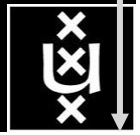
SC09 Holland Avond

The Power of Change!

Cees de Laat

University of Amsterdam



Themes for next years

- 40 and 100 gbit/s
- 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

Alien light From idea to realisation!

40Gb/s alien wavelength transmission via a multi-vendor 10Gb/s DWDM infrastructure

NCF

Alien wavelength advantages

- Direct connection of customer equipment[1] → cost savings
- Avoid OEO regeneration → power savings
- Faster time to service[2] → time savings
- Support of different modulation formats[3] → extend network lifetime

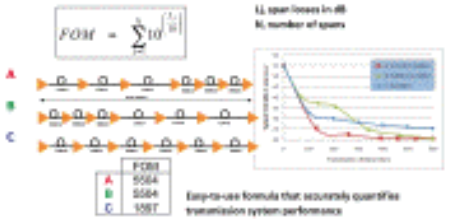
Alien wavelength challenges

- Complex end-to-end optical path engineering in terms of linear (i.e. OSNR, dispersion) and non-linear (FWM, SPM, XPM, Raman) transmission effects for different modulation formats.
- Complex interoperability testing.
- End-to-end monitoring, fault isolation and resolution.
- End-to-end service activation.

In this demonstration we will investigate the performance of a 40Gb/s PM-QPSK alien wavelength installed on a 10Gb/s DWDM infrastructure.

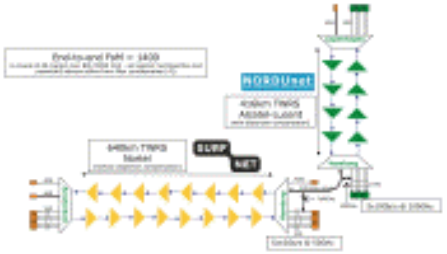
New method to present fiber link quality, FoM (Figure of Merit)

In order to quantify optical link grade, we propose a new method of representing system quality: the FOM (Figure of Merit) for concatenated fiber spans.



Transmission system setup

JOINT SURFnet/NORDUnet 40Gb/s PM-QPSK alien wavelength DEMONSTRATION.



Test results

Error-free transmission for 23 hours, 17 minutes → BER < 3.0 10^-15

Conclusions

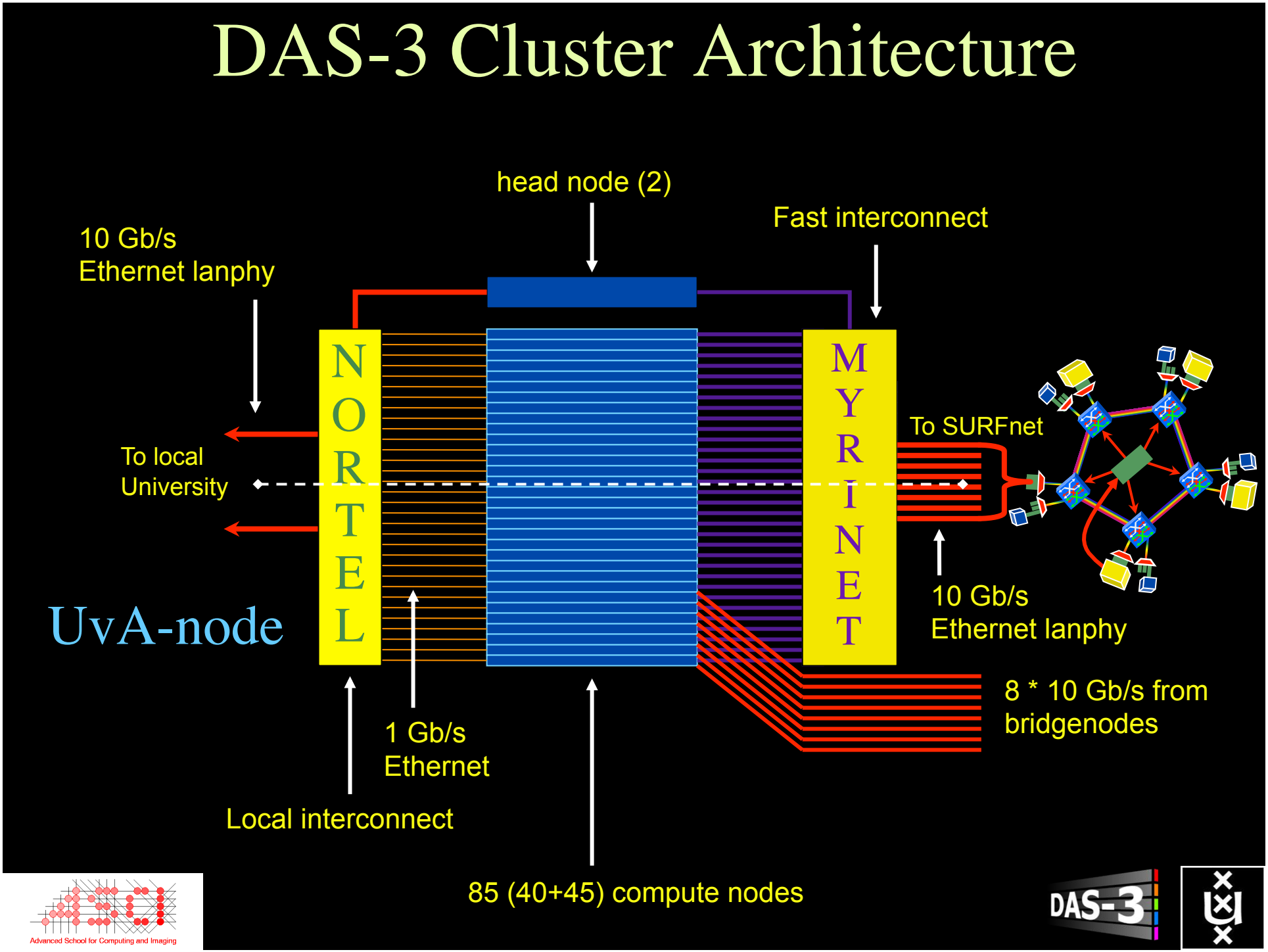
- We have investigated experimentally the all-optical transmission of a 40Gb/s PM-QPSK alien wavelength via a concatenated native and third party DWDM system that both were carrying live 10Gb/s wavelengths.
- The end-to-end transmission system consisted of 1056 km of TWRS (TrueWave Reduced Slope) transmission fiber.
- We demonstrated error-free transmission (i.e. BER below 10-15) during a 23 hour period.
- More detailed system performance analysis will be presented in an upcoming paper.

