



Connect. Communicate. Collaborate

New services in GÉANT2

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Agenda



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1. Brief presentation of GÉANT2
2. IP/MPLS services inherited from GÉANT
3. GÉANT2 Technology and Services Testing Activity
4. BoD in GÉANT2

What is GÉANT2?



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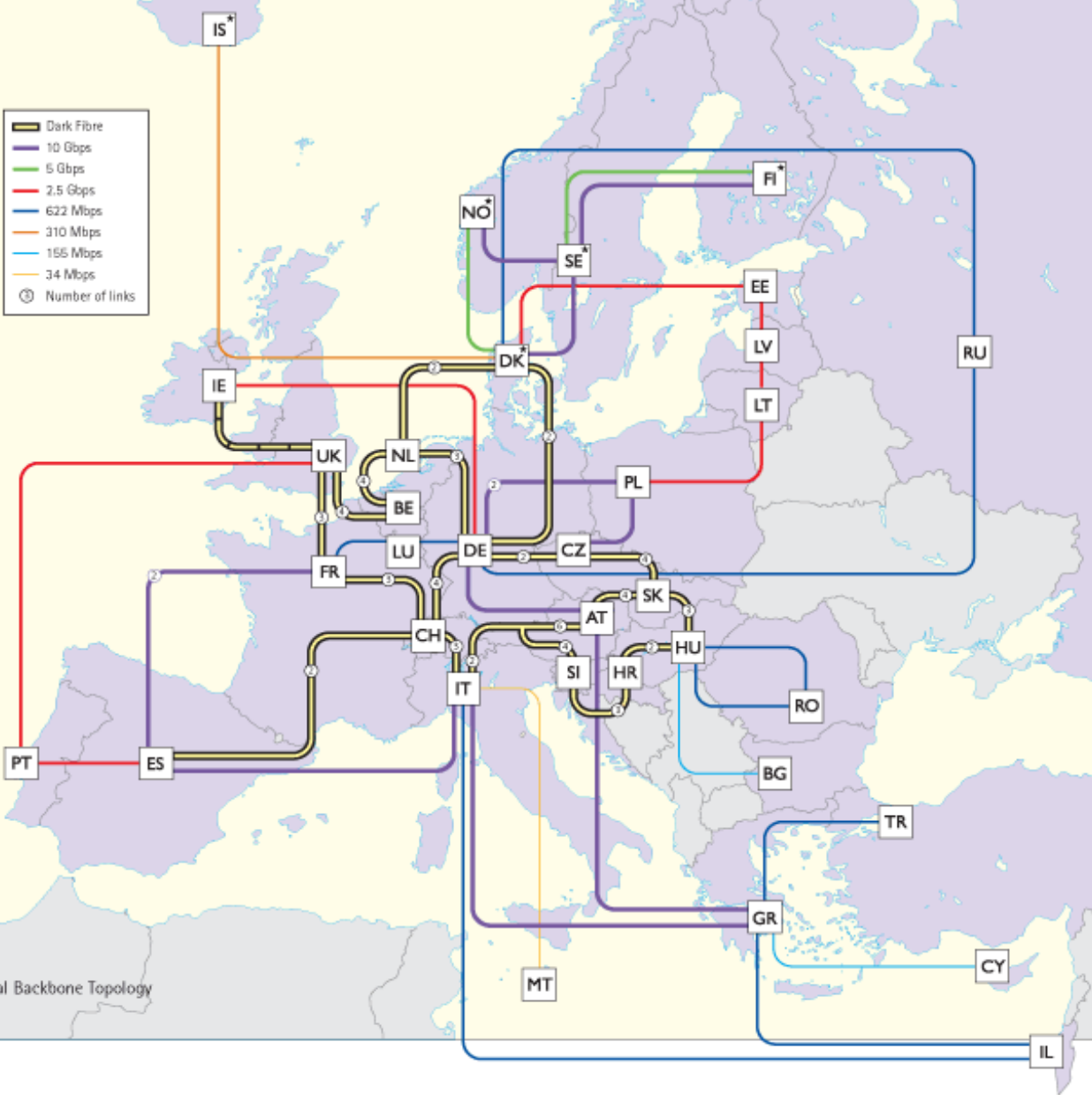
A European R&E Networking Model:

- 7th generation of pan-European research network infrastructure – continuation of a success story
- Project partners include 30 of Europe's national research and education networks (NRENs), DANTE and TERENA
- Will connect 34 European countries and serve over 3500 research and education establishments across Europe
- Over 30 million users
- Provides international connectivity to other world regions
- Funded jointly by NRENs and European Commission
- Project timescale September 2004 - August 2008



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- Dark Fibre
- 10 Gbps
- 5 Gbps
- 2.5 Gbps
- 622 Mbps
- 310 Mbps
- 155 Mbps
- 34 Mbps
- Number of links



GEANT2 Topology

GÉANT2 Objectives



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- Provide a gigabit-speeds infrastructure to support European research and education
- Deploy an international **hybrid** network: routed IP traffic combined with switched point-to-point circuits
- Implement end-to-end QoS provision
- Provide a research infrastructure for network technology developments
- Develop a wider range of network services
 - Performance monitoring
 - Security
 - **Bandwidth on demand**
 - **Testbed facility**
 - Mobility and roaming

Services inherited from GÉANT



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IP Services

Juniper routers

- Native Best Effort IPv4
- Native Best Effort IPv6
- Native Multicast v4
- Native Multicast v6
- QoS Services
 - Premium IP - PIP
 - Less than Best Effort IP - LBE

Services inherited from GÉANT



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MPLS services

- L2-VPNs
 - Started with Juniper CCC, “migrated” to LDP signalled L2-circuits
 - *Multi-domain and multi-vendor* L2-circuits in place.
- Traffic engineered paths
 - To enforce QoS
 - Part of multi-domain L2-VPNs
 - Stitching
 - Contiguous LSPs

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Multi-domain LSPs



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LSP Stitching

Pro: We are in control of the “transit” LSP

Cons: Done manually at the GÉANT/GÉANT2 border

- Not flexible
- Error prone

Contiguous LSP

Pro: Easy to configure it

Cons: Hard to enforce any policy

- TE across transit domain
- Bandwidth reservation across transit domain

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GÉANT2 Technology and Services Testing Activity

1. Distributed testbed in support for other activities and other FP6 projects
2. Technology testing
3. Cross Border Fibre evaluation

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Why we need a distributed testbed ?

1. Validation of the GMPLS implementation:
 1. Provisioning
 2. Protection
 3. Auto-discovery
2. Support Bandwidth on Demand research activities
3. Support various technology testing

New services in GÉANT2 Testbed facility



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Dedicated

- Costs money
 - » Dedicated connectivity
 - » Dedicated equipment
- Safe

“Virtual”

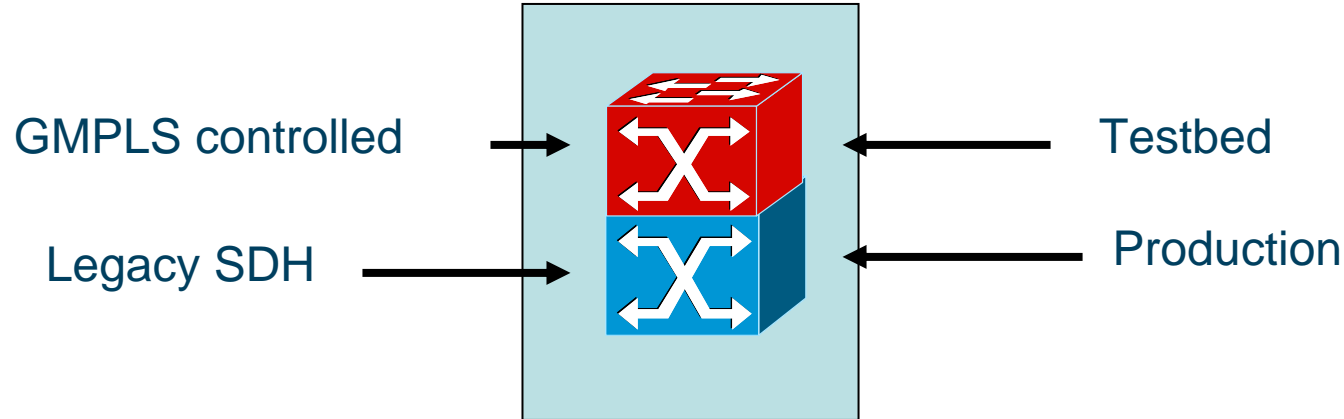
- Split the production OXC in two
 - » Shared equipment – dedicated control plane
- Dedicated connectivity

