

**GLIF @ OGF 25:
GOLE philosophy revisited**

Cees de Laat

GLIF.is founding member

SURFnet

EU

BSIK

NWO

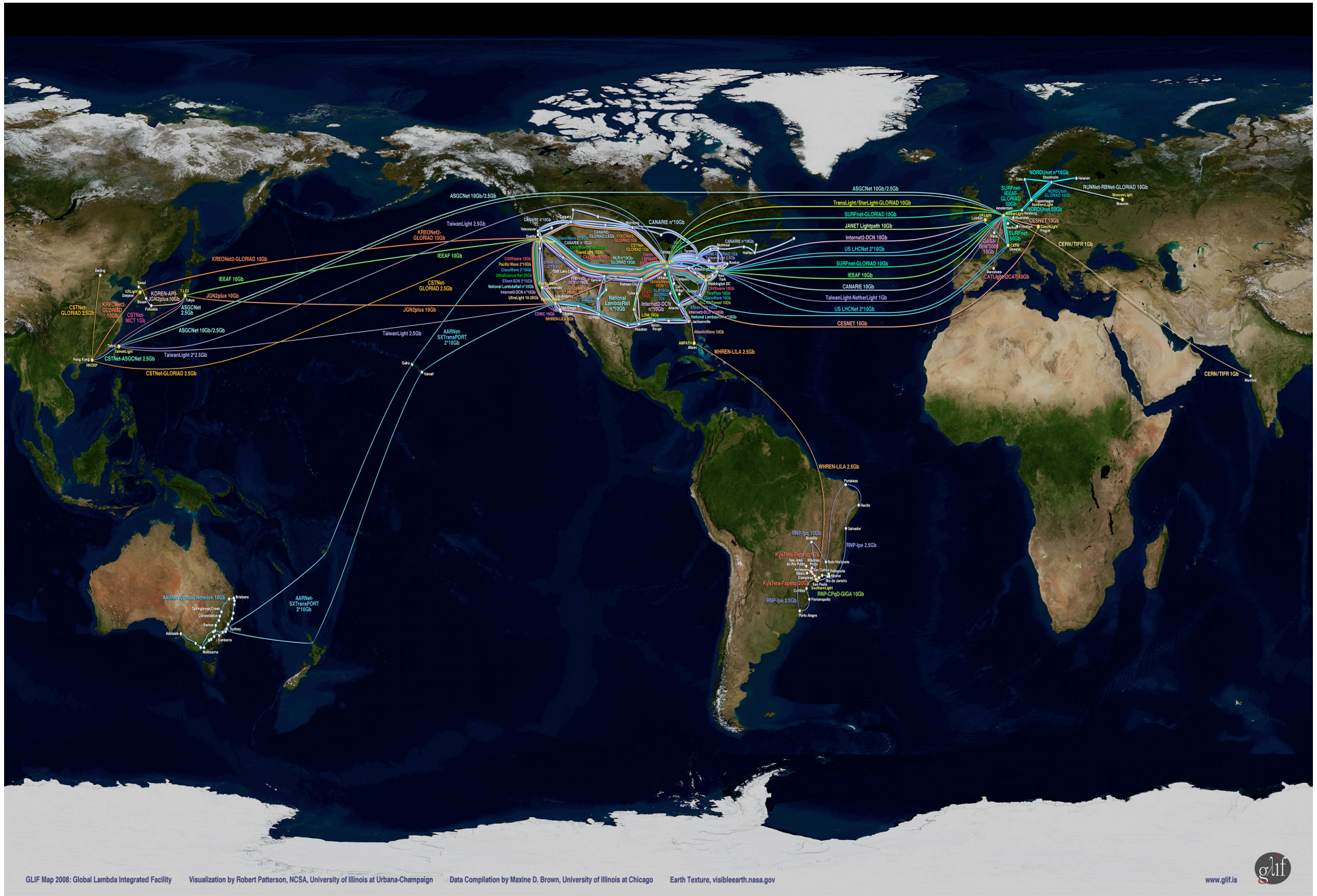
University of Amsterdam

TNO
NCF



They pay this trip ☺





GLIF Map 2008: Global Lambda Integrated Facility Visualization by Robert Patterson, NCSA, University of Illinois at Urbana-Champaign Data Compilation by Maxine D. Brown, University of Illinois at Chicago Earth Texture, visibleearth.nasa.gov

