



5th Generation connected and automated mobility cross-border EU trials

D6.7 Report on joint planning activities with 5G-PPP

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Glossary of terms and abbreviations used

Abbreviation / Term	Description
5G	Fifth Generation
5G-IA	5G Industry Association
5G-PPP	5G Public Private Partnership
6G-IA	6G Industry Association
AI	Artificial Intelligence
BVME	Business Validation, Models and Ecosystems
CAM	Connected and Automated Mobility
EMF	Electric and magnetic fields
ETP	European Technological Platform
ETSI	European Telecommunications Standards Institute
FRMCS	Future Rail Mobile Communication Systems
GA	Grant Agreement
FRMCS	Future Railway Mobile Communication System
KPI-VS	KPI Visualization System
MANO	Management and orchestration
NFV	Network Function Virtualization
NS	Network Service
OSM	Open-Source MANO
TWP	Tenant Web Portal
V2X	Vehicle-to-everything
VNF	Virtual Network Function
WG	Working Group
WP	Work Package

1 Executive Summary

5G-ROUTES project is a 5G-PPP phase 3 project on the topic ICT-53-2020 – *5G for Connected and Automated Mobility (CAM)* with special focus on the cross-border challenges as it aims to establish a 5G corridor (Via Baltica-North), traversing Latvia, Estonia and Finland. 5G-ROUTES aims to validate the latest 5G features and 3GPP specifications of CAM under realistic conditions across the mentioned cross-border corridor.

The current deliverable reports on the activities done in the 5G-ROUTES project, until June-2022 (M22), regarding the subtask T6.3.2 on “*5G-PPP Collaboration activities*”. Being a project that is part of the of the 5G-PPP programme, 5G-ROUTES is committed to collaborate with other 5G-PPP projects with the aim to advance in the 5G CAM vision, exploring potential synergies and collaborations, promoting the exchange of results, to share knowledge and experience as well as best practices.

For this purpose, and regulated by the 5G-PPP collaboration agreement [1], 5G-ROUTES has been contributing to joint activities under the 5G-PPP programme, such as, participation in different relevant 5G-PPPs Cross-project Working Groups (WGs), and peer to peer collaboration with other 5G-PPP projects, which is the scope of the work reported in this document.

Firstly, when the 5G-ROUTES project started, the different ongoing 5G-PPP working groups were analysed, and the most relevant ones were selected to be participated by the most suitable 5G-ROUTES partners in each case. Those working groups in which 5G-ROUTES is being involved are tackling the following topics: 5G Architecture, Software Networks, 5G for CAM (former Automotive group), Test, Measurement and KPI Validation, Vision and Societal Challenges - Business Validation, Models and Ecosystems, Trials, and SME. Besides, 5G-ROUTES is also involved in the 5G-PPP Steering Board and Technical Management Board by means of its Project Coordinator (Ericsson) and Technical Manager (Telia, with the support of TTU) respectively. The participation on these working groups implies the attendance to regular meetings, in which the different projects, including 5G-ROUTES, perform different presentations from each project perspective on various technical topics. In many cases, by means of these groups 5G-ROUTES is participating in joint dissemination activities such as workshops organizations, whitepapers elaboration, etc. so a wider audience can be reached.

Besides the collaboration on the context of the working groups, 5G-ROUTES has also been exploring direct contact with other projects. In some cases for dissemination and communication purposes, such as being part of a specific ICT-53 task force with the other 5G for CAM projects running at the same time that 5G-ROUTES. But 5G-ROUTES has also been considering technical work or results from other previous projects that are being evolved-upgraded in the context of 5G-ROUTES for the specific work on cross-border challenges. Other projects that are being specially explored by 5G-ROUTES given the close scope are: 5GCROCO [18], 5GCARMEN [19], 5G-MOBIX [17] as previous 5G projects for cooperative, connected and automated mobility, and other on-going 5G CAM projects, such as 5GMED [14] and 5G-BLUEPRINT [16], and 5GRAIL [15] regarding the rail use cases.

This document summarizes the work done in this respect, with the focus on the on-going work and outlining some plans already in place for the following months.

2 Introduction

The deliverable reports on the activities done in the 5G-ROUTES project, until June-2022 (M22) regarding the subtask T6.3.1 on “5G-PPP collaboration activities”.

Regulated by the 5G-PPP collaboration agreement [1], 5G-ROUTES has been contributing to joint activities under the 5G-PPP programme, such as, participation in different relevant 5G-PPPs Working Groups (WGs), and collaboration with other 5G-PPP projects, with the aim to advance in the 5G CAM vision, exploring potential synergies and collaborations, promoting the exchange of results, to share knowledge and experience as well as best practices.

2.1 Mapping 5G-ROUTES Outputs

Table 1 shows the mapping of 5G-ROUTES’s Grant Agreement commitments, both within the formal deliverable and task description, against the project’s respective outputs and work performed.

