implementation work of the preceding PRACE and DEISA projects, PRACE-2IP will enable seamless access to HPC systems and services to users, regardless of their country of work.
- PRACE-2IP will considerably strengthen and deepen the co-operation between HPC centres, funding bodies and research communities in a mutually beneficial partnership to enhance European scientific competitiveness.

State-of-the-art of Bulgarian Grid infrastructure

- The national Grid infrastructure includes 9 Grid clusters with a total of 1836 processor cores
- It is located in the institutes of BAS (8 clusters) and in Sofia University (1 cluster)
- The total performance of the Grid infrastructure is about 9 Tflops
- The total mass storage is about 140 TB
- The Grid infrastructure supports 5 national, 5 regional and 13 international virtual organizations
- The clusters have free user access for the Bulgarian Research Community for applications demanding significant computing resources

Distribution of the National Grid infrastructure resources

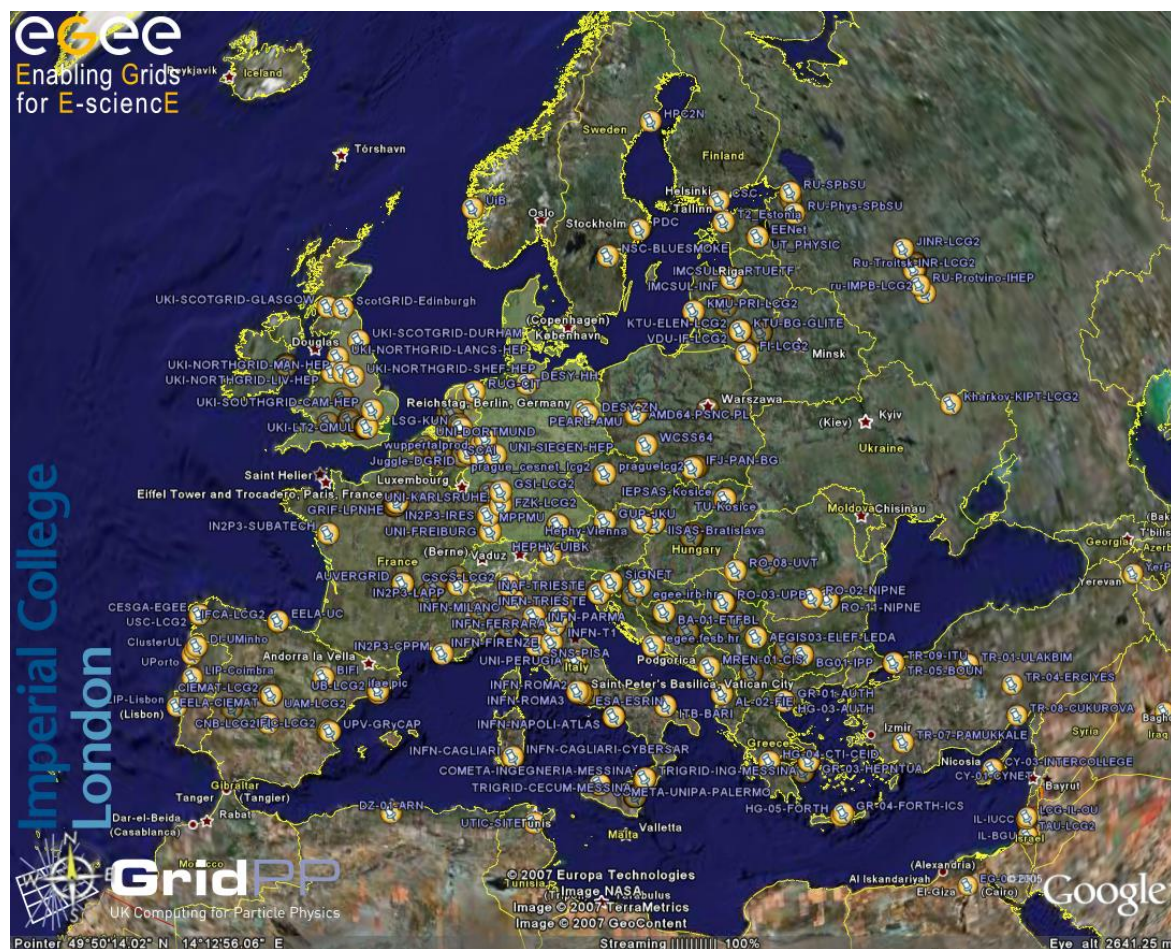
Organization	Cluster name	Number processor cores	Data storage [TB]
IICT-BAS	BG01-IPP	576	96
IM-BAS	BG02-IM	24	1
IICT-BAS	BG03-NGCC	200	10
IICT-BAS	BG04-ACAD	80	5
SU “Kl. Ohridsky”	BG05-SUGrid	24	1
NIGGG-BAS	BG06-GPHI	44	2
IICT-BAS	BG07-EDU	8	-
IOCCP-BAS	BG08-MADARA	800	24
INRNE-BAS	BG-INRNE	80	1
Total 6 organizations	Clusters- 9	1836 processors cores	Total 140 TB

