

# ICT & e-Science

**Cees de Laat**

GLIF.is & CineGrid.org founding member

**SURFnet**

**BSIK**

**NWO**

**EU**

**University of Amsterdam**

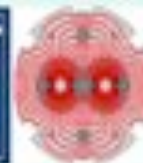
TNO  
NCF



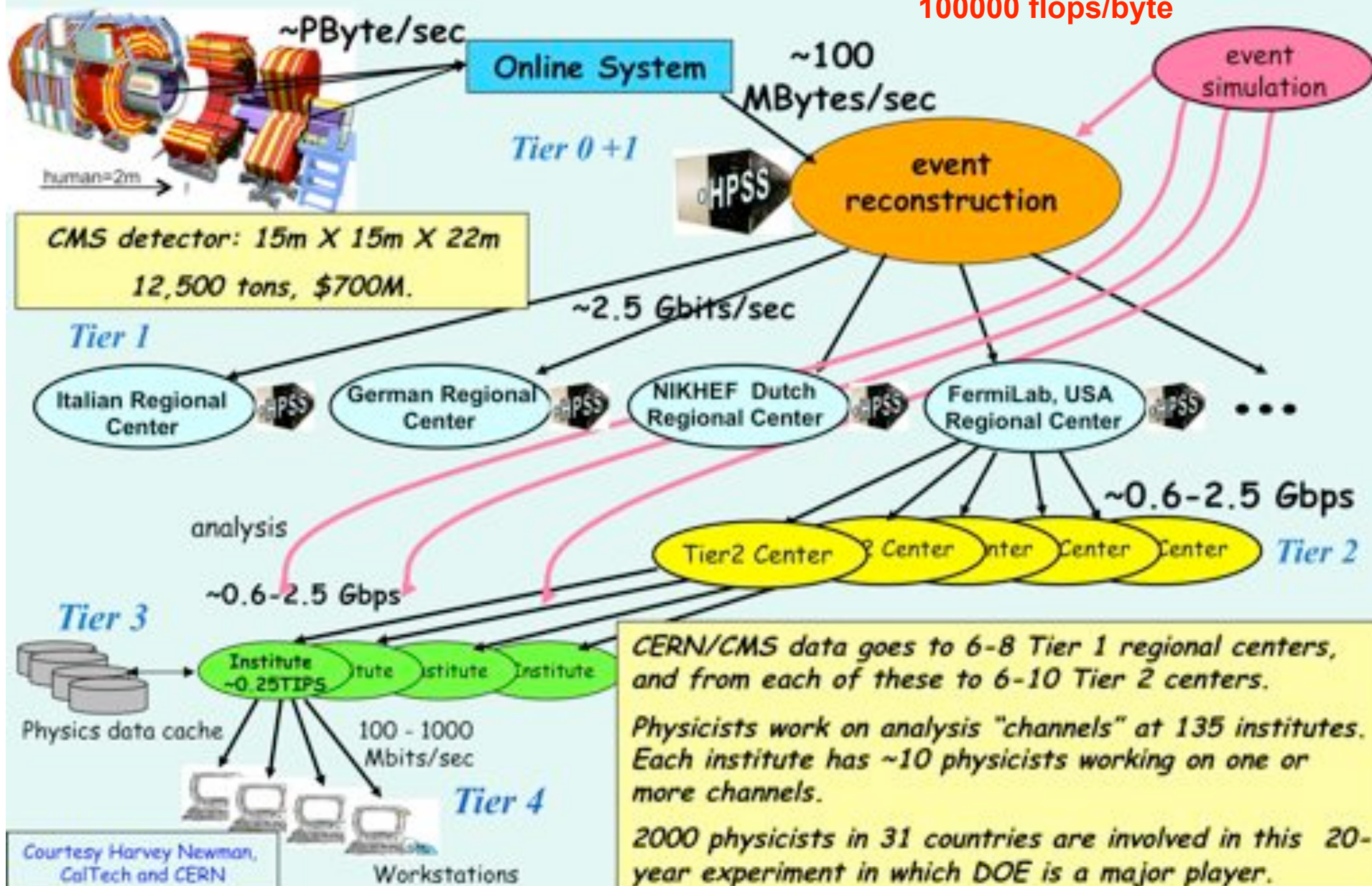


# LHC Data Grid Hierarchy

CMS as example, Atlas is similar



100000 flops/byte



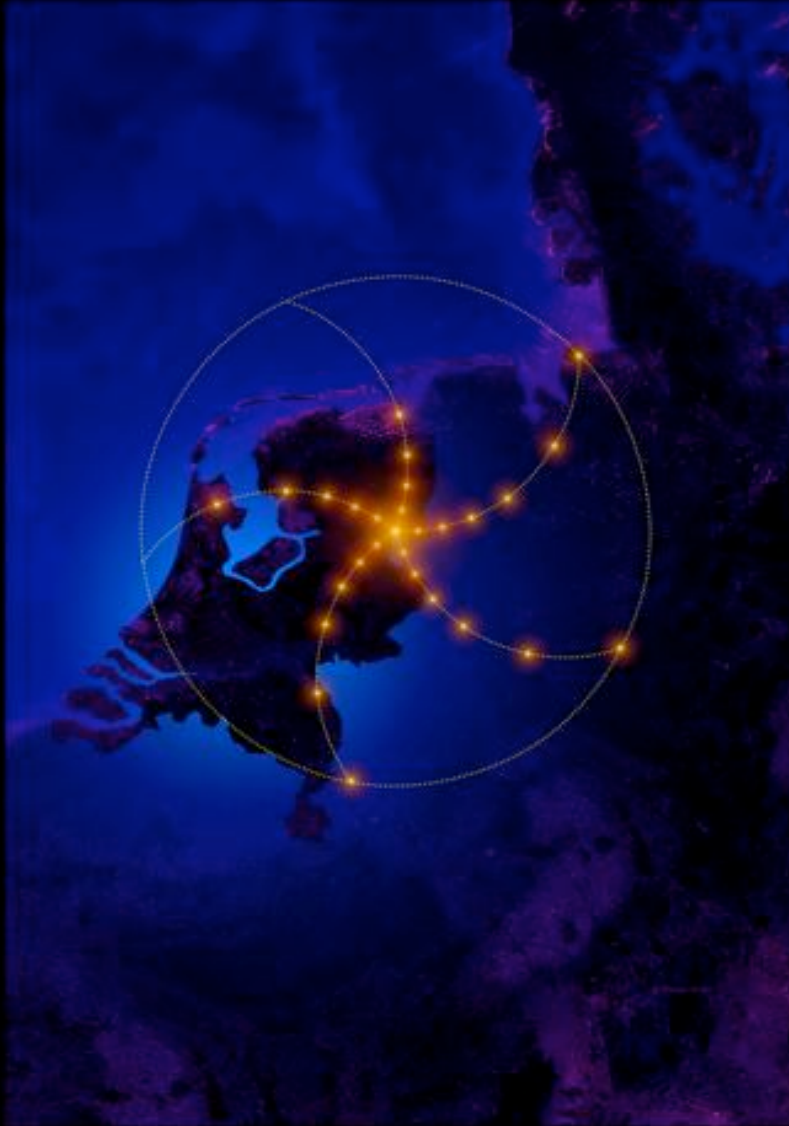
CERN/CMS data goes to 6-8 Tier 1 regional centers, and from each of these to 6-10 Tier 2 centers.

Physicists work on analysis "channels" at 135 institutes. Each institute has  $\sim 10$  physicists working on one or more channels.

2000 physicists in 31 countries are involved in this 20-year experiment in which DOE is a major player.

