Time for a new SIG

Special Interest Group for Time & Frequency Networks

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SIG-TFN

- In February at a meeting of NRENs and metrologists it was agreed to create a **new SIG**
- This will be a **new community** which brings together NRENs and metrology
- There is already **strong interest**: sig-tfn@lists.geant.org has 100 subscribers

SIG-TFN

GÉANT is the coordinator of SIG-TFN

- Web page: https://community.geant.org/sig-tfn/
- There are two working groups within the SIG-TFN:
  - T/F Sustainability (led by Richard Lui)
  - C-TFN technical specification (Led by Guy Roberts)
- We will have the first in-person SIG-TFN meeting in Amsterdam on the 16/17th Oct 2024. https://wiki.geant.org/display/SIG/1st+SIG-TFN+meeting+-+Amsterdam%2C+Netherlands

C-TFN sustainability working group

Team

Richard Lui
Raphaël Marion
Christian Chardonnet
Wojbor Bogacki
Christian Lisdat
Davide Calonico

Objectives

- Investigate a path to sustainability of the CLONETS-DS C-TFN, both for GÉANT and for participating NRENs and NMIs.
- Carry out cost modelling to identify the extent of the future funding needs for fibre and flywheels
- Engage EURAMET, NRENs, GÉANT and the European Commission to find solutions to long-term funding.

C-TFN technical specification working group

Team

Guy Roberts
Jochen Kronjaeger
Raphaël Marion
Krzysztof Turza
Jacques-Olivier Gaudron

Objectives

- Expand on the CLONETS-DS architecture and integrate lessons learnt from PTB-PSNC pathfinder.
- Investigate if tiers of flywheel performance are needed e.g NMI flywheel, NREN flywheel, etc.
- Prepare a technical specification for the C-TFN flywheels.
- Prepare a technical specification for the GÉANT should build their cross-border fibre links.