Table 2-1: Adherence to 5G-ROUTES’s GA Deliverable & Tasks Descriptions

5G-ROUTES GA Component Title	5G-ROUTES GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D6.7 Report on joint planning activities with 5G-PPP	A report on clustering activities aiming to advance the 5G CAM vision, to promote the exchange of results, to share knowledge and experience as well as best practices for the emerging 5G services to different relevant verticals.	All sections	Section 3 reports on the on-going activities within 5G-PPP working groups Section 4 reports on collaboration with other 5G-PPP projects Section 5 covers other planned clustering activities for the following months
TASKS			
Task T6.3 - 5G-PPP collaboration activities, recommendations and scale up	Given that within the 5G-PPP there are a number of cross-project Working Groups (WGs), in which shared issues and outputs of several projects are identified, 5G-ROUTES will have representatives from partners, participating in the 5G-PPP Steering Board and Technical Boards as well as in 5G-PPP WGs that are relevant to the project in order to contribute through white papers and workshops. This participation would include contacts and coordination to a number of 5G-PPP WG as	Section 3	Representatives from 5G-ROUTES in nine working groups are listed; as well as the report on the activities done in this context, e.g. organization of workshops, contribution to whitepapers

	outlined in Table 2.4b, including 5G-IA.		
Task T6.3 - 5G-PPP collaboration activities, recommendations and scale up	This task will define and prepare a clustering plan with associated activities aiming to advance the 5G CAM vision, to promote the exchange of results, to share knowledge and experience as well as best practices for the emerging 5G services to different relevant verticals.	Section 3 Section 4 Section 5	The planned activities are explained in Section 3 in the context of the working groups, in Section 4 regarding concrete projects, and more generally in Section 5.1

2.2 Deliverable Structure

This document is structured as follows:

- Section 1 provides the executive summary of this deliverable.
- Section 2 introduces the scope of the document, including references to the DoA and relation to other parts of the project.
- Section 3 reports on the participation of 5G-ROUTES partners to the different 5G-PPP working groups. The 5G-ROUTES representatives in each of them are listed, and then, for each working group, the main activities done in which 5G-ROUTES has contributed are described. It is also explained when there are activities planned to be done for the following months.
- Section 4 describes the peer to peer work that has been done with other different 5G projects and the relation with some of them. The section is organized grouping the project per topics and timing.
- Finally, Section 5 explains the conclusions of the current work, as well as describing the plans until the end of the project (Section 5.1).

2.3 Linkage to other Project Outputs

Table 2-2 shows how the information collected in this deliverable considers inputs from other previous deliverables in the project, as well how the information in this deliverable will be utilized by future work in the project in concrete future deliverables.

Table 2-2 D6.7 Contributions and Values of linkage

5G-ROUTES GA Component Title	Deliverable Chapter(s)	Contribution and Value of linkage
INPUTS from other deliverables utilised in this report		
D1.1 Use cases, scenarios, specifications and target KPIs for 5G for CAM	Section 3.7	5G-ROUTES composite KPIs methodology as input to 5G-PPP KPIs clustering work and 5G-ROUTES KPIs relation with overall 5G-PPP KPIs at programme level
D6.1 Dissemination and Communication Plans and Activities	Section 3	Dissemination plans regarding 5G-PPP collaboration activities

OUTPUTS from this report utilised by other deliverables		
D5.2 Commercialisation and marketing plan for 5G enabled business models for CAM final version	Section 3.8	Contacts and inputs on whitepapers and workshops on business modelling
D5.4 - Report on impact assessment and cost-benefit analysis final version	Section 3, 5	Contacts and inputs for workshop organizations with relevant external stakeholders
D6.2 “Dissemination & Communication plans and activities v2.0”	Section 3, 4	Final reporting on dissemination activities starting from 5G-PPP collaborations
D6.8 Report on technical, business, security, privacy, policies and regulatory recommendations	Sections 3, 4, 5	Contacts and inputs towards the gathering of recommendations
D6.9 Final recommendations and summary of joint activities with the 5G PPP	Sections 3, 4, 5	Contacts and inputs towards the gathering of recommendations, and final version on the 5G-PPP activities that are now ongoing

Table 2-3 Contributions of D6.7 from and to the rest of the deliverables.

3 Participation in 5G-PPP Working Groups

3.1 Overview

At the time that 5G-ROUTES project started, the different existing 5G-PPP Working Groups were explored, and those ones that were considered more relevant to 5G-ROUTES scope were selected in order to be attended by different 5G-ROUTES partners. A main first representative and a deputy or second representative were agreed for each of them. Some changes were done in the representation of some working groups; the current status is collected in Table 3-1.

