

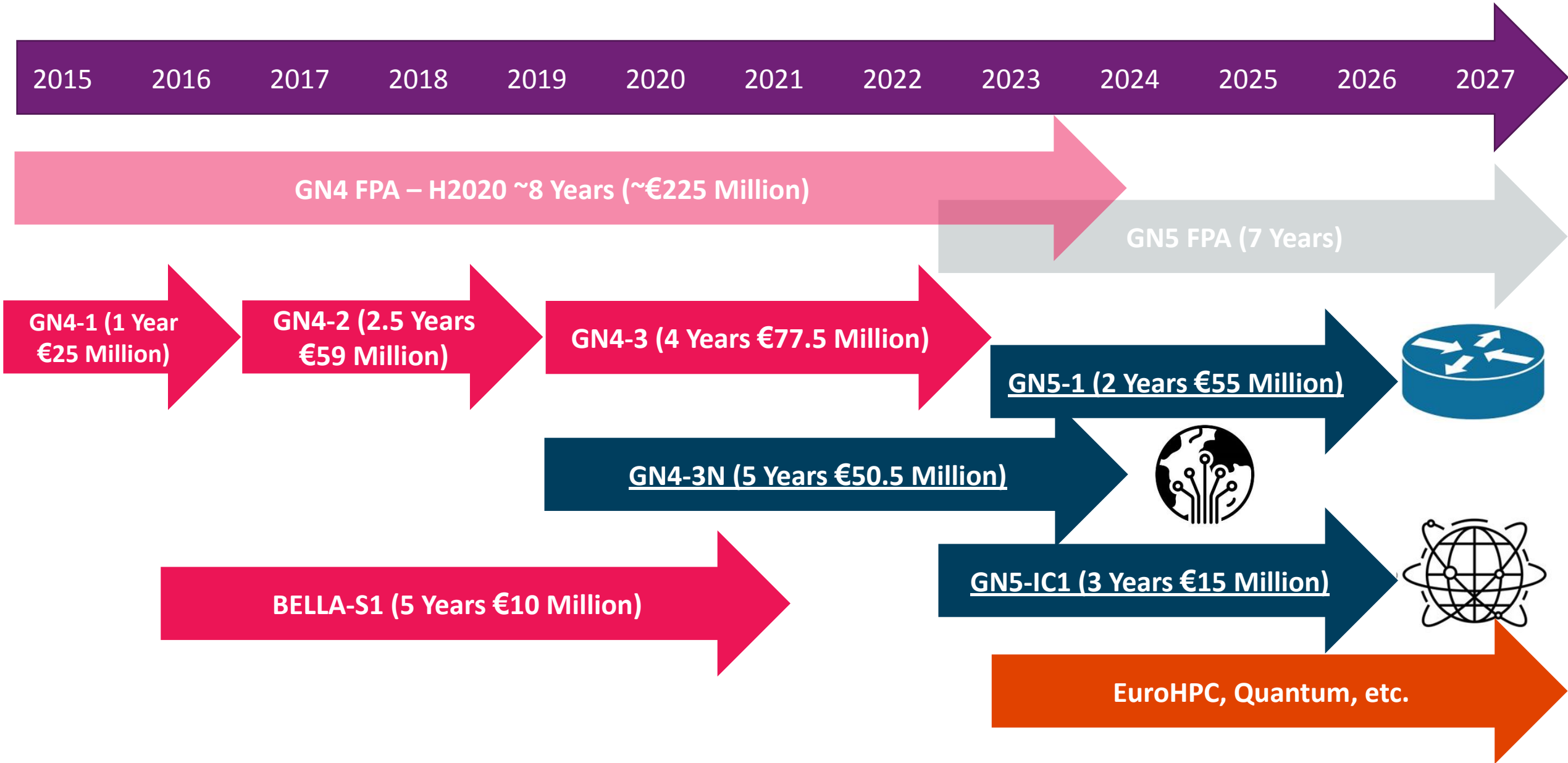


# GÉANT Network Evolution

*Internet2 Technology Exchange 2022*

**Sebastiano Buscaglione, Senior Network Architect @ GÉANT**  
**Mian Usman, Head of Network Evolution @ GÉANT**

6<sup>th</sup> December 2022



# Eternal (?) Challenge: Traffic Growth => Backbone Growth

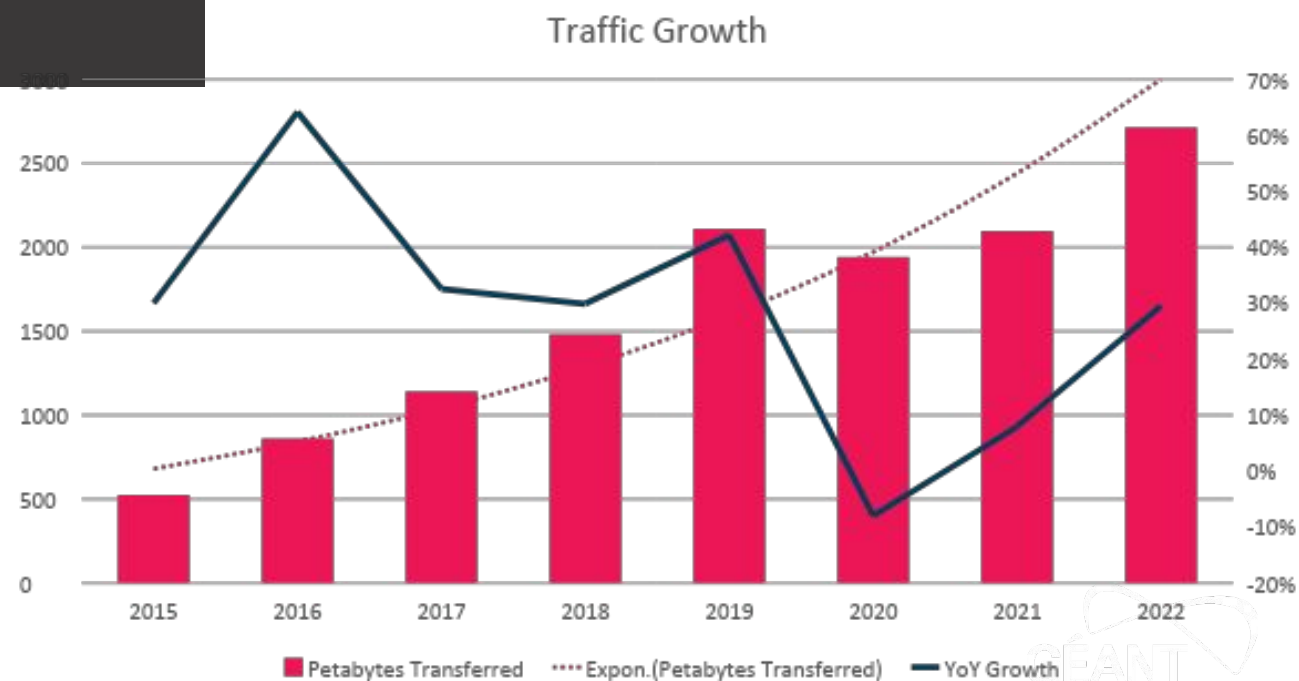
## Long Term Backbone Traffic Growth (on GÉANT network driven by scientific instruments)

- Total: 2010- 2022 growth of over 30% YoY
- 2015 – 2019: Traffic growth of 40% YoY
- 2015– 2022: Traffic growth of 27% YoY

