

# Network & Grid Research @ SciencePark Amsterdam

**Cees de Laat**

**GigaPort**  
**EU**

**SU RF/net**  

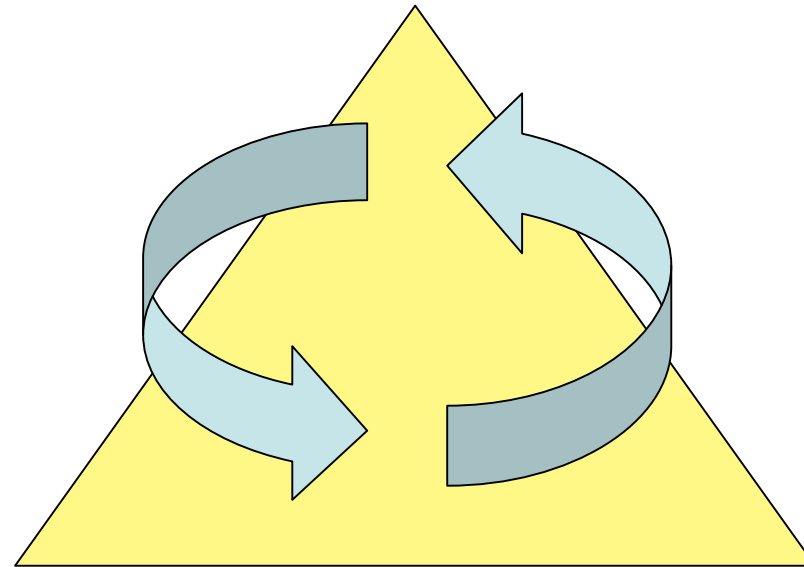

**University of Amsterdam**  
**TI**  
**SARA**  
NCF



# Science park

**Creators**

University,  
Institutes



**Producers**

Supercomputer center,  
Network exchanges,  
Storage providers  
Visualization facilities

**Consumers**

E-Sciences,  
HEP, Bio, Solid State Phys.  
Industry

# ***Advanced Internet Research Group @ UvA***

- **Optical networking architectures and models**
  - **Optical Internet Exchange architecture**
  - **Lambda routing and assignment**
- **IP transport protocols, performances monitoring and measurements**
  - **With respect to performance**
  - **Monitoring and reporting**
  - **Traffic generation with grid infrastructure**
- **Authorization, Authentication and Accounting**
  - **Concepts**
  - **Proof of concepts**
  - **Network & Grid integration and Applications**

