# GigaPort-RON SAC 2008

# Beyond Hybrid Networking


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## University of Amsterdam

# Hybrid Network Paradigm

- Capability to handle datatransport on different OSI layers
- Most NREN's now offer end-to-end Lightpath services to their users
- Last 2 years tremendous progress in control plane implementations.
- Commercial Internet world has >20.000 WSS's (ECOC2008)
- Differentiating factor: put user in charge!

# Quotes from OnVector 2008

prof. Ken-Ichi Sato:

- It is very difficult to predict future services, however, video is expected to be the king media used for bit rate demanding services. High-quality video technologies are rapidly advancing.
- TCP/IP bottleneck is becoming more and more tangible. It will limit the future envisaged network expansion -the energy bottleneck and throughput bottleneck need to be resolved.
- Fast optical circuit/path switching will play the key role to create cost effective and bandwidth abundant future networks.
- Hierarchical optical path network and the node technologies are very important, and hence they need to be fully developed soon.

# Quotes from OnVector 2008

- dr. Kazuo Hagimoto:
- NTT is developing a system that automatically generates metadata such as title, summary, and key words that are extracted from voice or subtitles.

dr. Shimizu:

- Applications for Tbit networks:
  - High Resolution Simulation
  - Weather Forecast
  - Earthquake Forecast
  - City Planning
  - Digital Engineering
  - Nano Device Engineering
  - Protein Structural Analysis

# Quotes from OnVector 2008

prof. Larry Smarr:

- Interconnecting Regional Optical Networks
  Is Driving Campus Optical Infrastructure Deployment

prof. Ed Seidel:

- Petascale computing will not only provide huge data, but will demand new computing modalities
- Will place new demands on networking, data management, visualization, resource co- allocation
- Applications need to be configurable for the new type of infrastructure, need to be aware of environment
- If we don't solve these problems, people will use machines anyway, but science will suffer!

Bill s'Arnaud:

- "Optical networks (as opposed to electronic routed networks) have much smaller carbon footprint"

# Gradually Building the FIRE Facility

## FP6: Early design & prototyping

One Lab

Panlab

TESTBED PROJECTS

## FP7 – WP 2007/08: Prototyping the concept of federating testbeds

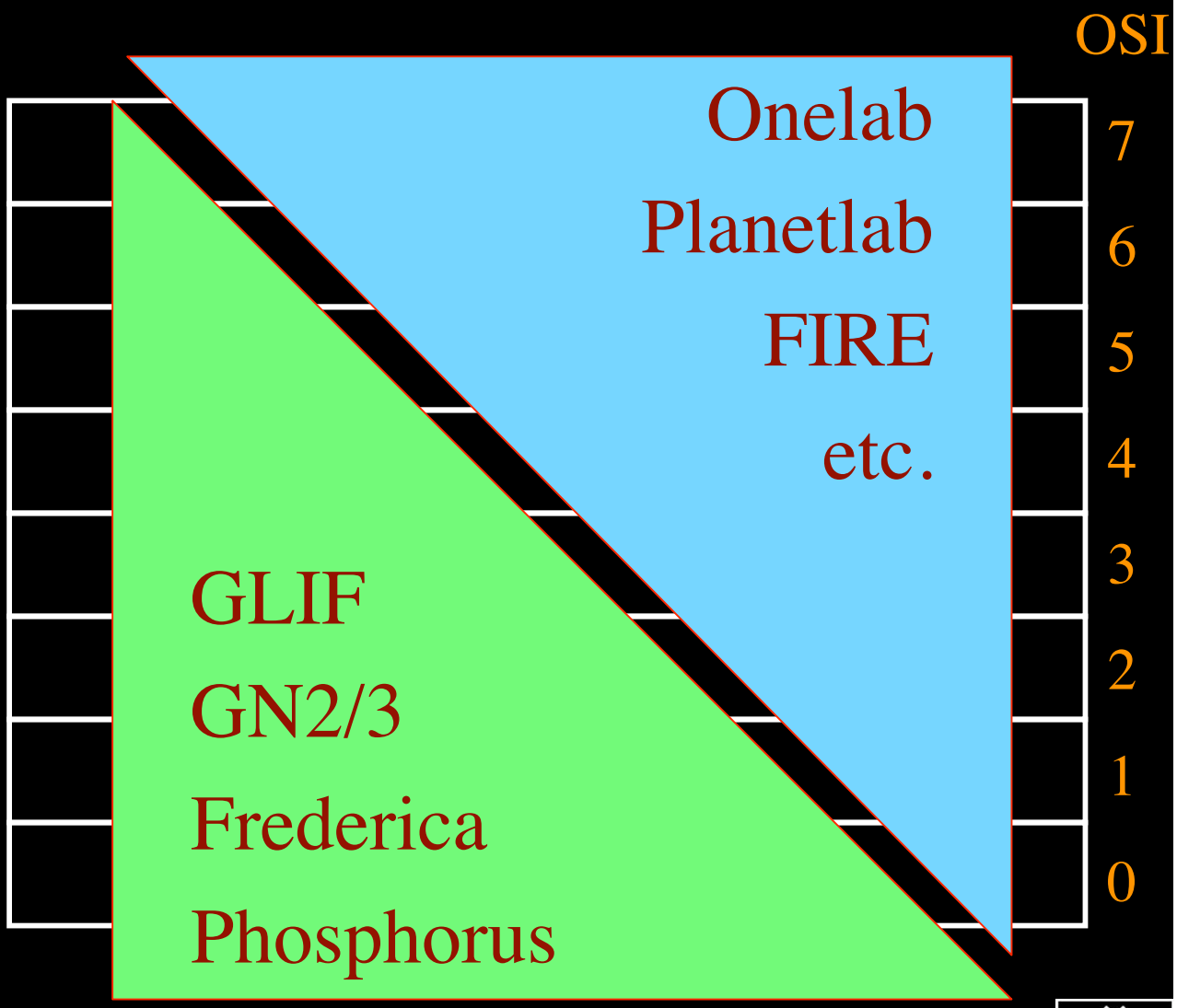

- focus on the telecom layers
- open and dynamic
- supporting academia and industry
- proof-of-concept → pre-commercial tbs
- discover the socio-economic dimension

