

GARR-T: Beyond Data Services

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23/05/2024

Workshop INFN CCR - Palau (Sassari)



Outline

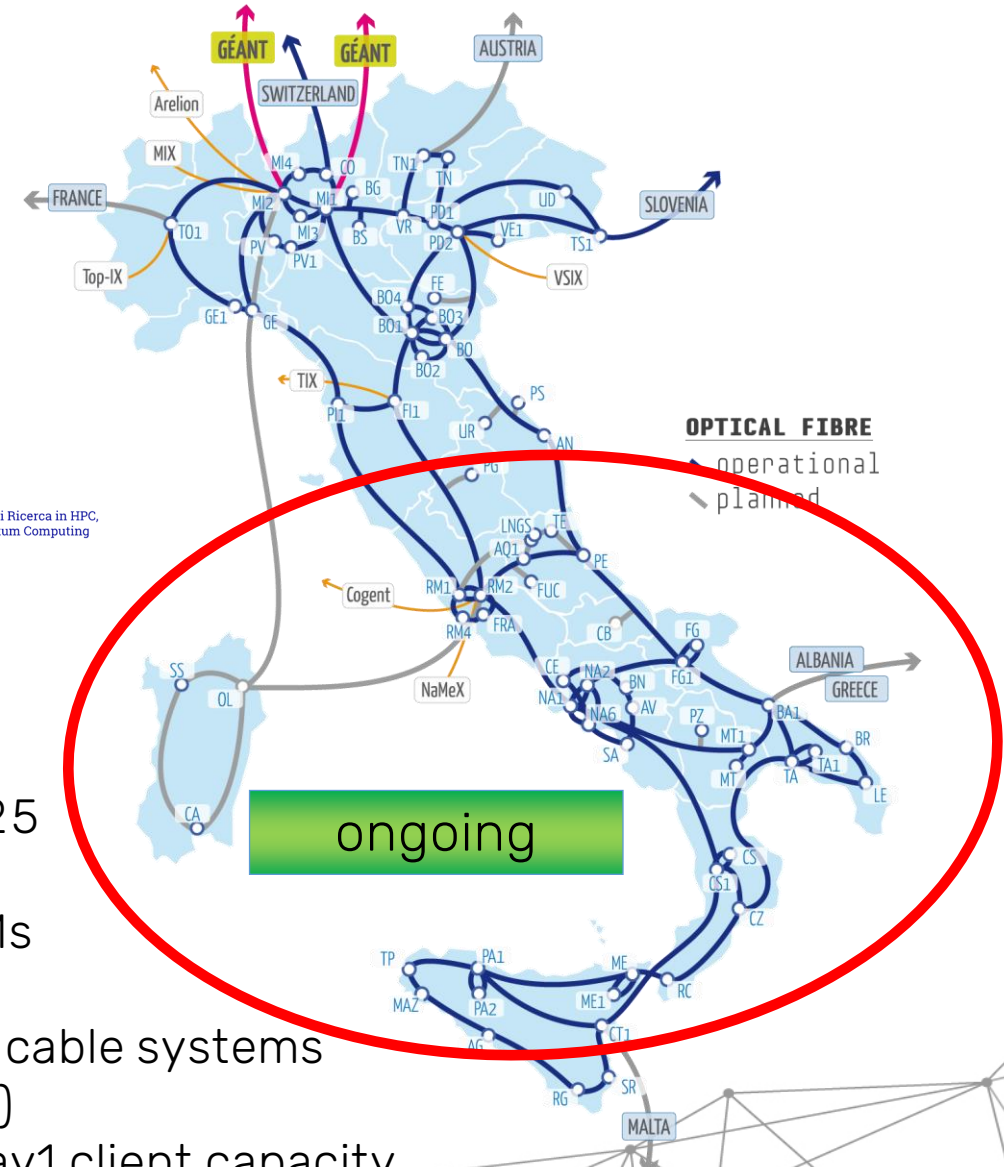
- GARR-T quick update
- Beyond Data Service
- GARR future activity quick overview

GARR-T: Optical Network current status and evolution



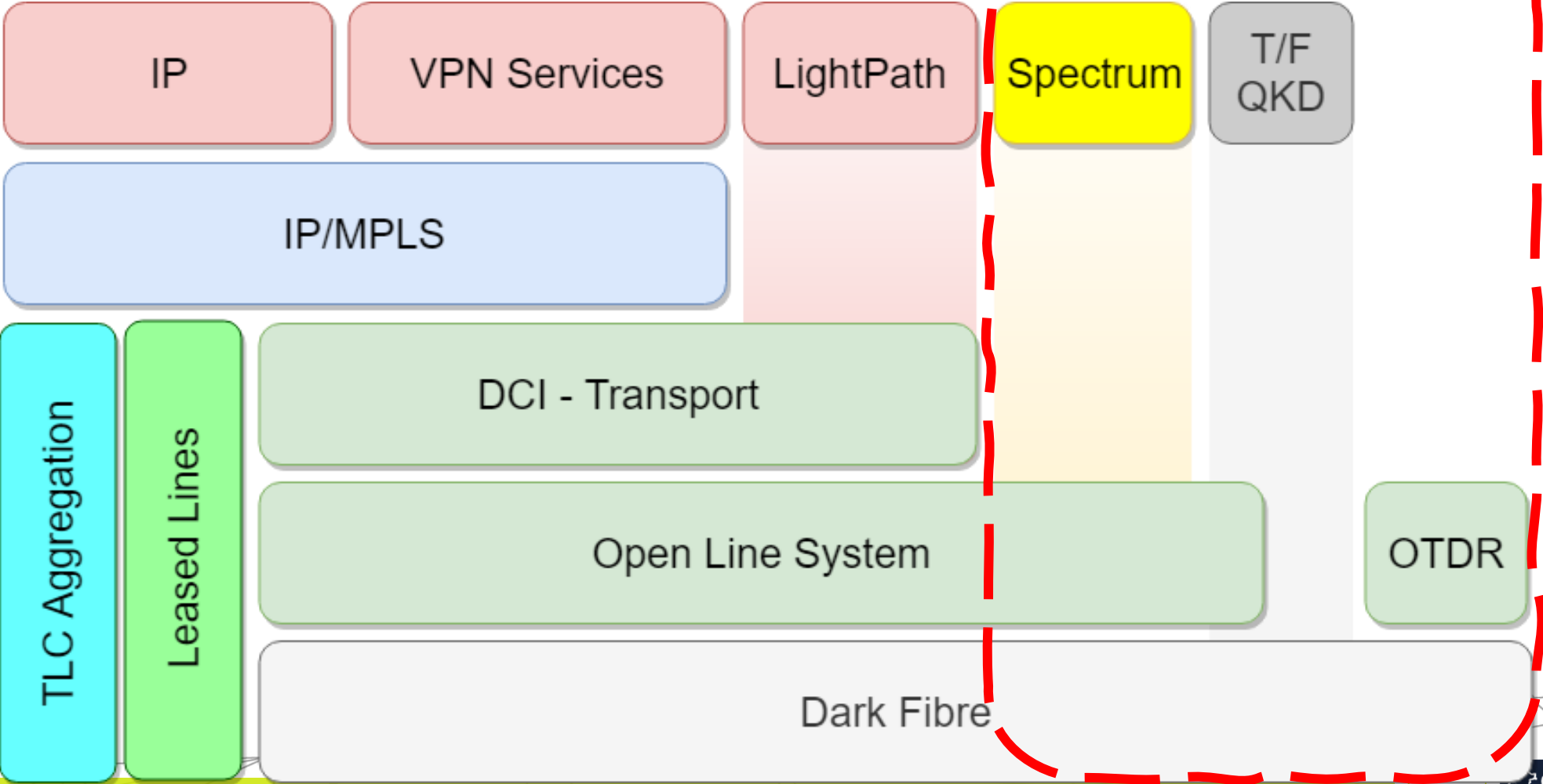
2020-2023
6200 km
42 ROADMs
35 ILA
18 Tbps day1 client capacity