Table 3-1 5G-ROUTES representatives in 5G-PPP Working Groups

Working Group (WG)	1st Representative	Partner	2nd Representative	Partner
5G-PPP Steering board	Kristjan Kuhi	EEE	Miquel Payaró	CTTC
5G-PPP Technical Board	Sven Päränd	TELIA	Priit Roosipuu	TTU
Architecture	Jaanus Väin	EEE		
Software Networks	Margus Rohtla	TTU		
5G for CAM (former Automotive WG)	George Agapiou	WINGS	Aurora Ramos	ATOS
Test, Measurement and KPI Validation (TMV)	Priit Roosipuu	TTU	Vangelis Kosmatos	WINGS
Vision and Societal Challenges (BVME)	Esther Garrido	ATOS	Patrick Durkin	ILS
Trials	Priit Roosipuu	TTU		
SME	Christos Skoufis	EBOS	Patrick Durkin	ILS

5G-ROUTES assigned representatives have been attending regularly the meetings organized in the context of the mentioned working groups, while contributing to the joint activities in each of them, in the way it is explained in the following sections.

3.2 Steering Board

Ericsson, as Project Coordinator has full participation in the Steering Board. On those meetings that Ericsson is not available it is being agreed that CTTC will be the replacement. Roughly nine meetings per year have taken place. In this way 5G-ROUTES is aware, aligned and contributing to program level decisions.

3.3 Technical Board

5G-PPP Technical Board (TB) is meeting regularly every 2-3 weeks. Telia, as Technical Manager, and TTU have been contributing to it.

5G-ROUTES project has provided description of its trials as well as infrastructure configurations. These data will be updated as real trials begin and 5G SA networks will be installed and functional.

Besides, 5G-ROUTES project was presented during the Localization session at the TB Workshop held on May 21st 2021.

During October 2021 the remote voting and election of a new Head for the TB Board was held. 5G-PPP TB has continued to be very active and has been a good source for information about the other projects as well as developing possible co-operations and distributing 5G-ROUTES project information. 5G-ROUTES has provided its project information into the project Cartography documents.

5G-ROUTES has been also actively participating in related Workshops. The last Workshop took place during 18-19 of January 2022, in which mainly ICT-17 and ICT-19, and ICT-52 projects showed their work and project outcomes.

Finally, there is a plan for ICT-41, ICT-42, ICT-52, ICT-53 projects to identify and agree on way to present their projects in the new 5G-PPP reference Figure. 5G-ROUTES has been taking the leading role of making the Reference Figure regarding ICT-53 projects.

3.4 Architecture

5G-ROUTES project overview, including main objectives and technical architectural approach, was presented within one of the meetings of this working group in May 2021, at the time that the 4th version of the joint whitepaper on “View on 5G Architecture” [2] was being elaborated.

3.5 Software Networks

TTU joined the 5G-PPP SDN WG team in February 2021. The working group meets once every two weeks via Webex or Teams. TTU has participated in most of the working group's meetings. The idea to join and participate in this working group is to gain more knowledge and contacts with professionals involved in various projects. In addition, other objective that is being pursued is to see what is being done elsewhere in countries and projects to collaborate and promote the activities of 5G-ROUTES project.

The SDN WG team is currently working on a white paper on the Network Application (NetApps) platform to find a new, more innovative and open source standardized platform to make it easier and faster for future development companies to bring new services to the market.

Currently, TTU is seeking to get an overview of what has already been done in various NetApps projects, regarding verticals service exposure, so that it can be applied to the 5G-ROUTES project. Firstly, ICT-41 5G projects contributed to the NetApps section, and in the second stage, when the white paper is ready, other projects, including 5G-ROUTES, will also contribute.

The finalization of the NetApps white paper and the joint discussion in the working group are currently underway, as there was a desire to have the white paper ready in the first half of this year.

3.6 5G for Connected and Automated Mobility (CAM)

This working group (WG) is of utmost relevance for 5G-ROUTES, and in general to all the projects in 5G providing Connected and Automated Mobility (CAM) services.

The initial name of this WG was “Automotive” WG. From the very beginning of 5G-ROUTES project, its representation within this WG was performed mainly by ATOS, participating in the weekly meetings.

In April-May 2021 5G-ROUTES project contributed to the joint brochure named “*Trials and Pilots for Connected and Automated Mobility*” [3] that was presented at EuCNC 2021.

Later this WG was renamed to “Connected and Automated Mobility”. Besides, it was migrated from 5G-PPP to 5G-IA, which had some legal implications. Among other impacts, this means that the WG is not strictly participated by projects, but by different concrete 5G-IA members/entities. Even though, the participation of 5GROUTES partners, at least two (ATOS and WINGS) means that they can take information towards 5GROUTES and also taking results from 5GROUTES towards the WG.

From December 2021, WINGS is also participating in this WG and became the main 5G-ROUTES representative.

During the last weeks, WINGS has been actively contributing to a joint whitepaper that has been published in June 2022: “*From 5G to 6G Vision. A Connected and Automated Mobility perspective*” [4]. This paper reflects on the lessons learnt during the execution of the key 5G-PPP projects which have been working on 5G for CAM and contribute to identifying, from the very beginning, new mobility requirements for the evolution of 5G and 6G communication systems. The paper also identifies the impending new technologies that are being considered for 6G and have the potential to have a highly positive impact on CAM.

