Intelligence to the Edge

Cees de Laat

University of Amsterdam

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Contents of this talk

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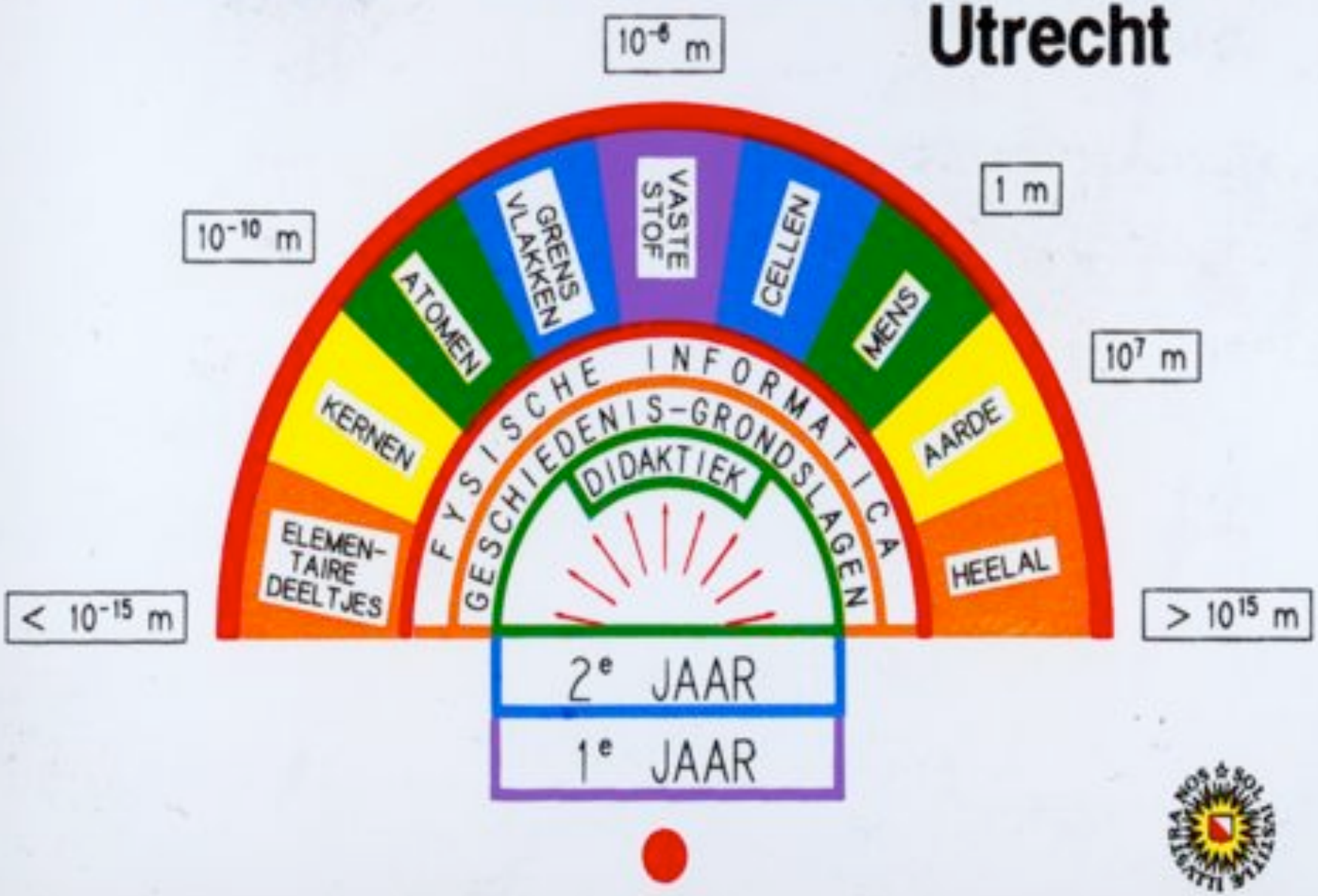
NATUUR- EN STERRENKUNDE

Utrecht



History of WFI

- Specification languages
- Computational Physics
- Advanced Electronics
- Neural Networks
- Computer based learning
- High performance and distributed computing
- Data Acquisition Systems
- Advanced networking
- Internet Applications

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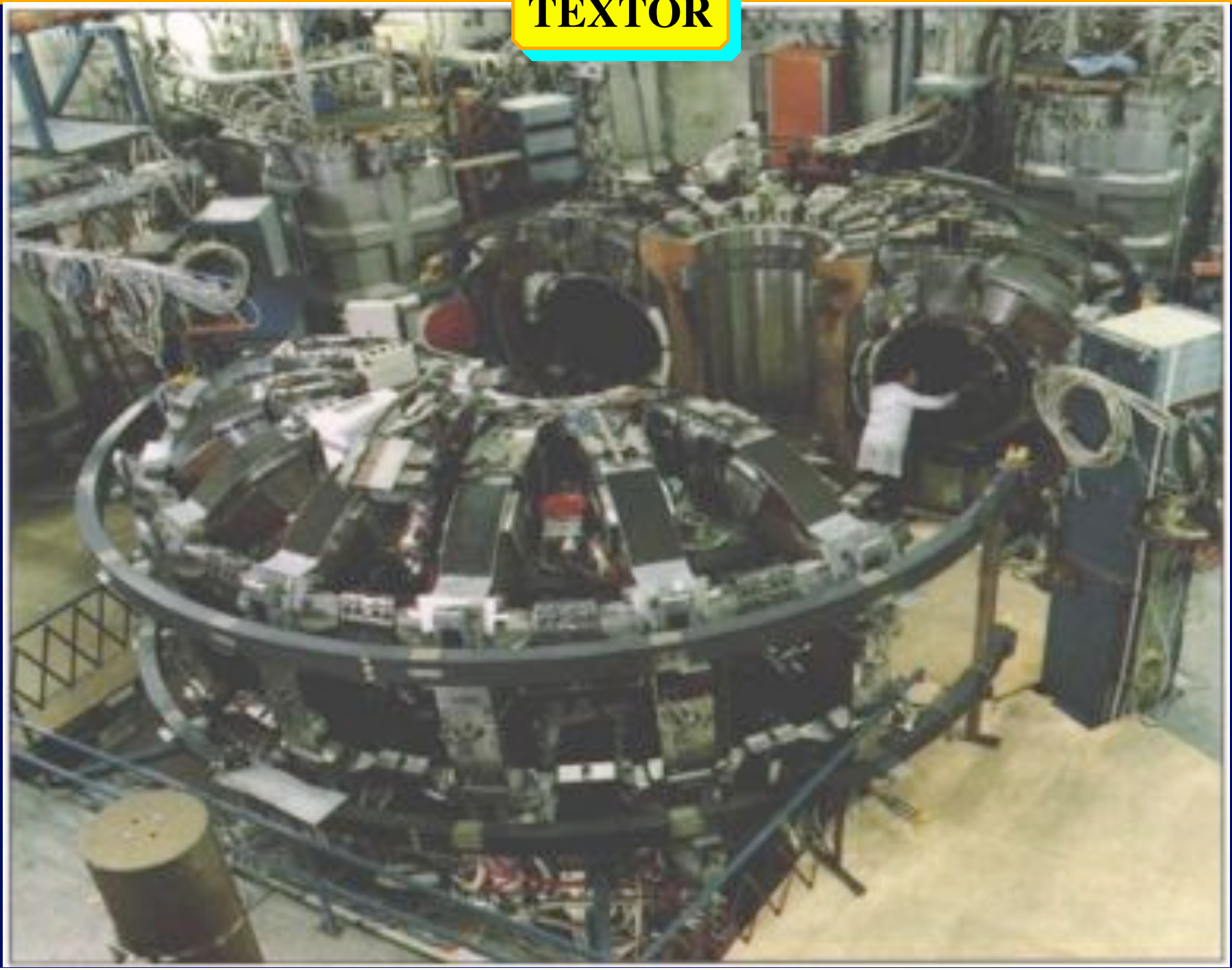
- **Advanced networking**
- **Internet Applications**