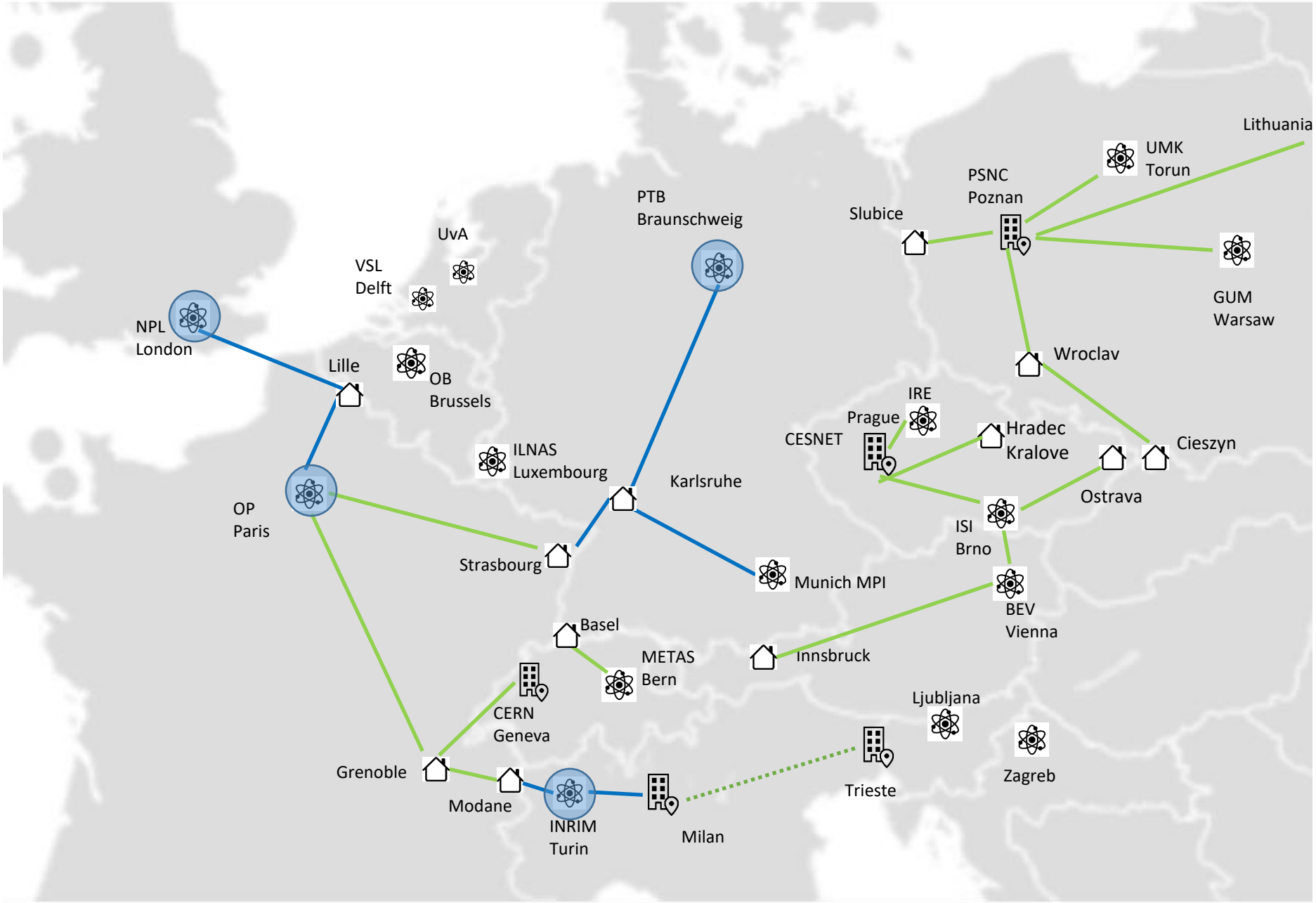
Summary of use cases

- **Supplement GNSS** with a fibre network to increase reliability of time distribution
- **Support the redefinition of the SI second** being carried out between now and 2030 by NPL, PTB, Syrte and INRIM.
- Perform **fundamental physics research** e.g. gravity wave experiments.
- Support **European-wide commercial services** such as very accurate time stamps for banks to validate high-frequency trading.

So what can GEANT/NRENs do?

- National TF fibre networks are **fragmented**, without a coordinated plan to integrate them into a unified network (CLONETS-DS)