NORTEL NORDUnet SURF NET

REFERENCES
[1] "OPERATIONAL SOLUTIONS FOR AN OPEN DWDM LAYER", G. GRIMLETT et al., OFC'2009 | [2] "NEXT OPTICAL TRANSPORT SERVICES", BARBARA S. SMITH, OFC'09 | [3] "OPEX SAVINGS OF ALL-OPTICAL CORE NETWORKS", ANDREW LORD AND GIEN, ENGINEER, ECOC2009 | [4] SURFnet/GUPNET INTERNAL COMMUNICATION

ACKNOWLEDGEMENTS
WE ARE GRATEFUL TO NORDUNET FOR PROVIDING US WITH BANDWIDTH ON THEIR EXPERIMENTAL LINK FOR THIS EXPERIMENT, AND ALSO FOR THEIR SUPPORT AND ASSISTANCE DURING THE EXPERIMENTS. WE ALSO ACKNOWLEDGE TERALINK AND NORTEL FOR THEIR INTERACTIVE DISCUSSIONS AND SIMULATION SUPPORT.

DAS-3 Cluster Architecture



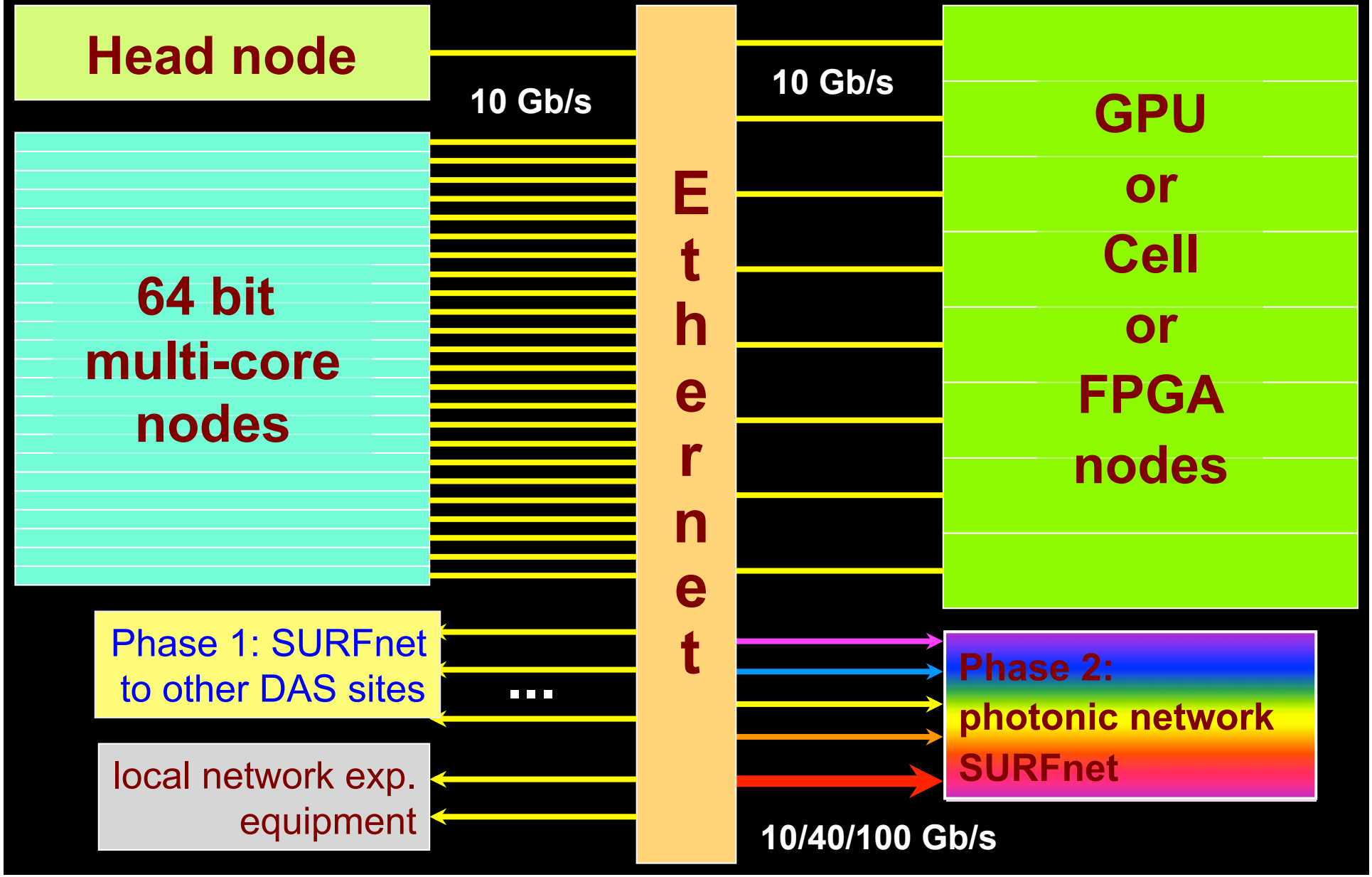
Advanced School for Computing and Imaging

