



Contents

Project updates	2
Highlights of the period	6
News & Events	7
Upcoming Events	10
Meet our partners	11



Project updates

WP2 Use cases, requirements, architectures, business models analysis and data models



D2.2 has been submitted to the European Commission. This deliverable provides a final version of the use case requirements, architecture, design, and data models that refer to ETSI TeraFlowSDN release 2.0. It also includes a business case analysis based on potential savings and new business opportunities for telcos. The document presents the most recent and brand-new specifications for TeraFlowSDN controller, followed by the updated architecture. The document completes with the prospective topics and future work.

The ETSI TeraFlowSDN (TFS) controller is now conceived as a new type of secure cloud native SDN controller that will radically advance the state-of-the-art in B5G networks. This new SDN controller will be able to integrate with the existing Network Functions Virtualisation (NFV) and Multi-access Edge Computing (MEC) frameworks as well as provide revolutionary features for both flow management (service layer) and optical/microwave network

equipment integration (infrastructure layer), while incorporating security using Machine Learning (ML) and forensic evidence for multi-tenancy based on Distributed Ledger Technologies (DLT).

Use cases for IP and optical networks are addressed and demonstrated in commercial solutions based on standard interfaces. The network area for the solution is transport network scenarios integrated with (edge) computing and storage resources. ETSI TeraFlowSDN will adapt dynamically based on flows and applications. TFS covers a wide variety of networks, ranging from distributed edge-computing, through transport backhaul (including optical and microwave solutions), to the network core. TFS provides carrier-grade connectivity services for B5G networks.

Telefonica

WP3 – Life-cycle automation and high performance SDN components



D3.2 has been submitted to the European Commission. It included:

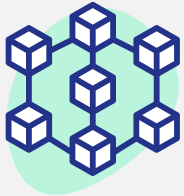
- A detailed design overview of each core TeraFlowSDN component, including internal architecture and adopted technologies
- A set of interfaces per component with clear interactions both with other TeraFlowSDN components and/or external entities
- Detailed workflows highlighting interactions between TeraFlowSDN

components and external systems and/or stakeholders,

- Evaluation results per component, focusing on performance and scalability aspects.
- A list of new features per component has also been provided to highlight the delta between release v1 (early 2022) and the latest release v2.

UBITECH
ubiquitous solutions

WP4 - Network security and interworking across B5G networks



D4.2 has been submitted to the European Commission. This deliverable concludes the evaluation of the TeraFlow security and B5G network integration and reflects the work done in the second phase of WP4. It describes the new features and extensions of security components of the TFS and B5G network integration providing an evaluation of each of them.

As for the cybersecurity components in Task 4.1 significant efforts have been devoted to their integration in two realistic scenarios that show how to detect and mitigate cyberthreats at the optical and packet layer. Furthermore, three research works have been conducted:

- a methodological framework for transforming neural network-based detectors into more efficient models with respect to the energy they consume.
- a new method for generating high-quality adversarial examples to transform machine learning-based detectors into equivalent models that are resilient to such adversarial attacks.
- a GAN (generative adversarial network) architecture to generate synthetic data that can fully substitute real data in the training of machine-learning based detectors and therefore avoiding the generation of privacy breaches when real data is used.

We also evolved the overall components by specialising the Attack Inference Component, allowing for more granular scalability features, the use of different ML models and techniques, as well as seamless updates of models. Future work will explore the generalisation of the energy efficiency framework to Recurrent and Convolutional Neural Networks and the generation of time-series of synthetic data, and mitigation strategies for attacks in the optical layer.

For the DLT (Distributed ledger technology) Component in Task 4.2, the DLT module described is the foundation to work on core blockchain technologies and improve the scalability, privacy, and governance. In particular, we enhanced the scalability of the underlying consensus algorithms using advanced architectures that distribute the transaction capacity without losing the core blockchain properties. In the current deliverable we designed and implemented a smart contracts for sharing, retrieving updates on the infrastructure, as

well as automatically notifying clients when new updates are included in the blockchain. Our smart contract aims at reducing the attack surface of TFS and its components by providing a platform to share all the different components of the infrastructure, effectively enabling any participant to do a complete check of the deployed components and ensure only trusted devices are included in the network topology. Future work may include using the DLT Component to additionally share resource utilisation in real time and enforce resource allocation and analysis of real time weaknesses of the network applications.

