

## **common Network Information Service Modelling and interacting with a real life network**

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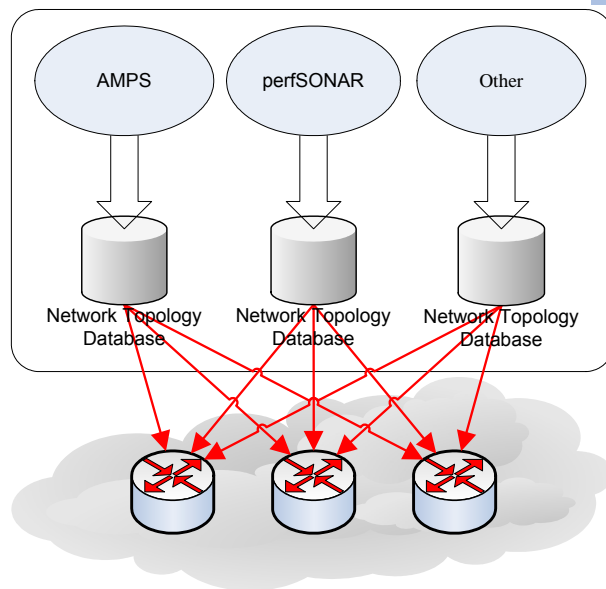
Terena Networking Conference 2009, Málaga, Spain

## From idea into project

- Virtual network model - a global view of a network's topology
- Common Network Information System - unified repository of all relevant network information about a single administrative domain
- Interacting with real network - efficiently, accurately and automatically collect topology data from the network elements
- Evaluation – cNIS deployment

# Motivation

GEANT2

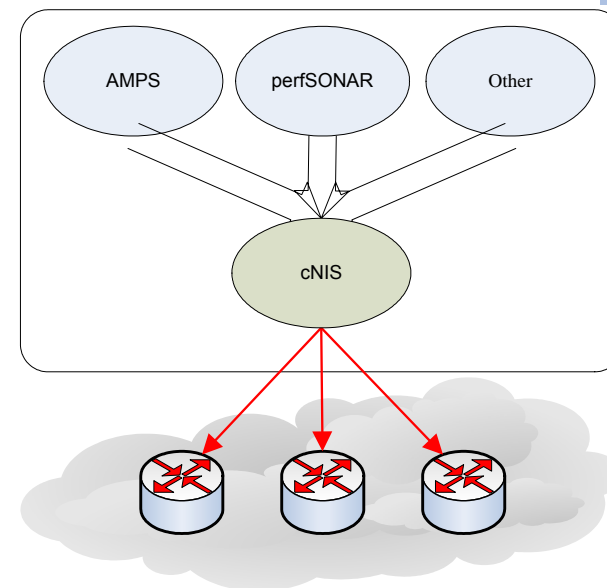


## Drawbacks

- Duplication effort
- Increased load
- Data inconsistency
- Error prone solutions



- Unified repository of all relevant network information about a single administrative domain.
- Gathering, managing and exposing network topology information



## Benefits

- Single point of storage
- Automatic population
- Seamless access
- Sanity checks

# Modeling the network topology

- Assumptions for cNIS model
  - *Generic elements* - a view of the network as a set of nodes, ports (interfaces) and links
  - *Layered structure* - network infrastructure can be divided into several functionally consistent parts which cooperate with each other
  - *Inter-layer relations* - relations between particular elements of each layer
  - *Layer autonomy* - due to the layered structure of networks a particular technology can be replaced with another one without influencing the layers above or below
- Related work
  - DMTF CIM Network Model
  - Network Description Language (NDL)
  - NMWG (Network Measurement Working Group)

