

# Measuring Circuit Based Networks

Joint Techs Feb 13 2007

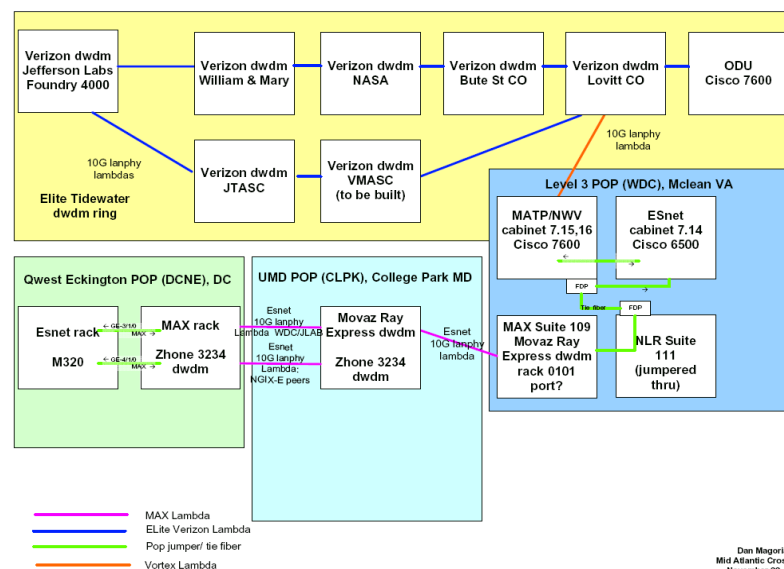
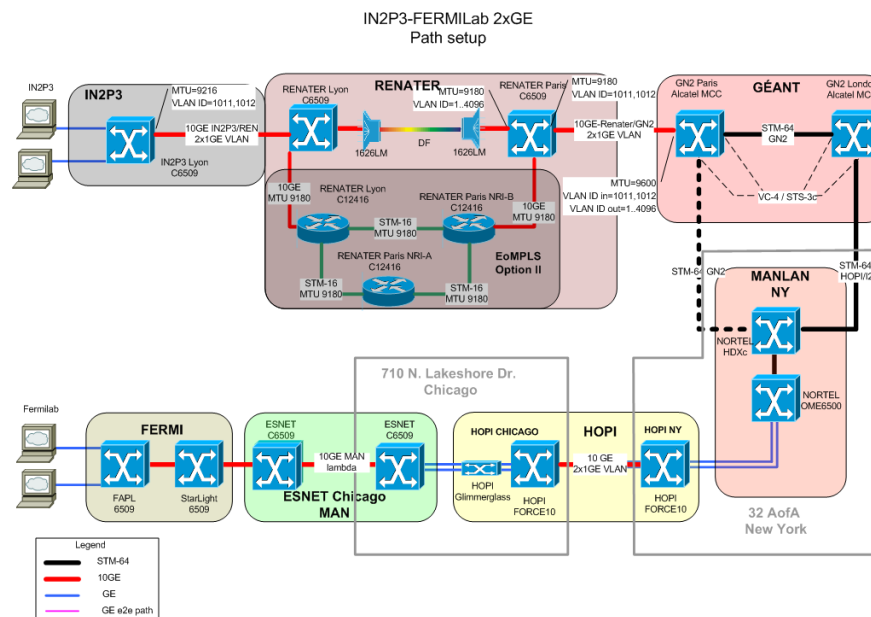
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# Problem Space