5G-ROUTES, by means of WINGS, has contributed to this whitepaper about new technologies that could be used for 5G-CAM services such as the Intelligent Reconfigurable Surfaces that can be used to enhance the vehicular channel conditions by either increasing the coverage area or by providing a better, more stable channel less prone to fluctuations. Besides, a contribution on Artificial Intelligence (AI) extended-edge computing infrastructures that can enhance the capacities of the edge computing capacities has been provided. Finally, a contribution about why 5G can change mobility has also been provided, which has been outlined as:

- 5G will revolutionise the way people can travel. V2V and V2I communication will result into a significant change to the information/entertainment services provided to the drivers to have a safer trip. The information can be monitored and transferred faster from vehicle to vehicle so that the drivers can have a safer trip.
- 5G could allow companies to take advantage of acquiring diagnostic data and metrics in real time, and can provide diagnostics and insights into driver behaviour and route efficiency.
- 5G will offer a revolutionary opportunity for cities with heavy road traffic to improve the public transport operations, provide dynamic transport plans with the ability to reduce traffic congestion that leads to the provision of more space for pedestrians and cyclists.

3.7 Test Measurement and KPI Validation

5G-ROUTES has been participating in 5G-PPP TMV Working Group since February 2021. 5G-PPP TMV WG is meeting on a bi-weekly basis and 5G-ROUTES has been participating in most of the meetings represented by TTU.

Beyond 5G and 6G KPI work has been on-going in this WG since November 2021 towards the elaboration of a collaborative whitepaper among multiple projects. Firstly, a template was prepared and sent out to the different projects to collect inputs. 5G-ROUTES provided contribution regarding the KPIs analysis done in the project. As a result, the working group published a *Basic Testing Guide A Starter Kit for Basic 5G KPIs Verification* [5].

Later on, separated meetings on discussions about 6G KPIs have been on-going additionally to the regular WG meetings for the elaboration of the whitepaper “*Beyond 5G/6G KPIs and Target Values*” [6] which has been finally released in June 2022. 5G-ROUTES project, by means of TTU, has been participating as one of the Editors of this White Paper. The main objective of this whitepaper has been to present the current view of the available B5G and 6G KPIs from 5G PPP phase III projects with a focus on projects of the ICT-52 call. This view includes mapping to KPIs previously defined for 5G and evaluating how they might evolve to fit the B5G and 6G visions. The white paper is intended to be updated and re-published every year to track the B5G and 6G KPIs evolutions. The evolutions will occur as projects, use cases and functionalities mature. KPI definitions from new B5G and 6G projects from projects participating in the 6G SNS R&I Work Programme will be taken into account when available (2023). Future version of this report will also integrate more information on KPIs target values and definition of methodology for how to measure them.

The just released version on June 2022 consolidates an agreed definition and method of measurement for each KPI. Besides it clusters the different KPI, in the following categories:

- Response time/latency
- Capacity/bandwidth

- Packet loss
- Compute
- Energy
- Security
- Channel
- Electric and magnetic fields (EMF)
- Localization
- Service availability and reliability

Under each of those categories, there are concrete KPIs that are especially being monitored by 5G-ROUTES given their relevance for the project, for instance: i) those related with CAM services, e.g. sensor to vehicle latency, vehicle density; ii) those related with localization iii) those related with service availability, but considering that 5G-ROUTES is taking especial attention to the challenge on service continuity in the cross-border.

Furthermore, this KPIs clustering work is very similar to 5G-ROUTES' Composite KPIs approach to reduce the number of KPIs to facilitate the analysis [7]. One major improvement that 5G-ROUTES have introduced with the composite KPIs methodology is:

- the evaluation of the satisfaction level in different status (in addition to the raw value) – bad, acceptable, good
- a method to evaluate each cluster. The method can be applied to technical and non-technical KPIs like business KPIs, human resource, etc.

This composite KPIs methodology has been implemented in the 5G-ROUTES tenant web portal (TWP). It is currently focused on use case KPIs but could easily be applied to network KPIs. This is a work that can be potentially taken as input to the next version of the collaborative whitepaper.

3.8 Vision and Societal Challenges

3.8.1 Business Validation, Models and Ecosystems subgroup – BVME

ATOS is part of BVME since it was created in February 2020. The goal of this subgroup (SG) inside the Vision and Societal Challenges WG is:

- To develop and share methods and best practices for 5G business validation, 5G business models, and ecosystems
- To capture and elaborate on the emerging vision for future 5G value propositions, business models, and ecosystems
- To introduce 5G societal validation and address how 5G interacts with e.g. societal challenges, climate issues, regulations and institutions

The SG holds regular meetings (biweekly) to foster discussion and work is also done offline to progress on the objectives. External experts are invited from time to time to bring new insights into the topics. 5G-ROUTES representative in the BVME-SG attends all the meetings and collaborates with the group bringing the project's perspective where relevant.

