

GLIF @ OGF 25: GOLE philosophy revisited

Cees de Laat

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SURFnet

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BSIK

NWO

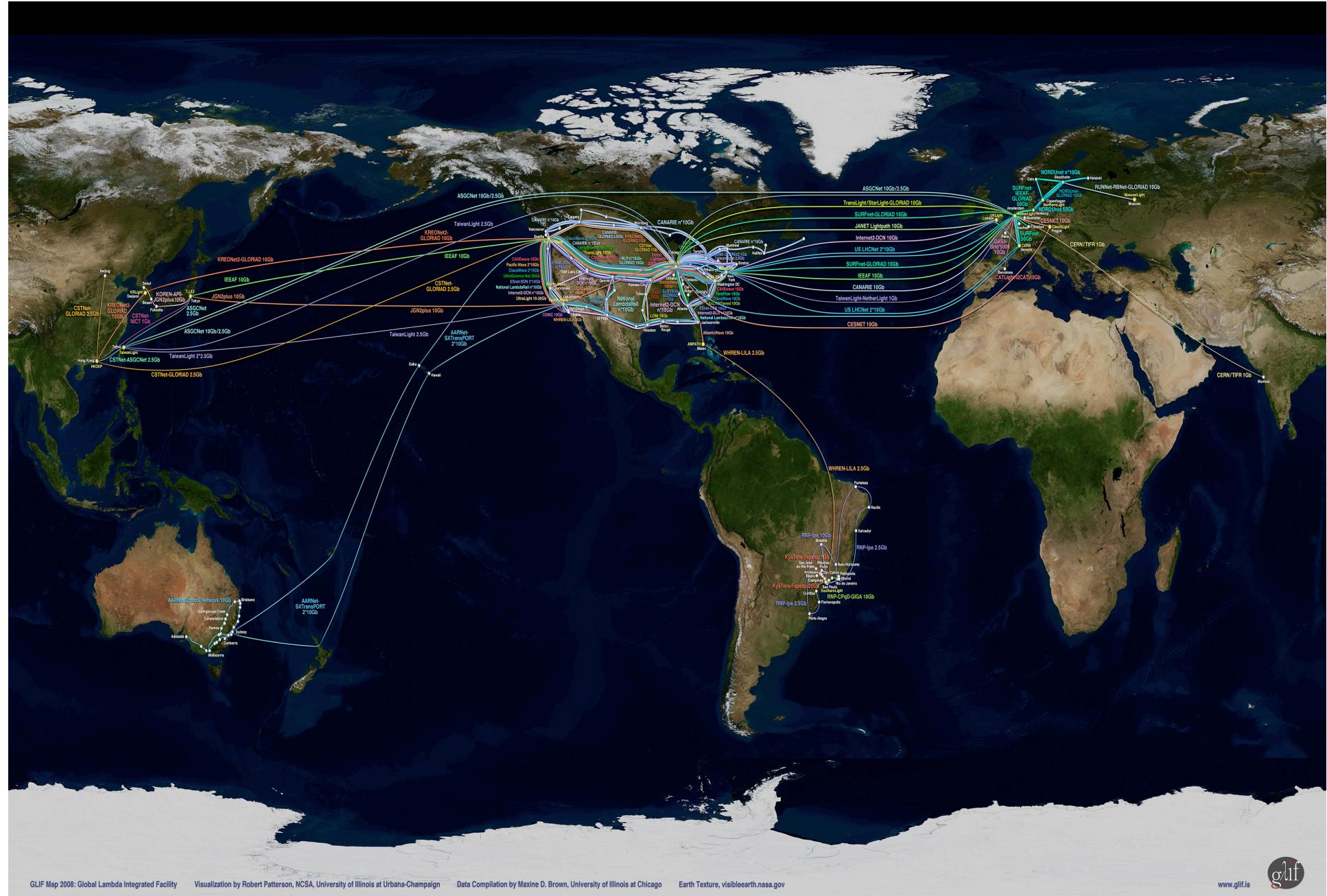
University of Amsterdam

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

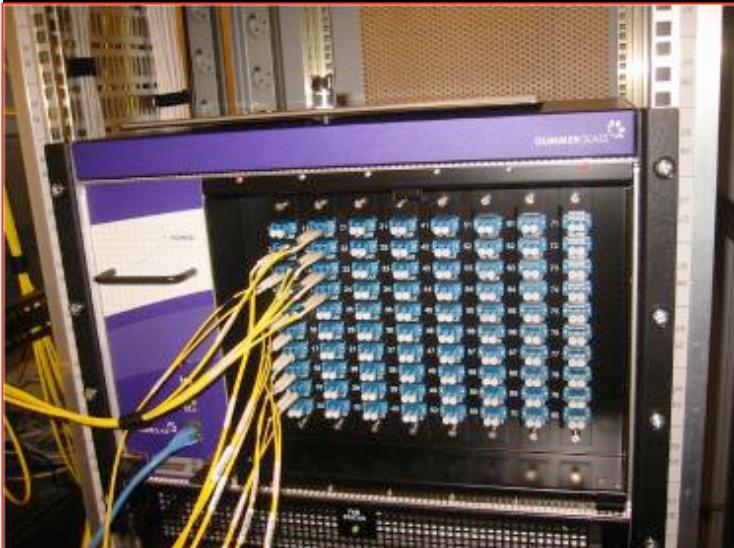
