FUDGE-5G

FUlly DisinteGrated private nEtworks
for 5G verticals

D5.2

Dissemination and Communication

Version 1.2

Work Package 5 - Exploitation, Standardization and Dissemination

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Disclaimer

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Abstract

The present document reports the dissemination and communication activities in the scope of the FUDGE-5G project, entailing both the project communication channels and dissemination activities in relevant events. It encompasses the methodology and procedures that FUDGE-5G has put in place to generate the communication and dissemination content, which include deliverables, news, scientific publications and presentations. The document also covers the initial communication and dissemination strategy. Moreover, the document lists all produced contents and presents a statistical overview of the performance of the established communication channels.

This is the final version of Deliverable D5.2, reporting all the dissemination and communication activities conducted in the scope of the project.

Versioning and contributions

Versioning

#	Description	Contributors
0.1	Table of contents	ONE
0.2	Communication and Dissemination Plan	ONE
0.3	Year One Communication and Dissemination report	ONE
0.4	IDE and 5CMM contributions Integrated	IDE, ATH
0.5	On-going disseminations activities incorporated; Dissemination overview.	ONE, UPV
1	Version submitted	ONE
1.1	Newsletters and Communication overview	ONE
1.2	Final Reporting	ONE

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Abbreviations

PPDR – Public Protection and Disaster Relief

CT – Communication Team

CM – Communication Manager

PMT – Project Management Team

EC – European Commission

SDO – Standard Development Organization

5GPPP - 5G Infrastructure Public Private Partnership

SDN – Software Defined Network

NFV – Network Function Virtualization

MWC – Mobile World Congress

ECC – Edge Computing Congress

EuCNC – European Conference on Networks and Communication

UAV – Unmanned Arial Vehicle

MCPTT – Mission Critical Push To Talk

NPN – Non-Public Network

WG – Working Group

Executive Summary

This deliverable covers the communication and dissemination activities for the FUDGE-5G first year. The activities performed are necessary to public disclosure the project results. It assures that the research results are known to various stakeholder groups.

The communication and dissemination report, that is presented in this document starts by creating the dissemination and communication strategy by identifying the target groups, which include: 5G operators, 5G technology providers, vertical industry, scientific community, decision makers and regulators, and end users.

For each of the target groups, the strategy identifies the dissemination and communication activities that provide the better results in achieving the target value. The activities include: the project website, promotional materials, conferences and workshops, participation in industry events, collaboration with other projects, and scientific publications.

The document establishes a methodology for the implementation of dissemination and communication activities and content production, towards public disclosure of project outcomes. Moreover, the document describes the intent and rational behind the created communication channels, website and social network accounts.

By implementing the initial strategy, distinct outcomes were produced within the FUDGE-5G consortium. The document describes both these outcomes and their reach throughout the project channels.

This is the final version of Deliverable D5.2, reporting all the dissemination and communication activities conducted along the project.

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1. Introduction

FUDGE-5G is an H2020-funded Innovation Action project which will enable highly customized cloud-native deployment of private 5G networks in five vertical trials (leveraging the 5G- VINNI testbed): Concurrent Media Delivery; PPDR; 5G Virtual Office; Industry 4.0; and Interconnecting Non-Public Networks. In this scope, the FUDGE-5G Communication and Dissemination report contains the initial communication and dissemination strategy, describes the established FUDGE-5G communication channels, and lists the dissemination artefacts produced until the submission of the document (Month 31).

The FUDGE-5G Communication and Dissemination report is a living document, which evolved during the project, as the number of produced dissemination and communication artefacts continued to grow. This document is the final version of the Communication and Dissemination report.

1.1. Methodology

This section describes the purpose and duties for the project promotion and the internal review process to be followed by the project partners, when producing content to be disseminated by the project.

The communication manager is responsible for planning, implementing and managing the FUDGE-5G communication strategy. His mission includes the promotion of FUDGE-5G, ensuring that the project outcomes are properly communicated and disseminated. The communication manager is responsible by identify the appropriate methods to promote and disseminate the FUDGE-5G objectives, achievements, and outcomes. On the other hand, he is responsible for ensuring that the communication artifacts have the appropriate quality and follow the project communication goals. Finally, the communication manager is responsible for evaluating the performed communication activities.

ONE is the FUDGE-5G communication manager. Its first step was to identify the target audiences and the communication objectives. Then, it created the project image identity, the project website and the FUDGE-5G social media channels. A communication strategy was developed and the plan for its implementation devised. The details of this plan are summarized in this document.

1.1.1. Internal Review Process

In order to assure the content quality and compliancy with regulations, FUDGE-5G established an internal review process, presented in Figure 1. The process is composed of the following main steps:

- Step 1: When a FUDGE-5G partner (or group of partners) intents to disseminate content, it produces the correspondent dissemination artifact and submits it to the Communication Manager.
- Step 2: The Communication Team (CT) is then responsible for validating the artifact, including the approval of any FUDGE-5G partner mentioned by the artifact. If the artifact needs to be modified, the CT requests it to the involved partner(s). When the artifact passes validation, the CT identifies the appropriate channels for publishing the artifact.
- Step 3: The submission is then forwarded to the Project Management Team (PMT), to be approved for publication. The PMT team can reject or ask the partner(s) to make some changes.
- Step 4: If the PMT team approves the artifact for publication, it is published by the CT in the previously defined channels.

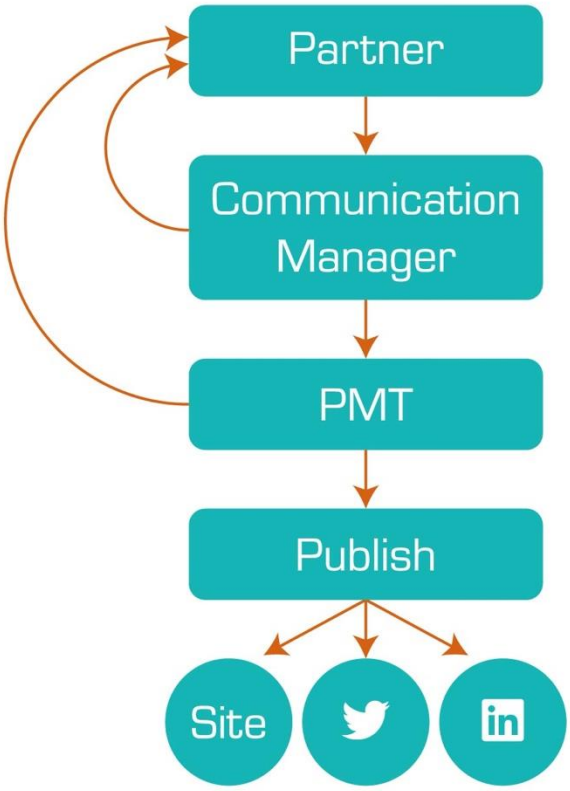

Figure 1 - Internal Content Review Process

2. Communication and Dissemination Strategy

Dissemination and communication are very important aspects in FUDGE-5G, to create the necessary industrialized framework and to leverage the core innovations into the evolving 5G architecture ecosystems. The project has identified the following target groups:

- 5G Operators.
- 5G Technology providers.
- Vertical Industry.
- Scientific community.
- Decision-makers and regulators.
- End-users.
- Public at large.

FUDGE-5G will carry out a set of different activities to reach each of the identified target audiences. FUDGE-5G knows that each activity will reach the target audience differently. Table 1 presents the target groups for each dissemination and communication activity (darker bullets represent primary targets; light bullets represent secondary targets).

Table 1 - Target groups per dissemination and communication activity.

Activity type	5G operators	5G technology providers	Verticals industry	Scientific community	Decision makers and regulators	End-users	Public at large
Website	●	●	●	●	●	●	●
Social Media	●	●	●	●	●	●	●
Promotional Materials	●	●	●	●	●	●	●
Conferences & Workshops	○	○	○	●	○		
Participation in industry events	●	●	●	○	○		
FUDGE-5G workshops	●	●	●	○	●	●	○
International seminars	●	●	●	○	●	●	○
Collaboration with projects	●	●	○	●	○	○	
EC Dissemination Mechanisms	●	●	●	●	●	○	○
Scientific Publications	○	○	○	●	○		

Publications in general media	○	○	○	○	○	●	●
Open-source repositories	○	○	○	●	○		
Advanced Training	●	●	●	●	●		
Community building	●	●	●	●	●	○	○

Four vertical stakeholders, from Norway, will act as end-users for the trials. They will not only participate in the technical validation trials, but were also part of the definition of the use cases and the corresponding technical blueprints[1]. The vertical stakeholders and their corresponding use cases are the Norwegian public service broadcaster NRK[2] (Concurrent Media Delivery), the Norwegian Defence Material Agency[3] (PPDR), the Oslo University Hospital[4] (5G Virtual Office) and ABB[5] (Industry 4.0 Campus Network).

2.1. Dissemination objectives

The following dissemination activities were planned and are summarised in Table 2:

- Industry dissemination, to present and demonstrate the FUDGE-5G Platform and its components in both 5G technology events and vertical industry events. Target events will be selected based on their size, profile and geographical coverage to maximize not only dissemination but also exploitation potential. A minimum of 9 demonstrations in industry events is targeted (one per 5G technology component). The individual demonstrations of the technology components might be combined to maximize the exploitation impact.
- Scientific dissemination, in the form of publications and presentations in top peer-reviewed research conferences, workshops and journals, as well as the organization of demos and special sessions in scientific conferences, in order to promote the innovative FUDGE-5G technologies. The project will target the following scientific contributions: 25 journal and conference papers, 10 workshops, in collaboration with ICT-17 5G-VINNI, 5 demonstrations, and 2 tutorials/summer schools.

The project and its results shall also be disseminated by each of the partners through their usual dissemination channels (e.g., publishing project information in its website, releasing white papers, case studies and newsletters) according to their core objectives. Communication aspects will be considered throughout all the stages of the project, as a way of ensuring a proper strategic alignment between the various communication activities, overall project goals and impact amplification.

[1] https://fudge-5g.eu/download-file/365/sq6G3zIXkRBOFWRM3bqO
[2] https://www.nrk.no
[3] https://www.fma.no/en
[4] https://oslo-universitetssykehus.no/oslo-university-hospital
[5] https://global.abb/group/en

Communication activities combined complementary actions that, altogether, provided an intentional and effective relay of information and awareness towards the whole array of relevant target audiences, including the 5G industry, the 5G SDOs, the research community, decision-makers (governments, public agencies and regulatory organizations), specialized end-user communities (e.g., public-safety organizations and use case owners) and the general public.

