GÉANT Infoshare: European Time and Frequency Services - Principles, Challenges and Use Cases

T&F Research and Innovation projects

Wojbor Bogacki, PSNC
Krzysztof Turza, PSNC

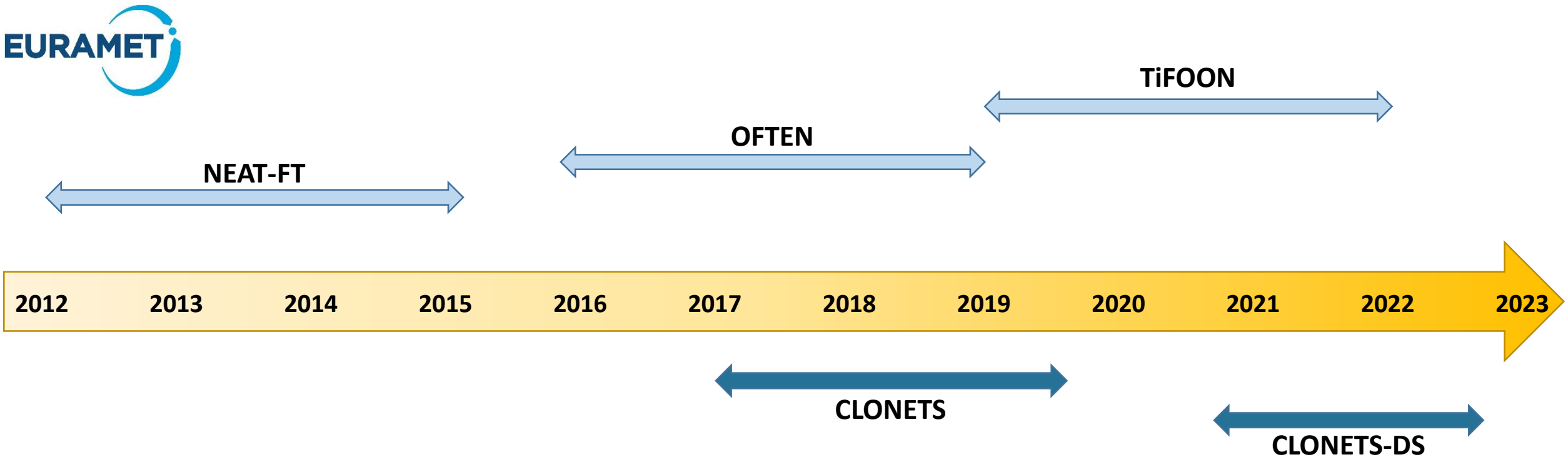
WP6 T1 OTFN
9 March 2021

Agenda

T&F Research and Innovation projects

- Introduction
- Group of users
- TiFOON
- CLONETS
- CLONETS-DS
- T&F project details and homepages

Introduction



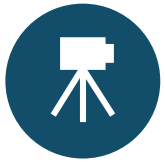
Horizon 2020
European Union Funding
for Research & Innovation

Group of users


Time keeping (NMI)


Telecoms


Radio astronomy (VLBI, LOFAR)


Geodesy


Navigation


Geophysics


Fundamental Research


Optical clocks

TiFOON project

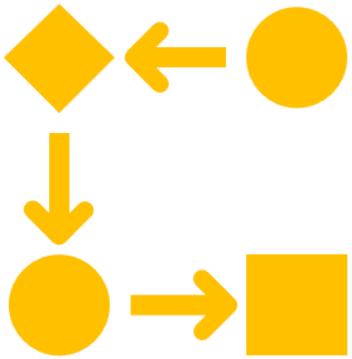
- This **project will advance fibre-based frequency transfer capabilities** in Europe towards a universal tool for time and frequency metrology **by developing combined time and frequency techniques with enhanced performance**, while ensuring compatibility with optical telecommunication networks. In addition the project will promote fibre-optic time and frequency dissemination for applications beyond metrology, for example in geodesy.