# Additional requirements for network informational model

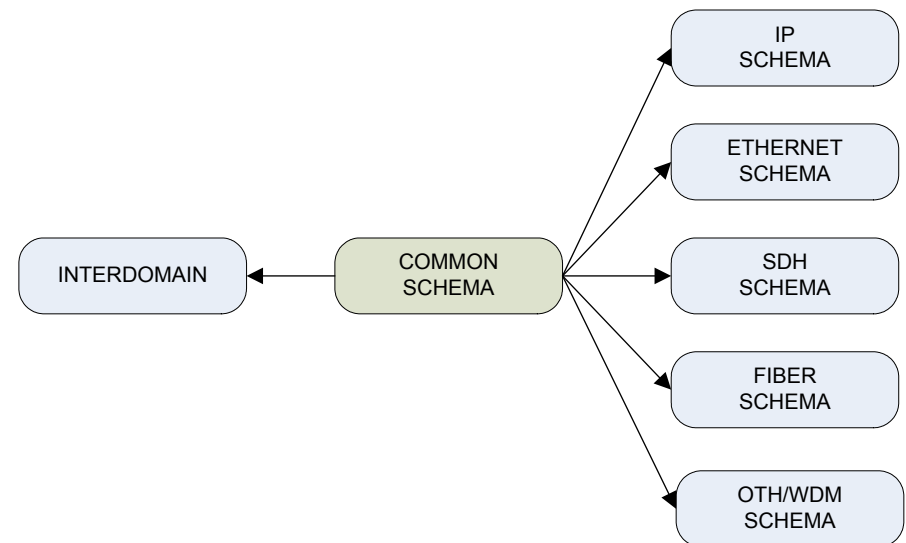


- *Historical data* – support for historical topologies, for example to merge past measurement archives with appropriate topology
- *Future topology* – support for future topology, for example to reserve a specific path or to enter and assess changes in a network topology.
- *Audit* – to record information who modified the data.
- *Flexibility* - no direct or hard-coded relationship between technology specific tables.
- *Tunnelling* - relationships between interfaces on the same or different network layers

# cNIS informational model

- *Common* – stores characteristics common to all protocols and network technologies (e.g. ‘description’, ‘unique ID’).
- *IP* – the topology of the IP network elements
- *Ethernet* – the topology of the Ethernet network elements
- *SDH* – the topology of the SDH network elements
- *Fiber* – fiber layer
- *OTH/WDM* – optical layer
- *Interdomain* – models virtual cross – domain links.

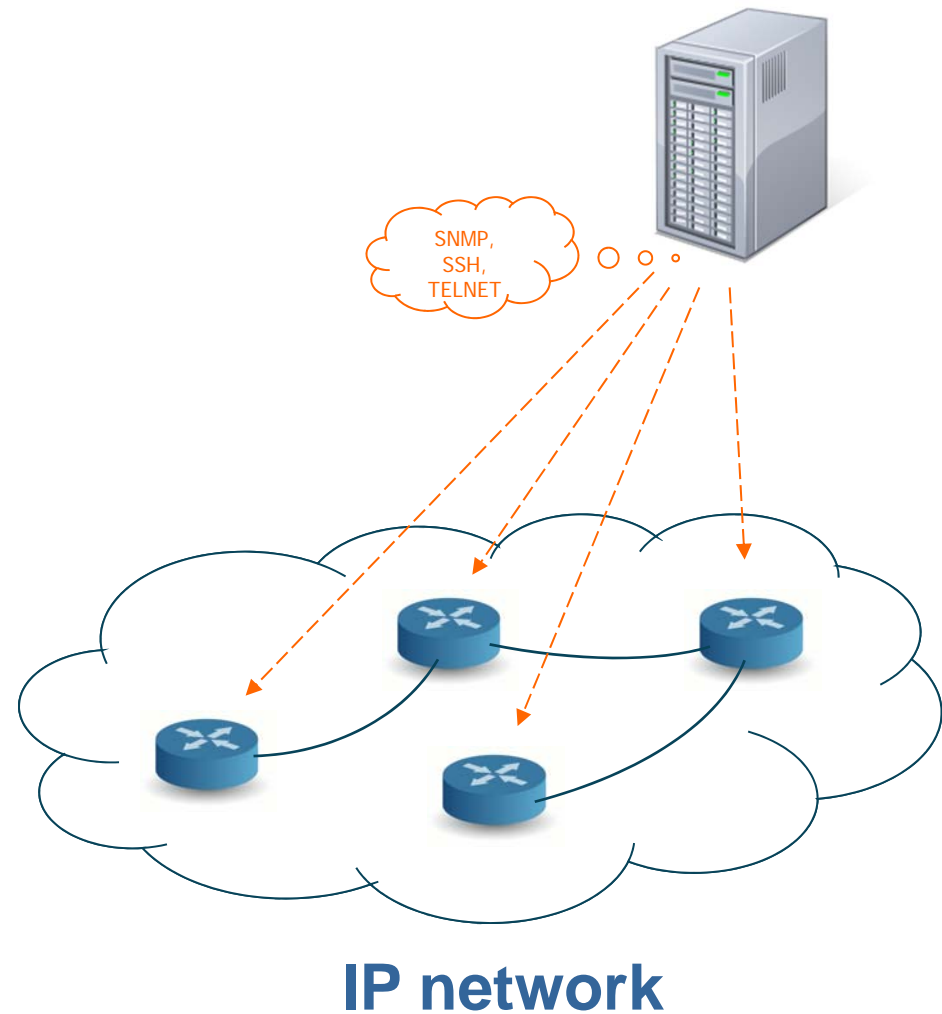
A joint effort of several NRENs:  
DANTE, GARR, GRNet,  
HEAnet, LRZ, NIIF/USZ, PSNC and  
Switch



