OTN3-2006: Very Dynamic LightPath Applications in DAS3 & StarPlane.

Cees de Laat

SURFnet

BSIK

EU

University of Amsterdam

NWO
TI
TNO
NCF

SURFnet

Advanced School for Computing and Imaging

History - 1

DAS = Distributed ASCI Supercomputer

- Project DAS-1 started in 1997 by Andrew Tanenbaum
- To prove distributed clusters were as effective as super...
- 4-5 clusters connected via high speed links
  - DAS-1 -> 6 Mbit/s full mesh ATM
  - DAS-2 -> Gbit/s L3
  - DAS-3 -> StarPlane

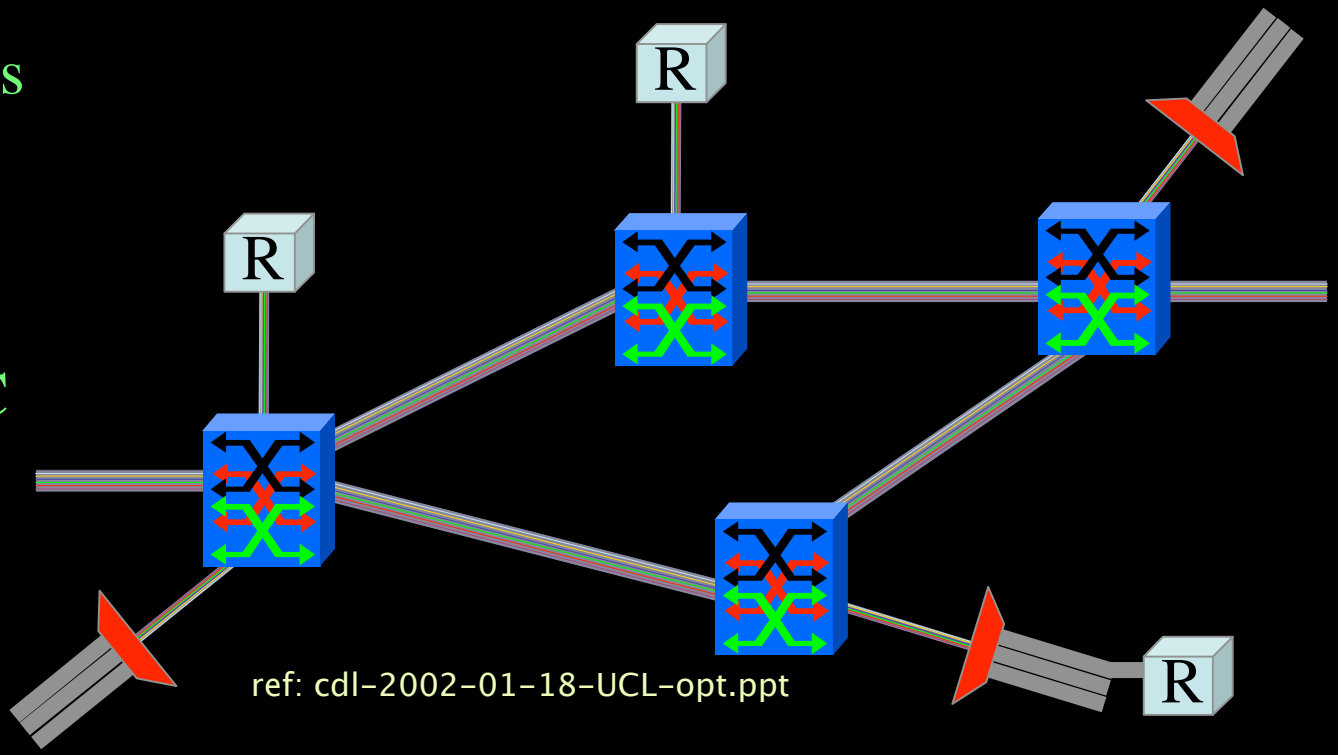
- DAS-1 ran BSD, changed to Linux (Andrew... :-)
- DAS-1 and 2 uniform architecture, not so in DAS-3
- Over 200 users, 25 Ph.D. theses
- http://www.cs.vu.nl/das/

Advanced School for Computing and Imaging

History - 2

SURFnet6 Architecture discussions 2001-2002

- photonic backbone
- (L2 and) L3 services
- NORTEL
- Static
- Summer 2004 K&C
- NWO-GLANCE
- StarPlane
- PHD-PD-SP



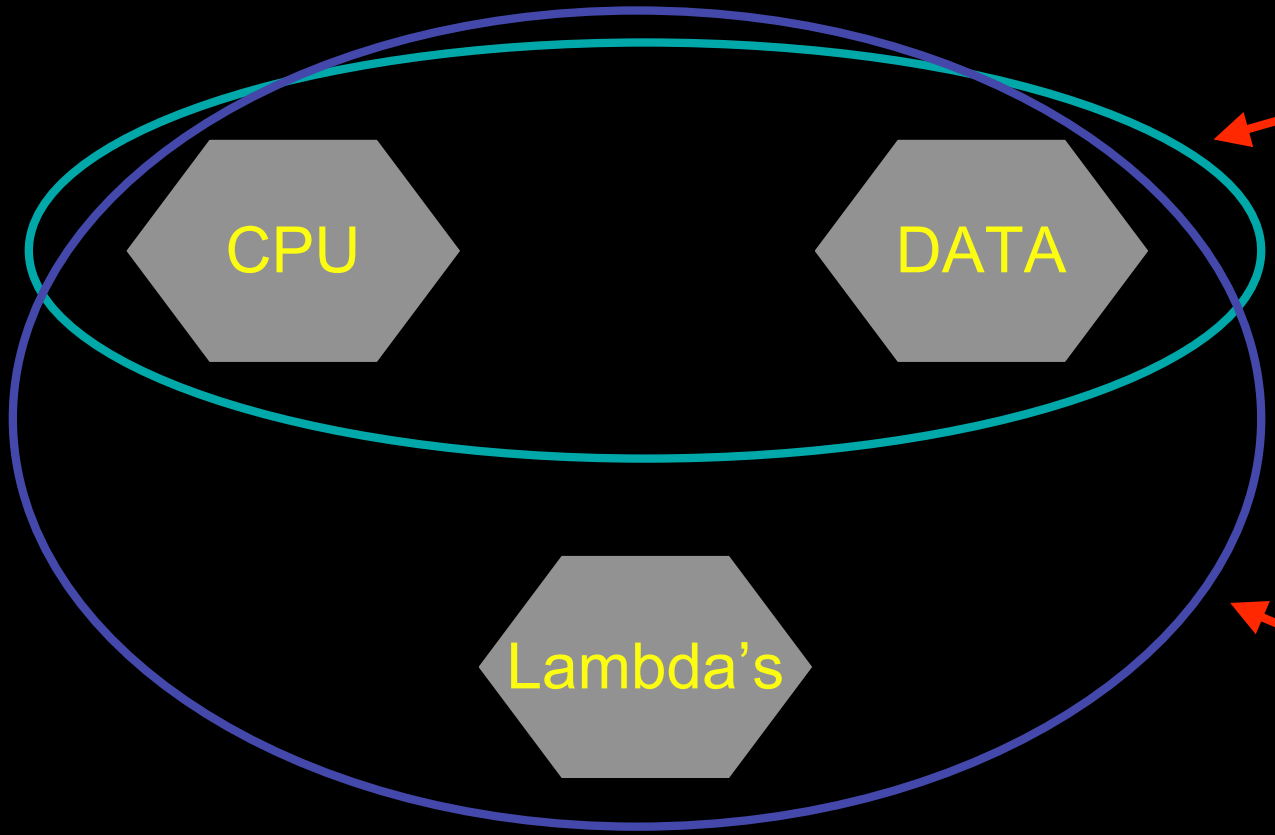
- Start 1-feb-06, Li Xu, Jan Philip Velders, Jason Maasen
  - Henri Bal, Paola Grosso, Herbert Bos, CdL, SN-folks.

StarPlane Approach

(PG)

- StarPlane is a NWO funded project with major contributions from SURFnet and NORTEL.
- The vision is to allow part of the photonic network infrastructure of SURFnet6 to be manipulated by Grid applications to optimize the performance of specific e-Science applications.
- StarPlane will use the physical infrastructure provided by SURFnet6 and the distributed supercomputer DAS-3.
- The novelty: to give flexibility directly to the applications by allowing them to choose the logical topology in real time, ultimately with subsecond lambda switching times.

GRID-Colocation problem space



Extensively under research

New!

