



GEANT2/JRA3: Bandwidth on demand service concepts for European research networks

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Connect. Communicate. Collaborate

Agenda

- Introduction
- JRA3 overview
- Inter-domain manager
- Intra-domain provisioning
- Technology stitching
- Monitoring
- Towards a common Network Information System



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GN2-JRA3 activity

- A 'Joint Research Activity' investigating the piloting of 'Bandwidth on Demand' services to the NREN community
- The environment:
 - Multi administrative domains
 - Multiple technology domains, e.g.
 - GFP over SDH, L2 MPLS VLL, Native Ethernet
 - Multi aggregated (e.g. GMPLS/UCLP) and provisioning (e.g. human/NMS/BLUEnet/DRAC) domains
 - Requirements for:
 - end-to-end non-contended deterministic capacity
 - a standardized interface for service requests by clients
 - service level indication to clients
 - advance reservation (scheduled)

Multi-domain provisioning*



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Additional info exchange, AAA, policy,...

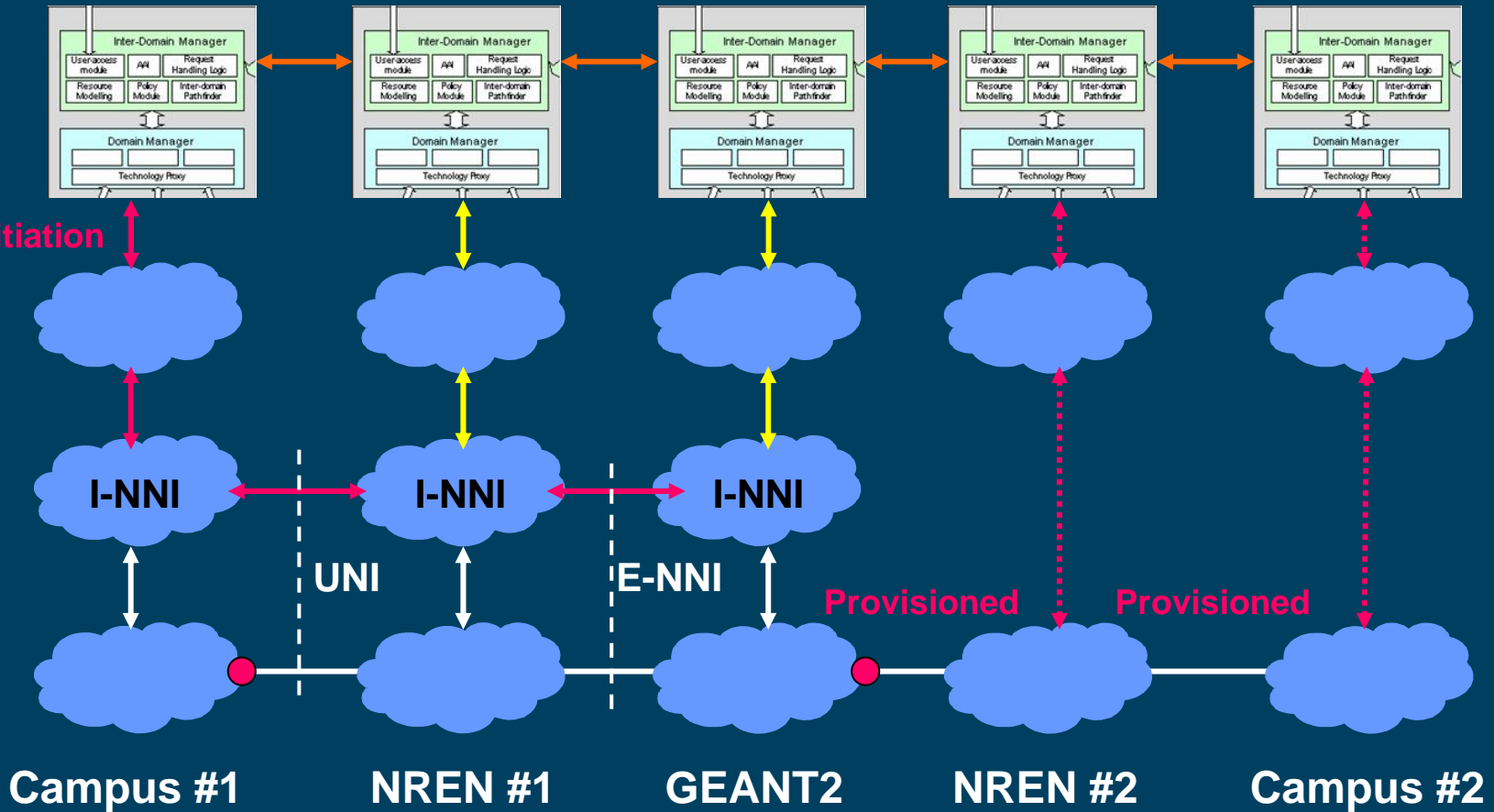
JRA3 System

SC/SPC initiation

Mgmt plane

Control plane

Data plane



↔ Active interface

↕ Notification

● SC/SPC end points

⋯ Provisioning/Mgmt



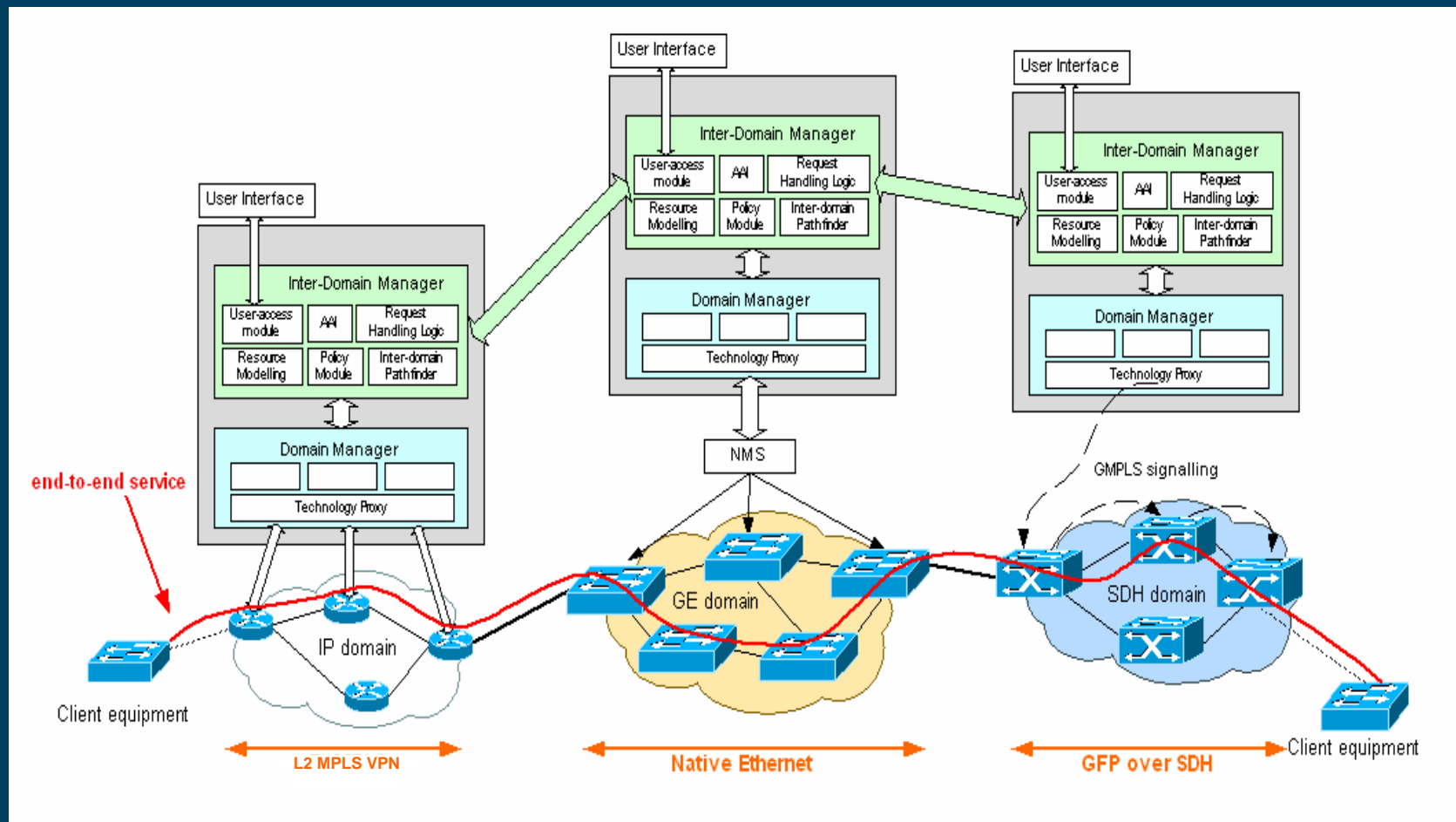
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GN2-JRA3 architecture

