



BOOSTED project

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Belgian Optical network for Optical frequency Standards and TimE Dissemination

> Implementing a Time & Frequency (T&F) network in Belgium

- ➢ Project lead: ROB
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 - P. Defraigne

With the great support of:



- Collaboration between ROB & Belnet
 - □ T&F signals produced by ROB
 - □ Transported by Belnet over its network

We are just one step on the way to an organization like REFIMEVE

> Also transport signals internationally through collaboration with GEANT into C-TFN project





National Network



The BELNET network







The Belnet network







The BOOSTED network











The FOTON network









The (EWI-FWO) network









Some use cases



Research & Education

Source : FOTON proposal



UCLouvain High-resolution spectroscopy



UMONS Coherent detection phase-OTDR



Space-qualified clock characterization







Cavity solitons









Secured TELECOM against GNSS threats



Quantum Key Distribution



Sensing / Navigation



Precise positioning for railway applications



To-do list :

- Smartgrid
- Trading
- Seismo (ROB)
- VLBI (ROB)



Towards a T&F market?



Connecting communities

European Transport Layer (Geant + NMI)

Producer Layer (NMI)

Transport Layer (NREN)

Commercial distribution Layer (TELCO)

Users Layer





Some open technical questions



The Northern EU "Ring(s)" design







Ring topology



Because it's cheaper and provides better service?

And the SAGNAC effect ?!





The downlink problem







The downlink problem







The downlink problem









So what ?

The "causality problem" could have two possibles explanations :

1. The breakdown in enough spans is sufficient to circumvent the Sagnac effect



A downlink following same path than uplink cancels out the discrepancies
BUT blinds the true frequency at the end node !!



So, downlink *useless* for <u>non-reciprocal noise</u> while ring could possibly provide additional info



The plan

Belgian level:

- 1. Check @AG Refimeve what are the alternative explanations ^^!
- 2. Focus first on dissemination (uplinks) and start with a ring (cheapest)
- 3. Check if it is possible to use the error signal for additional corrections

European level:

- 1. Listen the more experienced partners express themselves
- 2. Warn them that the design could not be changed easily before 10 years
- 3. Press them to speed up to a compromise because of the lead time of the material !!



Thank you !