- GÉANT and NRENs can build a unified network based on **federating** existing national time/frequency distribution infrastructures
- Invest in coordination between NRENS and NMIs to build a sustainable **community**
- Identify **long-term funding** beyond 2027

How things stand today



Frequency network:

- Green links built by NRENs in collaboration with national NMIs
- Blue links built by local NMIs/researchers

NMIs:

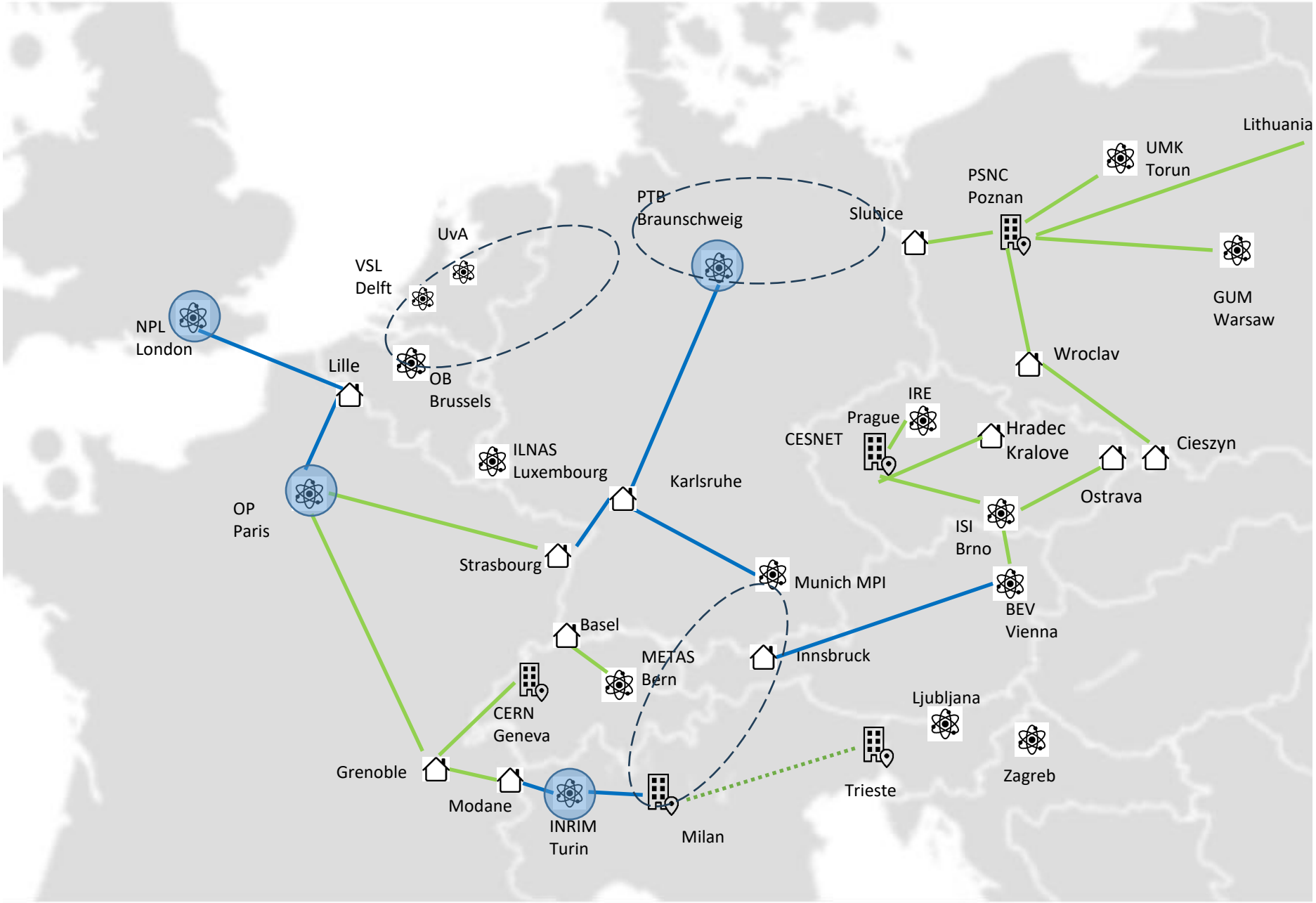
- Four big NMIs are involved in redefining the SI second highlighted in red

