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"Telecommunications,
Electronics and Informatics"



PERSPECTIVES OF REGIONAL CROSS-BORDER FIBER CONNECTIONS DEVELOPMENT



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Research and Educational networking in Europe



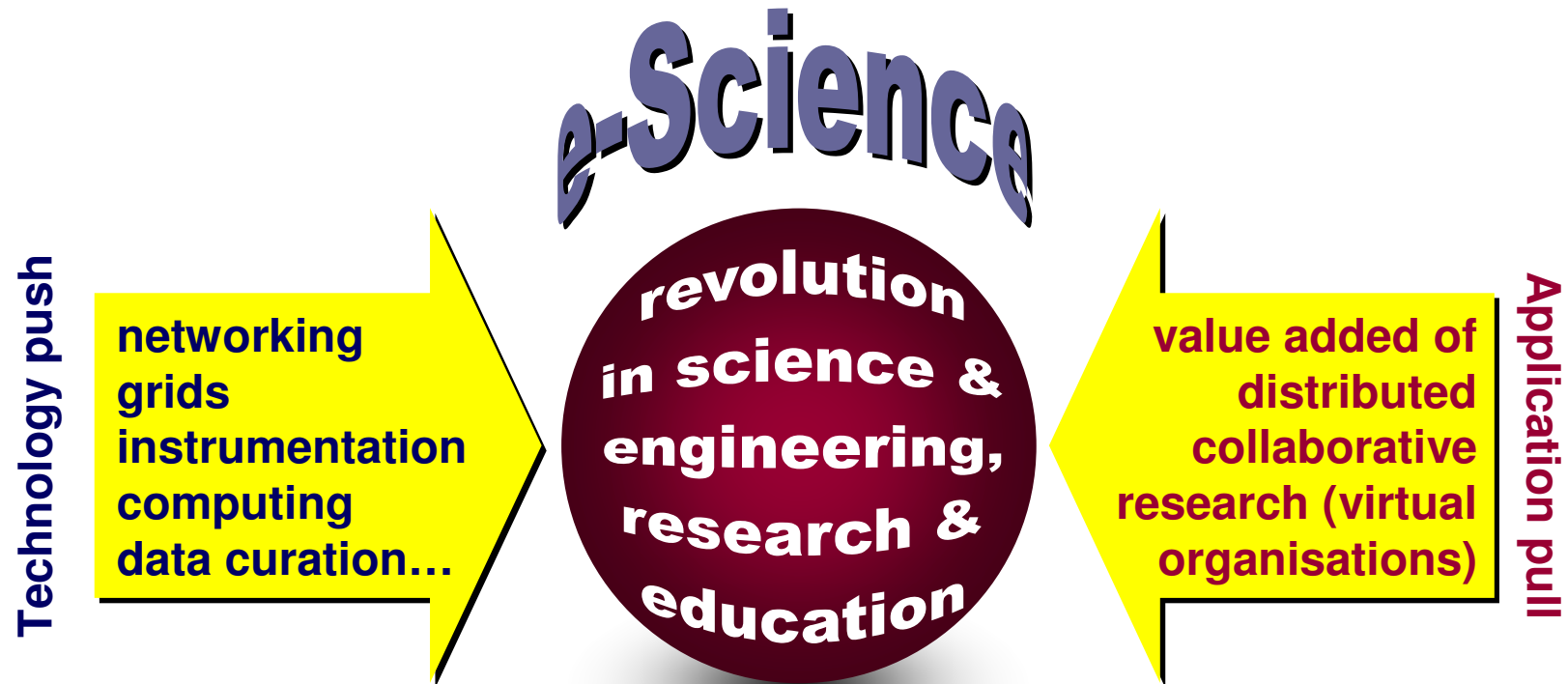
European Commission (EC) started development of common Pan-European networking infrastructure with the aim to unite all research and educational institutions since 1993. R&E network development passed several stages, now Trans-European infrastructure is named GEANT2 and has become one of the most developed Internet segment in the world. The fundamental principle of common Research & Educational (R&E) infrastructure building in Europe is role of National Research and Educational Networks (NREN). GEANT Network uses common approach – it unites one NREN in every country and these NRENs ensure interrelation and providing access for national R&E institutions to GEANT resources.

At present access to GEANT is organized not only directly through NREN, but existing and developing some regional initiatives and networks that are supported by EC, regional and national authorities:

- NorduNet - unites all Scandinavian countries and represents them in GEANT Consortium;
- EUMEDCONNECT a project of regional network creation that unites NRENs from Mediterranean Countries;
- TEIN2 (Trans - Asia Information Network) – a project for connection of 10 NRENs in Asia - Pacific region to GEANT;
- ALICE – huge initiative devoted to connection of 19 Latin-American NRENs to common GEANT infrastructure;
- SEEREN / SEE-LIGHT - EC founded regional R&E networking initiatives that have aim to provide access to GEANT network for South - Eastern European Countries;
- Black Sea Initiative (BSI) - the project focused on creation of regional network the will unite all countries of Black Sea Basin
- CAREN - Central Asian Research and Education Network project. The network is operational since July 2010 and currently interconnects scientists and students in Kyrgyzstan, Tajikistan, Turkmenistan and Kazakhstan.

