The road to optical networking

www.science.uva.nl/~delaat

www.science.uva.nl/research/air

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SURFnet

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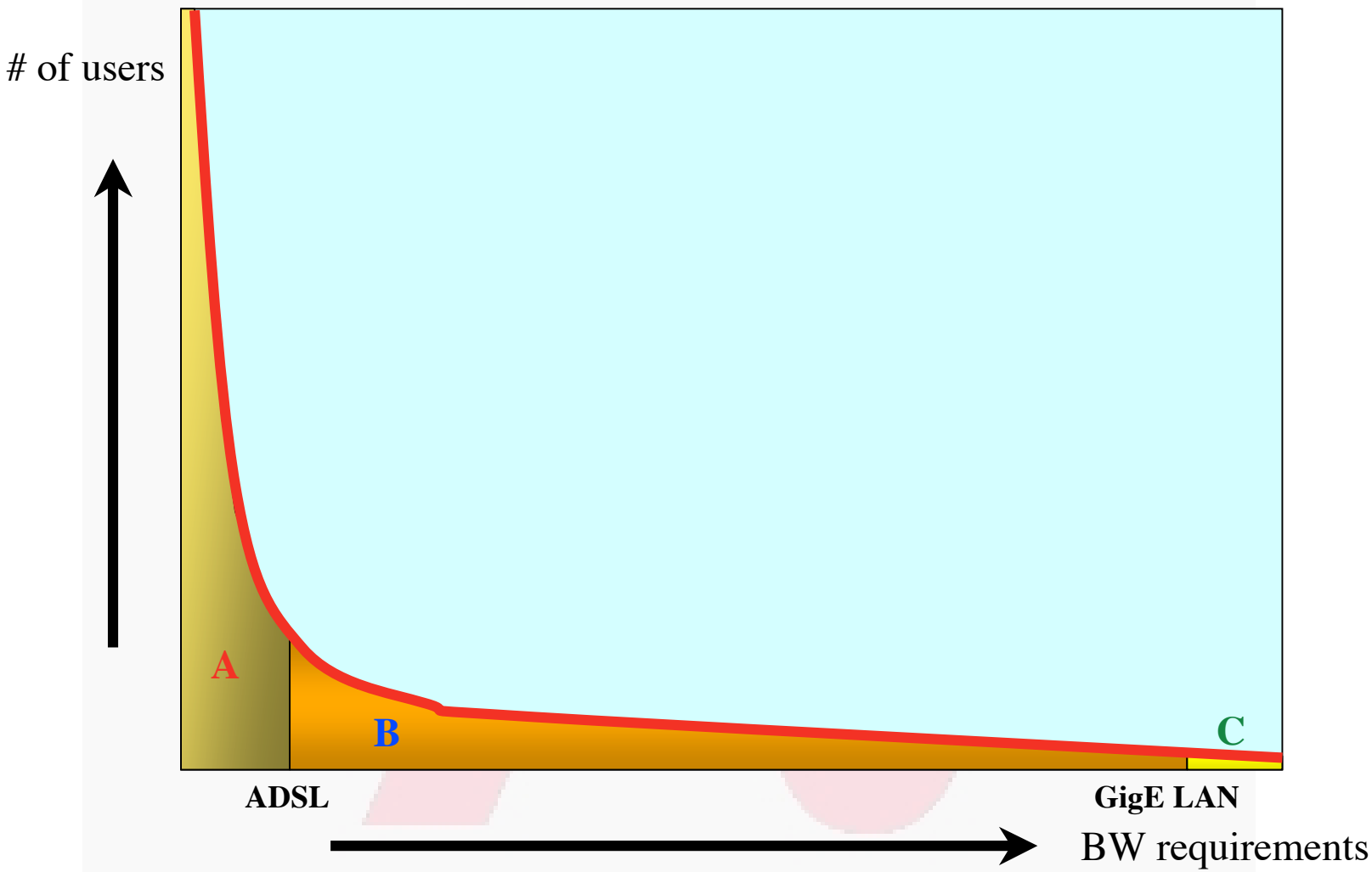
Know the user



A -> Lightweight users, browsing, mailing, home use

B -> Business applications, multicast, streaming

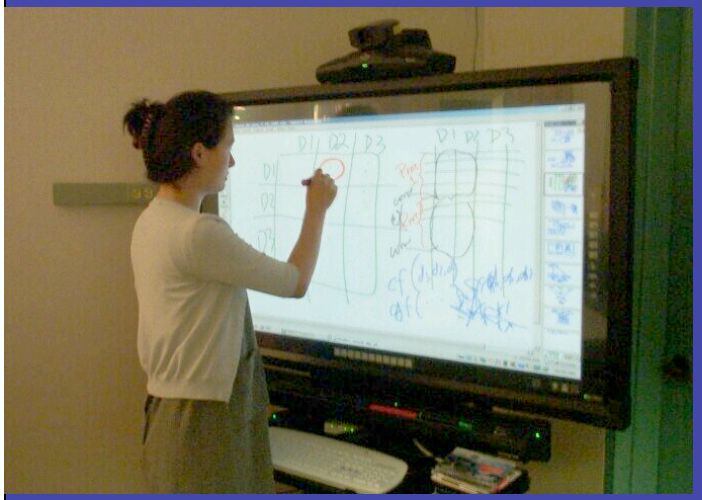
C -> Special scientific applications, computing, data grids, virtual-presence