Table 2 - Communication and Dissemination Targets

Activity	Phase I (Year 1)	Phase II (Year 2)	Phase III (Year 3 & beyond)	Target KPIs (Y1 to Y3)
Website	Established in M2	Ongoing	Ongoing	Monthly visitors ≥ 200/350/500
Social Media	Established in M2	Ongoing	Ongoing	Followers ≥ 100/200/300
Promotional Materials	Since M3: graphic identity, flyers, videos, templates, whitepaper, factsheet, newsletters	Ongoing: update of materials and new materials reflecting ongoing work	Ongoing: update of materials and new materials reflecting the project results	Newsletters 4/4/4 Flyers 400/800/1600 5 promotional videos. 500 views per video
Collaboration with other H2020 projects	Collaboration with 5G-VINNI. Identification and contact of relevant projects	Collaboration with AFFORDABLE5G and 5G-HEARTH. Liaison with other projects	Demos; collaborations;	Reached projects ≥ 1/3/6
EC Dissemination Mechanisms	Publication of official project information +5G PPP and other concertation events	5G PPP and other concertation events organized by the EC	5G PPP and other concertation events organized by the EC	Total of events ≥ 6
Open-source repositories	Identification of relevant open-source projects	Initial contributions; creation of a community	Contribution of full systems; integrators; demos follow up with the community	Opensource projects ≥ 3 Full systems ≥ 5
Advanced Training	Identification of potential MSc and PhD dissertation topics. Engaging of candidates.	MSc dissertations. Engagement of extra candidates. Preliminary training materials.	MSc and PhD dissertations. Training materials integrated into advanced training programs	MSc's up to Y3 ≥ 9 PhDs up to Y3 ≥ 3 Impacted training programs ≥ 3
Community building	Form first connections, capitalize previous communications and links that may exist from past activities	Key stakeholders, participation in events	Creation of vertical communities based on the collaborations	# of members ≥ 50

	(researchers, innovators, etc.)

2.2. Timing and FUDGE-5G strategy

A progressive strategy will be implemented during the FUDGE-5G, as presented in Figure 2 (for the first year), Figure 3 (for the second year) and Figure 4 (for the third year).

Figure 2 - Timeline of activities and target KPI's for the 1st year.

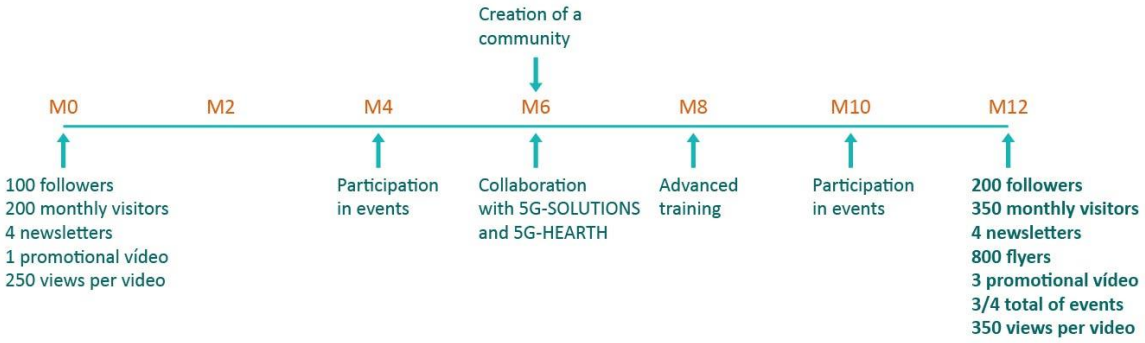

Figure 3 - Timeline of activities and target KPI's for the 2nd year.

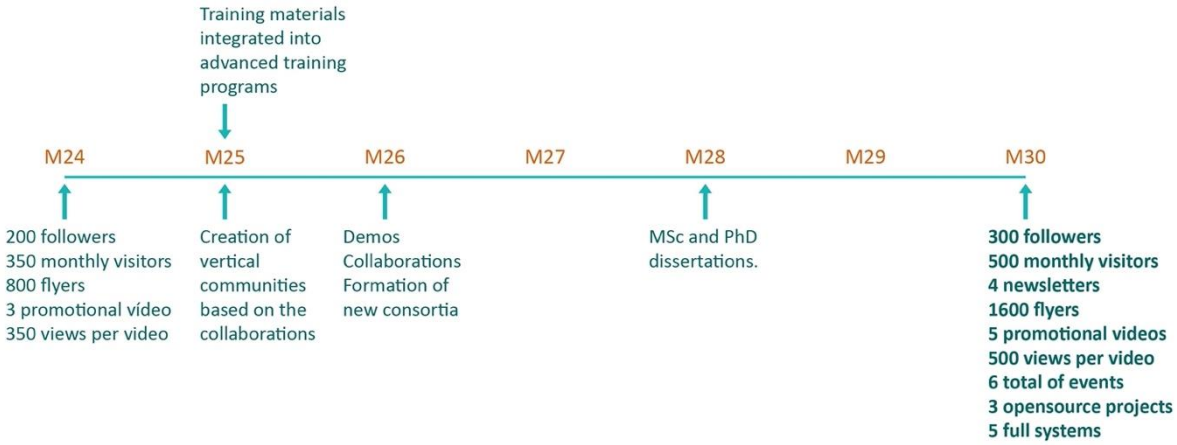

Figure 4 - Timeline of activities and target KPI's for the 3rd year.

3. Internal Communication

To facilitate communication between partners, several collaborative platforms were adopted. Online collaborative platforms connect geographically dispersed researchers, enabling uninterrupted cooperation, the sharing of research objects as well as ideas and experiences. Collaborative platforms are usually online services that provide a virtual environment to which several people can connect and work on the same task. They range from broad Virtual Research Environments that encompass a range of tools to facilitate sharing and collaboration, for example forums or wikis, hosting collaborative documents and tools for analysing or visualizing data and specialized tools that allow researchers to work together in real time on specific aspects of research (such as writing or analysis).

3.1. Collaborative tools

In order to facilitate the collaboration and communication between partners, FUDGE-5G adopted slack, a set of mailing lists, Confluence, Gitlab and a cloud repository.

3.1.1. Confluence

As a collaborative platform, Confluence was adopted as a repository for information and management of the different project activities (https://fudge-5g.atlassian.net/).

An initial structure proposal was created and organized by work packages, with information regarding activities, deliverables, milestones and meetings, as shown in Figure 5. The management of the structure of each work package is delegated to respective work package leader.

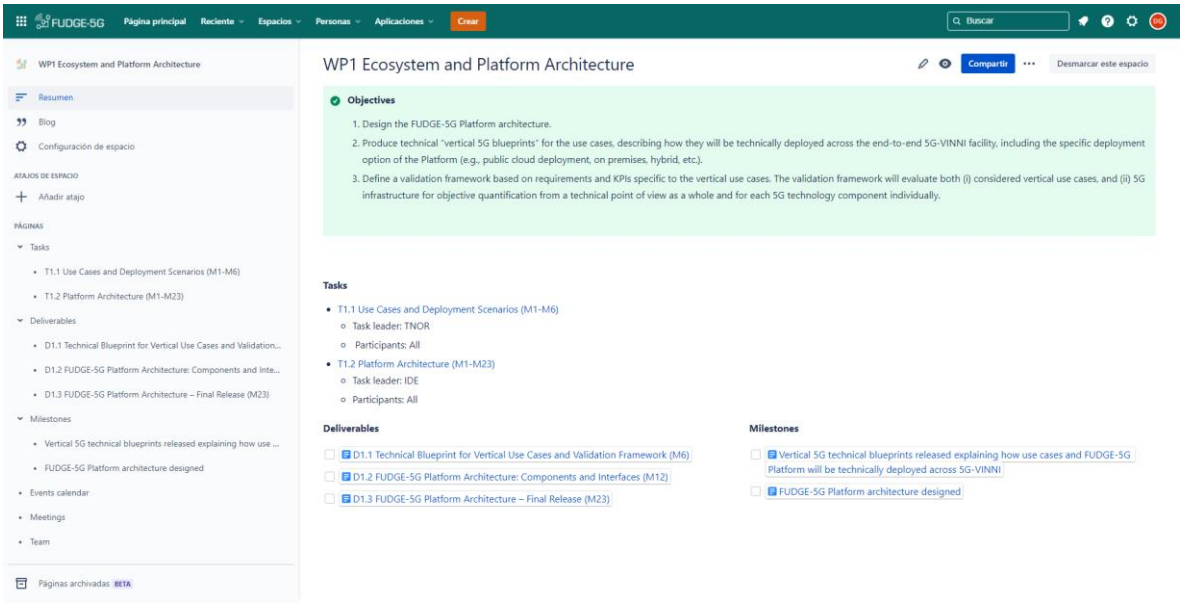

Figure 5 - Initial structure proposal for FUDGE-5G Confluence

3.1.2. Cloud Repository

As a way to complement the sharing of resources between project partners, a cloud platform was also created (https://cloud.fudge-5g.eu). The platform folder organisation, Figure 6, follows the project work packages and deliverables.

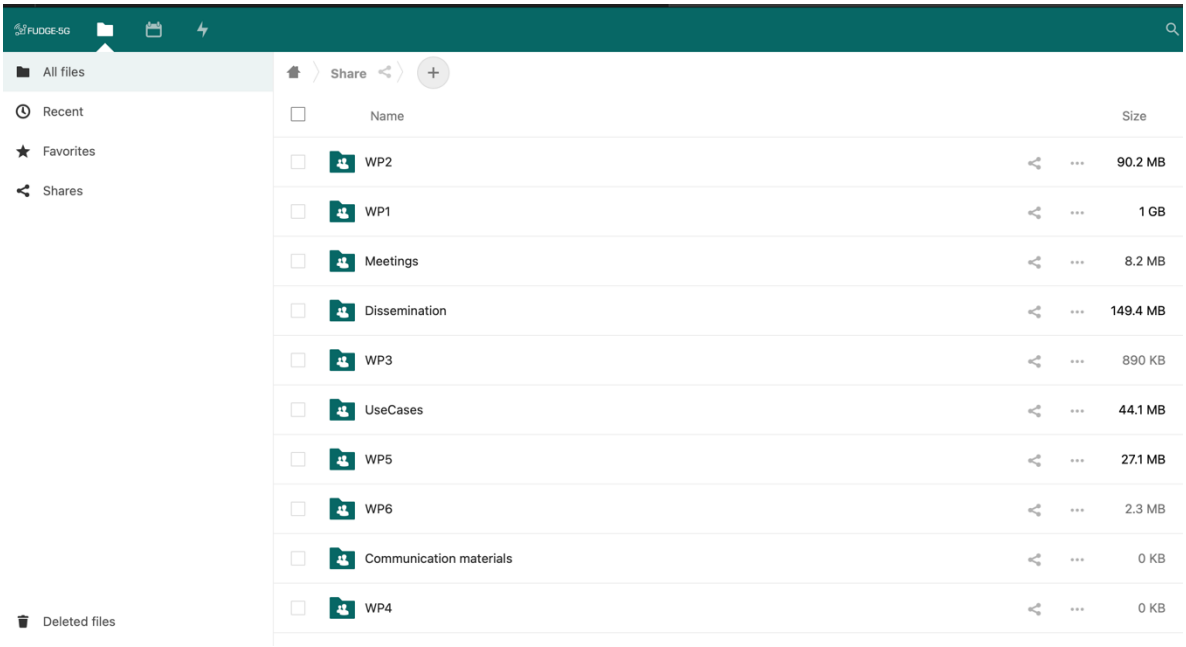

Figure 6 - FUDGE-5G cloud platform

3.1.3. Gitlab

As a mean to improve FUDGE-5G implementations management, a Gitlab repository, Figure 7, was created (https://gitlab.fudge-5g.eu). The repository provides issue tracking and a continuous development and deployment pipeline for the FUDGE-5G partners.

