



*EGI/BSUN Summer School on “Federated Digital Infrastructures
in Education, Scientific Research and Innovation”
5 - 9 September 2022*



Romanian Infrastructure for Advanced Scientific Computing (NGI-RO)

Mihnea Dulea

Department of Computational Physics and Information Technology (DECTI)
National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH)





Contents

- Romanian participation in the EGI Federation*
- NGI_RO contribution to the WLCG collaboration*
- NGI_RO contribution to EGI Federated Cloud*
- Computing resources @ NGI-RO*
- Software resources @ NGI-RO*
- Projects supporting EU/EOSC research funded from POC*
- Advanced computing @ West University of Timisoara (UVT)*
- Computing infrastructure @ 'Politehnica' University of Bucharest*

Romanian participation in the EGI Federation

EGI Council Participants			
 ACOnet	 BELSPO	 ICT	 SRCE
 CESNET	 CNRS	 Gauß-Allianz	 GRNET
 INFN	 SURF	 UKIM	 CERN
 CMCC	 EMSO ERIC	 MARIS	 CYFRONET
 FCT	 IFIN-HH	 IISAS	 ARNES
 CSIC	 TUBITAK ULAKBIM	 JISC	 Vilnius University for Lithuania
EGI Council Associated Participants			
 EISCAT	 SZTAKI	 ENHANCER	 UA-BITP

Romanian participation in the EGI Federation is strongly related to the national contribution in EU e-infrastructure projects and in RDI projects that depend on the European IT infrastructure.

In its current form of organization, it started in December 2014 as a technical necessity for supporting the Romanian contribution to the *Worldwide LHC Computing Grid collaboration* (WLCG), coordinated by CERN.

The formal representation of the national community of resource providers is made through the *Romanian Infrastructure for Advanced Scientific Computing* NGI_RO (<http://ngi-ro.ifin.ro/>).

NGI_RO currently consists of 7 members (3 research and 4 academic institutions), that signed an Agreement for membership (<http://ngi-ro.ifin.ro/docs/MoU-NGI.2021.pdf>).

Members
 'Horia Hulubei' NIRD in Physics and Nuclear Engineering
 NIRD for Isotopic and Molecular Technologies Cluj-Napoca
 Institute of Space Science
 'Alexandru Ioan Cuza' University of Iasi
 West University of Timisoara
 'Politehnica' University of Bucharest
 'Ovidius' University of Constanta

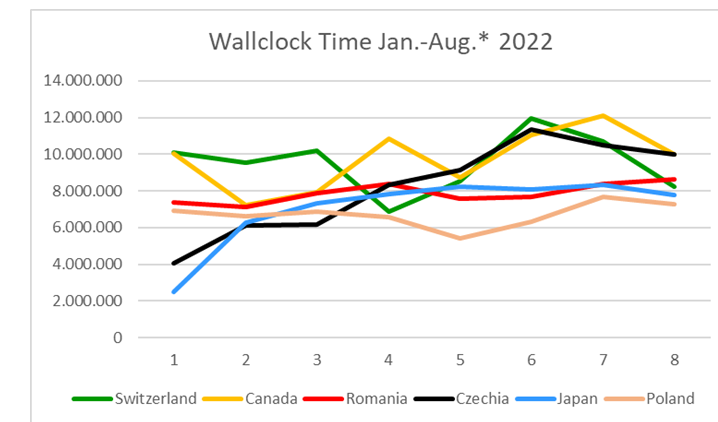
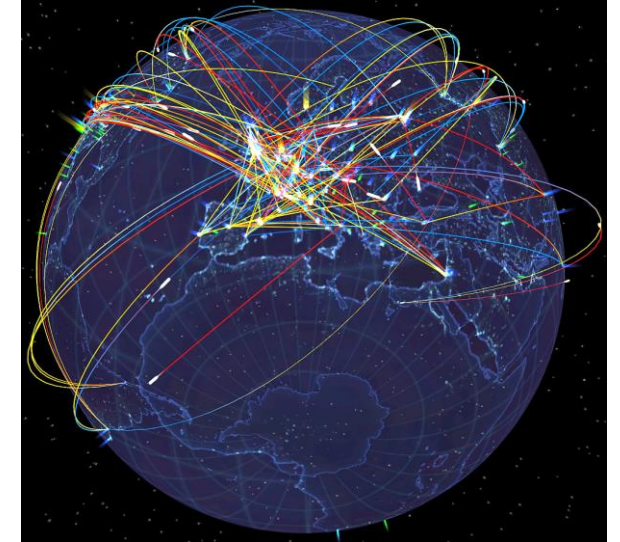
NGI_RO contribution to the WLCG collaboration

NGI_RO provides resources and Grid (HTC) services for the computational support of the ALICE, ATLAS and LHCb experiments carried out at the LHC accelerator at CERN, within the WLCG collaboration (<https://wlcg.web.cern.ch>).