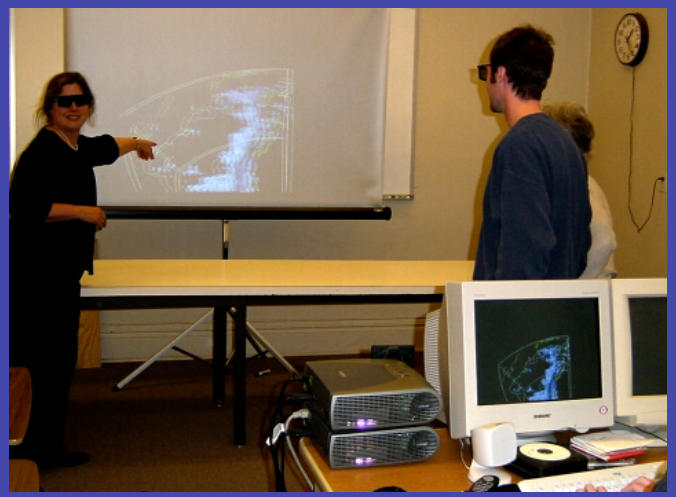
Integrating Distributed Collaborative Visualization


CAVE


AccessGrid

ImmersaDesk

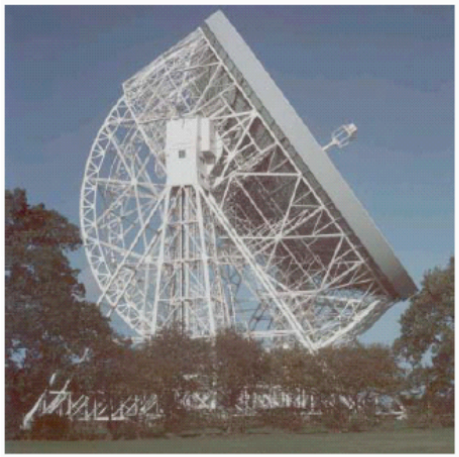

Plasma Touch Screen


AGAVE: Passive Stereo Wall

PDAs, Tablet PCs, Laptops

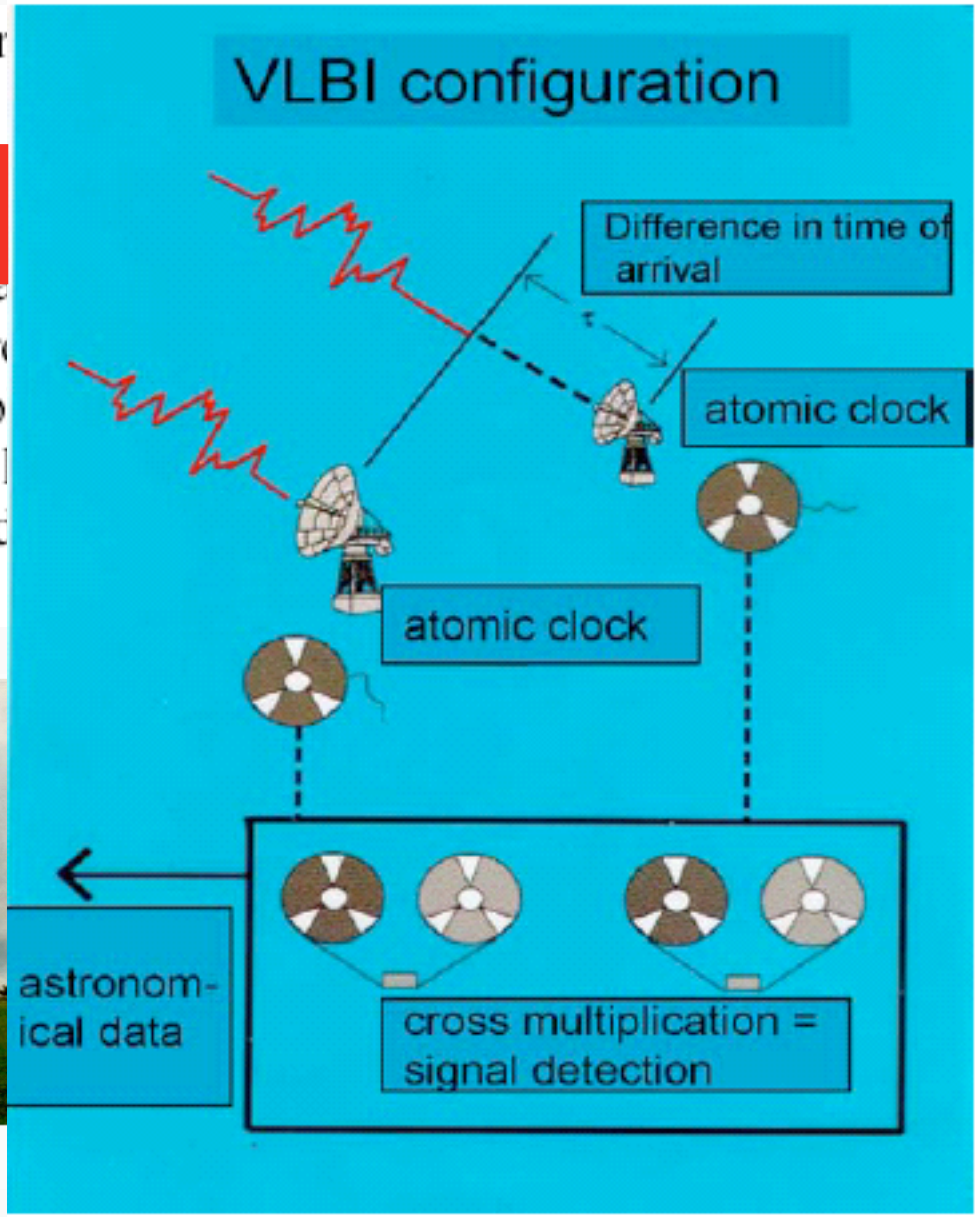
VLBI

ger term VLBI is easily capable of gener
The sensitivity of the VLBI array scales
(=data-rate) and there is a strong push to
Rates of 8Gb/s or more are entirely feasi
ider development. It is expected that para
orrelator will remain the most efficient appr
s distributed processing may have an app
lti-gigabit data streams will aggregate into
or and the capacity of the final link to the
tor.