NMI Frequency reference

Research institute

Hut for housing RLS

What is missing?



Missing:

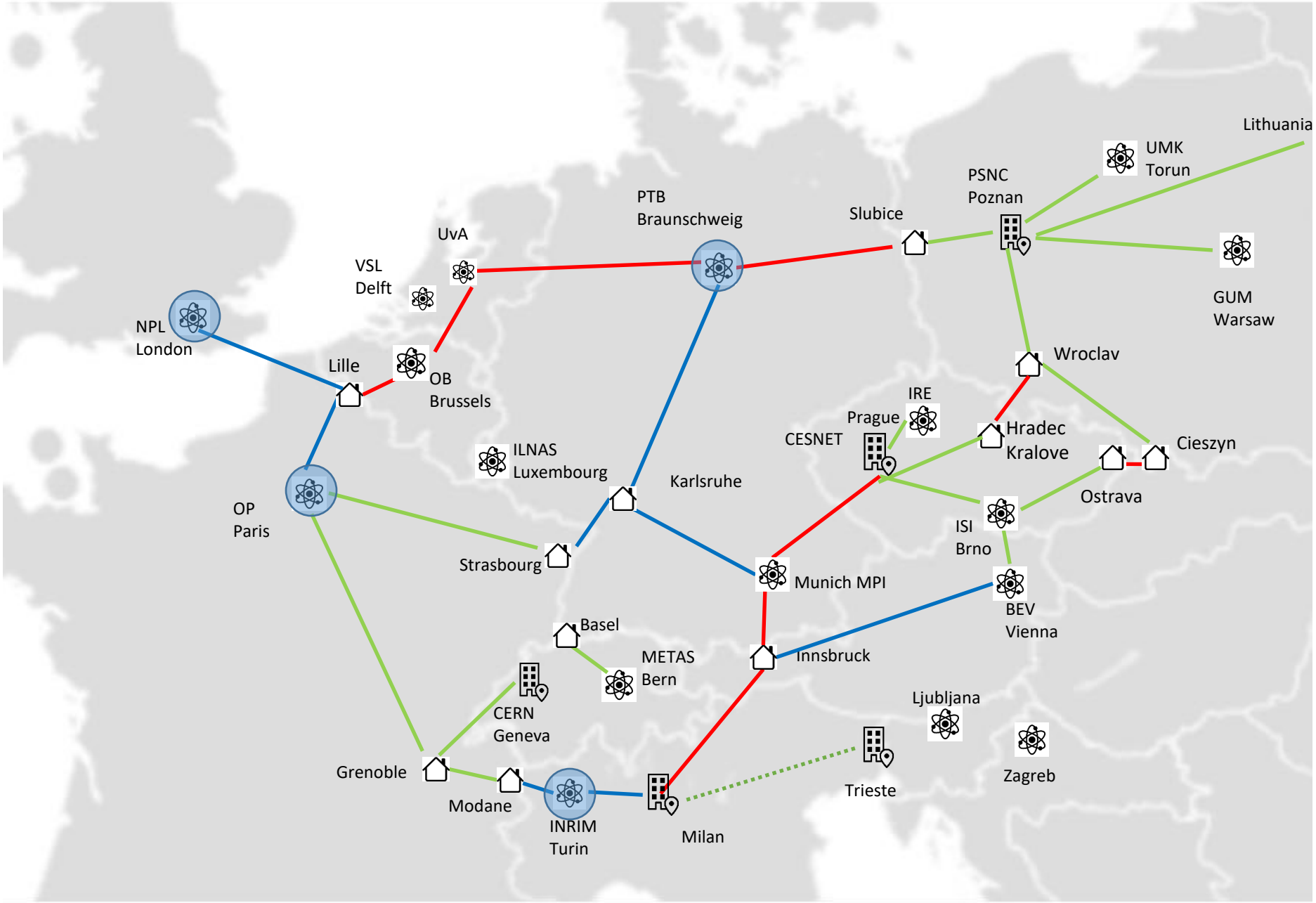
- National based networks need to be interconnected
- Eastern and Western islands of frequency services are not linked
- A full ring/mesh of the big four NMIs will enable them to complete definition of the SI second
- Link will also be needed to Nordics, SE and SW Europe as they develop Optical clocks

