

Clock Network Services:

strategy and innovation for clock services over optical fibre networks

WELCOME

Dear Colleagues,

welcome to the first issue of the CLONETS newsletter. In this first issue, we would like to introduce the CLONETS project, its objectives and partners and present some of the first results.

We hope that you enjoy reading this newsletter and learning more about the project and its progress. Any feedback regarding this newsletter is much appreciated, in particular as this is our first issue. Please email your comments and suggestions to contact@clonets.eu to help improve our newsletter.

Best wishes,

Eva Bookjans

CLONETS Project Manager

CLONETS – an Introduction

CLONETS (Clock Network Services) is a European funded project, which strives for the creation of a sustainable, pan-European optical fibre-based network providing high-performance time and frequency services to European infrastructures as well as support to a wide range of industrial and societal applications. CLONETS is motivated by recent progress in time and frequency (T&F) metrology and the increasing number of applications, which either are in demand for more accurate and stable T&F reference signals than are currently available through satellite techniques, or cannot rely on broadcasted signals due to, for example, security concerns or reception issues. Optical fibre links have been shown to outperform satellite systems by orders of magnitudes over distances up to the continental scale, while research infrastructures have been developing several different types of fibre-based T&F distribution technologies specifically designed and adapted for their needs. For example, national metrology institutes are installing and operating long-

distance fibre links, in order to compare their optical clocks and pave the way for a new definition of the second and consequently for significantly improved time scales. The project aims to strengthen the coordination between research infrastructures and research and education telecommunication networks, to aid the transfer of this new generation of technology to industry, to define a global vision for a European optical fibre-based T&F service and to define a European core network and prepare a strategy for its deployment.

Objectives:

- **Strengthen the European coordination** between research institutes, NMIs, NRENs and industry
- **Study applications** of fibre-based T&F reference signals and their requirements
- **Identify key technologies** for T&F transfer over optical fibre
- **Transfer knowledge and technology** to society and industry
- **Define a global vision for a T&F service** over optical fibre
- **Define the pan-European core network** and a deployment strategy
- **Inform stakeholders**, users, policymakers
- **Train engineers**, researchers



CLONETS is a Coordination and Support Action (CSA), which receives funding from the EU's Horizon 2020 Research and Innovation Programme under grant agreement no. 73177.

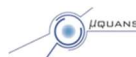
THE CONSORTIUM

The CLONETS project brings together a large variety of organizations with complementary fields of expertise from across Europe. Among the 19 partners are 4 National Measurement Institutes (NMIs), 4 National Research and Education Networks (NRENs), 5 academic laboratories and 6 industrial partners. Their collective knowledge and experience in time and frequency (T&F) applications, optical fibre networks and instrumentation is extensive.

The NMIs, with their state-of-the-art atomic clocks and expertise in T&F transfer, are among the leading institutes in T&F metrology constantly pushing the boundaries of the field. The participating NRENs are strongly invested in T&F dissemination through optical fibre and have a long-standing experience in transferring T&F signals through optical telecommunication networks. Similarly, the involved academic laboratories are continuously investigating new T&F transfer techniques and novel frequency standards. The industrial partners are specialists in developing and commercializing innovative products for T&F applications. Their expertise includes amongst others precise electrical measurements, digital electronics for time transfer through internet protocols, optics, telecommunication platforms and internet exchange and ultra-precise quantum sensors.

In Numbers

- 19 Partners
- 16 Consortium Members / 3 Third Parties
- 4 Types of Institutions
- 7 European Countries
- 30 Months – project duration



National Measurement Institutes

- Observatoire de Paris* (FR)
- National Physical Laboratory (UK)
- Physikalische Technische Bundesanstalt (DE)
- Istituto Nazionale De Ricerca (IT)

National Research and Education Networks

- GIP Renater (FR)
- CESNET, z.s.p.o. (CZ)
- Poznańskie Centrum Superkomputerowo-Sieciowe (PL)
- Consortium GARR** (IT)

Academic Laboratories

- Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie (PL)
- Université Paris 13 –LPL (FR)
- University College London (UK)
- Ústav přístrojové techniky AV ČR, v.v.i. (CZ)
- Centre National de la Recherche Scientifique** (FR)

Industry

- Muquans (FR)
- Menlo Systems GmbH (DE)
- Piktime Systems sp. z o.o. (PL)
- Seven Solutions s.l. (SP)
- Optokon a.s. (CZ)
- Consorzio Top-IX** (IT)