Visualization courtesy of Bob Patterson, NCSA
Data collection by Maxine Brown.



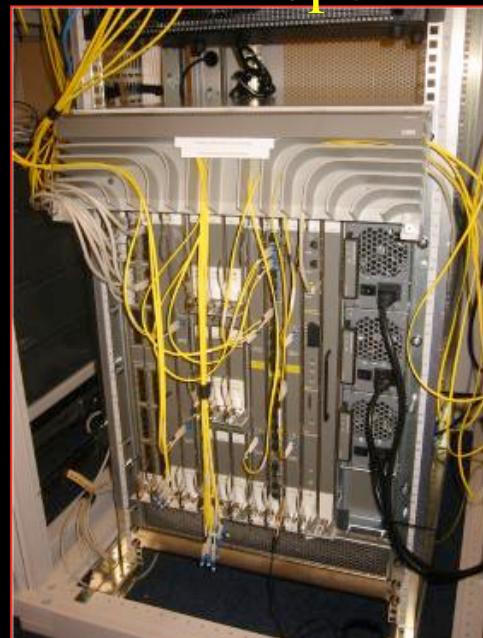
Towards Hybrid Networking!

- 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 !

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



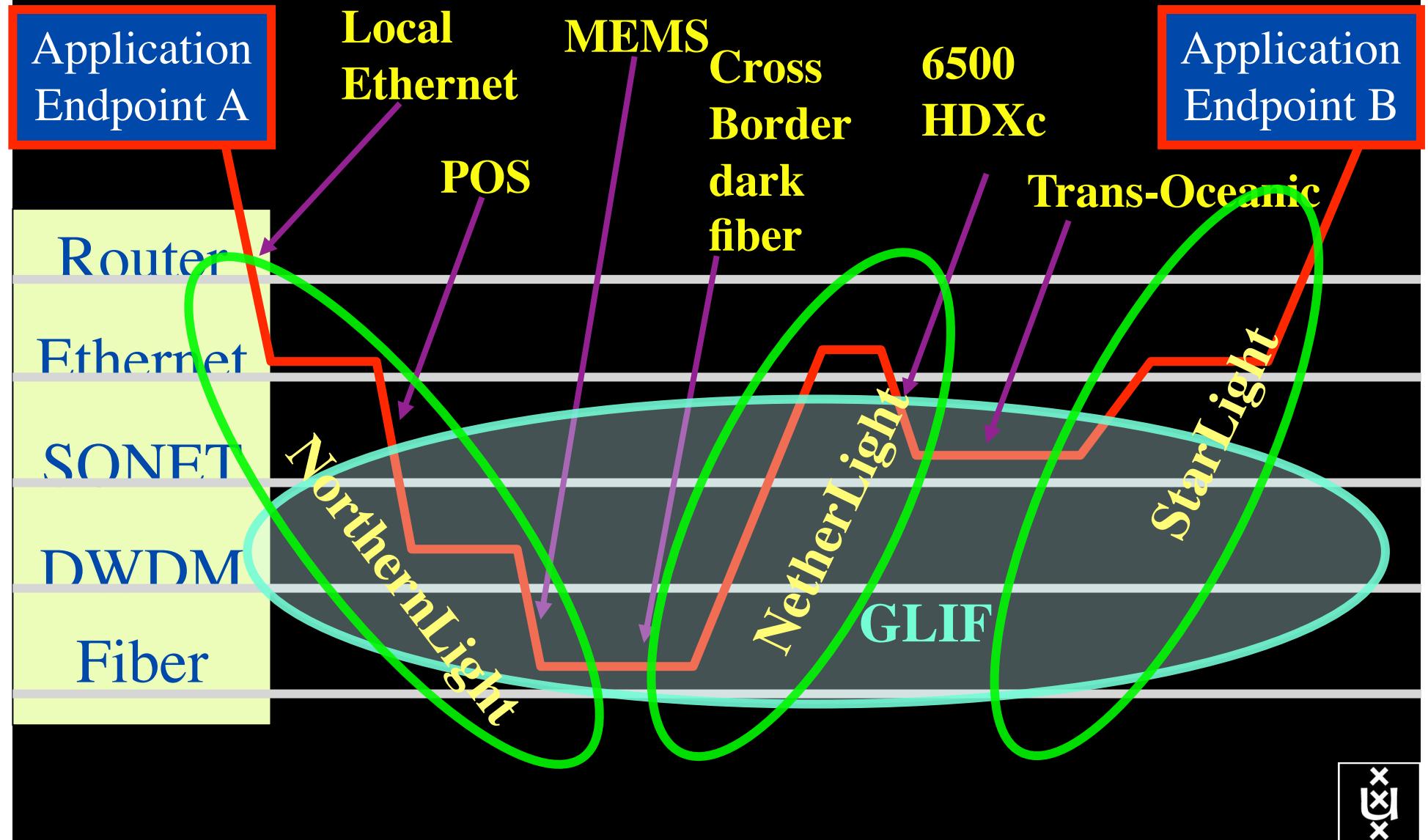
$L2 \approx 5-8 \text{ k\$/port}$
 $10-15 \text{ W/port}$



