



SEASON

Self-Managed Sustainable High-Capacity Optical Networks

Deliverable D6.1

Year 1 report on standardization, communication, and dissemination activities

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EXECUTIVE SUMMARY

SEASON as a collaborative project involving educational, research, and industrial partners, emphasizes effective communication and dissemination to maximize its impact. The project employs a diverse range of channels, including scientific publications, workshops, demo exhibitions, and engagement in standardization activities.

In this document, we outline all the communication, dissemination and standardization activities carried out during the 1st year of the project.

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1. INTRODUCTION

The SEASON project is a collaborative endeavor involving a consortium of educational, research, and industrial partners that embarks on a transformative journey at the forefront of technological innovation. This comprehensive report encapsulates the efforts and accomplishments of SEASON during its initial stages, focusing on the important areas of communication, dissemination, and standardization.

This deliverable reports on the planning and execution of communication and dissemination strategies, illustrating how SEASON maximizes its influence by effectively reaching diverse target audiences. The project's dedication to transparency, collaboration, and knowledge-sharing is evident in its involvement with scientific publications, workshops, and demo exhibitions.

Moreover, SEASON acknowledges the importance of standardization in ensuring interoperability and fostering a unified ecosystem. The report navigates through the project's active engagement with prominent Specification Developing Organizations (SDOs), outlining its tentative objectives, achievements in the first year, and plans for ongoing standardization activities. The deliverable is organized as follows. First, it reports the initial planning of activities -as documented in the Description of Work- and then, it summarizes the activities of the 1st year. This structure is repeated for Dissemination, Communication and Standardization activities.

2. COMMUNICATION AND DISSEMINATION - INITIAL PLAN AND ACTIVITIES

2.1. DISSEMINATION -INITIAL PLAN AND ACTIVITIES

Scientific publications in peer-reviewed conferences and journals are the primary channel to reach the scientific community and publish SEASON results. In addition, in conferences with technical exhibitions forums, it is also possible to reach specific target groups from the industry. During the 1st year, dissemination activities have been mainly concentrated on demonstrating the SEASON concept, its impact on optical networking, as well as raising the awareness of these target groups about the objectives and expected results of the project. Starting from the second year and onwards, the dissemination activities will evolve to publish concrete scientific results, with special focus on achieved results related to technological innovation.

Major Targeted Conferences: OSA Conference on Optical Fiber Communication (OFC), European Conference on Optical Communication (ECOC), IEEE International Conference on Transparent Optical Networks (ICTON), IEEE International Conference on Optical Network Design and Modelling (ONDM), IEEE International Conference on Communications (ICC), Global Communications Conference (GLOBECOM), and European Conference on Networks and Communications (EuCNC).

Major Targeted Journals: IEEE J. on Selected Areas of Communications, IEEE/OSA J. of Optical Communications and Networking; IEEE/OSA J. of Lightwave Technology; IEEE Trans. on Signal and Inf. Processing over Networks; IEEE Comm. Magazine,

Major target is to publish over 25 journals, articles, magazines, whitepapers, specifications, and standards.

Table.1: Dissemination activities and KPI

Dissemination Activity and Verification Plan	KPI Year 1	Achieved Year 1 (see list below)	KPI Year 2	KPI Year 3
Publication in selected peer-reviewed Journals	5	5	10	10
Presentation and publication at selected scientific conferences/workshops	10	27	15	15
Participation at industry conference/workshops/events	-	0	1	2

2.1.1. Scientific Publications

During the project's initial year, the following papers were published, presented, or received acceptance for publication.

Publications in Journals

1. M. Devigili, M. Ruiz, N. Costa, C. Castro, A. Napoli, J. Pedro, and L. Velasco, "Applications of the OCATA Time Domain Digital Twin: from QoT Estimation to Failure Management," *IEEE/OPTICA Journal of Optical Communications and Networking (JOCN)*, vol. 16, pp. 221-232, 2024.
2. L. Velasco, P. González, and M. Ruiz, "Distributed Intelligence for Pervasive Optical Network Telemetry," *IEEE/OPTICA Journal of Optical Communications and Networking (JOCN)*, vol. 15, pp. 676-686, 2023.
3. Margita Radovic; Andrea Sgambelluri; Filippo Cugini; Nicola Sambo, "Super-channel spectrum saving optimization procedure in elastic optical networks", *Journal of Optical Communications and Networking*, Volume 15, Issue 2, 2023
4. Nadal, L.; Ali, M.; Vilchez, F.J.; Fàbrega, J.M.; Svaluto Moreolo, M., "The Multiband over Spatial Division Multiplexing Sliceable Transceiver for Future Optical Networks", *Future Internet* **2023**, 15, 381. <https://doi.org/10.3390/fi15120381>.
5. H. Shakespear-Miles, Q. Lin, S. Barzegar M. Ruiz, X. Chen, L. Velasco, "Centralized and Distributed Approaches to Control Optical Point-to-Multipoint Systems Near-Real-Time," submitted to *IEEE/OPTICA Journal of Optical Communications and Networking (JOCN)*, 2023

