NEW NETWORK DESIGN FOR THE GRID INFRASTRUCTURE

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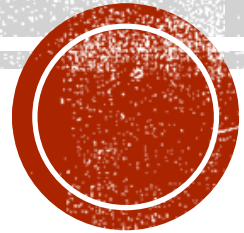

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❑What is GRID Computing.

Grid computing is the collection of computer resources from multiple locations to reach a common goal. – according to: https://en.wikipedia.org/wiki/Grid_computing

Grid computing is a distributed architecture of large numbers of computers connected to solve a complex problem. – according to: http://searchdatacenter.techtarget.com/definition/grid-computing

A scientist studying proteins logs into a computer and uses an entire network of computers to analyze data. A businessman accesses his company's network through a PDA in order to forecast the future of a particular stock. An Army official accesses and coordinates computer resources on three different military networks to formulate a battle strategy. All of these scenarios have one thing in common: They rely on a concept called **Grid computing**. – according to: http://computer.howstuffworks.com/grid-computing.htm

Started almost 14 years ago, as a need defined by the High Energy Physics communities used to analyse and process the data sets generated by CERN and presented as "Experiments at CERN generate colossal amounts of data. The Data Centre stores it, and sends it around the world for analysis" , is generating a tremendous load for all the computing infrastructure all over the world.

"**Approximately 600 million times per second, particles collide within the** Large Hadron Collider (LHC). Each collision generates particles that often decay in complex ways into even more particles**. Electronic circuits record the passage of each particle through a detector as a series of electronic signals, and send the data to the CERN Data Centre (DC) for digital reconstruction**."

https://home.cern/about/computing

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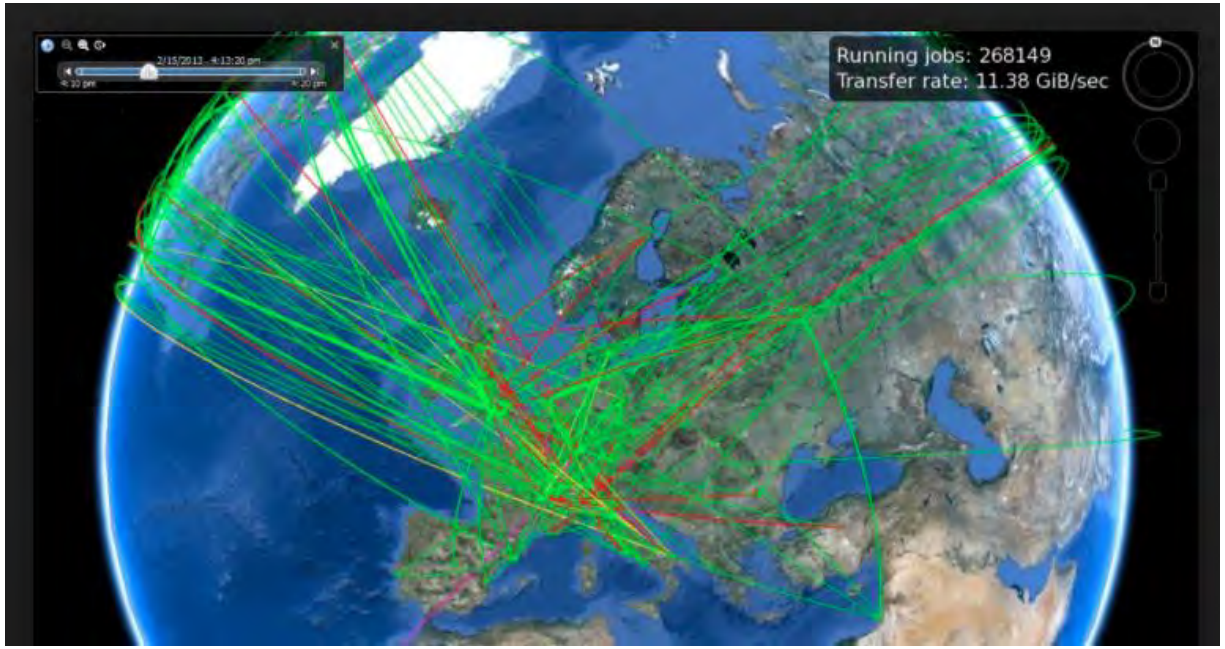

How it works:

- **Tier 0 (CERN, and Wigner in Hungary) is storing the data sets emerging from the Data Acquisition, those centers are doing the initial processing of the data and Tape Storage. The data is than distributed to Tier 1's.**
- **Tier 1 – Data centers that have Data Storage pledged to each experiment, are offering a big amount of Computing Power (10th of thousands of cores) that require access to large raw data sets for the data analysis and simulations.**
- **Tier 2 – Smaller data centers that will have da Data made available by the T-1's, mainly smaller sites that are organized and maintained by collaborating Research Institutes or Universities, supporting mainly users tasks**
- **Tier 3 – Small local clusters , dedicated to an experiment, deployed by a group of users or an individual PC**

The Worldwide LHC Computing Grid (WLCG) is a global collaboration of computer centres. Started 2002 to provide a resource to store, distribute and analyse the 15 petabytes (15 million gigabytes) of data generated every year by the Large Hadron Collider (LHC).

