

# StarPlane

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# EU

NWO

University of Amsterdam

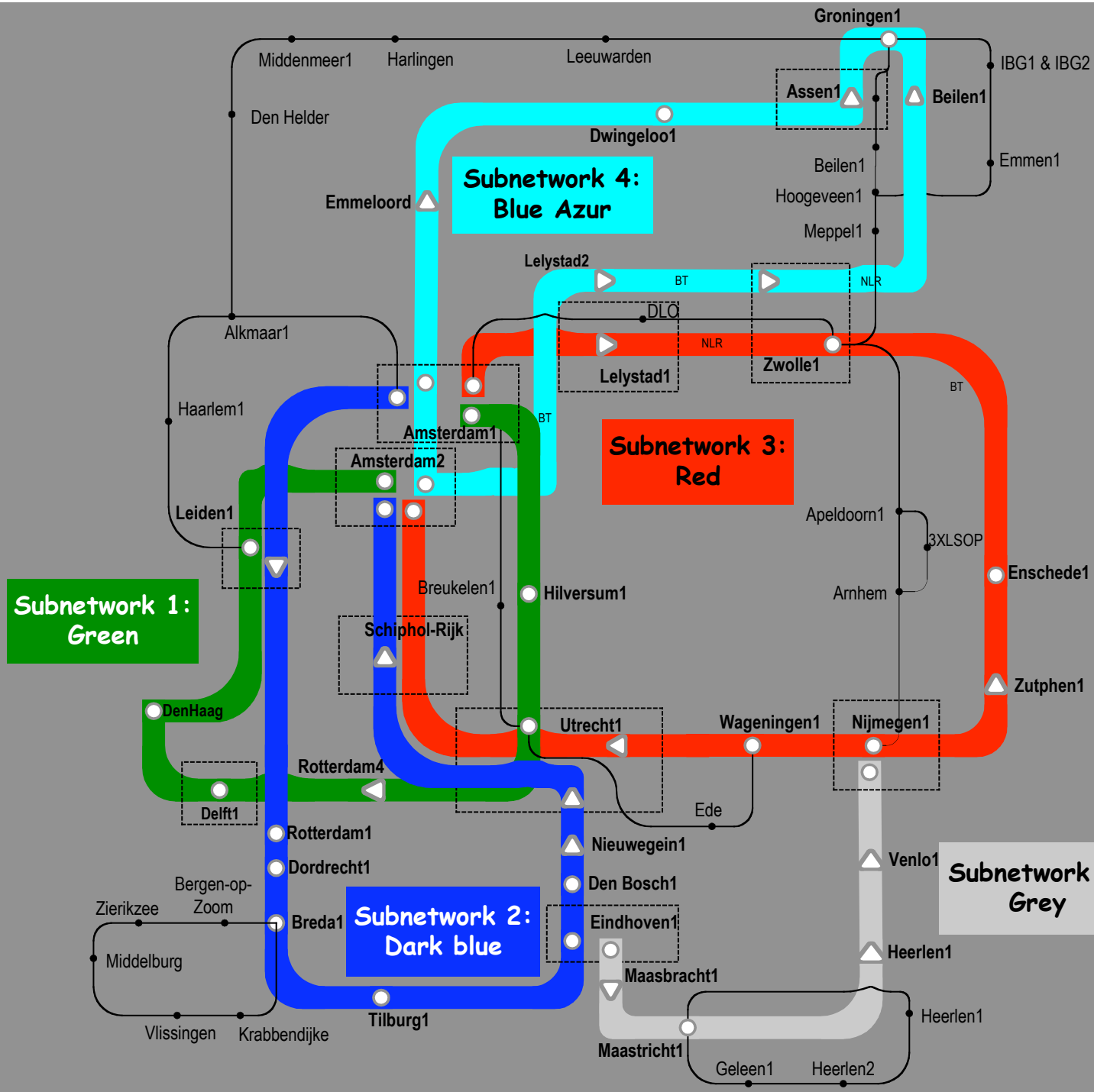
SARA

TI  
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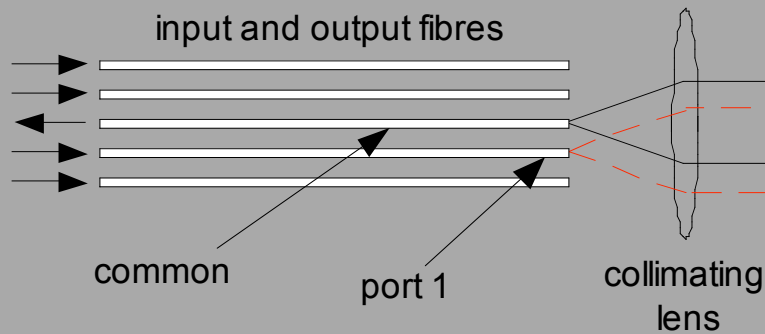


# Common Photonic Layer (CPL) in SURFnet6

~5000 km



# Module Operation

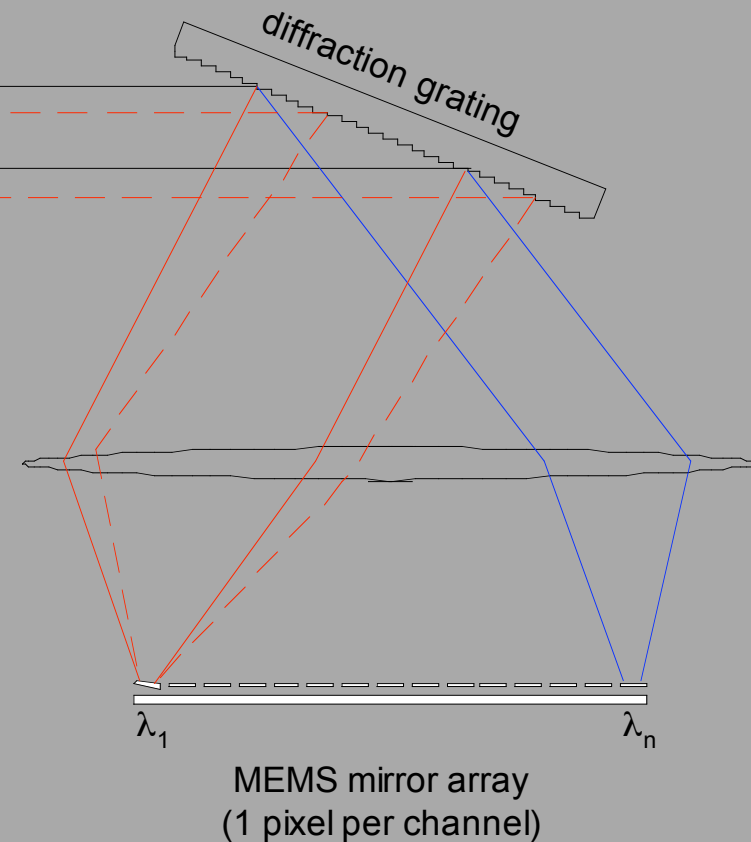


> this schematic shows

- several input fibres and one output fibre
- light is focused and diffracted such that each channel lands on a different MEMS mirror
- the MEMS mirror is electronically controlled to tilt the reflecting surface
- the angle of tilt directs the light to the correct port

