GigaPort

SURFnet6

Integrating the IP and Optical worlds

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On behalf of Kees Neggers

SURFnet, The Netherlands

SURFnet

Contents

GigaPort

- I save time on this one

- Note: I tweaked some of the slides

SURFnet

SURFnet

GigaPort

- Provides the Dutch National Research Network
- Not for profit company, 50 employees
- 150 connected organizations; 800,000 users
- Turnover (2002): 30 million Euro
- Infrastructure services:
  - innovation paid for by government
  - cost effective exploitation for higher education and research

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SURFnet5

GigaPort

- Partners BT and Cisco
- 15 PoPs connected by thirty 10 Gbit/s unprotected lambdas
- Managed dark fiber to 14 Remote PoPs
- Dual stack IPv4 and IPv6 since mid 2001
- More than 100 institutes connected at Gbit/s level
- 800,000 users

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GigaPort

GigaPort

- **Research networking is innovation engine between research and market introduction of new services**

  - **GigaPort (1999-2003):**
    - **Applications and Network**
    - **government grant: 70 million Euro**
    - **contribution of industry : ≥ 90 million Euro**

  - **GigaPort Next Generation Network (2004-2008):**
    - **consortium of 50 organizations**
    - **government grant: 40 million Euro**
    - **contribution of industry and institutions: ≥ 56 million Euro**

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GigaPort NG

GigaPort

- Networks for research
  - Build SURFnet6
- Research on networks
  - Optical networking
  - High performance routing and switching
  - Management and monitoring
  - Grids and access: reaching out to the user
  - Testing methodology

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Too much text, read it when you get the slides

GigaPort

- **Optical Networking:** What innovation in architectural models, components, control and light path provisioning are needed to integrate dynamically configurable optical transport networks and traditional IP networks to a generic data transport platform that provides end-to-end IP connectivity as well as light path (lambda and sub-lambda) services?
- **High performance routing and switching:** What developments need to be made in the Internet Protocol Suite to support data intensive applications, and scale the routing and addressing capabilities to meet the demands of the research and higher education communities in the forthcoming 5 years?
- **Management and monitoring:** What management and monitoring models on the dynamic hybrid network infrastructure are suited to provide the necessary high level information to support network planning, network security and network management?
- **Grids and access; reaching out to the user:** What new models, interfaces and protocols are capable of empowering the (grid) user to access, and the provider to offer, the network and grid resources in a uniform manner as tools for scientific research?
- **Testing methodology:** What are efficient and effective methods and setups to test the capabilities and performance of the new building blocks and their interworking, needed for a correct functioning of a next generation network?

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NetherLight

GigaPort

- Optical Internet exchange point in Amsterdam
- Built and operated by SURFnet
- Experiments with light path provisioning in a multi domain environment
- http://www.netherlight.net/

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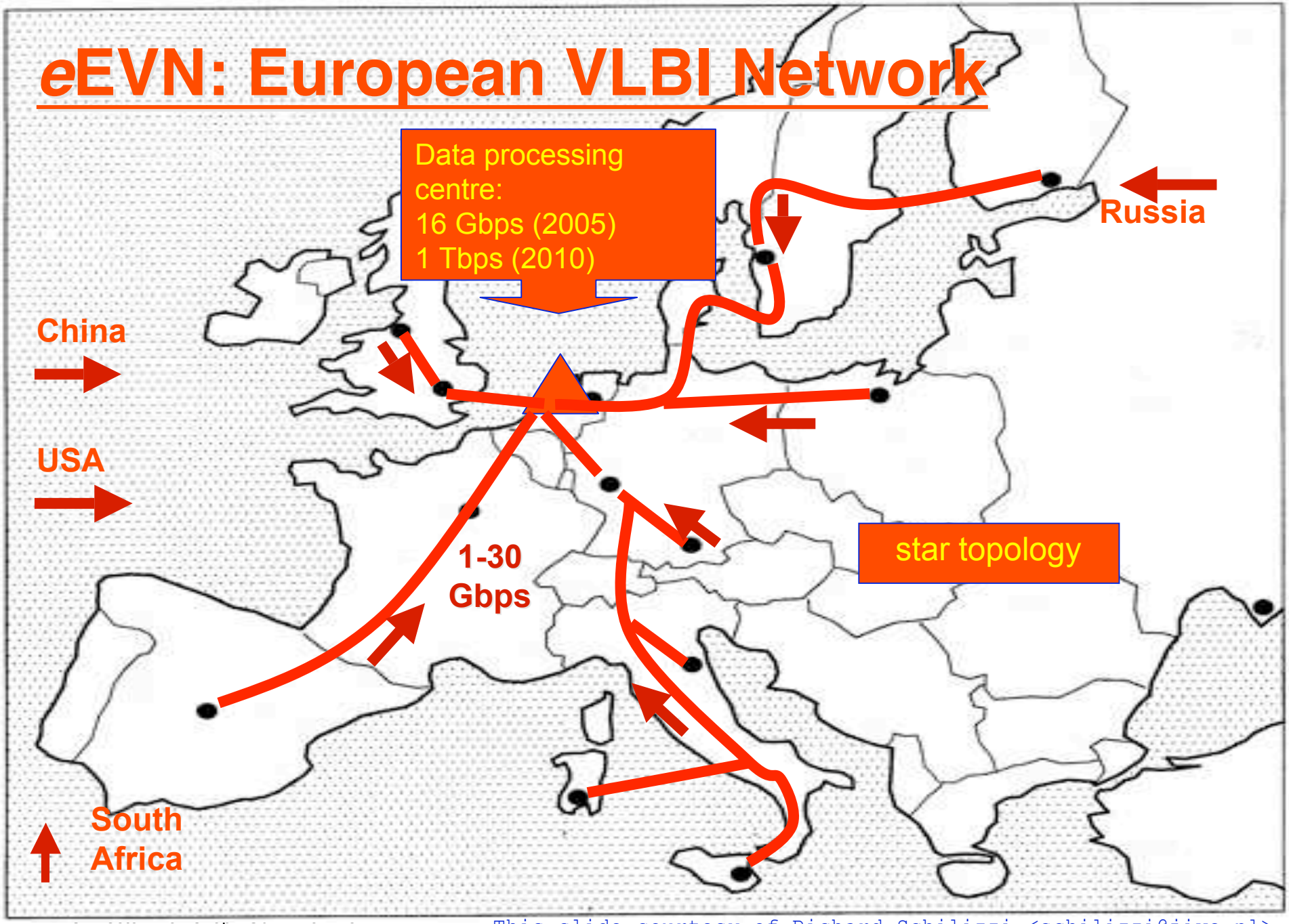
VLBI at JIVE in Dwingeloo today

