



Practical demonstration of Network Descriptions

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Introduction

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SARA Computing & Networking Services Departement High performance networking:

- SURFnet5 & SURFnet6 network operations centre (NOC)
- **Netherlight** network operations centre (NOC)
- Partner in Research on Networks GigaPort project



National Supercomputers



Visualization in the CAVE

Resource Description Format (RDF)

- Presentation Jeroen van der Ham (UvA) Glif meeting september 2005
See: <http://www.glif.is/meetings/2005/tech/vdham-rdf.pdf>
- Resource Description Format (RDF) is a Semantic Web technique.

Can be used to:

1. **Provide an overview of resources**
2. **Make path discovery easier**
3. Do simple problem detection

Example network description

- Netherlight network description in RDF format:

```
<!-- Description of TDM3.amsterdam1.netherlight.net -->
<ndl:Device rdf:about="#tdm3.amsterdam1.netherlight.net">
  <ndl:name>tdm3.amsterdam1.netherlight.net</ndl:name>
  <ndl:locatedAt rdf:resource="#amsterdam1.netherlight.net"/>
  <ndl:hasInterface:rdf:resource="#tdm3.amsterdam1.netherlight.net:503/3"/>
</ndl:Device>
```


Example network description

- Netherlight network description in RDF format:

```

<!-- Description of TDM3.amsterdam1.netherlight.net -->
<ndl:Device rdf:about="#tdm3.amsterdam1.netherlight.net">
  <ndl:name>tdm3.amsterdam1.netherlight.net</ndl:name>
  <ndl:locatedAt rdf:resource="#amsterdam1.netherlight.net"/>
  <ndl:hasInterface:rdf:resource="#tdm3.amsterdam1.netherlight.net:503/3"/>
</ndl:Device>

<!-- Description of interfaces 503/3 TDM3.amsterdam1.netherlight.net -->
<ndl:Interface rdf:about="#tdm3.amsterdam1.netherlight.net:503/3">
  <ndl:name>tdm3.amsterdam1.netherlight.net:POS503/3</ndl:name>
  <ndl:connectedTo rdf:resource="#tdm1.geneva1.netherlight.net:5/1"/>
  <rdf:capacity rdf:resource="#OC192"/>
</ndl:Interface>

```



Provide an overview of resources

- Create an overview / list of devices and interfaces
- Create an overview / list of connections (this is used for the dot file)
- Visualization of the network (demonstration)
- Create a graph (demonstration application)

This can all be done by using SPARQL queries



Provide an overview of resources

- Provide an overview of resources by visualization
- Graphviz - Graph Visualization Software
 - uses .dot file as input
- Relatively easy to generate a .dot input file from an RDF file
- Python script to generate a .dot file from an RDF file*
- Then generate a png,jpg,gif and lots more..
 - `dot -o netherlight.png -Tpng netherlight.dot`

Let's see the result.... ☺

* Author: Jeroen van der Ham, University of Amsterdam



Provide an overview of resources

Visualization of Netherlight network elements.
(Netherlight elements only)