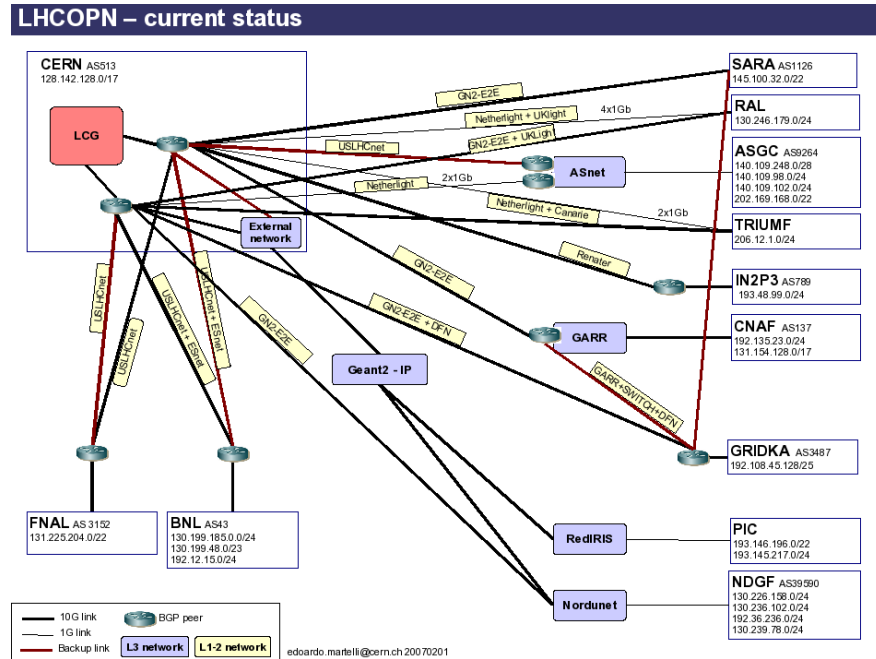
- Lots of different organizations are now providing circuit based services
- Application communities are manually stitching together all kinds of things into “circuits” to try to meet their end-to-end needs.
- Debugging performance problems across these stitched end-to-end circuits is difficult.



# A High Profile Example: the LHC Community

- LHCOPN

- An Optical Private Network connecting 11 Tier 1 centers around the world to CERN.
- The circuits to two of the larger Tier1 centers, FERMI & BNL cross ESnet
- There are more than 25 different organizations involved.



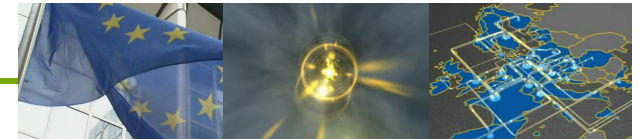
- The community expects a production quality service from these circuits.
- What about the rest of the LHC community?
  - 150+ Tier 2 centers around the world
  - 85+ Tier 3 centers in US alone

- E2Emon
  - An application suite developed by DFN for monitoring circuits using perfSONAR protocols
  
- E2ECU
  - End to End Coordination Unit that uses E2Emon to monitor LHCOPN Circuits
  - Run by the GEANT2 NOC

- E2Emon
  - An application suite developed by DFN for monitoring circuits using perfSONAR protocols
- perfSONAR is a global collaboration to design, implement and deploy a network measurement framework.
  - Web Services based Framework
    - Measurement Archives (MA)
    - Measurement Points (MP)
    - Lookup Service (LS)
    - Topology Service (TS)
    - Authentication Service (AS)
  - Some of the currently Deployed Services
    - Utilization MA
    - Circuit Status MA & MP
    - Latency MA & MP
    - Bandwidth MA & MP
    - Looking Glass MP
    - Topology MA
  - This is an **Active** Collaboration
    - The basic framework is complete
    - Protocols are being documented
    - New Services are being developed and deployed.