[Project - TiFOON (http://empir.npl.co.uk/tifoon/project/)](http://empir.npl.co.uk/tifoon/project/)

TiFOON - project

Direction of work

- Techniques for combined optical time and frequency transfer over fiber networks
- Towards human intervention-free optical time and frequency transfer
- Time and frequency transfer together with data common channels
- Dissemination of time and frequency beyond NMI



TiFOON project – 15 participants

NMI

NPL National Physical Laboratory

INRiM Istituto Nazionale di Ricerca Metrologica

PTB Physikalisch-Technische Bundesanstalt Braunschweig und Berlin

VSL Dutch Metrology Institute

l'Observatoire de Paris SYRTE Systèmes de Référence Temps-Espace

METAS

Academic & Research

RISE Research Institutes of Sweden

Politecnico di Torino

AGH

cnrs Université Paris 13

ISI CAS Institute of Scientific Instruments The Czech Academy of Sciences

TUM

NREN

cesnet

PSNC

Industry

µQUANS Precision Quantum Sensors www.muquans.com

TiFOON

CLONETS project

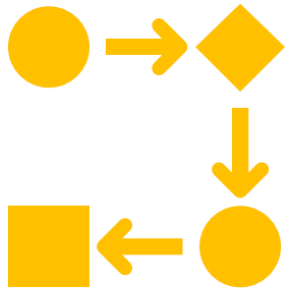
The CLONETS project aimed to prepare the transfer of T&F dissemination new generation of technology to industry and to strengthen the coordination between research infrastructures and the research and education telecommunication networks, in order to prepare the deployment of this technology **to create a sustainable, pan-European network, providing high-performance "clock" services to European research infrastructures**. Further this core **network** should be designed to be **compatible with a global European vision of time and frequency distribution over telecommunication networks, enabling it to provide support to a multitude of lower-performance time services**, responding to the rapidly growing needs created by developments such as cloud computing, Internet of Things and Industry 4.0.

[Project - CLONETS (https://www.clonets.eu/)](https://www.clonets.eu/)

CLONETS project

Direction of work

- Definition of key technologies and trends
- Definition of technology development roadmaps and strategic agenda
- Identification of additional applications and markets
- Impact, training and communication



[Project - CLONETS: Deliverables (https://www.clonets.eu/clonets-summary.html)](https://www.clonets.eu/clonets-summary.html)

CLONETS project – 19 participants

NMI

- l'Observatoire de Paris – SYRTE
- PTB
- NPL National Physical Laboratory
- INRiM Istituto Nazionale di Ricerca Metrologica

Academic & Research

- cnrs
- UCL
- ISI CAS Institute of Scientific Instruments The Czech Academy of Sciences
- AGH
- OPTOKON Fiber Optic Technology Calibration Laboratory
- LPL Laboratoire de physique des lasers – Université Paris 13

