Operating an Optical Private Network: the lessons learned from LCG

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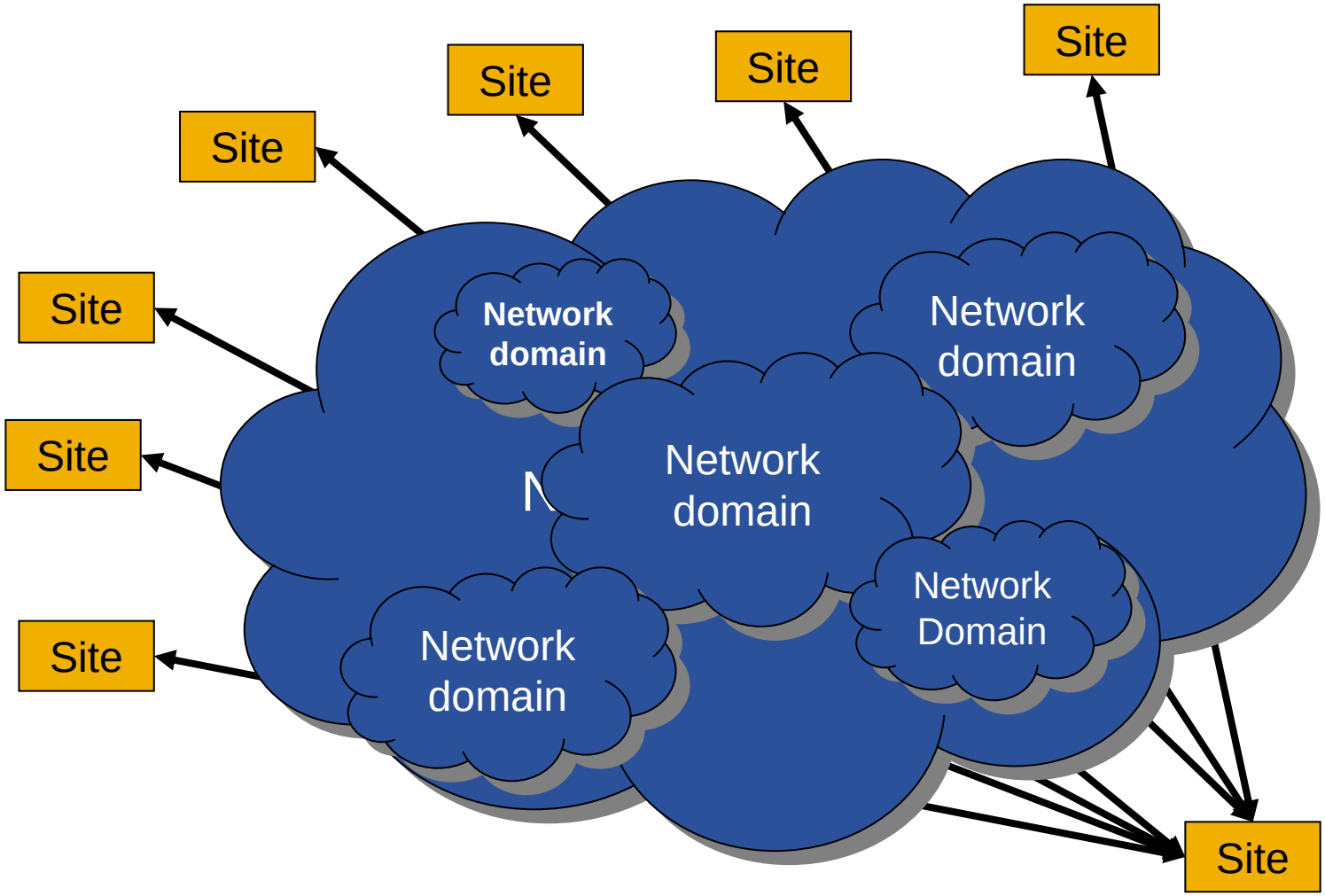
Outline