> in this example:

- channel 1 is coming in on port 1 (shown in red)
- when it hits the MEMS mirror the mirror is tilted to direct this channel from port 1 to the common
- only port 1 satisfies this angle, therefore all other ports are blocked



# StarPlane

*application-specific management of optical networks*

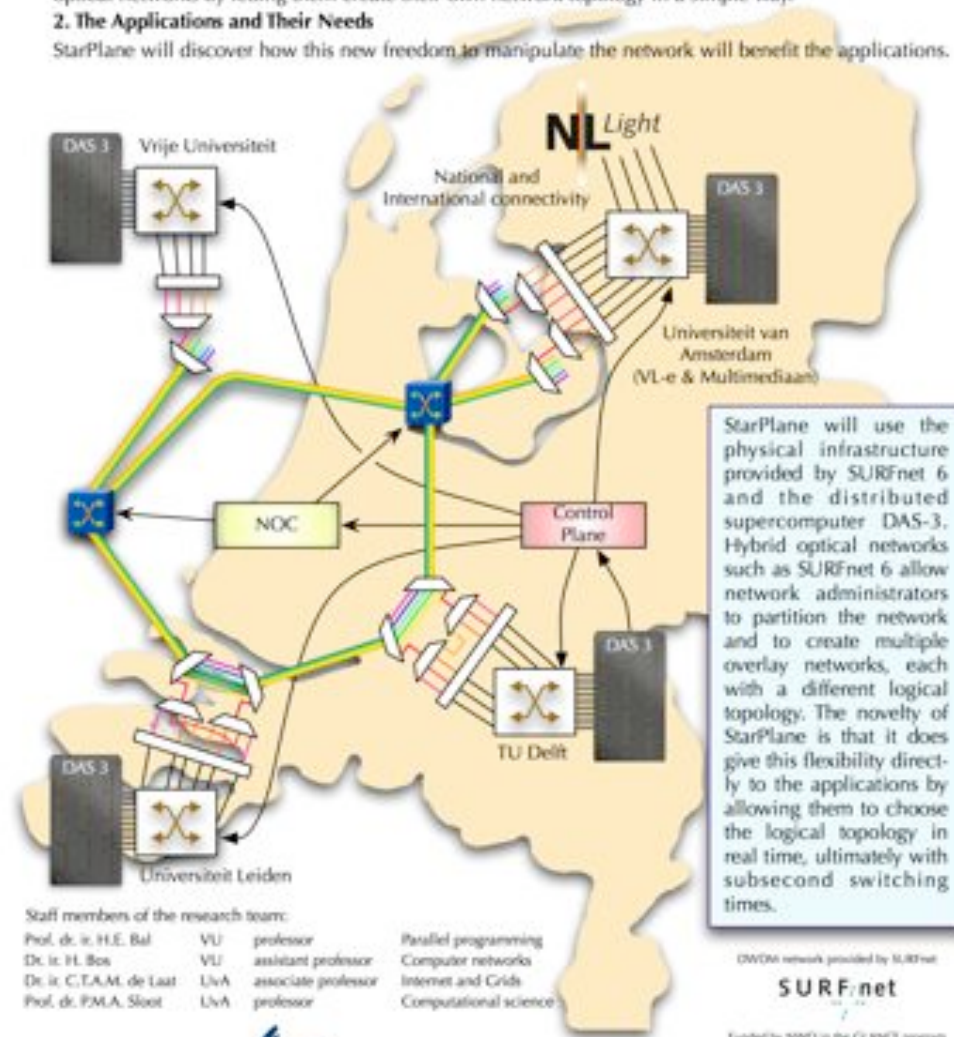
The StarPlane project addresses two concerns in optical networks:

## 1. The Basic StarPlane Management Infrastructure

StarPlane allows applications to take advantage of the increased bandwidth and potential flexibility in optical networks by letting them create their own network topology in a simple way.

## 2. The Applications and Their Needs

StarPlane will discover how this new freedom to manipulate the network will benefit the applications.



Staff members of the research team:

Prof. dr. ir. H.E. Bal	VU	professor	Parallel programming
Dr. ir. H. Bos	VU	assistant professor	Computer networks
Dr. ir. C.T.A.M. de Laat	UvA	associate professor	Internet and Grids
Prof. dr. P.M.A. Sloot	UvA	professor	Computational science