## Next: Expanding the concept & building the facility

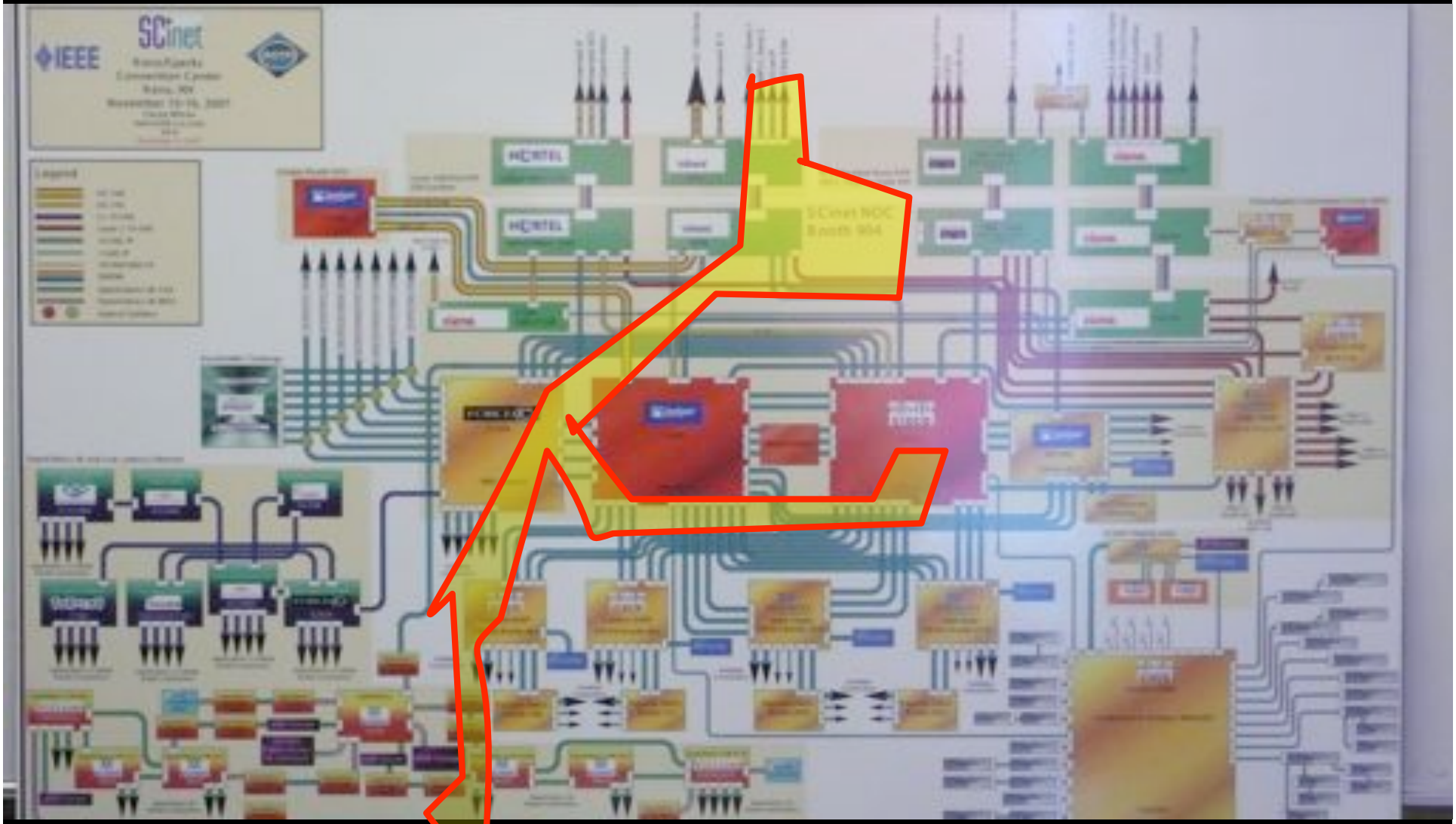
- expand to include service architectures
- support experimentation cutting across layers
- enable socio-economic impact assessment
- broaden involvement of large user communities
- support sustainability
- develop the facility in close cooperation with FIRE research projects

# My view

- needs repeatable experiment
- needs QoS & lightpaths
- needs capacity and capability
- needs infrastructure descriptions