Publications in scientific conferences

1. M. Devigili, D. Sequeira, M. Ruiz, N. Costa, C. Castro, A. Napoli, J. Pedro, and L. Velasco, "Extending the OCATA Digital Twin for Optical Connections based on Digital Subcarrier Multiplexing," accepted in *Optical Fiber Communication Conference (OFC)*, 2024
2. Marc Ruiz and Luis Velasco, "Privacy Preserving Digital Twin Knowledge Sharing for Multi-domain Networks," in *Optical Fiber Communication Conference (OFC)*, 2024.
3. Q. Wang, H. Shakespear-Miles, X. Chen, M. Ruiz, Z. Li, and L. Velasco, "On Real-time Optical Subcarrier Management in P2MP Networks with Mixed-strategy Gaming," in *Proc. Optical Fiber Communication Conference (OFC)*, 2023.
4. L. Velasco, S. Barzegar, and M. Ruiz, "Is Intelligence the Answer to Deal with the 5 V's of Telemetry Data?" in *Proc. Optical Fiber Communication Conference (OFC)*, 2023.
5. L. Velasco, M. Devigili, and M. Ruiz, "Applications of Digital Twin for Autonomous Zero-Touch Optical Networking [Invited]," in *International Conference on Optical Network Design and Modeling (ONDM)*, 2023.
6. S. Barzegar, M. Richart, S. Wang, A. Castro, M. Ruiz, and Luis Velasco, "Coordination of Radio Access and Optical Transport," in *International Conference on Optical Network Design and Modeling (ONDM)*, 2023.
7. H. Shakespear-Miles, M. Ruiz, and L. Velasco, "Dynamic Subcarrier Allocation for P2MP Connections," in *IEEE International Conference on Transparent Optical Networks (ICTON)*, 2023.
8. S. Wang, M. Ruiz, and L. Velasco, "Optical network traffic analysis under B5G/6G RAN operation," in *IEEE International Conference on Transparent Optical Networks (ICTON)*, 2023.
9. M. Devigili, M. Ruiz, N. Costa, C. Castro, A. Napoli, J. Pedro, and L. Velasco, "Extending the OCATA Digital Twin to the Frequency Domain," in *IEEE International Conference on Transparent Optical Networks (ICTON)*, 2023.

10. P. Khare, N. Costa, J. Pedro, A. Napoli, F. Arpanaei, J. Comellas, M. Ruiz and L. Velasco, "SSMS: A Split Step MultiBand Simulation Software," in IEEE International Conference on Transparent Optical Networks (ICTON), 2023.
11. S. Barzegar, M. Ruiz, and L. Velasco, "Reinforcement Learning for Autonomous Traffic Flow Capacity Management," in IEEE International Conference on Transparent Optical Networks (ICTON), 2023.
12. Laia Nadal, Josep M. Fabrega, F. J. Vilchez and Michela Svaluto Moreolo, "Next-Generation Optical Transceiver and Switching Solutions Exploiting MB and SDM", in SBMO/IEEE MTT-S International Microwave and Optoelectronics Conference (IMOC), Nov. 2023.
13. Ramon Casellas, Filippo Cugini, "The SEASON Project: Self-Managed Sustainable High-Capacity Optical Networks, within Session Maximizing the Impact of European 6G Research through Standardization," ETSI Research Conference, 6h-8th February, 2023, Sophia Antipolis, France.
14. Filippo Cugini; Ramon Casellas; Achim Autenrieth; Oscar González de Dios; Johannes K. Fischer; Emilio Riccardi; Luis Velasco; Antonio Napoli; Joao Pedro; Stefano Tennina; Trevor Moore; Panagiotis Demestichas; Roberto Magri, "The SEASON Project: Self-Managed Sustainable High-Capacity Optical Networks", EuCNC, 2023.
15. Andrea Sgambelluri, Margita Radovic, Filippo Cugini, Nicola Sambo, Piero Castoldi, "Self-Autonomous Multi-Carrier Optical Transmissions", in Proc. of ONDM Conf. 2023
16. Margita Radovic, Andrea Sgambelluri, Filippo Cugini, Nicola Sambo, "Experimental Optimization of Power-Aware Super-Channels in Elastic Optical Networks", in Proc. of ONDM Conf. 2023
17. Filippo Cugini, Mauro Agus, Marco Quagliotti, Emilio Riccardi, Carlos Castro, Bernhard Spinnler, Antonio Napoli, "Point-to-Multi-Point Coherent Optics on Data Processing Units (DPUs) for beyond-5G Low-Latency Applications", IEEE International Conference on Transparent Optical Networks (ICTON), 2023
18. Carlo Cavazzoni, Marco Caretti, Alessandro Percelsi, Mauro Agus, "Open RAN Mobile Access: The View of an Operator on an End-To-End Implementation" invited talk at Optical Fiber Communication Conference (OFC), 2023.
19. A. Souza, B. Correia, A. Napoli, V. Curri, N. Costa, J. Pedro, J. Pires, " Leveraging Raman Amplification to Improve and Equalize the Performance of a 20-THz Multi-band Optical System," 2023 European Conference on Optical Communication (ECOC), Glasgow, Scotland, 2023, pp. 1-4.
20. C. Centofanti, W. Tiberti, A. Marotta, F. Graziosi and D. Cassioli, "Latency-Aware Kubernetes Scheduling for Microservices Orchestration at the Edge," 2023 IEEE 9th International Conference on Network Softwarization (NetSoft), Madrid, Spain, 2023, pp. 426-431, doi: 10.1109/NetSoft57336.2023.10175431.
21. A. Marotta, C. Rinaldi, C. Centofanti, K. Kondepu, D. Cassioli and F. Graziosi, "O-RAN Neutral Hosting as a Viable Solution for First Responders Seamless Connectivity," 2023 International Conference on Information and Communication Technologies for Disaster Management (ICT-DM), Cosenza, Italy, 2023.
22. L. Valcarenghi, A. Marotta, C. Centofanti, F. Graziosi and K. Kondepu, "A Cooperative Energy Saving Scheme for NG-PON2-Based 5G X-Haul," 2023 International Conference on Photonics in Switching and Computing (PSC), Mantova, Italy, 2023.

