NORDUnet Operations

NORDUnet

Nordic Infrastructure for Research & Education

May 2009

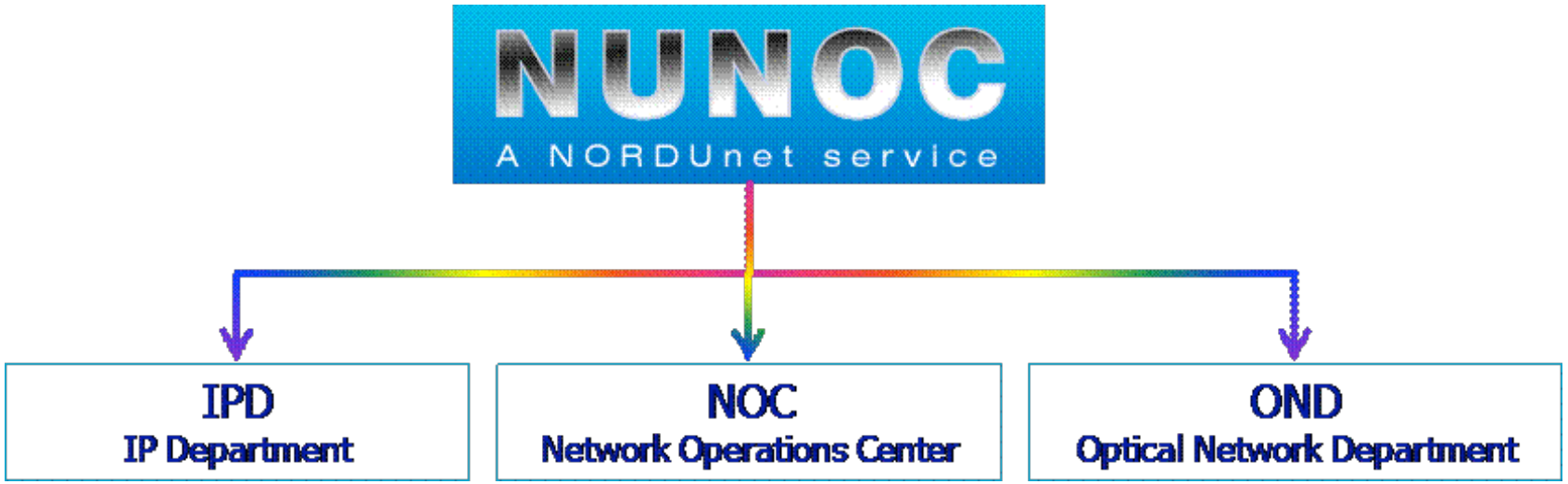
Jørgen Qvist

Chief Network Operating Officer

Agenda

- Organisation
- Networks and Sites
  - NOC
  - Optical Network
  - IP Network
- Documentation, Support systems and Procedures
  - Naming Standards
  - Document handling - wiki - Confluence
  - Incident and Project management – Jira
- AOB

NORDUnet Operations Organization



NUNOC is the 24x7 Operations organization established by NORDUnet, to operate and support Optical, IP network and einfrastructure for the NORDIC Research & Educational network(s).

NUNOC is currently operating and supporting the NORDUnet fibre, optical and IP networks as well as the national Swedish Research & Educational network (SUNET), but is available for all NORDIC Research and Educational organizations with a 24x7 network or einfrastructure operations and support requirement.

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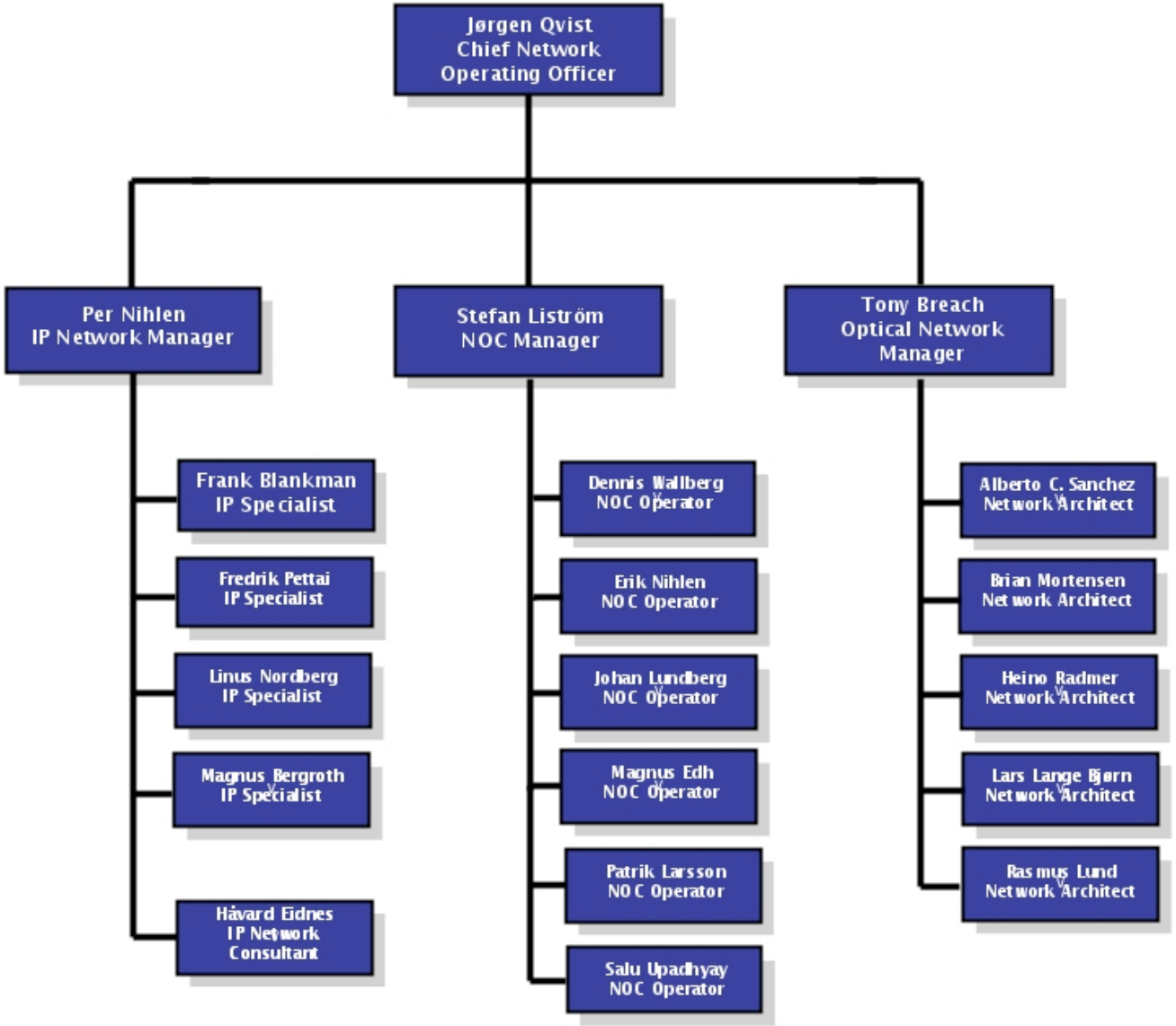
Who are we?



What do we do?

- NUNOC Service matrix

	FSKnet	FUNET	Rhnet	SUNET	UNINETT	NDGF	WAYF	Kalmar	Nordunet3
Rsearch IP	X	X	X	X	X				
IP Transit	X	X	X	X	X				
Lambda OPN	X	X		X	X	X			
SUB Lambda OPN				X	X				
24x7 NOC Services				X		X	X	X	
Hosting				X		X	X	X	
GN3 admin	X	X		X	X				
AAI				X					
WEB				X		X	X	X	X
Wiki				X		X	X	X	X
NEWS				X					
VCONF & Meeting				X		X	X	X	
Project Hosting / Admin						X			X
IPTV - VOD Trial				X					
Eduroam				X					

NORDUnet Sites

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NUNOC

EFG Partner AB
S:t Eriksgatan 58
Box 49 048
S-100 28 Stockholm

Tel. 08-617 68 30
Fax08-617 68 58
johan.bjurling@efg.se

www.efg.se

Stokab AB

STOCKHOLM

SIGN	SKALA	SKAPAT	RITN.NR
J. Bjurling	1 : 100	24.11.2006	1
SÄLJARE		UTSKRIVET	
Hans Lindh		27.11.2006	AAGAAP31 - 1

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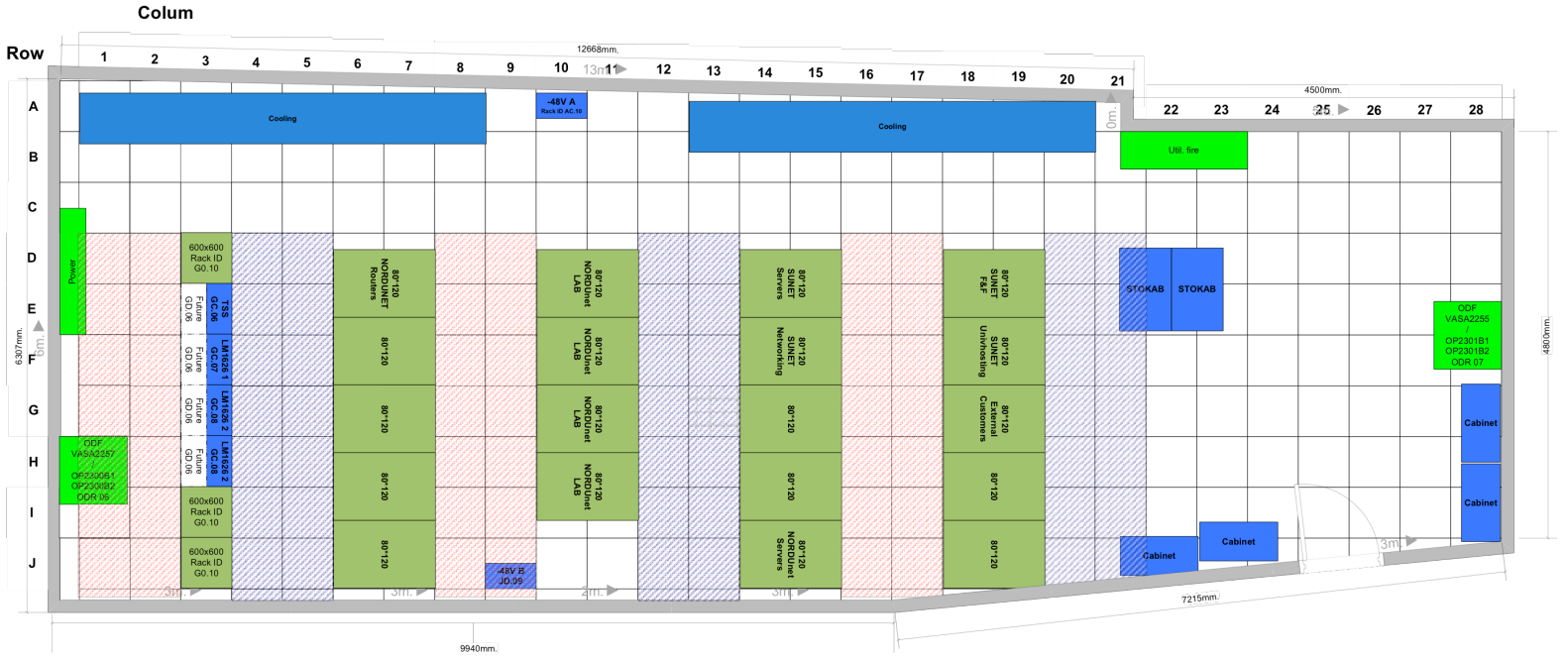
TUG Main Site

