# WANTIME4EC

## DEFIS/2020/OP/0007

# Alternative Position, Navigation and Timing (AltPNT) technologies

**Demonstration Day at the JRC**
**Ispra, Italy, May 18, 2022**



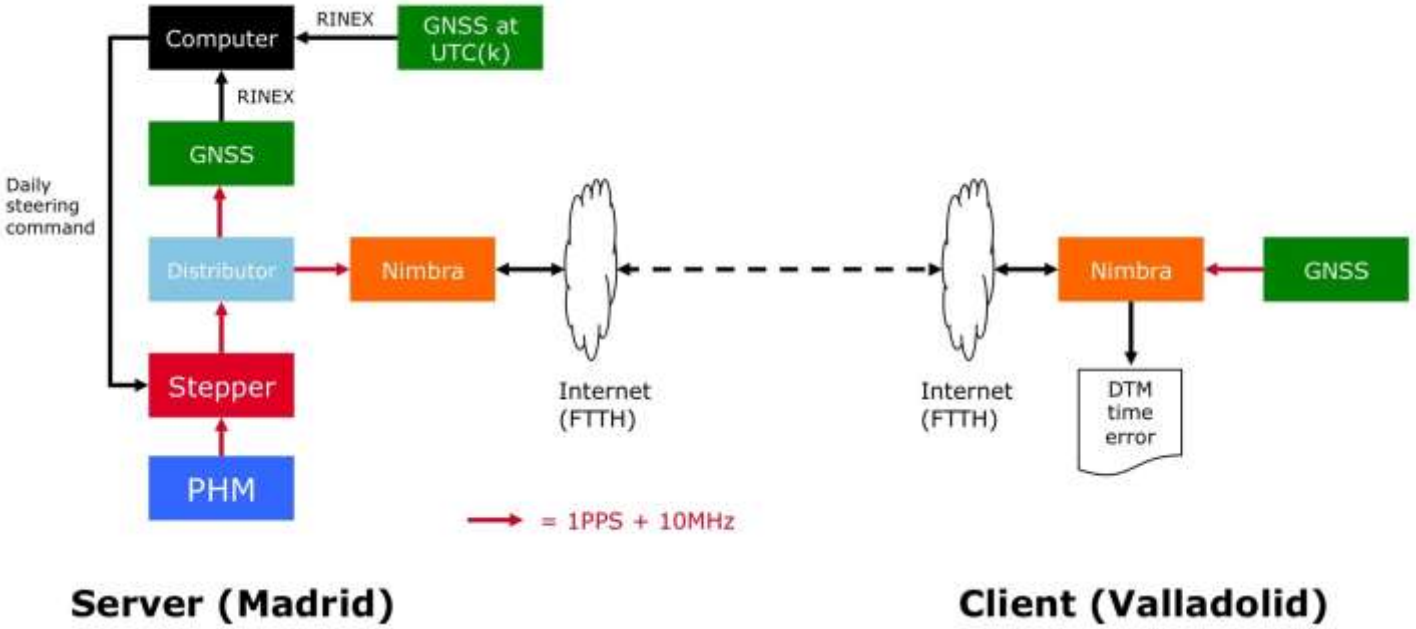
European Commission
JOINT RESEARCH CENTRE
Directorate Space, Security and Migration
Unit Technology Innovation in Security
netinsight
gmv INNOVATING SOLUTIONS

# Technologies

- Server:
  - ✓ Atomic clock (Passive Hydrogen Maser)
  - ✓ Frequency stepper
  - ✓ GNSS time transfer against UTC(k) labs
  - ✓ **DTM** (Nimbra box)
- Two links based on standard network services:
  - ✓ Spain: Fiber To The Home (FTTH), 130 km
  - ✓ Germany: MPLS, 300 km
- Client:
  - ✓ **DTM** (Nimbra box)
  - ✓ GNSS (*WANtime receiver*)
  - ✓ Time Interval Counter (TIC)

