

Fostering the Innovation Potential of Research Infrastructures
INFRAINNOV-2-2016: Support to Technological Infrastructures



CLONETS – CLOck NETwork Services
Strategy and innovation for clock services
over optical-fibre networks

Grant Agreement Number: 731107

Deliverable D4.3

Dissemination templates and training materials
Final

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LIST OF ACRONYMS AND ABBREVIATIONS

CLONETS	CLOck NETwork Services: Strategy and innovation for clock services over optical-fibre networks project
H2020	Horizon 2020
T&F	Time and Frequency
WR	White Rabbit

LIST OF PROJECT PARTNER ACRONYMS

AGH / AGH-UST	Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie, Cracow, Poland
CESNET	CESNET, zájmové sdružení právnických osob, Prague, Czech Republic
CNRS*	Centre National de la Recherche Scientifique, Paris, France
INRIM	Istituto Nazionale di Ricerca Metrologica, Turin, Italy
GARR#	Gruppo per l'Armonizzazione delle Reti della Ricerca, Rome, Italy
Menlo	Menlo Systems GmbH, Martinsried, Germany
Muquans	Muquans, Talence, France
NPL	National Physical Laboratory, Teddington, United Kingdom
OBSPARIS [¶]	Observatoire de Paris, Paris, France
OPTOKON	OPTOKON a.s., Jihlava, Czech Republic
Piktime Systems	Piktime Systems sp z o.o., Poznan, Poland
PSNC	Instytut Chemii Bioorganicznej Polskiej Akademii Nauk – Poznańskie Centrum Superkomputerowo-Sieciowe, Poznan, Poland
PTB	Physikalsch-Technische Bundesanstalt, Braunschweig, Germany
RENATER	Groupement d'intérêt Public pour le Réseau National de Telecommunications pour la Technologie, l'Enseignement et la Recherche, Paris, France
SEVENSOLS	Seven Solutions S.L., Granada, Spain
TOP-IX	Consorzio TORino Piemonte Internet eXchange, Turin, Italy
UCL	University College London, London, United Kingdom
UP13	Université Paris 13, Villetaneuse, France
UPT AV CR (ISI)	Ustav Pristrojove Techniky AV, v.v.i., Brno, Czech Republic

* linked third party to OBSPARIS

third party to INRIM

[¶] coordinator

EXECUTIVE SUMMARY

This deliverable, D4.3 “Dissemination templates and training materials”, describes materials, which were prepared for dissemination, communication and training activities to be held within the framework of the CLONETS project. In order to guarantee that these activities are explicitly associated with CLONETS, templates for presentations, posters and brochures have been created. These templates include the project and participant logos, project information and funding and are color-coded to match the logo.

Based on the deliverable D4.2 “Time and Frequency Training Blueprint”, the Consortium has additionally started a library of training presentations focusing on time and frequency metrology and its applications. A variety of training materials were developed targeting entry-level audiences as well as experts in time and frequency transfer methods. They are readily available to the Consortium and can be employed in various different training and dissemination events. As the project advances, the project participants will update and modify the existing materials and prepare new presentations, posters and brochures using CLONETS templates.

1 TEMPLATES

Training events or dissemination activities held by the CLONETS project should be explicitly associated with the CLONETS project. Therefore, templates for creating dissemination material were created. Templates were prepared for presentations, posters and brochures, respectively. They are color-coded to match the logo of the project, so that training and dissemination materials created using these templates are easily identified as being produced by CLONETS.

1.1 Presentation template

The title page of the presentation template includes the CLONETS logo, and space for the main title and a subtitle (Figure 1). The penultimate page (Figure 2) of presentation template acknowledges that the project is funded by the European Union's H2020 research and innovation programme. It contains the European flag and the project's grant agreement number. The last page (Figure 3) of presentation provides an overview of the CLONETS Consortium. It contains information on the project (proposal ID, topic, duration, start date, webpage) and the logos of all participants.