Step 15
Done



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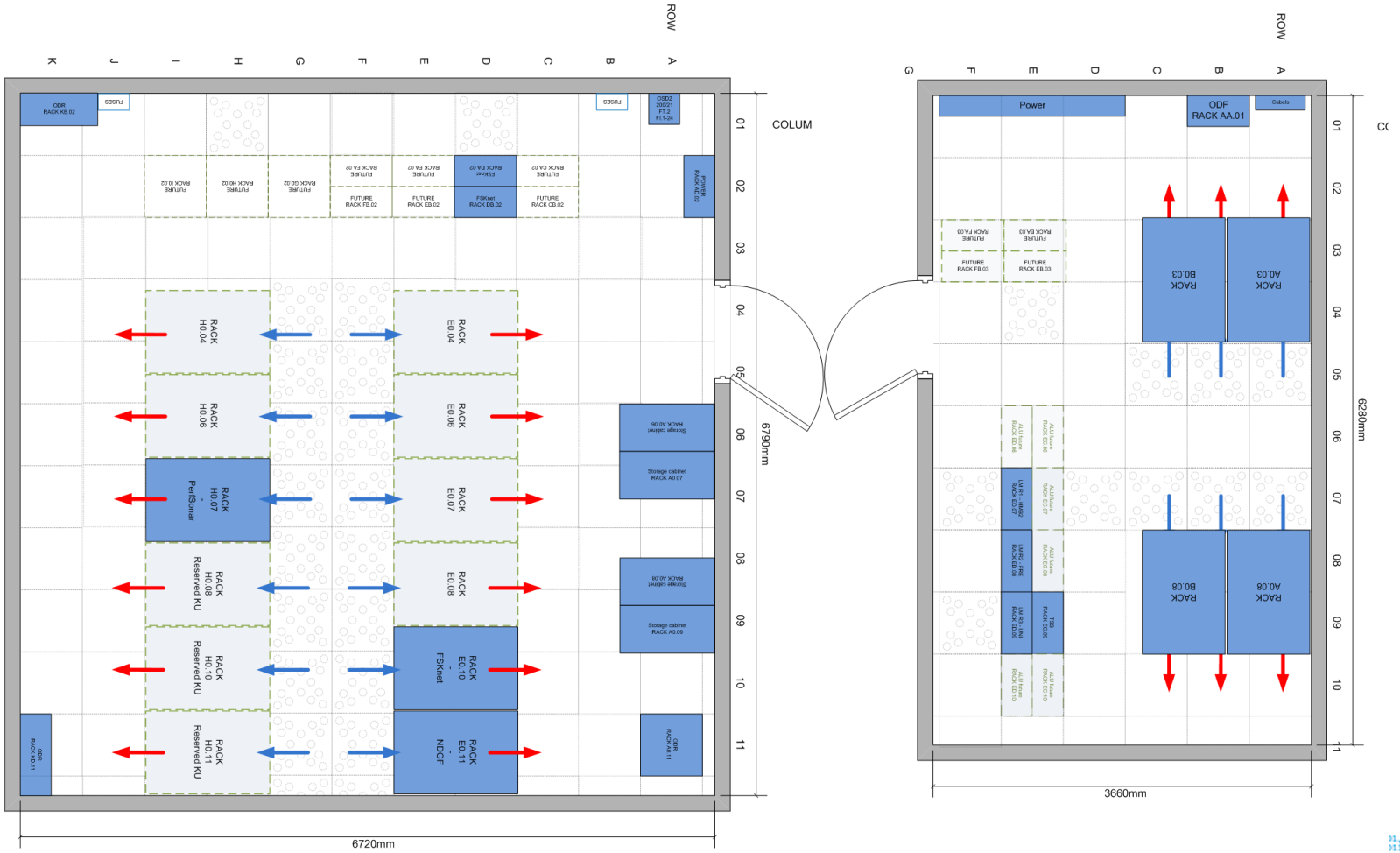
CPH Main Site



NORDUnet Networks

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Nordic NRENs

Denmark

FSKnet – National Hybrid Dark Fiber Infrastructure
>> DWDM and IP Core Routers

Finland

FUNET – National Hybrid Dark Fiber Infrastructure
>> DWDM and IP Core Routers

Iceland

RHnet – National Leased Infrastructure
>> Layer 2 switches and IP Core Routers

Norway

UNINETT – National shared Hybrid Infrastructure
>> DWDM, Layer 2 switches and IP Core Routers

Sweden

SUNET – National Hybrid Dark Fiber Infrastructure
>> DWDM, Layer 2 switches and IP Core Routers

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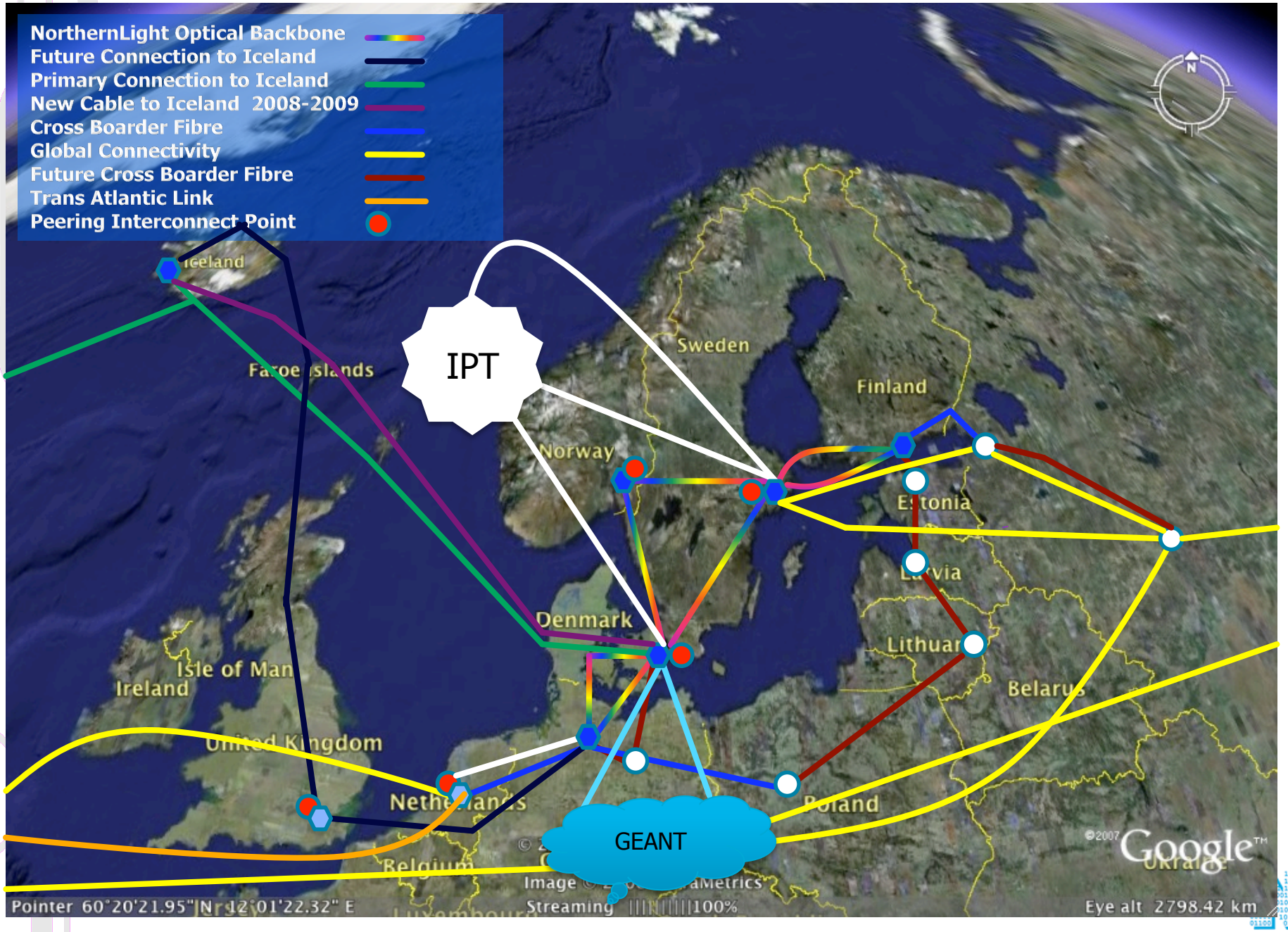
NORDUnet Infrastructure 2009



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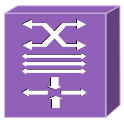
NORDUnet - Suppliers

- The Dark Fibre Network has been provided by
  - **Telenor**
    - Scandinavian Ring
    - Finland Link
  - **Global Crossing**
    - Southern Cross

Dark Fiber G.652

Dark Fiber G.655 TrueWave RS

- The Equipment has been provided by
  - **Alcatel-Lucent**
    - 1626 Light Manager
      - ULH DWDM
    - 1850 Transport Service Switch
      - SDH/Sonet
      - Ethernet
      - CWDM and SH DWDM
  - **Juniper**
    - T640



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Optical Network

NORDUFiber Background and Objectives

- Move from a Leased Line to a Dark Fiber infrastructure
- Accommodate the future demands for capacity
  - High-speed Internet
  - Lambda circuits
  - Private light path services
- Deployment of an Optical Exchange
- Fulfill these requirements without a substantial budget increase.

