LHCONE in Europe

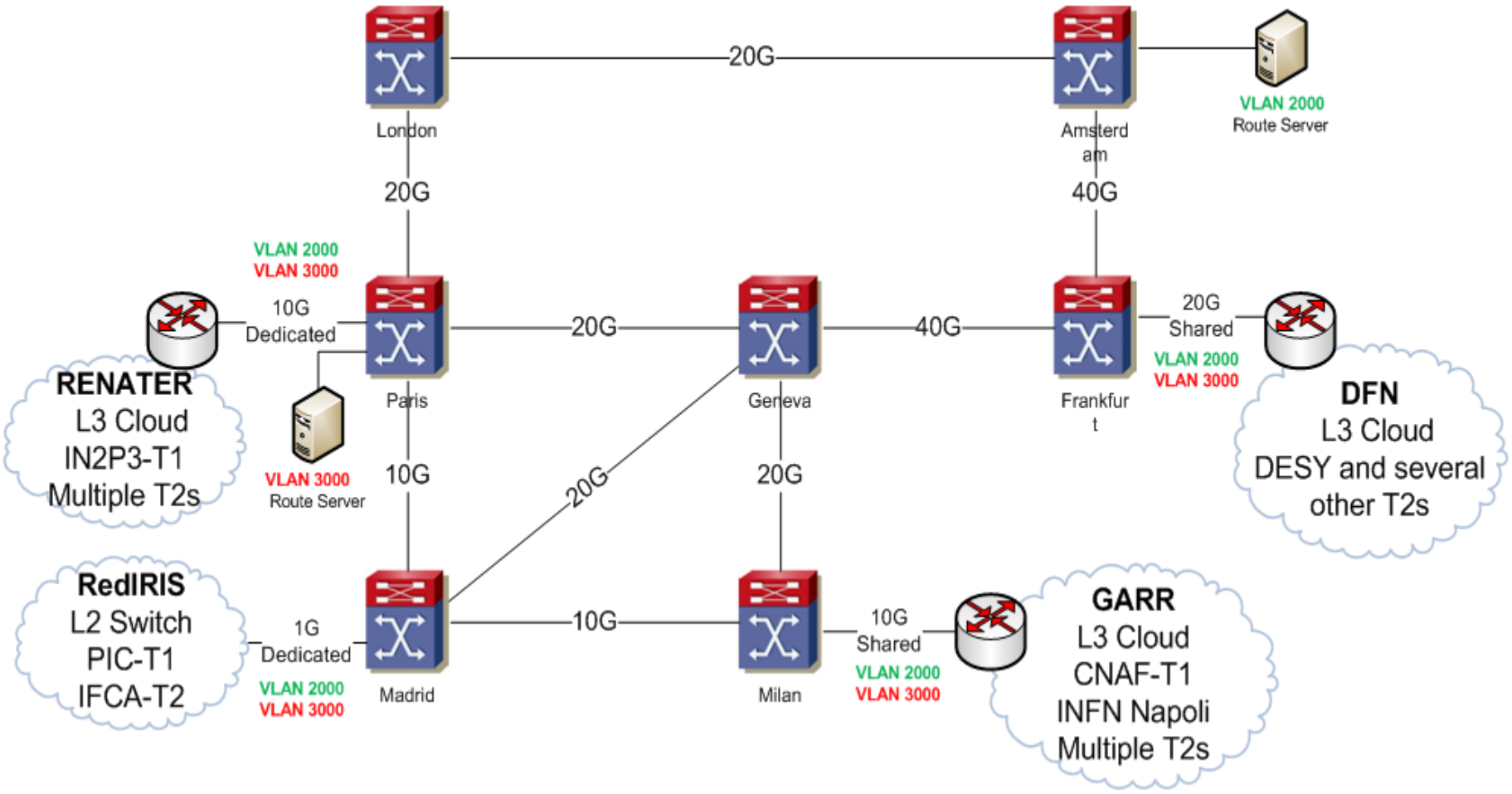
DANTE, DFN, GARR, RENATER, RedIRIS

LHCONE Meeting Amsterdam 26th – 27th Sept 11

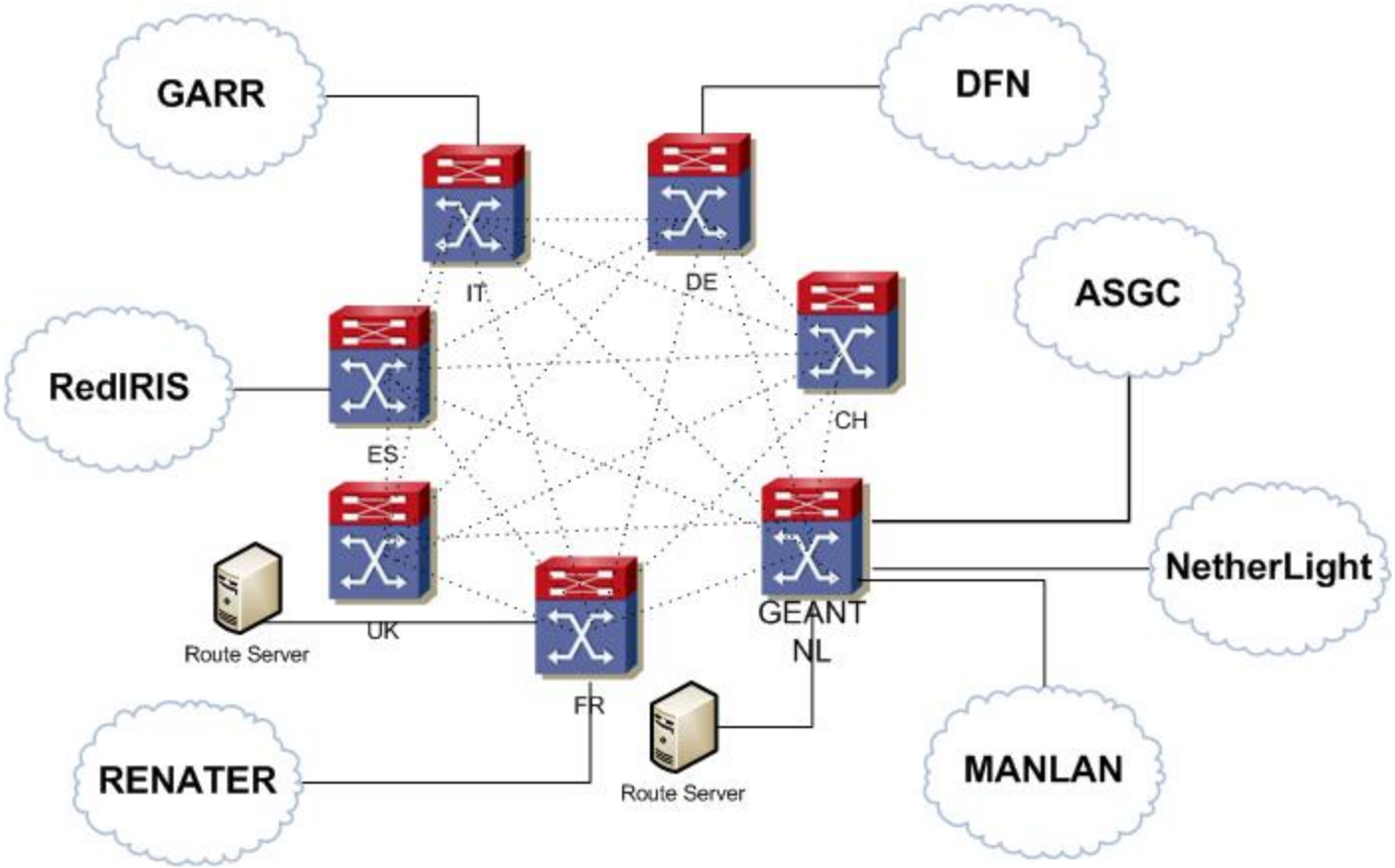
Agenda

- LHCONE Setup in GEANT
  - LHCONE in France
  - LHCONE in Italy
  - LHCONE in Germany
  - LHCONE in Spain
- Connection with CERN-T1
- LHCONE Interim Setup
  - Advantages and Disadvantages
- Move to a Scalable Network
  - Advantages of L3
- Conclusion