5G-ROUTES business evaluation assessment framework and methodology is following recommendations from the BVME-SG building on some of the material released within this SG. More concretely, the first publication of the BVME-SG was the white paper "*Business Validation in 5G-PPP Vertical Use Cases*" in June 2020 [8]. The document described how the SG carried out an initial survey of various 5G PPP projects to find common approaches and processes for business validation. One of these projects was 5G-SOLUTIONS, that defined and applied a methodology with a lean start-up approach to assess user needs and align potential commercialisation of outputs from the research project. The white paper took this methodology into consideration and merged it

with findings from other ICT-17 and ICT-19 projects, that were also attempting to identify a consistent approach to business validation in 5G verticals, acknowledging the many challenges present in all phases of the process. The business evaluation assessment framework and methodology that 5G-ROUTES is implementing is based on this white paper. Since then, the BVME-SG has been working in the development of representative analytic models and visualizations to overcome limitations of existing business modelling tools. These tools aim to facilitate the development of sustainable business models, ecosystems and business cases.

After the summer of 2020, at the time that 5G-ROUTES kick-off, the SG resumed its regular meetings and started the discussions for a new white paper on “5G Ecosystems”, in which also ATOS participated. The list of the 5G stakeholders was extracted from the 5G PPP Architecture white paper [2]. From that point, new stakeholders were identified, and their role and business relations analysed. The white paper defines an ecosystem as “a complex network of interacting cross-industry actors who work together and are dependent on each other to define, build and deliver value creating customer solutions”. 5G ecosystems are discussed from two different perspectives: the provisioning 5G ecosystem, and the 5G vertical ecosystem. In this complex setting, the white paper highlights how one part should mobilize the other to take part in value creation. Relevant sections of the white paper were presented on the 21st of May 2021 during the 5G PPP Technical Board Workshop. The document was finally published on the 9th of September 2021 [10].

At the beginning of this year, a proposal for a joint workshop in EuCNC22 was elaborated with the title “*The emerging 5G and 6G ecosystems: Understanding emerging 5G and 6G ecosystems effects, structures and drivers while facing challenges towards achieving sustainability and maximizing growth*”, in which 5GROUTES has participated. The proposal was not accepted but was re elaborated and submitted to GlobeCom 2022 in Rio, December 2022. The workshop proposal was accepted, and it is now part of the conference program [9]. Call for papers information has been distributed among 5G-ROUTES partners. Besides, a promotional brochure has been elaborated, including 5G-ROUTES project information, to be used at EuCNC 2022 [20], which is promoting the GlobeCom 2022 workshop.

Currently, the SG is working on a third white paper, that will focus on Business Models. Huawei’s business units representatives have been invited to the group’s meetings on several occasions to share their approach to business modelling on the basis of 5G ecosystems. 5G-ROUTES WP5 leaders have been invited to collaborate in the white paper, which is now working in progress, in order to show how the 5G-ROUTES’s business validation methodology, originally inspired by the first white paper of the BVME-SG [8], is being evolved and applied in the project.

3.9 Trials

5G-ROUTES is participating in 5G-PPP Trials Working Group since January 2021. During January 2021 5G-ROUTES trials information was distributed to be included in 5G-PPP documents.

5G-PPP Trials WG meets on a monthly basis and 5G-ROUTES has been participating on most of the meetings.

A brief overview of 5G-ROUTES project activities has been given during different Trials WG meetings. As 5G-ROUTES has not had live trials yet, we have not been able to supply data to any of the published editions of the Trials and Pilots Brochure. The intention of 5G-ROUTES project is to present the outcomes of live trials in such publication when possible within this WG.

3.10 SME

The SME Working Group is formally part of the NetworldEurope European Technological Platform (ETP) [11], not strictly speaking under 5G-PPP or 5GIA. This group is committed to supporting SMEs participation in the 5G PPP and more broadly in EU R&D initiatives, promoting SMEs' contributions and involvement, particularly in NetWorld2020 and 5G PPP, and assisting SMEs in obtaining 5G-PPP related funding. Furthermore, the group monitors and analyzes the participation of SMEs in EU projects, reporting results to the European Commission.

The SME Working Group activities are mostly focused towards two main areas. Firstly, to increase SME visibility towards big industry players by increasing SME social presence, develop networking opportunities, extend the 5G PPP brokerage service to take better into account SMEs needs, determining SME expertise, help define a “5G Value Chain” SMEs can position themselves in and interact with the EC, the NetWorld2020 Steering Board and the 5G Infrastructure Association. Secondly, to increase interaction amongst SMEs by utilizing social networking practices, organize meetings, events and webinars.

From the start, eBOS contribution and involvement in the SME Working Group included participation in quarterly telephone conferences and regular updates to the “Find your SME” web page [12] and SME brochure [13].

3.11 Summary of Tangible Outcomes

Among the different discussions in meetings and ongoing activities explained in the previous, sections Table 3-2 summarizes the key tangible outcomes that 5G-ROUTES has achieved until June 2022 due to the participation on the different Working Groups.

