Lightpath support in LANs

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- hybrid networks

- lightpaths

- inter-domain lightpath setup

- lightpath support at the edges

hybrid networks

- support for packet switched (routed IP) and circuit switched traffic

- many NRENs own managed dark fiber networks

- DWDM and SDH technology used to lit the dark fibers

- full wavelengths and SDH circuits offered to customers

- these circuits are called "lightpaths"

  deterministic QoS aspects

- some applications have specific QoS demands

    high bandwidth, low jitter

- only a few applications/projects at the moment

   CERN Large Hadron Collider Optical Private Network

    radio astronomy (eVLB, several signals correlated at one site)

- lightpaths have deterministic QoS aspects

- lightpaths make traffic engineering easier

- Layer 1 or layer 2 connection oriented circuits

- complete wavelength on a DWDM link

- (VCAT) circuit on TDM layer (typically 1GE)

- easier than MPLS/IP based circuits

- "leased lines"

Ethernet

MPLS

IP

Ethernet

SDH

SDH

DWDM

DWDM

fiber

fiber
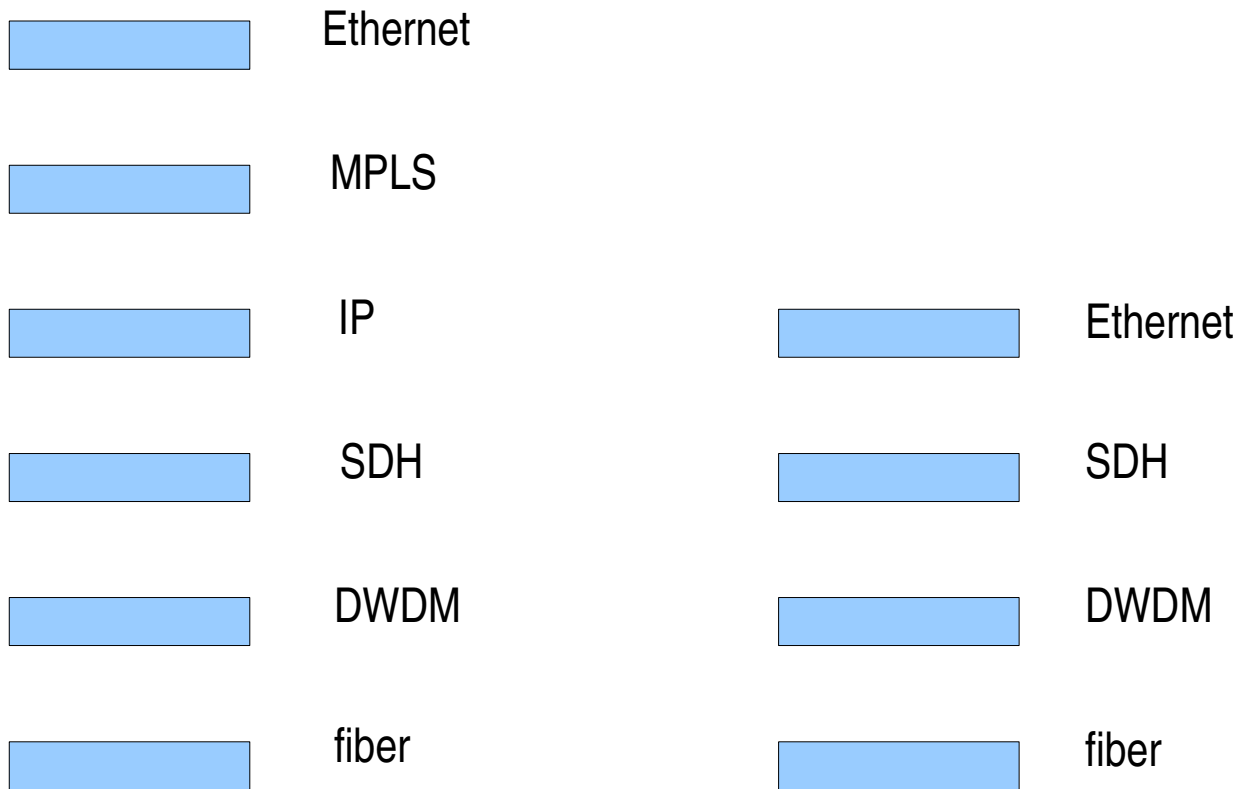
- current focus mainly on intra-domain lightpath services