www.glif.is 



GLIF 2008

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



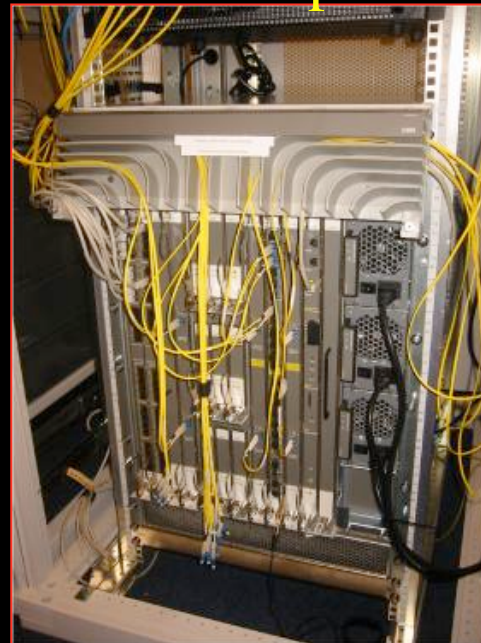
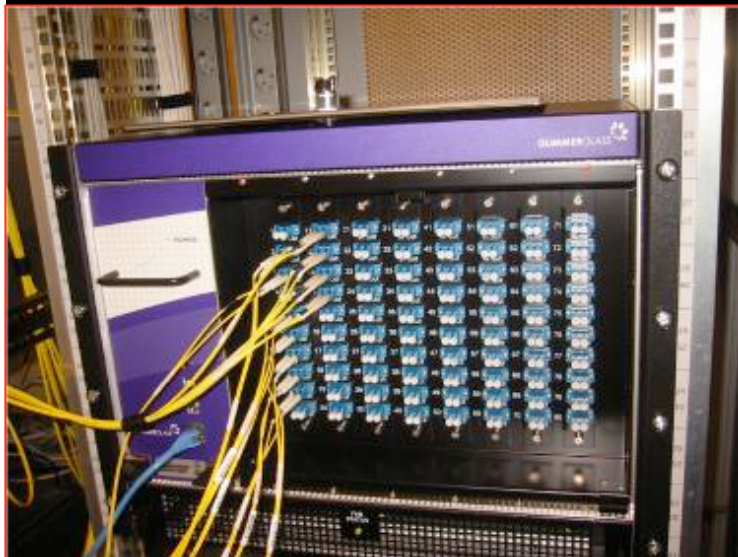
Towards Hybrid Networking!

- 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 and L2
- Give each packet in the network the service it needs, but no more !