tdm4.amsterdam1.netherlight.net

5/1

501/1

tdm1.amsterdam1.netherlight.net

12/1

6/1

501/2

505/1

tdm3.amsterdam1.netherlight.net

504/4

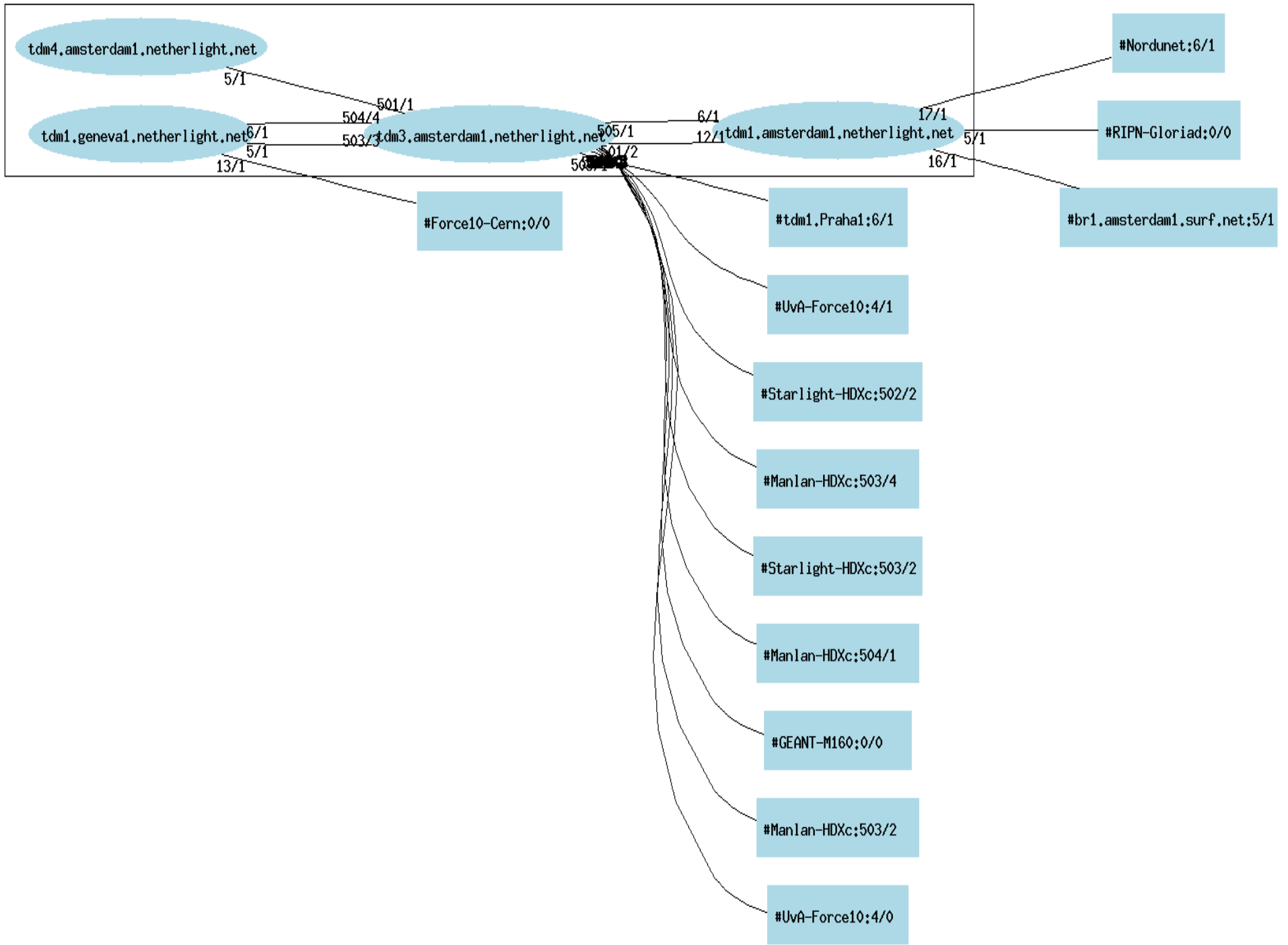
503/3

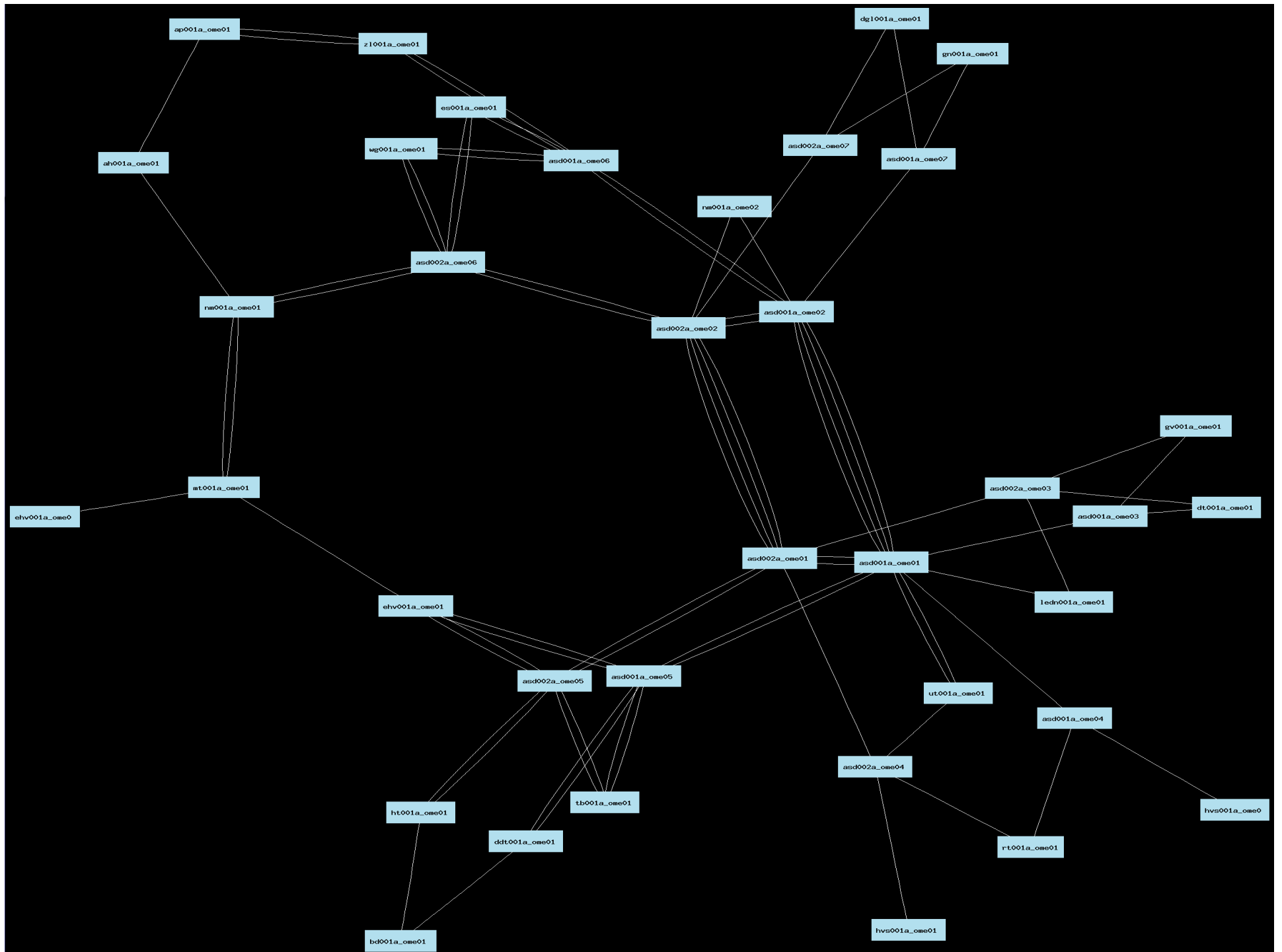
6/1

5/1

tdm1.geneva1.netherlight.net