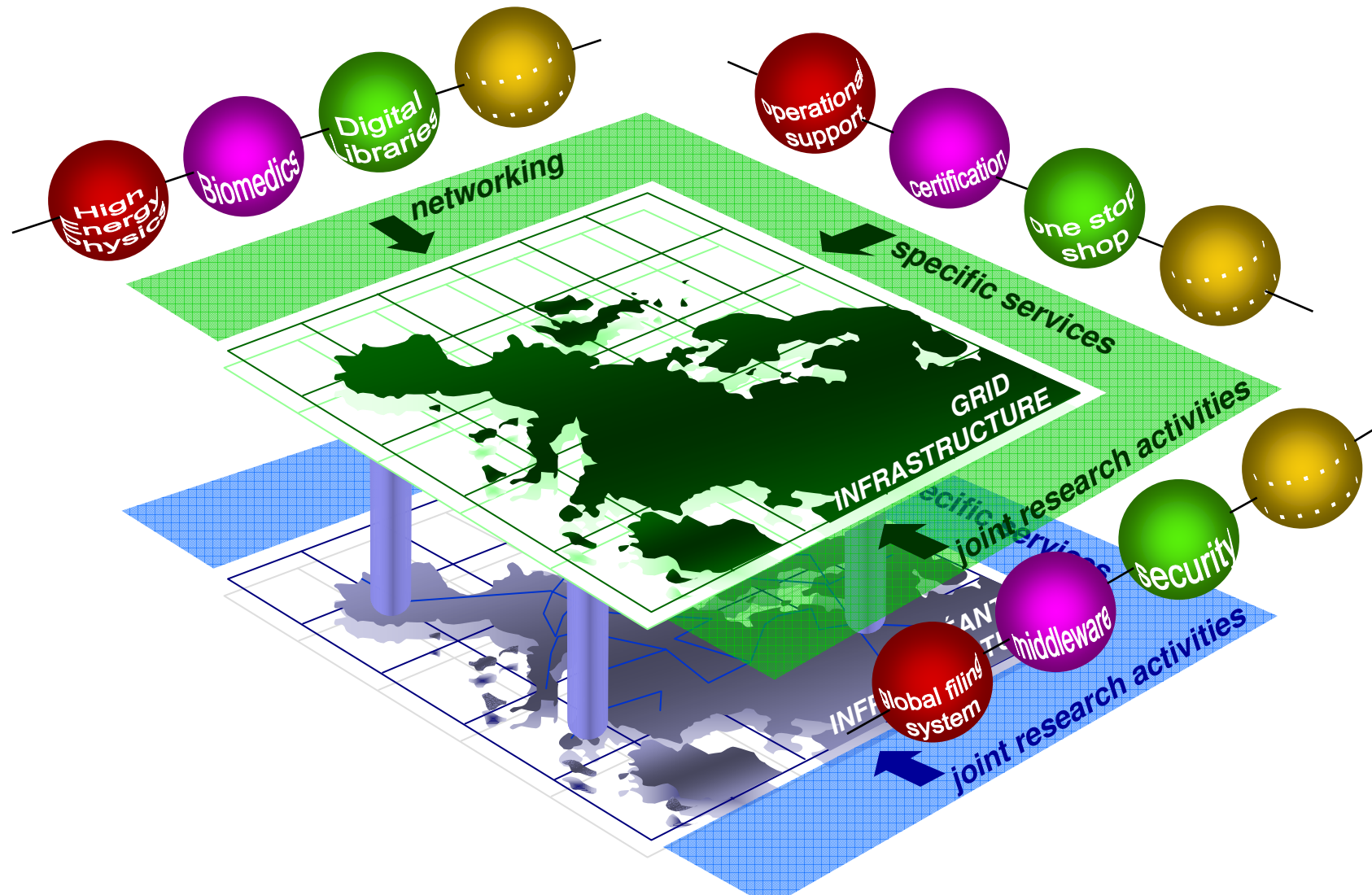


eInfrastructure - new way of doing Science

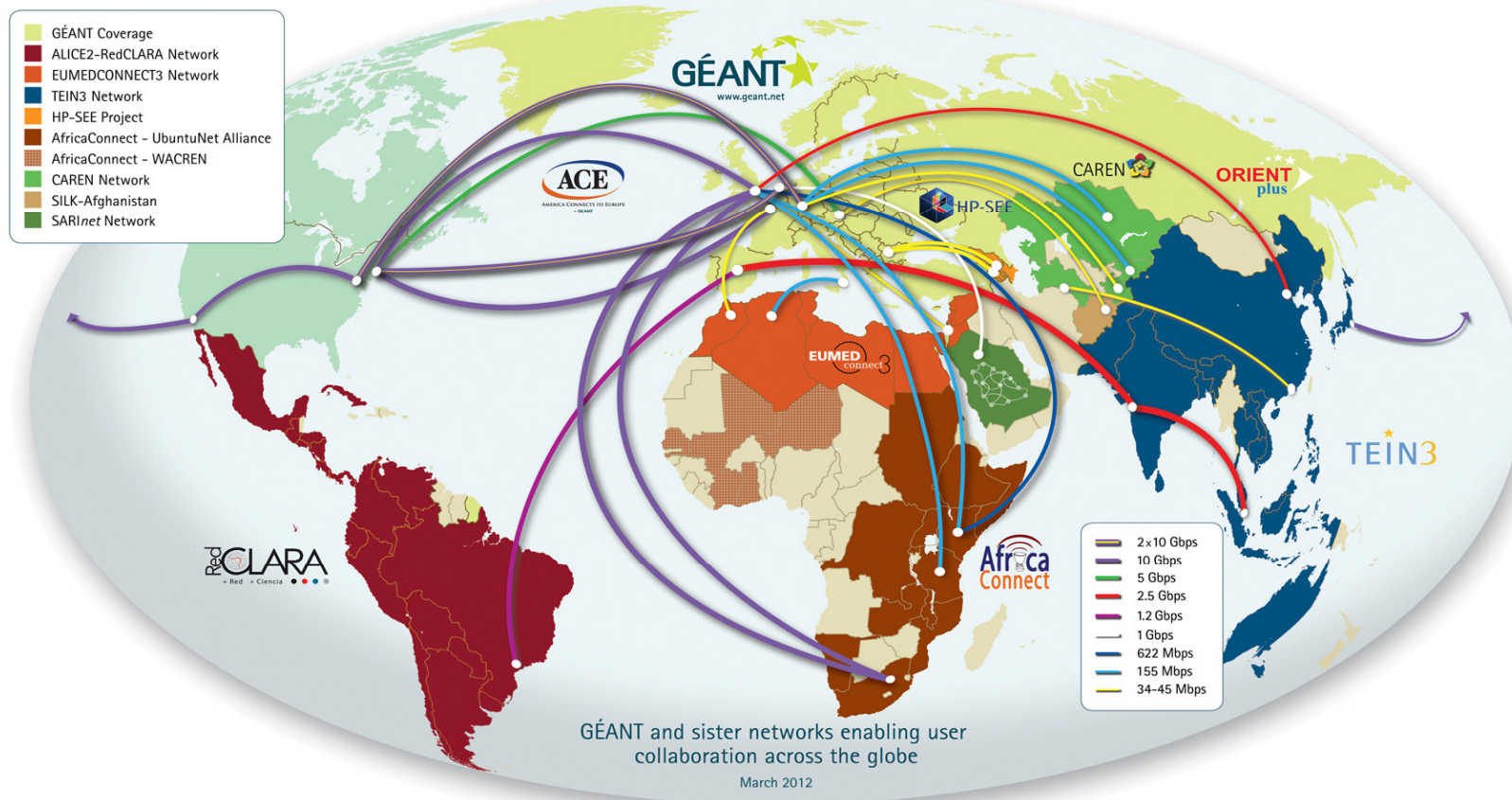


a new way for all scientists to work on research challenges that would otherwise be difficult to address