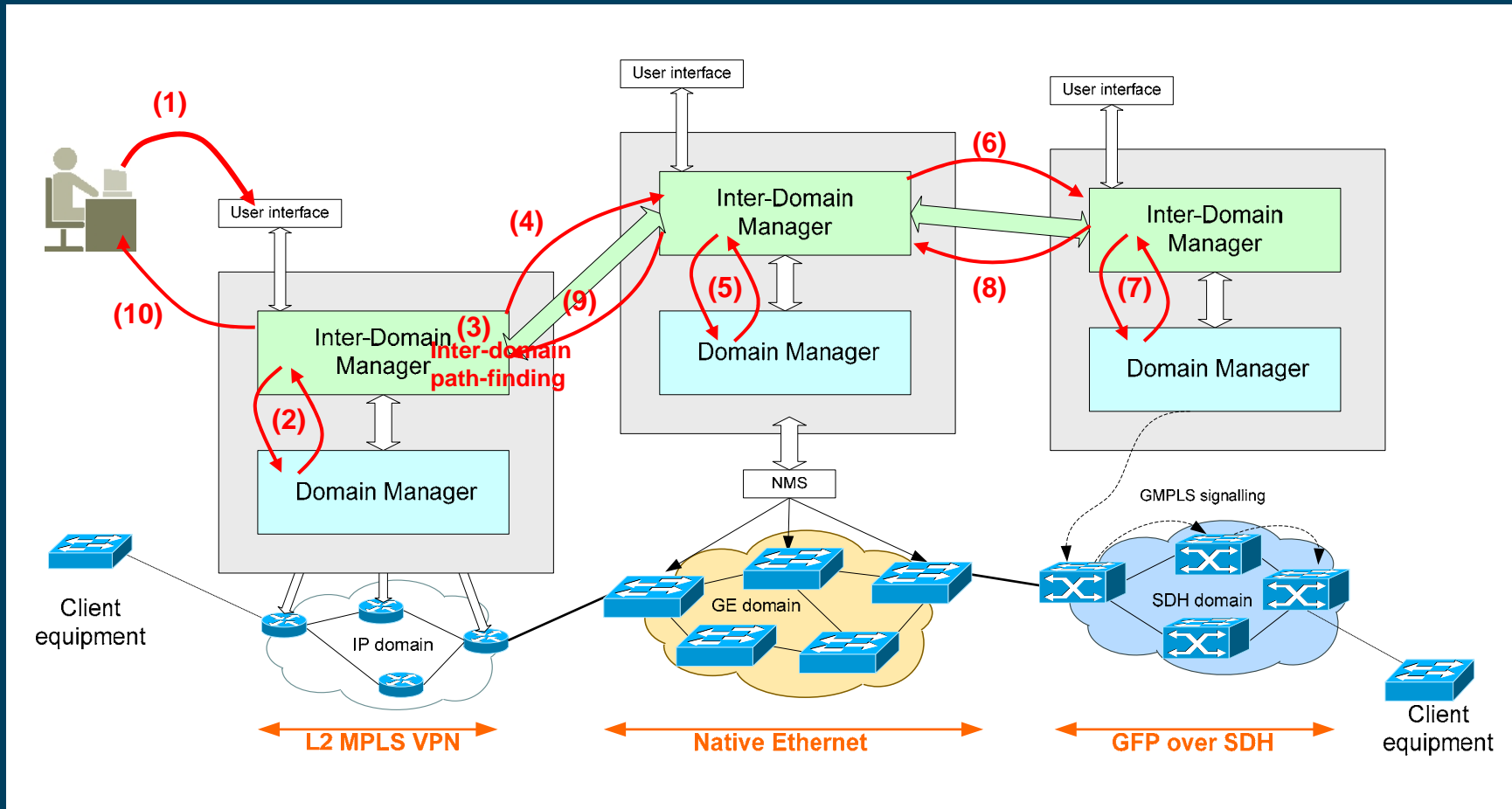
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Distributed approach

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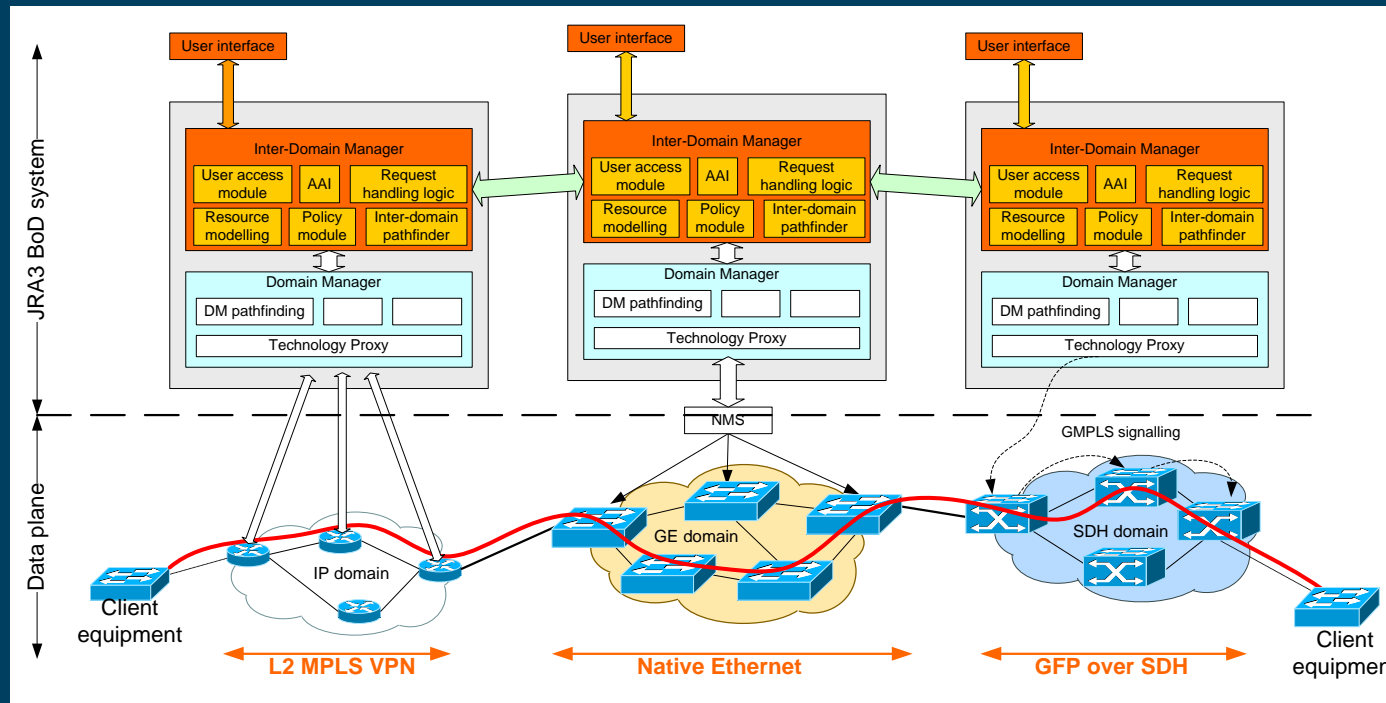
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Inter Domain Manager