    offer services to customers today

- research started on automatic inter-domain lightpath setup

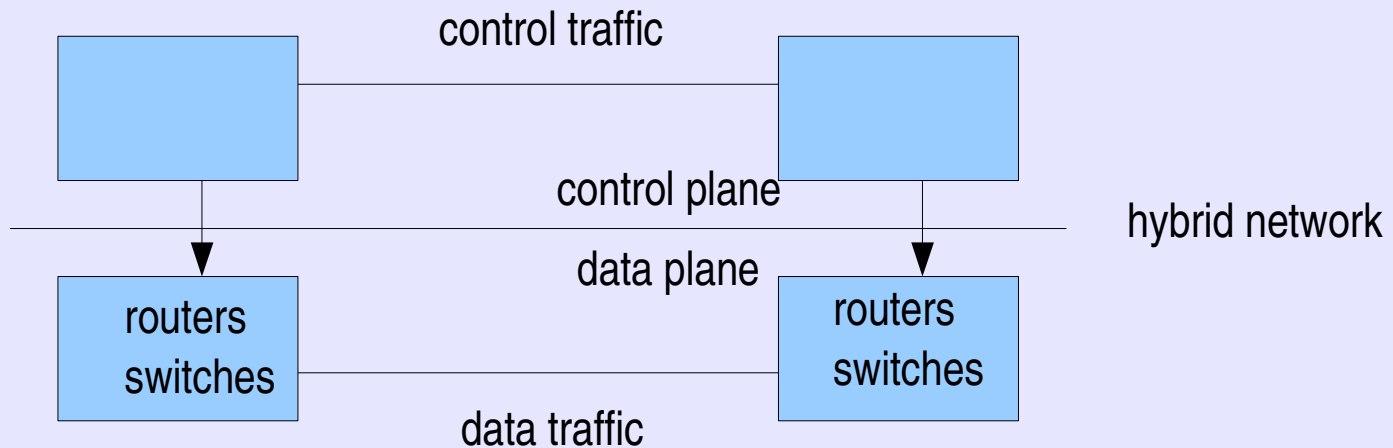   Geant2/JRA3, Lucifer, DRAGON

    investigate the services of tomorrow

- end-user controlled setup of lightpaths

    interaction between NREN and campus/enterprise LAN

    interaction between NRENs

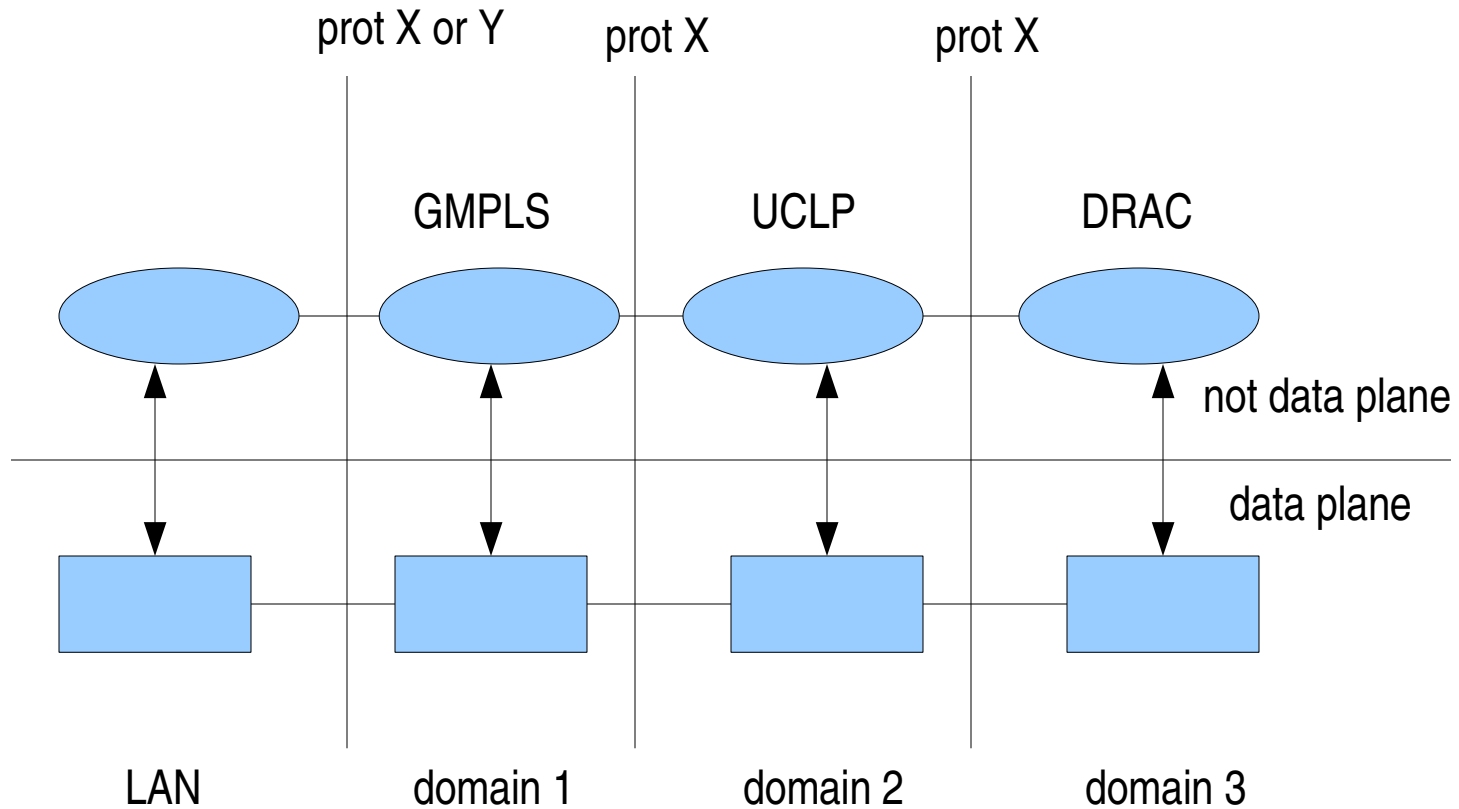- several lightpath setup technologies are being investigated

    GMPLS

    UCLP

    DRAC

- each has its specific use, combinations possible

- no clear architecture yet (control/management/service planes)

- it is getting too complex, KISS approach needed

- is has to be "good enough", not 100% perfect

lightpath support in LANs

- if application needs e.g. low jitter, this is needed end-to-end

- lightpaths need to be supported up to the applications

- compus/enterprise LAN needs same QoS as NREN WAN

- most campus/enterprise LANs are simple Ethernet networks

- LAN network manager does not want complex control planes

- KISS lightpath support in Ethernet LANs not trivial

- end-users want to use a grid

- they reserve grid resources at several sites

- they reserve the network connections needed

- they start using the grid

- grid resource providers have:

  - (super)computer clusters

  - data storage

  - visualisation equipment

- how to access these resources via lightpaths?

- lightpath support with QoS in LAN needed

- need to talk to control/mgmt/service plane of NREN

Application Driven Network Topology

- Application requests optimal topology OPN

  e.g. mesh, tree, ring topology

  StarPlane (http://www.starplane.org/)

- Topology needs to be described in machine readable format

  Network Description Language (NDL)   (poster outside)

  http://www.science.uva.nl/research/sne/ndl/   (poster outside)

