



Bandwidth on Demand in GÉANT2

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BoD in GÉANT2

Introduction



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- p2p services: Demand for Ethernet Private Line circuits growing in GÉANT2
- BoD could:
 - Improve the customer experience by providing circuit booking
 - Possible reduction in network operation overhead
 - But no solution implemented yet in GÉANT2
- Two solutions being actively pursued:
 - AutoBAHN
 - GMPLS

GÉANT2



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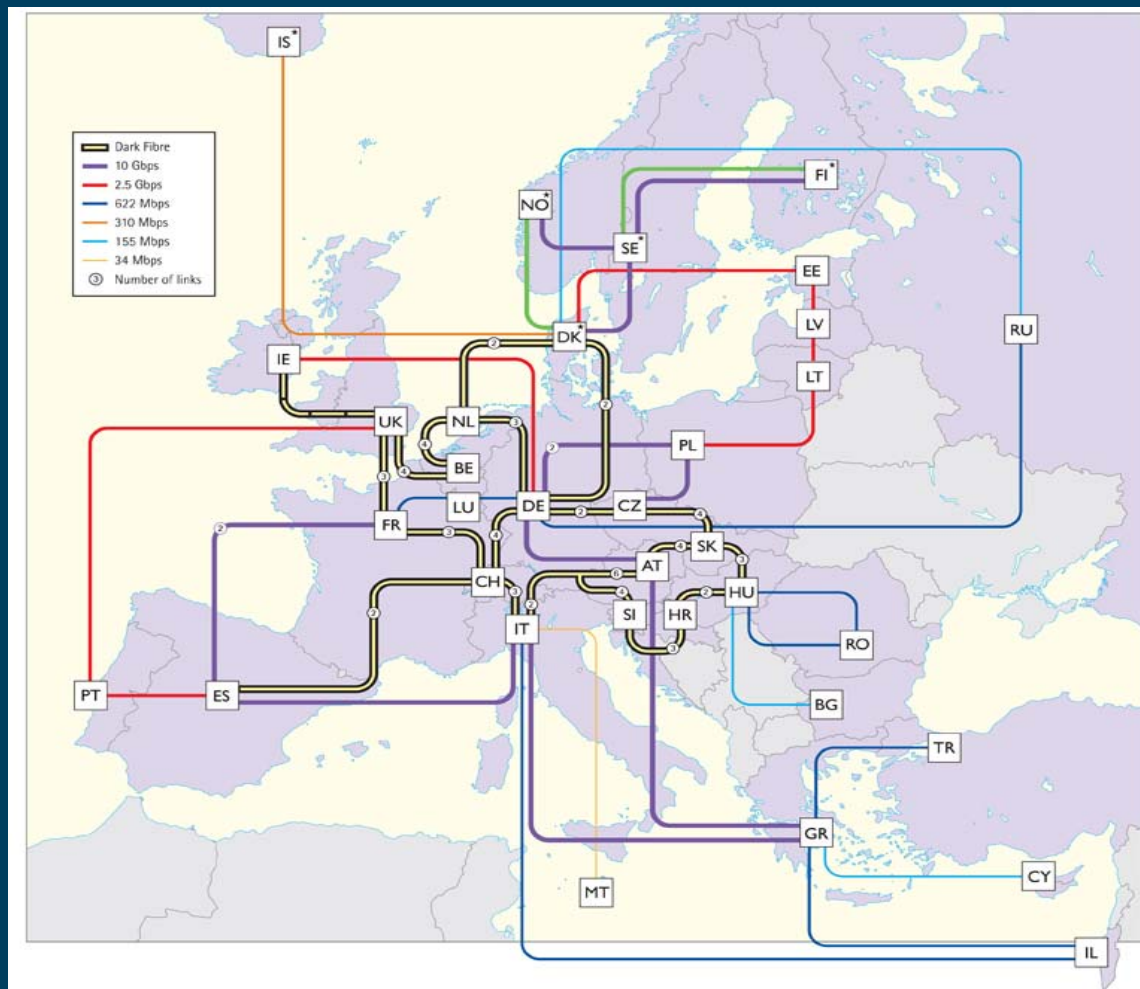
- 25 POPs serve >30 NRENs
- ~12000 km of fibre + 150 ILA sites
- 50+ x (own) 10G lambdas
- 9 x (leased) 10G lambdas
- 8 x 2.5G (leased) “lambdas” + some lower speed links
- SDH layer: Alcatel MCC 1678
- Juniper T640, M160, M40 routers
- NREN accesses at up to 10Gbps (+ backup) + P2P (“GÉANT+”)
- 4 x 10G to North America
- POP in NY
- connections to other R&E networks: Abilene, NLR, ESnet, CA*net4, SINET, TENET, RedCLARA, EUMEDCONNECT, TEIN2 (coming)