23. J. Pedro, M. Hosseini, N. Costa, A. Napoli, J. Prilepsky and S. Turitsyn, "Optimal Node Design in Filterless Horseshoe Networks with Point-to-Multipoint Transceivers", invited talk, IEEE Photonics Conference 2023, Orlando, Florida, USA, 2023.
24. N. Sambo, C. Castro, N. Costa, P. Castoldi and A. Napoli, "Energy Efficiency in Next-generation Optical Networks," 2023 23rd International Conference on Transparent Optical Networks (ICTON), Bucharest, Romania, 2023, pp. 1-4, doi: 10.1109/ICTON59386.2023.10207497.
25. A. B. Terki, J. Pedro, A. Eira, A. Napoli and N. Sambo, "Routing and Spectrum Assignment Based on Reinforcement Learning in Multi-Band Optical Networks," 2023 International Conference on Photonics in Switching and Computing (PSC), Mantova, Italy, 2023, pp. 1-3, doi: 10.1109/PSC57974.2023.10297291.
26. L. Z. Khan, et al., "Exploring the Potential of Model-Centric and Data-Centric Machine Learning for Soft-Failure Cause Identification in Optical Networks", ECOC, 2023
27. C. Castro, A. Tartaglia, R. Magri, B. Spinnler, J. Pedro, and A. Napoli, "Point-to-multipoint Coherent Transceivers for Next-Generation Mobile Transport", 2023 23rd International Conference on Transparent Optical Networks (ICTON), Bucharest, Romania, 2023.

Open access

SEASON uses Zenodo to deposit accepted scientific publications to comply with the Open Access policy for publications. To that end, the HORIZON SNS SEASON community has been created (https://zenodo.org/communities/horizon_sns_season/)

2.1.2. Organization of events: Workshops, tutorials, summer schools and demos

SEASON also organizes various events to complement the dissemination activities. Yearly workshops will be organized either to be co-located at well-known conference venues (e.g., ECOC, OFC, EuCNC) if possible or it will be organized as a separate event. Tutorial and summer schools will be organized to reach out to early-stage researchers as well as the scientific community.

Table.2: Planning of events

Planned organizational events	Month	Goal of the event
Publication in selected peer-reviewed Journals	M10, M22, M32	Communicating SEASON's concepts, goals, and ambitions
Presentation and publication at selected scientific conferences/workshops	M12, M24, M36	Educating the scientific community with technological development within SEASON.
Participation at industry conference/workshops/events	M28, M36	Real-time demonstration of SEASON's technology.

During the project's initial year, the following events were organized.