NMI Frequency reference

Research institute

Hut for housing RLS

Proposed solution



Solution:

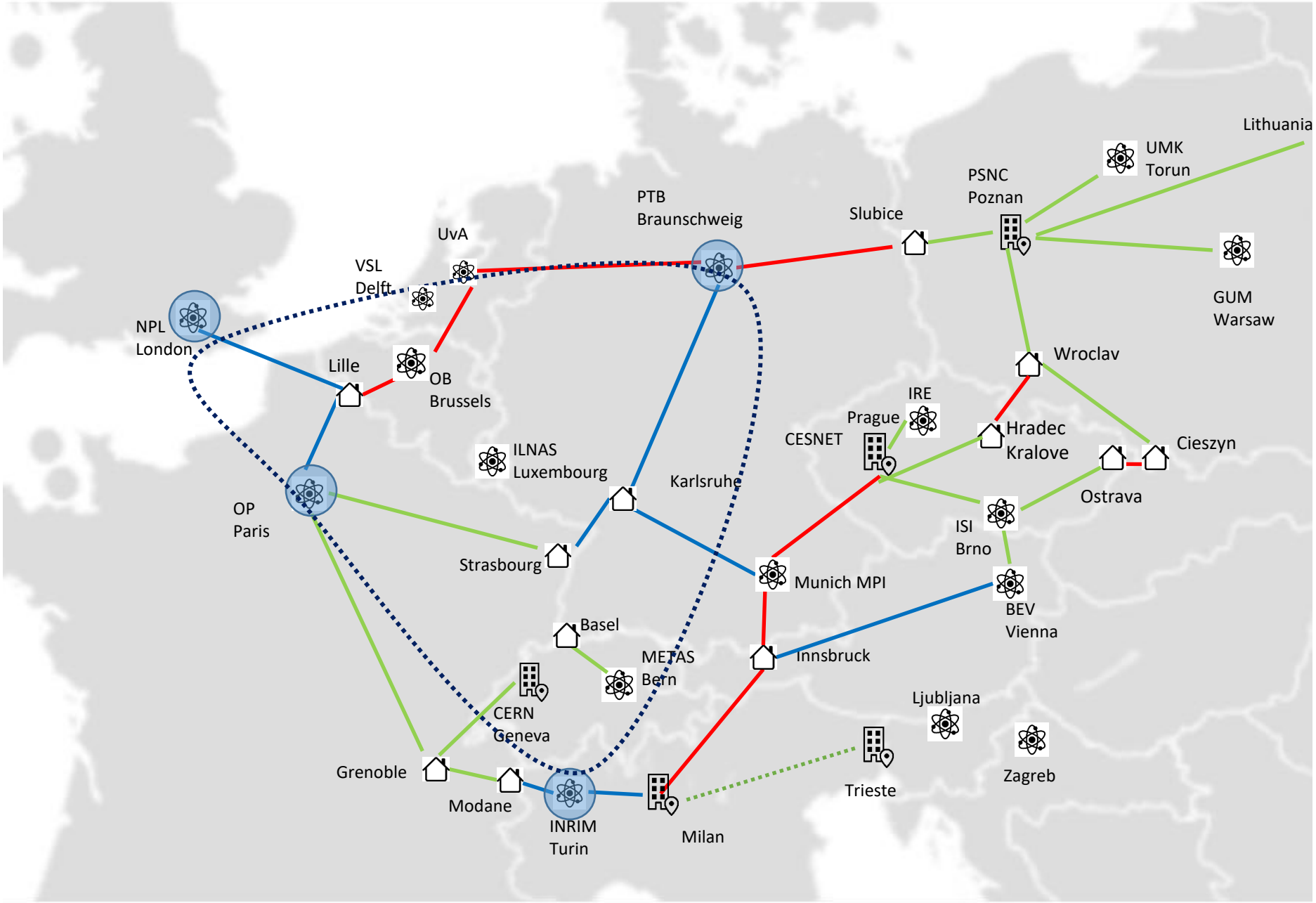
- Red lines are proposed for GN5-2
- These will interconnect national ‘islands’ of frequency networks
- Support redefinition of the SI second
- Primary users are national frequency reference providers
- Secondary users are research institutes that connect via their national frequency provider