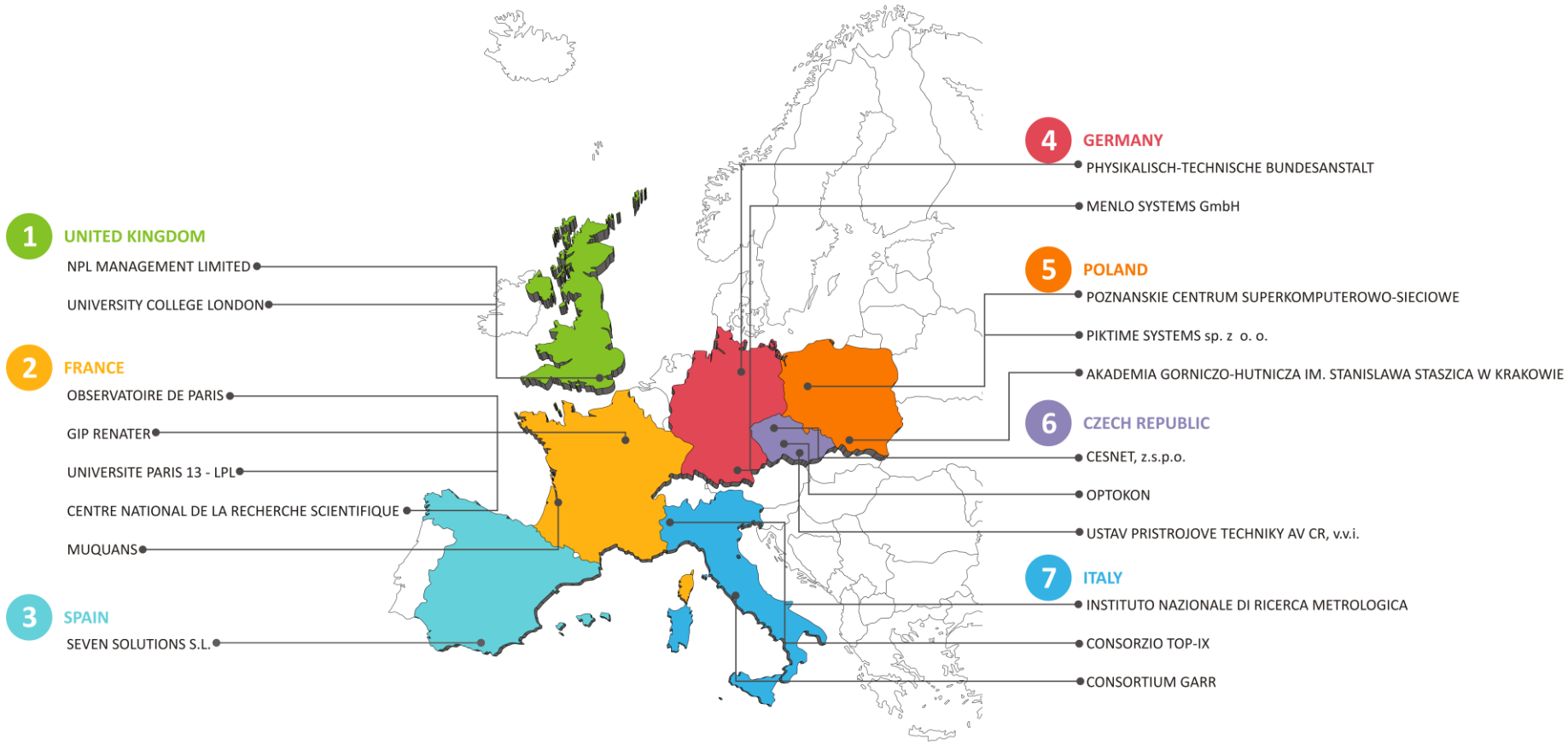
NREN

- PSNC
- cesnet
- Consortium GARR
- RENATER Connecteur de savoirs

Industry

- MenloSystems
- μQUANS
- top-ix torino piemonte internet exchange
- SEVEN Solutions
- PIK Time Systems

CLONETS Clock Network Services



1 UNITED KINGDOM
- NPL MANAGEMENT LIMITED
- UNIVERSITY COLLEGE LONDON

2 FRANCE
- OBSERVATOIRE DE PARIS
- GIP RENATER
- UNIVERSITE PARIS 13 - LPL
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE
- MUQUANS

3 SPAIN
- SEVEN SOLUTIONS S.L.

4 GERMANY
- PHYSIKALISCH-TECHNISCHE BUNDESANSTALT
- MENLO SYSTEMS GmbH

5 POLAND
- POZNANSKIE CENTRUM SUPERKOMPUTEROWO-SIECIOWE
- PIKTIME SYSTEMS sp. z o. o.
- AKADEMIA GORNICZO-HUTNICZA IM. STANISLAWA STASZICA W KRAKOWIE