TEXTOR

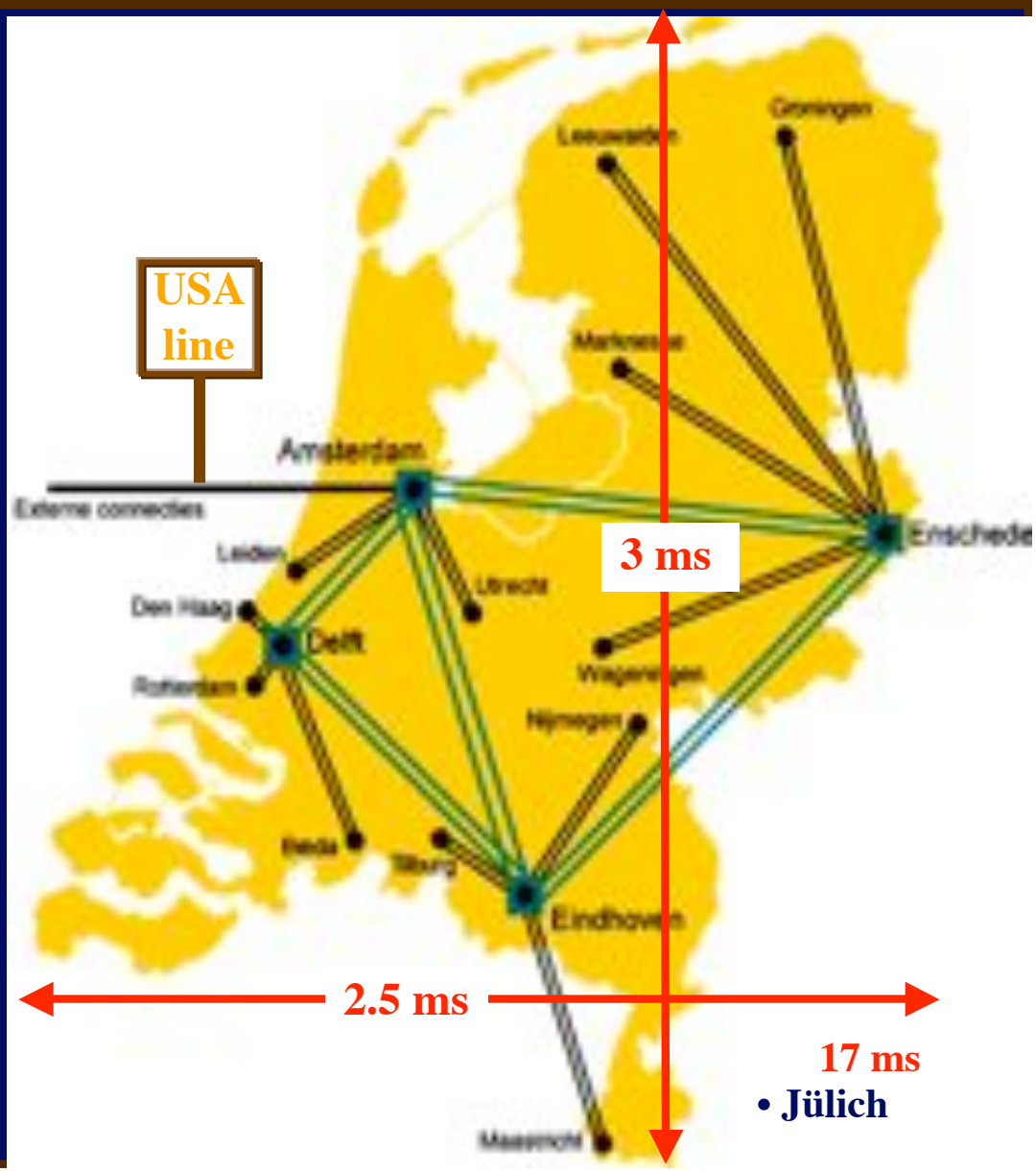


- **EU project REMOT / DYNACORE**
  - Collaboratories, virtual control rooms
  - Support science at the home institutes
  - Groupware, Videoconference tools point to point and point to multipoint
  - Corba services, distributed object db
  - www.phys.uu.nl/~dynacore