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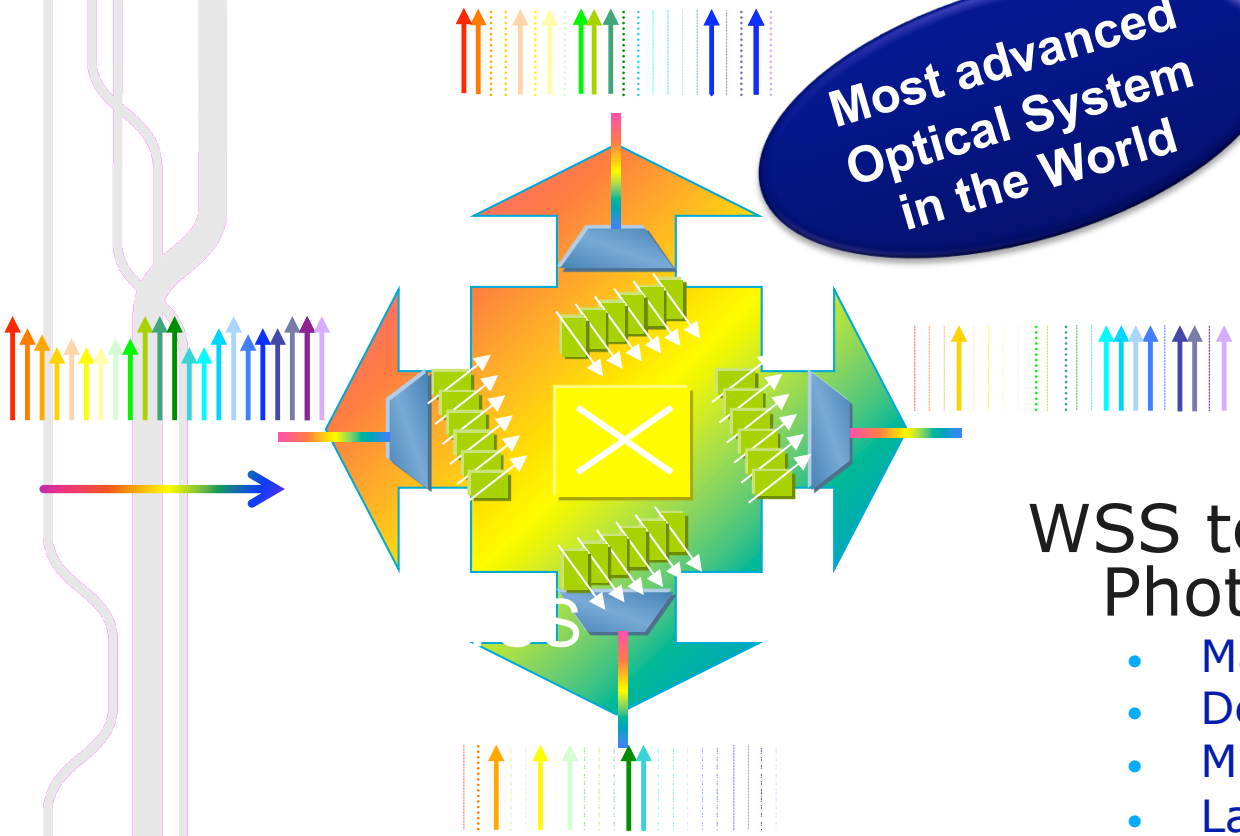
1626 Light Manager Tuneable-ROADM

- Wavelength Selective Switch 50GHz
- LH/ULH up to – 96 Ch. 72 Add/Drop
- Automatic system alignment
- Enhanced Tuneable Functionality
- Universal Transponder 10G and 40G
- Embedded Optical Protection



Most advanced Optical System in the World

WSS technology enables Photonic crossconnection

- Managing multiple ports: ≥ 2
- Demultiplexing
- Multiplexing
- Lambda switching
- Optical attenuation

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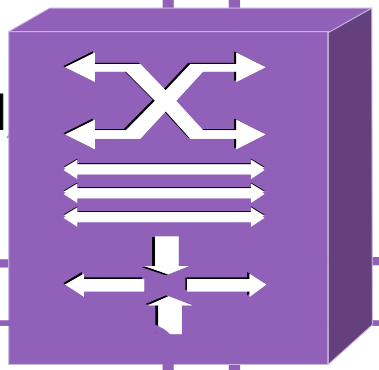
ALU 1850 TSS-320

SDH/SONET

- STM-1, 4, 16 & 64
- Cross-Connection
- Termination
- ETH Mapping over SDH
- Complete Scope of SDH, SONET Features



Ethernet

- 10GE LAN/WAN - Optical
- GE - Optical
- 10/100/1000 - Electrical
- ETH Traffic Classification
- Complete Scope of Ethernet Features

CWDM

- Terminal, Hub, OADM Ring
- Stacked C-WDM Rings

MSPP

- CLI, SNMP and TL1
- 2008 GMPLS feature set

1850 TSS-320

NORDUnet 3rd Generation

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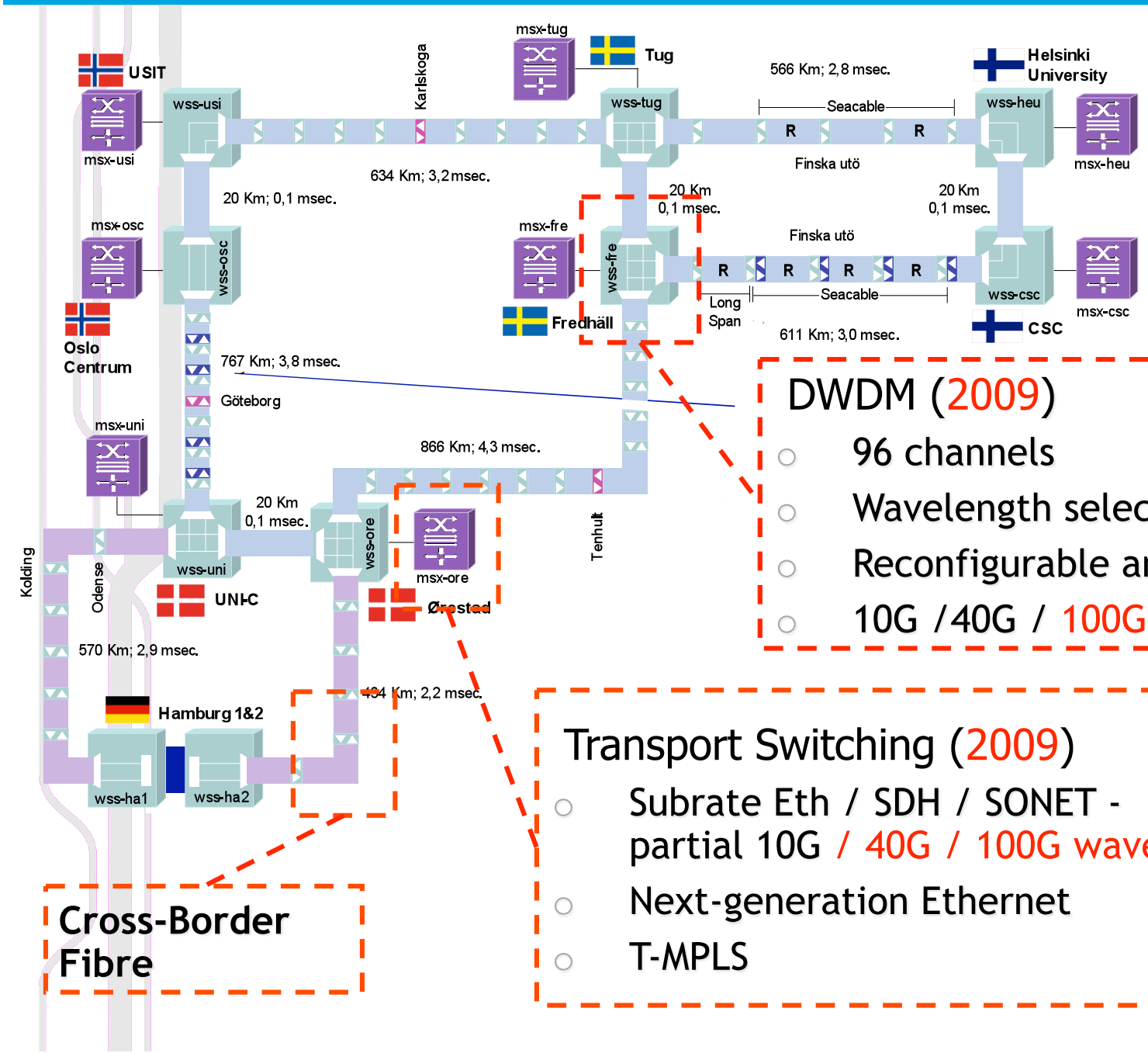

DWDM (2009)

- 96 channels
- Wavelength selector switches
- Reconfigurable and tunable
- 10G /40G / 100G waves

Transport Switching (2009)

- Subrate Eth / SDH / SONET - partial 10G / 40G / 100G waves
- Next-generation Ethernet
- T-MPLS

Cross-Border Fibre

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IP Network

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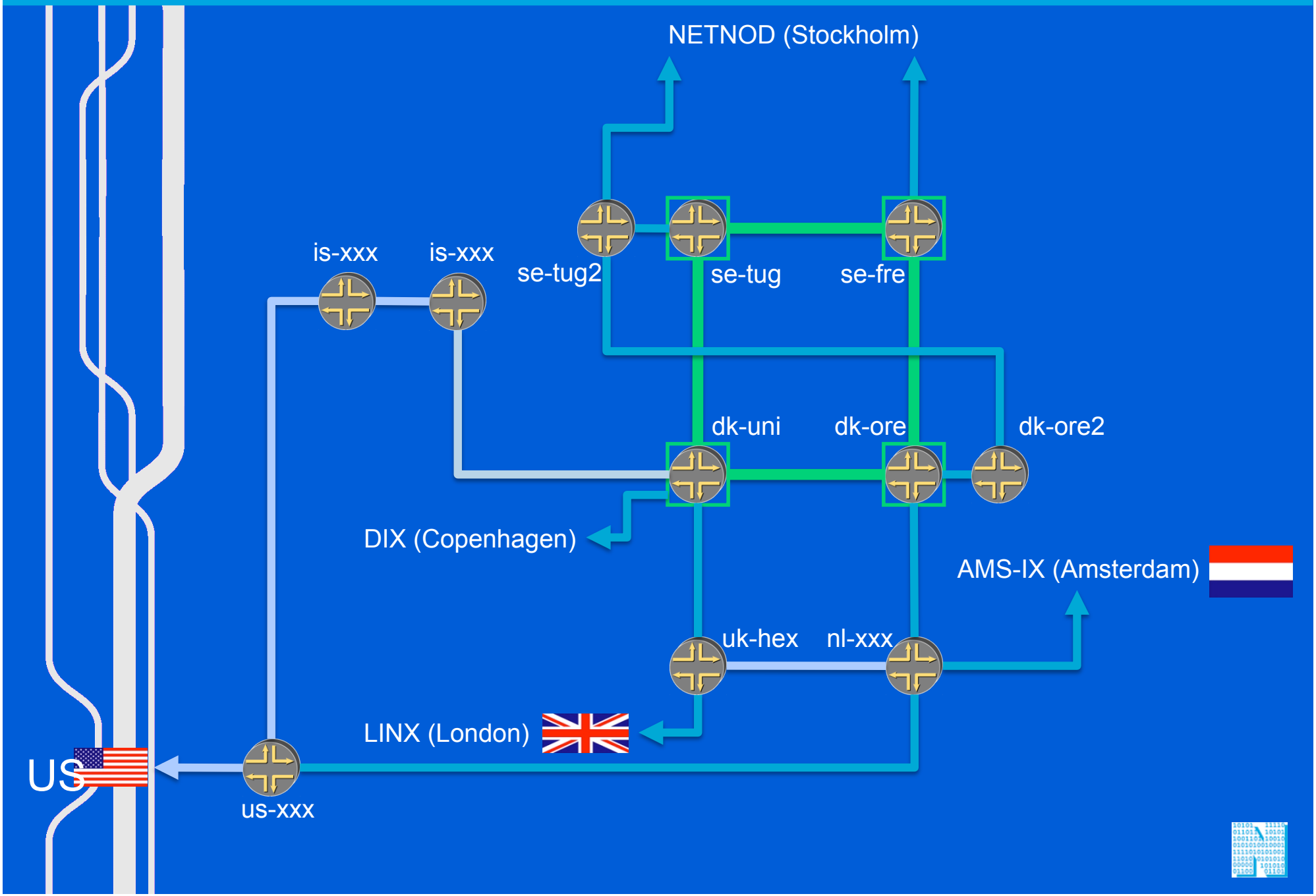