Table 3-2 5G-ROUTES tangible achievements through 5G-PPP Working Groups

Working Group (WG)	5G-ROUTES Tangible Achievements until June 2022
Technical Board	Leading role in implementing ICT-53 projects reference figure
Architecture	5GROUTES project presentation
Software Networks	Participation in ongoing whitepaper about <i>Netapps</i>
5G for CAM	Contribution to “ <i>Trials and Pilots for Connected and Automated Mobility</i> ” brochure [3] Contribution to “ <i>From 5G to 6G Vision. A Connected and Automated Mobility perspective</i> ” Whitepaper [4]
Test Measurements and Validation	Contribution to <i>Basic Testing Guide a Starter Kit for Basic 5G KPIs Verification</i> [5]. Contribution to “ <i>Beyond 5G/6G KPIs and Target Values</i> ” Whitepaper [6]
Business Validation, Models and Ecosystems subgroup	Workshop organization “ <i>Understanding emerging 5G and 6G ecosystems effects, structures and drivers while facing challenges towards achieving sustainability and maximizing growth</i> ”, GlobeCom 2022 in Rio, December 2022[9] Promotional brochure at EuCNC 2022 [20]
SME	Contribution to “ <i>Find your SME</i> ” web page [12] Contribution SME brochure [13]

The “Trials” WG would be the only group in which 5G-ROUTES is participating, attending the meetings, getting insights from other projects, but the actual 5G-ROUTES contributions will be performed once the field trials of the project will be more advanced.

4 Collaboration with other 5G-PPP Projects

Besides the collaborative work reported in Section 3 under the 5G-PPP working Groups structure, 5G-ROUTES has also performed other peer to peer collaborations activities, which is reported in the current section. Section 4.1 reports on the activities done in collaboration with ICT-53-2020 project – *5G for CAM*, which is the same topic as 5G-ROUTES', including a specific Task Force in which 5G-ROUTES is actively participating, as well as a short overview of each of them. Section 4.2 describes the collaboration with other relevant projects on CAM that started before 5G-ROUTES (ICT-18-2020 projects) and finally, Section 4.3 describes collaborations and relations with other 5G projects that in principle are not specific on CAM.

4.1 ICT-53 - 5G for CAM Task Force

5G-ROUTES is part of this task force group which has been created to promote collaboration between 5G CAM ICT-53-2020 projects. The main objectives of this group are:

- Maximize impact of the projects by identifying joint activities for dissemination and communication.
- Share best practices and strategies for the dissemination and communication in the context of CCAM, 5G and cross-border corridors.
- Build up joint events and webinars to increase the visibility towards different projects.

The other ICT-53 projects involved, besides 5G-ROUTES, are:

- 5GMED [14]: Sustainable 5G deployment model for future mobility in the Mediterranean Cross-Border Corridor
- 5GRAIL [15]: 5G for future RAILway mobile communication system
- 5G-Blueprint [16]: Next generation connectivity for enhanced, safe & efficient transport & logistics

The main collaborations resulting from the group, in which 5G-ROUTES has contributed, are:

- Joint workshop proposal submission among the four ICT-53 projects (5GMED, 5GRAIL and 5G-Blueprint) and ICT-18 (5G-MOBIX [17], 5GCroCo [18], 5GCARMEN [19]) projects to EuCNC [20], Grenoble, France, 7-10 June 2022
- Joint booth proposal submission with 5GMED and 5G-BLUEPRINT projects to EuCNC Grenoble, France, 7-10 June 2022) [20]
 - The proposal has been accepted and results will be reported in D6.2 “Dissemination & Communication plans and activities v2.0” (M28) and D6.9 “Final recommendations and summary of joint activities with the 5G PPP” (M48).

5G-ROUTES is represented at the force task group by the WP6 leader (and 5G-ROUTES Dissemination Manager). We will keep working to achieve more joint collaboration actions with other 5G-PPP projects until the end of the project.

At the technical level, 5G-ROUTES is planning discussions to explore synergies from the architecture and use cases implementation perspective. There have been already several bilateral conversations with 5MED about i) cross-border architectural challenges ii) infotainment use cases. Furthermore, especial focus will be put on the rail use cases, with 5GRAIL, on FRMCS (Future Rail Mobile Communication Systems) studies. FRMCS are 5G-based communication systems considered as a successors of GSM-R for safety controls, signaling, and communication of train drivers with railway control centers.

4.2 ICT-18 Projects: 5G for Cooperative, Connected and Automated mobility

4.2.1 5GCROCO

5G-ROUTES and 5GCroco [18] projects have co-organized the *1st Summer School on challenges and technologies for a 5G Connected Automated Mobility across Europe (5G-X-EU)* [21]. The Summer School was hosted by EURECOM (a consortium member of 5GCroco) in Sophia-Antipolis (France) on 23-24 May 2022. CTTC and TTU were part of the Organizing Committee. Besides, eight 5G-ROUTES partners participated providing technical presentations about 5G-ROUTES, especially regarding 5G-ROUTES enablers and use cases. In total, the participation was about 50 students and experts (online + on-site).

- Outputs will be reported in D6.2 “Dissemination & Communication plans and activities v2.0” (M28) and D6.9 “Final recommendations and summary of joint activities with the 5G PPP” (M48).