# Sensor Grids

## eVLBI



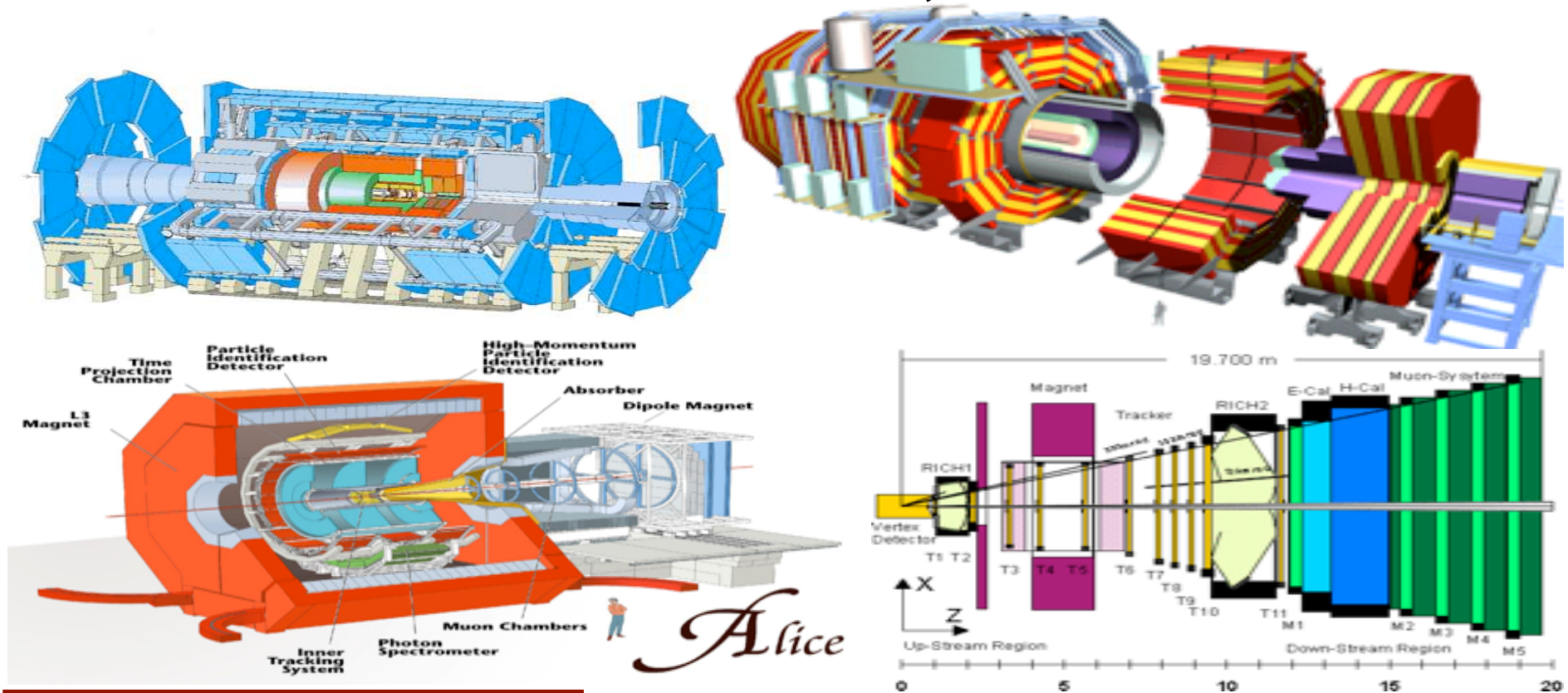
~ 40 Tbit/s  
[www.lofar.org](http://www.lofar.org)

longer term VLBI is easily capable of generating... The sensitivity of the VLBI array scales with... width (=data-rate) and there is a strong push to mo... dths. Rates of 8Gb/s or more are entirely feasible... o under development. It is expected that parallel... ed correlator will remain the most efficient approach... olves dist... , multi-gig... relator and... g factor.



*Westerbork Synthesis Radio Telescope -  
Netherlands*

# Four LHC Experiments: The Petabyte to Exabyte Challenge **ATLAS, CMS, ALICE, LHCb**



**6000+ Physicists &  
Engineers; 60+  
Countries;  
250 Institutions**

**Tens of PB 2008; To 1 EB by  
~2015**

**Hundreds of TFlops To PetaFlops**

# OptIPuter Project Goal: Scaling to 100 Million Pixels

- JuxtaView (UIC EVL) for PerspecTile LCD Wall
  - Digital Montage Viewer
  - 8000x3600 Pixel Resolution~30M Pixels
- Display Is Powered By
  - 16 PCs with Graphics Cards
  - 2 Gigabit Networking per PC



Source: Jason Leigh, EVL, UIC; USGS EROS

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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

