

# Lightpath Planning & Monitoring

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This work is done by  
Andree Toonk  
Ronald van der Pol  
and funded by  
SURFnet  
GigaPort

# Overview

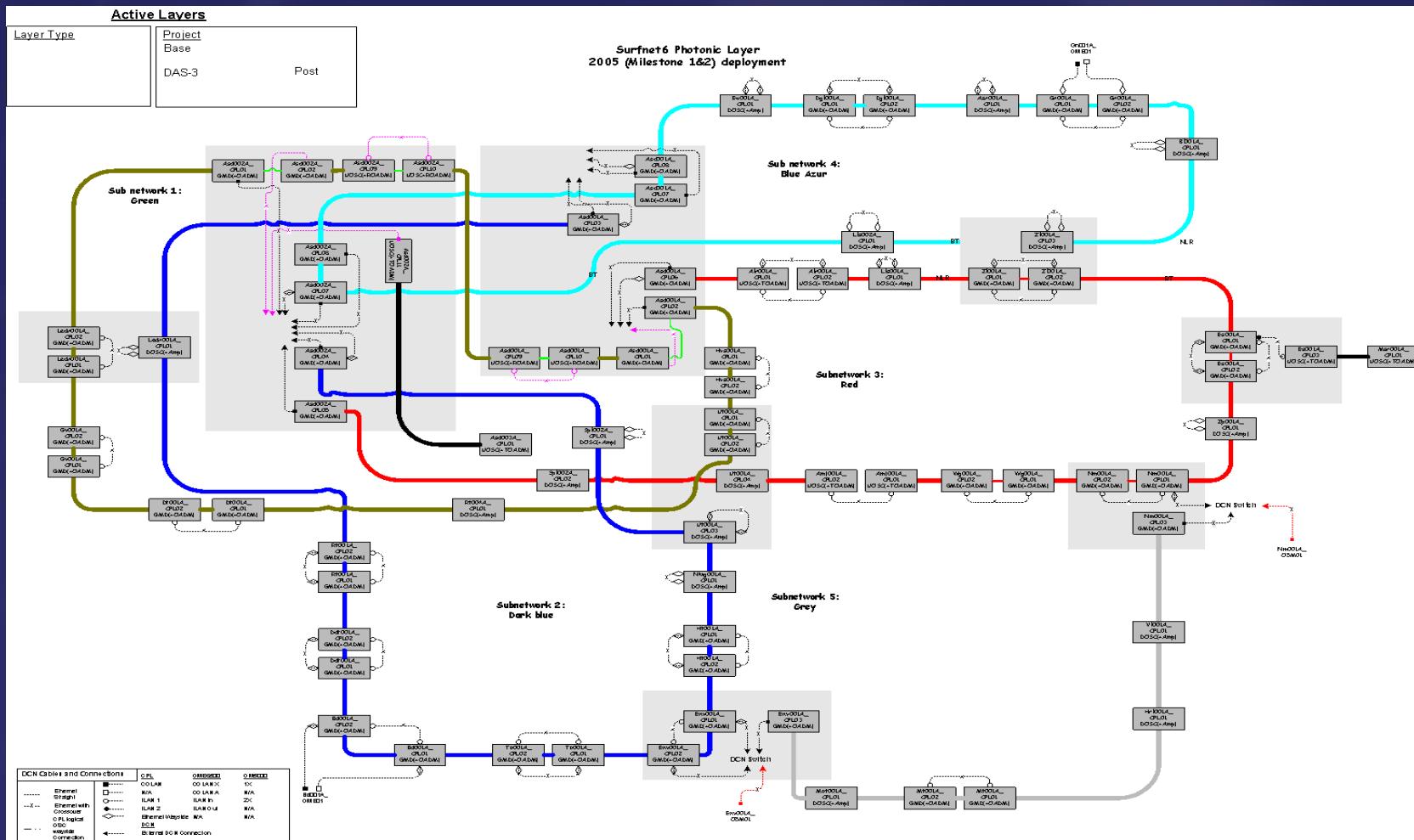
- ▶ overview of SURFnet6
- ▶ lightpaths in SURFnet6
- ▶ requirements for lightpath mgmt
- ▶ lightpath tool architecture
- ▶ planning and monitoring examples

# SURFnet6 Topology

- routing
  - Avici
- Optical Network
  - Nortel
- 6000 km dark fiber



- Nortel CPL (Common Photonic Layer)
  - ▶ DWDM
  - ▶ 36 (or 72) wavelengths per fiber
    - 100 GHz (50 GHz) grid
  - ▶ 9 groups of 4 (or 8) wavelengths
- driven by OM5200 and OME6500
  - @ OC192 (9.95 Gbps) speed
- lightpath support (OM5200, OME6500)



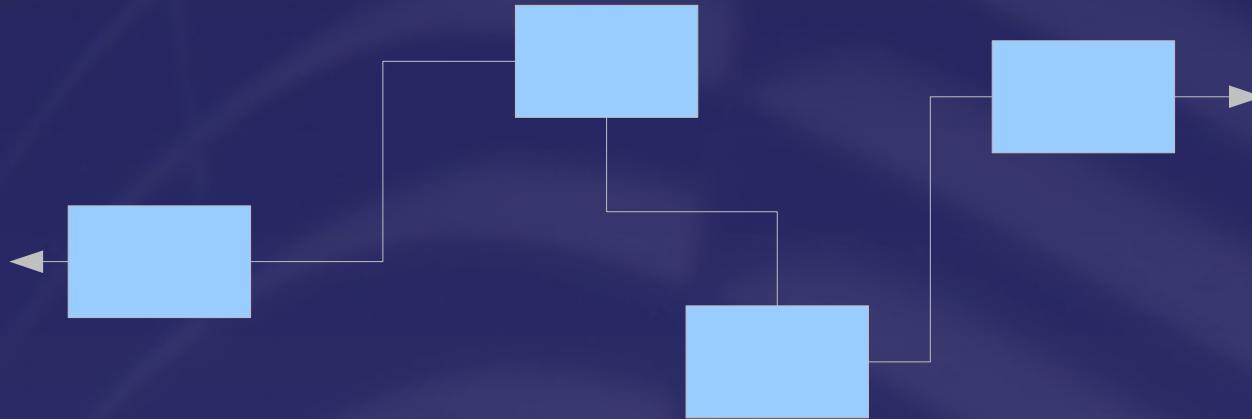
# Lightpaths

- ▶ 150 Mbps, 600 Mbps, 1 Gbps, 10 Gbps
- ▶ Ethernet as customer interface
  - ▶ 1 Gbps or 10 Gbps
- ▶ VCAT and GFP support
- ▶ protected or unprotected