Courtesy Harvey Newman, CalTech and CERN

# LOFAR as a Sensor Network



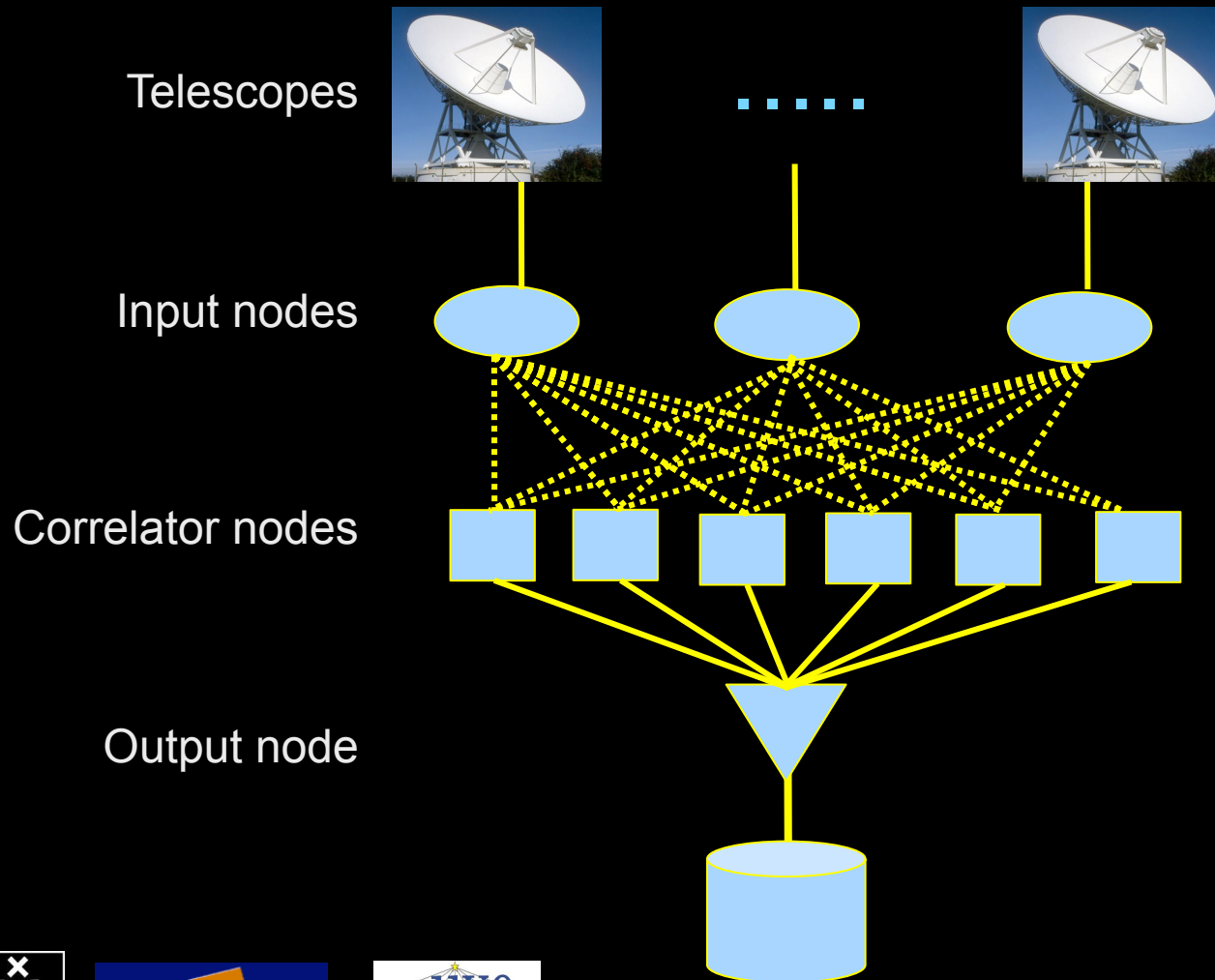
- LOFAR is a large distributed research infrastructure:
  - Astronomy:
    - >100 phased array stations
    - Combined in aperture synthesis array
    - 13,000 small “LF” antennas
    - 13,000 small “HF” tiles
  - Geophysics:
    - 18 vibration sensors per station
    - Infrasound detector per station
  - >20 Tbit/s generated digitally
  - >40 Tflop/s supercomputer
  - innovative software systems
    - new calibration approaches
    - full distributed control
    - VO and Grid integration
    - datamining and visualisation

10 flops/byte



# The SCARIE project

**SCARIE:** a research project to create a Software Correlator for e-VLBI.  
**VLBI Correlation:** signal processing technique to get high precision image from spatially distributed radio-telescope.



To equal the hardware correlator we need:

16 streams of 1Gbps

16 \* 1Gbps of data

2 Tflops CPU power

2 TFlop / 16 Gbps =

**1000 flops/byte**

**THIS IS A DATA FLOW PROBLEM !!!**



# The “Dead Cat” demo

SC2004 & iGrid2005

SC2004,  
Pittsburgh,  
Nov. 6 to 12, 2004  
iGrid2005,  
San Diego,  
sept. 2005

Produced by:  
Michael Scarpa  
Robert Belleman  
Peter Slood

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



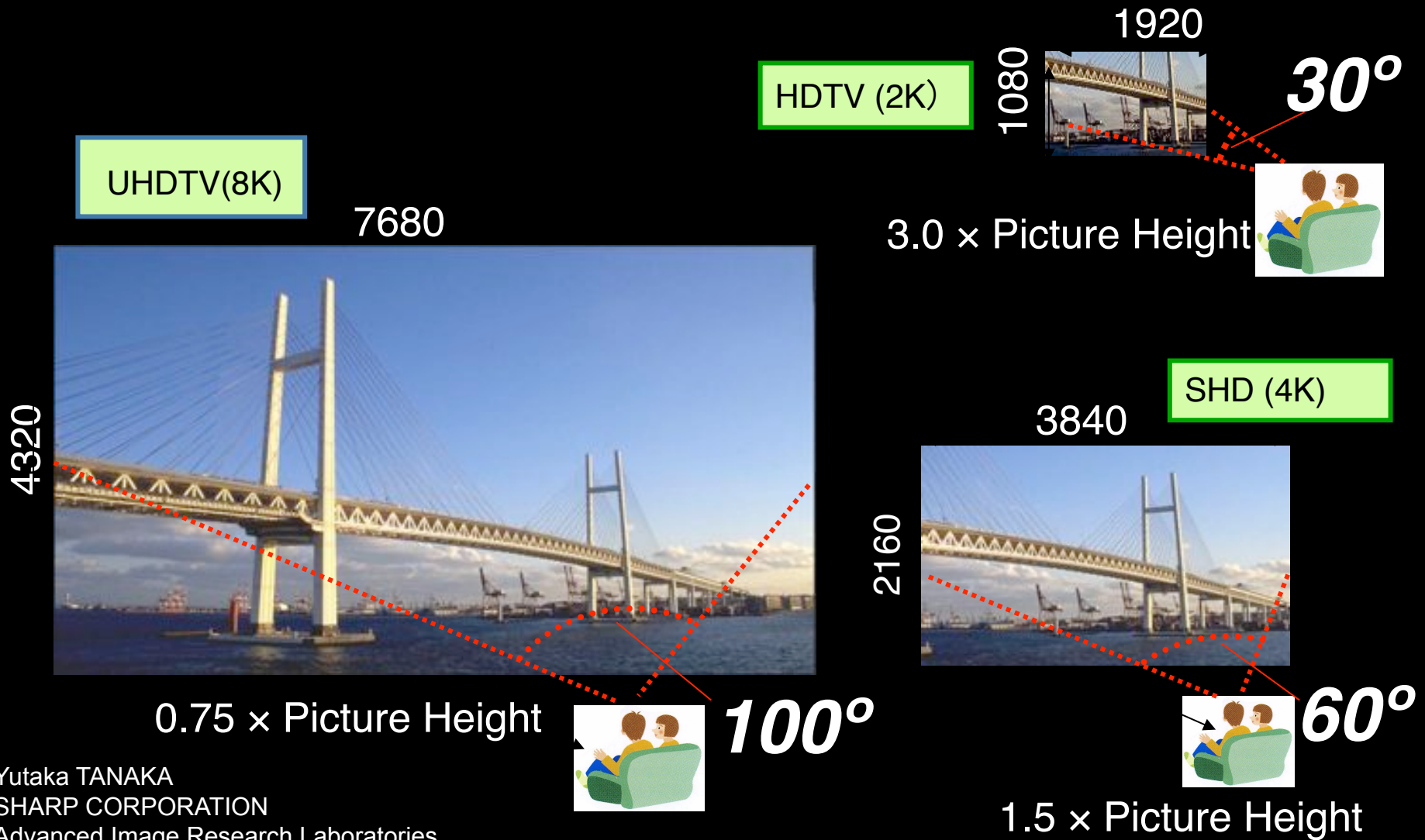


# CineGrid @ Holland Festival 2007



# Why is more resolution is better?

1. More Resolution Allows Closer Viewing of Larger Image
2. Closer Viewing of Larger Image Increases Viewing Angle
3. Increased Viewing Angle Produces Stronger Emotional Response



