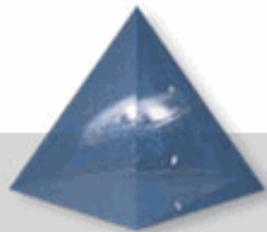


High Performance Networking for Grid Applications

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High Performance Networking for Grid Applications

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Cees de Laat

EU

SURFnet

University of Amsterdam

SARA
NIKHEF
NCF



Contents of this talk

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**I am not going to
talk about this
here, it feels like
preaching to the
pope**

u
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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

A

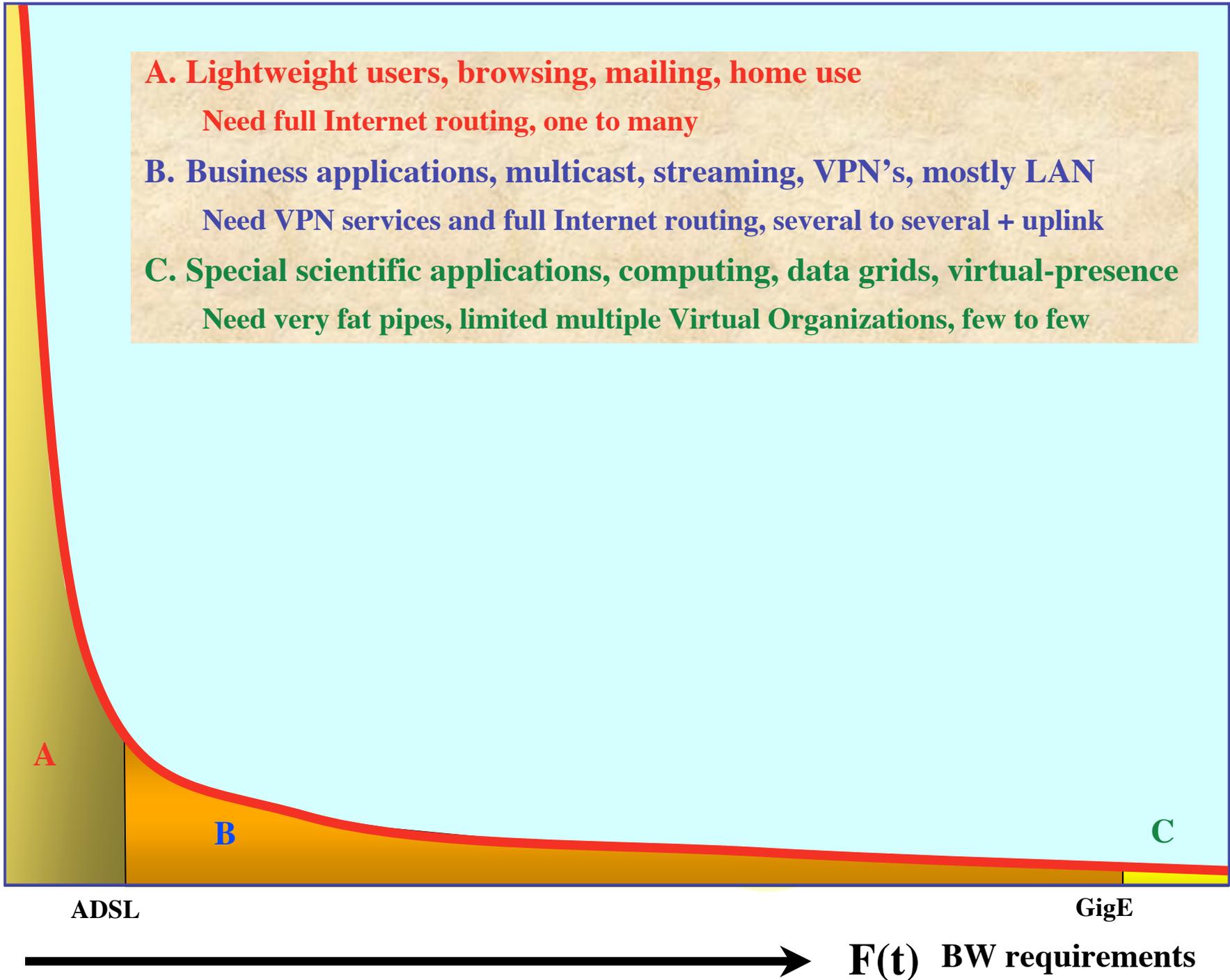
B

C

ADSL

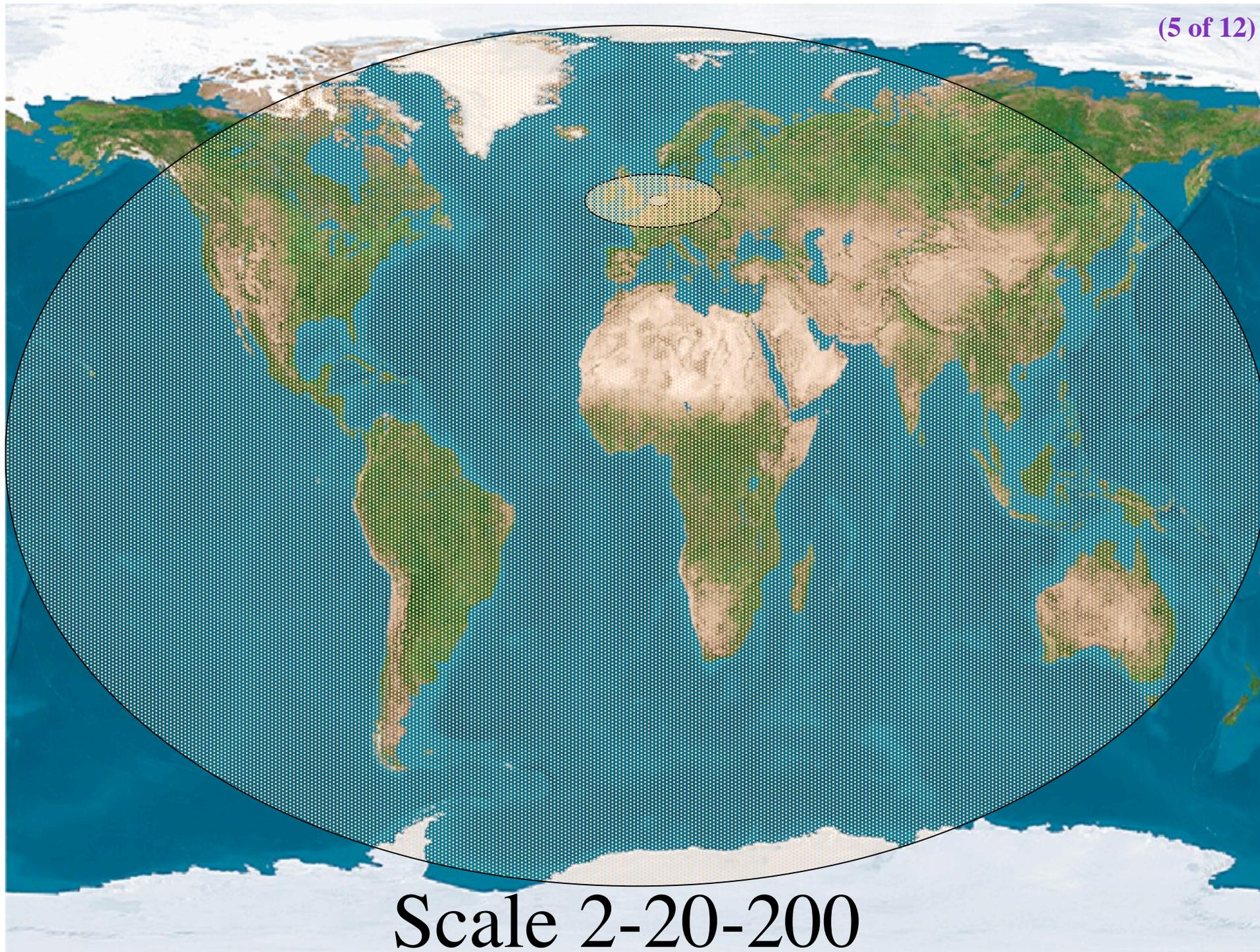
GigE

F(t) BW requirements



So what are the facts

- **Costs of fat pipes (fibers) are one-third of equipment to light them up**
 - **Is what Lambda salesmen tell me**
- **Costs of optical equipment 10% of switching 10 % of full routing equipment for same throughput**
 - **100 Byte packet @ 40 Gb/s -> 20 ns to look up in 140 kEntries routing table (light speed from me to you!)**
- **Big sciences need fat pipes**
- **Bottom line: create a hybrid architecture which serves all users in one consistent cost effective way**



Scale 2-20-200

The only formula's

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

Now, as having been a High Energy Physicist we set

$$c = 1$$

$$e = 1$$

$$\hbar = 1$$

and the formula reduces to:

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

Services

SCALE CLASS	2 Metro	20 National/ regional	200 World
A	Switching/ routing	Routing	ROUTER\$
B	VPN's, (G)MPLS	VPN's Routing	Routing
C $\# \lambda \approx \frac{200 * e^{(t-2002)}}{rtt}$	dark fiber Optical switching	Lambda switching	Sub- lambdas, ethernet- sdh

Legenda

- SURFnet5-netwerk
- BT Ignite
- Global Crossing
- Eurofiber
- Telecom Utrecht
- Essent (preferred supplier)
- KPN (preferred supplier)
- Hoofdaansluitpunten (PoP)
- Aansluitpunten



2 ms

3 ms



SURFnet
Lambda's
fibers

(old already)

