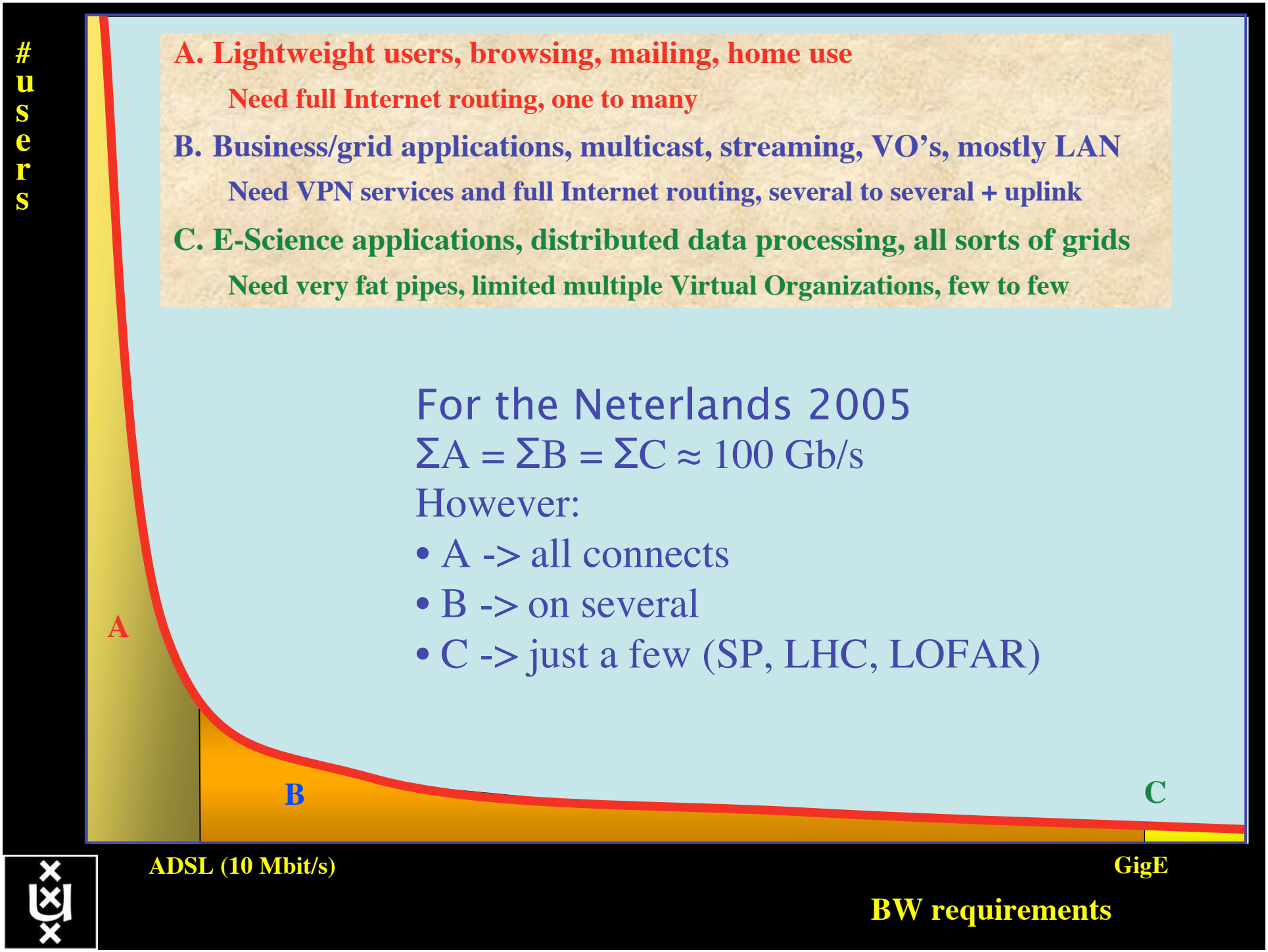
Lambda-Grids

TNC2006 Panel “circuit vs packet?”