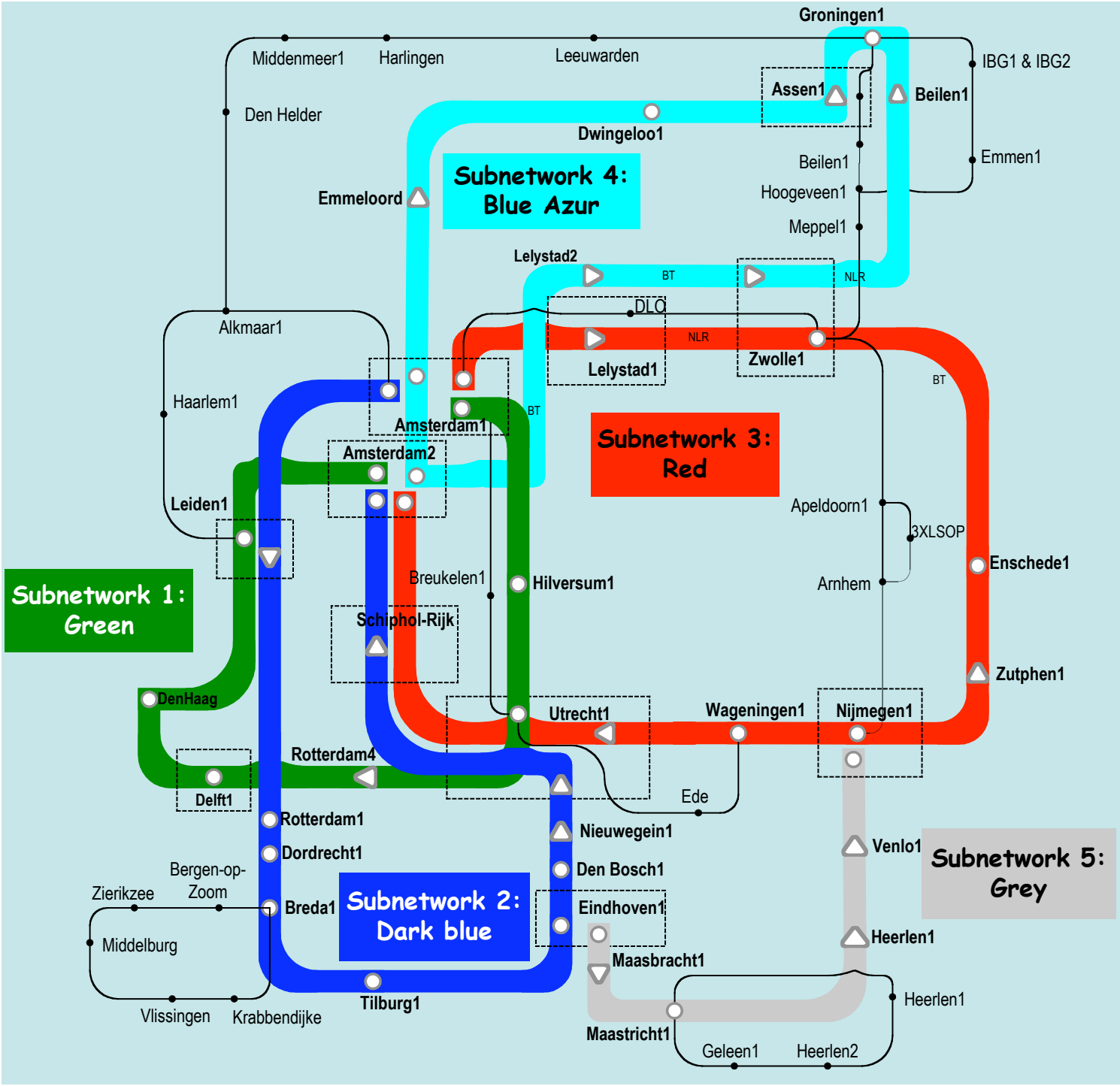
In The Netherlands SURFnet connects between 180:

- universities;
- academic hospitals;
- most polytechnics;
- research centers.

with a user base of ~750K users

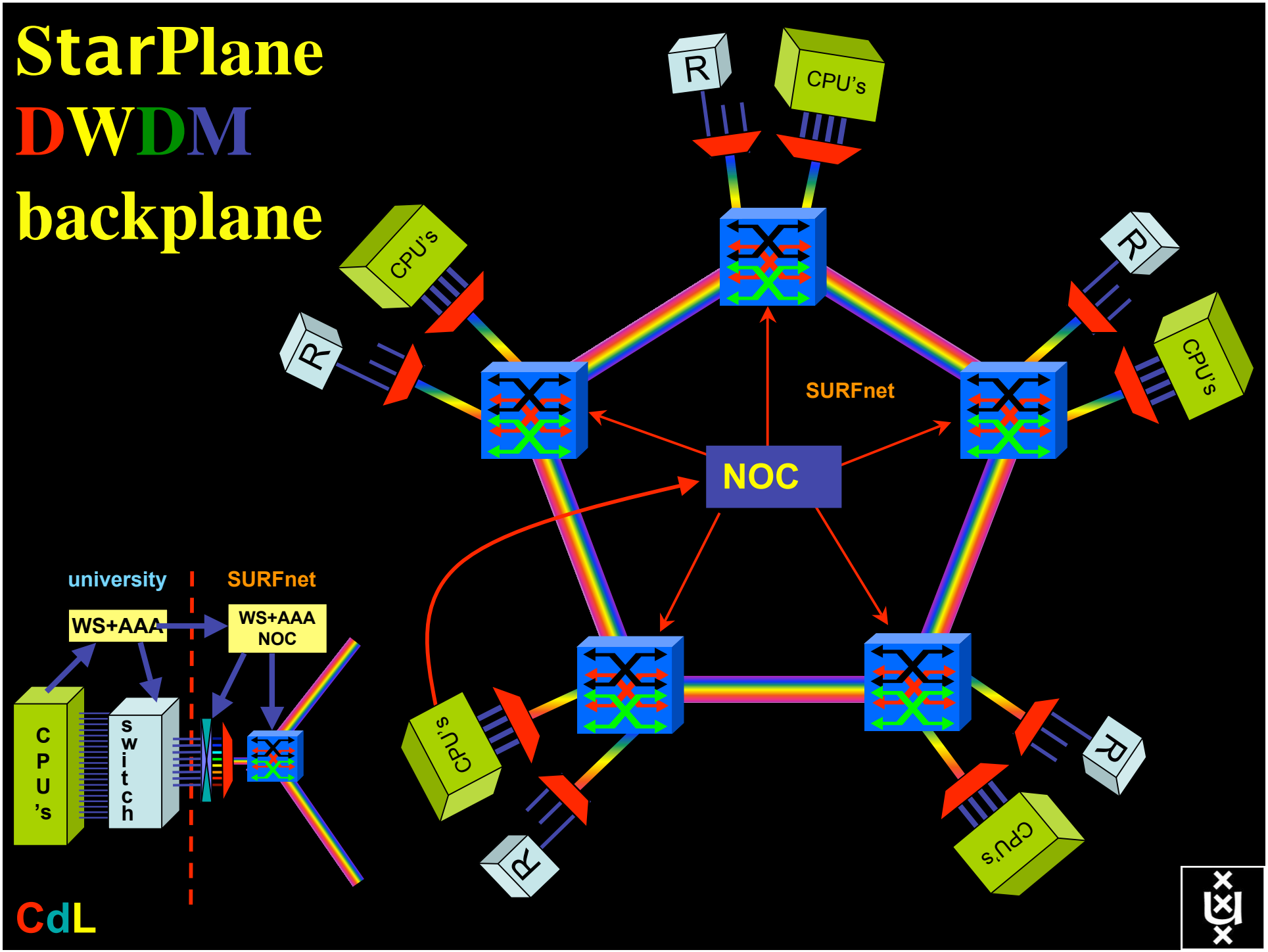
> 6000 km

comparable to railway system



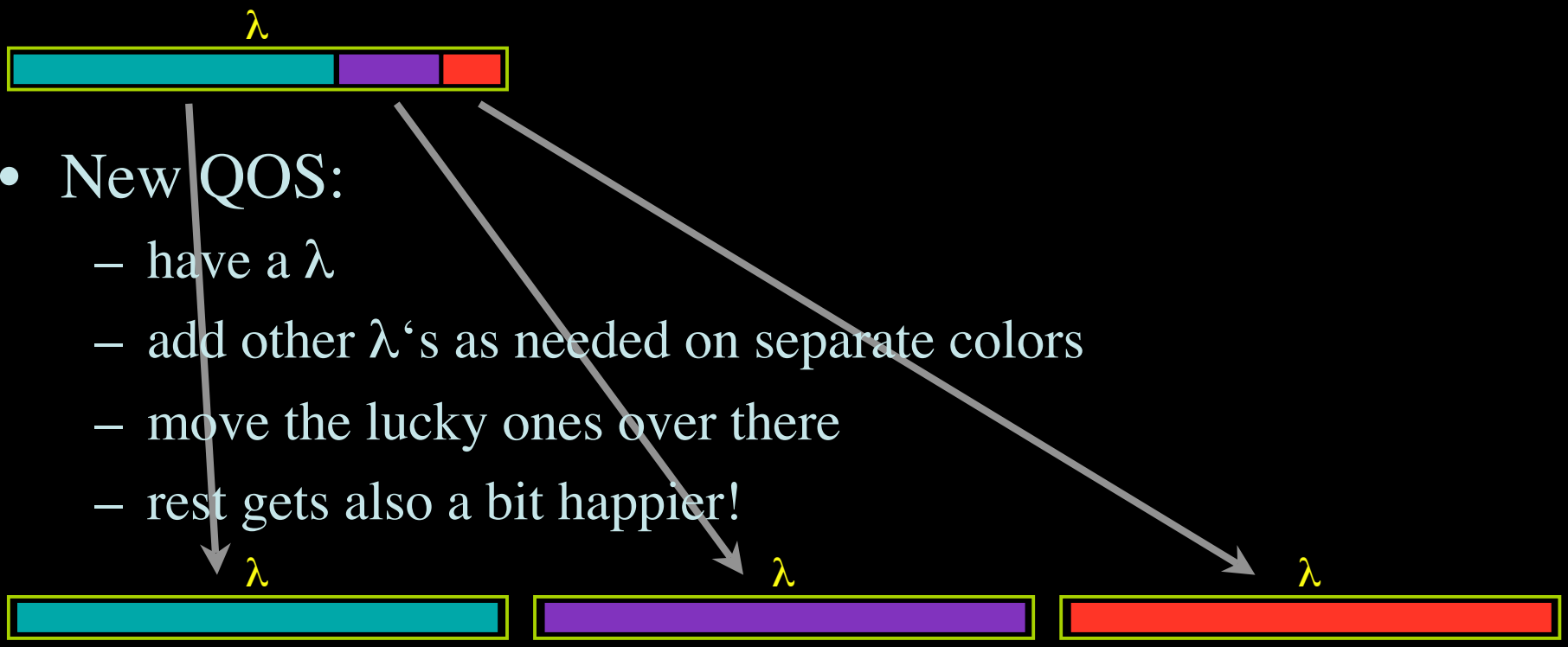
Common Photonic Layer (CPL) in SURFnet6

supports up to
72 Lambda's of
10 G each
40 G soon.


