

Using E2E technology for LHC

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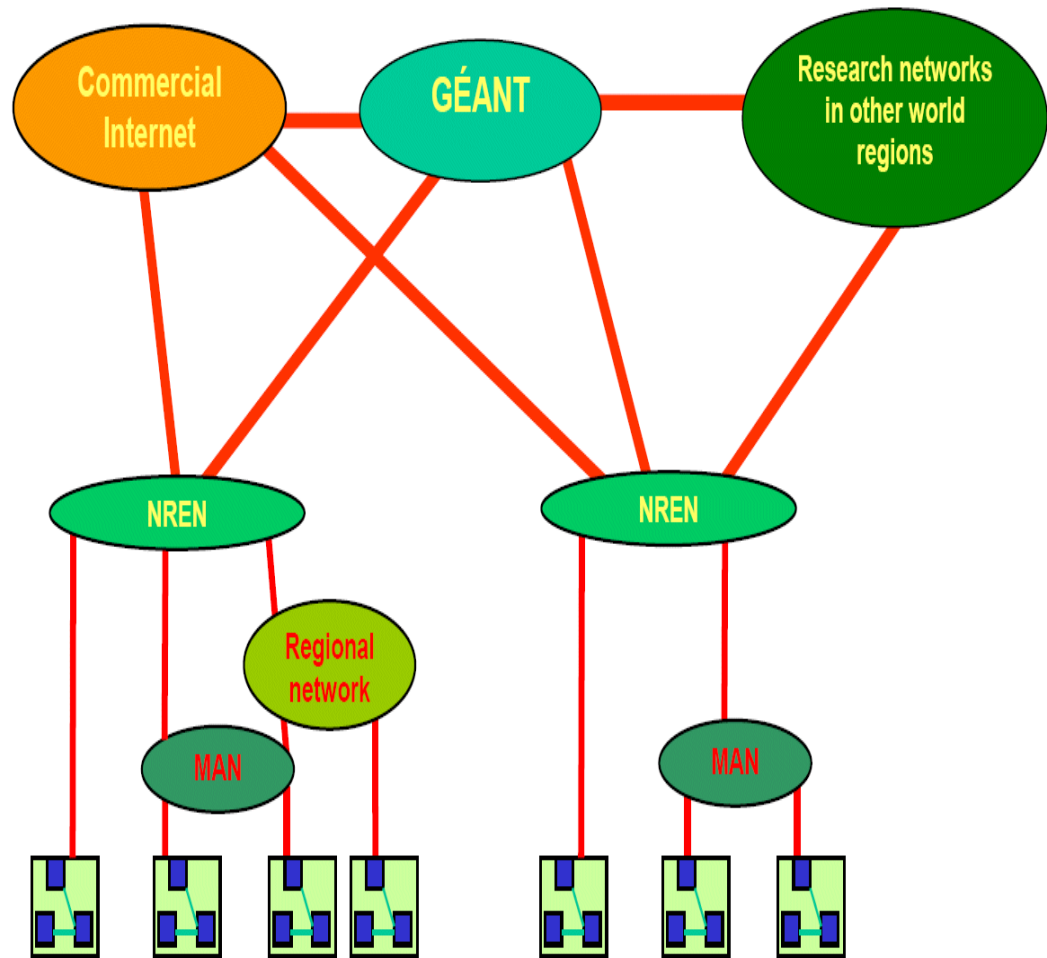


Agenda

- ▶ Multilayer and multidomain networks
- ▶ End-to-end or edge-to-edge?
- ▶ A case study: KarBol
- ▶ Challenges
- ▶ The LHCOPN

Multilayer Research Networks

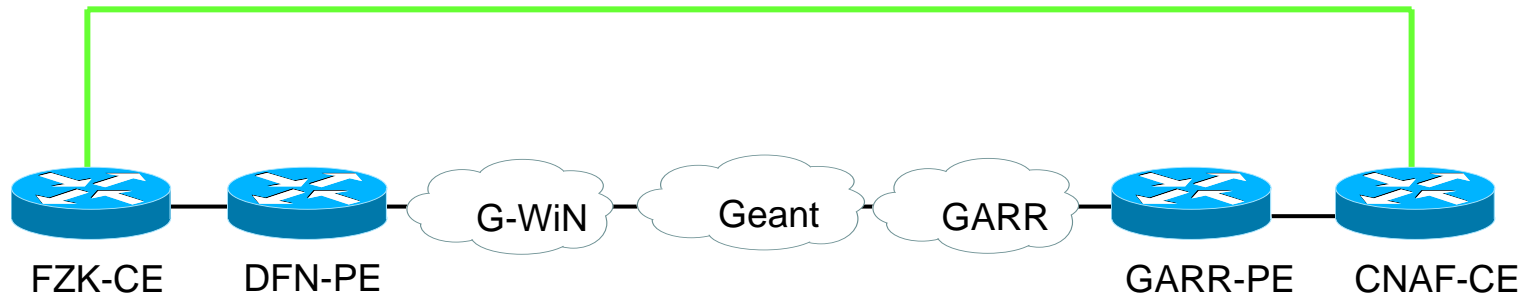
- ▶ Research networks multilayer approach
 - LAN
 - MAN
 - Regional Network
 - NREN
 - Continental backbones (GÉANT)
- ▶ Multiple domains
- ▶ Multiple responsibilities



End-to-end or edge-to-edge?