New services in GÉANT2 “Virtual” Testbed



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Hybrid node

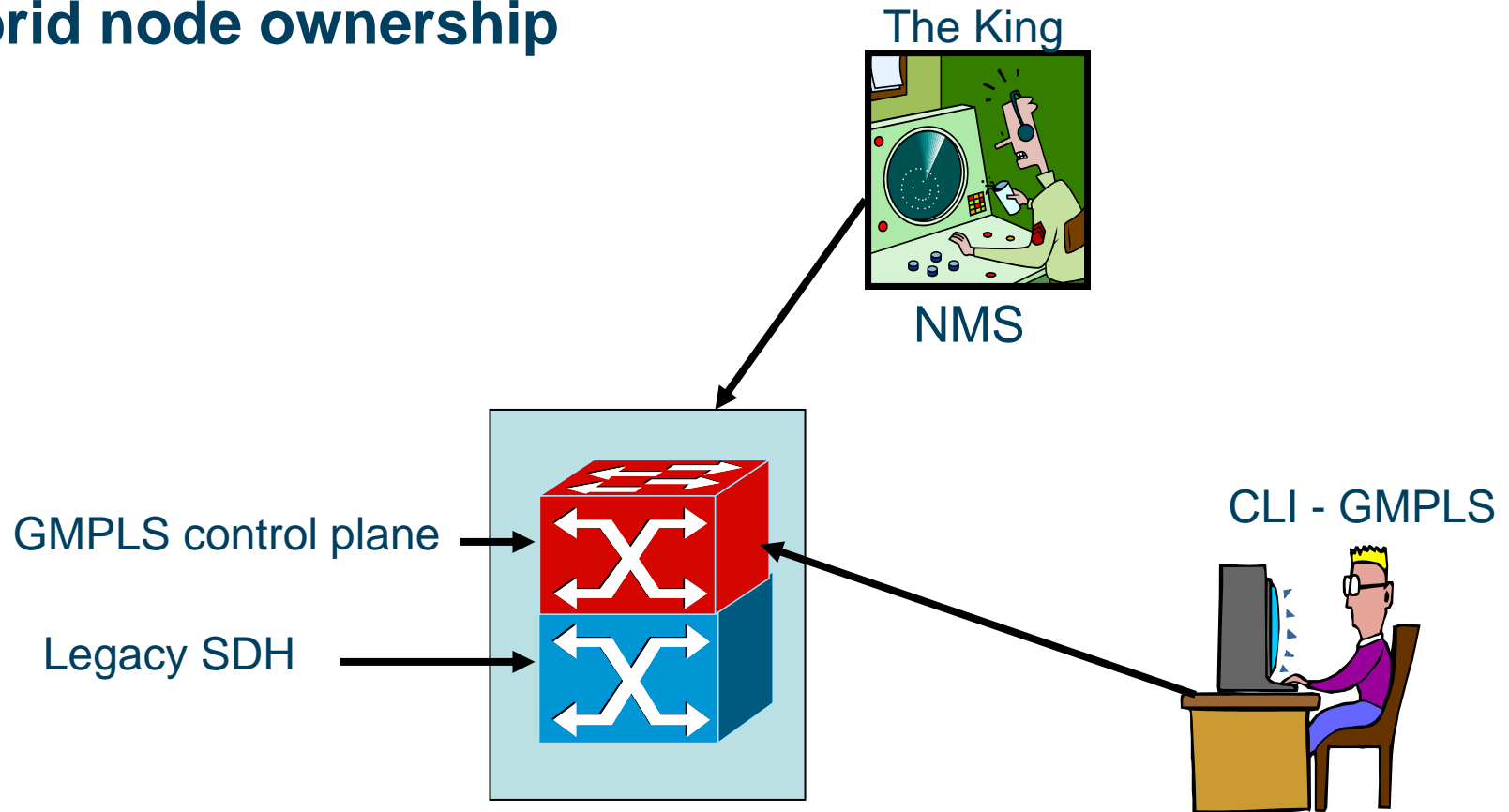


New services in GÉANT2 “Virtual” Testbed



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Hybrid node ownership



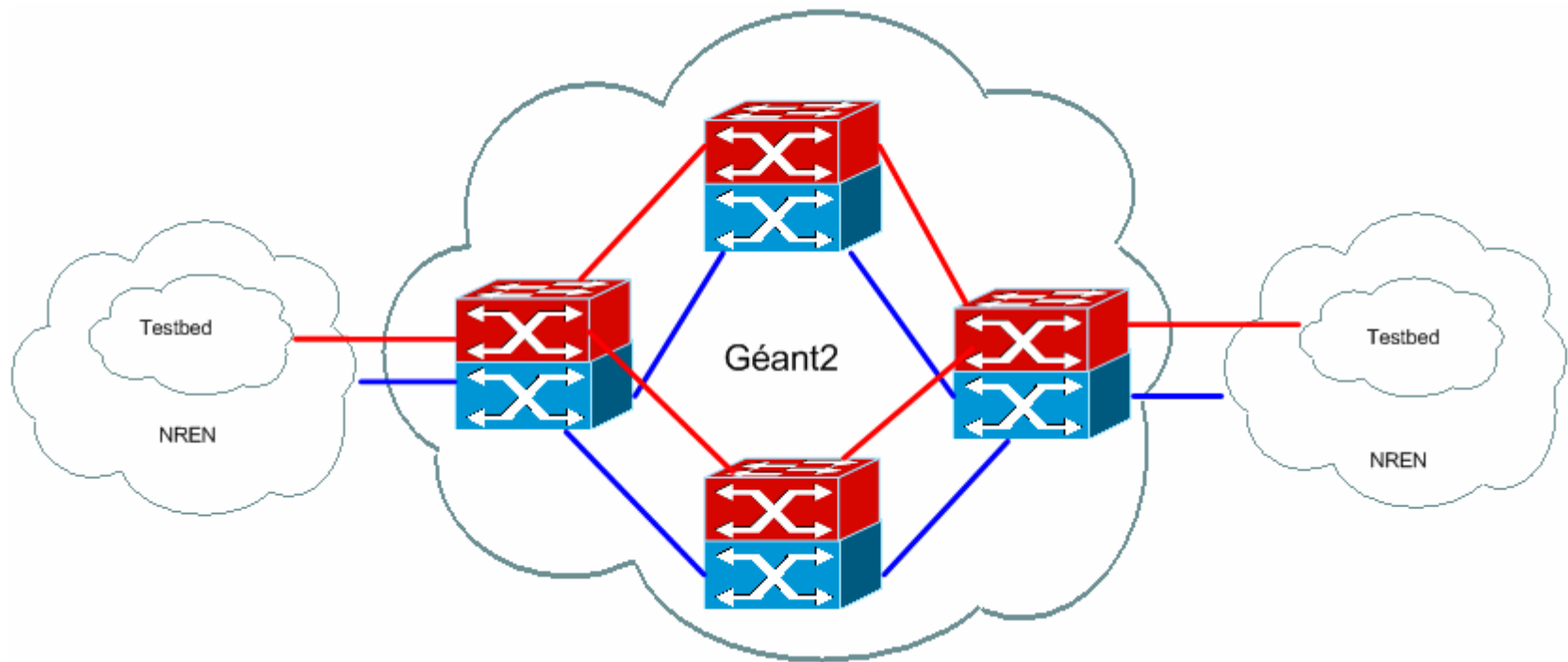
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“Virtual” Testbed



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Interconnection with other testbeds



New services in GÉANT2 “Virtual” Testbed



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Kill two birds with one stone:

- Provide the NREN and GÉANT2 researchers with a fully functional testbed
- Provide the NOC/Operations with experience
 - No need to convince them later on

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Bandwidth on Demand



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BoD Requirements:

- Deterministic bandwidth
- Deterministic delay
- Ethernet
- Automated provisioning
- Advanced reservation (?)

