

Data Center Interconnection (DCI) over Spectrum Sharing CNAF-CERN

PAOLO BOLLETTA

09/04/2024

14th SIG-NGN – Catania

A network diagram showing a complex web of nodes and connections. The nodes are represented by small circles, and the connections are lines. The diagram is primarily composed of green lines and nodes, with some white lines and nodes interspersed. The background is dark blue with a faint image of server racks.

Outline

- Spectrum Sharing
- DCI interconnection and L3 Overlay
- Data Challenge

GEANT project and the Spectrum Connection Service (SCS) team

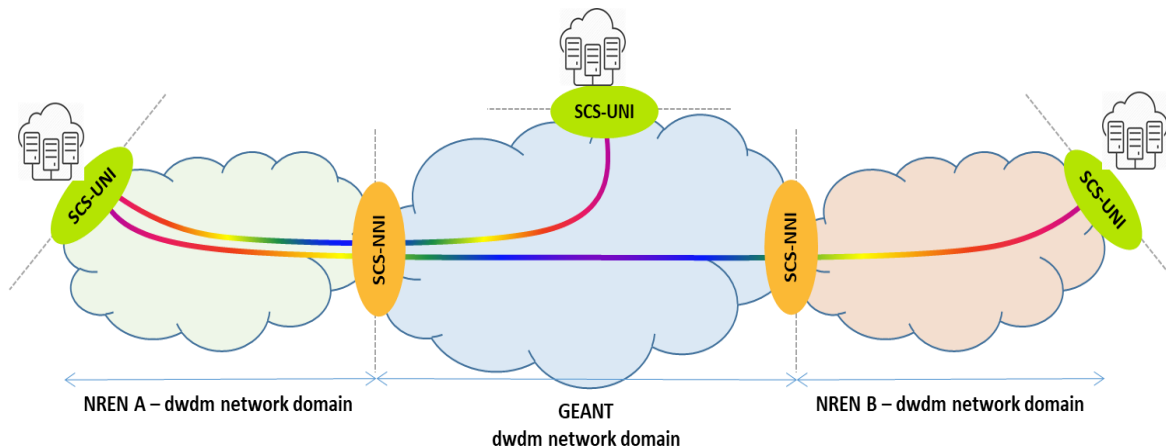
GEANT network has been upgraded during last years.

A new Spectrum Connection Service (SCS) has been proposed in the GEANT Network Evolution Plan

Activity started in GN4-3 WP7-T2 (SCS) and taken over in GN5-1 (NDS)

The SCS team

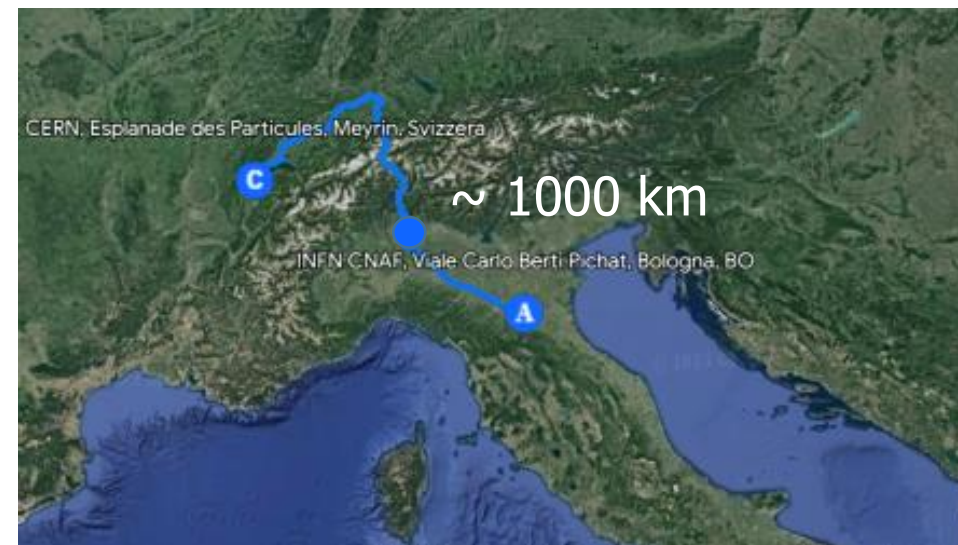
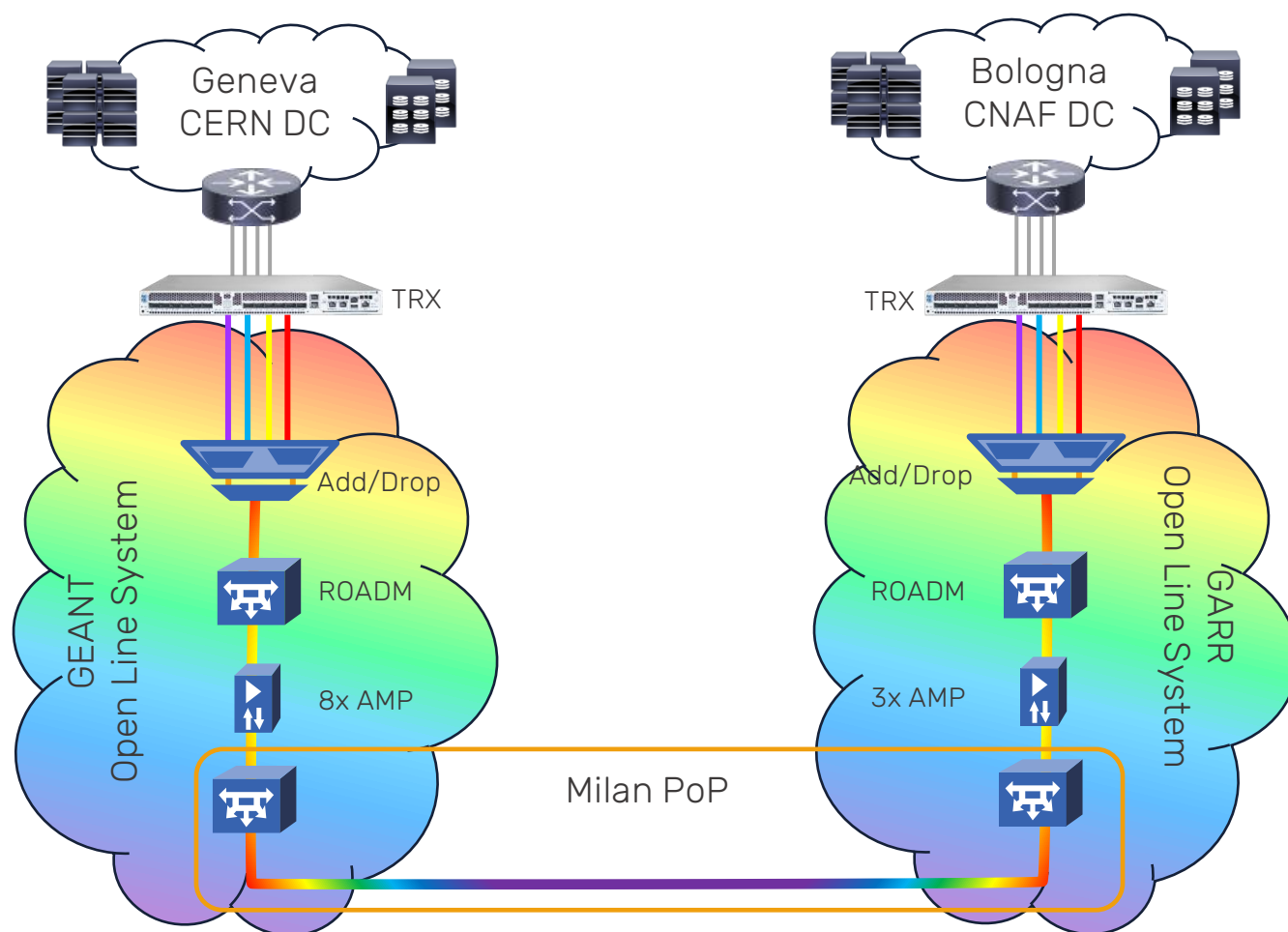
- has defined a service description
- is running field trials
- engages Users to run service pilots