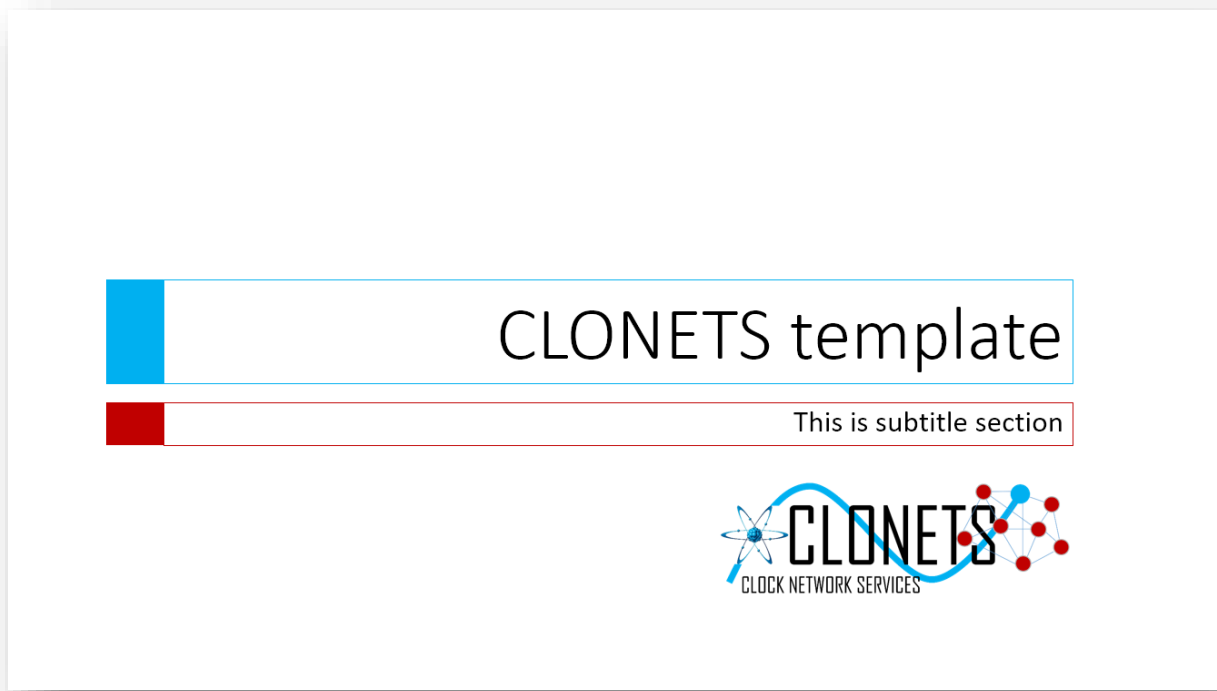




Figure 1. Title page of the CLONETS presentation template.




Thank you for your attention

 This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 731107


11/13/2017 name of conference 3

Figure 2. Funding acknowledgement.





CLONETS – Clock Network Services
 Strategy and innovation for clock services over optical-fibre networks


Proposal ID: 731107
 Topic: INFRAINNOV-2016
 Duration: 30 months
 Start date: 1st January 2017
 Web page: <http://www.clonets.eu>


Coordinator



Participants



MenloSystems



PIK TIME SYSTEMS



ISI CAS


SEVEN Solutions



OPTOKON



AGH



UCL



Third Parties


top





6/22/2018 name of conference 4

Figure 3. Consortium Information.

1.2 Poster template

The poster template is made in a similar style containing: the name of the project, the project logo, the webpage address, the logos of all participants, and information on the project's funding together with the EU flag (Figure 4).