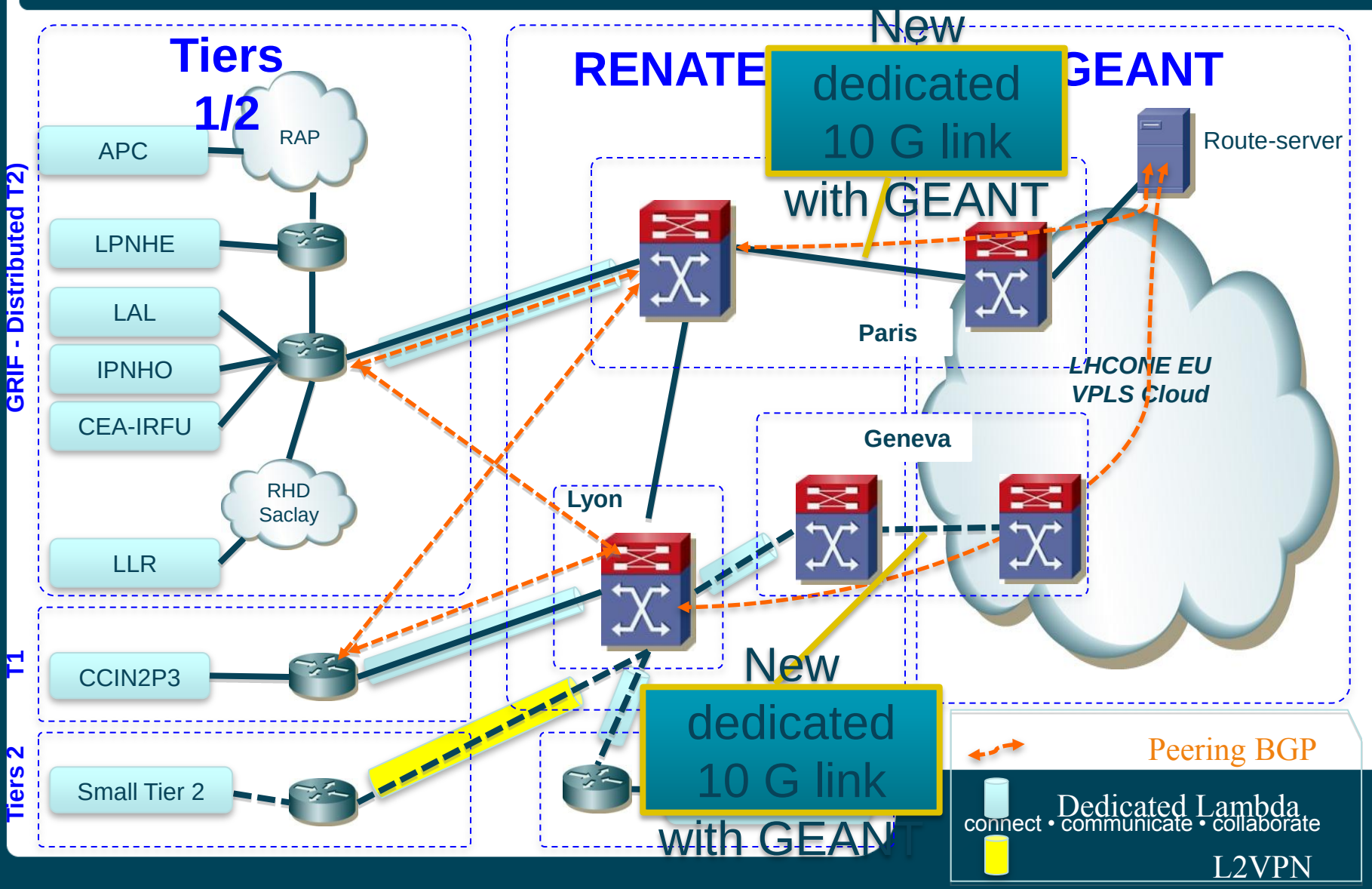
LHCONE in GEANT



LHCONE in GEANT



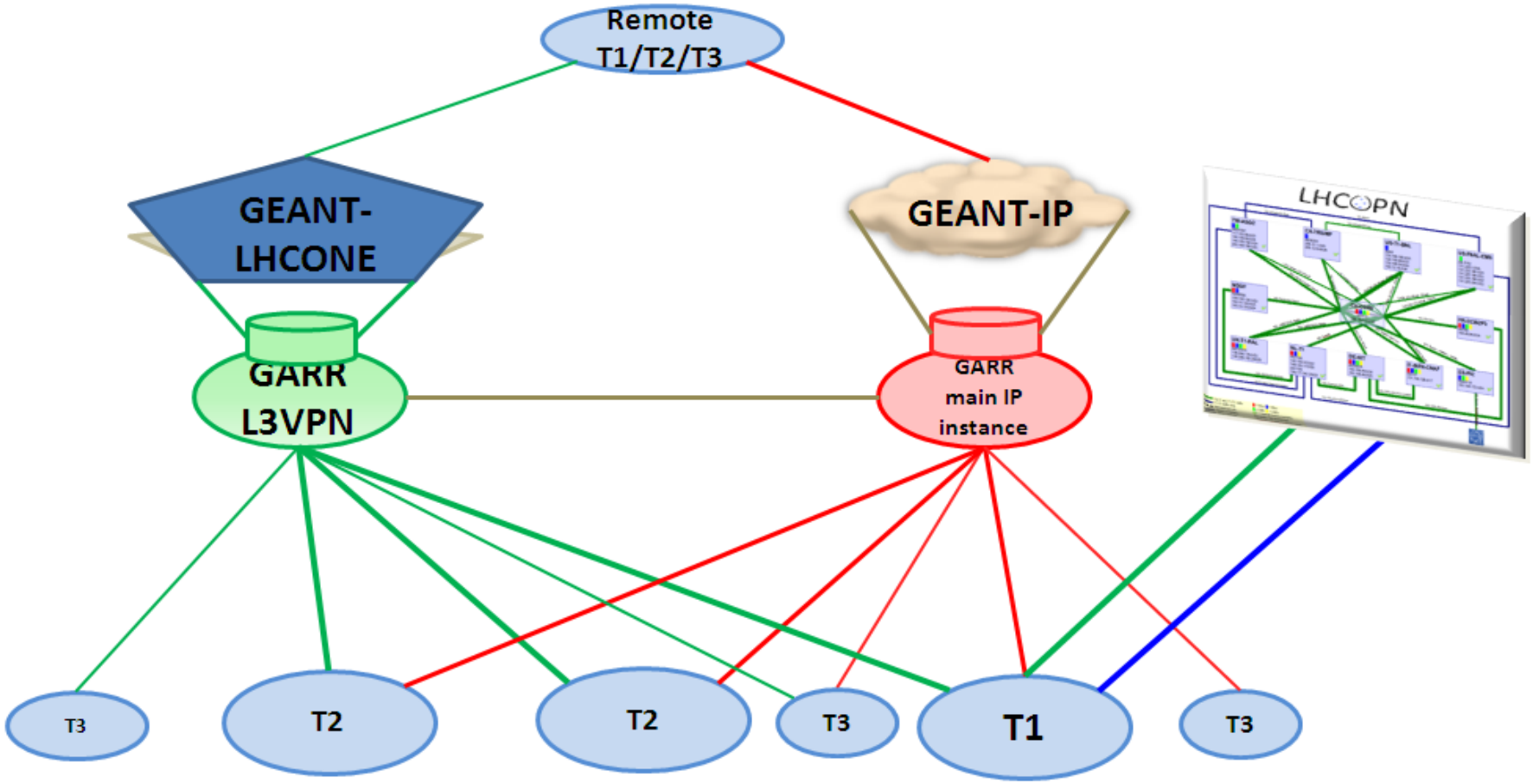
LHCONE in France
prototype and beyond (phase 2)