Organization of workshops:

- Demo Zone in the IEEE International Conference on Transparent Optical Networks (ICTON) 2024

- Workshop on 6G Network Operation (B5GNeO) collocated with the IEEE International Conference on Transparent Optical Networks (ICTON) 2024
- Workshop on Beyond-5G Network Operation (B5GNeO) collocated with the IEEE International Conference on Transparent Optical Networks (ICTON) 2023
- Workshop on Women in Telecommunications (WeInTel), collocated with the IEEE International Conference on Transparent Optical Networks (ICTON) 2023 and 2024.
- Co-organization of EUCNC Special Session, “Novel technologies in disaggregated packet-optical networks to support 6G”, Gothenburg June 2023

2.1.3. Coordination with other projects

- Joint meeting between SEASON and FLEX-SCALE projects, 2hours, Pisa, June 2023

Participation in the following SNS JU Coordination WGs:

- Steering Board (SB)
- Technical Board (TB)
- Communication Task Force

Participation in the following SNS JU WGs:

- Pre-Standardization
- Participation in Women in Telecommunications and Research (WiTaR)
- SME
- Vision and Societal Challenges
- 5G Architecture
- Test, Measurement and KPIs
- Participation in the Open SNS WG

2.2. COMMUNICATION ACTIVITIES

Communication activities in SEASON started early during the implementation to promote the project findings to relevant audiences. Based on the impact of the communication activities, the partners regularly update their strategy as appropriate, in a yearly updated deliverable.

Table.3: Planning of communication activities

Activity	1st year results
Project website https://www.season-project.eu/	Published. Project website is populated with the basic information of SEASON project such as its concept, technical objectives, communication leaflets, public deliverables and consortium info.
Project Portfolio	MS TEAMS repository, project logo and templates for deliverables and milestones have been created. Quality management procedures have been defined (see Milestone MS1.1, Task 1.3)

Social media	Project accounts at Twitter, and Instagram have been created. (see Milestone MS1.1, Task1.3]
Presentations of SEASON	R. Casellas, ONDM2023 Workshop Challenges of Optical Communications in the 6G Era: A View from EU Projects, 8-11 May 2023

Table.4: Communication KPIs

Communication Activity	KPIs	Achieved Year 1
Project website	>10000 unique visitors, ~2 min. Average duration of visit, >20000-page views.	3828 unique visitors, 10521 page views
Socials	>1000 accumulative followers, >250 interactions, >1000 accumulative posts, >10 videos, >6 news on EC events.	120 followers 1400 iterations 90 posts 6931 impressions 12 videos
Press releases and factsheets	10 press releases, >8 factsheets and brochures.	

2.2.1. Project logo

Figure 1 shows the SEASON Project logo.



Figure 1: SEASON logo

2.2.2. Project website and social media

Figure 2 shows the SEASON Project website.

Figure 3 shows the SEASON website statistics during Year 1.

The project has created its own account in the major social media portals:

- LinkedIn: horizon-sns-season
- Twitter/X: @HorizonSeason
- Instagram: @horizonsnsseason

- YouTube: @Horizon SNS Season

Figure 4 shows the SEASON YouTube Channel, where partners explain their activities in the project.