NMI Frequency reference

Research institute

Hut for housing RLS

Proposed solution



Solution:

- Ring supports the four big NMIs that are part of the campaign for redefinition of the SI second

NMI Frequency reference

Research institute

Hut for housing RLS

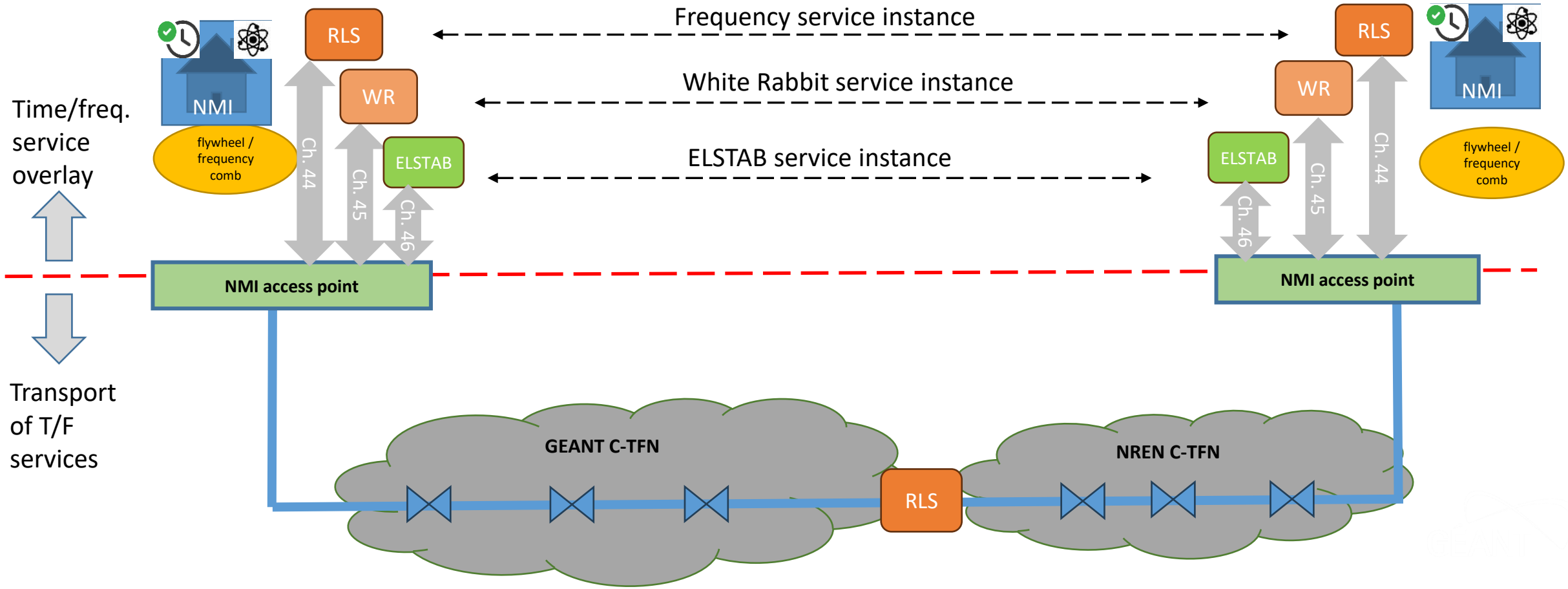
Architecture: services overlay fibre links