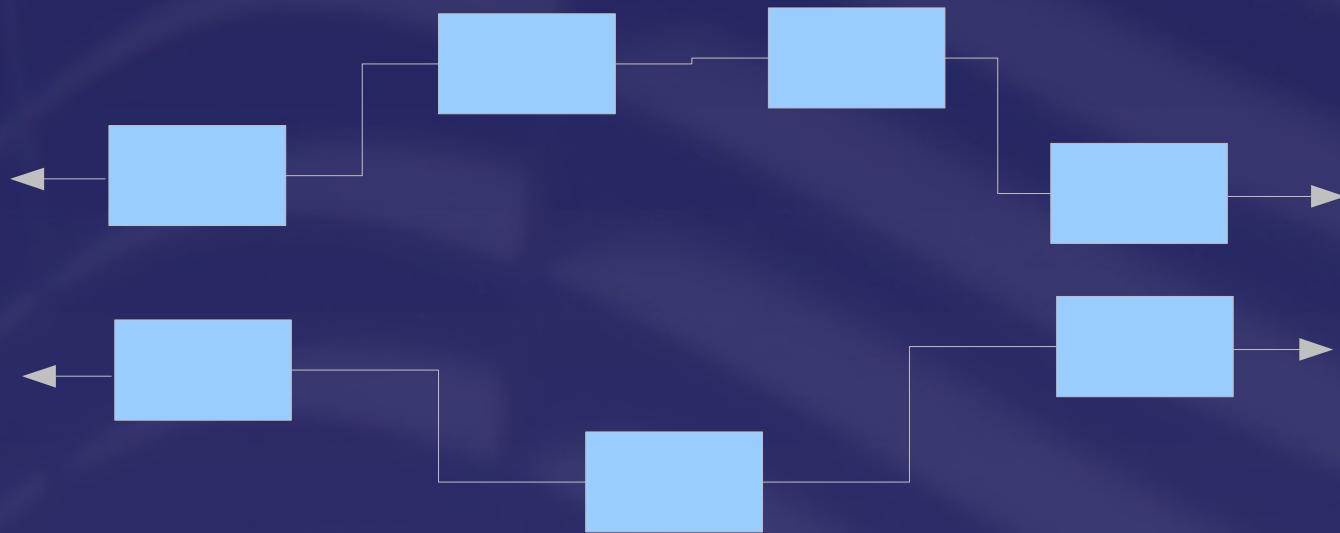
# Types of Lightpaths

- unprotected lightpath
- redundant lightpaths
- protected lightpath
- Optical Private Network