## Total Backbone Trunk Capacity

Feb-2019 : 2.7 Tbps

Now 2022 : 9.4 Tbps

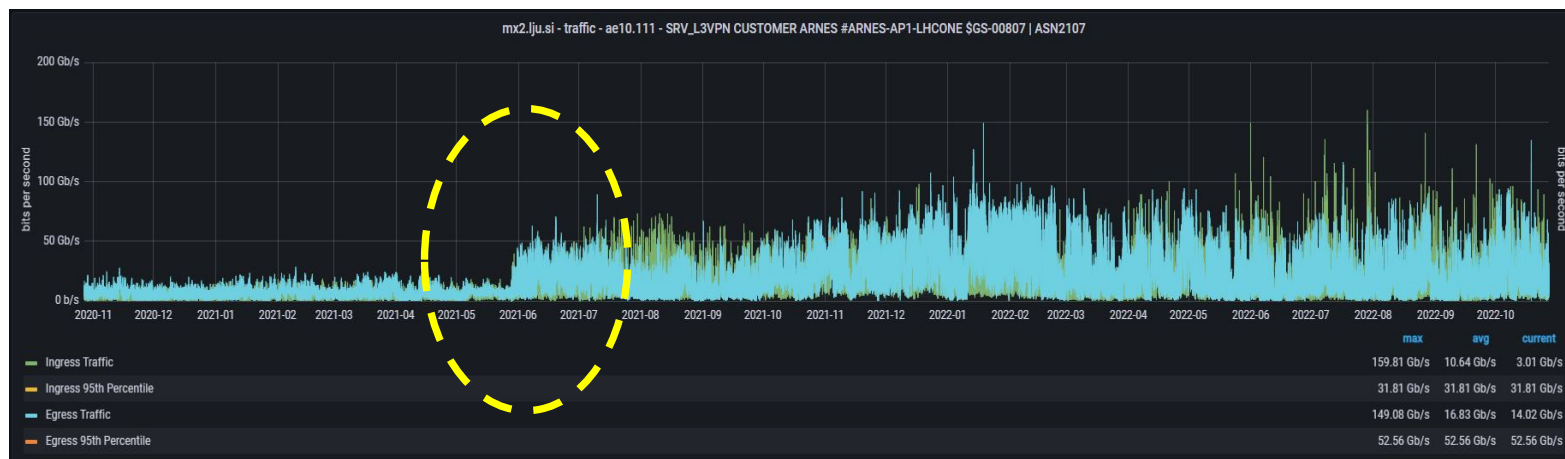
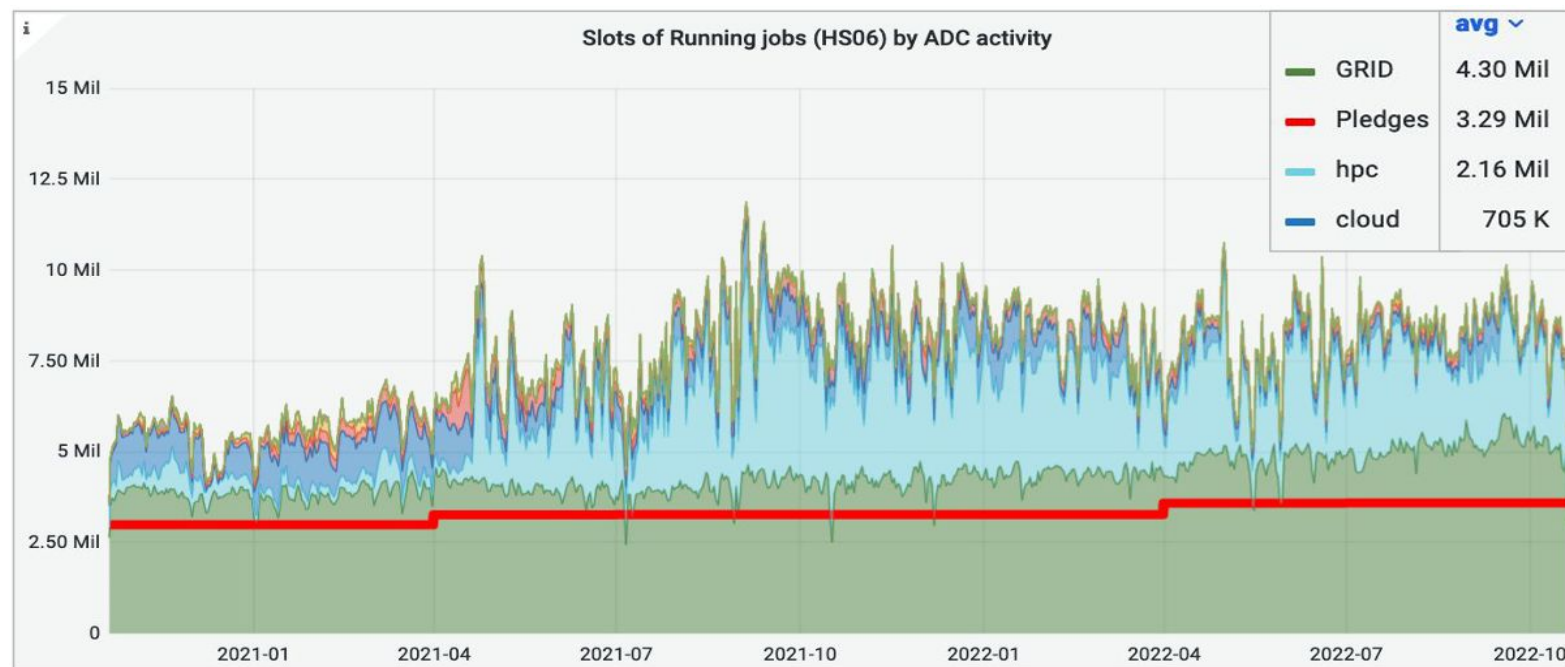


## Big Science Users and EuroHPC: Infrastructure is an Enabler

**Atlas experiment CERN started using Vega EuroHPC in Slovenia.**

Single HPC site now provides more than 50% resources and completes half the number of jobs by the WLCG (Worldwide LHC Computing GRID)