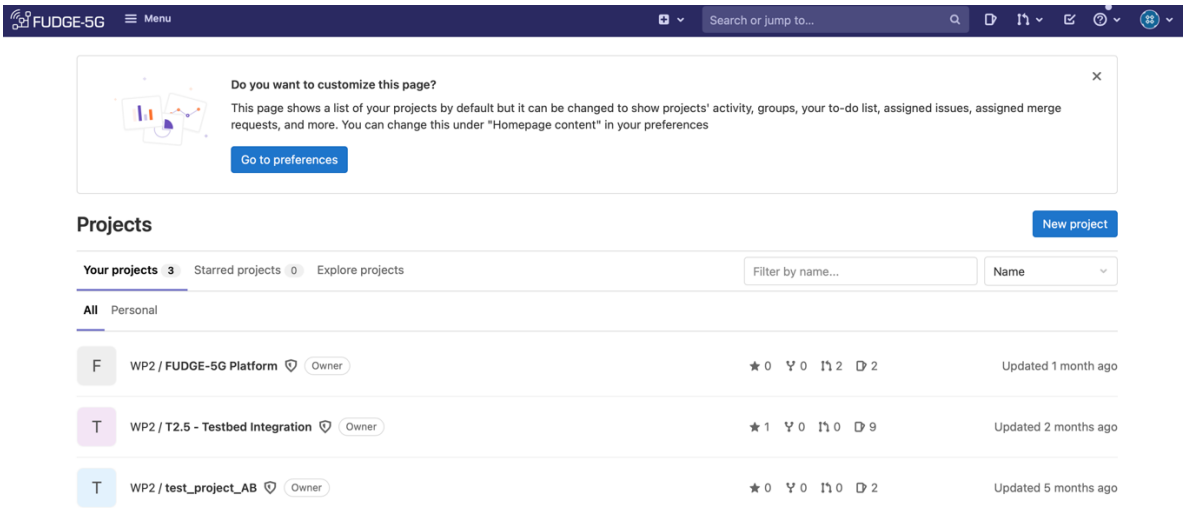

Figure 7 - FUDGE-5G Gitlab Repository

3.2. Internal communication tools

The WebEx platform was chosen to support the interaction between partners in live non-face-to-face meetings.

In order to facilitate communication between partners, the following mailing lists were also created. Each mailing list concerns a working group or a specific team, as shown in Table 3.

Scope	Address
All people	all@fudge-5g.eu
WP1 Ecosystem and Platform Architecture	wp1@fudge-5g.eu
WP2 5G Core Technologies and Platform Development	wp2@fudge-5g.eu
WP3 5G-VINNI Integration and Execution	wp3@fudge-5g.eu
WP4 Demonstration of Products	wp4@fudge-5g.eu
WP5 Exploitation, Standardization and Dissemination	wp5@fudge-5g.eu
WP6 Project Coordination	wp6@fudge-5g.eu
Administrative Work	admin@fudge-5g.eu
Project Management Team	pmt@fudge-5g.eu
External Advisory Board	eab@fudge-5g.eu

Table 3 - Mailing lists.

For a more direct communication, Slack[6], Figure 8, was adopted. The software allowed the creation of chat rooms for different topics within the project, as well as for direct communication between the teams and partners working together.

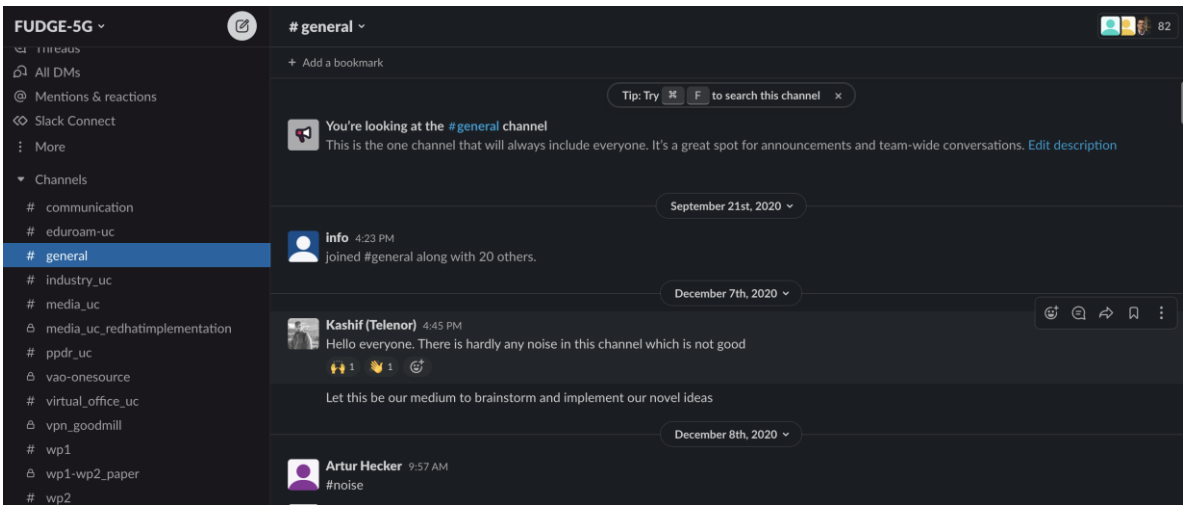

Figure 8 - FUDGE-5G Slack

[6] slack.com

4. Communication

In order to maximise the dissemination of the project outcomes to a multiplicity of audiences, FUDGE-5G implemented a set of communication channels, produced several communication materials and realized multiple communication activities that are described in this chapter.

4.1. Communication channels

Communication takes place through several channels. Next, we describe the visual communication such as the website and document templates, as well as communication through publication in journals, and presentations at events.

Papers submitted to journals, conferences and workshops are reviewed by consortium members to ensure a high quality. In the absence of confidential information, all the results of the papers will be included in at least one FUDGE-5G deliverable.

4.1.1. Visual Communication

Visual communication plays an extremely important role in the dissemination of a product. For this to have an impact and be efficient, it is necessary to create a strong visual identity that is remembered and quickly identifiable. The visual identity consists not only of the logo, but also of the colours, the typography and graphic elements that are transversal to all the communication materials. The development of the graphic identity of the FUDGE-5G started with the definition of the logo.

The FUDGE-5G logo was chosen from among four proposals that were voted by the project partners through the Doodle platform.

The chosen logo, presented in Figure 9, is composed of a graphic element and stylized lettering. The graphic element represents structure, architecture, components, connection, and wireless waves. The lettering consists of the name of the project, written in the Eurostile font by URW Type Foundry GmbH. This font was chosen because it has straight lines (not being too heavy or too thin) and for referring to the concept of digit. The chosen colours are blueish green and orange. These two colours are complementary colours creating a harmonious ensemble. A difference of colours in lettering gives evidence of the "5G" letters, without losing the "FUDGE" word, since its width is big enough to compensate the highlight of the last part. The difference of colours in the symbol creates an association between the connection lines with the text "5G" while the square elements are associated with the "FUDGE" word.

Figure 9 - Project logo.

After choosing the logo, a brief presentation of the graphic identity and possible applications on business cards, letter and email signature were prepared. As initial elements of communication, both a presentation template and a document template were created. These visual communication materials were shared with the project partners in order to consolidate the visual image of the project.

In the future, promotional materials such as posters and flyers will be created in line with the visual identity established by this logo.

4.1.2. Website

The FUDGE-5G website is an essential tool for the project dissemination. The project website allows for having a large amount of information permanently available, in order to address the interests of the various target audiences.

The website acts as a platform, hosting relevant content about the project, materials and formal documents produced by the consortium, news about the progress of the work, videos of the conferences, demonstrations and presentations that will be held.

The link between the website and social networks is also important so that users can follow the development of the project without being obliged to regularly access the website. The website has easily accessible links to the Twitter, LinkedIn and YouTube social networks, as well as a share button in each news item.

The content of the website and the social networks are being regularly updated as the project develops.

4.1.2.1. Website structure

The website consists of six main areas: “Homepage”, “About us”, “Use cases”, “Publications”, “News”, “Contacts”. The homepage was designed with the purpose of serving as the cover of the project, using a lot of visual elements and short blocks of text.

The “About us” page consists of five sub-pages: “*Description*”, “*Objectives*”, “*Work Structure*”, “*5G Components*” and “*Consortium*”. These pages are composed of content that defines and describes the project.

The “*Use* cases” pages gather all the information related to each “Use case”. At this moment they present only the description of each Use Case, but further content will be added along the project. These pages feature the following five use cases: Concurrent Media Delivery, PPDR, Industry 4.0, 5G Virtual Office and Interconnected NPNs.

The “Publications” section consists of three self-explaining sub-pages: “Research Papers”, “Presentations” and “Deliverables”. In this area, the formal documents produced by the consortium are made available for download as they are published.

The “News” area presents all the news published regarding the project, that are also made available at the adopted social networks.

Finally, the “Contacts” page provides the visitor with the contact details of the project consortium.

4.1.2.2. Website Pages

The homepage features a large banner with the project full name and its acronym. The background image of the banner is an image of two mirrored buildings. This banner serves to create an impact on the visitor and generate a sense of interest. When the visitor enters the page, this image appears enlarged, slowly changing to real size. This effect serves to lead the user to read the name of the project and to get his/her attention. When the page moves down, the banner image increases again, giving the feeling that the visitor is entering somewhere. The menu bar at the top of the page also reduces in size, giving space to the website’s content.

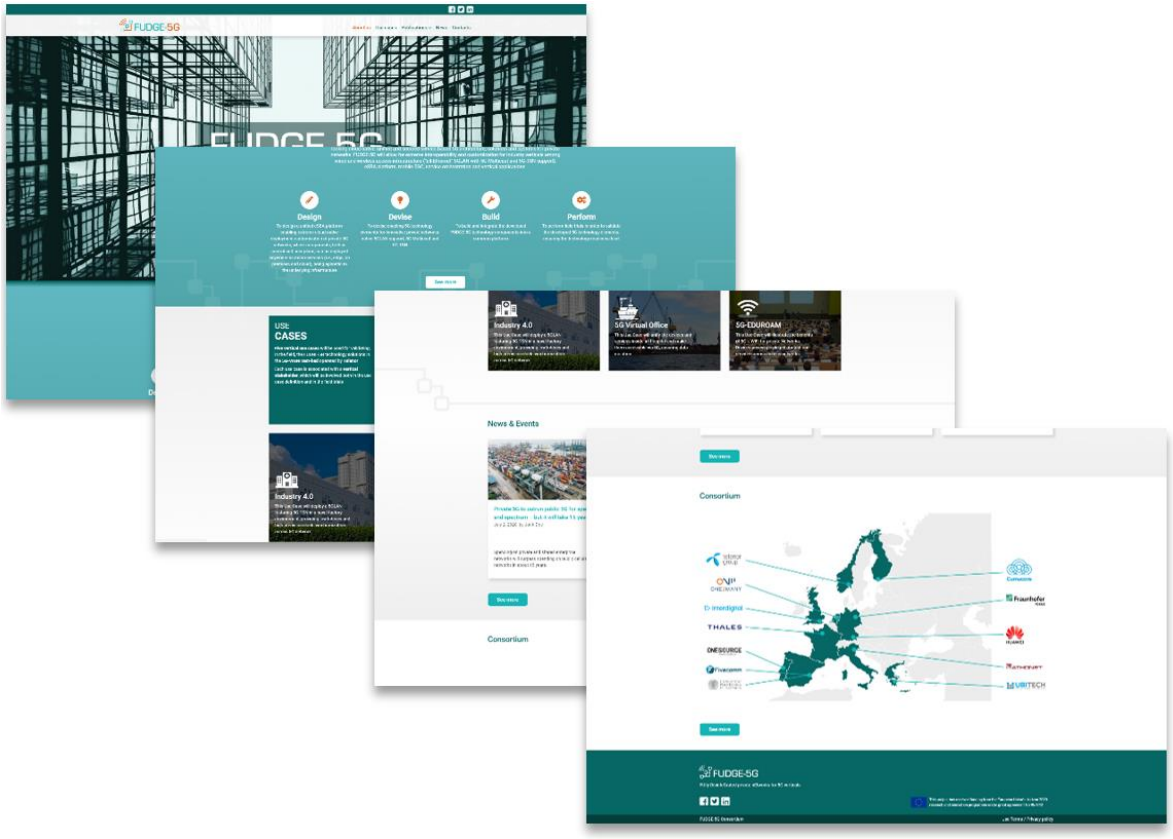

Figure 10 - FUDGE-5G Website Pages.