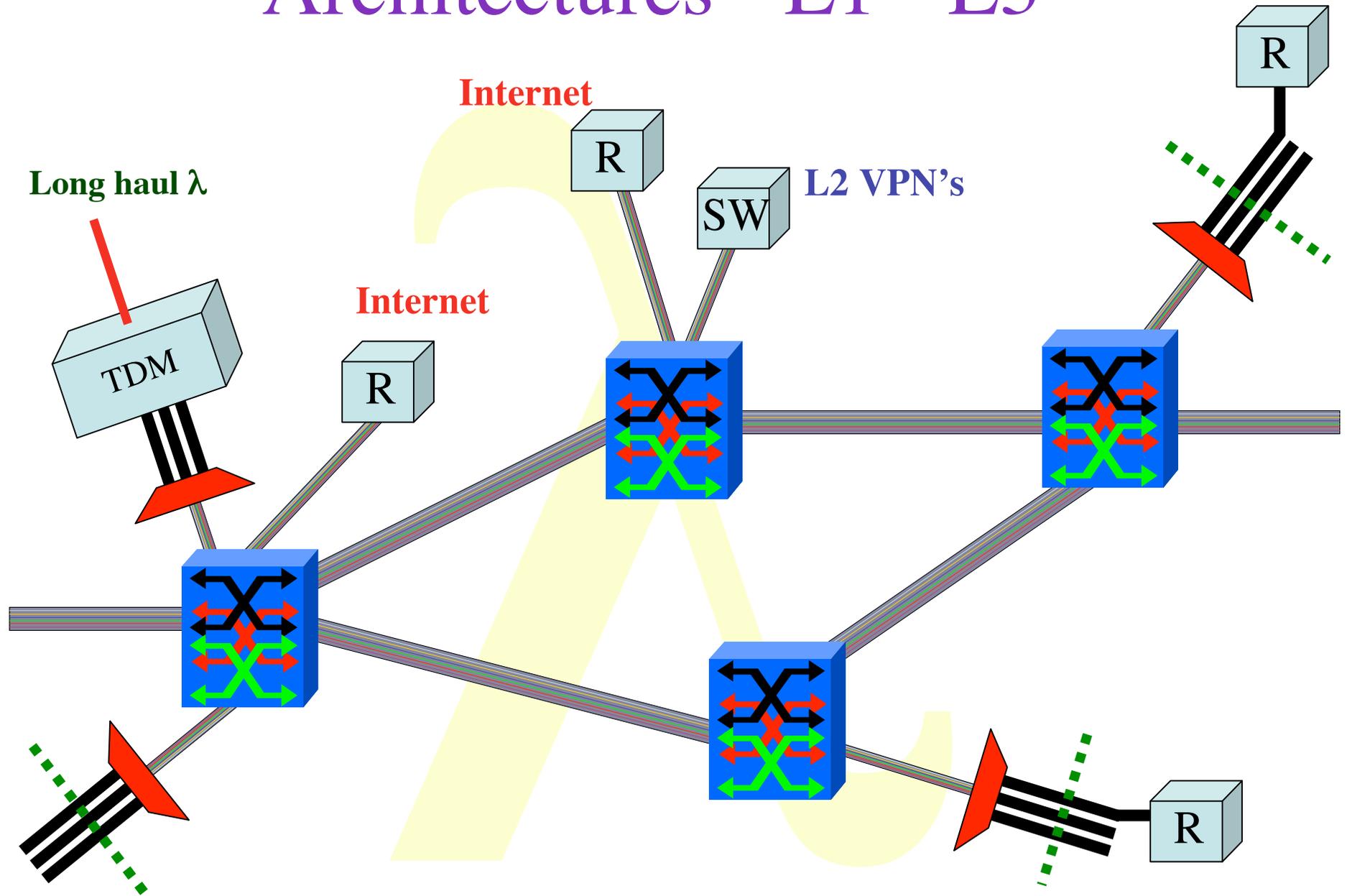
See Erik's talk

Current technology + (re)definition

- Current (to me) available technology consists of SONET/SDH switches, 10 gig ethernet and dark fiber environments
- Optical switch on the way (customs)!
- DWDM+switching included
- Starlight/NetherLight deploy VLAN's on Ethernet switches to connect [exactly two] ports (but also routing)
- We want to understand routerless limited environments
- So redefine a λ as:
 - “a λ is a pipe where you can inspect packets as they enter and when they exit, but principally not when in transit. In transit one only deals with the parameters of the pipe: number, color, bandwidth”