**The network was ready to take the traffic... (from 20 Gbps to 150 Gbps peak)**



# GN4-3N Project – Addressing the Challenge

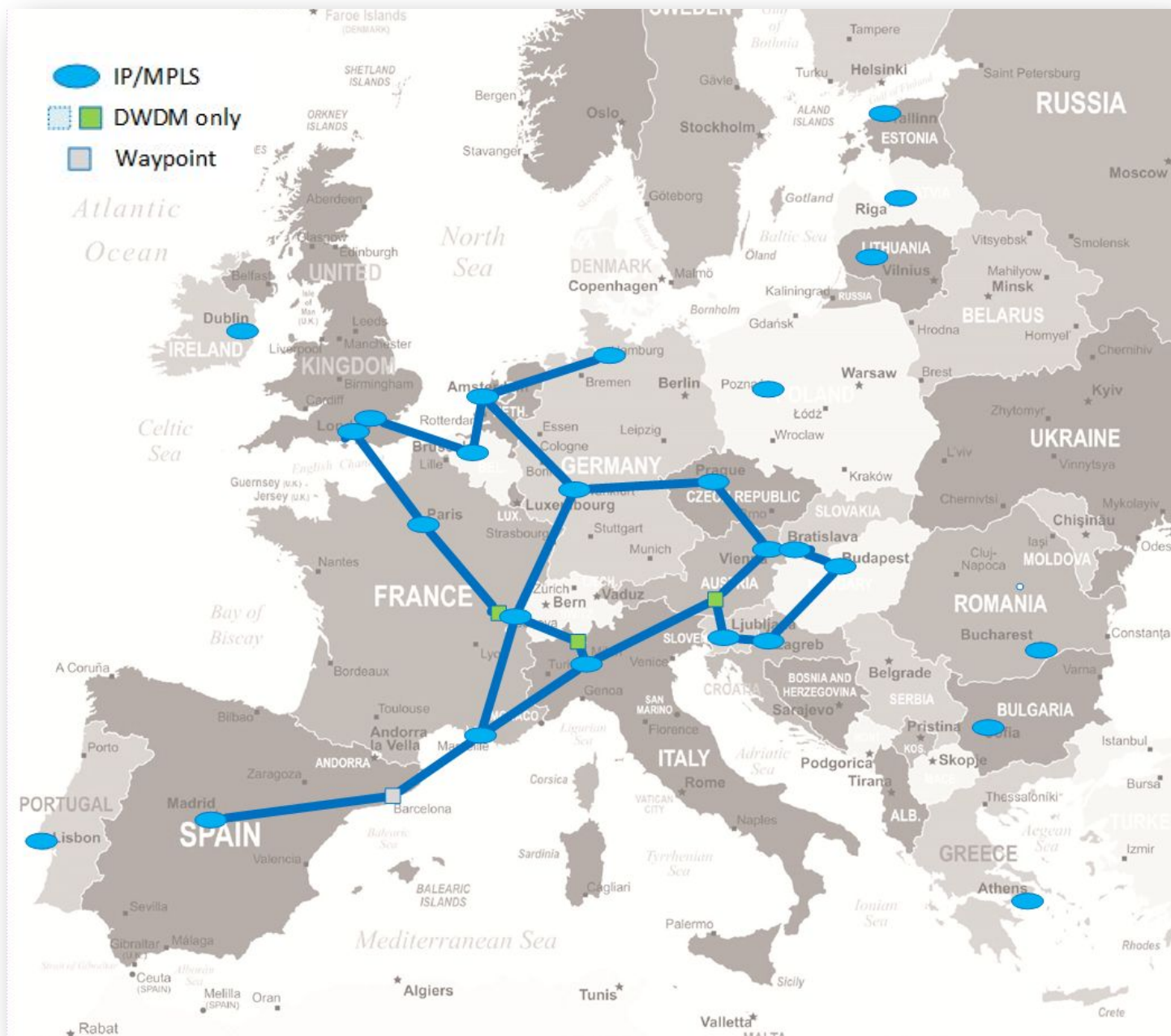
## **Project Proposal:**

*Go beyond the state-of-the-art  
by restructuring the backbone network  
through exploration and **procurement of**  
**long-term IRUs and associated equipment**  
to **increase the footprint**,  
stimulating the market in  
cross-border communications infrastructure  
whilst **decreasing the digital divide**  
**and reducing costs***



