UNICO 5G I+D

TIMING

Towards a smart and efficient telecom infrastructure meeting current and future industry needs (TIMING-SP1)
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Year 1 report on Exploitation, Standardization, Communication and Dissemination

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GLOSSARY

Abbreviations/ Acronym	*Description*
CTIO	Corporate Technology and IT Office
DetNet	Deterministic Networking
ENP	E-lighthouse Network Planner
EU	European Union
FRER	frame replication and elimination for redundancy
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Intellectual property
PhD	Doctor of Philosophy
SDN	Software-Defined Networking
SDO	Standards Developing Organization
SME	Small and Medium-sized Enterprise
SP	Sub-Project
TSN	Time-Sensitive Networking
WAN	Wide Area Network

EXECUTIVE SUMMARY

This document includes the initial activities carried out related to Exploitation, Standardization, Communication and Dissemination.

In section 2, the document defines the sub objectives of TIMING related to the general project objective number 5, which targets to maximize TIMING impact, to exploit TIMING's results and knowledge, and contribute to the digital transition of the industry and the green deal:

1. scientific dissemination,
2. contributions to Standards Developing Organizations (SDOs) and open-source projects,
3. co-organization of events,
4. engagement with on-going projects,
5. education and communication activities,

The individual exploitation plans defined by each partner in the project are summarized in Section 3.

Section 4 includes the activities carried out for generating opportunities for standardizing project's technologies (from TIMING to SDOs), as well as bringing standardization efforts to the project (from SDOs to TIMING).

Section 5 focuses on communication activities. It is important to note that the project knowledge site is up and running, and a set of social media accounts have been created to communicate TIMING activities. Two events have been already organized by the partners in TIMING, related to dissemination and educational activities, and partners activities to communicate project's updates are included.

Section 6 provides the details of talks and scientific publications related to the project.

Section 7 includes the actions carried out to proactively establish relationships with other projects addressing the time-sensitive problem.

Finally, section 8 summarizes the document.

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1 INTRODUCTION

This document provides the initial report on Exploitation, Standardization, Communication and Dissemination of TIMING, and it is the result of the collection of the activities performed in that directions by the different partners participating in the project pursuing a collective maximization of impact through the synergies found at the project execution.

The contents reported in this document are framed basically to the work done in relation to sub-project SP-1, even though some of the actions taken could be extended or equally applicable to SP-2 and SP-3.

This document will be updated through a subsequent report towards the end of the project, consolidating the number of actions in progress in respect to Exploitation, Standardization, Communication and Dissemination.

2 TIMING OBJECTIVES

TIMING has established from its inception a clear target on generating industry and academic impact at Spanish but also European and international levels. The TIMING SP-1 proposal included the objective number 5 pursuing "*to maximize TIMING impact by influencing major vendors and service providers on the adoption of the developed principles through communication, dissemination, and standardization activities, to exploit TIMING's results and knowledge, and contribute to the digital transition of the industry and the green deal*".

For that purpose, the axis of action for the project were defined as follows:

(a) scientific dissemination in peer reviewed international conferences, journals, and magazines
(b) contributions to Standards Developing Organizations (SDOs), Open-Source Projects and other non-profit network and computing consortia and alliances
(c) actively contributing to and shaping white papers, and co-organization of workshops and events
(d) engagement with on-going and future EU funded projects (e.g., HORIZON EUROPE programme)
(e) education and targeted communication activities of results and technologies.

The initial plan required some adjustments due to the re-scheduling of the execution period of the project. Despite that, the same targets are yet valid for the project, even though the achievements have been necessarily tailored to the effective time of execution at the time of releasing this deliverable.

3 EXPLOITATION

This section summarizes the individual exploitation plans defined by each partner in the consortium in regards the value provided by TIMING for each of the participating institutions.