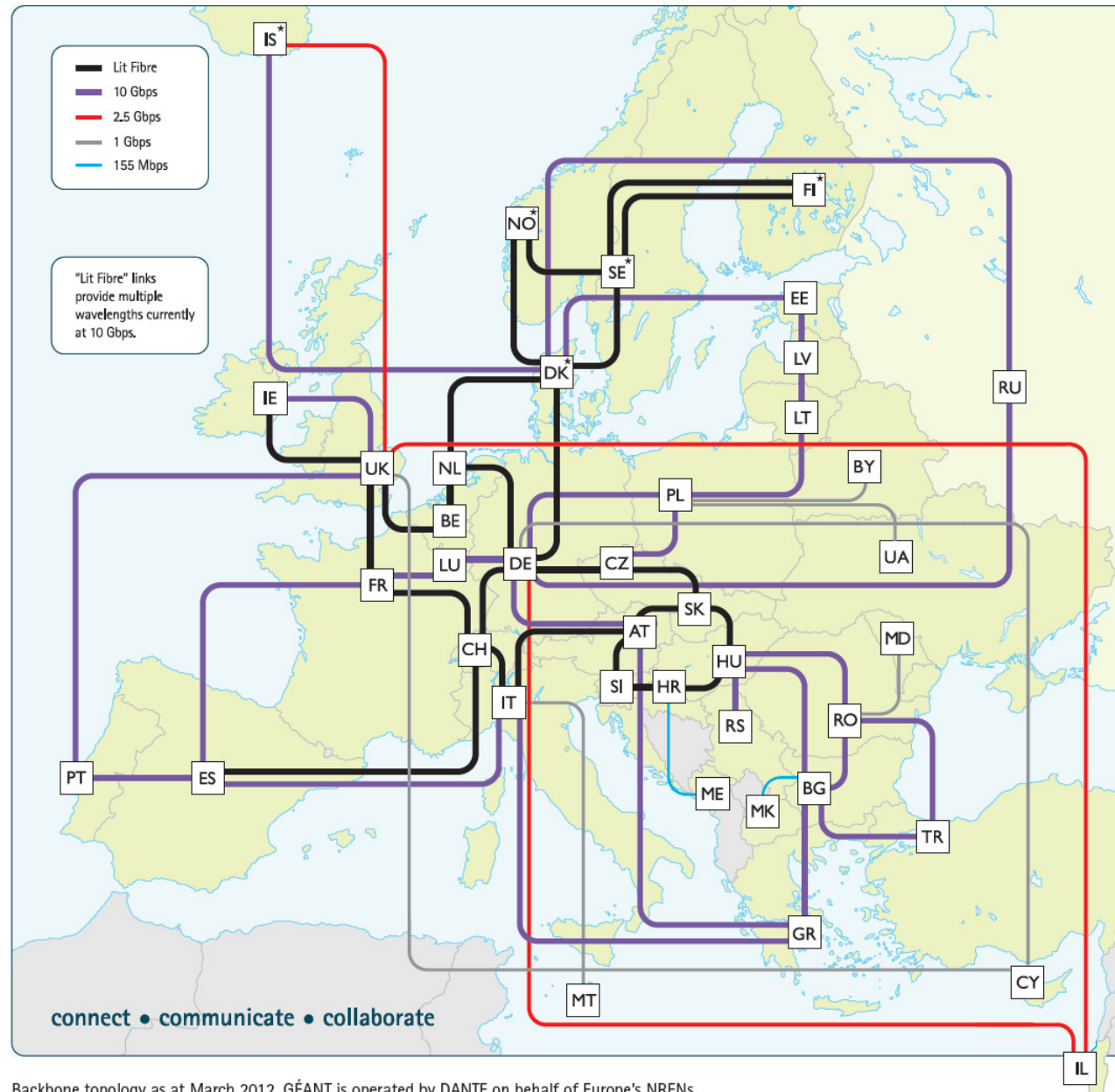
e-Infrastructure - Implementation blocks



GÉANT At the Heart of Global Research Networking



GEANT connections scheme



Backbone topology as at March 2012. GÉANT is operated by DANTE on behalf of Europe's NRENs.



Extension of GEANT to the East



Various solutions for extension of GEANT to the East were developed. Very roughly, the topology of the East European part of the global Trans-European Academic network can be pictured as multiple ring and arc structure. Some of these rings and arcs, that arise more or less naturally, are:

- **Baltic ring:** a ring around Baltic Sea. The beginnings of this ring go back to the start of the Internet in Baltic countries when the first connection of Latvia went from Riga to Tallinn and further to Helsinki and Stockholm. The ideas to create a geometrical fiber ring around Baltic Sea were expressed frequently, though till today it is not done yet.
- **Central arc:** Poland–Belarus and further to the industrial cities of Russia, then to St. Petersburg and back into Scandinavia.
- **Southern arc:** **Poland–Ukraine–Moldova–Romania** and further through Ukraine to the industrial cities of the Central Russia then to Moscow and further to cities of Ural and other regions of Russia.
- **Caucasus arc:** Ukraine–Georgia–Armenia–Azerbaijan - Turkey, etc. and then to the Far East in cooperation with Silk Highway and other projects.
- **Central and Eastern Europe** partner NRENs CBF connections



EC “Porta Optica Study” project



The “Porta Optica Study” was an European Commission co-funded FP6 Specific Support Activity Project.

Its main goal is stimulation and consolidation of initiatives to ensure the successful, dark-fiber based research network deployment in the Eastern Europe.