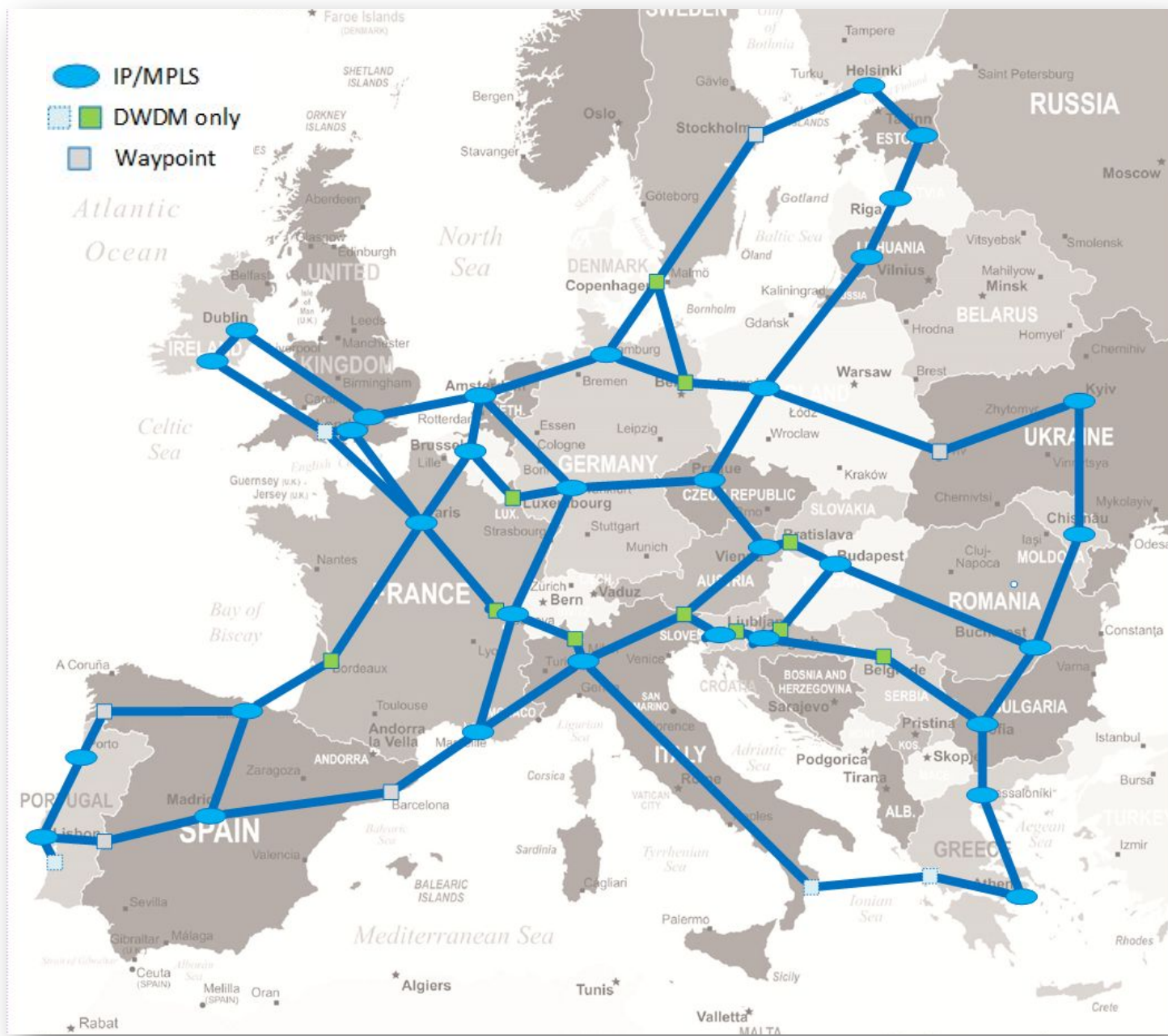
## GÉANT Topology 2018

- Fibre/Spectrum footprint covering **14 countries**
- Fibre/Spectrum lease contracts of **7 years**
- Rest connected by leased capacity
- Links to other world regions landing at Fibre connected nodes only
- **Frequent procurement cycles and cost variability** – years and areas