RETE
GARR



2023-2025
5000 km
35 ROADMs
38 ILA
2 sub-sea cable systems (spectrum)
16 Tbps day1 client capacity

GARR-T architecture



Beyond Data Service: Investigation and Developments



20 mila km di
fibra ottica

120 PoP



Banda L
disponibile



Spectrum Sharing

- CNAF-CERN DCI pilot (Multidomain GARR+GEANT)
- Spectrum Sharing Service testing and rollout



Time and Frequency

- White Rabbit over DWDM
- Pan-European Infrastructure (CLONETS)
- GN5-2 Incubator



Sensing

- Sensing over Subsea Cables
- GEANT WP7T2 Demo activity
- SUBMERSE project relationship



Quantum Technologies (QKD)

- University of Padua: QKD + Data link field trial
- Quantum Initiative
- Quantum Communication over dedicated fiber

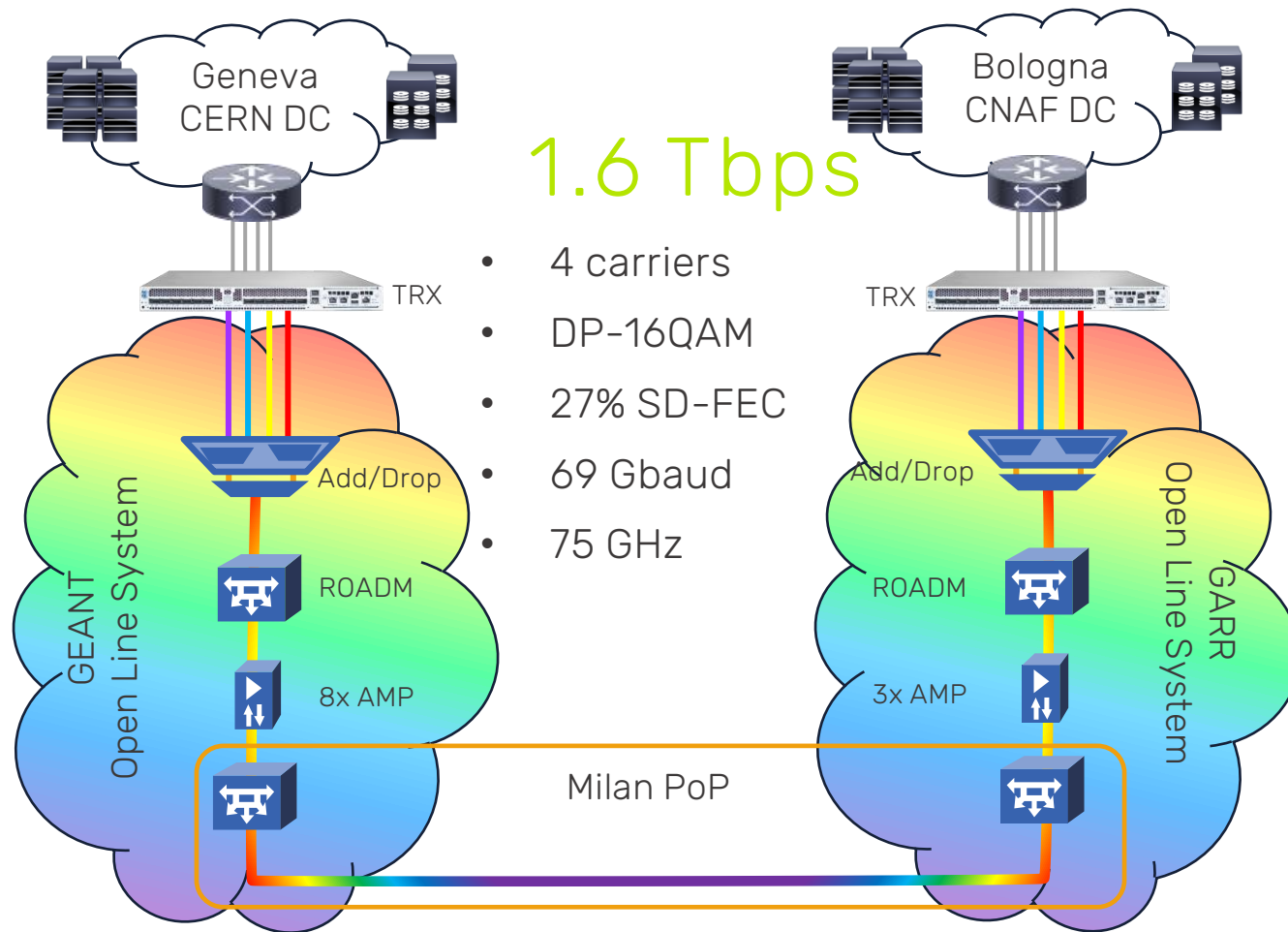