GEANT2



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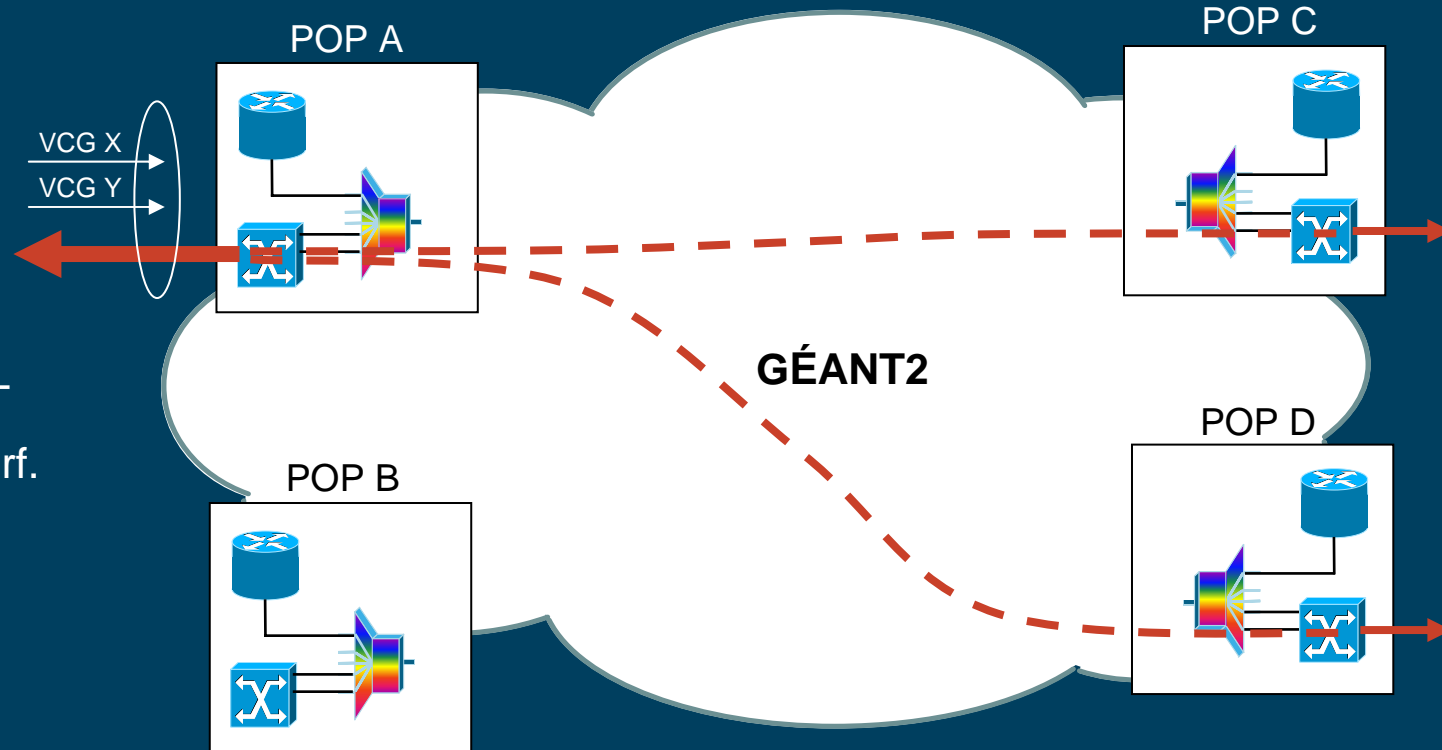
Current p2p services

- GÉANT2 offers point-2-point Ethernet services using:
 - MPLS LSPs (I2vpn)
 - Ethernet private lines (EPL) over Next Generation SDH
- LSPs preferred for capacities of up to 1 Gbit/s.
- For gigabit circuits EPL services offered
- But these service are manually entered by NOC:
 - on-demand services can improve customer experience

p2p GE/10G over NG-SDH



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Features:

- uses GFP-F/VCAT
- GE and 10GE interf.
- 10G Eth port uses VLANs (EVPL)
- GE supports EPL

- Currently provisioned by NOC - not on-demand

BoD has been promised before...