Multi Kingdom Problems

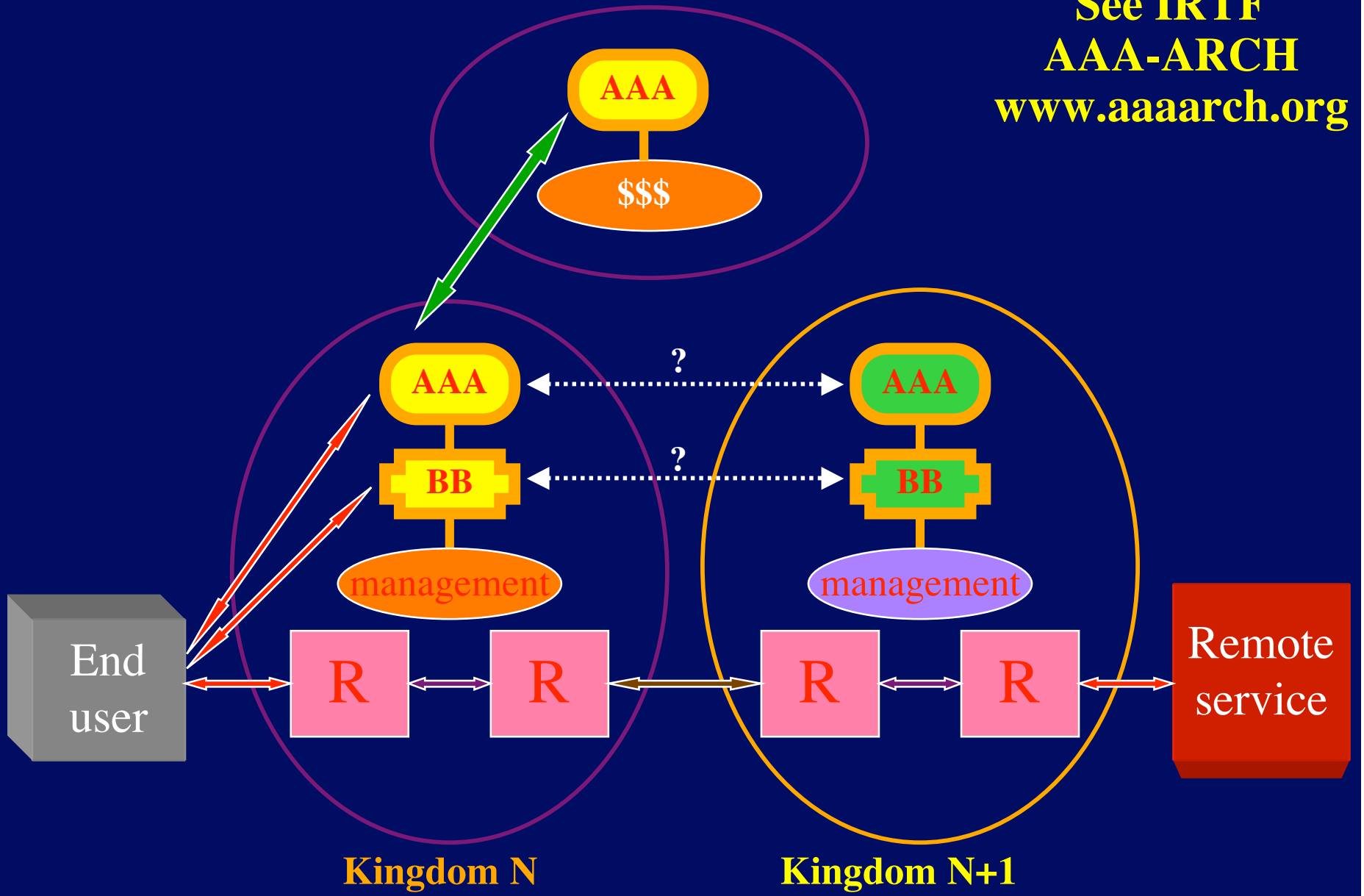
Physics-UU to IPP-FZJ => 7 kingdoms

- Netherlands
  - » Physics dept
  - » Campus net
  - » SURFnet
- Europe
  - » TEN 155
- Germany
  - » WINS/DFN
  - » Juelich, Campus
  - » Plasma Physics dept



