



# Belgian Time and Frequency Services

## Workshop 2026

10/03/2026

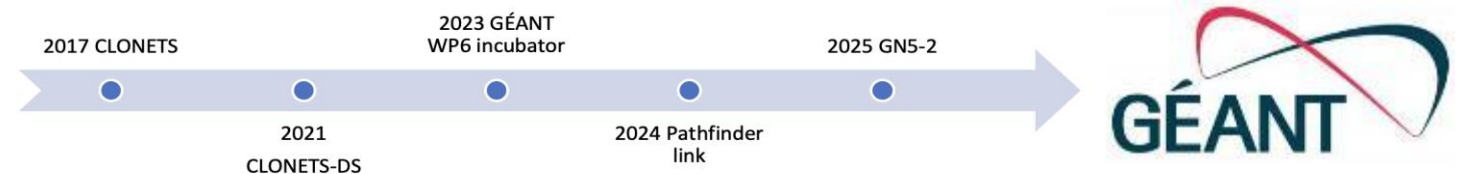
Raphaël Marion



**BOOSTED**

## The Belgian Optical network for Optical frequency Standards and TimE Dissemination project (*BOOSTED*)

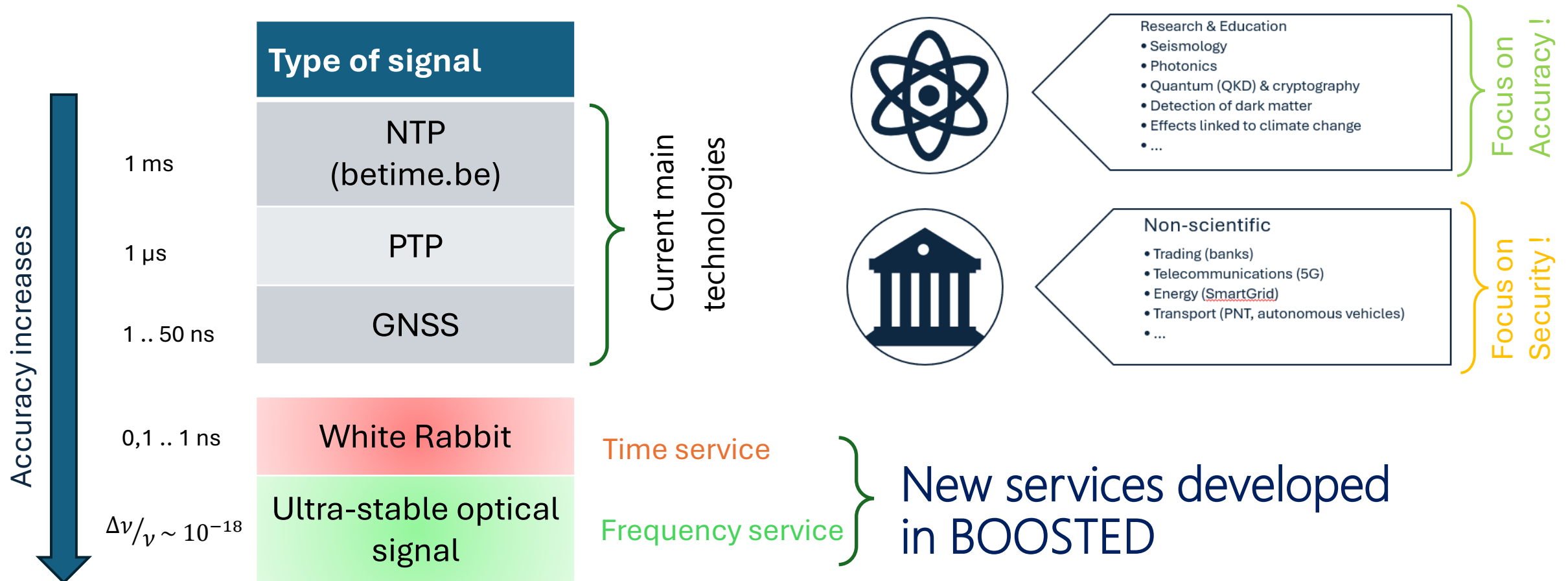
- 1 M€ funded by BELSPO, until end of 2026
- Project lead: ROB
- Strong collaboration between ROB & Belnet
  - ❑ T&F signals produced, broadcasted and monitored by ROB
  - ❑ Transported by Belnet over its optical fiber network
- Also transport signals internationally through collaboration with GEANT into European C-TFN project