- ▶ IP was designed as an end-to-end L3 protocol
- ▶ In principle, “lightpaths” use suggests a clear L1 or L2 end-to-end channel
- ▶ L2 services also possible using MPLS-L2VPNs and VPLS
- ▶ However, often it is necessary to cross several edge borders
- ▶ “stitching” of services across domain borders is necessary
 - Sharing the same setup (MTU, buffer and queue sizes)
 - Otherwise performance is affected!
- ▶ “stitching” of people is crucial

A case study: KarBol



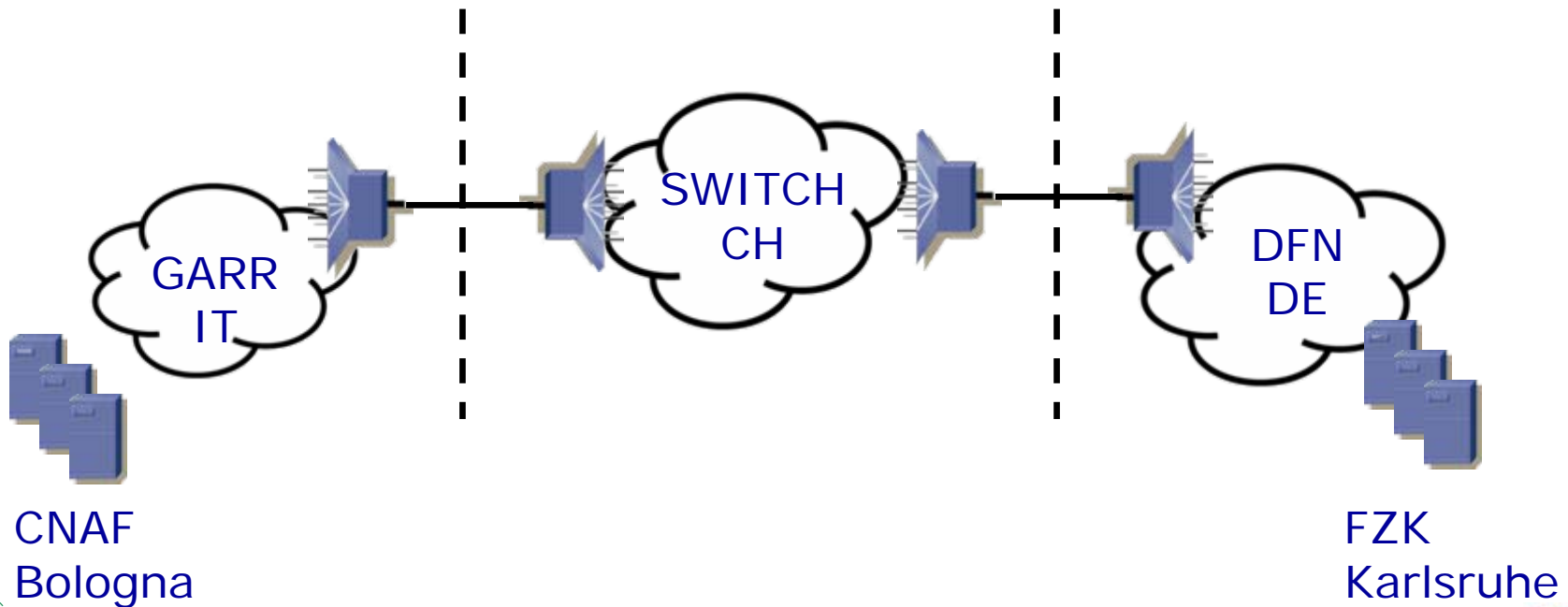
- ▶ In 2004, an MPLS-L2VPN was created between INFN-CNAF Bologna (Italy) and FZK-Karlsruhe (Germany)
- ▶ A model to implement end-to-end services between tier centers
- ▶ L2 connectivity between the 2 T1 centers obtained across an L3 path
- ▶ 5 different competence domains involved
- ▶ New technical challenges faced and solved

Challenges

- ▶ Multidomain L2VPN: something router manufacturers did not consider enough
- ▶ Interoperability between platforms
- ▶ An L2 path can be a security backdoor into someone's LAN
 - An alternative using L3VPN was studied
 - A trusted relationship is needed
- ▶ Sharing L3 addresses (private, public?)
- ▶ Complex setup
 - VPLS could be the solution to scale to T2 numbers

More challenges: CBF

- ▶ Cross-Border-Fibre, on rent or IRU, or digged (!)
- ▶ DWDM equipments, 10G lambdas
- ▶ Complementing GÉANT2 infrastructure
- ▶ Offering reciprocal backup path from T1 to T0



LHCOPN – LHC Optical Private Network

- ▶ Every Tier1 will be connected to the Tier0 with a direct 10Gbps "*lightpath*".
- ▶ Those lightpaths will be of different kinds:
 - single or concatenated layer 1 links (STM64, LANPHY, WANPHY)
 - layer 2 VLANs
- ▶ Tier1s should also provide a dedicated backup link to Tier0
 - during the startup phase (Service challenges) backup will be provided via routed paths (GN2, Esnet, Abilene, NRENs..).

