

Lambda-Grid developments

www.science.uva.nl/~delaat

Cees de Laat

SURFnet

EU

University of Amsterdam



SARA
TI
TNO
NCF

Contents

This page is intentionally left blank

- Ref: www.this-page-intentionally-left-blank.org



u
s
e
r
s

- A. Lightweight users, browsing, mailing, home use**
Need full Internet routing, one to many
- B. Business/grid applications, multicast, streaming, VO's, mostly LAN**
Need VPN services and full Internet routing, several to several + uplink
- C. E-Science applications, distributed data processing, all sorts of grids**
Need very fat pipes, limited multiple Virtual Organizations, few to few

For the Neterlands 2005

$$\Sigma A = \Sigma B = \Sigma C \approx 100 \text{ Gb/s}$$

However:

- A -> all connects
- B -> on several
- C -> just a few (SP, LHC, LOFAR)



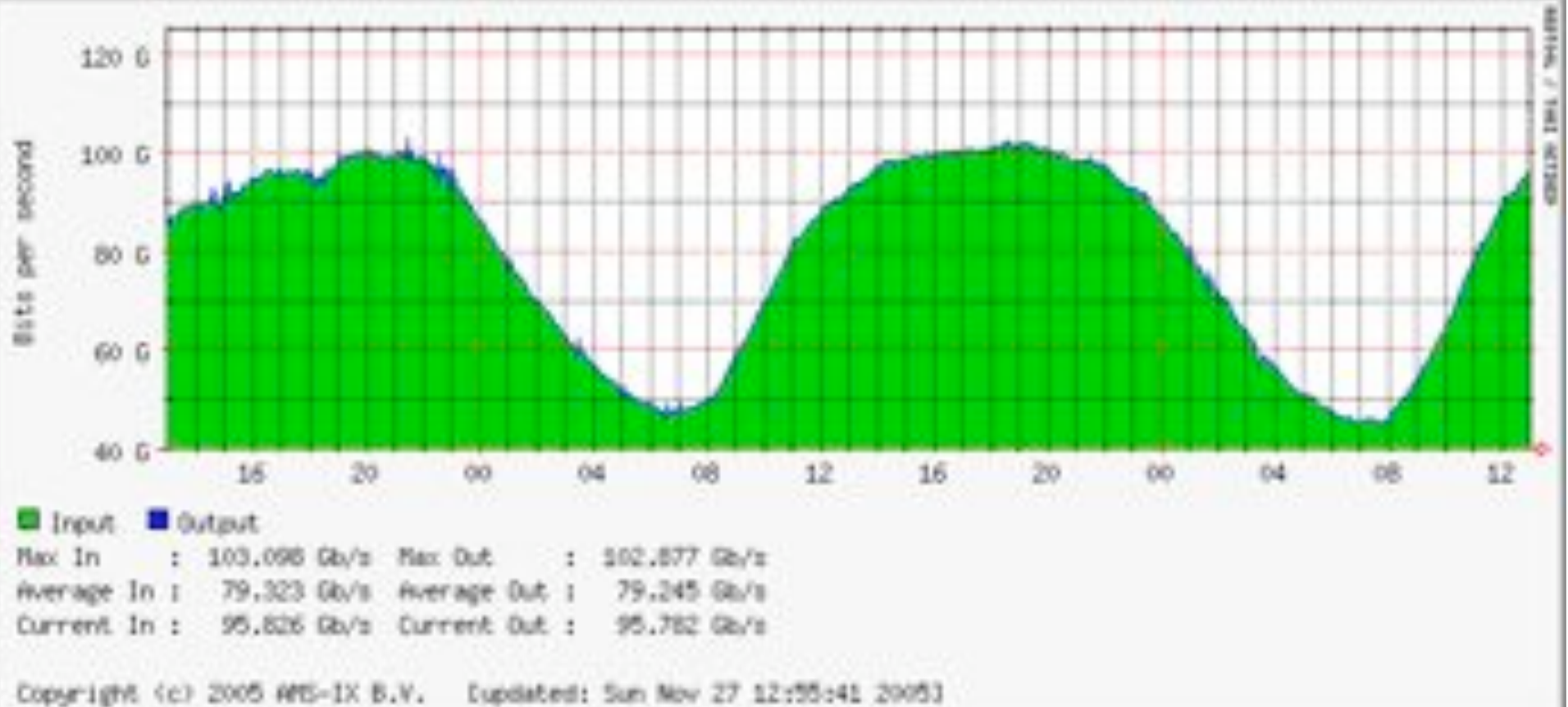
ADSL (10 Mbit/s)