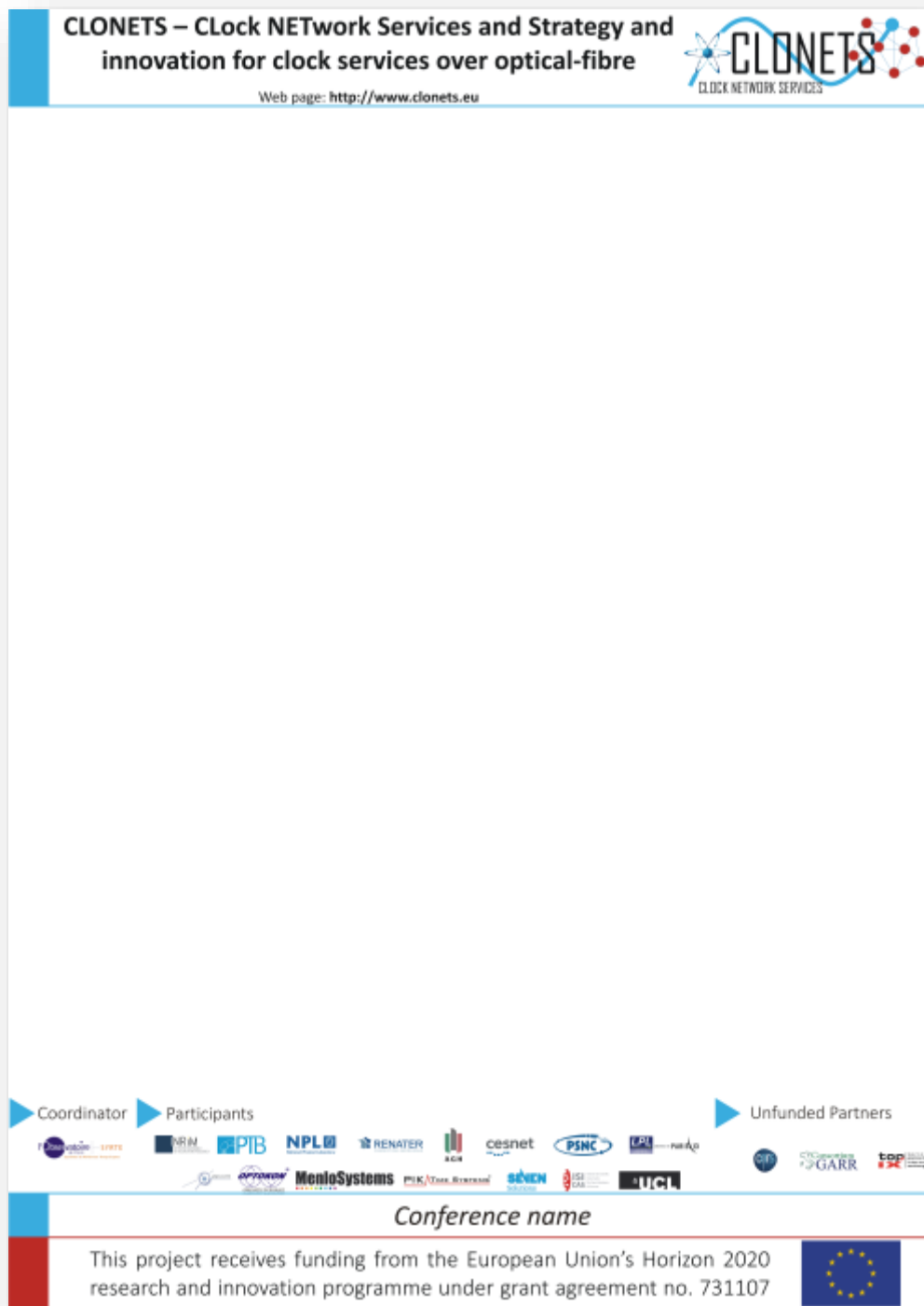


Figure 4. Poster template.

1.3 Brochure template

The brochure template design consists of a cover page (Figure 5) and inside page(s) (Figure 6), so that the brochure can be folded into a small booklet. The front page of the cover includes the project name, logo, the funding information and the EU flag. The back page includes a summary of the project information and contact information. The inside page contains the logos of all of the project's participants and space for news and information.