1. UNIVERSITAT POLITÈCNICA DE CATALUNYA

One of the purposes of UPC is to contribute to the investigation of deterministic networks deployments in industrial environments (in the context of the Industry 5.0 concept). Such contributions allow to strengthen UPC's position in the 6G networking research community. Through the expertise obtained in TIMING, the benefits for UPC will be in the following directions: improvement of the academic excellence in terms of seminars, PhD and diploma thesis as well as to introduce 6G-related technological concepts in (some) Masters courses; improvement of research excellence thanks to the strict cooperation with the industrial companies of the project, dissemination of the acquired knowledge by bringing the results to international events (industrial panels, workshops and conferences).

Within the TIMING project, the main role of UPC is the contribution to the design models, architecture, protocols and technical workflows implemented in software components. In particular, UPC is contributing to: 1) Efficient scheduling algorithms/techniques for radio resource allocation in multi-user scenarios; 2) Control and Management architecture for deterministic services provisioning, with special emphasis on the design and implementation of a TSN SDN Controller; 3) Design and implementation of a Digital Twin to assess the performance of deterministic and non-deterministic services.

We also target at transferring the technology to large industrial partners and SMEs located in Barcelona metropolitan area.

The technologies developed and mentioned in the previous section are key to UPC's academic purposes: improve the knowledge and increment the number of researchers in the group; improve the quality of the PhD and Master thesis and build links between the graduates and doctors with world class companies.

2. TELEFÓNICA INVESTIGACIÓN Y DESARROLLO

Telefonica the incumbent operator in Spain with major operations in Europe (Spain, Germany, UK) and Latin America (Brazil, Mexico, Argentina, Chile, etc.). Within the Telefónica group, the TID department participating in TIMING is part of the Corporate Technology and IT Office (CTIO). Being TID the innovation a pillar of Telefonica strategy, TID pursues the identification and definition of Telefonica's group transition to the B5G/6G ecosystem, especially in the area of time-sensitive and deterministic services, which challenge the existing networks of service providers.

Within TIMING, TID will provide the point of view of a telecom operator with different operational realities, using it to help in the definition of scenarios, use cases and gaps that could enrich TIMING scope.

From its participation in TIMING, TID expectation is to gain close-to-commercial experience and practices to anticipate market needs and requirements, to be included as part of the Telefónica group strategic technology roadmap. The project will help TID at the time of elaborating product specifications in different technological areas (with special emphasis on the support of time-sensitive and deterministic services in the transport network), when releasing RFIs and RFQs, as well as other industrial specifications (like contributions to Telecom Infra Project).

TIMING will serve to TID as a way for acquiring the sufficient know-how to determine evolution strategies when migrating existing networks towards 6G-enabled capable networks reinforcing the role of Telefonica as leading service provider in the markets where it is present, anticipating challenges in the evolution and transition especially in the support of time-sensitive and deterministic services, then making such evolution much more efficient, smooth and straightforward.

3. IKERLAN

IKERLAN will use the results of TIMING for collaboration with industry, and for future European and national project proposals. Ikerlan actively collaborates in the development of industrial wireless communication systems in various environments. Therefore, the knowledge obtained during the TIMING project will be reused in the development of diverse communication systems. Furthermore, the Wi-Fi TSN node platform developed within the project will enhance Ikerlan's technological offerings, allowing for advanced functionalities and improved performance in wireless communication systems.

Marketing Strategy: Ikerlan will conduct market research to identify the target audience and their specific needs and requirements, including developing a marketing plan that highlights the key features and advantages of the Wi-Fi TSN node device. The reach of the marketing plan is expected to include online platforms, shows, industry conferences, and direct sales efforts. Ikerlan will collaborate with industry partners and distributors and create product demonstrations to expand the reach and visibility of the product will also be considered.

Access to Other Funding Opportunities: Ikerlan will explore European Union (EU) funding programs and initiatives related to technology development and innovation, mainly in the Horizon Europe program. The objective will be to Identify and apply for relevant EU projects that align with the goals and objectives of the TIMING project and, in general, with the development of TSN and Wireless TSN technologies. Also, another option that will be explored will be other private funding sources interested in supporting cutting-edge technology projects (e.g., venture capital).