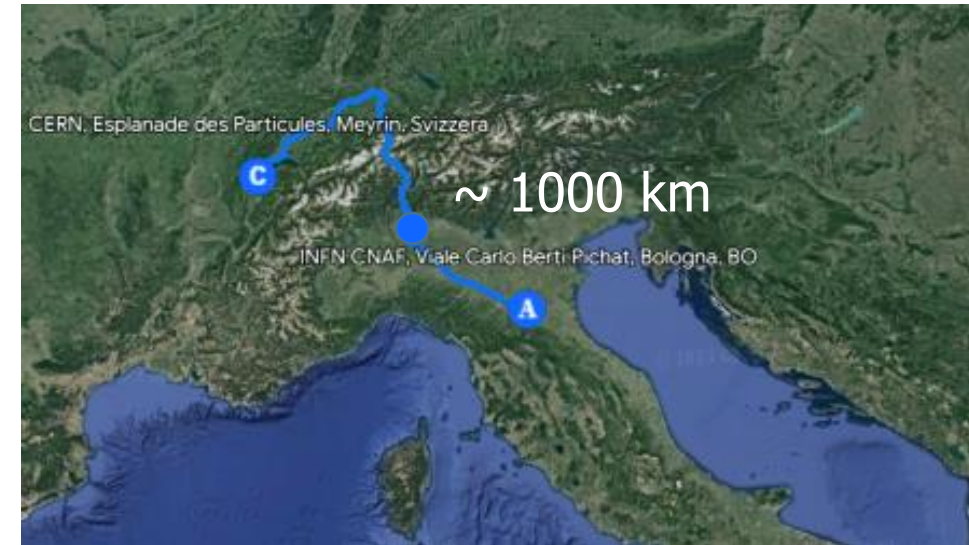
Spectrum Sharing - DCI



CERN – CNAF Data Centre Interconnection



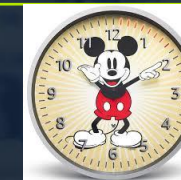
1.6 Tbps



Live @WLCG-DC24



Time and Frequency distribution



Time & Frequency distribution



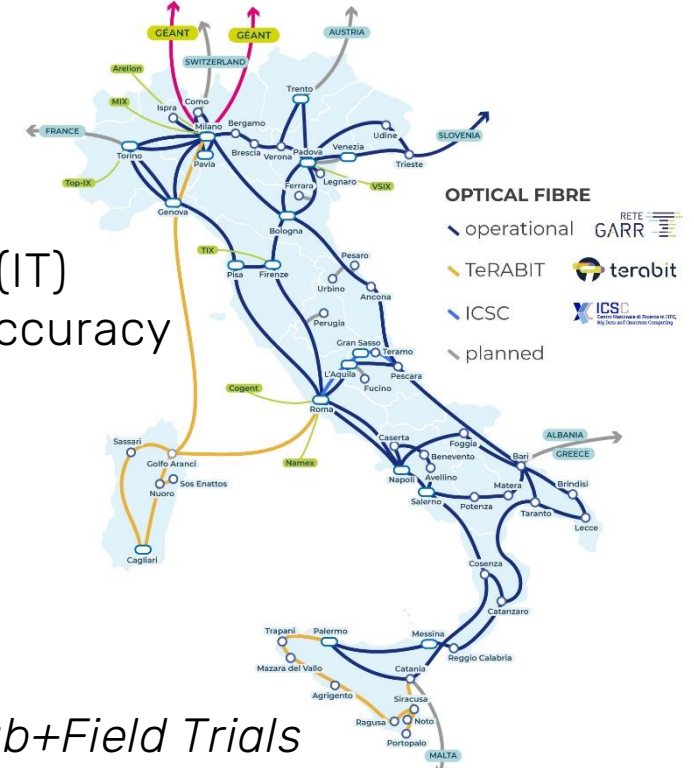
High-end users



UTC(IT)

INRiM has a dedicated fiber infrastructure for Frequency dissemination and quantum technologies -> high-end users

UTC(IT)
ns accuracy



Lab+Field Trials
White Rabbit over AlienWave

Less demanding users can benefit from the UTC(IT) reference

Pan-European effort for T/F network



Figure 3.1 shows one of the options considered. The final topology will be based on further consultation with the metrology community and the NRENS.