GigE

BW requirements



AMS-IX



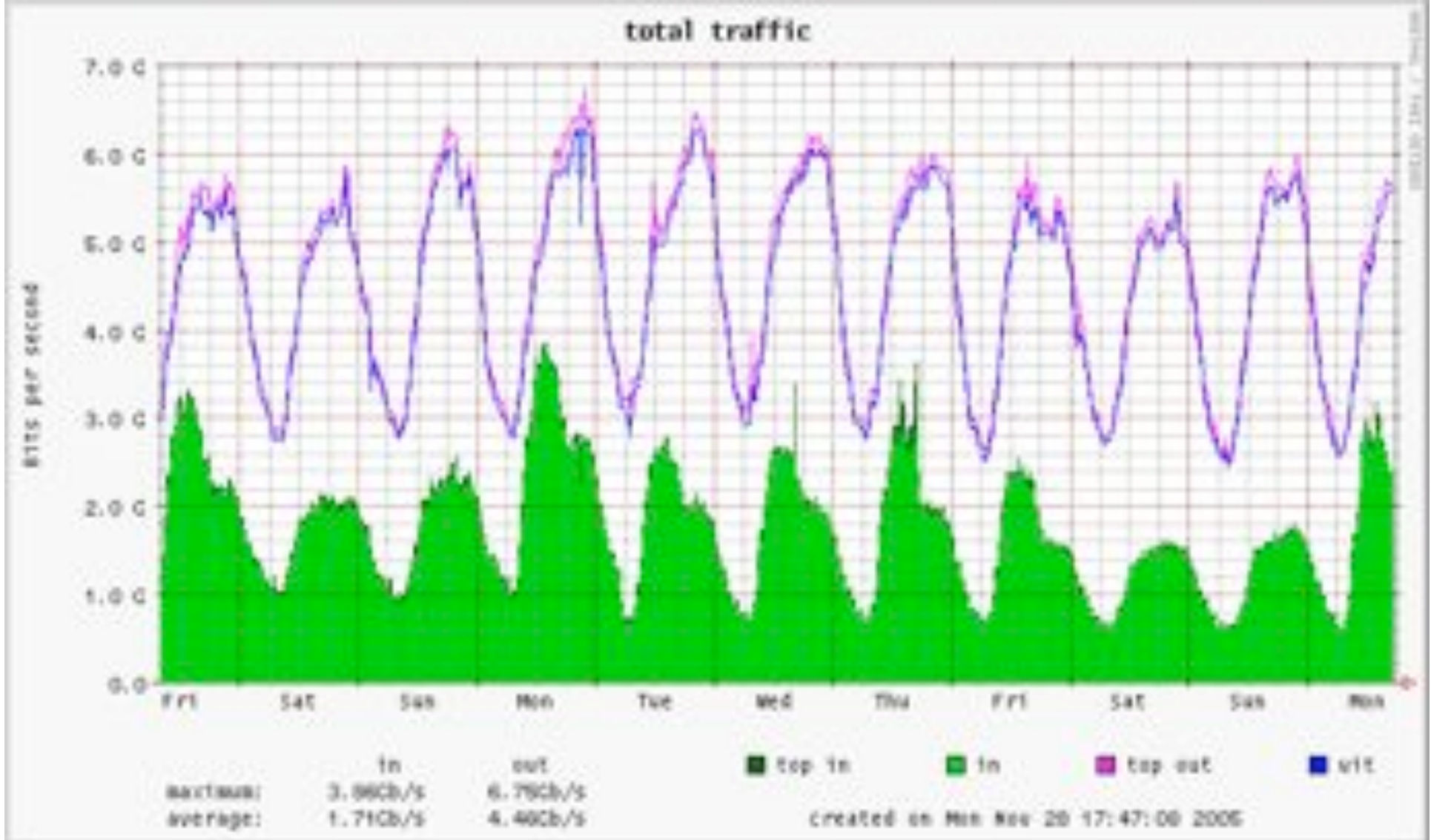
Nov 21th 2005

Lost :- (

European championship football **Holland -- Czech Republic**



SURFnet5 border router last week



Towards Hybrid Networking!

- Costs of photonic equipment 10% of switching 10 % of full routing
 - for same throughput!
 - Photonic vs Optical (optical used for SONET, etc, 10-50 k\$/port)
 - DWDM lasers for long reach expensive, 10-50 k\$
- Bottom line: look for a hybrid architecture which serves all classes in a cost effective way
 - map A -> L3 , B -> L2 , C -> L1
- Give each packet in the network the service it needs, but no more !