Intellectual Property Protection: Conduct a thorough analysis of the intellectual property (IP) generated through the development of the Wi-Fi TSN node device in the TIMING project. The objective of the analysis will be the identification of the key innovations and unique aspects that can be protected through patents, trademarks, copyrights, or trade secrets.

Collaboration and Partnerships: Ikerlan will Identify potential strategic partners, including other companies, research organizations, and industry associations. Ikerlan will seek to establish collaborations and partnerships to leverage complementary expertise, expand the product's capabilities, and access new markets.

4. SAFRAN

Since the beginning of this project, the company has gone from being Orolia, a medium-sized company, to SED, a large company within a group (Safran) that is huge. Within this group, TSN

technology is still very new and is in the process of establishing itself in different fields, such as Industry 4.0, aerospace, etc. Hence, this project is of high importance for the continuing efforts within the company to further validate and advance the level of maturity of the key elements of the TSN technology that are being explored within the Safran group.

The current scope of the technology has also evolved and gained traction during this transition, as there is now a drive to find other companies and departments within the Safran group that could be willing to use and exploit the technology. This has complemented our ongoing efforts to find external partners and stakeholders for our technology, that are usually harder to find to start a bilateral relationship with.

5. E-LIGHTHOUSE

E-lighthouse presents the exploitation objectives associated with TIMING project. Our primary aim is to maximize the capabilities and performance of the *E-lighthouse Network Planner* (ENP) tool to maximize the commercial value of the research outcomes generated during the project, driving innovation in the field of TSN network management.

- Development of Innovative and Trending Services: We are committed to transforming the research outcomes into practical and marketable products and services. We will closely collaborate with our technology partners and project experts to translate scientific advancements into tangible solutions that address the market's needs in the realm of TSN networks.
- Intellectual Property Protection: We recognize the importance of safeguarding intellectual property rights derived from our previous research. We will pursue suitable protection mechanisms to secure our innovations. Additionally, we will explore licensing opportunities and strategic partnerships to ensure the market expansion and accessibility of our technologies.
- Marketing Strategy: We will implement a comprehensive marketing strategy to position our ENP tool and services in the telecommunications market. This entails conducting thorough market and competitive analyses, identifying target segments, and devising effective launch plans. Moreover, we will establish strategic alliances with telecommunication carriers and integration companies to ensure the adoption of our solutions.
- Access to Funding and Investment Opportunities: We will actively seek sources of funding and investment opportunities to support the commercial exploitation of ENP tool. This involves exploring European funding programs and other capital sources to bolster our marketing, production, and expansion activities. Furthermore, we are committed to efficiently managing available financial resources.
- Impact Monitoring and Evaluation: We will implement a monitoring and evaluation system to measure the impact of the ENP solution on the telecommunications market. We will gather data on technology adoption rates, economic benefits generated, and key performance indicators. This information will be utilized to continuously improve our products and services.

We are dedicated to maximizing the potential of the research outcomes to drive progress in the field of telecommunications and the TSN network segment, contributing to the sustainable growth of our company and society at large.

6. ASEA BROWN BOVERI

The aim of ABB with the participation in TIMING is to improve the AMR telecommunications, technologies and systems to adapt them to the special needs demanded by the industry. The results will contribute to accelerating the automation and telecommunications in the industry sector, as well as to extend the AMR market, increasing the automation solutions, and therefore boosting the industry's competitiveness.

TIMING project will improve the company's products and processes, expanding the capabilities of current AMRs and logistics systems, enabling access to new sectors and applications, and increasing the competitiveness of ABB as a whole. Therefore, the target market covers all companies with recurrent flows capable of automating their internal logistics through the use of AMRs: food industry, automotive, pharmacy, aeronautics, cosmetics, etc.

ABB AMRs have been implemented in a large list of different market sectors and applications, among others: food sector, automotive industry, pharmacy, aeronautics, cosmetics industry, batteries, etc.