Real Use Case CNAF-CERN:



CERN – CNAF Data Centre Interconnection

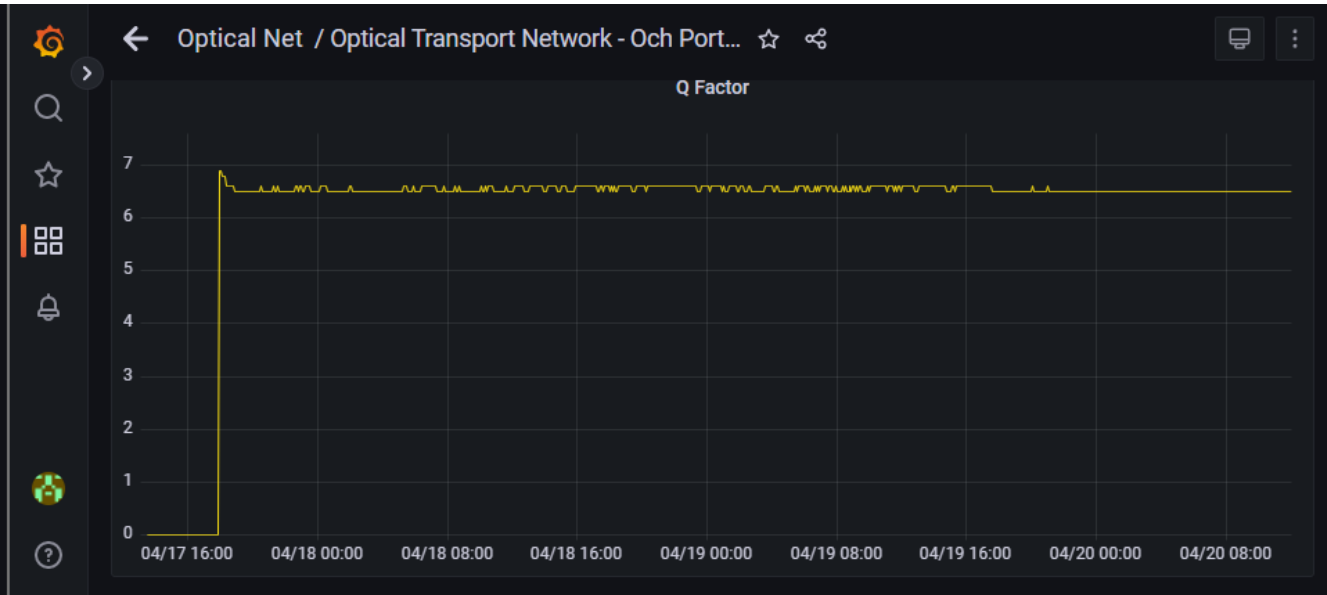
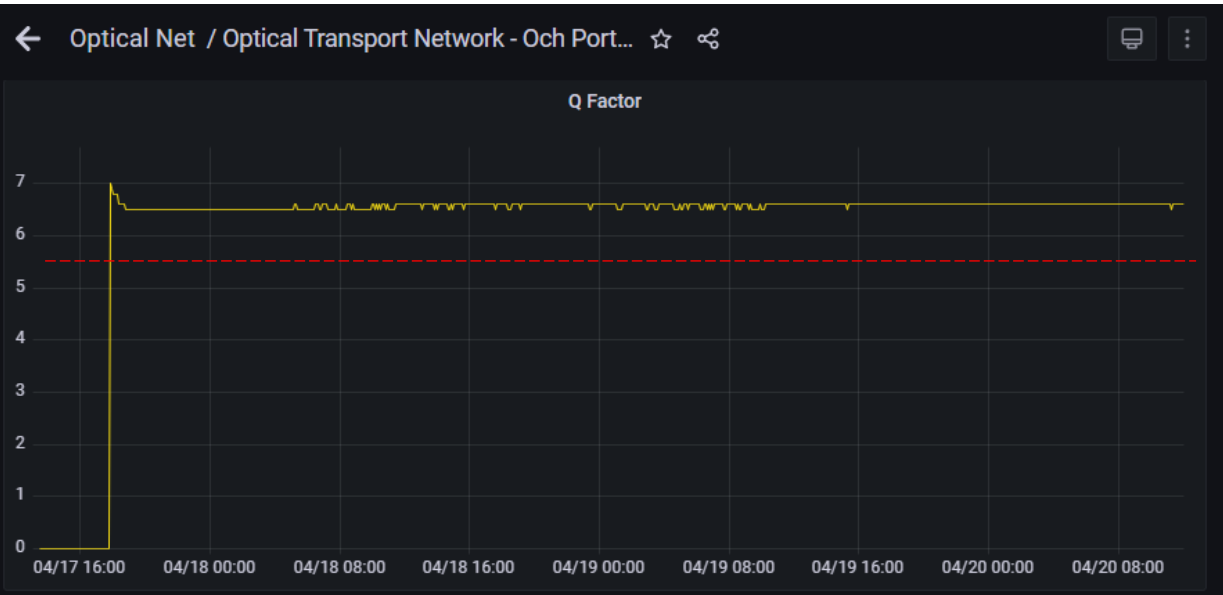