*e*EVN: European VLBI Network

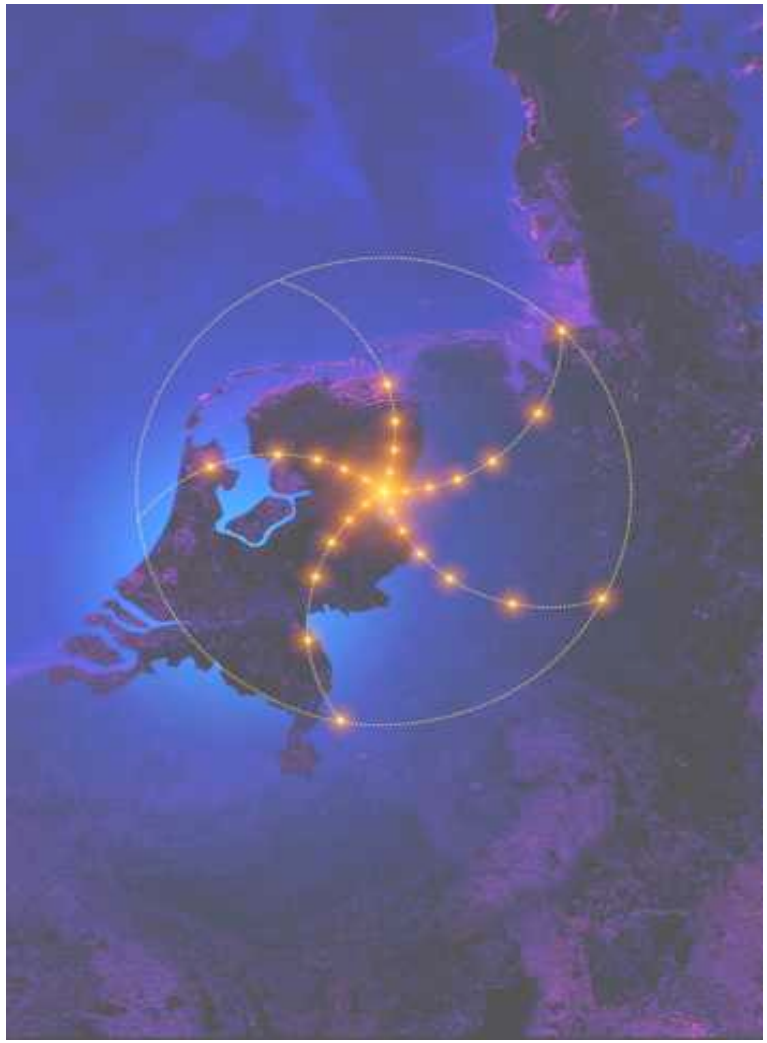


This slide courtesy of Richard Schilizzi <schilizzi@jive.nl>

Lambdas as part of instruments

GigaPort