The improvements to our product will not only be used in installations carried out so far but will be included in the range of ABB products and may be implemented in any of the facilities that are offered after its development. This will multiply the possibilities of commercialization of the new solutions offered.

On the other hand, the system would expand the range of functionalities offered by the AMRs platform and would allow us to improve the technical quality of all the ABB products. This would contribute to a significant increase in the sales figures of the company and the opening of new target markets and geographic sectors.

The results of the project will be exploited following a strategic plan to maximize the impact:

1. Develop the technology at prototype level under the project.
2. Integrate the developed technology into ABB vehicle range.
3. Create pilot project(s) with internationally well-known customer(s).
4. Define the marketing actions and the necessary documentation to market the new technologies.
5. Introduction of technology to potential customers in professional forums, newsletters and trade fairs.
6. Progressive implementation of the technology in AMR systems for the markets and the geographic areas currently targeted by ABB.
7. Accessing new market segments

4 STANDARDIZATION

The standardization of project outcomes is a vehicle for influencing the industry by means of transferring the experience gained in the execution of the project.

1. FROM TIMING TO SDOS

During this launching phase of the project there have not been opportunities of generating actual contributions to any standardization body. This section summarizes the activities pursued in this direction.

TID

TID is actively participating in a number of Standards Development Organizations (SDOs). During the period, TID have been monitoring the activities performed in several of them in the topics of time-sensitive and deterministic services, with focus on identifying potential venues for project contributions.

Being the TID group participating in TIMING the one related to transport technologies at corporate level, the most suitable venue to contribute at this stage is IETF. Within IETF there is a working group dealing with deterministic services, this group being named Deterministic Networking (DetNet). Some aspects of TIMING seem suitable to be contributed, especially in which related to the provision of deterministic or time-sensitive services spanning non-TSN domains, with the potential need of augmenting control plane capabilities, for instance at the time of specifying transport network slices.

This is yet a work in progress and can potentially involve some other partners in the consortium such as UPC and ELI which are effectively working on the definition of interfaces between controllers in the project.

Ikerlan

Ikerlan does not have a direct relationship with SDOs, but it may have an indirect impact thanks to different research collaborations with other institutions.

As a first example, Ikerlan strongly collaborates with the University of the Basque Country (UPV/EHU), which in turn actively participates in the IEEE Standard P3388. This initiative seeks to evaluate and improve the efficiency of wireless systems utilized in vital industrial applications. The outcomes of this effort will be of great benefit to wireless equipment manufacturers, system integrators, and users by aiding them in identifying the most suitable wireless technology for specific use cases, ensuring a predetermined level of performance. Then, Ikerlan expects to have an impact in this standard through this collaboration.

As a second example, Ikerlan has been actively collaborating with Intel Labs (Wireless Research), in deterministic wireless networking for Wi-Fi. Ikerlan and Intel have worked through this collaboration in research ideas that can drive next generation Wi-Fi, and Intel has proposed some of these ideas in the IEEE 802.11 standardization body.

In summary, although Ikerlan does not have direct relationship with standardization bodies, Ikerlan may have indirect impact in the standardization bodies through this collaboration, in the topics of validation of industrial wireless solutions in realistic environments and deterministic wireless networking.

2. FROM SDOS TO TIMING

The launching phase of the project has implied the analysis of existing state of the art, including outcomes generated by SDOs which could be useful for the project.

ELI, UPC and TID

ELI and UPC are working on the integration of control elements, basically the TSN Controller, the Metro (/WAN) Controller and the TSN Connectivity Manager. The integration of these three components will be based on the usage of standard interfaces, mostly the ones being defined in IETF for the provision of network services. As result of this integration, it is expected that some gaps could emerge, which will trigger the need for some joint contribution to IETF, yet under analysis.

By the way, the hierarchical control architecture, with a hierarchical controller abstracting the complexity of the TSN and non-TSN domains, is based on the open SDN architecture proposed in the Telecom Infra Project.