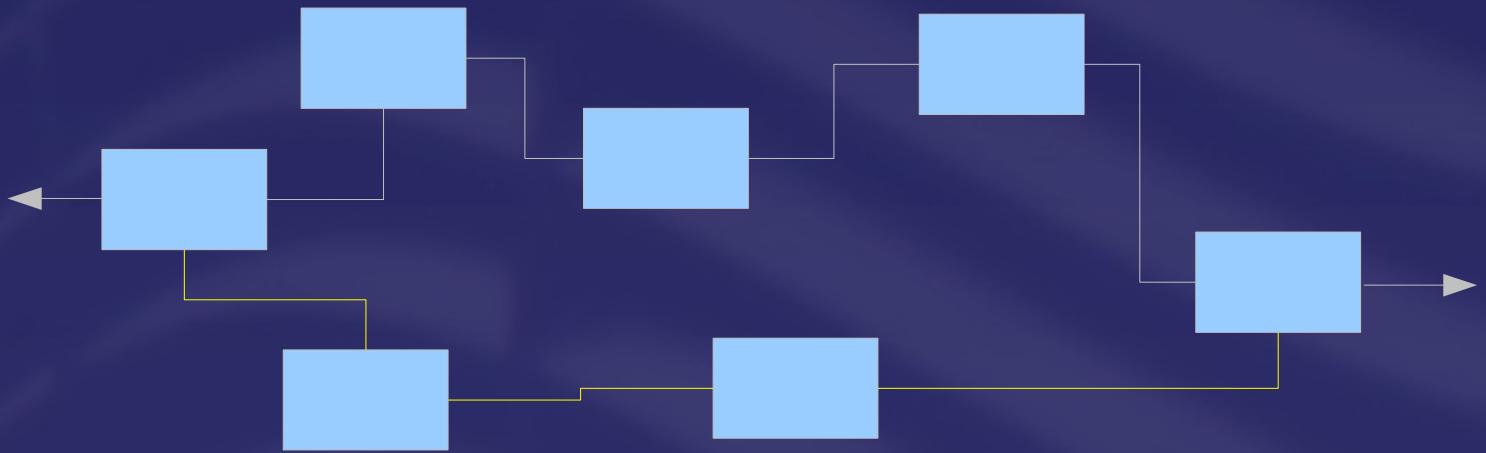
# Unprotected Lightpath



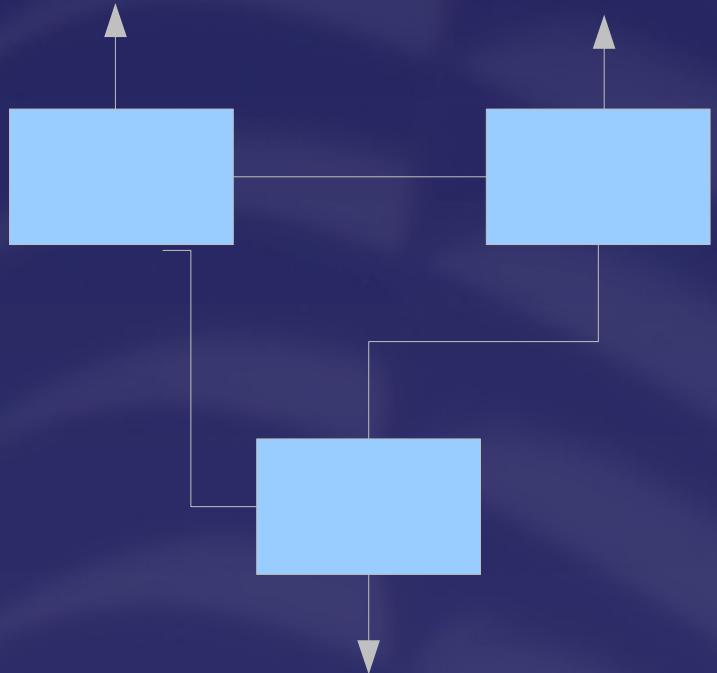
# Redundant Lightpath

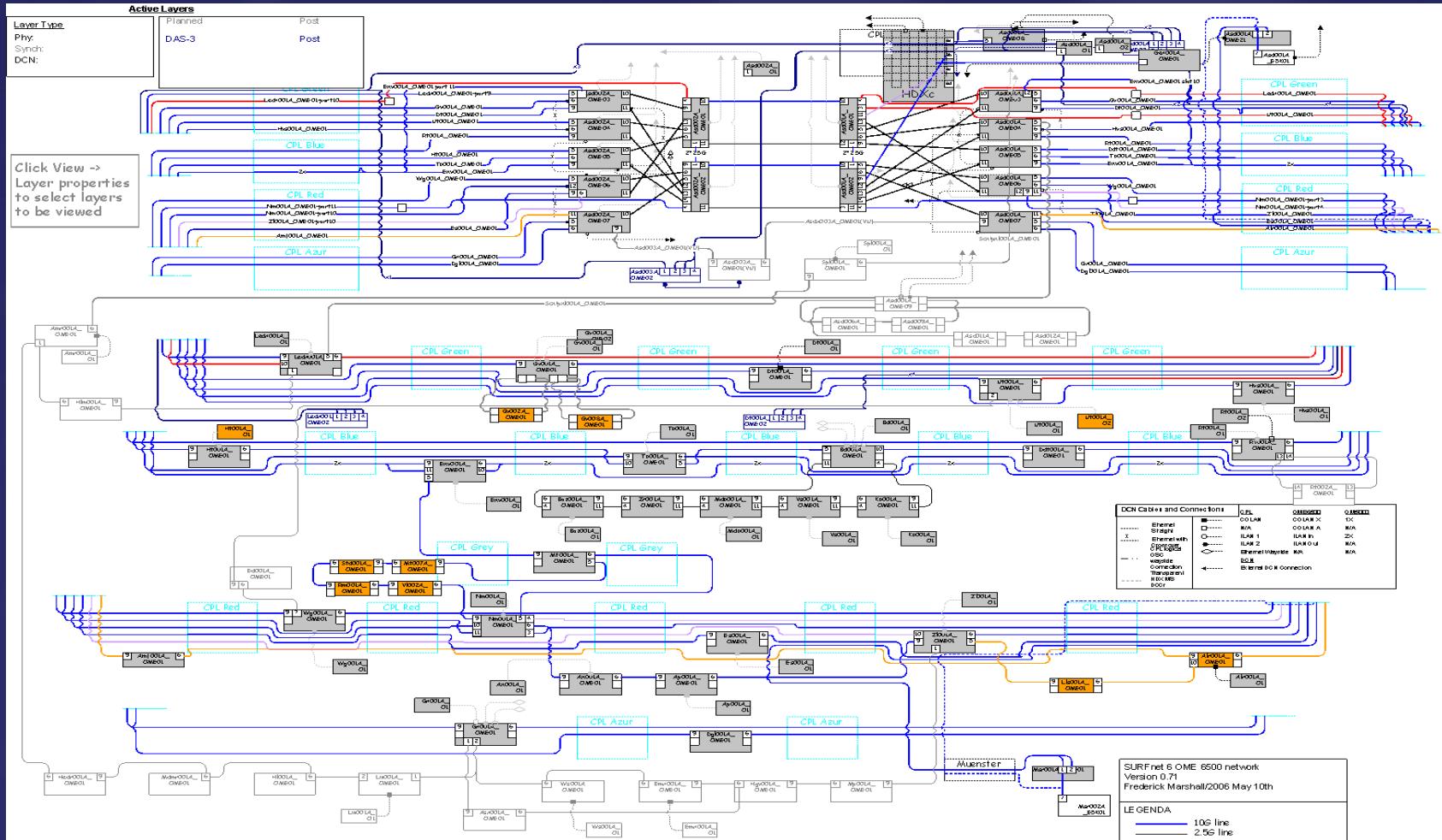


# Protected Lightpath



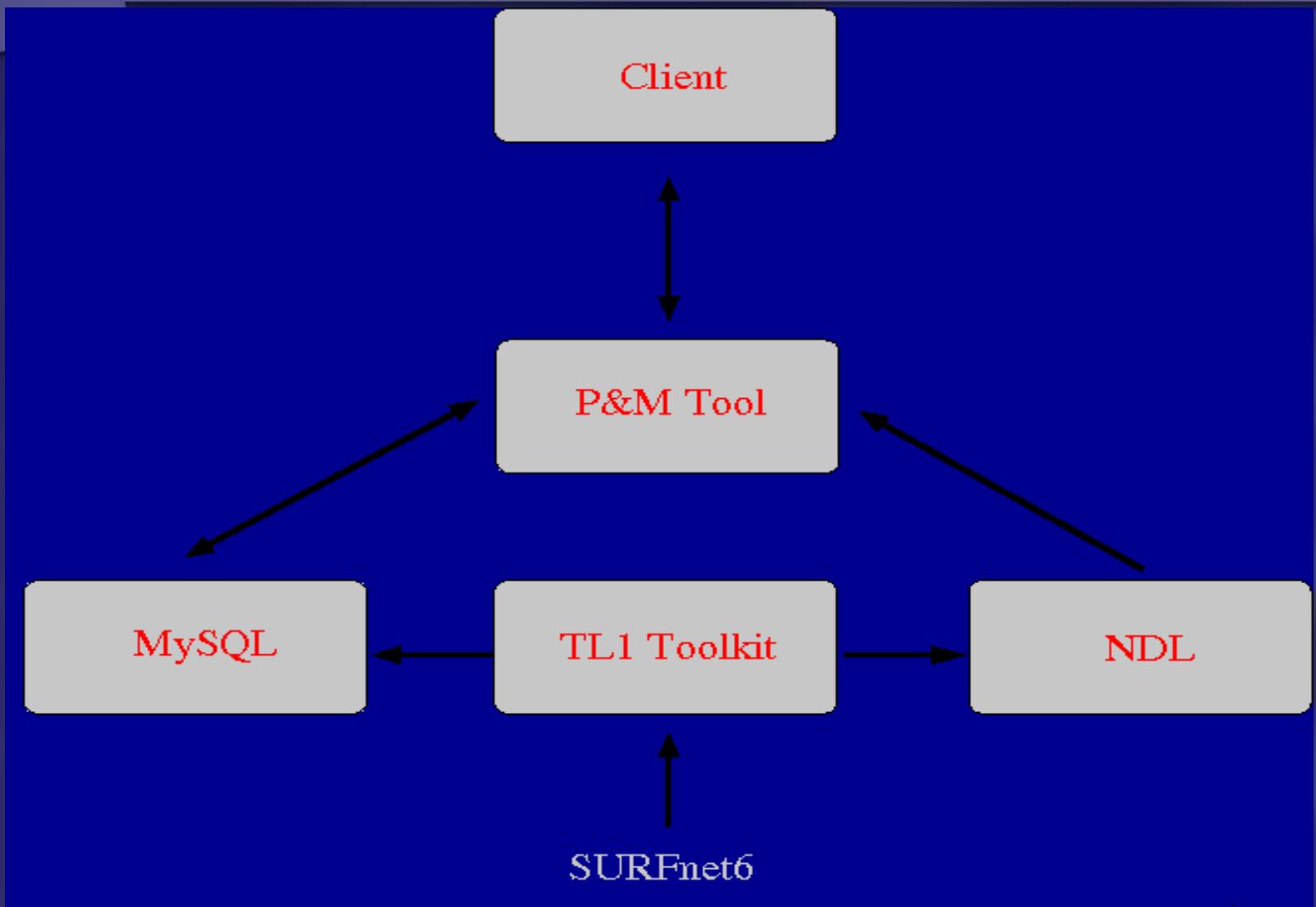
# Optical Private Network





- reservation of lightpath resources
  - ▶ customer request
  - ▶ quote and reservation
  - ▶ provisioning with Nortel NMS
- periodic reporting of free resources
- overview of all lightpaths
- mapping lightpath <--> fiber span
- open source software

# Architecture



## *TL1 Toolkit*

- Perl module developed by SARA
- Easy interface to TL1 based equipment (e.g. Nortel)
- Reads config from network elements

## *MySQL database*

- Used to store crossconnect info
- Used to store alarm information
- Used to store reservations

# Crossconnect table

localhost / localhost / surfnet6 / crossconnects | phpMyAdmin 2.8.2-Debian-0.2 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Getting Started Latest Headlines NOS.nl | Nieuws, Spo... DFT.nl Nieuws

http://localhost/phpmyadmin/index.php?lang=en-utf-8&token=efc04d903282199

Sort by key: None Go

in vertical mode and repeat headers after 100 cells

id	9785	9786	9787	9788
host	Ah001A_OME01	Ah001A_OME01	Ah001A_OME01	Ah001A_OME01
circuitname	Ah001A-Asd002A_Ge1(L2ss-01)	Ah001A-Asd002A_Ge1(L2ss-01)	Ah001A-Asd001A_Ge1(L2ss-01)	Ah001A-Asd001A_Ge1(L2ss-01)
bandwidth	3	3	3	3
fromslot	9	9	6	6
fromsubslot	0	0	0	0
fromport	1	1	1	1
fromfirststs	163	166	148	151
fromlaststs	165	168	150	153
toslot	2	2	2	2
tosubslot	0	0	0	0
toport	4	4	3	3
tofirststs	16	19	1	4
tolaststs	18	21	3	6
active	no	no	no	no
lastseen	2006-06-12 19:35:53	2006-06-12 19:35:53	2006-06-12 19:35:53	2006-06-12 19:35:53
inserttime	2006-05-01 16:47:38	2006-05-01 16:47:38	2006-05-01 16:47:38	2006-05-01 16:47:38
swnateslot	0	0	0	0
swnatesubslot	0	0	0	0
swnateport	0	0	0	0
swnatefromsts	0	0	0	0
swnatetosts	0	0	0	0
fromdate	2006-05-01 16:47:38	2006-05-01 16:47:38	2006-05-01 16:47:38	2006-05-01 16:47:38
todate	2020-12-12 12:12:12	2020-12-12 12:12:12	2020-12-12 12:12:12	2020-12-12 12:12:12
status	discovered	discovered	discovered	discovered