$\Sigma C \gg 100 \text{ Gb/s}$  →

$\Sigma B \approx 40 \text{ Gb/s}$

$\Sigma A \approx 30 \text{ Gb/s}$

A

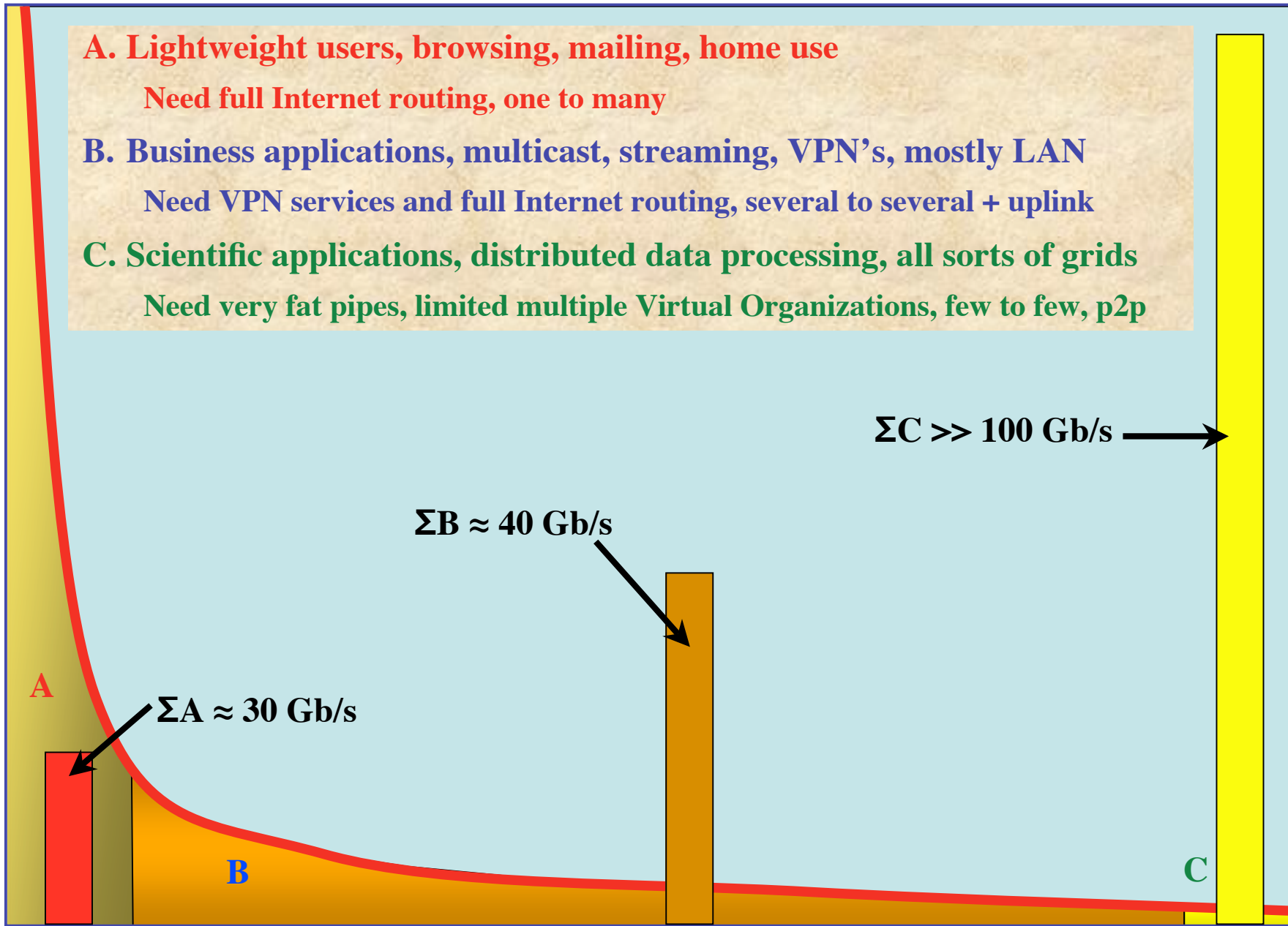
B

C

ADSL

GigE

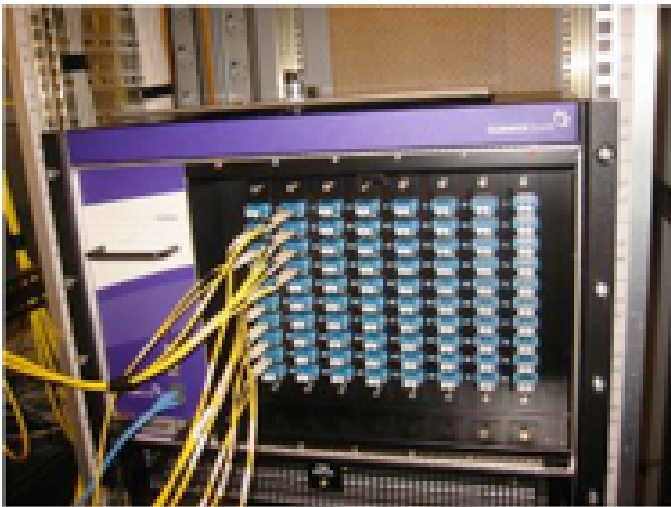
→  
BW requirements



# Towards Hybrid Networking!

- Costs of optical equipment 10% of switching 10 % of full routing equipment for same throughput
  - 10G routerblade -> 100-500 k\$, 10G switch port -> 10-20 k\$, MEMS port -> 0.7 k\$
  - DWDM lasers for long reach expensive, 10-50k\$
- 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 - 0.7 k\$/port**



