

Dutch LambdaGrid state @ sc2005 (more Lambda than Grid :-)

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A. Lightweight users, browsing, mailing, home use

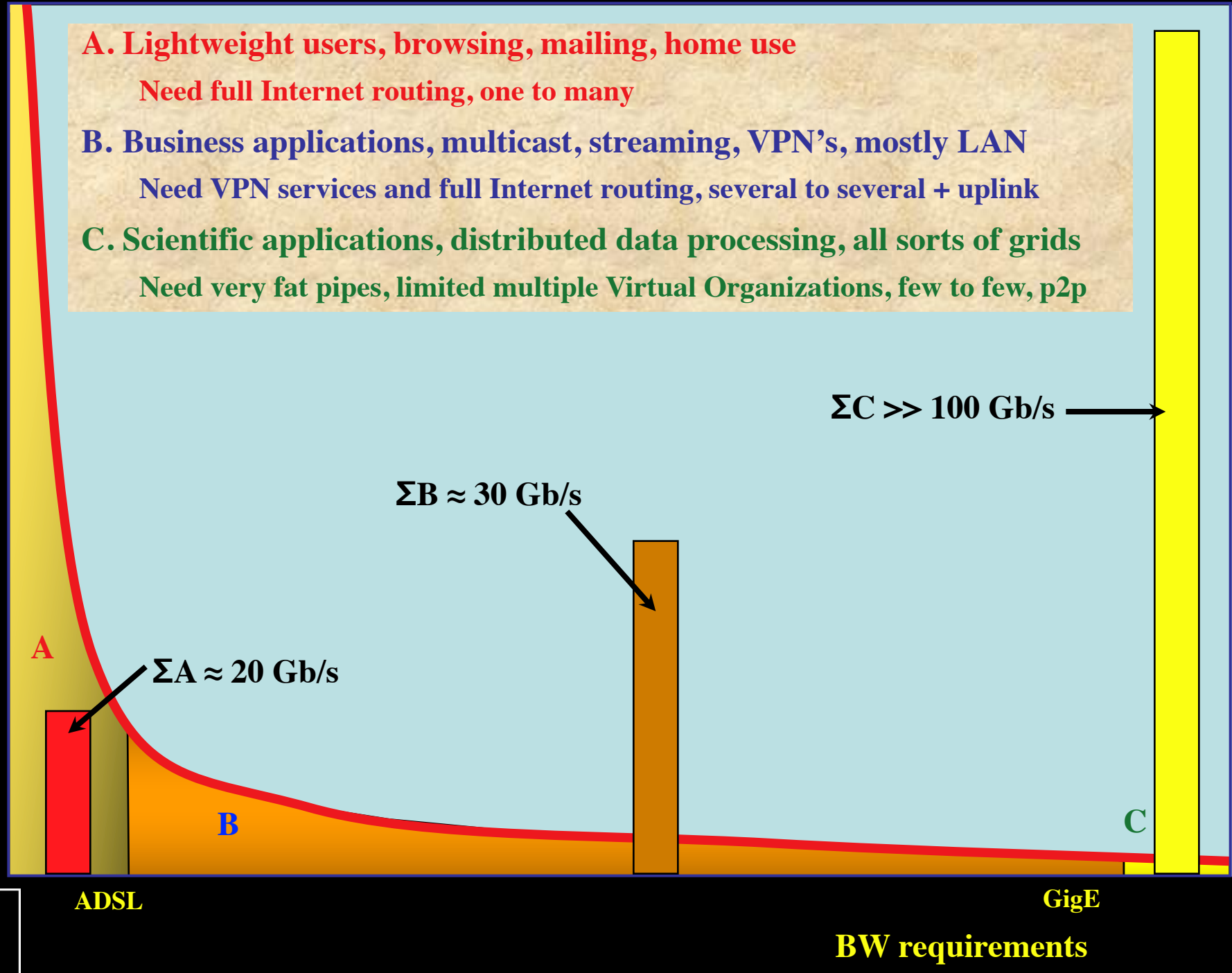
Need full Internet routing, one to many

B. Business applications, multicast, streaming, VPN's, mostly LAN

Need VPN services and full Internet routing, several to several + uplink

C. Scientific applications, distributed data processing, all sorts of grids

Need very fat pipes, limited multiple Virtual Organizations, few to few, p2p



BW requirements

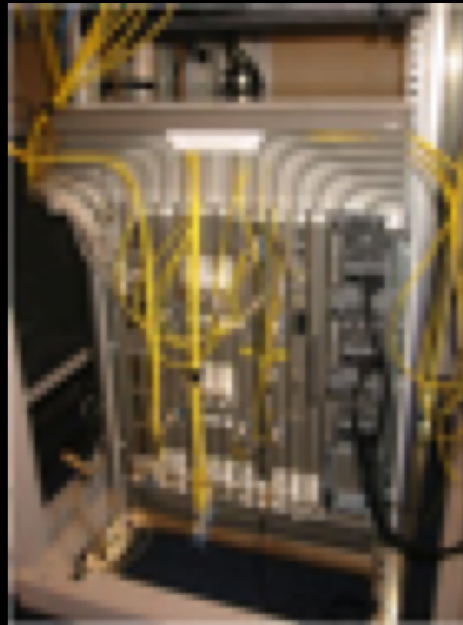
Towards Hybrid Networking!

- Costs of optical equipment 10% of switching 10 % of full routing equipment for same throughput
 - 10G routerblade -> 75-300 k\$, 10G switch port -> 5-10 k\$, MEMS port -> 0.5-1.5 k\$
 - 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 5-10 k\$/port