6 CZECH REPUBLIC
- CESNET, z.s.p.o.
- OPTOKON
- USTAV PRISTROJOVE TECHNIKY AV CR, v.v.i.

7 ITALY
- INSTITUTO NAZIONALE DI RICERCA METROLOGICA
- CONSORZIO TOP-IX
- CONSORTIUM GARR

CLONETS-DS project

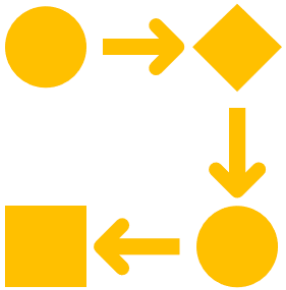
The proposed project aims to **establish a pan-European time and frequency reference system as a European Research Infrastructure to serve the European science community**. It is based on transmitting ultra precise time and frequency information via optical fiber. The proposed project builds on several joint European projects and its direct precursor project CLONETS. We now go far beyond previous efforts by designing a sustainable, pan-European, ultra-precise time-and-frequency reference-system available to the European research community. This Research Infrastructure considers user needs, designs the required architecture, engineering models and roadmaps, and develops a sustainability model for the future service, thus strengthening the European research area.

[Project - CLONETS-DS (https://clonets-ds.eu/)](https://clonets-ds.eu/)

CLONETS-DS project

Direction of work

- Scientific cases
- Technical design
- Governance and sustainability
- Impact and dissemination



CLONETS-DS project – 18 participants

NREN

GÉANT

cesnet

PSNC

RENATER
CONNECTEUR DE SAVOIRS

Academic & Research

cnrs

ISI CAS Institute of Scientific Instruments The Czech Academy of Sciences

UNIVERSIDAD DE GRANADA

AGH

Université Sorbonne Paris Nord

UNIVERSITÄT BONN

UCL

TUM

NMI

PTB

INRiM
ISTITUTO NAZIONALE
DI RICERCA METROLOGICA

Industry

MenloSystems

μQUANS

SEVEN Solutions

PIK TIME SYSTEMS®

CloNetS DS
Clock Network Services Design Study

1. **NETHERLANDS**
   - GEANT VERENIGING
2. **FRANCE**
   - CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS
   - RENATER
   - UNIVERSITÉ SORBONNE PARIS NORD
   - MUQUANS
3. **ITALY**
   - INSTITUTO NAZIONALE DI RICERCA
4. **GERMANY**
   - PHYSIKALISCH-TECHNISCHE BUNDESANSTALT
   - MENLO SYSTEMS GmbH
   - TECHNISCHE UNIVERSITAET MUENCHEN
   - RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITAT BONN
5. **UNITED KINGDOM**
   - UNIVERSITY COLLEGE LONDON
6. **CZECH REPUBLIC**
   - CESNET, z.s.p.o.
   - USTAV PRISTROJOVE TECHNIKY AV CR, v.v.i.
7. **POLAND**
   - POZNANSKIE CENTRUM SUPERKOMPUTEROWO-SIECIOWE
   - PIKTIME SYSTEMS sp. z o. o.
   - AKADEMIA GORNICZO-HUTNICZA IM. STANISLAWA STASZICA W KRAKOWIE
8. **SPAIN**
   - SEVEN SOLUTIONS S.L.
   - UNIVERSIDAD DE GRANADA

T&F project details and homepages

- NEAT-FT Project Details – EURAMET
- OFTEN Project Details – EURAMET
- TiFOON Project Details – EURAMET
- CLONETS CLONETS Homepage
- CLONETS-DS CLONETS-DS Homepage

Thank you

Any questions?

wojbor@man.poznan.pl

kturza@man.poznan.pl

The scientific work is published for the realization of the international project co-financed by Polish Ministry of Science and Higher Education in the years 2019 - 2022 from financial resources of the programme entitled "PMW"; Agreement No. 5023/H2020/2019/2