In T4.3 we supported the interworking of the TFS Controller for accommodating B5G services. This comprises three key components: NBI, WebUI and Inter-Domain. For the former, the different interfaces are described that enable interaction with external systems including network service creation requested by an NFV Orchestrator (i.e., ETSI OSM). This entails that the NBI not only processes the incoming NFV-O connectivity requests (e.g., to interconnect remote cloud sites), but also manages the interactions with other components (i.e., Service, Context, and PathComp) to handle the lifecycle management of the resulting network services. In this regard, the support of managing IETF L2VPN services has been presented. In addition, the NBI has also been enhanced to cover the processing to roll out network slices with stringent SLA needs. Last but not least, the specific objective of energy-efficiency has been addressed through presenting a devised algorithm aiming at reducing the network power consumption when deploying network services (e.g., between cloud sites). The next steps for the NBI will focus on increasing the supported functionalities and services that can be requested through this component, along with exhaustively conducting performance evaluation of selected algorithms such as for energy-efficient routing.

The overall architecture of the WebUI has been presented and detailed. As stated, the idea of this component is to increase the interactions of external user/applications, via HTTP and the defined REST API, with the TFS Controller. In this regard, the basic operations that are already supported (i.e., retrieving context information, triggering slice/service, and monitoring the status of selected artifacts/resources of the infrastructure) will be investigated with a view to being enhanced. The goal is to expose further and more advanced functions to the external

NEC

user/systems, such as increasing the granularity of monitored information (e.g., link occupancy, device ports, etc.).

Finally, the functional interactions carried out by the Inter-Domain Components hosted in peer TFS Controllers have been exhaustively presented for retrieving abstracted domain information and deploying multi-domain slice/connectivity services. To this end, the adopted solution leveraged blockchain technology using the DLT Component. The overall interactions in terms of workflows are detailed and have been successfully showcased in specific conferences. Moreover, in the context

of the evaluation of the Inter-Domain Component, the contribution bound to QoS-enabled inter-domain connectivity disseminated has been reported in two publications: traffic aggregation mechanisms and analysis of the trade-offs between slice isolation and delay performance. A planned next step for the Inter-Domain Component is to deploy TFS Controller instances for different domains and assess the SLA-violation of multi-domain slices/network services.

WP5: Prototype integration, demonstration and validation



D5.2 has been submitted to the European Commission. The first objective of this deliverable is to report on the integration efforts of TeraFlowSDN, reporting on the development and progress made since the previous version in terms of code integration, documentation and development environment. The second objective is to report the design of the metrics collection framework developed for TeraFlowSDN, which enables the partners and users to obtain a detailed performance analysis of the internal TeraFlowSDN components, potentially enabling further code optimizations. Finally, this deliverable reports on the efforts in defining and implementing the scenarios.

Three scenarios are leveraged to drive the integration and evaluation efforts. The main outcomes are the functional CI/CD environment as well as detailed documentation for new and experienced users. Moreover, a new metrics collection framework enables the internal monitoring and performance assessment of TeraFlowSDN components and workflows. Finally, each scenario has been detailed, including its motivation and challenges, alignment with the overall TeraFlowSDN architecture, setup used to evaluate the performance in the context of

the scenario, metrics relevant to the scenario, workflows, deployment and preliminary performance evaluation.

In terms of integration, the next steps are to include the functional tests created for the scenarios into the CI/CD environment. This will enable the validation of modifications not only in terms of unitary tests (i.e., tests more focused on the individual functionalities of each component) but also in terms of end-to-end workflows.

The scenarios will continue to be integrated and evaluated, with several points to be reported in D5.3.

WP6 – Standardization, Dissemination and Exploitation



This second half of the year has been crucial for impact creation. Partners have shown TFS capabilities in relevant conferences and 5G industry events, including: 6G O-RAN evolution workshop, OECC/PSC2022, ECOC2022, CSNDSP22, GLOBECOM22, IEEE NFV-SDN 2022, IETF-115 meeting, 1st TFS Hackfest in NextworkX and Layer123 World Congress, where TFS won the “Upstart of the Year” award, confirming its relevance in the whole community. Building on our earlier success in the year with two new RFCs (RFC9181 and RFC9182) related to Layer 2 and Layer 3 YANG models in February, the Project published its third RFC (RFC9291) in September. Three RFCs in a European Commission project is a significant achievement. In addition, our standards development pipeline is strong, with multiple IETF working group documents being developed by Project members which will yield further IETF RFCs in 2023. During the latter half of 2022, we also organised a SIGCOMM Workshop on Future Internet Routing & Addressing (FIRA), blending emerging research with technical standards development and the impact on the current Internet routing and addressing schemes.