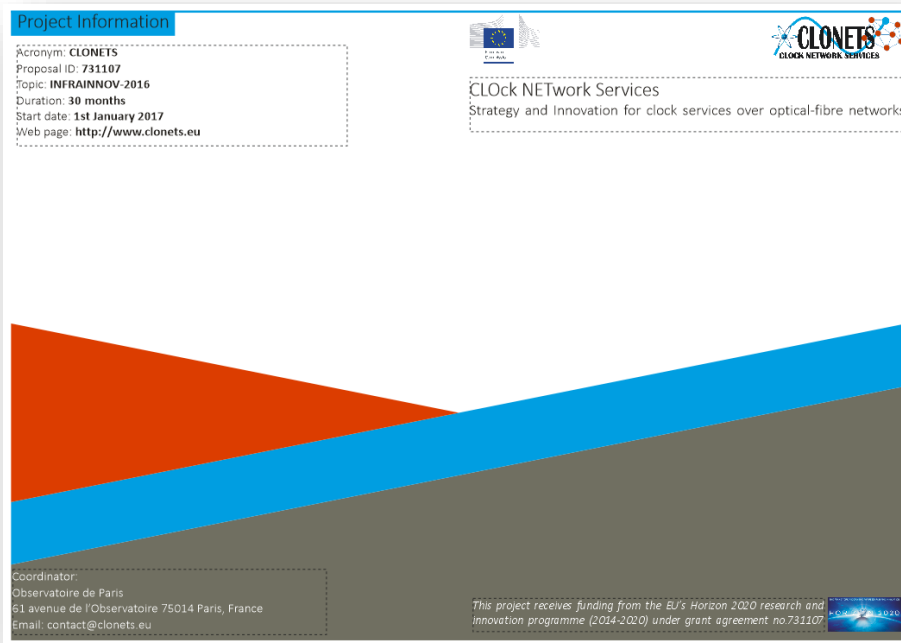


Figure 5. Brochure cover template.



Figure 6. Brochure inside page.

2 MATERIALS

The materials created for training events have been prepared to reach a variety of audiences: researchers, engineers, stakeholders, policy makers, specialists and non-specialists, etc. The project participants do not only focus on high-tech users familiar with time and frequency (T&F) issues, but also consider a broader public with little knowledge of T&F. There therefore are training materials for all levels, from entry to expert. The materials are readily available to the Consortium and serve as a resource for presentations and training events. As the project progresses and different training events are organized and being held, the library of training materials will be expanded.

2.1 Entry-level materials

Four entry-level presentations covering the key concepts of T&F dissemination through optical fibres have been prepared:

1. CLONETS – why do we need precise time (Figure 7)
2. CLONETS – Introduction to fibres (Figure 8)
3. CLONETS – Introduction to time and frequency (Figure 9)
4. CLONETS – Metrology concepts for time and frequency (Figure 10)