LOFAR



www.lofar.org

20 Tbit/s

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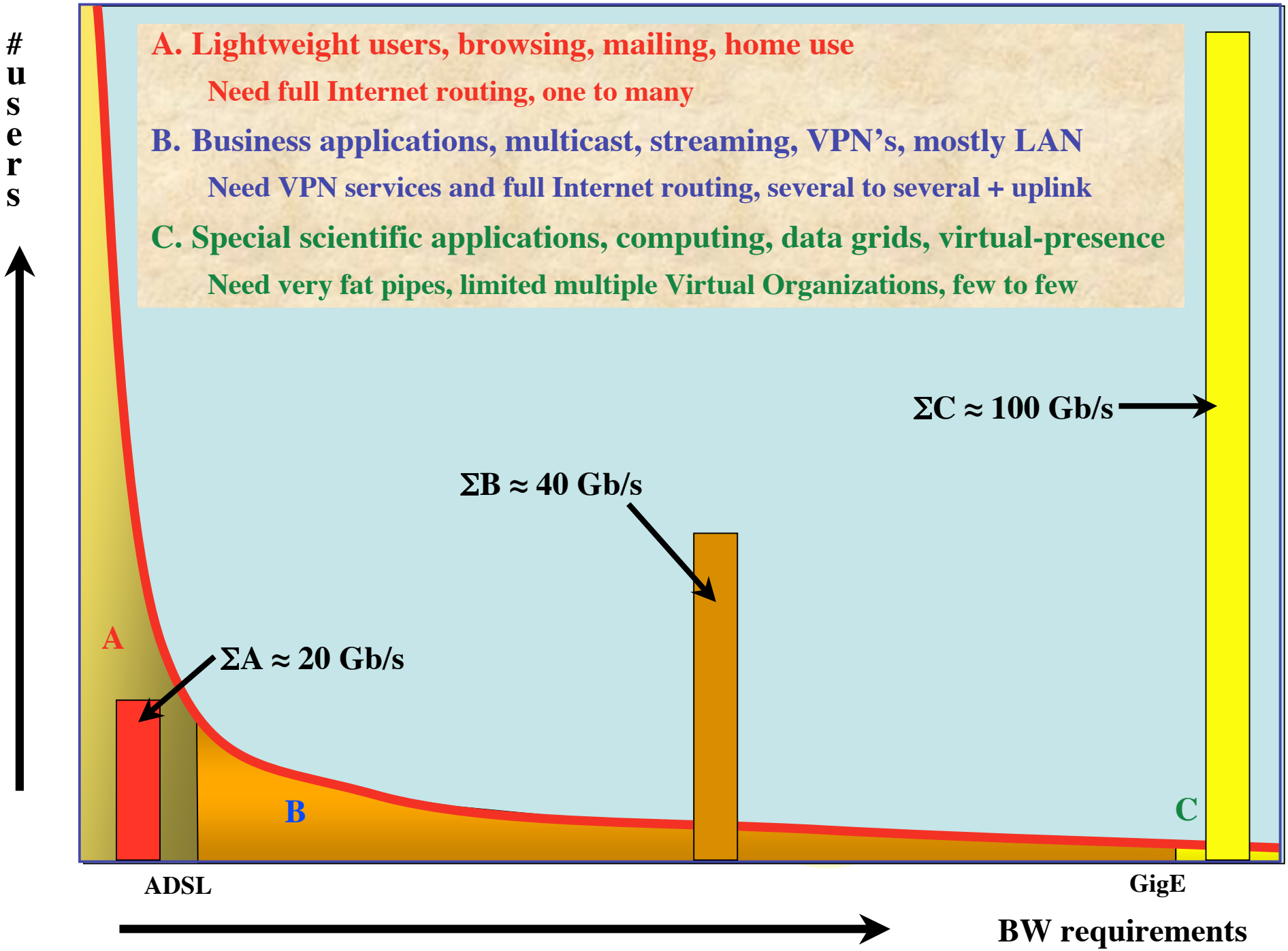
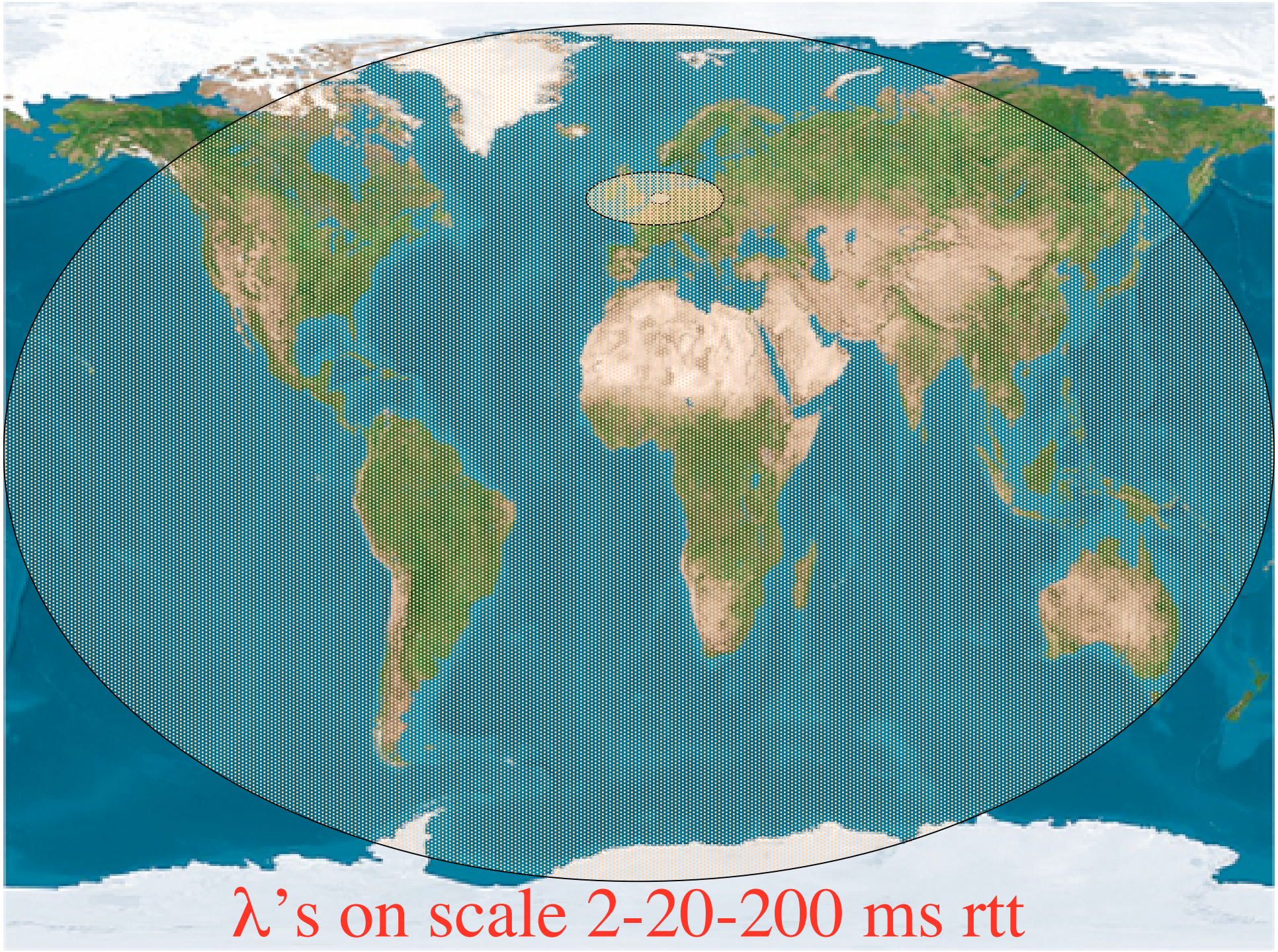