DWDM network provided by SURFnet

**SURF.net**

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**NWO**

vrije Universiteit amsterdam



UvA **U** UNIVERSITEIT VAN AMSTERDAM

www.starplane.org

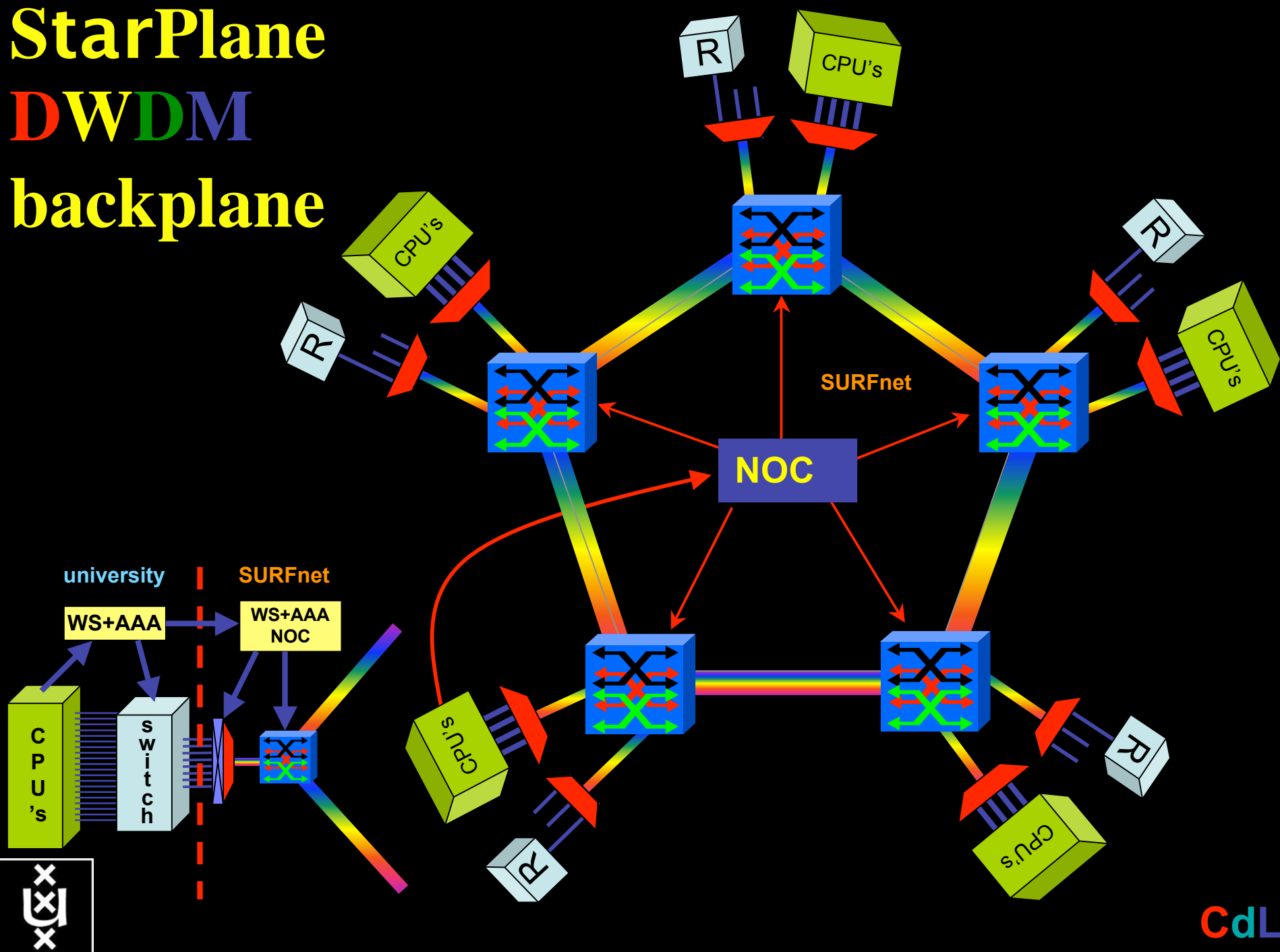


# StarPlane Goals

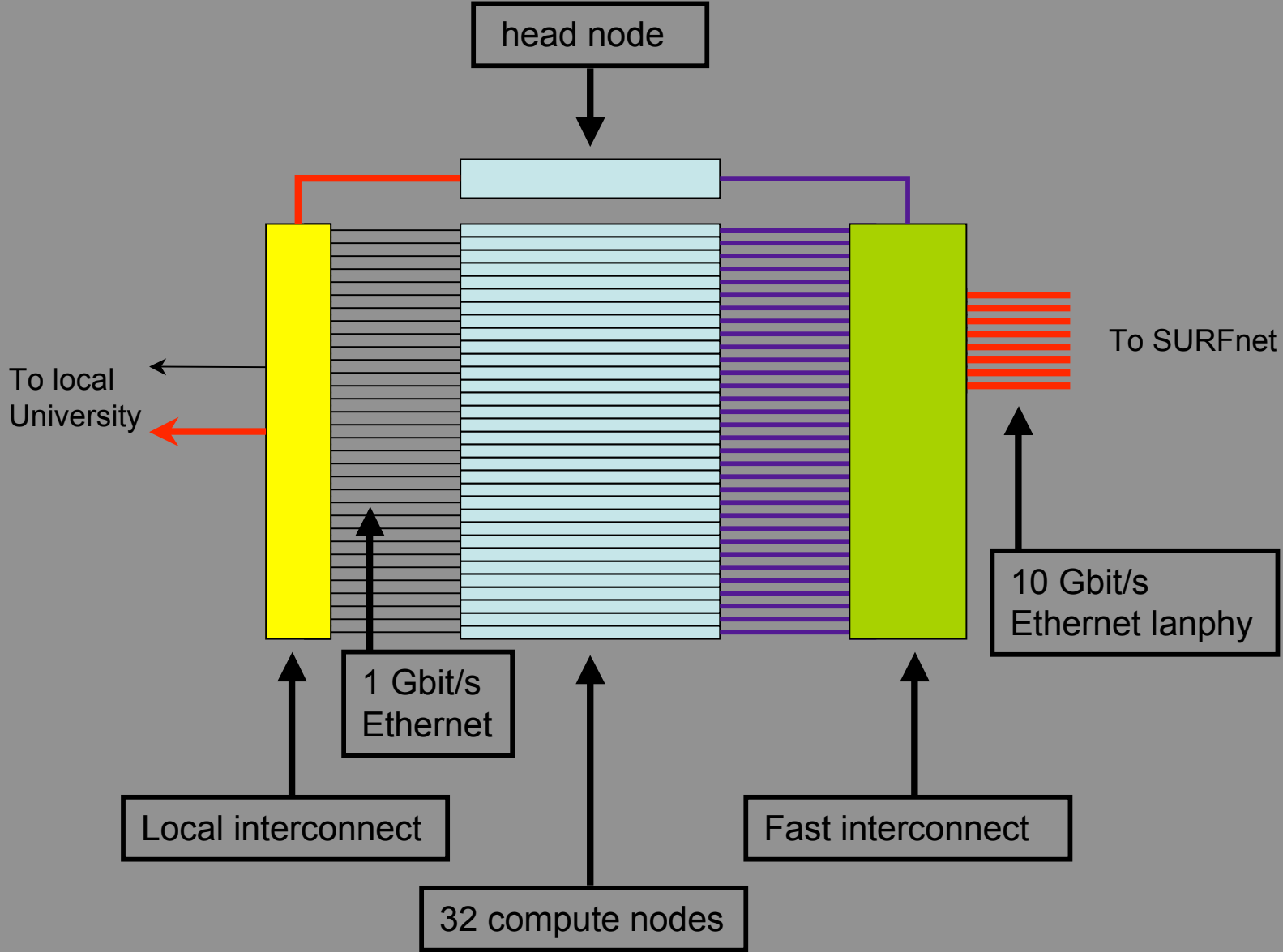
Goals in the proposed StarPlane project:

1. fast, application-specific allocation of the network resources with deterministic characteristics;
2. application-specific composition of the protocol stack that is used to control the resources;
3. low-level resource partitioning (and, hence, no interference);
4. high-level requests (whereby policies and inference are used to assist the user)..