LCG (the *Large Hadron Collider (LHC) Computing Grid*) consists of a distributed network of 170 computing centres (most of which are part of the EGI's 300+ centres) that offer computing, storage and HEP-specific applications for simulations and analysis of ~200 PB of experimental data produced yearly at the LHC.

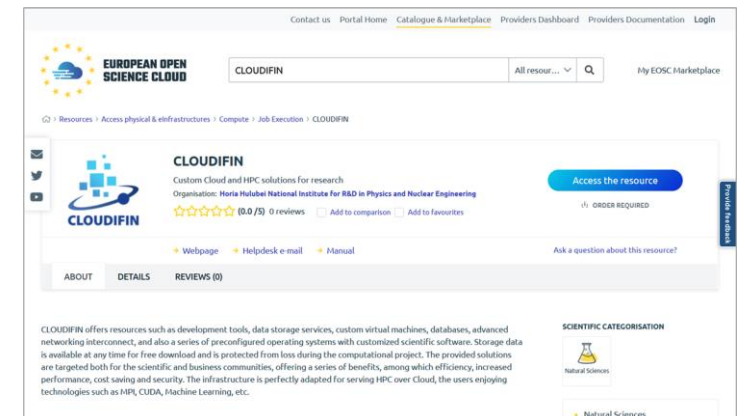
The EGI Federation provides essential services required by the WLCG distributed infrastructure: accounting; attribute management; configuration database (GOCDB); data transfer service; helpdesk service; operations portal; security coordination, online storage; validated software for the EGI infrastructure (eg middleware), etc.

NGI-RO participates in WLCG as a Tier 2 federation (RO-LCG) of 5 institutions (IFIN, ISS, ITIM, UAIC, UPB). It offers 15.000 CPU cores and 16.5 PB online storage. It ranks 9th worldwide regarding the walclock time (63 megahours (wall time), i.e. 3.3% of the total wall time provided by 27 national Tier2s for ALICE, ATLAS and LHCb (in Jan.-Aug. 2022).



NGI_RO contribution to EGI Federated Cloud

- ❑ IFIN-HH's Cloud center, CLOUDIFIN, was certified in EGI Fed Cloud in 2016
- ❑ Participation in EGI projects
 - H2020 **EOSC-Hub** - *Integrating and managing services for the EOSC (2018-2020)*
 - H2020 **EGI-ACE** - *EGI Advanced Computing for EOSC (2021-2023)*
 - DFCTI contributes to "T7.3 - HPC integration" and "WP3 - Service support".
 - Providing resources and technical support for EGI-ACE Use cases
 - "Perovskite material studies" - to be presented later
 - "Quantum Chemistry and Molecular Dynamics simulations to aid the interpretation of NMR experiments on biomolecules at ELI-NP".
- ❑ Support for other international projects
 - EGI-ESA partnership:
 - „Copernicus Space Component Worldwide Sentinels Data Access Benchmark”
- ❑ CLOUDIFIN was qualified as service provider for EOSC in 2021