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RO-LCG provides Grid resources and services through 7 computing centres:

1. Resource centres

RO-13-ISS (alice)
RO-14-ITIM (atlas)
RO-16-UAIC (atlas)

2. Resource centres (of the experimental groups @ IFIN-HH)

NIHAM (alice) RO-02-NIPNE (atlas) RO-11-NIPNE (lhcb) , RO-07-NIPNE (alice, atlas, lhcb)

Computing: ~ 8000 cores Storage: 2.8 PetaBytes

All those aspects issue many requirements for the connectivity such as:

- High Speed Data Transfers to/from multiple places
- Stable links as the site has to provide a good uptime
- Bandwidth/Latency monitored (perfsonar is deployed for each site).
- Redundancy for the backbone connections of the grid sites
- SLA to be implemented for the connections

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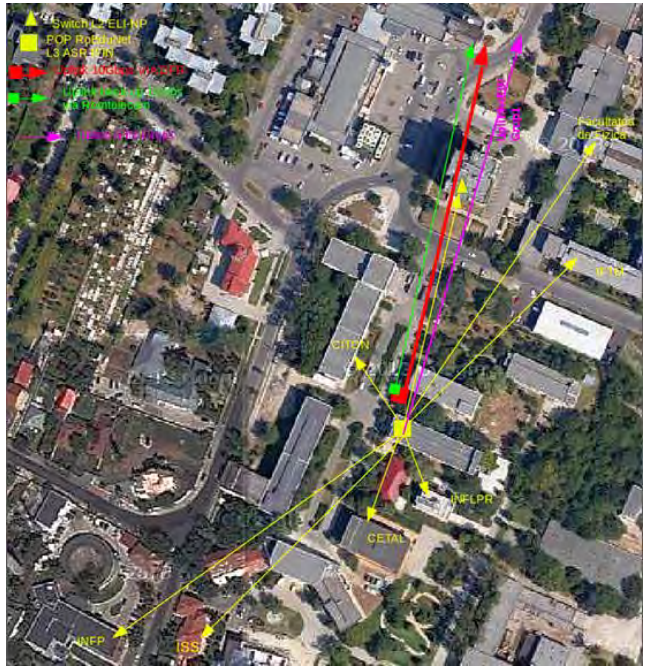
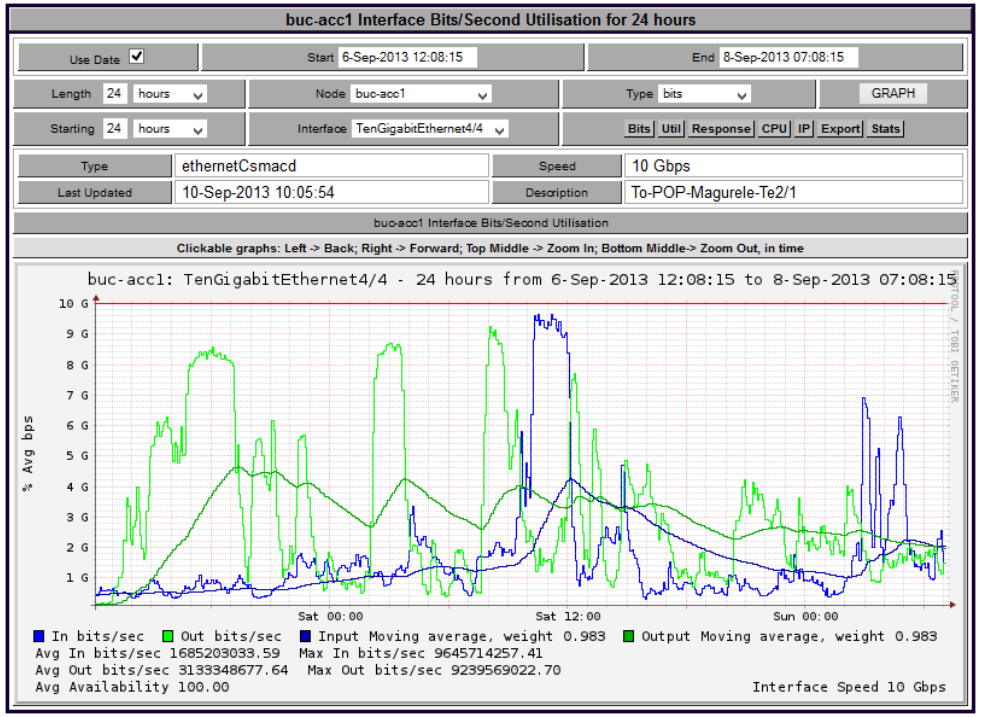


