Users and NRENs - protocooperation or mutualism?

Ukrainian National Grid as a ground for international scientific collaboration

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For whom we need National Research and Education Networks?
For what we need National Research and Education Networks?

Local users

- Fundamental research
- Applied research
- Education
- Libraries
- Data Bases
- Grid

External users

- Participation in International scientific, educational, applied program and projects

Global users

- NREN – element of Global World REN
- NREN as transmitter between other countries

Role of UNG in Ukrainian NREN

Collective and the main user of Ukrainian NREN

Initiates links with UNG partners

Stimulates permanent developing and improving the UNREN

Some history of the UNG

2004 – – 2005

The first grid clusters of this infrastructure have been made in the Kharkov Institute of Physics and Technology (*but during a long time it was running only as a part of the International Project RDMS at JINR (Dubna, Russia) as part of CMS experiment at CERN*) and in BITP and from the beginning has been included (*together with cluster of Kiev National University*) into the grid infrastructure of the ALICE Collaboration at CERN.

2006 The Academic Program "**Implementation of grid technology and construction of clusters in NASU**" is accepted.

- Clusters in 5 institute of NASU.
- Ukraine signs a MOU of WLCG

Some history of the UNG

2007 - **The first grid segment of NASU** (*6 institutes of NASU and KNU in Kiev and Lvov*)

- Ukraine becomes a non-contracting member of EGEE
- Ukraine becomes a member of EGI-DS

2008 - Distributed Grid infrastructure of NASU (Ukrainian Academic Grid, *22 institutes of NASU, KNU, KPI in Kiev, Kharkov, Lvov, Dnepropetrovsk, Sumy, Donetsk*).

- The Ukrainian Branch of the World Data Center is integrated into grid infrastructure.

2009 - The Program **"Implementation and application of grid technology for 2009-2013"** has been accepted by the Cabinet of Ministries of Ukraine (total budget 300 mln. UHA ~ 30 mln. €. In fact – 3.4 mln. €)