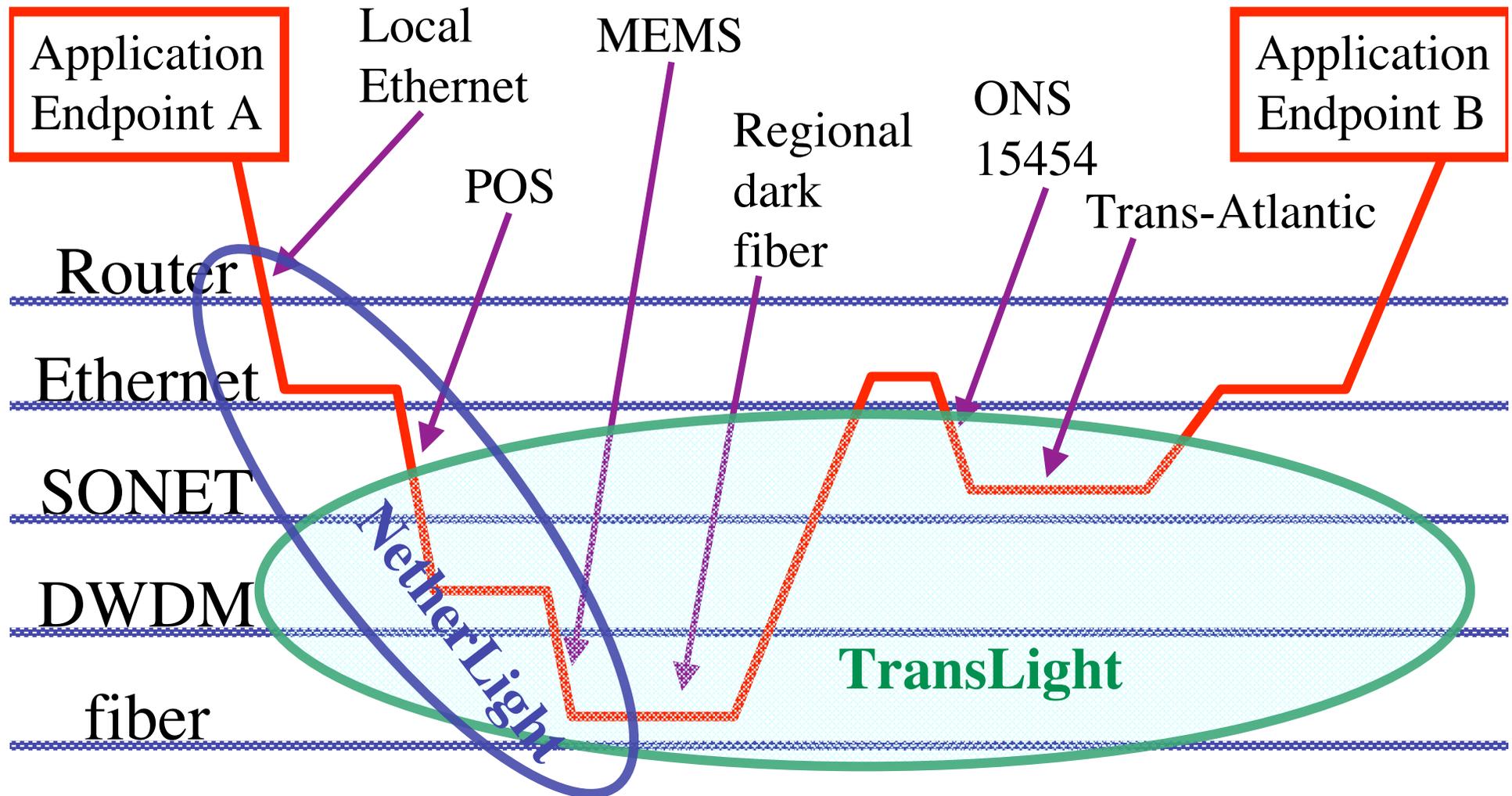
Architectures - L1 - L3

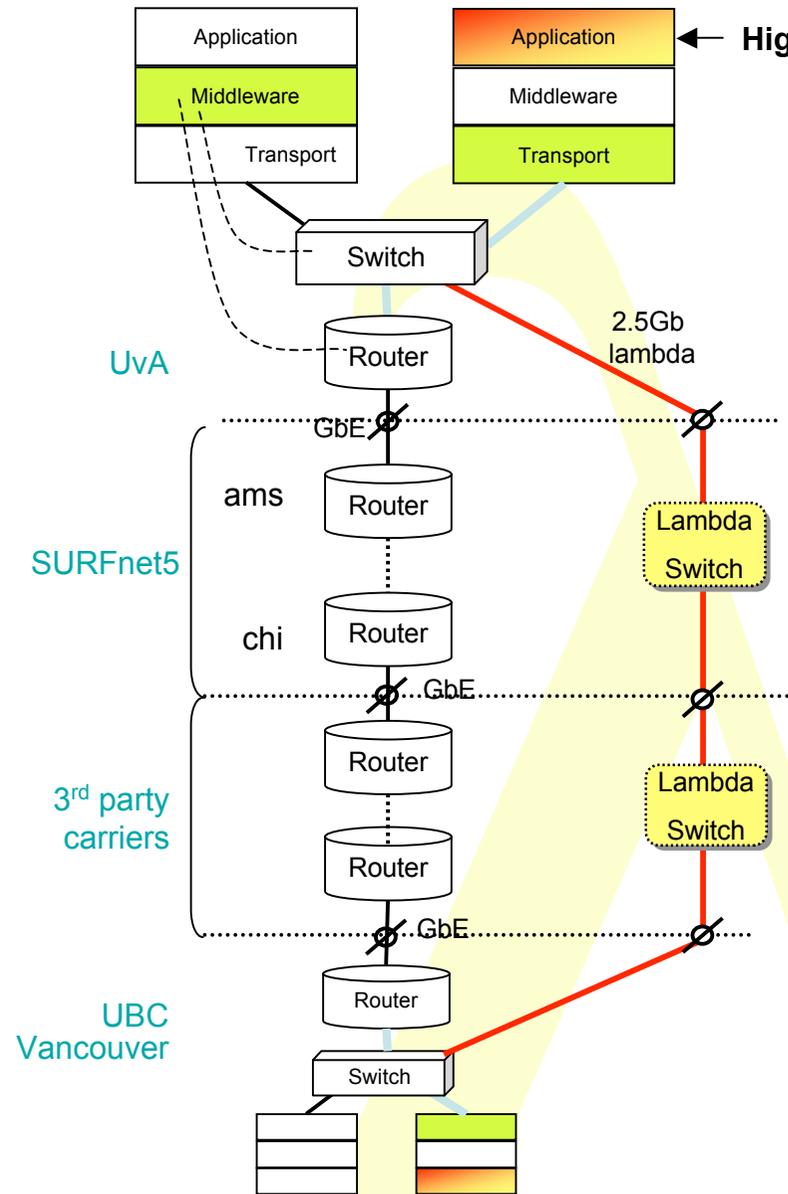
(10 of 13)



Bring plumbing to the users, not just create sinks in the middle of nowhere

How low can you go?