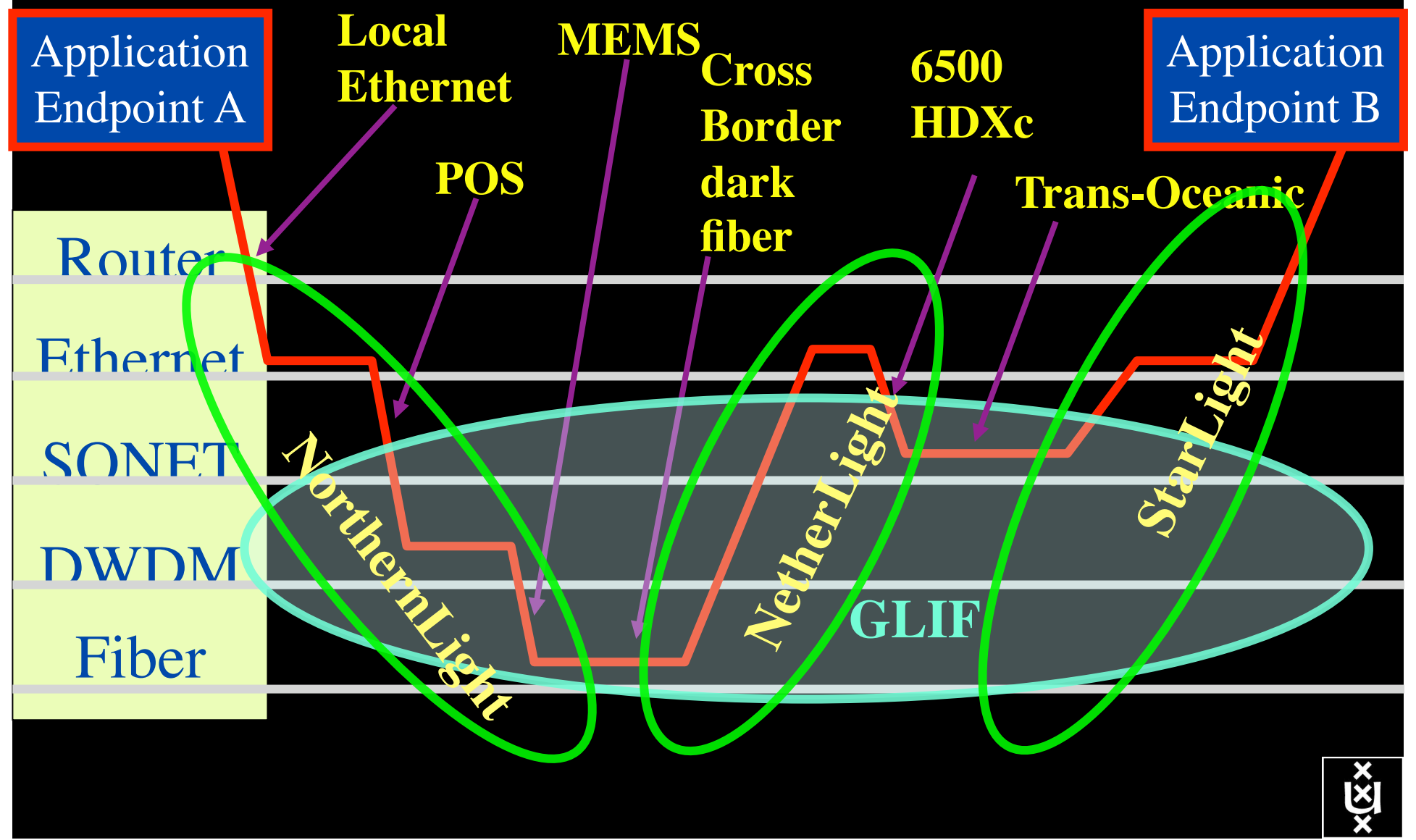
L1 \approx 2-3 k\$/port
0.5 W/port

L2 \approx 5-8 k\$/port
10-15 W/port

L3 \approx 75+ k\$/port
250 W/port



How low can you go?