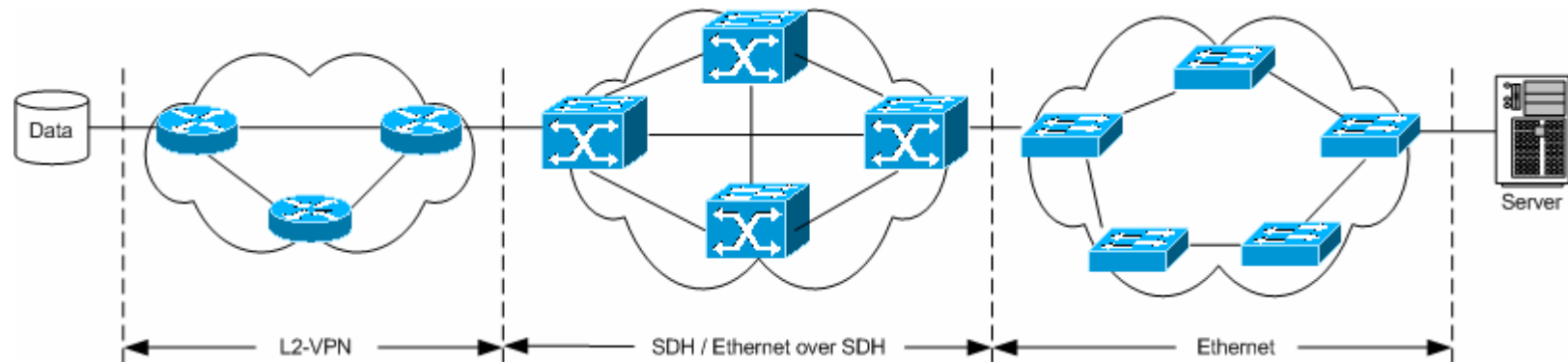
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Bandwidth on Demand



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Technological domains



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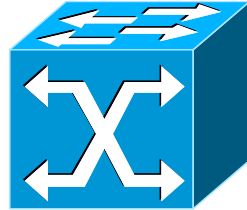
Bandwidth on Demand



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GÉANT2 OXC

Alcatel 1678MCC



Interface Switching Capabilities:

- TDM
- Ethernet L2SC

GMPLS control plane available for the TDM region

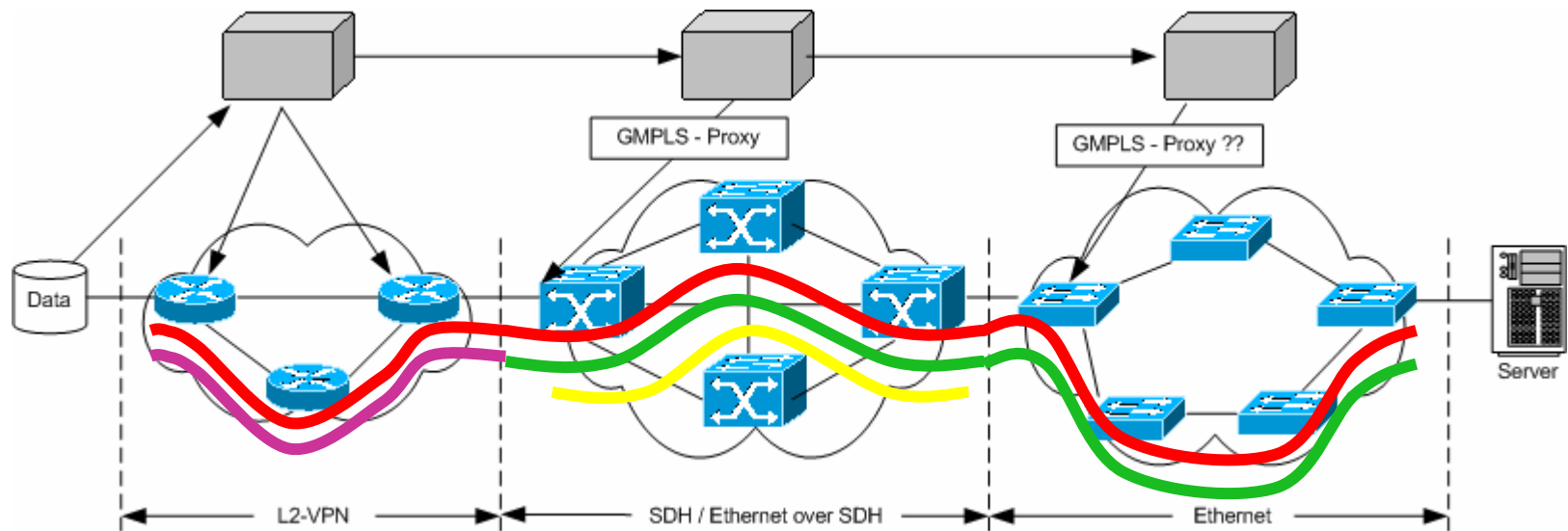
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Bandwidth on Demand



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Multi-domain/Multi-region operation



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Bandwidth on Demand



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How about the L2SC region ?