# CineGrid portal



CineGrid distribution center Amsterdam

[Home](#) | [About](#) | [Browse Content](#) | [cinegrid.org](#) | [cinegrid.nl](#)

## Amsterdam Node Status:

node41:  
Disk space used: 8 GiB  
Disk space available: 10 GiB

## Search node:

Search

## Browse by tag:

amsterdam animation  
[antonacci](#) blender boat  
bridge bunny cgi delta holland  
hollandfestival  
leidschestraat  
muziekgebouw  
nieuwmarkt opera prague ship  
train tram trains waag

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## CineGrid Amsterdam

Welcome to the Amsterdam CineGrid distribution node. Below are the latest additions of super-high-quality video to our node.

For more information about CineGrid and our efforts look at the about section.

## Latest Additions



### Wypke

Wypke

Available formats:

4k drc (4.0 KB)

Duration: 1 hour and 8 minutes

Created: 1 week, 2 days ago

Author: Wypke

Categories:



### Prague Train

Steam locomotive in Prague

Available formats:

4k drc (3.9 KB)

Duration: 27 hours and 46 minutes

Created: 1 week, 2 days ago

Author: CineGrid

Categories: delta prague train



### VLC: Big Buck Bunny

(C) copyright Blender Foundation | <http://www.bigbuckbunny.org>

Available formats:

1080p HPEG4 (1.1 GB)

Duration: 1 hour and 0 minutes

Created: 1 month, 1 week ago

Author: Blender Foundation

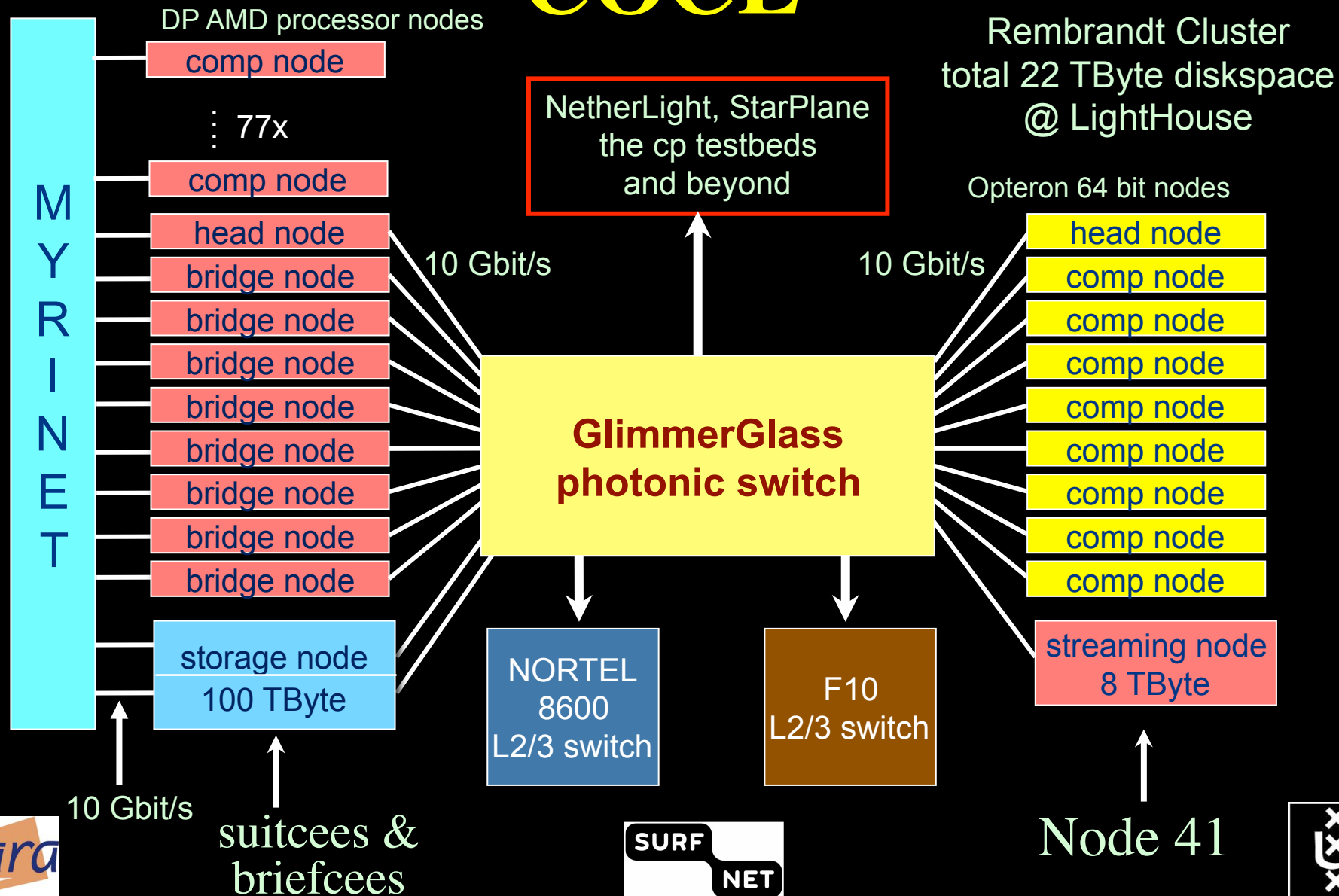
Categories: animation blender bunny  
cgi



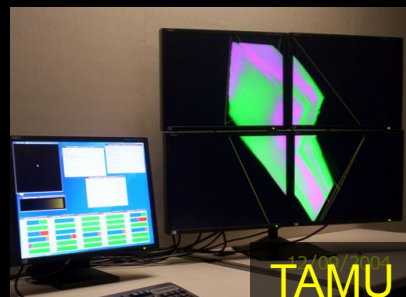
# Amsterdam CineGrid S/F node

DAS-3 @ UvA

## “COCE”



# US and International OptIPortal Sites





IJKDIJK



# Sensor grid: instrument the dikes

First controlled breach occurred on sept 27th '08:



**30000 sensors (microphones) to cover all Dutch dikes**

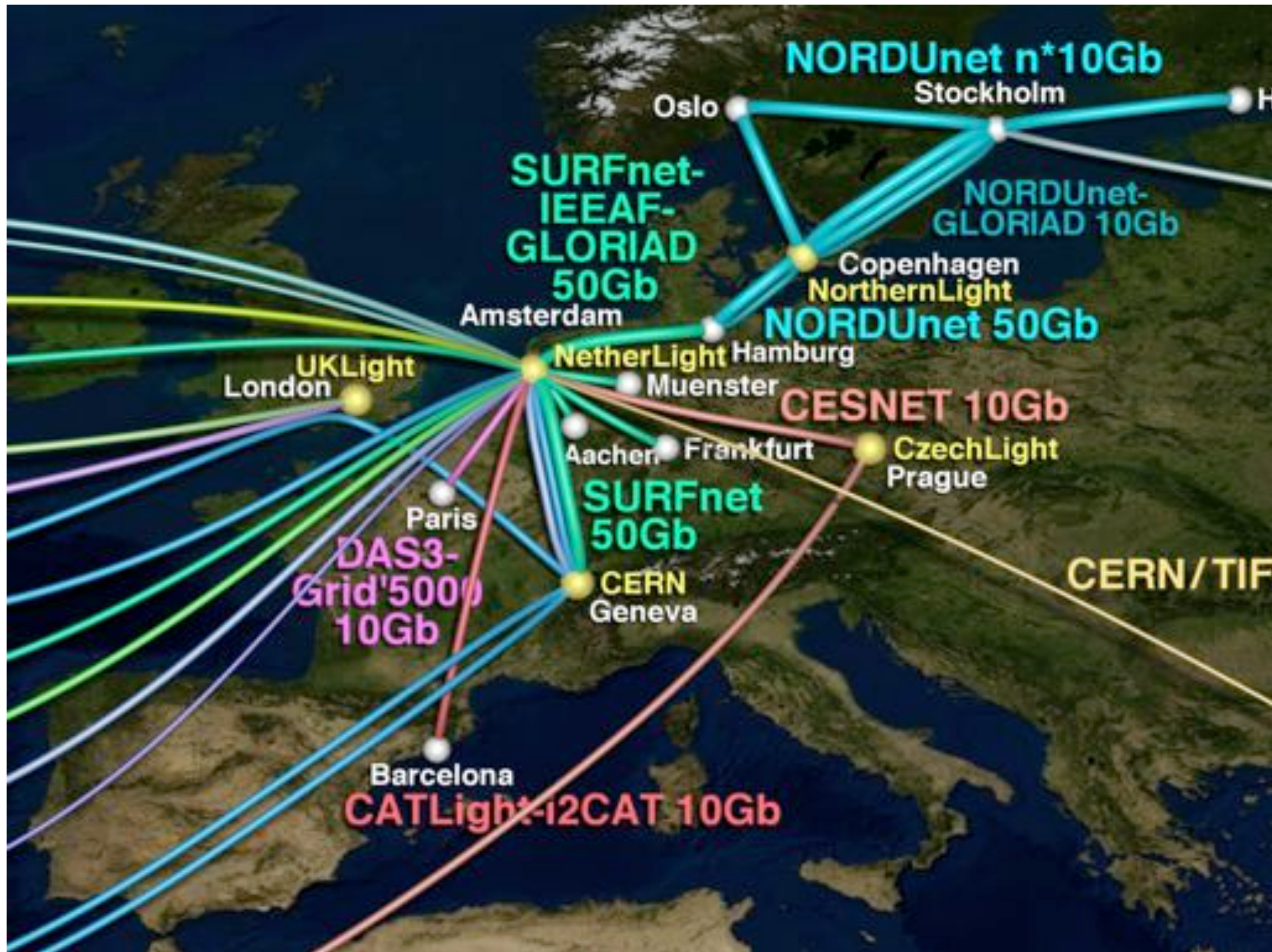




**GLIF 2008**

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





•VIZ

•DATA

NetherLight

•GRID

•SUPER

DataExploration

RemoteControl

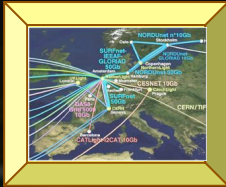
Management

Backup

TV

Medical

CineGrid



Gaming

Mining

Web2.0



Media

Visualisation

Conference

Meta

Security

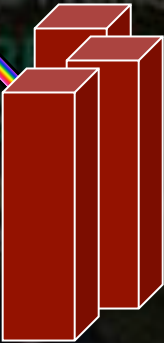
Workflow

Clouds



Distributed

EventProcessing



Simulations

StreamProcessing

Predictions





In The Netherlands SURFnet connects between 180:

- universities;
- academic hospitals;
- most polytechnics;
- research centers.

with an indirect ~750K user base

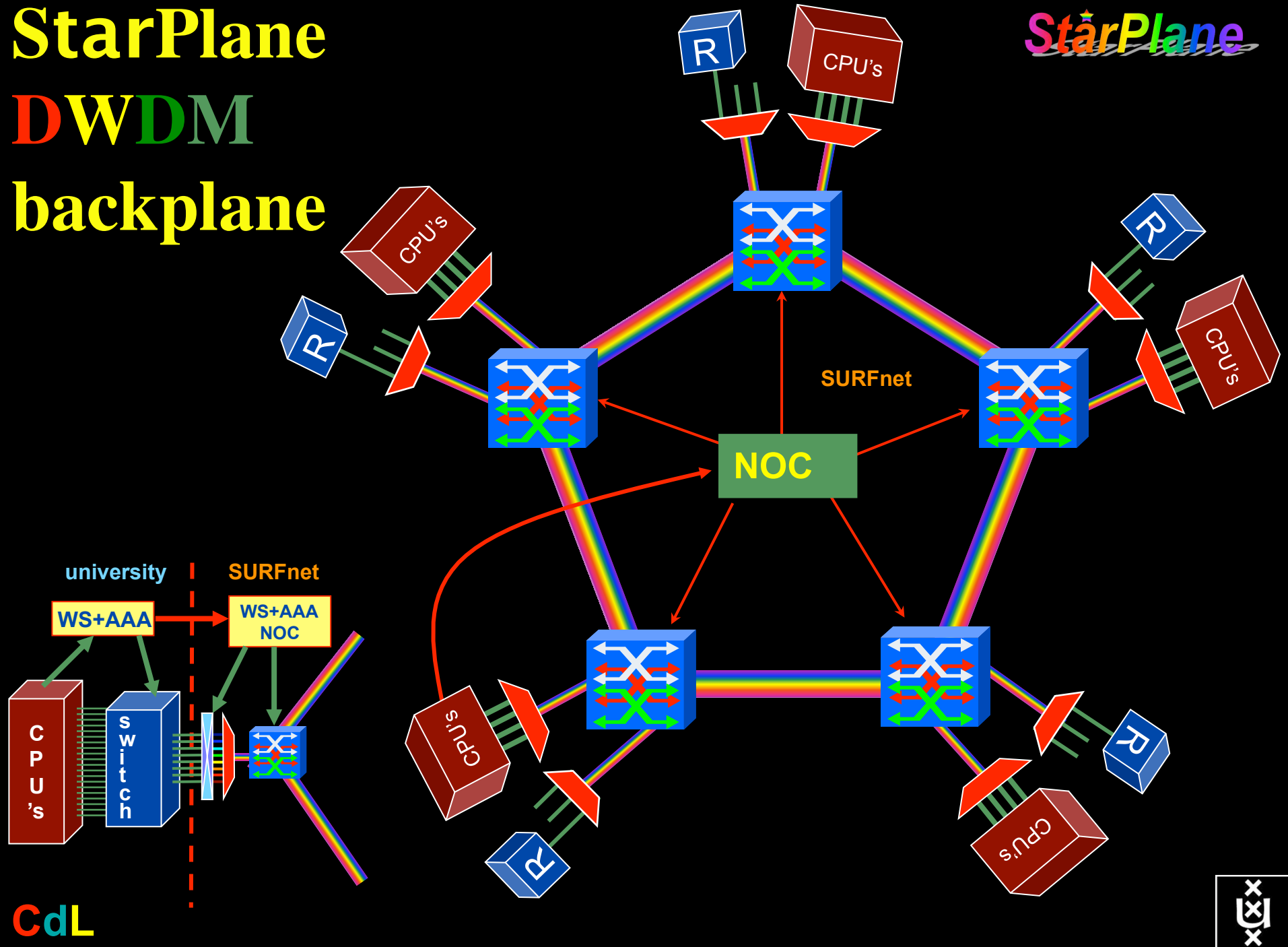
~ 8860 km  
scale  
comparable  
to railway  
system