## GÉANT Topology 2023

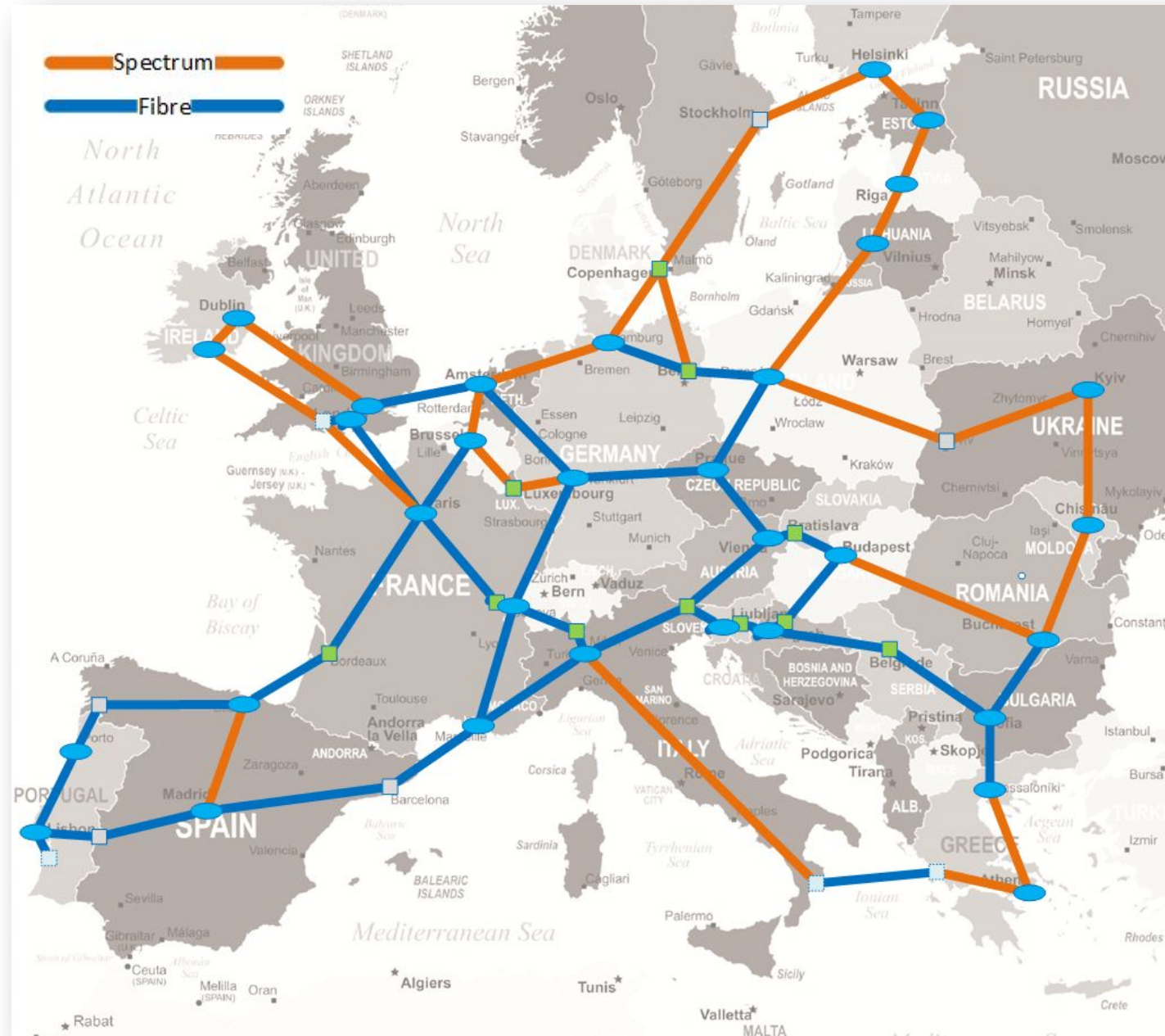
- Fibre/Spectrum footprint covering **30 countries** (2 as EAP)
- Fibre/Spectrum IRU contracts of **15+ years**
- **OPEX cost reduction vs 2018 >40%**
- NREN already providing **25%** of this infrastructure **7000+Km!**