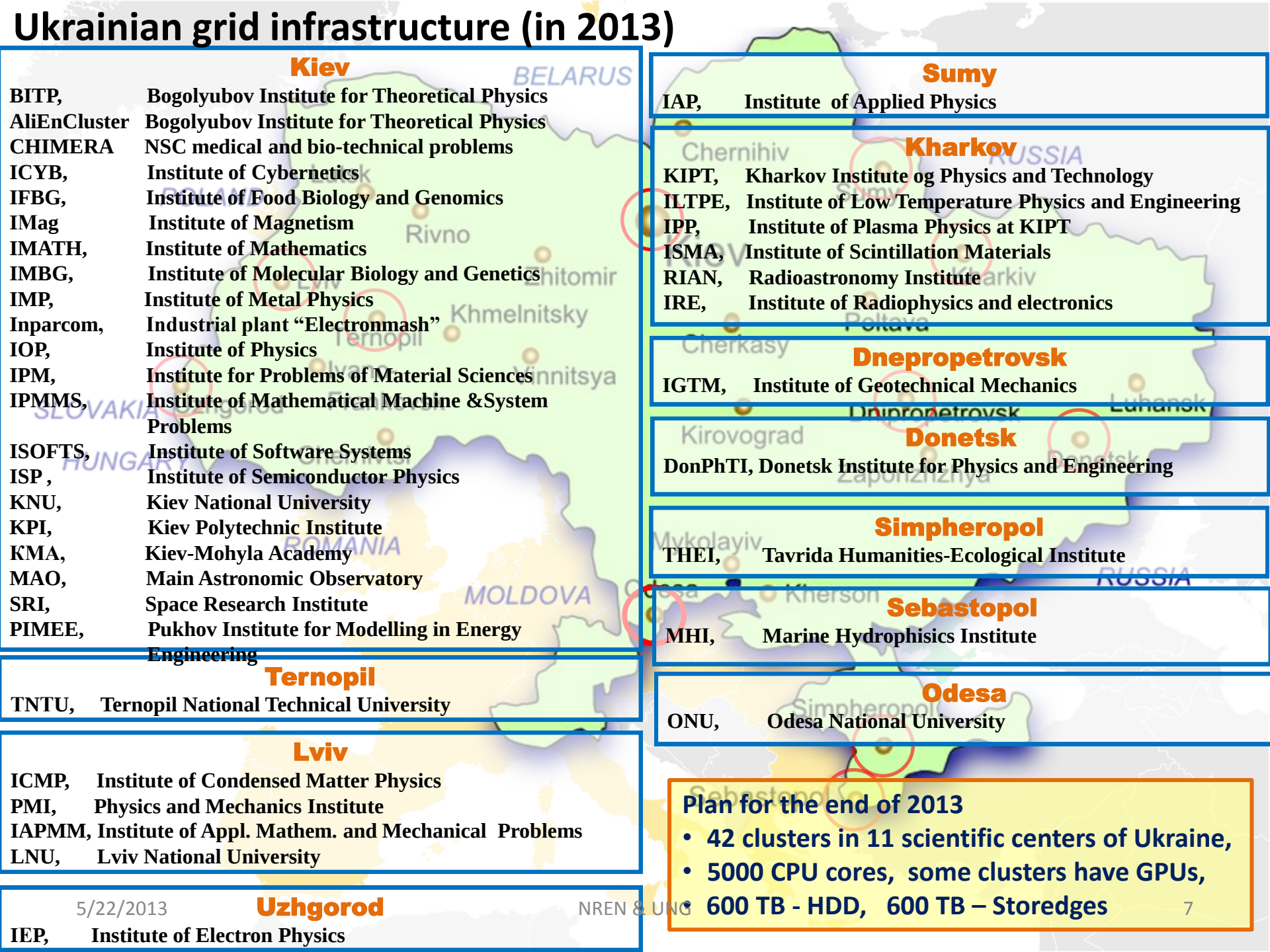
State Program on grid

Sections of the Program

1. Material and technical basis
2. Middleware, system software and support
3. Methods of information security
4. Grid applications (science, engineering, medicine)
5. Technology of data retention and data bases
6. Learning of grid technology

Ukrainian Academic Grid has been transformed to Ukrainian National Grid

Ukrainian grid infrastructure (in 2013)



Kiev

BITP,	Bogolyubov Institute for Theoretical Physics
AliEnCluster	Bogolyubov Institute for Theoretical Physics
CHIMERA	NSC medical and bio-technical problems
ICYB,	Institute of Cybernetics
IFBG,	Institute of Food Biology and Genomics
IMag	Institute of Magnetism
IMATH,	Institute of Mathematics
IMBG,	Institute of Molecular Biology and Genetics
IMP,	Institute of Metal Physics
Inparcom,	Industrial plant "Electronmash"
IOP,	Institute of Physics
IPM,	Institute for Problems of Material Sciences
IPMMS,	Institute of Mathematical Machine &System Problems
ISOFTS,	Institute of Software Systems
ISP ,	Institute of Semiconductor Physics
KNU,	Kiev National University
KPI,	Kiev Polytechnic Institute
KMA,	Kiev-Mohyla Academy
MAO,	Main Astronomic Observatory
SRI,	Space Research Institute
PIMEE,	Pukhov Institute for Modelling in Energy Engineering

Ternopil

TNTU,	Ternopil National Technical University

Lviv

ICMP,	Institute of Condensed Matter Physics
PMI,	Physics and Mechanics Institute
IAPMM,	Institute of Appl. Mathem. and Mechanical Problems
LNU,	Lviv National University

Uzhgorod

IEP,	Institute of Electron Physics

Sumy

IAP,	Institute of Applied Physics

Kharkov

KIPT,	Kharkov Institute og Physics and Technology
ILTPE,	Institute of Low Temperature Physics and Engineering
IPP,	Institute of Plasma Physics at KIPT
ISMA,	Institute of Scintillation Materials
RIAN,	Radioastronomy Institute
IRE,	Institute of Radiophysics and electronics