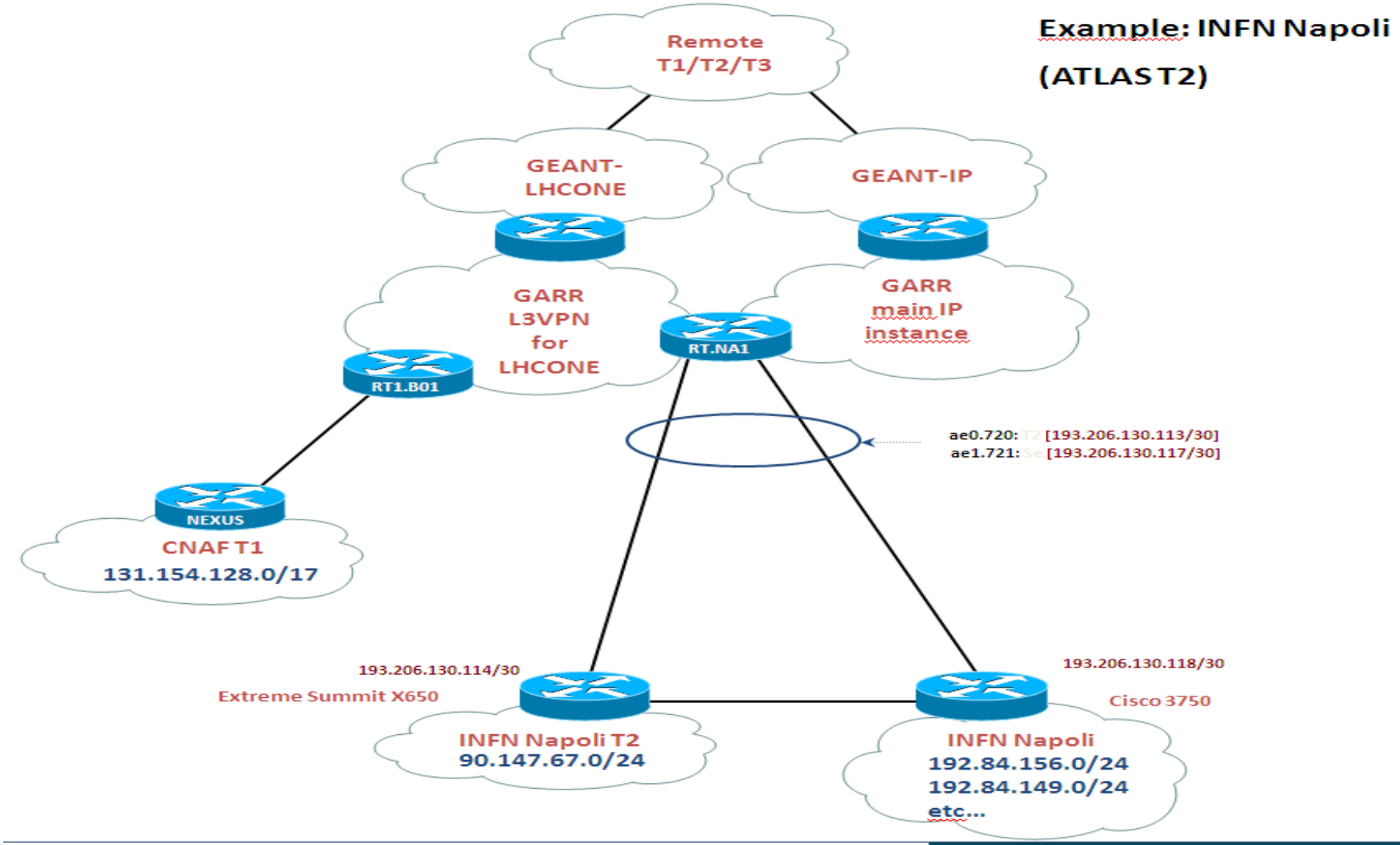
RENATER (French NREN)
Future Setup

Site	Network	Type of link	Phase
CCIN2P3 (T1)	Test :193.48.100.192/26 prod : 134.158.104.0/21 193.48.99.0/24 134.158.104.0/21 193.48.99.0/24	Dedicated lambda	Prototype already in place
Distributed T2 : GRIF Science laboratories APC IPNHO LAL LLR LPNHE	Test : 134.158.195.0/24 Prod : 134.158.72.0/23 134.158.78.0/24 134.158.132.0/24 134.158.159.0/24 134.158.188.0/24 194.54.206.0/23	Dedicated lambda	Prototype already in place
CCPM (T2)	Not given	L2VPN	2° Phase
GRIF : CEA-IRFU (T2)	Not given	Dedicated lambda	2° Phase
IPHC (T2)	Not given	L2VPN or Dedicated lambda	2° Phase
IPNL (T3)	Not given	To be discussed	2° Phase
LPC (T2)	Not given	L2VPN	2° Phase
LAPP (T2)	Not given	L2VPN	2° Phase
LPC (T2)	Not given	L2VPN	2° Phase
LPSC(T3)	Not given	L2VPN	2° Phase
Subatech (T2)	Not given	L2VPN	2° Phase