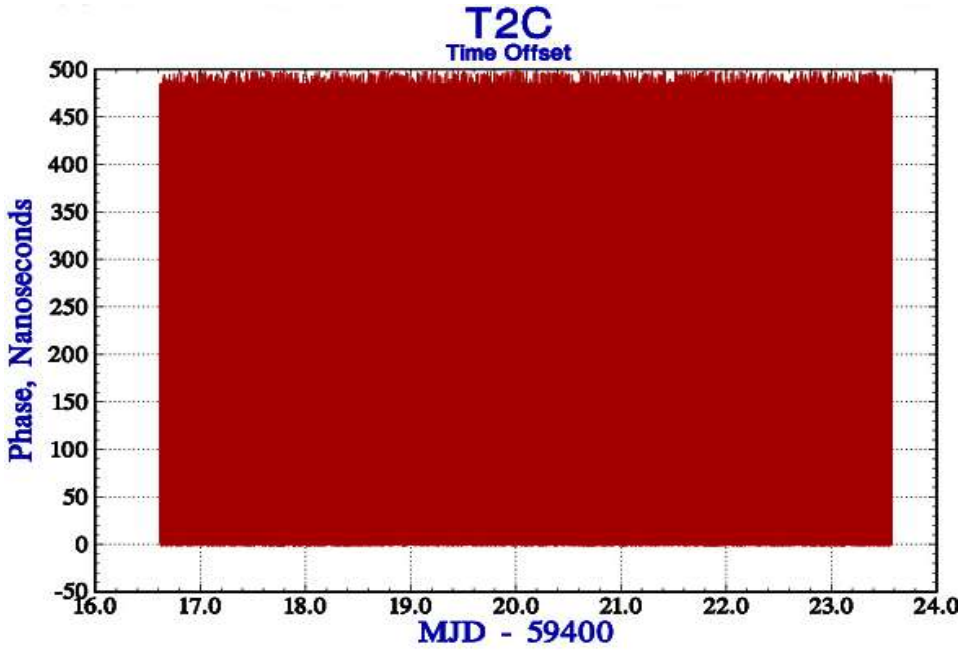


# Test setup (example)



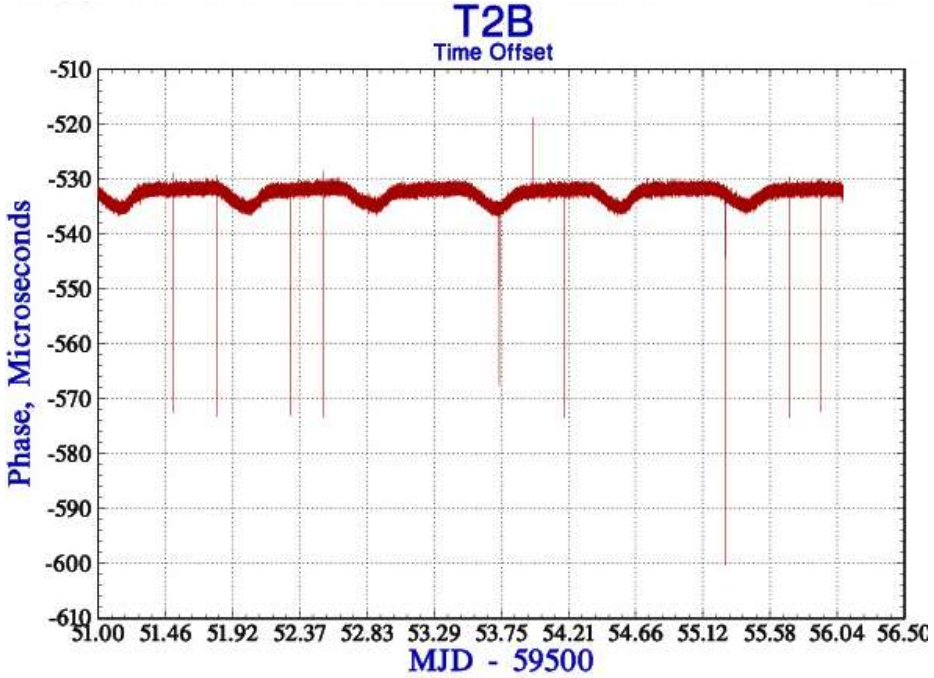
# Test results highlights (1/3)