A. Lightweight users, browsing, mailing, home use
Need full Internet routing, one to many
B. Business applications, multicast, streaming, VPN's, mostly LAN
Need VPN services and full Internet routing, several to several + uplink
C. Special scientific applications, computing, data grids, virtual-presence
Need very fat pipes, limited multiple Virtual Organizations, few to few
users
ΣC ≈ 100 Gb/s
ΣB ≈ 40 Gb/s
ΣA ≈ 20 Gb/s
A
B
C
ADSL
GigE
BW requirements

The Dutch Situation

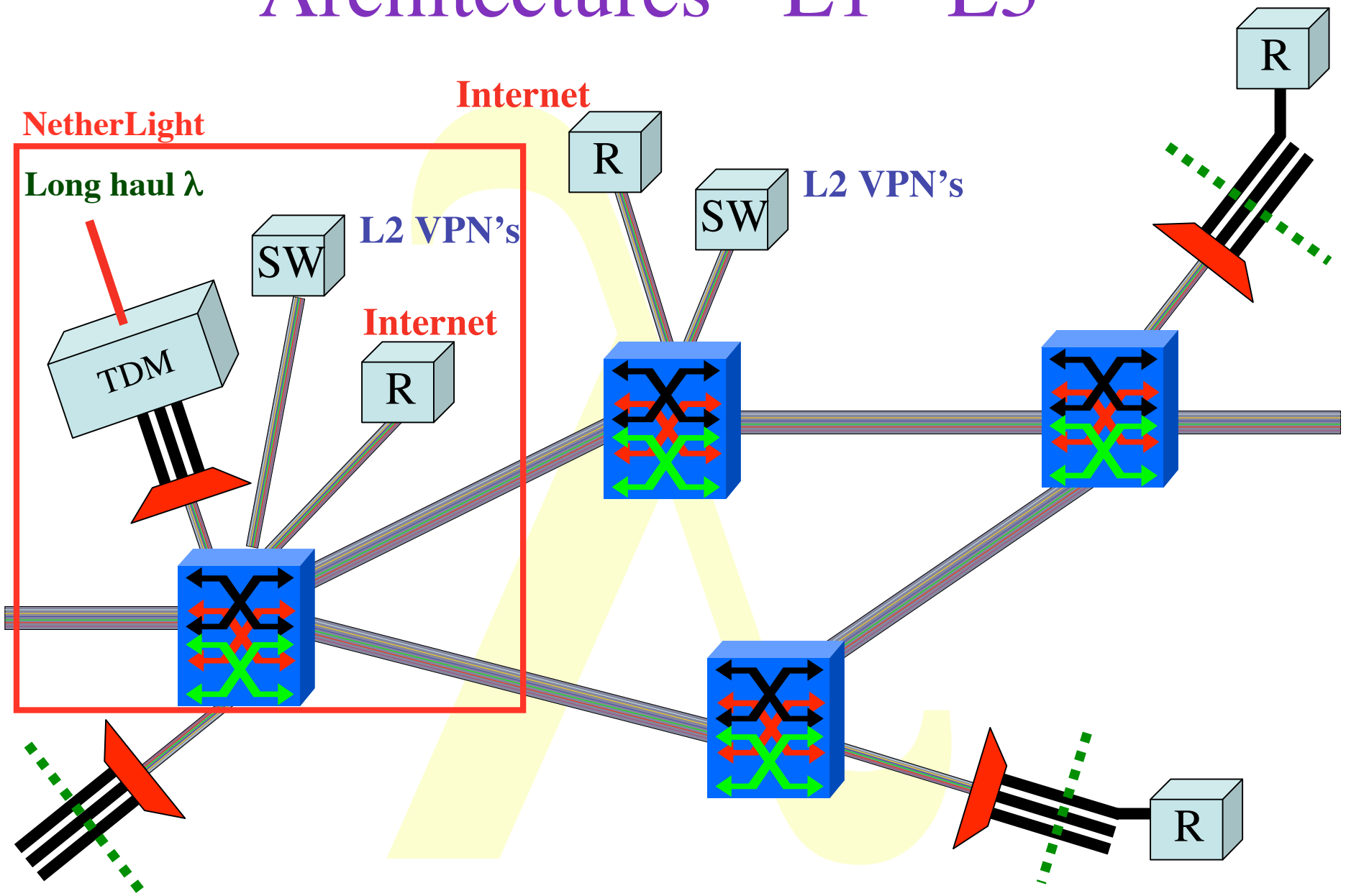
- **Estimate A**
  - **17 M people, 6.4 M households, 25 % penetration of 0.5 Mb/s ADSL, 40 times under-provisioning ==> 20 Gb/s**
- **Estimate B**
  - **SURFnet has 10 Gb/s to about 12 institutes and 0.1 to 1 Gb/s to 180 customers, estimate same for industry (overestimation) ==> 20-40 Gb/s**
- **Estimate C**
  - **Leading HEF and ASTRO + rest ==> 80-120 Gb/s**
  - **LOFAR ==> 20 TBit/s**