Right after the big banner are the main objectives, on a bluish green background. Each objective is associated with an icon to make reading easier. The “See more” button takes the visitor to the page where the objectives of the project are described in a more extensive way.

The section following the objectives is the “Use cases” section. Each use case is presented in a box with a background referring to its context. In order to facilitate the understanding and not obliging to read the full text, an icon was associated to each use case. When hovering the mouse over a use case box, the background image gains a greenish tint, and the content moves upwards. This animation serves to catch the user’s attention and to create some curiosity. When clicking on a use case box, the user will be taken to the page where all the information related to the selected use case is presented.

Another representative graphic element separates the “use cases” section from the “news” section. The “news” section presents the latest three news items, in order to access all the news, already published on the website, the user must click on the “see more” button. The news boxes also respond to the presence of the mouse hovering over them. This response consists of an enlargement of the image, the application of a green filter on the image and a change in the colour of the news title.

The last section of the homepage is the presentation of all consortium partners through their logos on a map of Europe.

All pages of the website have the menu bar at the top of the page, where there is access to all pages of the website as well as to the project’s social networks. Information about the consortium partners, the name of the project, EU funding, and links to social networks. The last footer bar contains links to the website's “Privacy Policy” and “Terms and conditions”.

4.1.3. Social networks

A social network is a platform where users have a page / profile and associate with other users. Social networks offer the user a selection of publications from the users to which they are associated. In this way, there is no longer a single point of communication, but several. The chosen social networks are Twitter, LinkedIn, and YouTube.

The profiles of FUDGE-5G on social networks are customized according to the visual identity of the project and in order to maintain consistency and facilitate its recognition.

At least one monthly publication is planned for the project, in addition to creating connections. The monthly publication will be made both on the project website and on Twitter and LinkedIn. Monthly publications will be produced by OneSource, based on content produced by the project consortium, and information about the status of the project will be provided by the project coordinator.

4.1.3.1. Twitter

Twitter is a social network where the purpose is to publish short messages, each message has a maximum of 255 characters which facilitates its reading. Twitter was chosen because it is used by the general public and allows quick perception. This network can help measuring the scope of the project's communication. The following account was created for the project: https://twitter.com/fudge5geu.

4.1.3.2. LinkedIn

LinkedIn is a social network dedicated to professional connections that will serve to create visibility for the project among companies, practitioners and researchers in the telecommunications sector. The following account was created for the project: https://www.linkedin.com/company/fudge-5g/?viewAsMember=true.

4.1.3.3. YouTube

YouTube is a social network where the goal is to publish videos. This network will serve to publicly host the videos of events and presentations of the project. The FUDGE-5G YouTube page can be found at https://www.youtube.com/channel/UCeL-7ukTWMczPkYhBrO1sCg

4.2. Communication materials

All materials produced by the project must follow the same graphic line in order to be easily recognized as part of a whole. To ensure this visual consistency, two templates were created, one for documents and another for presentations.

4.2.1. Document template

The document template, Figure 11, has a cover with a defined location for various types of information, it has a header, a footer, styles defined for various types of tables, titles, index, lists and highlighted text blocks.

Figure 11 - Word template.

4.2.2. Presentation template

The presentation template also seeks to respond to the various types of content and is composed by slides for the initial cover, section cover, index, text blocks, long text, text block highlighting, etc. Two possible templates were created Figure 12, one more suitable for bright rooms (only in shades of green and white) and another, more colourful, for darker rooms.

Figure 12 - Presentation template.

4.3. Communication Activities

Throughout the duration of the FUDGE-5G project, the consortium performed a set of communication activities using the project communication channels. This section presents those activities and measures their impact and reach by analysing the project communication performance in terms of engagement with the project website and social network accounts.

4.3.1. Communication Overview

FUDGE-5G partners were involved into a variety of communication channels and activities summarised into Table 4. The detailed description of these activities is provided in the next sections.

Table 4 - Communication Overview

Channel / Activity	#
Website	7632 visits total, 246 per month
Twitter	311 followers, 140 tweets
LinkedIn	318 followers, X publications
YouTube	39 subscribers, 1254 visualizations
News	93 published news
Newsletters	6 published newsletters

4.3.2. Website Statistics

The FUDGE-5G website[7] is the main channel for the project communication, as described in Section 4.1.2. Google analytics[8] was used to monitor the website's usage statistics. Figure 13 showcases the report for the website from September 1st, 2020, to March 31st, 2023. Table 5 presents the FUDGE-5G website usage data, with the total and monthly values.

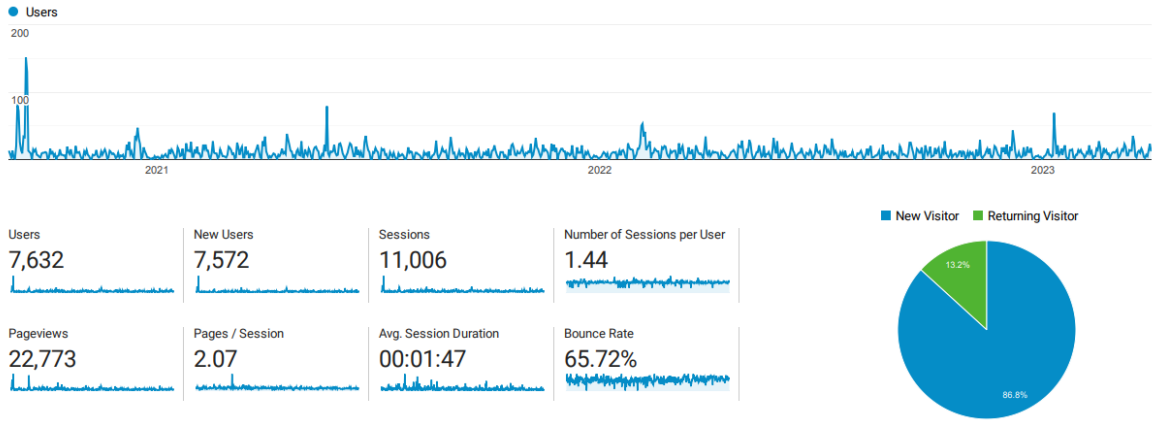

Figure 13 - Website Google Analytics Report, from Sep 1st, 2020, to Mar 31st, 2023.

[7] https://fudge-5g.eu
[8] https://analytics.google.com

Table 5 - FUDGE-5G Website Global and Monthly Achievements.

Field	Global Value	Average Monthly Value
Users	7632	246
New Users	7572	244
Sessions	11006	355
Page Views	227773	735

4.3.3. Social Network Statistics

The FUDGE-5G social network accounts/profiles complement the website in the project communication mission. In order to keep track of their reach, this section presents the most relevant statistical values for each of the social network accounts.

4.3.3.1. Twitter

The social network Twitter, described in Section 4.1.3.1, by March 31, 2023, had a total of 311 followers and 140 tweets. Another important metric is the Twitter Impressions. They measure the number of times that a publication has been seen, not only by followers, but across all members of the twitter social network. Up until now, FUDGE-5G reached a value in the thousand's degree. Table 6 displays the collected data regarding Twitter usage.

Table 6 - Twitter Statistics overview, for each year.

Period	# New Followers	# Tweets	# Impressions
Sep 2020 – Aug 2021	179	56	2984
Sep 2021 – Aug 2022	87	47	1448
Sep 2022 – Mar 2023	45	37	1677

4.3.3.2. LinkedIn

FUDGE-5G LinkedIn (cf. Figure 14) aims to fill the role described in Section 4.1.3.2. By March 31, 2023, FUDGE-5G LinkedIn had a total of 318 followers. As for Twitter, LinkedIn impressions also are at the thousand's degree for each year. Were as, in LinkedIn, the number of reactions is a more significant value, with a total of 1620, for the hundreds of publications done. Table 7 showcases the available usage data for LinkedIn.

Table 7 - LinkedIn statistics overview, for each year.

Period	# New Followers	# Publications	# Reactions
Sep 2020 – Aug 2021	111	n.d.	957

Sep 2021 – Aug 2022	109	n.d.	337
Sep 2022 – Mar 2023	98	n.d.	326

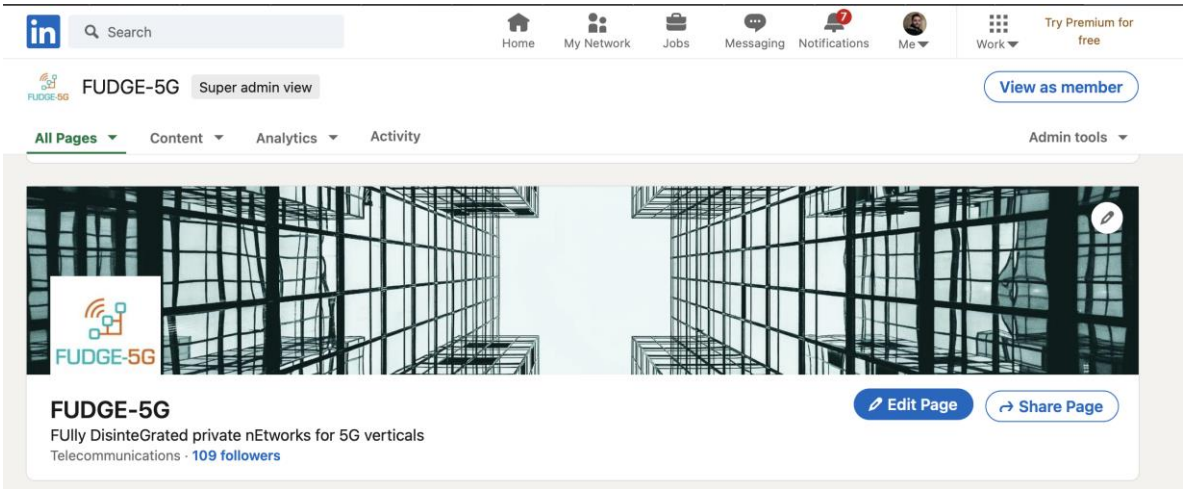

Figure 14 - FUDGE-5G LinkedIn Homepage

4.3.3.3. YouTube

FUDGE-5G established the YouTube channels, Figure 15, to fulfil the objectives described in Section 4.1.3.3. So far, the project had published eleven videos, listed in Table 8. By the end of March 2023, the channel has 39 subscribers and a total of 1254 video views.