# New physical support New performances New applications

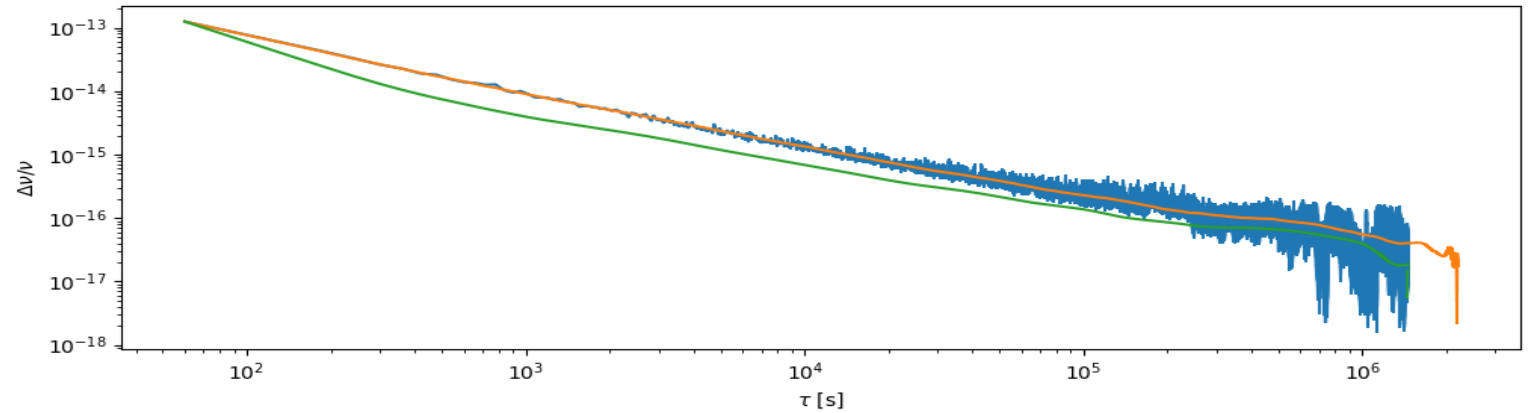
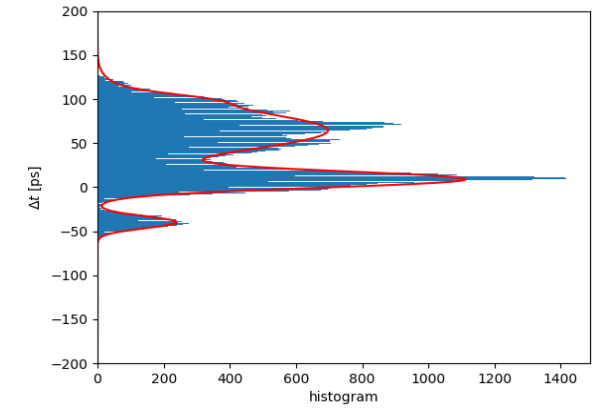
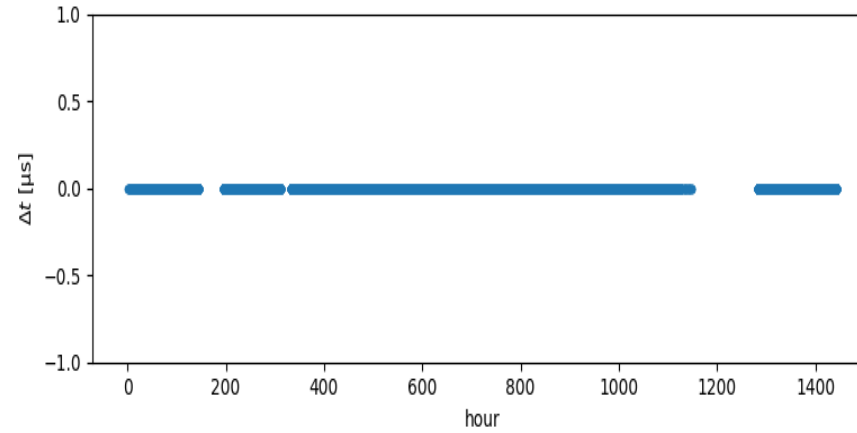
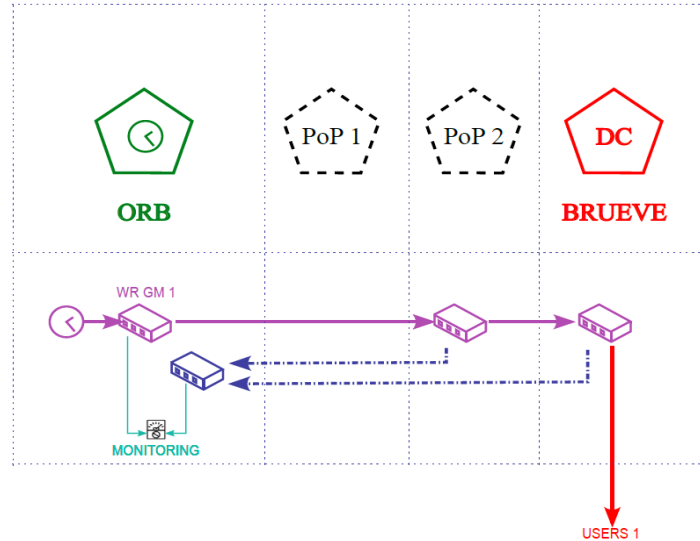
## Technologies