In light of these events, following market trends and the needs of TeraFlow's targeted stakeholders, project partners have categorised the TFS components by technology and applicability to analyse four paths for exploitation, together with an internal roadmap of concrete actions and milestones. All TFS components have been given an Apache 2.0 license with the idea of letting the community experiment with TeraFlow's innovative features and, at the same

time, allowing for a commercial version of the controller. The source code is publicly available for download and installation at the ETSI Labs repository under the ETSI Open Source Group for TeraFlowSDN. Besides, partners have prepared an intuitive virtual tutorial, which includes all the basic knowledge to understand and use ETSI TFS, thus facilitating exploitation to third parties. The tutorial, available via the TeraFlow YouTube channel and on ETSI Labs page, is intended for operators and service providers who want to get first-hand operational experience with TFS, for system integrators who want to develop their expertise with TFS, for Academia and Universities who are using or considering TFS as a platform for their research activities in networking, for TFS developers and users that want to share and test TFS with the community, and finally for members of other research projects interested in using TFS in their research and proof-of-concept activities.

Next year, new opportunities will be developed as we continue to plan activities, like participation in OFC, ONDM, ICC, P4 Global Workshop, HPSR, MWC, EuCNC, NGON and NetSoft. We expect that ETSI TFS will increase its visibility very rapidly with new and outstanding members joining the group. Stay tuned!

Atos

Highlights of the period

TeraFlowSDN won 'Upstart of the Year' Layer123 Award



On 6th December 2022, the ETSI TeraFlowSDN group won the Layer123 Network Transformation 'Upstart of the Year' Award. The awards ceremony was held at the prestigious hotel The Berkeley in Knightsbridge, London. This award recognizes the quality of the work done in TeraFlow and also ETSI strategy to provide new software development tools and practices to an evolving standardization ecosystem.

"This recognition rewards the intense work of the entire TeraFlowSDN community throughout this year. It is an honour and a motivation to receive this award and it encourages us to continue working for a very successful second release and thus help the adoption of transport SDN by operators" (Ricard Vilalta, CTTC, ETSI TeraFlowSDN Chair)

In the picture, our proud coordinator Ricard Vilalta from Centre Tecnològic de Telecomunicacions de Catalunya (CTTC) receives the prize from the Layer123 representatives. [Read more](#)



A very successful workshop on Future of Internet Routing & Addressing (FIRA'22) within SIGCOMM 2022

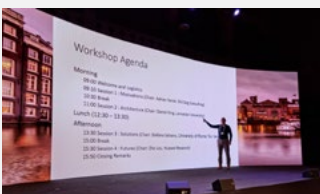
The ACM SIGCOMM conference seeks papers describing significant research contributions to the field of communication networks and networked systems. This year edition took place in Amsterdam, The Netherlands, on August 22 - 26, 2022.

In the framework of this conference, Daniel King from Old Dog Consulting in TeraFlow chaired the FIRA'22 Workshop

on Future of Internet Routing & Addressing on 22nd August. The event had an outstanding audience attendance; was sold out and the workshop got more than 150 attendees.

All TeraFlow accepted papers were published in the proceedings by ACM SIGCOMM. [Read more, FIRA'22 Proceedings.](#)

1st ETSI TFS hackfest in NetworkX



ETSI's Centre for Testing and Interoperability and the TeraFlowSDN community organized the first TFS Hackfest on 20 October 2022. The event was held during the Network X event in Amsterdam, Netherlands. Participation was free and open to all upon registration. Registration to the TFS Hackfest#1 granted a free NetworkX expo access. The event took the form of a tutorial featuring TeraFlow (pre-)Release 2 allowing participants to get hands on experience with TeraFlowSDN. [Read more.](#)



TeraFlowSDN virtual tutorial

To on-board users to ETSI TeraFlowSDN our team has prepared an intuitive virtual tutorial, which includes all the basic knowledge to understand and use ETSI TeraFlowSDN.