The need for AAA

See IRTF AAA-ARCH www.aaaarch.org



Policy based networking example

Experiment

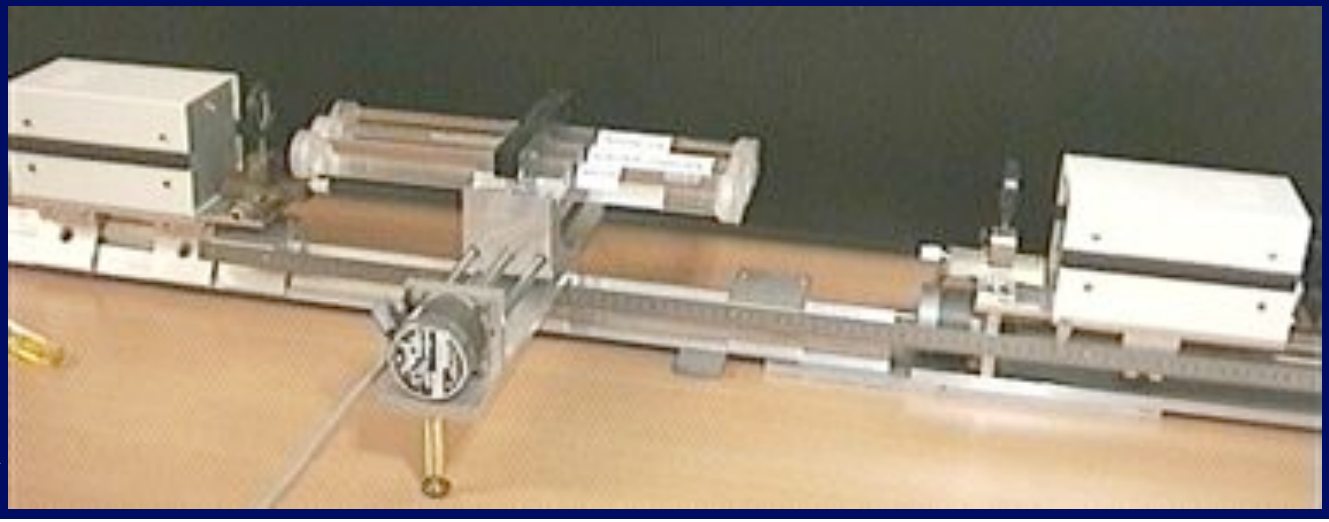
Pc

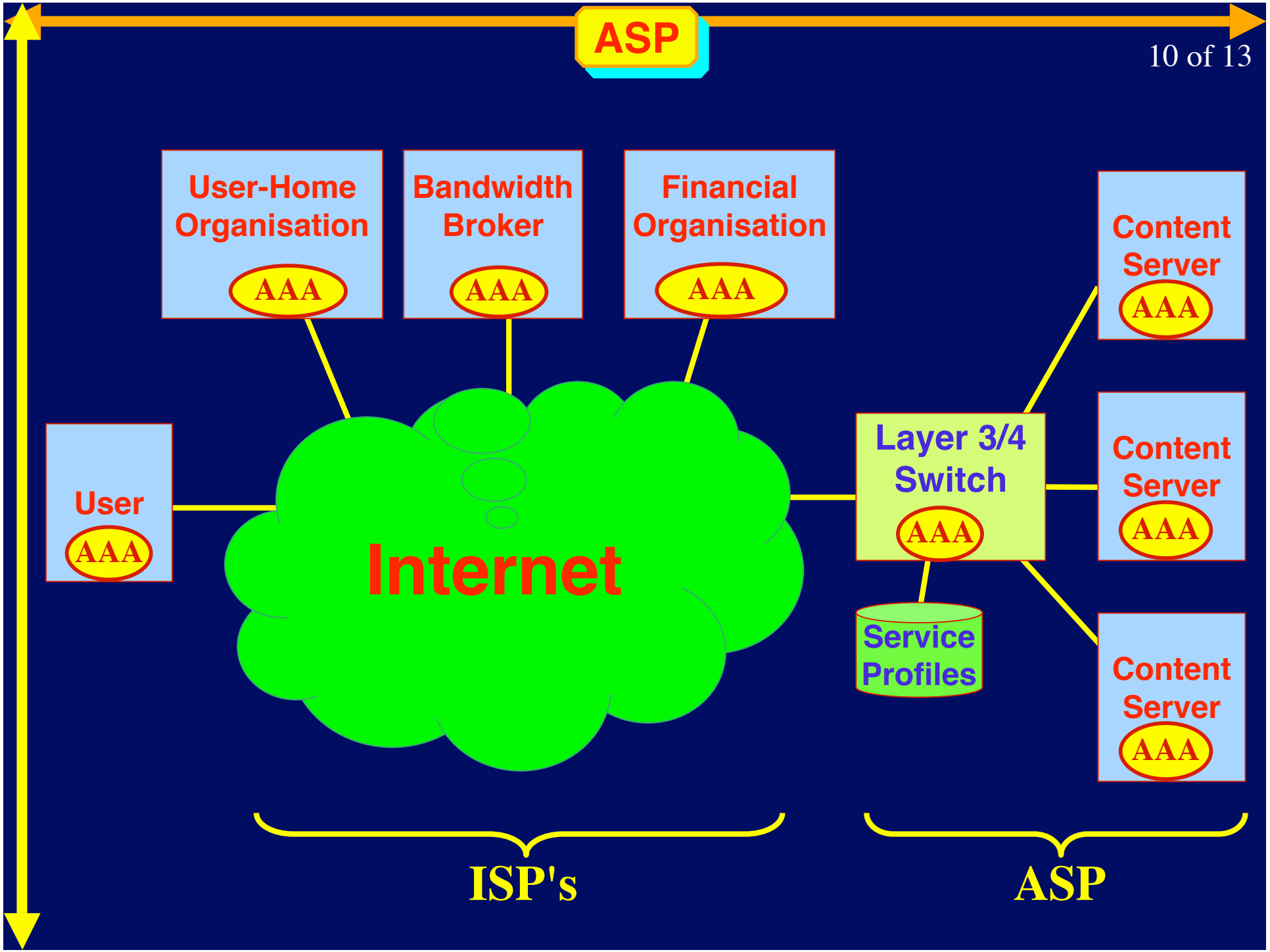
Camera

Macintosh

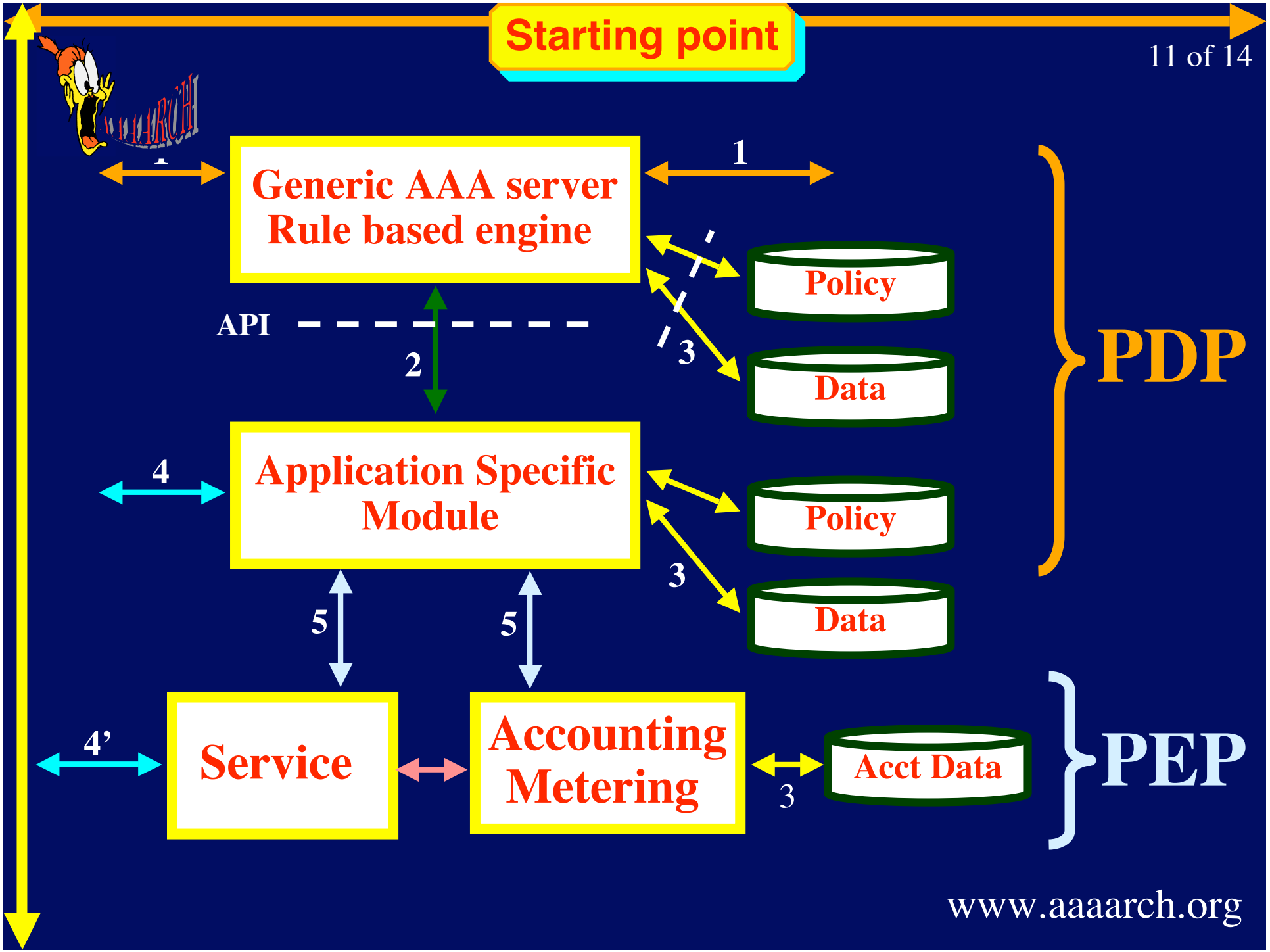
Policy based networking switch with > layer 4 AAA functionality