## Uses cases



# December 2025: The roll-out of the very first BTFS links

## BTS phase 1



# Roadmap 2026

- **Network**
  - Connect SMD, Mons, Charleroi, LLN
  - Planification of new paths
    - Route 1 : Antwerpen, Gent
    - Route 2 : Leuven, Hasselt, Liege, Arlon, Luxembourg
- **Time**
  - Expand the network
  - New partnerships to stimulate the service to the mass market
  - European network : OCITS
- **Frequency**
  - Develop the primary optical source
  - Roll-out of “big” equipment : MLS, COMB
  - European network : ARCSECOND



# PNT Commission

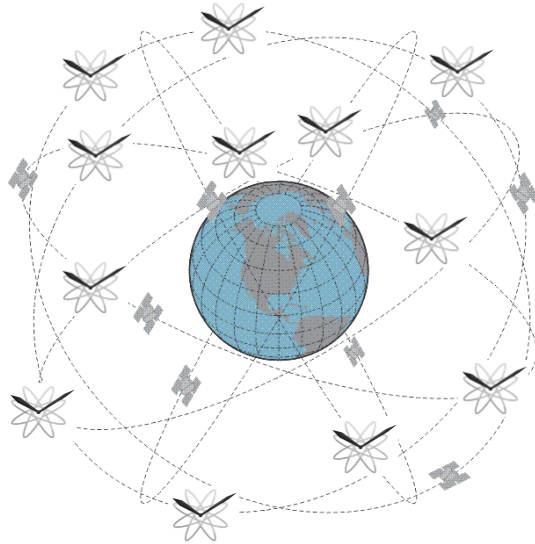