NMIs

- Build, own and operate the T/F equipment:
  - Flywheels, counters, frequency combs
- Retain ownership of time/frequency
- Generate and measure time/frequency
- Terminate T/F services

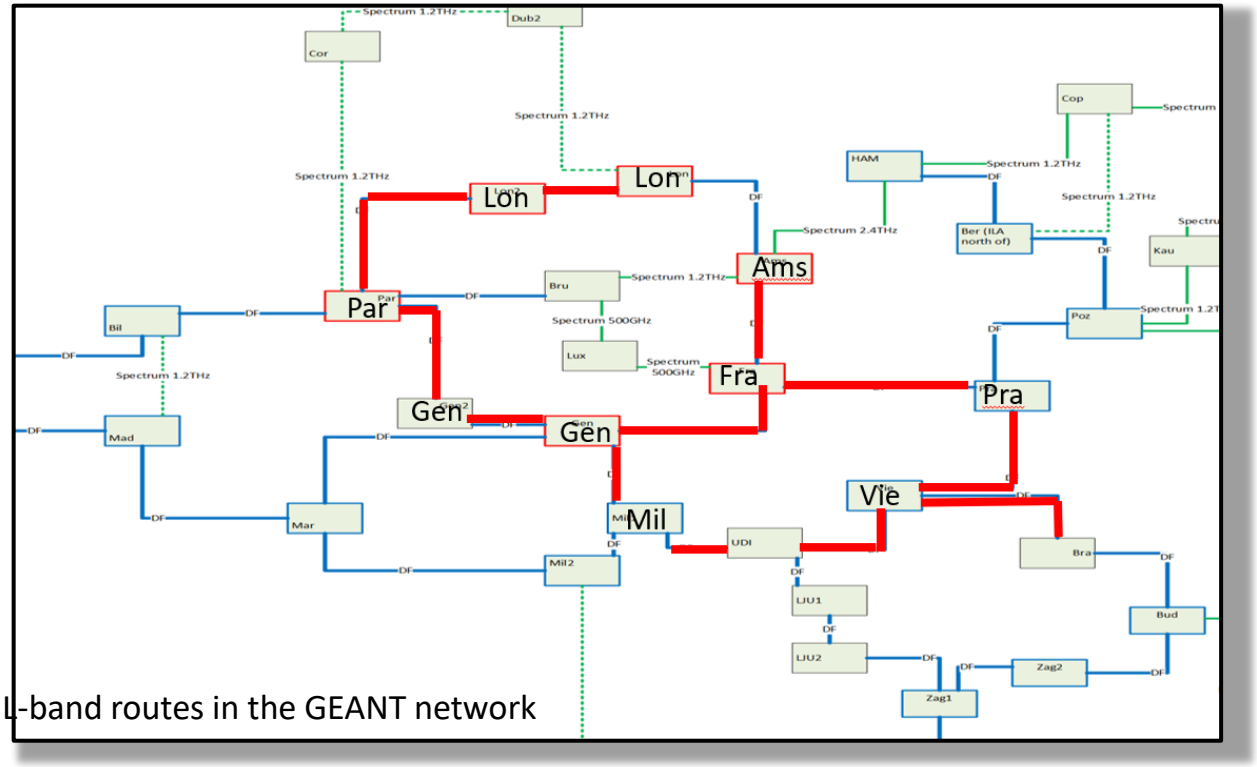
GEANT, NRENs

- build, own and operate transport links:
  - fibre, amplifiers, access points, intermediate RLS
- Provide a service to NMIs to carry T/F services



Frequency or White Rabbit on GEANT internet fibre?

- After detailed investigation we decided it was **not** feasible to mix frequency with data on existing GÉANT fibre due to limitations of our DWDM equipment.
- For this reason, **dedicated** fibre is recommended for **frequency** distribution.
- NRENs such as SURF and CESNET are deploying White Rabbit on their dark fibre networks.
- Could GÉANT put **WR on our network**?
  - possibly, pending further tests
  - either in the L-band links
  - or overhead channels



L-band routes in the GEANT network

Because of frequency distribution requirements, the C-TFN will need dedicated time/frequency distribution fibre

Benefits to NRENs of the C-TFN

- **Enhanced Knowledge Exchange and development expertise**
  By sharing knowledge and best practices with NRENs, this initiative fosters the development of specialized expertise in time and frequency network deployment and management.

