

Use Case GARR-T

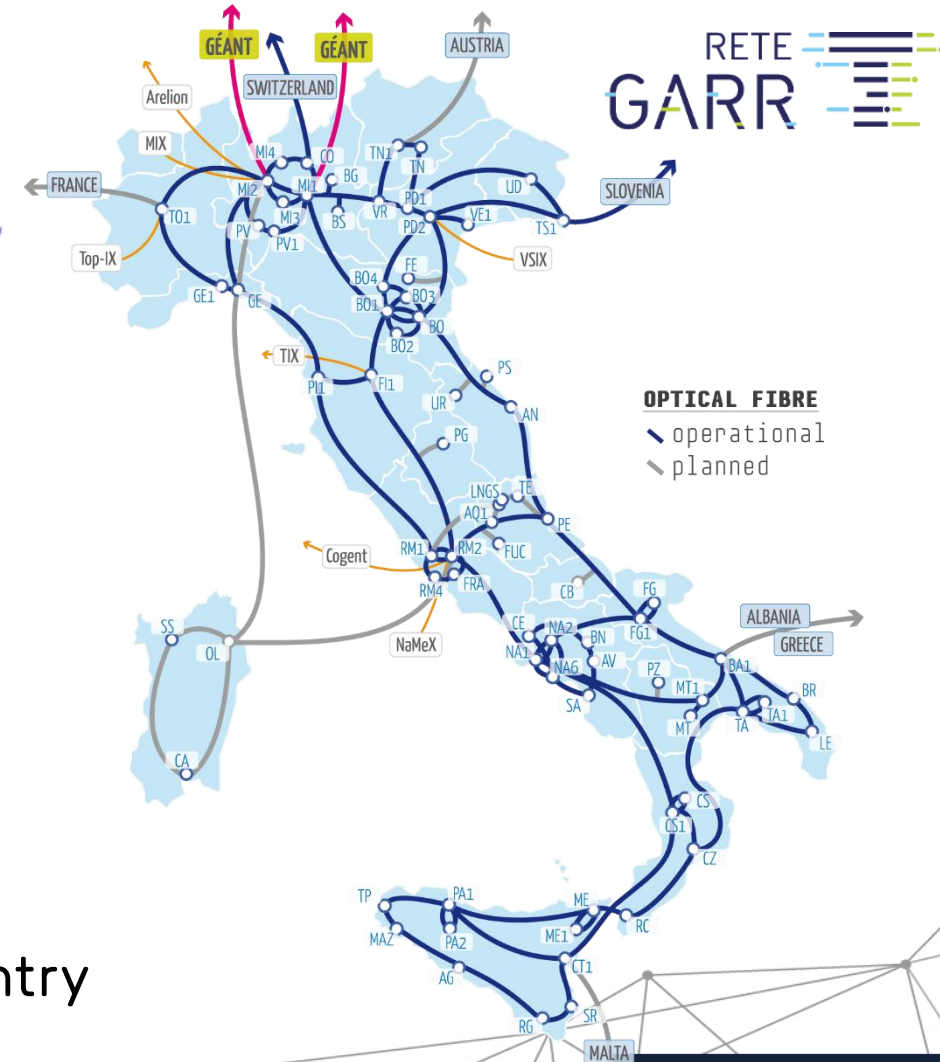
PAOLO BOLLETTA

26/06/2024

Bologna - WS TeRABIT



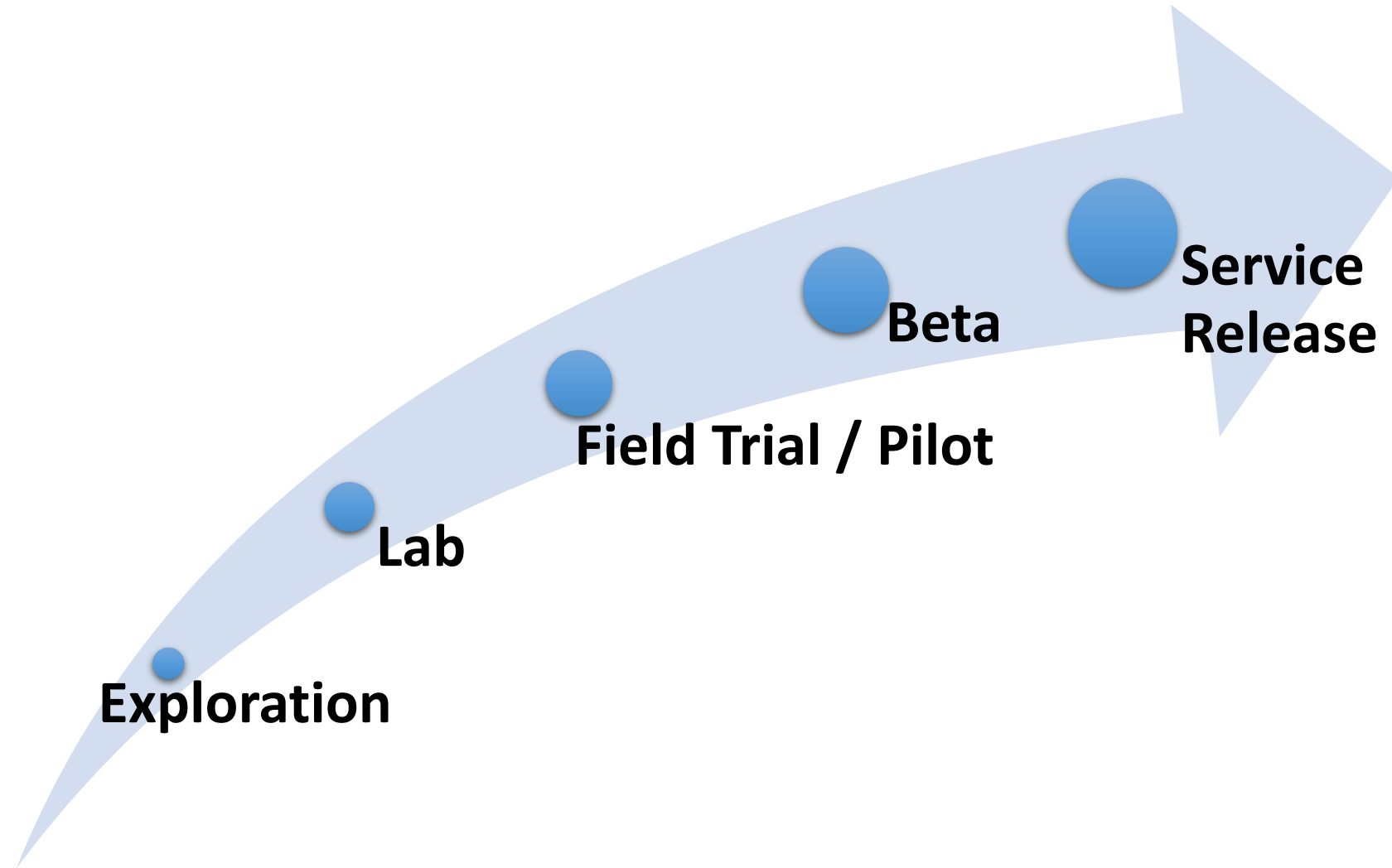
GARR-T (2.0) PNRR projects (2023-2025)