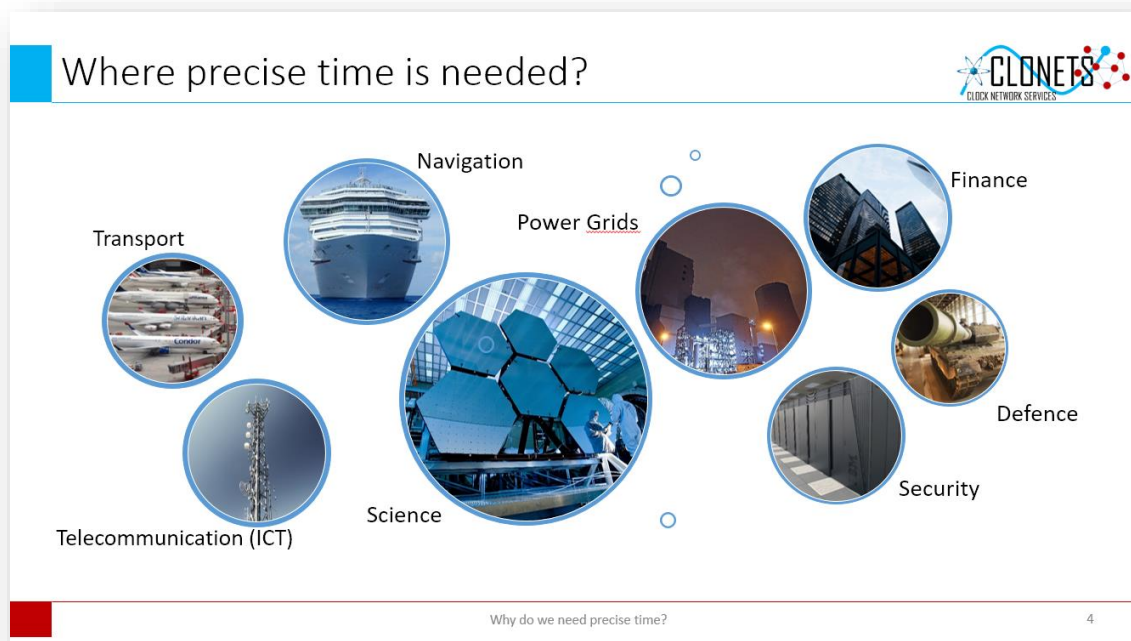


Figure 7. Example slide from “CLONETS – why do we need precise time” showing different applications requiring precise timing.

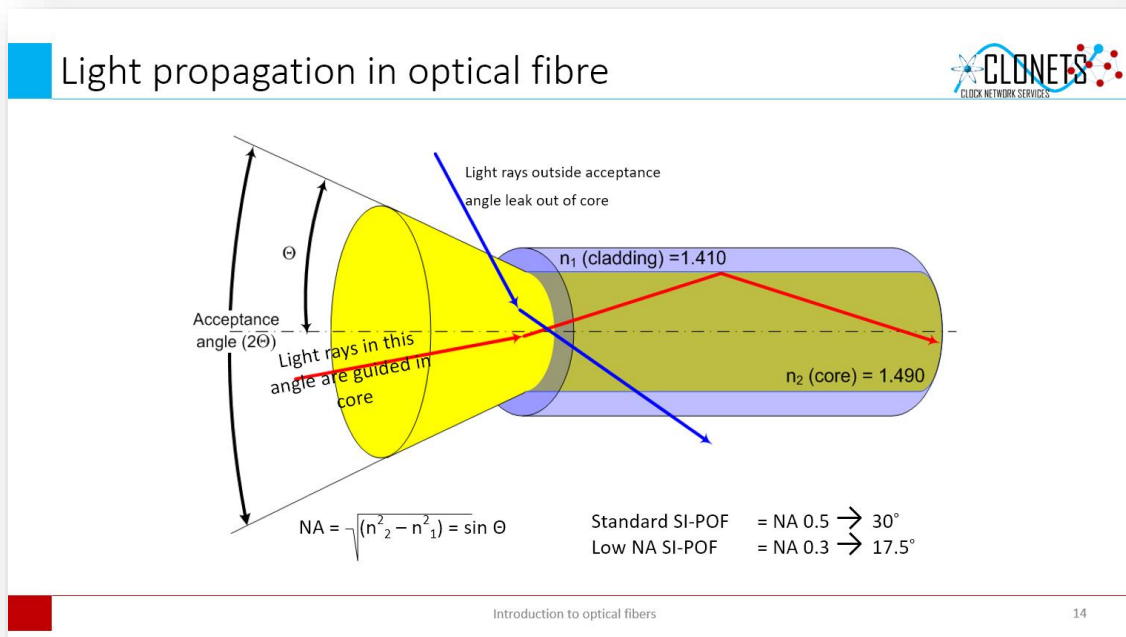


Figure 8. Example slide from “CLONETS – Introduction to fibers” showing how light is guided through optical fibres.