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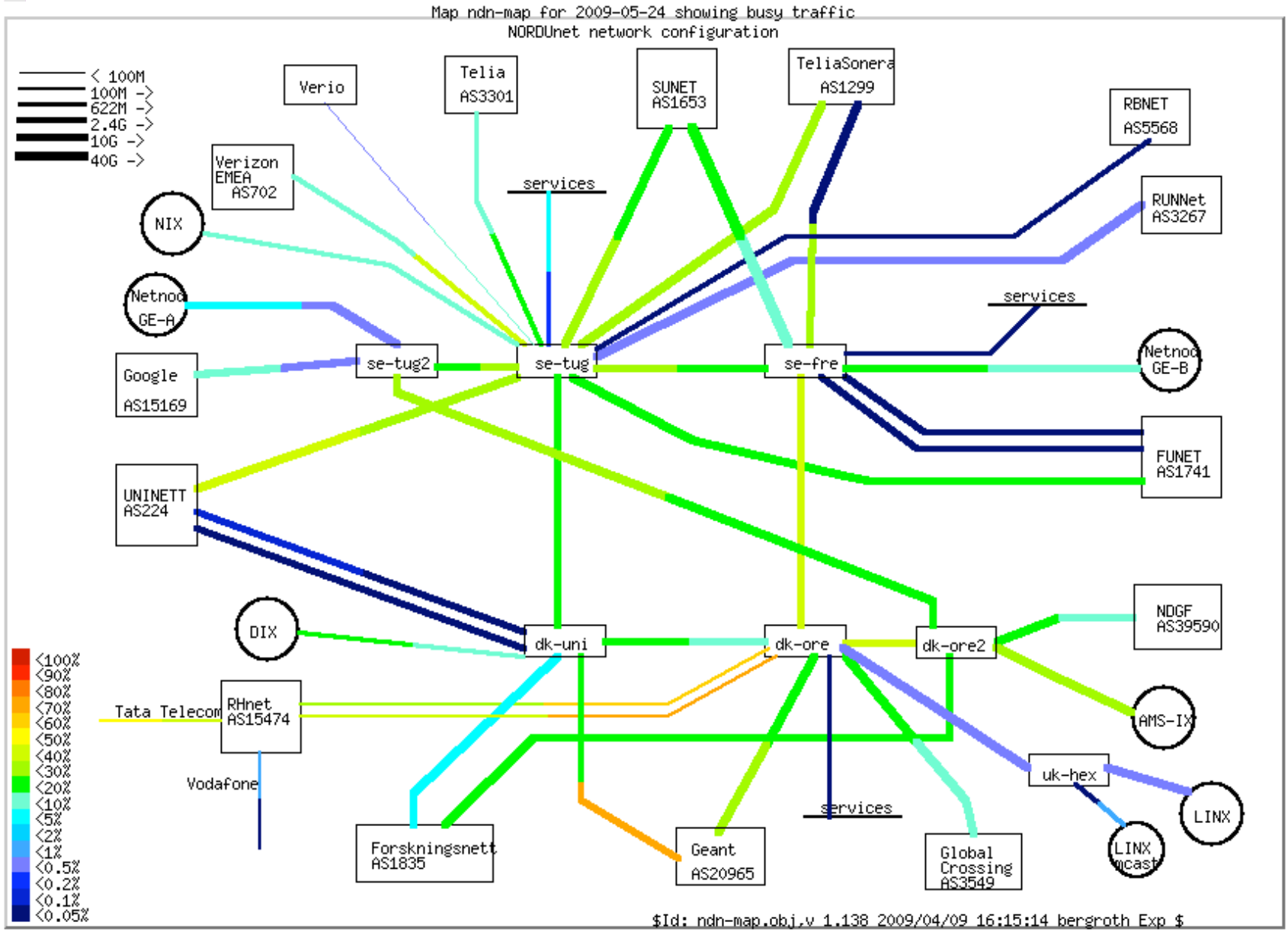
NORDUnet IP Network



http://www.nordu.net/stat-q/load-map/ndn-map,,traffic,busy

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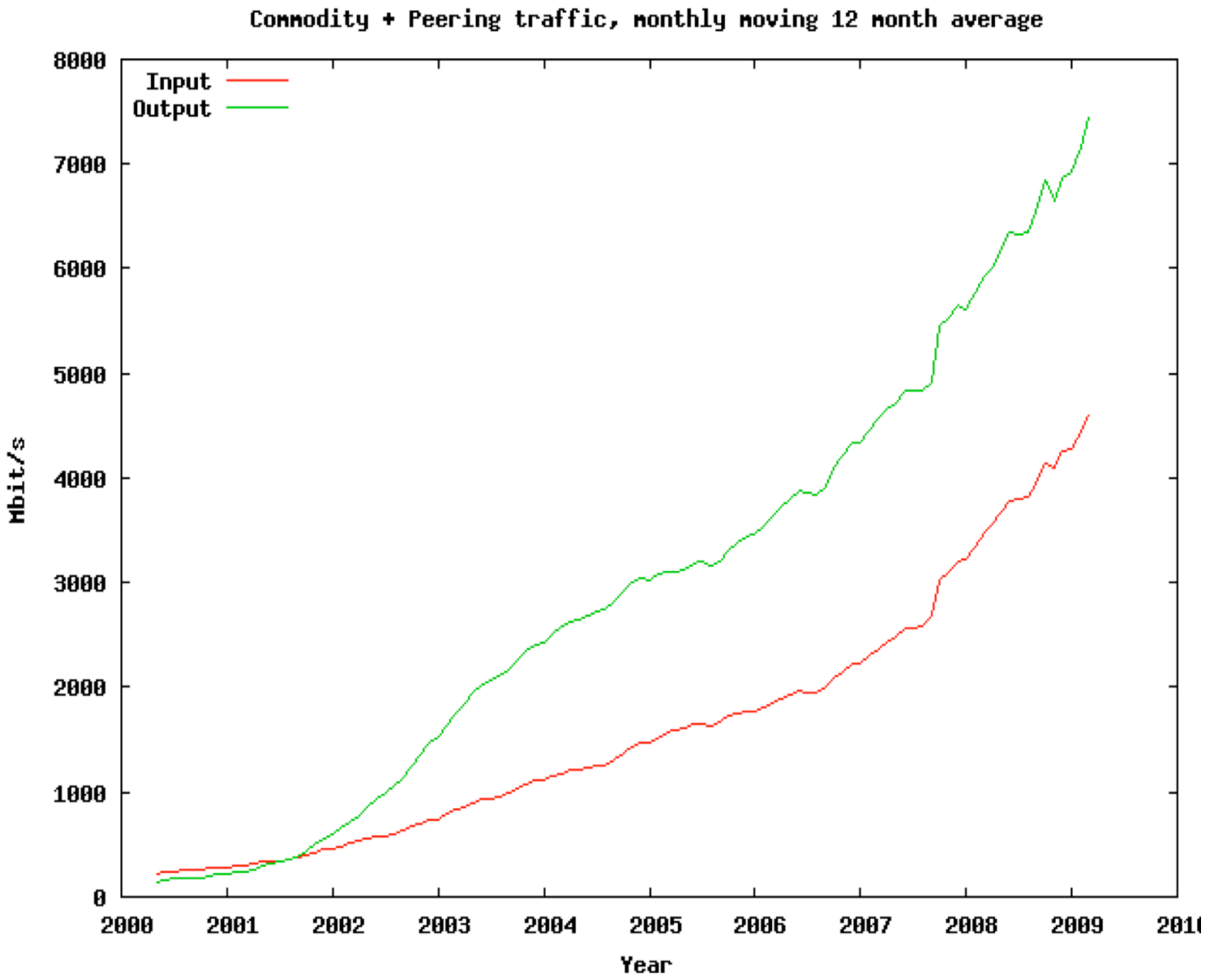
Total internet trafic



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The IP Transit challenge

Growth in traffic drives increased cost of IPT

Peering Strategy -
Increase peering % to 50

- Peering DIX, by end q1
- Peering NIX, by end q1
- Peering LINX, by end q2
- Peering NYIIX, by end q3