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- A set of automated procedures for the required non-technology specific inter-domain negotiations
- Can be considered as a 'bandwidth broker', but it is more than this



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IDM multi-domain issues

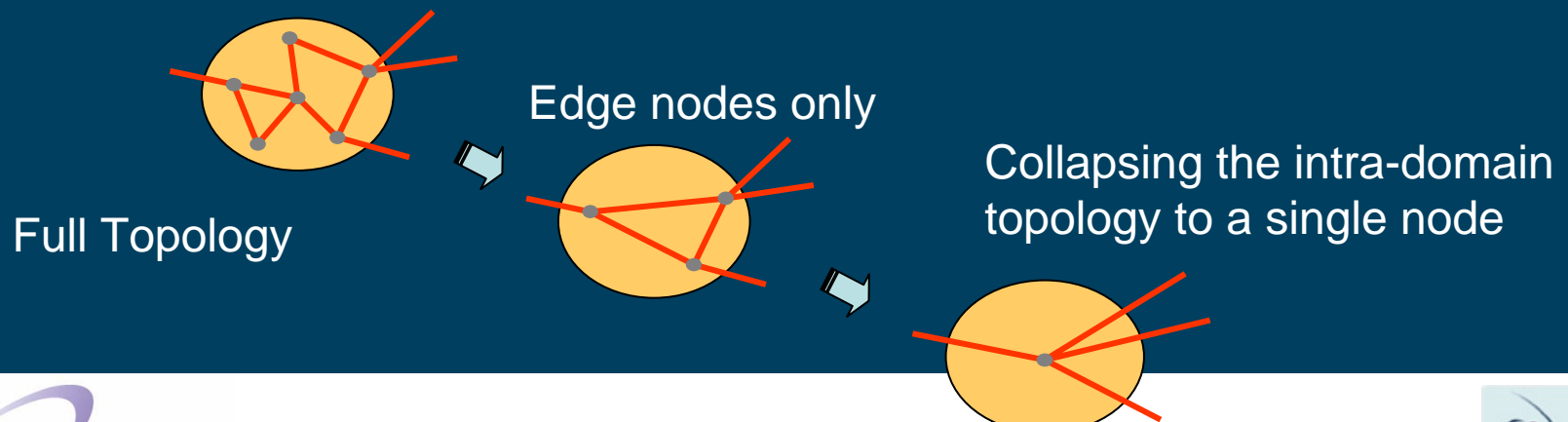
- The IDM faces a number of challenges related to its multi-domain scope:
 - domain independence for resource usage policies and technological choices
 - a service and network abstraction schema to describe implementation over very different networks
 - a schema which allows to clearly specify which type of service is requested
 - a network abstraction which allows inter-domain information exchange independently of the underlying technologies
 - advance reservation
 - multi-domain path finding procedure
 - monitoring
 - Authentication and Authorization