Table 8 – YouTube videos list

Date	Title	Views
14 Feb 2020	FUDGE-5G overview on Global5GEvolution event	86
14 Jun 2021	EuCNC 2021 FUDGE-5G poster presentation	82
28 Oct 2021	IoT for improving first responders' Situational Awareness and Safety	106
8 Nov 2021	FUDGE-5G Project Overview	318
17 Dec 2021	FUDGE-5G Use Cases overview	172
22 Aug 2022	5G powered Search and Rescue Operation Using Drones	198
19 Sep 2022	SBA Testbed Topology	60
30 Nov 2022	5G Network on Wheels demonstration at the 2022 ULENDT	59
19 Dec 2022	Service Request Scheduling Demo by HUAWEI	58
8 Mar 2023	Industry 4.0 with 5GLAN & TSN	63

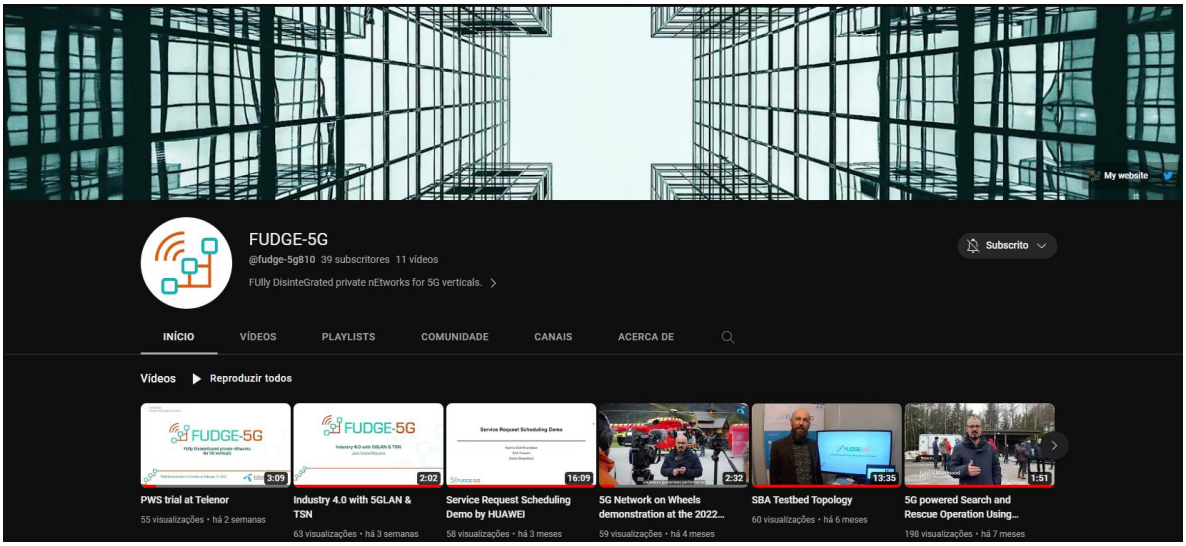

Figure 15 - FUDGE-5G YouTube channel homepage.

4.3.4. News Publications

Up until the submission of this deliverable, the project has published a total of 93 news related directly or indirectly to the FUDGE-5G project. The news list can be found in Table 9. Those news were published on the FUDGE-5G website and spread across FUDGE-5G social media accounts LinkedIn and Twitter.

Table 9 - FUDGE-5G published News

Title	Responsible Partner	Publication Date
EU boosts investment in 5G hardware innovation and trialling 5G-based connected and automated mobility	ONE	2020/06/16
COREnect: New consortium to develop a 5G and beyond strategic roadmap for future European connectivity systems and components	ONE	2020/07/01
Private 5G to outrun public 5G for spend and spectrum – but it will take 15 years	ONE	2020/07/16
FUDGE-5G kick off meeting September 8th and 9th	ONE	2020/09/10
Free Open5G from Athonet	ATH	2020/09/15
Mobitrust Platform was demonstrated at TechDays Aveiro 2020 with a fully functional 5G network	ONE	2020/10/19

The 5G Infrastructure Public Private Partnership (5GPPP) is organizing an online Workshop featuring the on-going Research Projects, their findings and innovations.	ONE	2020/12/07
FUDGE-5G General Assembly meeting December 14th and 15th	ONE	2020/12/14
FUlly DisinteGrated private nEtworks for 5G verticals baseline by Cumucore	CMC	2020/12/14
UPTIME 2021 - The Annual Private 5G & LTE World Community	ATH	2020/12/15
FUDGE-5G: The new kid on the EU block	UPV	2020/12/16
The Universitat Politècnica de València leads a European project to develop private on demand 5G networks	UPV	2020/12/21
Bosch to “gradually" deploy 5G in all 250 of its factories	UPV	2021/01/11
Busting the myths around cloud-native cores	UPV	2021/01/18
5G campus networks: The concept of Industry 4.0 becomes a reality with 5G	UPV	2021/02/01
The 5G PPP Webinar "New 5G Core Technologies Innovation Projects" is less then a week away!	UPV	2021/02/10
5G campus networks: The concept of Industry 4.0 becomes a reality with 5G	UPV	2021/02/15
Demand for private 4G and 5G set to create multi-billion-dollar market by 2024	UPV	2021/02/22
Deutsche Telekom to build ‘a million square metres’ of private 5G at Hanover Fairground	UPV	2021/03/01
5G Campus Network of Fraunhofer FOKUS	FHG	2021/03/02
Private Networks Deployment Tracker	UPV	2021/03/08
FUDGE-5G General Assembly meeting March 9th and 10th	ONE	2021/03/12
Aerospace company launches 5G trials to transform manufacturing productivity	UPV	2021/03/15
Why private 5G networks are on the rise	UPV	2021/03/28
Deliverable 1.1 - Technical Blueprint for Vertical Use Cases and Validation Framework	UPV	2021/03/28
MAESTRO embraces Service Based Architecture	UBI	2021/03/31
FUDGE-5G announces a new consortium member: Goodmill Systems Ltd	ONE	2021/04/13

Evaluating Gaps and Solutions to build Open 5G Core/SA networks	UPV	2021/04/19
OneSource performs connectivity tests in a 5G standalone network deployment	ONE	2021/04/30
Groundbreaking 5G solution paves the way for new digital services	UPV	2021/05/03
FUDGE-5G 2021 joint EuCNC & 6G Summit Workshop "5G Private Networks"	UPV	2021/05/11
Nokia CEO predicts private 5G network boost	UPV	2021/05/19
The European 5G Annual Journal 2021	UPV	2021/05/28
Evaluating Gaps and Solutions to build Open 5G Core/SA networks	UPV	2021/05/30
FUDGE-5G: our vision for the Industry 4.0	5CMM	2021/06/07
Fully Disintegrated Private Networks for 5G Verticals - EuCNC poster presentation	ONE	2021/06/08
FUDGE-5G announces a new member to the advisory board: Hewlett Packard Enterprise	UPV	2021/06/11
FUDGE-5G General Assembly meeting June 21st and 22nd	ONE	2021/06/22
OPPO partners with THALES for world's first 5G SA compatible eSIM	THA	2021/06/23
Open 5G HyperCore	UPV	2021/07/05
Vision and Expectations of Future Networks Cloud Native Platforms	IDE	2021/07/12
5G private networks; potential and challenges	UPV	2021/08/23
NTT launches first globally available Private 5G NaaS platform	UPV	2021/08/30
Intel powers private networks, market to reach $5.7b in 2024	UPV	2021/09/13
5G Time Sensitive Network (TSN)	CMC	2021/09/16
Nokia and DISH to deploy first 5G standalone core network in the public cloud with AWS	UPV	2021/09/23
The Private Network Hype Is Finally Over	IDE	2021/10/06
Airports: The roles of 5G & private networks		2021/10/06
FUDGE-5G trials in Norway considered the most advanced in Europe by NATO CCDCOE report.	TNOR	2021/10/14

Operators look to new vendors for 5G core	UPV	2021/10/18
FUDGE-5G Midterm Review meeting November 9th, 2021	ONE	2021/11/10
ASOCS provides cloud managed private 5G networks with Azure private MEC	UPV	2021/11/15
Boom year for private 5G? Telcos restructure to take enterprise bull by network horns	UPV	2021/11/22
Introduction AWS Private 5G | Amazon Web Services	UPV	2021/12/14
Private 4G/5G: Three markets, not one	UPV	2022/01/11
Newsletter "Analyses of CBCF – SCP in 5GC"	CMC	2022/02/01
FUDGE-5G General Assembly meeting February 2nd and 3rd	ONE	2022/02/03
FUDGE-5G Network on Wheel (NOW) used for Interference testing of 5G and Radar Altimeters	TNOR	2022/02/04
Mobitrust platform successfully integrated with RedHat OpenShift	ONE	2022/02/04
Presentation at the 2021 4th IEEE 5G Workshop on First Responder and Tactical Network	ATH	2022/02/14
UPTIME 2022 - The Private 5G World Community Conference	ATH	2022/02/14
Industry turns to private 5G to speed digital change	UPV	2022/02/14
Why private networks are the key to realising Industry 4.0	5CMM	2022/03/21
Ferrovial deploys one of the world's first 5G SA private wireless networks for its Silvertown Tunnel Construction site	UPV	2022/04/04
5G Virtual Office trials kickoff	ONE	2022/04/05
Digital ecosystem with 5G Non-Public Networks (NPNs)	FHG	2022/04/26
The projects 5G-LOGINNOV, FUDGE 5G and Affordable 5G are conjointly organizing an online technical workshop	UPV	2022/05/04
FUDGE-5G General Assembly meeting May 4th and 5th	ONE	2022/05/04
FUDGE-5G presentation at the "IoT and 5G in the Industry" conference	TNOR	2022/05/18
FUDGE-5G shortlisted for CCW award	UPV	2022/05/25
Accelerating 5G Innovation in Europe with 5GLOGINNOV, FUDGE 5G and Affordable 5G	UPV	2022/05/26
FUDGE-5G and Affordable5G joint booth at EuCNC	ONE	2022/06/06
FUDGE-5G and Affordable5G joint booth at EuCNC	ONE	2022/06/08

Realizing Synergies in European Horizon 2020 Research – One2many brings together projects FUDGE-5G and ENGAGE	O2M	2022/07/05
FUDGE-5G 8th General Assembly meeting in Oslo (september 13th and 14th)	ONE	2022/09/13
FUDGE-5G Tutorial (15th september)	ONE	2022/09/13
Workshop with 5G-HEART	ONE	2022/09/13
Join the FUDGE-5G tutorial now!	ONE	2022/09/15
Unified Service-Based Architecture Platform Under Trial	IDE	2022/09/19
Huawei's NPN Efforts	HWDU	2022/10/12
Private 5G's transcending impact	UPV	2022/10/31
5G Network on Wheels demonstration at ULENDT	TNOR	2022/11/10
Thales, ERICSSON and QUALCOMM to take 5G into Space	THA	2022/12/02
FUDGE-5G 9th General Assembly meeting in Berlin (December 6th and 7th)	ONE	2022/12/7
OneSource hands-on workshop at University of Coimbra	ONE	2022/12/16
FUDGE-5G announces a Cumucore 5G SA 5.4 installed December 12, 2022	CMC	2022/12/19
N4 and N5 integrations in FUDGE-5G	ATH	2023/01/10
Nkom has opened 3.8-4.2 GHz for local area 5G networks	FHG	2023/01/20
Transport and logistics: The role of private 4G/5G	UPV	2023/02/10
FUDGE-5G at MWC Barcelona	ONE	2023/02/16
Fraunhofer FOKUS 5G network for Emergency Services	FHG	2023/03/09
one2many and Cumucore perform successful trial of 5G stand alone PWS	O2M	2023/03/16

4.3.5. Newsletter Publications

At the date of submission of this deliverable, FUDGE-5G has published six newsletters with two more ready to be published in the following months, Table 10 provides the details.