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- BoD was promised by ATM
- ATM offered lots of nice features...
 - versatile BW capabilities
 - versatile QoS (in principle)
 - well-defined signalling & routing
 - nice OAM
- ...BUT complex, proved too expensive, GE came along in the meantime ...



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DANTE approach

DANTE is actively investigating two BoD solutions:

- Standards based solution:
ASON / GMPLS
- Multiple-technology domains with advanced reservation:
AutoBAHN



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GMPLS in DANTE

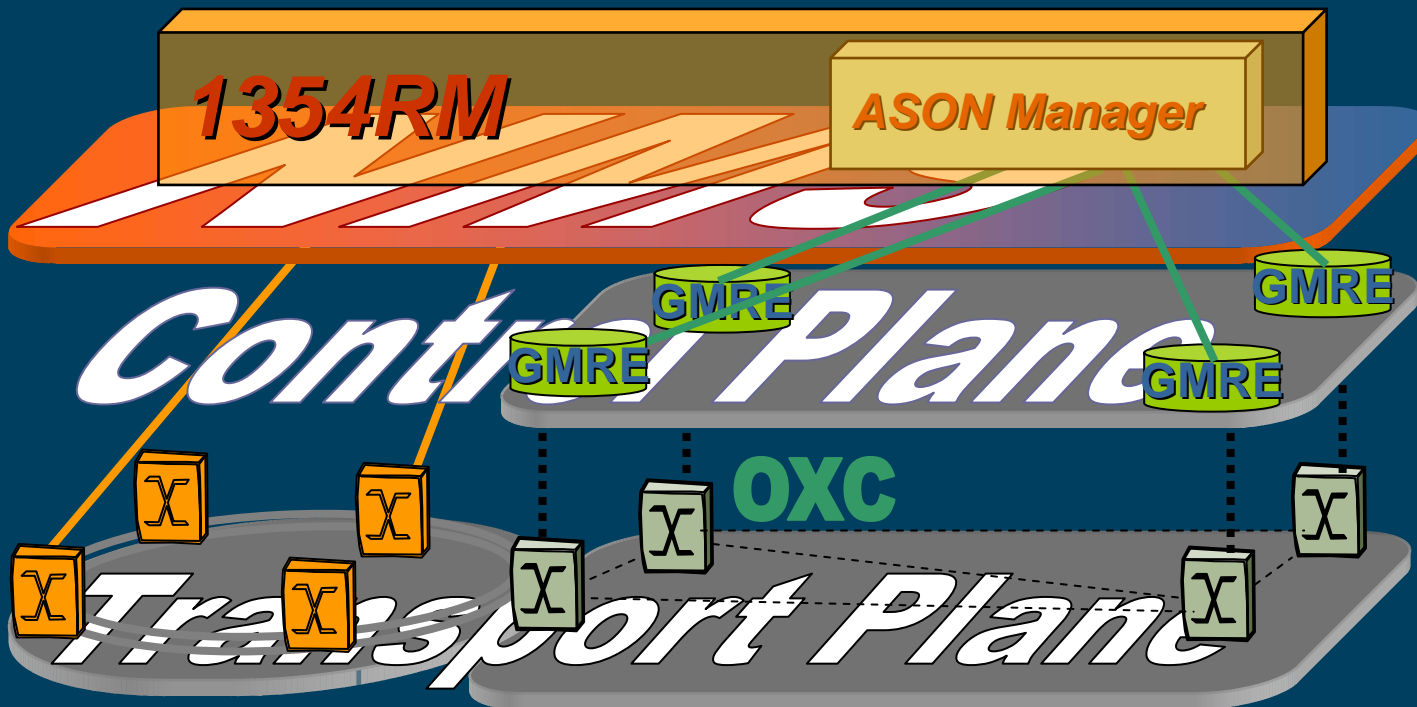
Overview

- Use Alcatel-Generic MPLS Routing Engine (GMRE)
- Testing done up to now (at Alcatel Stuttgart)
- Next step: GMPLS evaluation on the GÉANT2 testbed
- Deployment scenarios have been investigated

Alcatel GMPLS architecture



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Testing done so far...