- **T2C: DTM over MPLS** (Germany, 300 km)
  - ✓ Excellent results over a moderately priced network service (MPLS)
  - ✓ Very good stability over many days
  - ✓ Maximum error of **500 ns** -> fully meets EC requirement of 1 μs at 3-sigma
  - ✓ Very small mean offset (**240 ns**) -> no need for link calibration
  - ✓ Jitter of **140 ns** (1-sigma)



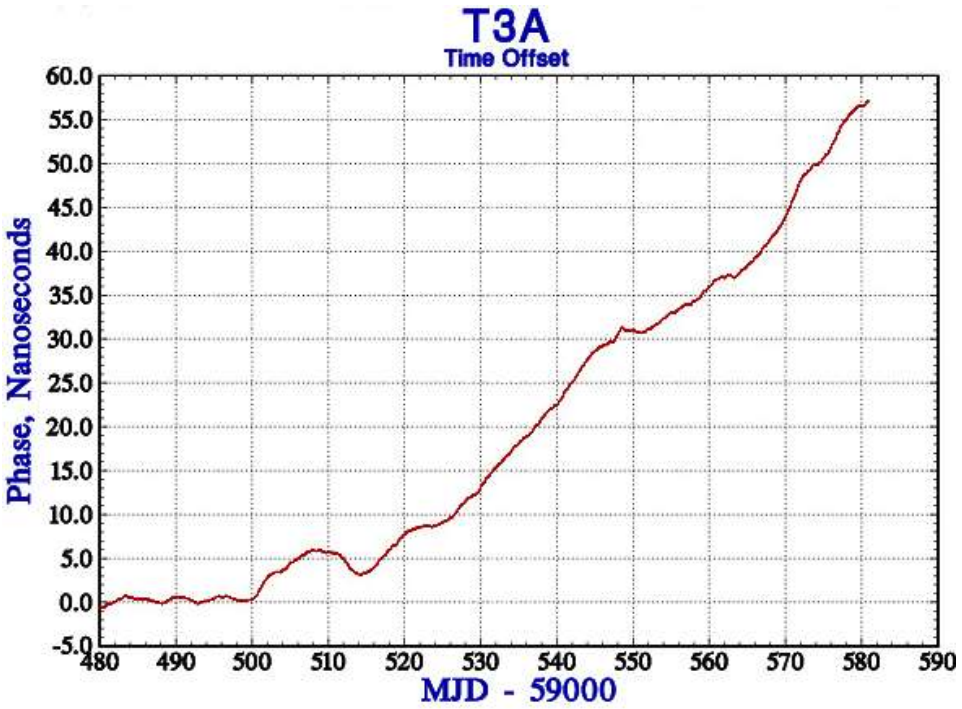
# Test results highlights (2/3)

- **T2B: DTM over FTTH** (Spain, 130 km)
  - ✓ Good general stability considering the inexpensive network service (FTTH)
  - ✓ Jitter is **1 us** (1-sigma) over one day
  - ✓ A "bump" is observed every day during the night
  - ✓ Jitter outside bump is **150 ns** (1-sigma) -> meets EC requirement of 1 µs at 3-sigma, but with an offset (see below)
  - ✓ Occasional "loss of lock" (peaks)
  - ✓ Large mean offset due to network asymmetry (unavoidable in FTTH) -> link calibration required
  - ✓ Occasional jumps in the link after several days due to network reconfigurations (not shown in the figure)



# Test results highlights (3/3)

- **T3A: long-term server holdover**
  - ✓ Excellent atomic clock holdover capabilities: **57 ns** after 100 days without GNSS
  - ✓ Very robust against GNSS outages
  - ✓ Could be eventually fully independent of GNSS by means of two-way time transfer (TWSTFT) to UTC(k) labs using geostationary satellites



# Implementation plan

- A pan-European public time distribution system?
- General-purpose service or focused on critical infrastructure
- Different network services for different accuracy levels (FTTH, MPLS, *dark* fibre…)
- Many synergies with **EGNOS** and **Galileo** ground infrastructure
- Alternative means to distribute Galileo System Time (GST) or Galileo "UTC" via network
- Time servers at EGNOS RIMS
- GNSS or TWSTFT time transfer between servers and the two Galileo PTFs (in Italy and Germany)

# Thank you!

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