Table 10 - FUDGE-5G Newsletters

#	Title	Status	Link
1	5G Non-public Cellular Networks on Demand	Published	fudge-5g.eu/download-file/438/pAXSpuOGGNYIim0Fbqm3
2	5G Private Networks and Slicing	Published	fudge-5g.eu/download-file/439/5btvnht069tK4YcdTkPt
3	FUDGE-5G announces a Cumucore's 5G core into the OpenShift Ecosystem	Published	fudge-5g.eu/download-file/441/RnJpr3KvzenUurnsy3f2
4	Global use cases support with distributed campus networks	Published	fudge-5g.eu/download-file/476/jhTk0P5wyWthBdjvp4PT
5	Analyses of CBCF – SCP in 5GC	Published	fudge-5g.eu/download-file/480/7UtoXwU3B2mewqdsZ3hL
6	FUDGE-5G and UBITECH's Vertical Application Orchestrator	Published	fudge-5g.eu/download-file/556/RPuGe2IFKBjv0DcEkdU6

5. Dissemination

The main goal of dissemination is to maximise the impact of the FUDGE-5G research results in the public domain. This chapter reports the main dissemination activities carried out up to Month 31, including the targeted events and the artifacts produced or planned to be produced for the purpose of dissemination (e.g. journal and conference papers, workshops, demonstrations and showcases, and advanced training programs).

5.1. Target Channels and Events

Dissemination activities will combine complementary actions that, altogether, provide an intentional and effective relay of information and awareness towards the whole array of relevant target audiences, including the 5G industry, the 5G SDOs, the research community, decision-makers (governments, public agencies, and regulatory organizations), specialized end-user communities (e.g., public-safety organizations and use case owners) and the general public.

The list of identified target venues for industry and scientific dissemination includes:

- **5G Technology Events**: Mobile World Congress (MWC), Next Generation Mobile Network (NGMN) Conference & Exhibition, Telecom Infra Project (TIP) Summit, SDN NFV World Congress, Edge Computing Congress (ECC), Open Networking Summit, FUSECO Forum.
- **5G PPP Events**: European Conference on Networks and Communications (EUCNC) Conference, ICT Conference.
- **Vertical Industry Events**: IBC Show (Media), EBU Forecast (Media), Public Safety Communications Europe PSCE Conference (PPDR), Critical Communications World (PPDR), European Emergency Number Association EENA Conference & Exhibition (PPDR), TMForum - Digital Transformation World, Smart Mobility World Congress, Wireless Broadband Alliance.
- **Research Conferences**: EuCNC, IEEE ICC, IEEE PIMRC, IEEE GLOBECOM, IEEE INFOCOM, IEEE WCNC, IEEE VTC, IEEE DYSPAN, IEEE CLOUD, IEEE ICWS, IEEE ICME, ACM CoNEXT, ACM SOSR, IEEE ICNP, ACM SIGCOMM.
- **Scientific Journals**: IEEE Trans. Wireless Commun., IEEE Trans. Mobile Comput., IEEE Comms. Mag., IEEE Wireless Comm. Mag., IEEE Trans. Cloud Comput., ACM Trans. Inf. & System Security (TISSEC), IEEE Trans. Consum. Electron, IEEE/ACM Transaction on Networking, ACM Computer Communication Review.

Dissemination and communication of results are very important aspects in FUDGE-5G to create the necessary industry led framework and to leverage the core innovations into the evolving 5G architecture.

The following dissemination activities are planned:

- **Industry dissemination** to present and demonstrate the FUDGE-5G Platform and its components in both 5G technology events and vertical industry events. Target events will be selected based on their size, profile, and geographical coverage to maximize not only dissemination but also exploitation potential. A minimum of 9 demonstrations in industry events is targeted (one per 5G technology component). The individual demonstrations of the technology components might be combined to maximize the exploitation impact.
- **Scientific dissemination** is targeted in the form of publications and presentations in top peer-reviewed research conferences, workshops, and journals, as well as the organization of demos and special sessions in scientific conferences, in order to promote the innovative FUDGE-5G technologies. The project will target the following scientific contributions: 25 journal and conference papers, 10 workshops, possibly in collaboration with ICT-17 5G-VINNI and ICT-19 5G-SOLUTIONS and 5G-HEART, 5 demonstrations, and 2 tutorials/summer schools.

5.2. Dissemination Activities Carried Out in the Reporting Period

5.2.1. Dissemination Overview

During the reporting period, the project partners engaged into the set of dissemination activities summarized into Table 11. The details of these activities are provided in the following sections of the document.

Table 11 - Dissemination Overview

Dissemination activity	#
Collaboration with other projects	6
Journal and Conference Papers	18
Open source repositories	3
Organized Workshops	7
Demos and Showcases	5
Advanced Training	8
Patent Applications	11
5GPP Events	4
Advisory Board Meetings	6
Keynote Presentations	3
Participations in 5GPPP working groups	2

Tutorials/summer schools	2
Other	8

5.2.2. Collaboration with other Projects

FUDGE-5G aims at collaborating with other 5GPP projects, in order to allow for additional validation trials for the FUDGE-5G Platform and to maximise synergies. Collaboration with six specific projects was done, as detailed in Table 12.

Table 12 - Collaborations with other 5GPPP projects.

Project	Collaboration Description
5G – VINNI 5g-vinni.eu	The 5G-VINNI project is aimed at developing an advanced 5G E2E facility able to validate 5G KPIs, supporting the execution of vertical use case trials, demonstrating the value of 5G solutions and ultimately fostering the widespread adoption of 5G technologies. 5G-VINNI provides all required radio components working in the 3.5 GHz and 26 GHz frequency bands for the FUDGE-5G trials in all Use Cases.
5G – HEART 5gheart.org	The collaboration is focused on the healthcare use cases, both from 5G-HEART and FUDGE-5G. FUDGE-5G is focused on Non-Public networks and the collaboration will allow for joint trials using the FUDGE-5G Non-Public network deployment on Oslo University Hospital and the 5G-HEART remote ultrasound Use Case.
5G!DRONES 5gdrones.eu	The 5G!DRONES project is focused in running and validate UAV Use Cases. The collaboration is focused into PPDR Use cases from both projects (Public Safety and Situational Awareness) and intents to integrate UAVs into the Non-Public Network. The integration will provide an enhanced situational awareness in the field for the relevant authorities and agencies.
AFFORDABLE5G affordable5g.eu	The collaboration involved work on a MCPTT solution to be used on the PPDR use cases for both projects. A strict collaboration took place between FUDGE-5G PPDR Use case partners and Nemergent Technologies to develop and trial the MCPTT implementation in collaboration with the Norwegian Defence Material Agency. Further collaboration was done in a joint booth at EuCNC 2022 and a workshop about the advancement in the adoption of 5G technologies in several sectors, that also included 5GLOGINNOV.
5G-RECORDS 5g-records.eu	5G-Records, with primary focus on the media production use case, has been of major value as a reference to what is possible to achieve with today's tech and implemented standards. FUDGE-5G was invited to their live-production demo in Copenhagen (Tivoli, se attachment) and

	during that visit was given detailed info on the challenges remaining to fully be able to integrate 5G (as the wireless part) in an IP infrastructure (ST 2110). The partners in that project also helped understand how to overcome the technical challenges with the need for increased uplink capacity and reach.
5GLOGINNOV 5g-loginnov.eu	The goal was to discuss and contribute to the debate about the advancement in the adoption of 5G technologies in several sectors. Organized by 5GLOGINNOV, FUDGE 5G and Affordable 5G, the three selected projects matured their 5G-expertises in relation to the optimisation of traffic operations at ports and logistics, the delivery of a solution covering the needs of private and enterprise networks and the definition of a 5G architecture for private networks allowing interoperability and customization for industry verticals.

5.2.3. Journal and Conference Papers

FUDGE-5G partners have produced the following journal and conference papers:

- Self-Driving Network and Service Coordination Using Deep Reinforcement Learning
- FUDGE-5G: Fully Disintegrated Private Networks for 5G Verticals
- 5G Non-Public-Networks (NPN) Roaming Architecture
- Self-Learning Multi-Objective Service Coordination Using Deep Reinforcement Learning
- Enabling Service Oriented Principles on the 5G User Plane
- European Annual Journal 2021
- Enabling Bi-directional Haptic Control in Next Generation Communication Systems: Research, Standards, and Vision
- Fully Disintegrated Private Networks for 5G Verticals: System Considerations and Insights
- Service-based management architecture for on-demand creation, configuration, and control of a network slice subnet
- CArDS: Dealing a New Hand in Reducing Service Request Completion Times
- SBA-Native: Argumentation Towards a Unified End-to-End Service-Based Architecture for 6G Access and Core Networks
- Under Trial: Evolved Service-Based Architecture Platform for Mobile Networks
- End-to-End Service-Based Architecture-Enabled Control Plane for the Sixth Generation of Mobile Telecommunication Networks
- Autonomous Private Mobile Networks: State of the Art and Future Challenges
- Enabling Service-Oriented Principles for the User Plane of Mobile Telecommunication Networks
- On-path vs Off-path Traffic Steering, That Is The Question

- Preliminary Evaluation of a Software-based Release 17 5MBS Prototype
- European 5G Annual Journal 2023

The tables presented in the next pages provide further details for each of these publications.

Table 13 - "Self-Driving Network and Service Coordination Using Deep Reinforcement Learning" conference paper description.

Field	Details
Title	Self-Driving Network and Service Coordination Using Deep Reinforcement Learning
Type	Conference
Keywords	Network and Service Management and Coordination, Reinforcement Learning, Self-Learning, Self-Adaption
Responsible Partner	HWDU
Event Name	16th Int. Conference on Network and Service Management (CNSM)
Date	November 2-6, 2020
Authors	Stefan Schneider, Adnan Manzoor, Haydar Qarawlus, Rafael Schellenberg, Holger Karl, Ramin Khalili and Artur Hecker
Abstract	Modern services comprise interconnected components, e.g., microservices in a service mesh, that can scale and run-on multiple nodes across the network on demand. To process incoming traffic, service components have to be instantiated and traffic assigned to these instances, taking capacities and changing demands into account. This challenge is usually solved with custom approaches designed by experts. While this typically works well for the considered scenario, the models often rely on unrealistic assumptions or on knowledge that is not available in practice (e.g., a priori knowledge). We propose a novel deep reinforcement learning approach that learns how to best coordinate services and is geared towards realistic assumptions. It interacts with the network and relies on available, possibly delayed monitoring information. Rather than defining a complex model or an algorithm how to achieve an objective, our model-free approach adapts to various objectives and traffic patterns. An agent is trained offline without expert knowledge and then applied online with minimal overhead. Com- pared to a state-of-the-art heuristic, it significantly improves flow throughput and overall network utility on real-world network topologies and traffic traces. It also learns to optimize different objectives, generalizes to scenarios with unseen, stochastic traffic patterns, and scales to large real-world networks.

Status	Published
Link	https://doi.org/10.23919/CNSM50824.2020.9269087

Table 14 - "FUDGE-5G: Fully Disintegrated Private Networks for 5G Verticals" journal and conference paper description.