DANTE tested GMRE functionality at Alcatel Labs early 2006:

- Network construction
 - Operations associated with initialising the control plane
- GMPLS network protection and Restoration
 - Traditional un-protected paths and SNCP protected paths supported
 - New in GMPLS: circuit restoration
- OIF-UNI 1.0 R2 client testing



Test conclusions

- The possibility of hybrid GMPLS / non-GMPLS operation confirmed
 - New layer for debugging – CLI
 - Broader palette of recovery and protection mechanisms
 - GMPLS implementation looks stable for production usage
 - UNI-1.0 was not recommended by Alcatel for production usage when tested in 2006
 - UNI-2.0 was not available for testing in 2006
- GMPLS not currently implemented in GEANT2



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Next steps

- Current release of GMPLS to be evaluated on GÉANT2 testbed
 - (re)assessment of advanced GMPLS/ASON functions
 - Current state of OIF-UNI 1.0-R2 & OIF-UNI 2.0
 - Multi domain and vendor inter-operability test?
- Operational aspects:
 - Migration strategy – hybrid GMPLS / non-GMPLS
 - On-demand hands network control over to users
 - Policy needs to be well understood



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GÉANT2 Testbed

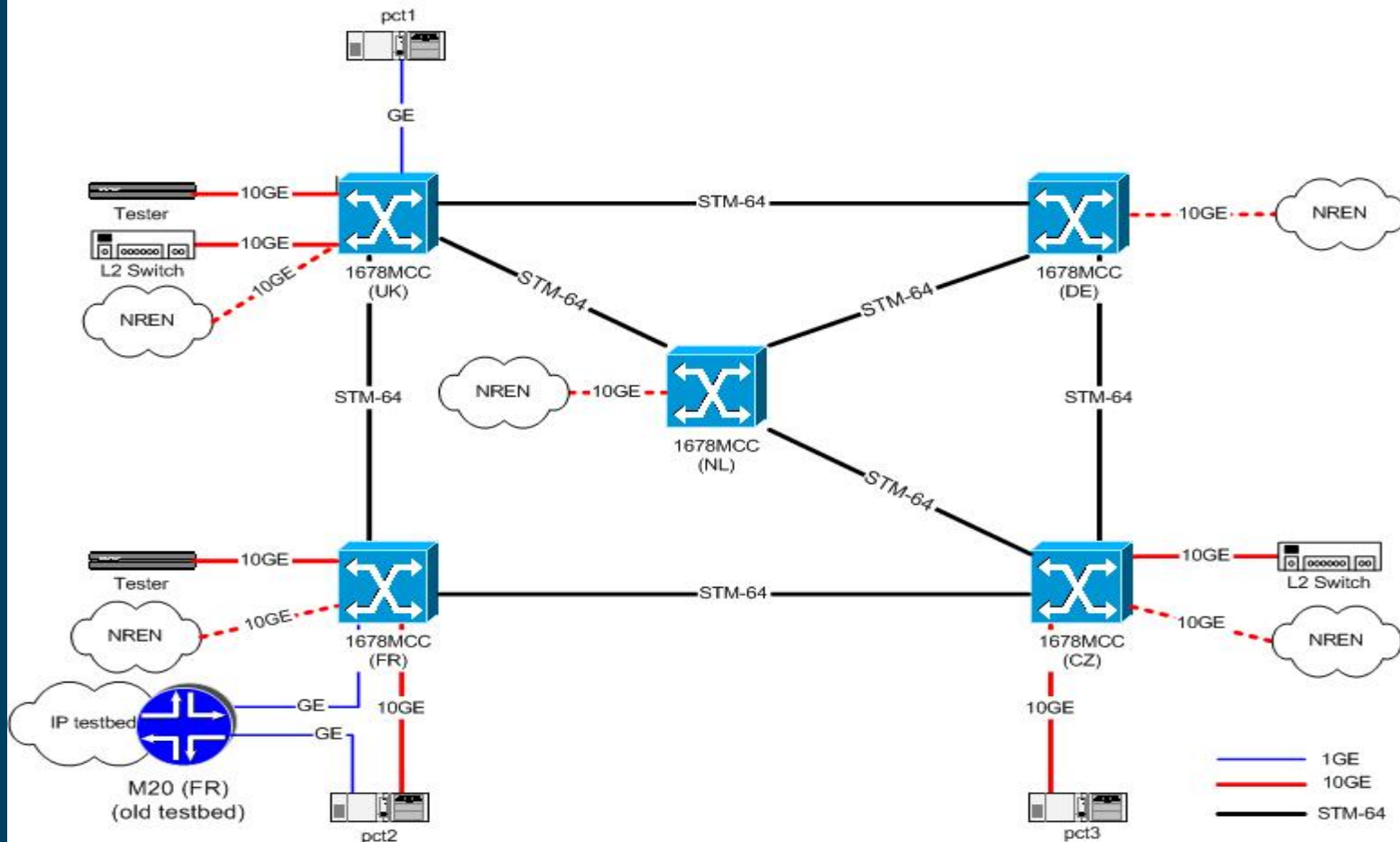
- Implemented using Alcatel 1678 MCC SDH NG-DXC's
- 5 locations have been selected: London, Paris, Amsterdam, Frankfurt and Prague.
- All PoPs are interconnected with dedicated STM-64 (10G) wavelengths
- Dedicated network management system is located in London