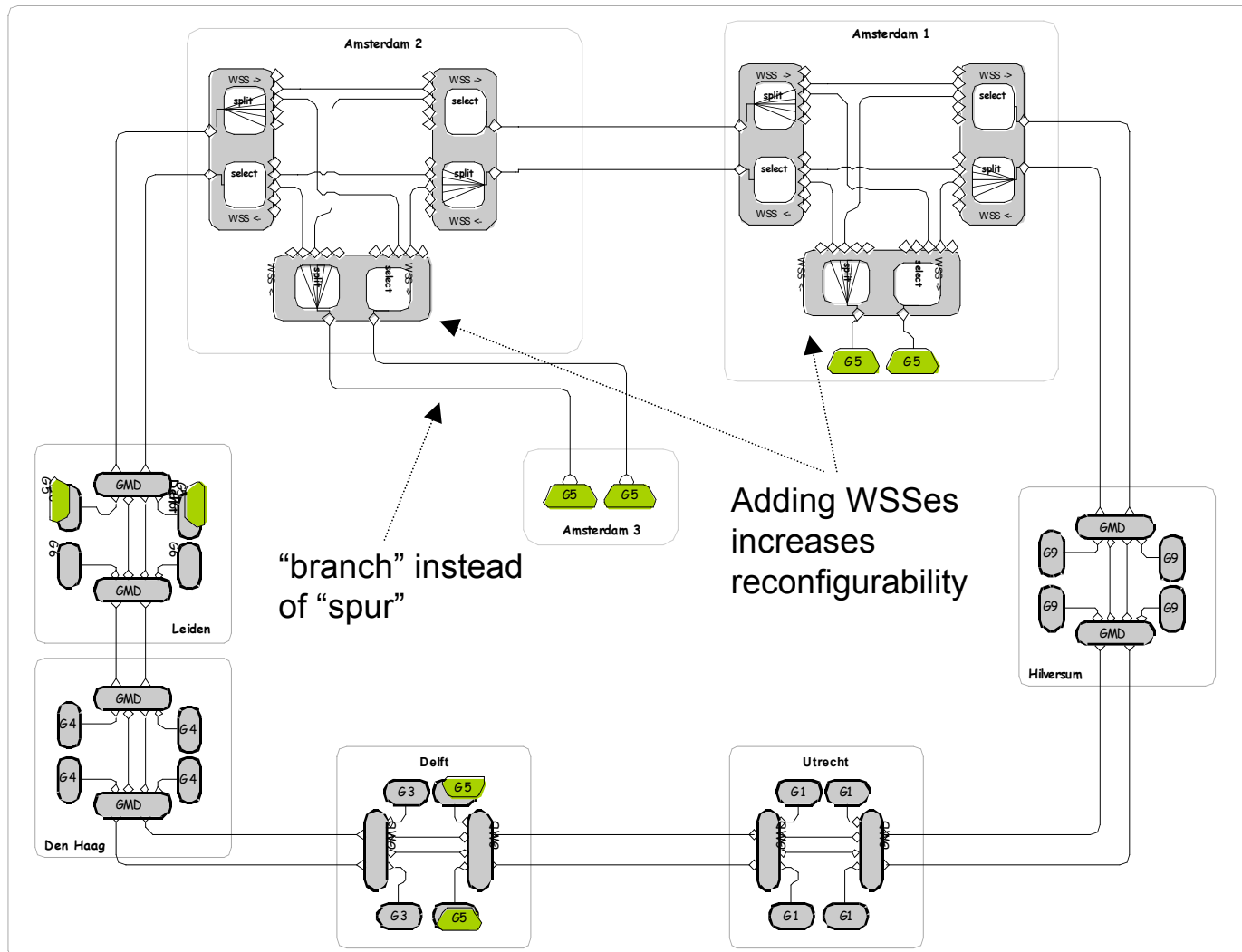
# StarPlane DWDM backplane



# DAS Cluster



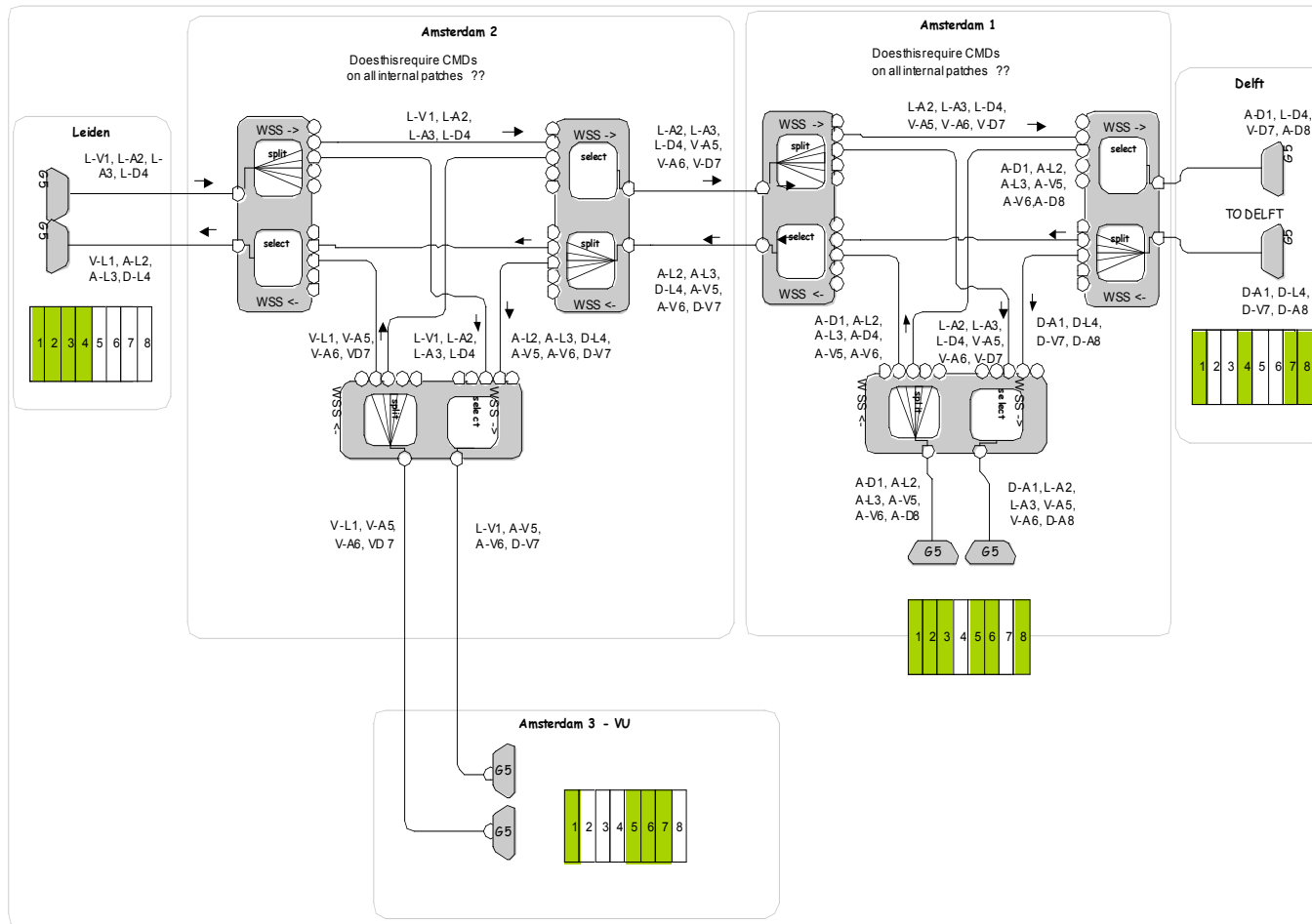
# Day 2 set-up: branching out...



- Add WSSes at Amsterdam sites
- Is NOT supported in March 2006
- Full reconfigurability achieved
- Only limits are
  - Presence of card
  - Wavelength blocking
- No changes to basic 'static' mesh

