Connect. Communicate. Collaborate

GÉANT2 and the GRID

Domenico Vicinanza

DANTE

EGEE 08 Meeting, Istanbul 22-26 September 2008

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AGENDA

Connect. Communicate. Collaborate

- GÉANT2 Introduction
- Multi Domain Operations
  - AutoBahn
  - Multi Domain Monitoring: perfSONAR
  - E2E Mon
- Multi Domain Services Support and Monitoring
- Conclusions

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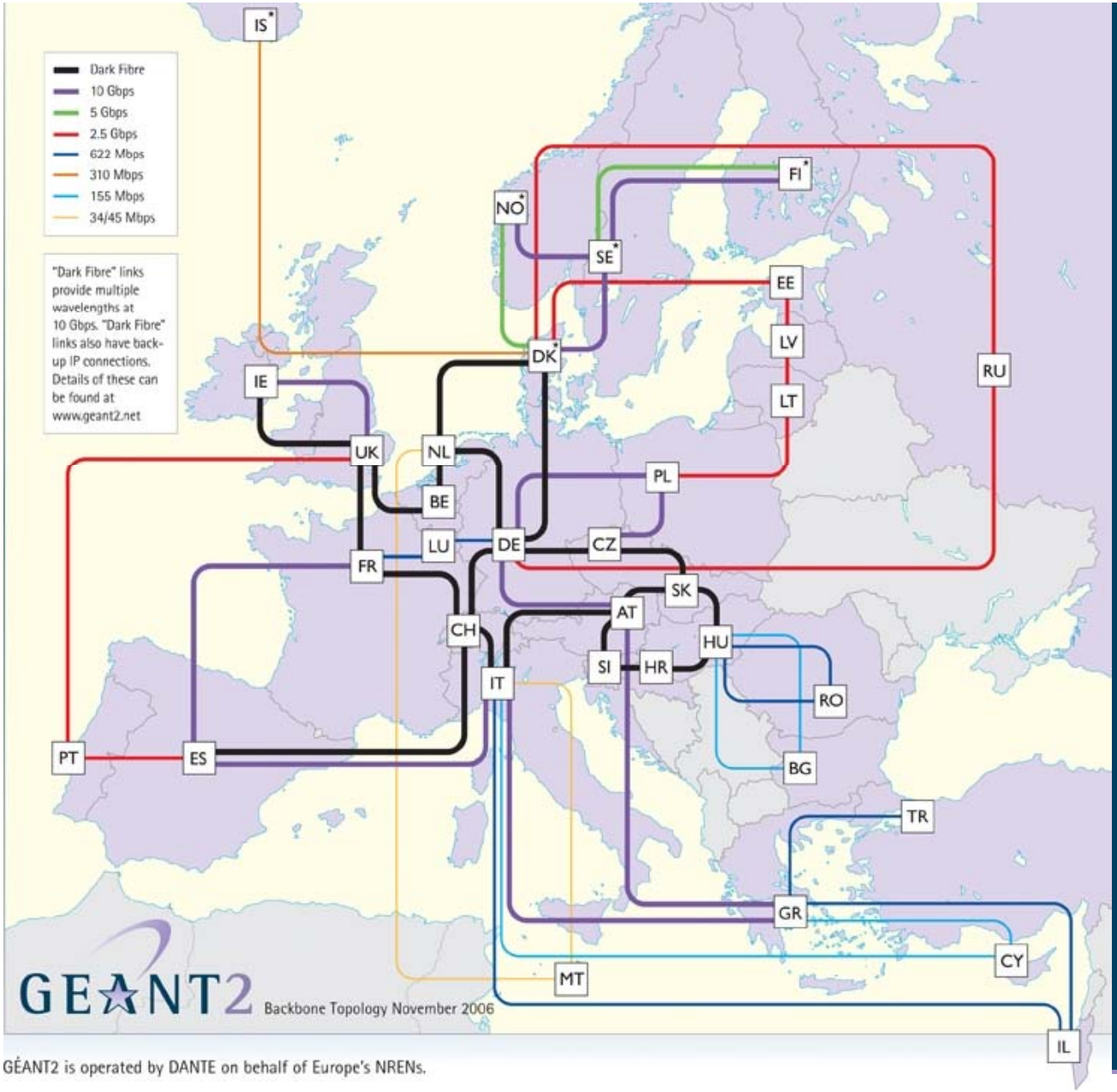

GÉANT2 is operated by DANTE on behalf of Europe's NRENs.

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GÉANT2 Topology

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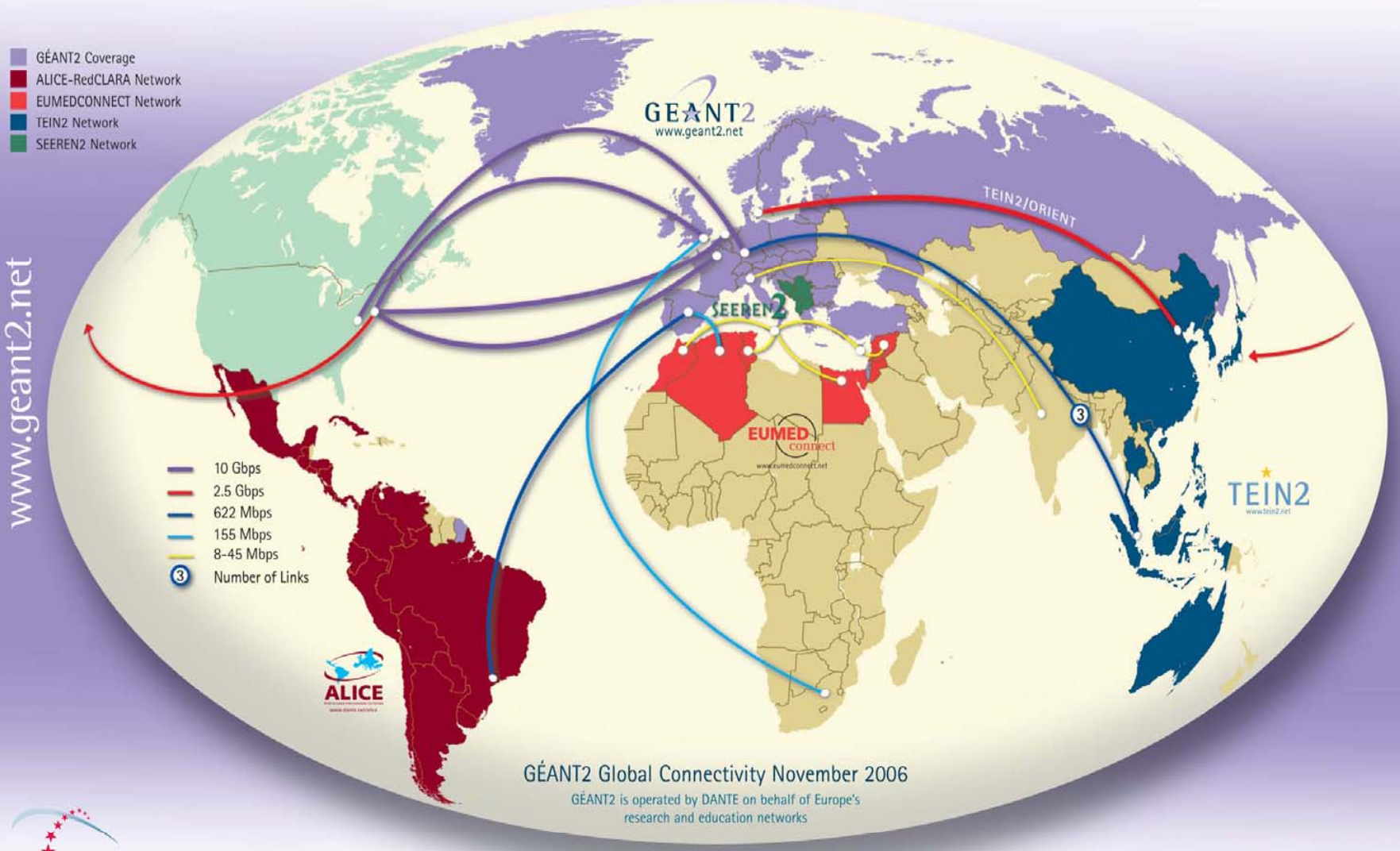
GÉANT2 At the Heart of Global Research Networking