Check All / Uncheck All With selected:

Done Adblock

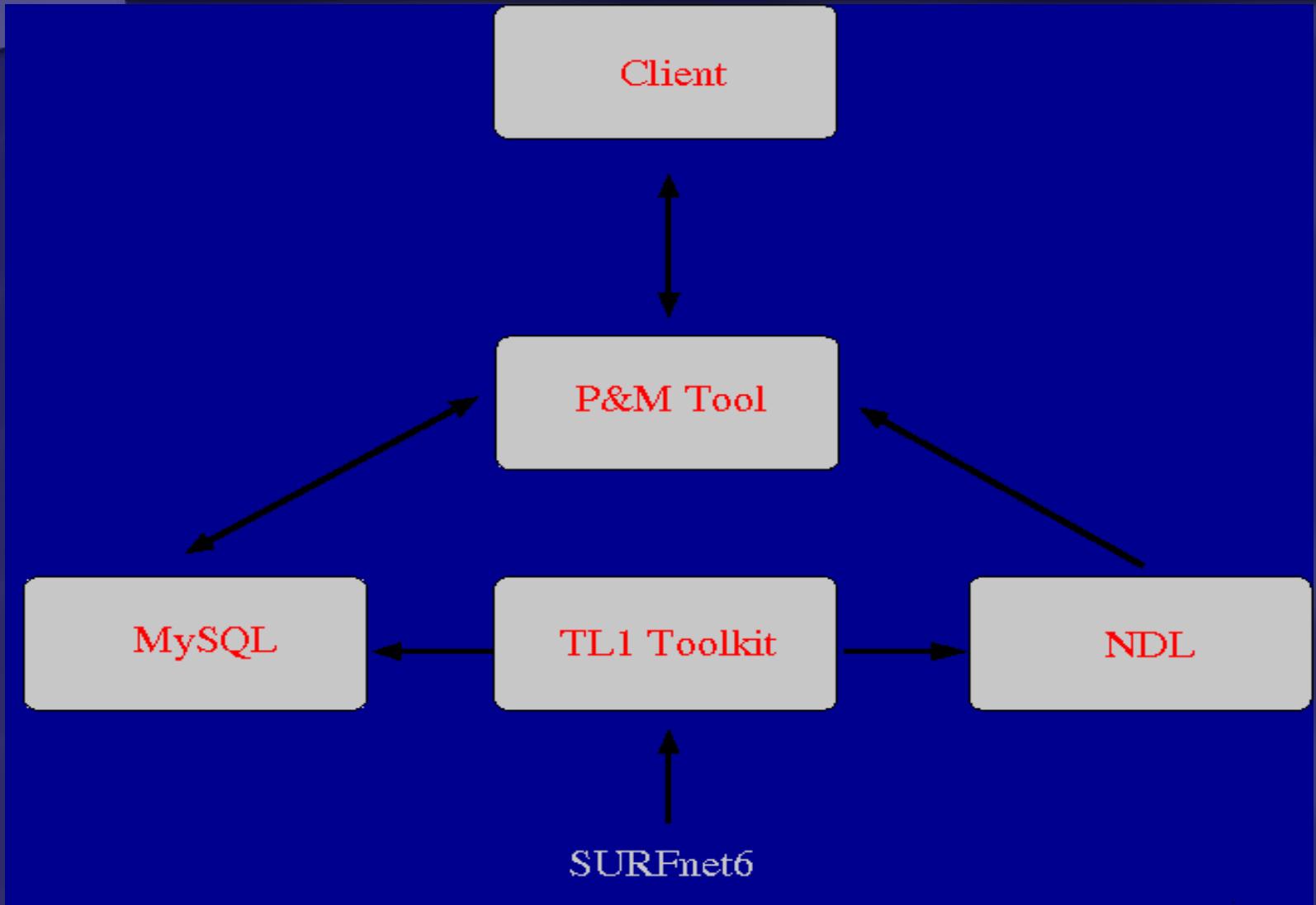
## NDL

- Network Description Language
- Framework developed by UvA
- NDL Perl module developed by SARA
- SURFnet6 NDL file generated from actual network configs (with TL1 Toolkit)
- Uses Section Trace for neighbour info

## *Planning and Monitoring Server*

- Read info from MySQL database
- Read NDL topology information
- Provide info via Web Services
- Write reservations to database

# Architecture



# Planning Example (1/4)

Path Provisioning - Mozilla Firefox

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http://localhost/cgi-bin/webform.cgi

Path Provisioning

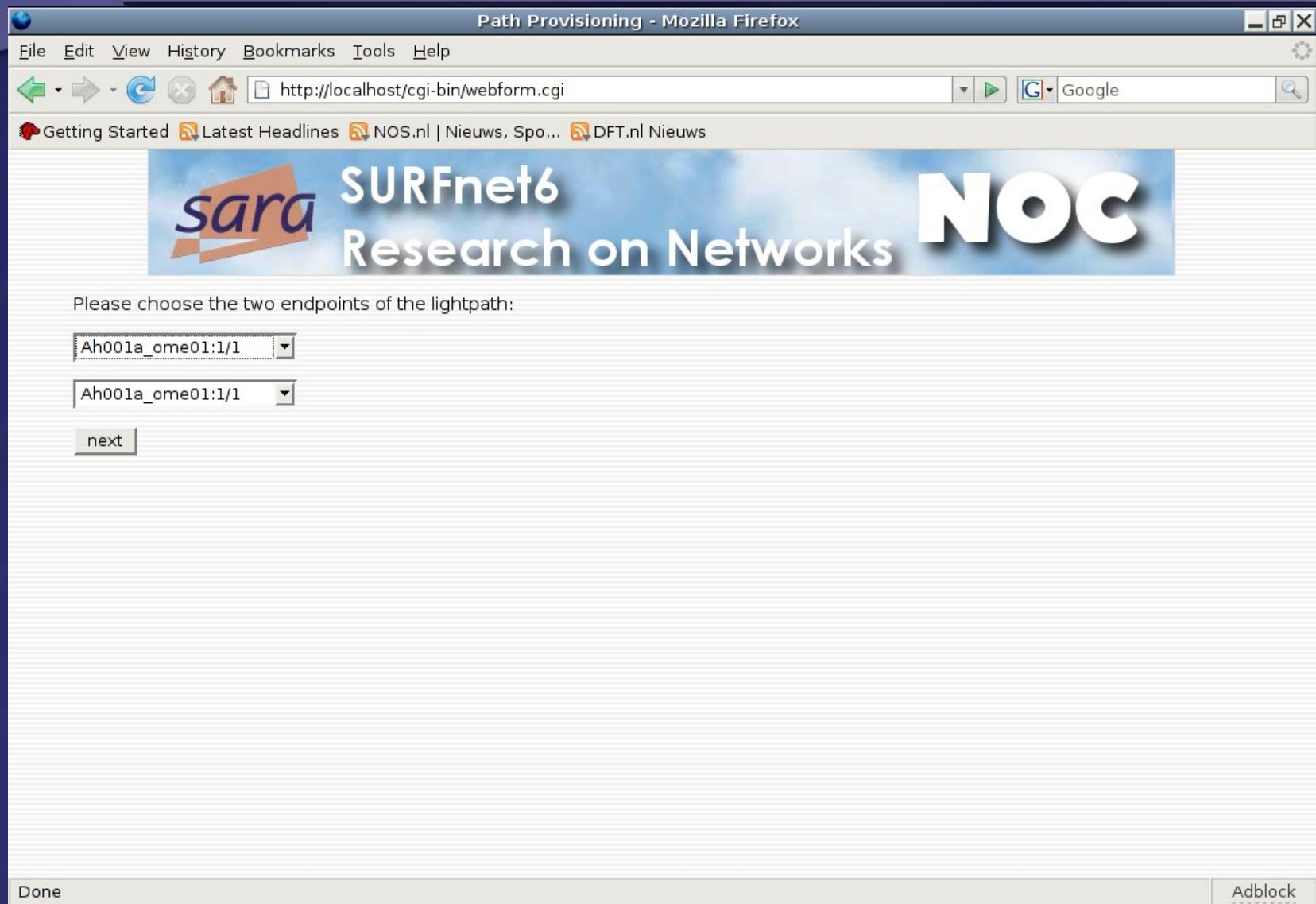
Please choose the two endpoints of the lightpath:

Ah001a\_ome01:1/1

Ah001a\_ome01:1/1

next

Done Adblock



# Planning Example (2/4)

Path Provisioning - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost/cgi-bin/webform.cgi

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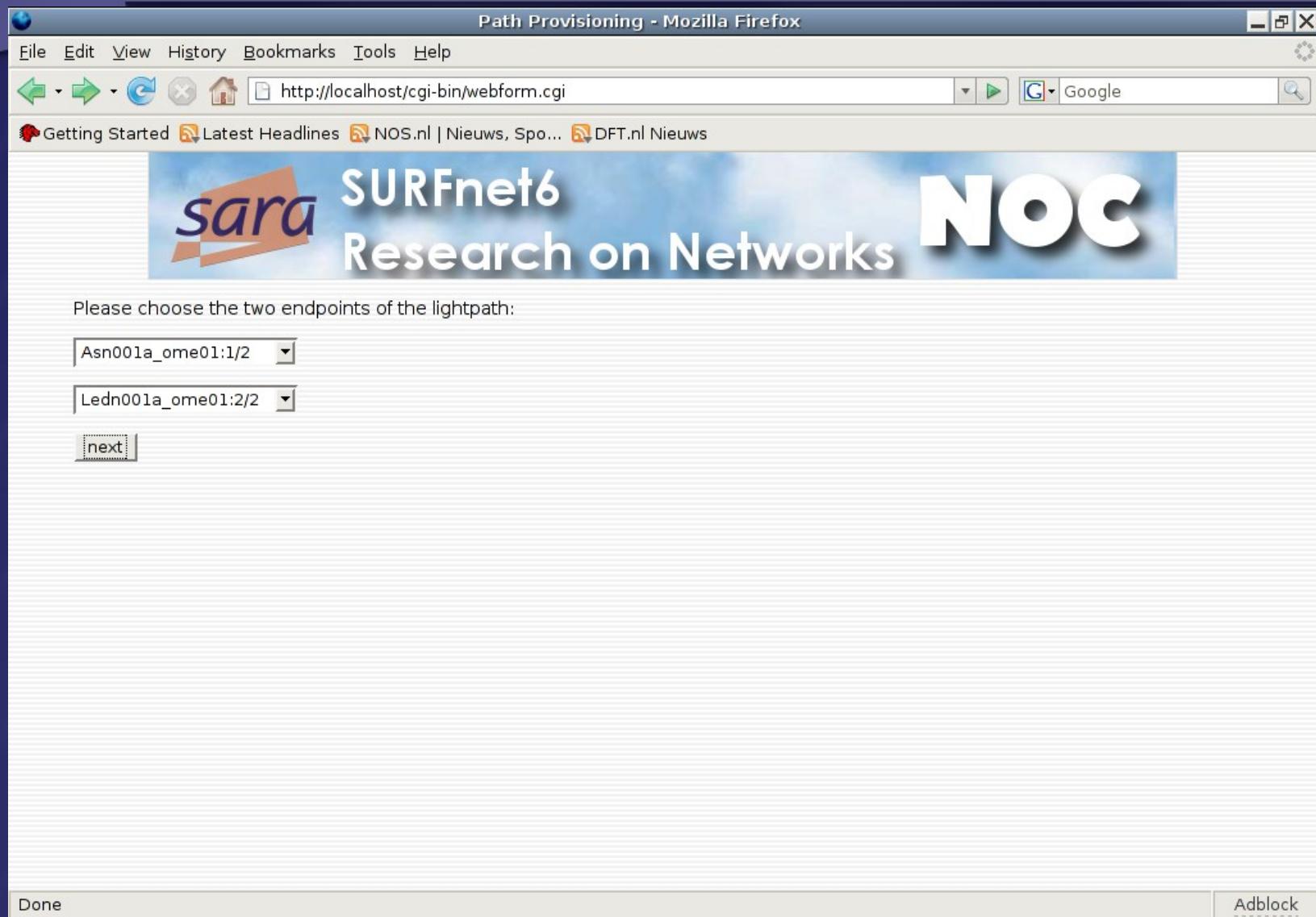
 **SURFnet6**  
**Research on Networks** 

Please choose the two endpoints of the lightpath:

Asn001a\_ome01:1/2

Ledn001a\_ome01:2/2

Done Adblock



# Planning Example (3/4)

Path Provisioning - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost/cgi-bin/webform.cgi

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 **SURFnet6**  
**Research on Networks** **NOC**

Lightpath between Asn001a\_ome01:1/2 and Ledn001a\_ome01:2/2:

Should this be a protected path?  yes  no

How many VC-4s? 7

Name of this lightpath: Asn001a-Ledn001a\_GE1(RoN test)

(finding a path may take some time)

Done

Adblock

# Planning Example (4/4)

Path Provisioning - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost/cgi-bin/webform.cgi

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**sara SURFnet6 Research on Networks NOC**

**Path**

From	Timeslots							To	Timeslots						
Asn001a_ome01:1/2	1	2	3	4	5	6	7	Asn001a_ome01:9/1	8	9	10	11	12	13	14
Gn001a_ome01:2/2	8	9	10	11	12	13	14	Gn001a_ome01:9/1	8	9	10	12	15	16	17
Asd002a_ome07:5/1	8	9	10	12	15	16	17	Asd002a_ome07:10/1	52	53	54	55	56	57	58
Asd002a_ome02:5/1	52	53	54	55	56	57	58	Asd002a_ome02:1/1	1	2	3	4	5	6	7
Asd002a_ome01:1/1	1	2	3	4	5	6	7	Asd002a_ome01:4/1	15	16	17	18	19	20	21
Ledn001a_ome01:10/1	15	16	17	18	19	20	21	Ledn001a_ome01:2/2	1	2	3	4	5	6	7