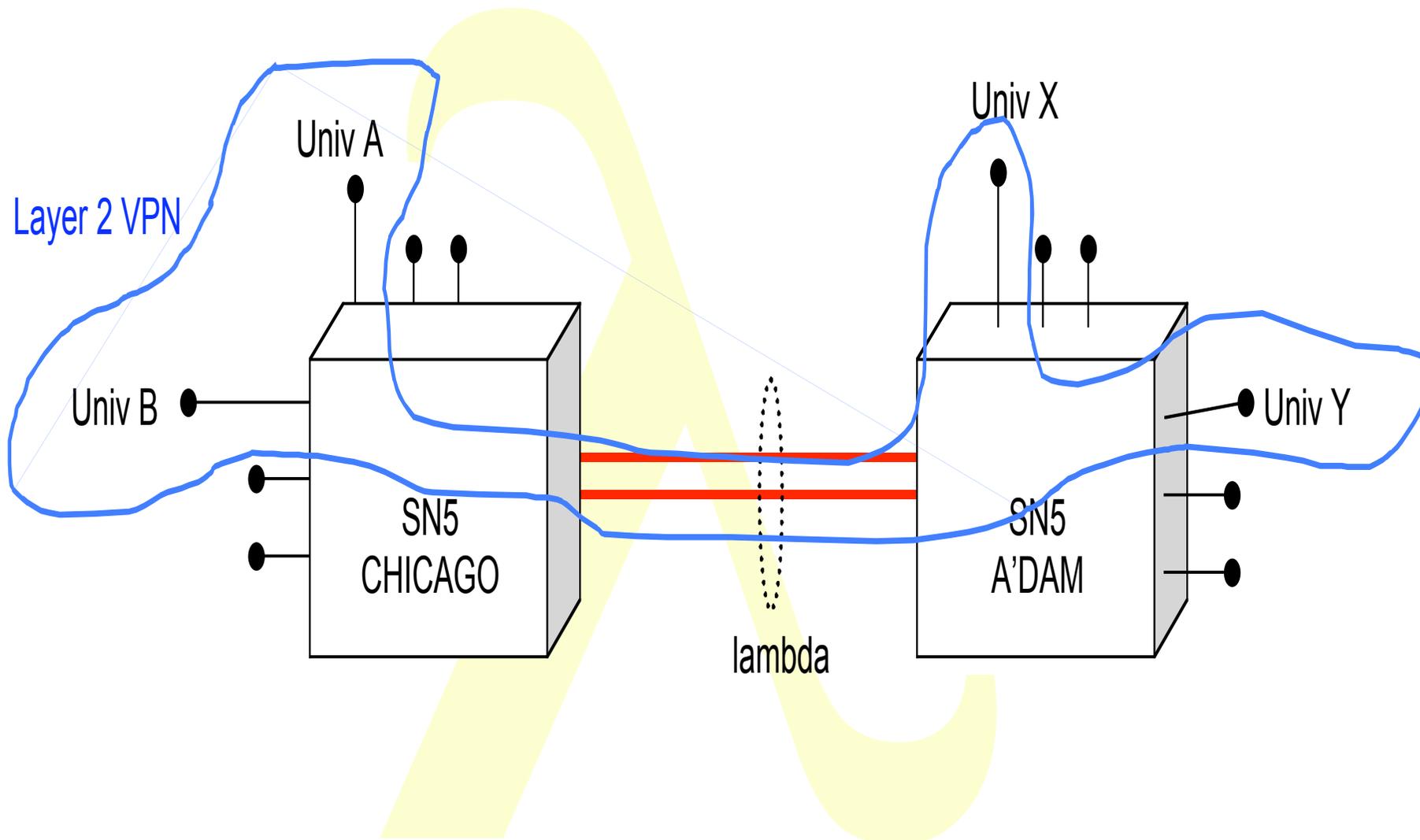


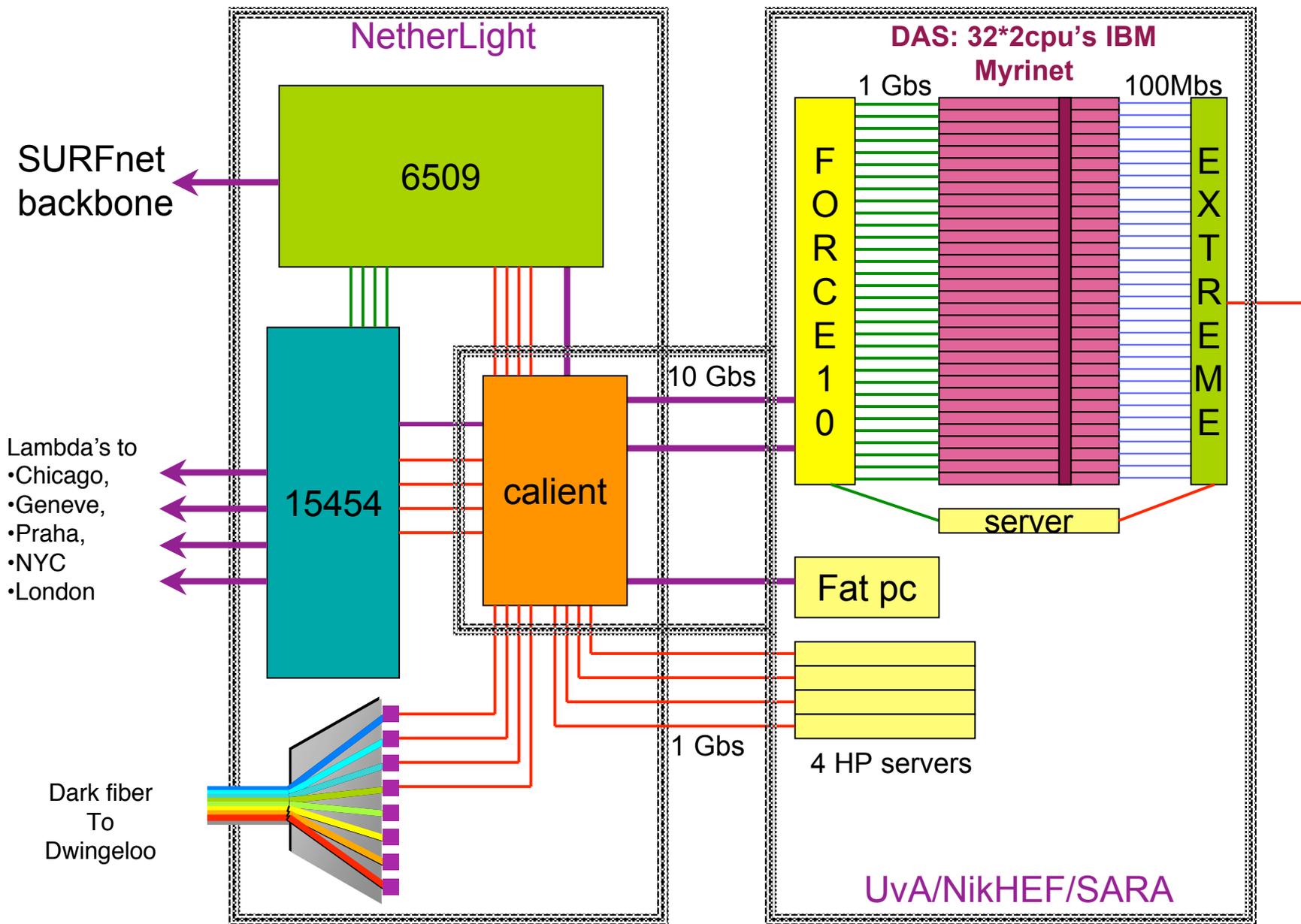


- lambda for high bandwidth applications
 - Bypass of production network
 - Middleware may request (optical) pipe
- RATIONALE:
 - Lower the cost of transport per packet