# Programmable Deterministic Service



# Sensor grid: instrumenting the dikes

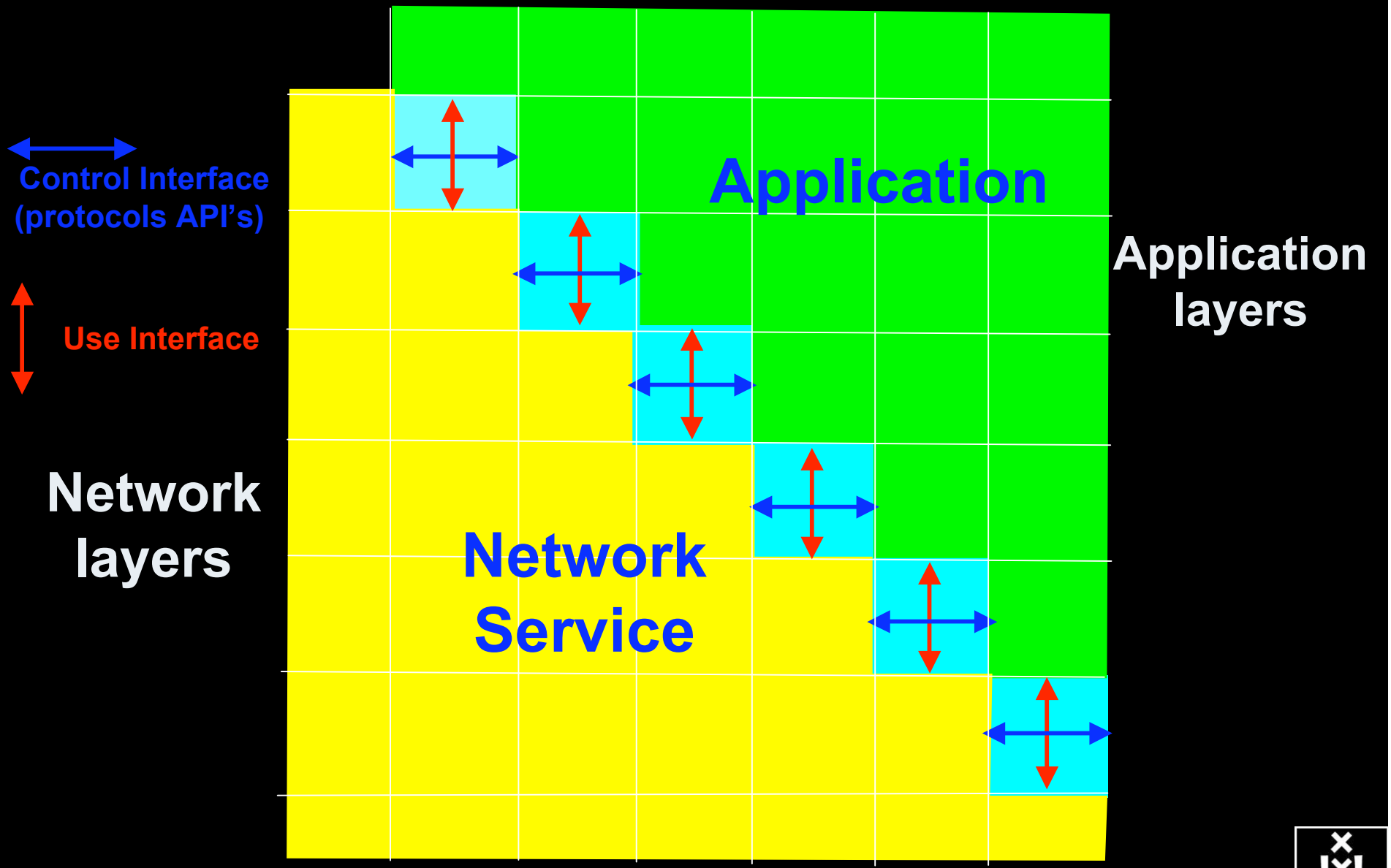
First controlled breach occurred on sept 27th ‘08:

- 30000 sensors (microphones) to cover Dutch dikes
- focus on problem area when breach is to occur