λ's on scale 2-20-200 ms rtt

Services

SCALE / CLASS	2 Metro	20 National/ regional	200 World
A	Switching/ routing	Routing	ROUTER$
B	Switches + E-WANPHY VPN's,	Switches + E-WANPHY (G)MPLS	ROUTER$
C	dark fiber Optical switching	Lambda switching	Sub-lambdas, ethernet-sdh

Architectures - L1 - L3



International light path network 1Q2004

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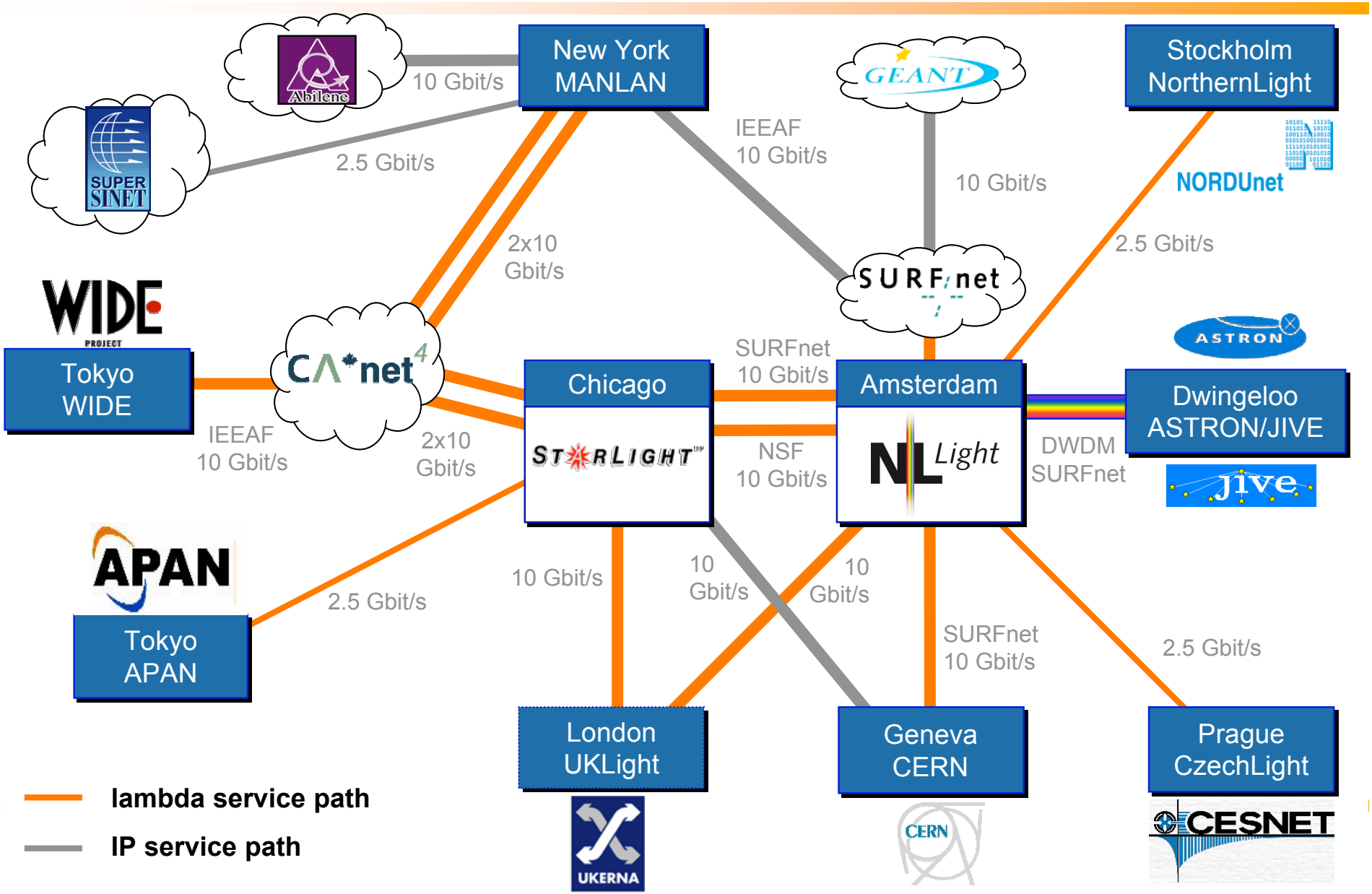