AAA




ASP
User-Home Organisation
AAA
Bandwidth Broker
AAA
Financial Organisation
AAA
Content Server
AAA
User
AAA
Internet
Layer 3/4 Switch
AAA
Content Server
AAA
Service Profiles
Content Server
AAA
ISP's
ASP

Starting point

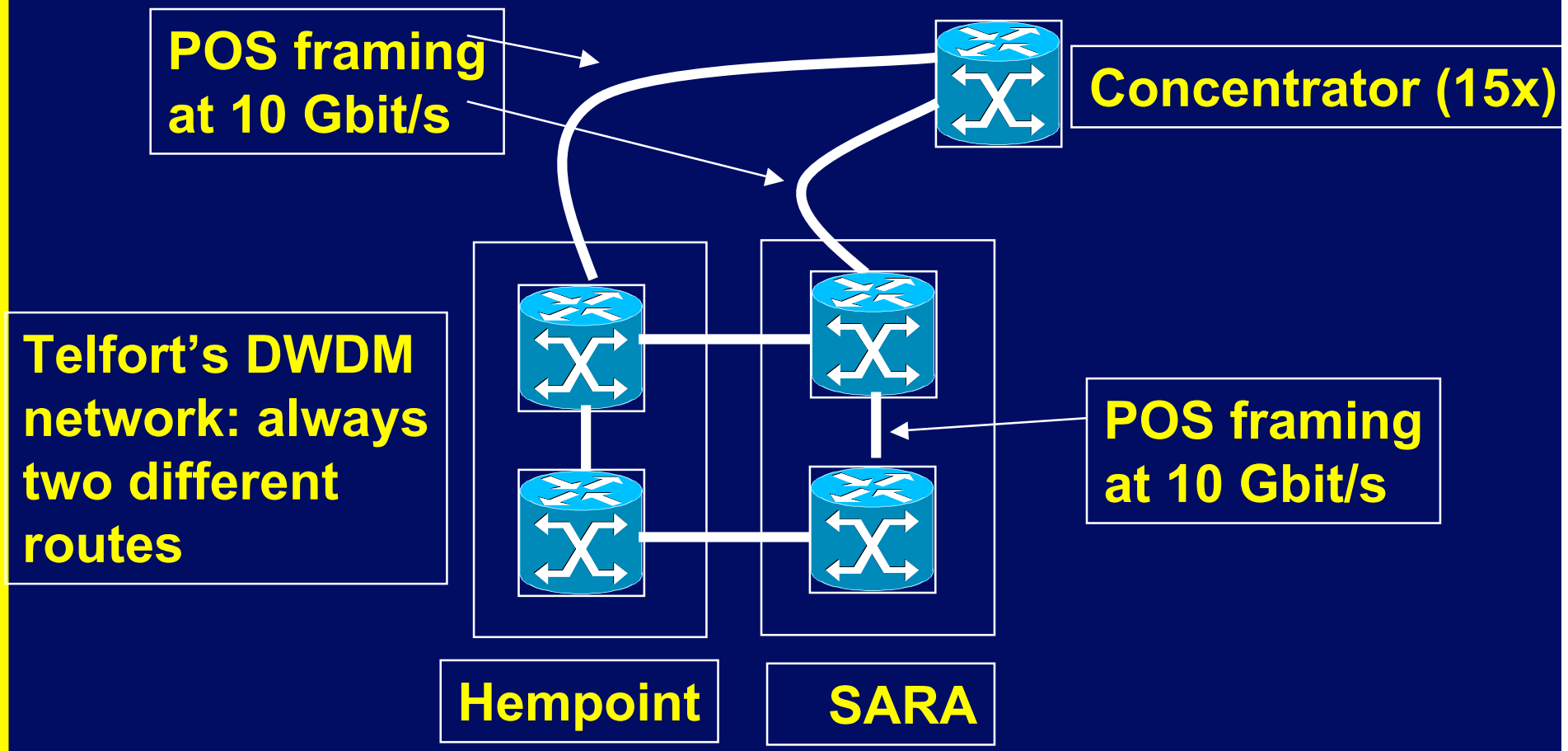


The three QoS scenario's

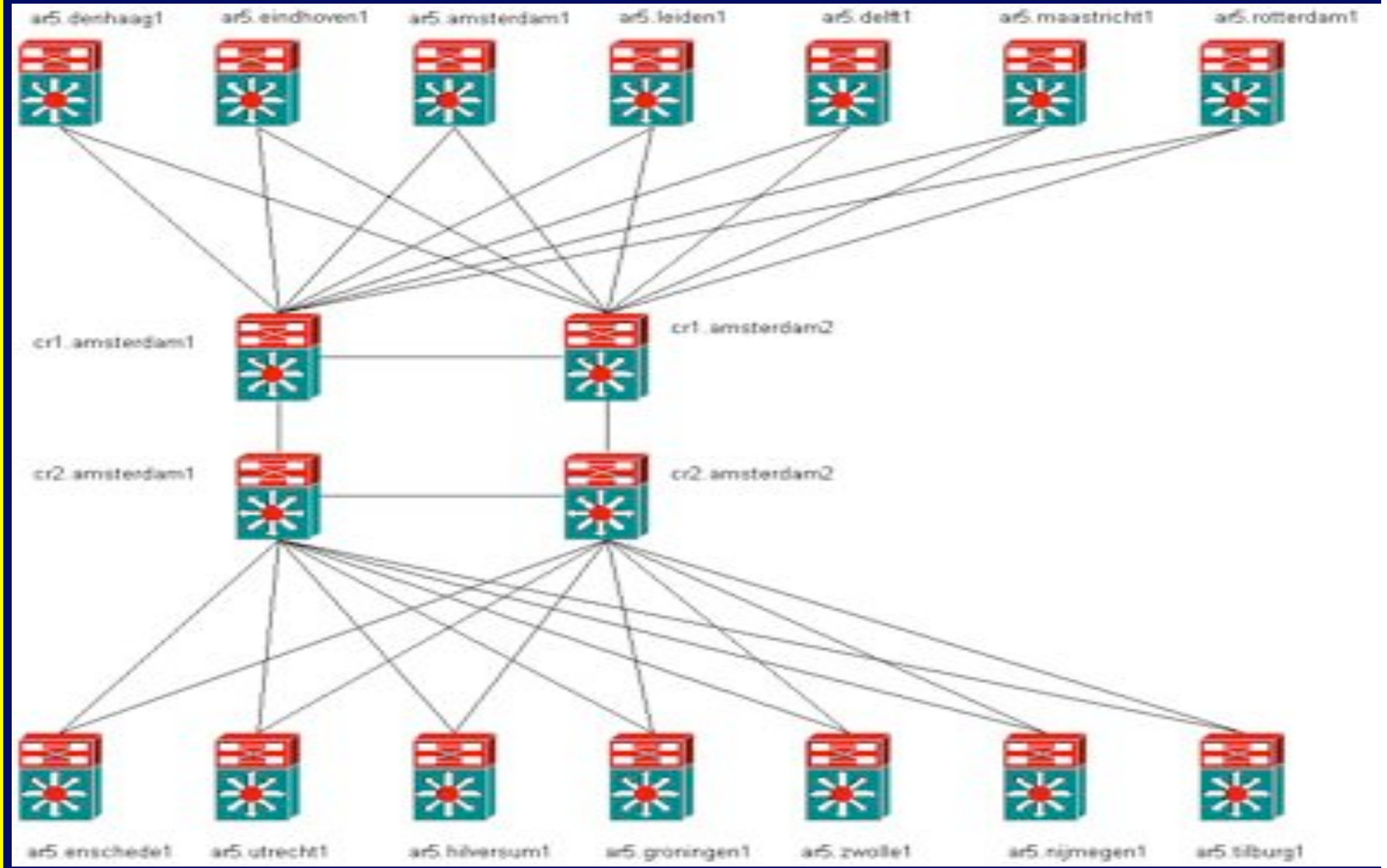
- **Bureaucracy**
  - Do the advanced applications by hand
  - Long turnaround (rtt ≈ days)
- **Complexity**
  - Automatic application setup
  - Need advanced middleware and probably also bureaucracy
- **Throw Bandwidth at the problem**
  - Might go wrong at bottlenecks
  - Easiest solution
  - Do it yourself services