DAS-3

Power is a big issue

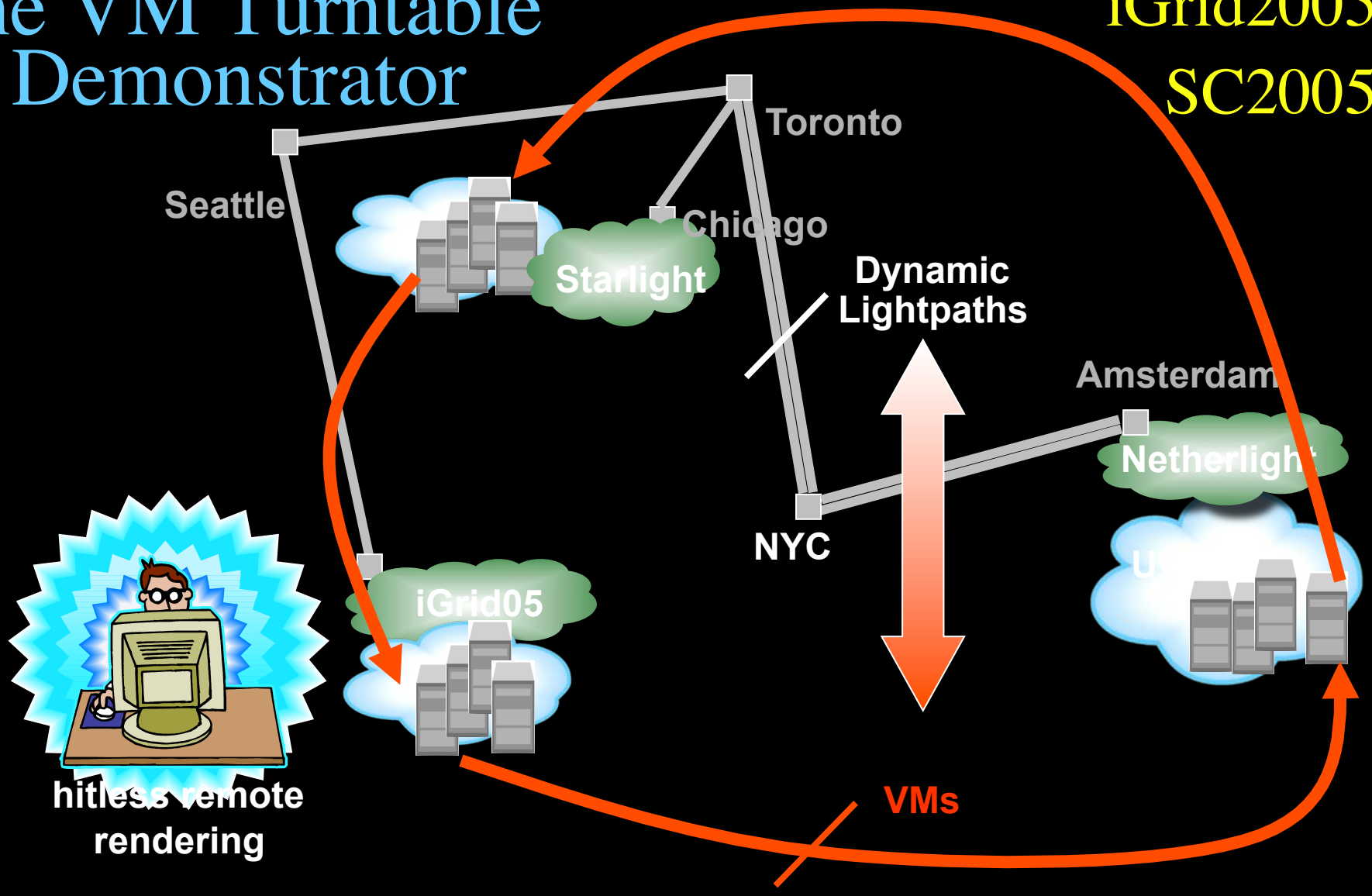
- UvA cluster uses (max) 30 kWh
- 1 kWh ~ 0.1 €
- per year -> 26 k€/y
- add cooling 50% -> 39 k€/y
- Emergency power system -> 60 k€/y
- over 4 year = 240 kEuro for a 500 kEuro set.
- per rack 15 kWh is now normal
- YOU BURN HALF THE CLUSTER OVER ITS LIFETIME!