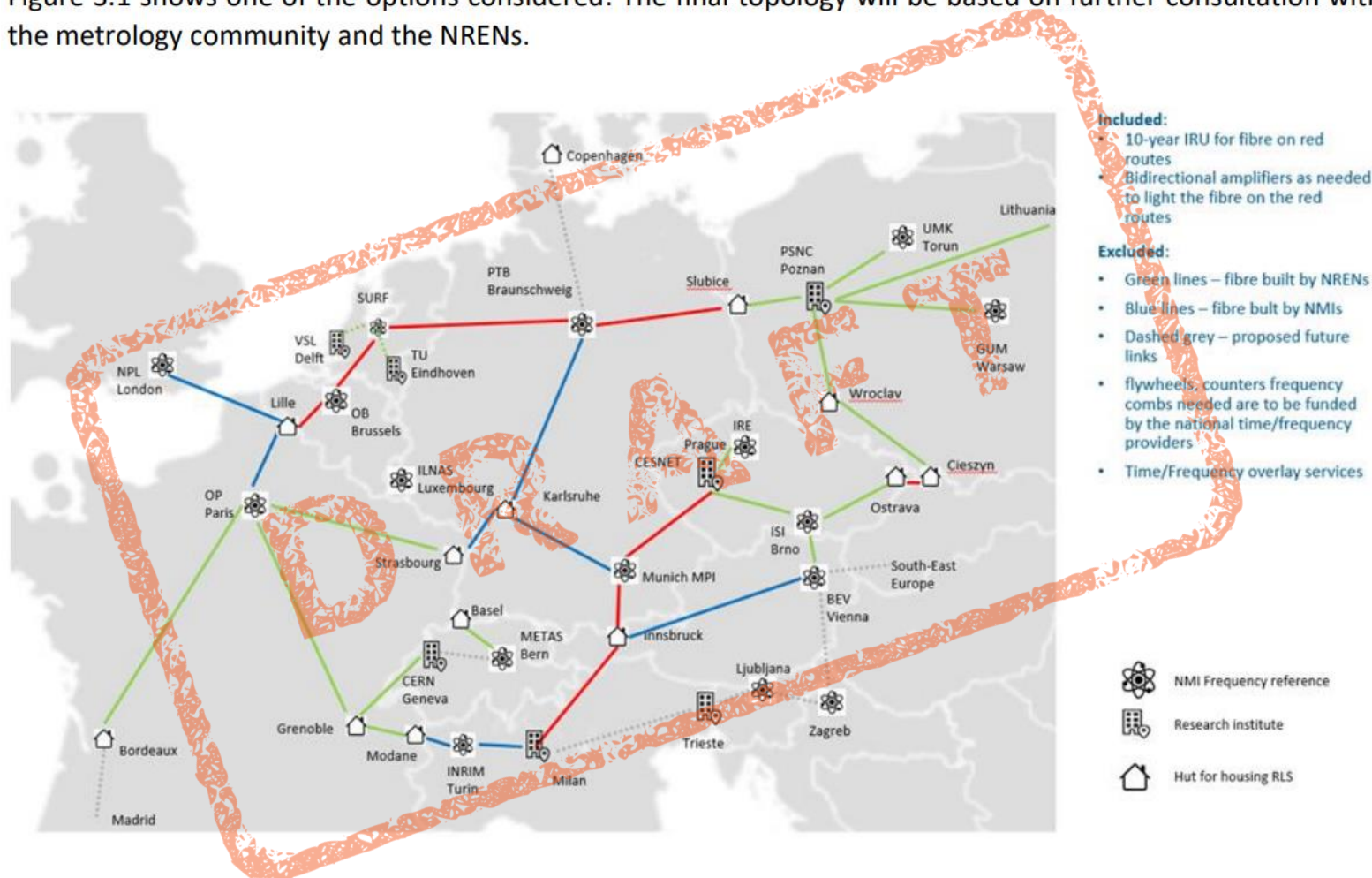


Figure 3.1: Proposed C-TFN Option A

White Rabbit Long Haul Trials



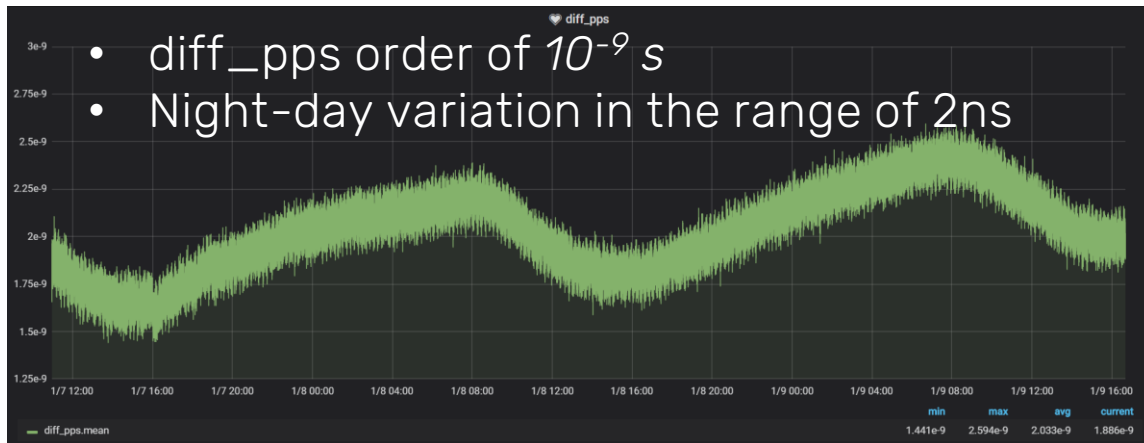
White Rabbit



Alien Wave DWDM
Transport



Unidirectional



Severe concerns
on possible
operational
models

(more details @ [wsgarr20](#))

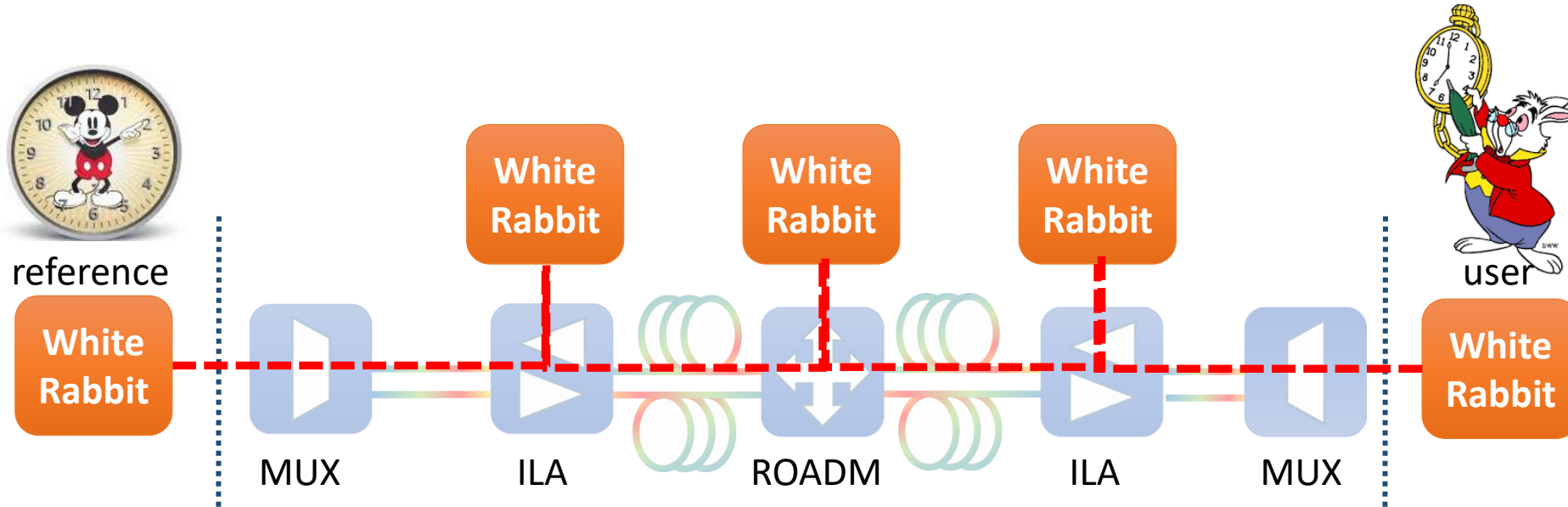
Next steps: GARR-T enables to reconsider the WR Transport model