Field	Details
Title	Fully Disintegrated Private Networks for 5G Verticals
Type	Extended Abstract / Poster
Keywords	5G, Non-Public Networks, Service-based Architecture, Cloud Native
Responsible Partner	UPV
Event Name	2021 EuCNC & 6G Summit
Date	8-11 June 2020
Authors	David Gomez-Barquero, Antonio Borges, Luis Cordeiro, Andre S. Gomes, Joao Henriques, Kashif Mahmood and Sebastian Robitzsch
Abstract	The use of 5G for private networks has seen an increased interest in industry and standardisation alike with an expected increase of that market in the coming years. FUDGE- 5G is the first 5G-PPP project that focuses solely on Non-private Network with an innovation space in the core network domain. Beyond utilising the advancements brought by 5G and the true adoption of cloud native principles in the telco world, Non-private Networks will bring the additional potential of fine-tuned, use case and Quality of Service centric 5G Core realisations fostering multi-vendor deployments due to the narrower scope in their applicability. Five use cases have been identified in FUDGE-5G focusing on the benefit of Non-private Networks underpinning the high innovation and business impact for the private 5G network market.
Status	Published
Link	https://zenodo.org/record/5137741#.YP696C1Q1QI (Extended Abstract) https://zenodo.org/record/5139613#.YP_k8y1Q1QI (Poster)

Table 15 - "5G Non-Public-Networks (NPN) Roaming Architecture" conference paper description.

Field	Details
Title	5G Non-Public-Networks (NPN) Roaming Architecture
Type	Conference
Keywords	5G, Non-Public-Networks, Roaming
Responsible Partner	FHG
Event Name	12th International Conference on Network of the Future
Date	October 6-8, 2021
Authors	Marius Corici, Pousali Chakraborty, Thomas Magedanz, Andre S. Gomes, Luis Cordeiro and Kashif Mahmood
Abstract	With the increasing deployment of 5G Non-public Networks, the telco environment is becoming massively multi administrated with a wide range of full networks deployed close and covering only the use case area. To benefit the most of this, a roaming solution must be set in place enabling devices to safely communicate using visited infrastructures either with local service or with the ones from the home networks. As a first step in this direction, this article proposes a new architecture for Non-public Networks roaming, stemming from the 3GPP 5G macro-operator roaming and adapted to the specifics of the communication for geographically distant, small networks interconnected by third party unreliable backhauls. Furthermore, the architecture is exemplified, and its potential is evaluated as further extensions to the Fraunhofer FOKUS Open5GCore, showing that it outperforms today's roaming solution in terms of flexibility and privacy of deployment, backhaul usage and reduced network administration.
Status	Published
Link	n.d.

Table 16 - "Self-Learning Multi-Objective Service Coordination Using Deep Reinforcement Learning" journal and conference paper description.

Field	Details
Title	Self-Learning Multi-Objective Service Coordination Using Deep Reinforcement Learning
Type	Journal
Keywords	Network and Service Management, Reinforcement Learning, Self-Learning, Self-Adaptation, Multi-Objective
Responsible Partner	HDWU
Journal Name	2021 IEEE Transactions on Network and Service Management (TNSM)
Date	April 2021
Authors	Stefan Schneider, Ramin Khalili, Adnan Manzoor, Haydar Qarawlus, Rafael Schellenberg, Holger Karl, and Artur Hecker
Abstract	Modern services consist of interconnected components, e.g., microservices in a service mesh or machine learning functions in a pipeline. These services can scale and run across multiple network nodes on demand. To process incoming traffic, service components have to be instantiated and traffic assigned to these instances, taking capacities, changing demands, and Quality of Service (QoS) requirements into account. This challenge is usually solved with custom approaches designed by experts. While this typically works well for the considered scenario, the models often rely on unrealistic assumptions or on knowledge that is not available in practice (e.g., a priori knowledge). We propose DeepCoord, a novel deep reinforcement learning approach that learns how to best coordinate services and is geared towards realistic assumptions. It interacts with the network and relies on available, possibly delayed monitoring information. Rather than defining a complex model or an algorithm on how to achieve an objective, our model-free approach adapts to various objectives and traffic patterns. An agent is trained offline without expert knowledge and then applied online with minimal overhead. Compared to a state-of-the-art heuristic, DeepCoord significantly improves flow throughput (up to 76%) and overall network utility (more than 2x) on real- world network topologies and traffic traces. It also supports optimizing multiple, possibly competing objectives, learns to respect QoS requirements, generalizes to scenarios with unseen, stochastic traffic, and scales to large real-world networks. For reproducibility and reuse, our code is publicly available.
Status	Published
Link	https://doi.org/10.1109/TNSM.2021.3076503

Table 17 - "Enabling Service Oriented Principles on the 5G User Plane" journal and conference paper description.

Field	Details
Title	Enabling Service Oriented Principles for the 5G User Plane
Type	Conference
Keywords	5G, User Plane, Service Routing, Service-based Architecture, Software-defined Networking, Name-based Routing
Responsible Partner	IDE
Event Name	8th ACM Conference on Information-Centric Networking (ICN 2021)
Date	September 2021
Authors	Sebastian Robitzsch, Ulises Olvera-Hernandez, Jose Costa-Requena, and Mika Skarp
Abstract	This paper presents the architectural considerations of integrating the non-IP-based service routing solution, Name-based Routing, to the 5G user plane. While entirely preserving the control plane procedures on the terminal, the carefully crafted out considerations argue for a new Session Management Function functionality and the transitioning of N4 to Nupf. Furthermore, this paper presents User Plane Function provisioning procedures based on Software-defined Networking principles mitigating the need for any manual management procedures and enabling a cloud native orchestration of all 5G Core Network Functions.
Status	Rejected
Link	n.d.

Table 18 – "European 5G Annual Journal 2021" journal paper description.

Field	Details
Title	The European 5G Annual Journal 2021
Type	Journal
Keywords	5G, 6G, European Commission, Smart Networks and Services
Responsible Partner	ONE
Event Name	The European 5G Annual Journal 2021
Date	May 2021
Authors	5G PPP

Abstract	COVID-19 has been and still is a tremendous challenge for all people on the planet and has also impacted our constituency. Many activities within the 5G PPP could somewhat advance thanks to remote access to labs and online conferencing. However, we saw delays in most projects, in particular as we are in the third phase of the 5G PPP with many trial and demonstrator activities. However, R&I initiatives on 6G technologies are now starting in leading regions worldwide, with the first products and infrastructures expected for the end of this decade. In January 2021, a first set of 6G projects was launched, worth 60 million EUR under the 5G PPP with the Hexa-X flagship developing a first 6G system concept complemented by 8 projects investigating specific technologies for 6G, putting Europe on a par with our global competitors. In February 2021, the Commission adopted a legislative proposal for the upcoming European partnership on Smart Networks and Services (SNS) towards 6G, the successor of our 5G PPP.
Status	Published
Link	The European 5G Annual Journal 2021

Table 19 – "Enabling Bi-directional Haptic Control in Next Generation Communication Systems: Research, Standards, and Vision" conference paper description.

Field	Details
Title	Enabling Bi-directional Haptic Control in Next Generation Communication Systems: Research, Standards, and Vision
Type	Conference
Keywords	Tactile Internet, B5G, Haptic, Multi-modality, Ultra-low latency communication, Use Cases, IEEE, 3GPP, IETF, Standards
Responsible Partner	IDE
Event Name	IEEE Conference on Standards for Communications and Networking
Date	December 2021
Authors	Chathura Sarathchandra, Sebastian Robitzsch, Mona Ghassemian, Ulises Olvera-Hernandez
Abstract	Human multi-modality information such as audio (hearing) and visual (sight) or a combination thereof audiovisual are transferred over communication networks. Yet interacting sense of touch (haptic) and particularly the kinaesthetic (muscular movement) component has much stricter end-to-end latency communication requirements between tactile user ends. The statements in this paper, to enable bi-directional haptic control, indeed follow the widely accepted understanding that

	edge computing is one of the key drivers behind Tactile Internet aiming to bring control and user plane services closer to where they are needed. However, with an updated wider analysis of (pre)standardisation activities that are chartered around Tactile Internet, this paper highlights the technology gaps and recommends open research topics in this area.
Status	Published
Link	https://cscn2021.ieee-cscn.org/

Table 20 – "Fully Disintegrated Private Networks for 5G Verticals: System Considerations and Insights" conference paper description.

Field	Details
Title	Fully Disintegrated Private Networks for 5G Verticals: System Considerations and Insights
Type	Conference
Keywords	Private Networks, Non-Public Networks, Servicebased Architecture, Cloud-Native, 5G
Responsible Partner	IDE
Event Name	EuCNC & 6G Summit
Date	June 2022
Authors	Sebastian Robitzsch, Mika Skarp, Luis Cordeiro, Andre S. Gomes, Marco Centenaro, Filippo Rebecchi, Thanos Xirofotos, Zoran Despotovic, Manuel Fuentes, Carlos Barjau, Borja Inesta, Josep Ribes and David Gomez-Barquero.
Abstract	With the hype around Private Networks turning into practical deployments and advances over a Public Network offering, this paper presents an effort to put a range of 5G technologies under trial such as Time Sensitive Networking, 5G Local Area Network and IP Multicast. These technologies are operated over an evolved Service-based Architecture platform offering a unified service routing, cloud-native orchestration and telemetry capabilities to 5G Core Network and vertical application vendors alike. Besides considerations around the evolution of Service-based Architecture and the disintegration of 5G Core Networks, all five vertical use cases and their need for a Private Network are described with technology insights from the partially conducted trials in each of them.
Status	Rejected
Link	n.d.

Table 21 – "Service-based management architecture for on-demand creation, configuration, and control of a network slice subnet" conference paper description.

Field	Details
Title	Service-based management architecture for on-demand creation, configuration, and control of a network slice subnet
Type	Conference
Keywords	5G, SBMA, OAM, MANO, NFV, Network Slicing, MIB, NMS, NSSMF, NFMF, NRM, multi-vendor
Responsible Partner	ATH
Event Name	IEEE International Conference on Network Softwarization (NetSoft)
Date	27 June - 1 July, 2022
Authors	A. Ishaq, D. Ronzani, A. Spinato, N.Di Pietro, M. Centenaro, A. Bellin, D. Munaretto
Abstract	The management of a 5G system comprises Operation and Management aspects defined by 3GPP, including Network Slicing, and the Management and Orchestration aspects specified in ETSI's Network Function Virtualization framework. Our Proof-of-Concept demonstrates the implementation of an on-demand provisioning procedure of a Network Slice Subnet composed of Virtual Network Functions from potentially different vendors. The demonstration includes a Network Management System conforming to the 3GPP Service-Based Management Architecture, an ETSI MANO orchestrator, and a Network Function Virtualization Infrastructure.
Status	Published
Link	netsoft2022.ieee-netsoft.org

Table 22 – "CArDS: Dealing a New Hand in Reducing Service Request Completion Times" conference paper description.