Function of a GOLE

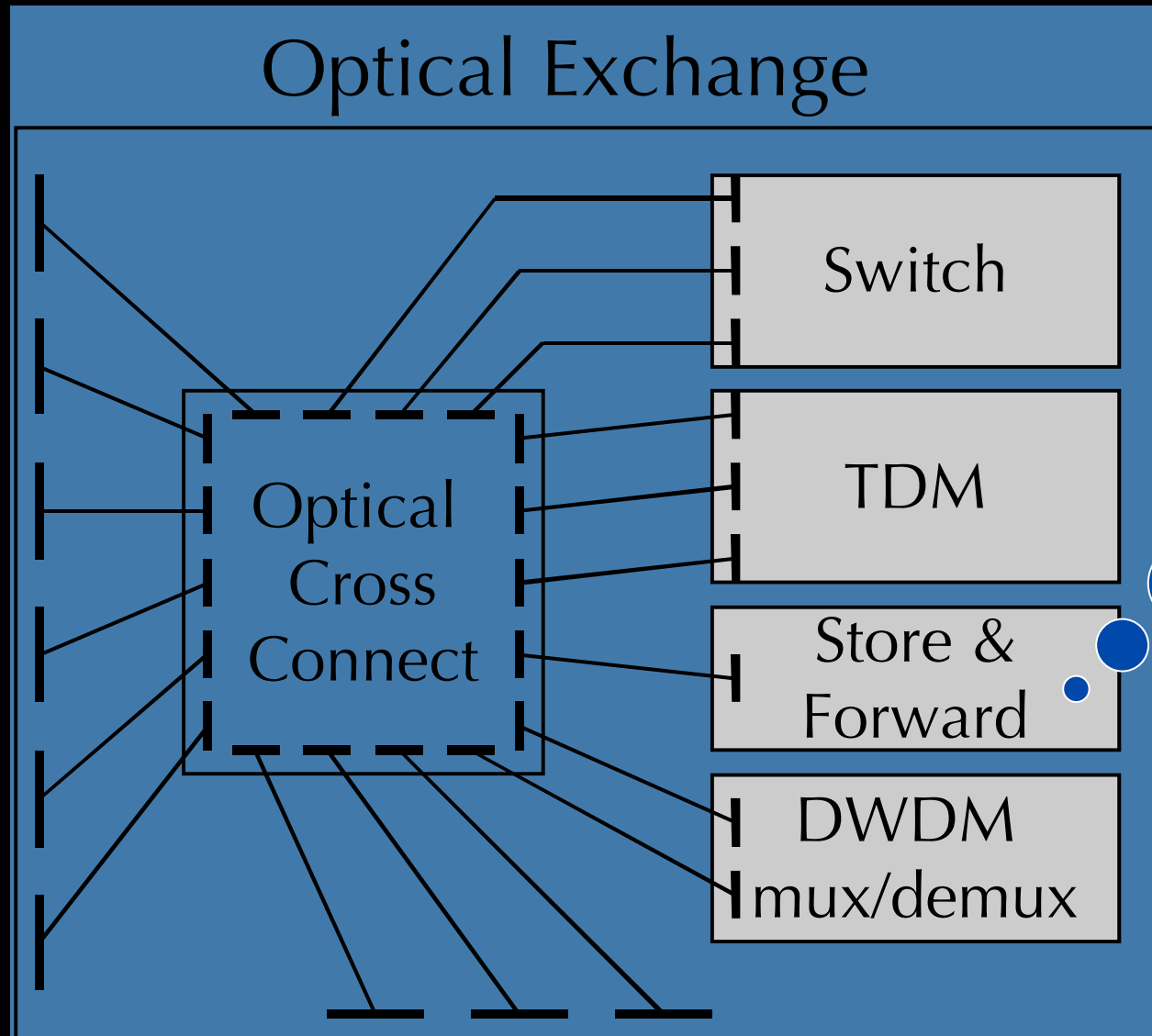
- Enable traffic exchange among peers
- Adapt data/traffic formats when necessary
- AND NOTHING MORE!

Why?

- Economy of scale



Optical Exchange as Black Box



- TeraByte
- Email
- Service

Service Matrix

From	To	WDM (multiple λ)	Single λ, any bitstream	SONET/SDH	1 Gb/s Ethernet	LAN PHY Ethernet	WAN PHY Ethernet	VLAN tagged Ethernet	IP over Ethernet
WDM (multiple λ)		cross-connect multicast, regenerate, multicast	WDM demux	WDM demux*	WDM demux*	WDM demux*	WDM demux*	WDM demux*	WDM demux*
Single λ, any bitstream		WDM mux	cross-connect multicast, regenerate, multicast	N/A *	N/A *	N/A *	N/A *	N/A *	N/A *
SONET/SDH		WDM mux	N/A *	SONET switch, +	TDM demux*	TDM demux ⁶	SONET switch	TDM demux*	TDM demux*
1 Gb/s Ethernet		WDM mux	N/A *	TDM mux	aggregate, Ethernet conversion +	aggregate, eth. convert	aggregate, Ethernet conversion	aggregate, VLAN encap	L3 entry *
LAN PHY Ethernet		WDM mux	N/A*	TDM mux ⁶	aggregate, Ethernet conversion	aggregate, Ethernet conversion +	Ethernet conversion	aggregate, VLAN encap	L3 entry *
WAN PHY Ethernet		WDM mux	N/A *	SONET switch	aggregate, Ethernet conversion	Ethernet conversion	aggregate, Ethernet conversion +	aggregate, VLAN encap	L3 entry *
VLAN tagged Ethernet		WDM mux	N/A *	TDM mux	aggregate, VLAN decap	aggregate, VLAN decap	aggregate, VLAN decap	Aggregate, VLAN decap & encap +	N/A
IP over Ethernet		WDM mux	N/A *	TDM mux	L3 exit *	L3 exit *	L3 exit *	N/A	Store & forward, L3 entry/exit+