# Conventional PNT: Basics

Belnet

Connecting communities

Constant speed of light:  $c = 30 \frac{cm}{ns}$

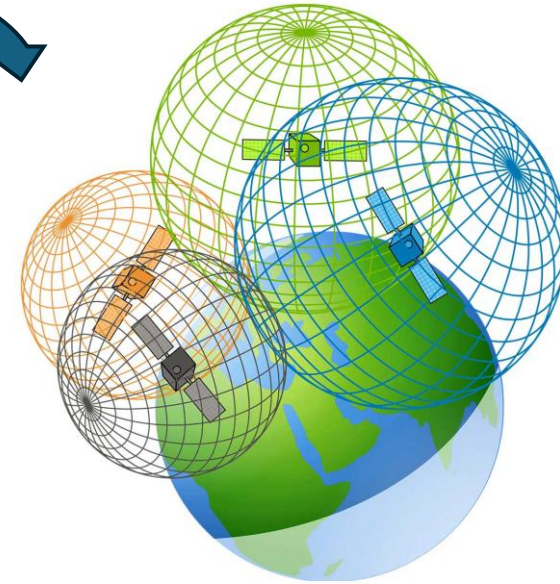
$$\Delta x = c \cdot \Delta t$$



Satellites



Flying clocks : {tsat}

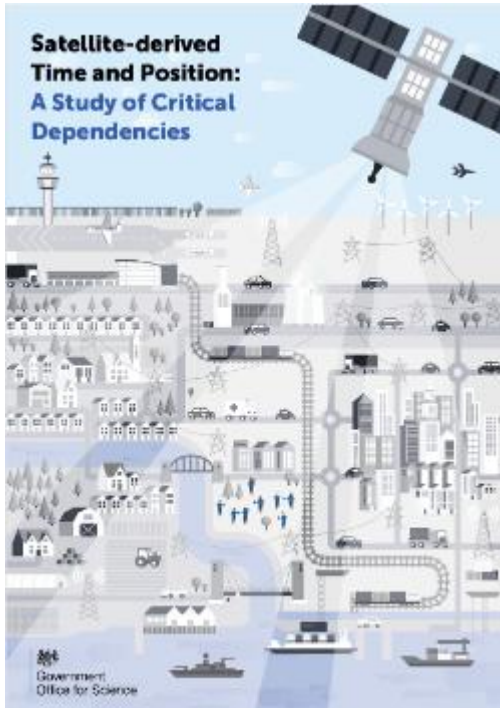


4 pseudo-ranges



Local time + 3D positioning

# Global navigation satellite system (GNSS) = "invisible utility"



Blackett review

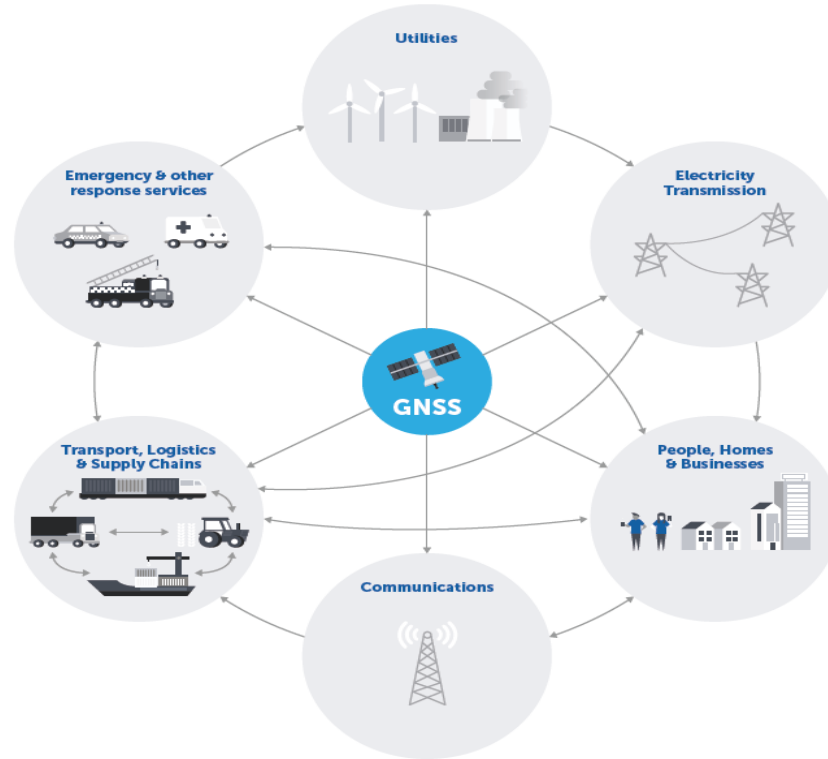


Table 3.1  
Sector dependency on time and position

	Telecoms	Emergency Services	Energy	Finance	Food	Transport
Time	✓	✓	✓	✓		
Position		✓	✓		✓	✓