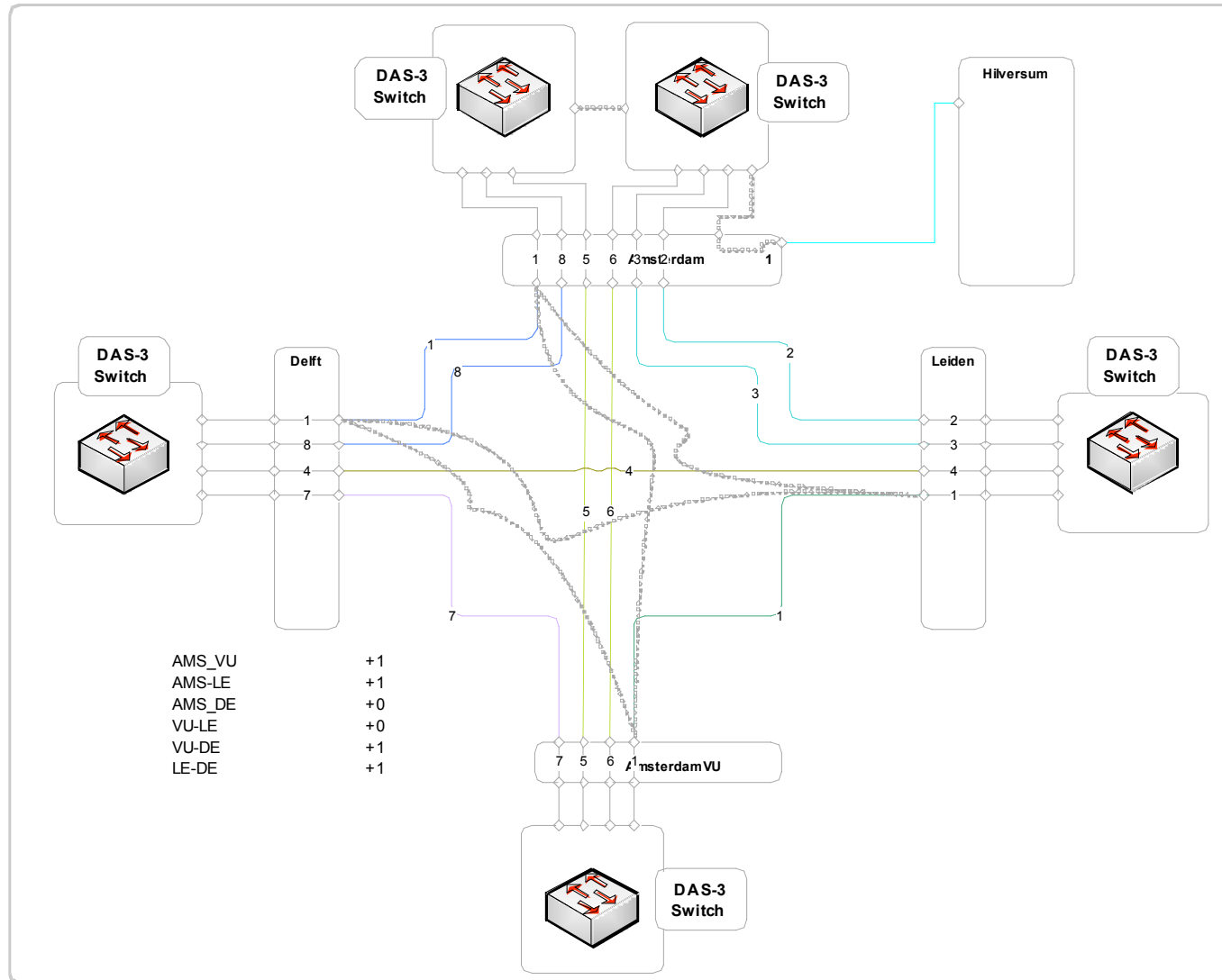


# Day 2 detail



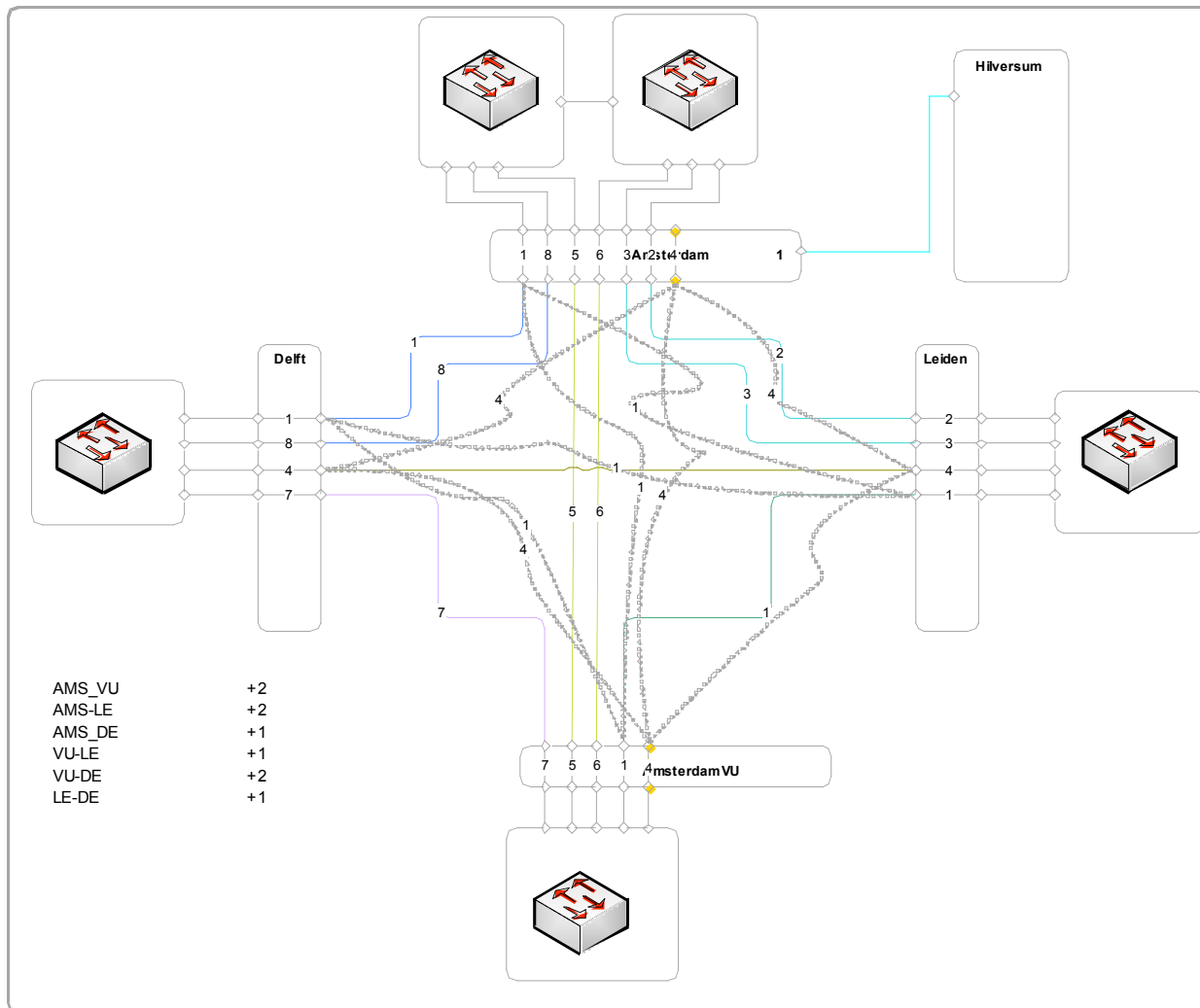
- Wavelength assignment remains – no external changes
- Adding WSSes allows redirecting wavelengths from/to VU and AMS