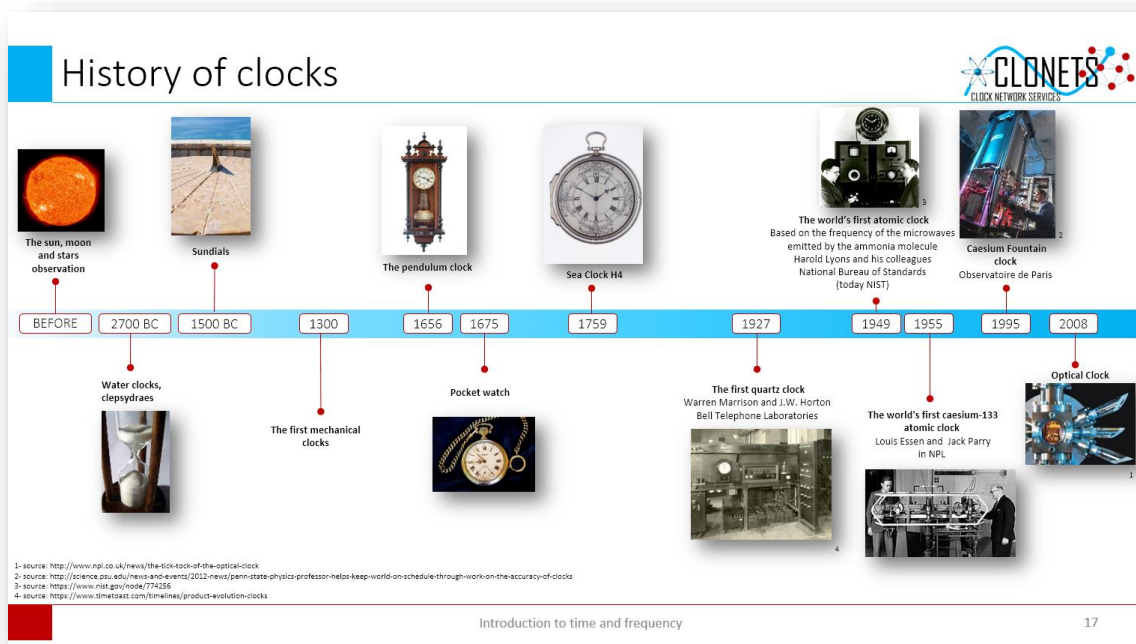


Figure 9. Example slide from “CLONETS – Introduction to time and frequency” showing the evolution of clocks throughout history.