**L2 - 10-20 k\$/port**

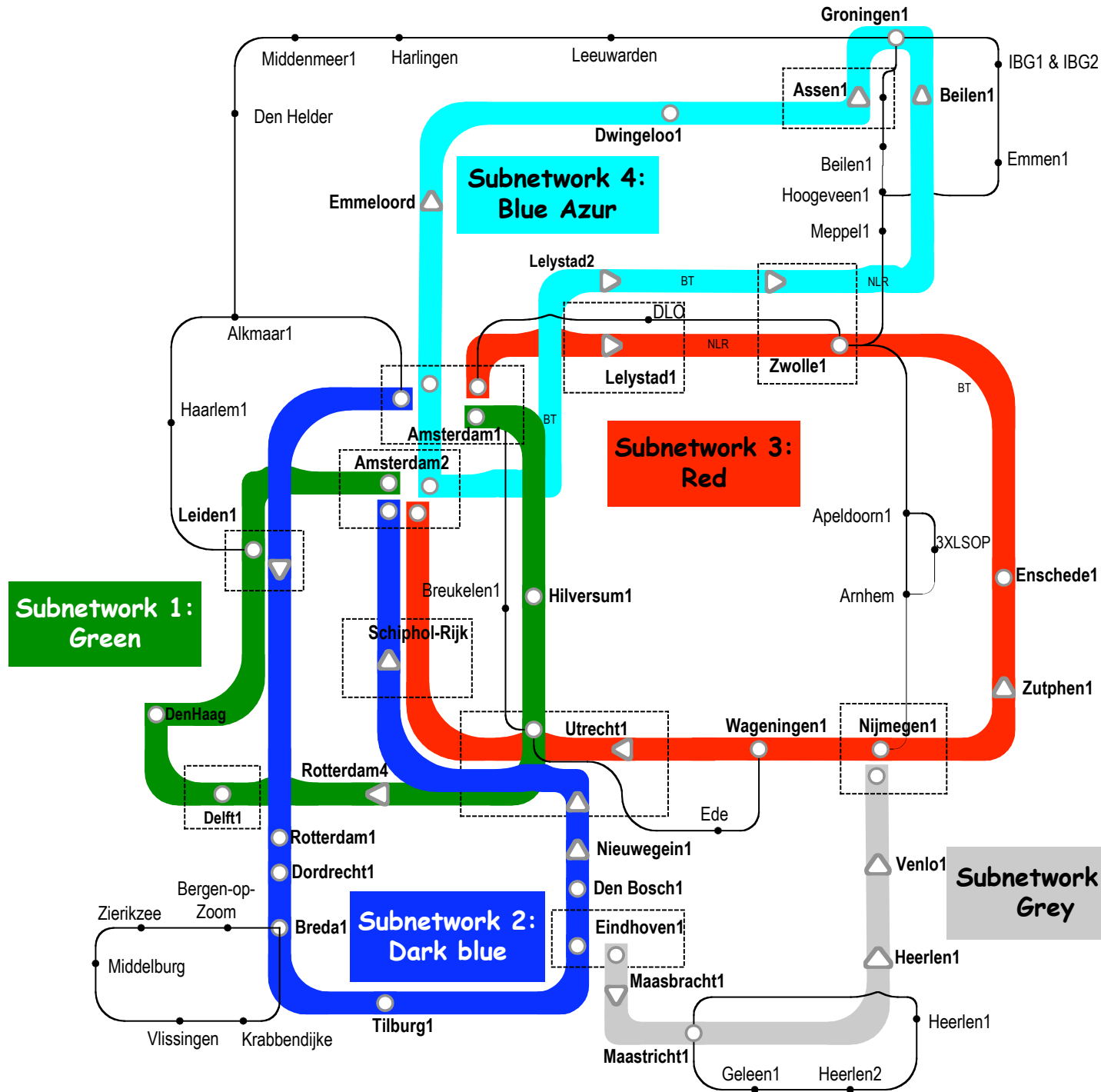


**L3 - 100-500 k\$/port**

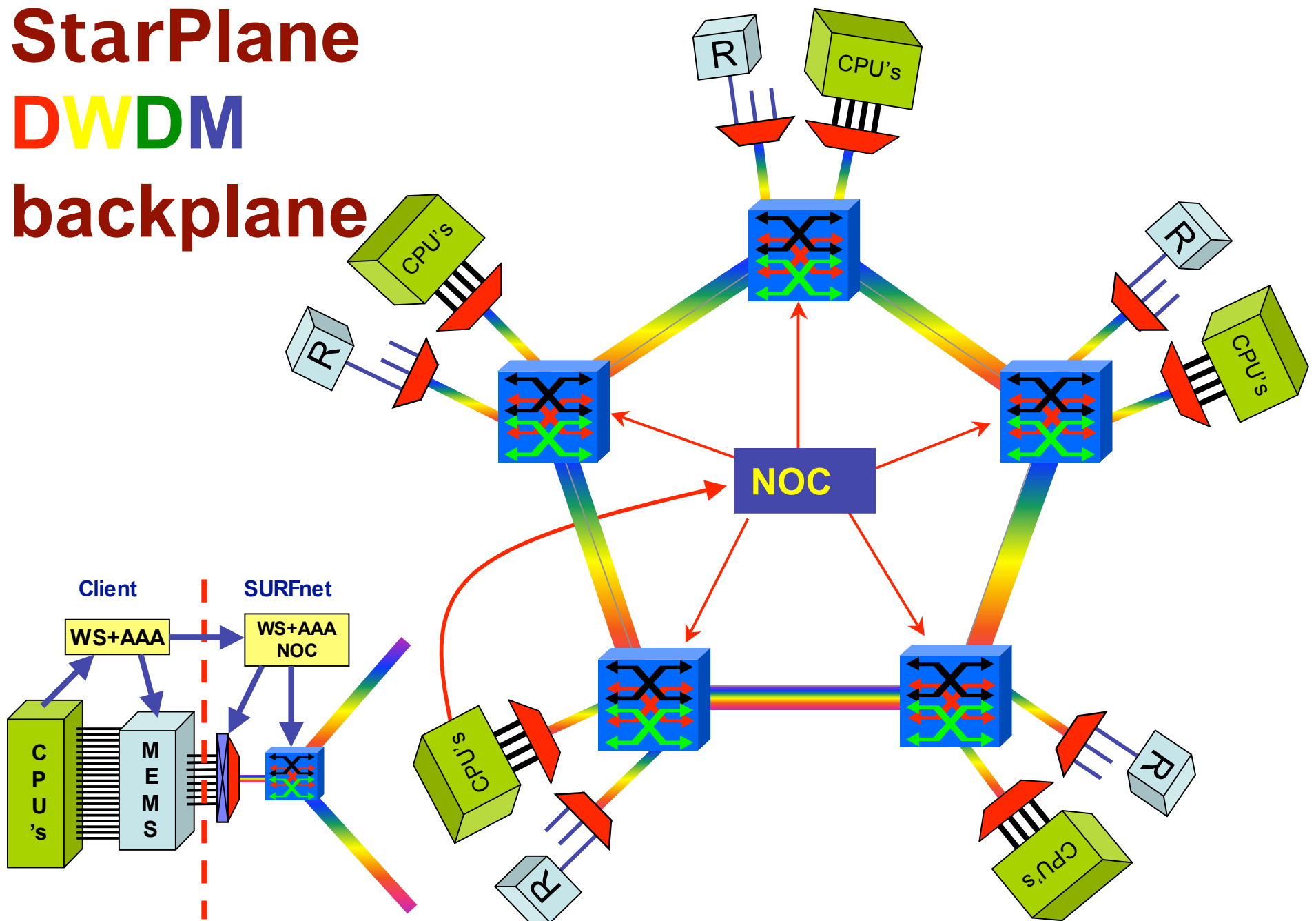




# Common Photonic Layer (CPL) in SURFnet 6



# StarPlane DWDM backplane



# GLIF Q4 2004



Visualization courtesy of  
Bob Patterson, NCSA.