L3 \approx 75+ k\$/port



UVA's

64*64

Optical Switch

@ LightHouse

**Costs 1/100th of
a similar
throughput router**

or

1/10th of

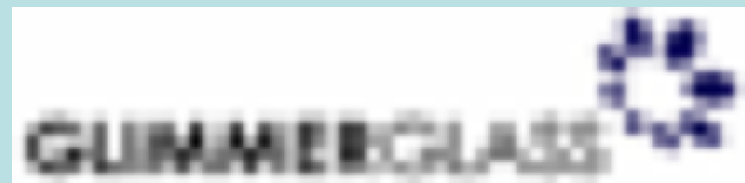
a similar

throughput

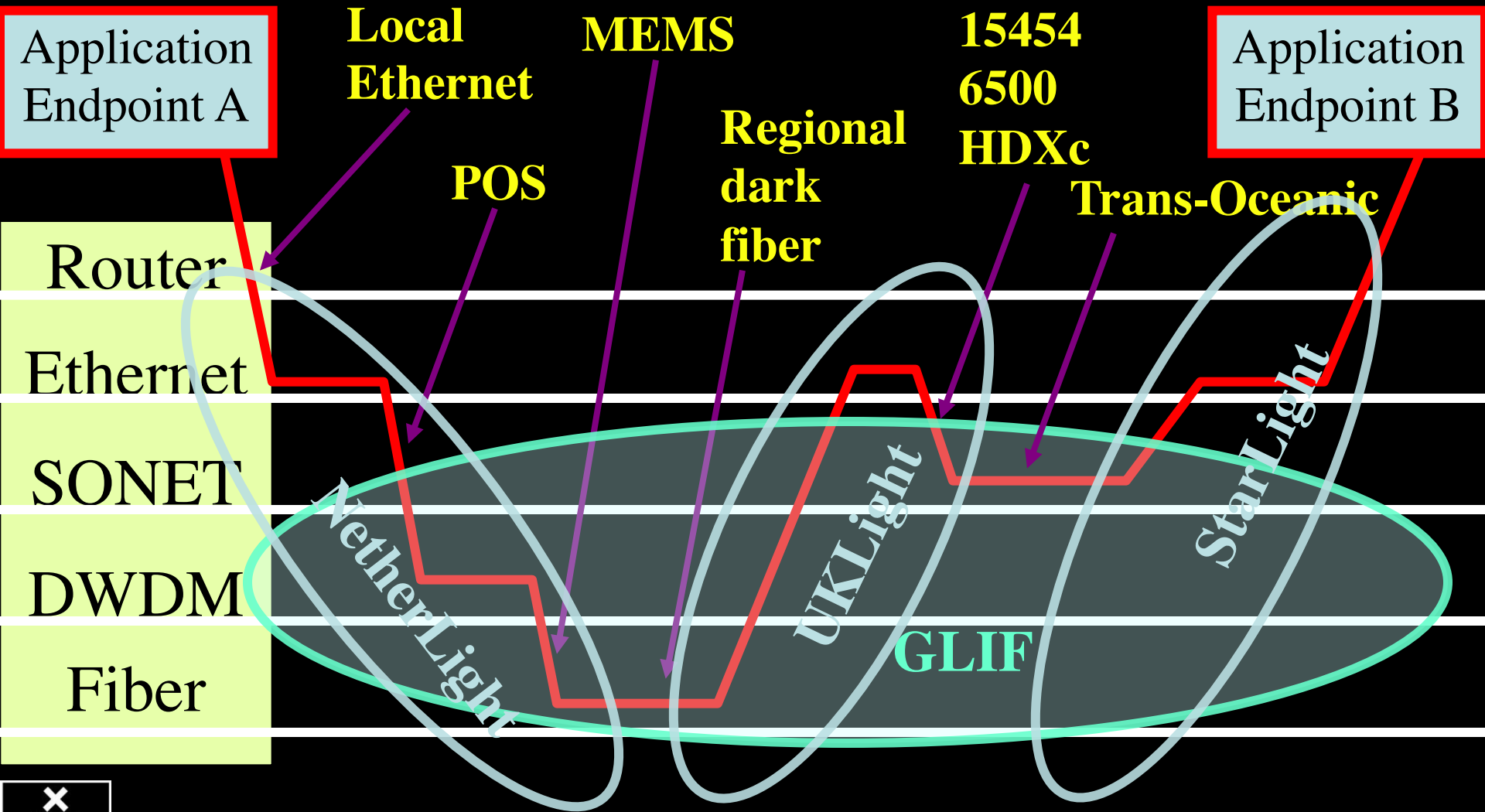
Ethernet switch

but has only

specific services!



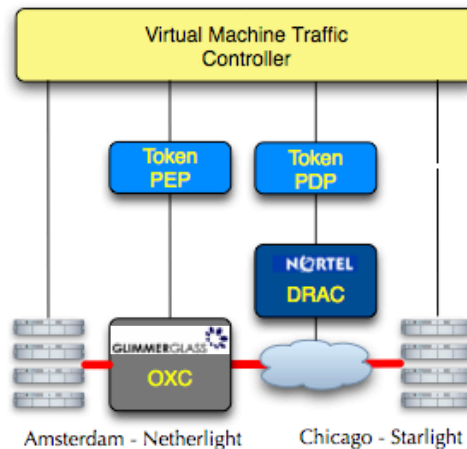
How low can you go?



Token Based Networking

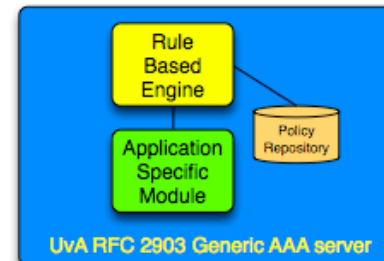
Access Control, Resource Management and Path Selection in Optical Networks using Tokens

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

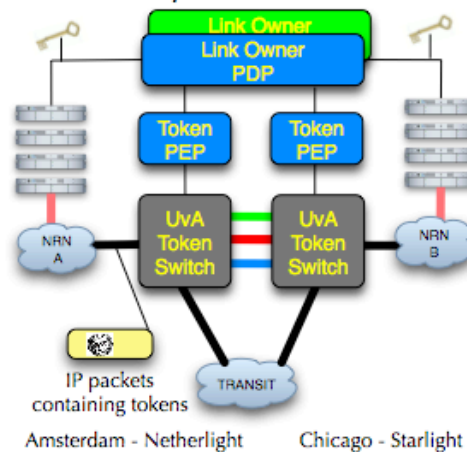


Tokens will allow:

- 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



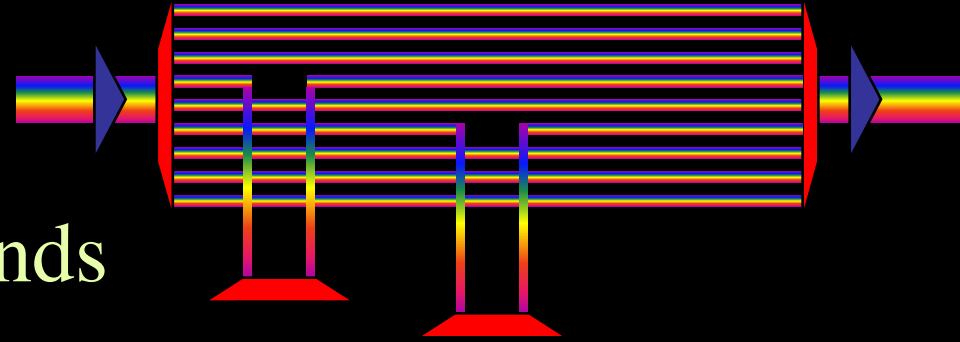
Token marked IP packets will allow:

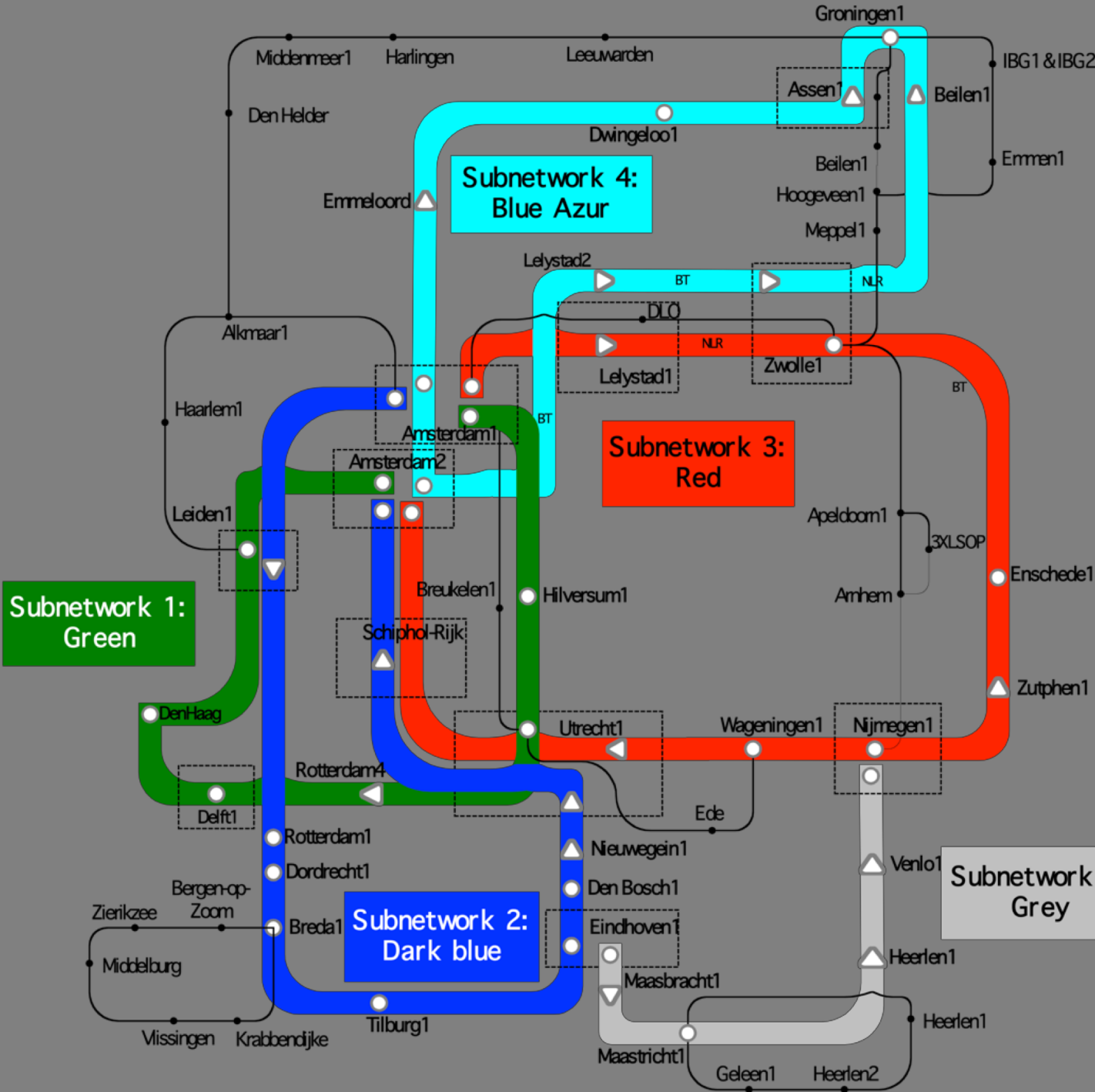
- Economic Link Owners to assign usage rights without routing changes.
- Recognition at Inter-Connection Points (Optical Exchanges). When authentic and valid, token marked traffic will use the Link Owners path.
- Implementations that support different business models
- Hardware (NPU based) recognition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



SURFnet 6 principles

- Based on dark fiber
- 4 DWDM rings of 9 bands
 - each 4, later 8, colors
 - Each capable of 10, later 40 Gb/s
- Universities have POP's on ring, each 1 band
- Connect with 1 or 10 Gb/s Ethernet
- Routing in Amsterdam in 2 core POP's!
- International connectivity in Amsterdam
- Lambda service between ring POP's and to NetherLight