- GMPLS controlled Ethernet Label Switching?

How about a single GMPLS control plane instance for multiple regions (TDM and Ethernet) Multi Region Network?

- Would be nice to have "triggered signalling" for lower layers.

Are we really missing these functions ?!

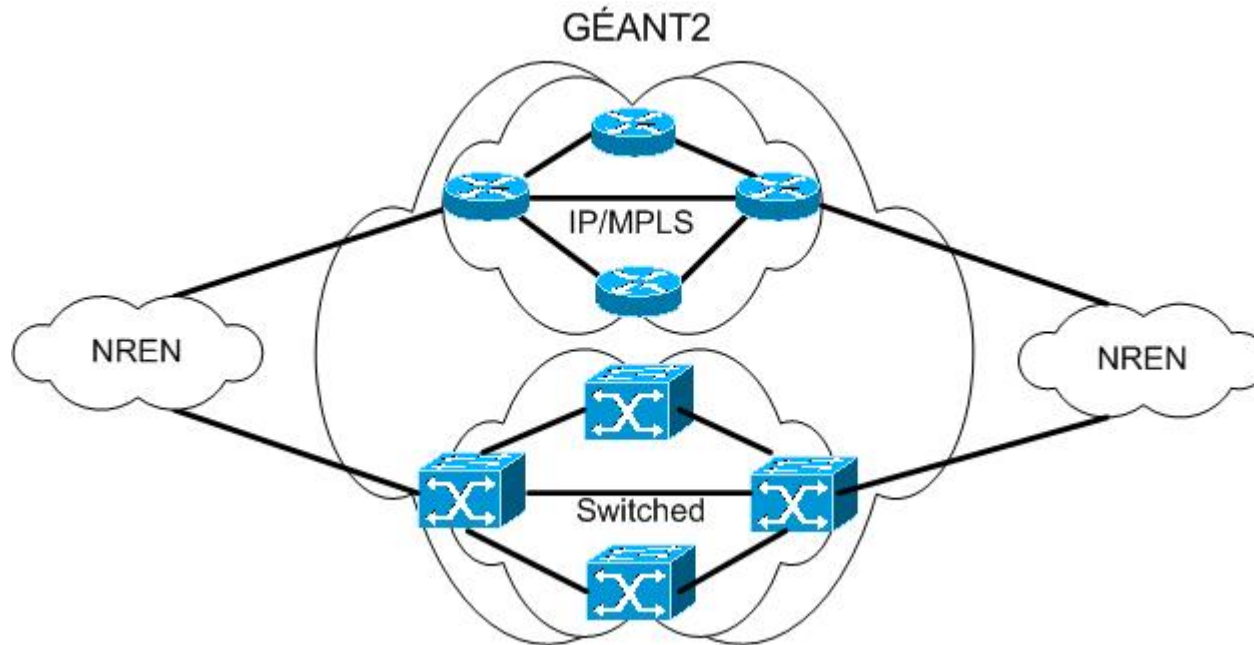
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Bandwidth on Demand



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Where the GÉANT2 IP network fits in this picture ?



They will form two separate service layers

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Bandwidth on Demand



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GÉANT2 IP/MPLS network

- Is used to provide low bandwidth BoD services <1G
- L2-circuits will do the job
 - Gaps to be filled:
 - Policy enforcement
 - Inter-domain MPLS-TE
 - » Stitching
 - » Contiguous
 - Anytime up to other solutions

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Bandwidth on Demand



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GÉANT2 switched

- Will be used to provide high bandwidth BoD services up to 10G
- GMPLS seems to be the right answer
 - But not the only one !
 - Gaps to be filled:
 - Multi-domain
 - Multi-layer/Multi-region
 - Ethernet

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Conclusion



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- **BoD is identified as a key service in GÉANT2**
 - GMPLS could be one method of providing it
 - Need to solve technological domains/layer integration
 - Multi-domain
 - Advance reservation (?)
- **A GÉANT2 testbed will be created**
 - Virtual or Dedicated for GMPLS testing
 - BoD research activities and other FP6 projects will fully benefit from it