RETE
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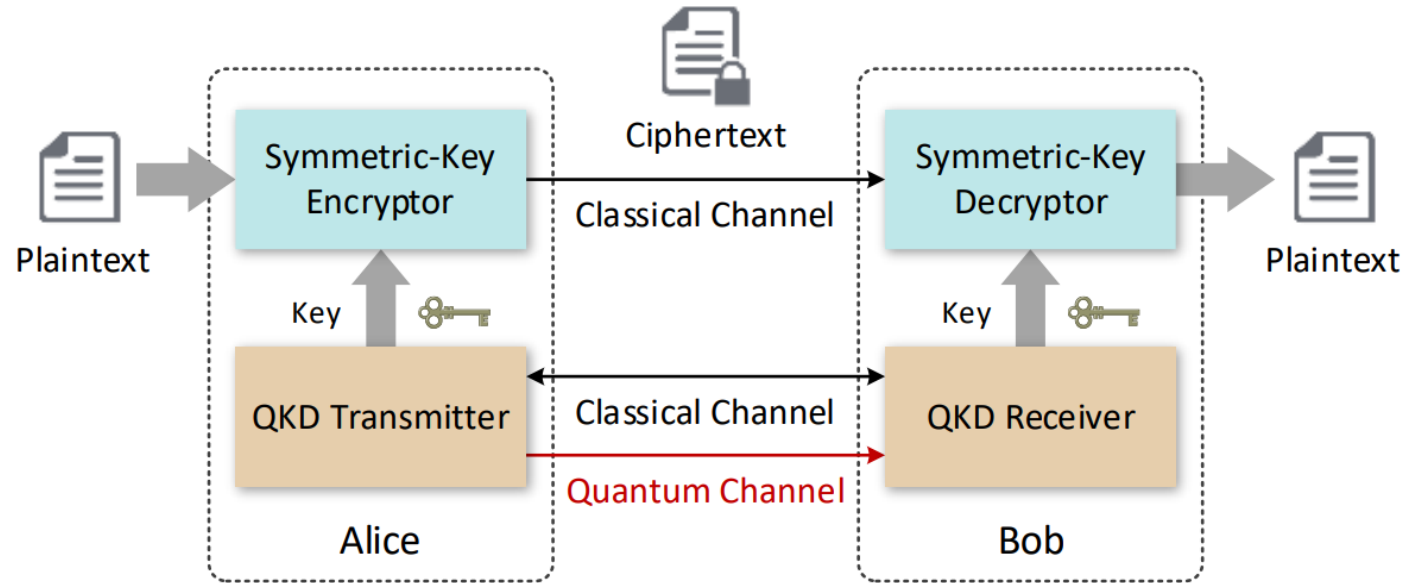
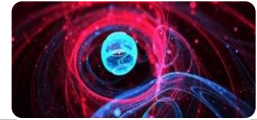


Bidirectional
L + C Band Multiplexing



QKD & Quantum Communication





- GARR può offrire QKD agli utenti sulle fibre in produzione?
- Quali sono le conseguenze per i servizi a pacchetto?
- C'è la necessità di scambiare stati quantistici?

QKD – Field Trial su link di accesso



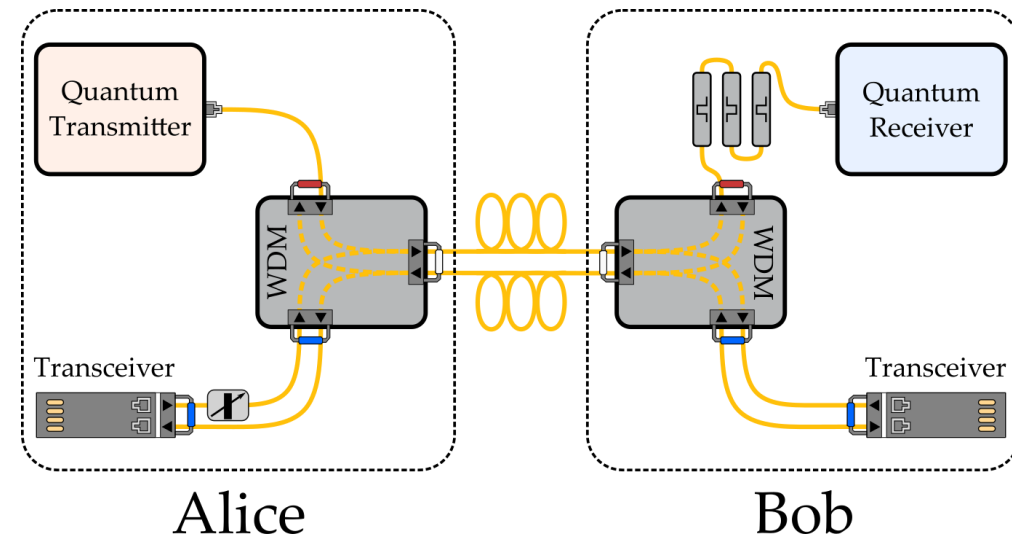
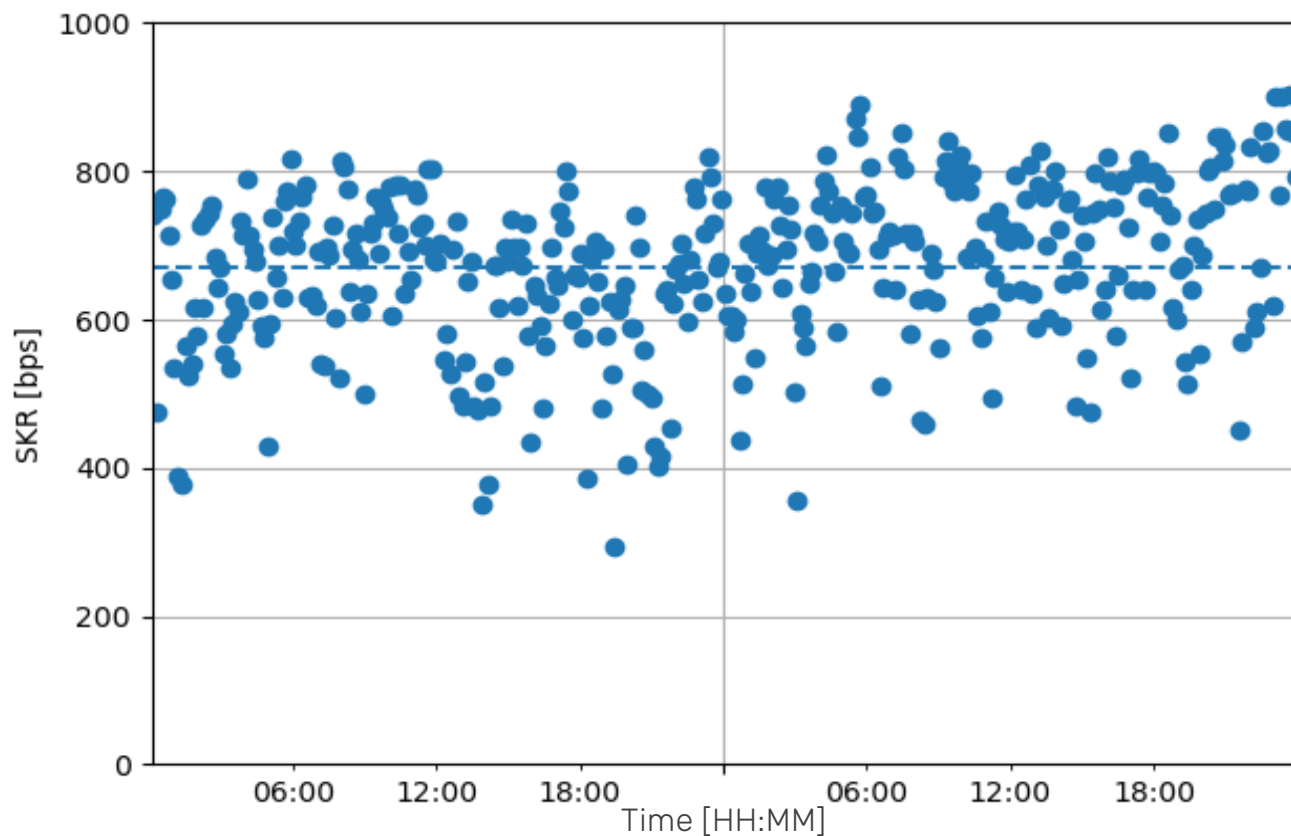
UNIVERSITÀ
DEGLI STUDI
DI PADOVA