Finally, at this stage, it is under evaluation the usage of ETSI Teraflow SDN controller as the component to implement the controller for the Metro / WAN segment.

Ikerlan:

In the TIMING project, SDOs, specifically standardization bodies, play a crucial role in boosting the project's success, taking into account that Ikerlan technology is based on the 802.11 standard with custom modifications for industrial traffic. In detail, we can note that:

1. Standardization bodies, such as the Institute of Electrical and Electronics Engineers (IEEE) responsible for the 802.11 standard, establish common specifications that products and technologies must adhere to. By adhering to these standards, Ikerlan's proprietary Wi-Fi TSN node can benefit from the latest advances considered in the Wi-Fi technologies. Also, some functionalities from 5G can be also used to drive the Wi-Fi TSN node design.
2. Industry Guidelines and Best Practices: Standardization bodies often provide guidelines and best practices based on their standards. These recommendations can help Ikerlan optimize its Wi-Fi platform design and implementation, leading to a more efficient and effective solution. For instance, the IEEE Standard P3388 (currently in development) aims to provide guidelines to validate wireless solutions in environments with interferences.
3. SDOs continuously evolve standards to meet industry demands and advancements. By engaging with these bodies, Ikerlan can stay updated on upcoming changes and emerging standards that might impact its Wi-Fi platform. This early input allows Ikerlan

to plan for future updates and enhancements, ensuring the platform remains relevant and competitive over time.

To sum up, use of the standards generated by SDOs play a vital role in the TIMING project's success since Ikerlan is utilizing a proprietary Wi-Fi-based platform based on the 802.11 standard. Their contributions to interoperability, system design, compliance, validation, industry guidelines, and collaborative networking can all lead to a more efficient and streamlined project timeline.

Safran:

Our solution makes use of the key specifications of the TSN family of standards to ensure the resilient and deterministic forwarding of the higher priority traffic along the Ethernet-based network segment that will be deployed in the context of TIMING. This has been translated into an architecture that makes substantial use of the main TSN components for traffic-class identification, VLAN-tagging, time-aware traffic shaping, and robust transmissions. These are summarized in the points below.

- The deterministic and reliable transmission of the critical data in our solution is handled through the use of proprietary implementations and adaptations of the main components for TSN-processing elements specified in the corresponding IEEE standards for traffic class identification and VLAN-tagging (802.1Q) for establishing and routing TSN streams on a hop-by-hop basis, time-aware traffic shaping (802.1Qbv) with preemption (802.1Qbu & 802.3br) for deterministic transmissions with low jitter, frame replication and elimination for redundancy (FRER – 802.1CB) for reliable data transport, and frame-based ingress policing (802.1Qci) for quality of service protection.
- Our solution also supports the dissemination of a network-wide time reference through a proprietary adaptation of the IEEE 1588-2008 synchronization protocol based on the PTPd stack with support for the main synchronization profiles of “default”, Telecom (G.8265.1, G.8275.1), and Power (IEEE C37.238-2011).

5 COMMUNICATION

This section describes the individual communication actions realized by partners generating external outreach.

1. WEB AND SOCIAL MEDIA

- The web site of the project is up and running (https://timing.upc.edu/).
- Social media:
  - Twitter account: https://twitter.com/unico5g_timing
  - Linkedin: https://www.linkedin.com/company/unico5g-timing/
  - Instagram: https://www.instagram.com/unico5g.timing/

2. EVENTS ORGANIZATION

1. UPC and TID co-organized the **3rd International Workshop on Time-Sensitive and Deterministic Networking**, co-located with the 2023 IFIP Networking conference, Barcelona, Spain.

   The goal of this workshop was to bring together researchers from academia and industry to investigate challenging aspects in the area of time-sensitive deterministic communications, as well as identify future research directions for ultra-low latency communications. Open issues and key innovations were discussed for both network performance and network management related aspects of deterministic communications.