  https://noc.sara.nl/nrg/presentations/rdf-tools-glif.pdf

NDL example

```
<ndl:Device rdf:about="#Dt001a_ome01">
      <ndl:name>Dt001a_ome01</ndl:name>
      <ndl:locatedAt rdf:resource="#SURFnet6"/>
      <ndl:hasInterface rdf:resource="#Dt001a_ome01:1/1"/>
      <ndl:hasInterface rdf:resource="#Dt001a_ome01:6/1"/>
      <ndl:hasInterface rdf:resource="#Dt001a_ome01:9/1"/>
</ndl:Device>

<ndl:Interface rdf:about="#Dt001a_ome01:6/1">
      <ndl:name>6/1</ndl:name>
      <ndl:connectedTo rdf:resource="#Asd001a_ome03:9/1"/>
      <rdf:capacity rdf:resource="#OC192"/>
      <rdf:type rdf:resource="#SONET"/>
</ndl:Interface>
```
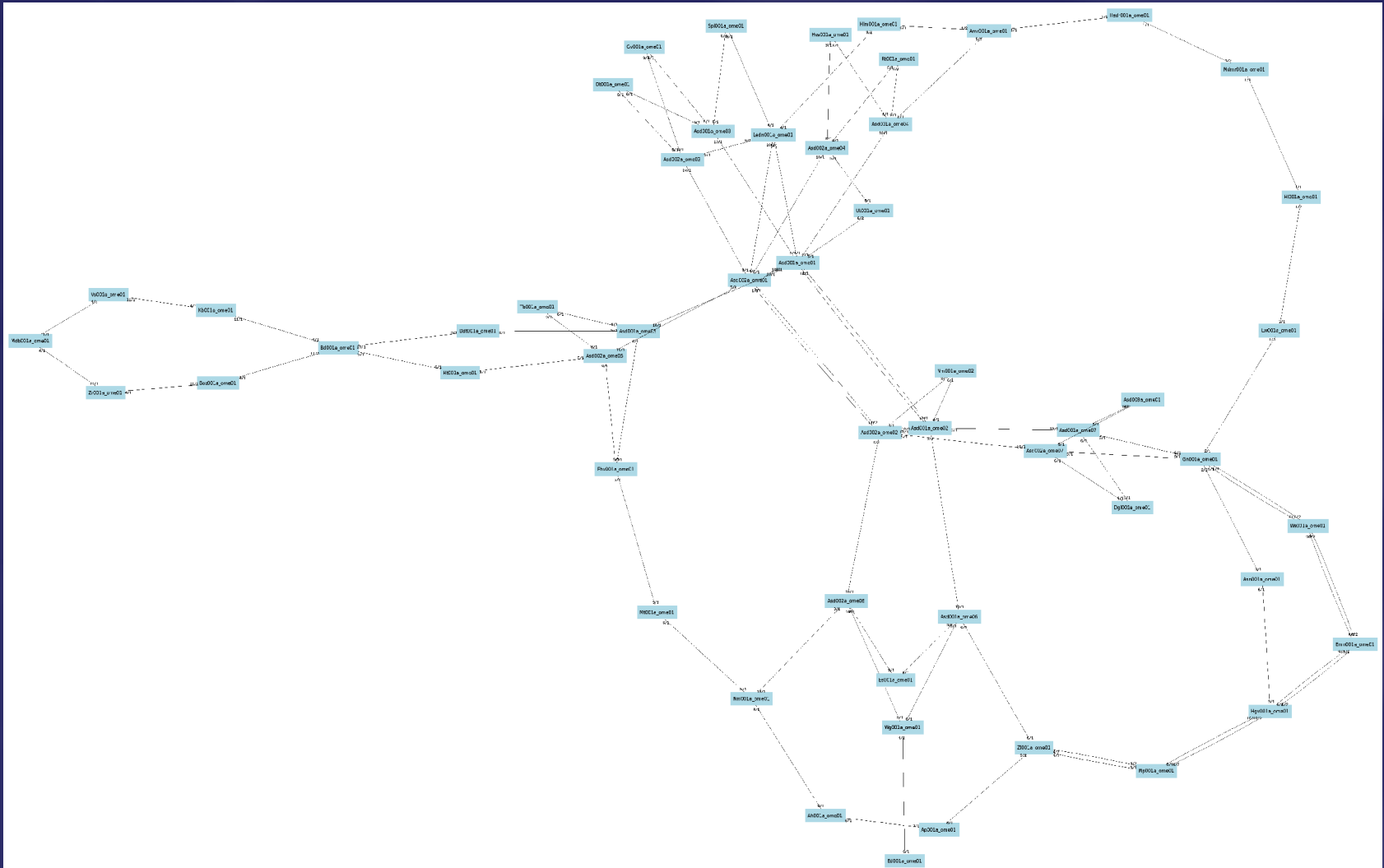
Topics to Investigate in LANs

- How to handle control/mgmt/service/etc planes?

- How to support lightpaths? What QoS can you offer?

    (dedicated) point-to-point connections through Ethernet?

- How to do AAA?

    who may use what?

- How to handle addressing?

    lightpaths are typically layer 2 interconnection

    use addresses of site A or of site B?

Thank you!

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