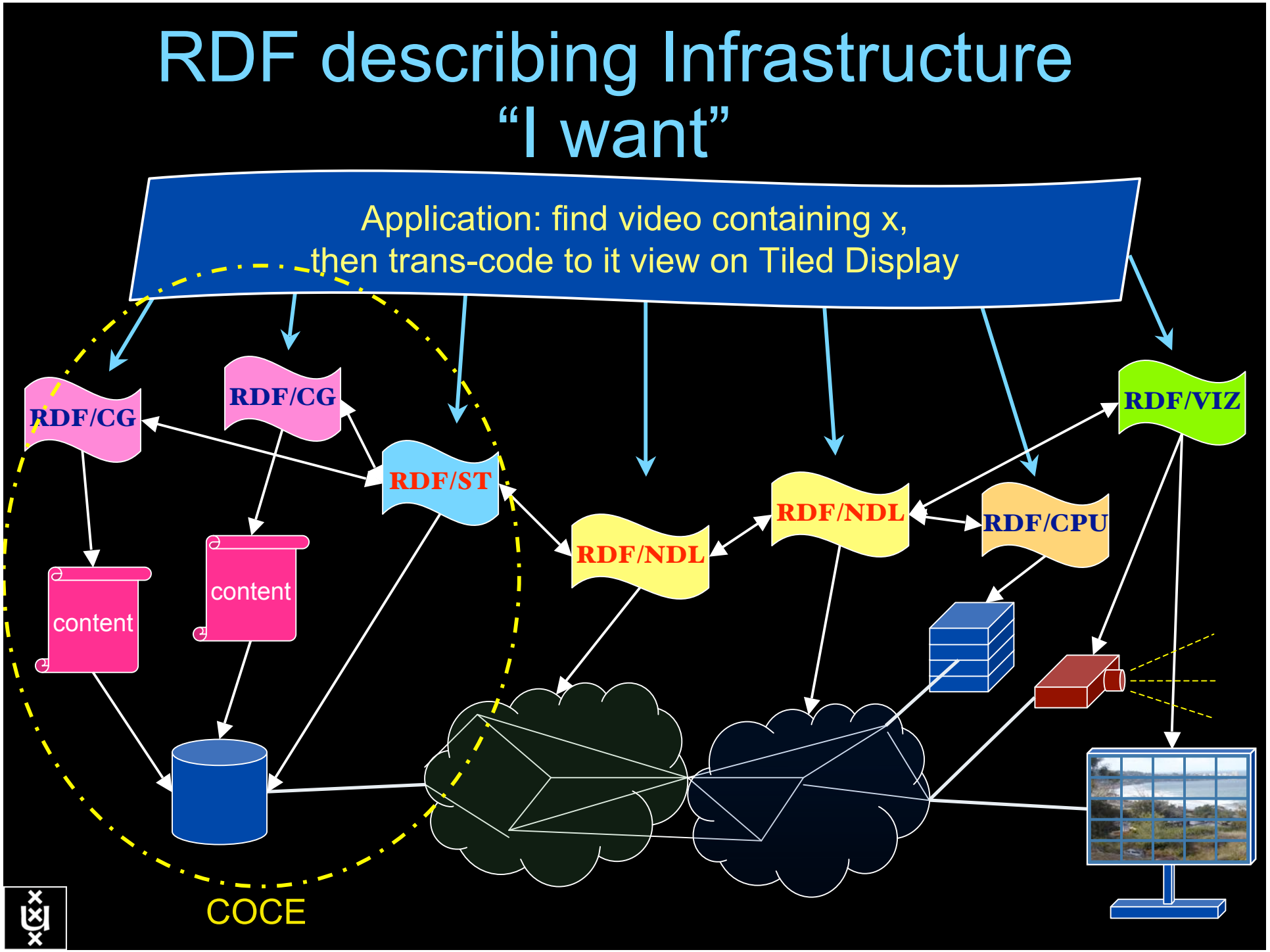
# Trends

- We have made baby-steps on the path to optical networking
  - Still many mails and phone calls
- See several trends:
  - lambda's get fatter and cheaper
  - photonic technology cheap per bandwidth
  - embedded computation capacity increasing
  - latency and high bandwidth congestion avoidance conflict
  - ethernet is getting circuit properties (PBT)
  - applications need more and more predictable behaviour

