



RO-LCG 2016 "Grid, Cloud and HPC in Science"
26-28.10.2016, Bucharest-Magurele



One Decade of Computational Support for Advanced Research

- from big research to the long tail of science -

Mihnea Dulea
DFCTI @ IFIN-HH



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RO-LCG, the *Romanian Tier-2 Federation*, celebrates 10 years of existence, since the conclusion of the Memorandum of Understanding of the *Worldwide LHC Computing Grid* (WLCG) Collaboration between CERN and the National Authority for Research and Innovation.

RO-LCG operates the only distributed, high throughput computing infrastructure in RO, which was designed to provide offline compute and storage services for the ALICE, ATLAS and LHCb experiments.

In 10 years of uninterrupted operation, more than 880 million CPU hours were run within its resource centres for data processing, data analysis, and Monte Carlo simulations.

RO-LCG's achievements are closely related to the evolution of WLCG's technical program, meeting the requirements of the experiments' research strategy in what regards their computing needs. Thus, the Romanian Grid sites have recently contributed, together with the experiments, the LHC infrastructure, and the other WLCG sites, to the discovery of the first evidence of the Higgs boson.



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FIRST STEPS TOWARDS A NATIONAL GRID INFRASTRUCTURE

2002-2004: first grid clusters implemented in IFIN-HH by the ALICE and ATLAS experimental groups.

Participation in the EU grid infrastructure projects:

- EGEE - Enabling Grids for E-science” (2004-2010) / FP6 – FP7
- SEE-GRID - South Eastern European GRid-enabled eInfrastructure Development” (2004-2008) / FP6

2004-2006: first Romanian sites registered in the EGEE infrastructure as production sites

2004: National Grid Initiative

Network infrastructure in 2005:

RoEduNet – GEANT: 622Mbps

IFIN – RoEduNet: 100 Mbps

Today: IFIN 100 Gbps

GEANT: 2x 10 Gbps

Institution	Experiment	Existing resources (May 2005)			
		CPU(nr.)	CPU(GHz)	RAM(GB)	Disc(TB)
IFIN-HH	ALICE	24	6.48	9.6	4
	ATLAS	5	13.6	7	0.5
	LHCb	5	16	5	0.5
	IFIN total	34	36.08	21.6	5
ISS	ALICE	32	76.8	32	13.5
	TOTAL	66	112.88	53.6	18.5



GRID RESOURCES

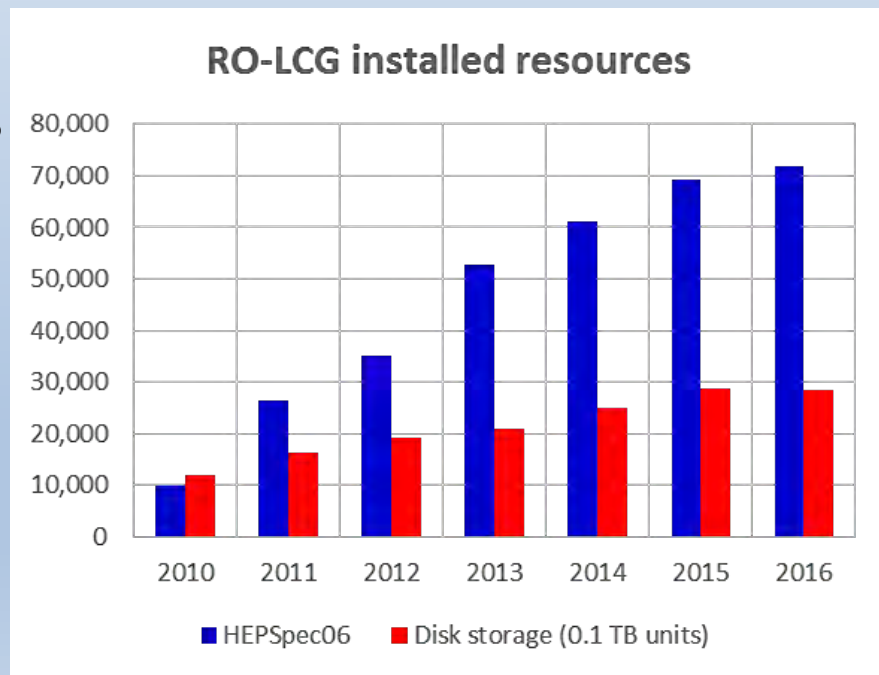
Grid activity dominated by HEP community's sites @ IFIN-HH