IDM pathfinder

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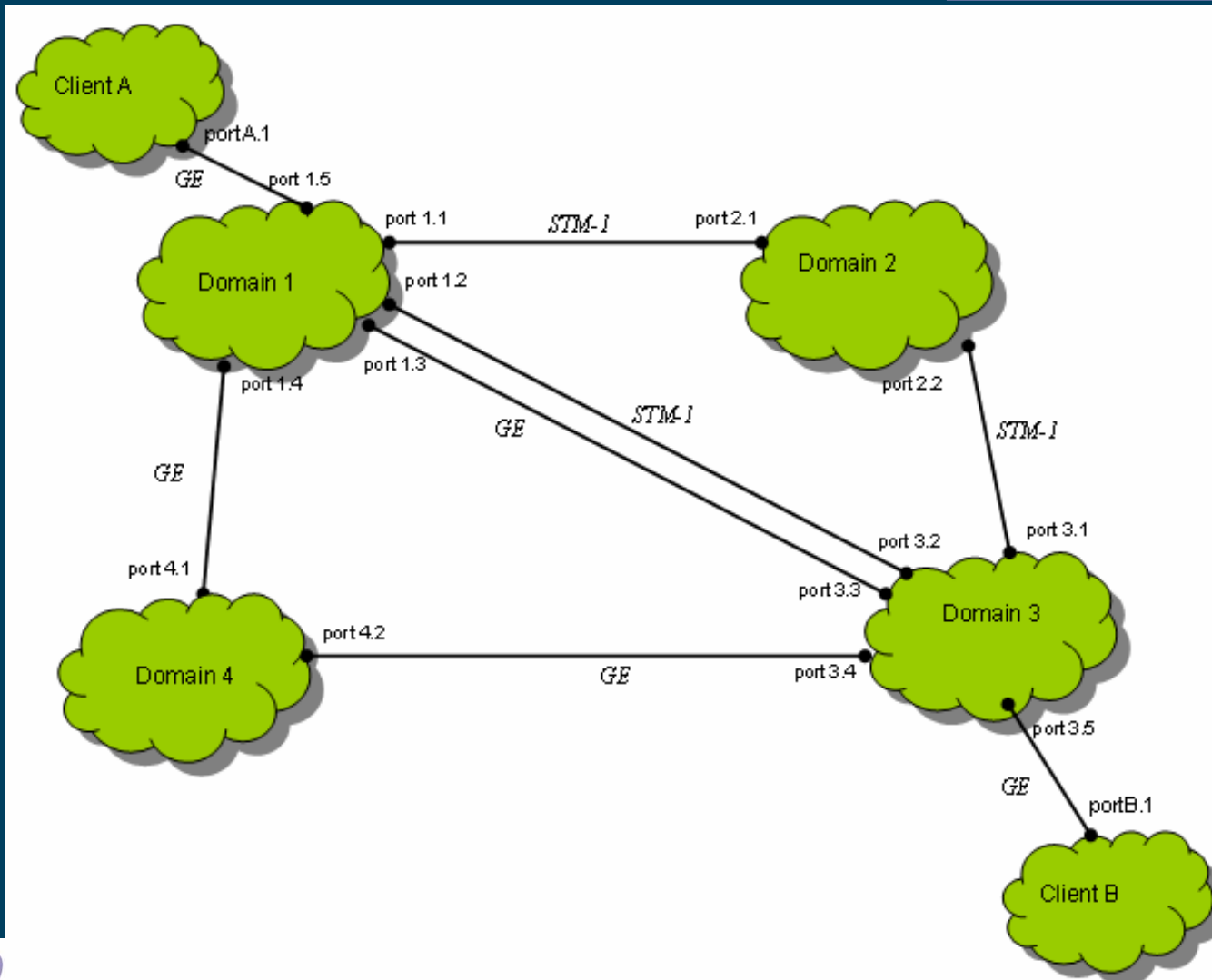
- The main task of the Pathfinder sub-module in the IDM is to provide all inter-domain feasible paths to fulfill a BoD request
- A separate Routing Protocol sub-module within each IDM is used for distributing the inter-domain routing information among IDMs
 - Link-state protocol
 - Traffic Engineering extensions are used to carry information such as link capacity, resiliency, policy related information
 - Path selection is based on technology-agnostic parameters
 - Each inter-domain link is advertised as-is, for intra-domain links, each domain can adopt the level of abstraction considered appropriate*



IDM Prototype testing



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Intra-domain provisioning

- Manual intra-domain configurations and provisioning for the establishment of the intra-domain segments of the end-to-end path
- Intra-domain provisioning design to accommodate
 - Domains that have a G.ASON/GMPLS CP “out of the box” e.g. Generic MPLS Routing Engine (distributed control plane in their Alcatel 1678 MCC OXC)
 - Domains operated via NMS
 - Domains that may decide to adopt proprietary Bandwidth Brokers



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Stitching framework for multi-technology domains



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- Stitching is making sure that one can make connections over different technology
- We do stitching (adaptation layer) in networking already for years:
 - host – ethernet – IP – ethernet - host
- Different layers
- Different peering points
- JRA3 tries to make the steps more explicit



