Lambda Networking Research

www.science.uva.nl/~delaat/optical

Cees de Laat

University of Amsterdam

SURFnet

λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ

Research on optical networks

This project is about to build a pure lambda networking facility in Amsterdam and connect it via dedicated lambda(s) to the StarLight setup in Chicago.

The facility will be used to investigate new concepts of optical bandwidth provisioning. Particulary we will look into different scenarios on how lambdas could be used to provide tailored network performance for high demanding grid applications.

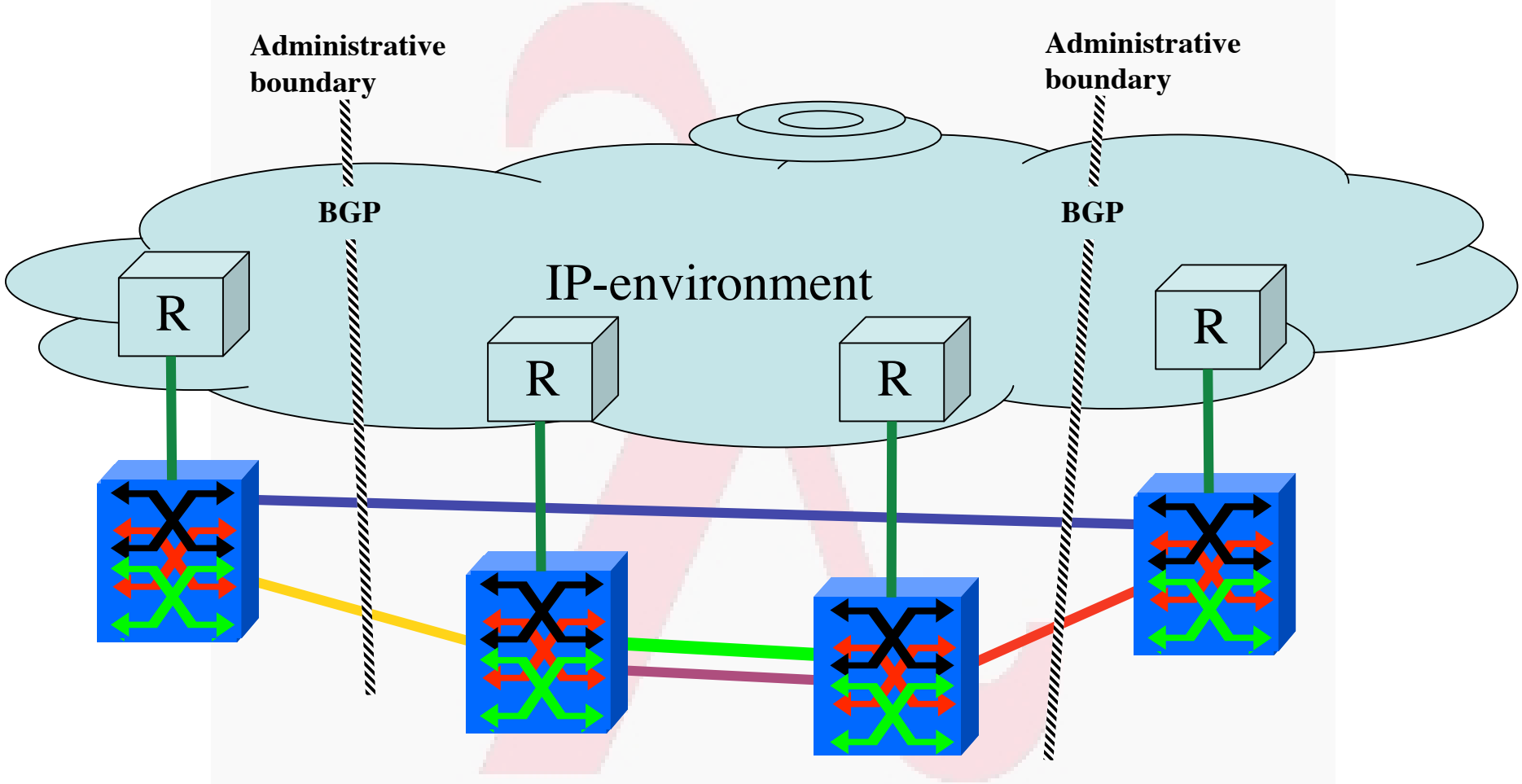
New challenges

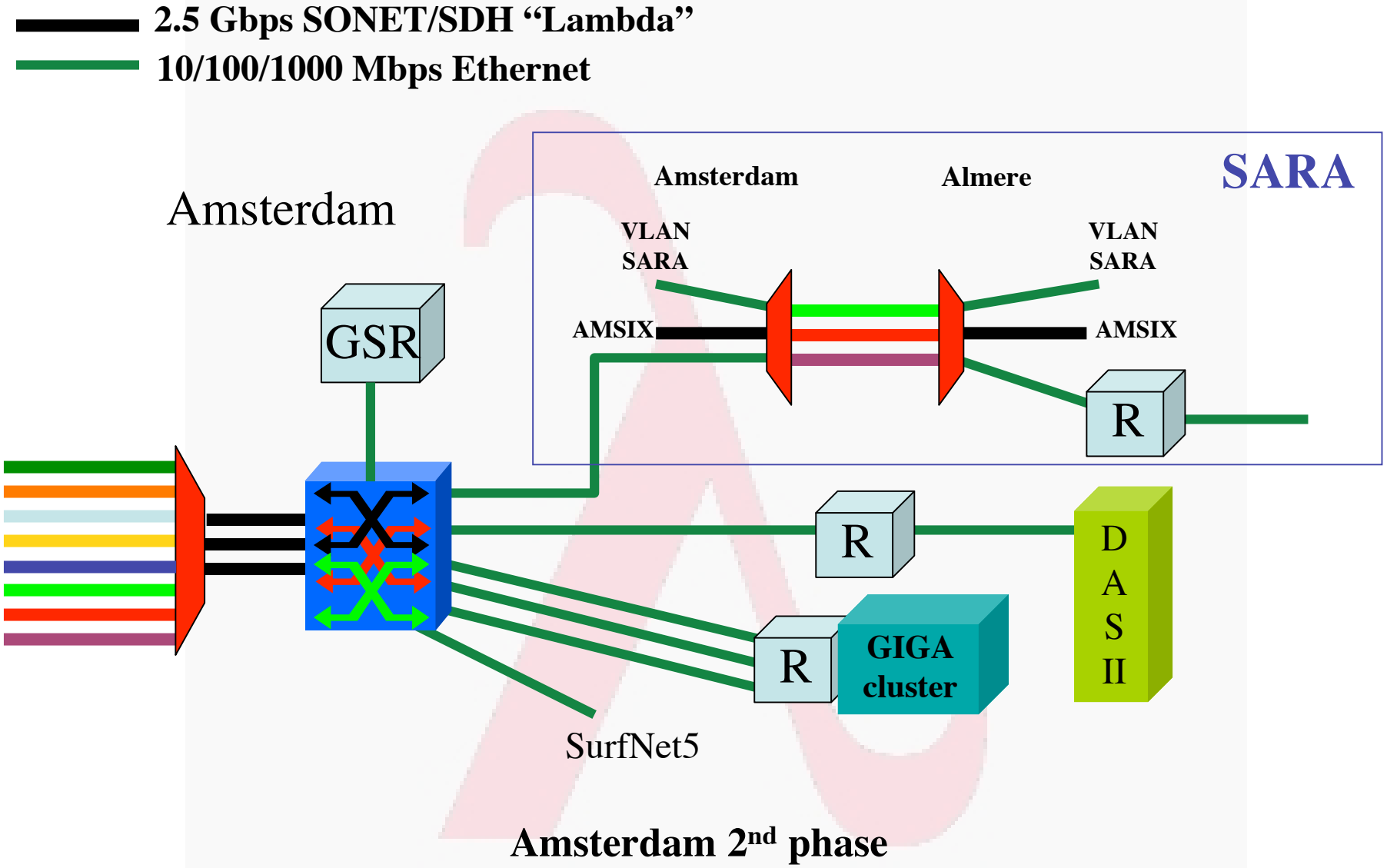
- **Large amounts of bandwidth become available**
- **Applications and Middleware need adaptations**
- **High speed protocol stacks**
- **Internet structure implicitly changes**
- **Intelligence to the edge of the network**
- **Organizational and bureaucratic changes**

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.**

Multi domain IP controlled





Amsterdam 2nd phase

λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ

Research with λambdas

- **High bandwidth applications on long RTT**
  - **gridftp**
- **Protected channels (no congestion)**
  - **WEB100 stuff**
- **The usual grid stuff**
  - **High energy physics**
  - **Astronomy**
  - **Distributed computing**
  - **Access grids**
  - **Tele-immersion**
  - **visualization**

λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ

Revisiting the truck of tapes

Consider one fiber

- **Current technology allows for 160 λ in one of the frequency bands**
- **Each λ has a bandwidth of 40 Gbit/s**
- **Transport: 160 * 40*10^9 / 8 = 800 GByte/sec**
- **Take a 10 metric ton truck**
- **One DLT contains 50 Gbyte, weights 200 gr**
- **Truck contains (10000 / 0.2) * 50 Gbyte = 2.5 PByte**
- **Truck / fiber = 2500000 / 800 = 3125 s ≈ one hour**
- **For distances further away than a truck drives in one hour (50 km) minus loading and handling 50000 tapes the fiber wins!!!**

λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ

www.science.uva.nl/~delaat/optical

λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ λ