After 2014 the only (EGI registered) national grid resources are those of RO-LCG

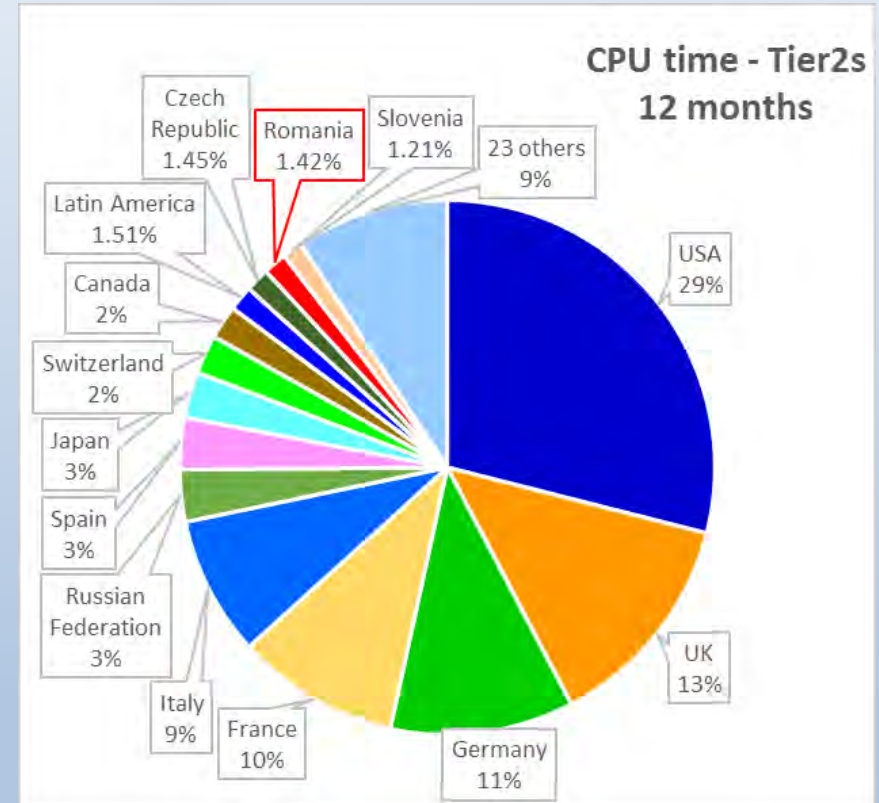
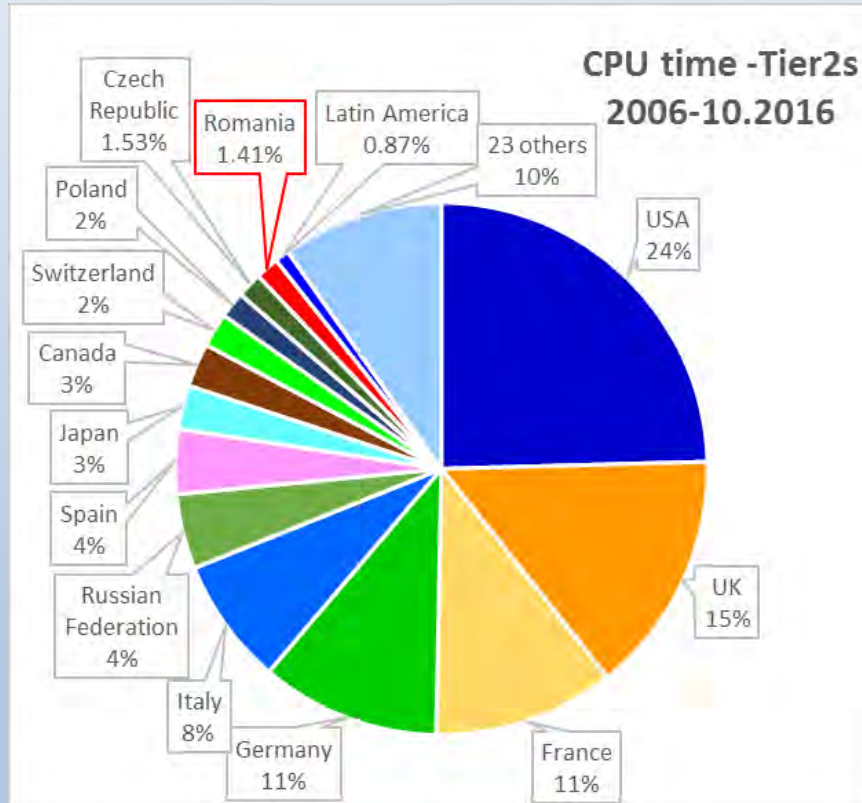
In 2016 RO-LCG ranks 11th among all the 37 Tier2 national centers regarding the resources offered for ALICE, ATLAS & LHCb.