News & Events



OECC/PSC 2022

3-6 July 2022 - Toyama International Conference Center (Japan)

The 27th OptoElectronics and Communications Conference is one of the foremost international conferences held annually in the Asia-Pacific region for the researchers and engineers working in the fields of optoelectronics, optical fiber transmission, and photonic network systems. This year, the conference was held jointly with Photonics in Switching and Computing (PSC). This joint conference attracts a lot of related engineers and researchers for most of the opto-electronics and communication field. TeraFlow paper "End-to-end Interdomain Transport Network Slice Management Using Cloud-based SDN Controllers" was presented in the event.



IEEE / CSNDSP 2022

20-22 July 2022 - Porto (Portugal)

The IEEE/IET International Symposium on Communication Systems, Networks and Digital Signal Processing (CSNDSP) attracts about 200 delegates from around the world. It has been recognised as an international forum to present and exchange research findings and discuss future research topics in the fields of communication systems, communications networks, digital signal processing and other related areas. Papers accepted for presentation are published in IEEEExplore while selected papers are published in prestigious sponsoring journals. CSNDSP 2022 is the 13th edition of this symposium and this year it celebrated its 25th anniversary.

Our TeraFlow colleague Paolo Monti from Chalmers University of Technology presented the project in the talk entitled "Optical Transport Networks in the 5G Era".



SIGCOMM 2022/FIRA Workshop

22-26 August 2022 - Amsterdam (The Netherlands)

ACM SIGCOMM is the flagship annual conference of the ACM Special Interest Group on Data Communication (SIGCOMM). It seeks papers describing significant research contributions to the field of communication networks and networked systems.

The 1st Workshop on Future of Internet Routing & Addressing (FIRA) was co-located to this event and was one of the highlights of this period with more than 150 attendees and a sold-out. Three papers from TeraFlow were accepted and published in the [workshop proceedings](#).

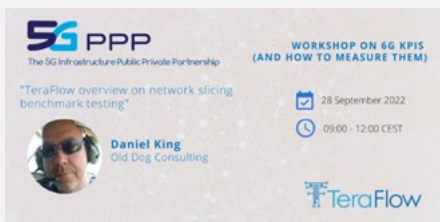


ECOC2022 European Conference on Optical Communication

18-22 September 2022 - Basel, (Switzerland)

The 48th edition of the European Conference on Optical Communication (ECOC) returned this year to the heart of Europe. It is the continent's largest event in the field and one of the most prestigious and traditional events on optical communications worldwide.

Two papers from TeraFlow were accepted for this event: "Experimental Demonstration of Transport Network Slicing with SLA Using the TeraFlowSDN Controller" and "Dynamic Upgrade/Downgrade of WDM Link Capacity in SDN-enabled WDM". In the Demo Zone of the 3rd Floor Foyer, our colleagues from CTTC presented the demo "Experimental Demonstration of Transport Network Slicing with SLA Using the TeraFlowSDN Controller". And also our colleague Marija Furdek from Chalmers discussed the question "Do network automation and security go hand in hand?" in the workshop "Adaptive everything! Do optical networks really need more flexibility?"



5GPPP Workshop on 6G KPIs

28 September 2022- online event

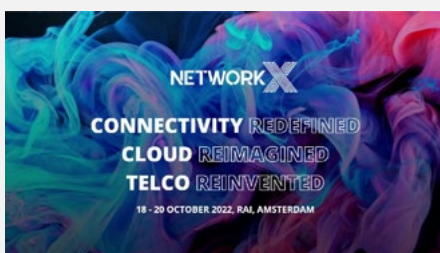
The 5GPPP Test Measurement and KPI Validation work group (TMV WG) celebrated a workshop to reflect on 6G KPIs and how to measure them. Our colleague Daniel King from Old Dog Consulting was there. The target of this workshop was to discuss the KPI definitions and which measurement techniques exists to monitor them. The workshop was also the kick-off of the next iteration of the white paper "Beyond 5G/6G KPIs and Target Values" based on input from several European Commission funded projects -TeraFlow amongst them. In this paper, KPIs from these projects were collected, described and related to existing 5G KPIs.