75 entities in relational schema  
91 tables in physical schema

# Interacting with the network

- The key to the successful adoption of cNIS is its ability to efficiently, accurately and automatically collect topology data from the network elements
- cNIS is meant to manage the infrequently changing part of the network information (static network data)
- Automatic topology discovery in cNIS is based on a pull method



## Dataflow in cNIS

Router list	Name	Location	Description	Vendor/Model
Router list	rt1-ams-01	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-02	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-03	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-04	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-05	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-06	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-07	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-08	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-09	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000
Router list	rt1-ams-10	Amsterdam, NL	Juniper Networks, Inc. 10000000000	Juniper 10000

### Geant applications

PerfSONAR E2E Monitoring  
CNM System



AMPS



AutoBAHN



SOAP/NMVG

SOAP/NMVG

SOAP/XML

SOAP/XML

### perfSONAR

SmokePing



Lookup Service



Integration with  
PerfSONAR network  
monitoring infrastructure

### Users



Web  
browser

Topology  
data gathered  
automatically  
using cNDMA  
framework

### Network

### cNIS

**Management  
Application**  
(web application)

With cNDMA  
framework included

**Topology  
Service**  
(SOAP/NMVG)

**PathFinder**  
(SOAP/XML)

**AutoBAHN  
Service**  
(SOAP/XML)

access  
interfaces

cNIS core

business  
logic

Database

data storage



# cNIS Network Discovery and Management Application (cNDMA)



- A versatile network discovery engine ready to support any network technology
- Programming framework for third parties to customize the network discovery platform for a given network
  - plug-ins that create capabilities to extend cNDMA to new vendor/technology specific options
  - drivers – plugin components used to interact with specific network devices.
- Current set of available plugins
  - IP plugin with two drivers – for Juniper and Cisco routers (*default configuration*)
  - Ethernet plugin
  - SDH plugin