StarPlane
DWDM
backplane
R
CPU's
SURFnet
NOC
university
SURFnet
WS+AAA
WS+AAA
NOC
CPU's
switch
CdL

QOS in a non destructive way!

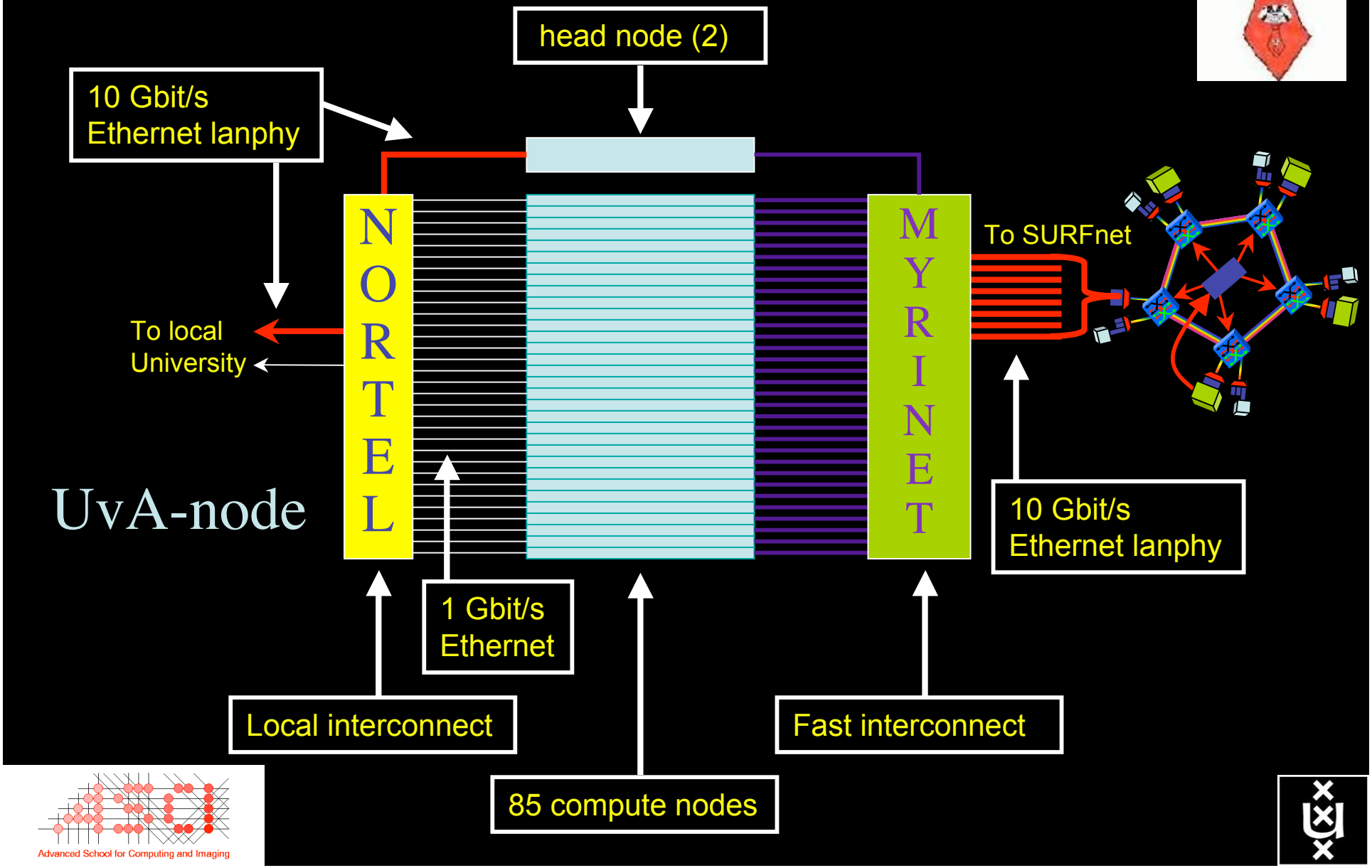
- Old QOS:
  - have a link or λ
  - set part of it aside for a lucky few under higher priority
  - rest gets less service



- New QOS:
  - have a λ
  - add other λ's as needed on separate colors
  - move the lucky ones over there
  - rest gets also a bit happier!