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European Commission
Information Society and Media

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GÉANT2 Vision

- Enable physicists, astronomers and researchers around the world to share their resources, their data and their knowledge
- Provide the best possible network connectivity
  - High Quality, Tailor-Made, Affordable
- Different stakeholders working together to provide a quality service
  - that reaches the users!
- GÉANT2 is not just a backbone network!

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What have we achieved?

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- Pan-European Hybrid networks
- Advanced IP services
- Lambda and circuit services
  - Since 2006 GÉANT2 provides pure wavelengths and GE circuits to interconnect NRENs across Europe
  - Currently ~50 point-to-point connections crossing Europe
  - More than 0.3 Tbps capacity dedicated to projects such as DEISA, LHCOPN, Express, Phosphorus
  - Aiming to provide these services across different world regions.

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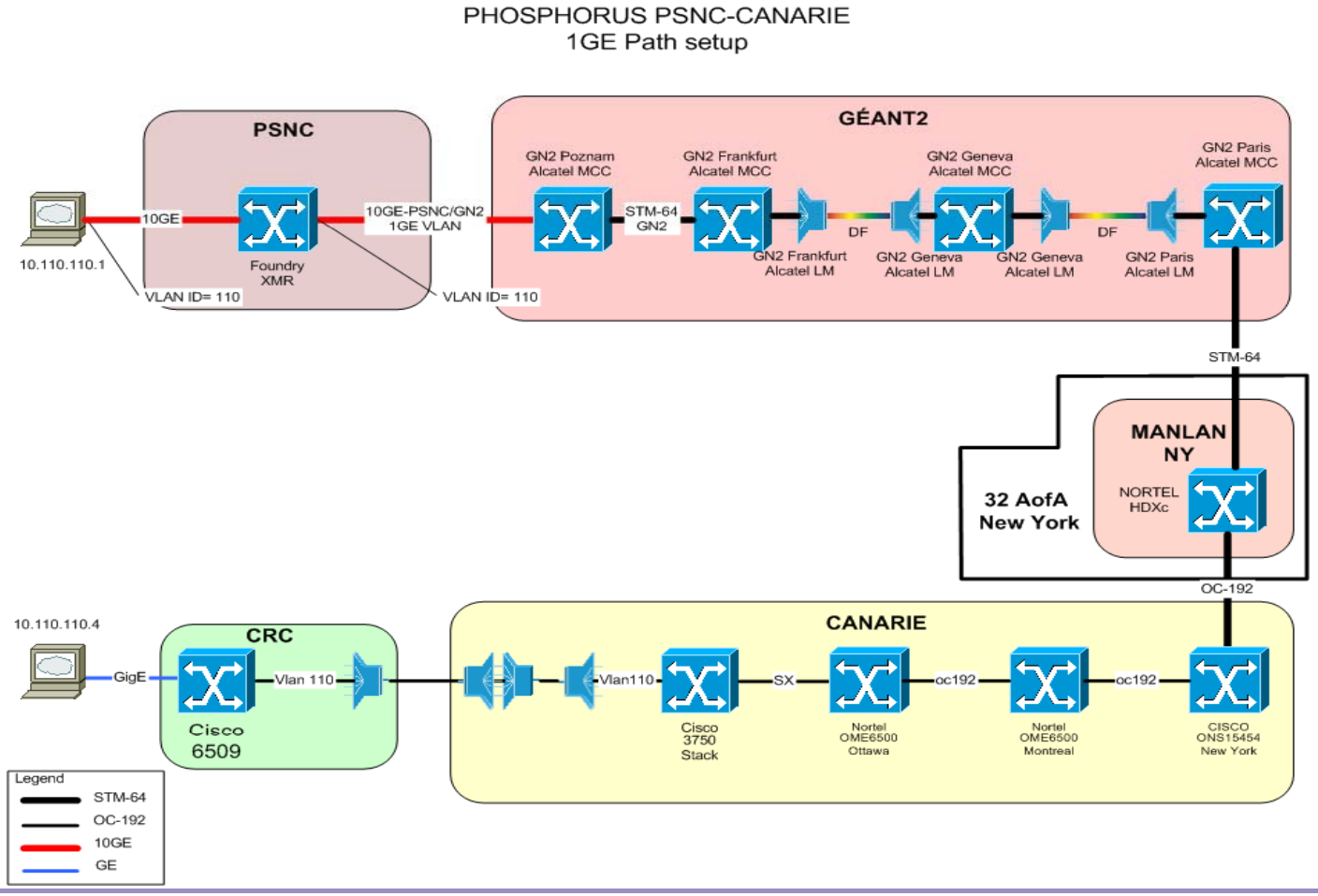
Phosphorus – CRC – PSNC



Lessons Learnt

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- Extra effort is required in order to set up the inter-domain parts of the connection: Multiple technologies
- Domain controlled tests are not always enough
- Domain controlled monitoring tools do not always help in the end-to-end connectivity supervision
- Each stakeholder has its own SLAs and business models
- How can we make sure that our operational model is scalable?