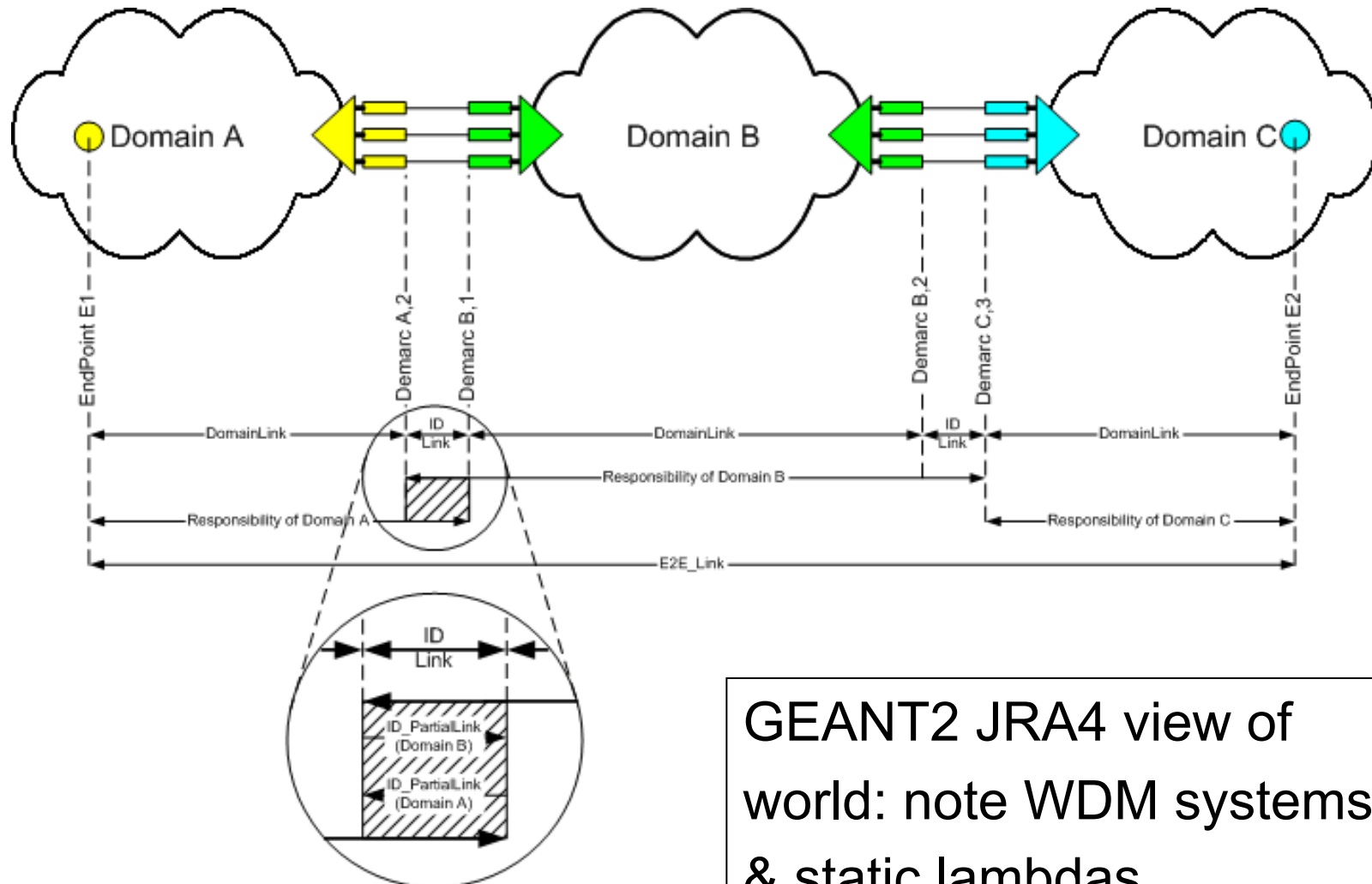
- Central Monitoring Software
  - Uses perfSONAR protocols to retrieve current circuit status every minute or so from MAs and MPs in all the different domains supporting the circuits.
  - Provides a web site showing current end-to-end circuit status
  - Generates SNMP traps that can be sent to other management systems when circuits go down
- MA & MP Software
  - Manages the perfSONAR communications with the central monitoring software
  - Requires an XML file describing current circuit status as input.
- Domain Specific Component
  - Generates the XML input file for the MA or MP
  - Multiple development efforts in progress, but no universal solutions
    - CERN developed one that interfaces to their abstraction of the Spectrum NMS DB
    - DANTE developed one that interfaces with the Acatel NMS
    - ESnet developed one that uses SNMP to directly poll router interfaces
    - FERMI developed one that uses SNMP to directly poll router interfaces
    - Others under development

# GEANT2 JRA4 Circuit Decomposition



## Divide & conquer (JRA4 E2Emon info model)

Connect. Communicate. Collaborate



GEANT2 JRA4 view of world: note WDM systems, & static lambdas

# E2Emon Central Monitoring Software

[http://cnmdev.lrz-muenchen.de/e2e/lhc/G2\\_E2E\\_index.html](http://cnmdev.lrz-muenchen.de/e2e/lhc/G2_E2E_index.html)

E2E Link Monitoring System - Mozilla Firefox

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**Domain view**

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[GARR](#)  
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**Project view**

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## E2E Links for Project LHCOPN