What can we learn from Internet Exchanges?

- **Example: Amsterdam Internet Exchange**
 - Basically a big Ethernet switch
 - L2 functionality
 - Peers do their BGP thing
 - Do not need to inform AMS-IX when setting up new peering arrangement (works for packet world, automatic mac learning)
- Exchange is agnostic to what is exchanged
- Exchange works on a need to know basis

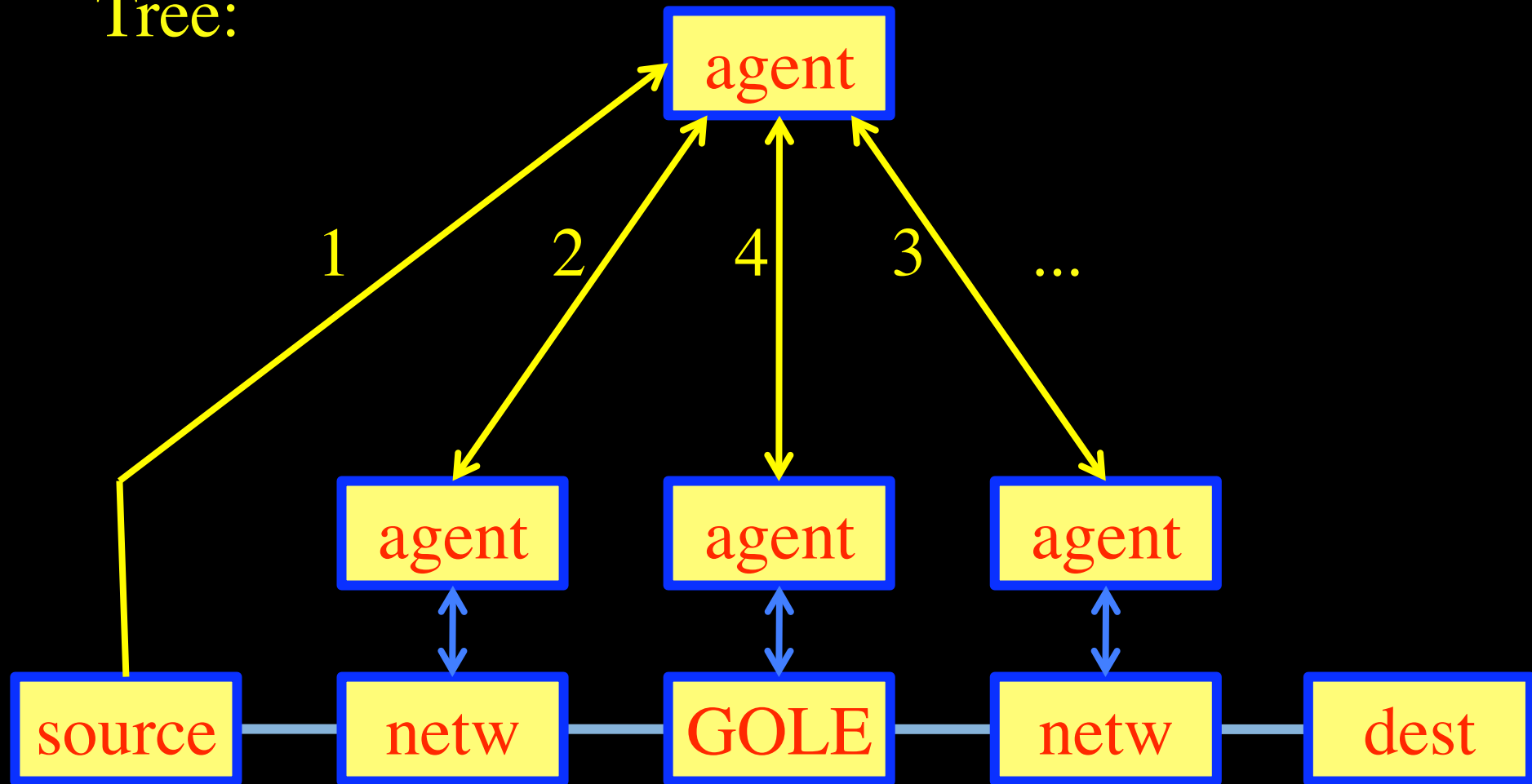
What does that mean for GOLE's ?