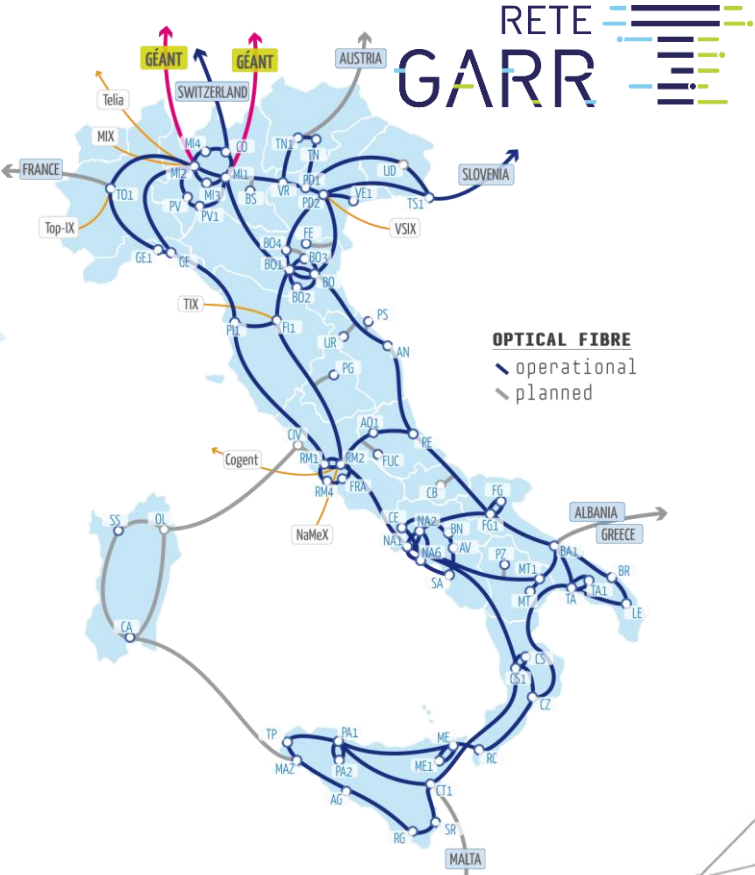
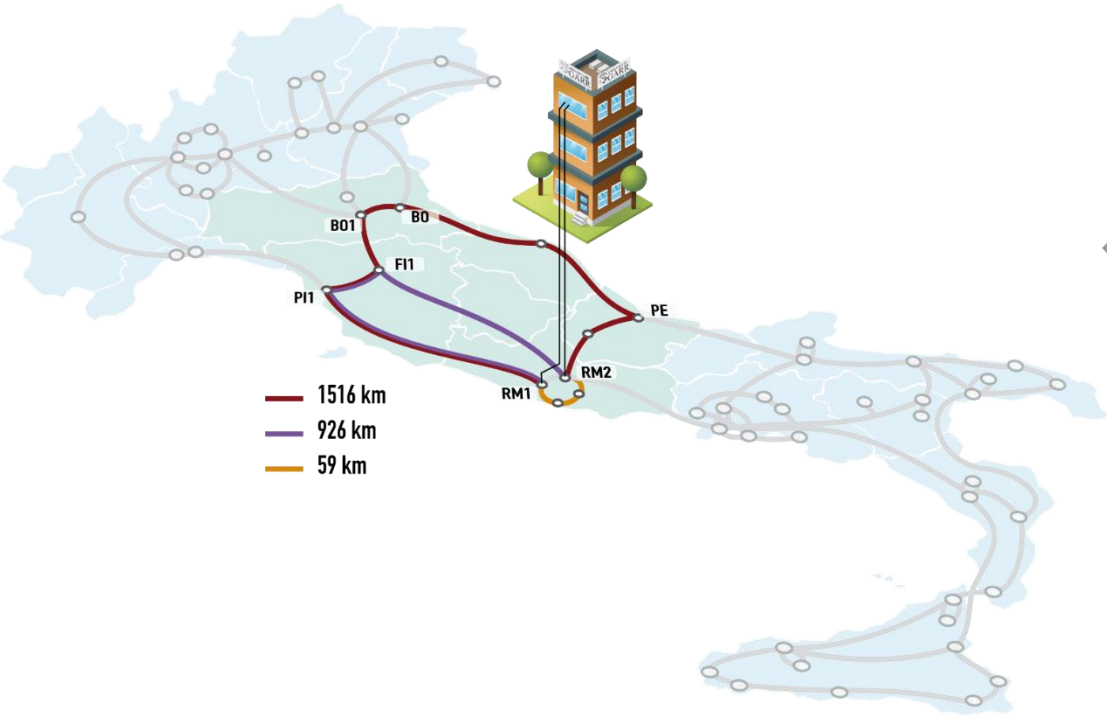
Opportunity to develop GARR-T network:

- Reach new areas: Sardinia and Abruzzo
- Upgrade and integrate network in the South of Italy
- Scale-up performance for HPC
- GARR-T can reach the goal to become a fully unified and pervasive network for R&E community in the whole country

Service Release Approach



GARR Optical Lab and Field Trials



USE CASE GARR – ELISA : High Capacity on demand

Problem Statement

Complete separation of user and GARR control and management planes

[MAIN GOAL] Dynamically establish high capacity interconnections between user premises (DC)

Provide interconnections self-management tools to the users

DC/Transport Network integrated load and failure management

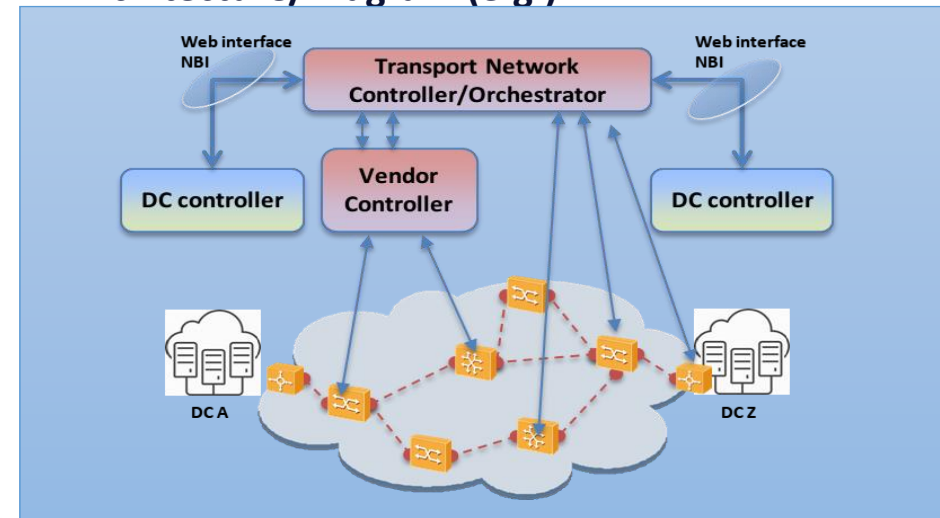
Actors

- GARR
 - (transport) network controller/orchestrator
 - provisioning/monitoring/accounting performance/fault management tools
- User
 - (DC) controller
 - provisioning/monitoring/accounting performance/fault management tools
- Vendor controller

Solution

- **A:** DC operators manually (?) ask for resources through a transport network interface (web/transport nms access)
- **B:** DC controller interacts with transport network through a network controller/orchestrator NBI
- **C:** DC App interacts with transport network through a network controller/orchestrator NBI

Architecture/Diagram (e.g.)



USE CASE: DCI over Spectrum Connection Service

Description:

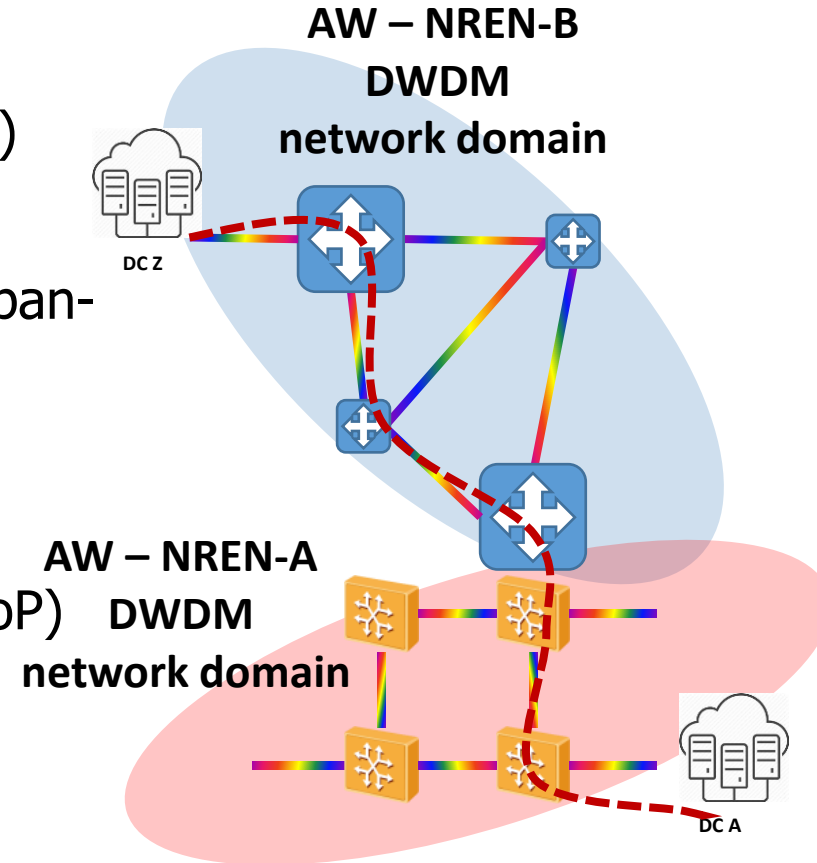
interconnection between 2 DC over multi-domain DWDM Networks (NREN + GEANT)

Prerequisites:

- Spectrum Connection Service over the pan-European network
- AW capable dwdm network domains
- DCI boxes
- Demarcation Points (e.g. MIL GEANT PoP)

Actors:

- Geant
- NRENs
- DC facilities

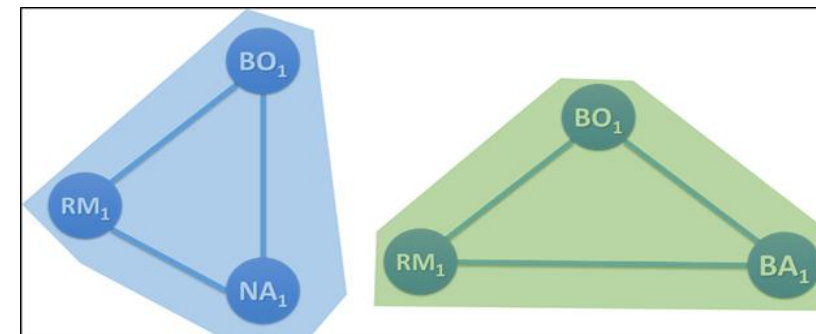
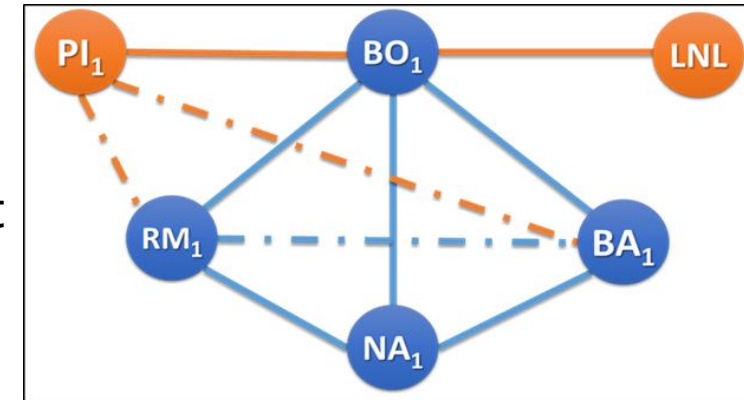


IDDLS: Italian Distributed Data Lake for Science

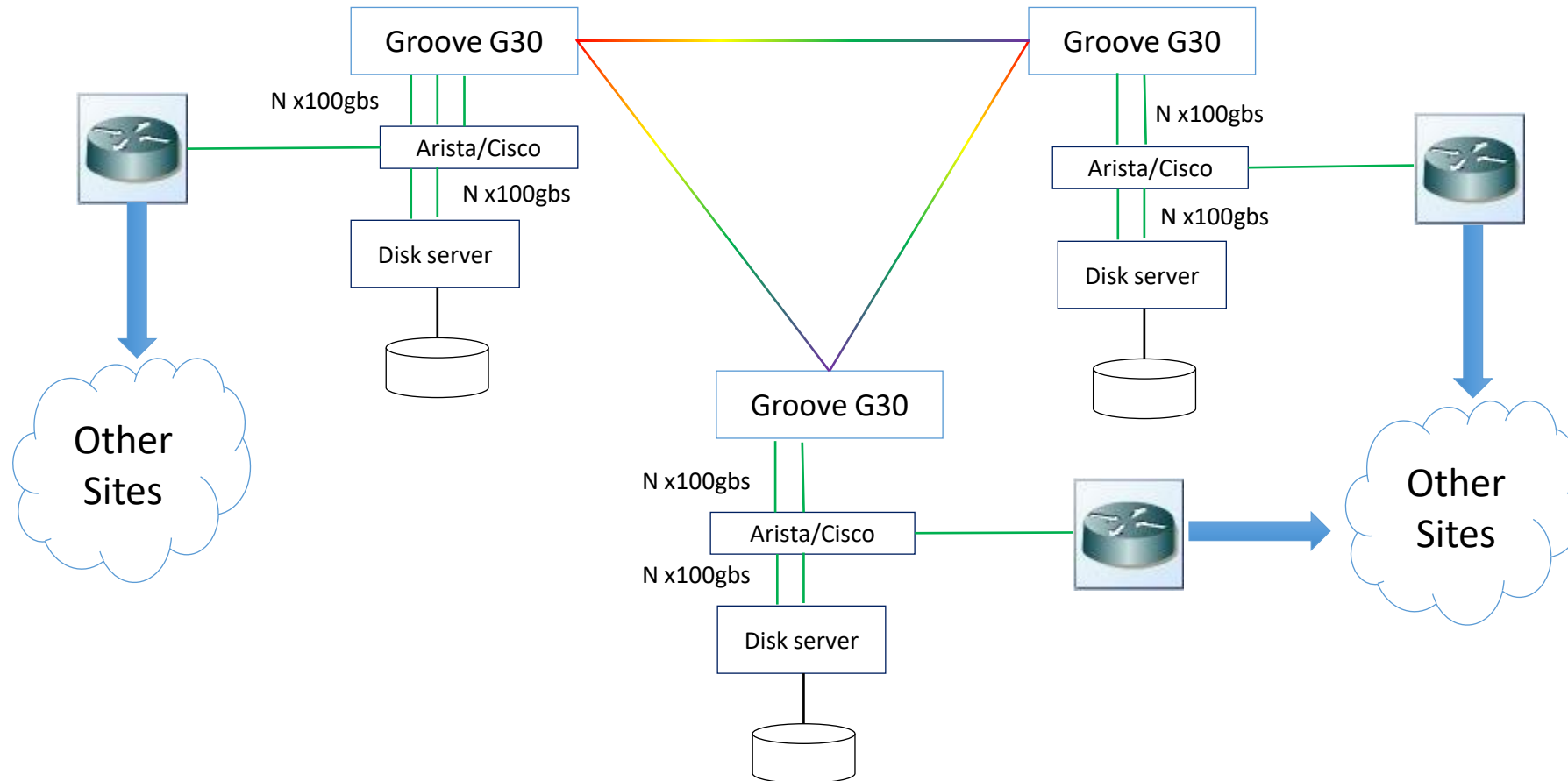


INFN-GARR collaboration to setup a prototype of an Italian DataLake exploiting:

- Last generation networking technologies provided by GARR
 - DCI (Data Center Interconnection) equipment
 - SDN (Software Defined Network) deployment
- Software for creating **scalable storage federations** provided by INFN
 - eXtreme-DataCloud (XDC) project
 - SCoRES project (INFN-NA)
- Real life use cases for testing
 - CMS
 - ATLAS
 - BELLE-II
 - Possibly involving LNGS experiments (XENON) and VIRGO



IDDLS Pilot Diagram



GEANT project and the Spectrum Connection Service (SCS) team

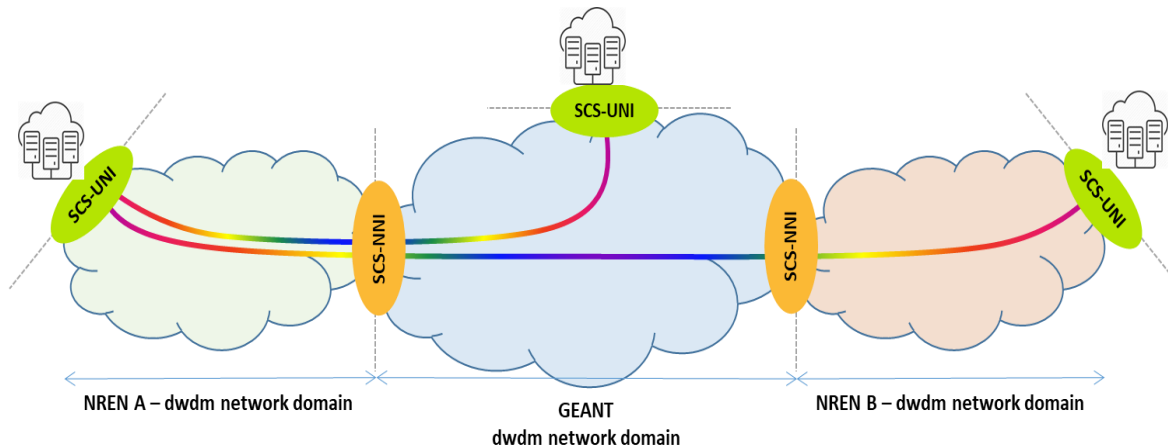
GEANT network has been upgraded during last years.