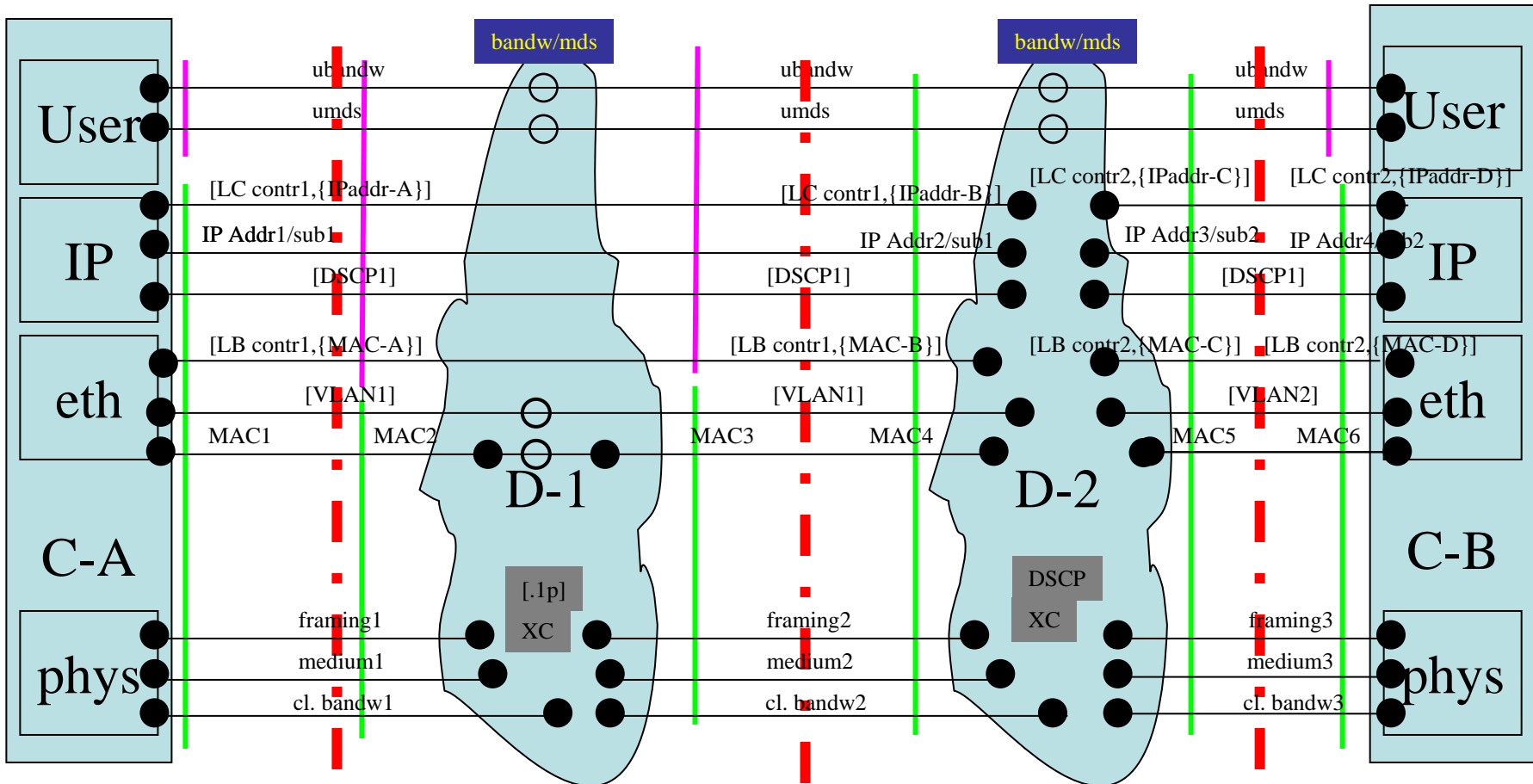
Layers in stitching

- Each layer (not necessarily OSI layers) has parameters:
 - Layer D+: User (human/application): e.g. IP Port number, wanted bandwidth, wanted max. datagram size, latency, reservation, etc.
 - Layer C (~routing):
IP layer: e.g. IP address and subnet, DSCP
 - Layer B (~switching):
L2 MPLS VLL: e.g. VC_ID#
Ethernet: e.g. VLAN#, MAC address
SDH/SONET: e.g. VCG#, VC-3/VC-4
 - Layer A (~physical):
interface: e.g. framing, medium (lambda), clock speed

Ethernet – IP



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Some scenarios covered by GN2-JRA3



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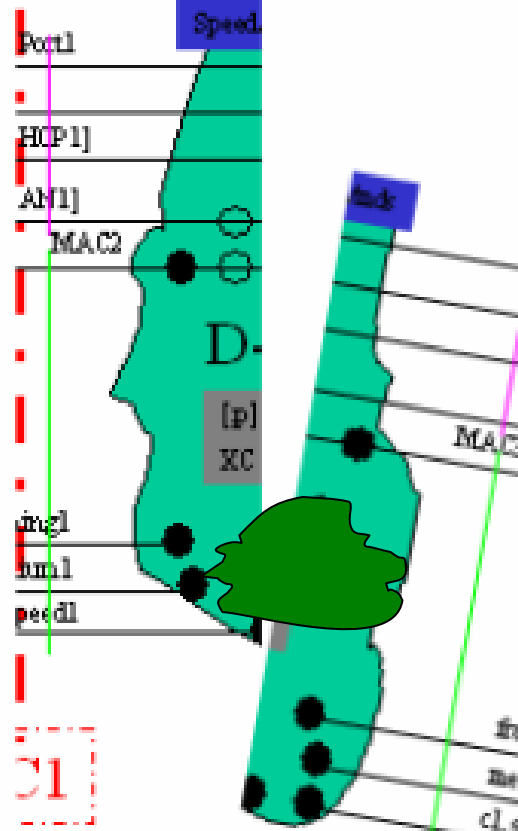
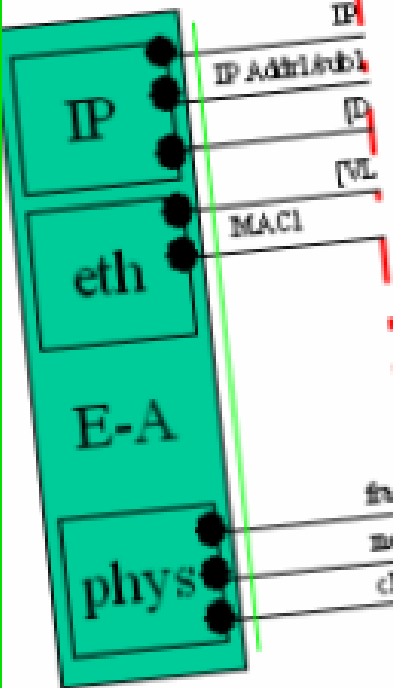
- SDH-SDH (scenario 5a)
- SDH-SDH-SDH (scenario 5b)
- Ethernet – L2 MPLS VLL (scenario 6)
- L2 MPLS VLL – L2 MPLS VLL (scenario 8a: no VC_ID# stitching)
- L2 MPLS VLL – L2 MPLS VLL (scenario 8a: VC_ID# stitching)
- Ethernet –PIP (scenario 9)
- Ethernet –Ethernet (scenario 14a: .1Q between domains)
- Ethernet –Ethernet (scenario 14b: .1ad between domains)
- L2 MPLS VLL – OOO (scenario 15)
- A jigsaw puzzle...