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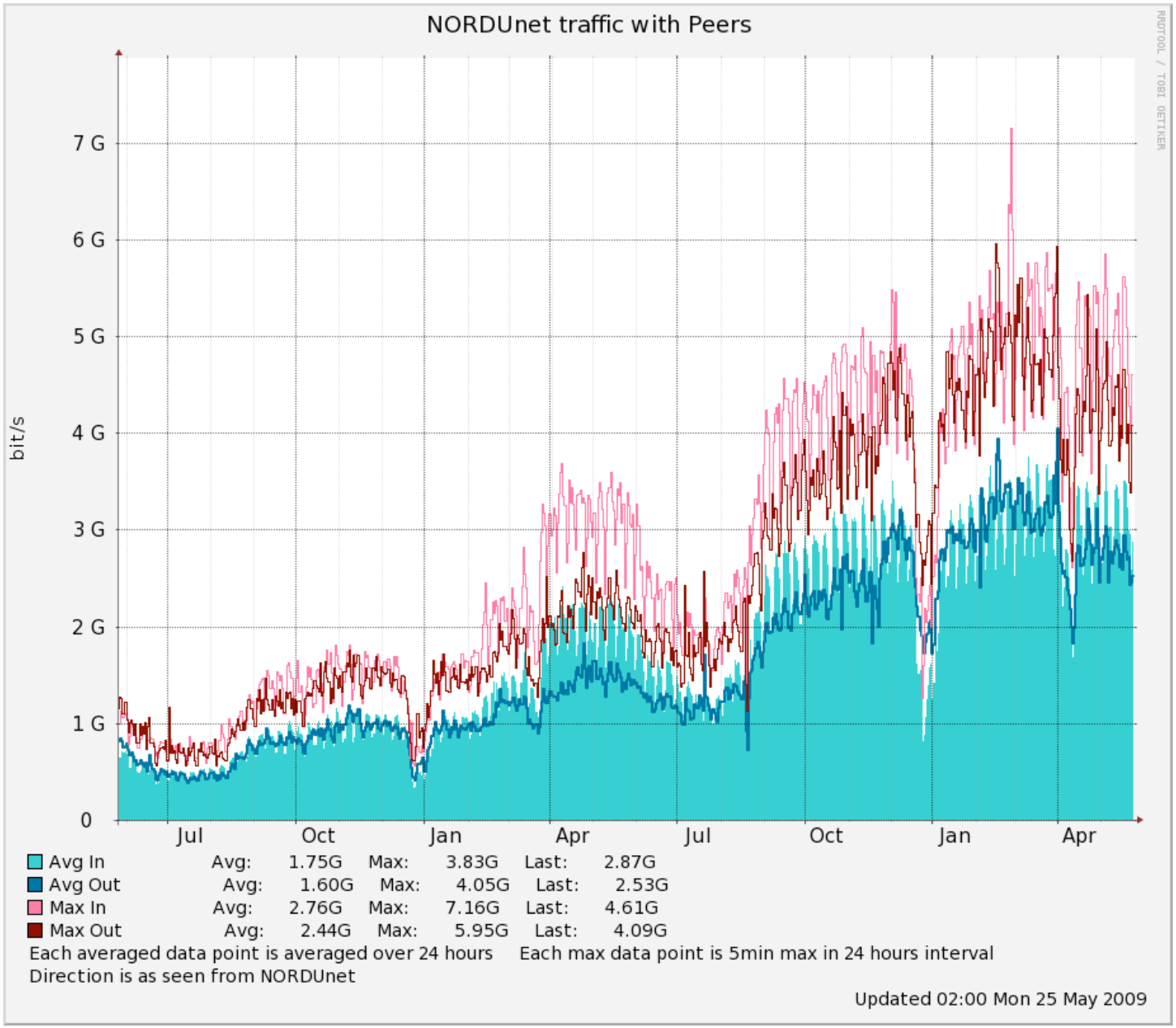
NORDUnet Peering



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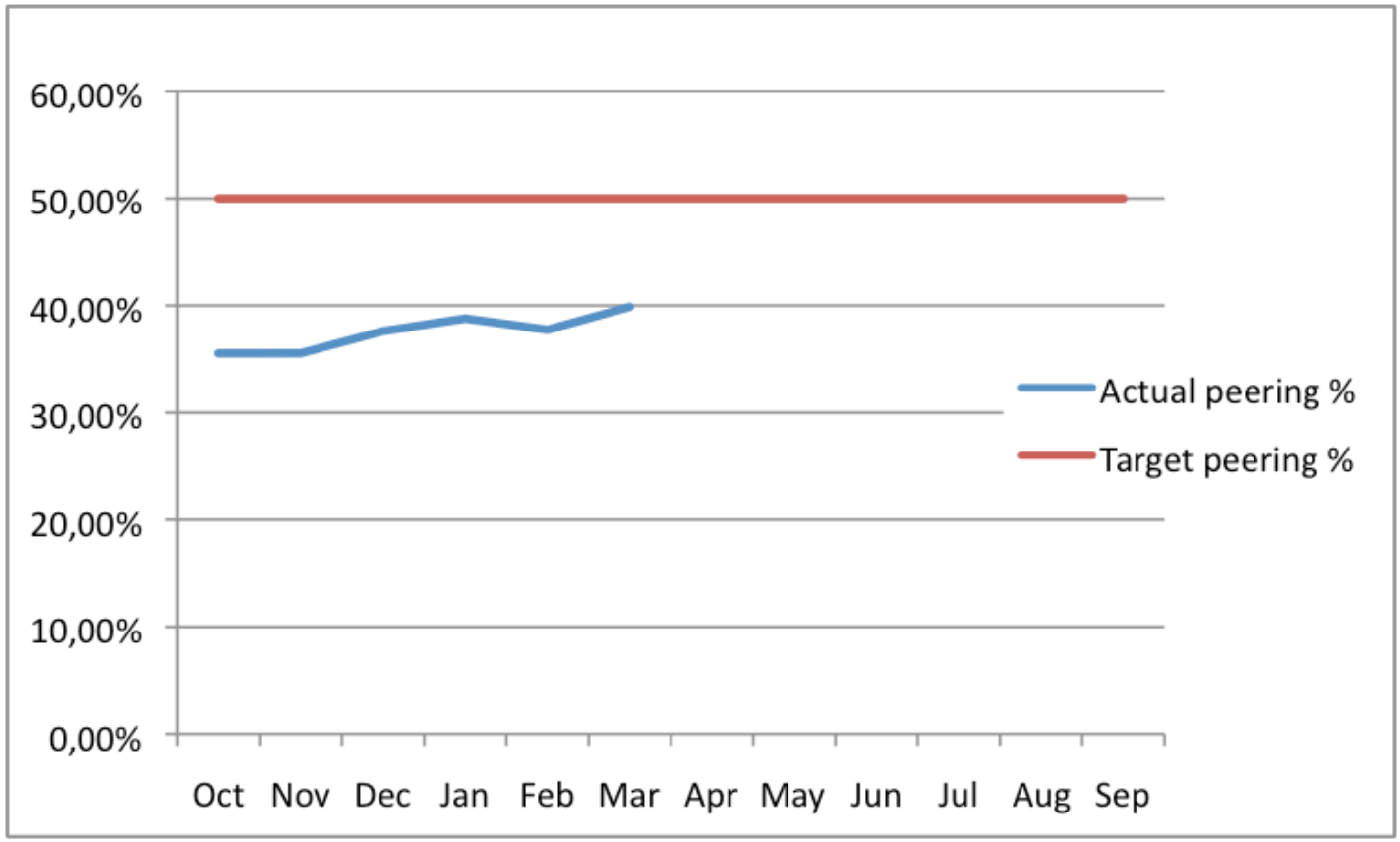
Peering Versus IP Transit

In Gbit/sec	2004	2005	2006	2007	2008
IP Transit	3,50	5,00	6,00	7,50	9,00
Peering	0,30	0,50	1,00	1,50	5,00
Total	3,80	5,50	7,00	9,00	14,00
Peering %	7,89%	9,09%	14,29%	16,67%	35,71%



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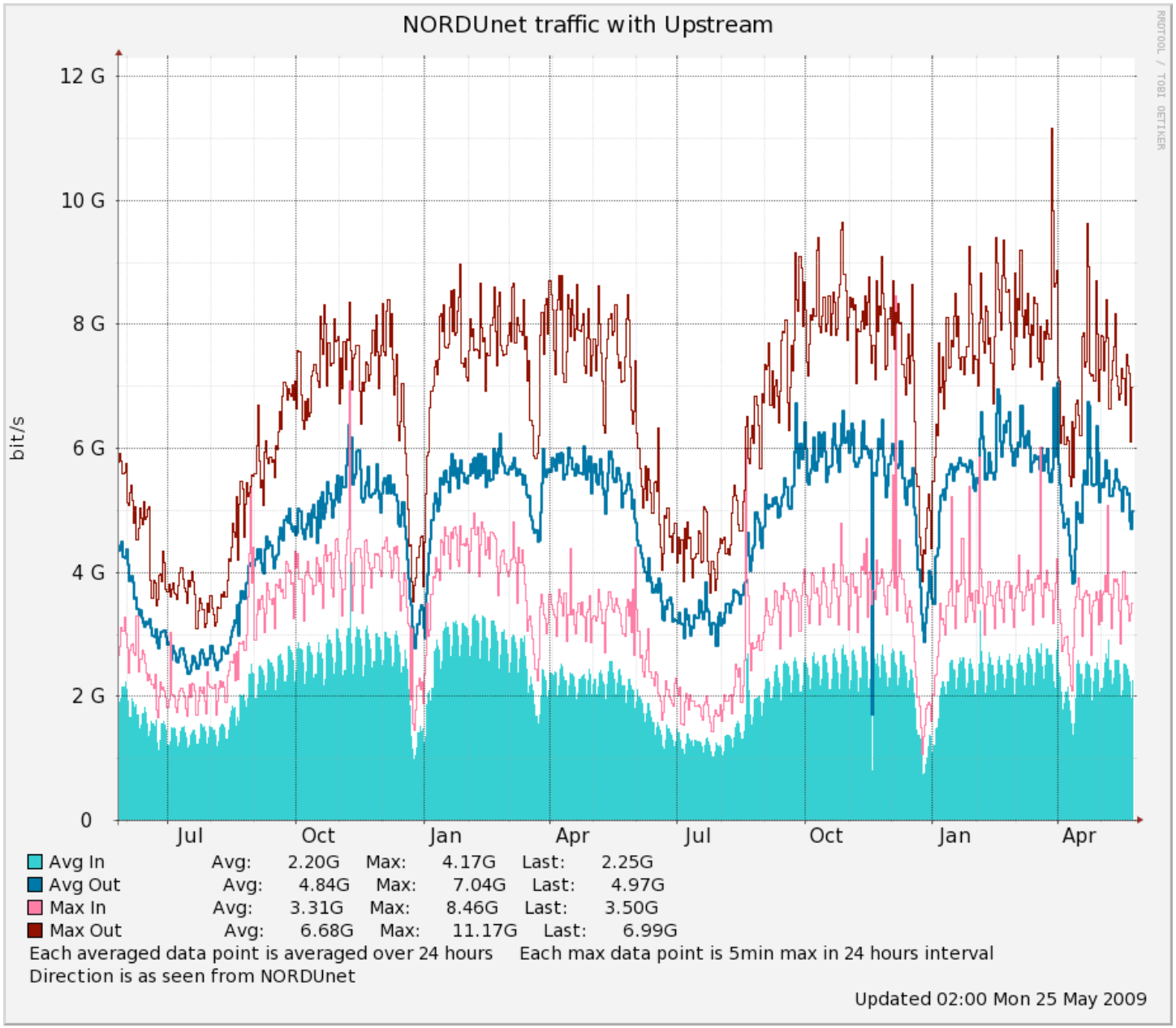
NORDUnet IP Transit