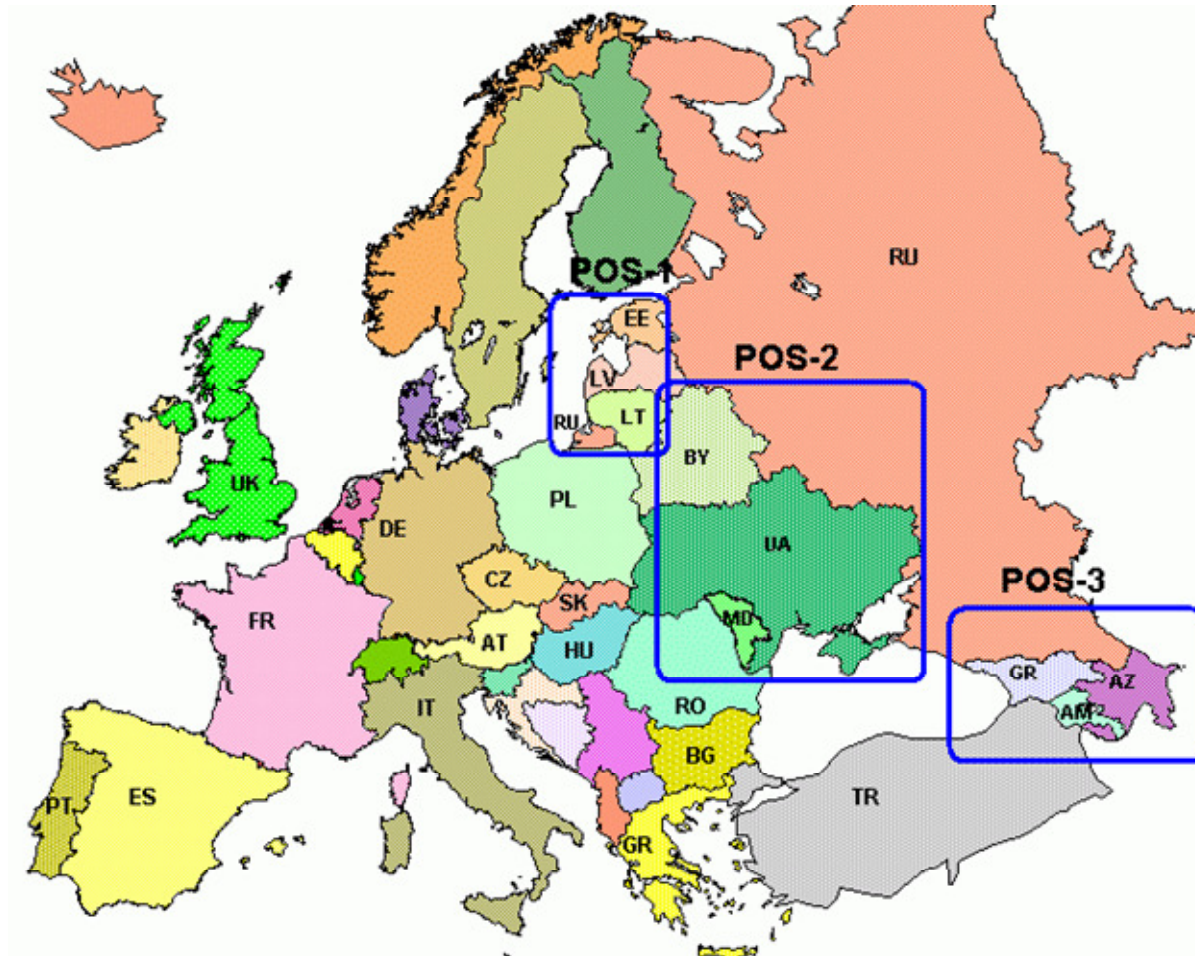
“Porta Optica Study” initiatives and elaborated DF deployment program have perspectives to have practical prolongation by support of various funding organizations (EU structured funds programs, ITU infrastructure projects, etc.)

<http://www.porta-optica.org>





“Porta Optica Study” project – regional covering



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Widening of regional connectivity



Participation in the regional R&E networks development projects:

- Project of RENAM-RoEduNet Fiber Optic Channel Construction
 - *Construction of Fiber Optic connection between two neighbor NRENs and implementation of new high capacity communication technologies*
- Participation of Eastern Europe NRENs in EC “Porta Optica Study” project:
 - *Examination of the possibilities and the best approached to the regional fiber based networking infrastructure deployment in the East Europe region; Moldova as a member of the regional sub-group that has perspectives of DF interconnections (cross-border fiber connections) implementation that will unite in Southern arc Moldova, Romania and also the Ukraine, Republic of Belarus and Poland.*
- Close cooperation with partner NRENs:
 - from Romania - RoEduNet
 - from the Ukraine – URAN and UARNet