# Multi Layer Service Architecture



# RDF describing Infrastructure
# "I want"

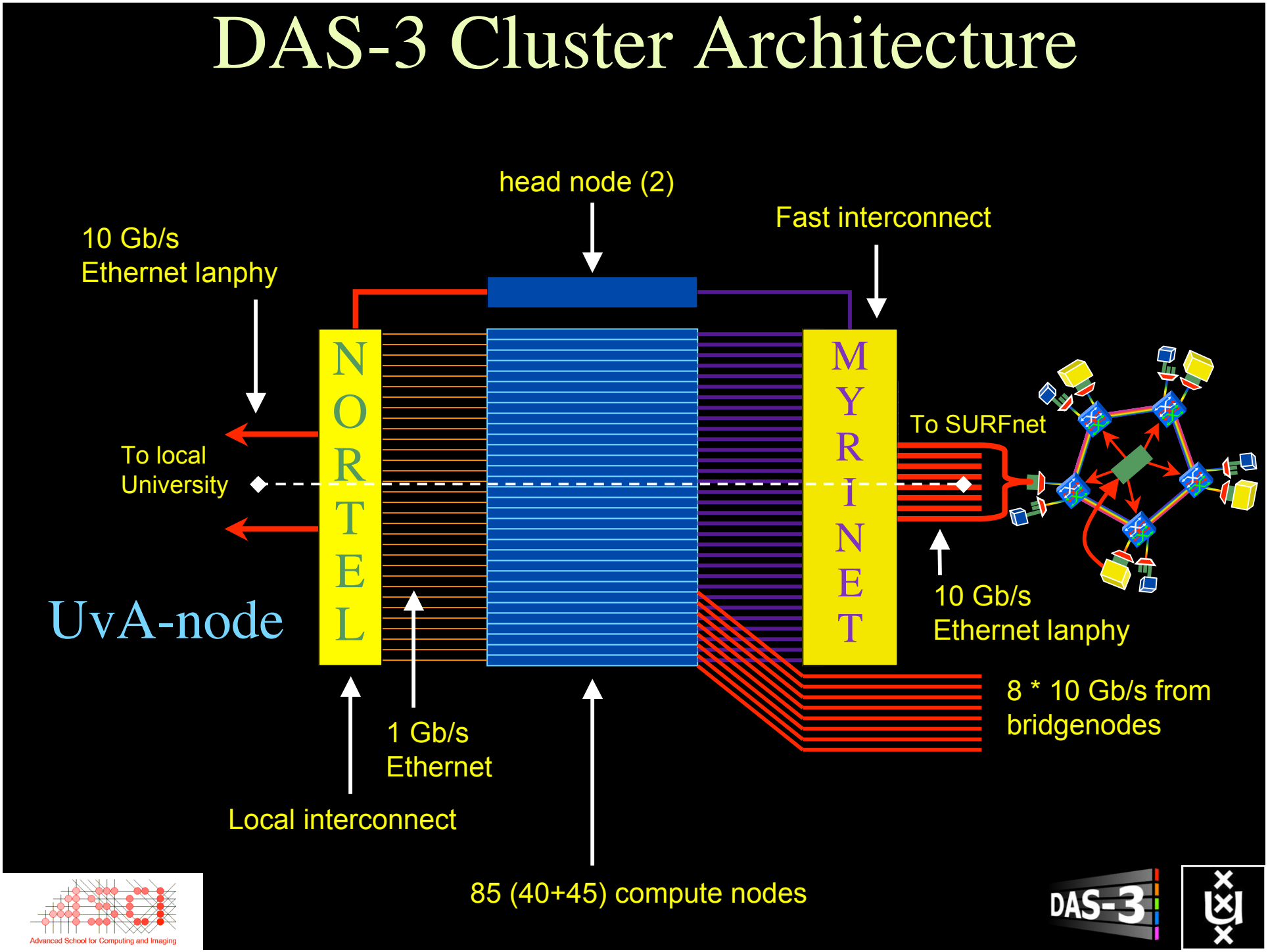


# TeraThinking

- What constitutes a Tb/s network?
- CALIT2 has 8000 Gigabit drops ?->? Terabit Lan?
- look at 80 core Intel processor
  - cut it in two, left and right communicate 8 TB/s
- think back to teraflop computing!
  - MPI makes it a teraflop machine
- massive parallel channels in hosts, NIC's
- TeraApps programming model supported by
  - TFlops -> MPI / Globus
  - TBytes -> OGSA/DAIS
  - TPixels -> SAGE
  - TSensors -> LOFAR, LHC, LOOKING, CineGrid, ...
  - Tbit/s -> ?