Moreover, 5G-ROUTES and 5GCROCO have participated in the *FITCE 5th technology Forum* in a session that was devoted on 5G infrastructures and CAM services [22]. A round table was organized by WINGS and IQU. The discussion was concentrated on the capabilities of 5G networks for functioning 5G CAM services and if there is a need for the next infrastructure provided by the upcoming 6G.

4.2.2 5G-MOBIX

5G-ROUTES is applying some tools developed in the 5G-MOBIX project, more concretely the checklist for field trial readiness in *T3.4 - Lab trials and operational readiness for large scale field trials*. This checklist, which was developed in 5G-MOBIX to check the trial readiness of the different user stories, has been adapted, using both the experiences in 5G-MOBIX as well as the specificities of 5G-ROUTES. Checks were added for the different 5G-ROUTES enablers, and the checklist will also be a tool to support testing the use cases together with the 5G-ROUTES enablers in the labs of CTTC and TTU during the second and third runs of lab trials.

Besides 5G-ROUTES has provided inputs to 5GMOBIX by means of a survey regarding business modelling; 5G-MOBIX issued a survey [23] aimed at elaborating business perspectives of various stakeholders, how they see value proposition, who are the key partners for them, what are the challenges on business level, what are their key resources to achieve 5G-CAM application, network, equipment, etc. From 5G-ROUTES side this survey has been filled by ILS as business and innovation manager.

4.3 Other 5G Related Projects

4.3.1 5G-HEART

5G-ROUTES co-organized a CAM workshop as part of the *IEEE 95-th Vehicular Technology Conference 2022 Spring* [24] together with EU Horizon 2020 5G-HEART [25] and 5G-MOBIX [17] projects, and the Celtic-Next 5G-SAFE-Plus project [26]. The workshop proposal was accepted and disseminated actively. Some contributions were received but not sufficient to organize the workshop, and, as a consequence, the workshop was cancelled.

4.3.2 5G-SOLUTIONS

For 5G-ROUTES *T2.4 – Design and development of Tenant Web Portal and deployment in the cloud*, the initial plan, according to the DoA, was to leverage the Key Performance Indicators Visualisation System (KPI-VS) from 5G-SOLUTIONS project [27] extending its functionality to cover the CAM use cases in 5G-ROUTES. After exploring this option, it was concluded that this was difficult to be performed, since most of the companies involved in KPI-VS implementation are not participating in the 5G-ROUTES Consortium. This makes the availability of the entire source code not feasible. So, the new approach taken has been to utilise the know-how gained from 5G-SOLUTIONS to implement the Tenant Web Portal (TWP) from scratch, addressing the 5G-ROUTES needs.

4.3.3 5GENESIS

The Connected and Automated Mobility (CAM) repository implemented in 5G-ROUTES is based on one of the results of a previous project, 5GENESIS [28]. In 5GENESIS project, the Virtual Network Function (VNF) repository functionality was implemented on top of Network Function Virtualization (NFV) Orchestrators to provide enhanced verification (for NFV artefacts such as network service (NS) descriptors and metadata) and access management among multiple VNF vendors for NFVO onboarding with privacy guarantees.

In 5G-ROUTES this asset is being evolved in a two-fold way:

1. In terms of NFVO compatibility and types of artefacts supported:
 - a. Breaking changes on the newer versions of ETSI Open-Source MANO (OSM) are being integrated. It is also envisioned to extend its support to different NFVOs such as the Ericsson Orchestrator that is used in 5G-ROUTES.
 - b. Cloud-Native artefacts such as container images and helm charts are being included in the asset catalogue of services as a way to provide an all-in-one registry of the NFV artefacts involved in a 5G deployment.
2. Implementing specific functionalities to the asset which are required in a cross-border deployment:
 - a. a multi-domain synchronization mechanism is being implemented to support the deployment of CAM Services across different administrative domains on a cross-border scenario.

4.3.4 Smart5Grid

Smart5grid [29] is planning to use the basic core functionality coming from CAM repository implemented in 5G-ROUTES adding a NetApp framework on top.

- The asset will be offering compatibility with NetApps which involves adding support to storing, verifying and provisioning a new type of artefact and its information model.
- Smart5grid project also aims at extending the verification part of the asset which will result on enhanced checks on the OSM's NS and VNF descriptors such as network topology consistency and integrity.

4.3.5 VITAL-5G and 5GDRIVE

At the IEEE Meditcom Conference, a special session was organised by WINGS inviting CAM projects. 5G-VITAL [30] and 5G-DRIVE [30] participated in the following way:

- Both projects presented results that have close relation to the outcomes and expectation to 5G-ROUTES.
- A round table was organized among the above partners that was chaired by WINGS. The discussion of the round table was concentrated on the readiness of 5G infrastructure to host 5G CAM services and the challenges that were encountered during the CAM service testing. The session was attended by 78 participants.