Information Society
and Media

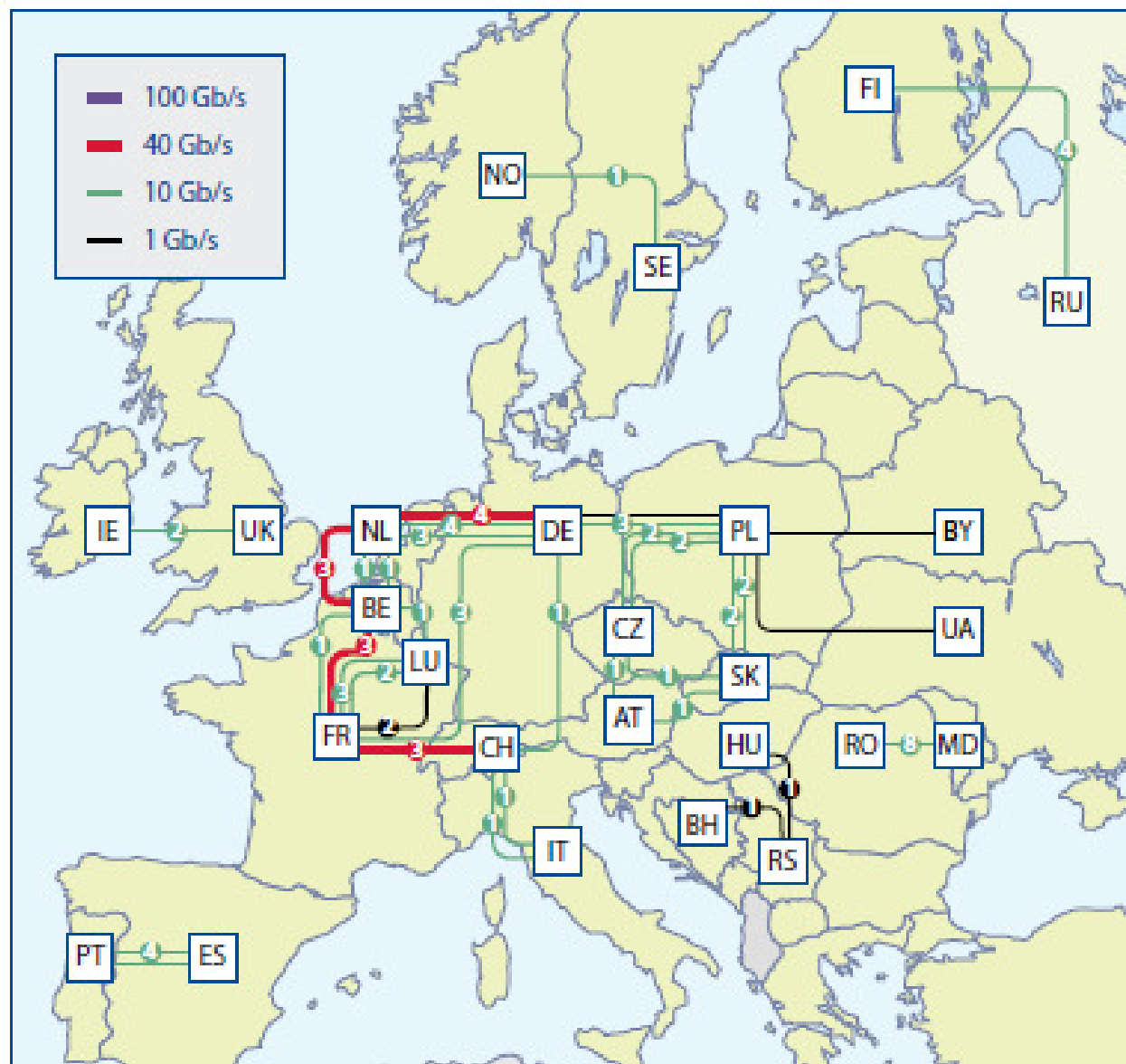


Dark Fiber & Cross Border Fiber



- “Dark fiber (DF)” is the new paradigm in the research networking around the world. It is the only transmission medium providing virtually unlimited capacity and flexibility in network development.
- DF infrastructure has been well proven by many EU National Research and Education Networks (such as SURFNet, PIONIER, CESNET, HEANET, RoEduNet and others) who have dramatically increased their network capacities over last years and now lead this community.
- The success of dark-fiber based NRENs also influenced pan-European research network – GÉANT, which also, in large parts, is based and predominantly developing on DF approach.
- NRENs DF interconnections, so called Cross Border dark Fibre – CBF concept, now being widely implementing in GÉANT network for optimization of GEANT optical backbone construction. CBF connectivity is already in service between many NRENs in Central Europe like in Austria, Czech Republic, Poland and Slovakia, etc. These countries use transit over self-interconnection CBF extensively (peak traffic is over tens gigabits per second in most days) and their positive experience and approaches are now investigating for practical deployment in Eastern Europe NRENs.

Cross-border dark fibre in Europe





Moldova-Romania Regional connectivity improvement



In order to improve RENAM-RoEduNet-GEANT connectivity and to overcome radio-relay-based limited capacity a new project called **“RENAM – RoEduNet Fiber Optic Link Construction”** and directed on construction of Fiber-Optics Cross Border connection between two NRENs was elaborated and proposed for discussions to EC and NATO Science Committee.

Two main strategic goals of the project:

- To improve the efficiency of direct link between research and educational institutions of Moldova and Romania countries
- To improve integration of Moldovan Academic network with Trans-European network GEANT2 through RoEduNet.



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Sibiu, 1-3 June, 2006

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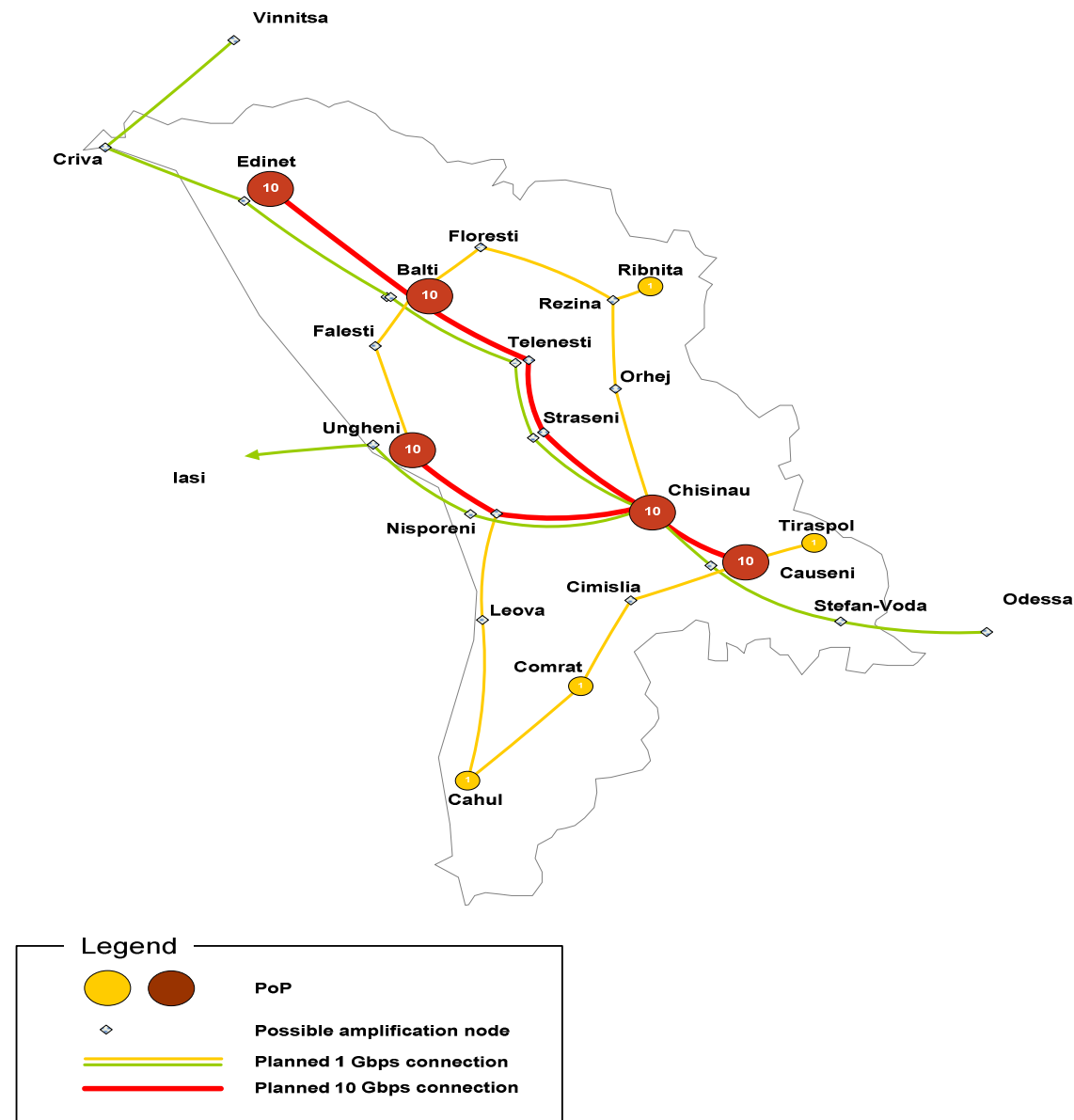
RENAM - RoEduNet channel capacity extension roadmap