Done Adblock

# Algorithm (1/2)

- Read NDL file with topology
- build graph
  - vertices: interfaces
  - edges: transmission lines between interfaces
  - + full mesh between interfaces within OME
- Read MySQL timeslot information
- Remove interfaces with too few free timeslots
- Apply metrics: prefer center stages in Amsterdam
- Run Dijkstra Constraint Based Shortest Path Algorithm

# Algorithm (2/2)

## ■ For protected paths:

- run Dijkstra for primary path
- remove interfaces of primary path
- run Dijkstra for backup path

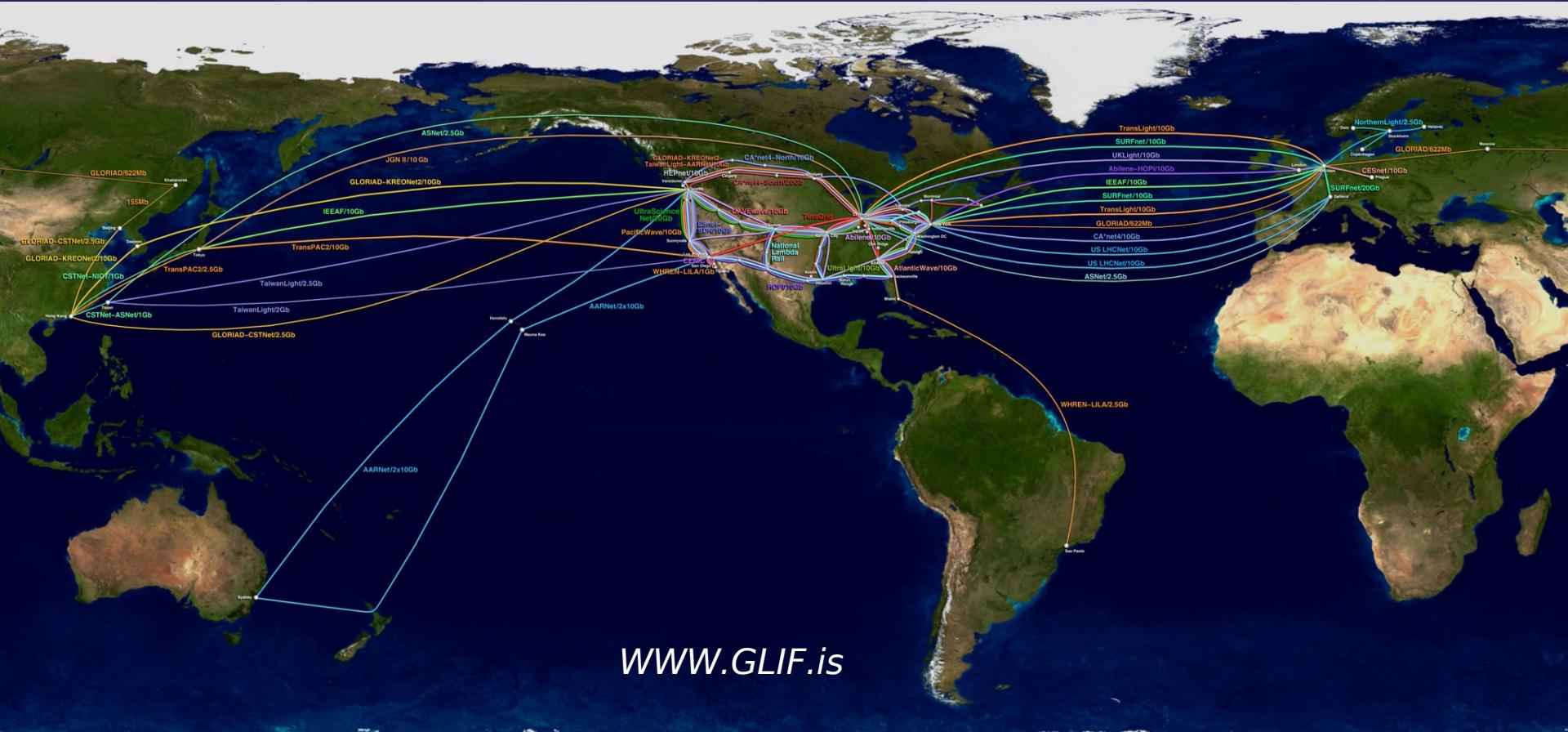
## ■ Loose protection: disjoint transmission lines only

## ■ Strict protection:

- disjoint transmission lines
- disjoint OME equipment (except start/end)

- Europe's largest Optical Exchange
- Interconnect for lightpaths
- Participant in GLIF and Gloriad
- Nortel HDXc at the heart

# Global Lambda Integrated Facility





## About this page

This page contains operational information about [NetherLight](#), the optical exchange point in the Netherlands. The lightpath status information and the topology picture are targetted to other GOLE operators. We hope it makes the daily operations of lightpaths easier. This is **work in progress**.

## Lightpath Overview

This overview is the [actual status of the lightpaths going through NetherLight](#).

This has been build with the help of SARA's TL1 Toolkit. For more information and examples see [TL1-Toolkit](#). There are also some [example scripts](#) available that show how the monitoring of NetherLight is done.

## Network topology

We try to keep this [network topology picture](#) of NetherLight up to date.

NetherLight is [connected](#) to several other [GLIF Open Lightpath Exchanges](#).

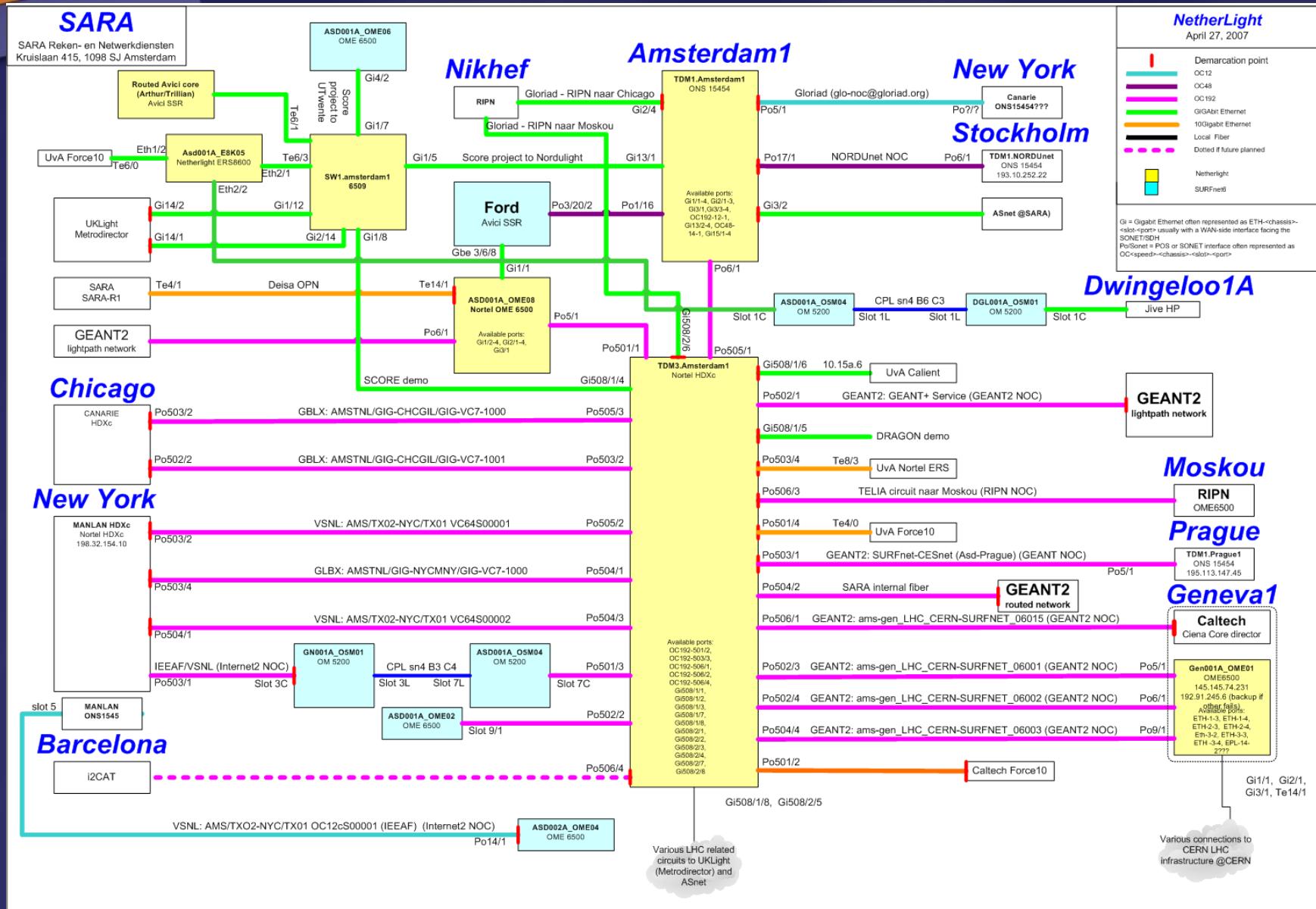
There is a [NetherLight NDL](#) file available.