GÉANT2 Testbed



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Testbed - MCC connectivity





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AutoBAHN is...

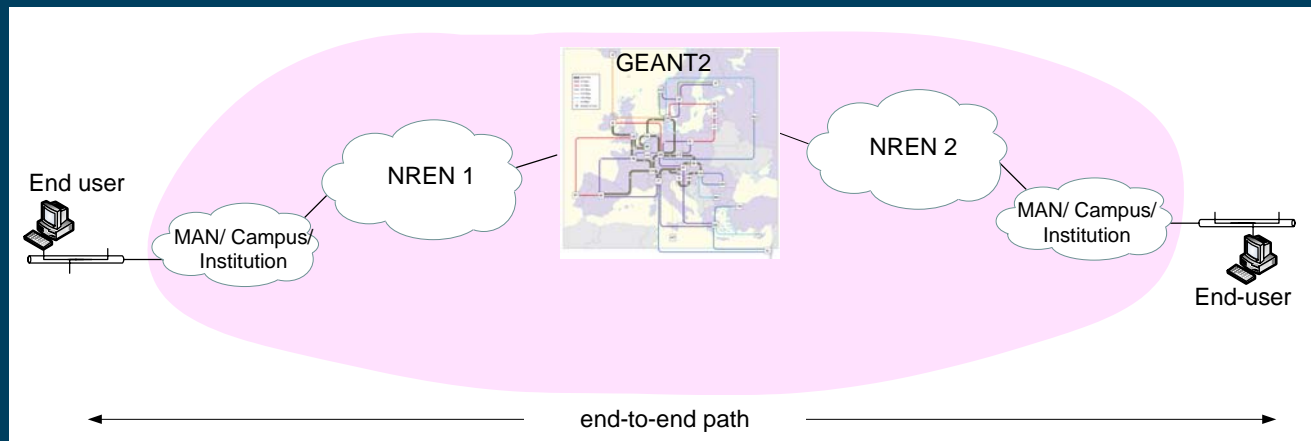
- ... a **research** activity for engineering, automating and streamlining the **inter-domain setup** of **guaranteed** capacity (Gbps) end-to-end **paths**
- AutoBAHN = Joint Research Activity 3 of the GN2 project
 - **GN2** is an **EC-funded** Integrated Infrastructure Initiative (I3) project, with all **NRENs** as partners (DANTE: coordinator)

e2e services over GÉANT2



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- The **hybrid** NREN - GÉANT2 service model enables:
 - Circuits between end hosts
 - May typically transit GÉANT2 + 2 NRENS and two campus networks – may not be GMPLS enabled
 - May include SDH EPL, L2 VPN, IP, native Ethernet