Distributed L2





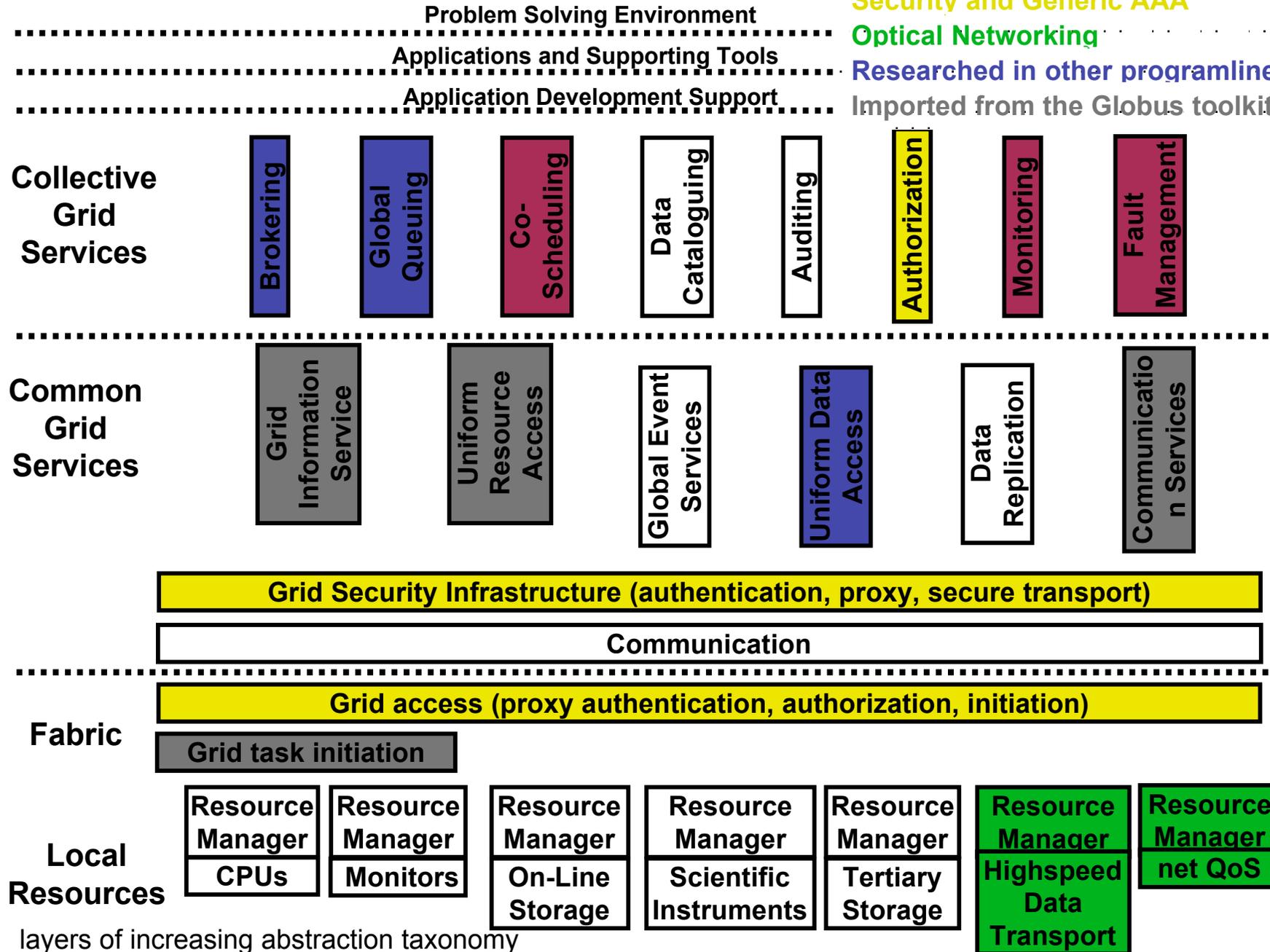
High performance computing and Processor memory co-allocation