## Open tickets

There is a [list of open tickets](#). Look for tickets that start with *NetherLight* (not SURFnet6).

## NOC contact information

The [contact information](#) is available on the GLIF website.



Applications Places System 

Fri May 18, 15:57:21 

**NetherLight lightpaths - Mozilla Firefox**

File Edit View History Bookmarks Tools Help

## NetherLight lightpath status overview

ok	<a href="#">2,5Gig SURFnet-Abilene</a>
ok	<a href="#">Amsterdam-chicago-DRAGON-1gbs</a>
ok	<a href="#">Amsterdam-NewYork-DRAGON-1gbs</a>
ok	<a href="#">Caltech-CERN</a>
ok	<a href="#">CERN-ASnet-1</a>
ok	<a href="#">CERN-ASnet-2</a>
ok	<a href="#">CERN-MANlan-Canarie-Triumph-1</a>
ok	<a href="#">CERN-MANlan-Canarie-Triumph-5Gig</a>
ok	<a href="#">CERN-SARA</a>
ok	<a href="#">F10-WAN-PHY-TST</a>
ok	<a href="#">Iperf_i2cat_test</a>
ok	<a href="#">IRNC - GEANT/Abilene OC192</a>
ok	<a href="#">LHC-CERN-RIPN</a>
ok	<a href="#">MAN LAN Laag 2 Exchange New York</a>
ok	<a href="#">NBD Amsterdam-Torun_polen</a>
ok	<a href="#">Prague ASnet - Korea</a>
ok	<a href="#">Prague-Chicago(ViLab)</a>
ok	<a href="#">Prague-Chicago-IoP-FNAL</a>
ok	<a href="#">RIPN to Moscow</a>
ok	<a href="#">RIPN-StarLight-Terraflow-project</a>
ok	<a href="#">RIPN/GLORIAD</a>
ok	<a href="#">SARA-Deisa</a>
ok	<a href="#">Shanghai-Jive test</a>
DOWN	<a href="#">tdm1.ams1.netherlight -- Oslo (score project)</a>
ok	<a href="#">tdm3.ams1_ManLAN-1GIG(Score-N-light)</a>

click on the lightpath name to get more information about the status/route and alarms for this specific lightpath.

Page generated on: 2007-05-18 15:56:53

Use this form to get a list of lightpaths going through a specific port:

device:

slot:

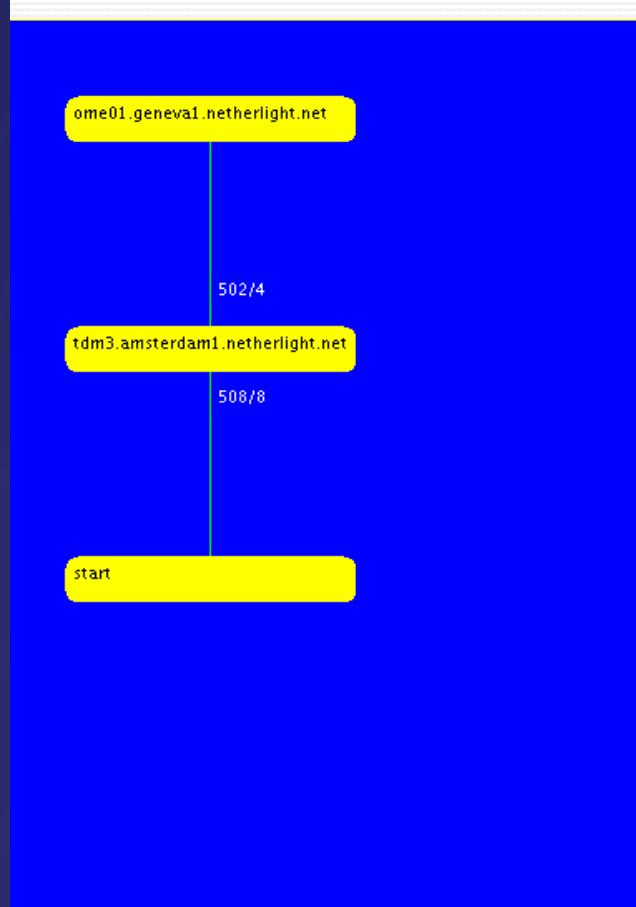
subslot:

xterm (3) 

Applications Places System  Fri May 18, 15:58:38

Netherlight TL1 Circuits - Mozilla Firefox

File Edit View History Bookmarks Tools Help



ome01.geneval1.netherlight.net

502/4

tdm3.amsterdam1.netherlight.net

508/8

start

**circuit details: CERN-ASnet-2**

Powered by the [TL1-Toolkit!](#)

NE	circuitname	bandwidth	begin	end	Alarm
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/22-24	2/1/1-3	OK
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/25-27	2/1/4-6	OK
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/28-30	2/1/7-9	OK
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/31-33	2/1/10-12	OK
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/34-36	2/1/13-15	OK
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/37-39	2/1/16-18	OK
gen001a_ome01.netherlight.net	CERN-ASnet-2	STS-3	6/1/40-42	2/1/19-21	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/40-42	508/1/8/19-21	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/37-39	508/1/8/16-18	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/34-36	508/1/8/13-15	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/31-33	508/1/8/10-12	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/28-30	508/1/8/7-9	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/25-27	508/1/8/4-6	OK
tdm3.amsterdam1.netherlight.net	CERN-ASnet-2	STS-3	502/0/4/22-24	508/1/8/1-3	OK

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xterm (3) Netherlight TL1 Circuits - Mozilla Firefox TNC2007-presentatie.ppt - OpenOffice....

# Monitoring in NetherLight (3/3)

Netherlight TL1 Circuits - Mozilla Firefox

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http://noc.netherlight.net/cgi-bin/drawjava.pl?Amsterdam-chicago-DRAGON-1gbs

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Back

Amsterdam-chicago-DRAGON-1gbs



Manian-HDXc

504/1

tdm3.amsterdam1.netherlight.net

508/5

UvA-DRAGON

**circuit details: Amsterdam-chicago-DRAGON-1gbs**

Status for this circuit is: **DOWN**

Powered by the [TL1-Toolkit](#)!