Some significant European infrastructure initiatives – European Grid Infrastructure (EGI)

- The **European Grid Infrastructure (EGI)** enables access to computing resources for European scientists and researchers from all fields of science, from High Energy Physics to Humanities.
- The **European Grid Infrastructure (EGI)** is a federation of resource providers set up to deliver sustainable, integrated and secure computing services to European researchers and their international partners.
- **EGI.eu** is an organisation established on 8 February 2010 to coordinate and manage the infrastructure (EGI) on behalf of its participants: National Grid Initiatives (NGIs) and European Intergovernmental Research Organisations (EIROs).
- **National Grid Initiatives or Infrastructures (NGIs)** are organisations set up by individual countries to manage the computing resources they provide to the European e-Infrastructure (EGI).
- The federated resources provided by EGI are available to all scientists and researchers who are members of a Virtual Organisation (VO).
- The resources coordinated by EGI are free at point of use:
 - individual users do not have to pay to use the grid infrastructure.
 - Participating countries and institutions contribute to the common costs of running the infrastructure.
 - The individual resource providers (NGIs) fund and maintain the hardware in their own countries.

Some significant European infrastructure initiatives and projects – EGI-InSPIRE

- **EGI-InSPIRE** (EGI-Integrated Sustainable Pan-European Infrastructure for Research in Europe) is a four-year project helping to establish a sustainable, reliable e-Infrastructure that can support researchers' needs for large-scale data analysis.
- EGI-InSPIRE involves 50 partners in over 40 countries. An idea for the scale and scope of the project resources could be taken from <http://gridportal.hep.ph.ic.ac.uk/rtm/>



EGEE-grid clusters in Europe

Summary of the EGI infrastructure resources and their utilisation

Metric		5 th quarter of EGI-InSPIRE project
Resource Centres	EGI-InSPIRE providers	329
	Including integrated providers	346 (+6.8%)
Participating countries	EGI-InSPIRE providers	50
	With integrated providers	57 (+18.75%)
Installed computing capacity	CPU Cores EGI-InSPIRE providers	248,424
	CPU Cores also including integrated and peer providers	337,608
	Resource Centres supporting MPI	93
	Installed capacity (HEP-SPEC 06 ¹)	1.93 million
Installed storage capacity	Disk (PB)	106.7
	Tape (PB)	112.8
Usage 2010-2011	Jobs	949,000
	Wall clock hours	3.2 million hours/day (+86.5%)
	HEP-SPEC 06 CPU wall clock hours	25.7 million hours/day

Source: http://www.egi.eu/infrastructure/Figures_and_utilisation/

ICT Cluster

- Established as one of the first cluster in Bulgaria in 2005
- The main goal is wider penetration of ICT tools and systems application by Bulgarian society for development of innovations and competitive economy

MAIN ACTIVITY DIRCTIONS:

- Improving the competitiveness of Bulgarian ICT companies
- Support of Bulgarian institutions for implementation of innovative and comprehensive policy in the ICT field
- Modernization and restructuring of EDU system according to global markets and global competition requirements
- Promotion of Bulgaria as HI TECH spot

Segments represented in ICT Cluster

- Software development-more than 60 companies in BASSCOM
www.basscom.org
- WEB based services and products-more than 34WEB studios,
WEB media companies-BWA www.bwa.bg
- Telecommunications-11 companies and Sofia TU; designers
and manufacturers of telecom equipment and systems.
Telecommunications sub-cluster was created 2008 by PHARE
project. www.btcluster.org
- Embedded systems and microelectronics-10desing houses,
Sofia University, TU of Sofia, Varna,Gabrovo. CMEEES was
established on Dec 2009 -www.cmees.org

OpenAIRE Other projects in BAS

The main goals of OpenAIRE are to:

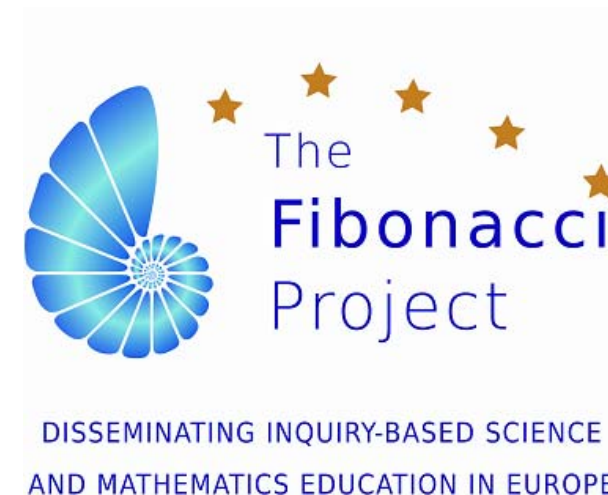
- Support researchers in complying with the FP& Open Access Pilot through a European Helpdesk System
- Support researchers in depositing their research publications in an institutional or disciplinary repository
- Build up an OpenAIRE portal and e-infrastructure for repository networks
- Explore scientific data management services

www.openaire.eu

The European Digital Mathematics Library

The main goals of EuOML are:

- to create a **common infrastructure** for seamless navigation, searching and interacting within the deeply interlinked network of **distributed validated** multilingual digital mathematical content available throughout Europe, which will make mathematics readily available for all users of this resource
- to provide a safe archival back-end so that publishers do not have to maintain their back catalogues indefinitely, and thus agree to transfer their content and to licence **eventual open access** to it according to their moving wall policy
- to satisfy the demand for **reliable and long-term availability** of mathematical research output



Fbonacci-project activities in Bulgaria



<http://www.math.bas.bg/omi/Fibonacci/>

The focus



Learning mathematics in inquiry-based style

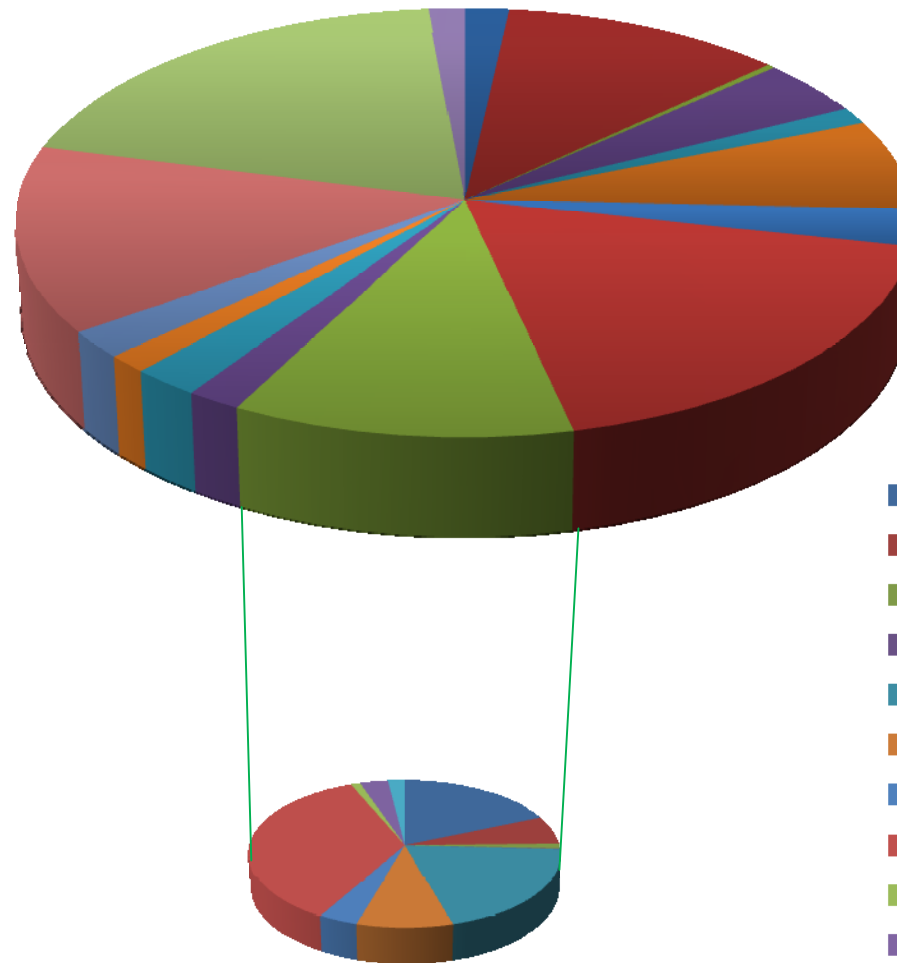


Some Statistic

- Software sales companies – 428 million leva
- Total number of employees – 8000 persons.
- Basscom companies have sales for 163 million leva and have 2500 employees
- The companies in the industrial electronic and microelectronic are mainly with foreign investment (Epiq, Melexis, etc) with sales for 500 million leva and 5000 employees

ICT value added produced by EU countries, % in EU ICT value added, PPP, 2008

Ireland - 1,75%
 Italy - 11,26%
 Luxembourg - 0,32%
 Netherland - 4,23%
 Portugal - 1,27%
 Spain - 6,77%
 Sweden - 2,80%
 United Kingdom - 18,01%
 Other - 11,18%
 Austria - 1,78%
 Belgium - 2,22%
 Denmark - 1,34%
 Finland - 2,05%
 France - 14,03%
 Germany - 19,44%
 Greece - 1,44%



Hungary - 1,70%
 Bulgaria - 0,56%
 Cyprus - 0,10%
 Estonia - 0,01%
 Romania - 1,81%
 Slovakia - 0,82%
 Slovenia - 0,34%
 Poland - 3,25%
 Malta - 0,10%
 Lithuania - 0,30%
 Latvia - 0,18%

Problems of Bulgarian e-infrastructure

- Low connectivity throughput – the trend is for sustainable connection speed lag of 4 to 10 times
- There is no regular budget funding for the development and support of BREN and the national Grid and Supercomputers infrastructure
- Solutions
 - One-time funding for BREN backbone build up
 - Provision of 3 to 4 mill. leva annual budget funding for e-infrastructure support

Thank you for your attention!