L1 \approx 0.5-1.5 k\$/port



L2 \approx 5-8 k\$/port



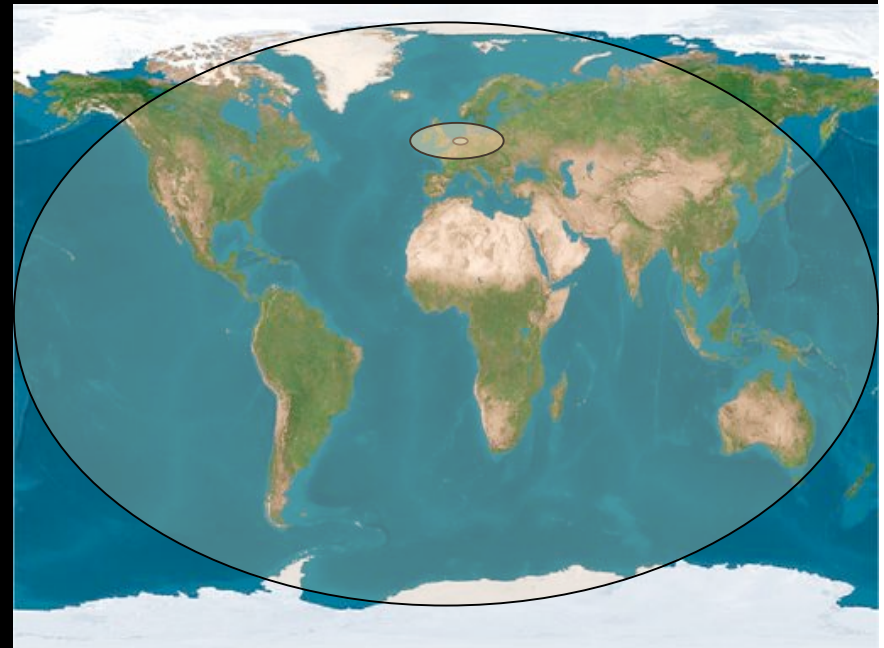
L3 \approx 75+ k\$/port

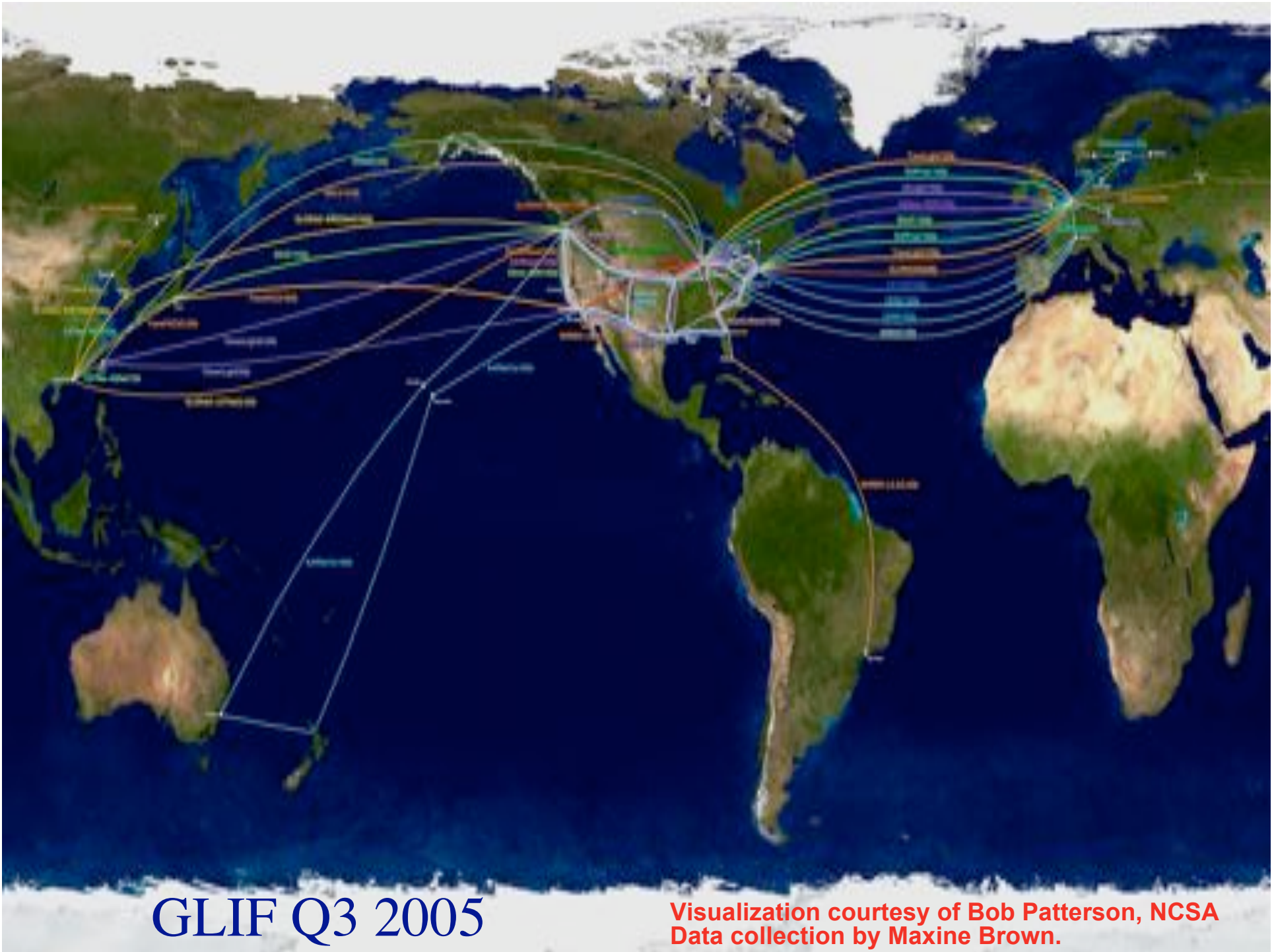


Scale of Infrastructure

- Global scale (200 ms)
 - Trans oceanic lambda's
 - Few Lambda's usually SONET framed
- Regional scale (20 ms)
 - Continent or big country wide network
 - Either dark fiber or many Lambda's on someone's infrastructure
- Metro scale (2 ms)
 - Dark fiber network
 - Photonic devices
- Degrees of Freedom
 - $L > R > M$