GARR (Italian NREN) Current Setup



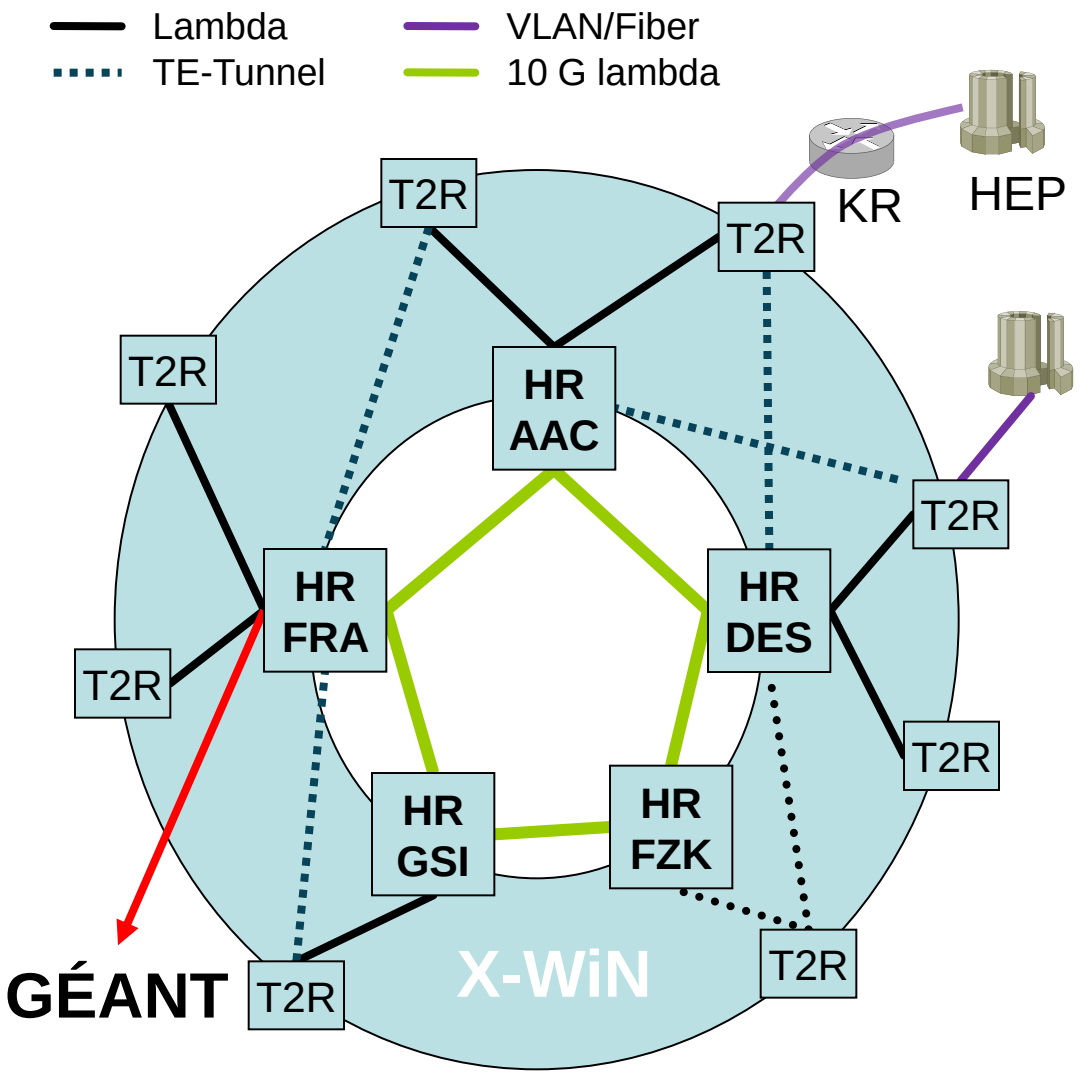
GARR (Italian NREN)
Example INFN Napoli



GARR (Italian NREN) Current Status

Site	Network	Dedicated link for LHCONE	Equipment for LHCONE access
INFN CNAF Bologna (T1)	131.154.128.0/17	✓	Cisco Nexus
INFN Bari (T2)	212.189.205.0/24 90.147.66.0/24	✓	HP Procurve 5412zl
INFN Catania (T2)	192.84.151.0/24	✓	Cisco 3750G
INFN Frascati (T2)	192.84.128.0/25	X	Cisco 7606
INFN Legnaro (T2)	192.135.30.0/27 192.135.30.192/27	X	Cisco 6500
INFN Napoli (T2)	90.147.67.0/24	✓	Extreme Summit X650
INFN Milano (T2)	192.135.14.0/24	✓	Juniper EX4500
INFN Pisa (T2)	192.135.9.0/24 193.205.76.0/23	✓	Juniper M7i
INFN Roma1 (T2)	141.108.35.0/24 141.108.36.0/24	✓	Cisco 3750
INFN Torino (T2)	193.206.184.0/26 193.205.66.128/25	X	Cisco 7304

Germany (1)
X-WiN and HEPPI



HR: HEPPI Router (P/PE)
T2R: PE Router
all standard X-WiN core routers!