O & C band multiplexing

Classical Data channel @10Gbps

QKD BB84 Protocol



Implicazioni:

1. ER o ZR (long range) optics in 10km link
2. fine tuning required

@WSGARR22

<https://u.garr.it/ws22colantonio>

Presentation@TNC23:

A QKD Network Including Coexistence of Quantum and Classical Signals

<https://tnc23.geant.org/sessions/#s265>

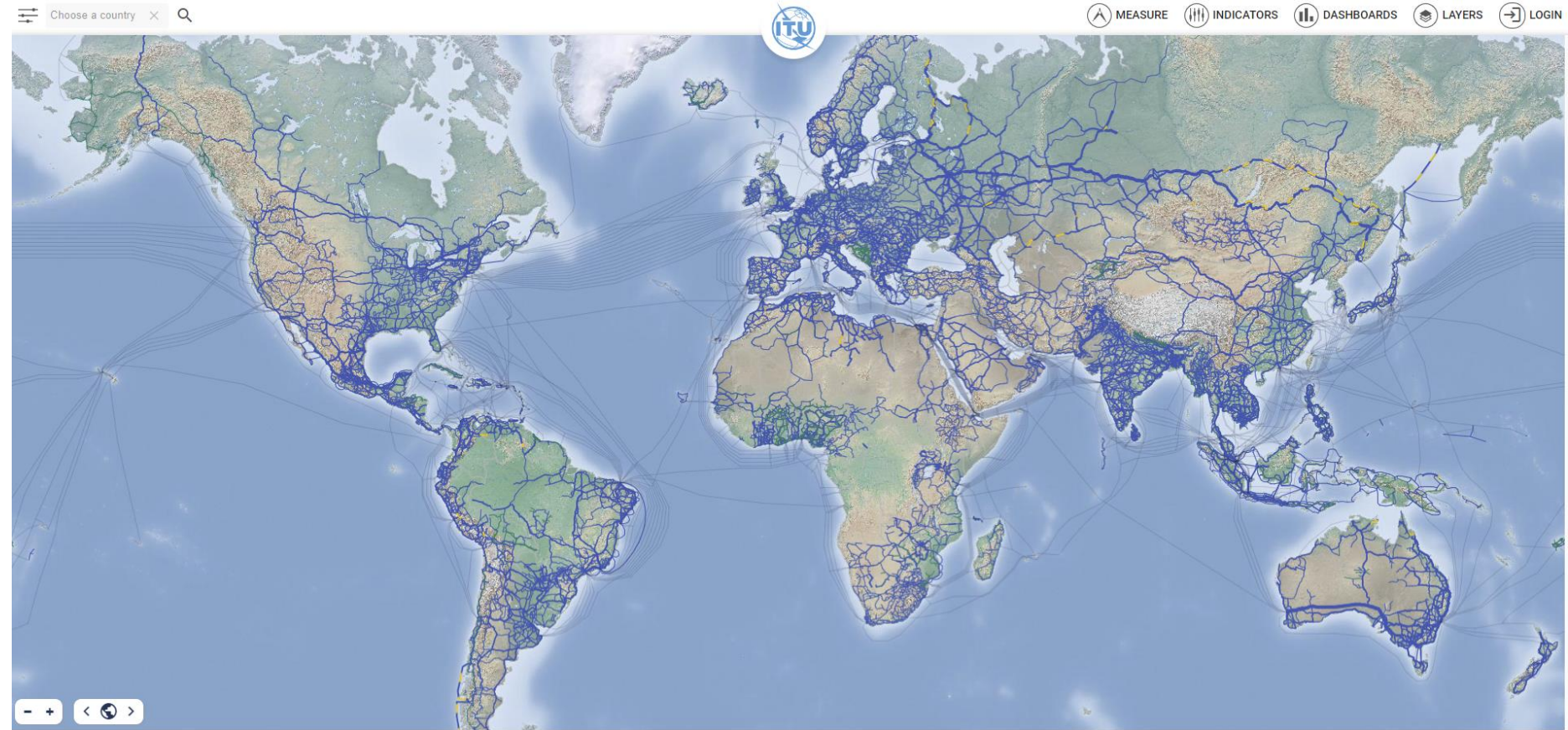
Sensing



Optical Fiber as a distributed sensor



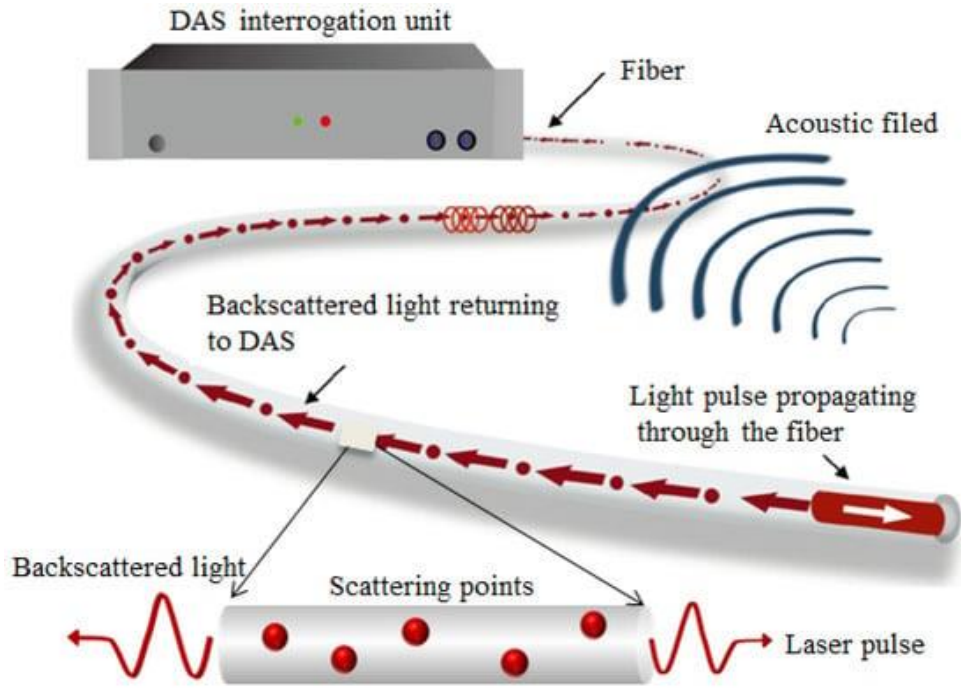
- Volcanoes
- Earthquake
- Geophysics
- Oceanography
- Sea Life
- Traffic
- Vehicles
- Infrastructure



Fiber Sensing Techniques

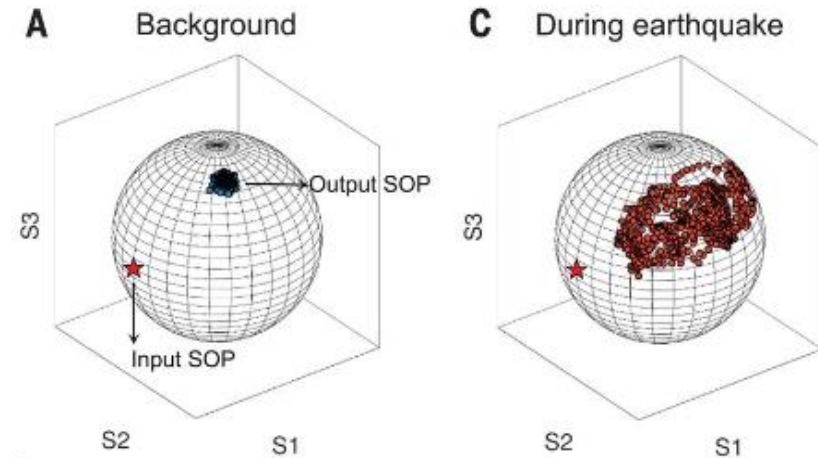


Distributed Acoustic Sensing