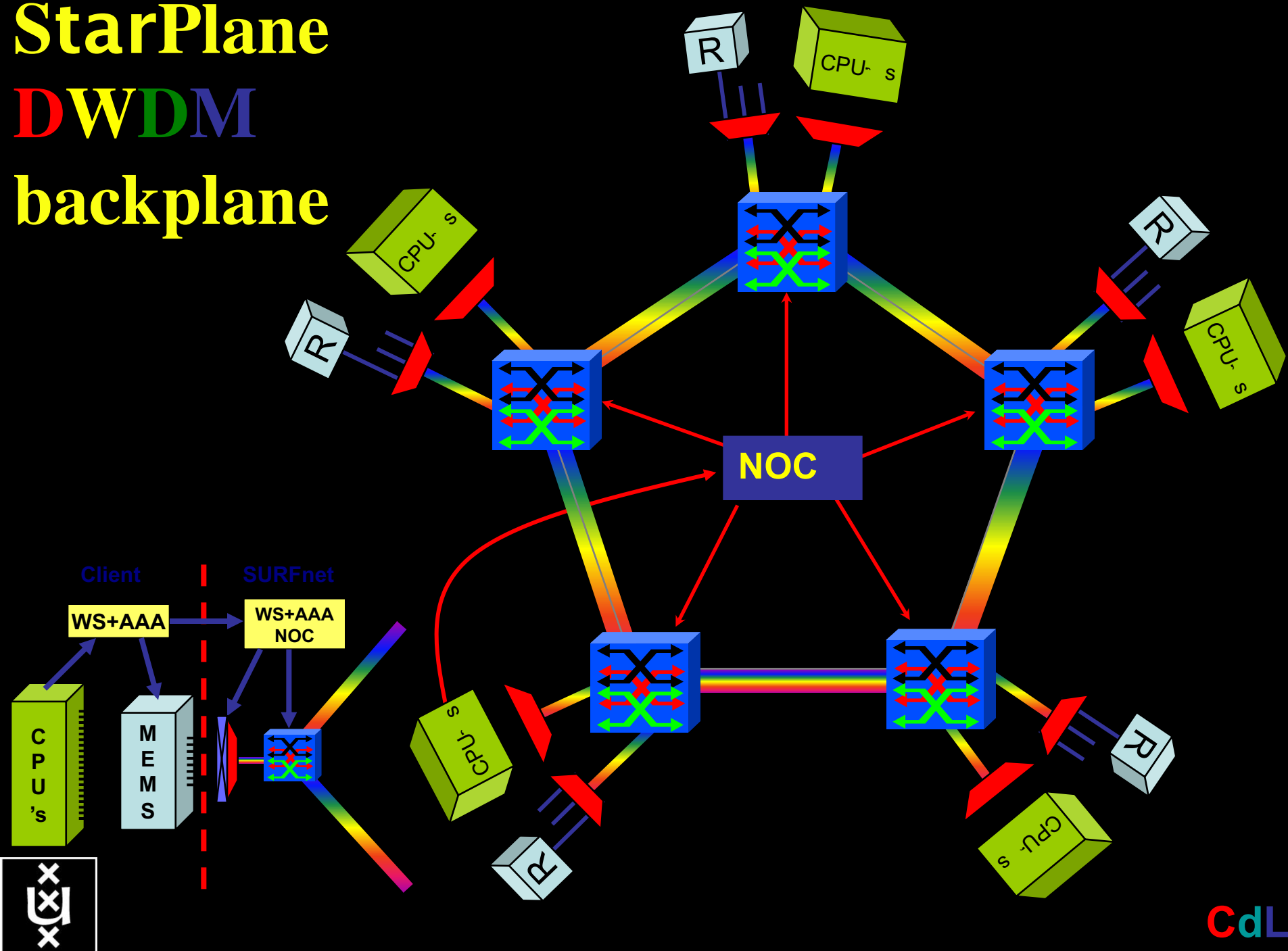


Common Photonic Layer (CPL) in SURFnet6

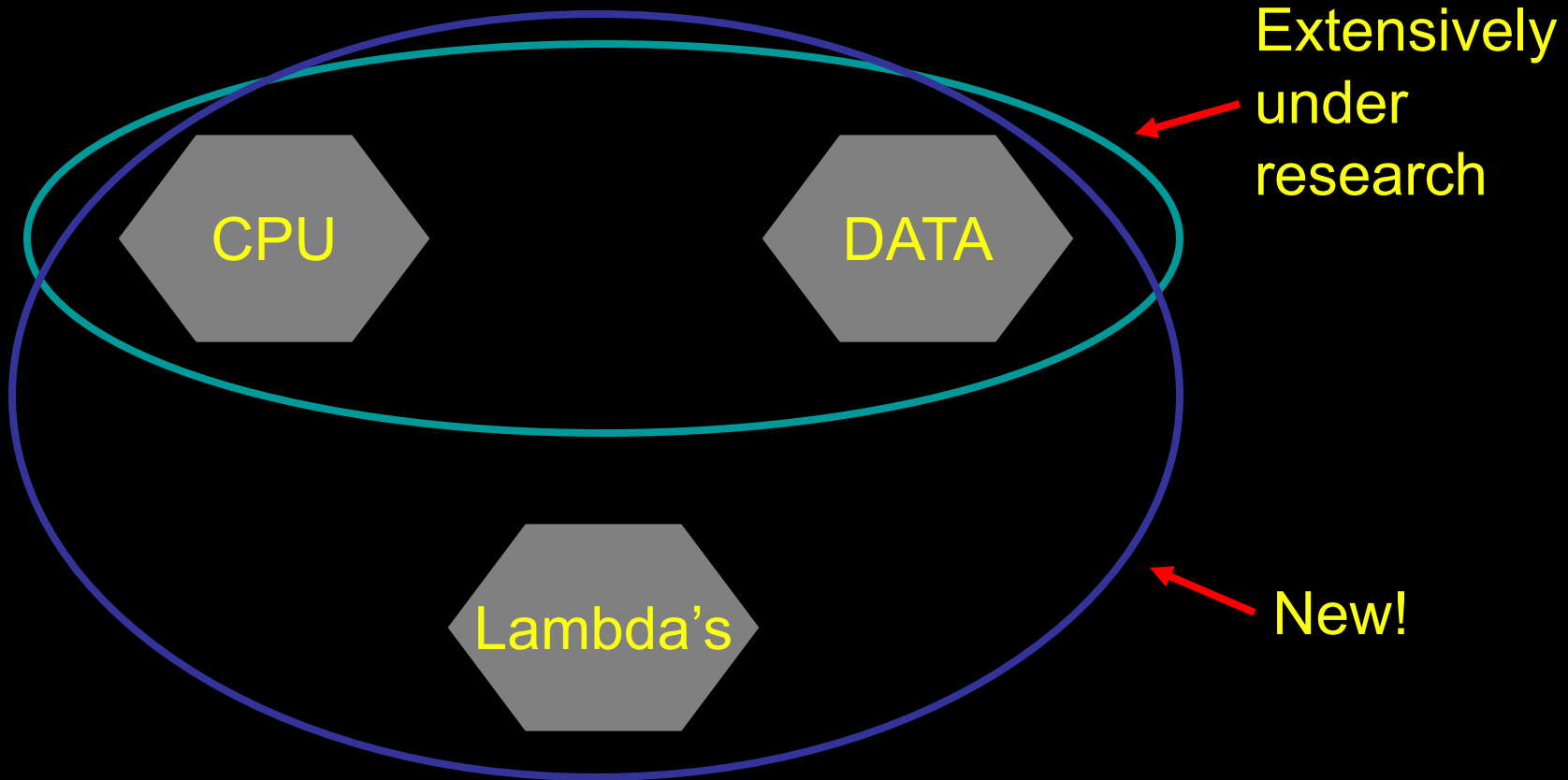
StarPlane

DWDM