$$\# \lambda \approx \frac{200 * e^{(t-2002)}}{rtt}$$



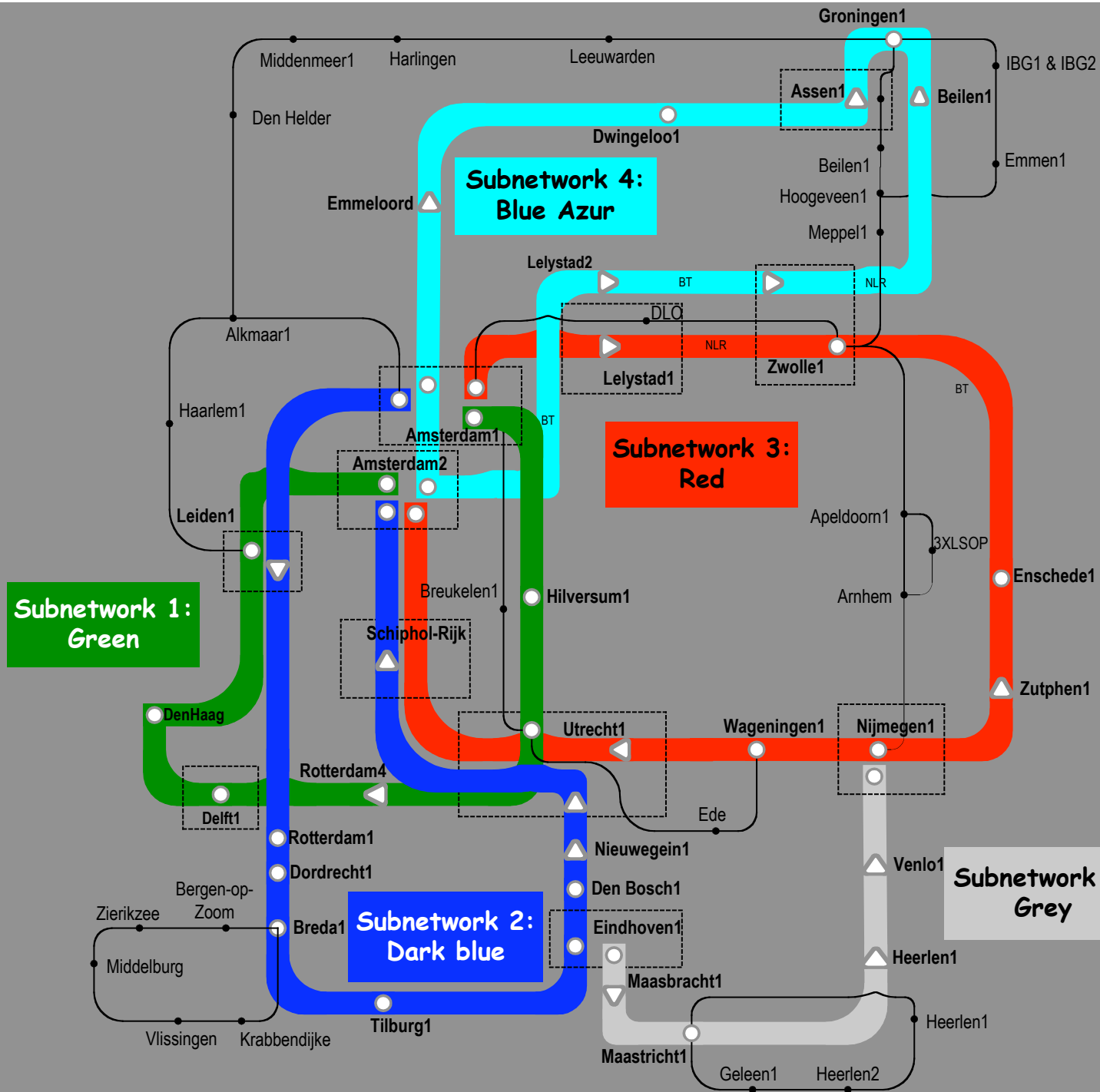


GLIF Q3 2005

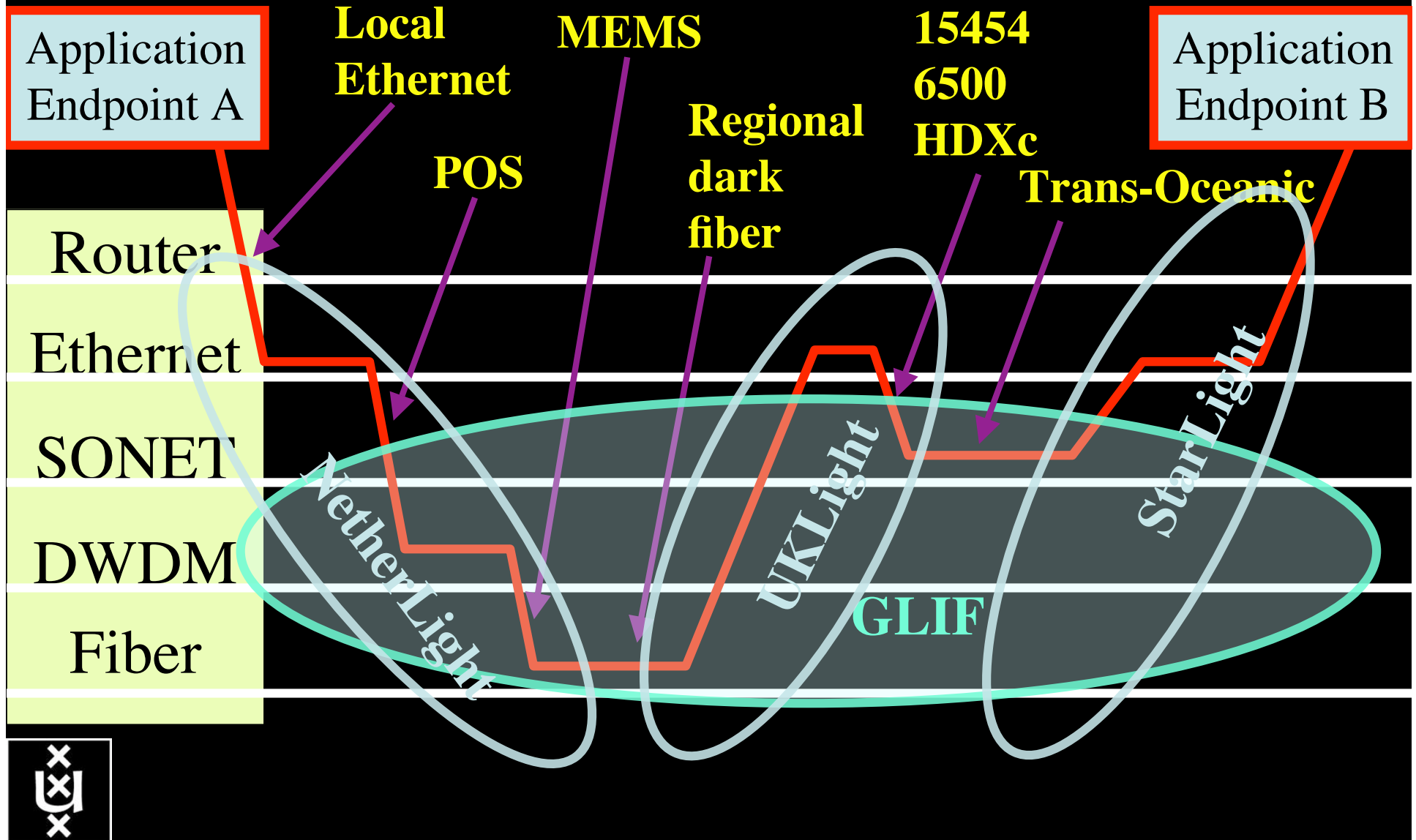
Visualization courtesy of Bob Patterson, NCSA
Data collection by Maxine Brown.

Common Photonic Layer (CPL) in SURFnet6

~5000 km



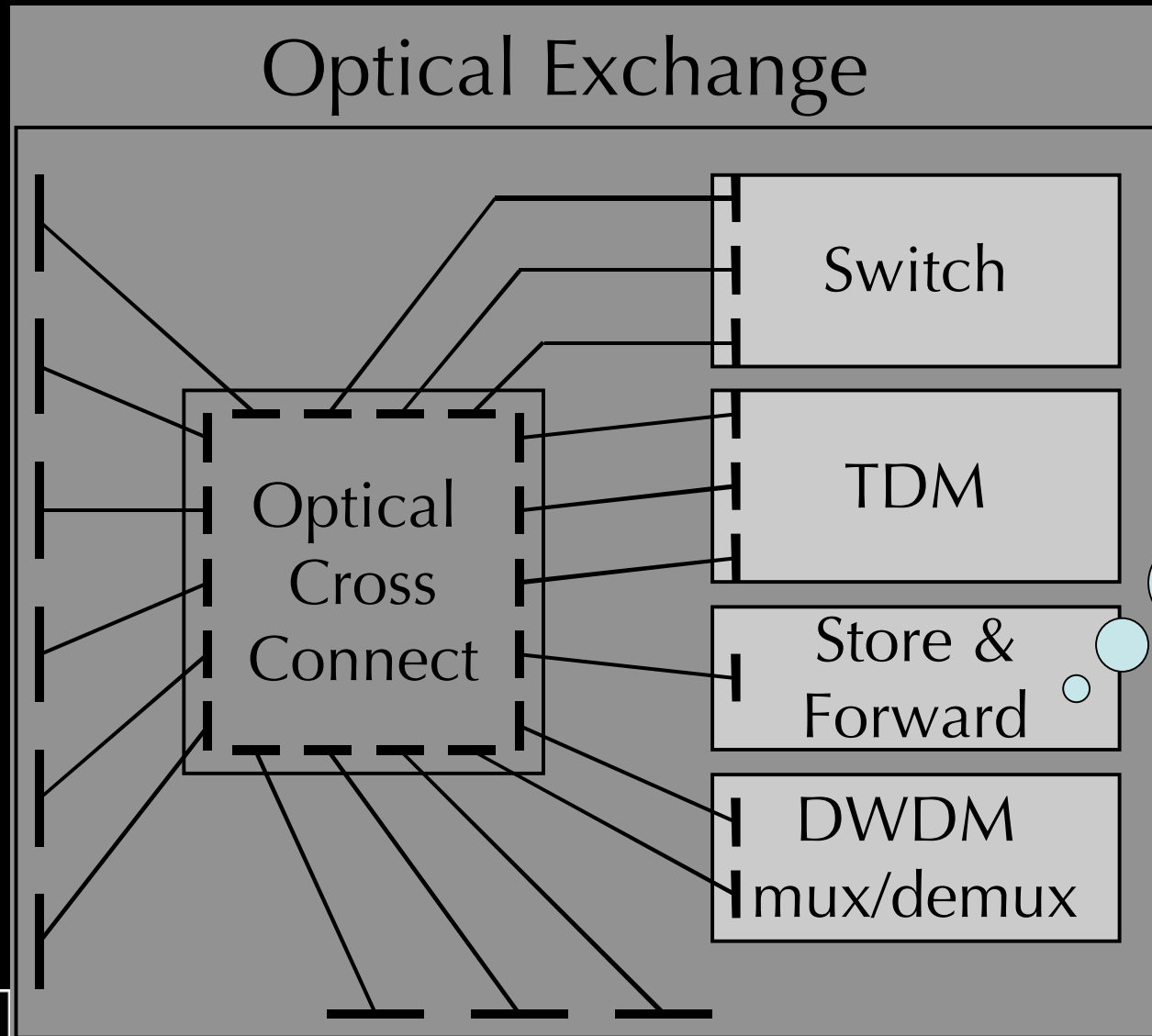
How low can you go?



Services

<div style="text-align: center;">SCALE</div> <div style="text-align: right;">CLASS</div>	<div style="text-align: center;">2 Metro</div>	<div style="text-align: center;">20 Regional</div>	<div style="text-align: center;">200 World</div>
A	<div style="text-align: center;">Switching/ Routing</div>	<div style="text-align: center;">Routers</div>	<div style="text-align: center;">ROUTER\$</div>
B	<div style="text-align: center;">Switches VPN's E-WANPHY</div>	<div style="text-align: center;">Routing Switches (G)MPLS E-WANPHY</div>	<div style="text-align: center;">ROUTER\$</div>
C	<div style="text-align: center;">dark fiber DWDM WSS Photonic switch</div>	<div style="text-align: center;">DWDM, TDM / SONET Lambda switching</div>	<div style="text-align: center;">VLAN's TDM SONET Ethernet</div>