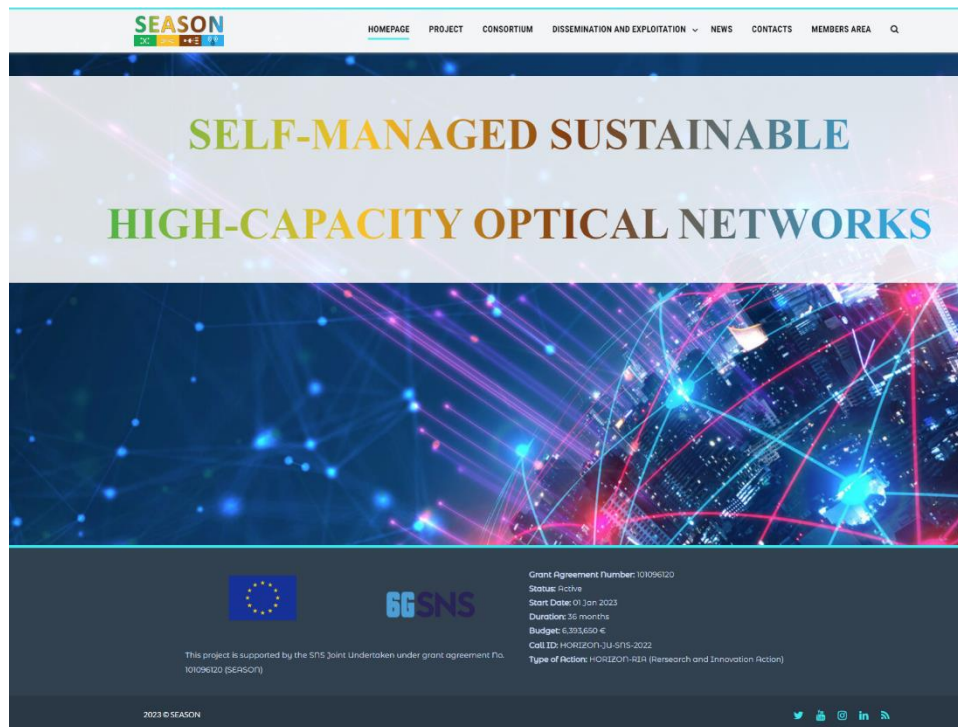


Figure 2: Home page of the SEASON website <https://www.season-project.eu/>

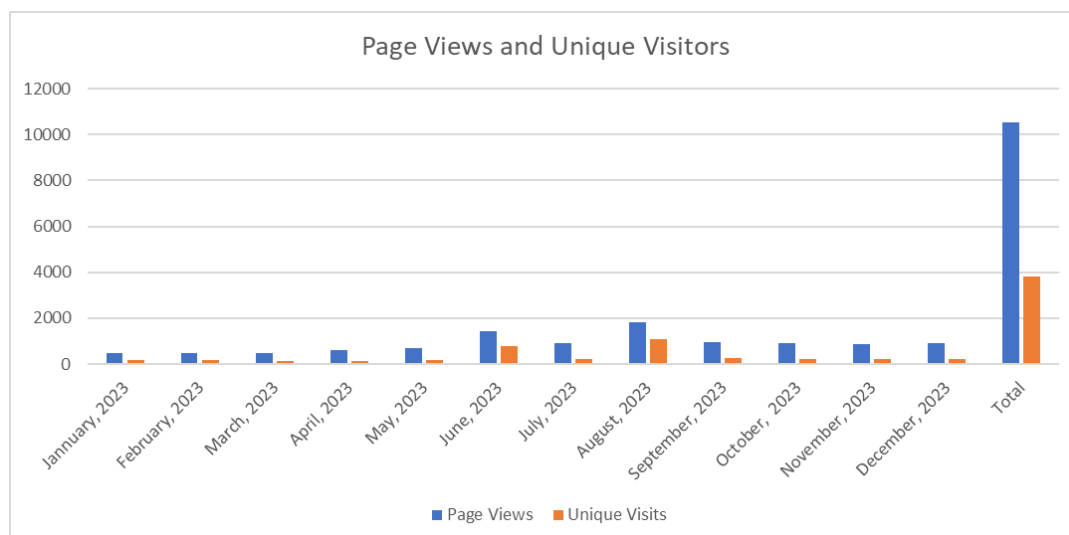


Figure 3: SEASON website statistics during Year 1.

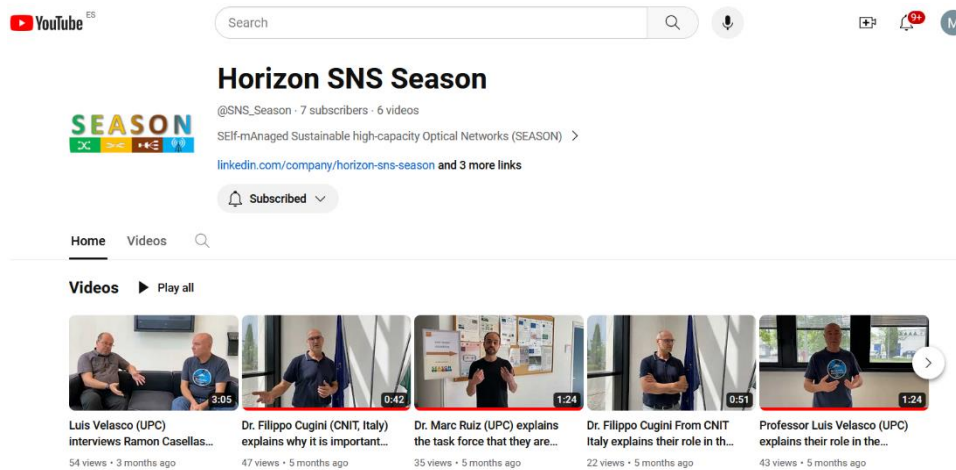


Figure 4: SEASON YouTube channel.

2.2.3. Specific Communication Activities

- During the first year of the project, CTTC plans for communication and dissemination include, first, raising project awareness in events and workshops given its role of Technical Manager. This includes, for example, presenting SEASON in the ETSI standards conference, (February 2023), ONDM (Coimbra, 2023) as well as participating in the Technical Board meetings of the SNS program. CTTC is contributing to social media commenting in SEASON related posts, sharing posts and insight and contributing to the overall optical networking ecosystem.