## Day 2 – black box reconfigurability



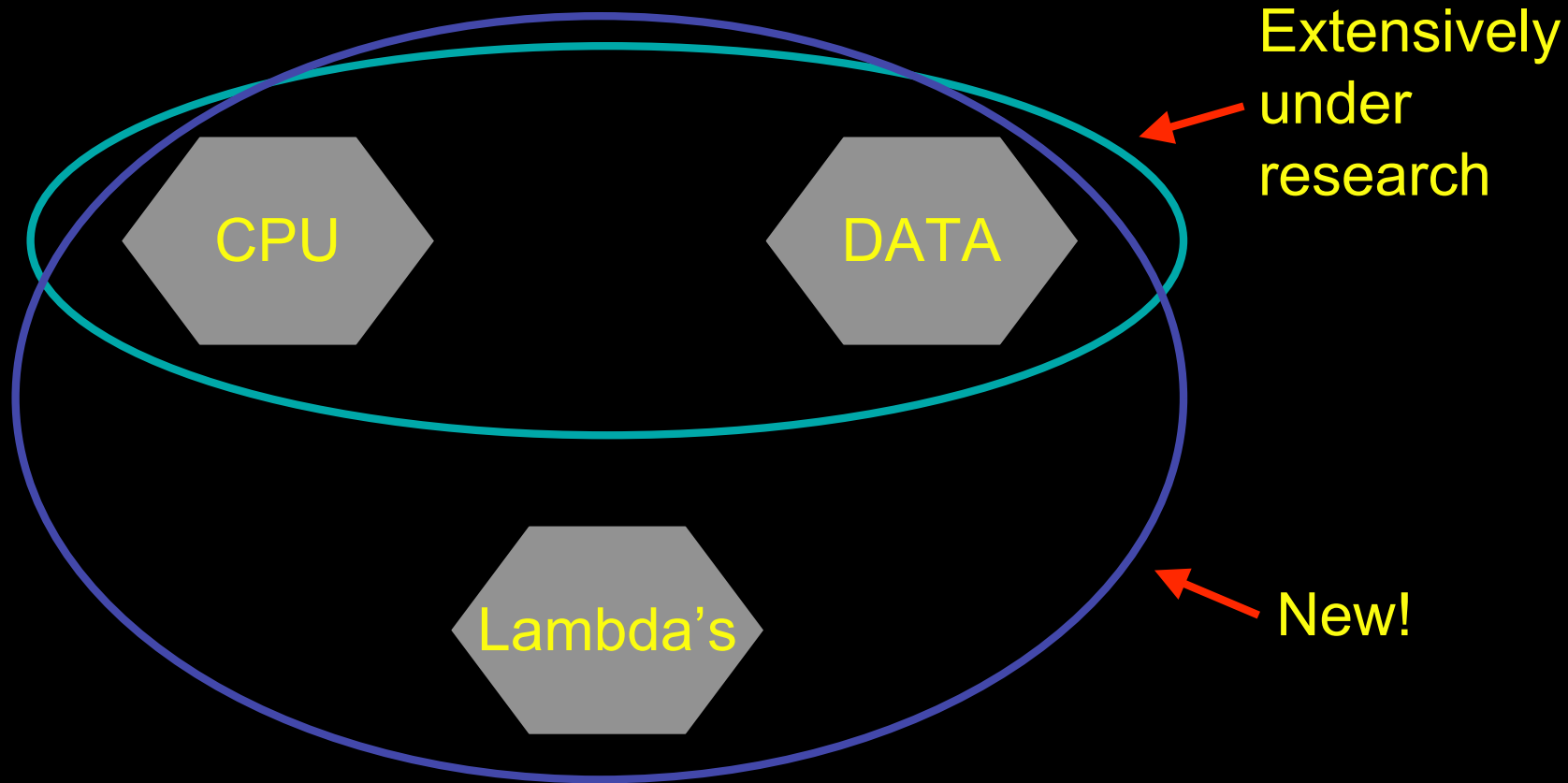
- Compared to day 1 now four instead of one possible redirection
- Redirection only limited by presence of cards and internal wavelength blocking