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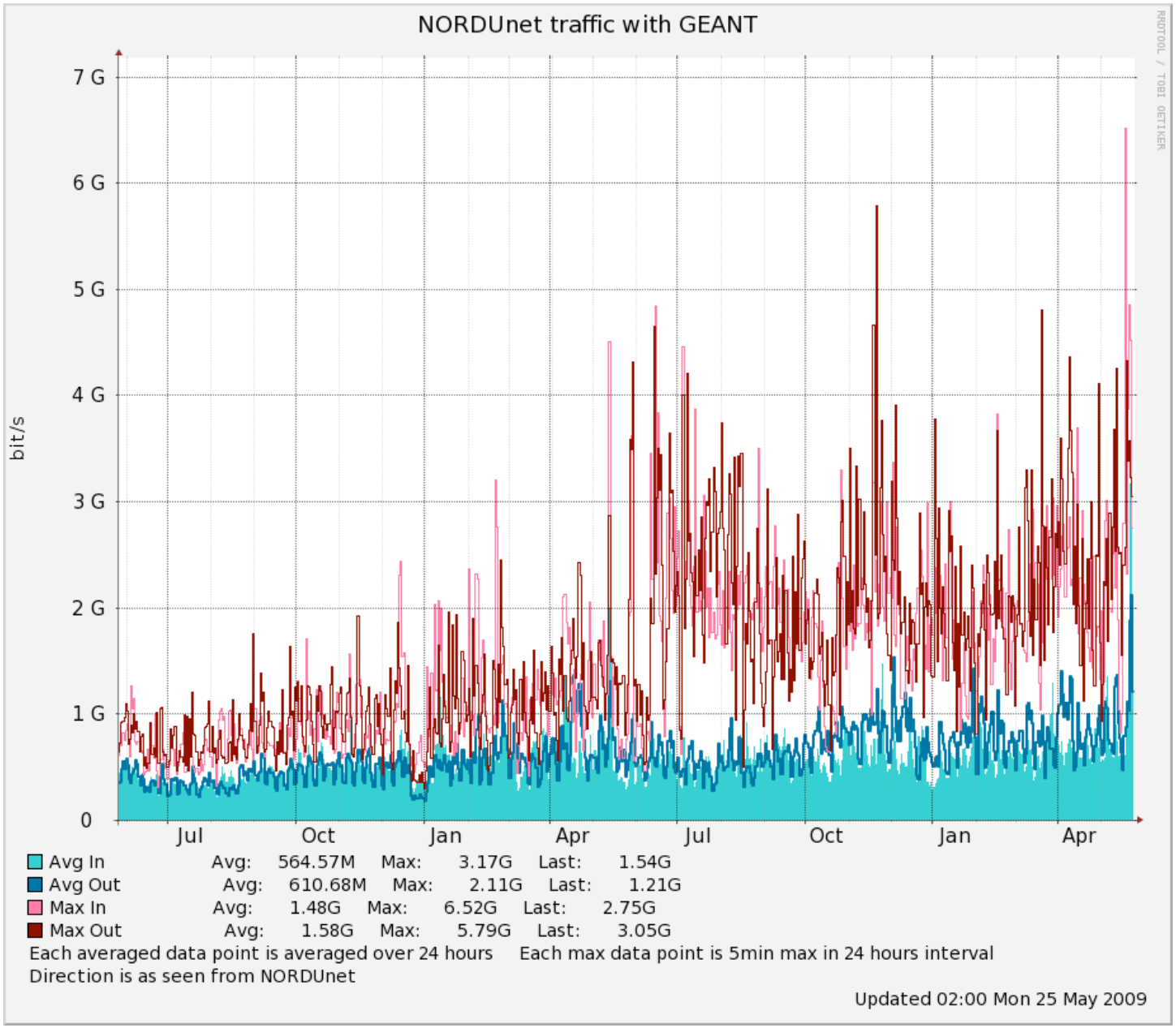
NORDUnet GEANT



Documentation, Support systems and Procedures

Naming Standards

Naming Standard

- Generic naming standard
  - Physical (sites, cables, equipment, etc.)
  - Logical (links, path, virtualized servers etc.)
  - Services
  - Organisations

  NORDUnet Generic naming standard can be found
  http://www.nunoc.net/nunocweb/services.html

- Linked to a data model

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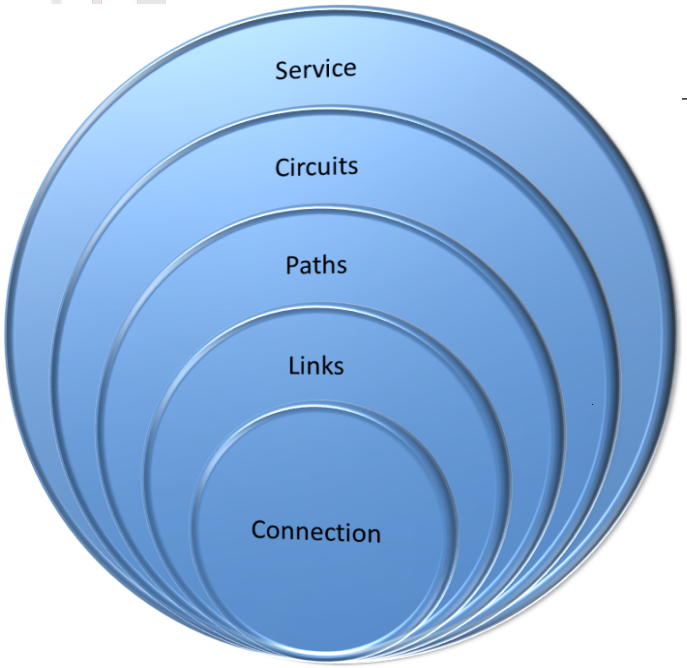
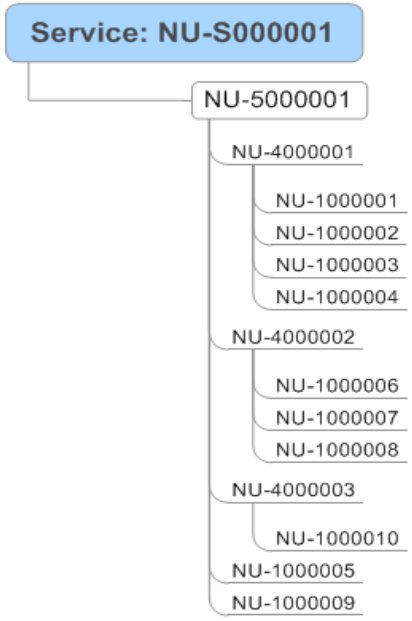
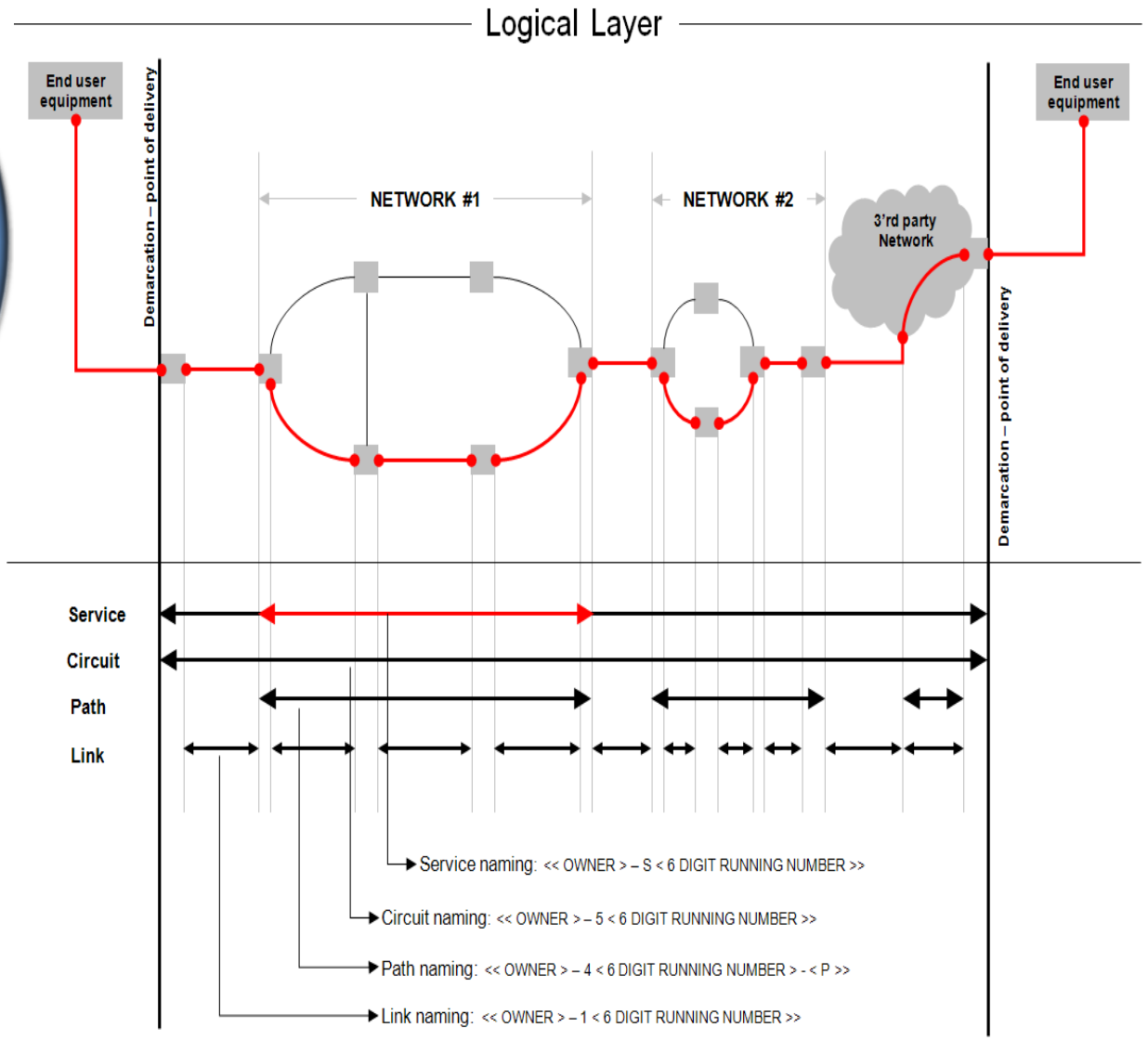
Data Model







The support systems

Document handling - wiki

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The Jira Trouble Ticket System