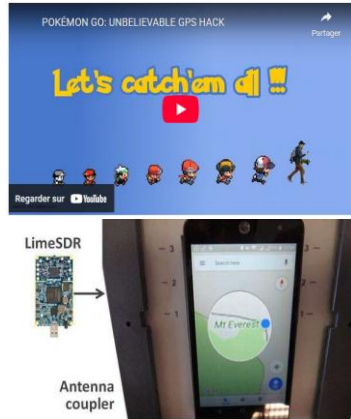
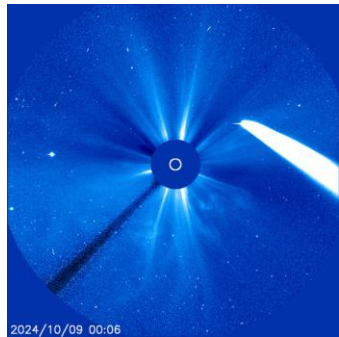
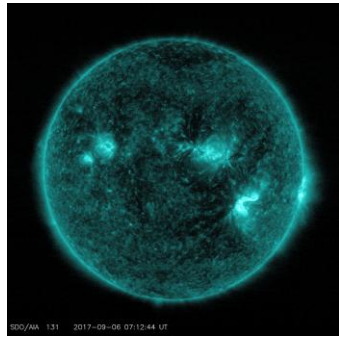
About **€1.40 trillion** is enabled by GNSS in EU (10% of Gross Domestic Product)

source : JRC – ERNP 2023

# GNSS threats

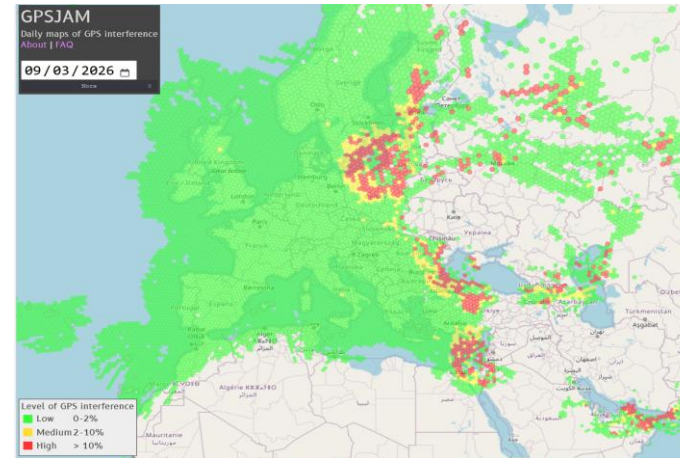
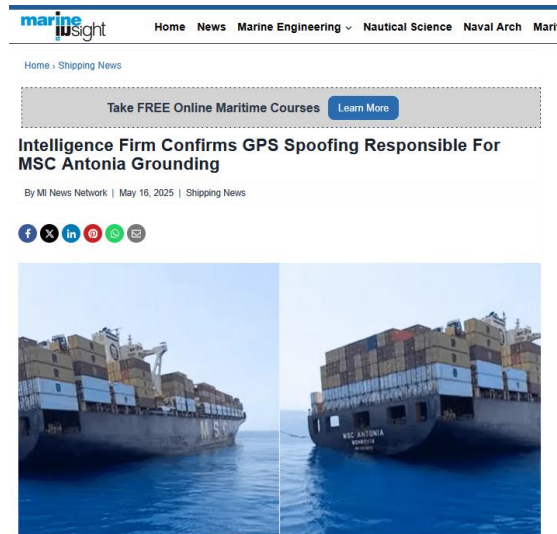
Natural causes...