# StarPlane DWDM backplane

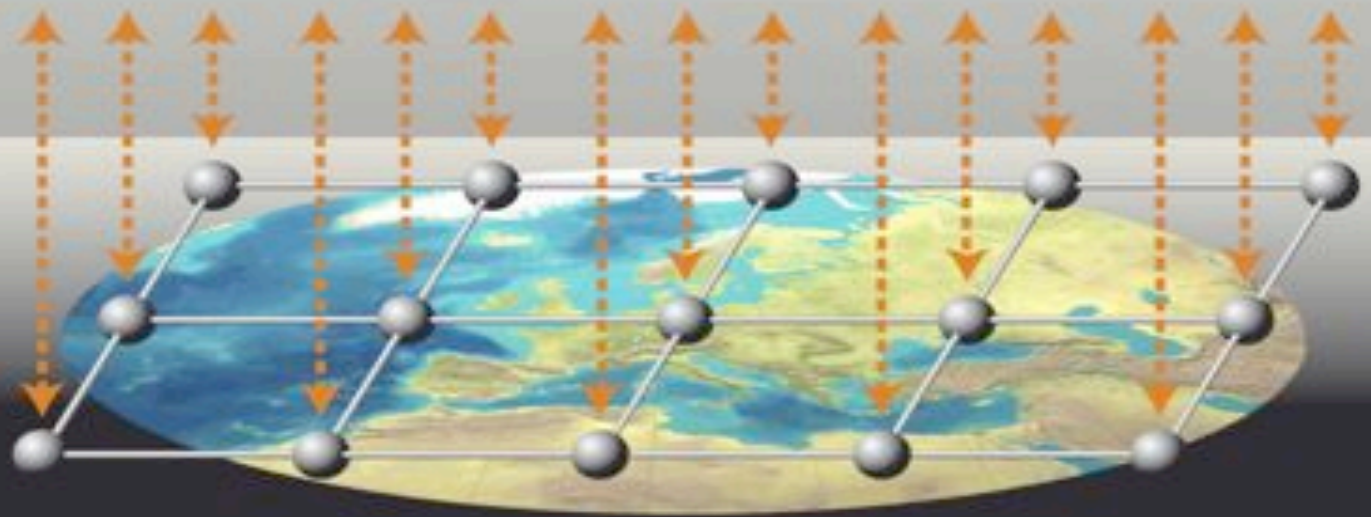
StarPlane



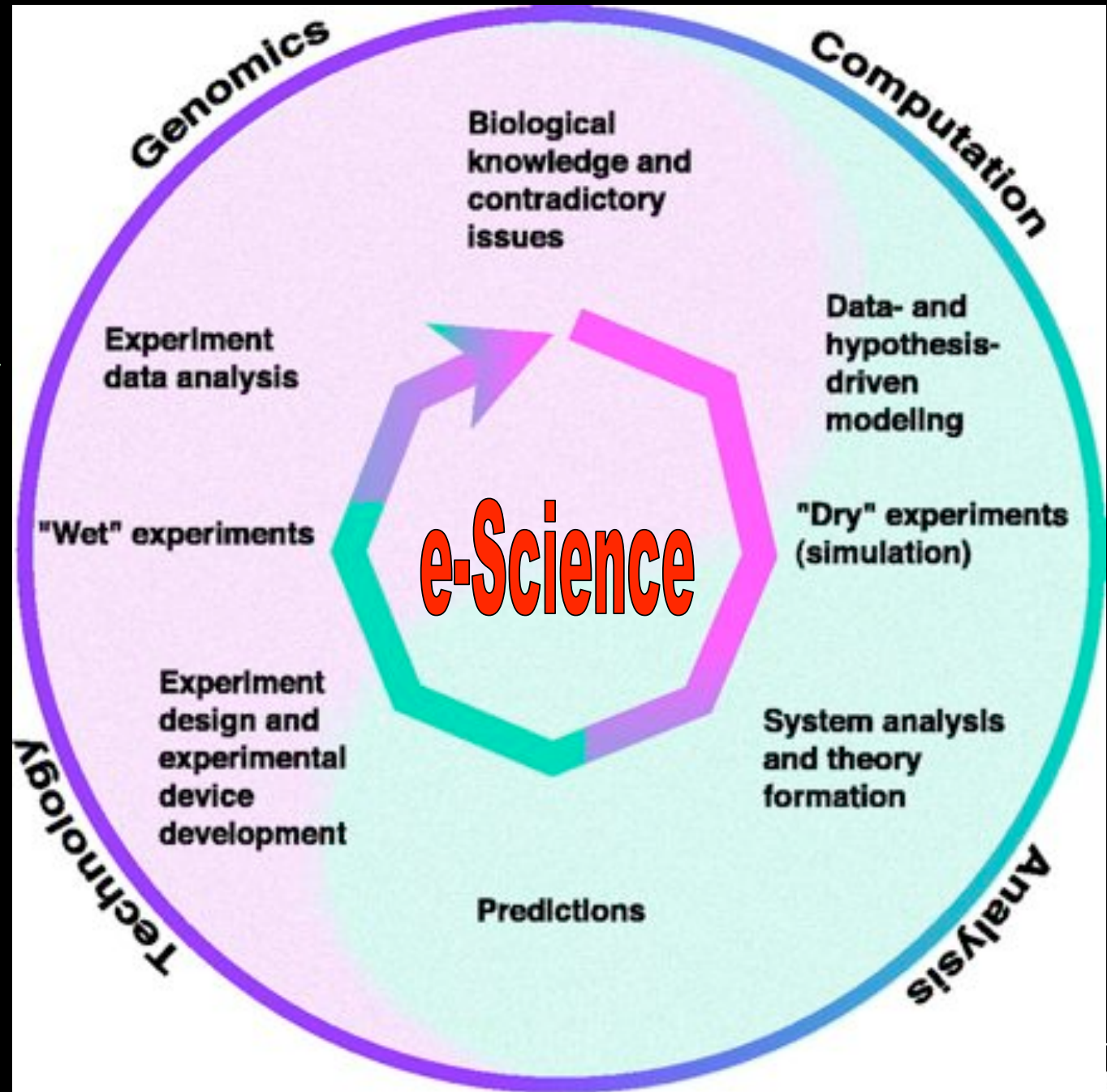


**Virtual Laboratory  
generic e-Science services**

**High Performance & Distributed Computing  
Web & Grid services**



# e-Science toegepast in biologie



# Waarom e-Science?



- ICT probleem voor wetenschap, Industrie en maatschappij
  - Er wordt heel veel data verzameld
    - LOFAR, CEKN, Life sciences, Earth sciences, etc
  - Er wordt heel veel data gegenereerd
    - Klimaatmodellen, watermanagement, drugdesign, etc
    - Simulaties van ‘catastrofes’ die niet experimenteel getoetst kunnen worden i.v.m. Veiligheid, complexiteit, capaciteit en/of kosten
  - Nieuwe vormen van wetenschap
    - Interdisciplinair: Impact van High Throughput techniques (sequencing) in biologie, MRI in medische wetenschappen en farmacie
    - Science 2.0
- Nu Inefficiënt: ieder domein (biologen, chemici, etc.) vindt het wiel opnieuw uit.
  - Geen kennisoverdracht op gebied van techniek en methoden
  - Te beperkte interdisciplinair onderzoek
  - Te weinig professionele ICT support waardoor er kostbare ‘science’ tijd verloren gaat
  - Door te weinig gebruik van ICT in onderzoek kunnen we, op een aantal gebieden, de aansluiting bij de wereld gaan missen.

# Problemen

- Coördinatie activiteiten
- Te weinig interdisciplinaire samenwerking
- Gekwalificeerd personeel
- Financiering
  - NWO etc zijn klassiek discipline georganiseerd
  - Nationale infrastructuur vereist nationale fondsen
  - Structureel geld en niet alleen impuls (core)
- Status. Science of Engineering?
- Mensen, met kennis van Science en ICT.
  - > Zijn belangrijker dan Computers!