- inner core with 10GE
- all traffic in L3VPN
- traffic flow HEP1<->HEP2 via HR
  - except if connected to same T2R
- additional loopback interfaces on all routers that are part of HEPPI
  - serve as BGP next-hops in L3VPN
- separate OSPF process to distribute next-hops
- TE-Tunnels: if OSPF not possible then static routing for loopbacks
- GÈANT access as VLAN on existing 2x10GE channel

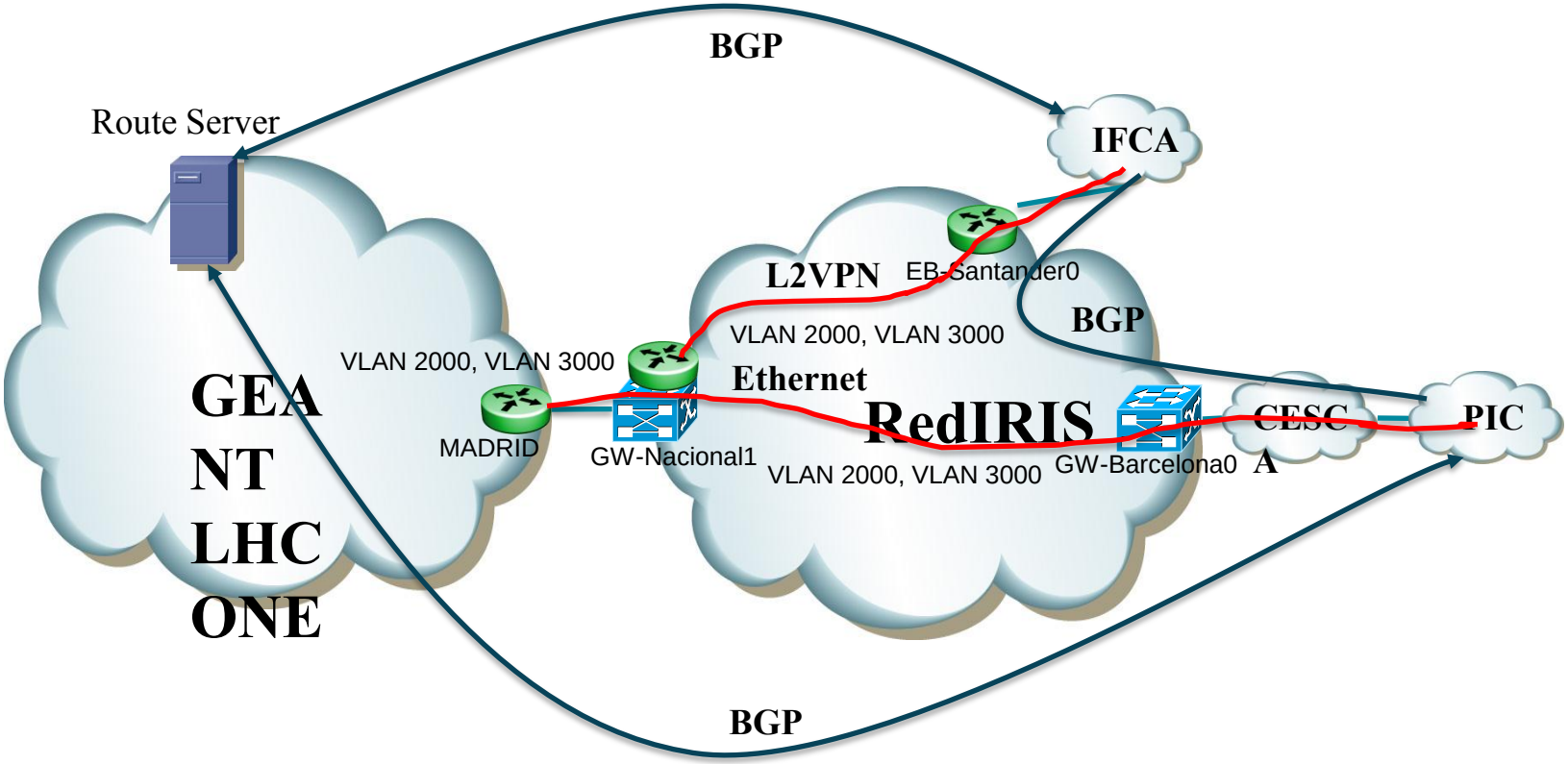
Germany (2)
Current Status

- Inner core of 10 G wavelengths is in operation
  - connects KIT, DESY, GSI, RWTH Aachen and Frankfurt
  - management and accounting procedures are ready
- Router interfaces at sites for HEPPI are configured and tested
- Propagation of HEPPI Routes via BGP is working
  - HEPPI LAN only for HEPPI Traffic (separated from IP traffic)
  - Backup via normal IP service
- Dedicated 10 G GÉANT capacity to connect HEPPI to LHCONE via L3 in place