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What do we need?:
Multi Domain Operations

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- Several GÉANT2 activities are focused in supporting Multi Domain Operations
- Objective: Delivery and support of multi domain services as one ‘virtual’ domain from the end user point of view
- Challenges: Deliver a **complex** service packaged in an **simple** format at an **affordable** operational cost

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Multi-Domain Operations:

Reducing operational costs
IP services monitoring
Lambda services monitoring

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Multi Domain Operations-1: Reducing Operational Costs

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- Automated Provisioning of a service
  - AutoBahn

- Efficient Delivery of Service Levels guaranteed to the customers:
  - Ease fault detection and resolution
    - Monitoring: perfSONAR, E2EMon
  - Ease communication between stakeholders
    - i-Share
    - eduGAIN

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Automated Bandwidth Reservation: AutoBahn

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- Demand for Ethernet Private Line circuits growing in GÉANT2
- Bandwidth on Demand could:
  - Improve the customer experience by providing circuit booking
  - Possible reduction in network operation overhead
- Solution:
  - AutoBahn (Automated Bandwidth Allocation across Heterogeneous Networks)

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AutoBahn

- Service architecture tailored to the needs of the multi-domain, multi-technology pan-European research and education community.
- On demand dedicated circuits
  - spanning multiple countries
  - multiple networks
  - administered by different entities
  - using different technologies.

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Multi Domain Operations-2: Monitoring for IP services

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- Hardware and software distributed across Europe (within GÉANT2 network and the NRNs)
- It gives a global view of the network connectivity and performance
- Defined set of parameters:
  - One Way Delay
  - Bandwidth (BWCTL)
  - Link utilization, Link Status, errors, drops:
    - Cacti, RRD MA

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Monitoring for IP services: perfSONAR MDM tool

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- GÉANT2 multi-domain monitoring (MDM) tool: perfSONAR
- Objective:
  - Correctly, efficiently and quickly identify network problems
  - Provide fast, reliable and uninterrupted network communication
  - Track issues across multiple domains
- Strategy:
  - cross-domain monitoring capability
  - access network performance metrics from across multiple domains
  - perform network monitoring actions in different network domains
  - network problems and performance bottlenecks can be traced and eliminated quickly
  - proactively identify and prevent problems before service disruption occurs

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perfSONAR MDM: accessing network information across several domains

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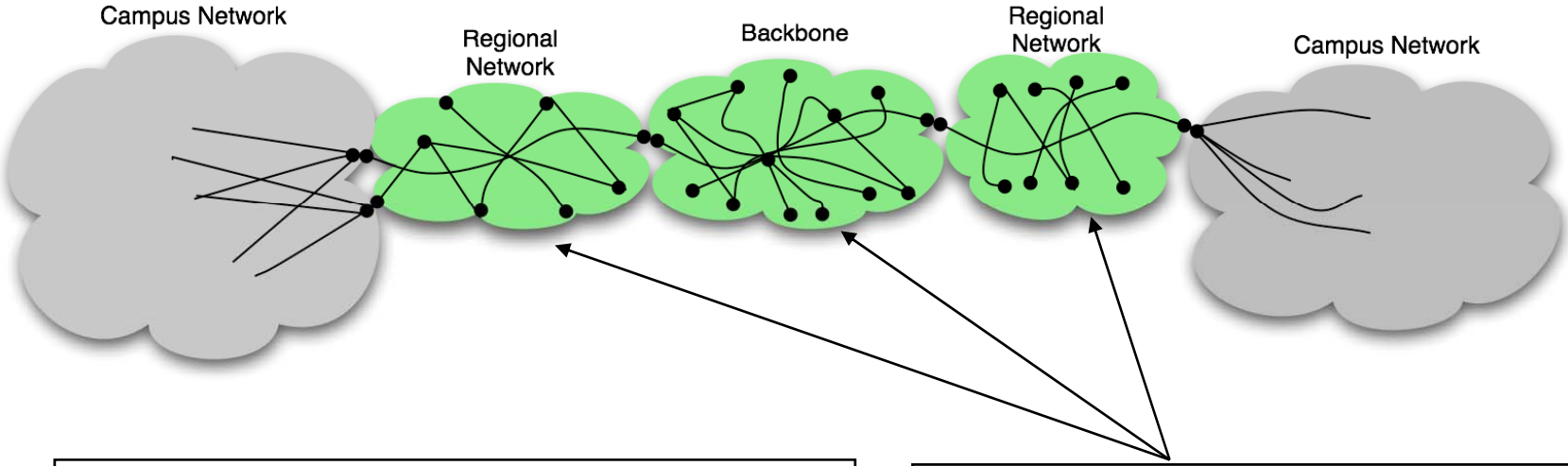

perfSONAR is carried out by a consortium of organisations (GEANT 2, ESnet, Internet 2 and RNP)

perfSONAR aims at making it easier to solve end-to-end performance problems on paths crossing several networks.

Authorized users can have access to network performance for diagnosis and troubleshooting