1.6 Tbps

4 carriers

- DP-16QAM
- 27% SD-FEC
- 69 Gbaud
- 75 GHz

Quality of Transmission (Q-factor)

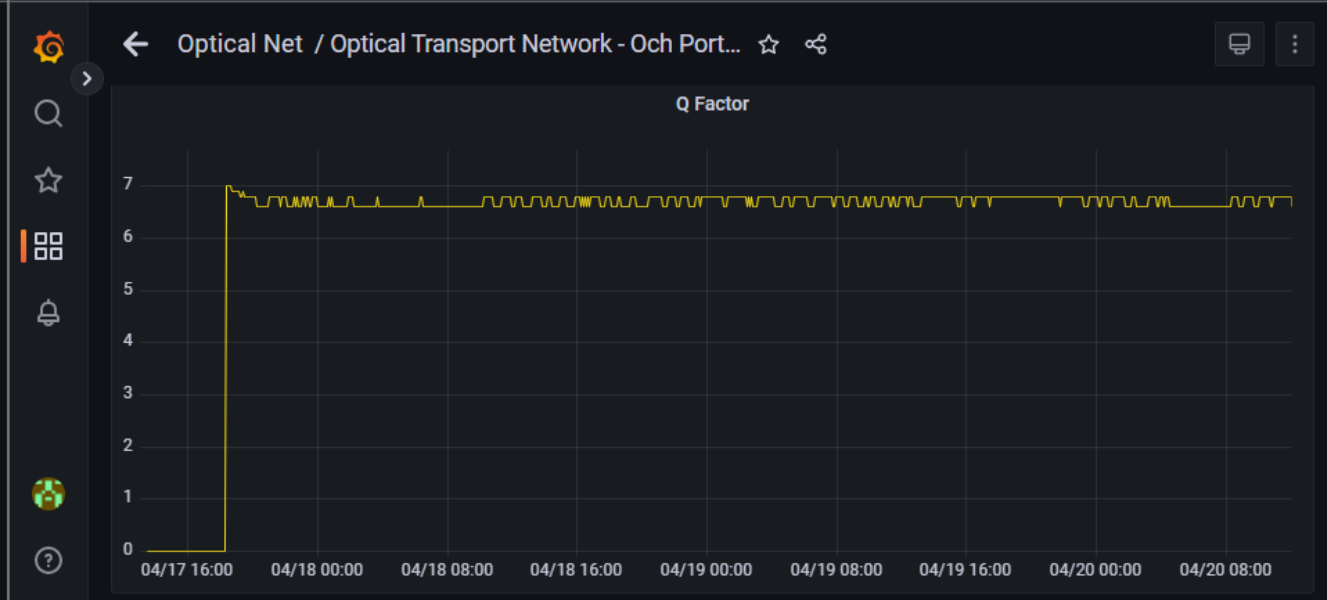
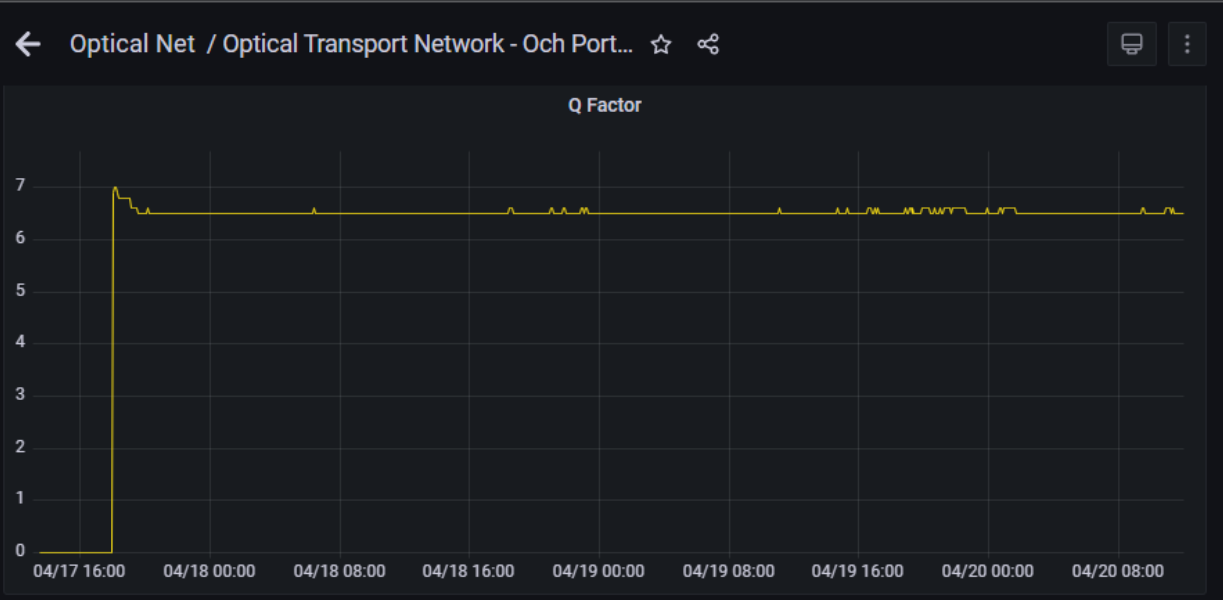


panel - Optical Transport N x +

grafana.ba1.infra.garr.it/d/69A_uy74k/optical-transport-network-och-port-view?orgId=3&var-de...