Optical Exchange as Black Box



TeraByte
Email
Service



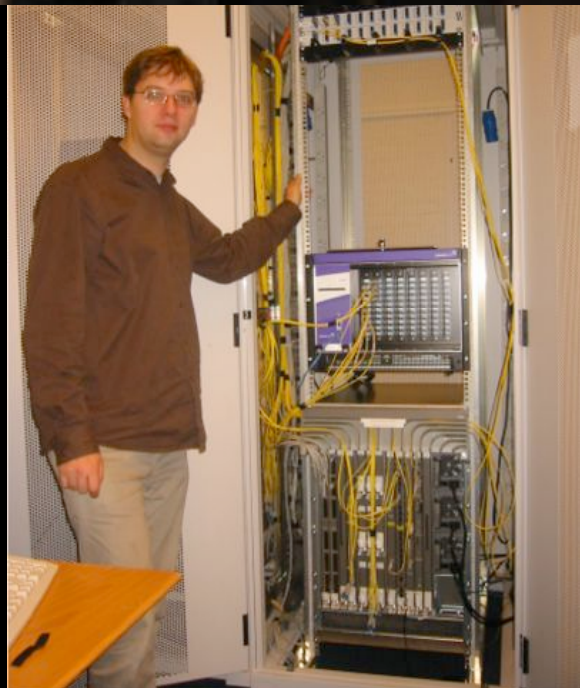
Ref: gridnets paper by Freek Dijkstra, Cees de Laat

R&D

- Resource virtualization
- Path description/selection
- Web services
- Authorization
- Photonic switching