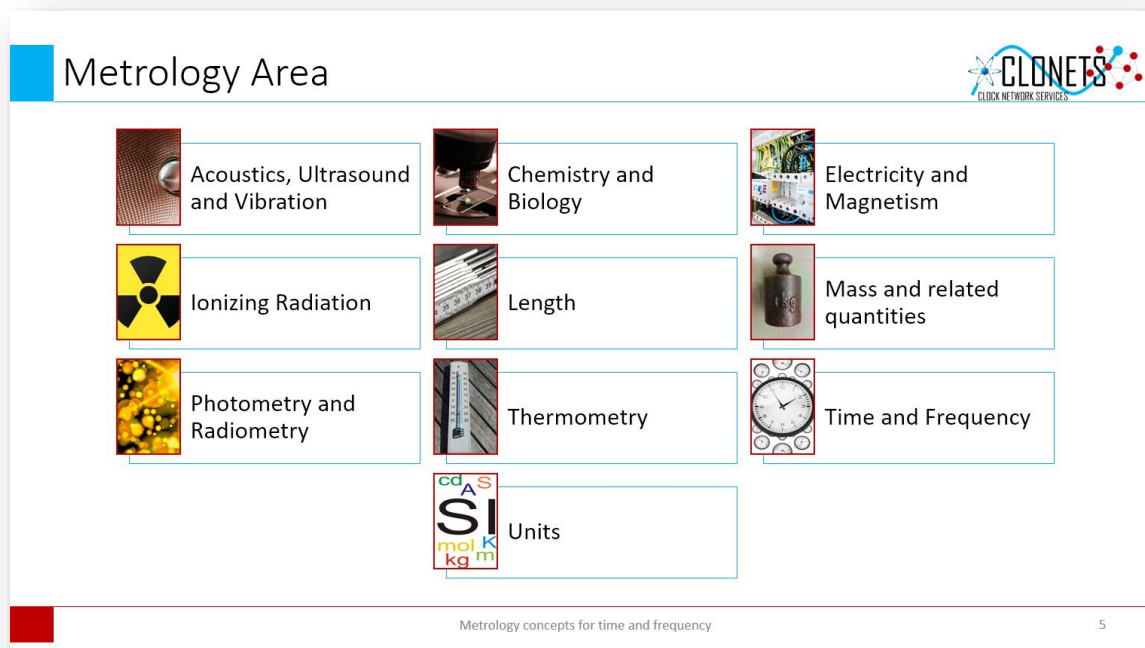


Figure 10. Example slide from “CLONETS – Metrology concepts for time and frequency” showing the fields of interest for metrology.

2.2 Intermediate- and advanced-level materials

The Consortium also has prepared training materials intended for an audience already familiar with T&F issues. These are intended to further deepen the knowledge of the audience and provide more details on T&F dissemination over optical fibre networks. Two key presentations have been prepared:

1. CLONETS – Optical Fibre link for ultrastable frequency dissemination (Figure 11)
2. CLONETS – Time and frequency networks (Figure 12)

CLONETS
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Noise compensation in an optical fiber link

- Fluctuation of the propagation delay frequency transfer
- « Round-trip » method for noise compensation

Optical fiber link for ultrastable frequency dissemination

25/01/2018 10

Figure 11. Example slide from “CLONETS – Optical Fibre link for ultrastable frequency dissemination”. The slide shows a fibre noise compensation technique in an optical fibre link.

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General characteristics of developed fibre T/F transfer techniques

	fibres noise suppression scheme	communication link type	demonstrated distance	demonstrated performance (ADEV, TDEV, uncertainty)	TRL
CW optical carrier					
	active cancellation	bi-directional dark fibre	> 1000 km	10-15@1s; 10-20@1d	6-7
	two-way comparison	bi-directional dark channel	50...100 km	10-17@1s; 10-21@1d	5-6
Optical frequency comb					
	active cancellation	bi-directional dark fibre	50...150 km	TDEV 500 fs@1s	4-5
RF carrier					
	active cancellation with optical delays	bi-directional dark fibre	< 100 km	10-14@1s; 10-17@1d	5-6
	active cancellation with electronic delays (ELSTAB)	bi-directional dark fibre	> 600 km	10-13@1s; 10-17@1d	7-8
		uni-directional DWDM channel	up to 3000 km	10-15@1day for old DWDM 10-16@1 day for coherent DWDM	7-8
	phase conjugation	bi-directional dark fibre	100...150 km	10-18...10-19@1d	5-6
Time					
	two-way comparison	bi-directional dark fibre or channel	~600 km	TDEV ~2 ps	6-7
		uni-directional DWDM channel	~500 km	TDEV ~30 ps calibration through GPS	6-7
	optical frequency comb	bi-directional dark fibre	> 100 km	calibration uncertainty < 40 ps	4-5
	active cancellation with electronic delays (ELSTAB)	bi-directional dark fibre	> 600 km	TDEV < 1 ps calibration uncertainty < 40 ps	7-8
	protocol-based (White Rabbit PTP)	uni-directional DWDM channel	> 1000 km	verified with GPS disagreement within ±2 ns	7-8
		bi-directional dark fibre	40...80 km	calibration uncertainty < 10 ns	7-8

More information on Deliverable D1.5 „Fiber TF Techniques” – CLONETS project

Time and frequency networks 43

Figure 12. Example slide from “CLONETS – Time and frequency network” listing the general characteristics of different T&F transfer techniques.