E2E Link ID	State Oper	State Admin	Additional Info
<a href="#">CERN-GRIDKA-LHCOPN-001</a>	Up	Normal Oper.	<b>Error:</b> E2E Link is <b>not</b> contiguous (End Point missing or gap found)
<a href="#">CERN-FERMI-LHCOPN-002</a>	Up	Normal Oper.	<b>Warning:</b> Operational state is known not for all involved links <b>Warning:</b> Administrative state is known not for all involved links
<a href="#">CERN-CNAF-LHCOPN-001</a>	Down	Maintenance	
<a href="#">CERN-RAL-LHCOPN-001</a>	Up	Normal Oper.	<b>Warning:</b> Operational state is known not for all involved links <b>Warning:</b> Administrative state is known not for all involved links
<a href="#">CERN-FERMI-LHCOPN-001</a>	Up	Normal Oper.	
<a href="#">CERN-BNL-LHCOPN-002</a>	Up	Normal Oper.	<b>Error:</b> E2E Link is <b>not</b> contiguous (End Point missing or gap found) <b>Warning:</b> Operational state is known not for all involved links <b>Warning:</b> Administrative state is known not for all involved links
<a href="#">GRIDKA-SARA-LHCOPN-001</a>	Up	Normal Oper.	<b>Error:</b> E2E Link is <b>not</b> contiguous (End Point missing or gap found) <b>Warning:</b> Operational state is known not for all involved links <b>Warning:</b> Administrative state is known not for all involved links
<a href="#">CERN-NDGF-LHCOPN-001</a>	Up	Normal Oper.	<b>Error:</b> E2E Link is <b>not</b> contiguous (End Point missing or gap found) <b>Warning:</b> Operational state is known not for all involved links <b>Warning:</b> Administrative state is known not for all involved links
<a href="#">CERN-IN2P3-LHCOPN-001</a>	Up	Normal Oper.	<b>Error:</b> E2E Link is <b>not</b> contiguous (End Point missing or gap found) <b>Warning:</b> Operational state is known not for all involved links <b>Warning:</b> Administrative state is known not for all involved links
<a href="#">CERN-BNL-LHCOPN-001</a>	Up	Normal Oper.	
<a href="#">CNAF-GRIDKA-LHCOPN-001</a>	Up	Normal Oper.	
<a href="#">CERN-SARA-LHCOPN-001</a>	Up	Normal Oper.	

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**E2ECU view**

[All E2E Links](#)  
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**Domain view**

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**Project view**

## Status of E2E Link CERN-FERMI-LHCOPN-001

Oper. State: **Up**  
Admin. State: **Normal Oper.**

Domain	CERN				USLHCNET				ESNET				FERMI			
Link Structure	EP	←.....→	.....→	DP	←.....→	DP	←.....→	.....→	DP	←.....→	DP	←.....→	.....→	DP	←.....→	EP
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	ID Part.Info	Demarc	Domain Link	EndPoint
Local Name	CERN-TO	S513-C-BE1	CERN-FERMI-LHCOPN-001-GVA-CERN	USLHCNET-GEN	CERN-FERMI-LHCOPN-001-GVA-CHI	USLHCNET-CHI	CERN-FERMI-LHCOPN-001-CHIESNET	CERN-FERMI-LHCOPN-001-STARLIGHT-Tail	ESNET-STARLIGHT	CERN-FERMI-LHCOPN-001-FERMI-STARLIGHT	ESNET-FERMI	CERN-FERMI-LHCOPN-001-Site-Tail	md8	FERMI-ESNET	md2	FERMI-T1
State Oper.	-	Up	Up	-	Up	-	Up	Up	-	Up	-	Up	Up	-	Up	-
State Admin.	-	Normal Oper.	Normal Oper.	-	Normal Oper.	-	Normal Oper.	Normal Oper.	-	Normal Oper.	-	Normal Oper.	Normal Oper.	-	Normal Oper.	-
Timestamp	-	2007-01-26 T13:15:22+01:00	2007-02-06 T17:31:23+01:00	-	2007-02-09 T17:20:33+01:00	-	2007-01-26 T13:15:19+01:00	2007-02-09 T16:20:36.0	-	2007-02-09T16:20:36.0	-	2007-02-09 T16:20:36.0	2007-02-09 T16:20:00.0-6:00	-	2007-02-09 T16:20:00.0-6:00	-

- The current system provides only one Measurement
  - Up or Down
- It will be extended to include additional features
- Potential directions
  - UP
    - For how long?
    - Any errors?
    - Is it expected to stay up?
  - Down
    - Why?
    - Is anybody working on fixing it?
    - Estimated time to repair