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Cheap

Customizable

Info. distribution

Reporting

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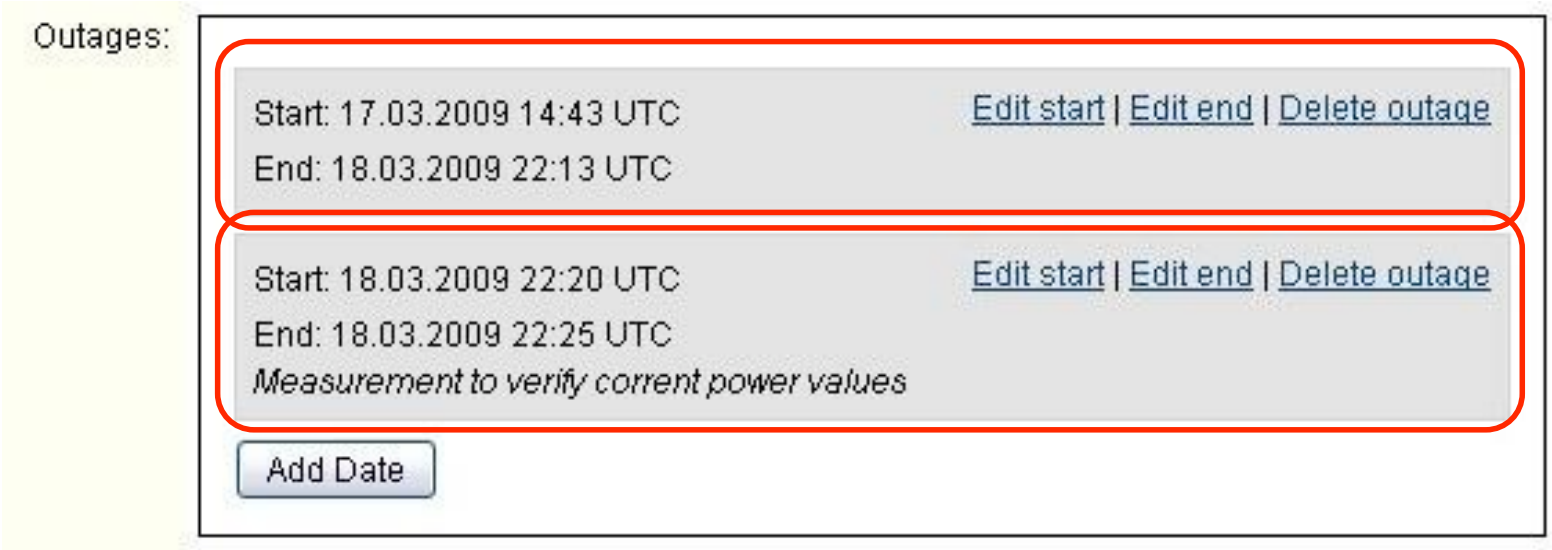
Cheap

Customizable

Info. distribution

Reporting

Multiple outages



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Ticket scope

Cheap | Customizable | Info. distribution | Future

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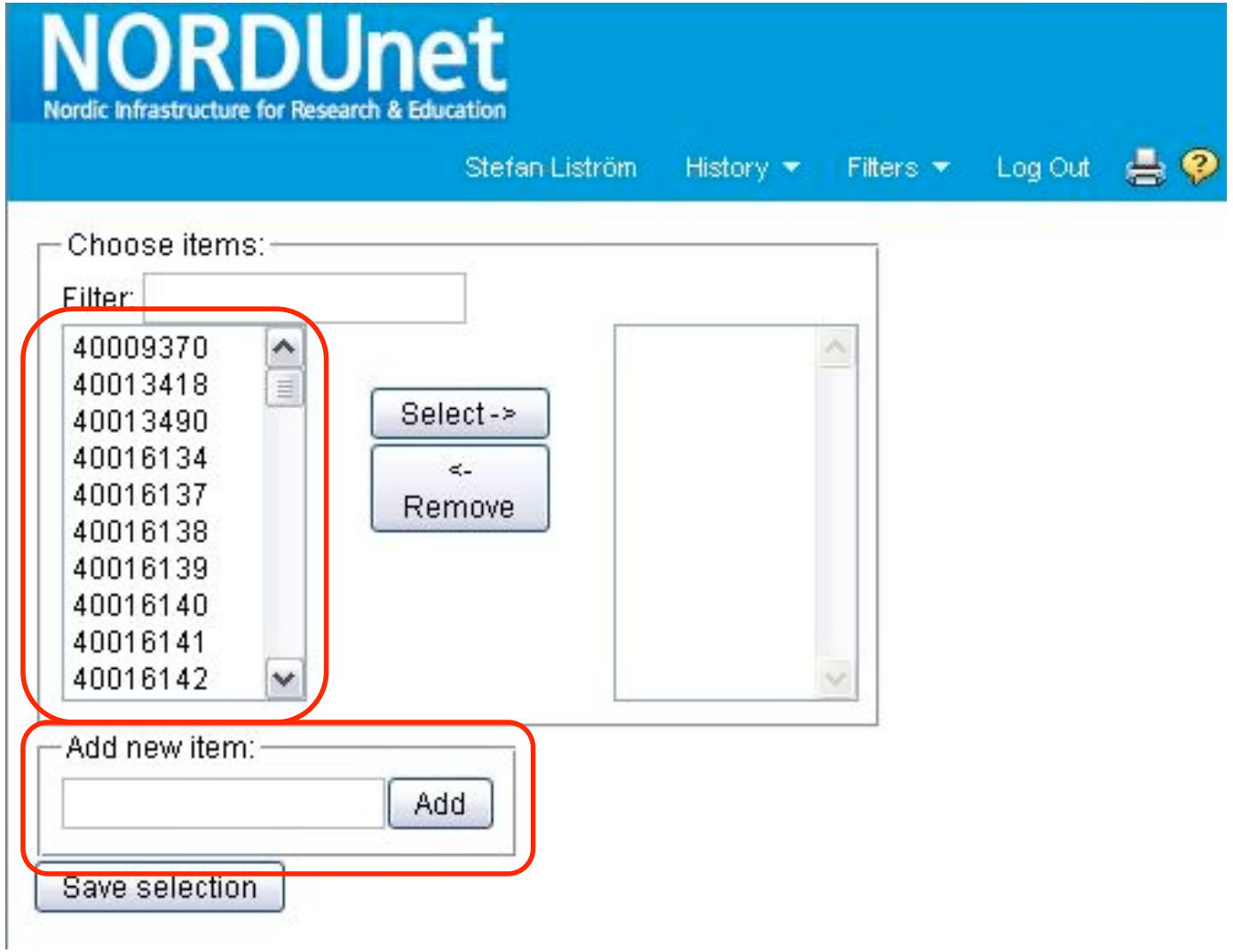
Dynamic value picker



Cheap | Customizable | Info. distribution | Future

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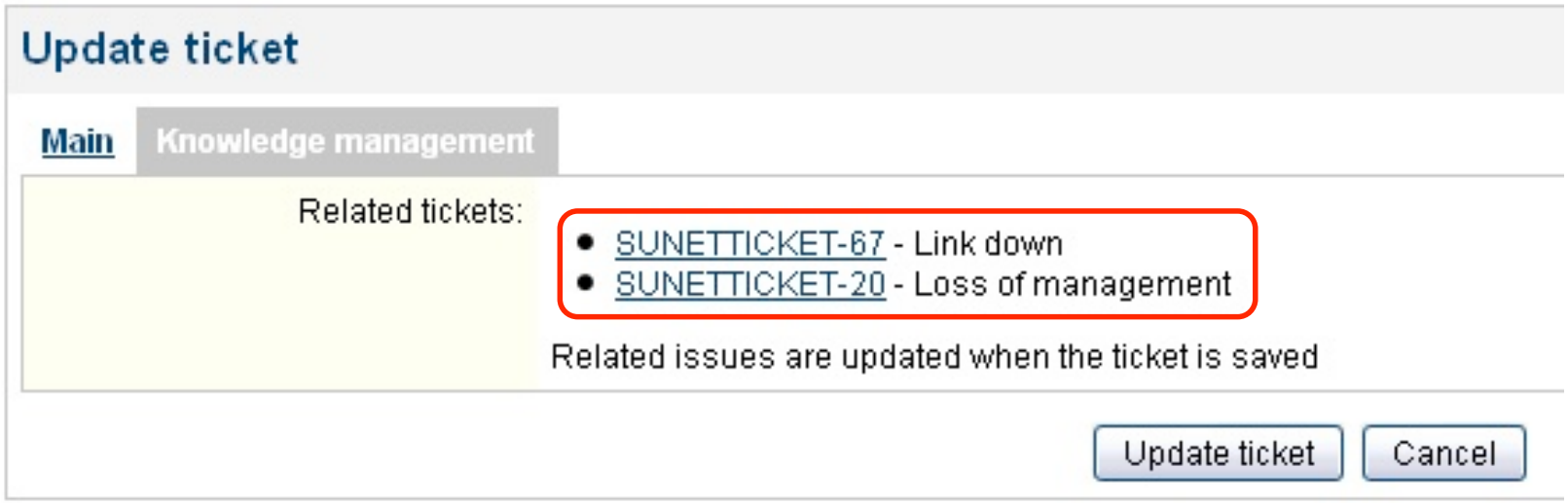
Knowledge management