Security and Generic AAA

Optical Networking

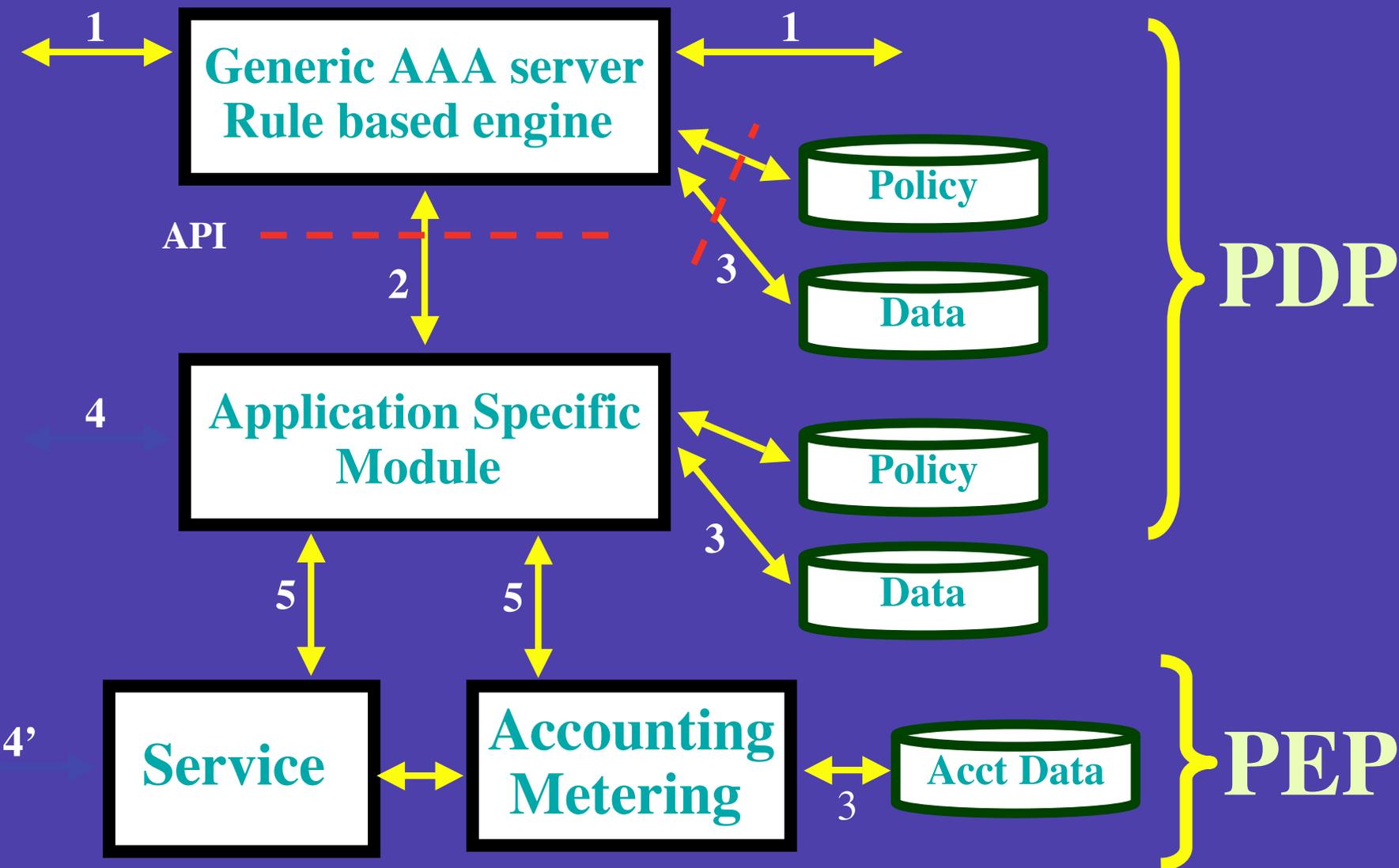
Researched in other programlines

Imported from the Globus toolkit



layers of increasing abstraction taxonomy

Starting point



(Future) Projects

•National:

- NCF Grid project
- VLE
- GigaPort-NG
- LOFAR

•European