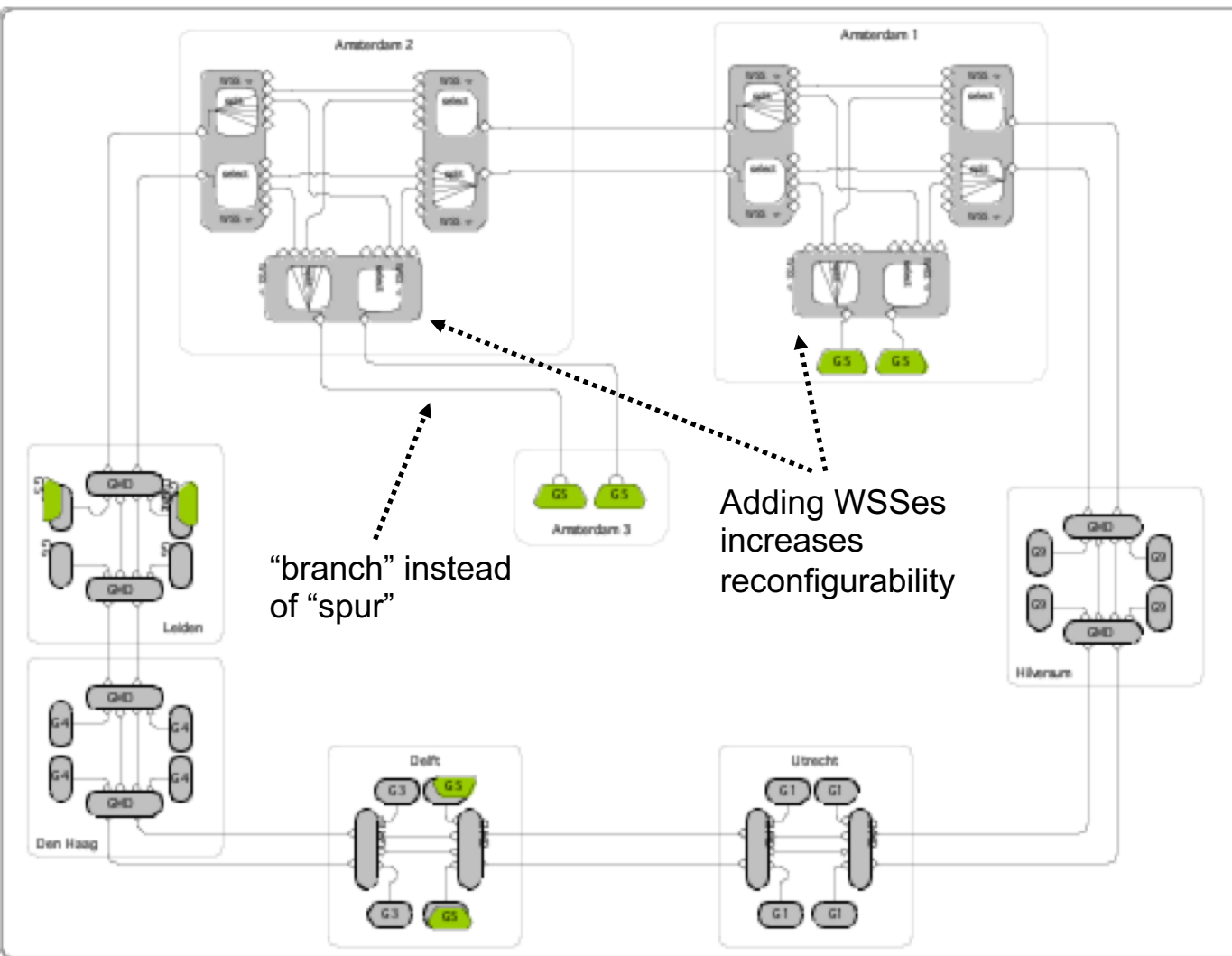
backplane



GRID-Colocation problem space

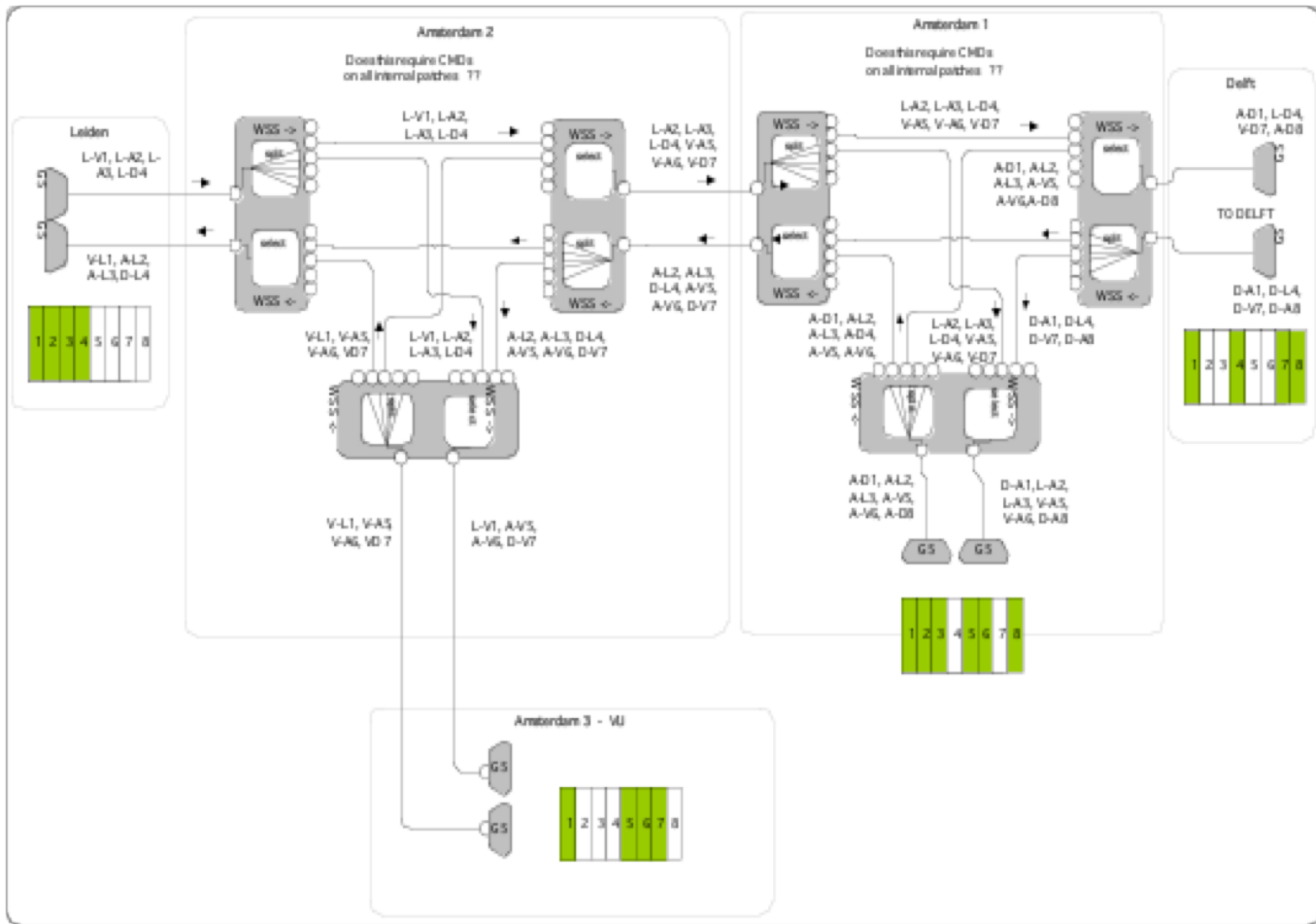


Day 2 set-up: branching out...