www.science.uva.nl/~delaat

Cees de Laat

University of Amsterdam


#users
A. Lightweight users, browsing, mailing, home use
Need full Internet routing, one to many
B. Business/grid applications, multicast, streaming, VO's, mostly LAN
Need VPN services and full Internet routing, several to several + uplink
C. E-Science applications, distributed data processing, all sorts of grids
Need very fat pipes, limited multiple Virtual Organizations, few to few
For the Neterlands 2005
ΣA = ΣB = ΣC ≈ 100 Gb/s
However:
• A -> all connects
• B -> on several
• C -> just a few (SP, LHC, LOFAR)
A
B
C
ADSL (10 Mbit/s)
GigE
BW requirements

Towards Hybrid Networking!

- Costs of photonic equipment 10% of switching 10 % of full routing
  - for same throughput!
  - Photonic vs Optical (optical used for SONET, etc, 10-50 k$/port)
  - DWDM lasers for long reach expensive, 10-50 k$
- Bottom line: look for a hybrid architecture which serves all classes in a cost effective way
  - map A -> L3 , B -> L2 , C -> L1
- Give each packet in the network the service it needs, but no more !

L1 ≈ 0.5-1.5 k$/port

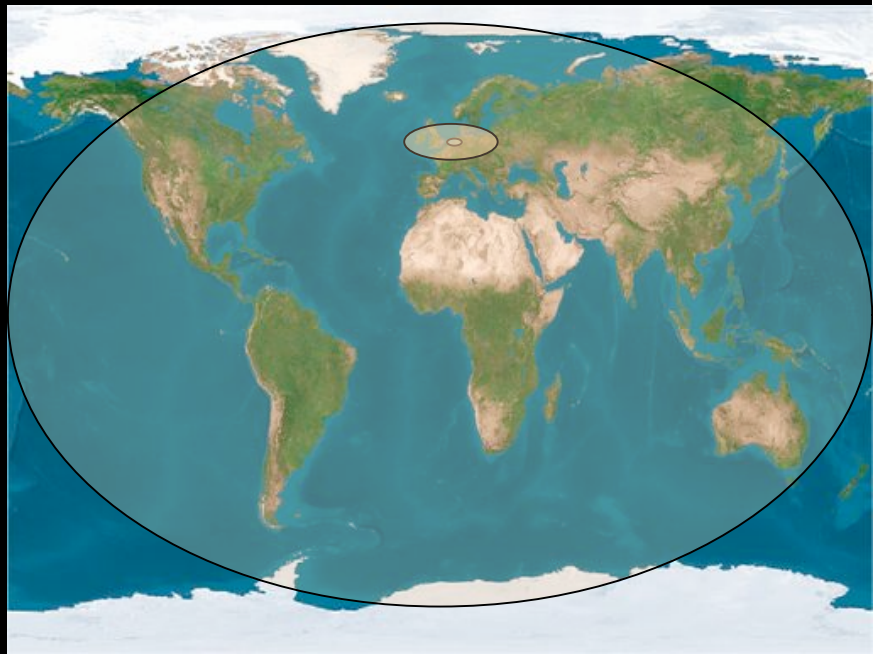