# n.a.v. interview met Kees Neggers (SURFnet) & Cees de Laat (UvA)



- BSIK projects GigaPort &
- VL-e / e-Science



[cookreport.com](http://cookreport.com)

## ICT and E-Science as an Innovation Platform in The Netherlands

### A National Research and Innovation Network

### What Can the US Learn from Dutch Experience?

"The dogmas of the quiet past are inadequate to the stormy present. As our case is new, so we must think anew and act anew." Abraham Lincoln

By means of an examination of research networks in Holland, this issue presents some ideas for ways in which an American National Research, Education and Innovation Network could be structured.

possible are carried out by decentralized groups.

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THE COOK REPORT ON INTERNET PROTOCOL

FEBRUARY 2009

## The Basis for a Future Internet?

### Optical Hybrid Networks and e-Science as Platforms for Innovation and Tech Transfer

**Editor's Note:** I continued the discussion begun on No-

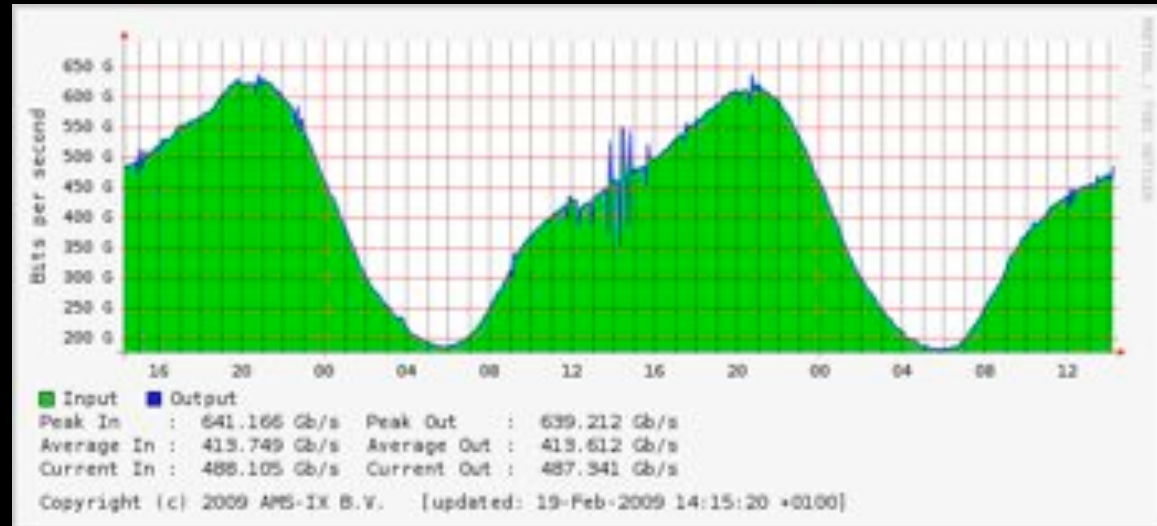
slide shows our organization within the University and the

search department of KPN. He did a lot of virtualization

# Example: Network Research for next years

Some themes:

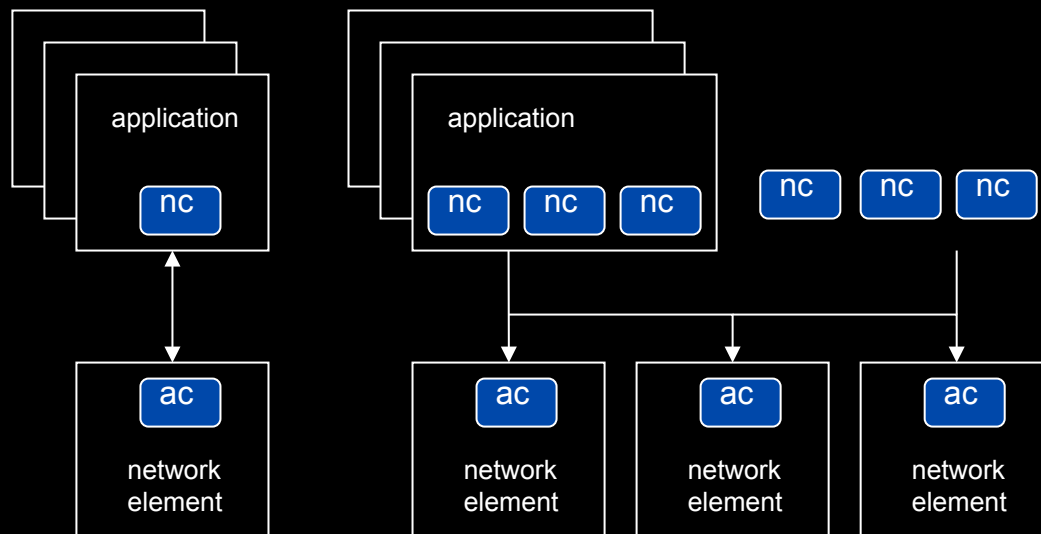
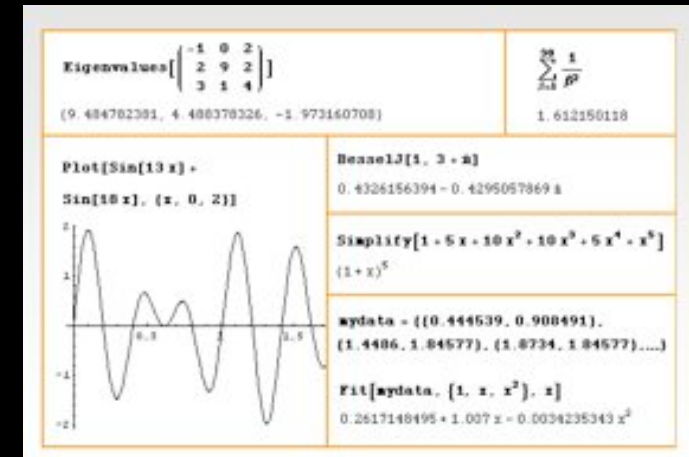
- Terabit Networks
- Green-Light
- Cloud Data - Computing
- Reasoning about services
- eScience integrated services
- Data and Media specific services
- Network modeling and simulation
- Cross domain Alien Light switching
- Web Services based Authorization
- Network Services Interface (N-S and E-W)
-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



Needs dirty  
Laboratoria

# User Programmable Virtualized Networks allows the results of decades of computer science to handle the complexities of application specific networking.

- The network is virtualized as a collection of resources
- UPVNs enable network resources to be programmed as part of the application
- Mathematica, a powerful mathematical software system, can interact with real networks using UPVNs