DFCTI provides access to RoEduNet for 9 institutions and 5 grid sites located in Magurele.
These grid sites are connected by DFCTI to the NREN's NOC through a 10 Gbps link and backups.
Since 2013, DFCTI hosts the Magurele PoP (point of presence) of the RoEduNet.
Due to the massive transfer of WLCG data, the in/out traffic is occasionally reaching values close to the bandwidth limit (see below).
Performance issues were carefully handled and redundancy is made for all the networking equipments and links



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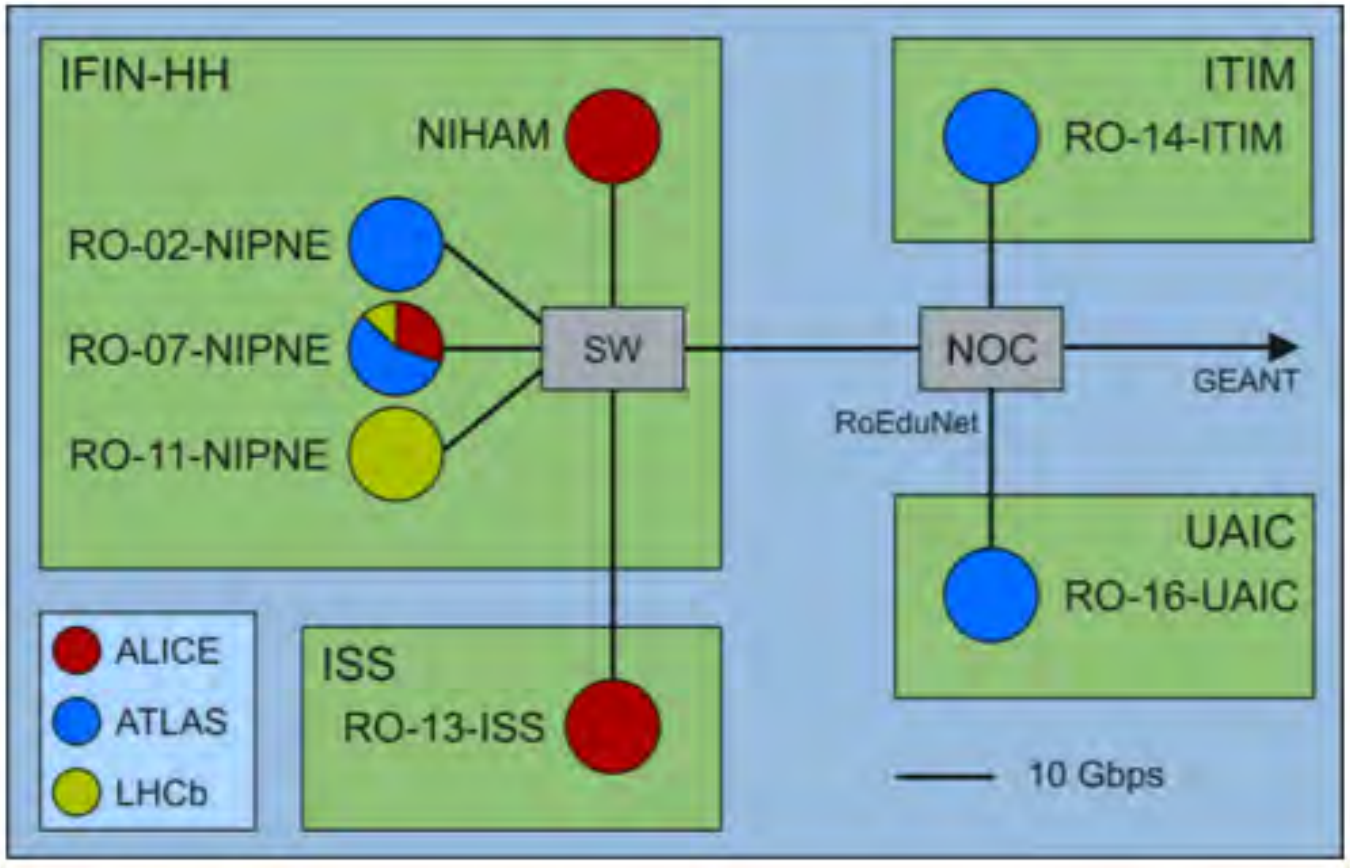

Problems on this design:
- Single IPV4 broadcast domain
- No redundancy for the distribution layer
- Multiple sites in the same Layer 2 network

Technical design proposal covers:
- Ip addressing issues
- Splits the broadcast domains
- Reliability and availability
- Virtual gateway for HA.