L2 ≈ 5-8 k$/port

L3 ≈ 75+ k$/port

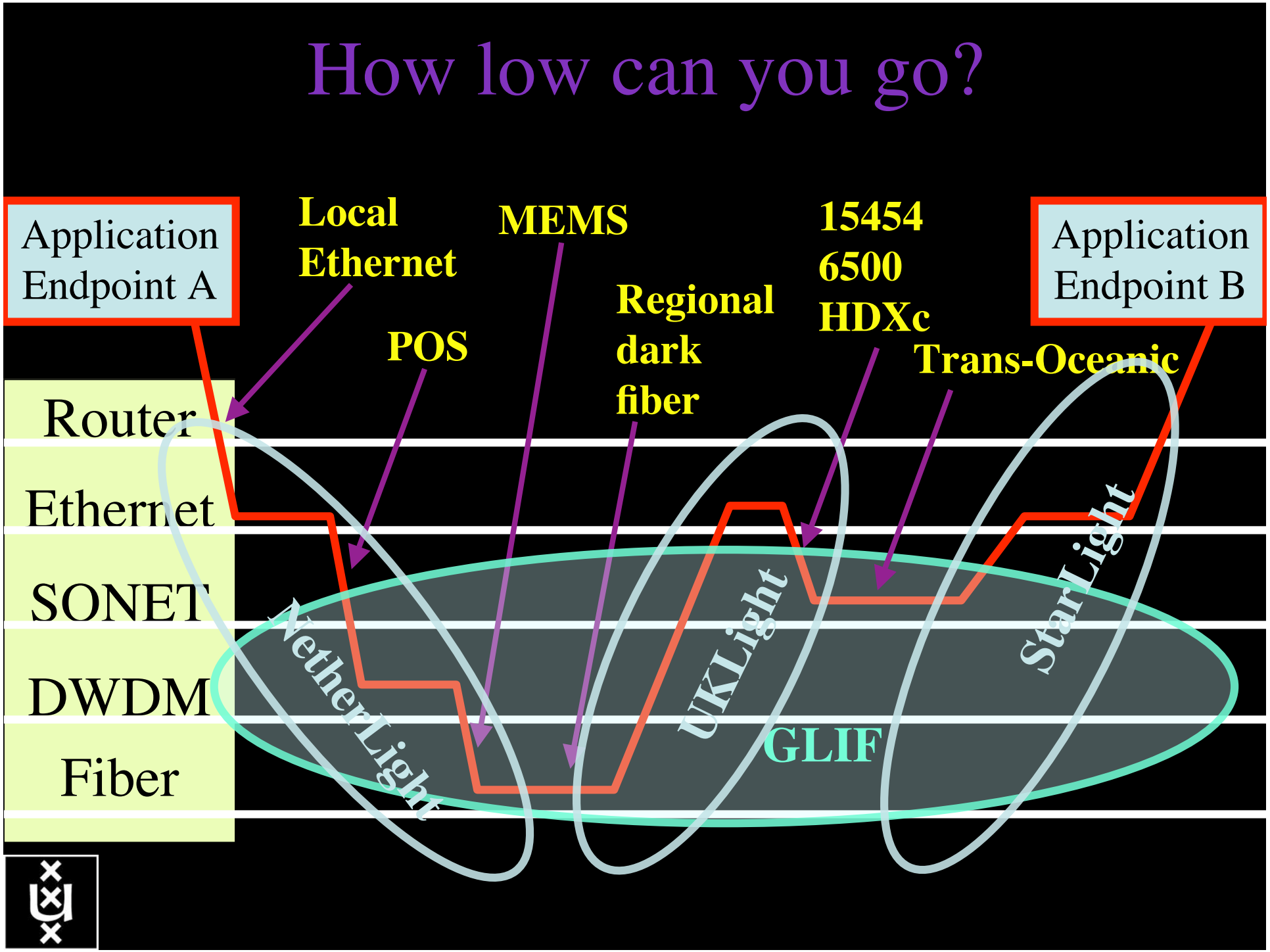
Scale of Infrastructure

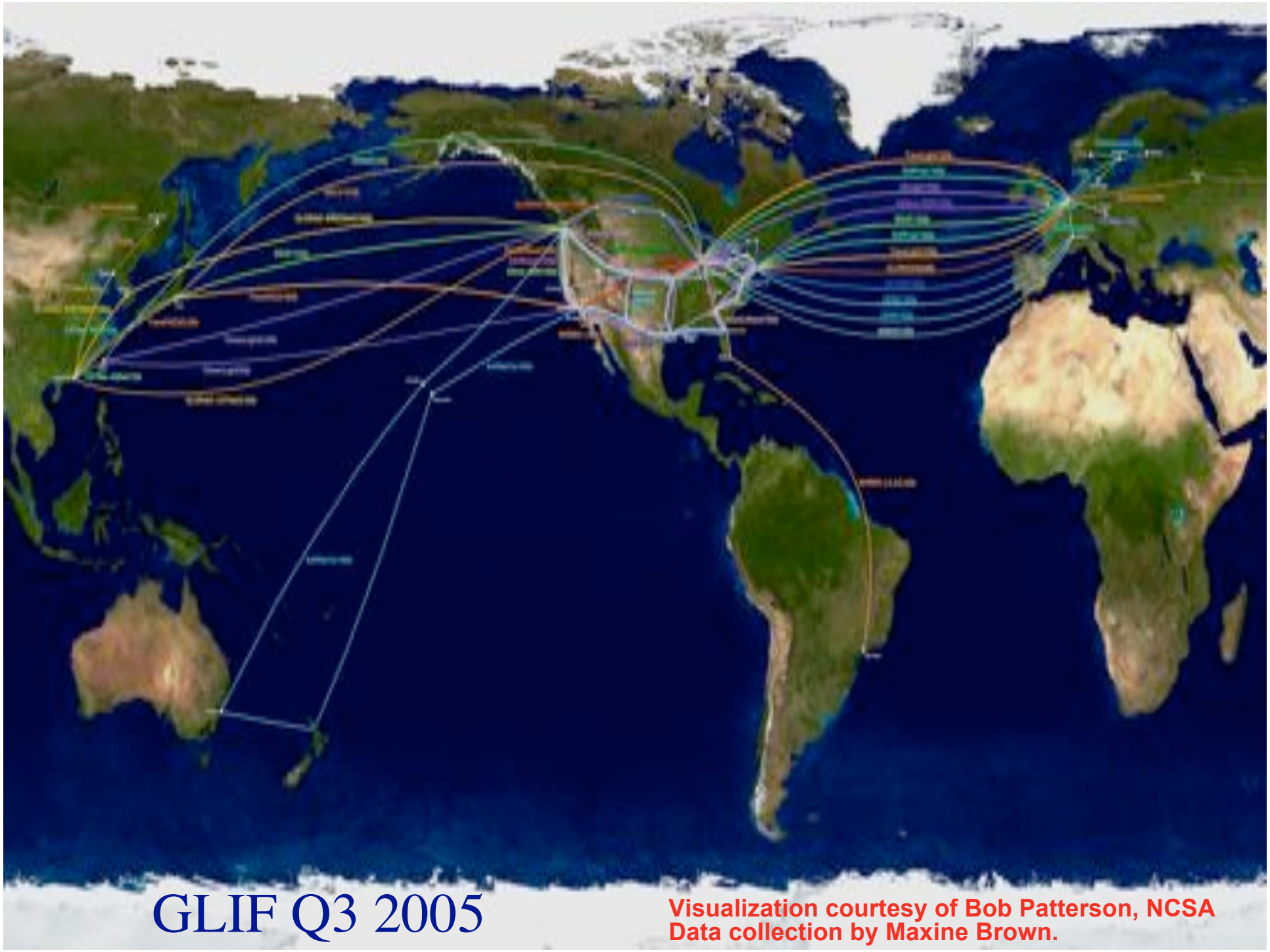
- Global scale (200 ms)
  - Trans oceanic lambda's
  - Few Lambda's usually SONET framed
- Regional scale (20 ms)
  - Continent or big country wide network
  - Either dark fiber of many Lambda's on someone's infrastructure
- Metro scale (2 ms)
  - Dark fiber network
  - Photonic devices
- Degrees of Freedom
  - L > R > M

$$\#\lambda \approx \frac{200 * e^{(t-2002)}}{rtt}$$



How low can you go?