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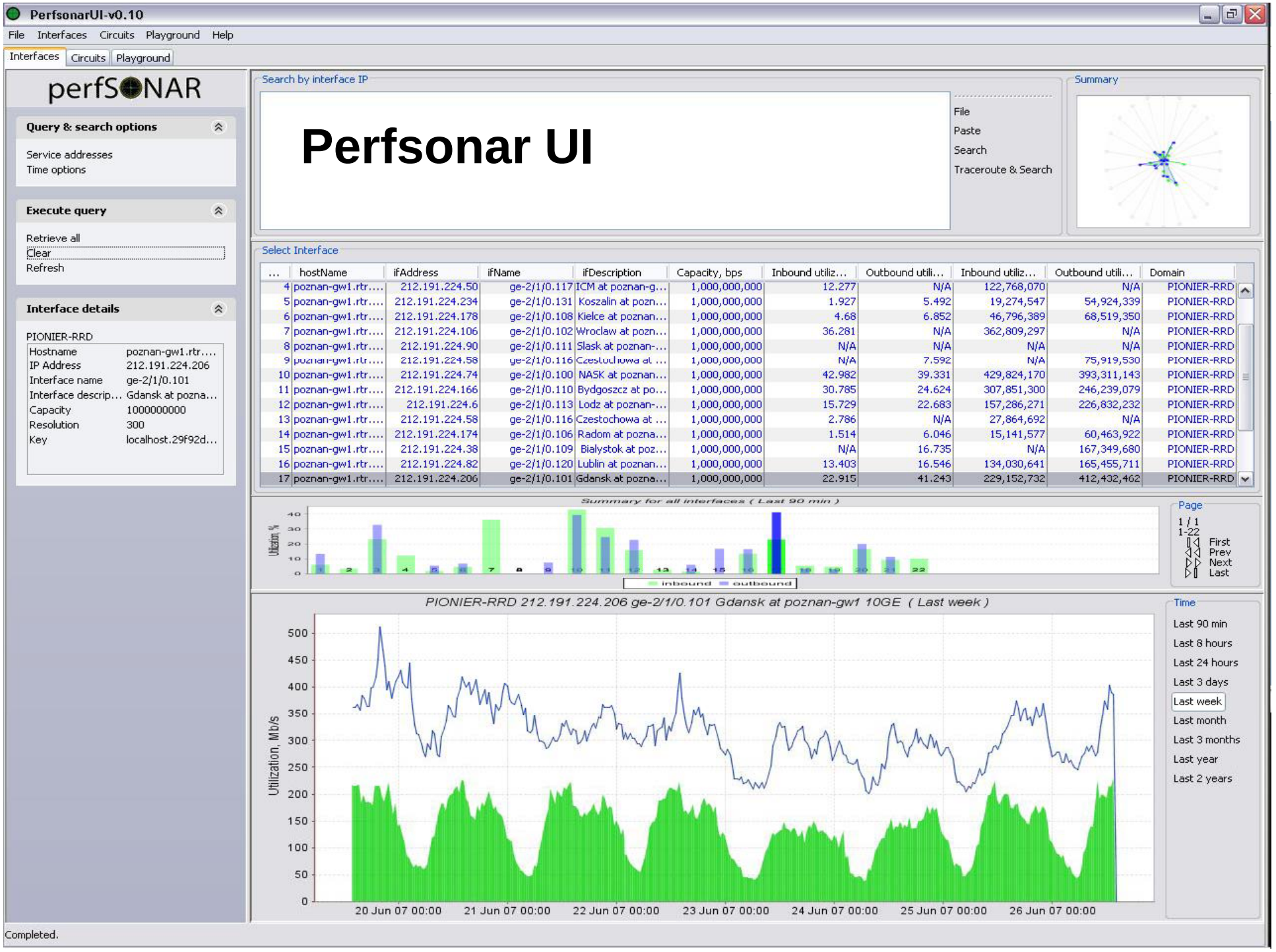
PerfsonarUI-v0.10
File Interfaces Circuits Playground Help
Interfaces Circuits Playground
perfSONAR
Query & search options
Service addresses
Time options
Execute query
Retrieve all
Clear
Refresh
Interface details
PIONIER-RRD
Hostname poznan-gw1.rtr....
IP Address 212.191.224.206
Interface name ge-2/1/0.101
Interface descrip... Gdansk at pozna...
Capacity 1000000000
Resolution 300
Key localhost.29f92d...
Search by interface IP
Perfsonar UI
File
Paste
Search
Traceroute & Search
Summary
Select Interface
... hostName ifAddress ifName ifDescription Capacity, bps Inbound utiliz... Outbound utili... Inbound utiliz... Outbound utili... Domain
4 poznan-gw1.rtr.... 212.191.224.50 ge-2/1/0.117 ICM at poznan-g... 1,000,000,000 12.277 N/A 122,768,070 N/A PIONIER-RRD
5 poznan-gw1.rtr.... 212.191.224.234 ge-2/1/0.131 Koszalin at pozn... 1,000,000,000 1.927 5.492 19,274,547 54,924,339 PIONIER-RRD
6 poznan-gw1.rtr.... 212.191.224.178 ge-2/1/0.108 Kielce at poznan... 1,000,000,000 4.68 6.852 46,796,389 68,519,350 PIONIER-RRD
7 poznan-gw1.rtr.... 212.191.224.106 ge-2/1/0.102 Wroclaw at pozn... 1,000,000,000 36.281 N/A 362,809,297 N/A PIONIER-RRD
8 poznan-gw1.rtr.... 212.191.224.90 ge-2/1/0.111 Slask at poznan-... 1,000,000,000 N/A N/A N/A N/A PIONIER-RRD
9 poznan-gw1.rtr.... 212.191.224.58 ge-2/1/0.116 Czestochowa at ... 1,000,000,000 N/A 7.592 N/A 75,919,530 PIONIER-RRD
10 poznan-gw1.rtr.... 212.191.224.74 ge-2/1/0.100 NASK at poznan... 1,000,000,000 42.982 39.331 429,824,170 393,311,143 PIONIER-RRD
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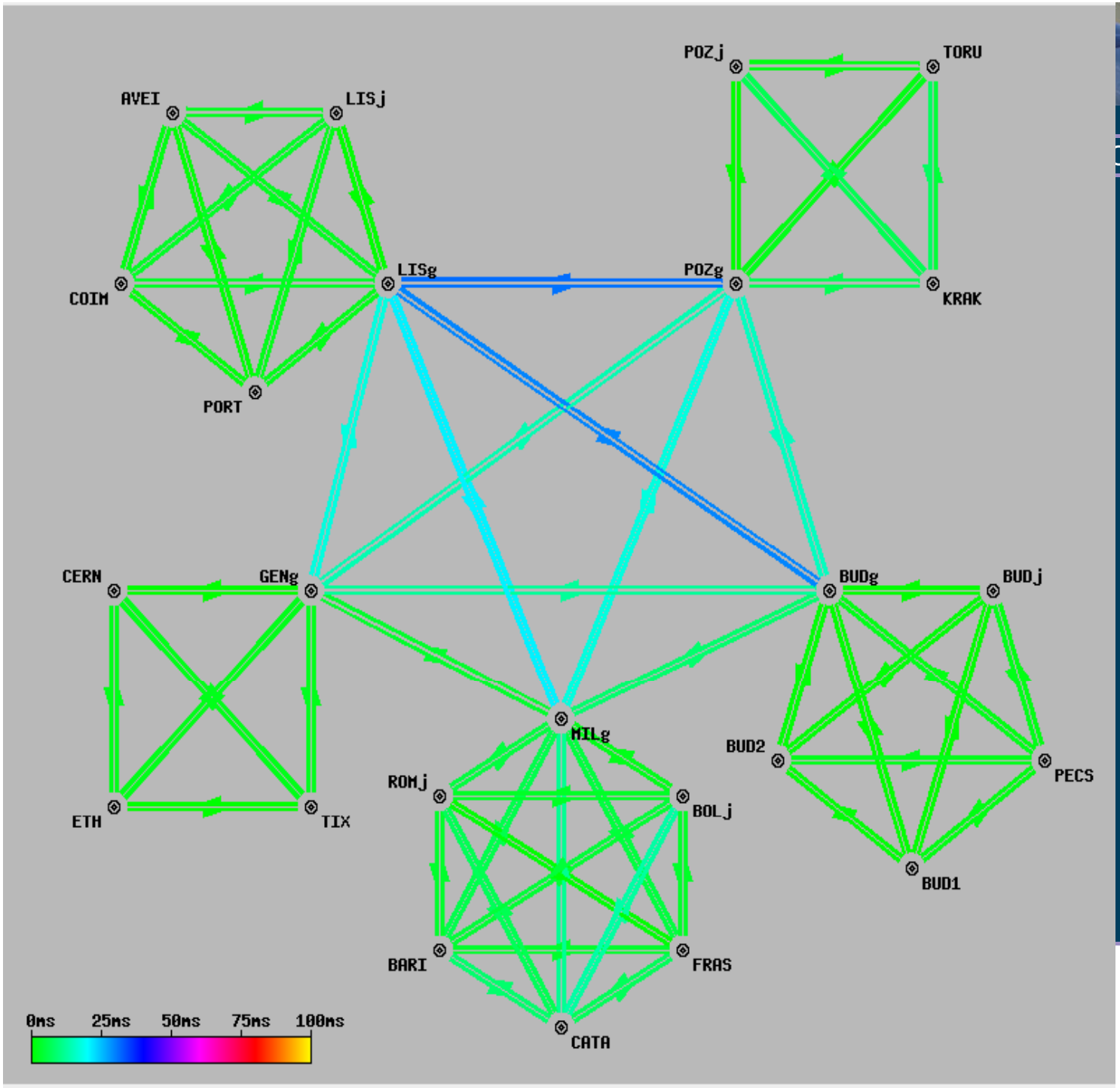
13 poznan-gw1.rtr.... 212.191.224.58 ge-2/1/0.116 Czestochowa at ... 1,000,000,000 2.786 N/A 27,864,692 N/A PIONIER-RRD
14 poznan-gw1.rtr.... 212.191.224.174 ge-2/1/0.106 Radom at pozna... 1,000,000,000 1.514 6.046 15,141,577 60,463,922 PIONIER-RRD
15 poznan-gw1.rtr.... 212.191.224.38 ge-2/1/0.109 Bialystok at poz... 1,000,000,000 N/A 16.735 N/A 167,349,680 PIONIER-RRD
16 poznan-gw1.rtr.... 212.191.224.82 ge-2/1/0.120 Lublin at poznan... 1,000,000,000 13.403 16.546 134,030,641 165,455,711 PIONIER-RRD
17 poznan-gw1.rtr.... 212.191.224.206 ge-2/1/0.101 Gdansk at pozna... 1,000,000,000 22.915 41.243 229,152,732 412,432,462 PIONIER-RRD
Summary for all interfaces (Last 90 min)
Utilization %
inbound outbound
Page
1 / 1
1-22
First
Prev
Next
Last
PIONIER-RRD 212.191.224.206 ge-2/1/0.101 Gdansk at poznan-gw1 10GE (Last week)
Utilization, Mb/s
20 Jun 07 00:00
21 Jun 07 00:00
22 Jun 07 00:00
23 Jun 07 00:00
24 Jun 07 00:00
25 Jun 07 00:00
26 Jun 07 00:00
Time
Last 90 min
Last 8 hours
Last 24 hours
Last 3 days
Last week
Last month
Last 3 months
Last year
Last 2 years
Completed.