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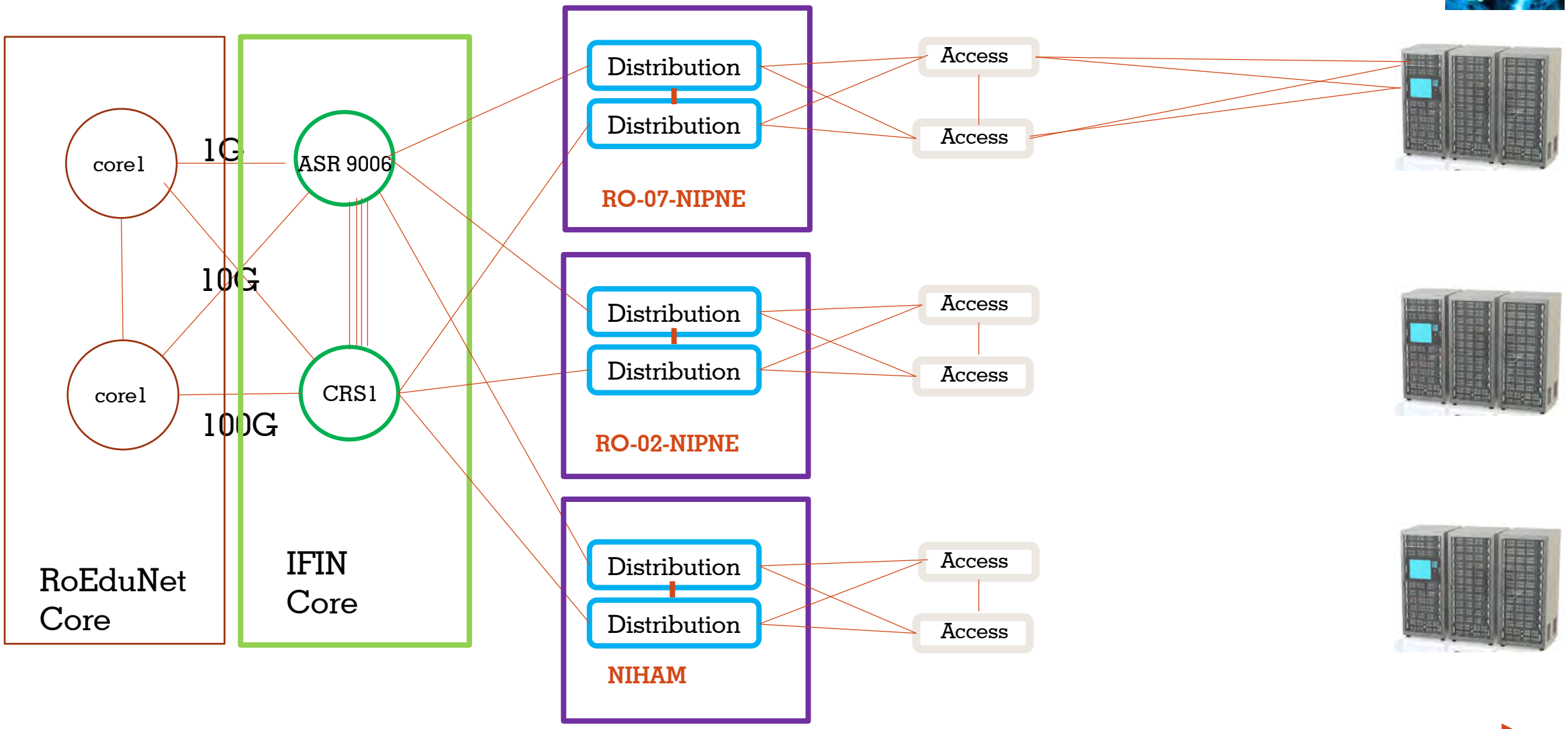

Done in 2014-2015

Physical connection finished this year

2017

Thank you for your attention!!!