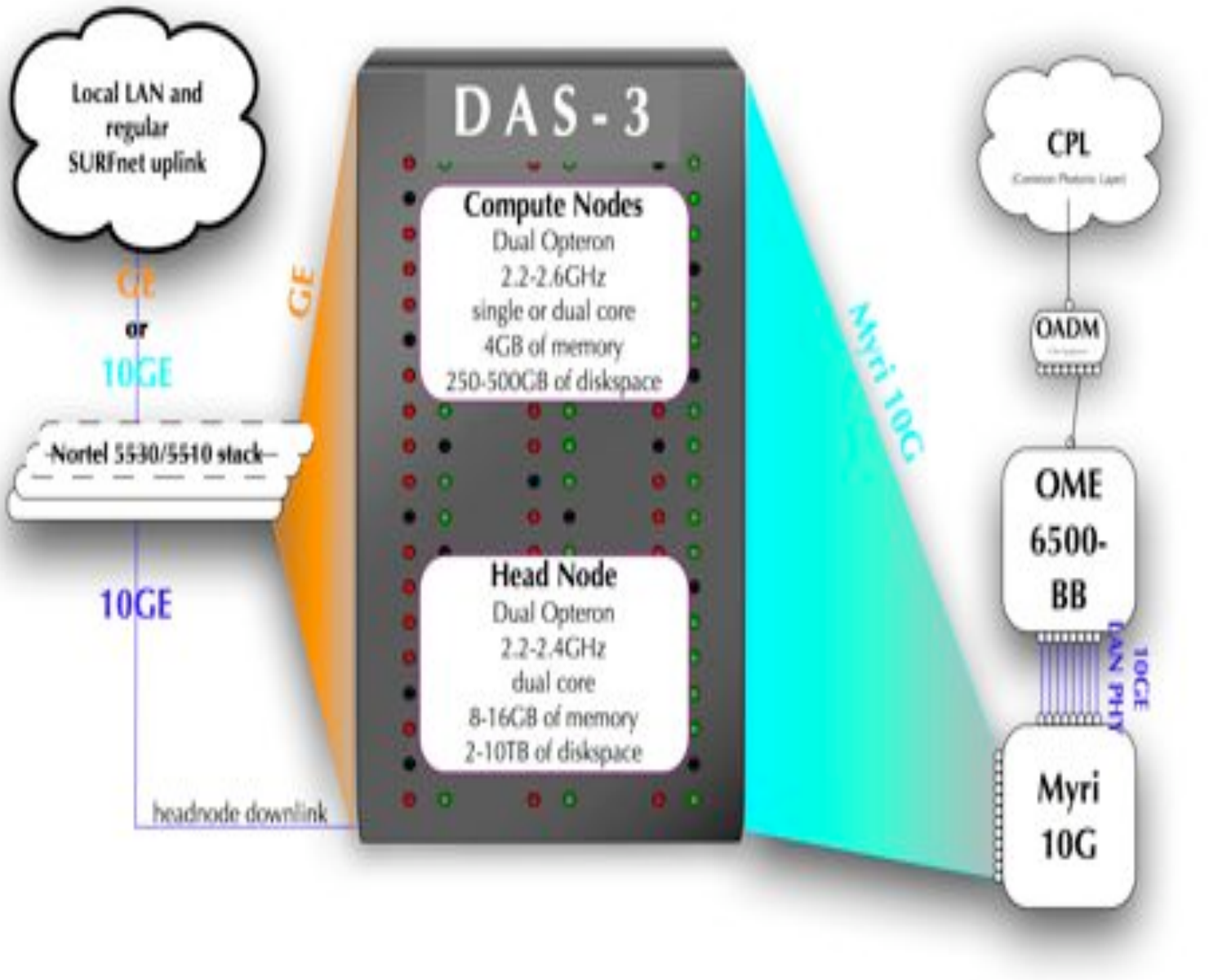
DAS-3 Cluster Tender

http://www.clustervision.com/pr_das3_uk.html



Advanced School for Computing and Imaging

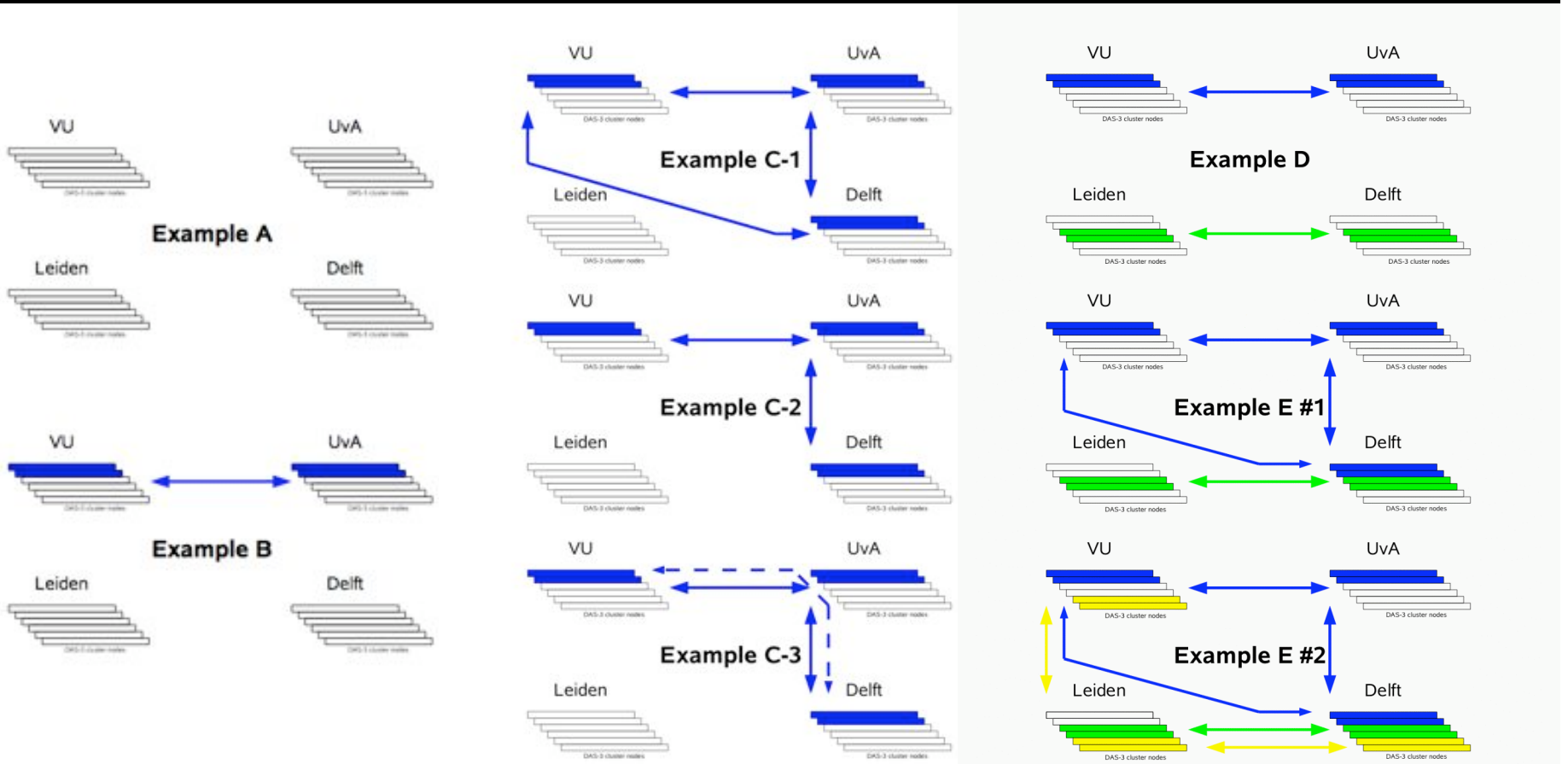
Photonics


Local LAN and
regular
SURFnet uplink
GE
or
10GE
Nortel 5530/5510 stack
10GE
headnode downlink
GE
DAS-3
Compute Nodes
Dual Opteron
2.2-2.6GHz
single or dual core
4GB of memory
250-500GB of diskspace
Head Node
Dual Opteron
2.2-2.4GHz
dual core
8-16GB of memory
2-10TB of diskspace
Myri 10G
CPL
OADM
OME
6500-
BB
10GE
LAN PHY
Myri
10G

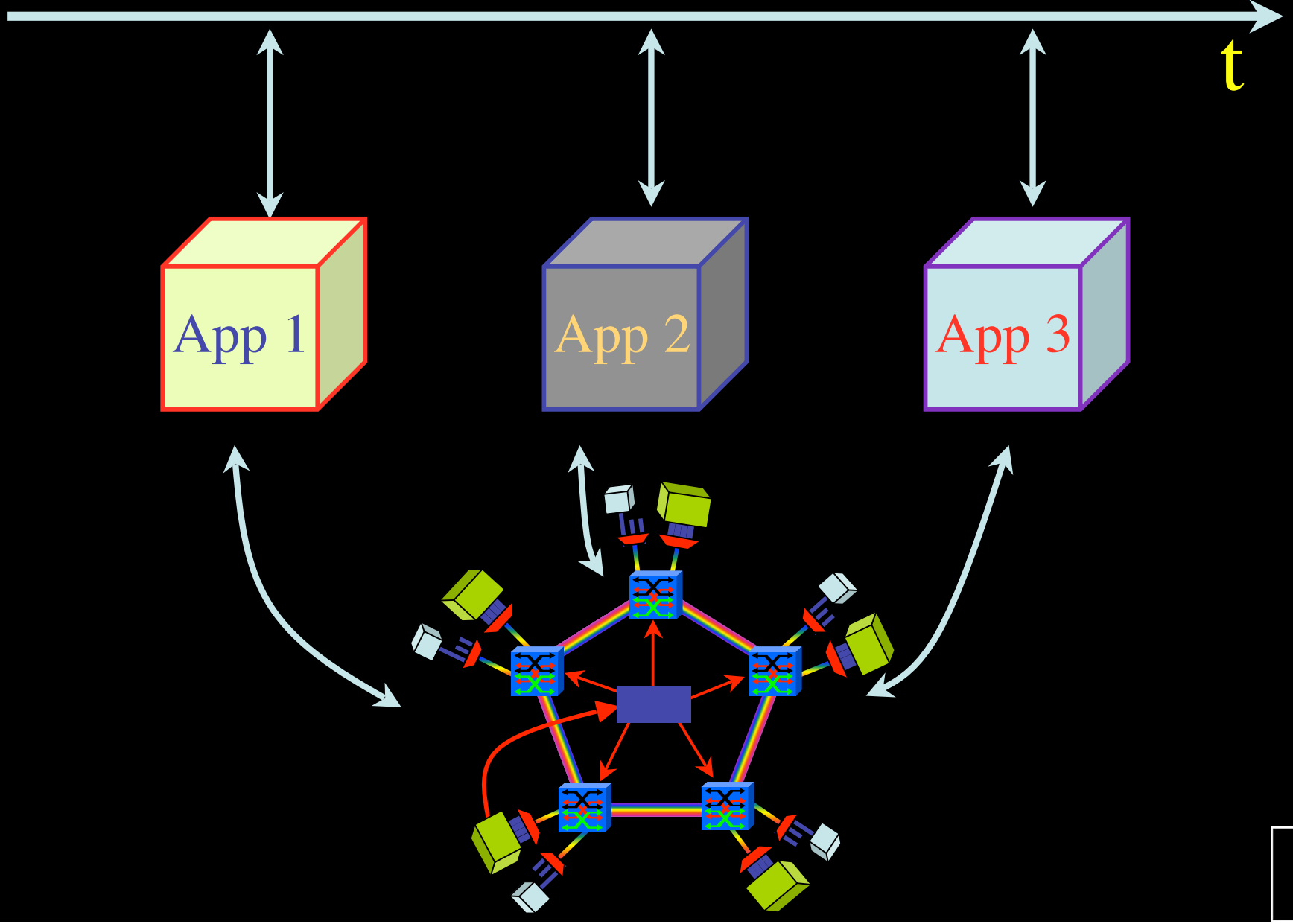
What makes StarPlane fly?