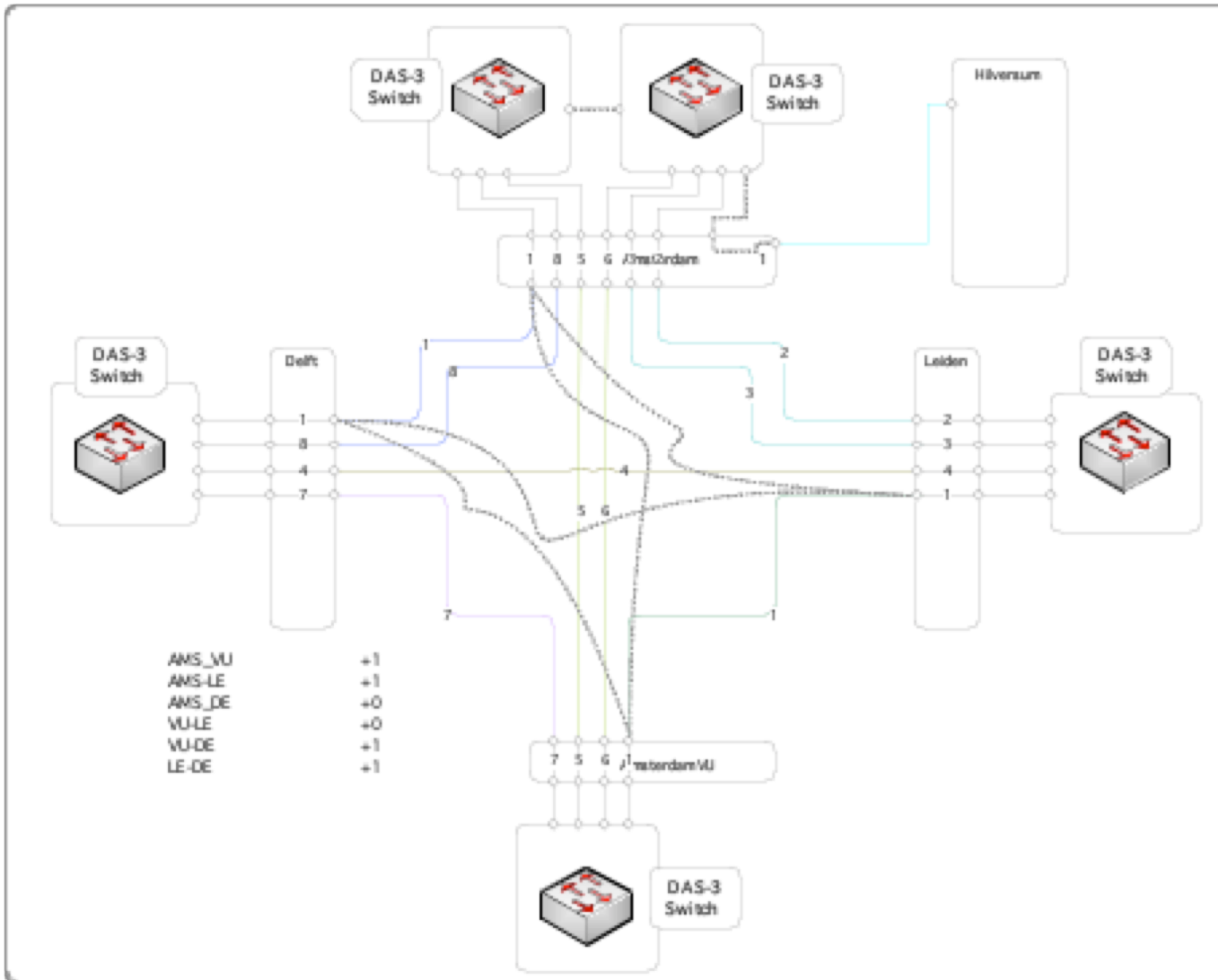
- Add WSSes at Amsterdam sites
- Is NOT supported in March 2006
- Full reconfigurability achieved
- Only limits are
 - Presence of card
 - Wavelength blocking
- No changes to basic 'static' mesh

Day 2 detail



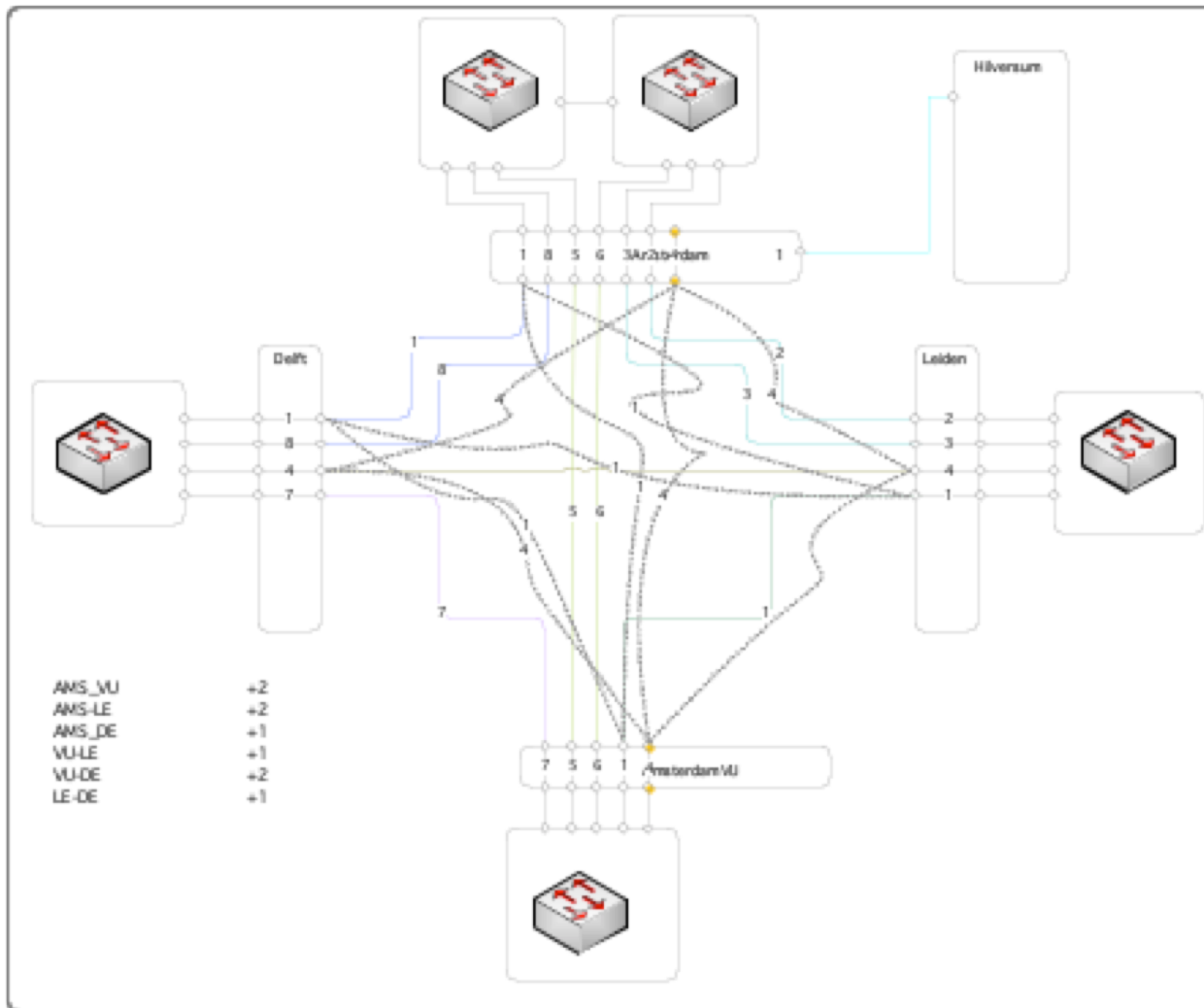
- Wavelength assignment remains – no external changes
- Adding WSSes allows redirecting wavelengths from/to VU and AMS