- **Introduction:**
  - Context description
  - Operational problematic
- **The End-to-End coordination unit:**
  - Scope and responsibilities
  - Requirements
- **The project NOC (aka EGEE NOC):**
  - Roles
  - Tools
- **How do they interact?**
- **Conclusion**

The context


Site
Site
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Site
Site
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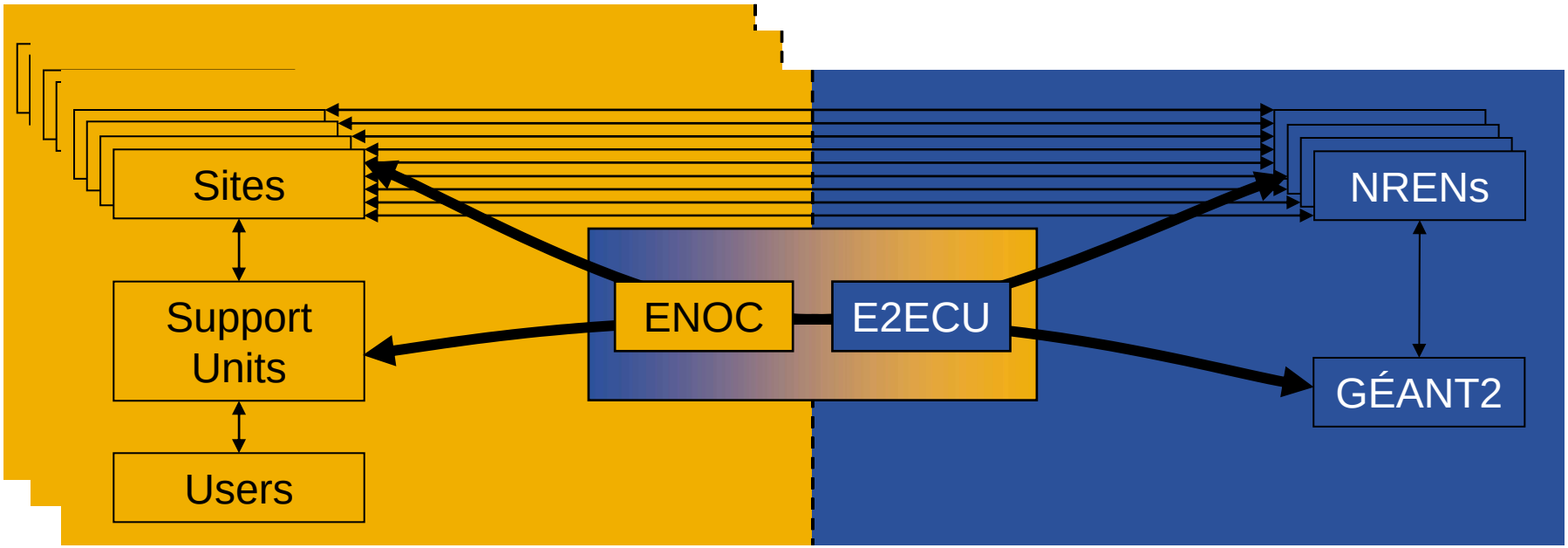
Site
Site
Network domain
Network domain
Network domain
Network domain
Network Domain
Site