- **Strengthened Collaboration between NMIs and NRENs**
  The initiative acts as a bridge, enhancing the flow of information and support between National Metrology Institutes (NMIs) and NRENs.

- **Direct Engagement with the Research Community**:
  By working closely with researchers, GÉANT and NRENs can contribute significantly to the development of science data repositories and scientific workflows.

- **Opportunities for New Services and Applications**:
  The expanded capabilities of the C-TFN will enable NRENs and GÉANT to explore and offer new non-data services, potentially opening new opportunities for collaboration in diverse scientific and commercial sectors.

- **Contribution to European Scientific Leadership**:
  By fostering an integrated European T/F network, this initiative significantly contributes to Europe's standing as a global leader in high impact scientific research and technology.

Pathfinder system

- First proof-of-concept link for the CLONETS C-TFN, the purpose is to prove both frequency and time transfer
- GÉANT fibre is now in place from PTB to the polish border an PSNC fibre to Poznan
- Amplifier and RLS equipment installation is happening now

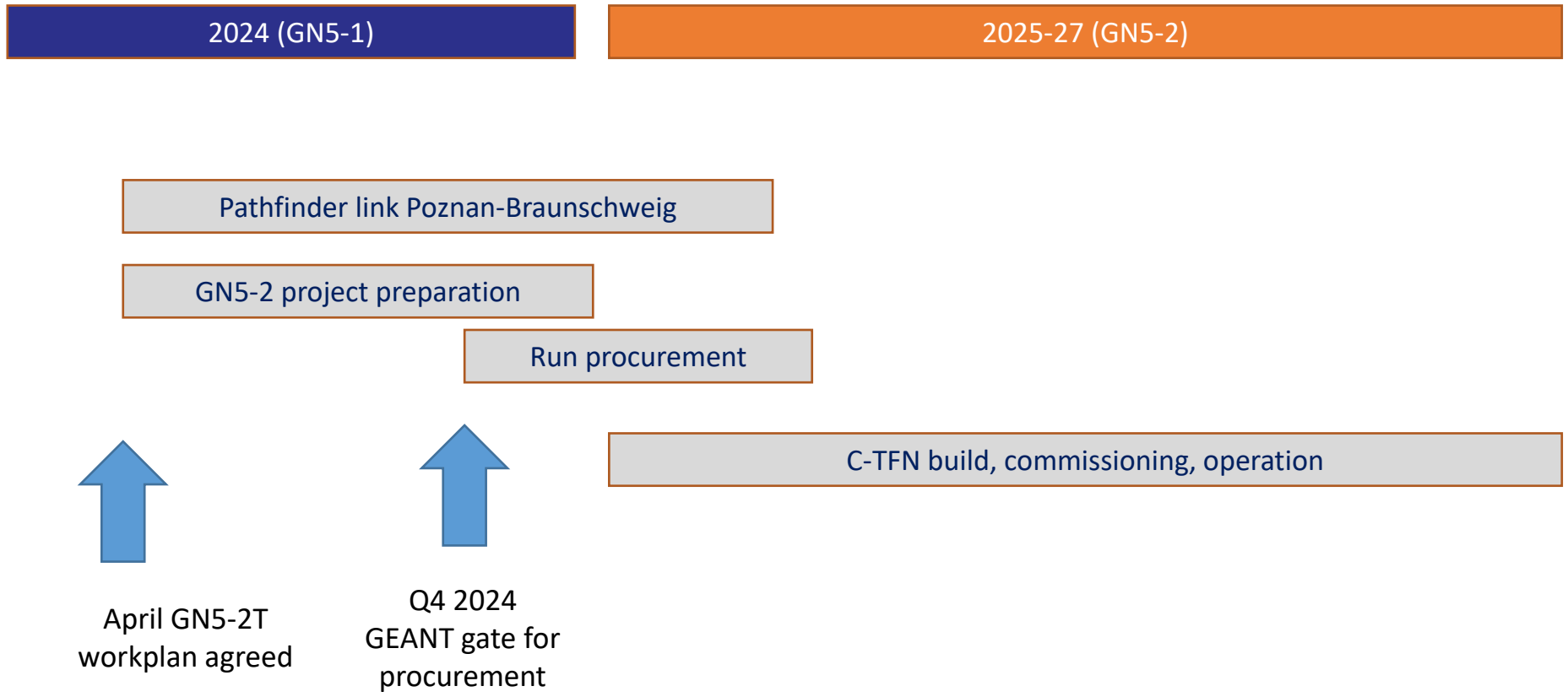
Bi-directional amp

Regenerator laser station

ELSTAB

C-TFN Timeline

- 2024: build and Pathfinder link and prepare C-TFN
- 2025 - 2027: Build TFN Phase 1
- After July 2027: TFN Phase 2 (funding not yet identified)



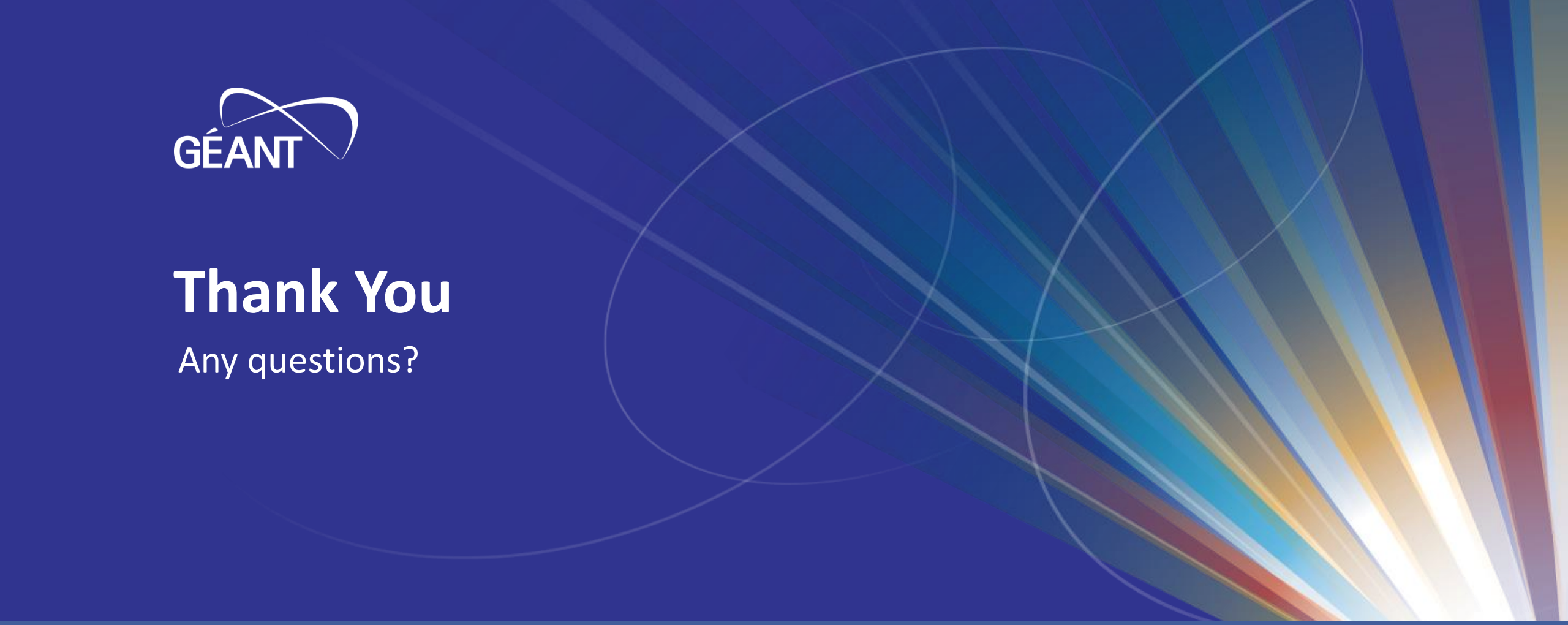
Conclusions

GÉANT is building two new fibre links:

- France-Belgium-Netherlands-Germany-Poland in 2025
- Italy-Austria-Germany-Czechia-Poland in 2026

GÉANT coordinates the requirements of both NMIs and NRENs in SIG-TFN along with its specialist sub-groups

Sustainability efforts will identify GÉANT, NREN and NMI funding for 2027 and beyond



Thank You

Any questions?

www.geant.org

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