6G O-RAN evolution workshop 5GPPP Workshop on 6G KPIs

20 October 2022- Marriott Auditorium Hotel & Conference, Madrid (Spain)

O-RAN ALLIANCE e.V. was founded in February 2018 by AT&T, China Mobile International Limited, Deutsche Telekom, NTT DOCOMO and Orange and has become a world-wide community of mobile network operators, vendors and research & academic institutions operating in the Radio Access Network (RAN) industry. Speakers from industry and academia shared their views on requirements, use cases, standard gap, architecture, native AI, security and research platforms. More than 100 participants joined the workshop. Raúl Muñoz from CTTC was invited to participate in 6G O-RAN evolution workshop and he gave a talk about the TeraFlowSDN group in ETSI, working in the development of an open source SDN controller for 6G xHaul transport networks. This talk was part of a panel that will discuss 6G use cases, architecture and AI.



TeraFlow SDN - ETSI Hackfest in NetworkX

20 October 2022, Amsterdam (The Netherlands)

The event is addressed to developers, network operators, service providers, system integrators, academia and universities, and it took the form of a tutorial allowing participants to get hands on experience with TeraFlowSDN. Read more about this event in the section "Highlights of the period" of this newsletter!



115th meeting of the IETF

05-11 Nov 2022 London (UK)

The IETF-115 meeting took place in London and online with a plenary session. TeraFlow is making significant contributions to the standardisation work of the IETF specially through our colleagues Adrian Farrel and Daniel King from Old Dog Consulting with the collaboration of other members of the project.

Three TeraFlow drafts were presented at the TEAS (Traffic Engineering Signaling and Architecture) working group meetings. The TEAS working group is where traffic engineering in the IETF is predominantly developed and is specifically responsible for network slicing. A further TeraFlow Internet-Draft, "Extensions to the Access Control Lists (ACLs) YANG Model", was presented in the Netmod working group. As a follow-up to the successful Future Internet Routing and Addressing (FIRA) workshop at SIGCOMM, an unofficial side meeting was organised during IETF-115. This side meeting also helped to promote two TeraFlow drafts.



IEEE NFV-SDN 2022

14-16 Nov 2022 Chandler, Arizona (USA) (hybrid event)

The 8th IEEE Conference on Network Functions Virtualization and Software-Defined Networking (IEEE NFV-SDN 2022) fostered knowledge sharing and discussion on new approaches as well as work addressing gaps and improvements in NFV and SDN-enabled architectures, algorithms and operational frameworks for virtualized network functions and infrastructures.

Ricard Vilalta and Lluís Gifre (CTTC) presented a hands-on tutorial. This tutorial showed the novel protocols and data models that are arising to control and monitor packet-optical network equipment and offered an overview and hands-on experience on programming the necessary tools to control and monitor the network equipment, while introducing the novel ETSI TeraFlowSDN controller, which is an open-source cloud native SDN controller that enables smart connectivity services for future networks beyond 5G. The event helped to explain that the need bread of cloud-native SDN controllers will allow rapid prototyping and experimentation in research and standardization activities.

During IEEE NFV-SDN 2022, the coordinator of TeraFlow Ricard Vilalta (CTTC) also organized the panel session on "Network Automation in Carrier Networks: Reality vs.

Myths". The proposed panel presented a fact checking against current state of the art network automation mechanisms and its purpose was to evaluate current deployed and proposed use cases for software defined transport networks. Special attention was given to aspects of network automation such as the exposure of network capabilities (using standard interfaces), as well as the deployment of End-to-End connectivity services. Multiple network technologies were discussed, including network disaggregation, considering whiteboxes that can act as cell site gateways, broadband network gateways and optical transponders. Finally, participants discussed on the current status of cloud-based network automation and proposed solutions for software-defined everything.



Layer123 World Congress

07 Dec 2022 QEII Centre, London (UK)

Layer123 World Congress is the leading event in Europe dedicated to network transformation and its applications. This event brings together network operators and owners, telecommunications industry associations, the analyst community and solution providers to the largest thought leadership and networking platform of its kind in Europe.

Ricard Vilalta (CTTC), Juan Pedro Fernández Palacios (Telefónica), Håkon Lønsethagen (Telenor) and Silvia Almaglia (ETSI) presented "Fostering innovation in Transport Networks with ETSI TeraFlowSDN controller" as one of the Closing Keynotes of the event. TeraFlow won the Layer123 Network Transformation 'Upstart of the Year' Award - this was another highlight of this period.