Visualization of Netherlight network elements including edge devices on next slide

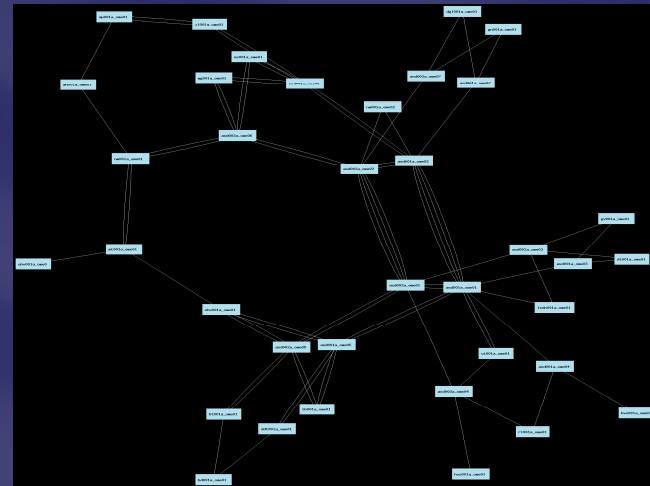




Path discovery

- Provisioning a circuit through a ‘big’ network can be time consuming
 - 1) finding a (protected) path across the network
 - 2) enough time slots available?