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

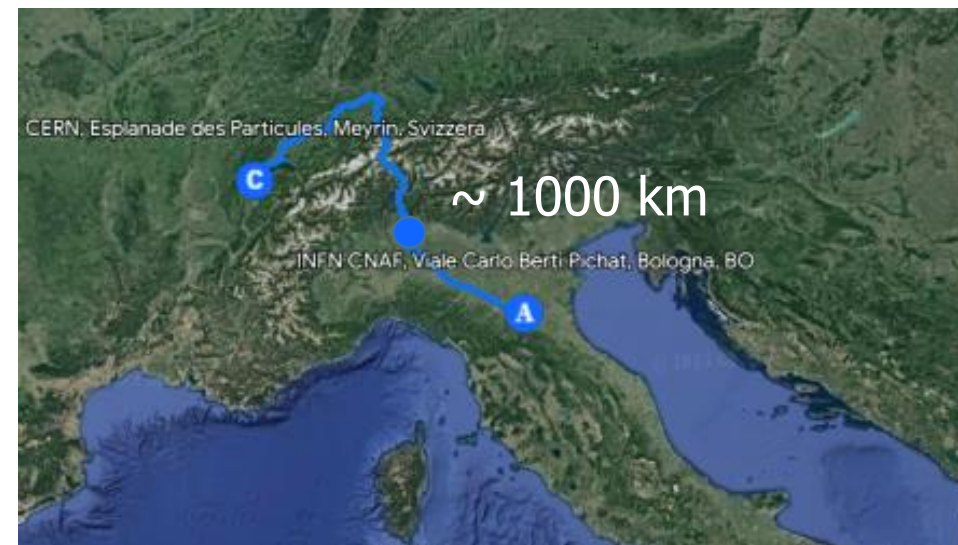
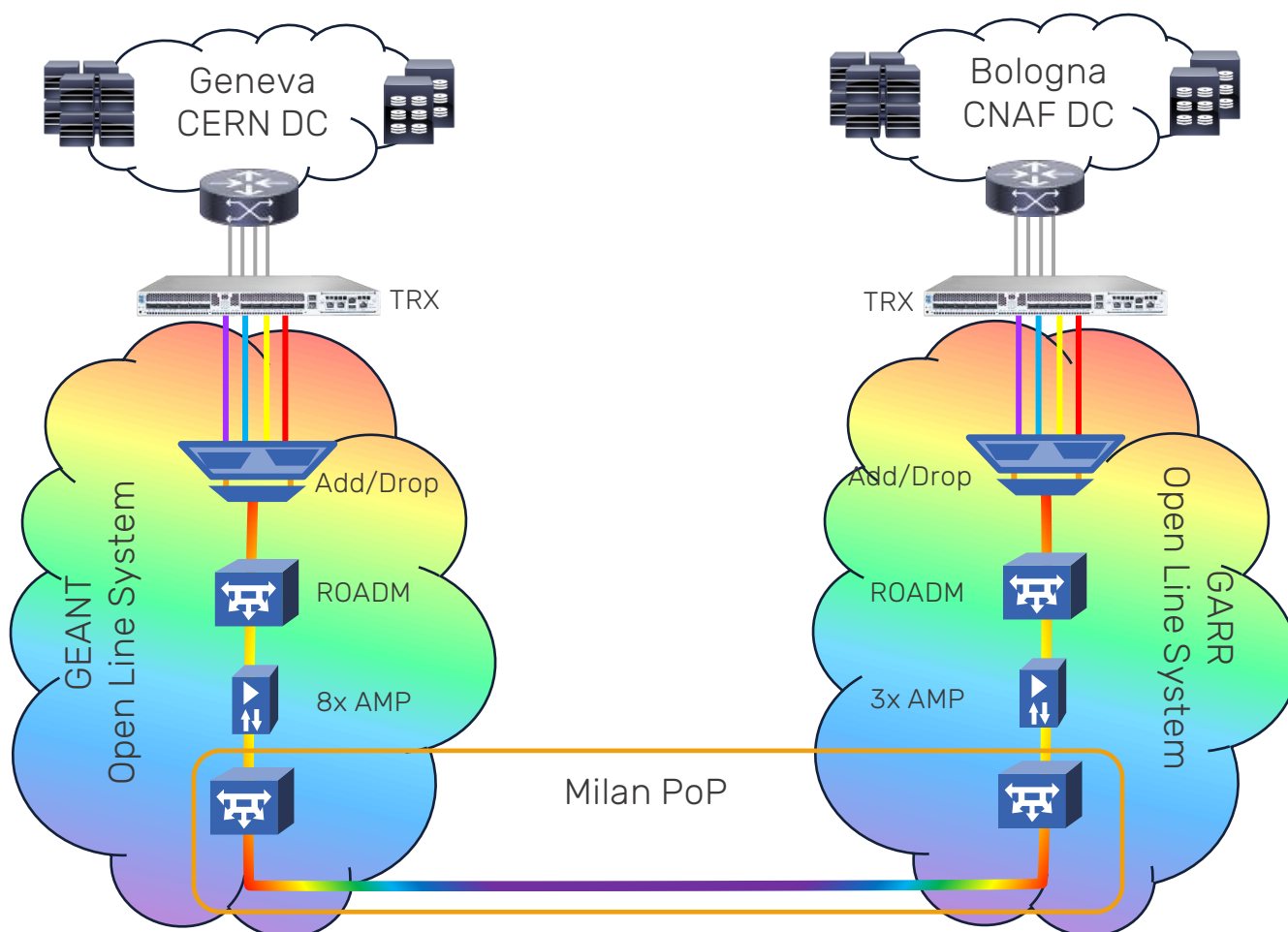
- has defined a service description
- is running field trials
- engages Users to run service pilots



Real Use Case CNAF-CERN:



CERN – CNAF Data Centre Interconnection

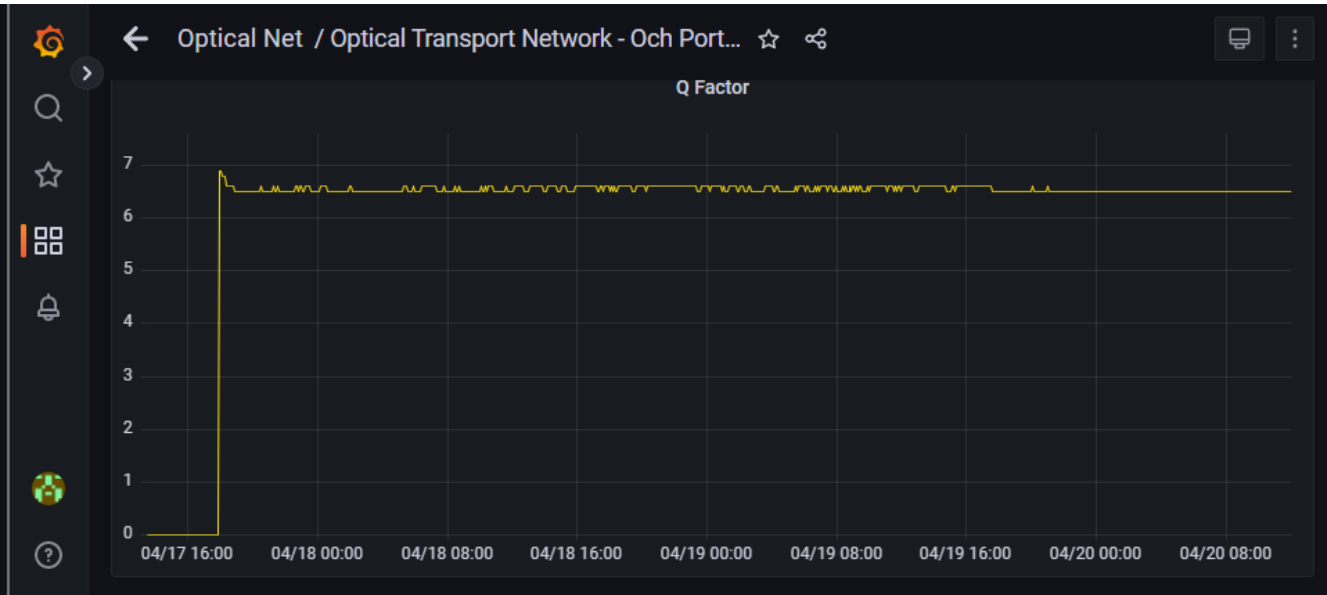
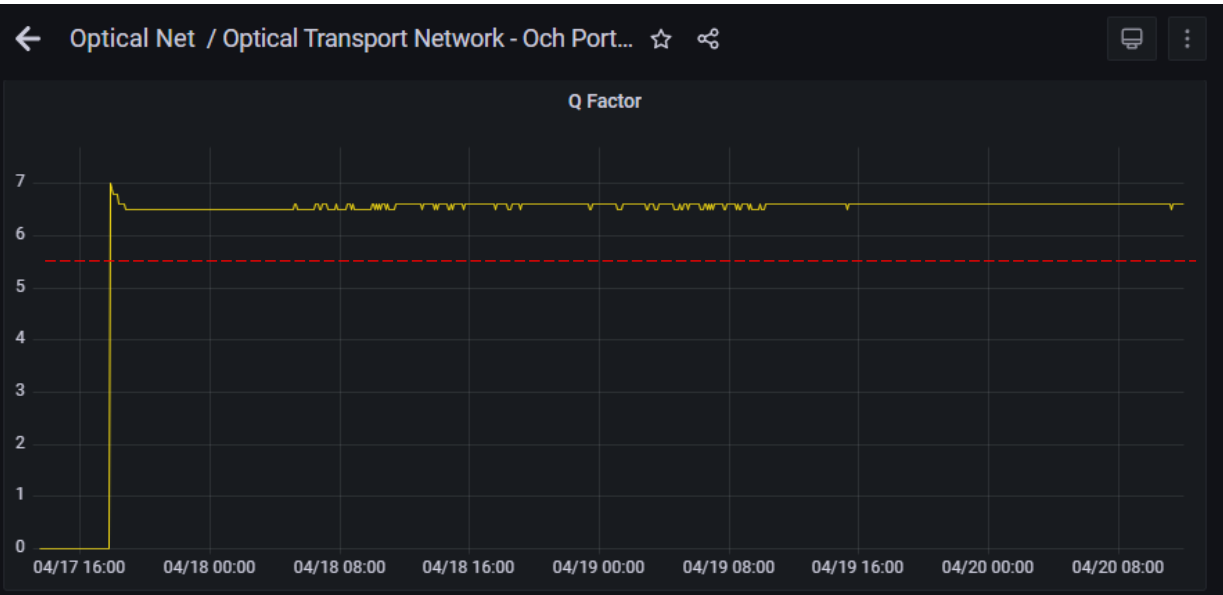