Computing resources @ NGI-RO

CLOUDIFIN

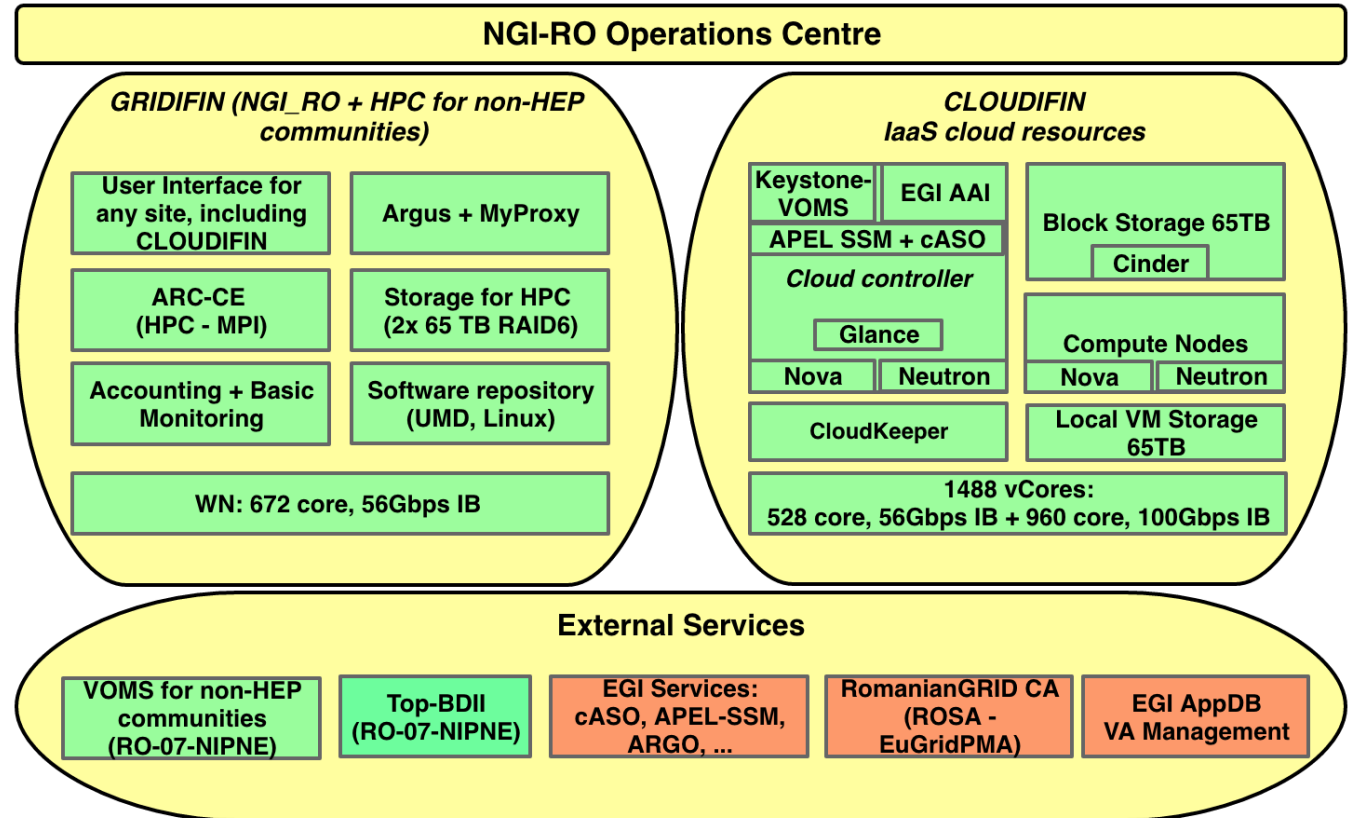
- vCores: 1488 (Intel+AMD); 4 GB RAM/core
- storage: 130 TB
- connectivity: IB EDR (960), FDR

GRIDIFIN

- supporting HTC for non-HEP communities
- VOs supported: eli-np.eu, ronbio.ro, gridifin.ro

HPC

- CPU cores: 672 + 248 (local); Intel
- storage: 130 TB
- connectivity: IB FDR, QDR
- OpenMPI 3.x





Software resources @ NGI-RO

☐ OS: CentOS 7.9

CLOUDIFIN

- OpenStack Rocky (glance, neutron, nova, cinder, horizon, etc.)
- Custom Image VM's with CentOS, Ubuntu, Debian
- uDocker

GRIDIFIN

- ARC, SLURM
- OpenMPI
- OFED (IB)

HPC

- OFED
- OpenMPI 4.x
- CUDA

Scientific Software (VM or BareMetal on HTC/HPC)

- ORCA (molecular dynamics for fullerenes)
- EPOCH (PiC for laser-matter interaction)
- NAMD (molecular dynamics)
- Siesta (DFT electronic properties)
- TranSiesta (transport)
- TensorFlow (AI)
- KERAS (AI)
- FANN 2.2. (neural networks)