LIGHTHOUSE



sara
Computing & Networking Services



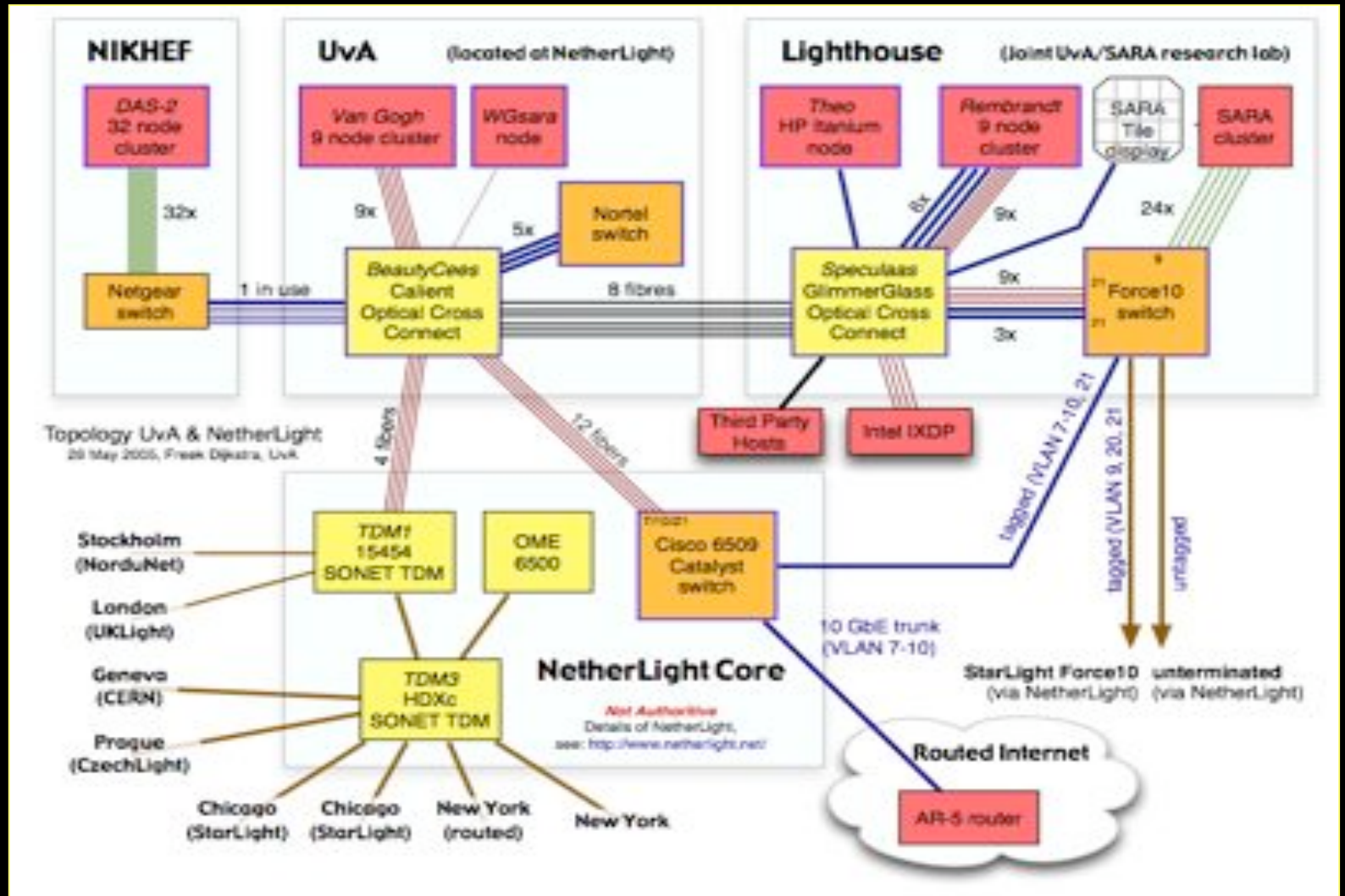
DEMO US117b – GLVF TOPS

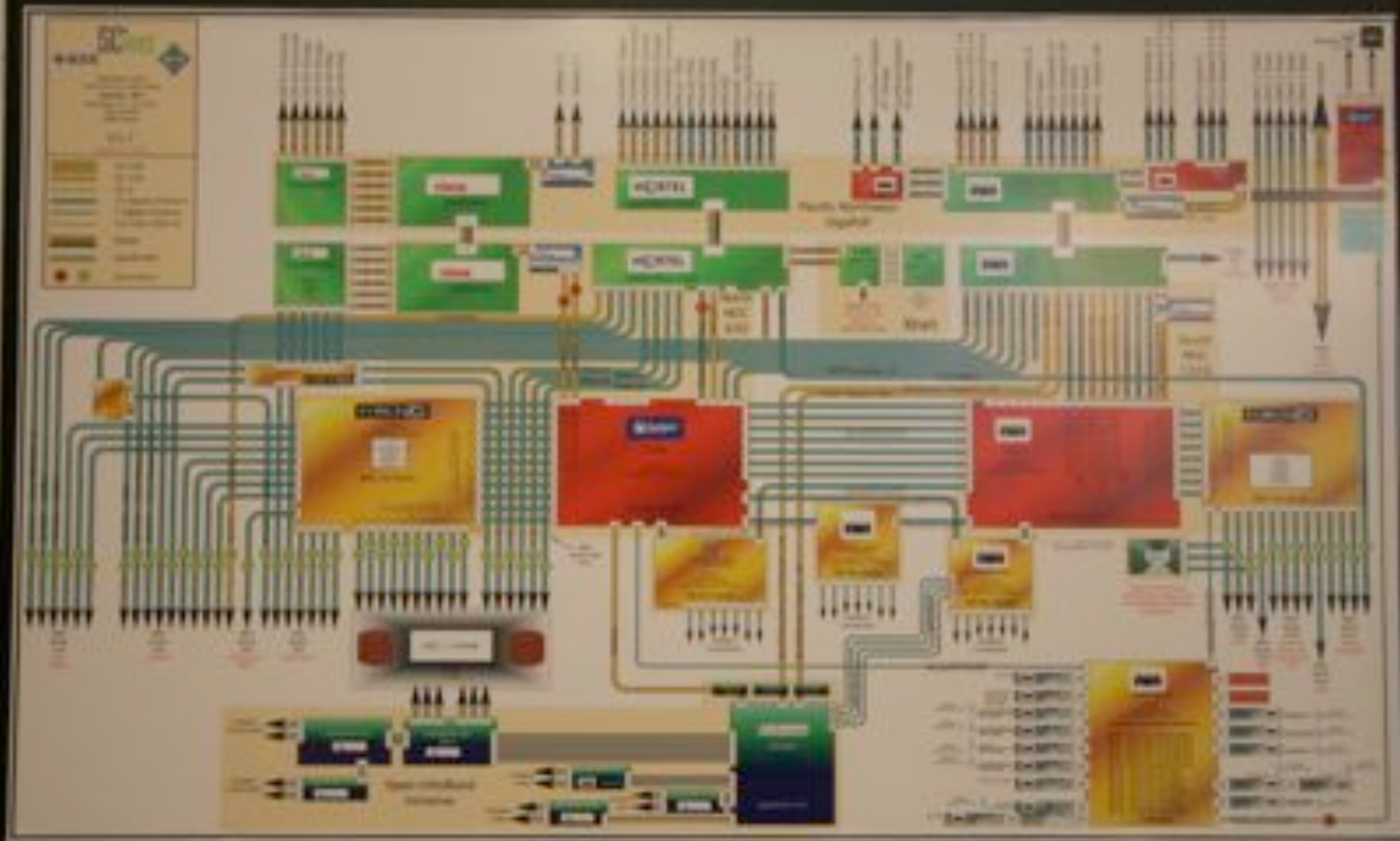
- 2D and 3D datasets located at SARA
- Render cluster (29 nodes) at SARA
- 20 Gbps connectivity from cluster via UvA-F10 to NetherLight
- 2 * 10 Gbps lambda between Amsterdam and San Diego (SURFnet, CaveWave, WANPHY Amsterdam-SD)
- UCSD LambdaVision display at iGrid: 100 Megapixel Tiled Display
- 1 Frame = 100 Mpixel*24 bits = 2.4 Gbits



SARA/UvA 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, webservice, GSP





sc2005 SCinet



Key issue #1:
how to describe such networks?