IEEE GLOBECOM - NETMAN6G

08 Dec 2022 Rio de Janeiro, Brazil (Hybrid event)

The paper "Intent-Driven Management for Multi-Vertical End-to-End Network Slicing Services" by Min Xie (Telenor Research & Telenor Group, Norway); Pedro Henrique Gomes (Ericsson Research, Brazil); Jörg Niemöller (Ericsson, Sweden); Patrick Waldemar (Telenor ASA, Norway) with acknowledge to the TeraFlow project was presented on session "Massive MIMO/Network Slicing" of this event.

Upcoming Events



Workshop on 6G organized by the Hexa-X project and ICT-52 cluster

18- 19 January 2023, online

Ricard Vilalta (CTTC) will present "TeraFlow: Do we need yet another SDN controller? Use cases for a novel cloud-native SDN controller for beyond 5G networks" in this event. [workshop on the Hexa-X project website](#)



OFC 2023

5-9 March 2023, San Diego, California (USA)

OFC is the largest global conference and exhibition for optical communications and networking professionals. The program goes from research to marketplace, from components to systems and networks and from technical sessions to the exhibition. OFC draws attendees from all corners of the globe. Five TeraFlow papers have been accepted for this [conference](#).



ONDM 2023

8-11 May 2023, Coimbra (Portugal)

The 27th International Conference on Optical Network Design and Modelling (ONDM 2023) will address cutting-edge research in established areas of optical networking and their adoption in support of a wide variety of new services and applications. This includes the most recent trends such as 5G and beyond, data-centre networking, Internet of things, cloud/edge computing, content delivery, big data, data analytics, network telemetry, real-time monitoring, autonomic networking, artificial intelligence / machine learning assisted networks, visible light networks and quantum secured networks. Within this conference a workshop entitled Challenges of optical communications in the 6G era: a view from EU projects is being organized. Six EU projects have been invited to participate in this workshop and TeraFlow is amongst them. Marija Furdek from Chalmers University will briefly present TeraFlow and participate in a panel with the other project representatives. [ONDM conference website](#).



IEEE ICC'23 conference, AI/ML-driven Autonomous 6G networks workshop

29 May 2023, Rome (Italy)

TeraFlow will be part of the Workshop on "AI/ML-driven Autonomous 6G networks" organised by the 6G Smart Networks and Services Industry Association (6G-IA) in the framework of the IEEE ICC'23 conference. Ricard Vilalta will present "TeraFlow SDN controller for AI-based cybersecurity and network automation".

Meet our partners

IN THIS SECTION WE WILL BE PRESENTING THE PARTNERS OF THE CONSORTIUM, THEIR PROFILE, MAIN EXPERTISE AND CONTRIBUTION TO THE PROJECT. IN OUR FOURTH NEWSLETTER YOU CAN KNOW MORE ABOUT INFINERA, SIAE AND UPM.

INFINERA



Infinera Corporation is a vertically integrated manufacturer of Wavelength division multiplexing (WDM)-based packet optical transmission equipment and IP transport technologies for the telecommunications service provider market. It is a pioneer in design and manufacture of large-scale photonic integrated circuits (PICs).

Infinera sells hardware and software networking options that underpin Tier 1 carrier, Internet content provider, cable operator, government, and enterprise networks worldwide. Infinera products, which include optical line systems, packet optical transport systems, compact modular platforms, carrier-grade routers, and management and automation systems, deliver industry-leading economics and performance in long-haul, subsea, data center interconnect, and metro transport applications.

Infinera has several R&D divisions worldwide, including USA, Canada, China, India, Germany and Finland. Specifically, for this TeraFlow project, Infinera infrastructure and organisation in Espoo (Finland) is the one driving, specifying and producing the contributions to this project. The R&D site

in Espoo is the main site for the Infinera's router software and hardware development and the team in Espoo has a solid background in developing router products for over 15 years and certain portion of the development has always been performed by the local of third party sub-contractors. Moreover, Infinera equipment is part of Telefónica Future Network Lab.

Within TeraFlow Infinera contributes to WP3 providing OpenConfig support and necessary extensions in IP routers in the TeraFlow project. Other protocols and monitoring solutions are considered to provide network automation and L3 services. Moreover, Infinera contributes in WP5 to demonstrate UC1 B5G network automation.