LHCOPN challenges

▶ Security

- The LHCOPN will bypass the security system (firewall, IDS...) already in place at every Tier; current technologies cannot deal with the requested bandwidth

▶ Operations

The **ENOC** is Network Co-ordination Service. It is required to:

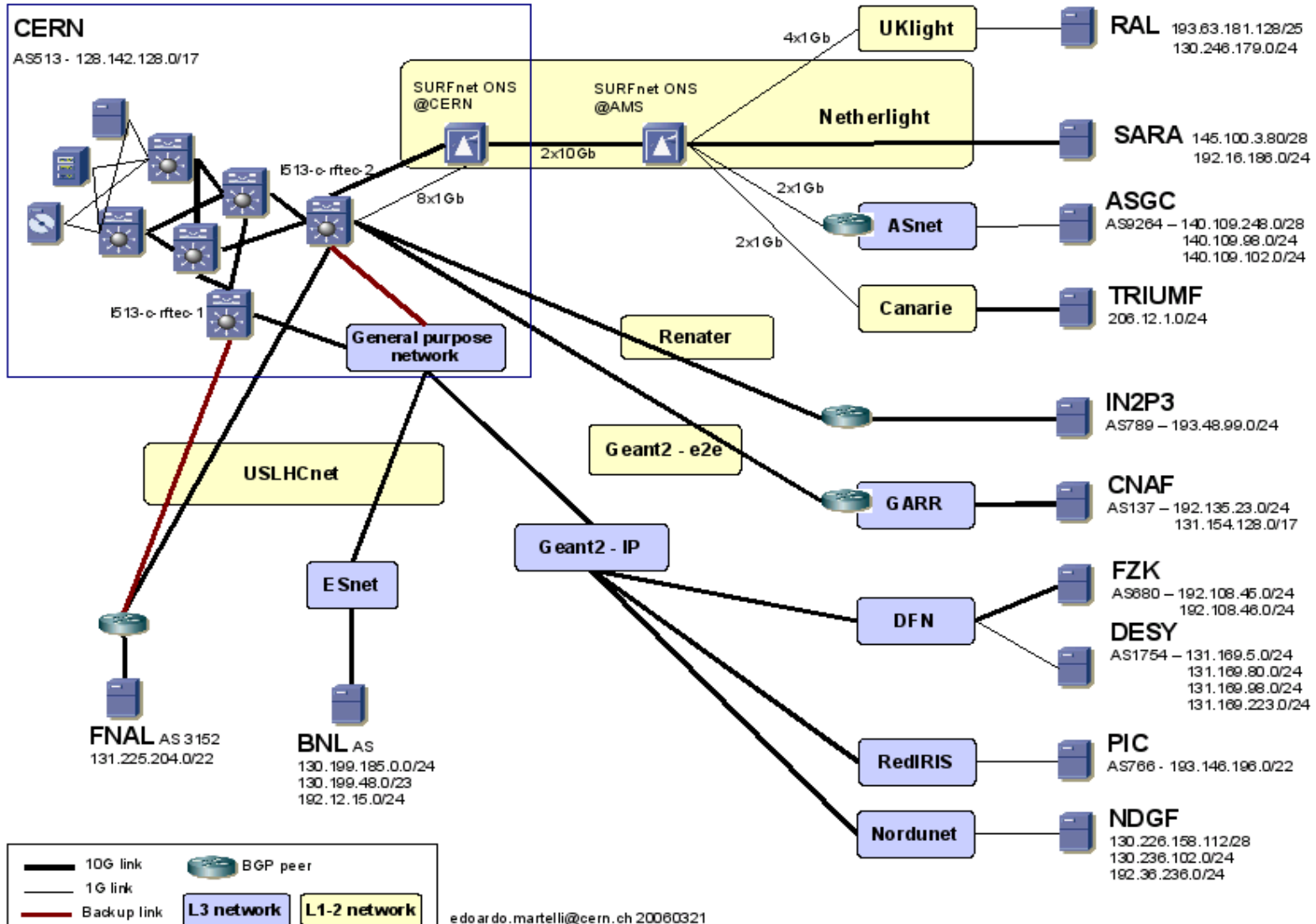
- look after network issues for EGEE and LCG
- receive network TTS from NRENs, analyse them and provide relevant information to the GGUS who will then interact with the users
- monitor the e2e status of the lightpaths and trigger the appropriate corrective actions

▶ Monitoring

- Several metrics, several different devices, and several OSI stack levels to monitor

Current LHCOPN topology

LHCOPN – current status



The End

Thanks to Edoardo Martelli, CERN