View panel - Optical Transport N x +

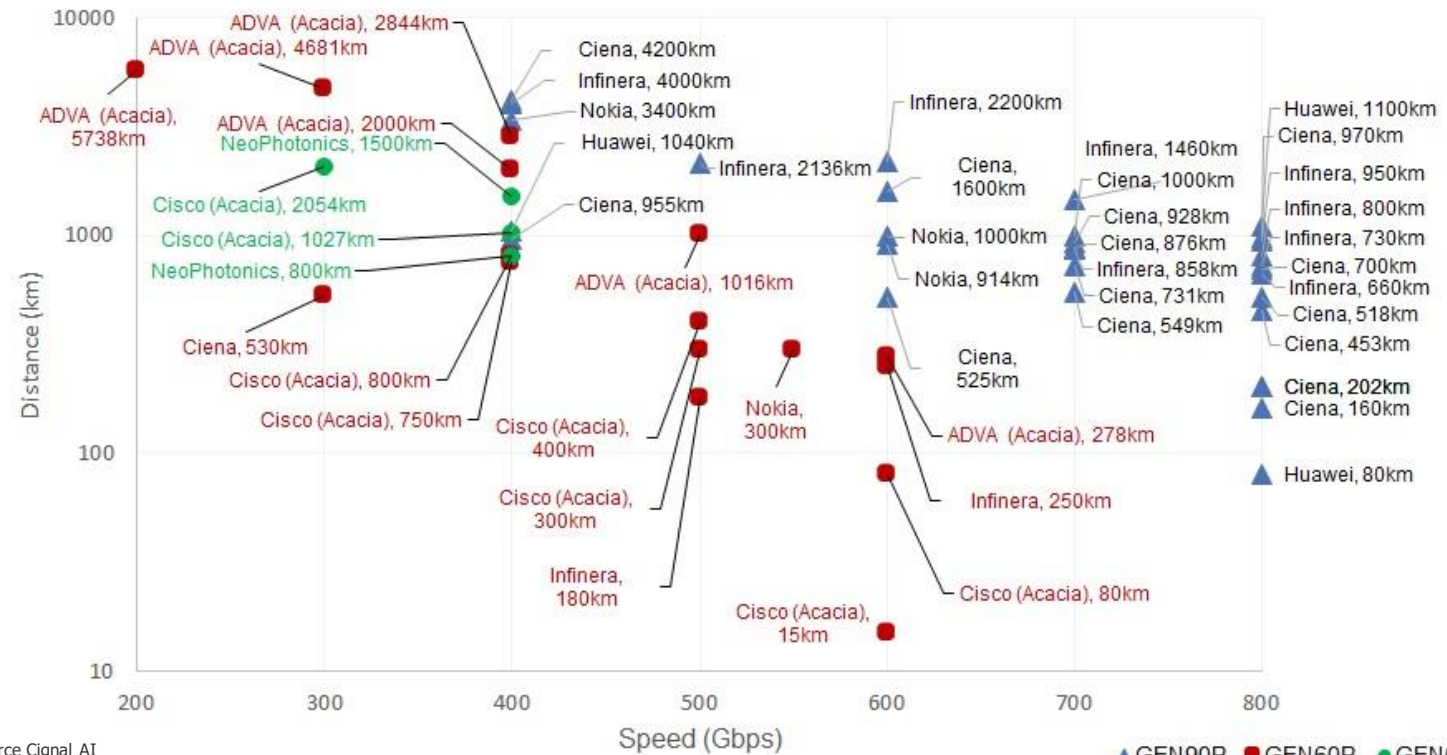
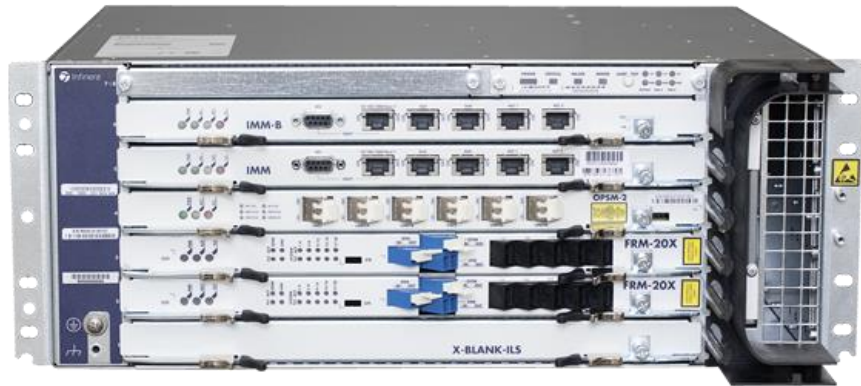
grafana.ba1.infra.garr.it/d/69A_uy74k/optical-transport-network-och-port-view?orgId=3&var-de...



Enabling Technology

Disaggregated optical network:

- Open Optical Line System (~10y life span)
- Coherent optical interfaces (~3y life span)
 - Transponders boxes
 - Pluggable transceivers