Dnepropetrovsk

IGTM,	Institute of Geotechnical Mechanics

Donetsk

DonPhTI, Donetsk Institute for Physics and Engineering

Simpheropol

THEI,	Tavrida Humanities-Ecological Institute

Sebastopol

MHI,	Marine Hydrophisics Institute

Odesa

ONU,	Odesa National University

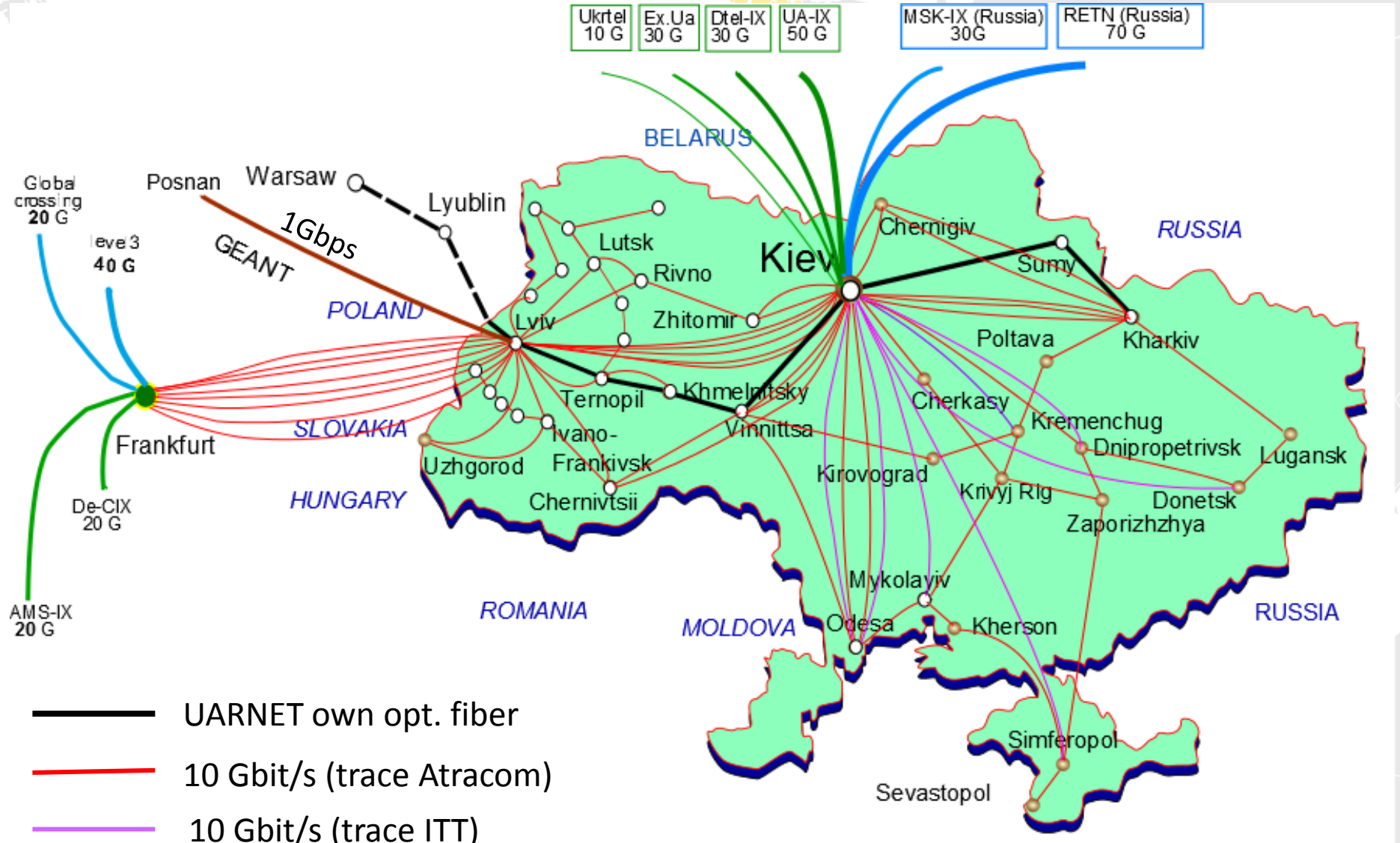
Plan for the end of 2013

- 42 clusters in 11 scientific centers of Ukraine,
- 5000 CPU cores, some clusters have GPUs,
- 600 TB - HDD, 600 TB – Storedges

Grid Network in UNG (end of 2012)