Mika Silvola

SIAE



[SIAE Microelettronica S.p.A.](#) is a leading provider of wireless backhaul solutions, explicitly specialized in point to point (PTP) microwave and mmWave radio systems that provide 4G/5G mobile backhaul, IP and TDM technologies, high speed LAN to LAN interconnections with more than 90 000 PTP radio installed per year. SIAE Group is based in Italy and currently employs up to 1 500 people. SIAE is a global provider of products and services for backhaul radio, and operates globally providing microwave systems, multiplexers, and network management systems. SIAE Microelettronica Group is a member of the ONF (Open Network Foundation) and has chaired the Microwave Workgroup since June 2016.

The MMIC Design Team takes care of projects in Gallium-Arsenide, Gallium-Nitride and Silicon-Germanium technology processes. In detail the team takes care of design, measurements, reliability and qualification of the radiofrequency and millimetre-wave



Michele Milano

modules, since competences ranging from transistor model extraction to top-level system analysis.

The SDN team takes care of the design and implementation of the Software Defined Network capabilities in a microwave domain controller software responsible for radio and management plane configuration and monitoring. The team is focused on standard data models defined by ETSI, ONF and IETF and where needed augmented with proprietary functionalities.

The SDN Team includes senior software architects and designers with specific skills in the solutions for Telecom networks management. The addressed scenarios are usually coming from customer-based Use Cases and supported by Radio and Traffic Network Planning internal team. The SDN team is part of software department: it is responsible for equipment firmware and management software design

Within TeraFlow, SIAE Microelettronica (SIAE) contributes to WP3 in the definition

of the novel TeraFlow OS SDN controller architecture. Specifically, as a vendor of microwave and mm-wave transport network equipment, SIAE contributes to T3.2 by defining new models or upgrading existing models for the management of radio devices and integrating them into the TeraFlow OS. Within T3.4, SIAE investigates and implements specific transport network slicing strategies that are best suited to the radio transport network domain.

SIAE also contributes to WP5 in the activities for demonstration and validation of the TeraFlow OS concept in UC1. As leader of T5.1, SIAE collects the contributions of the other partners, and on the basis of the inputs received SIAE coordinates the preparation of the testbed facilities that are used for the experimentation and performance evaluation activities together with the development of the qualification platform.



Nicola Carapellese

UPM



Universidad Politécnica de Madrid (UPM) - Technical University of Madrid - is the largest Spanish technological university. With two recognitions as Campus of International Excellence, it is outstanding in its research activity together with its training of highly-qualified professionals, competitive at an international level. More than 2,400 researchers carry out their activity at the UPM, grouped in 204 Research Groups, 19 Research Centers or Institutes and 55 Laboratories, all of them committed to transform the knowledge generated into innovation advances applied to the production sector, contributing to solve the challenges of the European citizens. The intense collaboration with governmental bodies and industry guarantees that research at the UPM offers real solutions to real-world problems.

It is among the Spanish universities with the greatest research activity and first in the capture of external resources in a competitive regime.

UPM headed the Spanish University participation in the 7th European Framework Program with 290 projects. In H2020 UPM keeps on its active participation thank to its highly innovation driven profile. UPM signs annually around 600 contracts with private businesses, due to its traditional and close relationship with the industrial and business sector, which supports and back its research and technology development in all Engineering fields. UPM obtains around 40 patents per year, demonstrating a high commitment to innovation. One of the main UPM technology transfer driver is the business creation, such as the ActúaUPM program that has generated +200 businesses in the last 10 years, 80% of which still exists. All this shows that UPM is an institution committed to the transfer of knowledge generated to society, and its transformation into advances

and technological developments applied to the productive sector.

Within TeraFlow, the UPM team brings to the project its research and innovation experience in the design of scalable distributed systems, analytics, data mining, machine learning and optimization algorithms jointly with its know-how in Big Data, Artificial Intelligence, Cybersecurity and in general, innovation topics that can be applied to identify possible

UPM leads the cybersecurity use case and contributing to the requirements identification, and architecture definition jointly with the design of Data Models (WP2). In addition, UPM leads task 4.1 related to the cybersecurity and integration of TeraFlow for beyond 5G networks (WP4) and contributes to demonstrations and validation in WP5 leading task 5.4 related to KPI validation.



Alberto Mozo



Telefónica

Atos

VOLTA
Networks



Finfinera

NEC







UBITECH



NTNU



teraflow-h2020 
TeraFlow_h2020 
TeraFlow H2020 
teraflow-h2020.eu 

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101015857



5G PPP