## Extending the reach - Spectrum

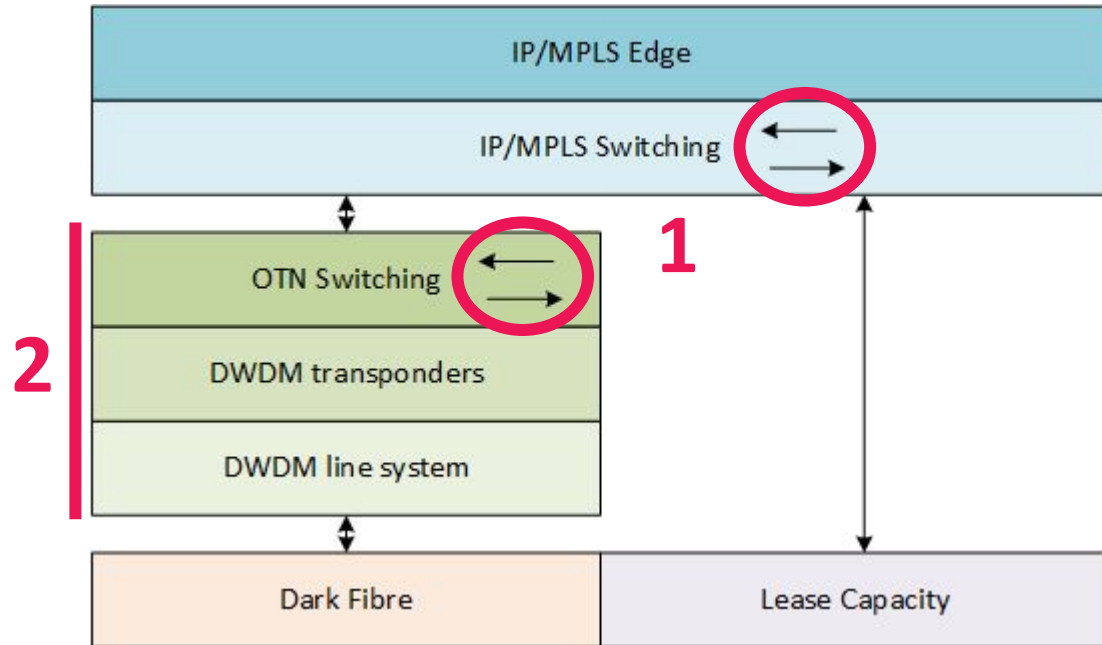
- About **30%** of the new network **Spectrum based**
- Links provided by mix of NRENs and commercial operators
- Working on all major vendor technologies
- Typically, spectrum using **25%** of a **dark fibre** at about **40%** of the **cost** of a full fibre
- Capacity of **2.4 to 6Tbps**