UARNET - Ukrainian Academic Research Network (mainly NASU institutes**)**

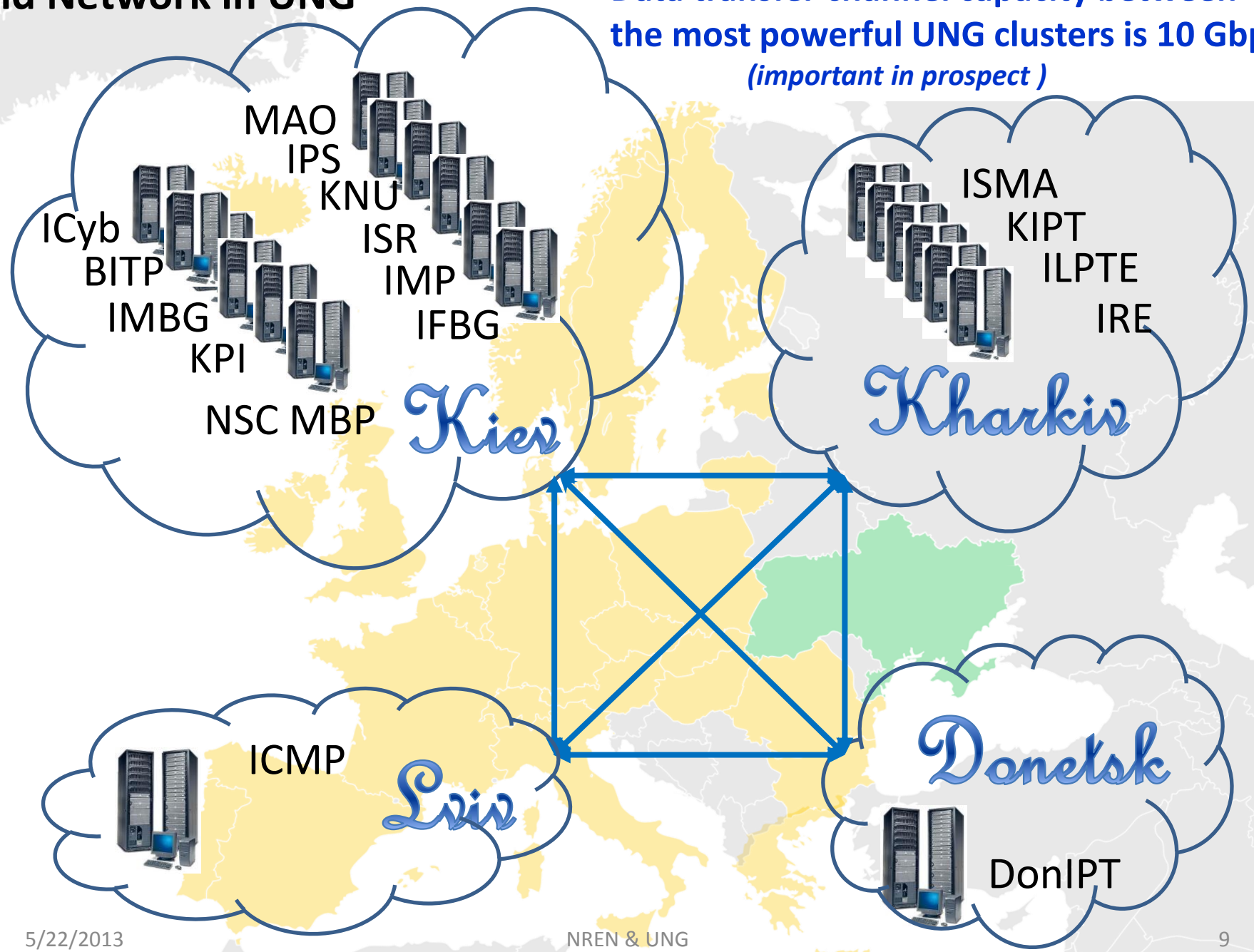
URAN - Ukrainian Research & Academic Network (mainly educational institutes and universities**)**