... or not



Article  
**Jamming and Spoofing Techniques for Drone Neutralization: An Experimental Study**

Younes Zidane<sup>1,2</sup>, José Silvestre Silva<sup>1,3</sup> and Gonçalo Tavares<sup>2,4</sup>  
Drones 2024, 8(12), 743; <https://doi.org/10.3390/drones8120743>



gpsjam.org

- GNSS has many vulnerabilities:
  - Jamming
  - Spoofing
  - Meaconing

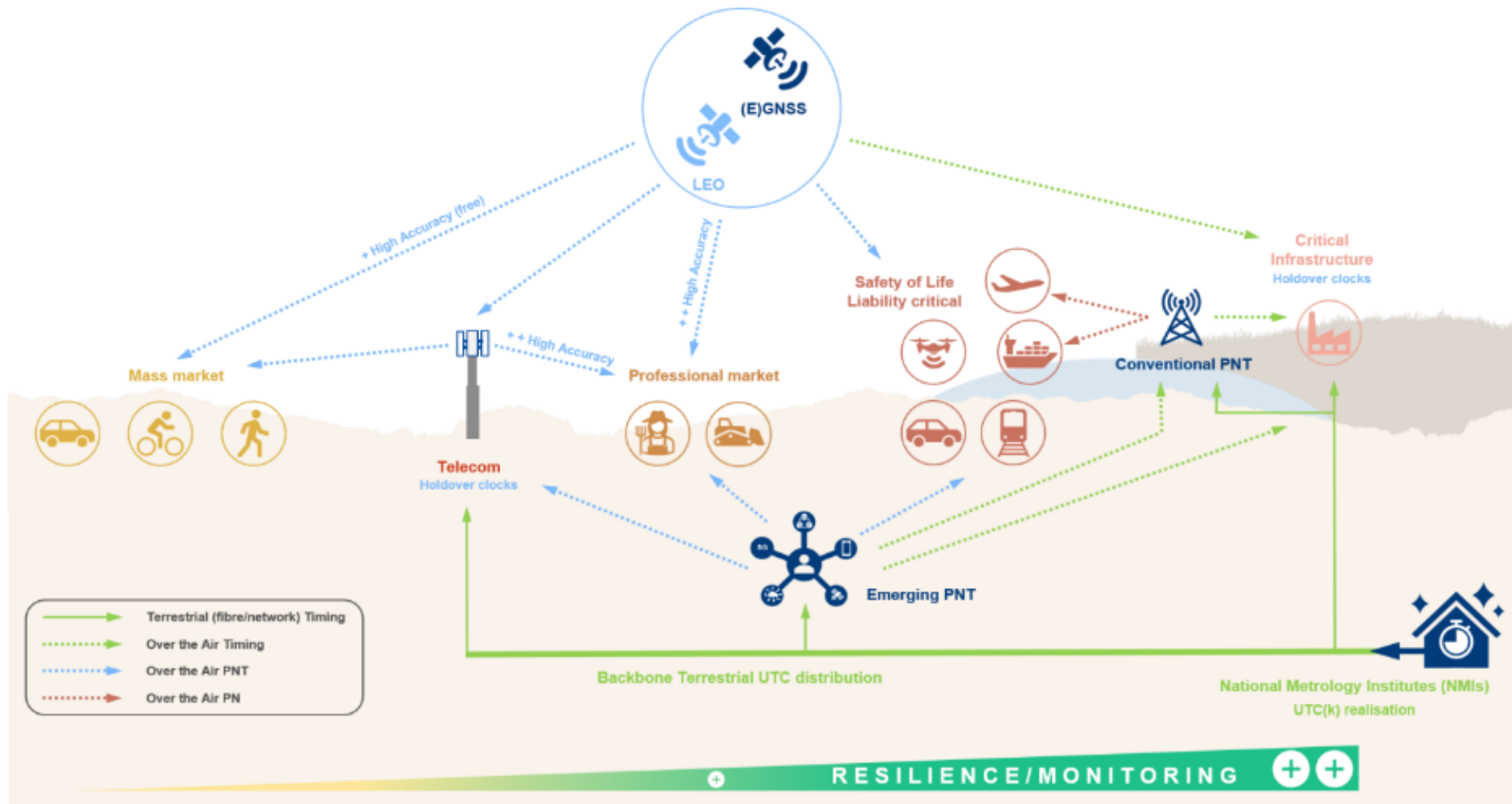
- UK estimated that a GNSS outage would cost the UK €90 billion/week !