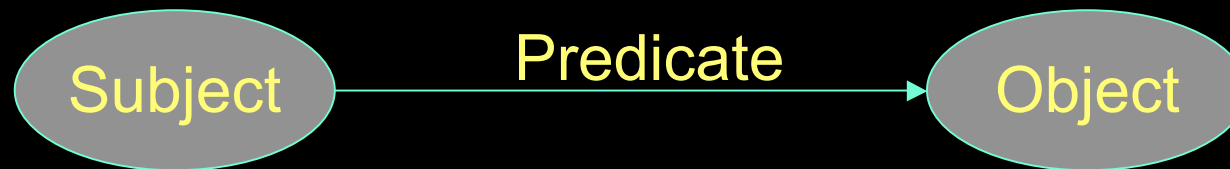


Semantic web

“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>
```



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



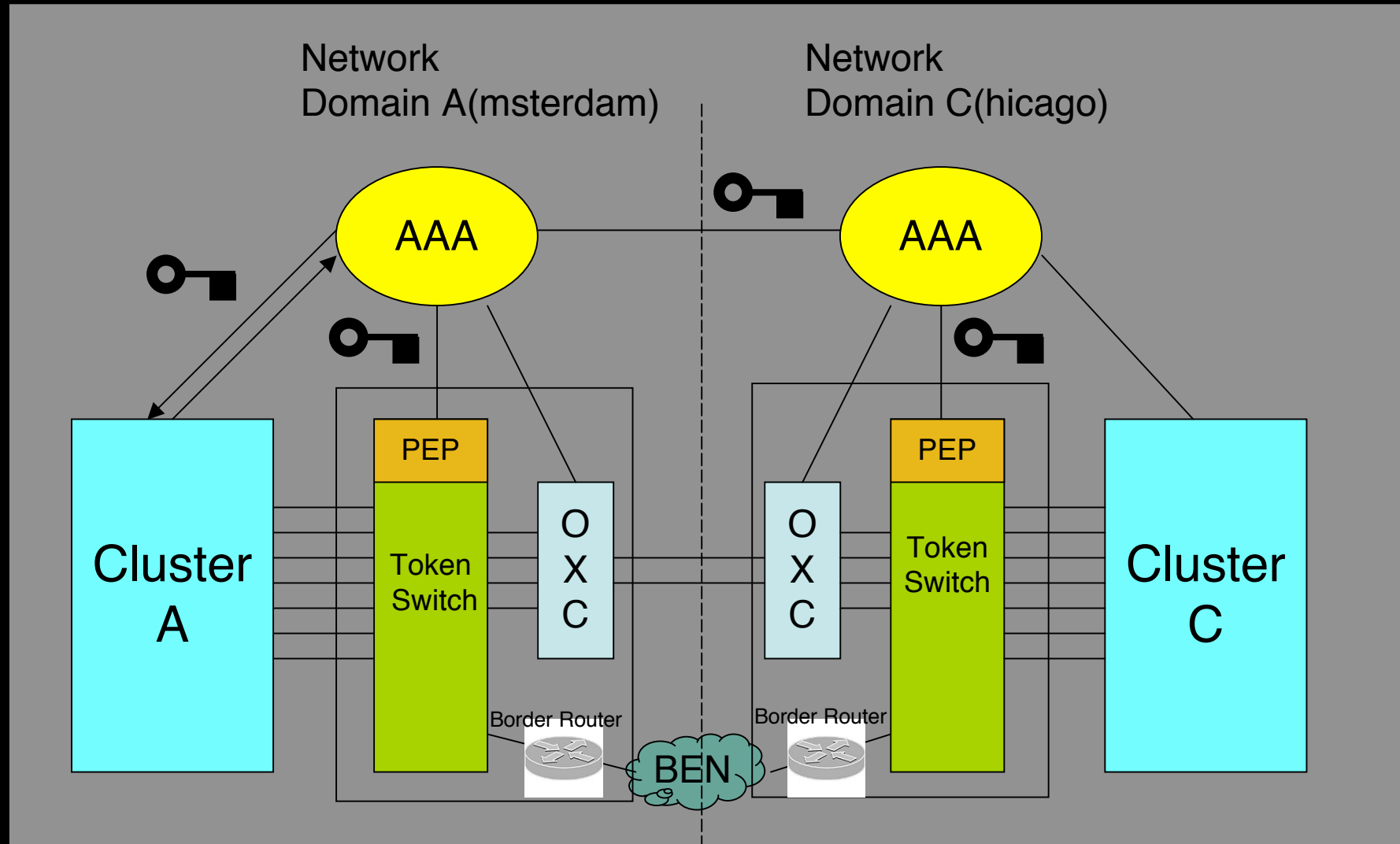
Web services

Web services interfaces provide the API for the reservation framework:

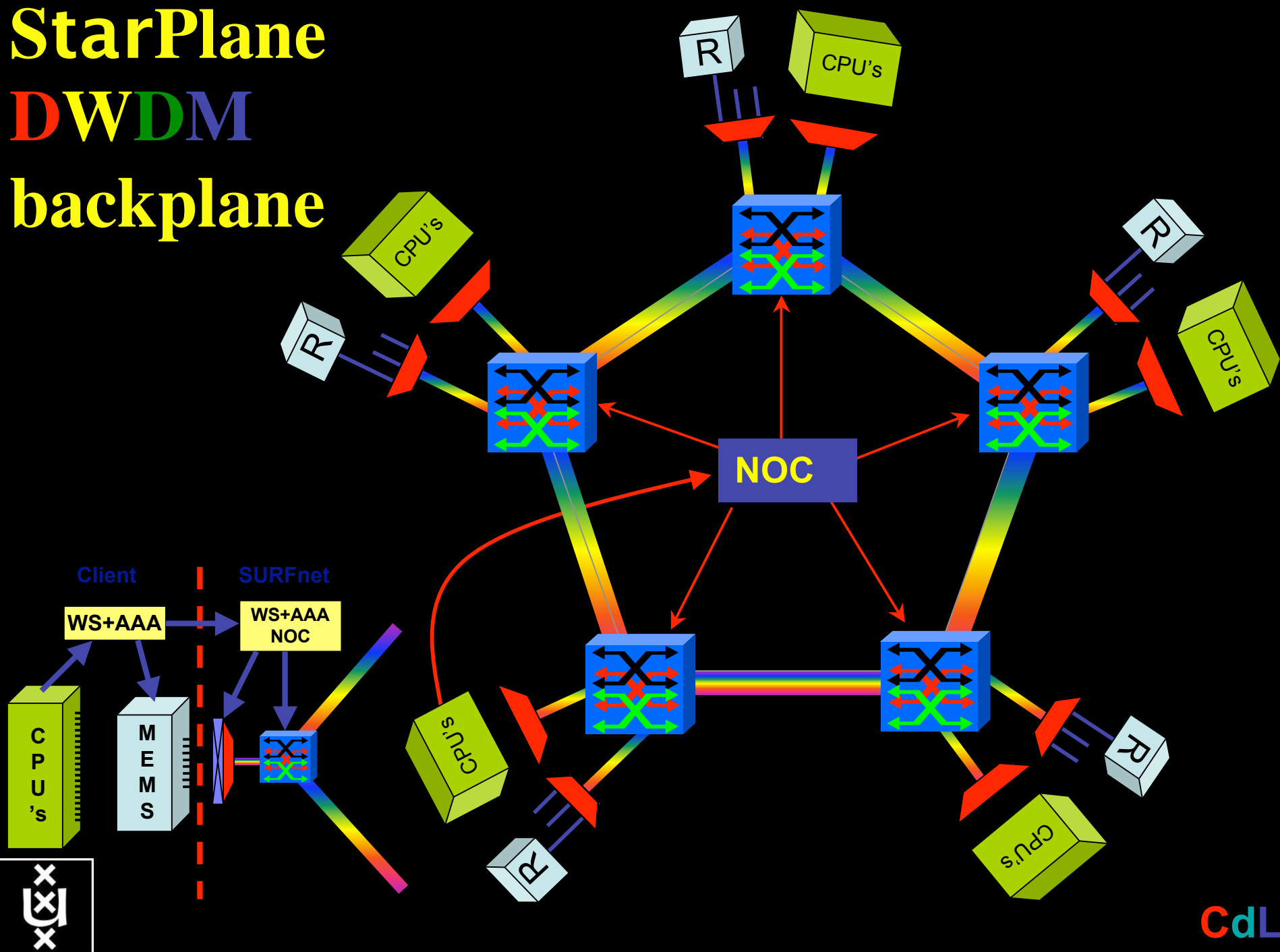
```
<wsdl:operation name="getResourceInformation">  
<wsdl:operation name="getResourceList">  
<wsdl:operation name="getTypeList">  
<wsdl:operation name="getResourcesOfType">  
<wsdl:operation name="reservePath">  
<wsdl:operation name="getPossiblePaths">  
<wsdl:operation name="isPathAvailable">  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