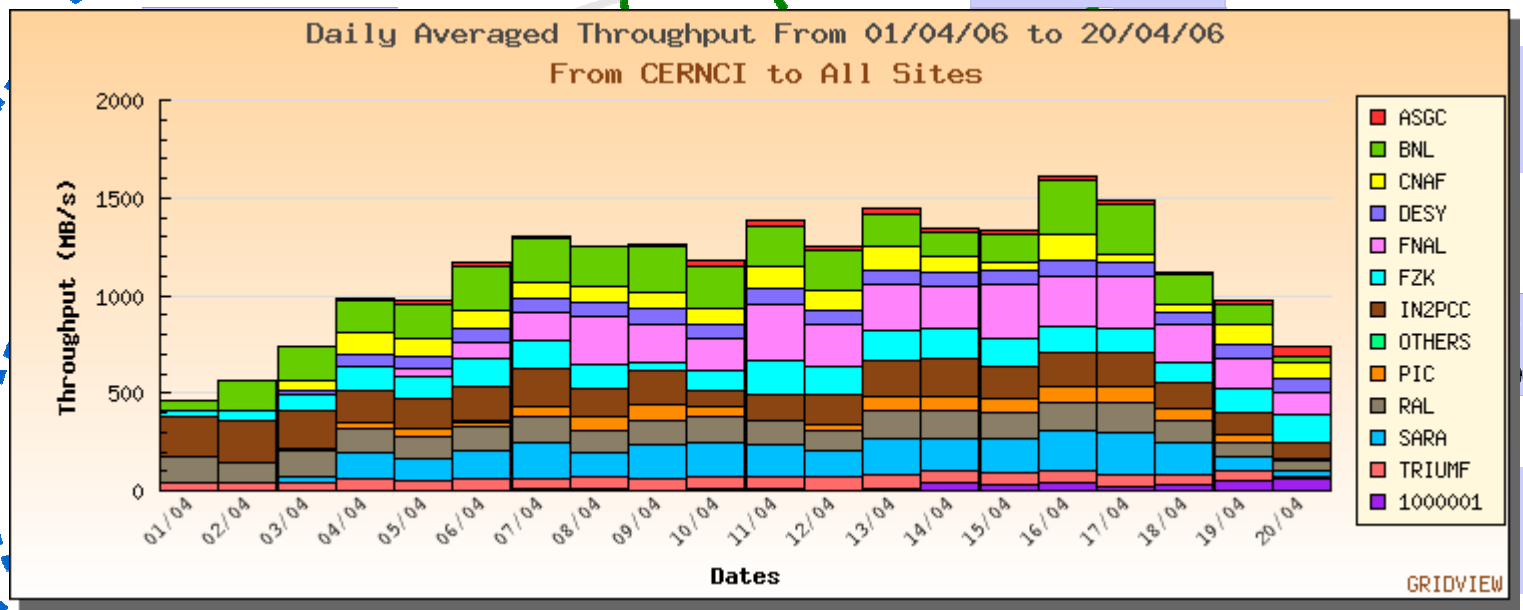
Operational issues



- **Multi-domains issues**
- **Streamline the communication channels**
- **Central repository:**
  - Filter the information
  - Consolidate the information (impact assessment)

The LHC Optical Private Network

Courtesy of Edoardo Martelli, CERN



TRIUMF
AS36391
206.12.1.0/24

BNL
AS43
130.199.185.0/24
130.199.48.0/23
192.12.15.0/24

SARA
AS1126
145.100.32.0/22

GRIDKA
AS34878
192.108.45.128/25
192.108.47.0/24

CNAF
AS137
192.135.23.0/24
131.154.128.0/17

Local NREN
SURFnet
USLHCnet
GN2 p2p
Cross Border fibre
Upcoming
(thick) 10Gbps
(thin) less than 10Gbps

= Alice = Atlas = CMS = LHCb

End-to-End Coordination Unit

- **Purpose:**
  - To communicate the state of international end-to-end circuits (transiting GN2) to all appropriate entities (transit domains, end-sites)

- **Responsibilities**
  - Monitor (indirectly) the state of all end-to-end circuits
  - Receive reports from all involved entities of changes to circuits (faults, planned maintenance)
  - Advise all entities of known changes to circuits (learned from direct reports and E2ECU monitoring)
  - Escalate (and receive escalations about) unresolved issues

EGEE Network Operations Centre

- **Purpose:**
  - Administer the EGEE “overlay” network

- **Responsibilities:**
  - Act as EGEE’s single point of contact with European networks
  - Receive notifications about network faults and planned maintenance, and inform EGEE users about the resulting impact
  - Troubleshoot suspected network problems reported by EGEE users
  - As appropriate, establish Service Level Agreements (SLAs) with individual networks
  - Monitor SLA compliance

Scope of responsibilities

- **ENOC:**
  - All EGEE end-user networking requirements
  - Handle the “service” provided to the user

- **E2ECU:**
  - Only concerned with end-to-end circuits in optical private networks
  - Only concerned with circuit outages (identifying and reporting)

- ***Some* possible overlap:**
  - E.g. Campus net administrators may be mailed e2e circuit outage info by E2ECU, and may also see this information in the project ticketing system.