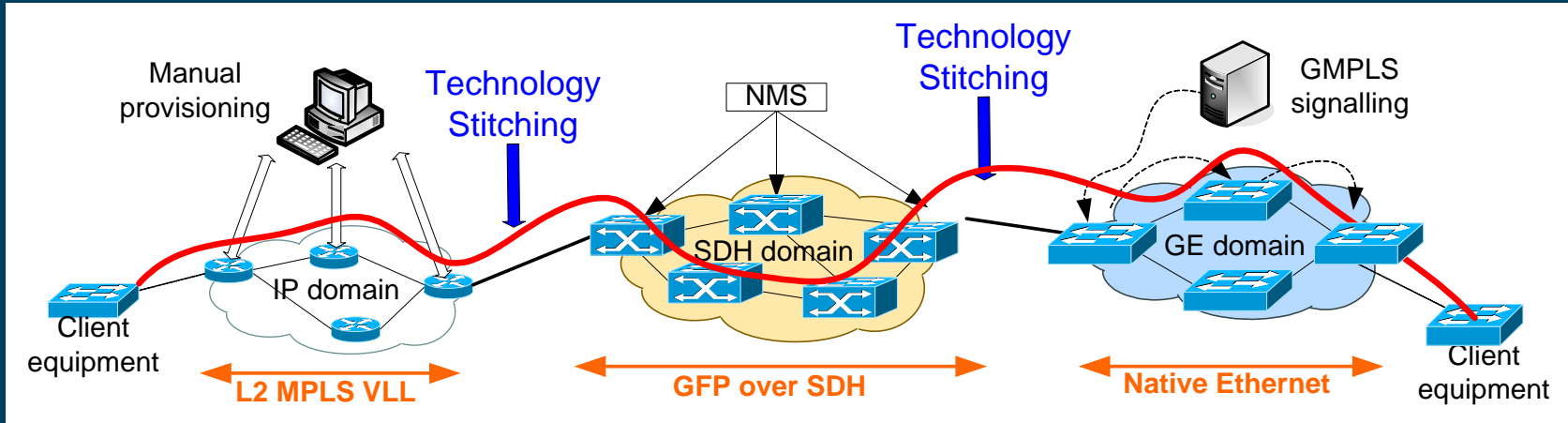




Multi-domain BoD

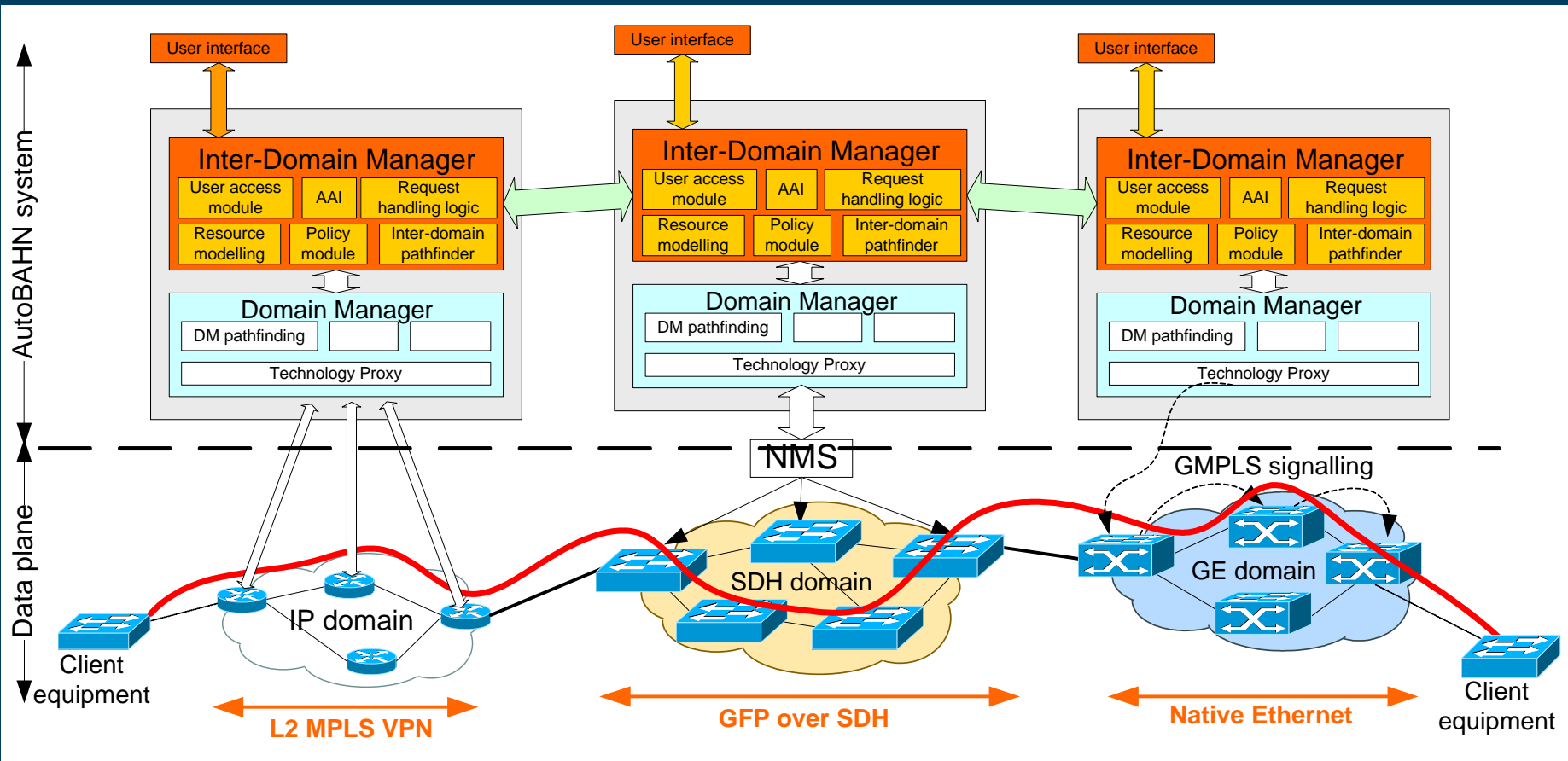
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- ...multi-technology, multi-disciplinary environment
- Control and provisioning has to be distributed
- Business-layer related interactions include AA, policies, advance reservations etc.
- Privacy and control of intra-domain resources must be safeguarded