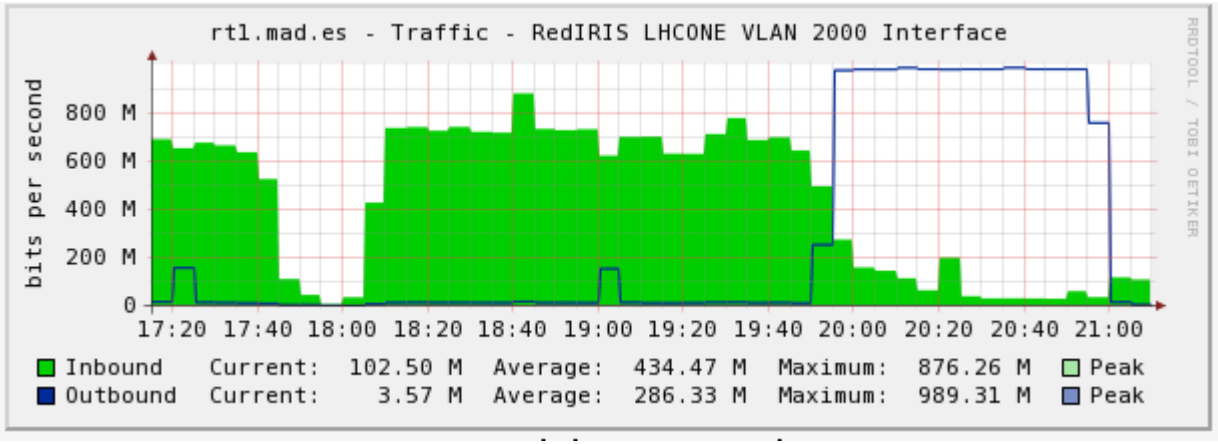
Germany (2)
Current Status

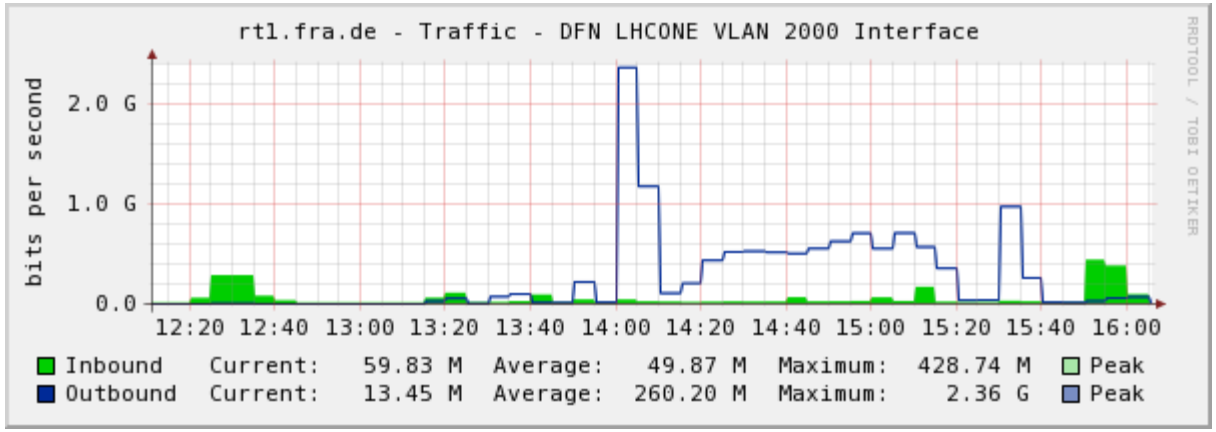
Site	Network	Type of link	Phase
KIT, Karlsruhe (T1)	192.108.45.0/24 192.108.46.0/23	Dedicated lambda	Prototype already in place
DESY, Hamburg (T2)	131.169.98.0/24 , 131.169.160.0/21, 141.34.192.0/21, 141.34.200.0/24, 141.34.224.0/22, 141.34.228.0/24, 141.34.229.0/24, 141.34.230.0/24, 141.34.216.0/23, 141.34.218.0/24, 141.34.219.0/24, 141.34.220.0/24	Dedicated lambda	Prototype already in place
GSI, Darmstadt (T2)	140.181.2.0/24	Dedicated lambda	Prototype already in place
RWTH, Aachen (T2)	134.61.24.0/22	Dedicated lambda	Prototype already in place
University of Goettingen (T2)	Not given	L3VPN	2° Phase
University of Wuppertal (T2)	Not given	L3VPN	2° Phase
University of Freiburg (T2)	Not given	L3VPN	2° Phase
LMU Munich (T2), Leibniz Rechenzentrum, Garching	Not given	L3VPN	2° Phase
Max-Planck-Institut fuer Physik, Munich (T2), Rechenzentrum Garching of the Max Planck	Not given		

LHCONE in Spain (RedIRIS)