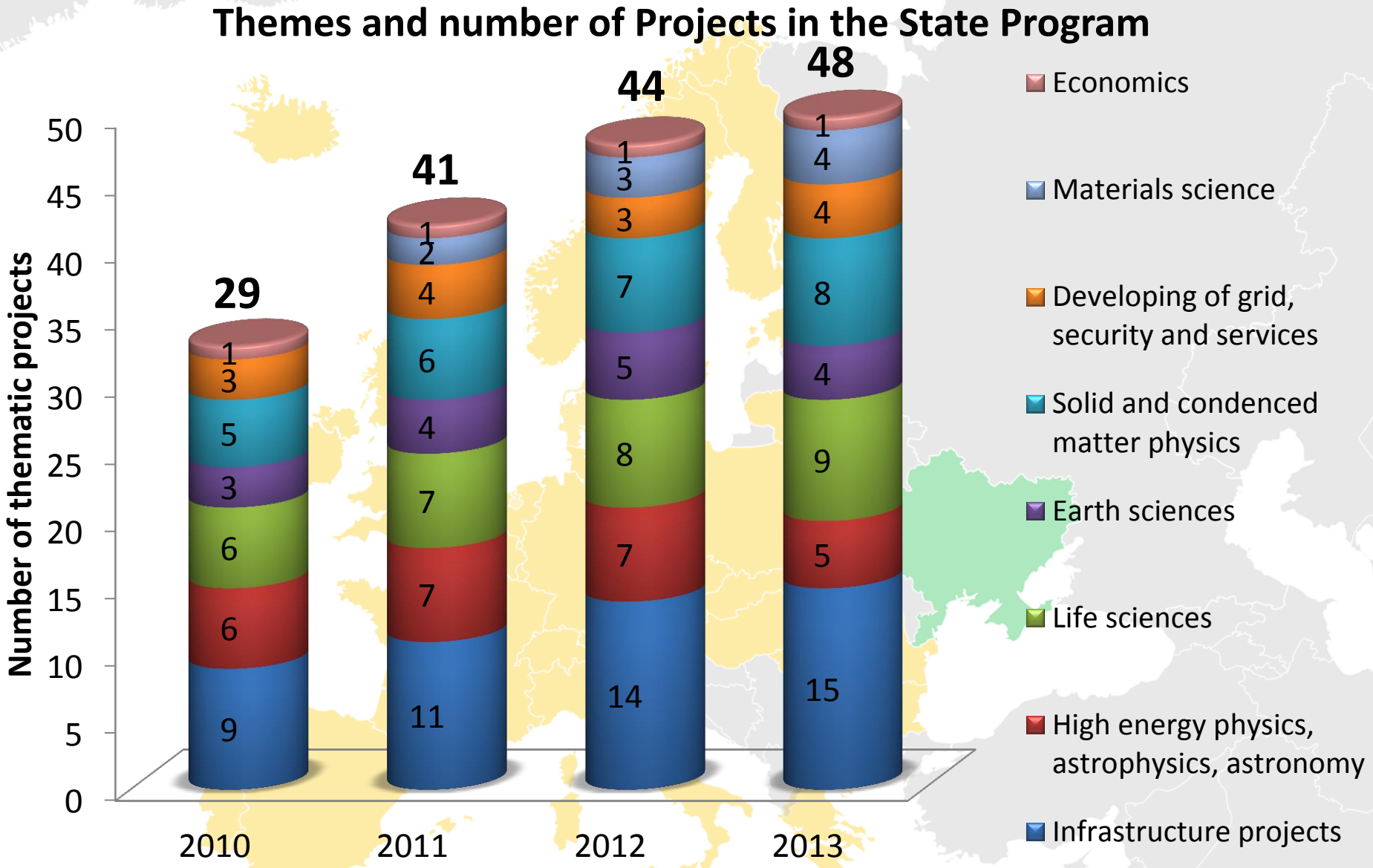
Grid Network in UNG

Data transfer channel capacity between the most powerful UNG clusters is 10 Gbps

(important in prospect)



Projects in the State Program



Only a few examples of grid applications in UNG

UNG & CERN-WLCG CERN-CMS, CERN-ALICE

Ukraine sings MoU with WLCG (Worldwide LHC Computing Grid) on April 25 in 2006.

Three clusters (KIPT in Kharkiv, BITP in Kiev, ISMA in Kharkiv) in UNG work for LHC experiments.
Very soon KNU, ICyb and KPI clusters will be involved in the ALICE grid infrastructure.

Physicists from KIPT team are co-authors of the discovery of the new boson (Higgs boson?).