SURFnet5: Pre-production network

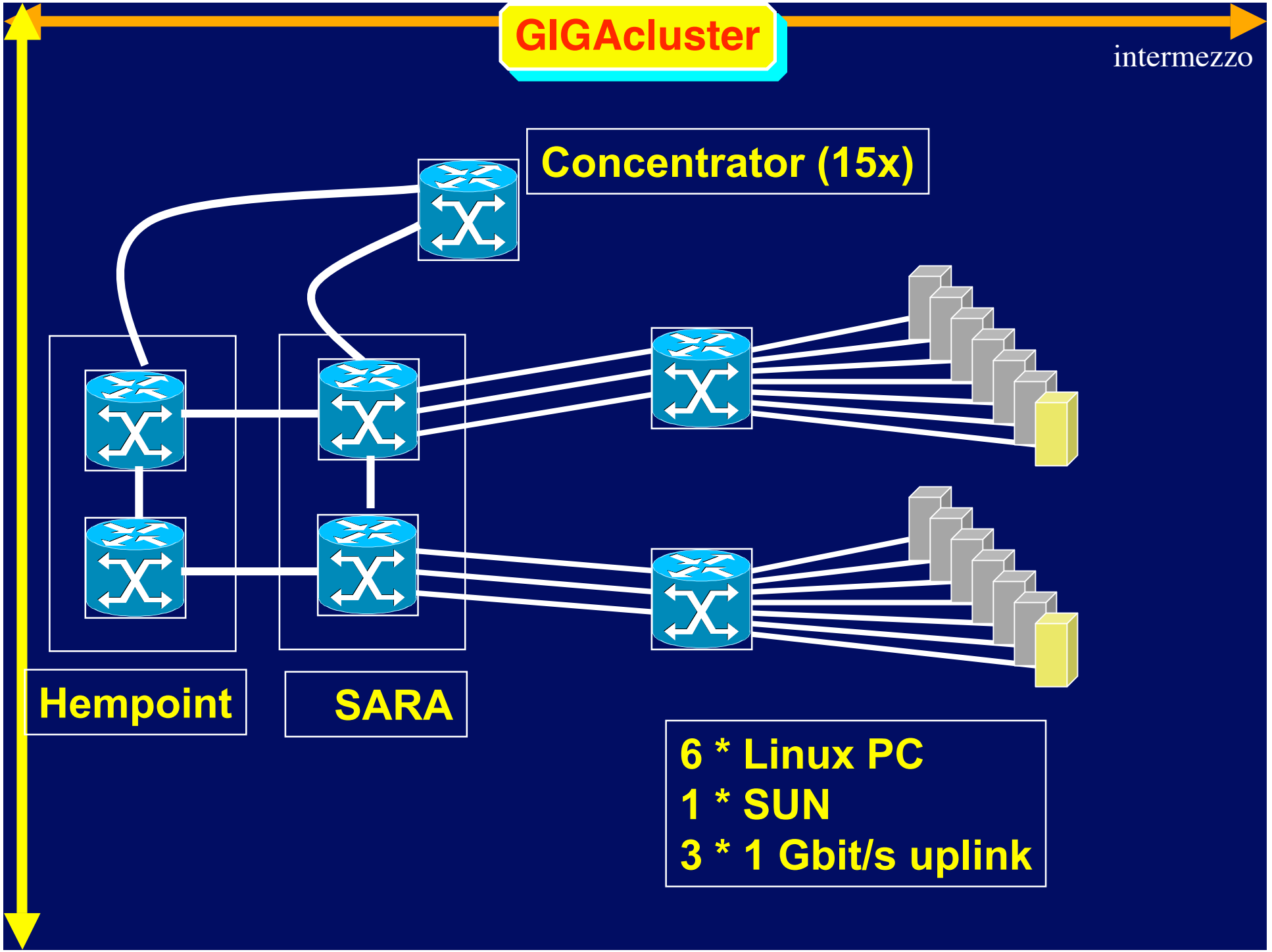
intermezzo



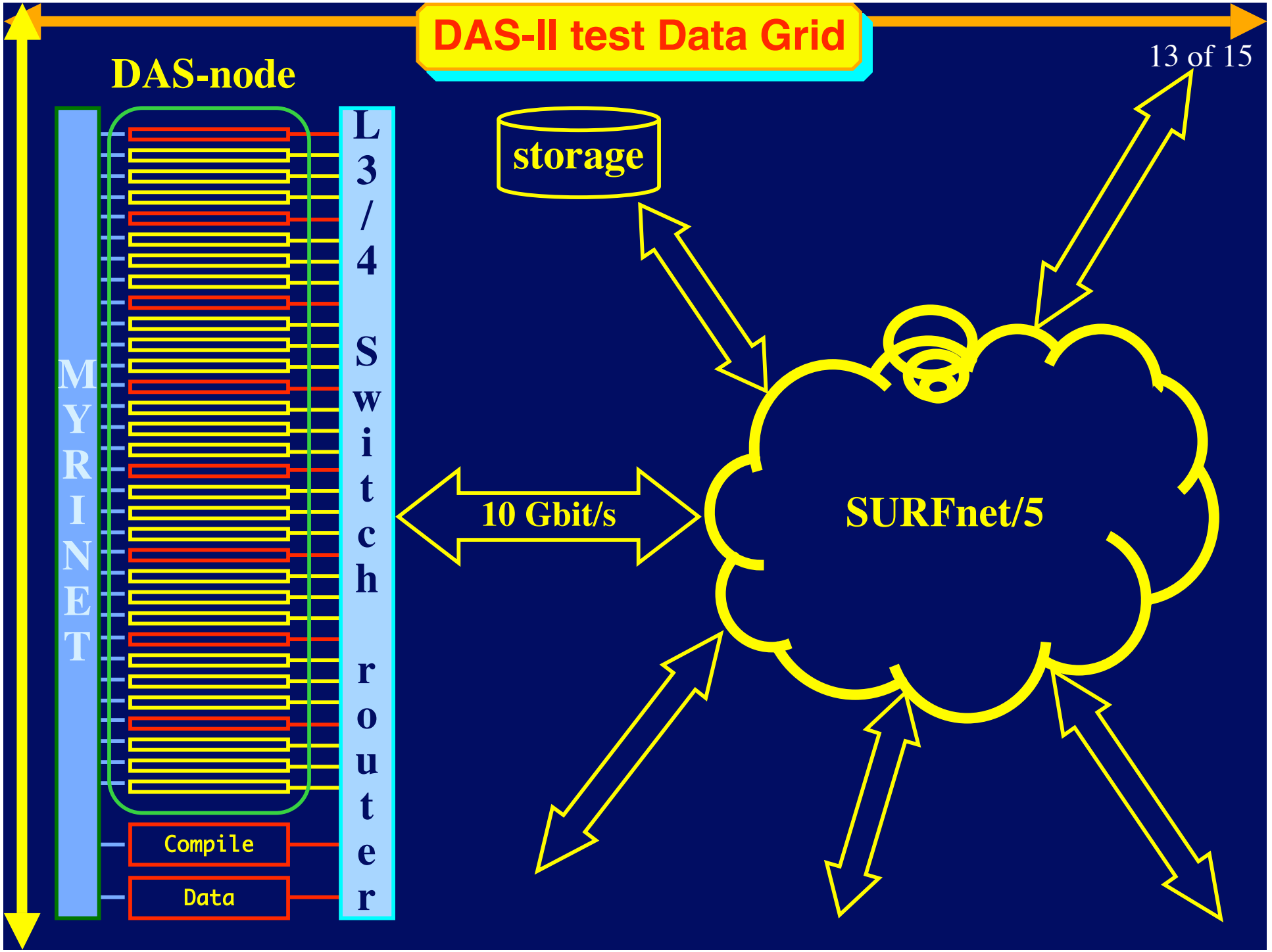
SURFnet5 topology



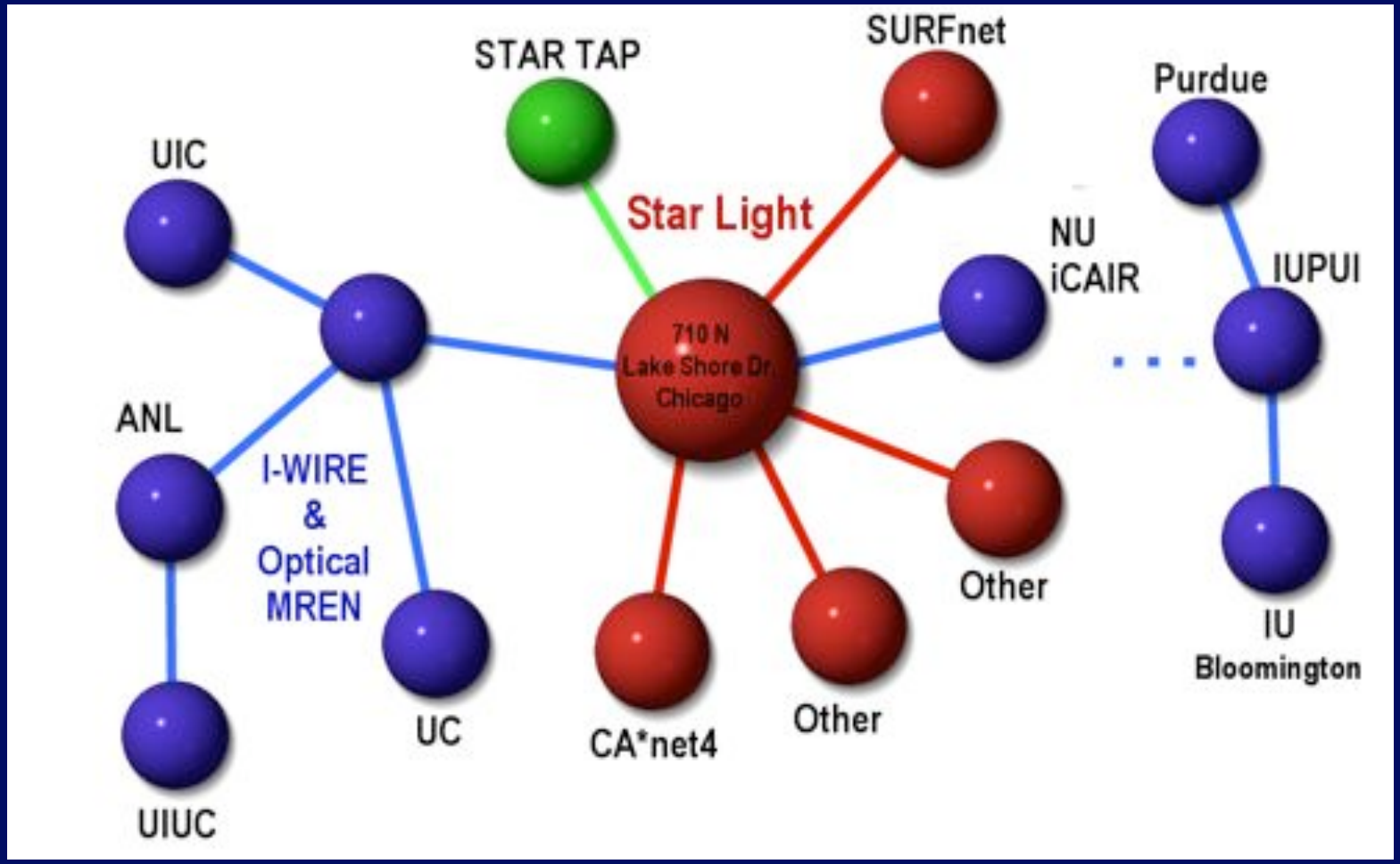
GIGAcluster



DAS-II test Data Grid



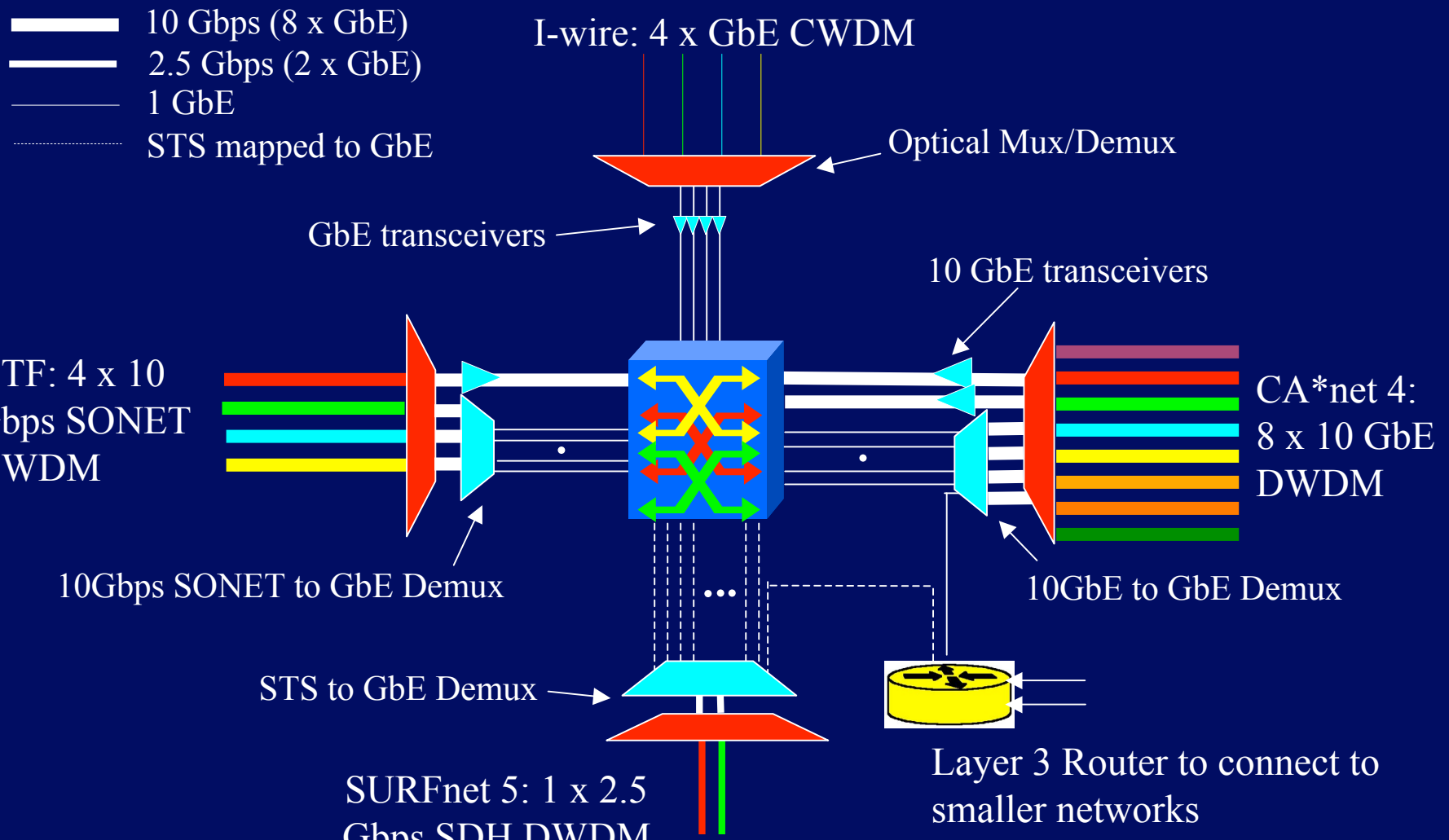
StarLight: The Optical STAR TAP



This diagram subject to change

Courtesy Bill St.Arnaud

Possible STAR LIGHT configuration



Courtesy Bill St.Arnaud

Changing architecture of the Internet

- **Old:**
  - **~ "OSI model"**
  - **IP in the core network**