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One Way Delay

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Multi Domain Operations-3: End-to-End Network Monitoring

E2E Link Monitoring Goal

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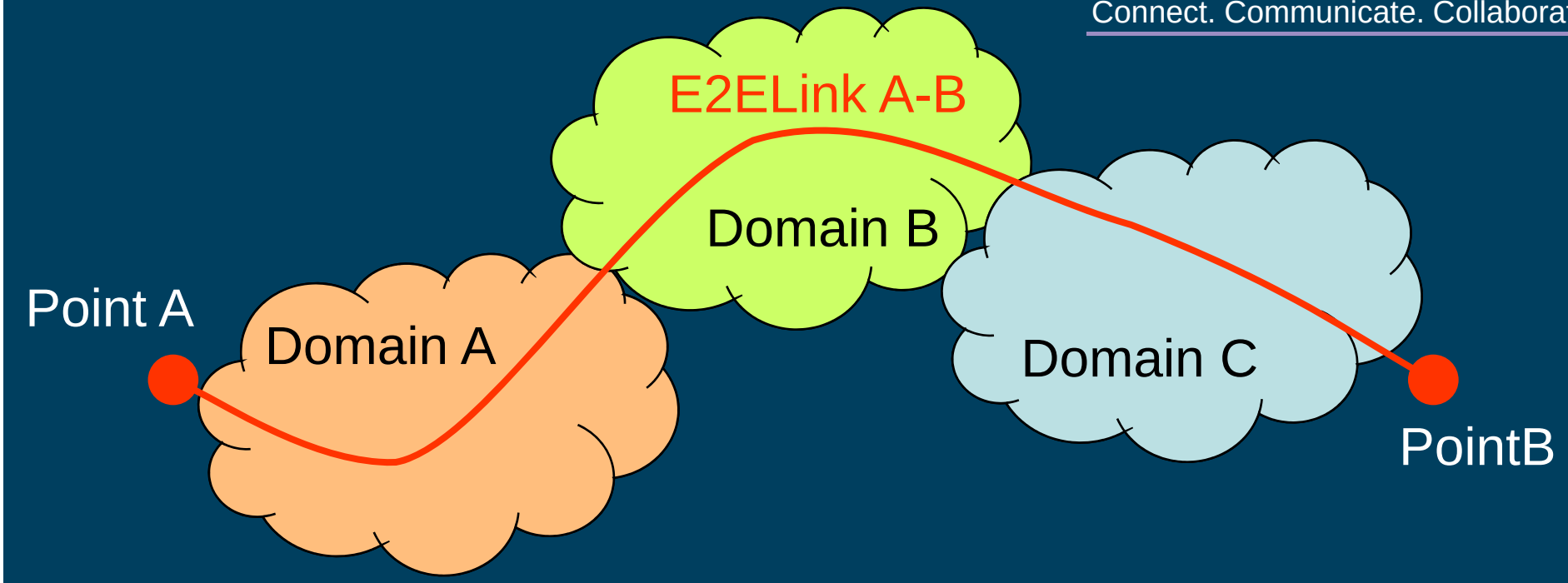

Goal: (near) real-time monitoring (link status) of constituent DomainLinks (and links between domains) and whole end-to-end Link A-B.