DAS-4 Proposed Architecture

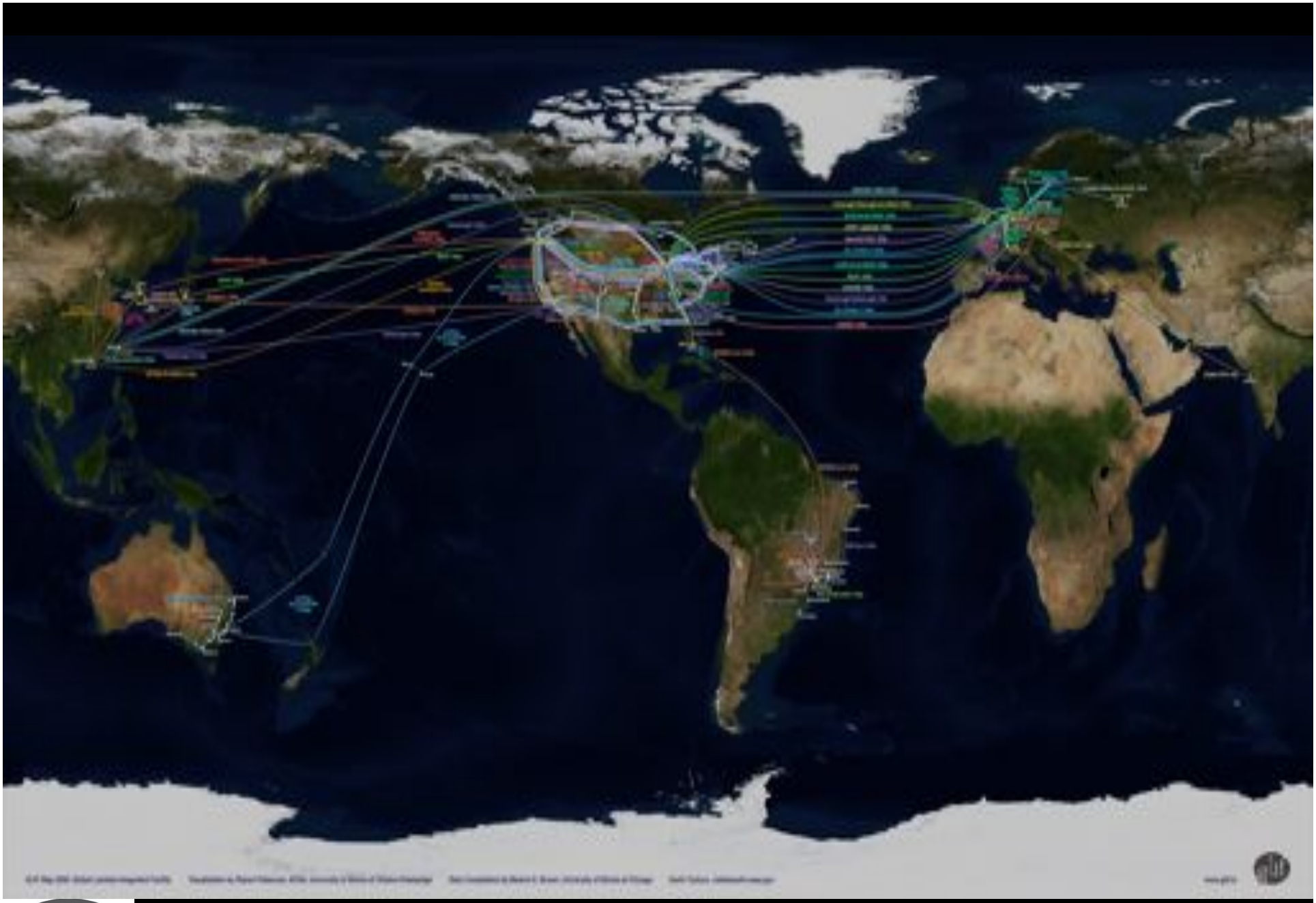


The VM Turntable Demonstrator

iGrid2005
SC2005



The VMs that are live-migrated run an iterative search-refine-search workflow against data stored in different databases at the various locations. A user in San Diego gets hitless rendering of search progress as VMs spin around