Jodrell Bank Lovell Telescope - UK

Westerbork Synthesis Radio Telescope - Netherlands



Coming…..

iGrid 2002

The International Virtual Laboratory

www.startap.net/igrid2002
www.igrid2002.org (COMING SOON)

24-26 September 2002
Amsterdam Science and Technology Centre (WTCW)
The Netherlands

Cees de Laat
University of Amsterdam
Maxine Brown
University of Illinois at Chicago

Acknowledgments

iGrid 2002 Organizing Institutions

Amsterdam Science and Technology Centre (WTCW), The Netherlands
GigaPort Project, The Netherlands
SARA Computing and Networking Services, The Netherlands
SURFnet, The Netherlands
Electronic Visualization Laboratory, University of Illinois at Chicago, USA
Internat'l Center for Advanced Internet Research, Northwestern Univ., USA
Math and Computer Science Division, Argonne National Laboratory, USA
Office of the Vice President for Information Technology, Indiana Univ., USA

iGrid 2002 Participating Organizations

Internet2, USA
CANARIE, Canada
TERENA, The Netherlands

iGrid 2002 Sponsors

Amsterdam Science and Technology Centre (WTCW), The Netherlands
GigaPort Project, The Netherlands
National Science Foundation NL (NWO)
European Union (pending)
National Science Foundation, USA

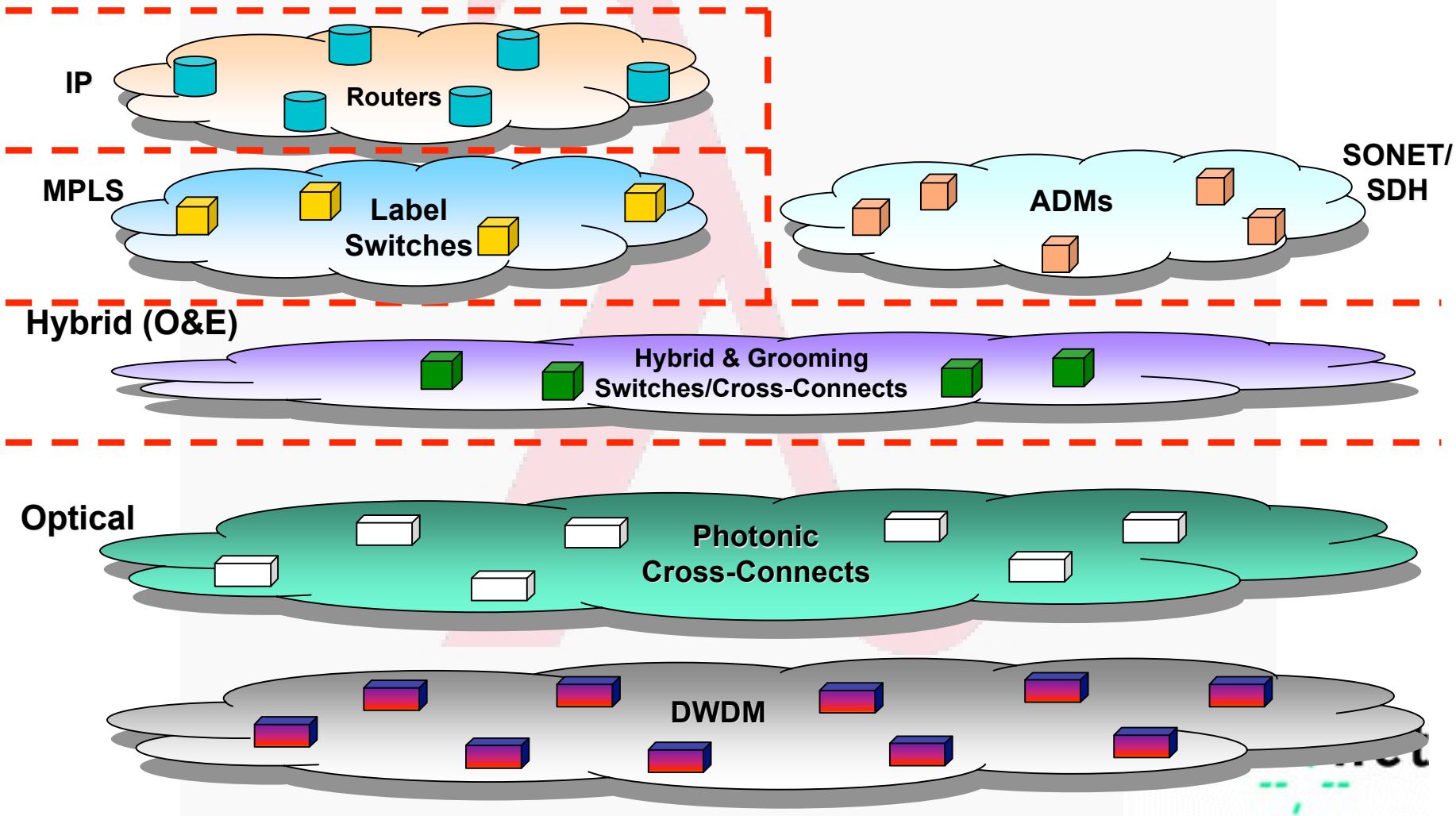
Help Develop the iGrid 2002 Testbed!

Bring us your applications and/or engineering support!