2. UPC organized the **PhD Symposium on Next Generation Networks: AI, Architectures, Interfaces, and Implementations** (https://networking.ifip.org/2023/index.php/phd-symposium), collocated with the 2023 IFIP Networking conference, Barcelona, Spain, on 14 June 2023. The symposium was co-sponsored by TIMING, and the following MSCA ITN projects: 5GSmartFact, Ewoc, GreenEdge, WindMill and Explor. Each project contributed with a significant number of their PhD ESR fellows.

   The goal of this symposium was being a forum for discussion among PhD students and senior researchers, for original works in the general topic of Next Generation Networks. The participation was of 35 PhD students of 7 different projects. 17 institutions and 12 countries were represented.

Participants of the PhD Symposium on Next Generation Networks

3. COMMUNICATION ACTIONS

The following are specific actions conducted for socializing the TIMING project.

ELI

E-lighthouse has recently shared insightful updates about the ongoing TIMING project on its official LinkedIn profile and its company webpage (https://e-lighthouse.com/). Detailed

information of the news can be accessed through the following link: https://e-lighthouse.com/news

Safran:

During this period, in line with what has been commented in the exploitation part, "internal" meetings have been held with different companies and departments belonging to the Safran group to make known how we work and in which projects we are involved.

In addition to internal dissemination, we are working on future congresses such as the ITSF and we have participated in the "i+Dones" forum (May 30, 2023) where TSN technology has been highlighted.

6 DISSEMINATION

Dissemination is crucial to present project scope and results. The following are specific actions for dissemination of project focus and outcomes.

1. TALKS

UPC

UPC presented the project at the 3rd International Workshop on Time-Sensitive and Deterministic Networking (TENSOR) Workshop. The talk gave an overview of the project objectives and planned demonstration. Next, the tools being developed in the project for time sensitive and traffic flow analysis, named CURSA-SQ, was presented.

TID

TID presented a talk entitled “Deterministic communications, Emphasis on latency and jitter” at the 3rd International Workshop on Time-Sensitive and Deterministic Networking (TENSOR) Workshop. This talk elaborates on the operator’s perspective in regards time-sensitive and deterministic services, the impacts and challenges that represent for current service provider networks.

2. SCIENTIFIC CONTRIBUTIONS

The following scientific papers have been produced in the framework of the TIMING project.

UPC:

UPC has contributed to disseminating the results achieved in the TIMING project through the following publications:

Journals

1. S. Barzegar, M. Ruiz, and L. Velasco, “Autonomous Flow Routing for Near Real-Time Quality of Service Assurance,” submitted to IEEE Transactions on Network and Service Management, 2023. **Link to Zenodo:** Pending of paper acceptance.

Conferences

The following conference papers have been presented at the IEEE ICTON 2023 Conference, held in Bucharest (Rumania) on July 2-6, 2023:

1. M. Ruiz, D. Careglio, and Velasco, "CURSA-SQ models for Time-Sensitive Networking," in proc. IEEE ICTON 2023. **Link to Zenodo: https://zenodo.org/record/8190192**.
2. J. Comellas, M. Ruiz, and L. Velasco, "PILOT: A Methodology for Modeling the Performance of Packet Connections," in proc. IEEE ICTON 2023. **Link to Zenodo: https://zenodo.org/record/8190213**.
3. D. Careglio, M. Ruiz, and L. Velasco, "Disaggregated Delay Modeling in Multidomain Networks", in proc. IEEE ICTON 2023. **Link to Zenodo: https://zenodo.org/record/8190200**.
4. F. Tabatabaeimehr, L. Velasco, M. Ruiz, H. Khalili, R. Aparicio-Pardo, "Dynamic Traffic Prediction Model Retraining for Autonomous Network Operation," in proc. IEEE ICTON 2023. **Link to Zenodo: https://zenodo.org/record/8190219**.
5. S. Spadaro, F. Agraz, A. Pages, "Control and Orchestration Solutions for End-to-End Time Sensitive Services in Future 6G Networks", in proc. IEEE ICTON 2023. **Link to Zenodo: https://zenodo.org/record/8191536**.