The End-to-End Coordination Unit

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Key points

- **E2ECU concerned only with operational status of end-to-end circuits:**
  - aka “lightpaths”, “point-to-point circuits”, “optical circuits”, “wavelengths”, “lambdas”, etc.
  - On/Off status of (the sections of) the circuits
- **By extension, E2ECU is *not* concerned with:**
  - IP status of point-to-point circuits (ENOC)
  - End-site IP network connectivity (ENOC/NRENs)
  - Provisioning new point-to-point circuits (GN2/NRENs)

Description

- **Fault detection on inter-domain and domain links for End-to-end links**
  - Supervision of the e2e links (through PerfSONAR)
  - Fault/Maintenance announcement → Trouble Tickets
- **Co-ordination**
  - Setup of the links
  - Troubleshooting of the issues
- **Provide monthly report to DANTE**
  - Describe the e2e links availability and tickets opened
  - One monthly report per project

E2ECU status

- **0.5 FTE, collocated with the GÉANT2 NOC**
  - Since the beginning of the year
  - Not limited to LCG: currently IGTMD, probably DEISA later
- **Trouble Tickets**
  - Sends TTs to registered users per project
  - Each user will receive the TTs related to their project but not for other projects
- **Database**
  - Spreadsheet with e2e links information and entities to contact:

E2E links ID / Responsible NOC of the links / Contact phone numbers - emails

  - DANTE is cooperating with GÉANT2 for future common DB
- **Monitoring Tool (NAGIOS) modified for E2ECU**
  - Plugins and files developed to receive, filter, save and treat the E2ECU traps

E2E links monitoring

Start page

E2ECU view

All E2E Links
Problem Links

Domain view

CERN
DFN
ESNET
FERMI
GARR
GEANT2
IN2P3
REDIRIS (?)
RENATER (?)
SURFNET
SWITCH
USLHCNET

Project view

IGTMD
LHCOPN

Availability Statistics

Current Month
Last Month

E2E Links for Project LHCOPN

E2E Link ID	State Oper	State Admin	Additional Info
CERN-FERMI-LHCOPN-001	Up	Normal Oper.	
GRIDKA-SARA-LHCOPN-001	Up	Normal Oper.	Error: E2E Link is **not** contiguous (End Point missing or gap found) Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
GRIDKA-IN2P3-LHCOPN-001	Down	Normal Oper.	Error: E2E Link is **not** contiguous (End Point missing or gap found) Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-BNL-LHCOPN-001	Up	Normal Oper.	
CERN-SARA-LHCOPN-001	Up	Normal Oper.	
CERN-GRIDKA-LHCOPN-001	Up	Normal Oper.	
CERN-FERMI-LHCOPN-002	Up	Normal Oper.	Error: E2E Link is **not** contiguous (End Point missing or gap found) Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-SARA-LHCOPN-004	Up	Normal Oper.	Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-CNAF-LHCOPN-001	Up	Normal Oper.	
CERN-SARA-LHCOPN-002	Up	Normal Oper.	Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-RAL-LHCOPN-001	Up	Normal Oper.	Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-BNL-LHCOPN-002	Up	Normal Oper.	Error: E2E Link is **not** contiguous (End Point missing or gap found) Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-SARA-LHCOPN-003	Up	Normal Oper.	Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-NDGF-LHCOPN-001	Up	Normal Oper.	Warning: Operational state is not known for all involved links Warning: Administrative state is not known for all involved links
CERN-IN2P3-LHCOPN-001	Up	Normal Oper.	
CNAF-GRIDKA-LHCOPN-001	Up	Normal Oper.	

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E2E links monitoring (cont.)