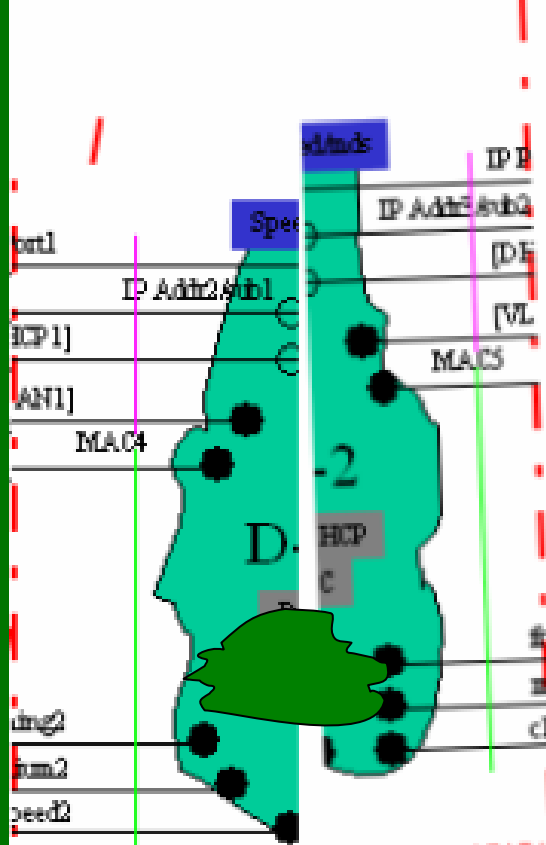
Stitching jigsaw puzzle

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Client A

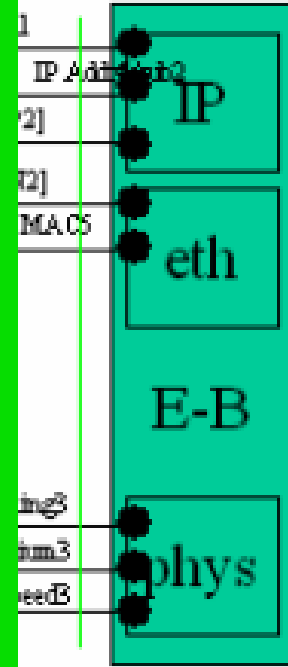


Domain 1



Domain 2

Client B



3



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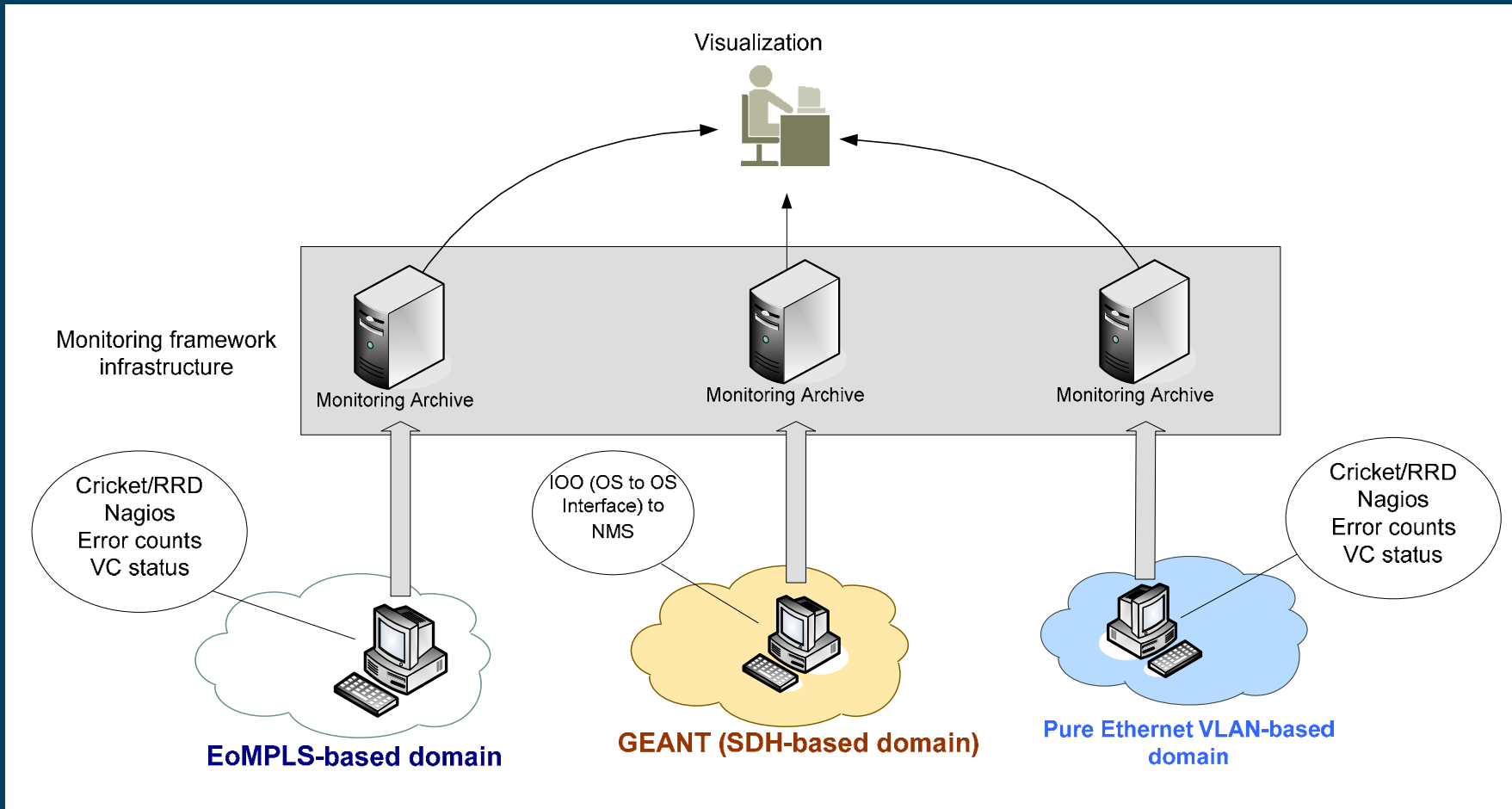
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E2E monitoring overview