# cNIS Management Application



Logout

System Common Ethernet SDH IP Visualization E2E

**Routers**

Router list

Add router

**Links**

Link list

Add link

**Networks**

Network list

Add network

**Network discovery**

Control panel

Results

Logs

**Exploring**

Routers

Interfaces

Links

Networks

## Router list

Name	Location	Description	Vendor/model	
rt1.ams.nl.re0	Amsterdam, NL	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.ath.gr.re1	Athens, GR	Juniper Networks, Inc. m160 interne ...	juniper	<a href="#">View</a>
rt1.par.fr.re0	Aubervilliers, FR	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.bud.hu.re0	Budapest, HU	Juniper Networks, Inc. t640 interne ...	juniper	<a href="#">View</a>
rt1.cop.dk.re0	Copenhagen, DK	Juniper Networks, Inc. t640 interne ...	juniper	<a href="#">View</a>
rt1.fra.de.re0	Frankfurt, DE	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.gen.ch.re0	Geneva, CH	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.kau.lt.re0	Kaunas, LT	Juniper Networks, Inc. m120 interne ...	juniper	<a href="#">View</a>
rt1.lon.uk.re0	London, UK	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.mad.es.re0	Madrid, ES	Juniper Networks, Inc. t640 interne ...	juniper	<a href="#">View</a>
rt1.mil.it.re0	Milan, IT	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.poz.pl.re0	Poznan, PL	Juniper Networks, Inc. t640 interne ...	juniper	<a href="#">View</a>
rt1.pra.cz.re0	Prague, CZ	Juniper Networks, Inc. t640 interne ...	juniper	<a href="#">View</a>
rt1.rig.lv.re0	Riga, LV	Juniper Networks, Inc. m120 interne ...	juniper	<a href="#">View</a>
rt1.tal.ee.re0	Tallinn, EE	Juniper Networks, Inc. m120 interne ...	juniper	<a href="#">View</a>
rt1.vie.at.re0	Vienna, AT	Juniper Networks, Inc. t640 interne ...	juniper	<a href="#">View</a>

Back

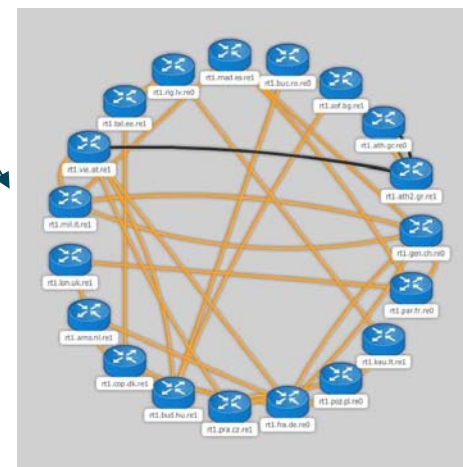
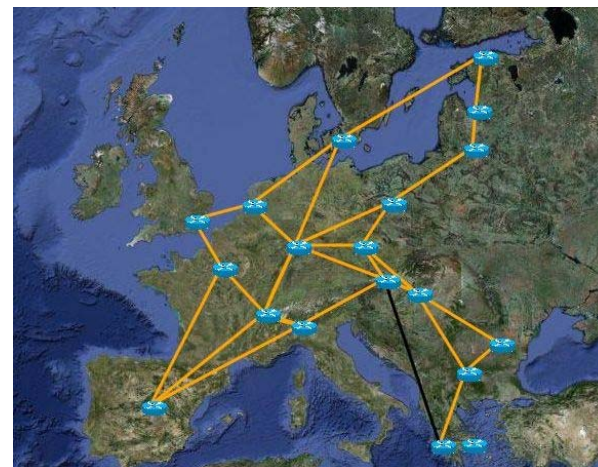


connect • communicate • collaborate

# Deployment



- GN2 project
  - Pilot deployment on Geant network
  - Test deployment in several NRENs: DFN, FCCN, GARR, HEAnet, Hungarnet and PIONIER
- GN3 project
  - Moving towards operational deployment in BREN, FCCN, HEAnet, PIONIER and RedIRIS



connect • communicate • collaborate

# GN3 project

- GN3 SA2 Task 5: develop and maintain tools that help create domain independent workflows in support of the multi-domain services
  - AMPS, AutoBAHN, cNIS, ISHARe,...
- Service delivery platform - a platform comprising a set of tools to deliver multi-domain services on top of an existing network infrastructure.
- Participants: BREN, Dante, DFN, GRNET, GARR, MARNET, MREN, NIIF, PSNC (PIONIER), RedIRIS, Switch

- Multi-domain provisioning of wavelengths.
- Multi-domain provisioning of sub-lambda circuits.
- QoS treatment of selected IP traffic flows and aggregates.
- Multi-point virtual networks.
- Optical Private Networks