NGI-RO: 9 registered sites, > 8000 cores, 2.8 PB

ROMANIAN GRID PRODUCTION SHARING (%)					
(source http://www3.egee.cesga.es)					
	2006	2007	2008	2009	2010
IFIN-HH	93,14	98,63	99,31	99,01	96,66
ISS	-	-	0	0,38	2,52
ITIM	-	-	-	0,26	0,02
UVT	-	0,03	0,18	0,15	0,55
UTCN	-	-	0	0,11	0,18
ICI	6,86	1,34	0,38	0,05	0,07
UPB	-	-	0,13	0,04	0,01
UAIC	-	-	-	0	0,01



RO-LCG's ACTIVITY RANKING

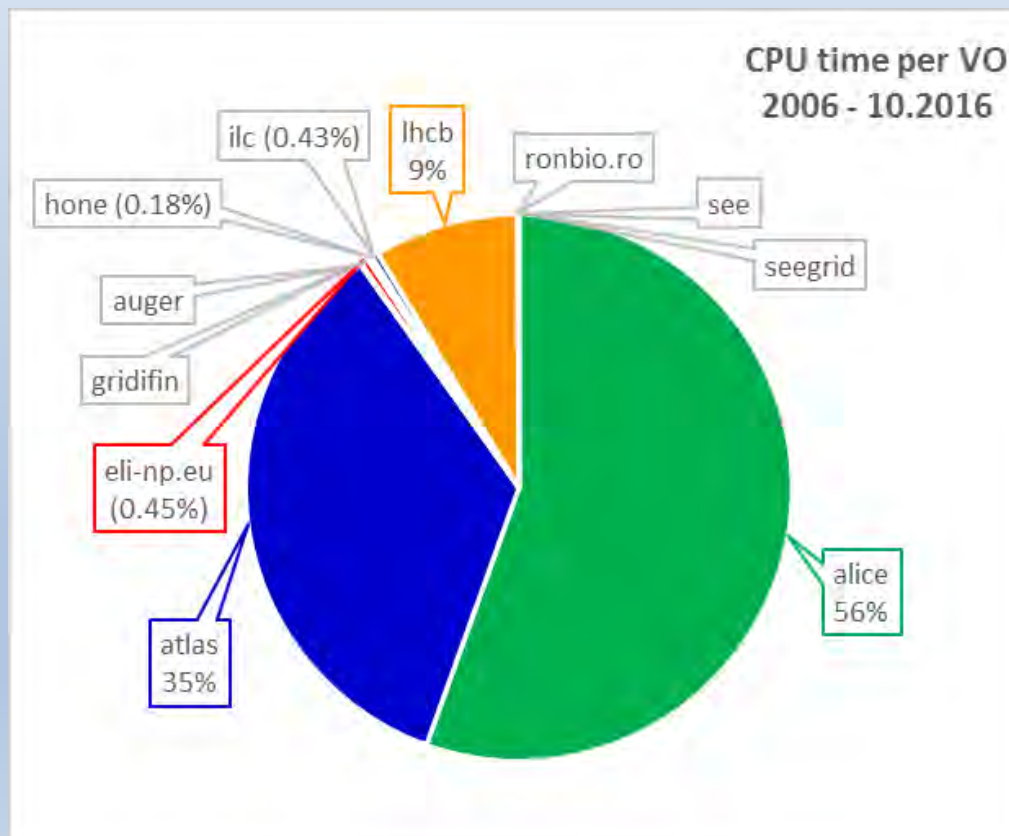


Preserving its 13th position among the Tier2 national contributions

USER COMMUNITIES

The national Grid infrastructure temporarily supported virtual research communities different from HEP (e.g. related to environmental research).

The main support during the last decade was provided for:





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HTC / HPC SUPPORT FOR ELI-NP

After the LHC VOs, **eli-np.eu** is the most active VO within NGI-RO (670,000 CPU hours ran since November 2015 on the GRIDIFIN site, that is 2.82% of the total CPU time).

eli-np.eu is the only active VO of ELI

Scientific computing & data processing

Total number of cores:	336
Type of CPU:	Intel Xeon X5650
Number of cores / node:	12 (2x6 cores)
RAM per core	3 GB
Disk storage per core:	38 GB/core (local disk)
Inter-node connectivity:	Infiniband QDR

Data storage and management

Effective stored volume:	60 TB HDD in RAID6
Connectivity (bandwidth):	Infiniband QDR (int); Ethernet 10Gbps (ext)
Filesystem:	XFS
Type of access:	NFS, GridFTP



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Installed community software includes:

Epoch 1D, 2D, 3D; FLUKA; Geant4; ROOT

Examples of currently developed computing projects

- Particle in Cell (PIC) simulations of laser plasma acceleration
- Simulation of high-power laser-target interaction, secondary particles with Geant4 and ROOT