- Wavelength Selective Switches
  - for the “low cost” photonics
- Sandbox by confining StarPlane to one band
  - for experimenting on a production network
- Optimization of the controls to turn on/off a Lambda
  - direct access to part of the controls at the NOC
- electronic Dynamically Compensating Optics (eDCO)
  - to compensate for changing lengths of the path
- traffic engineering
  - to create the OPN topologies needed by the applications
- Open Source GMPLS
  - to facillitate policy enabled cross domain signalling

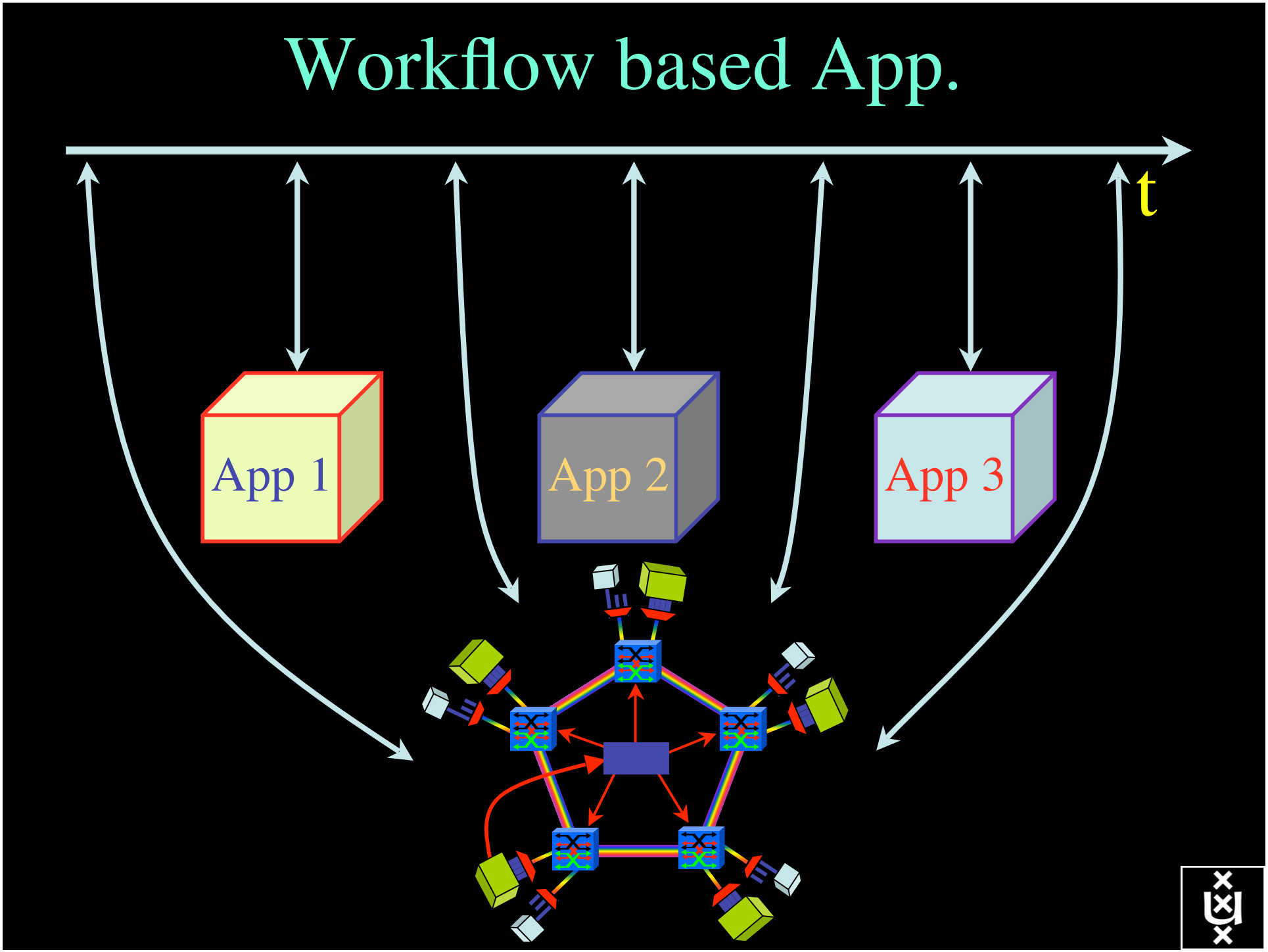
Traffic engineering



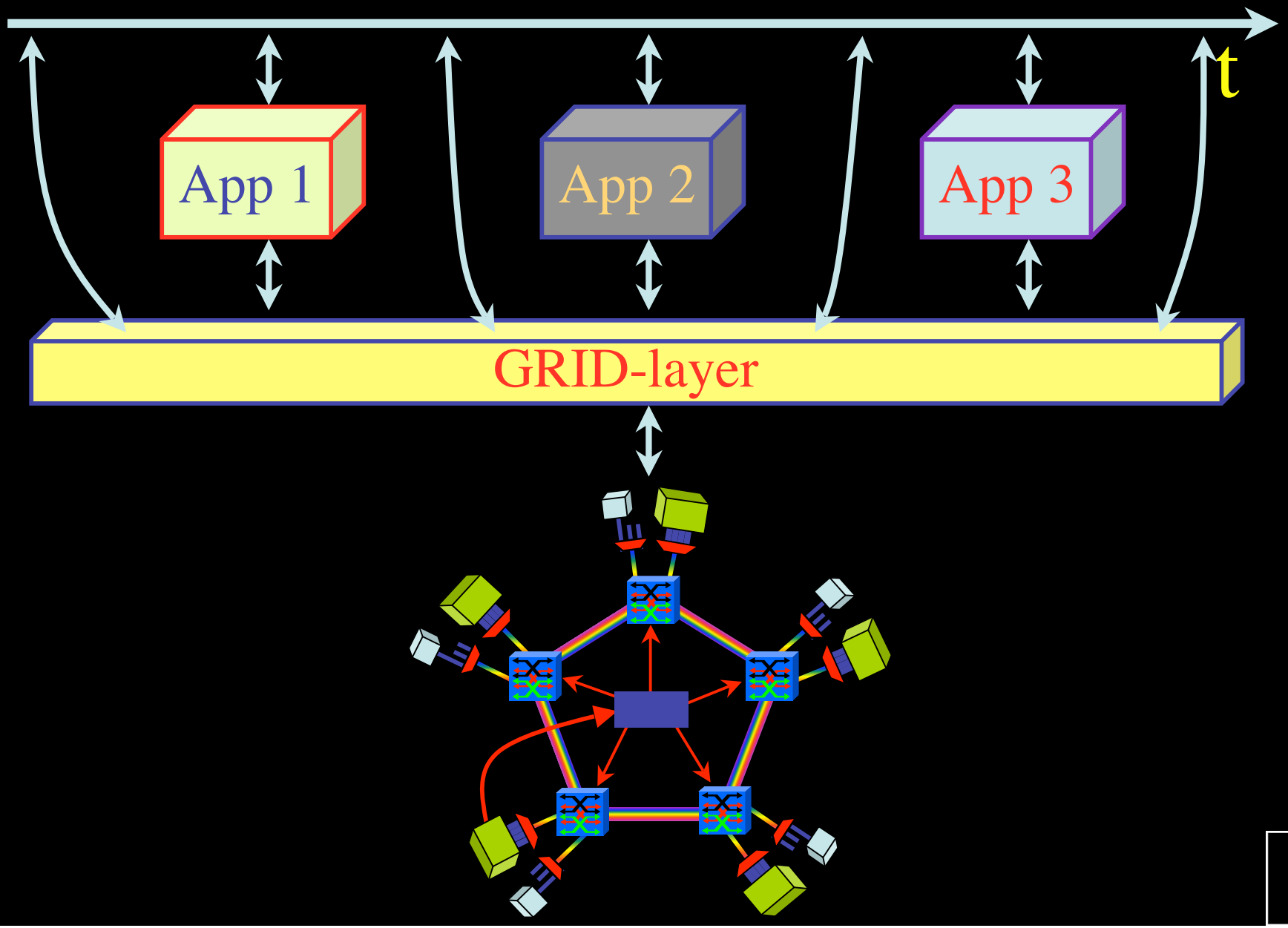
Application - Network interaction



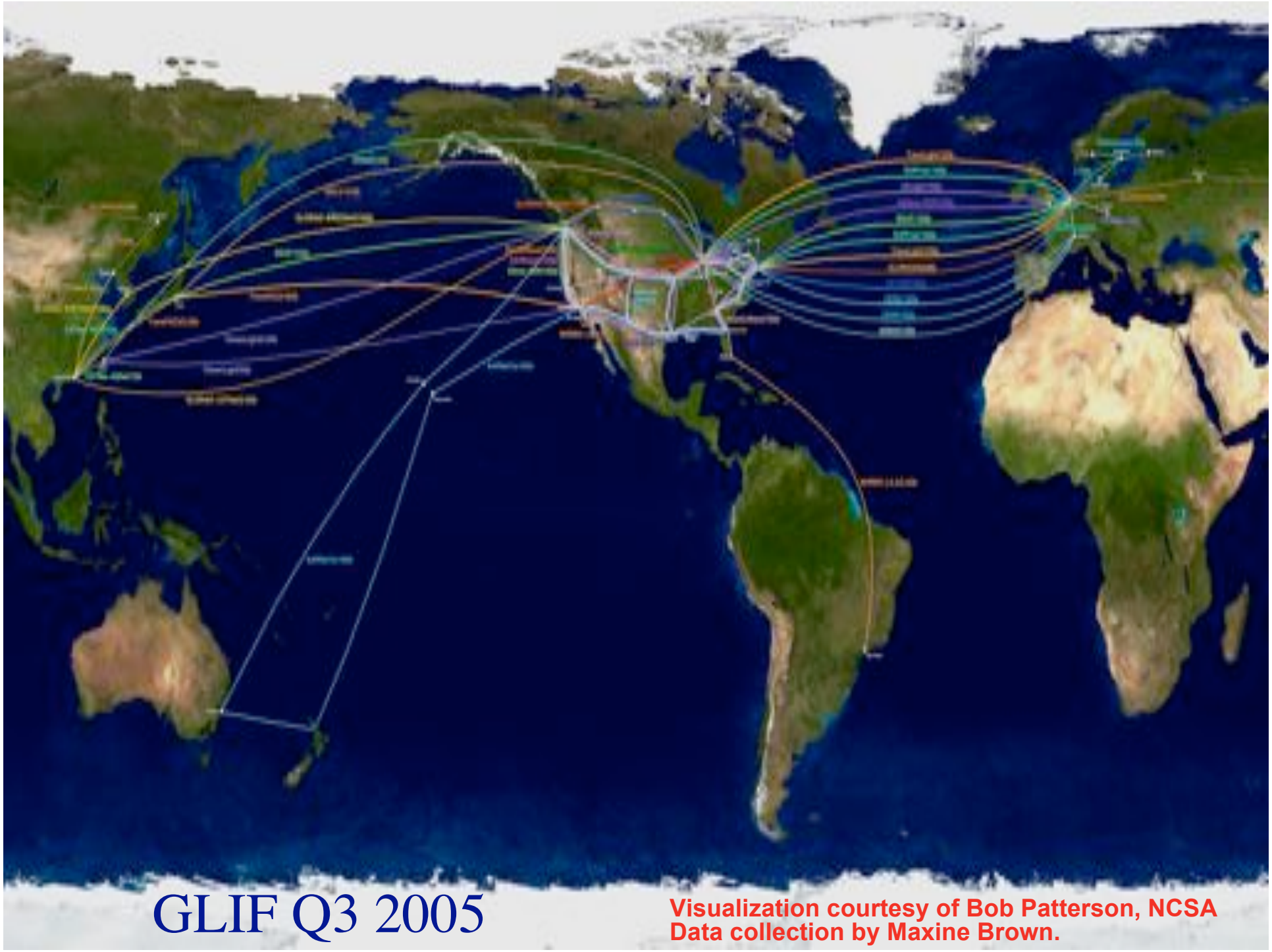
Workflow based App.