Day-to-day lightpath use

GigaPort

- Part of lambda capacity statically configured for IP production traffic
  - Router-to-router SONET circuits between Amsterdam and Chicago for SURFnet and others (e.g. NSF link)
  - Link & interface state monitored by SURFnet NOC
- Part of lambda capacity for lightpath research community
  - Changed on weekly/monthly basis upon request
  - Has a ‘test’ status; is hardly monitored by NOC

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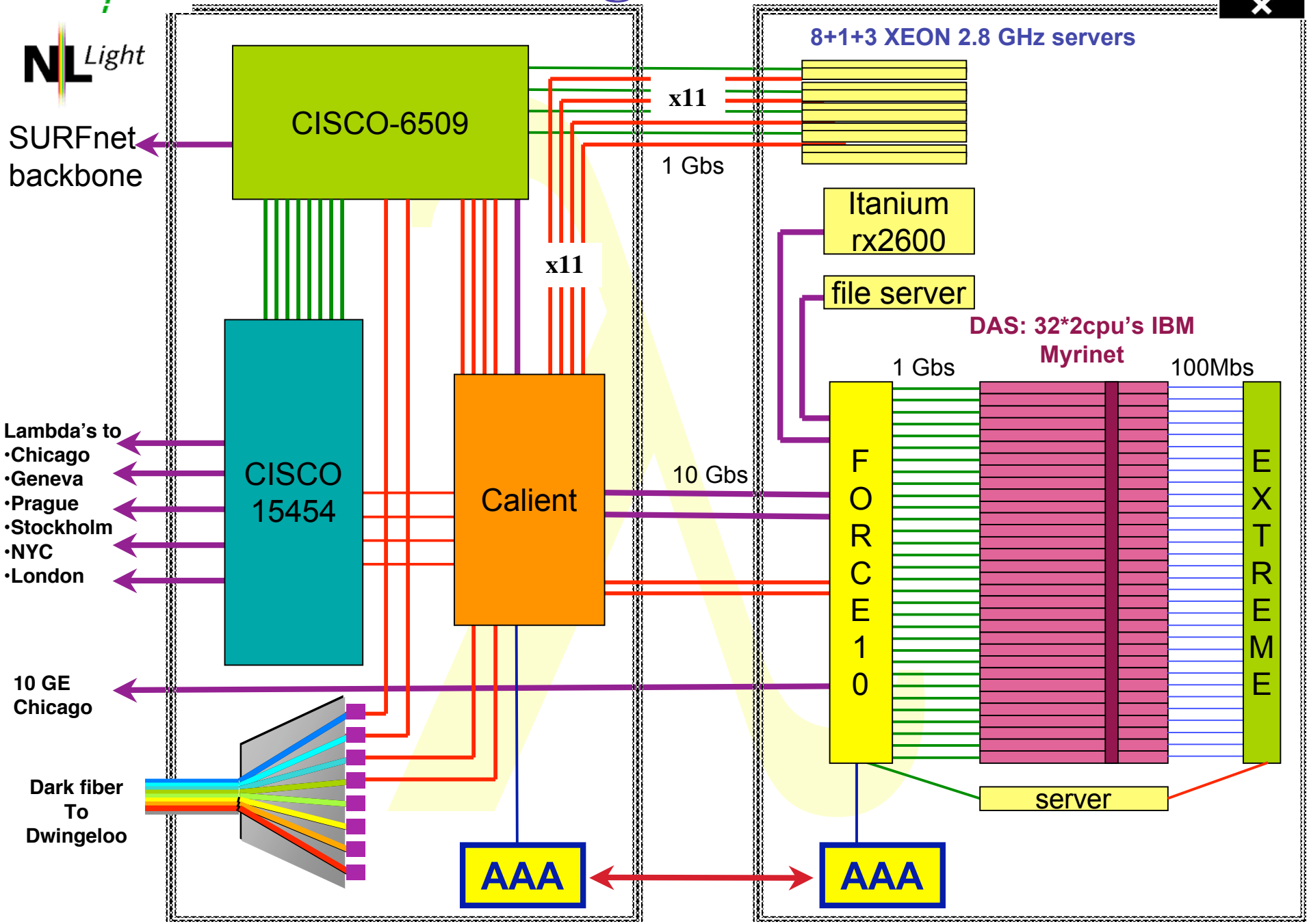
NetherLight <-> UvA



SURFnet6 overview

GigaPort

- **Realization of a next generation hybrid network with seamless end-to-end communication:**
  - Based on dark fiber
  - Native IPv4, IPv6 and Lambda Services over a single transmission infrastructure managed via a single control plane
  - Multi-domain networking
  - Ethernet services as part of the WANs (IP over GE over lambda)
  - Intelligence of networks and the associated responsibilities at the edges