Cheap | Customizable | Info. distribution | Future

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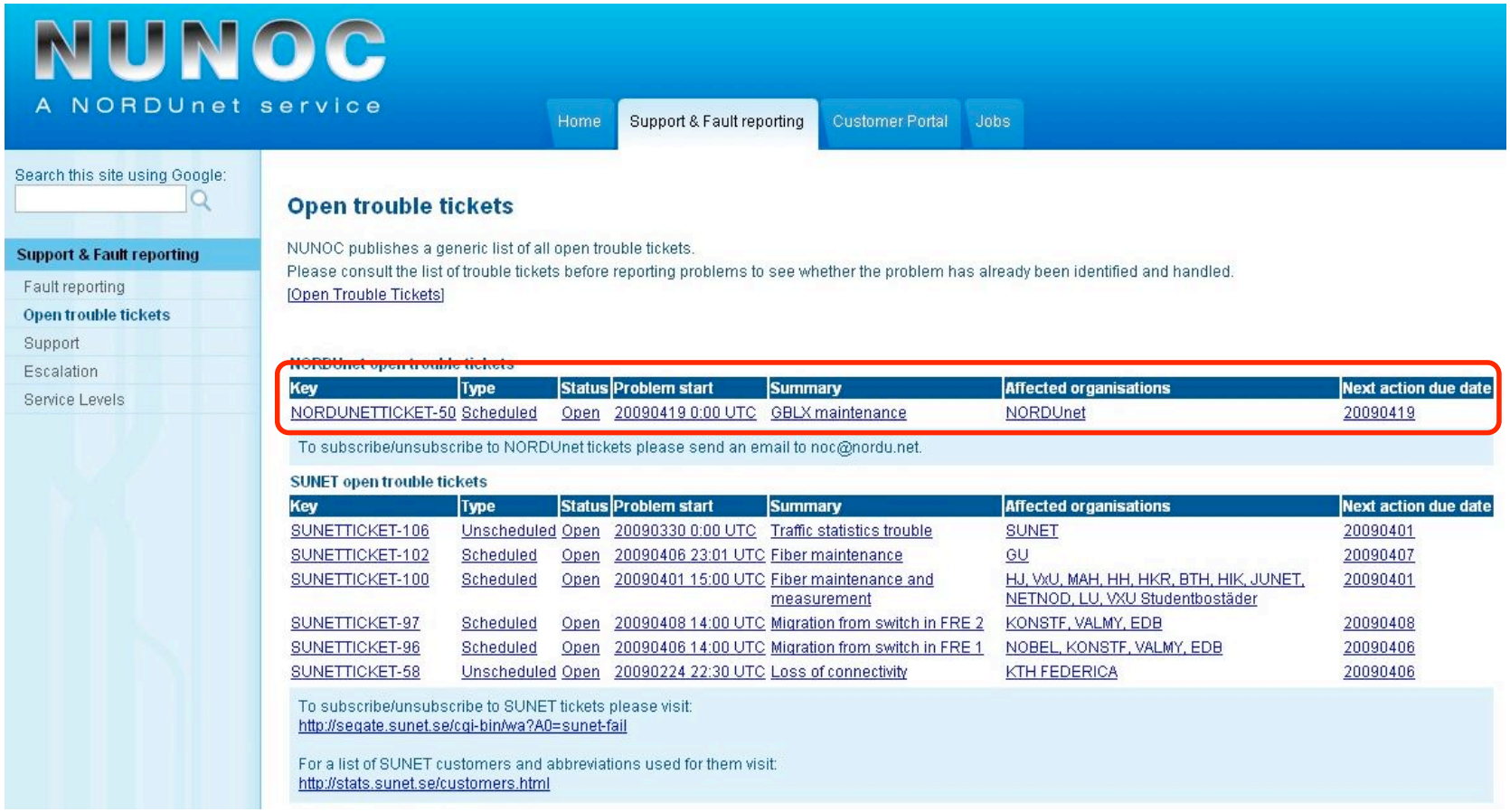
Webpage visualization



NUNOC
A NORDUnet service

Home | Support & Fault reporting | Customer Portal | Jobs

Search this site using Google:

Support & Fault reporting
- Fault reporting
- Open trouble tickets
- Support
- Escalation
- Service Levels

Open trouble tickets

NUNOC publishes a generic list of all open trouble tickets.
Please consult the list of trouble tickets before reporting problems to see whether the problem has already been identified and handled.
[Open Trouble Tickets]

NORDUnet open trouble tickets

Key	Type	Status	Problem start	Summary	Affected organisations	Next action due date
NORDUNETTICKET-50	Scheduled	Open	20090419 0:00 UTC	GBLX maintenance	NORDUnet	20090419

To subscribe/unsubscribe to NORDUnet tickets please send an email to noc@nordu.net.

SUNET open trouble tickets

Key	Type	Status	Problem start	Summary	Affected organisations	Next action due date
SUNETTICKET-106	Unscheduled	Open	20090330 0:00 UTC	Traffic statistics trouble	SUNET	20090401
SUNETTICKET-102	Scheduled	Open	20090406 23:01 UTC	Fiber maintenance	GU	20090407
SUNETTICKET-100	Scheduled	Open	20090401 15:00 UTC	Fiber maintenance and measurement	HJ, VxU, MAH, HH, HKR, BTH, HIK, JUNET, NETNOD, LU, VXU Studentbostäder	20090401
SUNETTICKET-97	Scheduled	Open	20090408 14:00 UTC	Migration from switch in FRE 2	KONSTF, VALMY, EDB	20090408
SUNETTICKET-96	Scheduled	Open	20090406 14:00 UTC	Migration from switch in FRE 1	NOBEL, KONSTF, VALMY, EDB	20090406
SUNETTICKET-58	Unscheduled	Open	20090224 22:30 UTC	Loss of connectivity	KTH FEDERICA	20090406

To subscribe/unsubscribe to SUNET tickets please visit:
http://seqate.sunet.se/cgi-bin/wa?A0=sunet-fail

For a list of SUNET customers and abbreviations used for them visit:
http://stats.sunet.se/customers.html

Cheap | Customizable | **Info. distribution** | Future

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Reporting

EditGrid Welcome, stefan. Preferences | Verify Email | Logout — Spreadsheets | Organisation

Spreadsheet / klaus / Example - AvailabilityReport with TTS field mapping

File Edit View Format Insert Data Share Publish Collaborate — Auto Saved

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SUNET report					TDC			November 2008				
2													
3	TT	VT	Ty	Problem start (CET)	Problem escalated (CET)	Problem end (CET)	Plan	ET	Duration	NW	Trail	Circuit ID	Cause/Comment
4	3224	PW53922	1	04 Nov 08:00		04 Nov 22:17	Y	24h	31d 14h 17m	NR	SU-2000047	40019242	TDC needed to do a perform maintenance on IRF Kiruna's backup link to SUNET due to earlier cable damage.
5	3326	484990	1	25 Nov 02:50	25 Nov 09:27	25 Nov 14:05	N		31d 11h 15m	WG	SU-2000109	40016643	Outage to CTH and Onsala was due to a fiber cut in Göteborg
6	3293	PW54382	1	27 Nov 11:41		27 Nov 12:54	Y	6h	31d 1h 13m	WG	SU-2000014	40016155	TDC performed maintenance in Borlänge.
7													
8													

Cheap Customizable Info. distribution Future

Network Expansion 2009

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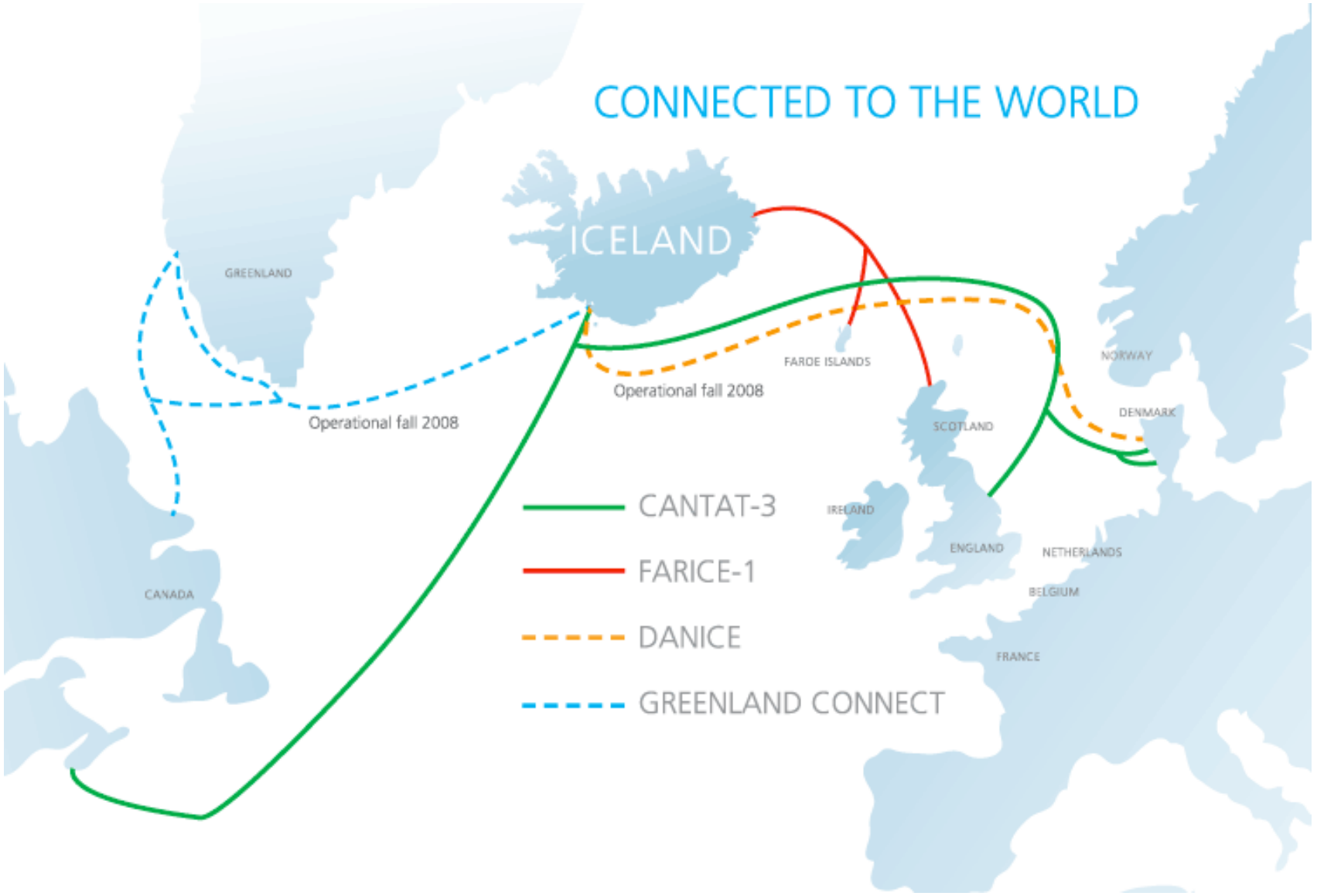
Icelandic Connectivity



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NORDUnet Network Evolution

- Upgrade of Core IP Backbone to 40 Gbit
- Upgrade all NREN connections to 10 Gbit
- New Network Projects:
  - CPH – LON
  - Iceland – Greenland – US
  - CPH – US
  - CERN Redundancy
  - CBF:
    - Hamburg – Poznan
    - Helsinki – Sct. Petersburg (Moscow)
- Peering:
  - Nordic, DIX, NIX
  - LINX
  - NYIIX, LAMBDARAIL, INTERNE2

Network Evolution Trends

Optical Networking Trends

- Federated networks built from NREN facilities:
  - Cross Border Fibers
  - Light path Exchanges
- Collapsed backbone topology
- Dynamic Circuit Networking
  - From static configurations to tunable lasers and filters
  - Wavelength Selector Switches for flexible routing of entire lambdas in the optical domain
  - Alien waves – for inter-domain lambdas
  - Dynamic configuration that allows control plane systems to alter lambda routes “on the fly”
- Transmission:
  - Multi-domain WSS 40G,
  - 100G trials
- Virtualization (logical routers, service oriented middleware, cloud computing ..)

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The Federated Challenge