ref Larry Smarr & CdL

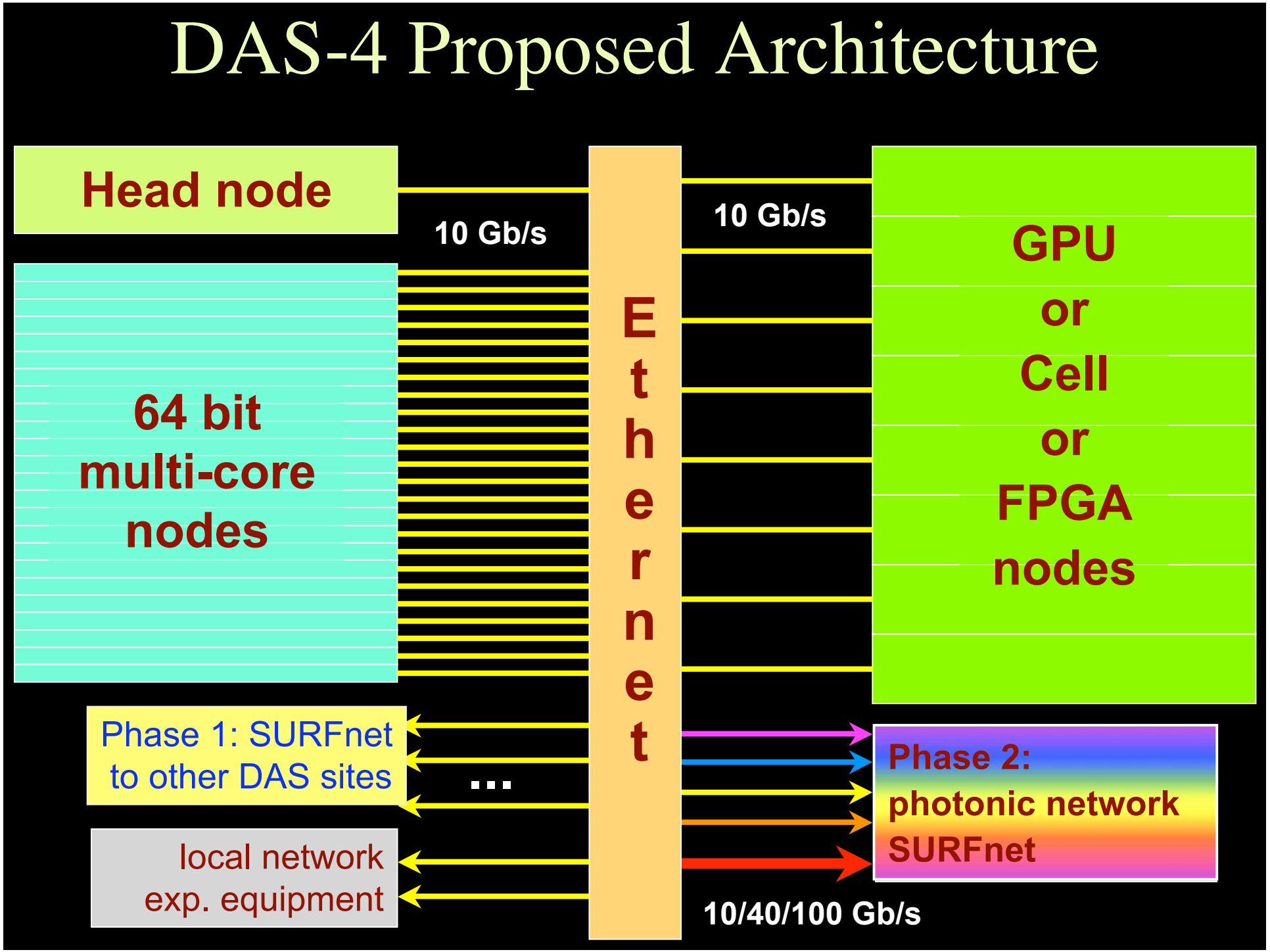
# DAS-3 Cluster Architecture




Advanced School for Computing and Imaging

DAS-3

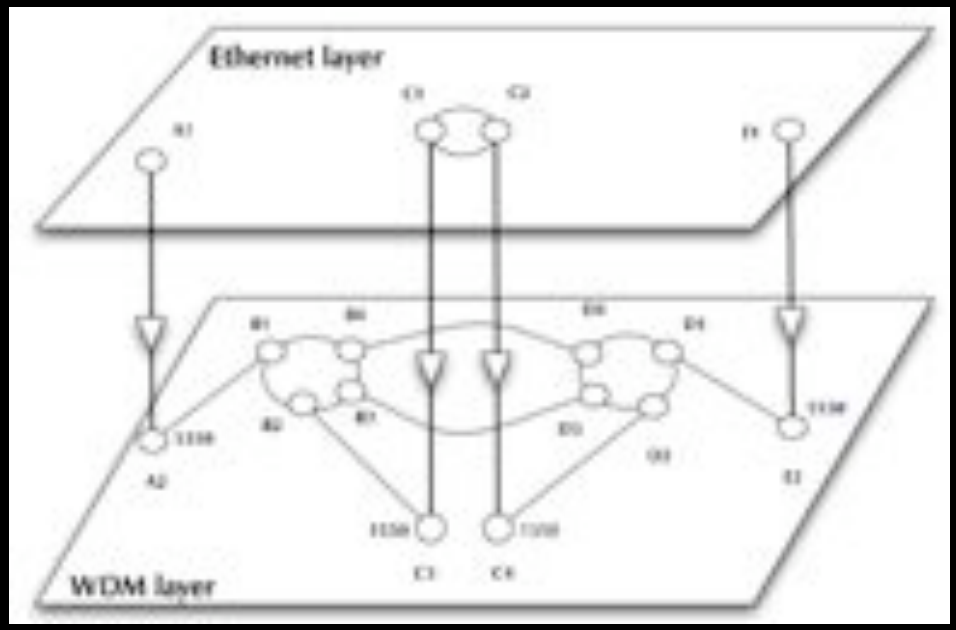
# DAS-4 Proposed Architecture

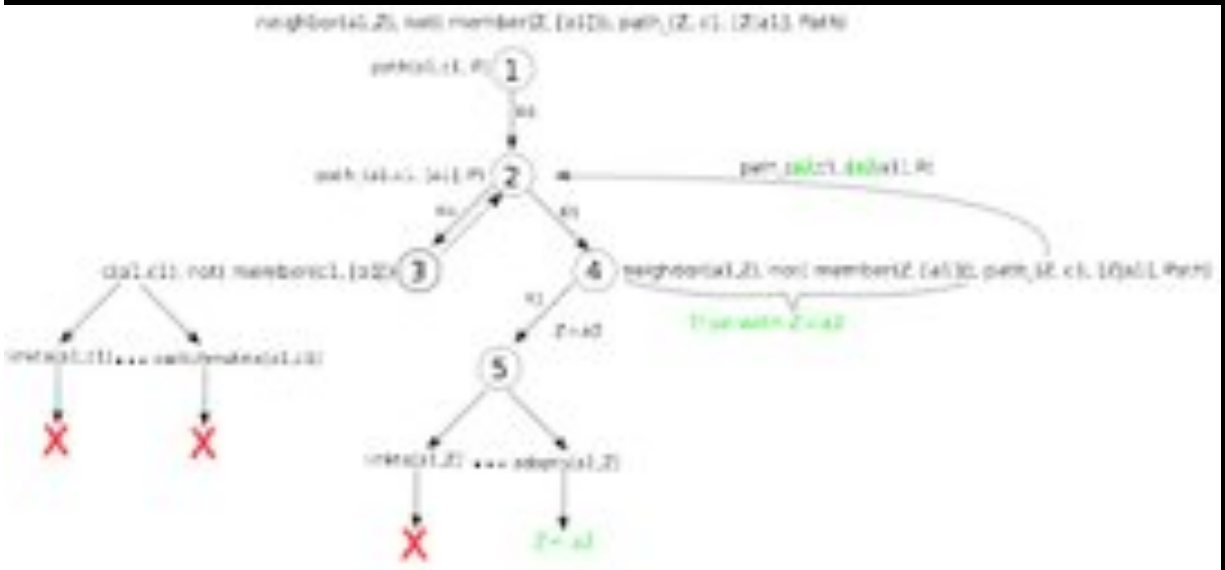


# NDL + PROLOG

Research Questions:

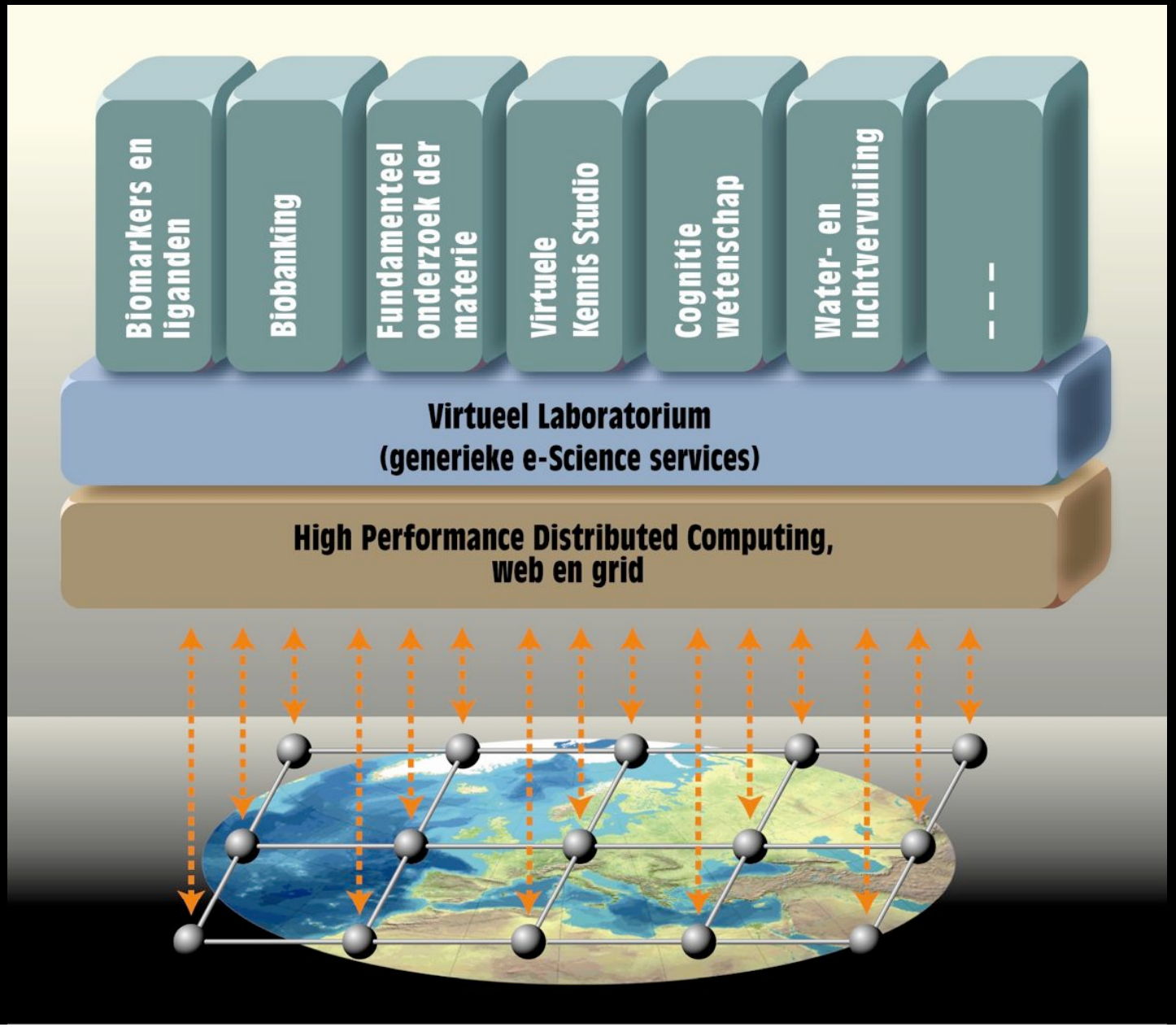
- order of requests
- complex requests
- Usable leftovers