$L3 \approx 75+ \text{ k\$/port}$
 250 W/port



How low can you go?



Function of a GOLE

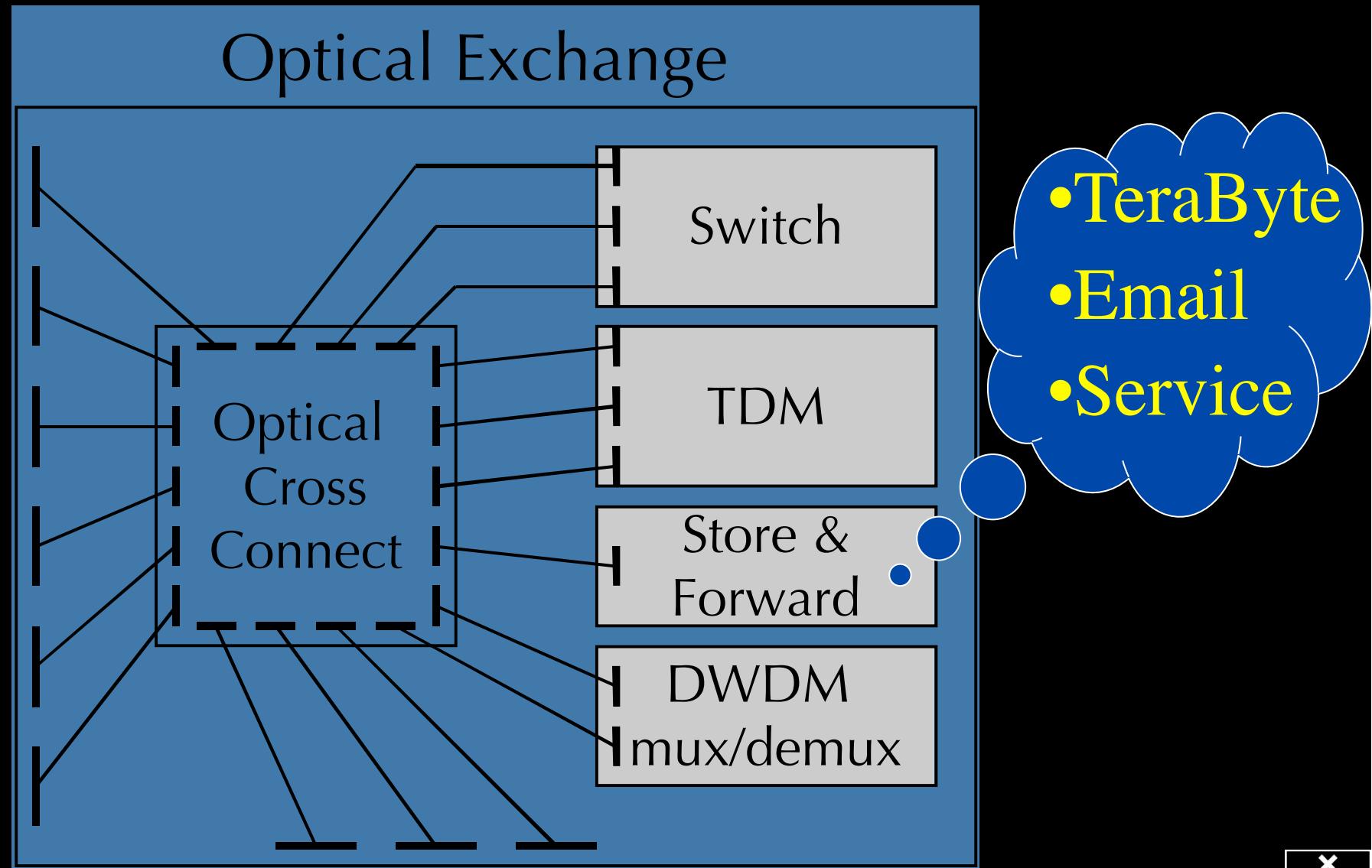
- Enable traffic exchange among peers
- Adapt data/traffic formats when necessary
- AND NOTHING MORE!