NE	circutname	bandwidth	begin
tdm3.amsterdam1.netherlight.net	Amsterdam-chicago-DRAGON-1gbs	STS-3	508/5/1-3

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Done

Adblock

# SURFnet6 lightpaths

Lighpath status overview - Mozilla Firefox

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http://localhost/cgi-bin/LP-status.pl

182	up	Spl001A-Asd001 GE1(InHolland SN6 IP)
183	up	Spl001A-Asd002 GE1(InHolland SN6 IP)
184	up	Spl001A_Gv001A_Ge1(InHolland-Gv)
185	up	Spl001A_Gv001A_Ge2(InHolland-Gv)
186	up	Std001A_Ehv001A_Ge1(Fontys-Std)
187	up	Tb001A_Ehv001A_Ge1(Fontys-Tb)
188	up	Ut001A-Asd001A_GE1(OU-Ut)
189	up	Ut001A-Asd001A_GE1(OU_Ut)
190	up	Ut001a-Asd001a_GE1(OWINSP)
191	up	Ut001a-Asd002a_Ge1(OU-Ut)
192	up	Ut001a-Dt001a_GE-TNO Soesterberg
193	up	Ut001a-DT001a_GE1-TNO Soesterberg
194	up	VC4
195	up	Veg001A_Ehv001A_Ge1(Fontys-Veghel)
196	up	VL002A_Ehv001A_Ge1(Fontys-Venlo)
197	up	Vs001A-Asd001A_3VC4(HZeeland)
198	up	Vs001A-Asd001A_Ge1(OU-Vs)
199	up	Vs001A-Asd002A_3VC4(Roosevelt)
200	up	Vs001A-Asd002A_1VC4(HZeeland)
201	up	Vs001A-Asd002A_3VC4(Roosevelt)
202	up	Vs001A-Asd002A_Ge1(OU-Vs)
203	up	Vs001A-Mdb001A_Ge(LP Zebi Hzee)
204	up	Vs001A-Mdb001A_Ge2(LP Zebi Hzee)
205	up	Wq001A-Lls001A_GE3(WUR-DLO)
206	up	Ws-Emn-Asd002A_GE1(L2SS01)
207	up	Ws-Emn-Asd002A_Ge1(L2SS01)
208	up	Ws_Asd001A_GE1 (L2SS-Ws-Mp)
209	up	Yer001A-Asd002A_1VC4(NIOO)
210	up	Zl001A-Asd001A-L2ss-01
211	up	Zl001A-Asd002A-L2ss-01
212	up	Zl003A-Asd001A_Ge2(OU-Zl)
213	up	Zl003A-Asd001A_Ge2(OU_Zl)
214	up	Zl003A-Asd002A_Ge2(OU-Zl)
215	up	Zl003A-Asd002A_Ge2(OU_Zl)

Click on the circuitname to get more information.

Done

Adblock

# Resources Overview



## interface information for Asd001a\_ome05

Interface	Card Type	Neighbour	Capacity (STS Timeslots)	number of free STS timeslots
Asd001a_ome05:1/1	GigE	NA	21	0
Asd001a_ome05:1/2	GigE	NA	21	0
Asd001a_ome05:1/3	GigE	NA	21	21
Asd001a_ome05:1/4	GigE	NA	21	0
Asd001a_ome05:10/1	SONET	Asd001a_ome01:9/1	192	84
Asd001a_ome05:11/1	SONET	Asd001a_ome02:12/1	192	87
Asd001a_ome05:2/1	GigE	NA	21	0
Asd001a_ome05:2/2	GigE	NA	21	0
Asd001a_ome05:2/3	GigE	NA	21	0
Asd001a_ome05:2/4	GigE	NA	21	0
Asd001a_ome05:3/1	GigE	NA	21	18
Asd001a_ome05:3/2	GigE	NA	21	21
Asd001a_ome05:3/3	GigE	NA	21	18
Asd001a_ome05:3/4	GigE	NA	21	21
Asd001a_ome05:4/1	GigE	NA	21	0
Asd001a_ome05:4/2	GigE	NA	21	18
Asd001a_ome05:4/3	GigE	NA	21	21
Asd001a_ome05:4/4	GigE	NA	21	0
Asd001a_ome05:5/1	SONET	Ddt001a_ome01:6/1	192	21
Asd001a_ome05:6/1	SONET	Tb001a_ome01:6/1	192	129
Asd001a_ome05:9/1	SONET	Elw001a_ome01:6/1	192	0

# Backbone usage

Ah001a_ome01:6/1 - Ap001a_ome01:9/1	OC192 - free timeslots 42	78%
Ah001a_ome01:9/1 - Nm001a_ome01:6/1	OC192 - free timeslots 39	80%
Alr001a_ome01:6/1 - Asd001a_ome07:11/1	OC192 - free timeslots 129	33%
Amr001a_ome01:1/1 - Hedr001a_ome01:2/1	OC48 - free timeslots 0	100%
Amr001a_ome01:1/2 - HIm001a_ome01:6/1	OC48 - free timeslots 6	88%
Amr001a_ome01:5/1 - Asd001a_ome04:5/1	OC192 - free timeslots 102	47%
Ap001a_ome01:6/1 - Zi001a_ome01:9/1	OC192 - free timeslots 42	78%
Ap001a_ome01:9/1 - Ah001a_ome01:6/1	OC192 - free timeslots 42	78%
Asd001a_ome01:1/1 - Asd001a_ome02:1/1	OC48 - free timeslots 6	88%
Asd001a_ome01:1/2 - Asd001a_ome02:1/2	OC48 - free timeslots 6	88%
Asd001a_ome01:10/1 - Asd002a_ome01:10/1	OC192 - free timeslots 51	73%
Asd001a_ome01:12/1 - Asd002a_ome01:11/1	OC192 - free timeslots 192	0%
Asd001a_ome01:13/1 - Asd001a_ome06:11/1	OC192 - free timeslots 69	64%
Asd001a_ome01:3/1 - Ut001a_ome01:6/1	OC192 - free timeslots 150	22%
Asd001a_ome01:4/1 - Ledn001a_ome01:5/1	OC192 - free timeslots 108	44%
Asd001a_ome01:5/1 - Asd001a_ome03:10/1	OC192 - free timeslots 3	98%
Asd001a_ome01:6/1 - Asd001a_ome04:10/1	OC192 - free timeslots 60	69%
Asd001a_ome01:9/1 - Asd001a_ome05:10/1	OC192 - free timeslots 84	56%
Asd001a_ome02:1/1 - Asd001a_ome01:1/1	OC48 - free timeslots 6	88%
Asd001a_ome02:1/2 - Asd001a_ome01:1/2	OC48 - free timeslots 6	88%
Asd001a_ome02:10/1 - Asd002a_ome02:10/1	OC192 - free timeslots 6	97%
Asd001a_ome02:12/1 - Asd001a_ome05:11/1	OC192 - free timeslots 87	55%
Asd001a_ome02:13/1 - Asd001a_ome04:11/1	OC192 - free timeslots 150	22%
Asd001a_ome02:14/1 - Asd001a_ome03:11/1	OC192 - free timeslots 108	44%
Asd001a_ome02:3/1 -	OC192 - free timeslots 186	3%
Asd001a_ome02:4/1 - Nm001a_ome02:6/1	OC192 - free timeslots 192	0%

# Timeslot Information

## Es001a\_ome01 6/1

free

reserved

used

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

# Thank you!

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Poster at the lunch break this afternoon