## GEANT network service delivery platform

### cNIS

Common  
Network  
Information  
Service

### I-SHARe

Information  
Sharing across  
Heterogeneous  
Administrative  
Regions

### AMPS

Advance Multi-  
domain  
Provisioning  
System

### AutoBAHN

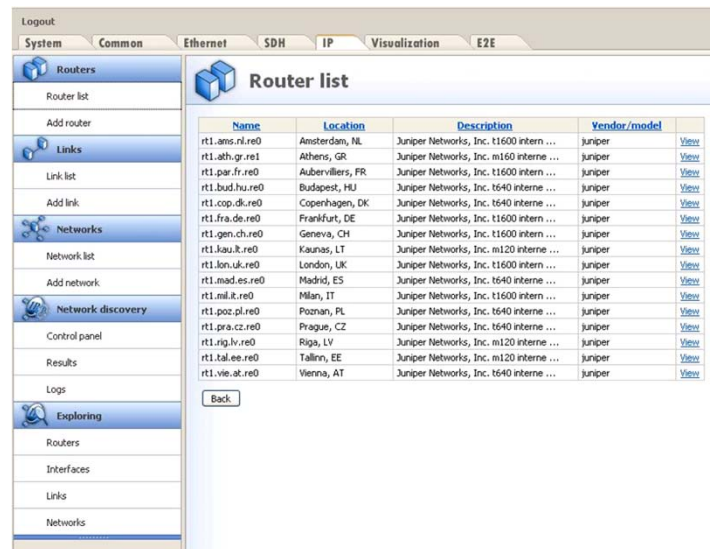
Automated  
Bandwidth  
Allocation  
across  
Heterogeneous  
Networks



- Conclusions
  - Unified model of a computer network for a single administrative domain guarantees reliable operations of networks and services
  - Interacting with a real life network and automatic data gathering is an essential aspect of wide adoption of network repository
- Future directions
  - Standardization for data exchange model - OGF NML (Network Markup Language), OGF NSI (Network Service Interface), YANG recommendations
  - cNIS framework – network topology discovery, network data model, network information exchange, ...

# More about cNIS

- Interim GN3 Project Portal, accessible from <http://wiki.geant.net/bin/view> (available for GN3 participants only)
- cNIS in PSNC, accessible from <http://cnis.psnc.pl/>
- cNIS development site, accessible from <http://stats.geant2.net/cNIS-site/index.html> (available for GN3 participants only)
- GN2-07-045v4 (DS3.13.1): cNIS Database Schema, accessible from <http://www.geant2.net/>



The screenshot shows the 'Router list' page in the cNIS application. The left sidebar contains navigation links for Routers, Links, Networks, Network discovery, Control panel, Results, Logs, and Exploring. The main content area displays a table of routers with columns for Name, Location, Description, and Vendor/model. Each row includes a 'View' link. A 'Back' button is located at the bottom of the table.

Name	Location	Description	Vendor/model	
rt1.amc.nl.re0	Amsterdam, NL	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.ath.gr.re1	Athens, GR	Juniper Networks, Inc. m160 intern ...	juniper	<a href="#">View</a>
rt1.par.fr.re0	Aubervilliers, FR	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.bud.hu.re0	Budapest, HU	Juniper Networks, Inc. t640 intern ...	juniper	<a href="#">View</a>
rt1.cop.dk.re0	Copenhagen, DK	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.fra.de.re0	Frankfurt, DE	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.gen.ch.re0	Geneva, CH	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.kau.lt.re0	Kaunas, LT	Juniper Networks, Inc. m120 intern ...	juniper	<a href="#">View</a>
rt1.lon.uk.re0	London, UK	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
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rt1.mil.it.re0	Milan, IT	Juniper Networks, Inc. t1600 intern ...	juniper	<a href="#">View</a>
rt1.poz.pl.re0	Poznan, PL	Juniper Networks, Inc. t640 intern ...	juniper	<a href="#">View</a>
rt1.pra.cz.re0	Prague, CZ	Juniper Networks, Inc. t640 intern ...	juniper	<a href="#">View</a>
rt1.rig.lv.re0	Riga, LV	Juniper Networks, Inc. m120 intern ...	juniper	<a href="#">View</a>
rt1.tal.ee.re0	Tallinn, EE	Juniper Networks, Inc. m120 intern ...	juniper	<a href="#">View</a>
rt1.vie.at.re0	Vienna, AT	Juniper Networks, Inc. t640 intern ...	juniper	<a href="#">View</a>

## cNIS demo

*Wednesday, 14:15 - 15:00*

*Tuesday, Dante Booth, 11.00*