Projects supporting EU/EOSC research funded from Competitiveness Operational Programme



- **Cloud and Big Data Center for participation in the European Cloud for Open Science (CeCBiD-EOSC), IFIN-HH**
"...the creation of a high-performance data center to be integrated into the EOSC"



- **Increasing UPB's research capacity in Cloud technologies and massive data processing (CloudPrecis), UPB**
"The development of Cloud services for ensuring ... interconnection to national and international networks"



- **The development of the numerical computing infrastructure of the Ovidius University of Constanta, for numerical modeling, simulation and processing of massive data structures by creating a Cloud Data Center, UOC**
"The creation of ... a high-performance Cloud infrastructure in order to integrate into international Cloud structures and massive data infrastructures"



- **The development of the INCDTIM data center for the creation of a Cloud platform, integrated in the European RDI networks**
"Creating the premises for INCDTIM's accession ... to the European initiative regarding the implementation of EOSC"



Advanced computing @ West University of Timisoara

Computer Science Department, <https://hpc.uvt.ro/>

'MOISE' POC project 2022

MOISE Project Cluster⁽²⁰²²⁾

- state of the art container based data-center;
- redundant power supply to offer 99.(9)% availability (main power line plus a generator set as a backup);
- redundant cooling and fire protection systems.
- raw compute power at a glance: 2048 cores, 16TB RAM, 16TB local storage, 210TB dedicated storage.

Hardware specifications:

Compute nodes: HPE ProLiant DL385 Gen10 (16 nodes)

Specification	Description
CPU	128x AMD EPYC 7702 2,0Ghz cores
Memory (RAM)	1024 GB
Storage	2x 480GB SSD local harddrives
Inter-connect (storage and commun.)	2x 25GbE adaptors
Other connectivity	10GbE Internet, 2x1Gbps management

Services nodes: HPE ProLiant DL385 Gen10 (3 nodes)

Specification	Description
CPU	48x AMD EPYC 7352 2,3Ghz cores
Memory (RAM)	256 GB
Storage	2x 480GB SSD local harddrives
Inter-connect (storage and commun.)	using 2x 25GbE adaptors
Other connectivity	10GbE Internet, 2x1Gbps management

Dedicated storage: HPE PRIMERA C630

Specification	Description
Storage capacity	214 TB hybrid (46TB SSD / 168TB SAS)
Storage Connectivity	8x 25GbE

BID POWER CLUSTER

IBM Power System AC922 - hostname: kratos

Specification	Description
CPU	160x Power9 3,6Ghz cores
GPU	4x NVidia V100 16GB GDDR5 with NVLink
Memory (RAM)	314 GB
Storage	2x 960GB SAS local harddrives
Remote storage	using 2x 40Gbps QDR adaptors
Inter-connect	2x 40Gbps QDR Infiniband
Connectivity	10GbE Internet, 2x1Gbps management

IBM Power System AC922 - hostname: kraken

Specification	Description
CPU	160x Power9 3,7Ghz cores
GPU	4x NVidia V100 32GB GDDR5 with NVLink
Memory (RAM)	633 GB
Storage	2x 960GB SAS local harddrives
Remote storage	using 2x 40Gbps QDR adaptors
Inter-connect	2x 40Gbps QDR Infiniband
Connectivity	10GbE Internet, 2x1Gbps management

Spectrum Scale Storage

Specification	Description
Storage capacity	1 PB (PetaByte)
Storage Connectivity	4x 100Gbps FDR Infiniband and 4x 10GbE
Software support:	developers have access to IBM specific compilers for both CPU and GPU (CUDA, IBM PowerAI for distributed deep learning)

HOST GPU CLUSTER (FP7)

7x GPU Compute Nodes

Specification	Description
CPU	2x Intel Xeon 3.46Ghz
GPU	1x NVidia Tesla M2070Q (448 cores, 6GB GDDR5)
Memory (RAM)	32GB
Storage	2x 250GB NL-SAS local harddrives
Remote storage	using 2x40Gbps Infiniband;
Inter-connect	2x 40Gbps FDR Infiniband
Connectivity	10GbE Internet, 2x1Gbps management