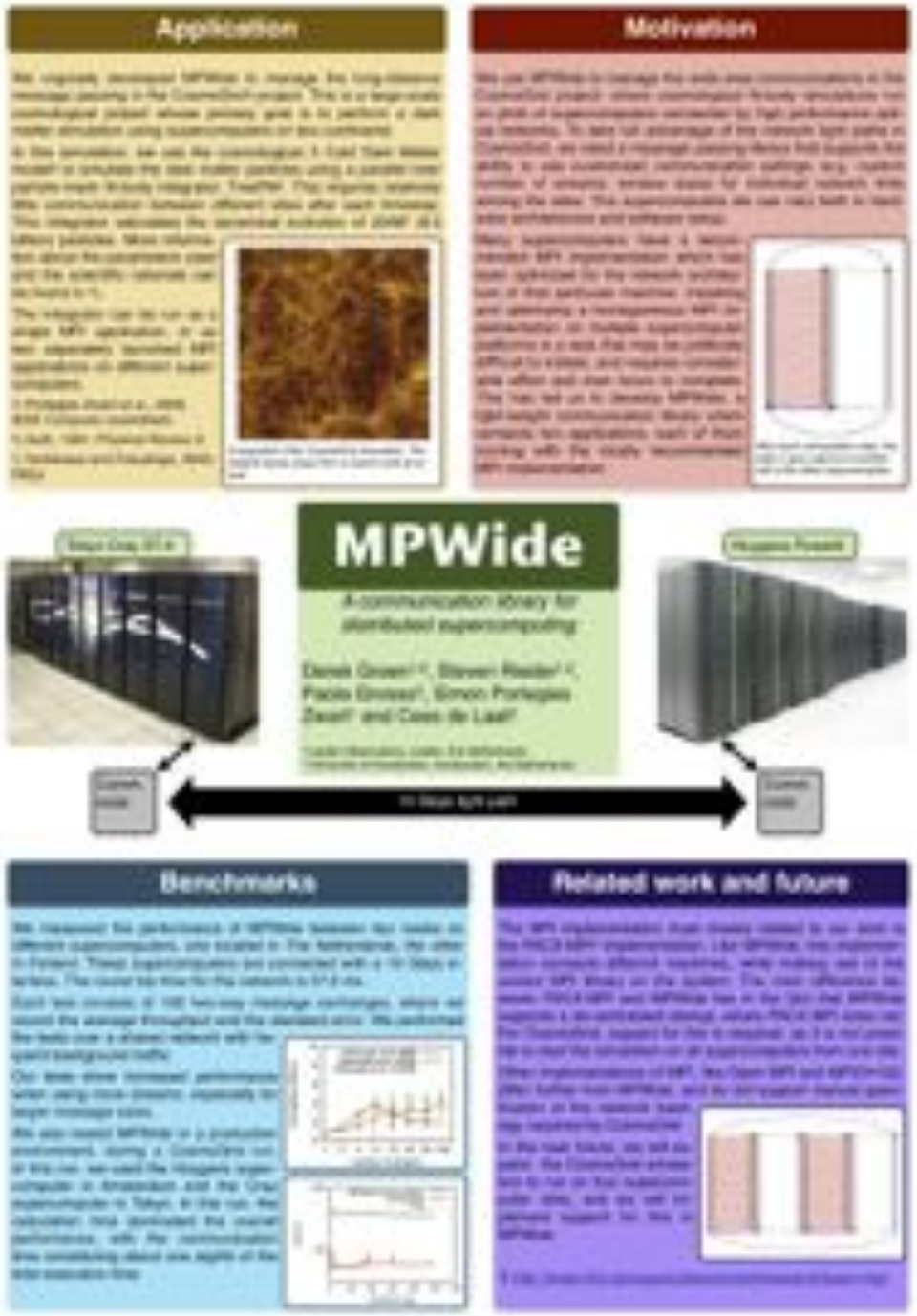
GLIF 2008

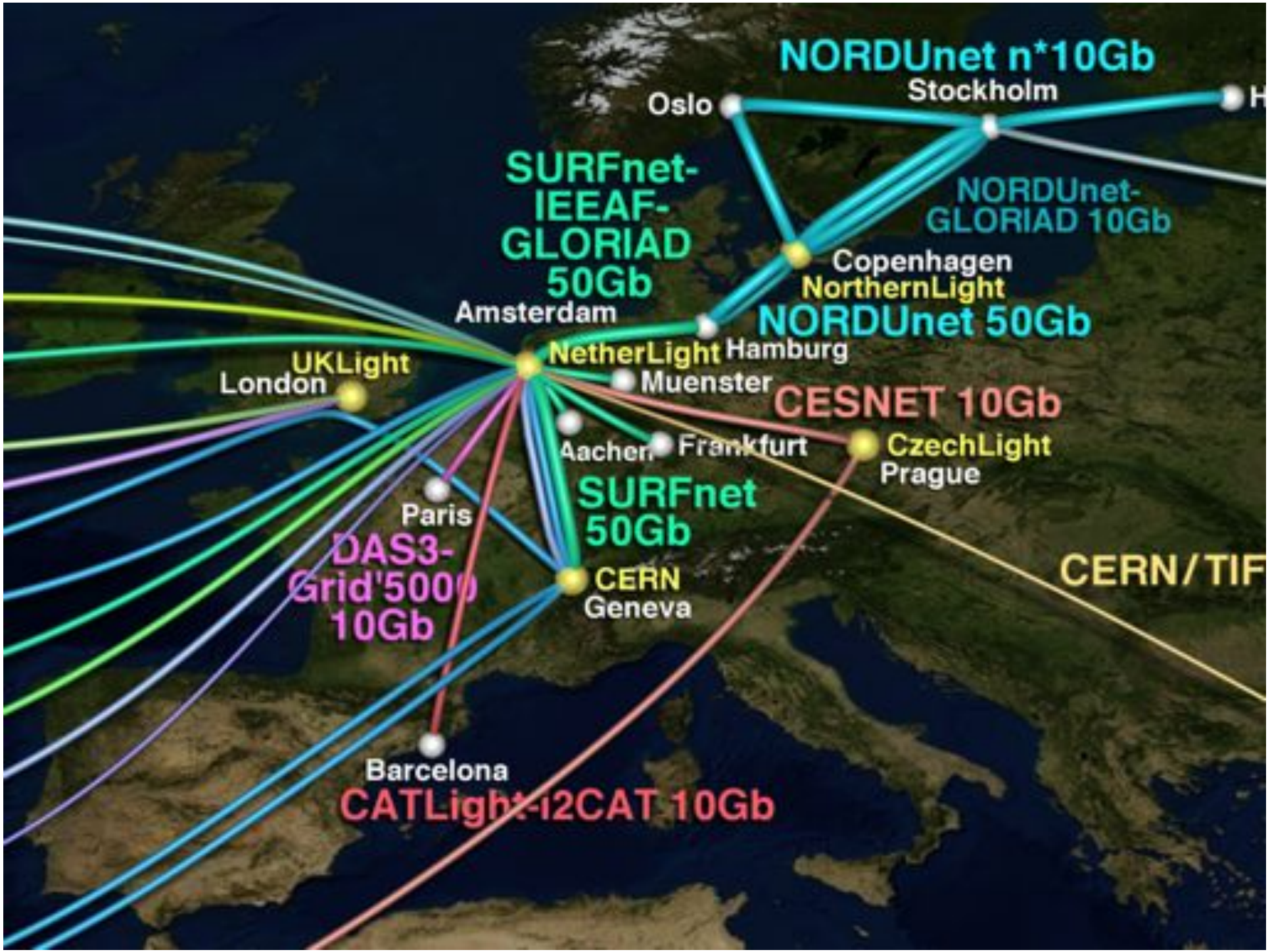
Visualization courtesy of Bob Patterson, NCSA
Data collection by Maxine Brown.