Status of E2E Link CERN-FERMI-LHCOPN-001

Time of State Aggregration: 2007-04-27, 11:26:39 MEST (Cycle time: 60 s.)
Operational State: Up
Administrative State: Normal Oper.

Domain	CERN		USLHCNET					ESNET				
Link Structure	EP	◄·····	·····►	DP	◄——►	DP	◄·····	·····►	DP	◄——►	DP	◄·····
Type	EndPoint	ID Part.Info	ID Part.Info	Demarc	Domain Link	Demarc	ID Part.Info	ID Part.Info	Demarc	Domain Link	Demarc	ID Part.Info
Local Name	**CERN-T0**	S513-C-BE1	CERN-FERMI-LHCOPN-001-GVA-CERN	**USLHCNET-GEN**	CERN-FERMI-LHCOPN-001-GVA-CHI	**USLHCNET-CHI**	CERN-FERMI-LHCOPN-001-CHI-ESNET	CERN-FERMI-LHCOPN-001-STARLIGHT-Tail	**ESNET-STARLIGHT**	CERN-FERMI-LHCOPN-001-FERMI-STARLIGHT	**ESNET-FERMI**	CERN-FERMI-LHCOPN-001-Site-Tail
State Oper.	-	Up	Up	-	Up	-	Up	Up	-	Up	-	Up
State Admin.	-	Normal Oper.	Normal Oper.	-	Normal Oper.	-	Normal Oper.	Normal Oper.	-	Normal Oper.	-	Normal Oper.
Timestamp	-	2007-04-25 T11:18:57+02:00	2007-04-25 T11:18:50+02:00	-	2007-04-25 T11:18:14+02:00	-	2007-04-25 T11:18:48+02:00	2007-04-27 T09:25:56.0	-	2007-04-27T09:25:56.0	-	2007-04-27 T09:25:56.0

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The project NOC

aka the EGEE Network Operations Centre

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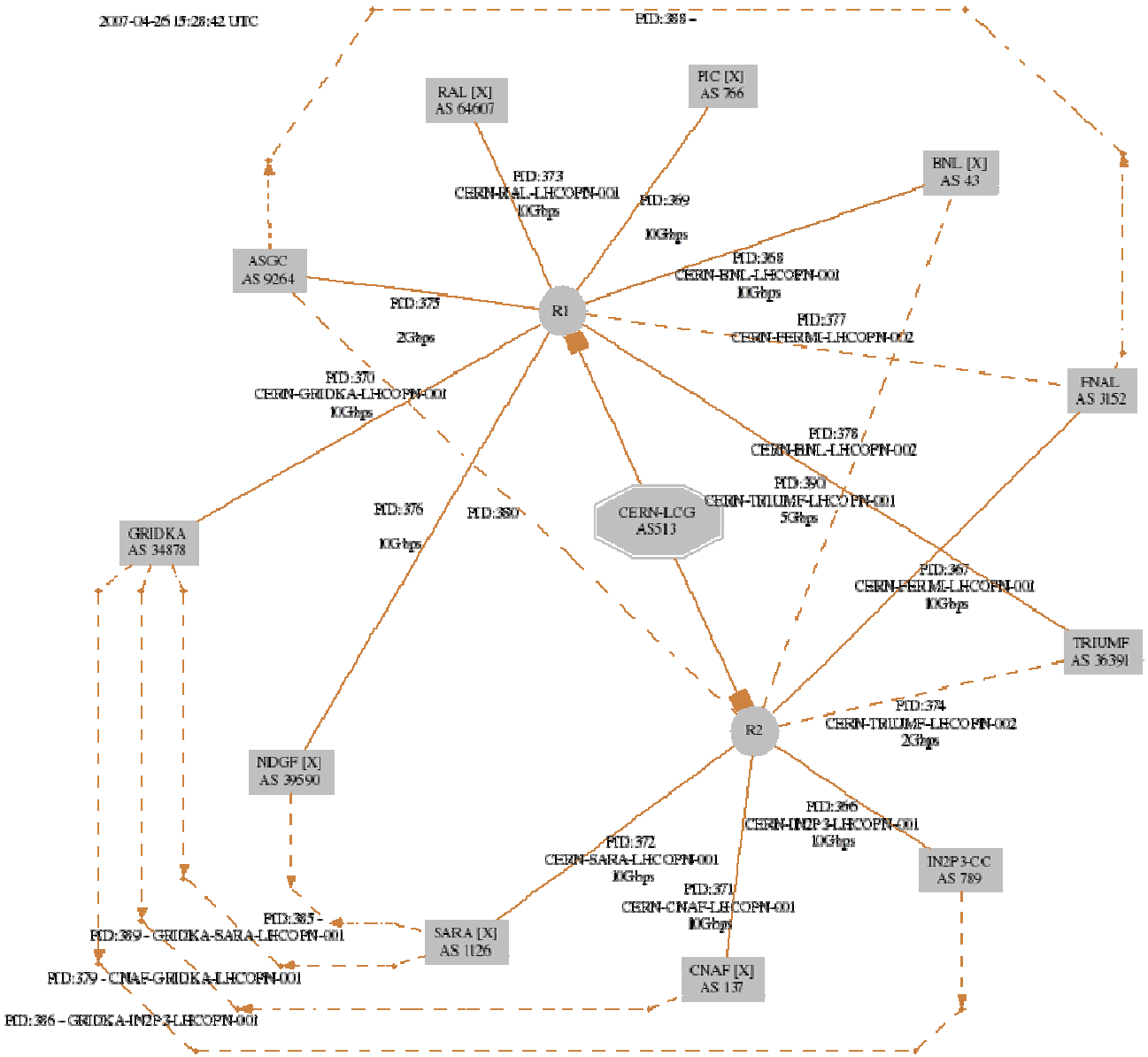
Description