4.3.6 5GROWTH and 5G-TRANSFORMER

Within the technical activities carried out in WP2 and the lab trials in WP3, 5G-ROUTES is taking as a reference, in the CTTC lab site, the management and orchestration (MANO) platform that CTTC developed in the context of 5GROWTH [32] and 5G-TRANSFORMER projects [33]. The aim is to evolve the service and resource orchestration capabilities of this platform in order to (i) deploy and interact with some technological enablers developed within the scope of 5G-ROUTES T2.1 and T2.2 (e.g., predictive resource allocation of V2X related network functions, CAM repository, Integration Fabric), and (ii) automate the provision of the virtualized network functions associated to the CAM services proposed in use cases related with 360 immersive multiuser gaming and 3D real-time virtual collaboration.

5 Conclusions

This deliverable has presented the work done under the scope of the subtask T6.3.2 on “5G-PPP collaboration activities” until June 2022 (M22 of the project).

5G-ROUTES partners are currently collaborating in eight 5G-PPP cross-project working groups (WG). These WGs are holding regular meetings that different 5G-ROUTES partners are attending. As a result of these meetings, 5G-ROUTES work is being disseminated to other 5G projects, contributing to the evolution of the 5G CAM vision. These fora of collaboration also allow 5G-ROUTES to get to know about the technical work done by similar projects, that can be applicable for 5G-ROUTES scope. For instance, it is especially relevant the work on KPIs methodology to be aligned within the community. The participation in those WGs also allows 5G-ROUTES to join efforts for dissemination and exploitation of results by collaborative communication activities, such as joint workshops and participation in whitepapers, so a wider audience can be reached. It is especially relevant for 5G-ROUTES objectives the collaboration with other 5G CAM projects, but also other 5G-PPP community projects for some technical 5G issues, for instance regarding network slicing and software networks. 5G-ROUTES plans to continue collaborating in the aforementioned WGs until the end of the project. Besides, potential new working groups that may be appearing in the following months or years will be also considered in case they are interesting for 5G-ROUTES scope.

Besides the work done within those WGs, 5G-ROUTES is also doing peer to peer actions with several projects, to find synergies and complementarities that can be relevant for the project. 5G-ROUTES is leveraging on some previous 5G projects results or assets which are being enhanced and evolved within 5G-ROUTES by adding the required specific functionalities to cope with 5G-ROUTES requirements; this is the case for 5GENESIS repository functionalities or the 5G-TRANSFORMER and 5GROWTH orchestration mechanisms. Projects that are being specially explored by 5G-ROUTES due to the proximity on its scope are: i) previous 5G for cooperative, connected and automated mobility projects: 5G-MOBIX, 5G-CARMEN and 5GCROCO ii) other 5G for CAM projects, such as 5G-BLUEPRINT and 5GMED regarding cross-border architecture and infotainment use cases and iii) 5GRAIL and 5G-VICTORI regarding the rail use cases.

5.1 Roadmap Forward/Next Steps

The following work is planned to be done within T6.3.2 subtask regarding “5G-PPP Collaboration activities” until the end of the project:

- 5G-ROUTES will be participating in the current 5G-PPP working groups, to continue exchanging results with other 5G projects, and for the organization of collaboration activities regarding dissemination, e.g. workshops and whitepapers, especially on the technical scope of KPIs and trials in cross-border scenarios.
- 5G-ROUTES will continue being part of ICT-53 task force. In this context, a series of workshops will be proposed to the ICT-53 projects during the last part of this year (dates and topics are still tentative) in the following way:
 - o Sept’22: Workshop 1 – 5G Teleoperated
 - o Oct’22: Workshop 2 – FRMCS services and Infotainment
 - o Nov’22: Workshop 3 - AI and cybersecurity
 - o Dec’22: Workshop 4 – Rail, Road, Water Communication systems
- 5G-ROUTES will continue establishing technical discussion with other projects 5G for CAM projects, especially regarding rail use cases to find potential synergies.
- 5G-ROUTES will be aware of the potential new working groups that may be created in the context of the 5G-IA and/or 6GIA in case some of them are on the interest of 5G-ROUTES to participate.
- 5G-ROUTES plans to organize workshops between WP6 and WP5 (T5.1 - Business models development, marketing plan and sustainability and T5.2 - Impact assessment and cost/benefit analysis) on business models development and impact assessments involving partners from other 5G form CAM projects. The objective is to investigate whether there are common business areas between the 5G cluster projects on

the 5G technology opportunities in European corridors, to discuss and create a common business framework, based on which the specificities of each project will be built upon, depending on the area of application. This will allow better understanding between the involved stakeholders of how 5G technology would better return its investment not only in one domain, but in all related domains of application, so as the benefit is maximized to the best possible extent. 5G-ROUTES proposes to organize a business stakeholder group between the involved projects, that can meet regularly, be invited in focused business events and/or organize common events as webinars or special sessions in selected Congresses

- 5G-PPP communication channels that 5G-ROUTES has established, and explained in this report, will be exploited to get inputs from other projects and WGs also towards the elaboration of recommendations that will be released by 5G-ROUTES in a later stage in the project. One of the ways, among others, to collect the information from stakeholders from other projects will be by means of surveys in some joint workshops.

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