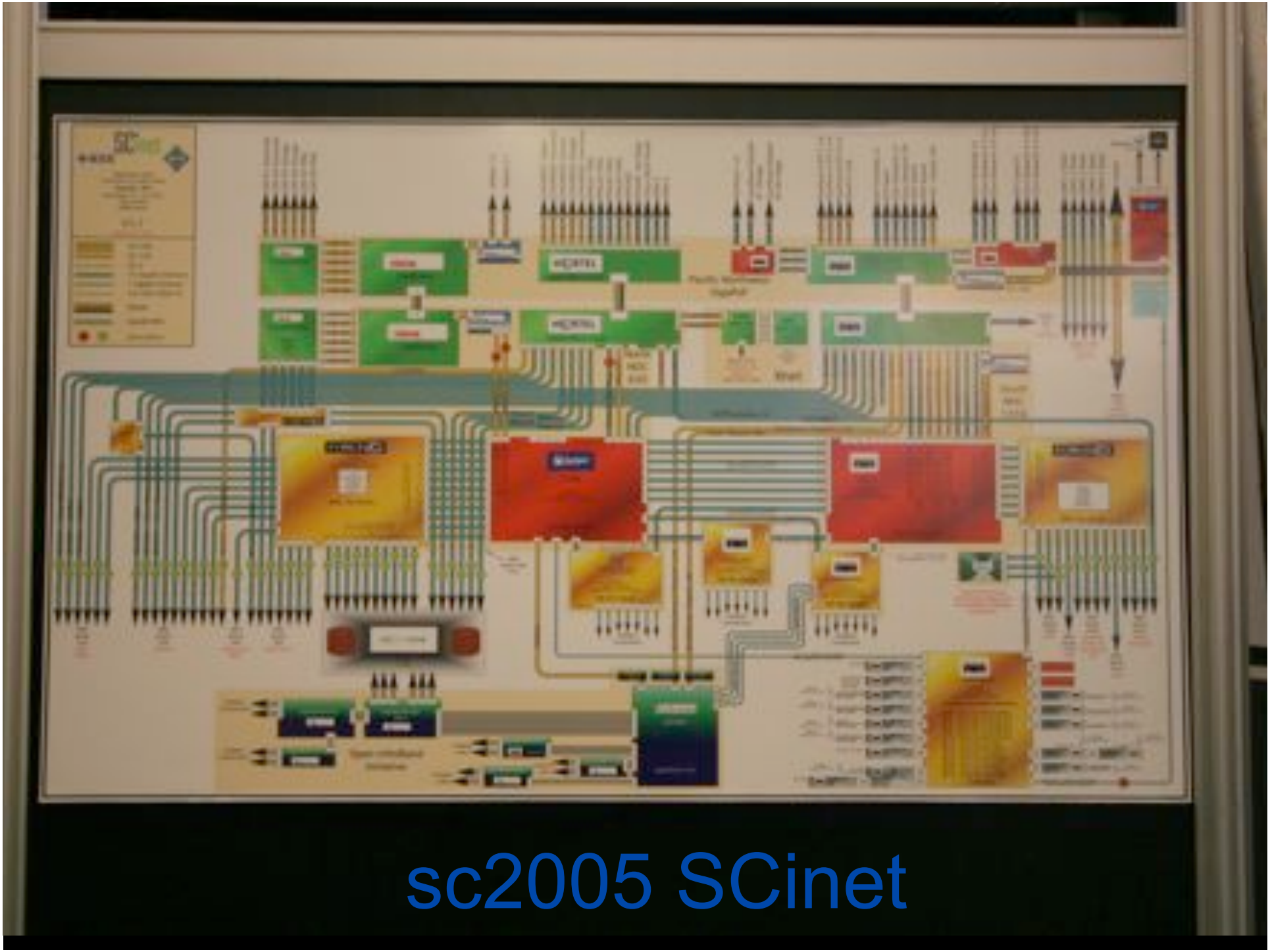


Workflow based App via grid.



Key issue #1:
how to describe such networks?

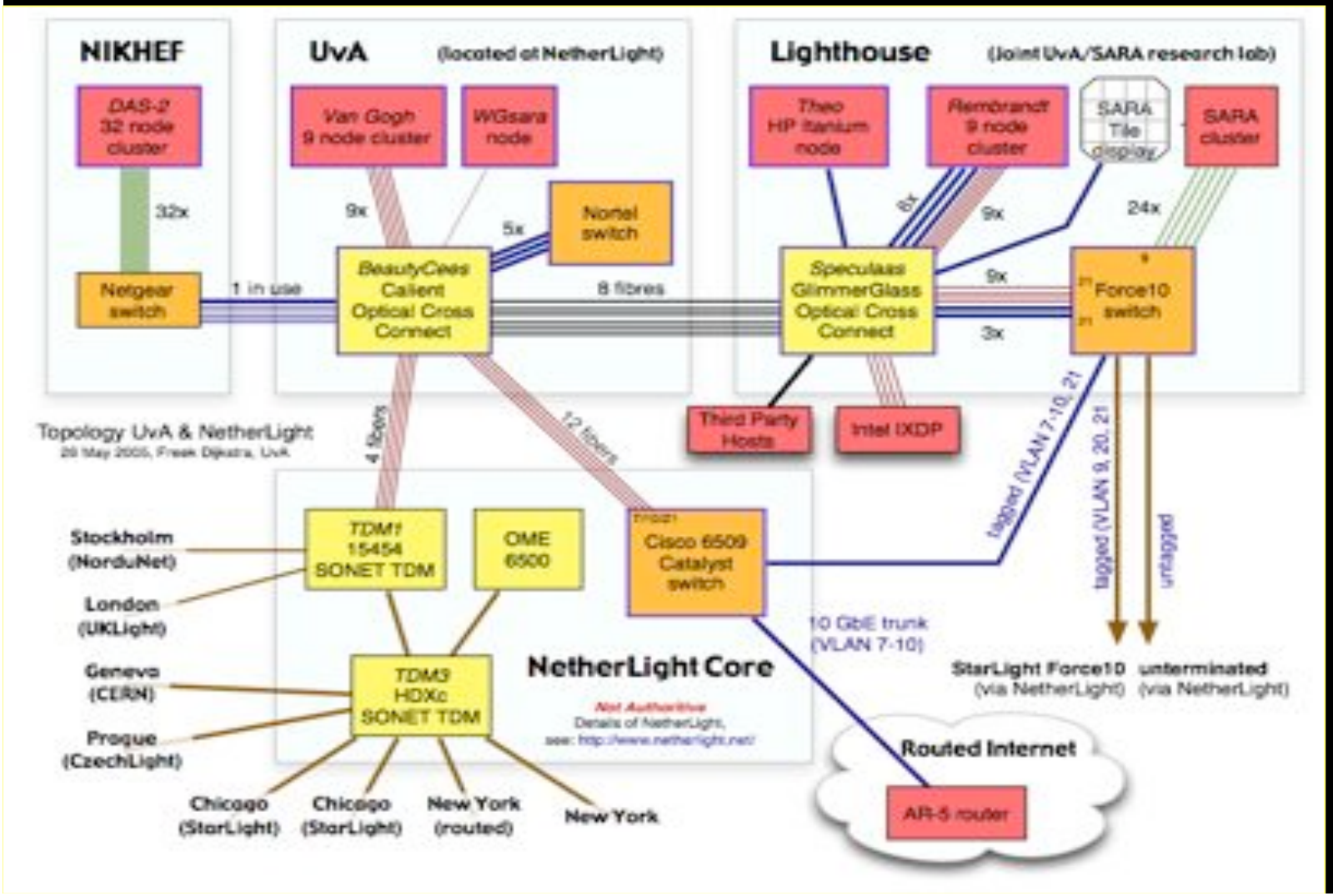

GLIF Q3 2005
Visualization courtesy of Bob Patterson, NCSA
Data collection by Maxine Brown.