Why?

- Economy of scale



Optical Exchange as Black Box



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



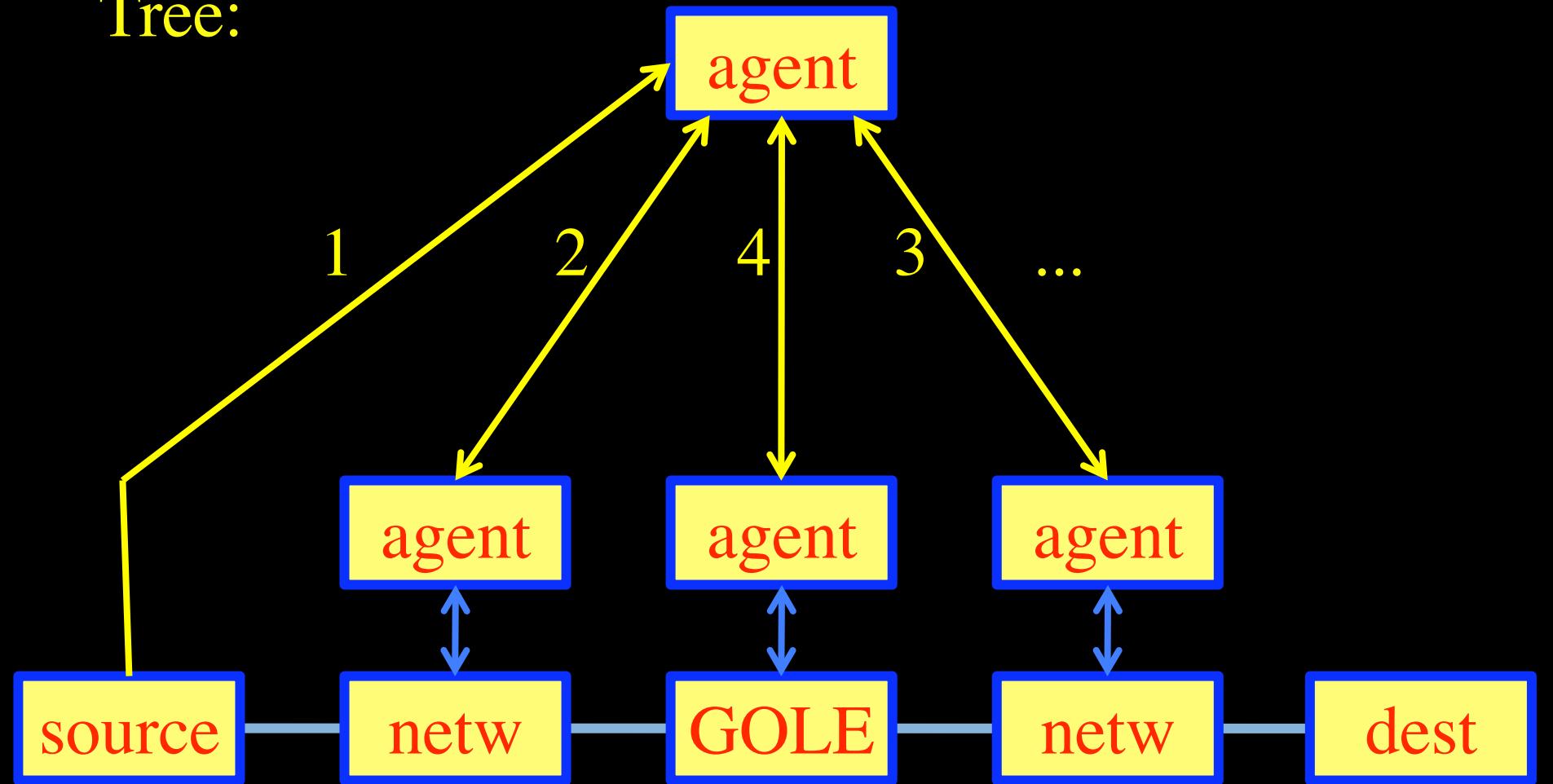
What does that mean for GOLE's ?