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Monitoring priorities

- Technologies: BoD Ethernet circuits over
 - One EoMPLS/switched Ethernet network
 - One SDH-based network
- Metrics to be monitored, in order of priority
 - Up/down
 - Degraded/not degraded
 - Level of usage (where possible)



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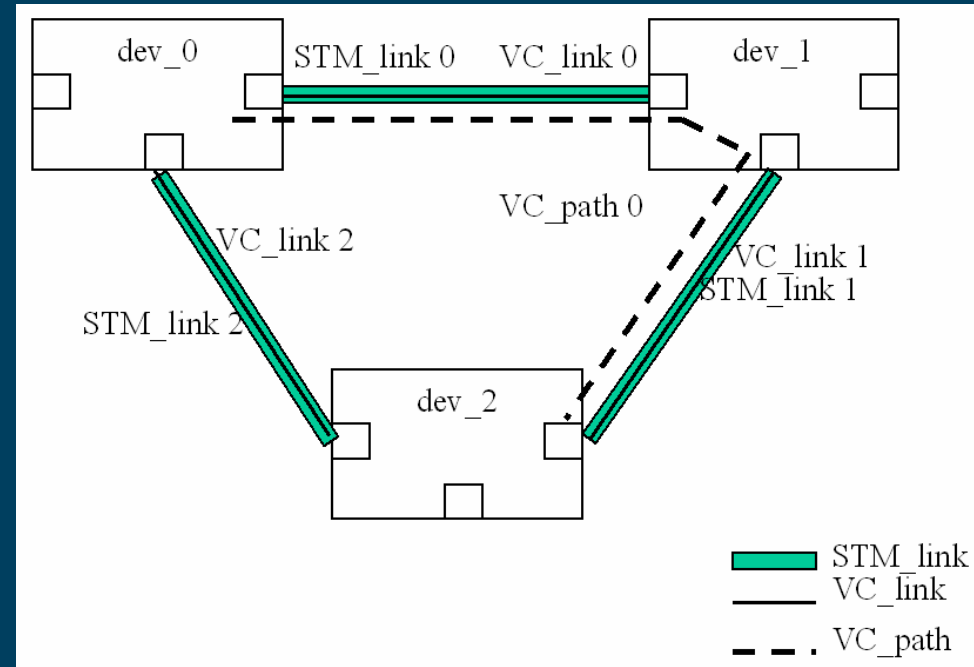
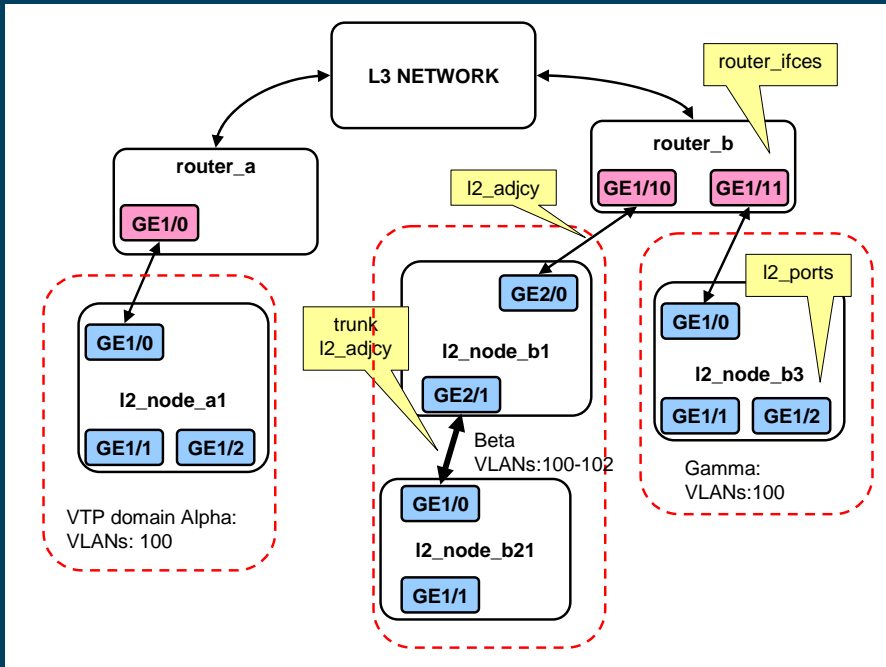
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Towards a common NIS

- Network Information System
- JRA3 focuses on SDH and Ethernet topology modeling





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Thank you!
Questions?