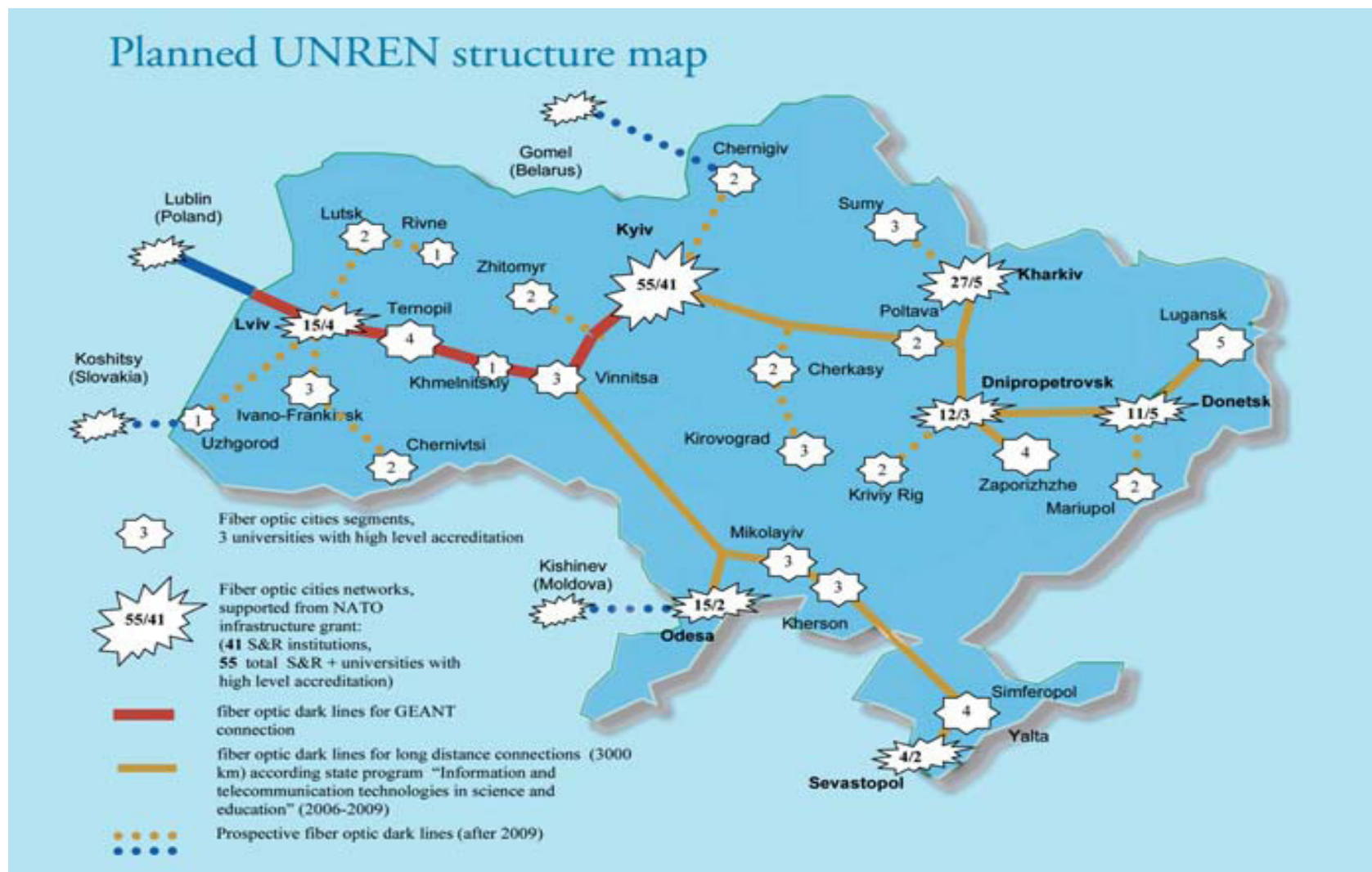
- **2001-2003.** RENAM-RoEduNet networks direct link and gateway construction. 4 Mbps. NATO grant NIG978385
- **2005-2006.** Increasing traffic capacity of the radio-relay channel Chişinău – Iaşi up to 16 Mbps and negotiation of leasing additional 16 Mbps bandwidth of the existing radio-relay channel Chişinău – Iaşi
- **2005-2007.** Organization of supplementary channel for Internet access by StarNet ISP and providing additional permanent traffic and backup facilities for RENAM network: 4M bps (backup 8 Mbps) – **2005**; 4 Mbps (backup 10 Mbps) – **2006**; 8 Mbps (backup 16 Mbps) - **2007**
- **2005.** Assuring 100 Mbps optical connection to the “Internet Exchange Point” of “Moldtelecom” S.A.
- **2007.** Increasing IX access capacity up to 1 Gbps
- **2006, November.** Widening bandwidth of the radio-relay channel Chişinău – Iaşi over *32Mbps*
- Elaboration and promotion of international projects for upgrading RENAM-GEANT via RoEduNet connection by using radio-relay channel facility and new fiber optics link Chişinău-Iaşi construction:
 - **1st stage – extension of the radio-relay channel up to 155 Mbps (2007);**
 - **2nd stage – extension of the radio-relay channel up to 2x155 Mbps (11.2008);**
 - **3rd stage – transition from radio-relay technology to usage of optical channel and upgrading its capacity up 1 Gbps (10.2009);**
 - **4th stage – transition to 10 Gbps optical channel operation.**