AutoBAHN overview

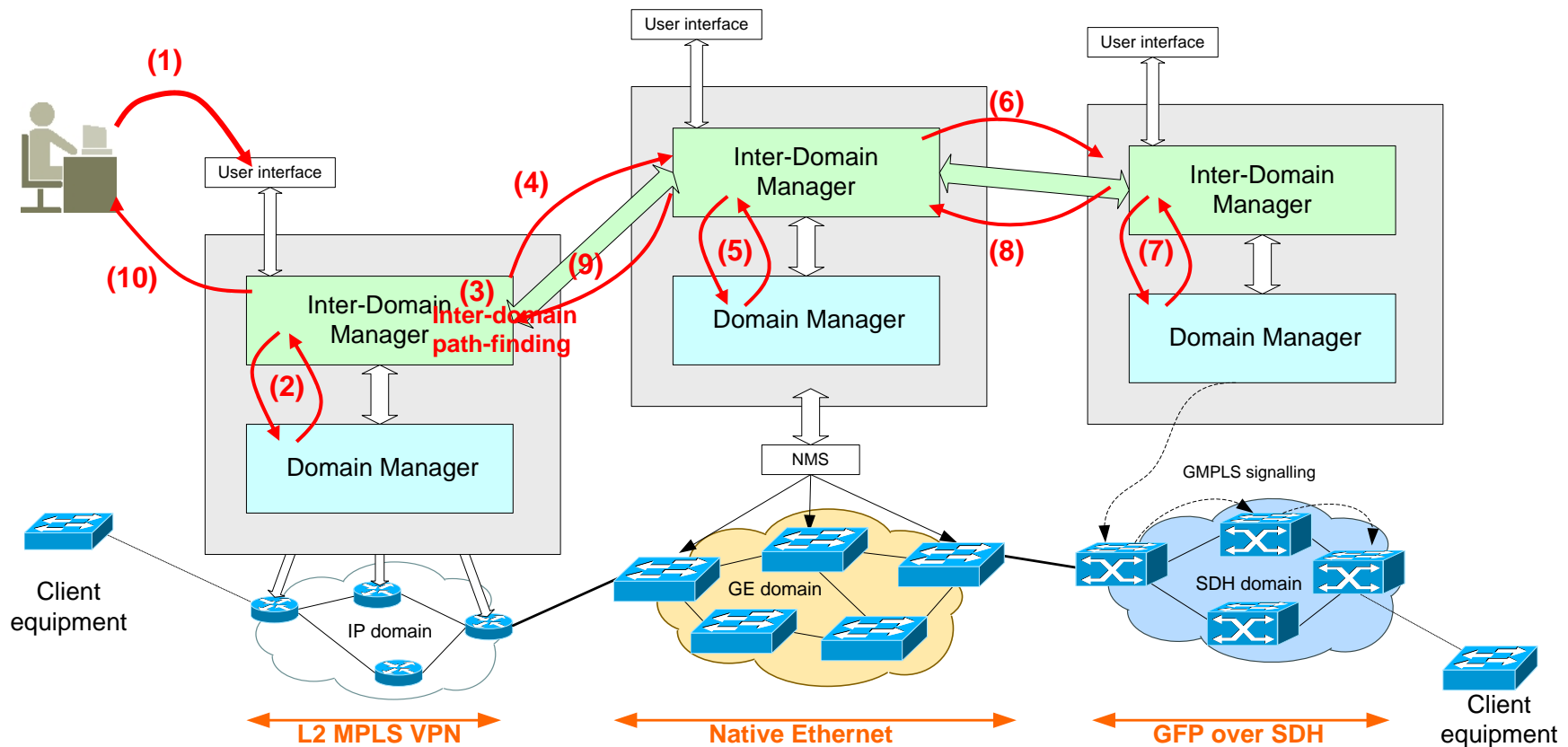
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A distributed approach