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E2EMon Approach

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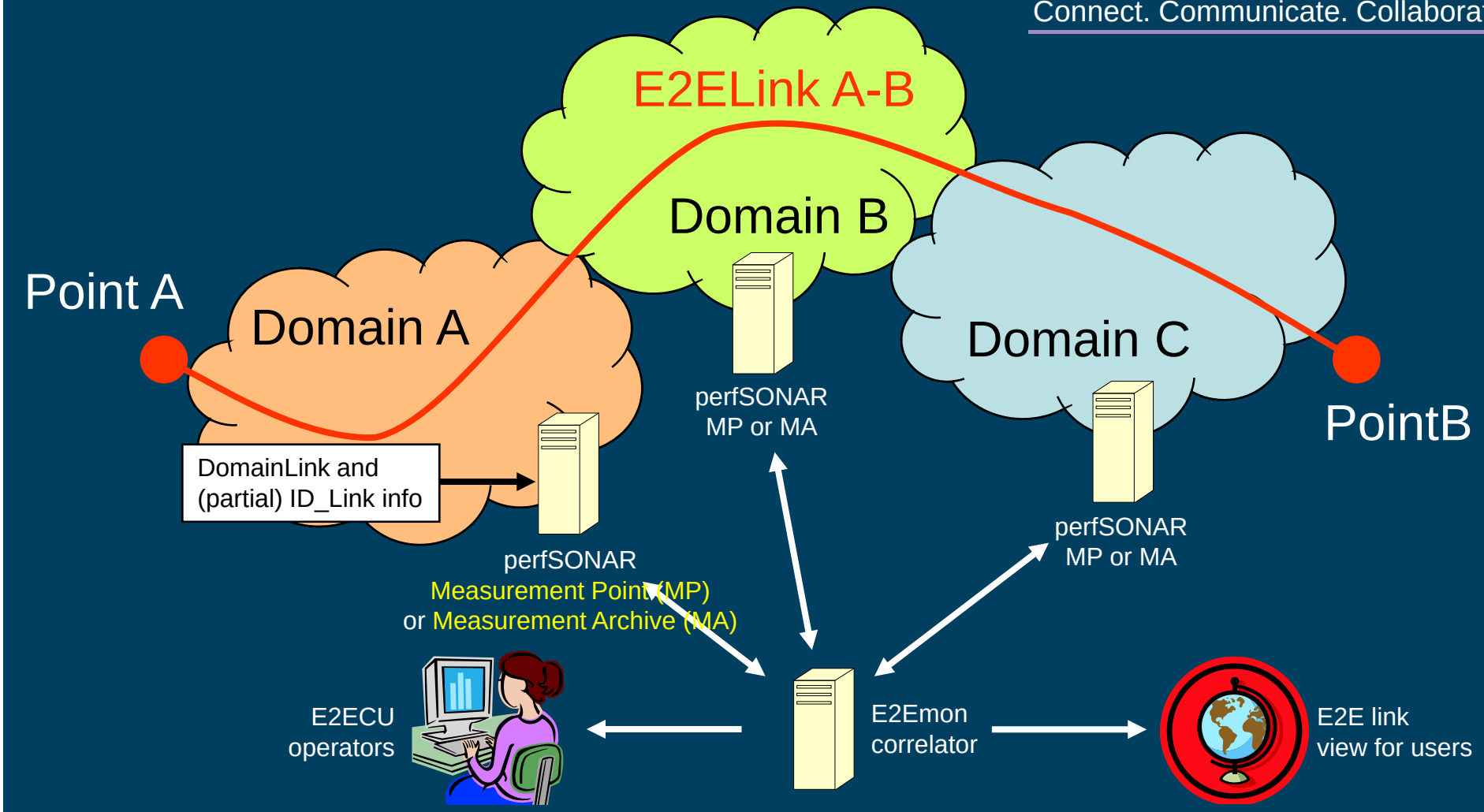

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End-to-End Monitoring

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- Each domain installs software probes to capture up/down status of their links from network hardware
- This status info sent to PerfSONAR MP or MA:
  - Collecting network status info [UP / DOWN only]
  - Historical archive for network status info
  - Checks info and reformats into XML for collection by E2EMon
- E2E Monitoring System
  - Queries PerfSONAR MPs & MAs
  - Concatenates DLs & IDLs to form E2E Links

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Prod. | Non Prod. | All Links

Start page

E2ECU view

E2E Links
Mon. Links
Problem E2E Links
Problem Mon. Links

Domain view

CANARIE
CERN
CESNET
DFN
ESNET
FERMI
GARR
GEANT2
HOPI
IN2P3
INTERNET2
NETHERLIGHT
PSNC
REDIRIS
RENATER
SWITCH
USLHCNET

Project view

IGTMD
LHCOPN

E2E Links for Project LHCOPN (Prod.)

E2E Link ID	State Oper	State Admin	Additional Info
CERN-BNL-LHCOPN-001	Up	Normal Oper.	
CERN-BNL-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-CNAF-LHCOPN-001	Up	Normal Oper.	
CERN-FERMI-LHCOPN-001	Up	Normal Oper.	
CERN-FERMI-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-GRIDKA-LHCOPN-001	Up	Normal Oper.	
CERN-IN2P3-LHCOPN-001	Up	Normal Oper.	
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-PIC-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
CERN-SARA-LHCOPN-001	Up	Normal Oper.	
CNAF-GRIDKA-LHCOPN-001	Up	Normal Oper.	
GRIDKA-IN2P3-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-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

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Multi-Domain Services Support and Services Monitoring

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Monitoring the monitoring systems on the network

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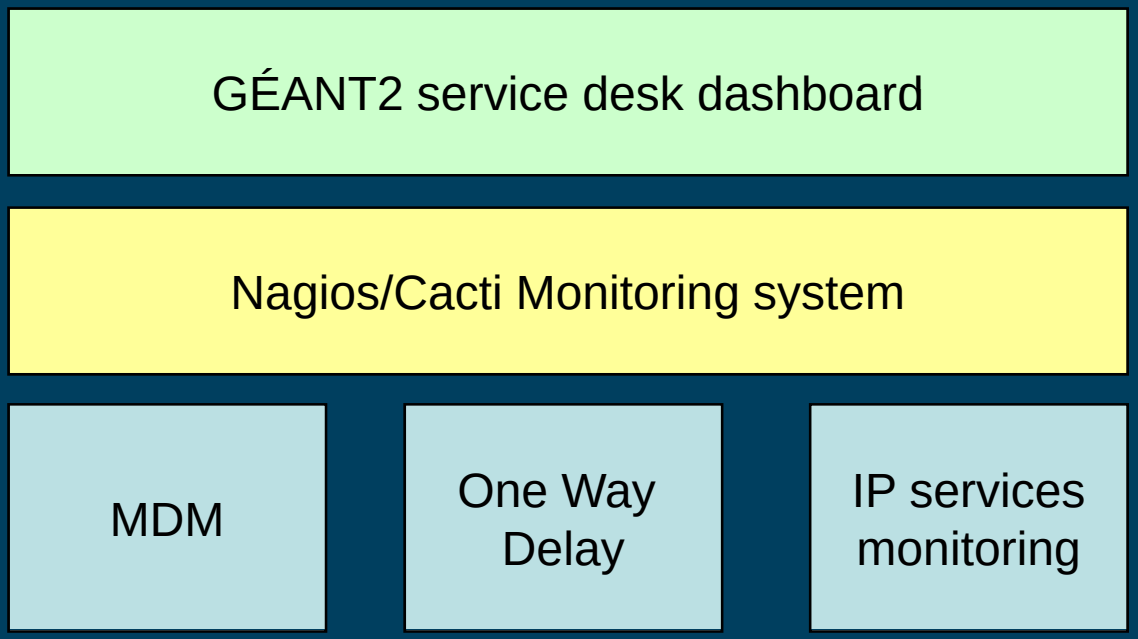

- Multi-Domain Monitoring and IP services monitoring systems are installed on servers physically located in the network and put under constant monitoring
- This ensures that the Multi-Domain Monitoring activity is always looked after and proactive action can be successfully carried out