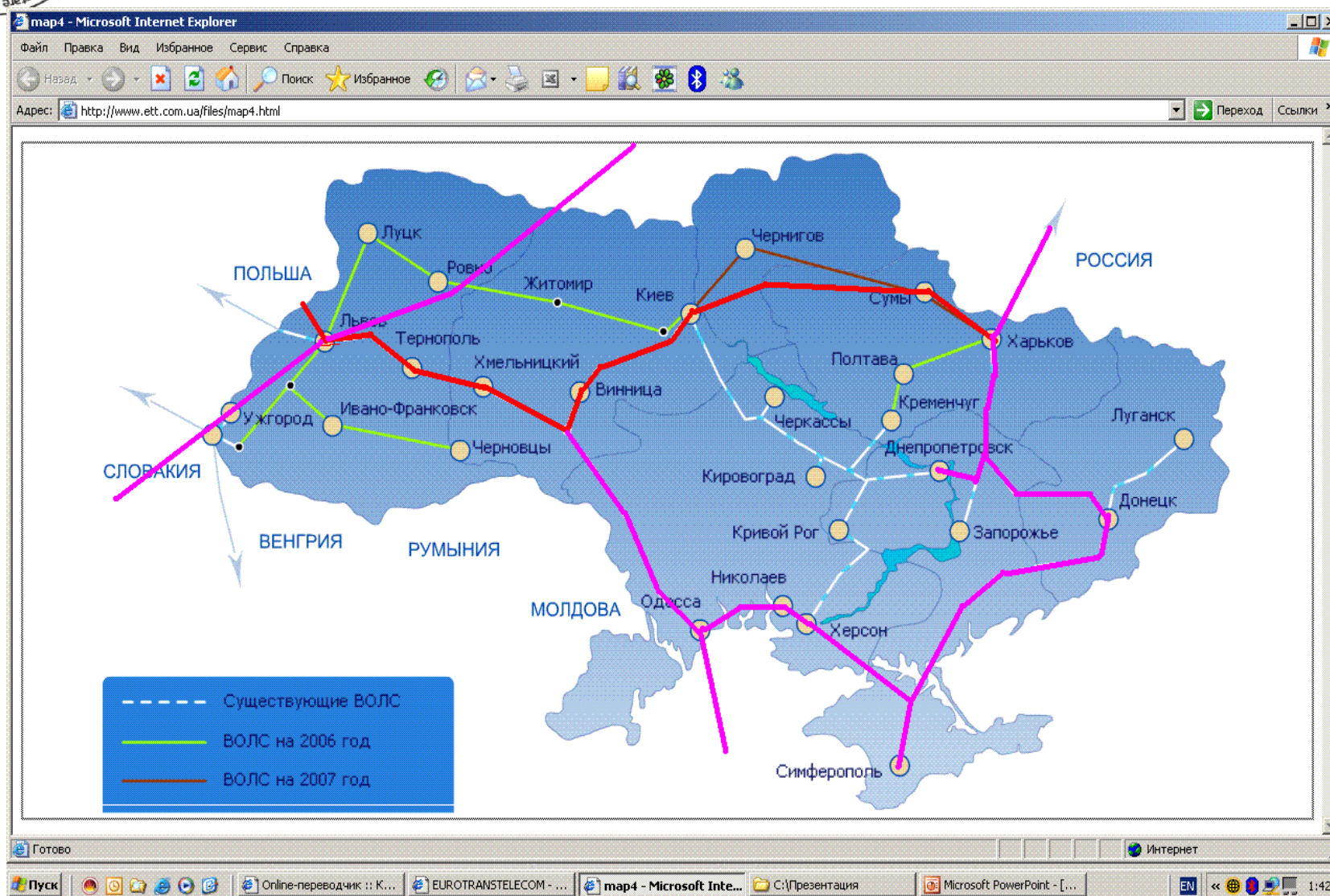
Scheme of fiber gateways organization between Moldova, Romania and Ukraine