## Day 2 – increased reconfigurability - adding cards



- Adding two cards allows to create more connectivity between ALL sites!
- Some sites can connectivity threefold (from 10 Gb/s to 30 Gb/s)

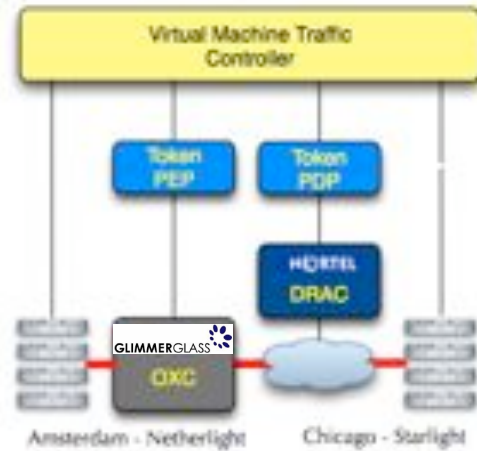
# GRID-Colocation problem space



# Token Based Networking

## Access Control, Resource Management and Path Selection in Optical Networks using Tokens

Tokens performing Resource Management and Access Control in Virtual Machine Turntable Experiment.

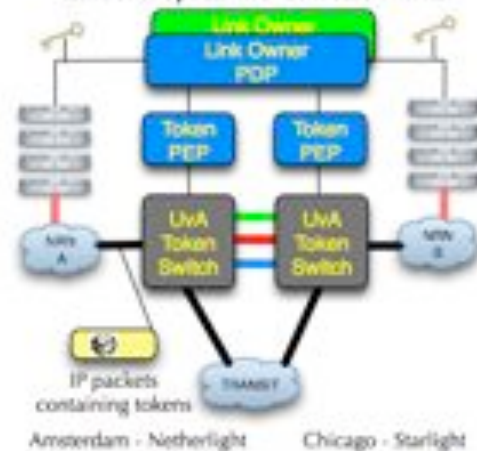


Tokens will allow:

- Separation of (slow) authorization process and real time usage.
- Binding to many different types of attributes: user, time, resource, etc.
- Policy Decision to be abstracted from Policy Enforcement Point.
- Anonymous usage
- Resource Management



Tokens performing Path Selection and Access Control at Optical Inter-Connection Points



Token marked IP packets will allow:

- Economic Link Owners to assign usage rights without routing changes.
- Recognition at Inter-Connection Points (Optical Exchanges). When authentic and valid, token marked traffic will use the Link Owners path.
- Implementations that support different business models
- Hardware (NPU based) recognition rate expected to be a 10 Gbps.



Key issue #1:  
how to describe such networks?

# Semantic web

*“a universal medium for the exchange of data where data can be shared and processed by automated tools as well as by people”*

The Resource Description Framework (RDF) uses XML as an interchange syntax.

Data is described by triplets:



# NDL - Network Description Language

A way to describe network resources using RDF.

Parser can use the data to:

- generate network maps
- provide information to schedulers

```
<ndl:Device rdf:about="#Vangogh3">  
  <ndl:name>Vangogh3</ndl:name>  
  <rb:isOfType>ComputingElement</rb:isOfType>  
  <ndl:locatedAt rdf:resource="#Lighthouse"/>  
  <ndl:hasInterface rdf:resource="#Vangogh3:eth2"/>  
</ndl:Device>
```