- **Paving the way to a ubiquitous and scalable Services Grid**

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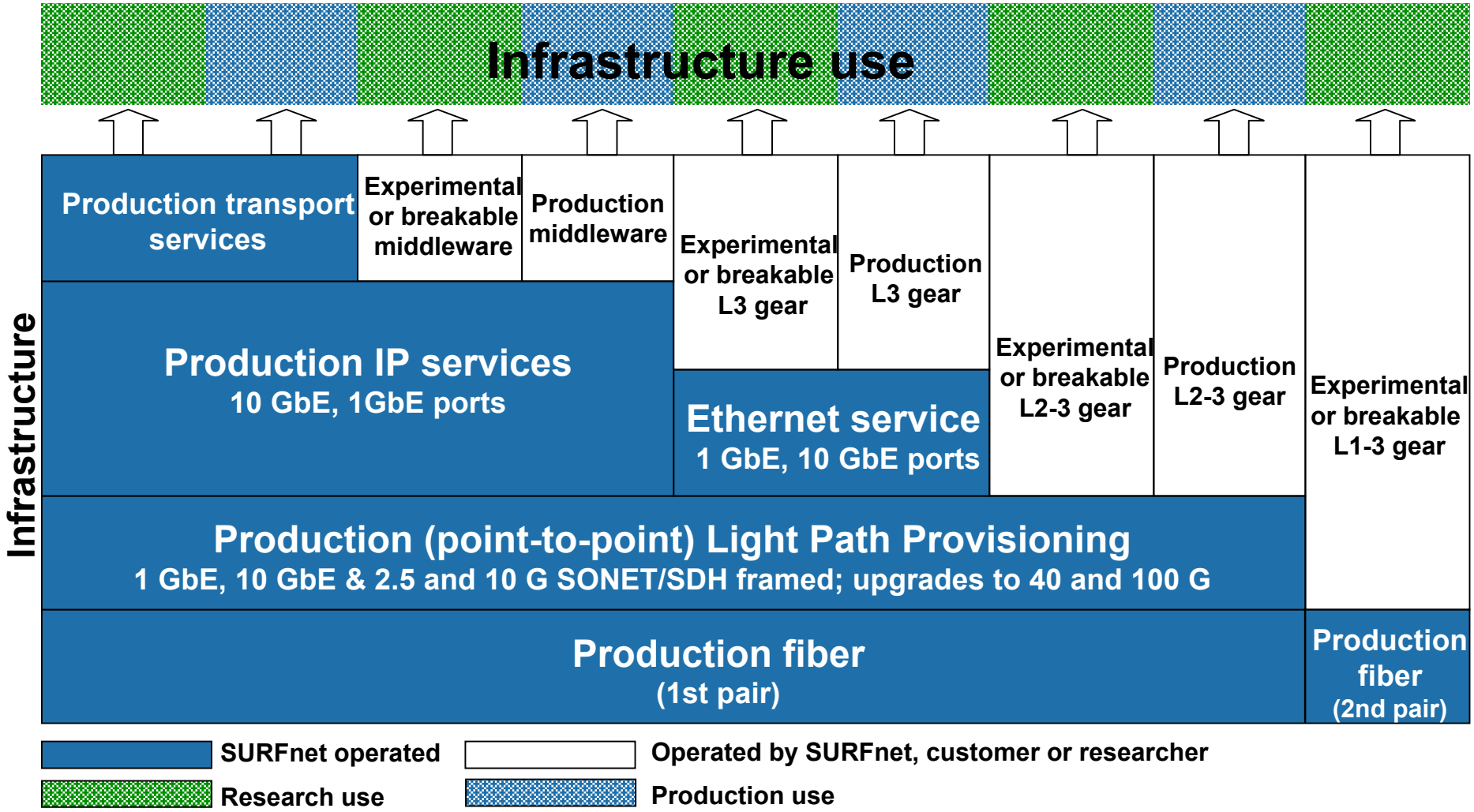
Dual use of SURFnet's infrastructure



SURFnet6 will be based on dark fiber

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- Over 3500 km fiber pairs already available, average price paid for 15 year IRUs is 7 Euro/m per pair
- More than 25 co-location facilities in use
- Managed dark fiber infrastructure will be extended with new routes

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Cost model

(6 year old slide, before aaaarch)

- Networks are expensive resources
- Borrow from supercomputer era
- New unit: megabit/s kilometer second (mks)
  - Actually bit/s meter seconds (b/s x ms => bm)
  - SURFnet has: 20 * 155 * 200 * 31536000 ≈ 1.9E13 mks
  - Dynacore needs: 1 * 20 * 400 * 80 * 8 * 3600 ≈ 1.8E10 mks
  - DAS needs: 24 * 10 * 100 * 50 * 24 * 3600 ≈ 1.0E11 mks
- Establish a program advisory commission
- Use ecash on virtual bank to account
- Use chipcards with certificates to do CAC
- NOW=> AAA, OGSA and WSRF
- SURFnet now has ≈ 1.9E21 mks (5.4E21 mks)

In search of an Industry Partner

GigaPort

- Participates in realization GigaPort NG Network
- Supplies, implements, maintains and supports transmission, switching and routing equipment
- Provides a major own contribution to the project

- Selection via European procurement procedure
  - Qualification phase: eight candidates
  - Four consortia submitted a valid proposal
  - Negotiations started end of November 2003
  - Contracting scheduled March 2004

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Conclusion

GigaPort

- NREN users need new services that current networks cannot support
- Data communication infrastructures will become part of the Grid and will be integrated in scientific instruments
- Hybrid networks delivering IP and Lambda Services can meet user demand within budget constraints, using IP-GE-lambda + overprovisioning + KIS
- SURFnet6 will be a showcase for hybrid networks