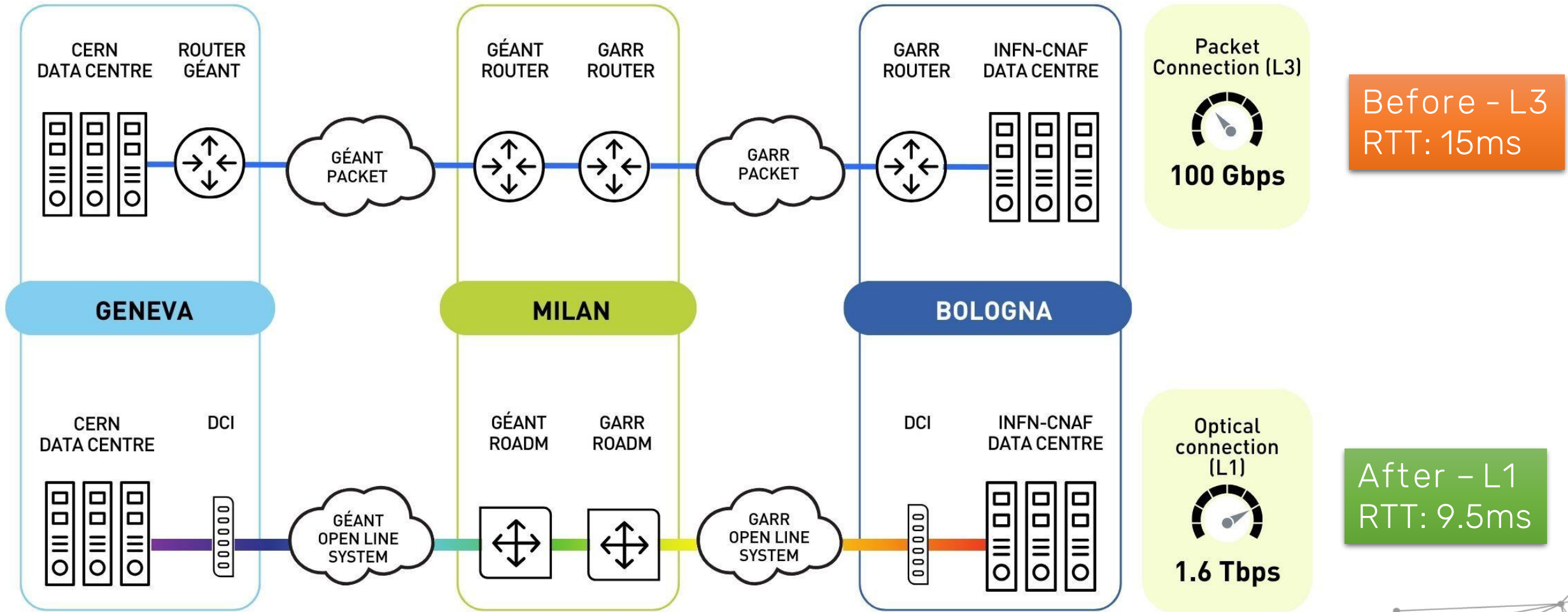


Source Signal AI

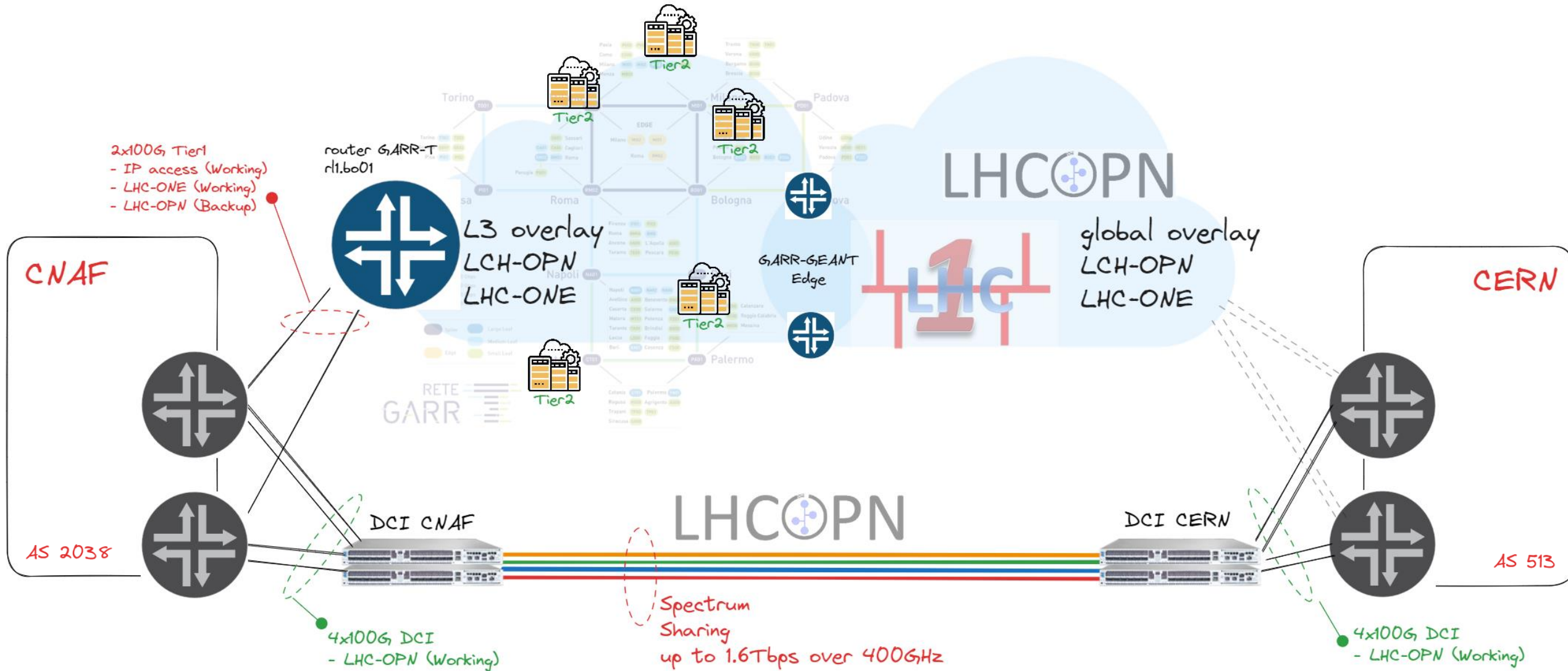
▲ GEN90P ● GEN60P ● GEN60

DCI LHCOPN [CNAF-CERN] L3 vs. L1

CERN-CNAF DCI

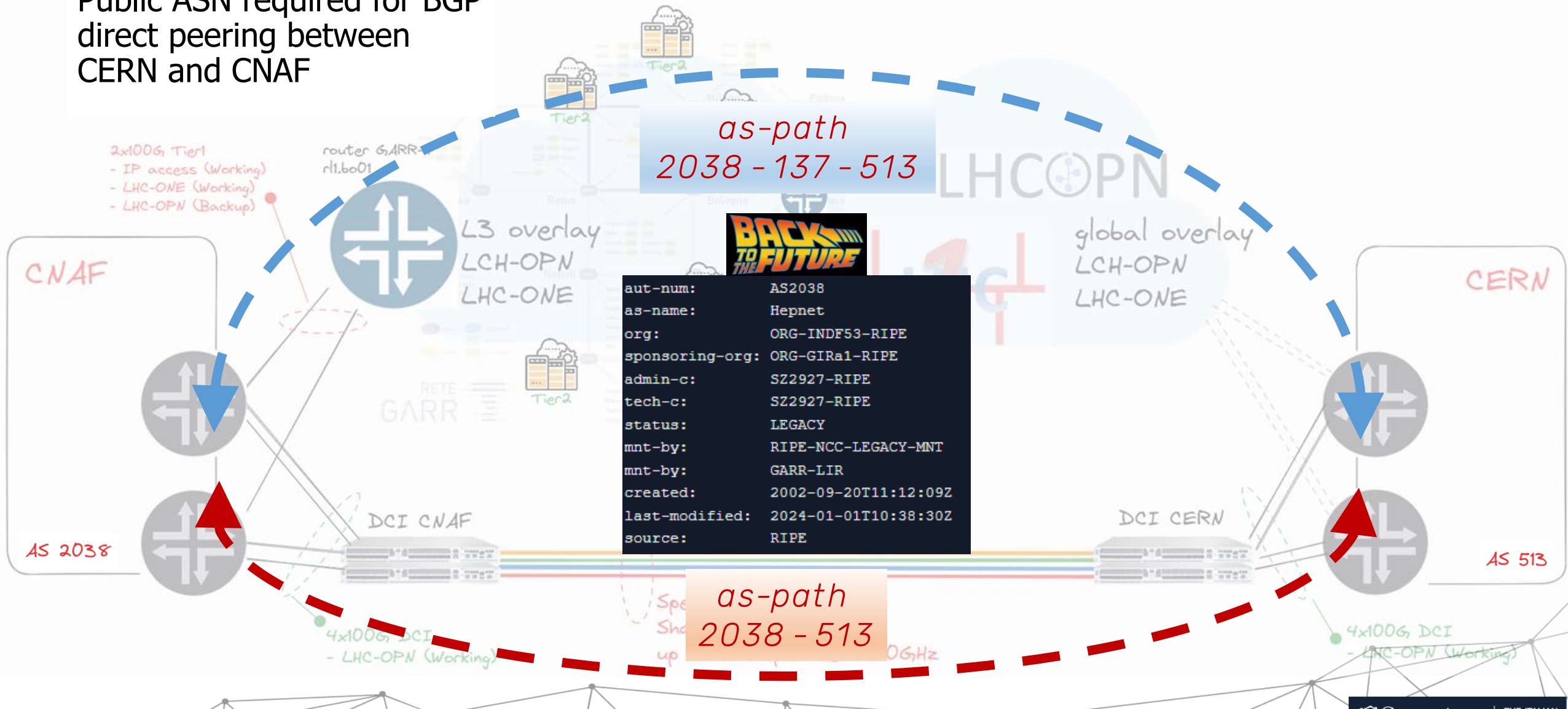


Overlay: full picture

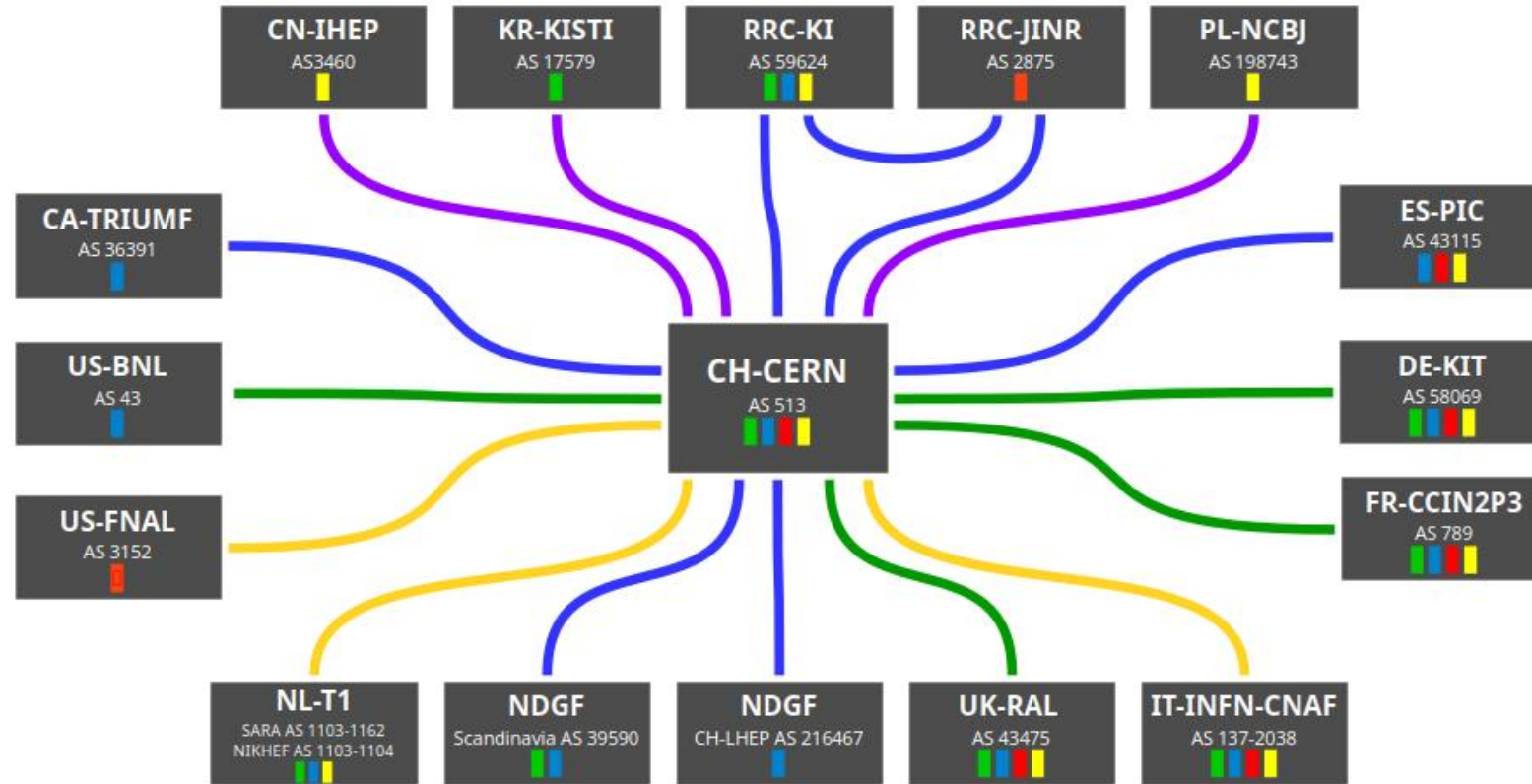


Overlay: full picture

Public ASN required for BGP
direct peering between
CERN and CNAF



LHCOPN

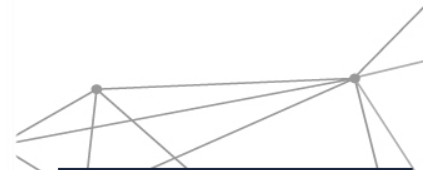


Line speeds:
20Gbps (purple)
100Gbps (blue)
200Gbps (green)
400Gbps (yellow)
800Gbps (red)

Experiments:
Alice (green), Atlas (blue)
CMS (red), LHCb (yellow)

Last update:
20240308
edoardo.martelli@cern.ch

Credits: CERN-WLCG wiki



Data Challenge WLCG – [12-24/02/24]



Image credits: AI MS-Copilot

From 12/02/24 to 24/02/24

- Opportunity to verify if the network is ready and able to match WLCG needs and expectations
- GREAT Opportunity to understand if a pure multidomain optical connection (based on SCS) may be fully considered a stable and valid element in the WLCG networking
- CNAF and GARR sprint aimed to include the new SCS connection as primary link for LHCOPN between CNAF and CERN (T0 -->T1)
- Decision to use SCS connection for DC24 early December 2023
- By mid-January setup implemented, tested and fully operational