- Reason about graphs
- Find sub-graphs that comply with rules

# e-Science


Biomarkers en liganden
Biobanking
Fundamenteel onderzoek der materie
Virtuele Kennis Studio
Cognitie wetenschap
Water- en luchtvervuiling
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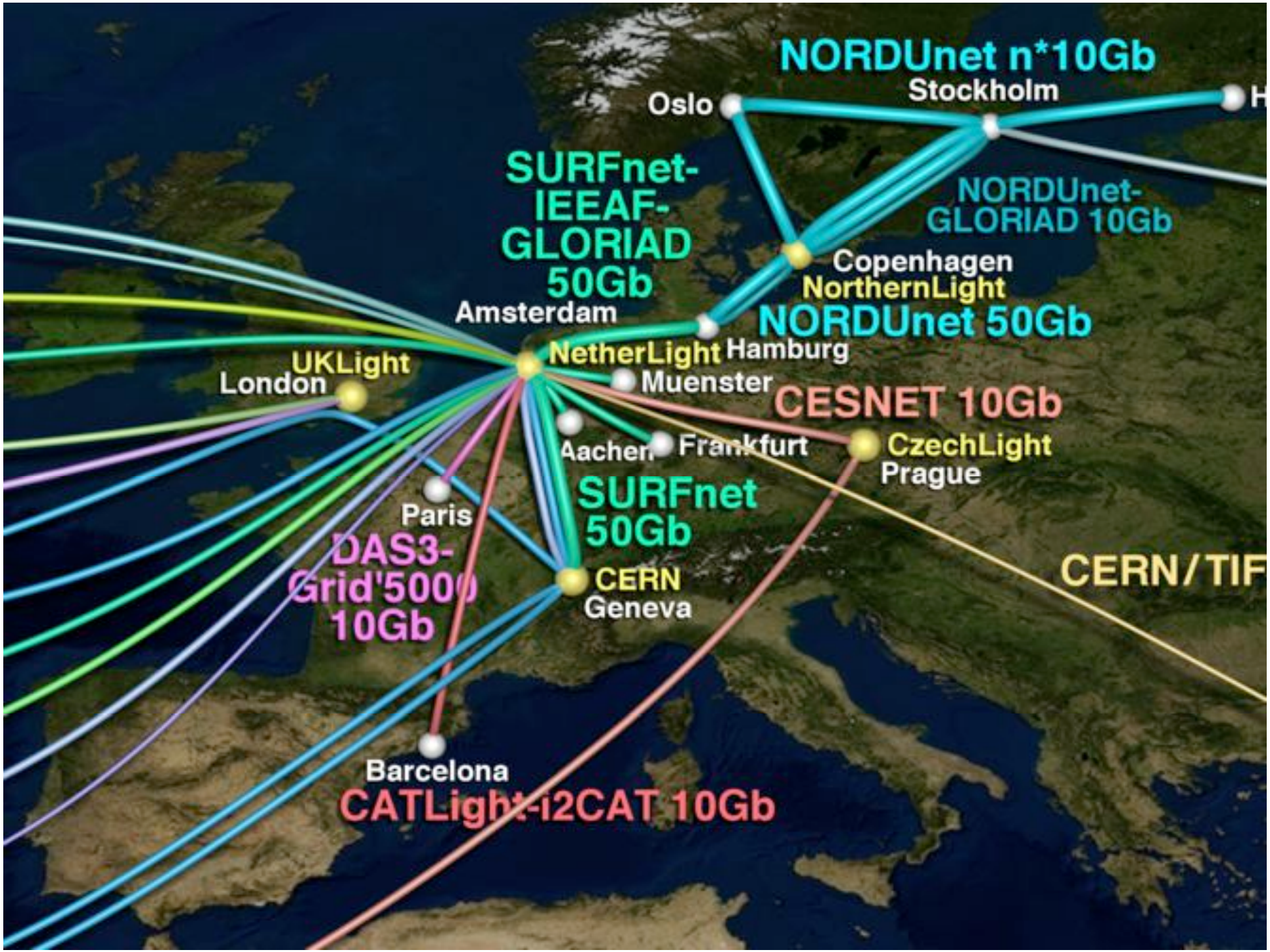
Virtueel Laboratorium
(generieke e-Science services)
High Performance Distributed Computing,
web en grid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NorthernLight
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Amsterdam
NetherLight
Hamburg
UKLight
London
Muenster
CESNET 10Gb
Aachen
Frankfurt
CzechLight
Prague
SURFnet
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DAS3-
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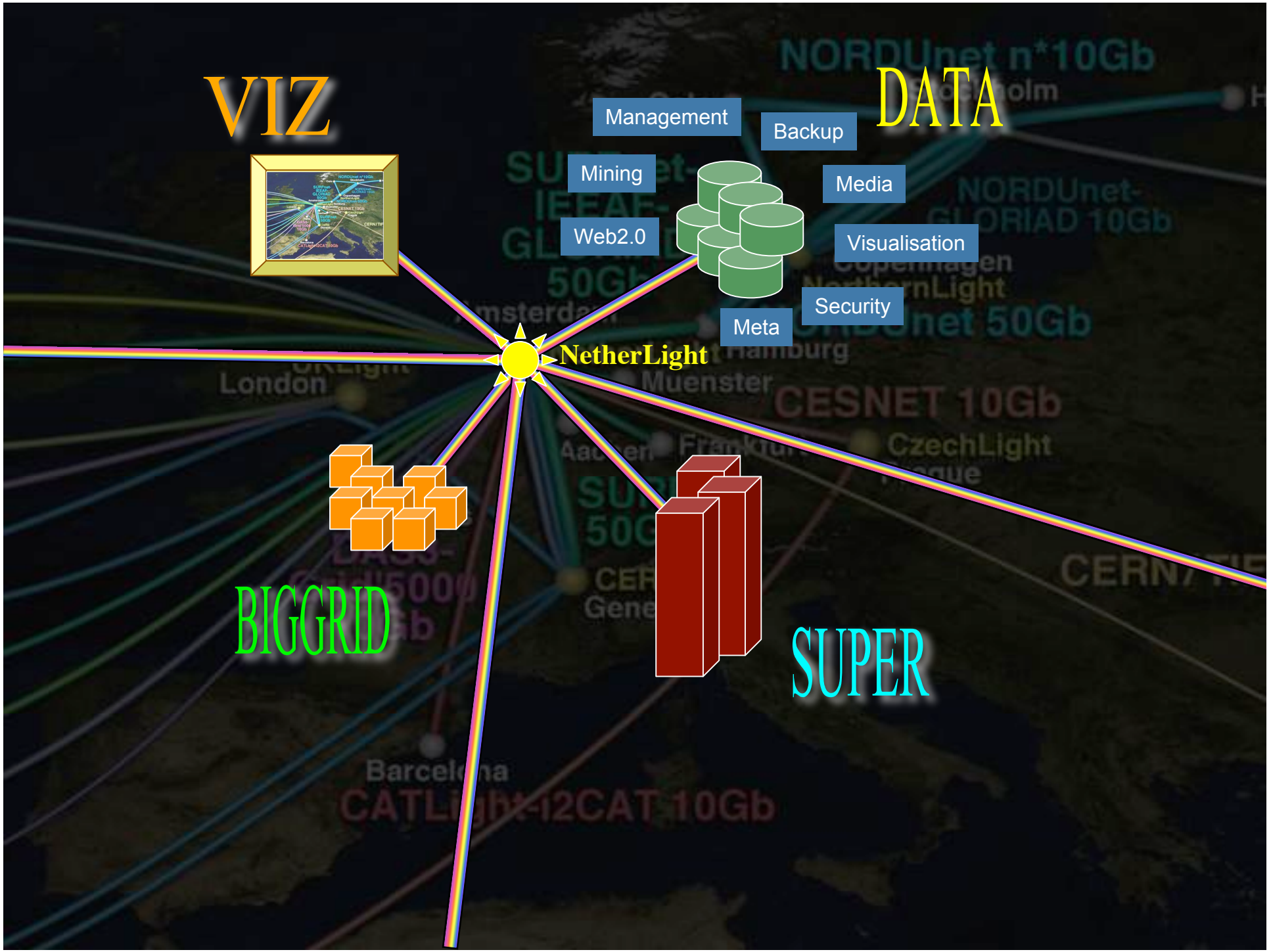
CERN
Geneva
CERN/TIF
Barcelona
CATLight-i2CAT 10Gb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Backup
Mining
Media
Web2.0
Visualisation
Security
Meta
NetherLight
BIGGRID
SUPER
NORDUnet n*10Gb
NORDUnet-GLORIAD 10Gb
50Gb
CESNET 10Gb
CzechLight
London
Barcelona
CATLight-I2CAT 10Gb

# Themes for next years

- Network modeling and simulation
- Cross domain Alien Light switching
- Green-Light
- Network and infrastructure descriptions & WEB2.0
- Reasoning about services
- Cloud Data - Computing
- Web Services based Authorization
- Network Services Interface (N-S and E-W)
- Fault tolerance, Fault isolation, monitoring
- eScience integrated services
- Data and Media specific services

*Questions ?*