Ikerlan:

Ikerlan has already started the dissemination of the work done in the project. The current results are two conference papers. One of them has been already presented at the 3rd International Workshop on Time-Sensitive and Deterministic Networking (TENSOR) Workshop at the 2023 IFIP Networking, while the second one has been accepted (but not yet presented at the time of releasing this deliverable) at the International Conference on Emerging Technologies and Factory Automation (ETFA) 2023 conference. The reference to the papers with their corresponding abstract can be found as follows.

1. Ó. Seijo, R. Torrego, and I. Val, "On the integration of OPC UA over Wired – Wireless Time Sensitive Networking," 2023 IFIP Networking Conference (IFIP Networking), Barcelona, Spain 2023. **Link to Zenodo: https://zenodo.org/record/8058300**
2. W. Mao, Ó. Seijo, M. Park, and H. Nikopour, "Network Coding for Ultra-Reliable Wi-Fi: An Experimental Study," IEEE 28th International Conference on Emerging Technologies and Factory Automation (ETFA), Sinaia, Romania, 2023. Accepted, to be presented at the conference. **Link to Zenodo:** Pending of paper presentation.

7 RELATION WITH OTHER PROJECTS

TIMING has proactively established relationships with other projects addressing the time-sensitive problem space as a means of cross-fertilization and as a vehicle for interchanging and enriching project outcomes. The following reports on interaction with other projects at European and Spanish levels.

1. UNICO 5G PROJECTS

TIMING invited UNICO 5G DATADRIVEN project to the face-to-face meeting held in July in Madrid, hosted by TID. During this meeting, the DATADRIVEN project, represented by Dr. Carlos J. Bernardos from the Universidad Carlos III de Madrid, was described in terms of scope, orientation and achievements so far. Similarly, the TIMING project was described and presented, generating a fruitful discussion and considering further future actions such as a common demonstration.

2. EUROPEAN PROJECTS

TIMING has established strong links with two EU SNS Phase I projects, namely PREDICT6G and DESIRE-6G projects. Two of the partners in TIMING, UPC and TID, are also partners in these SNS projects.

There was a presentation from PREDICT6G project in the TENSOR workshop, with the participation of his project coordinator, Dr. Antonio de la Oliva, from the Universidad Carlos III de Madrid. Apart from that, complementary aspects to PREDICT6G are being defined or are under development in TIMING, so a future joint demo is under consideration. The common ground between TIMING and PREDICT6G is on the usage of TSN technologies as baseline for the time-sensitive communication.

In the case of DESIRE-6G, there is also sharing of common interests and complementary technology aspects, in this case more related to the DetNet technologies and its development in IETF. Informal discussions have been taken between participants in both projects, and it can also expect joint efforts on developments or conceptual demonstrations in the future.

8 CONCLUSIONS

The following table summarizes the achievements produced so far versus the initial ambition of the project proposal.

Activity	Execution	Achievement
Scientific dissemination in peer reviewed international conferences, journals, and magazines	Partial	Publication of 7 papers in international conferences Submission of 1 paper to a major Journal
Contributions to SDOs, Open-Source Projects and other non-profit network and computing consortia and alliances	None	The re-schedule of the project execution didn't allow to generate results at this point valuable for generating contributions
Actively contributing to and shaping white papers, and co-organization of workshops and events	Done	Co-organization of a workshop co-located with an international conference, as well as a student's symposium

Engagement with on-going and future EU funded projects (e.g., HORIZON EUROPE programme)	Done	Effective engagement with two EU SNS Phase I projects, namely PREDICT6G and DESIRE-6G
Education and targeted communication activities of results and technologies	Partial	Work in progress, being also relevant in this respect the student's symposium promoted by TIMING mentioned before

It is expected during the second phase of execution of the project to continue increasing the different actions on Exploitation, Standardization, Communication and Dissemination as long as the development and integration of components and solutions start, since the original planned schedule was necessarily reformulated.

TIMING keeps the original commitments as targets for the final project impact.