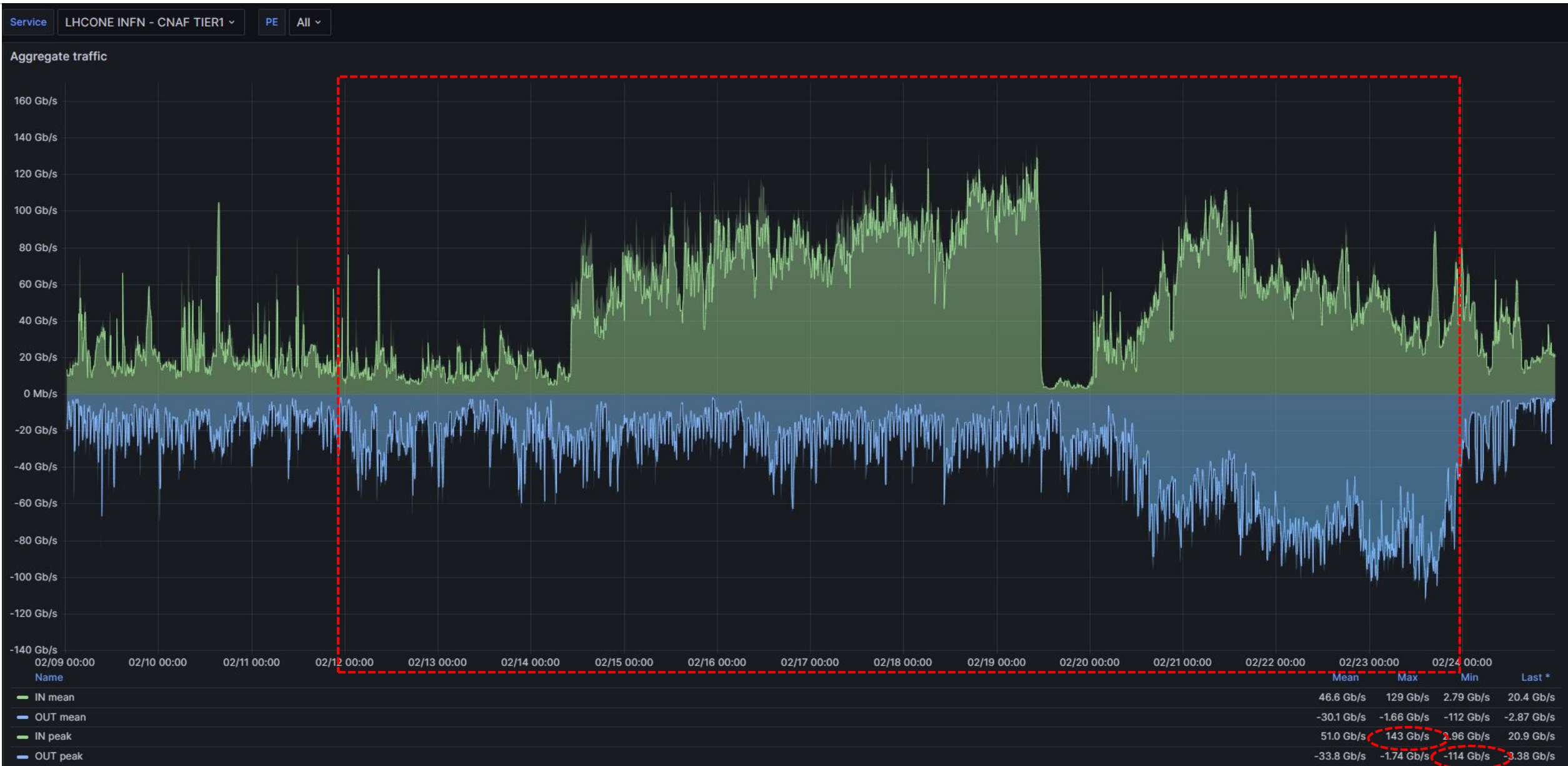
OPN DCI Spectrum Sharing – CNAF CERN Data Challenge

OPN DCI Max IN: 136Gbps Max OUT: 289Gbps



CNAF LHCONE VPN (L3)

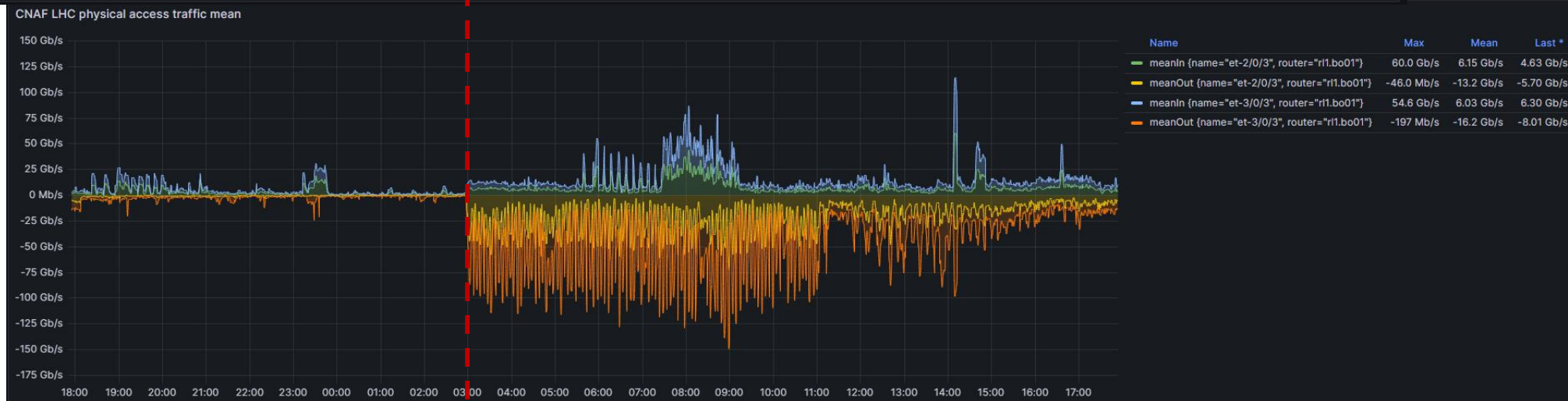
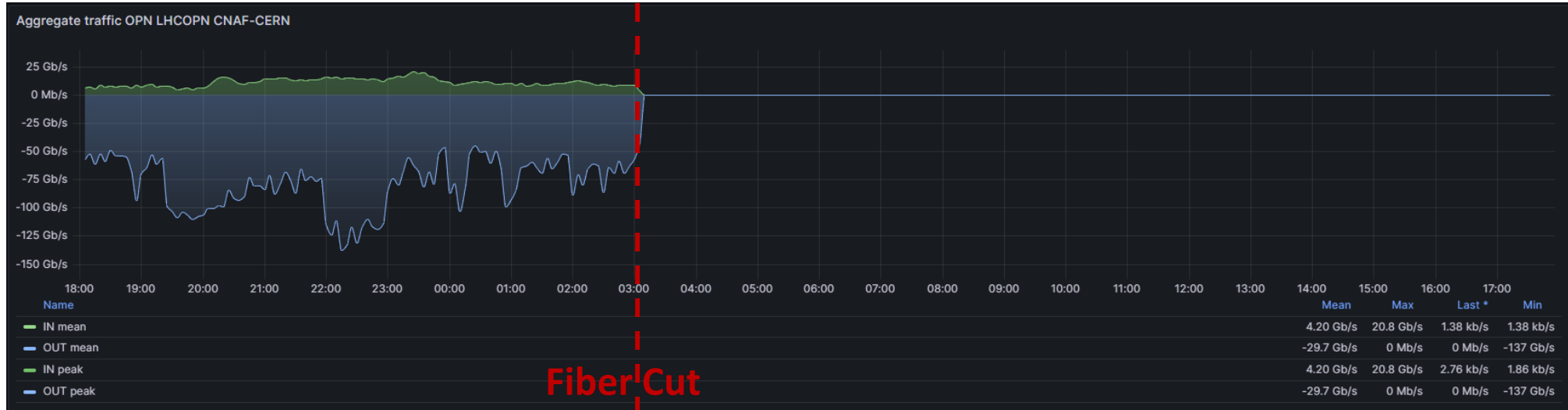
LHCONE Max IN: 143Gbps Max OUT: 114Gbps