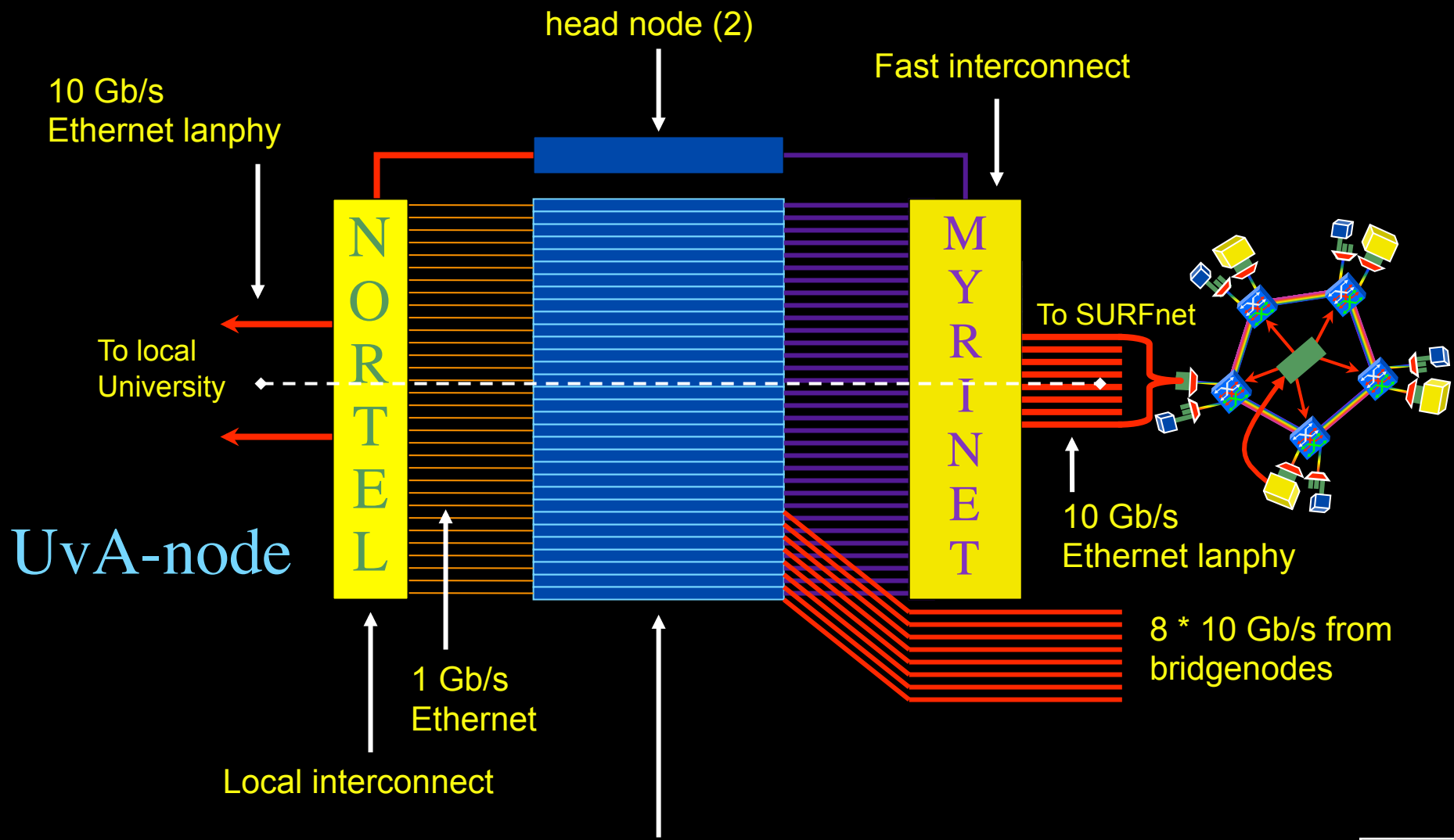
# Interactive programmable networks



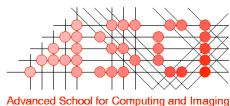
# Our Christmas Trees ☺



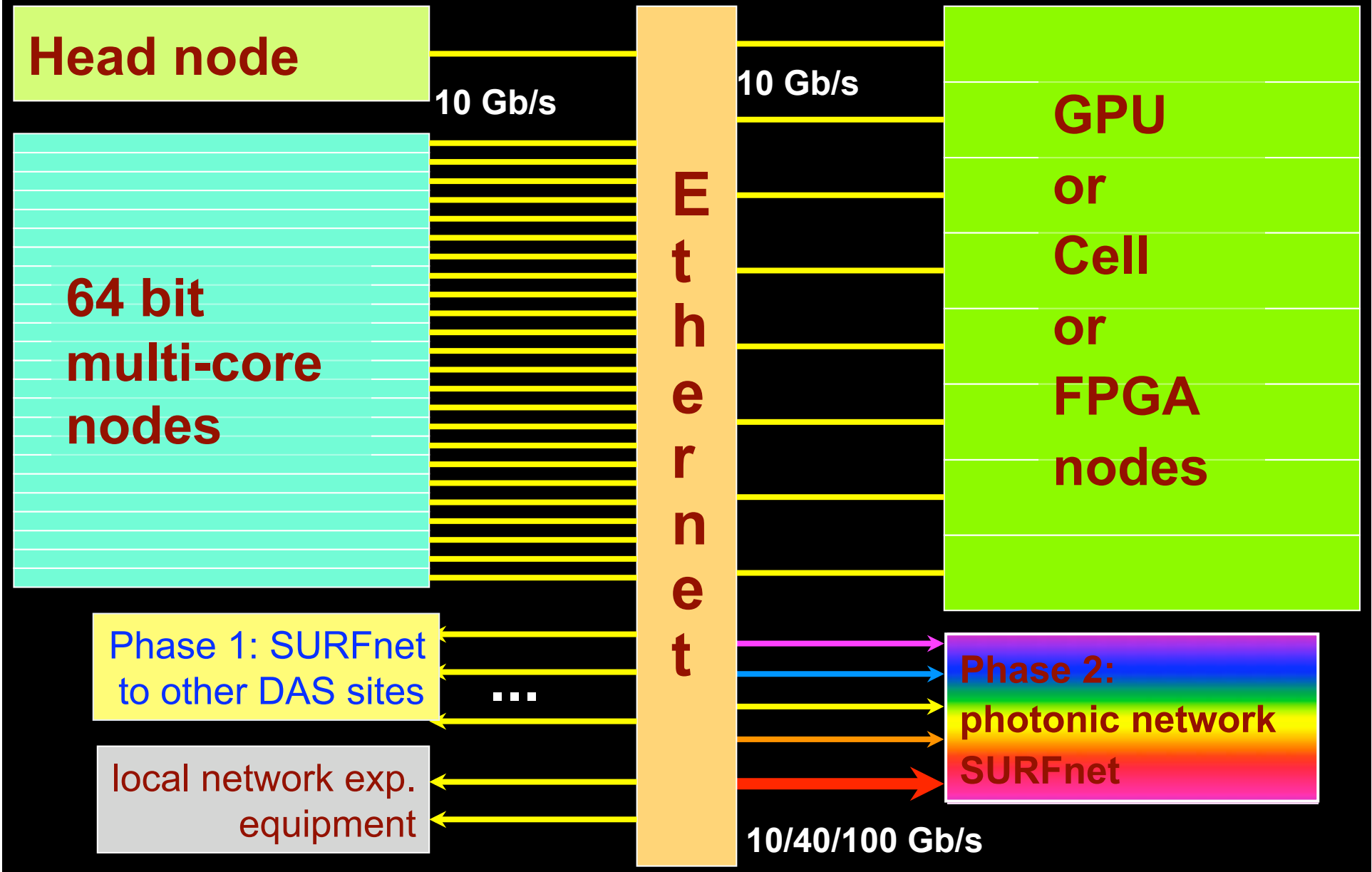
# DAS-3 Cluster Architecture



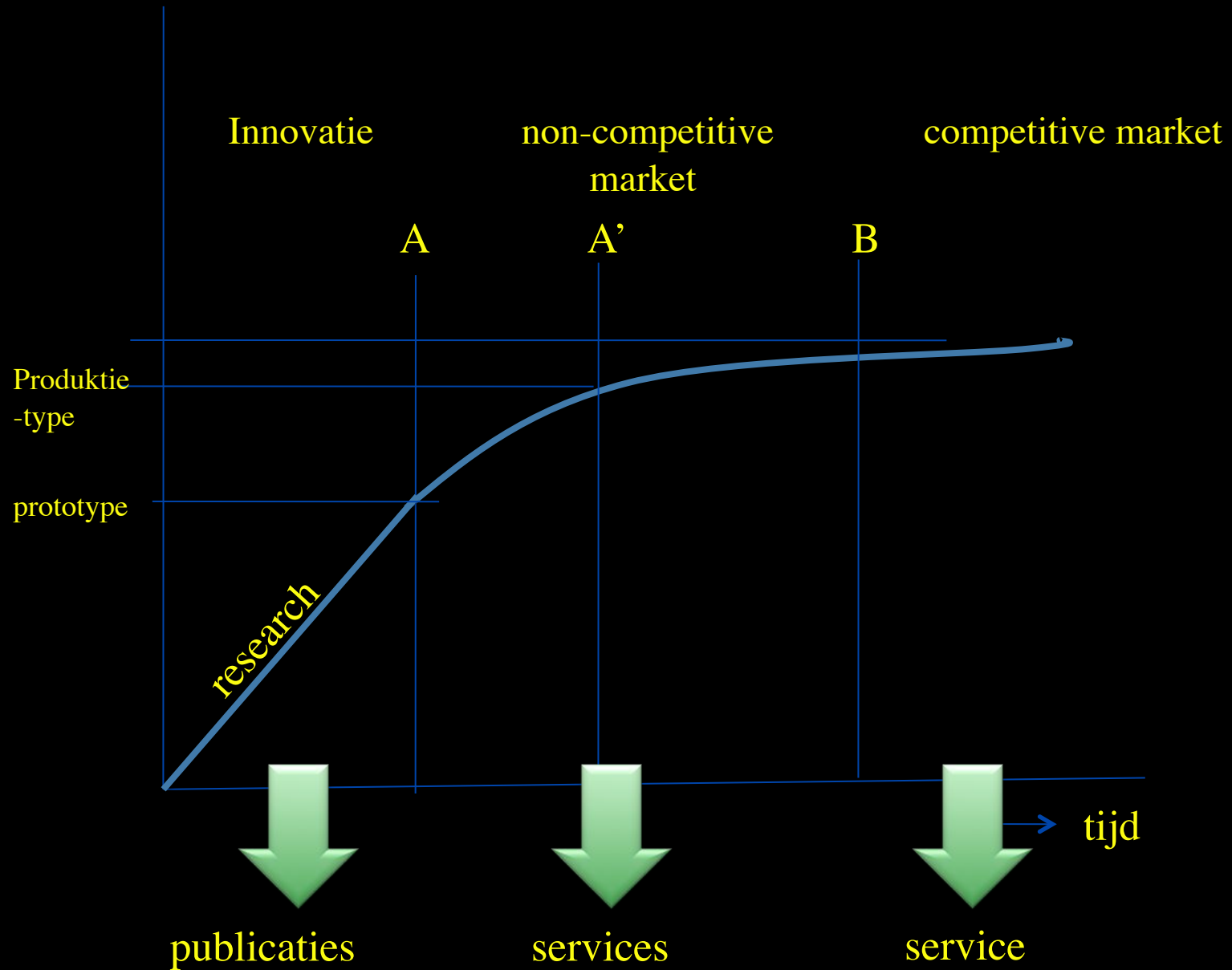
85 (40+45) compute nodes

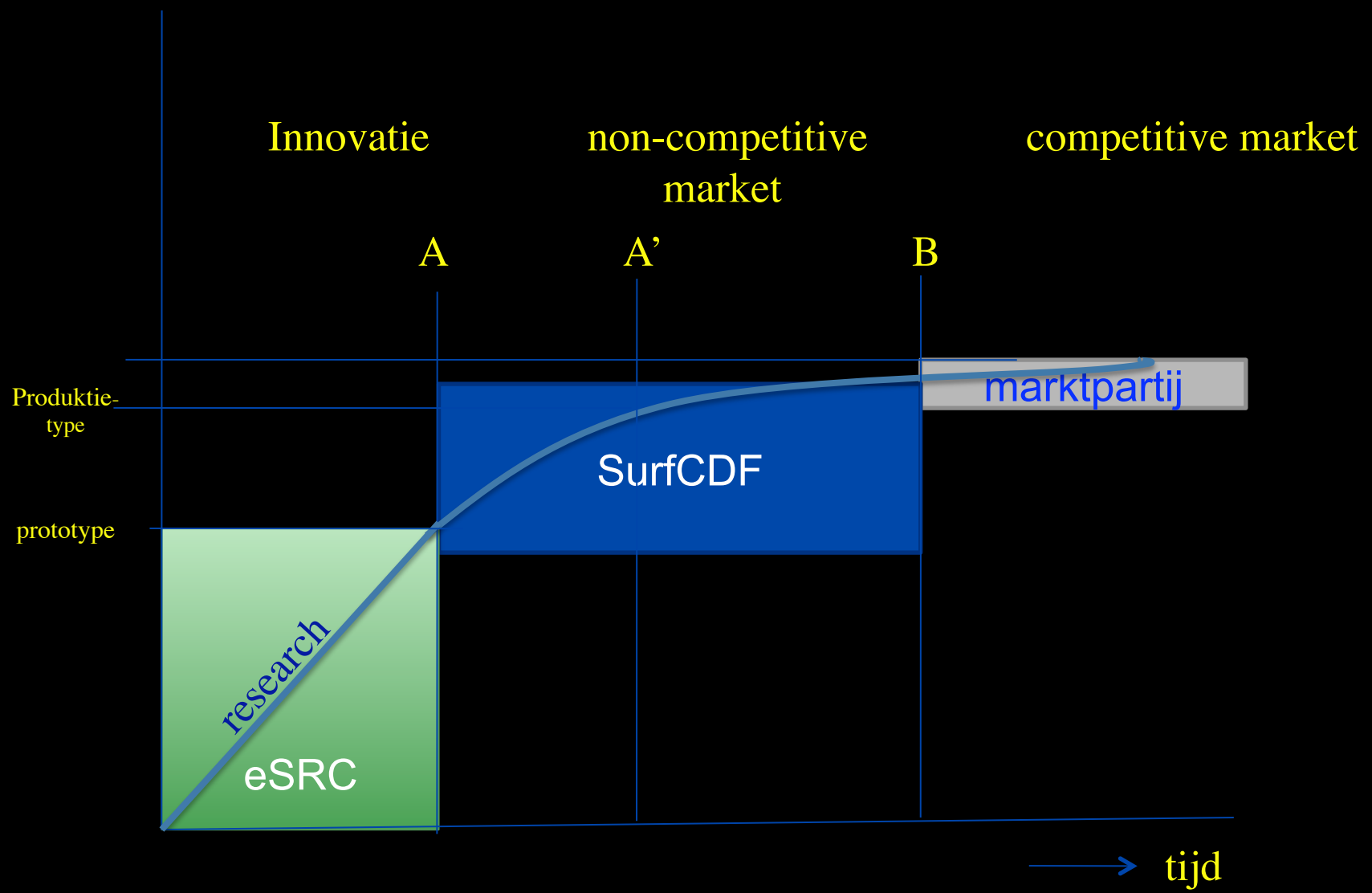


# DAS-4 Proposed Architecture



# OUTPUT





# ATG

- Stands for Advanced Technology Group
- Created in 2005 on initiative of Hans Dijkman & CdL
- Aims to keep state of the art knowledge on computing, data and networks
- Participates in international experiments
  - CineGrid, OptIPuter, SC0x, Phosphorus, ...
- Participates in workshops to keep frontier knowledge
  - GigaPort, Terena Task Force meetings, SCInet, ...
- Participates in SURFnet CERT
- Liaison function for knowledge transfer to IC

# Onwards!

- We aim for extreme [comp,data,net,viz] experiments!
- Computer & Computational & e- Science needs open and unrestricted environments for experimentation with ICT!
- Our laboratory must be very well connected!
- Our laboratory must be easy accessible and nearby!
- Participation in master education.
- We need ATG type participation from IC to build & operate & utilize our laboratory!
- We need to be able to break things!

If we never broke something we did not try  
hard enough!





# *Questions ?*

Thanks: Paola Grosso & Henri Bal & Hans Dijkman & Bob Hertzberger  
& Jeroen vd Ham & Freek Dijkstra & team for several of the slides.