- **Service level support:**
  - Assess the impact of an incident in the OPN
  - Warn the involved entities (sites, user support)
  - Follow up issues filled in a ticketing system and concerning the OPN
- **Do not modify the equipments!**
  - Responsibility of the sites
  - Only a coordination role
- **Tools needed:**
  - Database to represent the network
  - Routing status of the OPN (prototype ready)
  - Monitoring of the status at the IP level (PingER to be deployed)

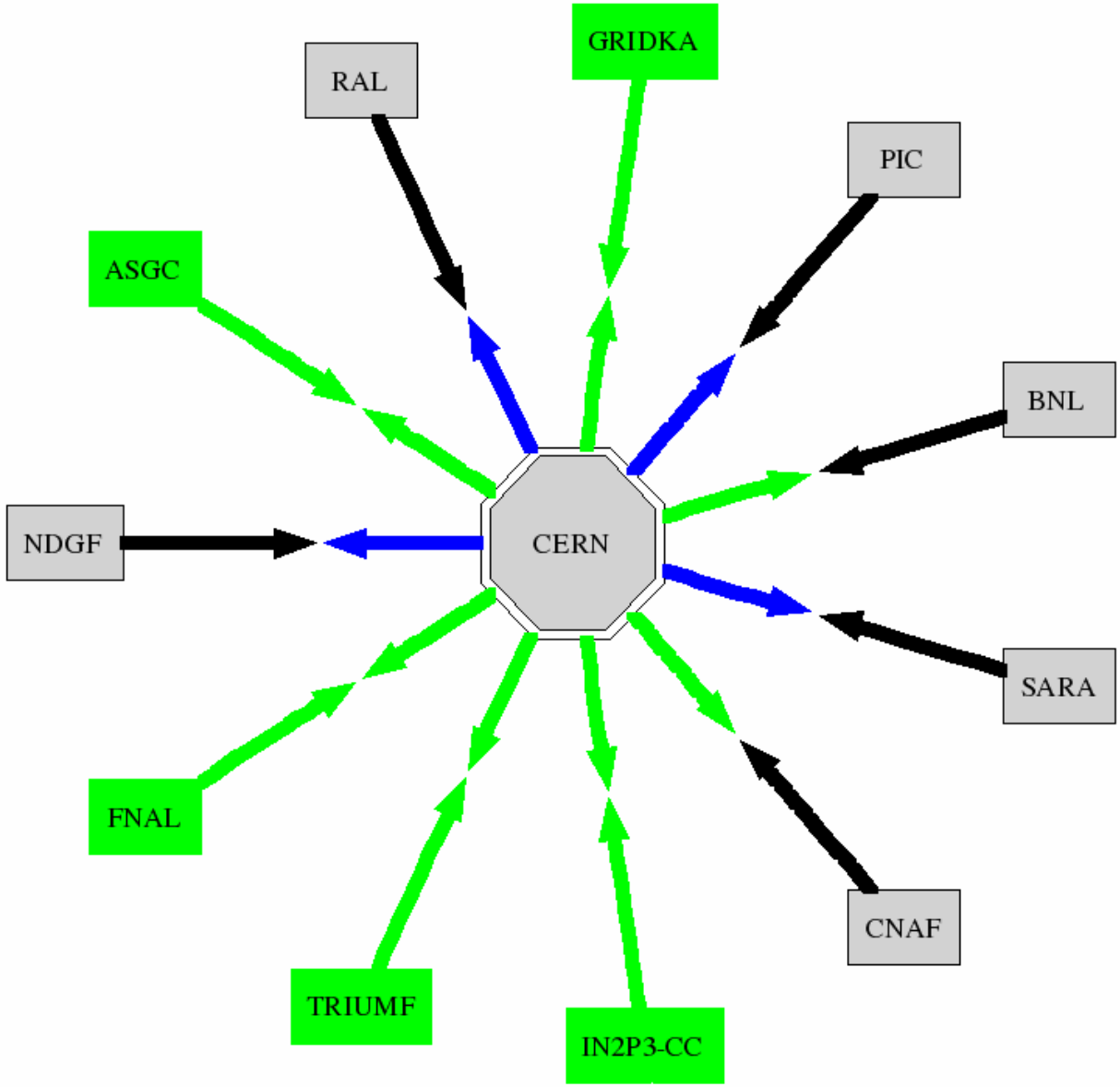
ENOC status

- **Fully implemented at the beginning of EGEE-II:**
  - Based on the prototype run during EGEE
  - 2 FTEs dedicated to it in a single place (CC-IN2P3, Lyon FR)
  - Documents describing tools and procedures:
    - *ENOC implementation*: https://edms.cern.ch/document/725295/
    - *Assessment of the ENOC*: https://edms.cern.ch/document/817091/
- **Not limited to the OPN:**
  - Same kind of role for the standard IP connectivity of sites
  - Network support unit for the EGEE overlay network (~300 sites over 40 countries)
  - Scalability level improved: effort invested towards a high level of automation of the procedures