# Showed you 5 types of Grids

- Sensor Grids
  - Several massive data sources are coming online
- Computational Grids
  - HEP and LOFAR analysis needs massive CPU capacity
  - Research: dynamic nation wide optical backplane control
- Data (Store) Grids
  - Moving and storing HEP, Bio and Health data sets is major challenge
- Visualization Grids
  - Data object (TByte sized) inspection, anywhere, anytime
- Lambda Grids
  - Hybrid networks

# SC2004 “Dead Cat” demo

**SuperComputing 2004,  
Pittsburgh,  
Nov. 6 to 12, 2004**

**Produced by:**

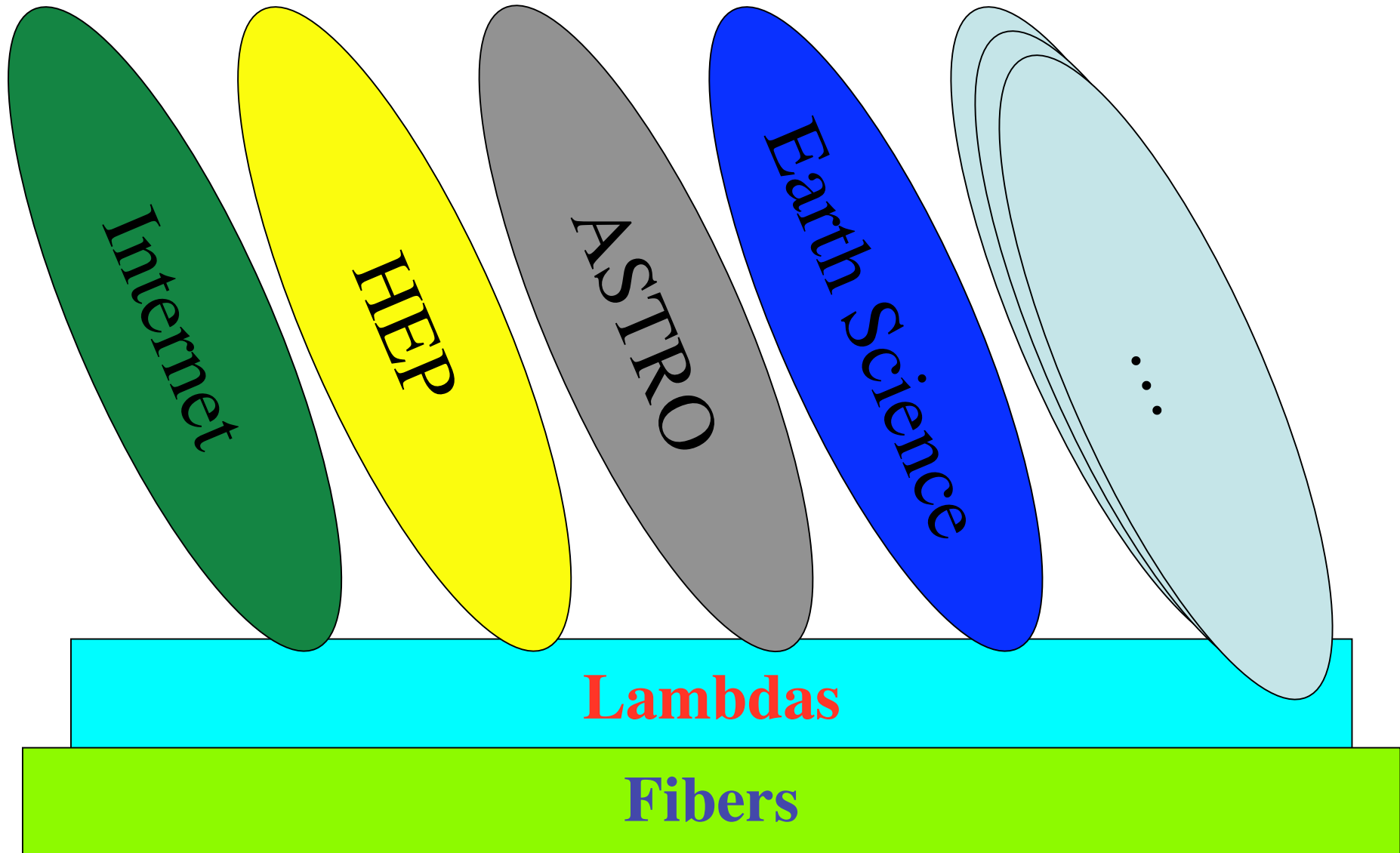
Michael Scarpa  
Robert Belleman  
Peter Slood