* Project Coordination

**Third parties

Kick-off meeting
Observatoire de
Paris

28th Feb. 2017

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

- ISTITUTO NAZIONALE DI RICERCA METROLOGICA
- CONSORZIO TOP-IX
- CONSORTIUM GARR

MASTER IN PHOTONICS FOR DATA NETWORKS AND METROLOGY



Pilot Master
January 2019 – March 2020

Applications Open!
Deadline: Sept. 28th 2018

In close collaboration with CLONETS, Politecnico di Torino and INRiM have created a Level-2 Master specializing in Photonics for Networks and Metrology. This pilot Master Program focuses on fibre optic networks and their application for T&F metrology and includes lectures, hands-on laboratory courses and an internship in a European company or research institute providing on the job training in the field of photonic technologies. Through this 12 month multidisciplinary Master Program, the students will be trained to design and manage state-of-the-art photonic networks, which support the ever-increasing IP traffic as well as distribute T&F reference signals.

The Master Program is scheduled to start in January 2019 with applications open until end of September 2018. For more information see: <https://didattica.polito.it/master/phonics/2019/glance>

KEY TECHNOLOGIES AND TRENDS

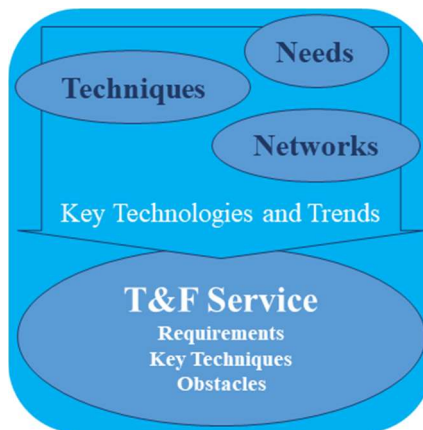
In the first year of the project, CLONETS has gathered information from the time and frequency (T&F) metrology community, NRENs and research infrastructures on state-of-the-art fibre-optic T&F transfer techniques, the fibre-optic networking technologies employed and the need for high performance T&F references via an optical fibre network.

The consortium has identified and surveyed research infrastructures, including NMIs, the result of which indicates a growing awareness of the potential of a fibre-based T&F service and at the same time an increasing need for better performance than currently available via classical satellite based technology.

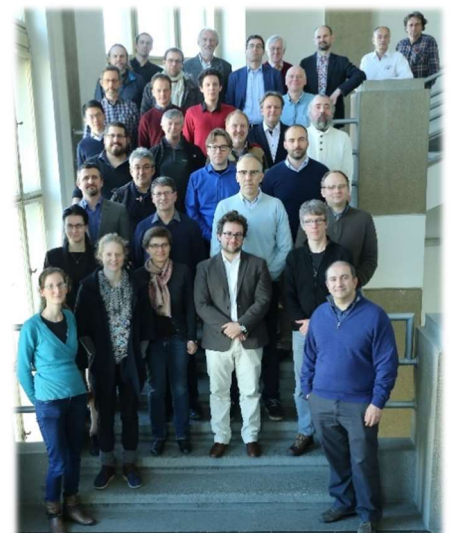
In parallel, the fibre optic networks of NRENs and their capacity for integrating a T&F service into their networks was studied since the fibre-optic networking technologies deployed in telecommunication networks will determine which measures need to be taken to allow for T&F transfer over the network. A special focus was placed on the suitability of "Alien Wavelength" or "Dark Channel" methods for a T&F transfer, with the involved NRENs reporting on their experience with such methods, the accompanying constraints and the considerations that need to be made for their deployment in a network.

Additionally, the consortium has provided a comprehensive overview of high performance T&F techniques including fibre noise compensation and signal regeneration techniques.

The information collected has been summarized in reports that can be found on the projects website (<http://www.clonets.eu/>) and serve as building blocks for the formulation of a common vision for a fibre-based T&F service.



CONSORTIUM MEETING



The second CLONETS Consortium Meeting was held on the 15th-16th January 2018 at CESNET in Prague and was followed by a workshop during which

- the likely key T&F transfer techniques of the future,
- the potential role of fibre compared to satellite based services,
- the requirements for the implementation and integration of fibre based T&F services into an NREN network and
- the key obstacles to implementation were discussed, evaluated, summarized and agreed upon.

Contact:

contact@clonets.eu

Website:

<http://www.clonets.eu/>