OPN representation



OPN routing status



Interactions & procedures

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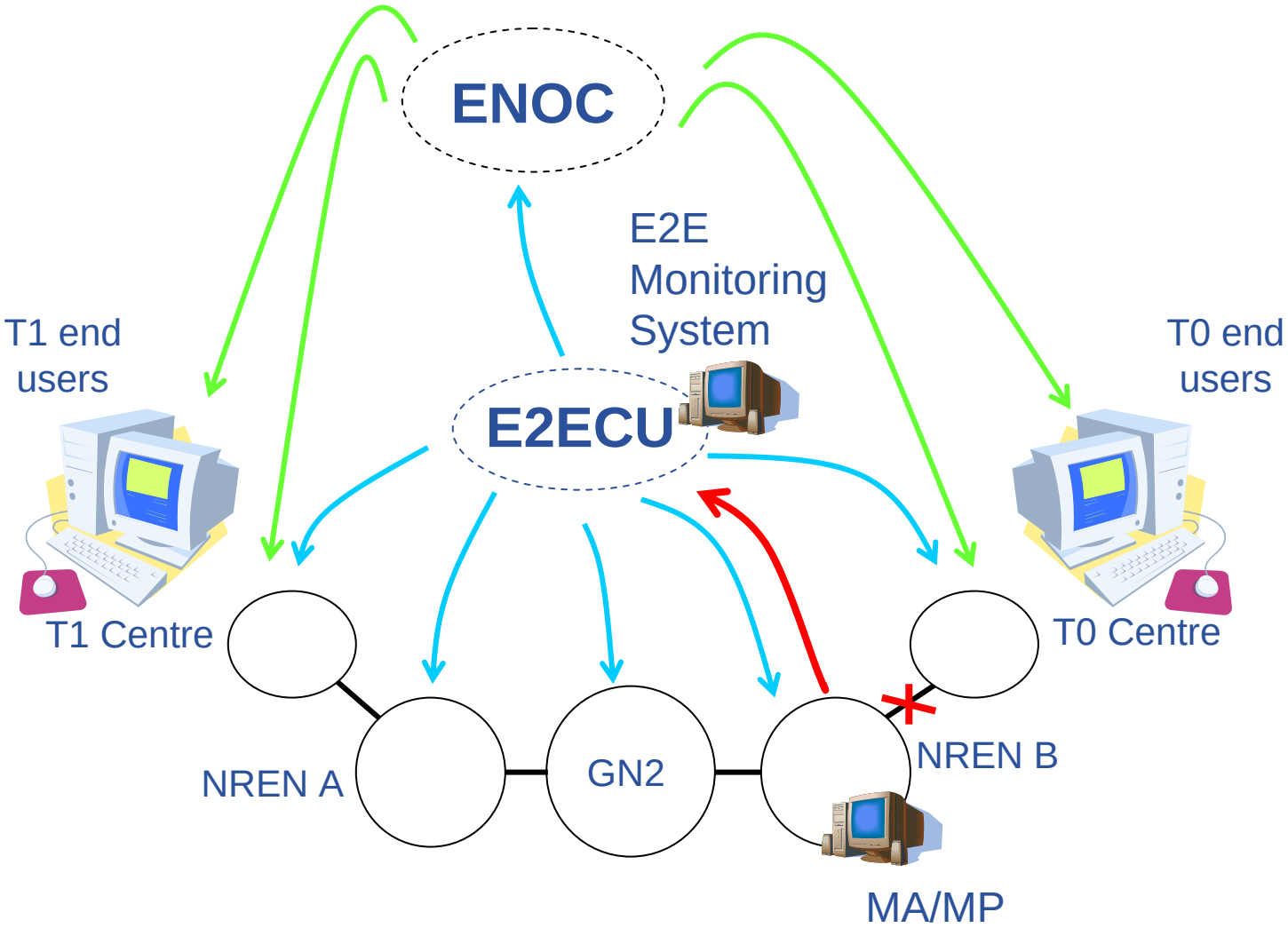
Circuit Fault Reporting



Procedures

- **Procedures are mostly in place:**
  - Currently being formalized, capitalizing on the experience gained during the first few months of running
  - Should encompass all the involved entities (NRENs, E2ECU, ENOC, sites, project user support)
- **Details processes to follow:**
  - Requirements in terms of tools deployment, responsibilities, roles and actions
  - Communication processes (who is responsible for what)
  - Escalation procedures
  - Reporting
- **Nothing really new and that is not commonly done in today's network providers…**

Conclusion

- **With e2e circuits, one (project, institute, etc.) can build a global multi-domain network:**
  - Means that you also need to **operate it!**
- **GÉANT2 provides now the interface for projects:**
  - The End-to-End Coordination Unit
- **The project/institute/… should provide its counterpart:**
  - Especially if the network is complex!
  - Requirements also in terms of deployment, monitoring
- **Procedures formalization:**
  - Depending on the requirements
  - Should leverage the experience gained so far in EGEE/LCG, DEISA, etc.
  - Not all issues solved: need to elaborate as soon as they pop up

EGEE'07 Conference

Building Bridges…

- Between Science and business
- Between users and infrastructures
- Between countries
- Between scientific disciplines
- Between projects

http://www.eu-egee.org/egee07

Thank you for your attention!

Questions?