**Many thanks to:**

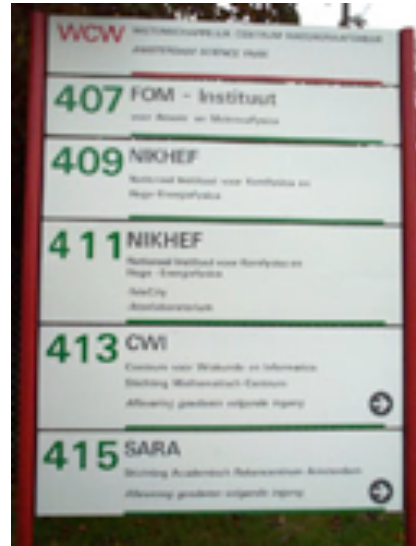
AMC  
SARA  
GigaPort  
UvA/AIR  
Silicon Graphics, Inc.  
Zoölogisch Museum



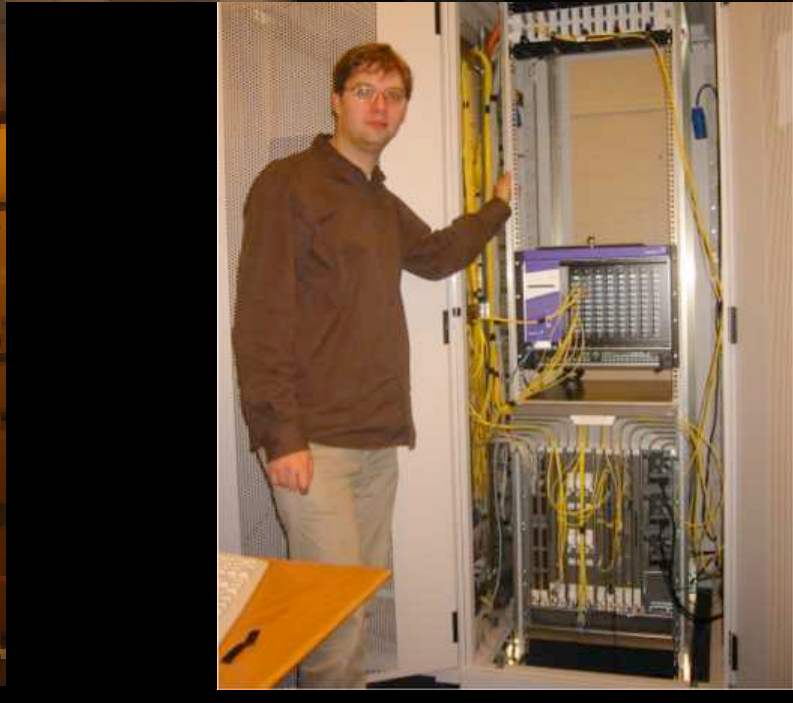
# Discipline Networks



# Laying of fiber near/at Science Park Amsterdam

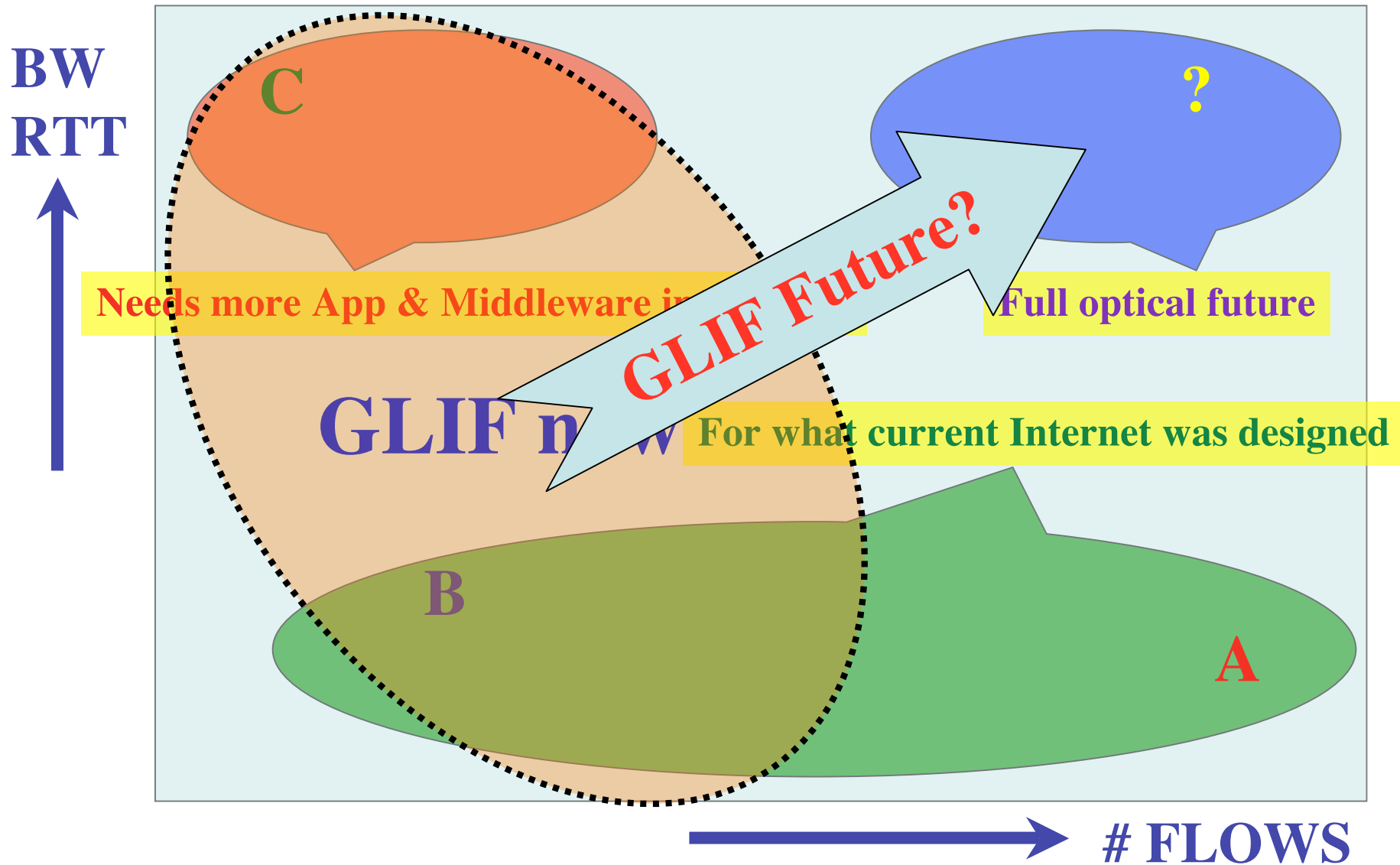


Pictures by Yuri Demchenko





# Transport of flows



# World of Tomorrow - 2005

## *i*Grid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

September 26-30, 2005  
University of California, San Diego  
California Institute for Telecommunications and Information Technology [Cal-(IT)<sup>2</sup>]  
United States

iGrid 2002 was held at Science park Amsterdam