1.6 Tbps

4 carriers

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

Quality of Transmission (Q-factor)

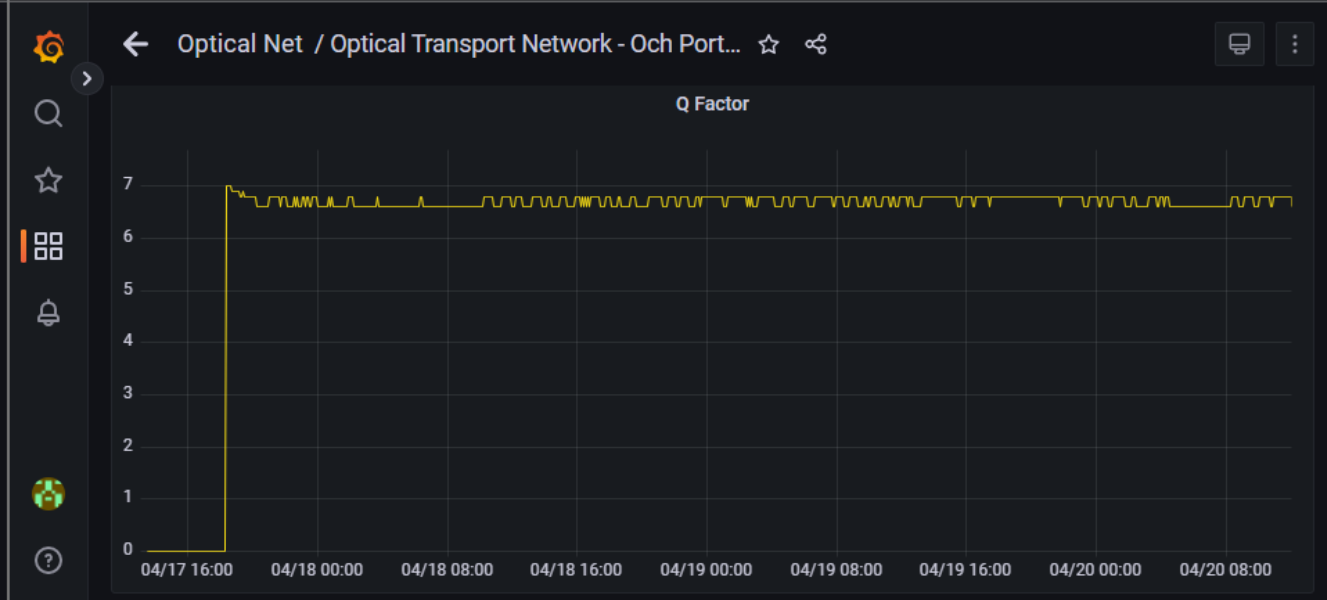
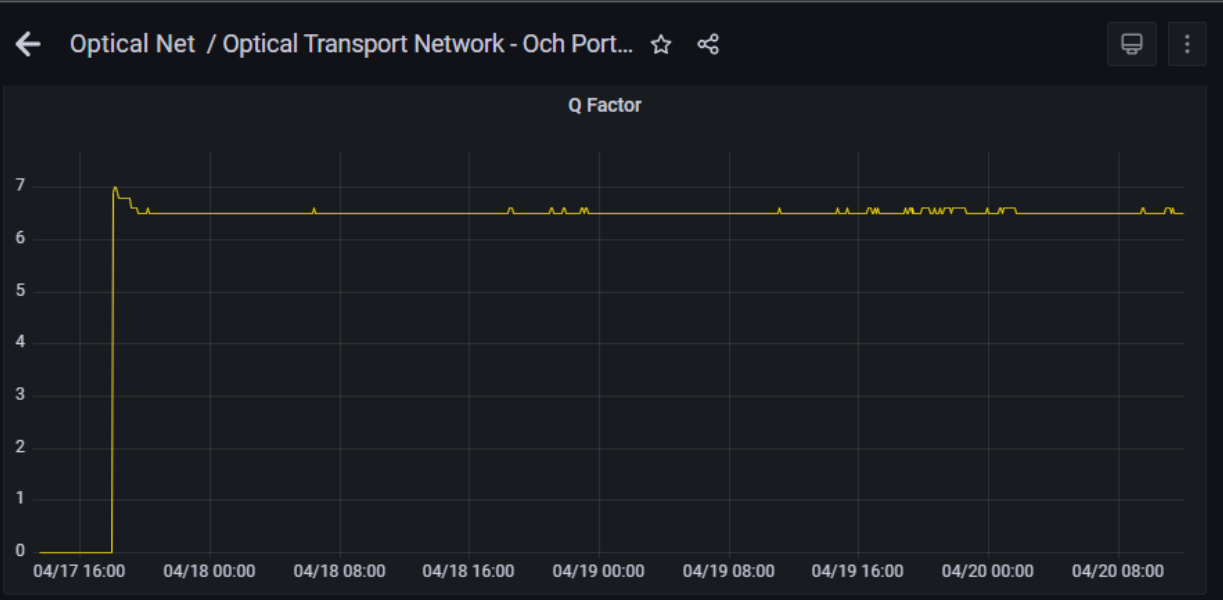