- DataGrid
- DataTAG

•International

- NetherLight
- StarLight
- AnyLight, LowLight, BackLight
- Optiputer

Research:

Models of Lambda networking

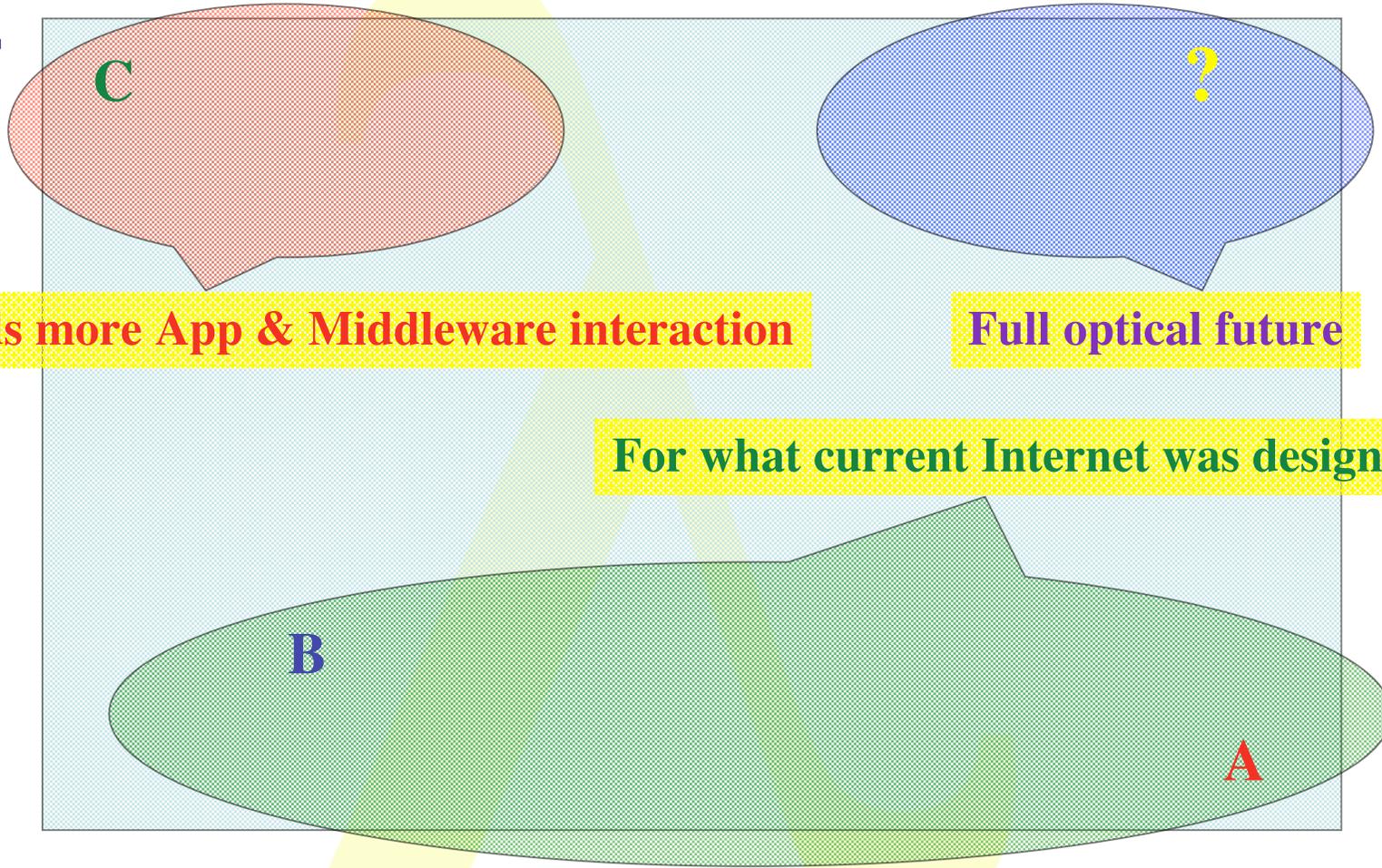
Transport

AAA



Transport in the corners

$BW * RTT$



FLOWS

The END

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