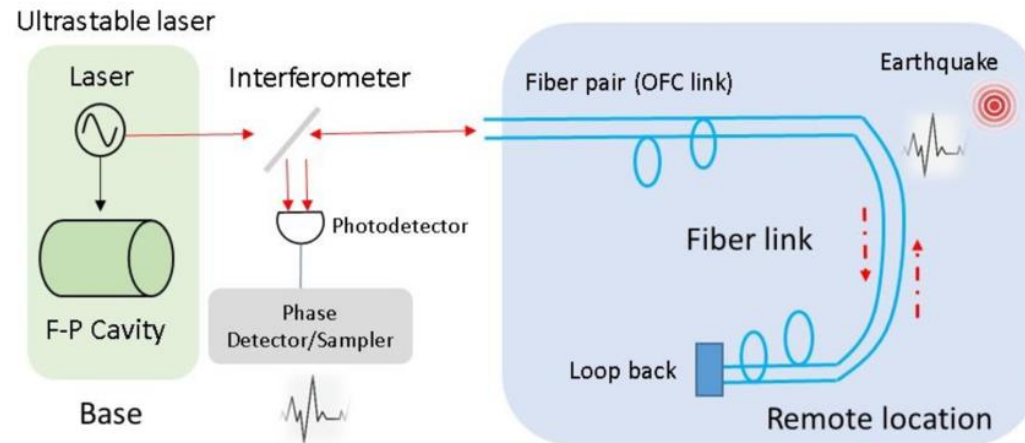
DOI: [10.3390/s22197550](https://doi.org/10.3390/s22197550)

State of Polarization



DOI: [10.1126/science.abe6648](https://doi.org/10.1126/science.abe6648)

Ultra Stable Laser Interferometry - USLI



DOI: [10.22541/essoar.168988438.80532994/v1](https://doi.org/10.22541/essoar.168988438.80532994/v1)



- GARR has a widely spread optical fiber infrastructure covering also very geologically active areas
 - Coexistence with Data Traffic is a MUST
- GARR aims to support all the research activities in the field to:
 - Enhance technical knowledge of state of the art technologies (TRL:high)
 - Support on the development of new or improved techniques (TRL:low)