- 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.



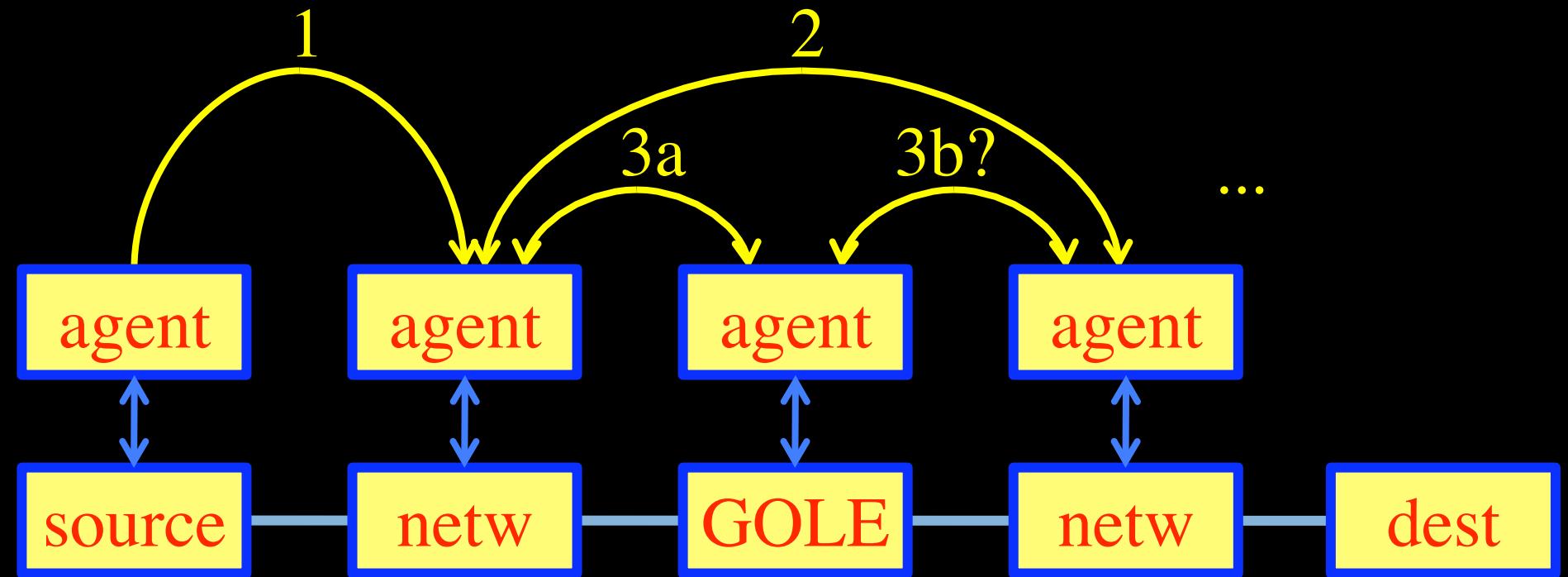
Consequences for signaling

Tree:



Consequences for signaling

Chain:



Questions ?