CTTC has contributed to the Special Session proposal that has been submitted to EuCNC. At the time of writing, this proposal is still under evaluation.

From the point of view of scientific and technical publications, CTTC plans to submit conference and journal papers covering the topics of multiband S-BVT, multi-granular optical node, SDN control plane and AI/ML in support of network operation. There are several accepted and submitted conference and journal papers (listed later in this document).

- During this first year of the project communication plan is mainly devoted to internal dissemination, discussing with colleagues from the engineering departments the solutions that are being developed to understand their applicability in the evolution TIM network.

Several collaborations are ongoing with other partners that will end in future contributions to scientific papers and conferences.

- In the 1st year, the objective and scope of the project for ADVA has been communicated in Advanced Photonic Congress 2023 in the “Special Programs” Event on “AI and Digital Twin” workshop session, presented on the topic “Digital Twins in Optical Transport Network”. The scope and ongoing contributions in the project are also disseminated to internal research team during the regular meetings to discuss on the optimal solutions to improve the work further. The publications associated with the project are updated in zenodo, and also social media posts are shared/re-posted to increase the project visibility.

- During the period being reported in this document, Infinera (INF-P and INF-G) has focused on internal communication of the project guiding principles and potential architectures, aiming to (i) collect useful feedback on the scope of applications of SEASON solutions; and (ii) further refining some of the concepts being investigated in the project. INF-P and INF-G have and will continue to be engaged in cooperation with multiple project partners that led/will lead to publications in major conferences and journals in the field. Moreover, INF-P and INF-G intend to make more extensive use of social media (e.g., LinkedIn) to disseminate the project findings to a larger audience.
- In Genoa, professionals, experts and industry leaders gathered the 14th and 15th of November to discuss the future of mobile networks during the 12th edition of the Ericsson R&D Italy Innovation Days.



Figure 5: Ericsson R&D Italy Innovation Days

The program of the two-days event included panels and presentations with the participation of Ericsson customers, technology experts and companies driving the evolutions of 5G mobile networks.

The plenary sessions were interleaved with live demonstrations of innovative prototypes developed by Ericsson researchers, within the three major R&D centers of excellence in Italy: Genoa, Pisa and Pagani. Post | LinkedIn



Figure 6: Live demonstrations of innovative prototypes during Ericsson R&D Italy Innovation Days

A dedicated space, in the main live demos area, has been set-up to share the commitment of Ericsson in EU funded projects as part of the innovation program. A set of selected dissemination slides, continuously running on a monitor, highlighted the vision, goals and challenges of SEASON Project. Dedicated presentations were given to visitors during the demo sessions.

- In this period, the main dissemination activity of WEST was related to the preparation and submission of papers in scientific venues, such as conferences and journals.

During the phases of demo preparation, as per the proposal, WEST intends (i) to participate in EU Researcher's Night in L'Aquila, with a target 300-400 audience of school students, engaging students in a research environment and familiarizing them with EU-funded actions and SEASON activities as well as (ii) to present preliminary demo results from working testbeds in industry attended events or events organized by the EC. The main project's social media channels will inform the general public regarding the project's events, activities, and advances.

- ACC promoted and credited SEASON at available speaking slots, specifically at the 'imec Wireless Community' event on 5/10/2023 (<https://www.wirelesscommunity.be/work-meetings/softwarization-and-virtualisation-for-intelligent-wireless-networks/>), a Belgian technical forum facilitated by imec, where Simon Pryor presented a talk on 'Going green and saving OPEX with 5G Open RAN', where the SEASON next-gen transport networks, with WP4 multi-domain Open RAN RIC intelligence, was discussed and elaborated, within an energy saving context.

The goal of ACC is to further promote and disseminate SEASON at future events and conferences (like EuCNC but also industry events and fora relevant to Open RAN, mindful of ACC being an industrial rather than an academic partner). There is growing industry-wide interest in this specific topic of cross-domain integration (of RAN, transport network & core) in the control-plane towards 6G, especially within an Open RAN context, leveraging the RIC, and ACC considers this an ideal vehicle to promote and position the ACC brand and thought leadership, resulting from the excellent SEASON research to date.

3. STANDARDIZATION - INITIAL PLAN AND ACTIVITIES

3.1. PROVISIONAL TARGETS FOR STANDARDIZATION

For SEASON project standardization a key target and many aspects of SEASON developments are subject for active standardization. The list of targeted standardization activities is compiled below.