2.3 Technology-oriented materials


Finally, the Consortium has also collected specialized technology-oriented training materials. The materials describe in depth existing T&F transfer technology. Two such technology-oriented presentations have been created:

1. CLONETS – ELSTAB system (Figure 13)
2. CLONETS – White Rabbit system (Figure 14)

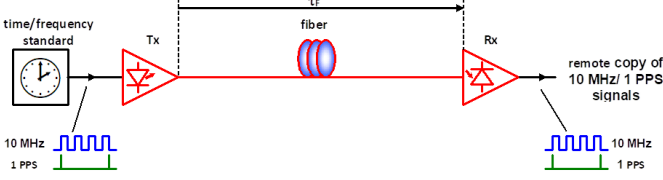
with the training materials covering the White Rabbit (WR) technology containing multiple presentations:

1. Introduction to WR
2. The WR-Core
3. LAB1 Installation WR SPEC Starting Kit
4. LAB2 WRPC SW dw and install
5. LAB3 Using the WRC
6. LAB4 SPEC WRS Synchronization
7. LAB5 Playing DIO channel
8. LAB6 grand master len
9. Introduction to git
10. Playing with WR
11. PPSi complete
12. WRS LAB folders configuration dotconfig
13. WRS LAB backend and web interface
14. WRS hw sw
15. Calibration
16. Writing calibration parameters into WRC
17. Wrs developer manual v4.2
18. Wr switch sw v3.3 20130725 build
19. RTU
20. WRS LAB buildroot
21. WRS Flashing
22. WRS LAB SNMP
23. WRS v5

Introduction



• Direct approach - one-way, uni-directional fiber T/F transfer



$$\Delta\tau_F = \frac{L}{c} \frac{\partial n_g}{\partial T} \Delta T_{FIB} + \frac{L n_g}{c} \frac{\partial L}{L \partial T} \Delta T_{FIB} + \frac{L}{c} \frac{\partial n_g}{\partial \lambda} \Delta \lambda_{LAS}$$

Fundamental limit:
time dependence of the propagation delay of the optical fiber

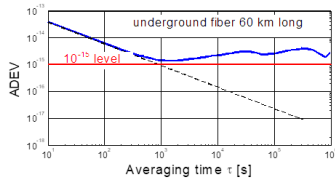
$\tau_F = f(T) = f(t)$

thermo optic coefficient
 $\frac{\partial n_g}{\partial T} \approx 1.1 \cdot 10^{-5} \text{ K}^{-1}$

thermal expansion coefficient
 $\frac{\partial L}{L \partial T} \approx 5.5 \cdot 10^{-7} \text{ K}^{-1}$

↓


$\frac{1}{L} \frac{\partial \tau_F}{\partial T} \approx 37 \dots 40 \text{ ps} \cdot \text{km}^{-1} \cdot \text{K}^{-1}$



11/13/2017
ELSTAB system
6

Figure 13. Example slide from “CLONETS – ELSTAB system” introducing the ELSTAB technology.

Important bug fixes



The more important bug fixes that you might have found with current v4.2 release.

- Improve SNMP (crash, refresh)
- Improve calibration with more than one fiber type
- Correct error while flashing (checksum verification, disk full)
- Update new leap-second (01-01-2017)
- Notify if grandmaster has been locked or not
- Use wr1-wr18 instead of wr0-wr17

If you find some new issue please contact us support@sevensols.com or you can also send an email to the list: white-rabbit-dev@ohwr.org

You can also consult <http://www.ohwr.org/projects/wr-switch-sw/issues> to know if the issue is already tracked

www.sevensols.com
Seven Solutions - When every nanosecond counts - 2016
3

Figure 14. Example slide from “WRS v5” providing information on bug fixes that have been made in a new version of WR.

3 CONCLUSION

The participants of the CLONETS' project have prepared presentations that can be employed in various different training and dissemination events. As the project advances, the project participants will update and modify the existing materials and prepare new presentations, posters and brochures using CLONETS templates.