- Call for Participation

  www.startap.net/igrid2002
- Contact
  - maxine@startap.net
  - delaat@science.uva.nl

Optical networking tomorrow



Optical networking, 3 scenarios

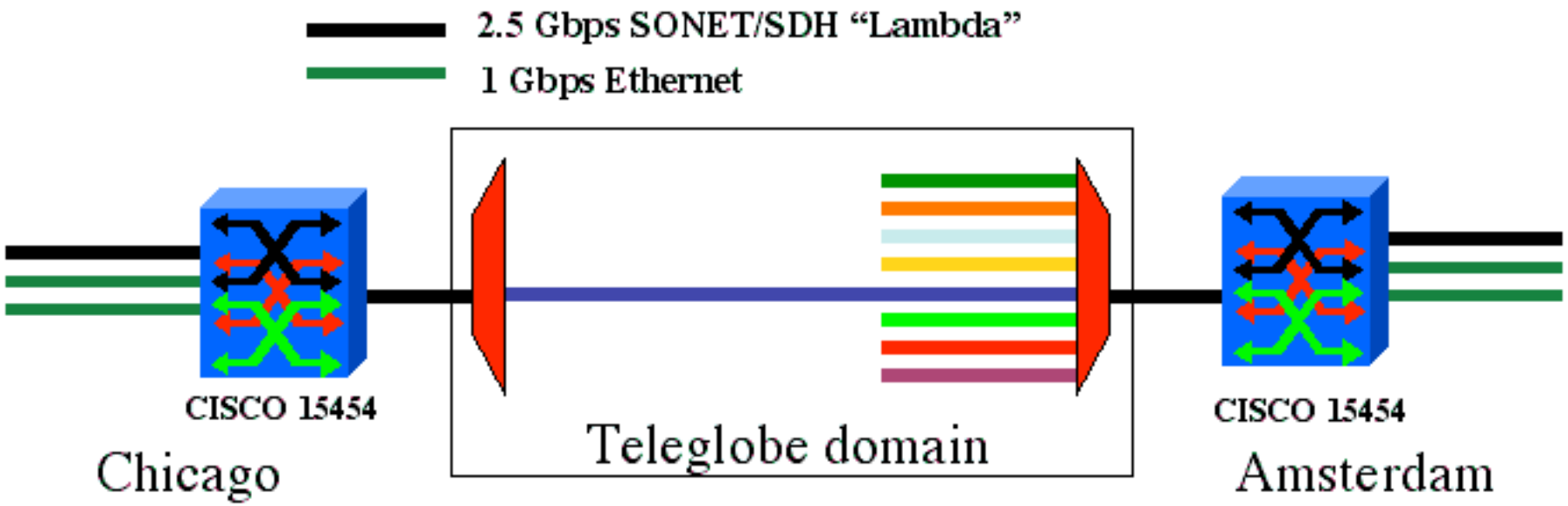
- **Lambdas for internal ISP bandwidth provisioning**
  - **An ISP uses a lambda switching network to make better use of its (suppliers) dark fibers and to provision to the POP's. In this case the optical network is just within one domain and as such is a relatively simple case.**
- **Lambda switching as peering point technology**
  - **In this use case a layer 1 Internet exchange is build. ISP's peer by instantiating lambdas to each other. Is a N*(N-1) and multi domain management problem.**
- **Lambda switching as grid application bandwidth provisioning**
  - **This is by far the most difficult since it needs UNI and NNI protocols to provision the optical paths through different domains.**

Current technology + (re)definition

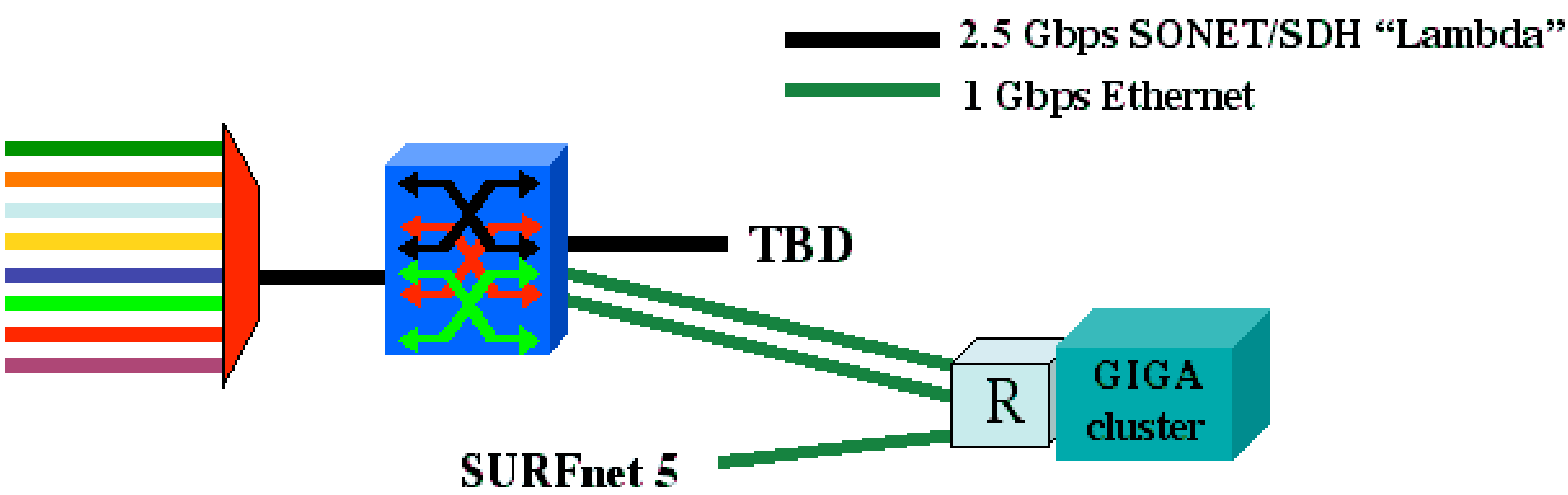
- Current (to me) available technology consists of SONET/SDH switches
- DWDM+switching coming up
- Starlight uses for the time being VLAN's on Ethernet switches to connect [exactly] two ports
- So redefine a λ as:

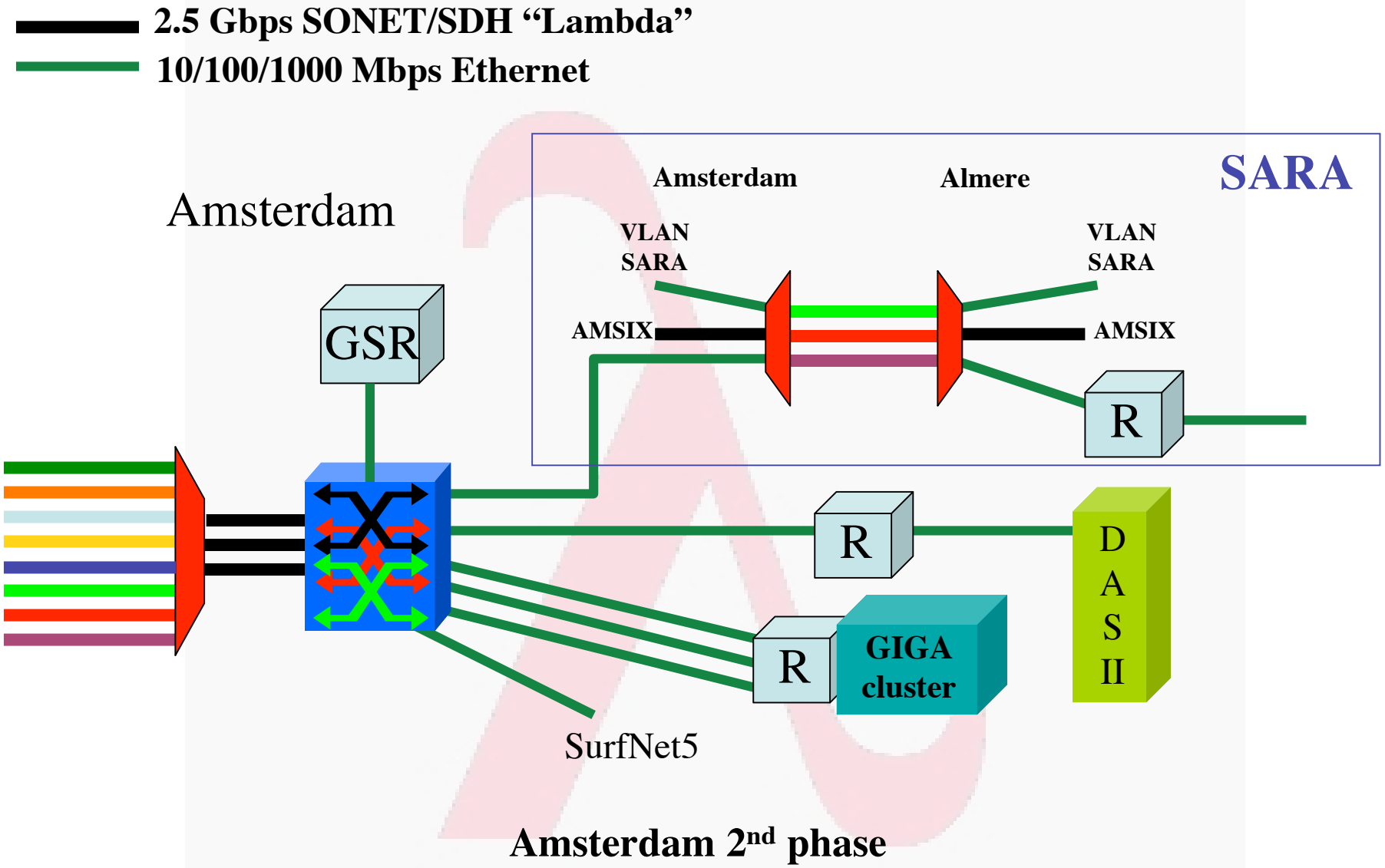
"a λ is a pipe where you can inspect packets as they enter and when they exit, but principally not when in transit. In transit one only deals with the parameters of the pipe: number, color, bandwidth"