sc2005 SCinet

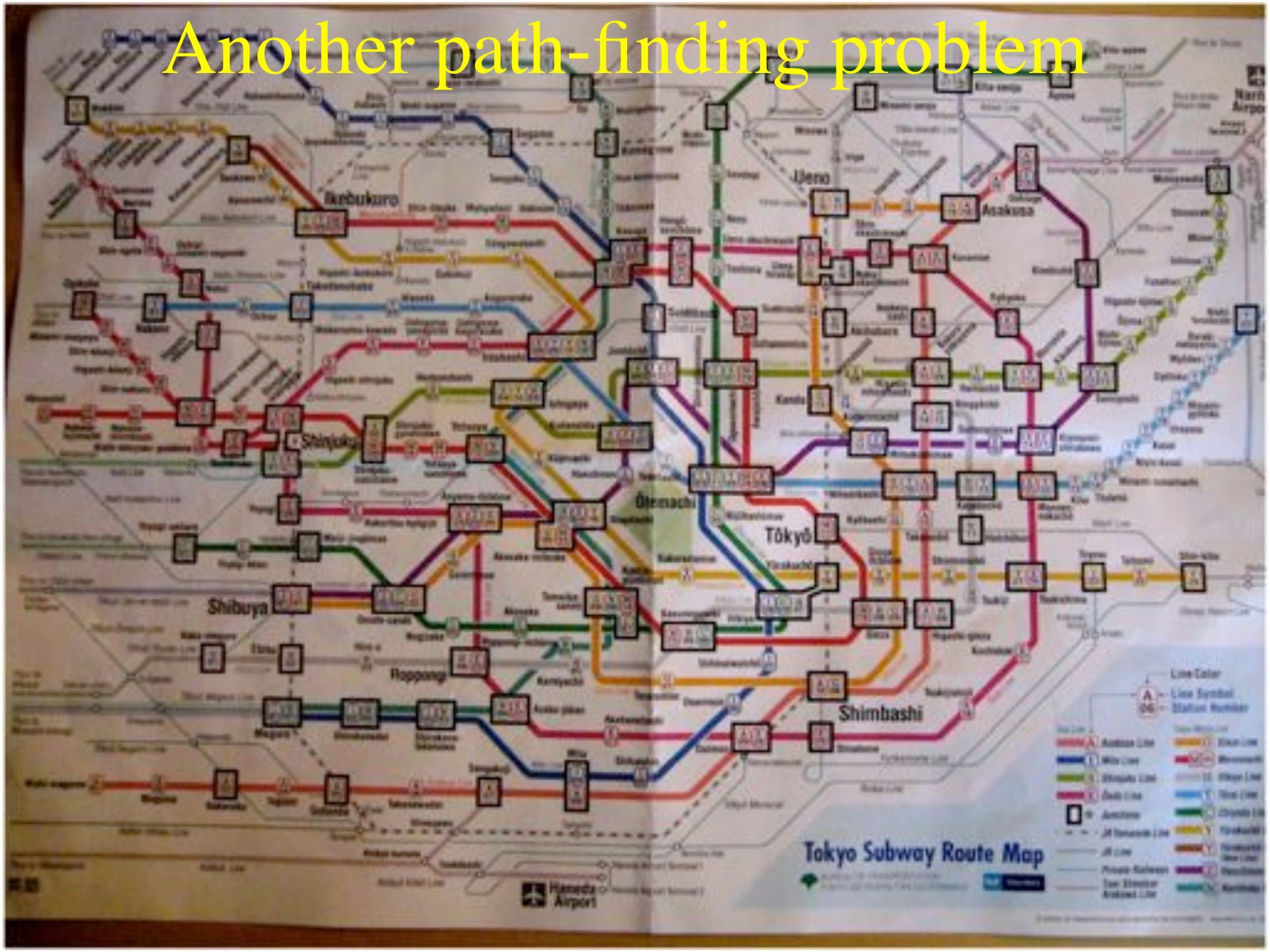
UvA/SARA LightHouse

A joint network research lab of the University of Amsterdam and SARA.
Connects end resources to NetherLight.
Proof of concept e.g. tier 0/1, webservices, GSP



sara
Computing & Networking Services

Another path-finding problem



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>
```

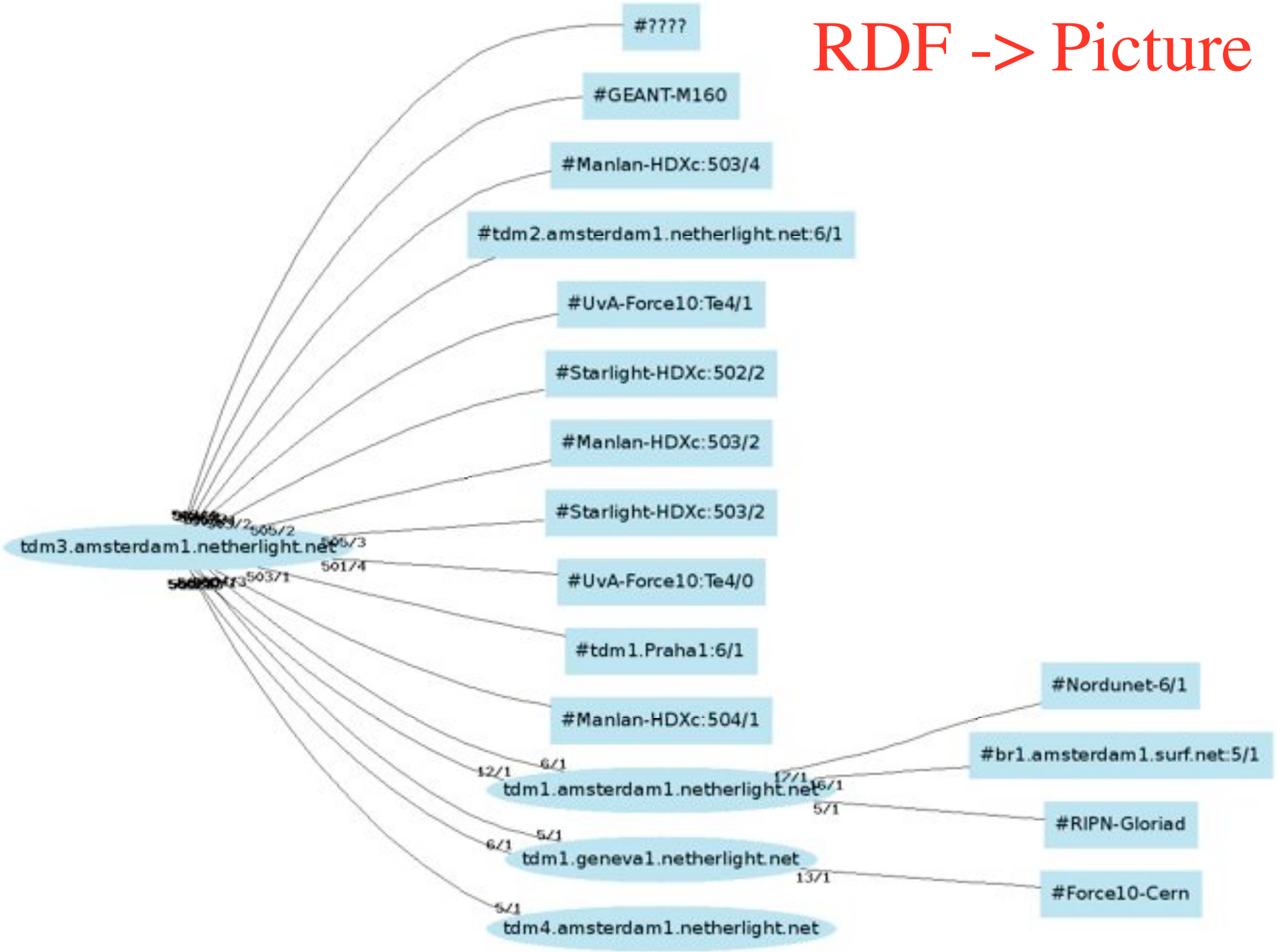
NetherLight in RDF

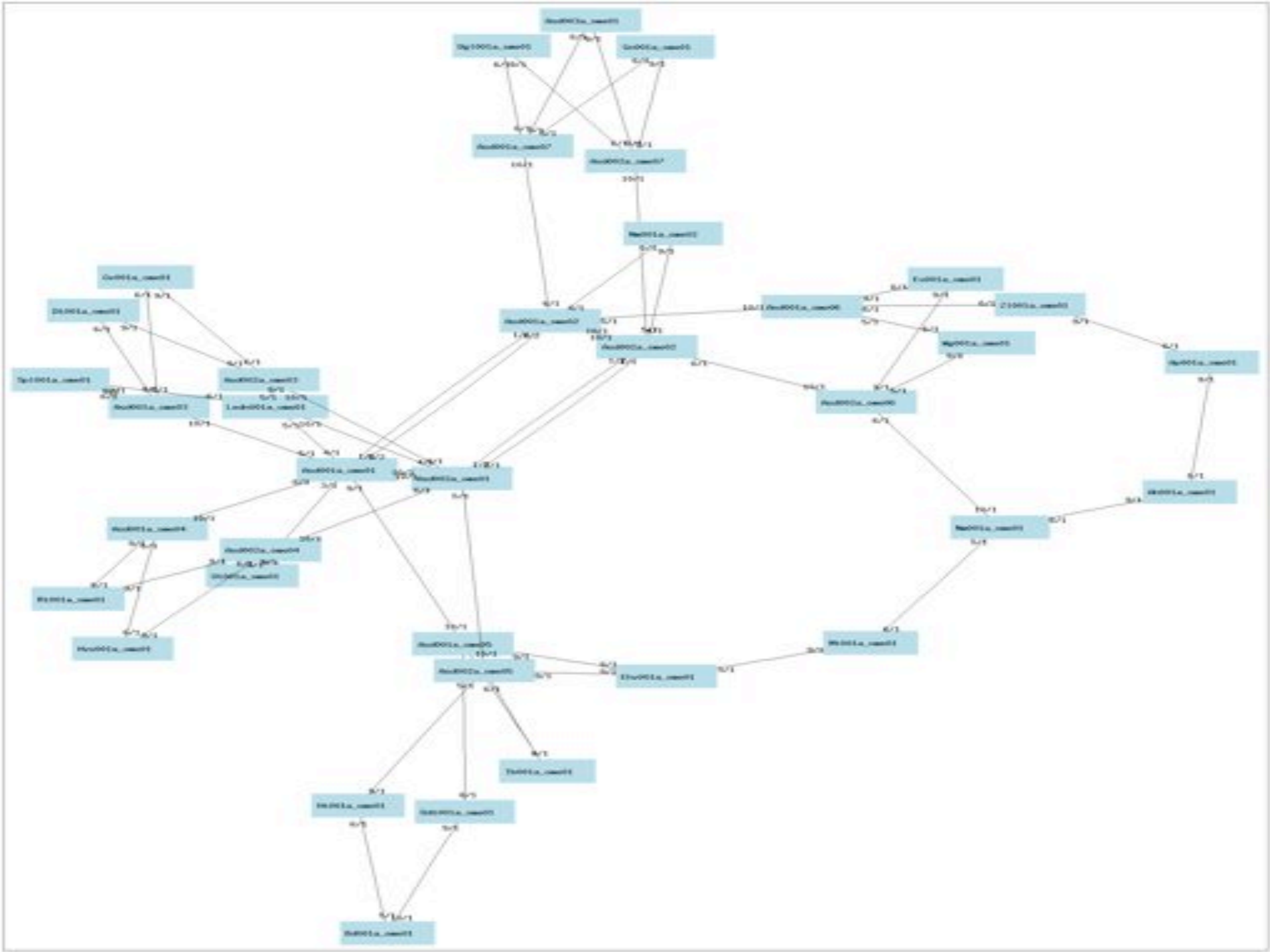
```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
      xmlns:ndl="http://www.science.uva.nl/research/air/ndl#">
<!-- Description of Netherlight -->
<ndl:Location rdf:about="#Netherlight">
      <ndl:name>Netherlight Optical Exchange</ndl:name>
</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:resour
      <ndl:hasInterface rdf:resour
      <ndl:hasInterface rdf:resour
      <ndl:hasInterface rdf:resour
      <ndl:hasInterface rdf:resour
      <ndl:hasInterface rdf:resour
      <ndl:hasInterface rdf:resour
      <ndl:hasInterface rdf:resour
```