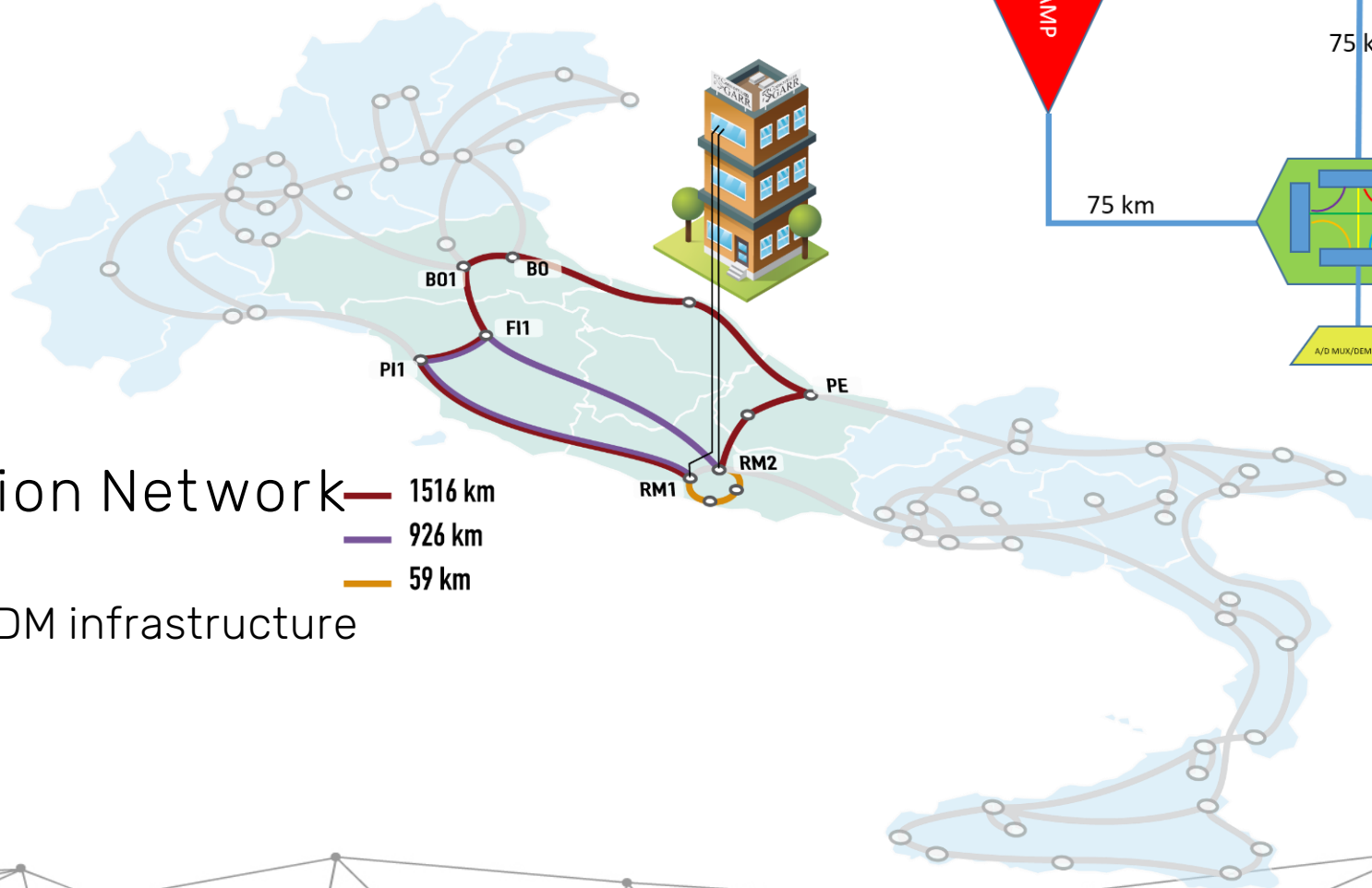
Next Steps:

- Since coherent transponders are already deployed on the Data Transport Network, GARR is going to preliminarily investigate SOP based techniques (HW already available and deployed)
- WORK IN PROGRESS support in project based on DAS and Interferometry Techniques

GARR Optical LAB

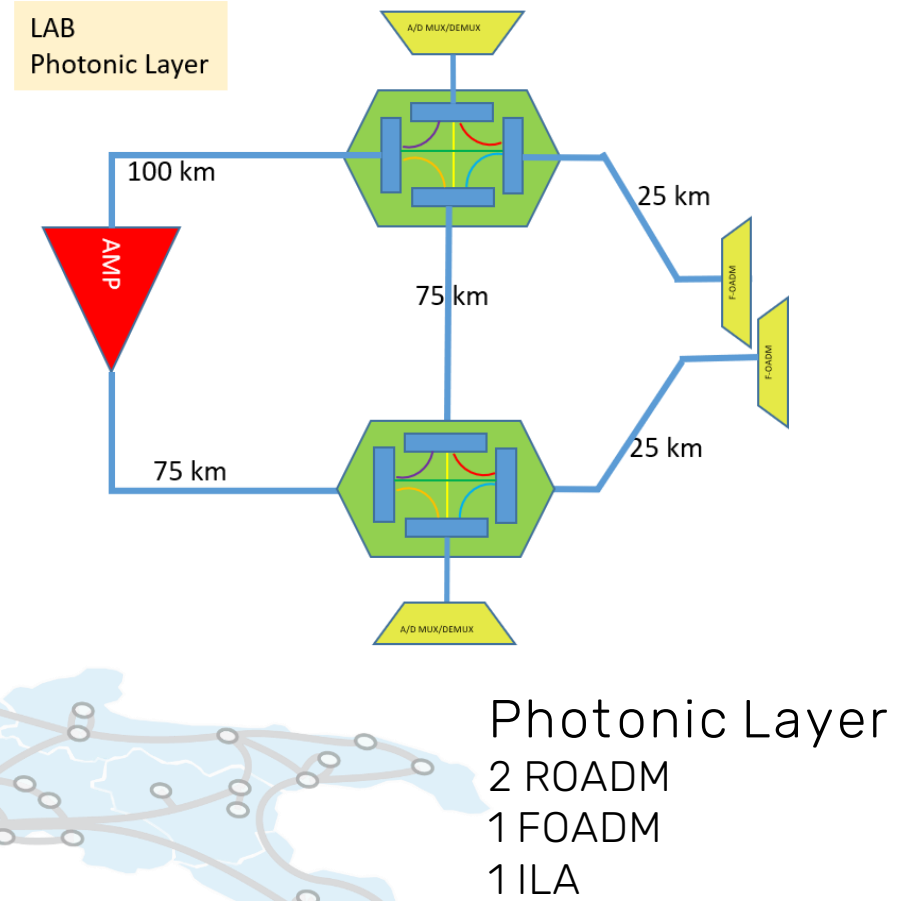


Fiber spools
300km G.652d fiber
Spools of 25 and 50 km



LAB/Production Network Integration
Paths on GARR DWDM infrastructure
60km
900km
1500km

- 1516 km
- 926 km
- 59 km



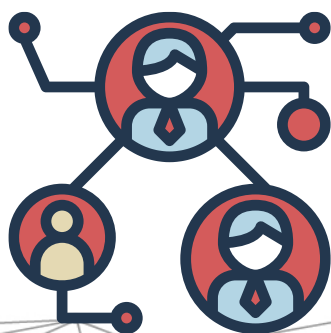
Conclusion

Infrastructure:
GARR-T network as an enabling
infrastructure not only for Data Services

RETE
GARR



Opportunities:
Fully exploit fiber infrastructure potential
supporting community research activities



Challenges:
Technical and mindset shift
Beta Testers
Implications not related with R&E community