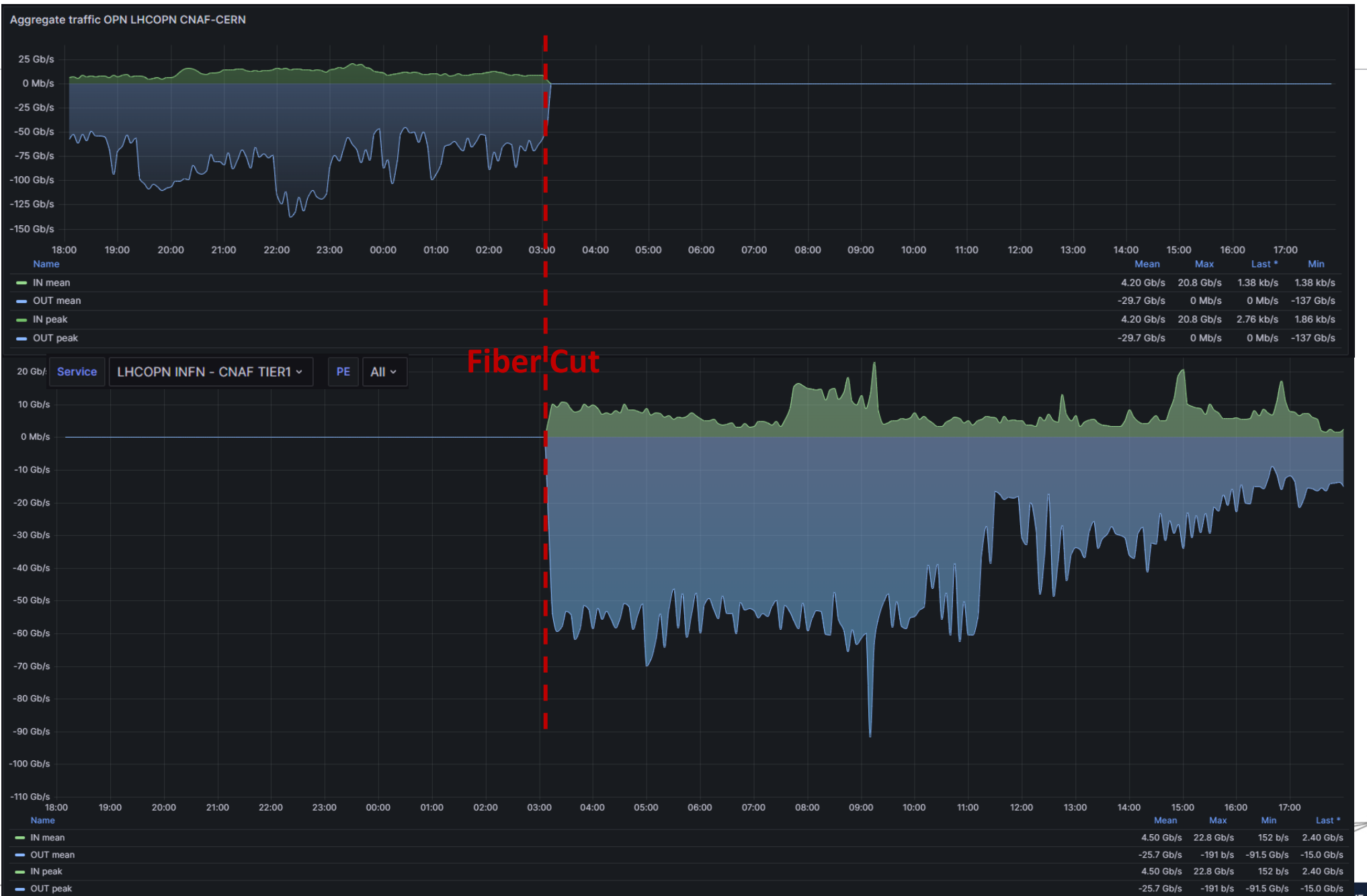
CNAF LHC physical interface



Failover



Failover



Next Steps

Pilot

- 400GEth interface evaluation
- Satellite Sites integration
--> new site B006@Tecnopolo
- Network to Network interconnection (@MI01) standardization process with GEANT
- 3rd party Planning Tool (GNpy)

Production

- Channel diversification in order to improve interconnection resiliency
- GEANT Geneva ROADM setup reshuffling
- Transition from Pilot to Production Service (ongoing)
 - 4 x 100GHz channels:

Conclusions

- Solution ready to production and to scale-up and evolve
- Network service model could be exported and adopted in other communities.
- Pilot and development activities will continue
- Alternative Cross Board Path should be investigated ?



Acknowledgments:

- GARR Optical : Colantonio, Vuagnin
- GARR Packet : Inzerilli, Marletta, Valiante
- GARR DC & DevOps : Cesaroni, Chiarelli, Marzulli
 - CNAF Team: Zani, De Girolamo
 - CERN Team: Martelli
- GEANT Team: SCS Team, Roberts
- GARR Management/Amm/CTS

Contact:

- paolo.bolletta@garr.it
- infra.optical@garr.it

'image: Flaticon.com