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Some thoughts (CdL)

GigaPort

- Don't bother to subdivide pipes (diffserv, sonet)
  - complex switches / routers
  - deal with the complete pipes themselves
- Use case: Lambda setup for sc2004
  - 3 months preparation
  - 240 emails
  - 2 phone conferences
  - Tuning sessions with T-Systems
  - Several times physical patching
  - Two week discussion about IP and routing
- The above should happen in 300 ms
  - On the log scale we are half way (30 sec at sc2003)

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3th Lambda workshop @ NORDUnet 2003

Lambda workshop

- **Amsterdam - Terena**
  - **Concepts**
  - **Initial testbed (SURFnet Lambda to StarLight)**
- **Amsterdam - iGrid2002**
  - **Rechecking concepts models**
  - **Initial experiences and measurements**
  - **Expansion of Lambda testbed**
- **Reykjavik - NORDUnet**
  - **Towards persistent demonstrations and applications**
  - **Re-factored to GLIF**
- **Next one in Nottingham, UK sept 3th 2004**

The END

Thanks to

Kees Neggers, Tom DeFanti, Joel Mambretti, Bill St. Arnaud, Larry Smarr

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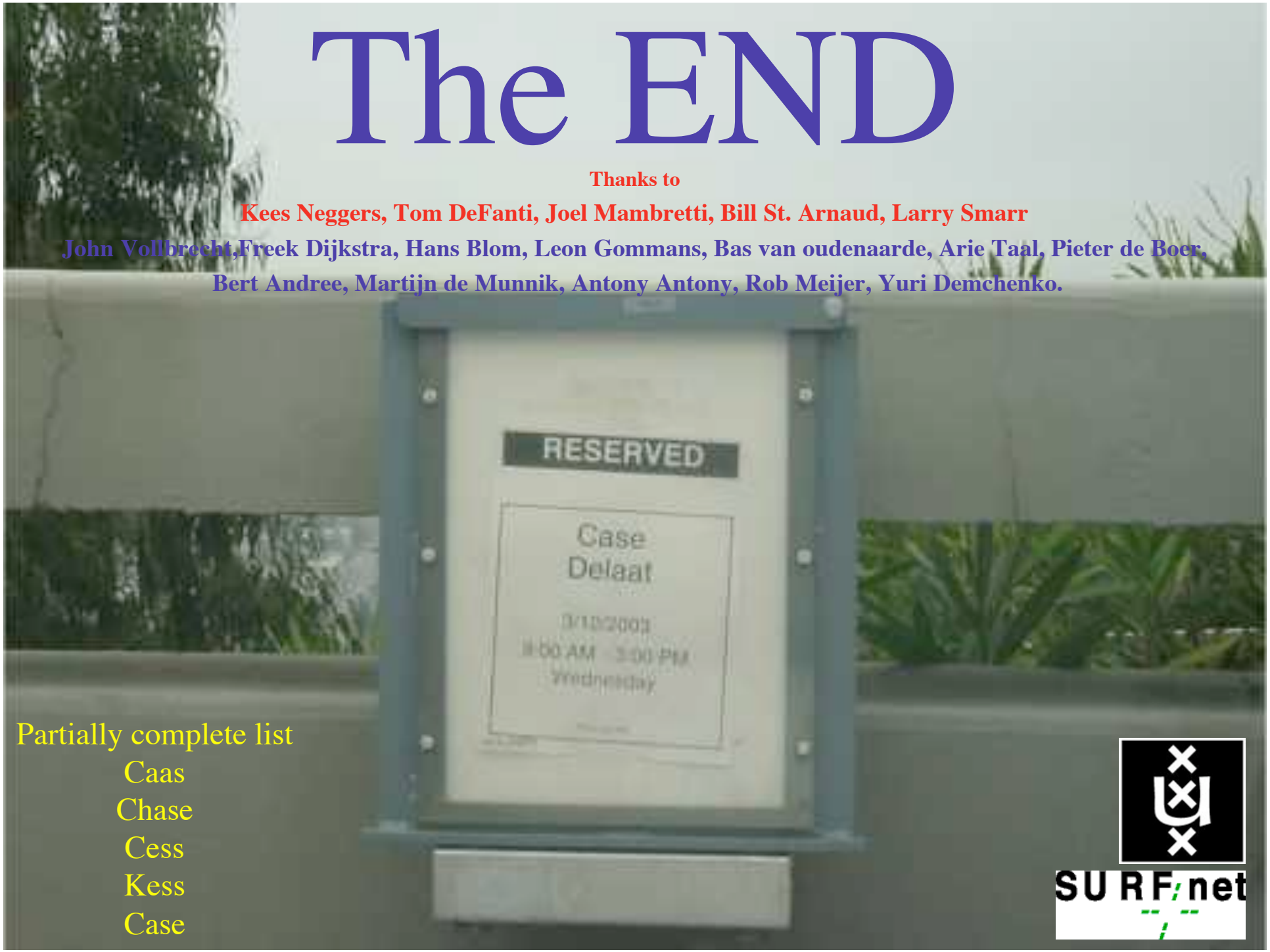

Partially complete list

Caas

Chase

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SURFnet