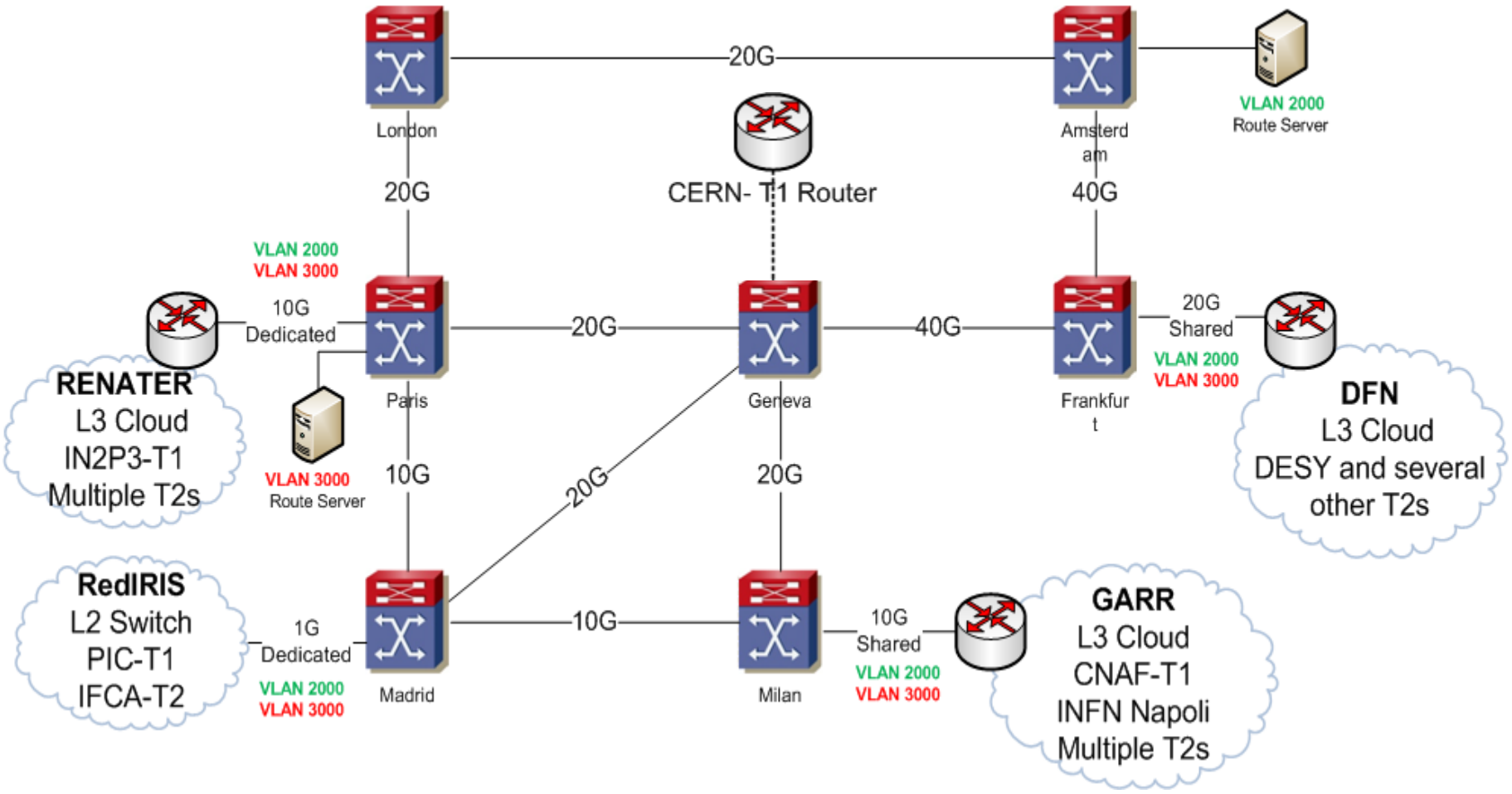


Current Status





LHCONE in GEANT



Operational Issues

- Lack of operational procedures and process
  - Troubleshooting
  - Bringing up new connection
  - Reporting problems

Summary

- European NRENs and end-sites are ready and operational
- Connection between CERN-T1 and GEANT Geneva node is a must
- We all need to work on procedures/process
- Points for discussion
  - T1-T1 traffic
  - LHCONE backup via general IP
  - AUP and configuration guide for end-sites

LHCONE Interim Setup

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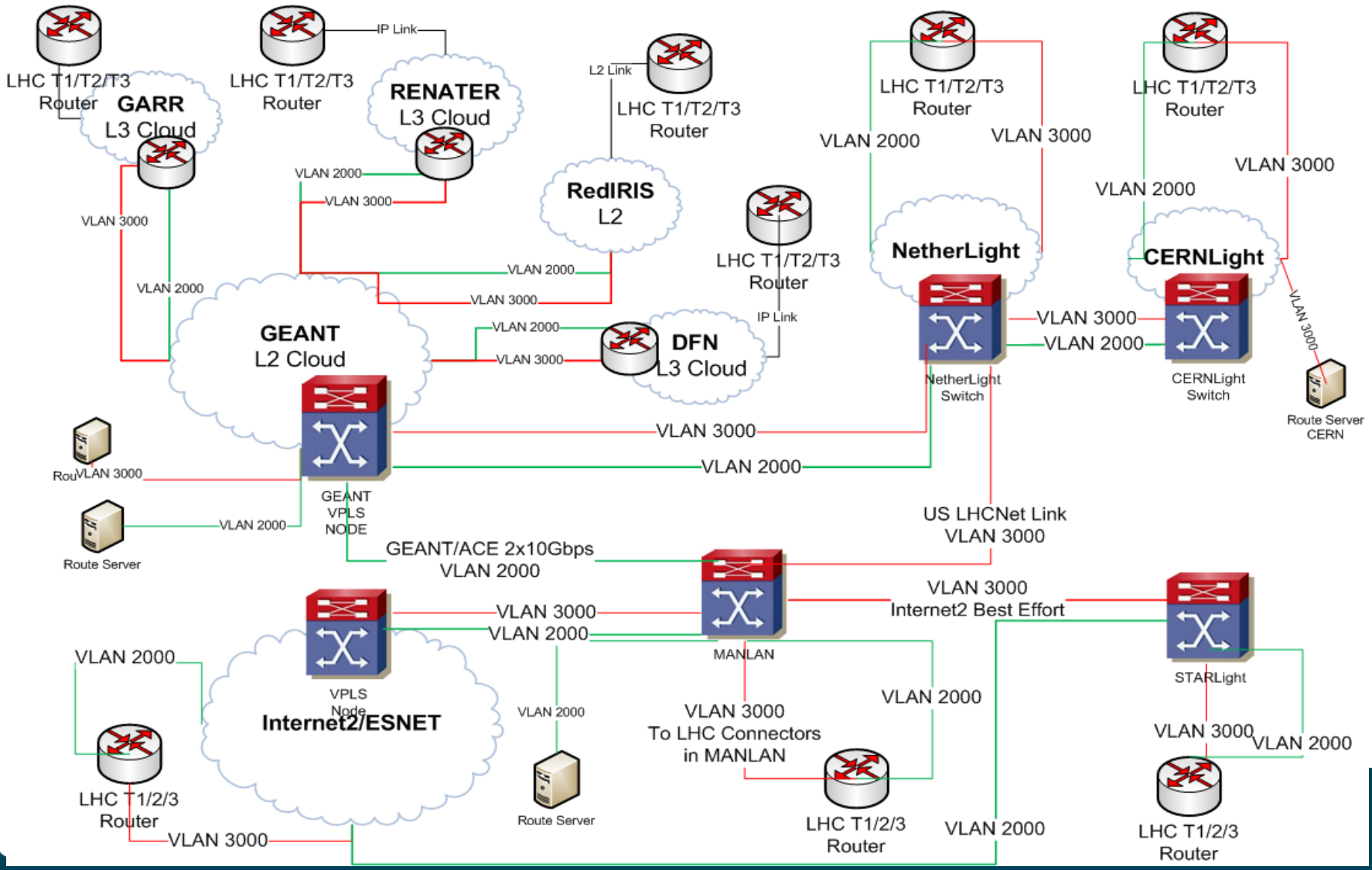
Interim Setup