Might sound easy but can be difficult →



- Tool written by SARA’s network research group to automate this
- Uses an RDF network description as topology description
- Uses a MySQL database that has knowledge of all current cross connects in the network

■ Tool written in Perl *

```
usage: get_path ne1 slot1-port1 ne2 slot2-port2 #timeslots
```

```
shortest path between ne1 and ne2
```

```
e.g. ./get_path.pl \
```

```
tdm1.amsterdam1.netherlight.net 6-1 \
```

```
tdm1.geneva1.netherlight.net 3-5 \
```

```
21
```

The example above will show you how to provision a circuit between tdm1.geneva1.netherlight.net interface: 6/1 and tdm1.amsterdam1.netherlight.net interface 3/5 with a capacity of 21sts containers (1Gb/s using GFP/VCAT)

*Authors:

- Ronald van der Pol (SARA's network research group)
- Andree Toonk (SARA's network research group)

- With the RDF information we build a graph representing the network.
 - SPARQL query that gets all connected interfaces
 - Check if these interfaces have enough free timeslots available (MySQL)
 - Add the two interfaces as vertices to the graph
 - Add the link between them as an edge of the graph
 - Add edges to the graph for all internal connections between all the interfaces of one network element

- **Now a graph representing the network has been built.**
 - Use the Dijkstra algorithm to find the shortest path
 - Returns all the information to create the (VC4 / STS3c) cross connects on the network elements,
 - ▶ Includes: network elements, slots, ports, timeslots (MySQL) all the information to create the cross connects on the network elements,



Provisioning tool: Demo

```
$ ./get_path.pl tdm3.amsterdam1.netherlight.net 504-3 tdm1.amsterdam1.netherlight.net 17-1 9
```

path A:

```
tdm3.amsterdam1.netherlight.net-504-3 1 tdm3.amsterdam1.netherlight.net-501-2 49
```

```
tdm3.amsterdam1.netherlight.net-504-3 4 tdm3.amsterdam1.netherlight.net-501-2 52
```

```
tdm3.amsterdam1.netherlight.net-504-3 7 tdm3.amsterdam1.netherlight.net-501-2 55
```

```
tdm1.amsterdam1.netherlight.net-12-1 49 tdm1.amsterdam1.netherlight.net-17-1 25
```

```
tdm1.amsterdam1.netherlight.net-12-1 52 tdm1.amsterdam1.netherlight.net-17-1 28
```

```
tdm1.amsterdam1.netherlight.net-12-1 55 tdm1.amsterdam1.netherlight.net-17-1 31
```

path B:

```
tdm3.amsterdam1.netherlight.net-504-3 1 tdm3.amsterdam1.netherlight.net-505-1 73
```

```
tdm3.amsterdam1.netherlight.net-504-3 4 tdm3.amsterdam1.netherlight.net-505-1 76
```

```
tdm3.amsterdam1.netherlight.net-504-3 7 tdm3.amsterdam1.netherlight.net-505-1 79
```

```
tdm1.amsterdam1.netherlight.net-6-1 73 tdm1.amsterdam1.netherlight.net-17-1 25
```

```
tdm1.amsterdam1.netherlight.net-6-1 76 tdm1.amsterdam1.netherlight.net-17-1 28
```

```
tdm1.amsterdam1.netherlight.net-6-1 79 tdm1.amsterdam1.netherlight.net-17-1 31
```



Future: Provisioning tool

- Next step is to generate the TL1 commands
 - All the necessary cross connect information is available

Syntax:

```
ENT-CRS-ST3C:"NE-name":STS3C-shelf-slotA-portA-timeslotA,STS3C-shelf-slotB-portB-timeslotB:CTAG-NUMBER::2WAY:CKTID="name of Xconnect";
```

Example:

```
ENT-CRS-ST3C:"tdm4.amsterdam1.netherlight.net":STS3C-1-6-1-22,STS3C-1-1-3-1:66::2WAY:CKTID="DEMO";
```

- SARA already has developed a TL1 toolkit (Perl)*
 - * Easy to execute TL1 commands with TL1 toolkit
 - * Specific functions for: OME6500, CPL, HDXc, ONS15454
 - * Planning to add a `create_Xconnect()` function

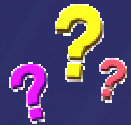
* Based on TL1 Perl module of Arien Vijn, Amsterdam Internet Exchange

URLs + Questions

- SARA's network research group:
Information about TL1 toolkit & RDF tools.

<http://nrg.sara.nl/>

Email: nrg@sara.nl



- Network Description Language:

<http://staff.science.uva.nl/~vdham/research/ndl/>

That's all Folks!