Table.5: List of target standardization activities

SDO / Open-Source Project	Target direction for standardization	Partners
ETSI OSM	Integration of ETSI OSM with transport SDN with the development of OSM plugins to interwork with the TAPI North Bound Interface of Transport SDN controllers, to dynamically provision end to end connectivity services.	CTTC, TID
ETSI ISG F5G	Align with the ETSI Industry Specification Group on 5th generation fixed network, to support three main features: full-fibre connection (FFC), enhanced fixed broadband (eFBB) and guaranteed reliable experience (GRE). CTTC, HHI and TID are members of the ETSI ISG	CTTC, HHI, TID
ETSI ZSM / ENI	Provision of information regarding the orientation of the project, architecture elements, results from PoC	WINGS
IETF/IRTF	Interaction with research groups working on network management and related algorithms and operations WG (e.g., OPSAWG).	WINGS, TID
ITU-T	Contribute to ITU-T Focus Group on “Environmental Efficiency for Artificial Intelligence and other Emerging Technologies” (FG-AI4EE) with SEASON innovation on energy efficiency SDM Optical Access. Contribute to ITU-T SG15 Q2 “Optical systems for fibre access networks”	WEST, TIM
5G-PPP TMV WG	Contributions related to Test, Measurement, and KPIs Validation for validating technology performance.	WINGS
OIF	Contribution to PLL WG MANAGEMENT TRACK for pluggable interface management using CMIS interface and Network Operator (Netop) WG	TID
ONF ODTN/ONOS	ONOS SDN Controller and open data models to control (1) disaggregated Multi-band over SDM infrastructure, (2) innovative computing nodes and DPU/smartNICs equipped with coherent pluggables for edge-to-cloud power-efficient interconnections.	CNIT, CTTC, ADVA
ONF OTCC	Development of TAPI NBI. Improvement of the photonic media layer, with focus on the modelling of physical layer impairments, provisioning of services B100G, new cases related to Path Computation, Alarm Management and OAM, based on successive refinements over the TAPI 2.3 version. Develop transport SDN use cases to be fed to for a, such as TIP.	CTTC, TID, ADVA

Open Config	Development of data modes and Manifest files in support of Optical Transport devices such as transponders.	TID
OpenROADM	Optical and YANG data models interoperability specifications of ROADM switch as well as transponders and pluggable optics.	TIM, INF-G/P
ORAN	Submission of results of integration of optical transport SDN controllers with SMO and Near-RT RIC for potential O-RAN standard evolution (WG1, WG3, WG4, WG9)	ACC
TIP MANTRA	Development of PoC and demonstrations in the TIP Metaverse ready Architectures for Open Transport (MANTRA) subgroup, to demonstrate unified SDN control and management of the disaggregated, multi-vendor components within an open optical network: Open Line System (OLS), Open Terminals (OTs) and Optical Planning tools, in view of the Multi-vendor integration and service operations were achieved through open standard models and APIs supported by the Optical SDN Controller, including OpenConfig, Transport-API (TAPI) and Open REST	TID
TIP MUST	Development of Transport SDN Use Cases in sub-group within the Open Optical & Packet Transport project group, called MUST (Mandatory Use Case Requirements for SDN for Transport). The main objective is to accelerate and drive the adoption of SDN standards for IP/MPLS, Optical and Microwave transport technologies	TID, CTTC, TIM
OpenXR Optics Forum	Contribute with scientific works and standard proposals towards enabling the deployment of P2P & P2MP smart transceivers.	TID, TIM, INF-G/P

3.2. STANDARDIZATION AND OPEN-SOURCE ACTIVITIES IN YEAR 1

ETSI F5G. CTTC has been contributing to the F5G ETSI ISG in several ways. CTTC has been participating in the technical meetings and standardization meetings, characterizing the evolution of F5G advanced. CTTC has organized and contributed to F5G workshops and talks, such as NGON / NetworkX talk on “ETSI: Evolving Towards F5G-Advanced for Green 10Gbps Everywhere”, by Dr. Raul Muñoz.

TeraflowSDN CTTC is leading the effort on ETSI TFS and managing the overall community. TFS is being used by several projects in the SNS umbrella, such as SEASON, FLEXSCALE, PROTEUS-6G, or ACROSS. SEASON is contributing to the TeraflowSDN ecosystem in aspects such as network orchestration or IP control.

ETSI OSM. Given the relative maturity of ETSI Open-Source Mano (OSM), the contributions to OSM are targeted, and these include making sure that the OSM releases can be integrated with the TFS SDN controller and minor changes to the underlying framework. CTTC contributes to hackfests and coordinated events in support of Open SOuce.