Storage Server

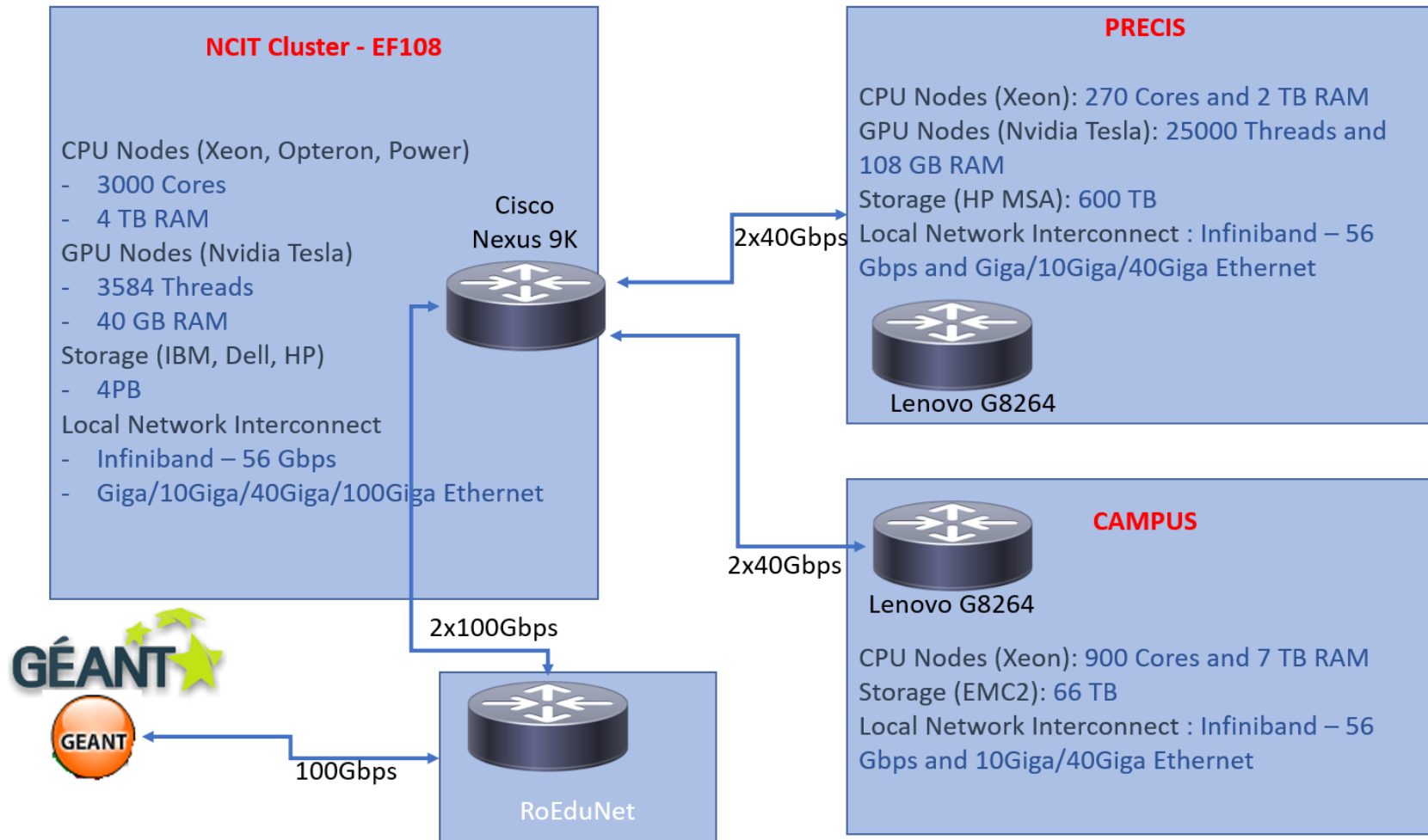
Specification	Description
Storage capacity	600x 300GB SAS harddrives; 18TB total raw storage
Storage connectivity	8x 8Gbps FC (IO nodes), 2x 40Gbps IB (network)

Software support: access to GNU Compilers, Intel XE Compilers, software libraries like MPICH2, OpenMP etc.

Software upgrades: GPFS licenses; LoadLeveler Workload Scheduler; Intel Cluster Studio XE (compilers, debuggers);

Computing infrastructure @ 'Politehnica' University of Bucharest

□ Computing Science Department, <https://cs.pub.ro/>





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THANK YOU FOR YOUR ATTENTION !