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MDM services monitoring

- MDM systems monitoring is performed using **Nagios/Cacti** (developing a customised set of probes and interfaces)
- DANTE Service Desk is currently checking MDM servers:
  - **Hardware layer**: CPU, MEM, disk space, network interfaces, TCP/UDP traffic
  - **Resource layer**: login attempts, Tomcat RRT, eXist RTT, MySQL, NTP
  - **Service layer**: MDM services availability and performace
- Additional tools:
  - **Syslog** server (with MySQL support)
  - security **log auditing** (with automatic report tools)
  - Google-map/Nagios integration

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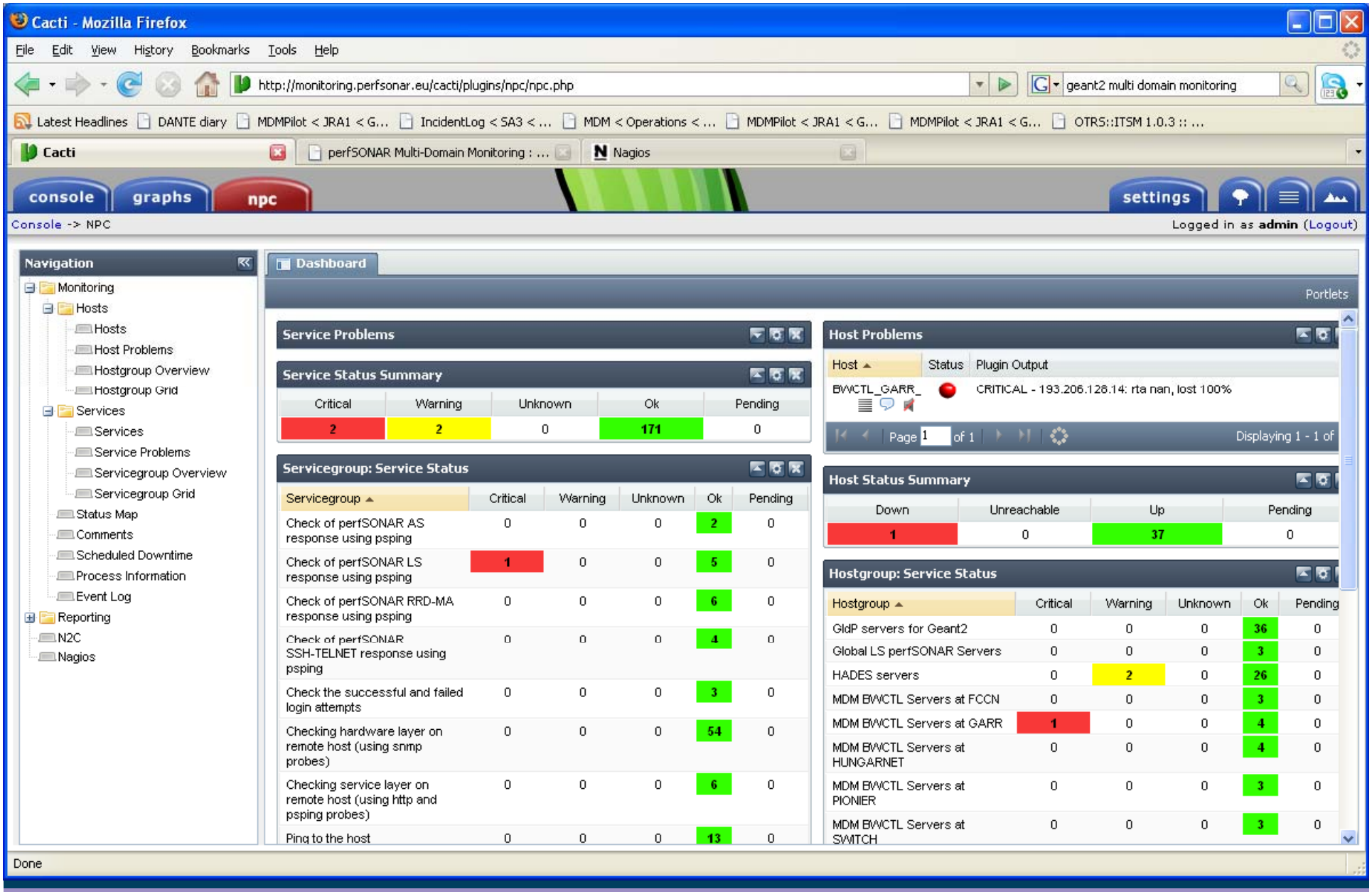

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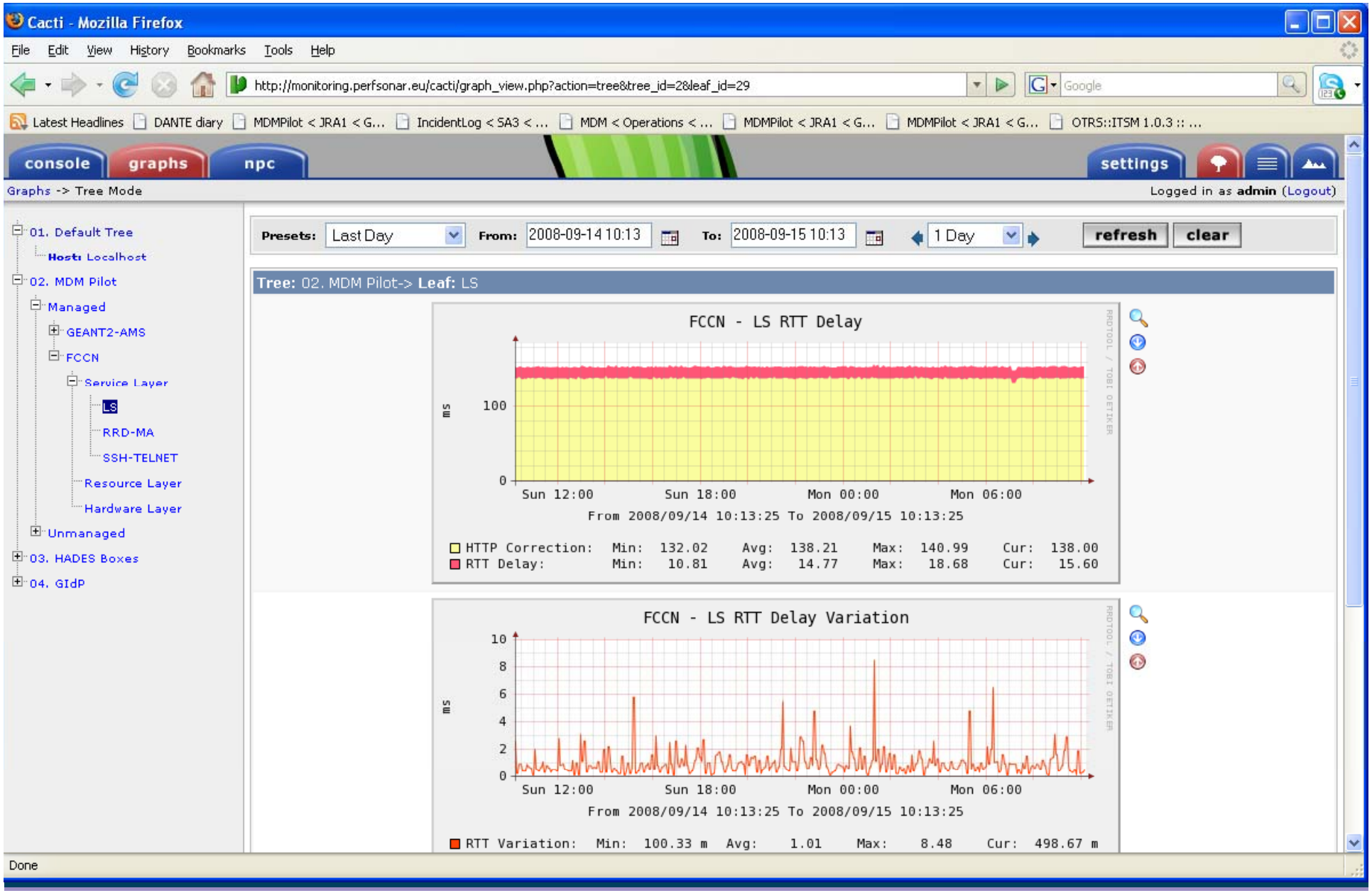