SDN Controller. CNIT was expected to use and improve the ONOS SDN Controller to control disaggregated Multi-band over SDM infrastructure as well as innovative computing nodes and DPU/smartNICs equipped with coherent pluggables for edge-to-cloud power-efficient interconnections. However, during the early phase of the project, the SEASON Consortium

agreed that ONOS is not the ideal open-source SDN platform to perform the required technical activities. Instead, the ETSI TeraFlow (TFS) SDN Controller has been identified as the adequate SEASON Platform to be used as SDN Controller. During Year 1 multiple enhancements to TFS have started and are progressing well. Such enhancements will be released as open-source when adequately tested (e.g., during Year 3 of the Project).

Similarly, CTTC is not contributing to the ONOS SDN Controller after recent changes in organization. Priorities have been shifted to either contribute to TeraflowSDN or, in the specific case of optical control, rely in its own proprietary software.

TIP MUST Telefonica (with contributions and collaboration from CTTC) has been contributing to TIP MUST , mostly in topics related to the adoption of Transport SDN from the perspective of network operators, consolidating use cases and raising awareness of TeraflowSDN as a reference platform.

ONF TAPI As a member of the Technical Steering Team (TST) CTTC contributes to the TAPI releases 2.4 and 2.5 having served as editor of the TR-547 on Reference Implementation Agreement. AT this point, the data models are considered mature and further contributions will be limited.

OpenROADM. TIM has held the role of chairperson of the consortium since October 2022 until September 2023; within this period, YANG models releases 12.1, 13.0 and 13.1 14.0 have been published. Within SEASON Project an OpenROADM agent developed by TIM complied to R12.1, has been updated for the management of external pluggable transceivers.

4. EXPLOITATION PLANS

Innovation aspect	TR level (current expected) →
<i>DPU's loaded with pluggable optical transceivers to offer joint network and computational functionalities.</i>	2->5
<i>Teraflow SDN Controller for openconfig-based control of IP and optical resources (i.e., coherent transceivers).</i>	3->5
<i>ROADM-based control of coherent transceivers</i>	2->5
<i>MB(oSDM) sliceable bandwidth/bitrate variable transceiver (S-BVT)</i>	2->4
<i>MBoSDM node</i>	2->4
<i>Multi-band Optical Power Consumption Models and Energy-Efficient ML-enabled Algorithms to assist SDN control operations</i>	2->4
<i>SDN Controller for multi-band flexi-grid over SDM networks</i>	2->4
<i>Advanced Sustainable AI/ML solutions for SDN-controller multi-band/SDM transport networks</i>	2->4
Telemetry Agent	3->4
Optical Network Digital Twin	2->3
NetDevOps based telemetry streaming and network management	1->3
OCATA Digital Twin	2->4
Dynamic bandwidth allocation optimization software based on a point-to-multipoint transmission scheme	2->3
Power Optimization on Multi-band Systems Using Multi-Objective Genetic Algorithm	2->3
SDM-PON	2->4
REST Controller for Optical Access Networks	4->5
XR system with computation at the Edge	4->5
The integration of Near-RT RIC with optical transport SDN controllers.	3->4
AI/ML-powered Service/Application-component orchestration	2->3/4
<i>E2E 5G lab continuously updated with latest Ericsson Radio, Baseband and RAN Transport Solutions</i>	2->4
<i>Industrial collaboration and technology transfer to P2MP technology</i>	3->5

5. GLOSSARY

Acronym	Description
B5GNeO	Workshop on 6G Network Operation
DPU	Data Processing Units
ECOC	European Conference on Optical Communication
eFBB	enhanced fixed broadband
EuCNC	European Conference on Networks and Communications
FFC	Full-fibre connection
FG-AI4EE	Focus Group on Environmental Efficiency for Artificial Intelligence and other Emerging Technologies
GLOBECOM	Global Communications Conference
GRE	Guaranteed reliable experience
ICC	IEEE International Conference on Communications
ICT-DM	Information and Communication Technologies for Disaster Management
ICTON	IEEE International Conference on Transparent Optical Networks
IMOC	International Microwave and Optoelectronics Conference
JOCN	Journal of Optical Communications and Networking
MANTRA	Metaverse ready Architectures for Open Transport (
MUST	Mandatory Use Case Requirements for SDN for Transport
NetSoft	International Conference on Network Softwarization
OFC	Conference on Optical Fiber Communication
OLS	Open Line System
ONDM	IEEE International Conference on Optical Network Design and Modelling
OSM	Open-Source MANO
OT	Open Terminal
PSC	Photonics in Switching and Computing
SB	Steering Board
S-BVT	Sliceable bandwidth/bitrate variable transceiver
SDO	Specification Developing Organizations
TAPI	Transport-API
TB	Technical Board
TST	Technical Steering Team
WeInTel	Women in Telecommunications
WiTaR	Women in Telecommunications and Research (