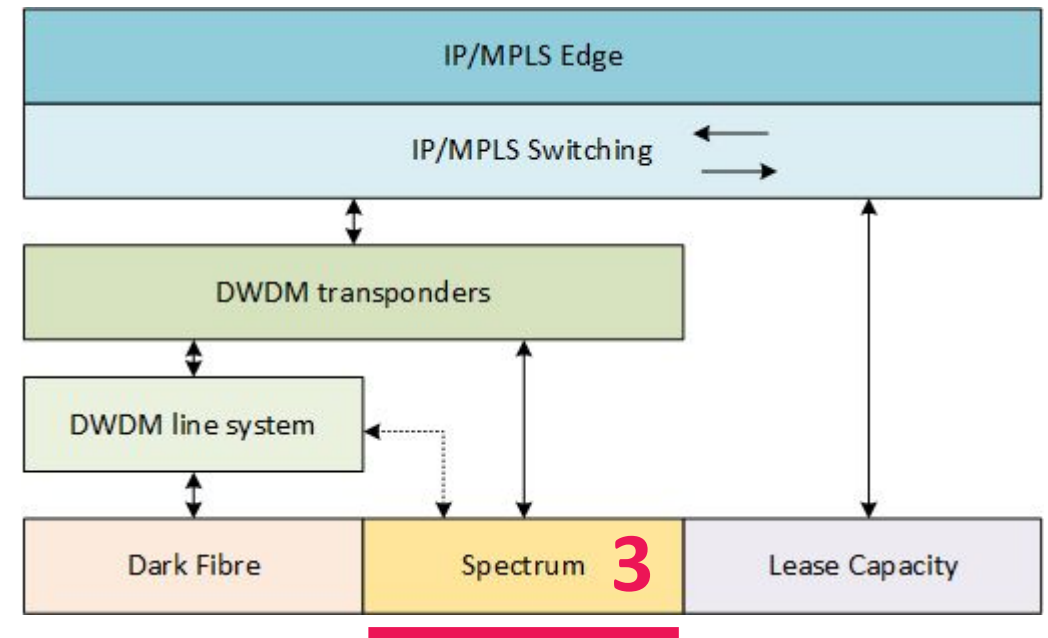


# Optical transmission stack optimization

*Before*



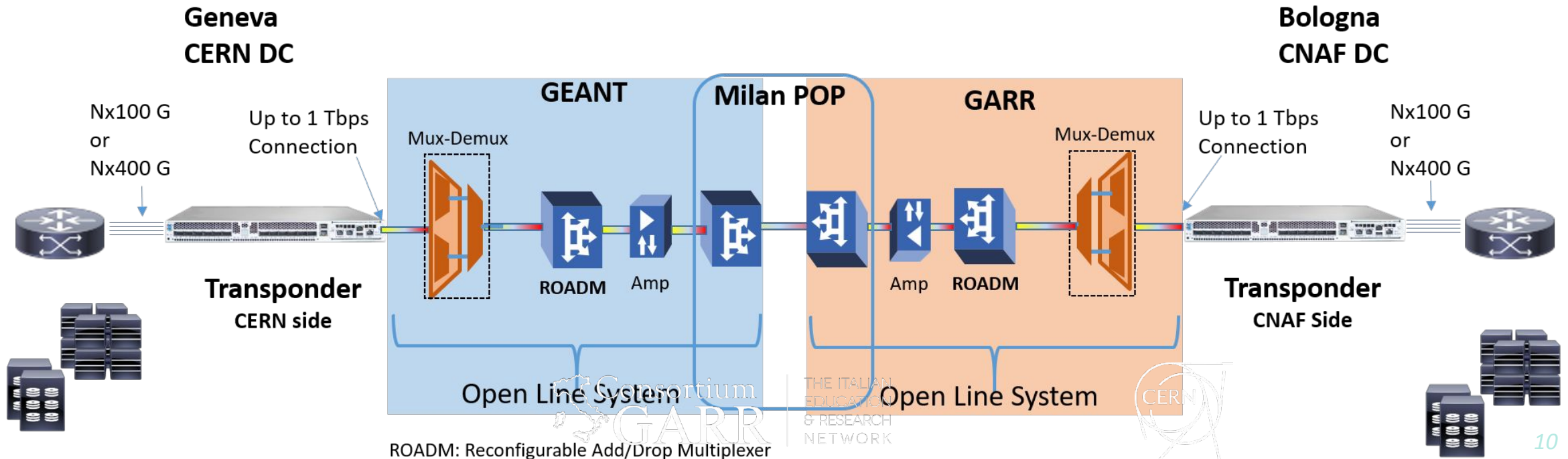
*After*



1. Electronic Switching at MPLS layer only with removal of OTN switching
2. Disaggregation at DWDM layer between Transponders and Line System (OLS)
3. Use of Spectrum as connectivity option for the substrate

# CNAF to CERN spectrum service

- Use Case: CNAF Tier1 to CERN Tier0 via GARR and GEANT SCS service
- GARR-GÉANT connection in Milan is now in place
- DCI equipment is housed in end-site racks, but managed by GARR
- Main benefit is significant cost reduction for users