CosmoGrid

Supercomputing Grid across Continents and Oceans

And yes,
it works!




NORDUnet n*10Gb
Stockholm
Oslo
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IEEAF-
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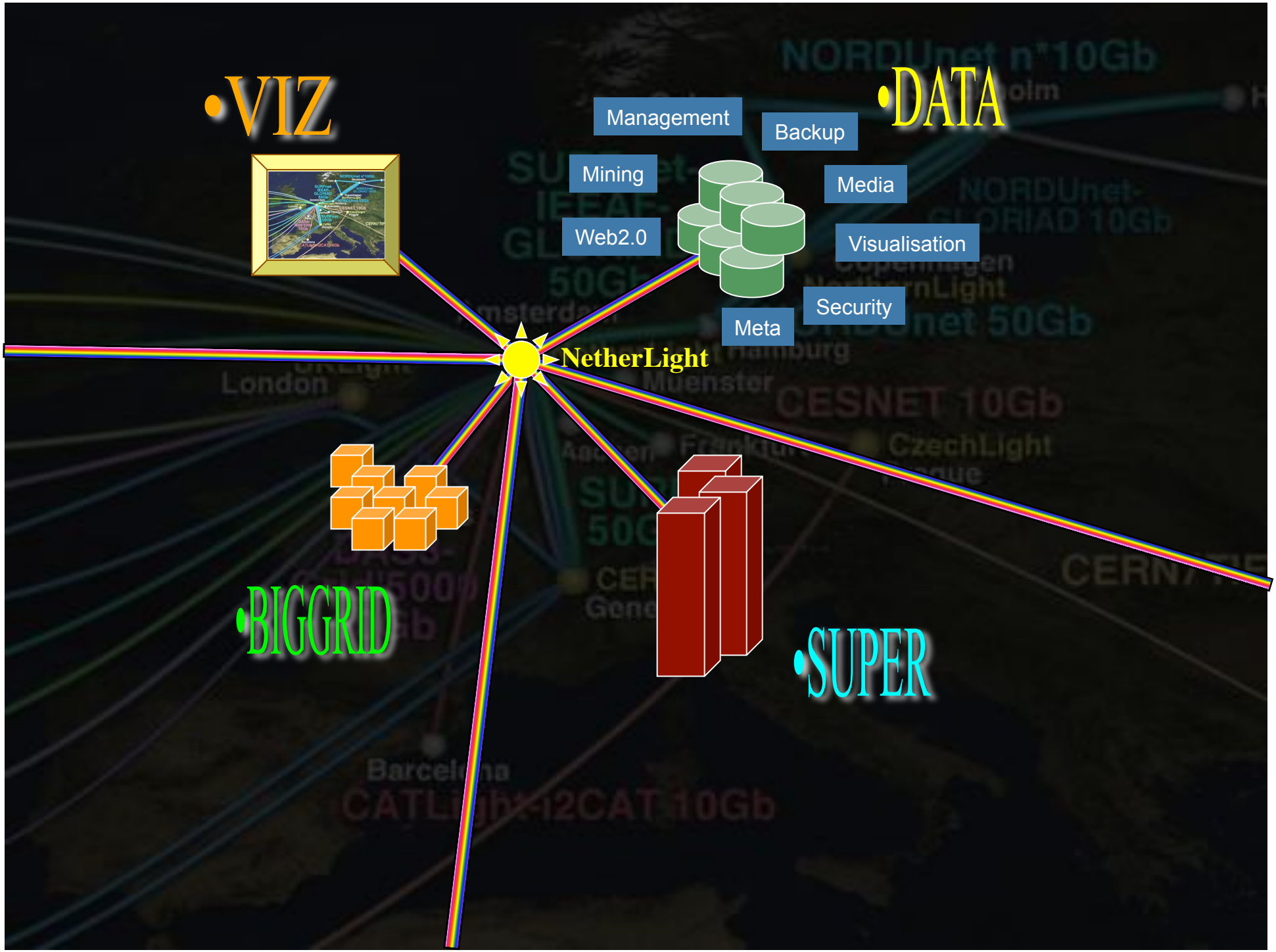