Basic phase 1



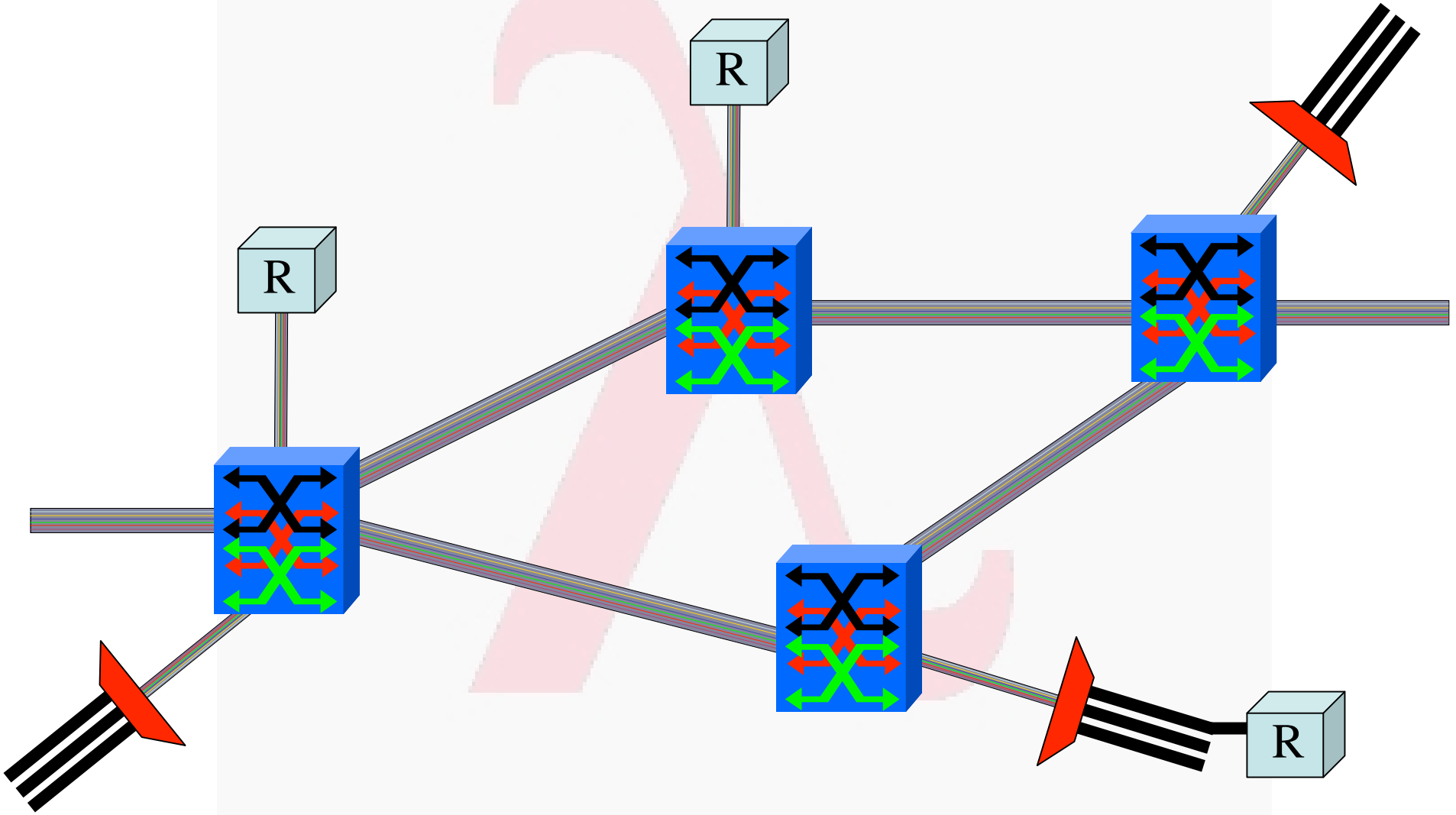
Amsterdam 1st phase



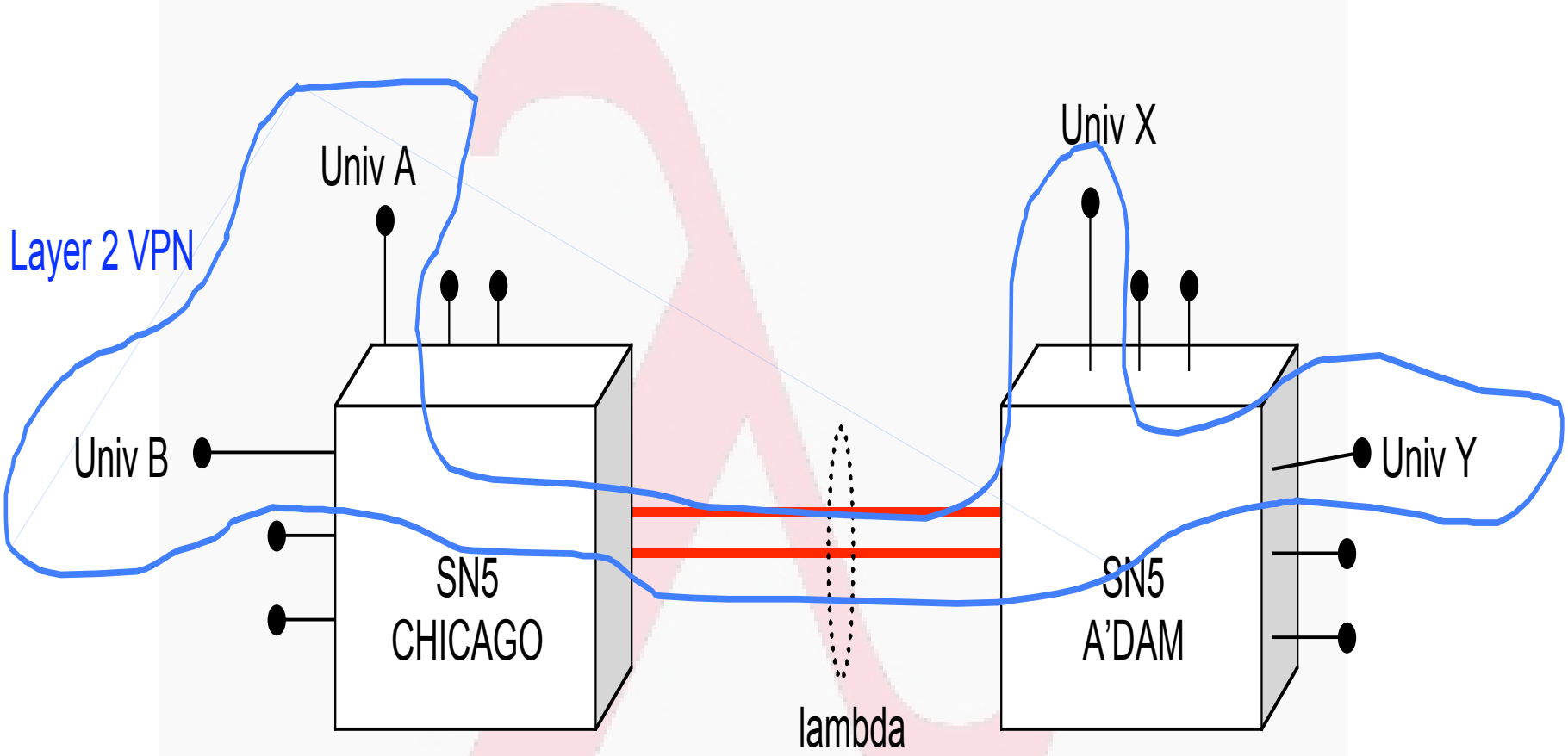


Amsterdam 2nd phase

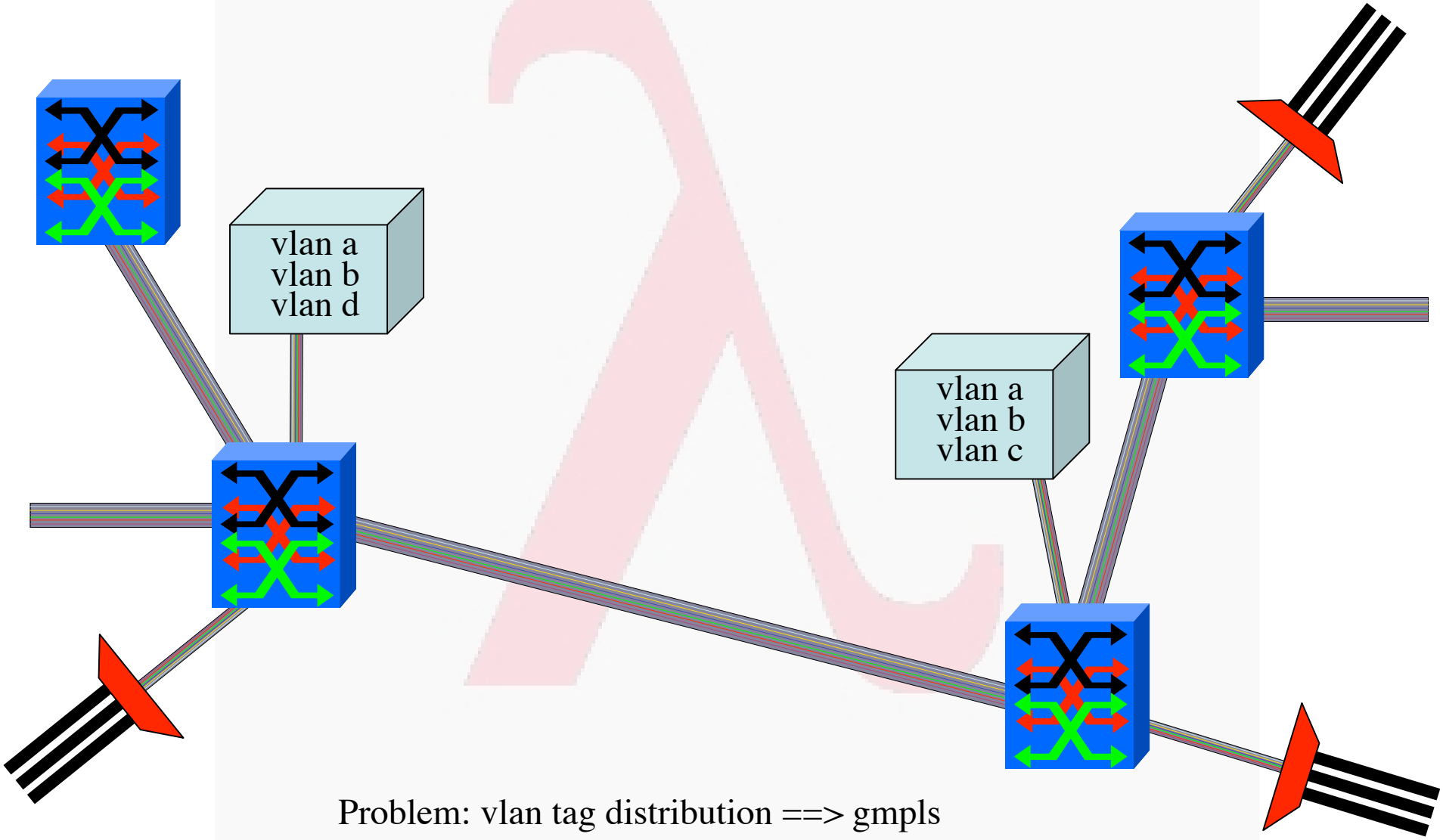
Other architectures - L1 - 3



Distributed L2

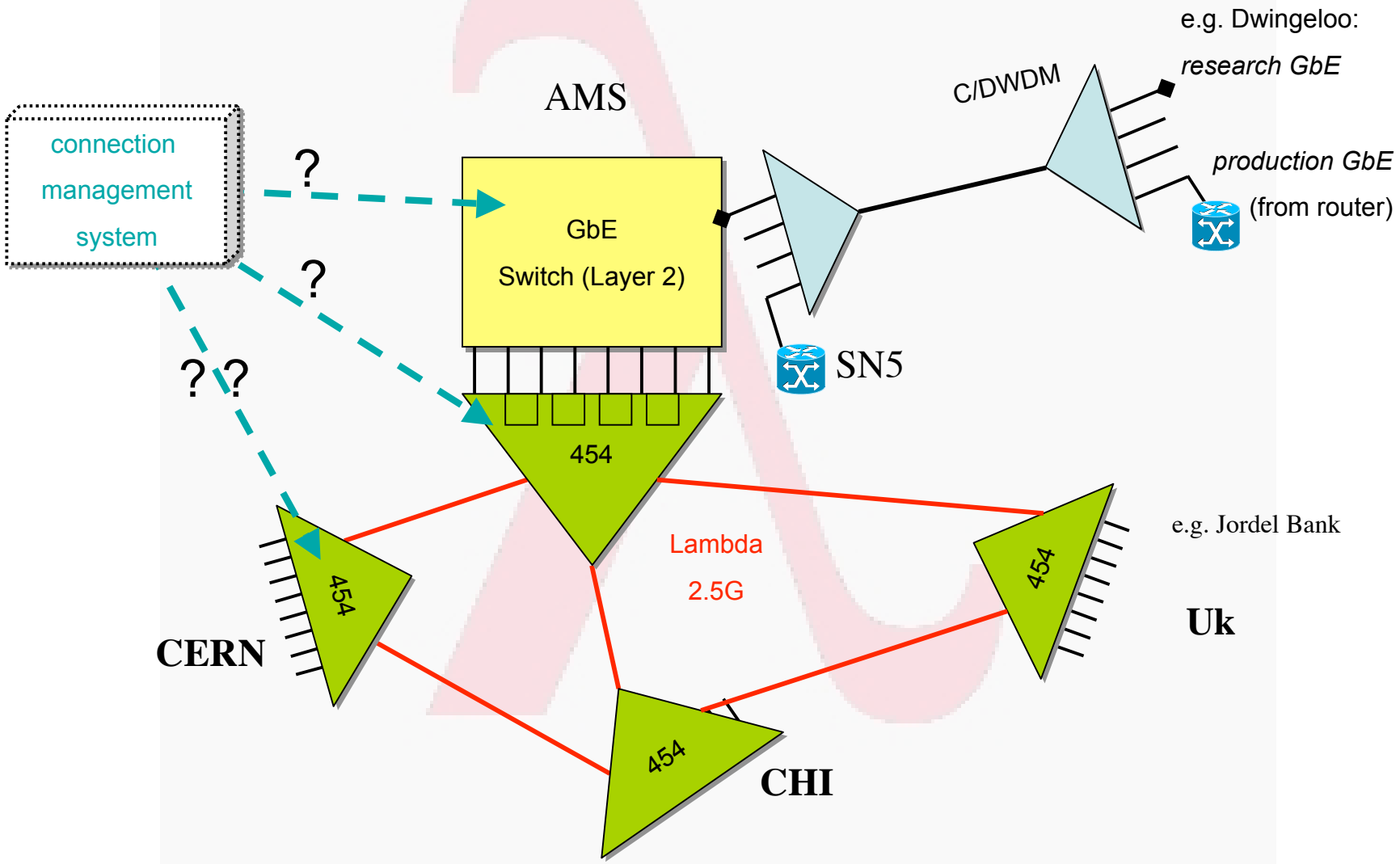


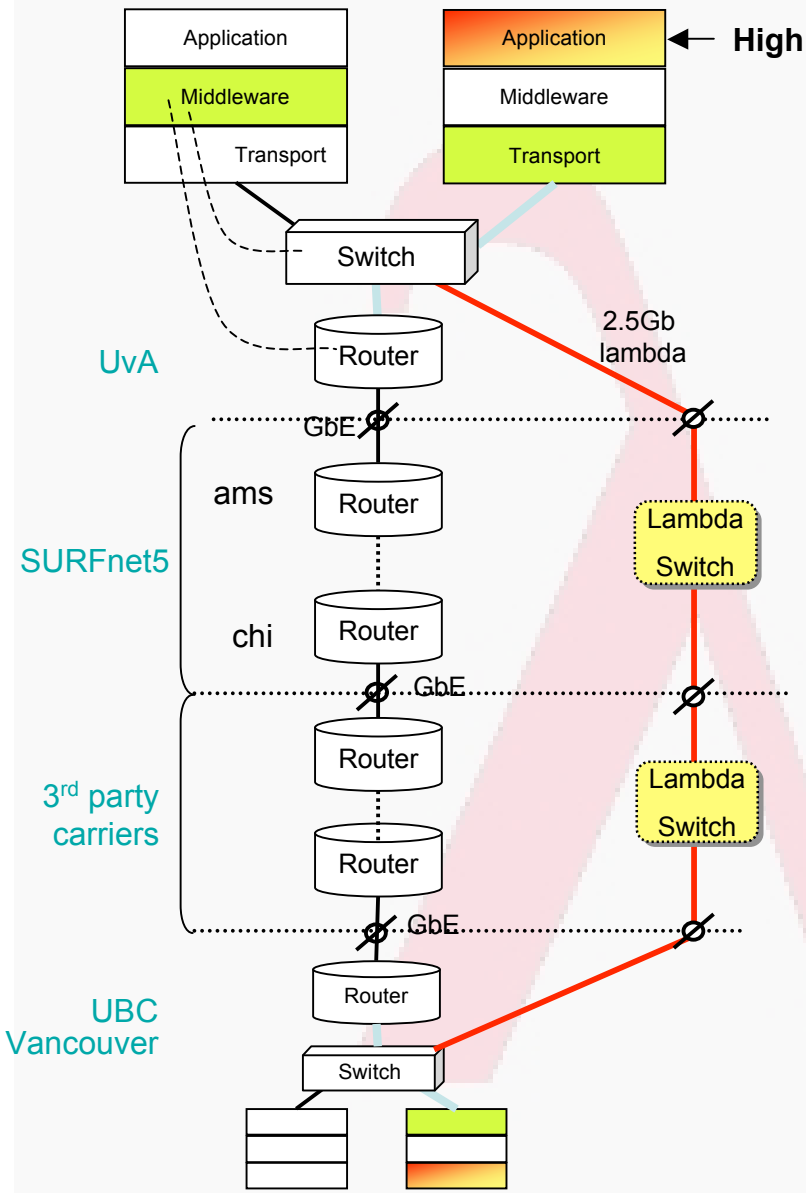
Other architectures - Distributed virtual IEX’es



Problem: vlan tag distribution ==> gmpls

Lambda/GbE exchange





- lambda for high bandwidth applications
  - Bypass of production network
  - Middleware may request (optical) pipe

research on λ's

- how to get traffic in and out of lambdas
- how to map load on the network to a map of lambdas
- how to deal with lambdas at peering points
- how to deal with provisioning when more administrative domains are involved
- how to do fine grain near real time grid application level lambda provisioning

Research with λ's

- High speed TCP (high rtt and BW)
- Routing stability
- Routing responsibility
- Extremely multihomed Networks
- Roles, organizational issues
- SLA's
- Models (Connection less versus oriented)
- Discreet versus continuous in time

Proposal

- Do a few well defined proof of concepts
- Aim at IGRID2002
- Look into dynamics in lower layer
- Define interfaces
- Look into roles of different players
  - Who is owner of what part (GSP)
- Multi domain, policy, BW-brokering, AAA
- Optimal? : make 10 % protected and run the rest in scavenger mode