➔ BE ≈ €1 billion/wk

- International context increases the probability of PNT disruptions

➔ [www.stce.be](http://www.stce.be)

# A resilient C-PNT system-of-systems



- An **opportunity** for new applications
- A **must-have** for any critical users / infrastructures / services :
  - Telecom
  - Energy
  - Transport
  - Finance
  - ...

Source : *European Radio Navigation Plan 2023*

# A resilient C-PNT in practice ?

Belnet

Connecting communities

## Sectors

Telecoms

Energy

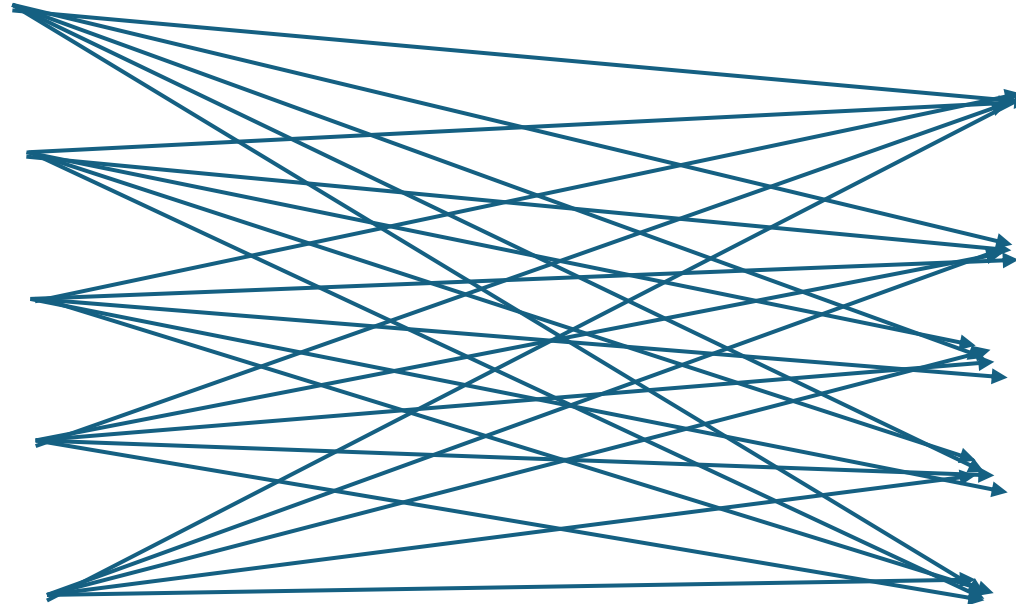
Transport

Finance

Military

...

For now, in BE



## Ministries

Interior  
Affairs

Foreign  
Affairs

Economy

Energy

Mobility

Research

Budget

Defense

North Sea

Finance

# A resilient C-PNT in practice ?



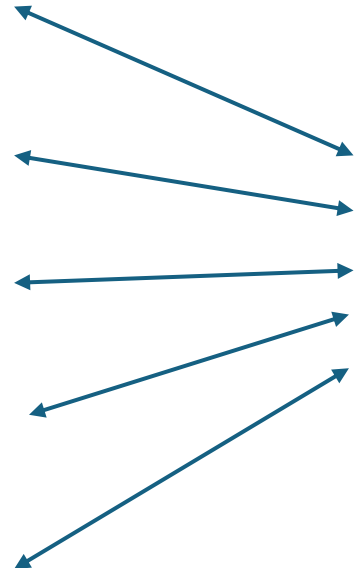
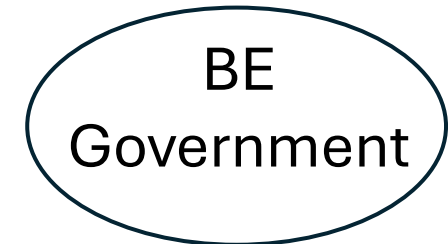
## Sectors

- Telecoms
- Energy
- Transport
- Finance
- Military
- ...

Tomorrow in BE ?