```
<!-- 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


#????
#GEANT-M160
#Manlan-HDXc:503/4
#tdm2.amsterdam1.netherlight.net:6/1
#UvA-Force10:Te4/1
#Starlight-HDXc:502/2
#Manlan-HDXc:503/2
#Starlight-HDXc:503/2
#UvA-Force10:Te4/0
#tdm1.Praha1:6/1
#Manlan-HDXc:504/1
#Nordunet-6/1
#br1.amsterdam1.surf.net:5/1
#RIPN-Gloriad
#Force10-Cern
tdm3.amsterdam1.netherlight.net
tdm1.amsterdam1.netherlight.net
tdm1.geneva1.netherlight.net
tdm4.amsterdam1.netherlight.net
505/2
505/3
501/4
503/1
12/1
6/1
12/1
6/1
5/1
6/1
5/1
13/1
5/1



Current status: NDL

NDL - Network Description Language - an RDF based model for hybrid network descriptions.

It leverages all the semantic web tools, to provide:

- graphs and visualization of connections and lightpaths
- lightpath provisioning support at inter and intra domain level.

Latest developments will be presented at the GLIF meeting in Sep. '06.

Google map and NDL…

…the GLIF connections described by NDL.

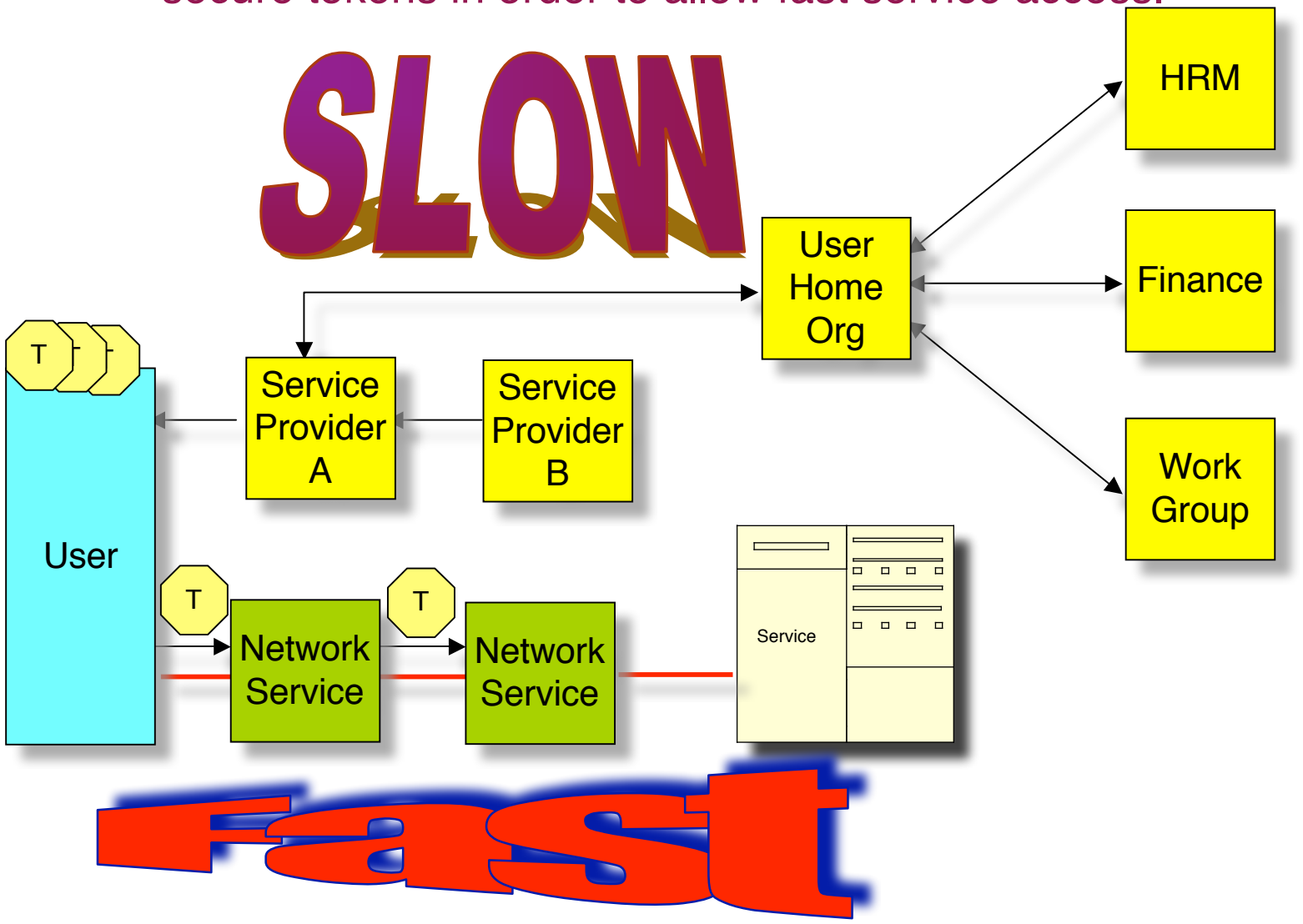
Key issue #2:
how to policy enable optical networks?

Simple service access

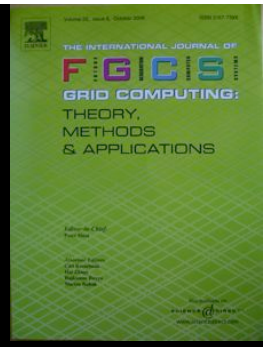
Pitlochry, Scotland - Summer 2005


surfnet
FAST. FUN. EASY.
SURFNET PREMIERE
HELP
net
Three Easy Steps :
Click the START button
Insert money...
$0.25 per minute...
Example :
$1 = 4 minutes
$5 = 20 minutes
No change is provided!
Surf the web!

Use AAA concept to split (time consuming) service authorization process from service access using secure tokens in order to allow fast service access.



Conclusions



- We try to go for fast (subsecond) Lambda setup and teardown, that is different from most other initiatives
- We need to work on GMPLS, webservices, RDF, AAA, supporting tools to make this happen
- We need to stress the current control loops and procedures to get there
- Workflow systems and/or applications need to become network aware.

Questions ?

Credits: some slides from Paola Grosso or Henri Bal

sara
Computing & Networking Services

Advanced School for Computing and Imaging

SURFnet