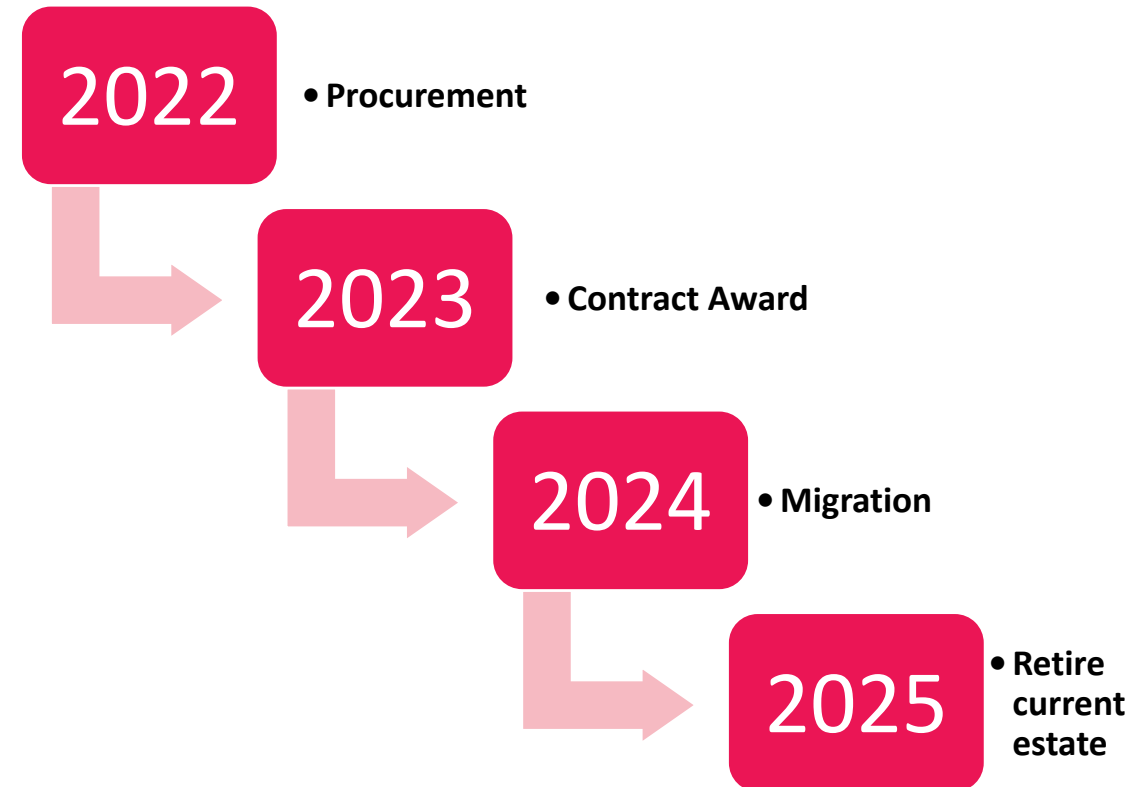
## Packet Layer Renewal

**3 years project** started early 2022

**400G availability** throughout the whole  
GÉANT footprint

Highspeed network availability to the  
edges of Europe

Enabling global partners to connect at  
or close to landing stations





## GN5-Intercontinental Connectivity 1

**Building on the GN4-3N experiences**

**3 years project starting 1<sup>st</sup> December 2022**

**€15M funding (~13M on Connectivity)**

**Two regions – Southeastern Asia and North America**

**Deliver in collaboration with international partners**

**Establish long term Intercontinental capacity planning  
and investment plan**

## GN5-IC1 – Connectivity between Europe and North America

- **GÉANT along with partner R&E networks, aim to have 4+ links at terabit scale by 2027**
- **For North America under IC1 GEANT aim to obtain ~20/30% of a DF link, across 1, 2 or 3 cable systems**
- **Base contract on 15+ Years IRU of Spectrum – preferably unmanaged**



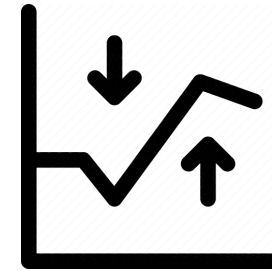
**~€100 million**  
**investment** in  
building the  
next  
generation  
network



Strong  
**foundation** of  
long-term  
infrastructure



Bridging the  
**Digital divide**  
by expanding  
the networks  
to the edges  
of Europe



**Reduced**  
**dependency**  
on the  
market



**Strong**  
**collaboration**  
**with partners**  
is key to  
success





# Thank You

Any questions?

[architects@geant.org](mailto:architects@geant.org)

[Sebastiano.Buscaglione@geant.org](mailto:Sebastiano.Buscaglione@geant.org)

[Mian.usman@geant.org](mailto:Mian.usman@geant.org)

[www.geant.org](http://www.geant.org)



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