CLOUD INFRASTRUCTURE

The CLOUDIFIN site will support: fedcloud.egi.eu, eli-np.eu

The technologies and services to be provided are based on OpenStack (Mitaka) API:

- Image replication mechanism
- Integrated view about resource/service usage
- Integrated interfaces or user environments
- virtual machine management
- block and object storage (in the near future)



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PROSPECTS

- Integration of the CLOUDIFIN site within the EGI Federated Cloud (in progress)
- National Cloud Infrastructure for Research and Education ->
-> EGI Federated Cloud -> EOSC
- DIRAC4EGI
- Later: preparation for the support of HL-LHC (High Luminosity LHC)
- NGI-RO / IFIN-HH is open to the computational support of the ESFRI projects in which Romania is involved:
 - ELI Extreme Light Infrastructure (ELITRANS H2020 project)
 - DANUBIUS International Centre for Advanced Studies on River-Sea Systems
 - EMSO EU Multidisciplinary Seafloor & Watercolumn Observatory
 - LifeWatch E-Science EU Infrastr for Biodiversity & Ecosystem Res.
 - EPOS European Plate Observing System
 - KM3Net Neutrino Telescope in the Mediterranean



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CONCLUSIONS

During the last 10 years, RO-LCG:

- has made a notable contribution to the WLCG collaboration;
- represented (and still represents) the core of the national computing grid;
- has created a valuable team of advanced computing experts with potential for developing new projects;
- has created for NGI-RO the potential and opportunities for new collaborations and projects with topics that extend beyond its initial domain.



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THANK YOU FOR YOUR ATTENTION !