- Open: do not introduce any other policy than device (or technical) policy
- Act on requests that are ack'ed by both peers, nothing else
- Keep in mind carefully on what attributes or labels you do the connection or forwarding!
- Work on need to know basis.



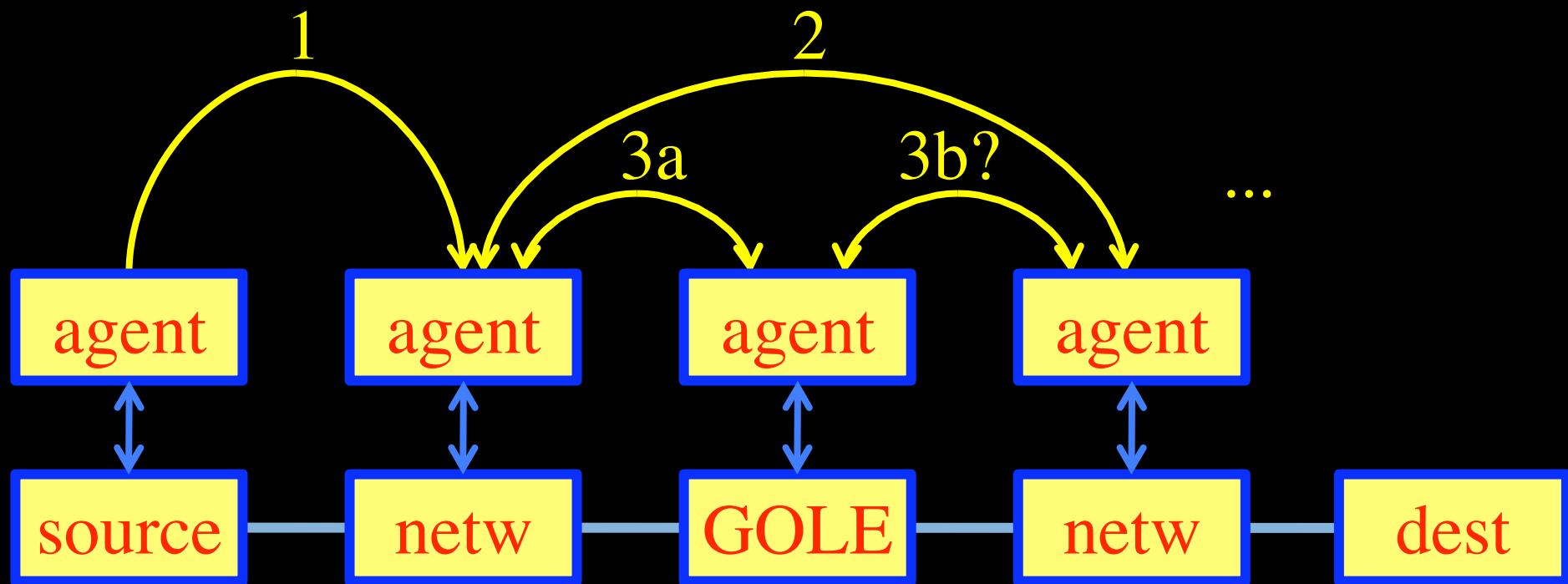
Consequences for signaling

Tree:



Consequences for signaling

Chain:



Questions ?