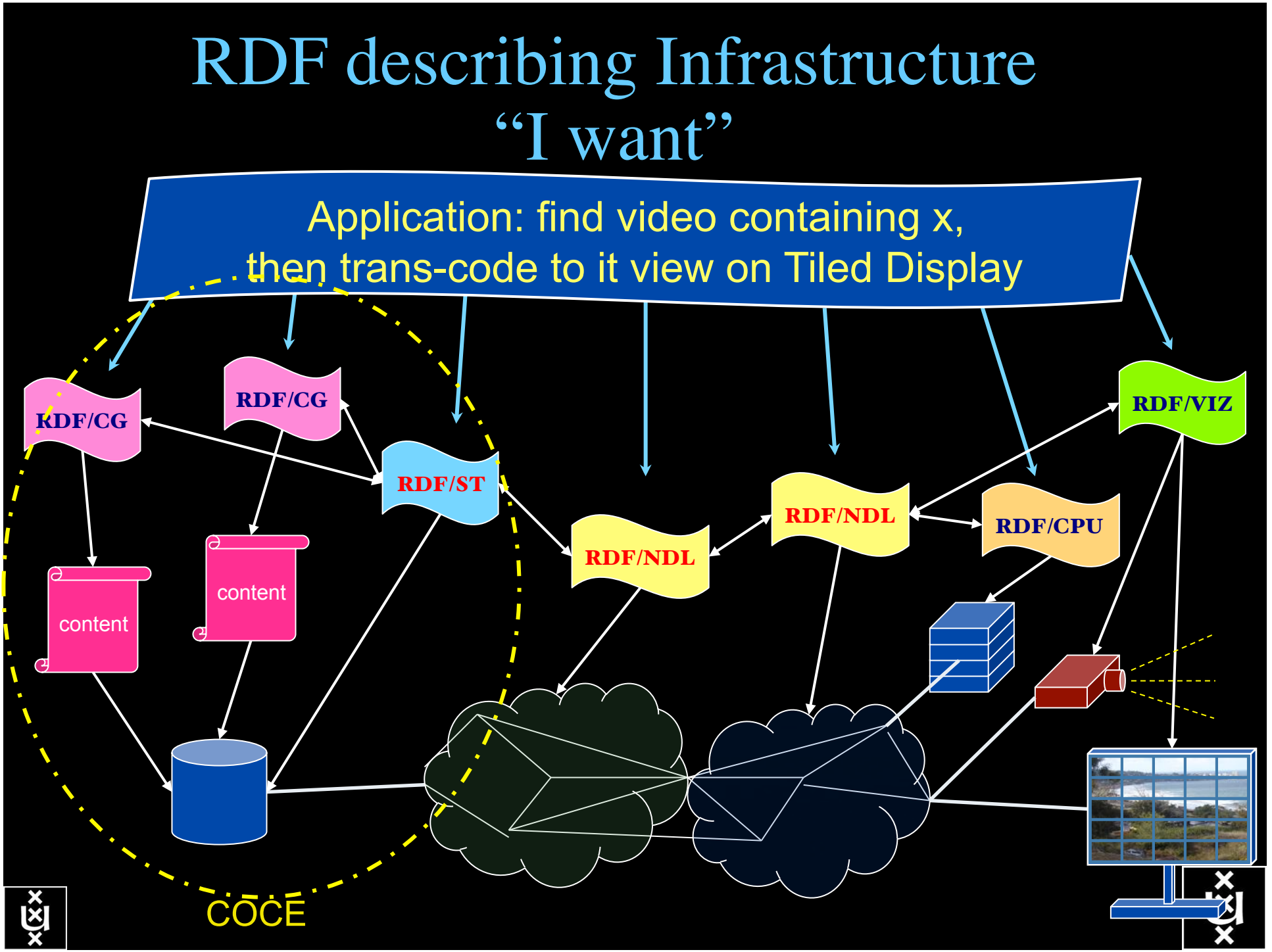
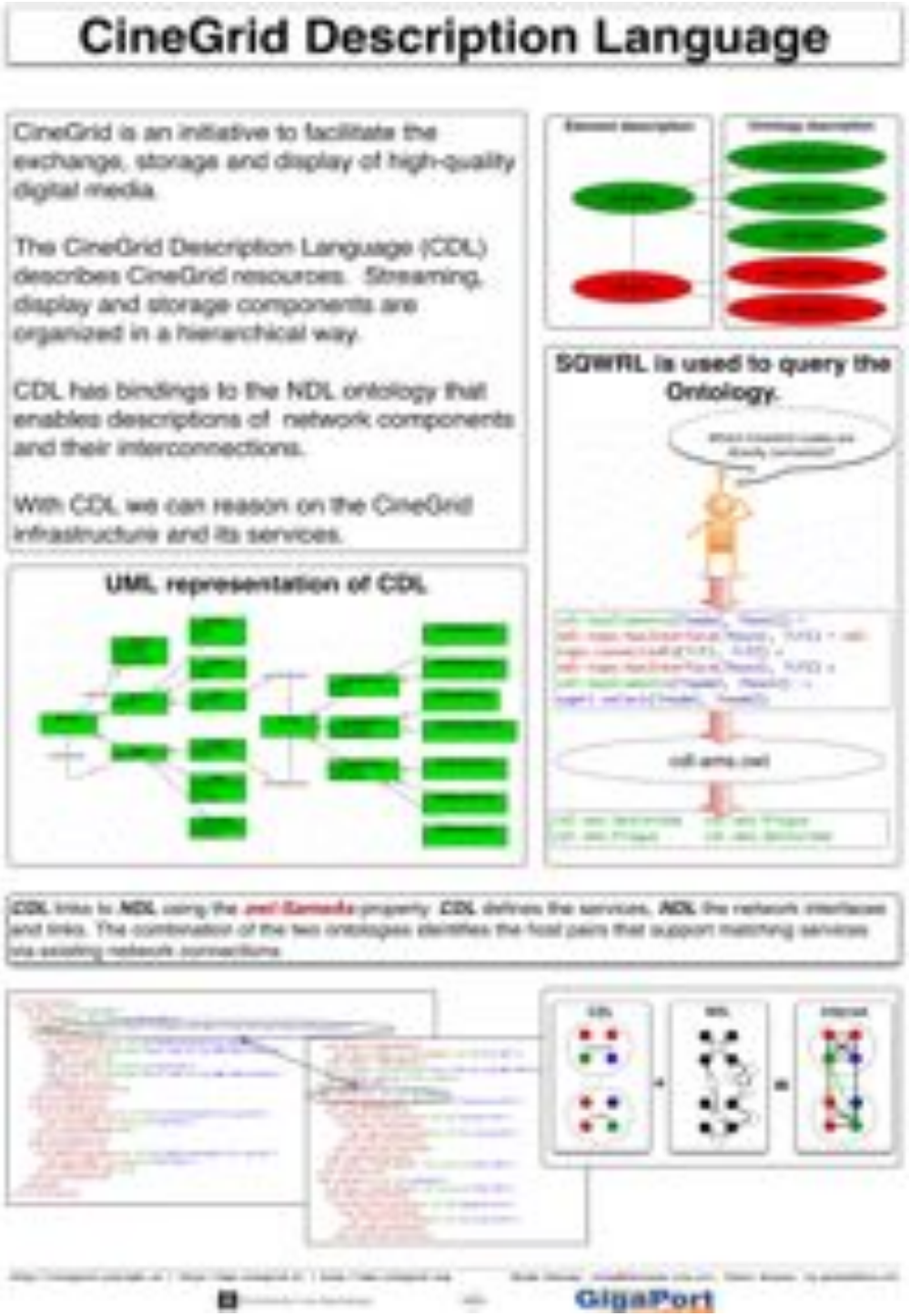
NorthernLight
NORDUnet 50Gb
Amsterdam
NetherLight
Hamburg
UKLight
London
Muenster
CESNET 10Gb
Aachen
Frankfurt
CzechLight
Prague
SURFnet
50Gb
Paris
DAS3-
Grid'5000
10Gb
CERN
Geneva
CERN/TIF
Barcelona
CATLight-i2CAT 10Gb