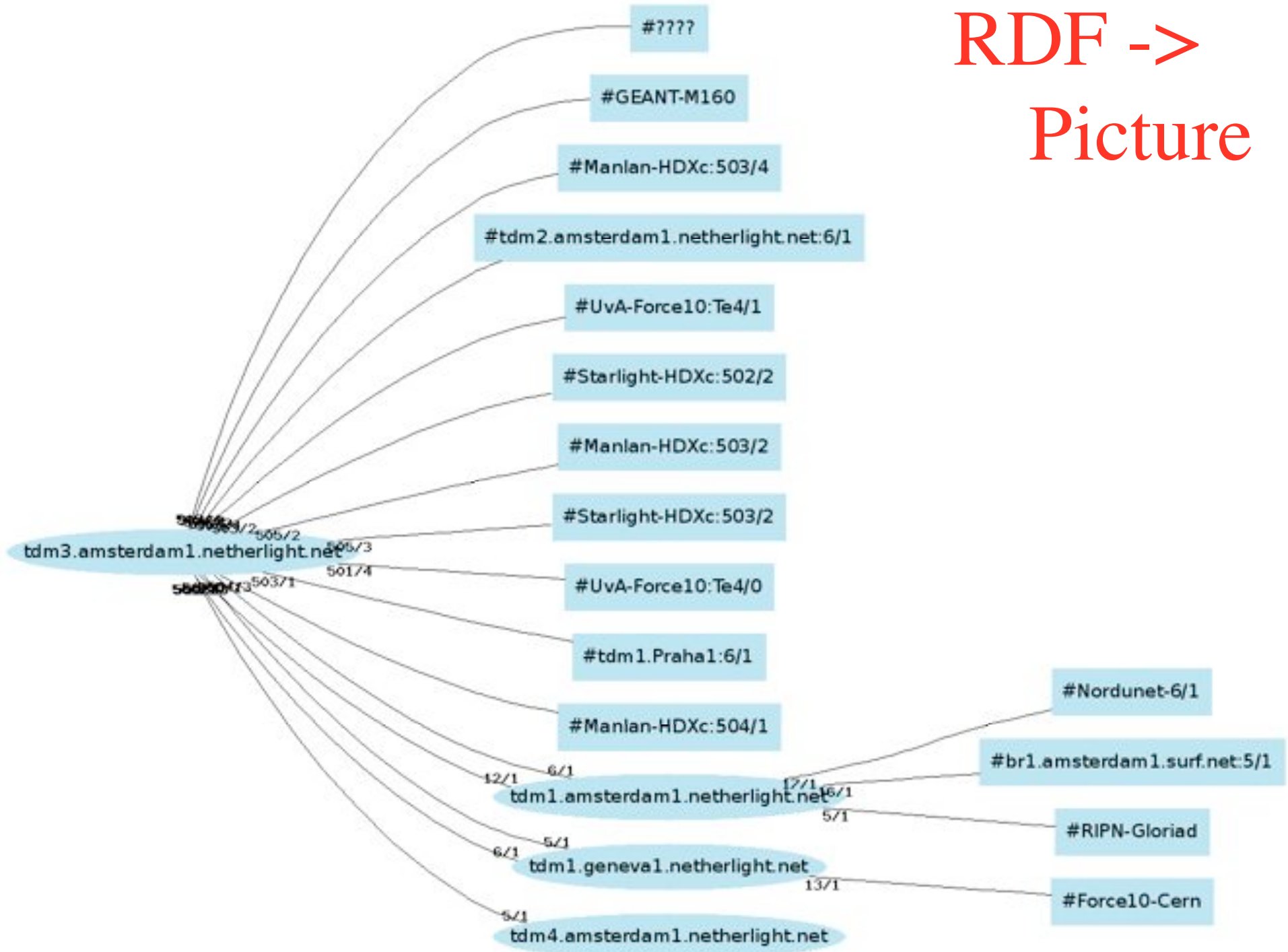


# NetherLight in RDF

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:ndl="http://www.science.uva.nl/research/air/ndl#">
  <!-- Description of Netherlight -->
  <ndl:Location rdf:about="#Netherlight">
    <ndl:name>Netherlight Optical Exchange</ndl:name>
  </ndl:Location>
  <!-- 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:501/1"/>
    <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:501/3"/>
    <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:501/4"/>
    <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:503/1"/>
    <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:503/2"/>
    <ndl:hasInterface rdf:resource="#tdm3.amsterdam1.netherlight.net:503/3"/>
    <!-- all the interfaces of TDM3.amsterdam1.netherlight.net -->
    <ndl:Interface rdf:about="#tdm3.amsterdam1.netherlight.net:501/1">
      <ndl:name>tdm3.amsterdam1.netherlight.net:POS501/1</ndl:name>
      <ndl:connectedTo rdf:resource="#tdm4.amsterdam1.netherlight.net:5/1"/>
    </ndl:Interface>
    <ndl:Interface rdf:about="#tdm3.amsterdam1.netherlight.net:501/2">
      <ndl:name>tdm3.amsterdam1.netherlight.net:POS501/2</ndl:name>
      <ndl:connectedTo rdf:resource="#tdm1.amsterdam1.netherlight.net:12/1"/>
    </ndl:Interface>
```



# RDF -> Picture



**Key issue #2:**  
**How to book resources on such  
networks?**

# Web services

Web services interfaces provide the API for the reservation framework:

```
<wsdl:operation name="getResourceInformation">  
<wsdl:operation name="getResourceList">  
<wsdl:operation name="getTypeList">  
<wsdl:operation name="getResourcesOfType">  
<wsdl:operation name="reservePath">  
<wsdl:operation name="getPossiblePaths">  
<wsdl:operation name="isPathAvailable">  
<wsdl:operation name="confirmPathReservation">  
<wsdl:operation name="cancelPathReservation">
```

# Resource Brokering: Your Ticket Into NetherLight

## Application architecture:



**Lambda networking** allows the creation of application specific light paths.

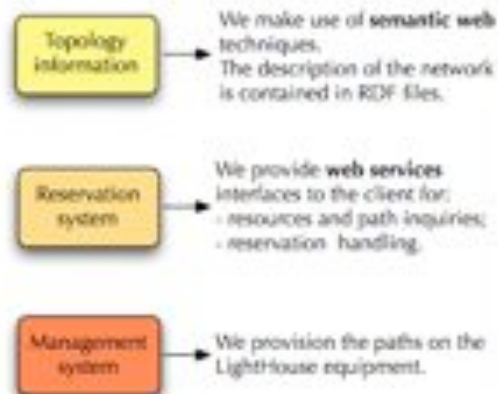
Lambda networking facilities empower users to request services and provision **end-to-end light paths** if and when they need it.

**NetherLight**, located in Amsterdam, The Netherlands, is one of such facilities.

The Amsterdam **LightHouse** is a joint research laboratory of the UvA and SARA.

Resources in the LightHouse can be used by collaborators to prove the concepts of hybrid networks.

## Lightpath setup components:



### Semantic web

The Network Description Language, an RDF Schema, describes networks in a standard, interoperable way.

### Web Services

A WSDL file describes the interfaces to the service available to clients. Clients can interact with the service directly or via a portal.

### Our SC|OS demonstration

We show the setup of dynamic connections between two computing nodes through the LightHouse/ Netherlight Optical Exchange.



# Business as usual :-)



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# Questions ?



## Credits:

- Leon Gommans, Paola Grosso, Bas Oudenaarde, Arie Taal, Freek Dijkstra, Bert Andree, Jeroen van der Ham, Hans Blom, Yuri Demchenko, Fred Wan, Karst Koymans, Martijn Steenbakkers Jaap van Ginkel
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- NORTEL: Franco Travostino, Kim Roberts, Rod Wilson
- SARA: Anwar Osseryan, Paul Wielinga, Pieter de Boer, Ronald van der Pol, teams
- Joe Mambretti, Bill stArnaud, GLIF community
- Tom & Maxine & Larry, Laurin, OptIPuter, OnVector team !!!!