RENAM – URAN cooperation

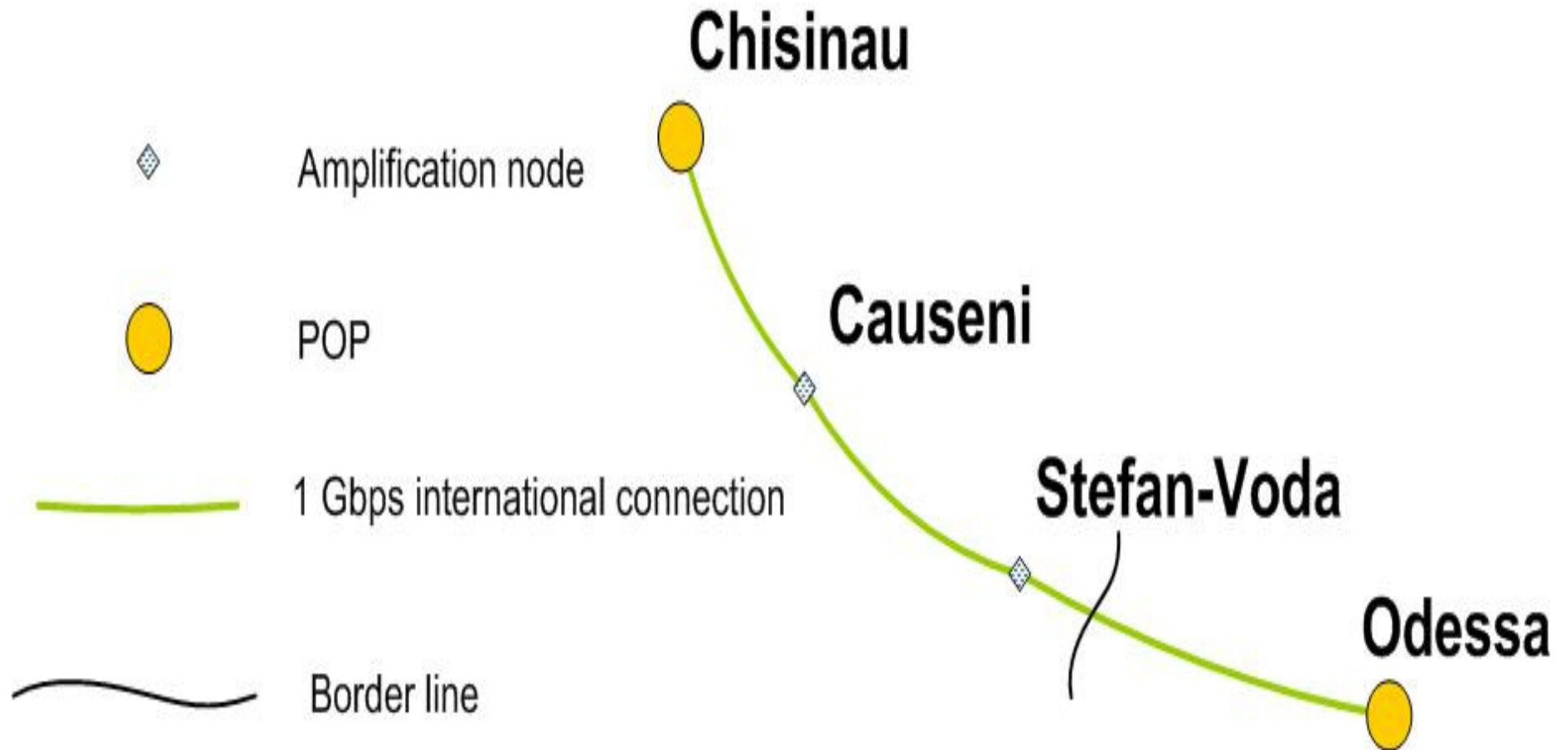


Ukrainian R&E networking infrastructure (fiber footprint)



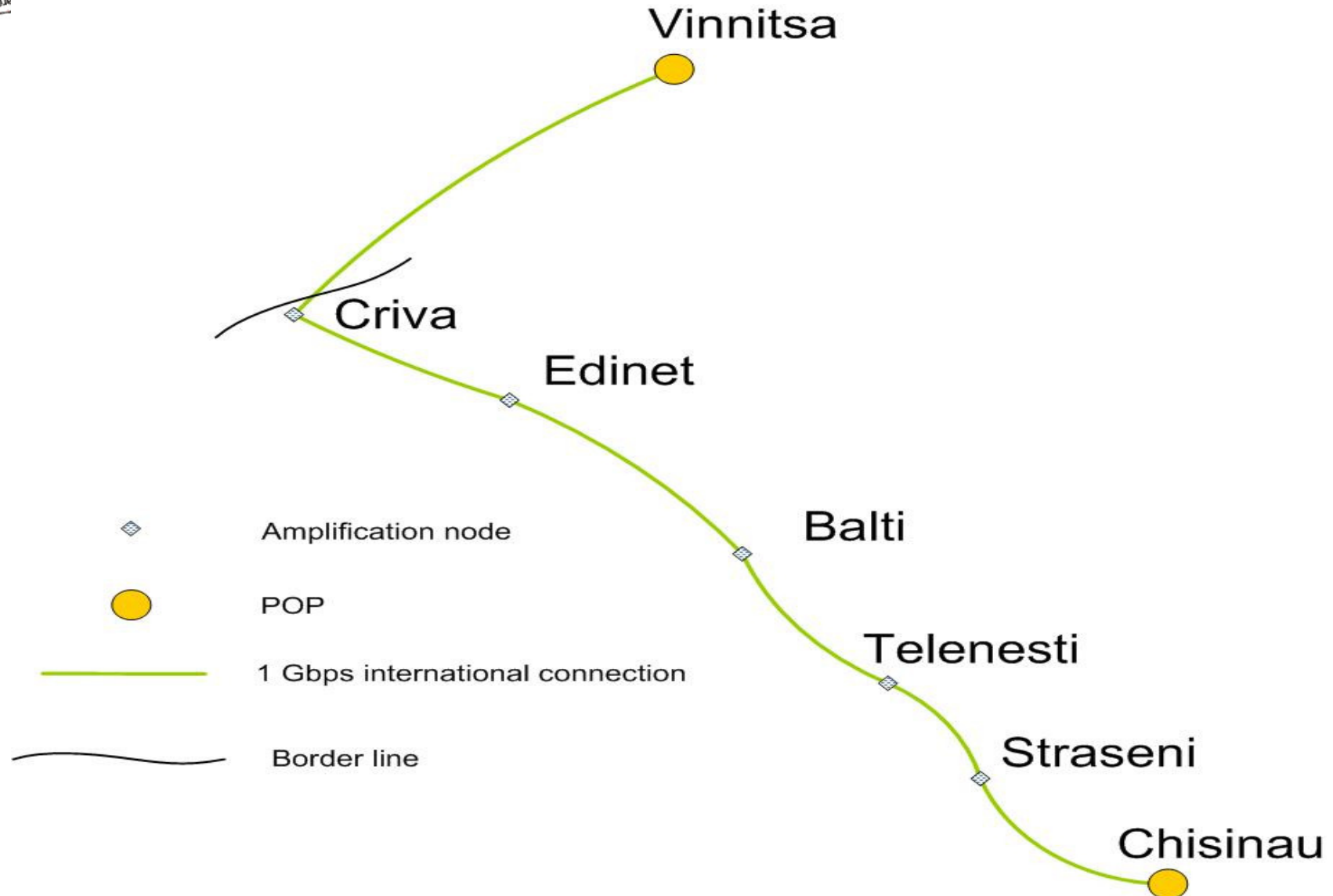


RENAM – Ukrainian NREN Connection, Sought route





RENAM – Ukrainian NREN Connection, North route





Main directions of current and future activities



- Promotion of participation of Moldova NREN (as well as other NRENs from Eastern Europe) in GEANT3+ project with the aim to deploy GEANT network PoP in Moldova;
- External connections development and participation in regional CBF networking infrastructure development projects;
- Wide installation of "Dark Fiber" links for transferring principal arterial RENAM network connections to new technological basis. The central, mostly overloaded traffic exchange highways proposed to be realized by means of DF optic communication media and creation multi Gbit Ethernet technology fiber segments.
- Implementation of xWDM communication technology in optical Chisinau MAN backbone taking in account the necessity to implement in near future transition to 10 Gbps capacity connections.
- Chisinau & Balti MAN backbones infrastructure development
- New territorial DF links construction to cover all principal regional R&E centres.



Thank you!



Questions ?

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www.renam.md

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www.roedu.net