## Ministries



# FASTER Collaboration



# The FASTER Collaboration



“The Frequency And Synchronisation Timing for Enhanced Research (FASTER) Collaboration is a grouping of all universities, high school, research centres, etc. interested in using time and frequency (T&F) signals for scientific research and technological development purposes”

Members:



Interested, but not a member yet ?  
We looking forward to welcome you !

# The FASTER Collaboration

- Numerous and various R&D topics, driven by its members
  - Space-qualified clocks
  - Fiber sensing
  - Photonics
  - Quantum
  - PNT systems
  - Spectroscopy
  
- Collaborative approach to deliver the best accuracy through the interdependent T&F optical network, in adequation of the needs
  
- A platform able to coordinate large scientific projects, from national to international scale



# Europe

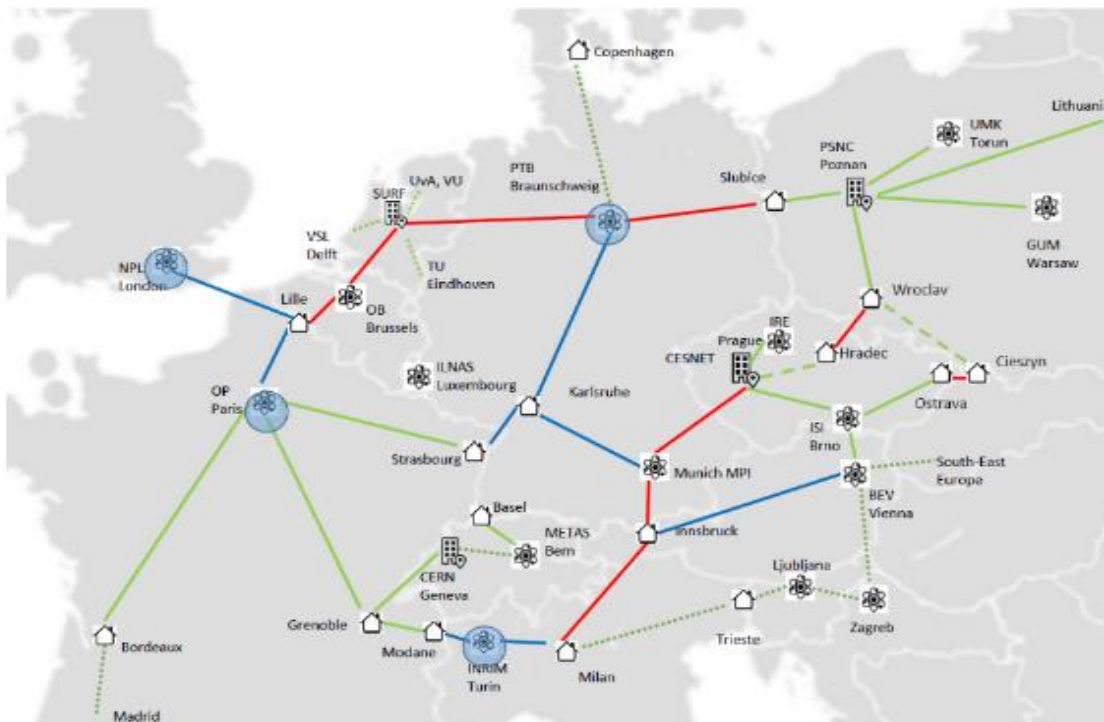


# The pan-European Core-Time&Frequency Network (C-TFN)



C-TFN is the bedrock...

.. on which many EU projects rely



Present

Probable

Future



SRT01 : ArcSecond  
SRT10 : OCITS



New RI on ESFRI  
roadmap

Bureau  
International des  
Poids et  
Mesures



...

➡ C-PNT is currently included within the [next MFF](#) (p78, 3L)



## SAVE THE DATE

Tuesday 24/06 – Wednesday 25/06

Géant 3rd SIG-TFN meeting @ ROB



<https://wiki.geant.org/spaces/SIG/pages/1373241475/3rd+SIG-TFN+meeting+-+Brussels+Belgium>



# Thank You!



**Stay tuned !**

Register for the BTFS newsletters