  - **Switching to the wire centers**
  - **Hubs to connect computers and equipment**
- **New:**
  - **Edge devices layer 4 or higher aware**
  - **Central router-ISP layer 3 connection**
  - **ISP network layer 2 (MPλS)**
  - **Optical core network topology**
  - **Core -> optical switching, DWDM, layer 1**
- **Classical model turned inside out**
- **Multihoming -> exploding router tables**

Revisiting the truck of tapes

Consider one fiber

- Current technology allows for 160 λ in one of the two frequency bands
- Each λ has a bandwidth of 40 Gbit/s
- Transport: $160 * 40*10^9 / 8 = 800$ GByte/sec
- Take a 10 metric ton truck
- One DLT contains 50 Gbyte, weights 200 gr
- Truck contains 10 * 1000 * 5 * 50 Gbyte = 2.5 PByte
- Truck / fiber = 2500000 / 800 = 3125 s ≈ one hour
- For distances further away than a truck drives in one hour (50 km) minus loading and handling 50000 tapes the fiber wins!!!

(Ref: passen en meten, W. Lourens, 1988)

Wim is weg

NAVERTELD DOOR ANNIE M. G. SCHMIDT

GETEKEND DOOR ROGIER BOON

OORSPRONKELIJK NEDERLANDS GOUDEN BOEKJE

DE BEZIGE BIJ