•VIZ
•DATA
Management
Backup
Mining
Media
Web2.0
Visualisation
Security
Meta
NetherLight
•BIGGRID
•SUPER

RDF describing Infrastructure
"I want"

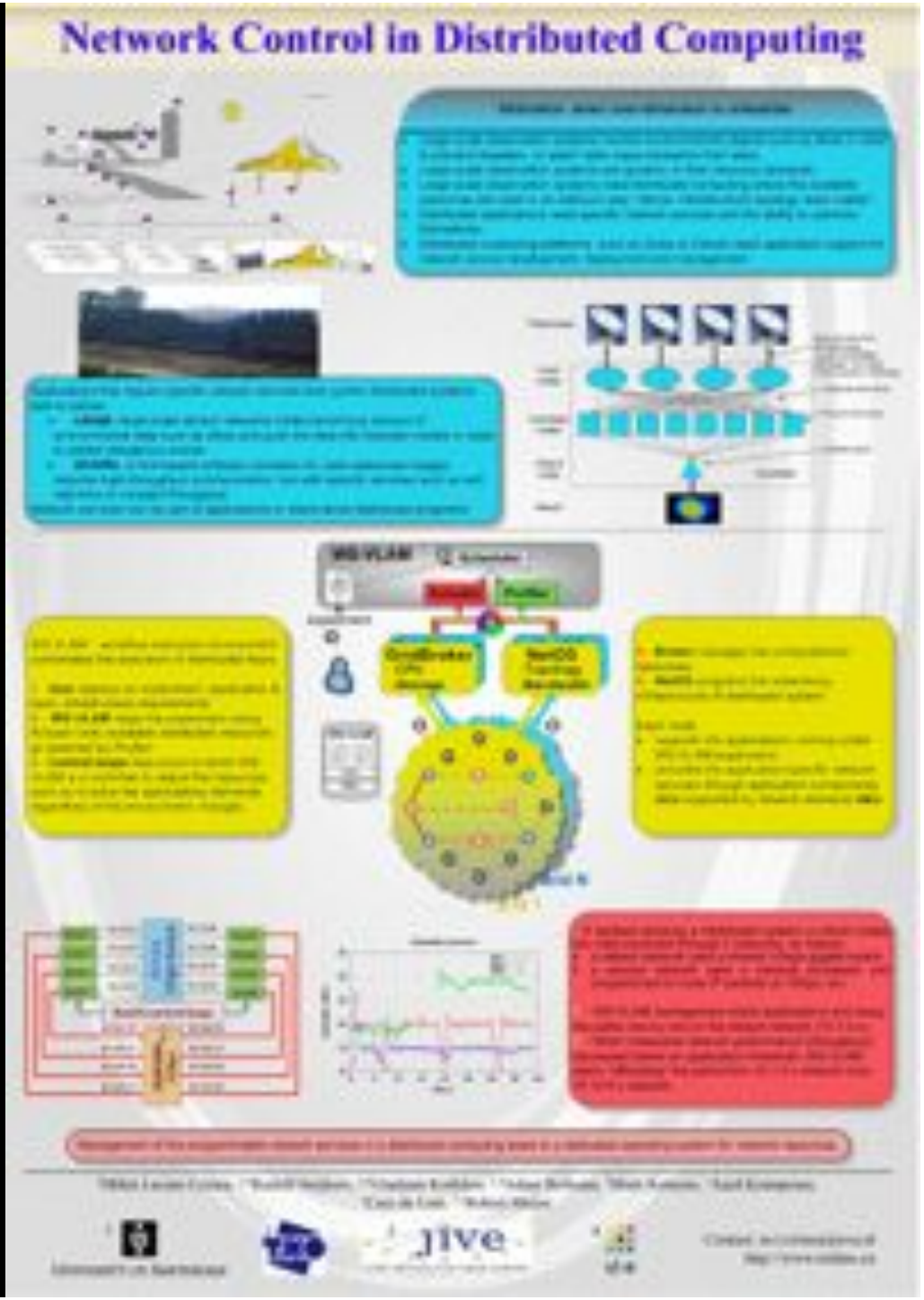


Applications and Networks become aware of each other!



Interactive programmable networks

SCARIe
Programmable networks to distribute work



Last Thoughts

- Energy consumption is the main issue
- Cloud Computing as solution
- We did Hybrid networking
  - now hybrid computing, what else?
- Network photonics developments

The Power of Change?

OR

The Change of Power!

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Questions ?