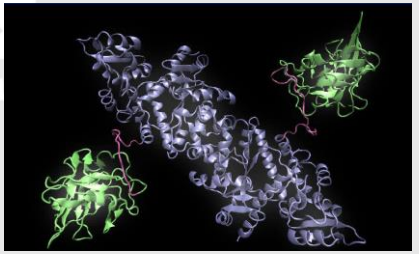
Generally, Ukrainian scientists from KIPT and BITP are co-authors of more than 250 CMS and ALICE well-known and highly cited publications.

The first clusters with EMI middleware in the ALiEn-Grid were ISMA and BITP clusters. Their experience is using for other clusters in ALICE grid-infrastructure.

The own physical models for high energy physics are developing and calculating making use of grid.

Only a few examples of grid applications in UNG

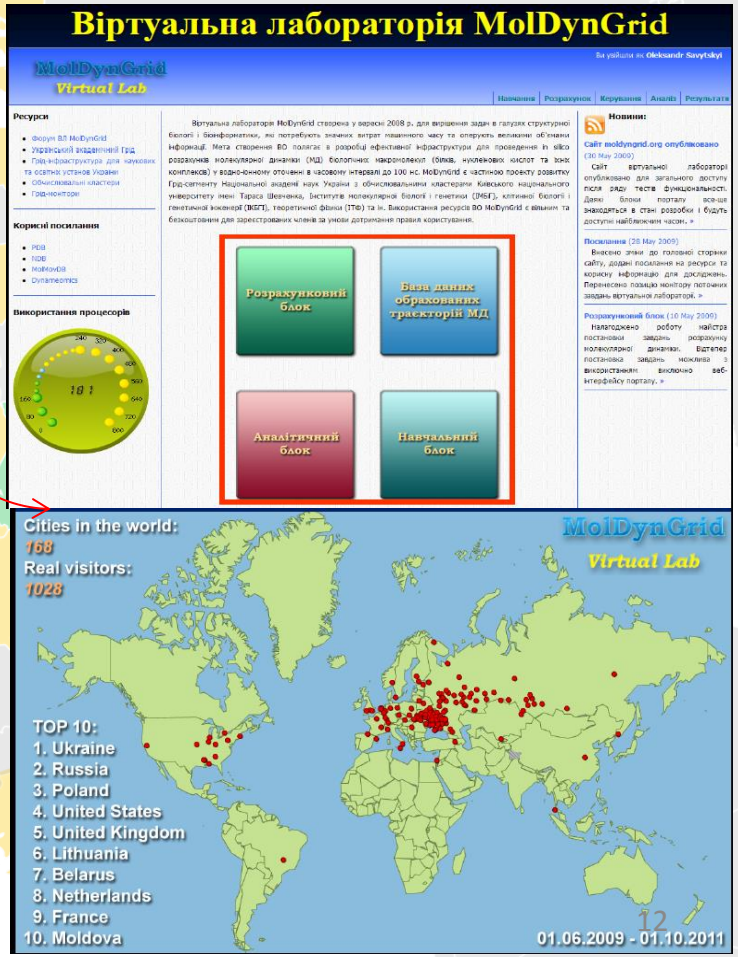
MolDynGrid VO (IMBG, KNU) and investigation of biological systems by molecular dynamics methods



Interface for users;
Bank of data for molecular dynamics trajectories;
Package “Pteros” for MD calculations and analysis *(in collaboration with Institute of Physics);*
Support of VO MedGrid (ISMA, IPMMS).

Big interest to MolDynGrid in the world;
Contacts and collaboration with

- We-NMR (A worldwide e-Infrastructure for NMR and structural biology);
- GPGPU (General-Purpose computation on Graphics Processing Units);
- Domain-oriented services and resources of Polish Infrastructure for Supporting Computational Science in the European Research Space – PLGrid Plus“;
- NorduGrid and others



Only a few examples of grid applications in UNG

Earth Sciences - **ISR, IPMMS, IGF** (Kiev), **MHI** (Sevastopol)

ISR – UN-SPIDER Regional Support Office (RSO) in Ukraine
Grid-technologies in Earth observation, hydrometeorology, biodiversity

IPMMS – mathematical modeling of the environment and creating the computer systems of forecasting and decision support on ecological safety and environmental management, energetics and energy conservation. Collaboration with many world projects.