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)

StarPlane

application-specific management of optical networks

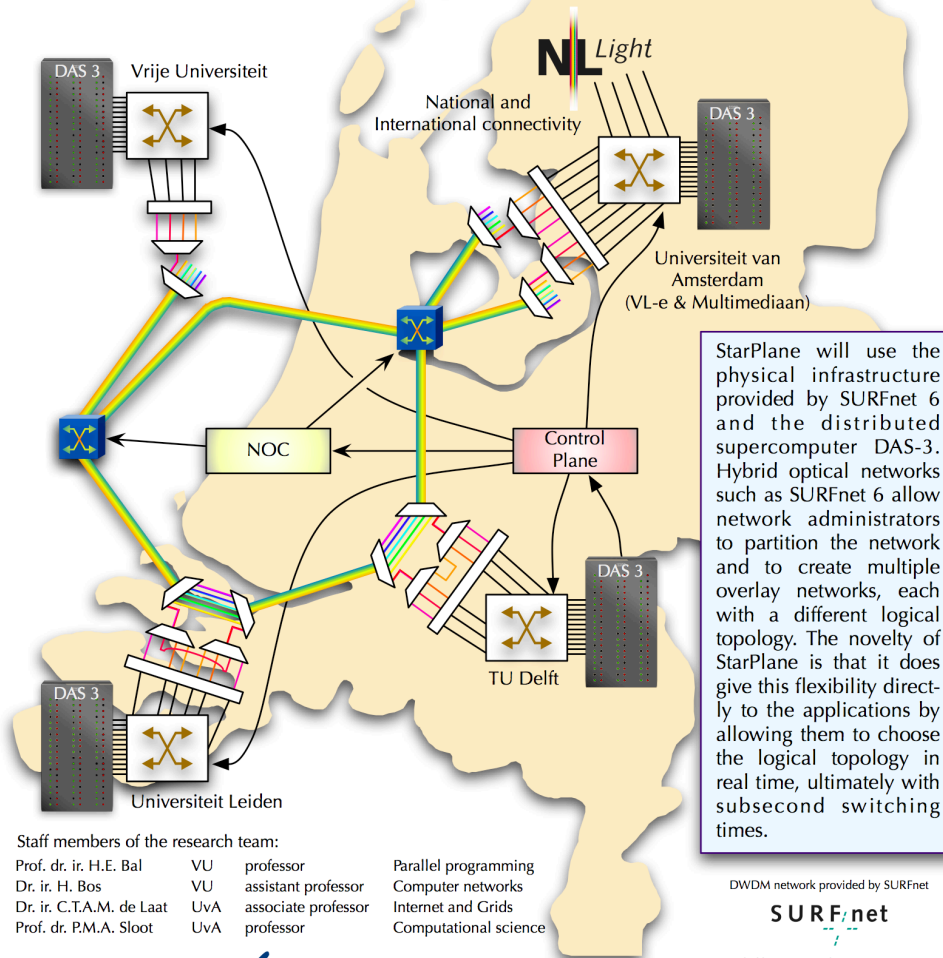
The StarPlane project addresses two concerns in optical networks:

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

StarPlane will use the physical infrastructure provided by SURFnet 6 and the distributed supercomputer DAS-3. Hybrid optical networks such as SURFnet 6 allow network administrators to partition the network and to create multiple overlay networks, each with a different logical topology. The novelty of StarPlane is that it does give this flexibility directly to the applications by allowing them to choose the logical topology in real time, ultimately with subsecond switching times.

DWDM network provided by SURFnet

SURFnet

Funded by NWO in the GLANCE program

NWO
Netherlands Organisation for Scientific Research

www.starplane.org

GLIF Mission Statement

Global Lambda Integrated Facility

- **GLIF is a world-scale Lambda-based Laboratory for application and middleware development on emerging LambdaGrids, where applications rely on dynamically configured networks based on optical wavelengths**
- **GLIF is an environment (networking infrastructure, network engineering, system integration, middleware, applications) to accomplish real work**



GLIF Structure

GLIF Governance and policy

Aka de tulpenbollen-inpakkers

Our small-scale Lambda Workshop is now turning into a sub-activity. TransLight and similar projects contribute to the infrastructure part of GLIF. A good and well understood governance structure is key to the manageability and success of GLIF. Our prime goal is to decide upon and agree to the GLIF governance and infrastructure usage policy.

GLIF Lambda infrastructure and Lambda exchange implementations

A major function for previous Lambda Workshops was to get the network engineers together to discuss and agree on the topology, connectivity and interfaces of the Lambda facility. Technology developments need to be folded into the architecture and the expected outcome of this meeting is an agreed view on the interfaces and services of Lambda exchanges and a connectivity map of Lambdas for the next year, with a focus on iGrid 2005 and the emerging applications.

Persistent Applications

Key to the success of the GLIF effort is to connect the major applications to the Facility. We, therefore, need a list of prime applications to focus on and a roadmap to work with those applications to get them up to speed. The demonstrations at SC2004 and iGrid 2005 can be determined in this meeting.