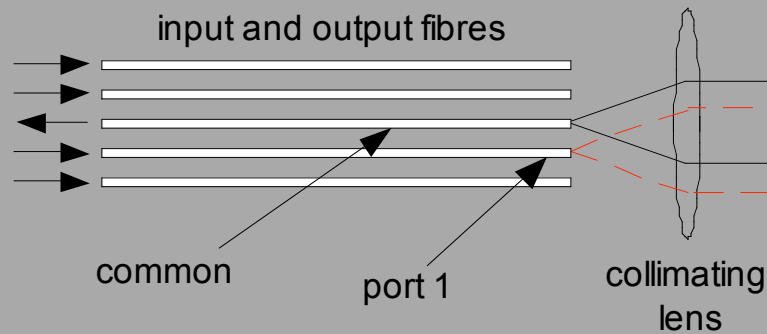
Token Based Networking



StarPlane DWDM backplane



Module Operation

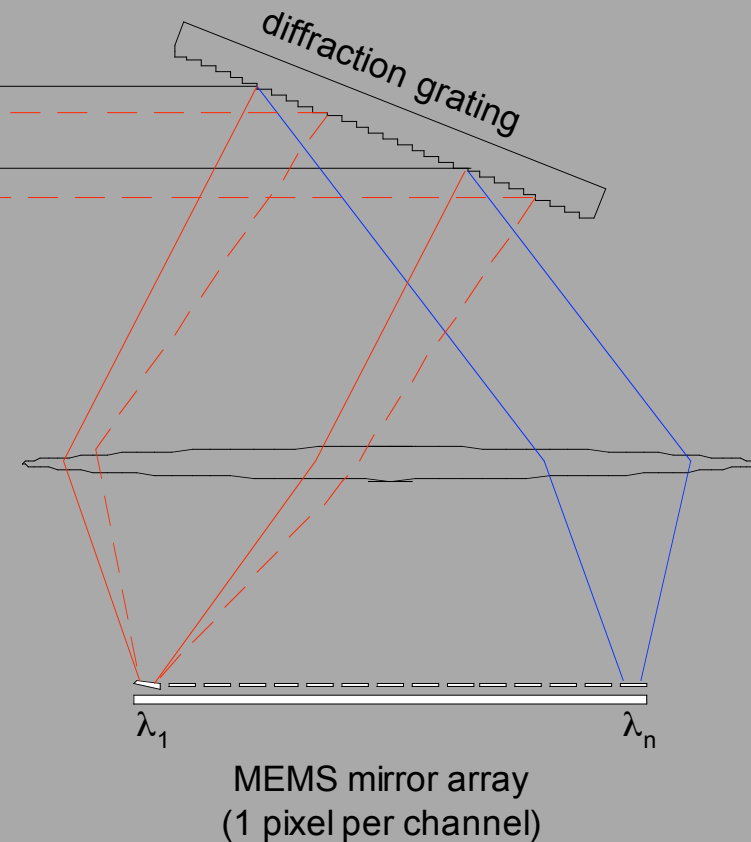


> this schematic shows

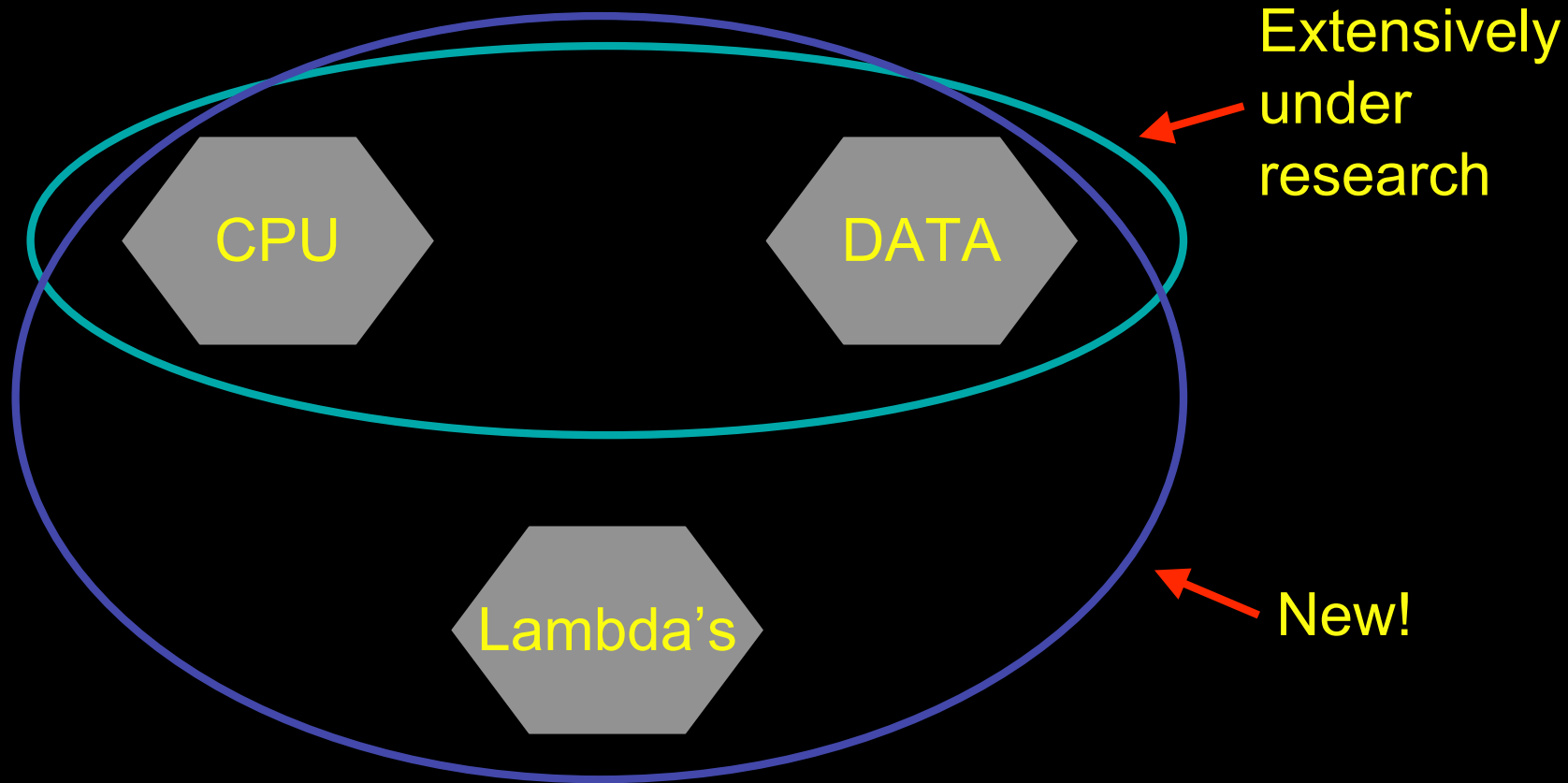
- several input fibres and one output fibre
- light is focused and diffracted such that each channel lands on a different MEMS mirror
- the MEMS mirror is electronically controlled to tilt the reflecting surface
- the angle of tilt directs the light to the correct port

> 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



GRID-Colocation problem space



Posters @ sc2005

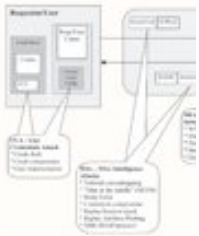
Web Services and Grid Security Vulnerabilities and Threats Analysis and Model

Vulnerability-Incident life-cycle

Vulnerability == Exploit == Threat == Incident == Mitigation

Vulnerability is a flaw or weakness in a system that can be exploited to cause damage. An exploit is a means to take advantage of a specific vulnerability. A threat is a potential for violation of security, which will occur unless it is prevented by security controls. An incident is an event or action that causes security to be at risk. Mitigation is an action or process to reduce the severity of a system.

Attacks grouping in interacting



Service/Resource Security zones



Related EGEE/CG activities and text

Web Services Security Vulnerabilities and Threats Analysis and Model (WSSVAT) is a project of the EGEE/CG community. It is a joint effort of the EGEE/CG community and the NetherLight project. The project is funded by the Dutch government and the European Union.

UNIVERSITEIT VAN AMSTERDAM

StarPlane

application-specific management of optical network

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 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



Members of the research team:

Prof. dr. 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

www.starplane.org

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.

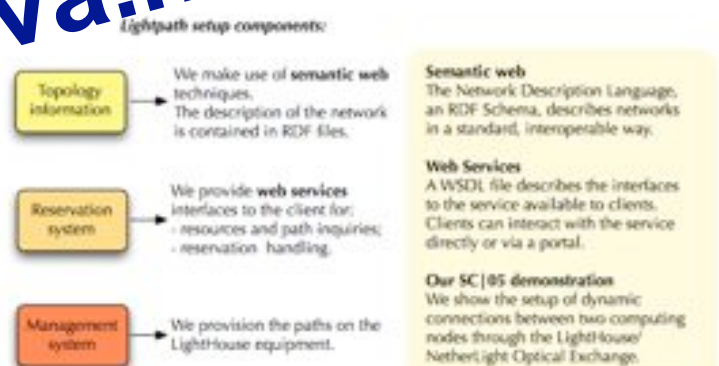
Tokens will allow:

- Separation of (slow) authorization process and real time usage.



UNIVERSITEIT VAN AMSTERDAM

Resource Brokering: Your Ticket Into NetherLight



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 SC05 demonstration
We show the setup of dynamic connections between two computing nodes through the LightHouse/NetherLight Optical Exchange.

UNIVERSITEIT VAN AMSTERDAM

See www.science.uva.nl/~delaat

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
- SURFnet / GigaPort, Kees Neggers, Erik-Jan Bos, et al!
- 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 !!!!