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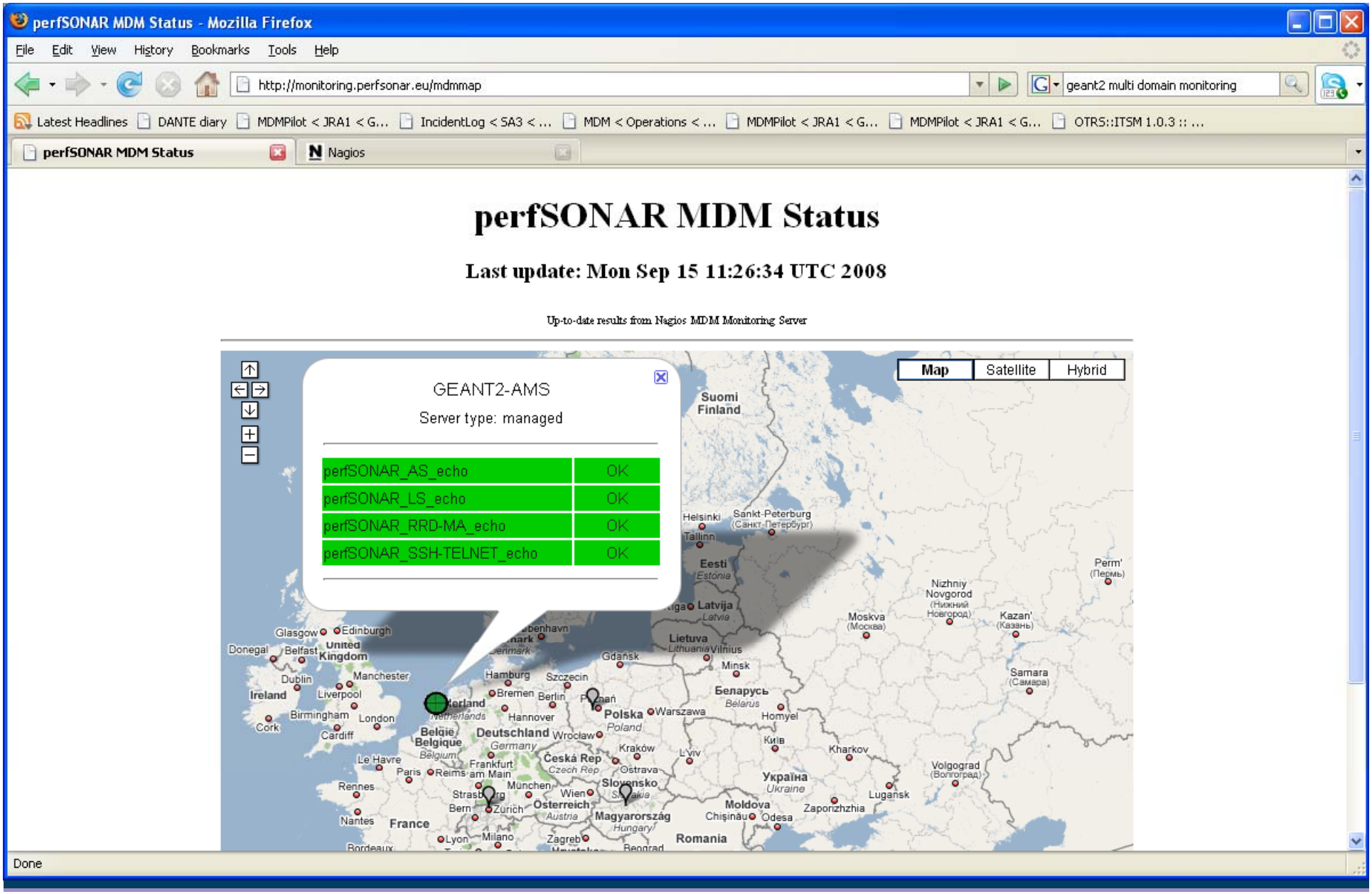
perfSONAR MDM Status - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://monitoring.perfsonar.eu/mdmmap
geant2 multi domain monitoring
Latest Headlines
DANTE diary
MDMPilot < JRA1 < G...
IncidentLog < SA3 < ...
MDM < Operations < ...
MDMPilot < JRA1 < G...
MDMPilot < JRA1 < G...
OTRS::ITSM 1.0.3 :: ...
perfSONAR MDM Status
Nagios
perfSONAR MDM Status
Last update: Mon Sep 15 11:26:34 UTC 2008
Up-to-date results from Nagios MDM Monitoring Server
GEANT2-AMS
Server type: managed
perfSONAR_AS_echo OK
perfSONAR_LS_echo OK
perfSONAR_RRD-MA_echo OK
perfSONAR_SSH-TELNET_echo OK
Map
Satellite
Hybrid
Done

Liaising with other research networks

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Other research networks (Internet2, Esnet), together with GEANT2:

- Combined effort in the tools development and deployment

- Exchange of operational experiences

  Common definition of services to users

  Definition of global operational processes

  Jointly address NOC requirements

  Standardise user support

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Conclusions

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- Multi-Domain Operations
  - Advanced network services (AutoBahn)
  - Multi-Domain Monitoring: perfSONAR
  - E2EMon
- The future: GEANT3
  - Extending the service portfolio to production quality Multi-Domain hybrid networking

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For More Information

- GEANT2 website: www.geant2.net
- For latest news and factsheets http://www.geant2.net/media
- For research activities http://www.geant2.net/research
- AutoBahn: http://www.geant2.net/server/show/nav.756
- perfSONAR web pages - www.perfsonar.net
- perfSONAR UI and deployment monitoring http://perfsonar.acad.bg
- GÉANT2 MDM Service http://www.geant2.net/server/show/nav.1801

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