panel - Optical Transport N x +

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

View panel - Optical Transport N x +

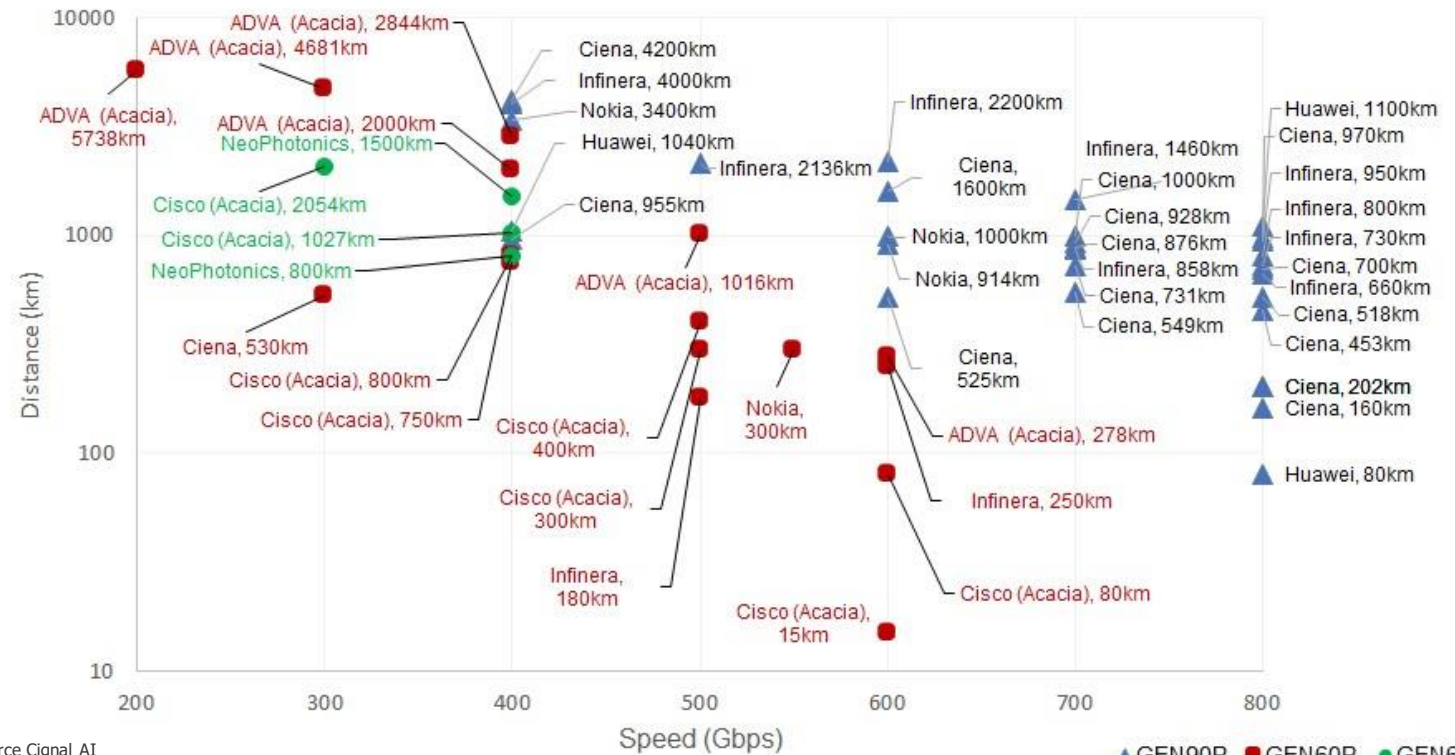
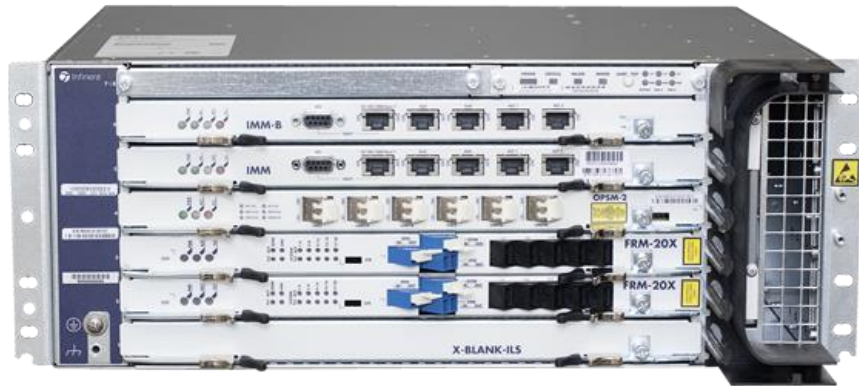
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Enabling Technology

Disaggregated optical network:

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

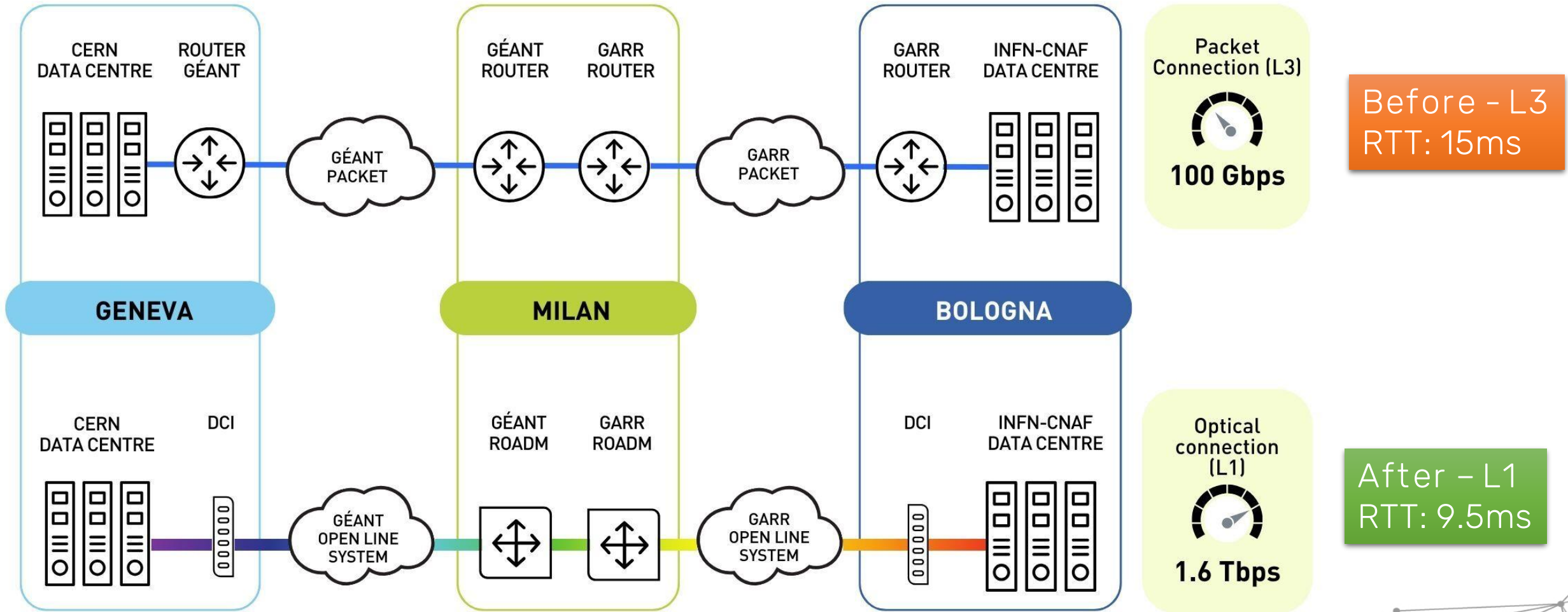


Source Signal AI

▲ GEN90P ● GEN60P ● GEN60

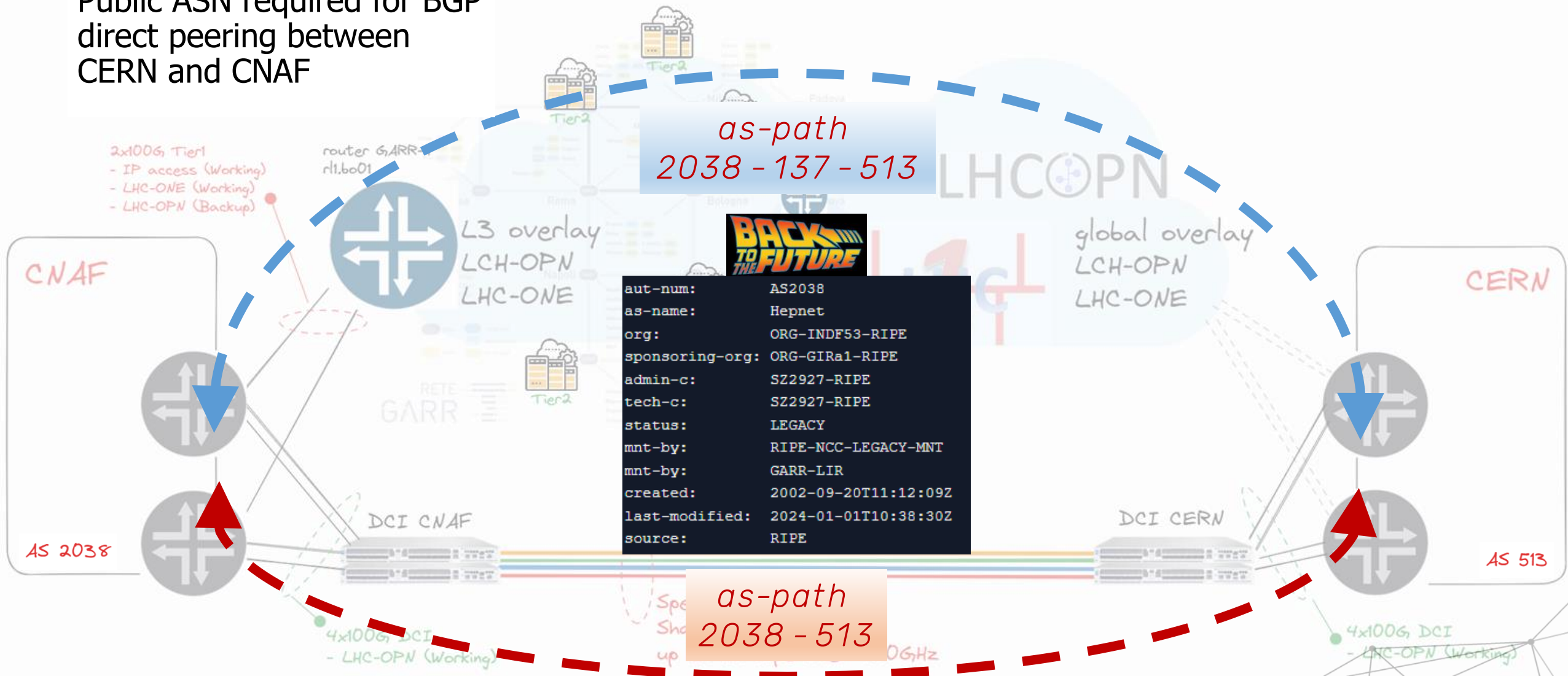
DCI LHCOPN [CNAF-CERN] L3 vs. L1

CERN-CNAF DCI

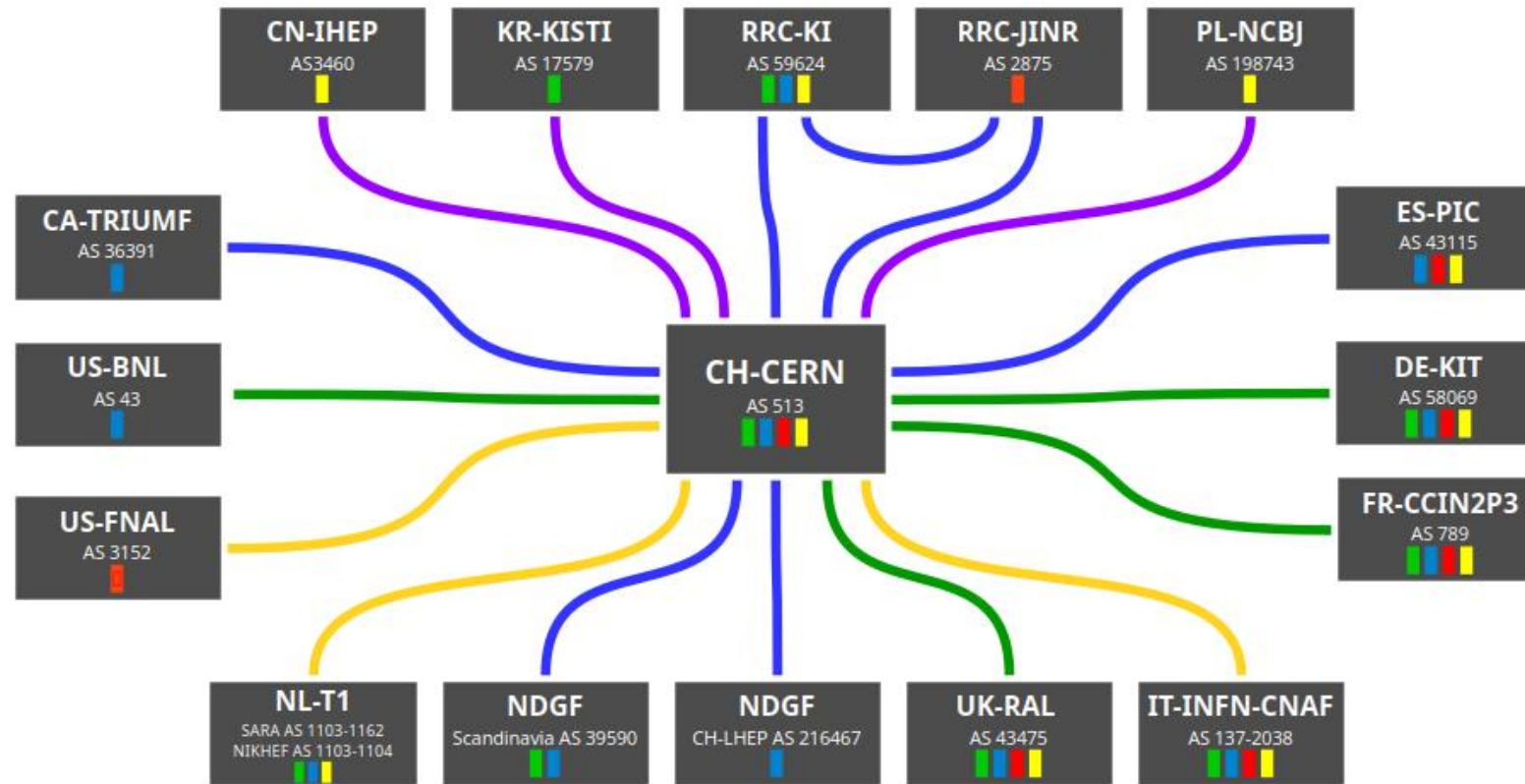


Overlay: full picture

Public ASN required for BGP direct peering between CERN and CNAF



LHCOPN

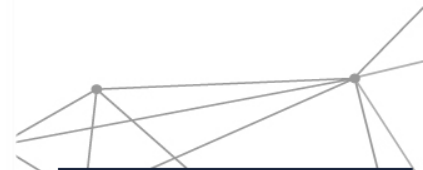


Line speeds:
20Gbps (purple)
100Gbps (blue)
200Gbps (green)
400Gbps (yellow)
800Gbps (red)

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

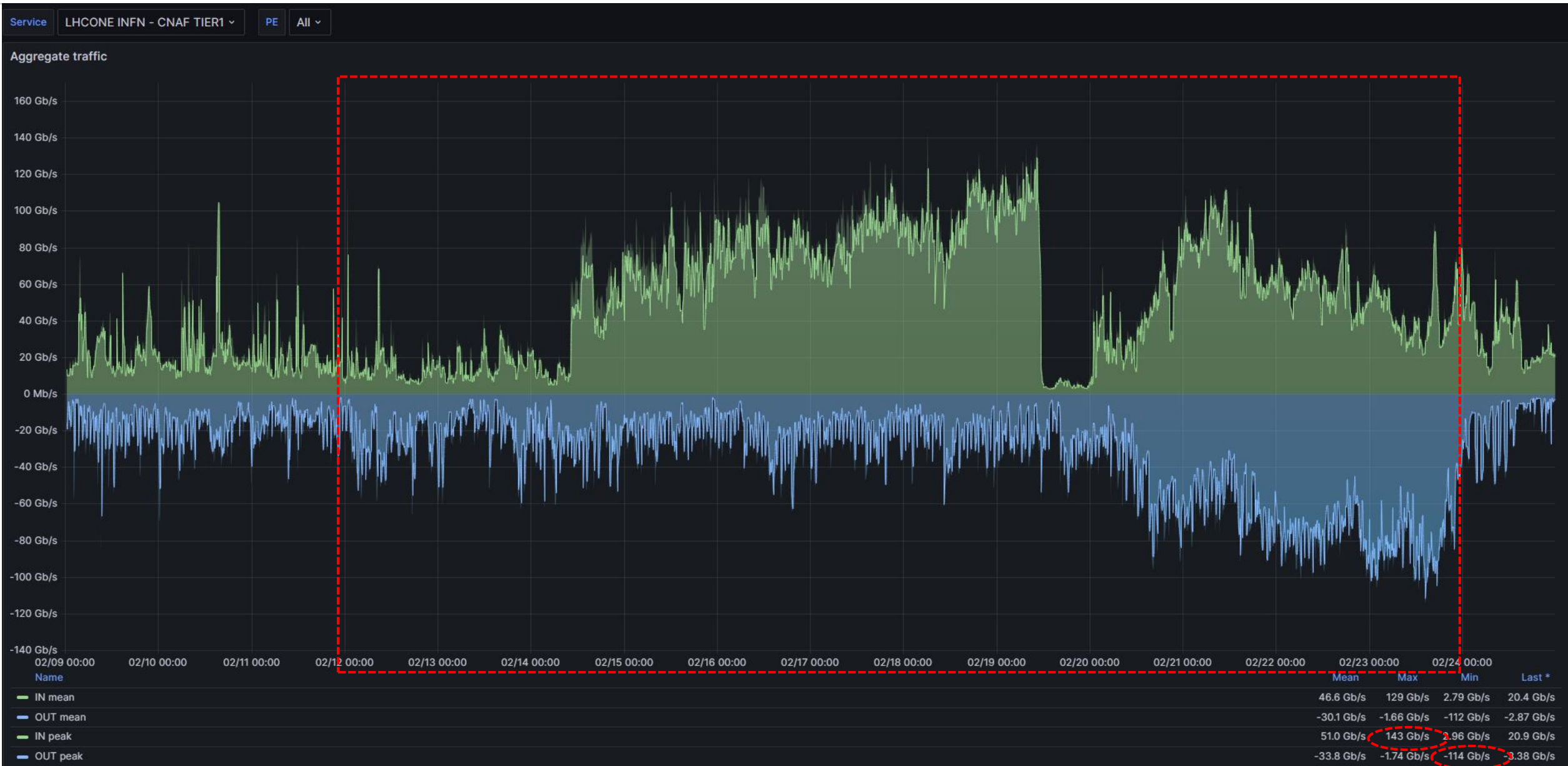
OPN DCI Spectrum Sharing – CNAF CERN Data Challenge