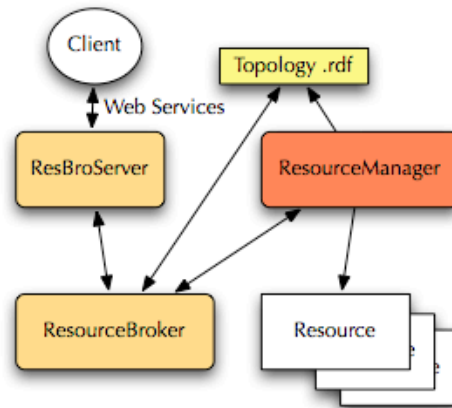
Control Plane and Grid Integration

The GLIF can only function if we agree on the interfaces and protocols that talk to each other in the control plane on the contributed Lambda resources. The main players in this field are already meeting, almost on a bi-monthly schedule. Although not essential, this GLIF meeting could also host a breakout session on control plane middleware.



Resource Brokering: Your Ticket Into NetherLight

Application architecture:



Lambda networking allows the creation of application specific light paths.

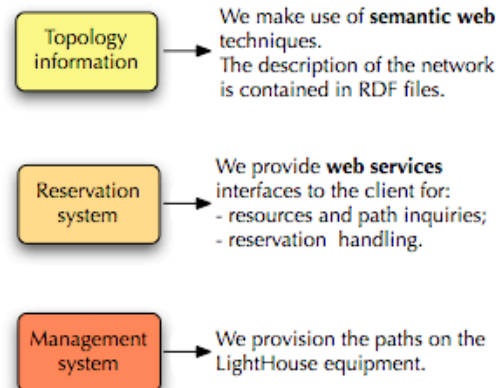
Lambda networking facilities empower users to request services and provision **end-to-end light paths** if and when they need it.

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.

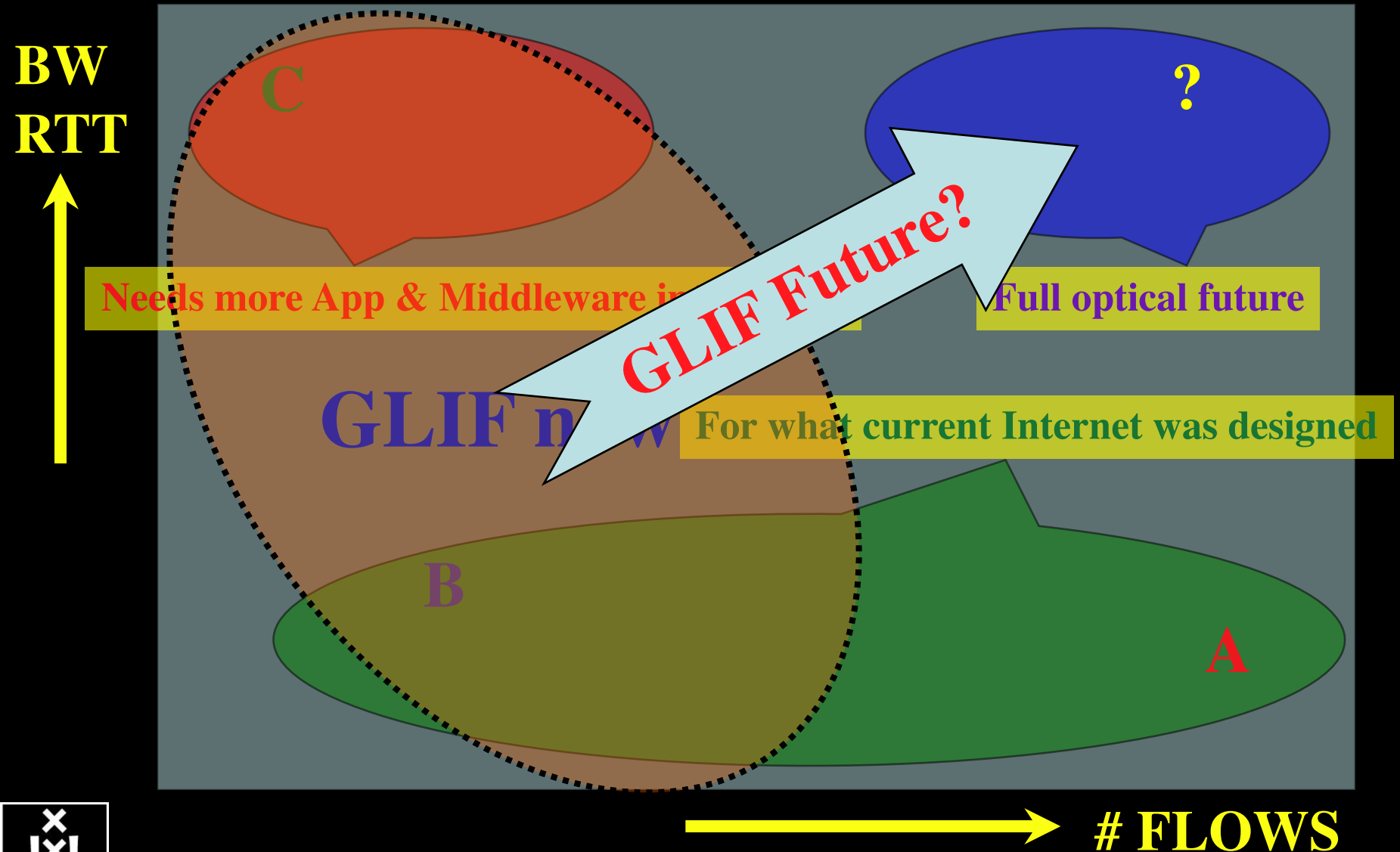
Web Services

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|05 demonstration

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

Transport of flows



- Very large 2D and 3D datasets located at SARA in Amsterdam
- Render cluster (29 nodes) at SARA
- 20 Gbps connectivity between cluster and NetherLight, via University of Amsterdam switch
- 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
- Uncompressed and compressed mode
- Streaming pixels from Amsterdam to San Diego



- Third demoslot, 2 times 10 Gbps available
 - Sustained bandwidth used between rendering and display 18 Gbps
 - Peak bandwidth of 19.5 Gbps!
- New world record of transatlantic bandwidth usage by one single application visualizing scientific content

Ask Paul Wielinga

The “Dead Cat” demo



Produced by:
Michael Scarpa
Robert Belleman
Peter Sloot
Cees de Laat

Many thanks to:
AMC
SARA
GigaPort
UvA/AIR
Silicon Graphics
Zoölogisch Museum



I am not that bad!



Photo 1977



Questions ?

More info:

<http://www.glif.is/>

<http://www.science.uva.nl/~delaat>

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