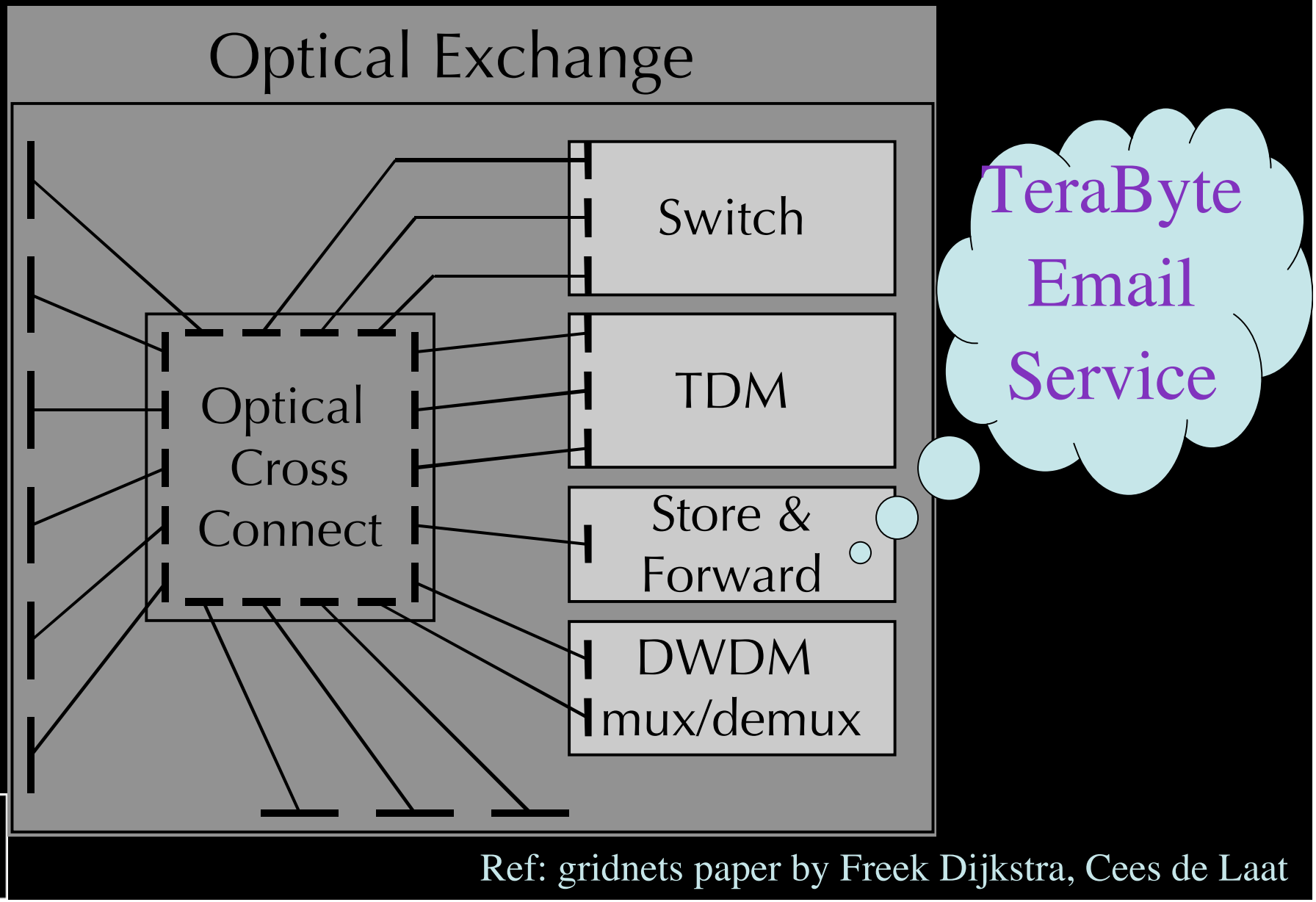
GLIF Q3 2005

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

Services

CLASS \ SCALE	2 Metro	20 Regional	200 World
A	Switching/ Routing	Routers	ROUTER$
B	Switches VPN's E-WANPHY	Routing Switches (G)MPLS E-WANPHY	ROUTER$
C	dark fiber DWDM WSS Photonic switch	DWDM, TDM / SONET Lambda switching	VLAN's TDM SONET Ethernet

Optical Exchange as Black Box



Ref: gridnets paper by Freek Dijkstra, Cees de Laat

Cases for circuits

- where a single application needs interface speeds
- currently LHC and ASTRO (eVLBI)
- e-Health and e-Bioscience around the corner
- it depends on scale of network and time factors of the application what kind of circuit technology and CP is optimal
- inside a country “copy” customer interfaces to a central routing place.
- on circuits the transport protocols can switch off the congestion control which usually ruins throughput
- The NREN’s of today are the Telco’s of tomorrow Universities, you know what to do!

Let's panel !