Advantages of Interim Setup

- Establishes connectivity between EU and US

Disadvantages of Interim Setup

- Disadvantages of the Architecture:
  - Complex L2 Network
    - *Multiple switch form a virtual switch across the world*
    - *Several entities managing small parts of the network*
    - *No clear demarcation points*
  - MANLAN single point of failure for connectivity between EU and US
  - Not Scalable
  - High risk of broadcast storm
  - High risk of asymmetric traffic

Disadvantages of Interim Setup

- Disadvantages for End-Sites and NRENs:
  - Configure multiple VLANs
  - Establish peering with 4 routes servers operated by multiple organizations
  - Complicated end-site requirement e.g. prefer a VLAN or configure ECMP, etc
  - Need to understand the LHCONE Architecture to decide if end-site wants to prefer a VLAN or use ECMP, etc.
  - Complicated procedures/processes required to bring up new end-site connections

Disadvantages of Interim Setup

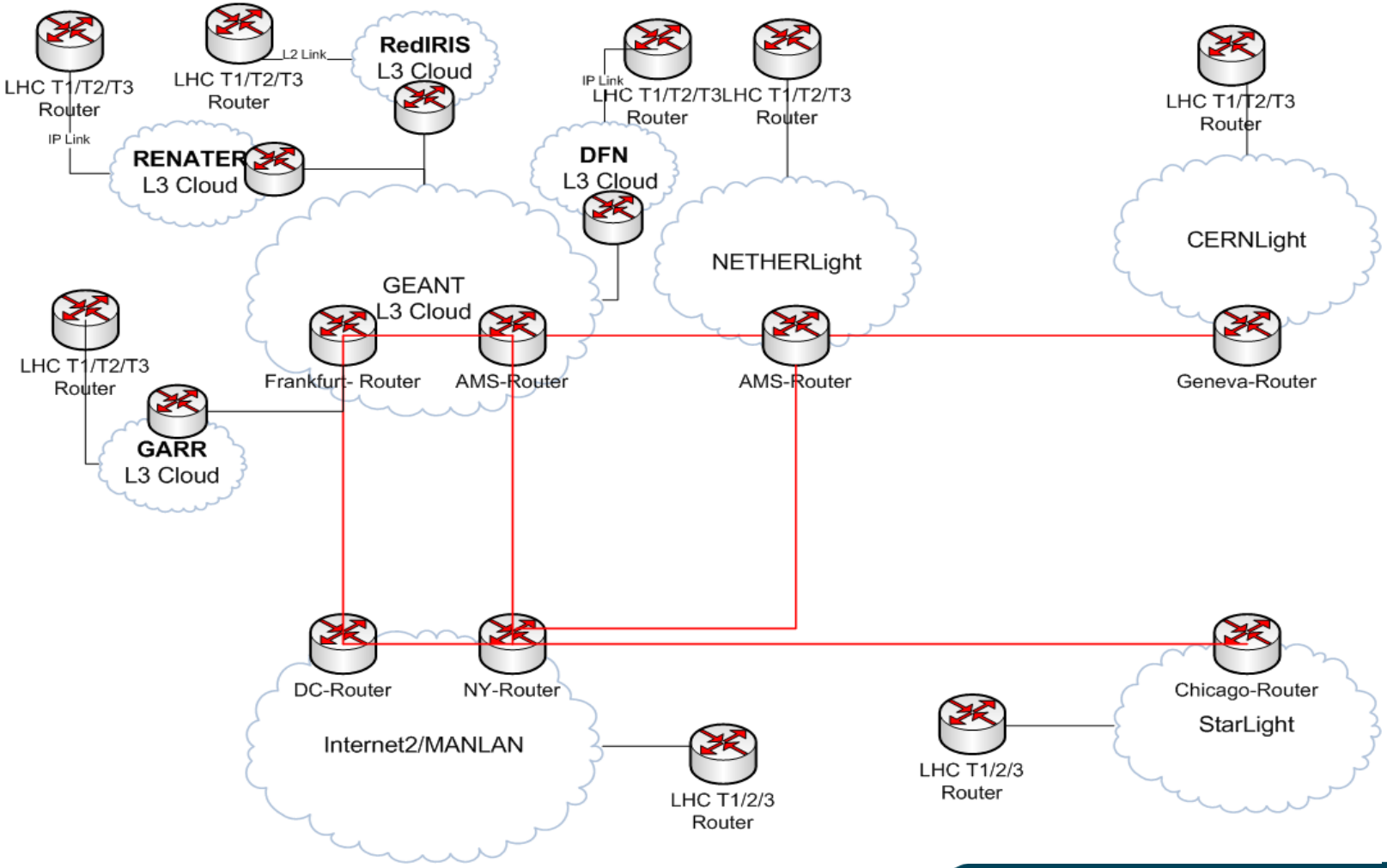
- Disadvantages for LHCONE Operators:
  - Can not use another Trans-Atlantic links e.g. Frankfurt – DC link
  - Complicated procedure for brining up new connection
  - No control over path selection for traffic from A to B
  - Difficult for NOC engineers to troubleshoot issues in this complicated L2 topology

Move to a Scalable network

- As discussed and agreed in Washington meeting L3 is the solution

- Advantages of a move to a L3 implementation
  - Operational teams familiar with L3 domain and also multi-domain management
  - Resilience and load sharing are well known
  - More control over path selection/Traffic engineering
  - Robust architecture demonstrated on the Internet
  - Well established demarcation points

Similar L3 Topology



Advantages of L3 Topology

- Advantages for LHCONE Operators:
  - Less complicated procedure/process for brining up new connection
  - More control over path selection/traffic engineering
  - Make use of additional TA capacity without introducing
    - Another VLAN and
    - Two more route servers

- Advantages for LHCONE end-sites:
  - Single interface/VLAN to LHCONE
  - Single BGP peering
  - Single Point of contact for all connectivity/peering issues

Conclusion

- Interim solution provides TA connectivity, but
  - Is not scalable and
  - Not manageable
- Washington Meeting agreed on L3 Implementation
  - T2 in Europe are ready to go the L3 way
- Study group needs to agree on L3 topology and migration plan

Questions?

- Questions?