IGF – dimensional complex geophysical models of geological structures; elaboration of technological automated systems of processing and interpretation of geophysical information; geophysical studies of the environment; forecast of seismic and other hazardous natural phenomena, in particular, implicating grid-technology. Results are important for practical applications in searching various mineral, gas and oil deposits.

MHI – Monitoring of the winds and waves in the basin of Azov and Black See. Developing of the hydrophysical model, predictions for future phenomena in the area. Many other problems and tasks related with the Black See show a huge potential for international cooperation and for global international program **"Black See"**

Only a few examples of grid applications in UNG

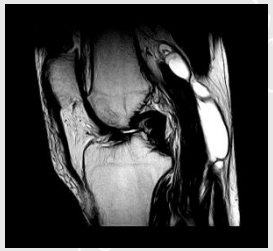
Pilot grid projects for medicine

IPMMS

Medical Grid-system for population research in the field of cardiology with electrocardiogram database

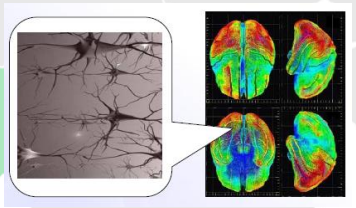
ISMA

Data base and tools for handling and analysis medical imagines



NSC MBP

Grid technology for neurosystems modeling



2013 - Three new projects in cooperation with the institutes of Academy of Medical Sciences
(data bases, handling and treatment various types of medical imagines and data)

There are other interesting grid applications in UNG (e.g. engineering, material science)

International cooperation

(impossible without well developed NRENs!)

Cooperation has to be extended

The main lessons of UNG (especially in 2012)

- ✓ **Many tasks which are solving now within UNG have not sense even to be articulated without grid**
- ✓ **Stronger links as well as the new ones between the various thematic projects, scientific institutions of different types and departmental affiliation have been established**
- ✓ **Integration with European (EGI, CERN-WLCG, NorduGrid) and global grid organizations as well as international grid projects is significantly intensified and became deeper**
- ✓ **The number of grid jobs running at UNG clusters is strongly increased in 2012** (*psychological barrier has been overcame*)
- ✓ **Many young scientists and experts (till 30 years old) were involved to perform the state program tasks**

Problems and difficulties

Internal problems

- **Nonsufficient financial support (**science budget is 0.4% of the national product instead of 1.9% in accordance with Ukrainian science law**).**

  Dangerous tendency: Only programs and projects with guaranteed economical effect must be supported.

  Fundamental researches (and generally, science) are not interesting for the current power and business companies.

- As result: **weak computational resource of UNG** (by orders less than in many European countries).

- Unfortunately **there is no an explicit interest in HPC of many applied projects** (performed often outside of NASU).

  However, grid gives an opportunity for complicated and **fast** calculations.

Problems and difficulties

“External” problems

- **Ukraine is not the member of ES, support from EU is very restricted (especially for fundamental sciences).**

- **Strong bureaucratization of all procedures in FP7, EGI and other programs, overcomplicated forms of documents.** (*It is my personal impression)*
  To satisfy the formal requirements for documents, proposals it is necessary to have special expert with perfect English and juridical knowledge (again, additional, presently lacking money).

- **Possible purchasing system for access to computational resources (and clouds) will in fact close a door for Ukrainian users** (if a current state of science in Ukraine remains) (problems above mentioned).
  I am afraid than it would be some kind of well-known “iron curtain”.

Prospects

Nevertheless we are optimists. Alternative is to stop activity.
It is not our choice.

- ✓ **We believe in a more favourable future for Ukrainian science.**
- ✓ **We will continue to develop the Ukrainian Grid Infrastructure, to increase its power, to develop new grid applications.**
- ✓ **We will try to pay more attention for applied projects, running on the base of fundamental research and results.**
- ✓ **We will search new collaborators extending area of interest, we will reinforce our participation in the international programs and projects.**

Conclusion

Let me answer on the question “protocooperation or mutualism?” in the title of my talk.

I think that now we are in the first phase, protocooperation , but the aim of our evolution is the second phase, mutualism.

The phase transition is in a progress.


THANK YOU FOR YOUR ATTENTION!