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



CNAF LHCONE VPN (L3)

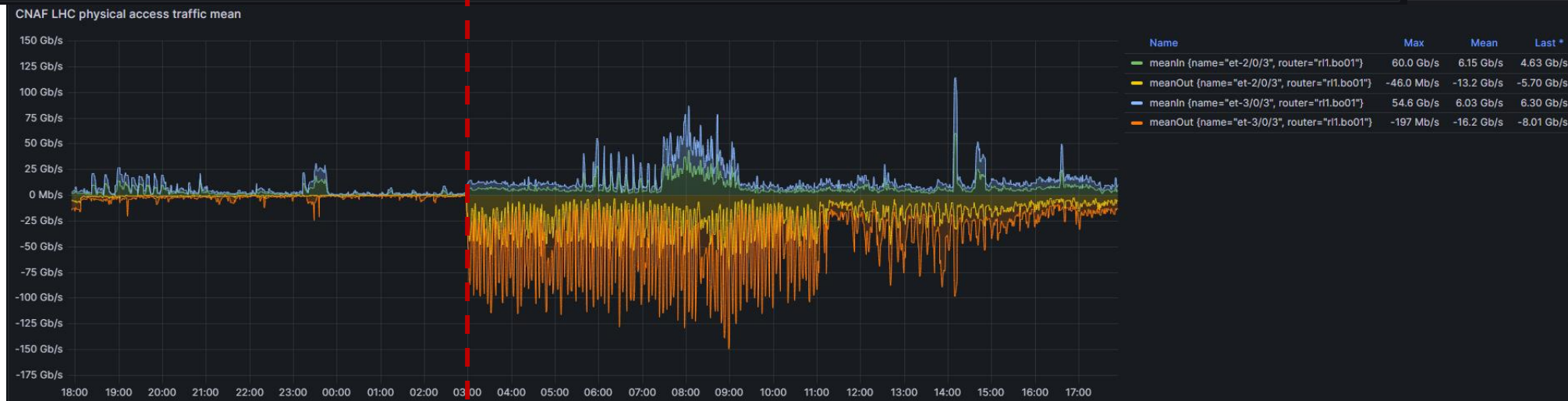
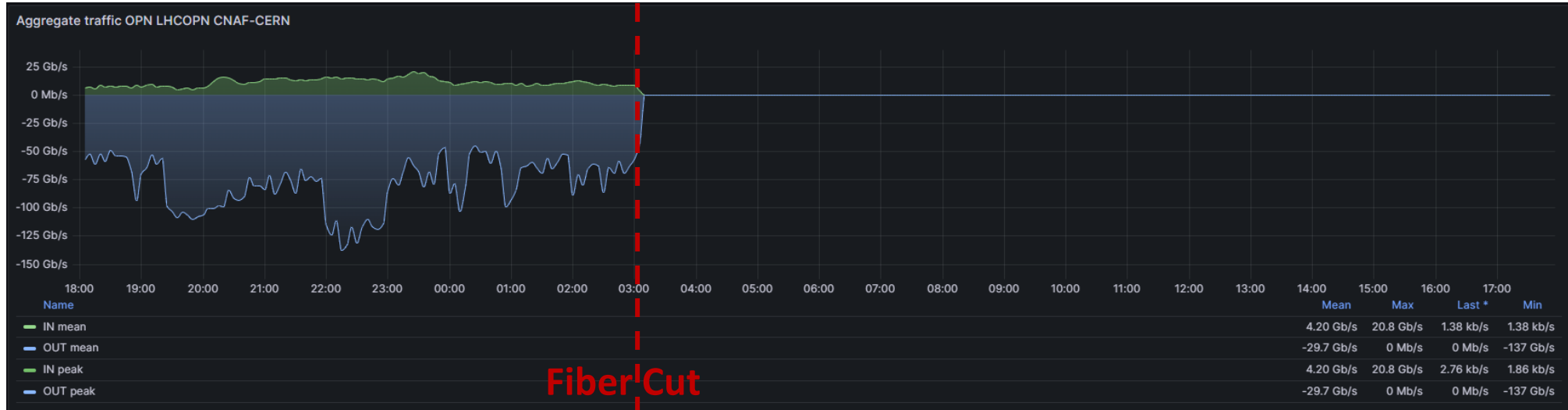
LHCONE Max IN: 143Gbps Max OUT: 114Gbps



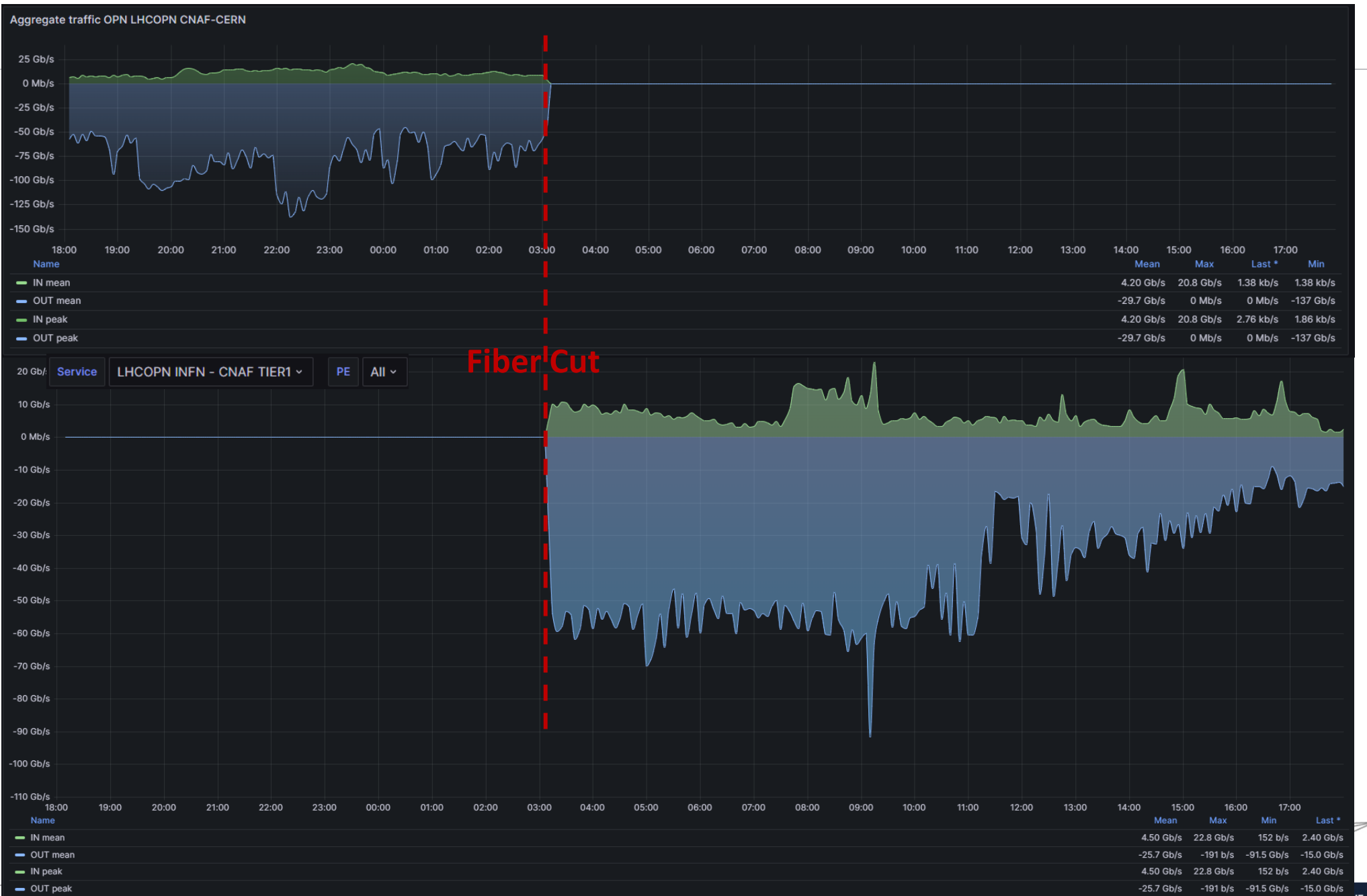
CNAF LHC physical interface



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

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'image: Flaticon.com