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Summary

- Immediate problem: DANTE needs to implement an AutoBAHN DM for GEANT2
- Currently considering two approaches:
 - DM working against ISN (provisioning via n/bound i/f to NMS)
 - Using GMPLS intra-domain with “UNI glue” (a la VIOLA)
- Longer term / more widely:
 - GMPLS end-2-end has pros:
 - Pros: “standards”, “vendor support”
 - Cons: pieces missing - policy control, scheduling
 - AutoBAHN has pros:
 - Pros: scheduling, policy control hooks, does not rely on GMLS enabled networks
 - Cons: proprietary, development is resource starved ..
- OVERALL: The jury is still out...!!!



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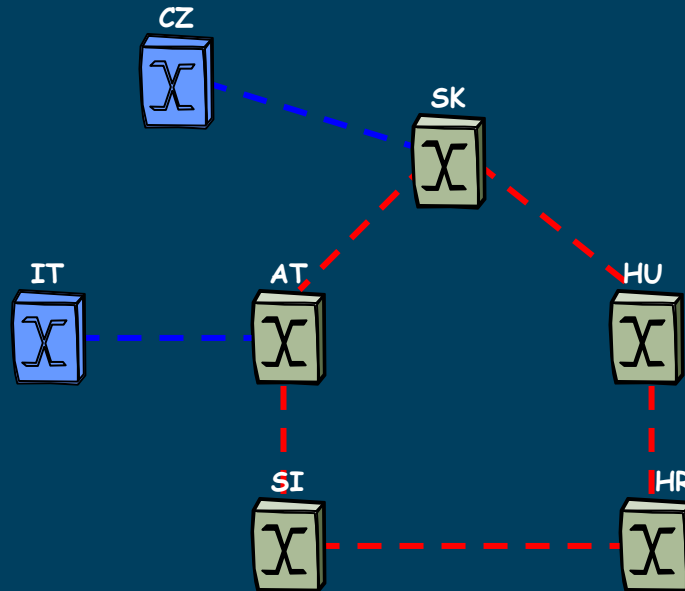
Thanks for your attention!





Partial deployment trial

- AT, HU and SK seems to be the right place to start.
- HR and SI when they are deployed.





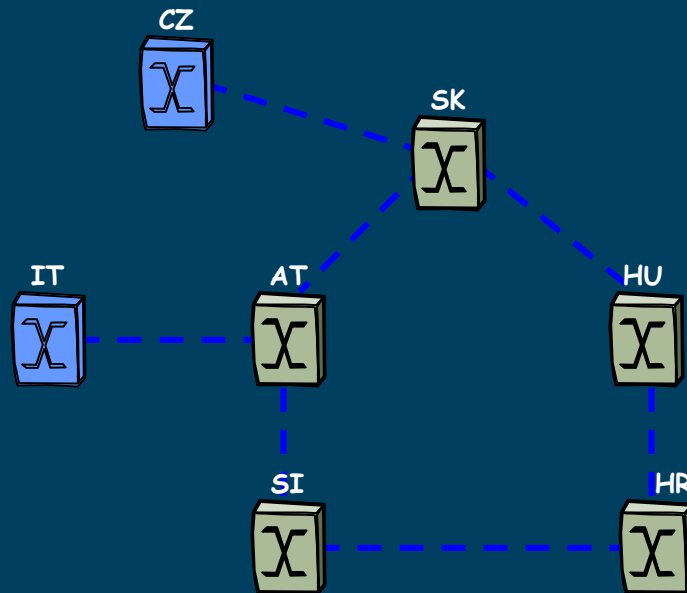
Trial phases

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Phase I – GMRE enabled on AT,SK and HU 1678 MCCs

Phase II – SK-HU link to the GMRE network – Migrate circuits

Phase III – SK-AT link to the GMRE network - Migrate circuits





Trial phases (cont.)

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Phase IV - Test of different types of GE paths.

Phase V – GMRE enabled on HR and SI

Phase VI – migrate backbone IP path AT-HU to GMPLS