Field	Details
Title	CArDS: Dealing a New Hand in Reducing Service Request Completion Times
Type	Conference
Keywords	5G, cloud-native, network, data plane
Responsible Partner	HWDU
Event Name	IFIP Networking

Date	13 - 16 June 2022
Authors	Karima Saif Khandaker, Dirk Trossen, Ramin Khalili, Zoran Despotovic, Artur Hecker, Georg Carle
Abstract	The cloud-native paradigm advocates agile development and deployment of virtualized micro-services, introducing a flexibility and dynamicity for service endpoints that may exist in many locations of a provider's network, not just data centers. Such ability leaves open the problem of scheduling traffic from clients to those possible locations. In this paper, we position our solution to this problem at the data plane level, avoiding the shortfalls of existing solutions in terms of latency and path stretch. For this, we present a system model for forwarding service requests based on compute information, with a distributed scheduler realizing the traffic steering decision at line rate and with measurable performance gains against existing networklevel solutions. We evaluate our solution against several design aspects to provide insights for real-world deployments, while quantifying performance improvements for use cases where such scheduling decisions could indeed be performed at the level of each service request. Here we show that our improvements in request completion time may lead to serving up to 162% more clients within the bounded request time that would ensure acceptable quality of experience.
Status	Published
Link	ieeexplore.ieee.org/document/9829778

Table 23 – "SBA-Native: Argumentation Towards a Unified End-to-End Service-Based Architecture for 6G Access and Core Networks" conference paper description.

Field	Details
Title	SBA-Native: Argumentation Towards a Unified End-to-End Service-Based Architecture for 6G Access and Core Networks
Type	Conference
Keywords	Service-Based Architecture, Cloud-Native, 6G, 3GPP, System Architecture, Radio Access Network, Core Network
Responsible Partner	IDE
Event Name	WWRF '47
Date	7-10 June 2022
Authors	Sebastian Robitzsch, Mohamad Kenan Al-Hares, Filipe Conceição

Abstract	This article presents system design arguments to re-think the current mobile telecommunication network architecture. Undeniably, 5G has seen tremendous efforts in Access and Core Network domains to design a flexible and modern system, which aims to allow to vendor-multiplexing within the deployment of a single network and to scale (ideally) on demand. However, the vision to utilise cloud-native orchestration and operation procedures combined with microservice-based software architecture realisations did not materialise in the telco domain as of yet. This article focuses on the current system architecture, combined with proposed 6G technical Key Value Indicators, to demonstrate how 5G hinders the full end-to-end utilisation of Service-Based Architecture, ultimately allowing more end devices to utilise this standard to access services of any sort and any Quality of Service characteristic.
Status	Published
Link	https://www.wwrf.ch

Table 24 – "Under Trial: Evolved Service-Based Architecture Platform for Mobile Networks" conference paper description.

Field	Details
Title	Under Trial: Evolved Service-Based Architecture Platform for Mobile Networks
Type	Conference
Keywords	Service-Based Architecture, 5G, Mobile Networks, Demonstration, Core Network, 3GPP, Cloud-Native
Responsible Partner	IDE
Event Name	IEEE Future Networks World Forum 2022
Date	21 August 2022
Authors	Sebastian Robitzsch, Josep Ribes, André S. Gomes, Hergys Rexha, Luis Cordeiro, Mohamad Kenan Al-Hares, Marius Corici, David Gomez-Barquero
Abstract	5G has brought many system improvements to both the Radio Access Network and Core Network, with the shift towards a Service-Based Architecture for the Core Network as one of the most significant changes. This paper presents the argumentation for this architectural transformation in the Core Network, combined with the capabilities such change entails and a proposition towards the next steps for Service-Based Architectures towards Release 18 and beyond. Most notably, the

	domain of Private Networks and stronger inclusion of vertical requirements is the key driver for such continuous transformation, which were demonstrated as a live demo at an European conference and forms the key contribution of the work presented
Status	Published
Link	ieeexplore.ieee.org/document/10056661

Table 25 – "End-to-End Service-Based Architecture-Enabled Control Plane for the Sixth Generation of Mobile Telecommunication Networks" conference paper description.

Field	Details
Title	End-to-End Service-Based Architecture-Enabled Control Plane for the Sixth Generation of Mobile Telecommunication Networks
Type	Conference
Keywords	Service-Based Architecture, 5G, 6G, 3GPP, Non-Access Stratum, Control Plane
Responsible Partner	IDE
Event Name	2nd Workshop on Architectural Evolution Toward 6G Networks - 6GArch
Date	4-8 December 2022
Authors	Sebastian Robitzsch, Mohamad Kenan Al-Hares, Ulises Olvera-Hernandez
Abstract	The adoption of service-centric architectural principles for 3GPP's system has been a game changer for vendors and operators, enabling a never-seen flexibility for mobile telecommunication networks in the 5G era. As this paper presents though, only the Core Network partially adopted Service-Based Architecture principles, leaving out the User Equipment entirely and forcing the 5G control plane to combine modern communication and software design patterns with decades-old approaches. As a result, a truly end-to-end Service-Based Architecture-enabled control plane for 6G is described herein, with User Equipment procedures to authenticate as an example. To ease the transitioning towards 6G, 6G Standalone and 6G Non-Standalone modes are considered, similar to 5G.
Status	Rejected
Link	link

Table 26 – "Autonomous Private Mobile Networks: State of the Art and Future Challenges" journal paper description.

Field	Details
Title	Autonomous Private Mobile Networks: State of the Art and Future Challenges
Type	Journal
Keywords	Time-Sensitive Networking, Wireless and Radio Communications, Cloud and Edge Computing, Management and Orchestration, IoT and Machine-Type Communication
Responsible Partner	ATH
Event Name	IEEE Communications Standards Magazine
Date	September 2022
Authors	Arturo Bellin, Marco Centenaro, Nicola di Pietro, Arif Ishaq, Daniele Munaretto, Daniele Ronzani, Andrea Spinato, Stefano Tomasin, and Fabrizio Granelli
Abstract	As mobile systems for private use are gaining momentum, the area of network management automation is bound to attract renewed attention from standardization organizations and vendors. Prominent examples of tasks that would benefit from network automation tools are provisioning, diagnosing, and healing. Nevertheless, due to the various network and service providers as well as stakeholders involved in the deployment of a non-public mobile system, the success of such automation heavily depends on a smooth and effective interoperability among the components of the overall system. In this paper, we review the state of the art of network operations, administration, and management in the context of mobile systems for nonpublic use, highlighting the differences with respect to traditional public networks. Then, we provide insights about the automated provisioning of an entire core network and a network slice subnet, both for private use, performed on a research testbed under continuous integration. Finally, we propose a list of future challenges in this research area.
Status	Accepted
Link	n.d.

Table 27 – "Enabling Service-Oriented Principles for the User Plane of Mobile Telecommunication Networks" conference paper description.

Field	Details
Title	Enabling Service-Oriented Principles for the User Plane of Mobile Telecommunication Networks
Type	Conference
Keywords	service routing, SMF, Service-Based Interface, UPF, Software-Defined Networks, cloud-native orchestration
Responsible Partner	IDE
Event Name	IEEE Conference on Standards for Communications and Networking (CSCN)
Date	November 2022
Authors	Sebastian Robitzsch, Ulises Olvera-Hernandez, Jose Costa-Requena, Mika Skarp
Abstract	This paper presents the architectural considerations of integrating a non-IP-based service routing solution, Name-Based Routing, to the 5G user plane. While entirely preserving the control plane procedures on the terminal, the carefully crafted considerations herein argue for a new Session Management Function functionality and the transitioning of the N4 interface to become a Service-Based Interface, i.e. Nupf. Furthermore, this paper presents User Plane Function provisioning procedures based on Software-Defined Networks principles mitigating the need for any manual management procedures and enabling cloud-native orchestration procedures for all 5G Core Network Functions.
Status	Published
Link	ieeexplore.ieee.org/document/10051037

Table 28 – "On-path vs Off-path Traffic Steering, That Is The Question" conference paper description.

Field	Details
Title	On-path vs Off-path Traffic Steering, That Is The Question
Type	Conference
Keywords	Traffic steering, latency, network, AR, VR, ingress points
Responsible Partner	HWDU
Event Name	ACM SIGCOMM Workshop on Future of Internet Routing & Addressing

Date	23 September 2022
Authors	Karima Khandaker, Dirk Trossen, Jinze Yang, Zoran Despotovic, Georg Carle
Abstract	Service-level traffic steering in the Internet has been using an indirection-based model for decades now, using the DNS to resolve a name to a locator, often complemented with load balancing techniques. Contrasting this off-path realization, service information as part of the data packet itself may determine the one of possibly many communication endpoints on-path while traversing the network. This paper compares both design choices regardless of the specific decision mechanism used. For this, we assume a compute-aware traffic steering mechanism for both approaches and determine latency penalties through off-path resolution steps as well as distributing scheduling decisions to on-path network ingress points. Lastly, we investigate latency variances and resilience in an AR/VR scenario.
Status	Published
Link	dl.acm.org/doi/10.1145/3527974.3545721

Table 29 – "Preliminary Evaluation of a Software-based Release 17 5MBS Prototype" conference paper description.

Field	Details
Title	Preliminary Evaluation of a Software-based Release 17 5MBS Prototype
Type	Conference
Keywords	Point-to-multipoint communications, 5G system, 5G Multicast-Broadcast Services, 5G Core, network traffic, bandwidth
Responsible Partner	UPV
Event Name	BMSB 2023
Date	11 March 2023
Authors	Carlos Barjau, Borja Iñesta, David Gómez Barquero, Pousali Chakraborty, Hemant Zope, Marius Corici
Abstract	Point-to-multipoint communications were introduced in the 5G System as part of Release 17. This technology is known as 5G Multicast-Broadcast Services (5MBS) and provides a scalable procedure to reuse New Radio in mass delivery of multimedia. In order to evaluate the impact of Point-to-multipoint communications in the 5G Core, a 5MBS software prototype was implemented by extending existing Point-to-point Network Functions of Open5GCore, a commercial 5G Core solution. A performance comparison between Point-to-point and developed Point-

	to-Multipoint components has been carried out; using network traffic tools and video delivery. The results show that the 5MBS prototype can course traffic to multiple users simultaneously without demanding more network bandwidth, but the maximum bitrate coursed is degraded when compare versus Point-to-point.
Status	Accepted
Link	www.bmsb2023.com

Table 30 – "European 5G Annual Journal 2023" journal paper description.

Field	Details
Title	European 5G Annual Journal 2023
Type	Journal
Keywords	5G, 6G, European Commission, Smart Networks and Services
Responsible Partner	ONE
Event Name	European 5G Annual Journal 2023
Date	March 2023
Authors	5G PPP
Abstract	n.d.
Status	Submitted
Link	n.d.

5.2.4. Organized Workshops

An important part of FUDGE-5G dissemination activities are the workshops organized by the project. These workshops target the scientific community and allow FUDGE-5G to share and discuss the project outcomes. FUDGE-5G has organized five workshops and participated in two other external workshops. Further detail can be found in the next sections.

5.2.4.1. 5GPPP Technical Board eWorkshop

Table 31 - "5GPPP Technical Board eWorkshop" description.

Field	Details
Workshop name	Session 6: Integrating Public and Private Networks
Entity	5GPPP
Type	Organized
Date	Thursday, December 10th 2020
Responsible partner	TNOR
Webpage	https://5g-ppp.eu/tb-eworkshop-dec-2020/
Location	Online
Keywords	Private Networks
Description	The workshop session was organized by the FUDGE-5G partners and stakeholders. In the workshop, the integration of private and public networks was showcased, covering relevant vertical use cases, business models, operation, and new findings of the project.
Workshop Chairs	• Kashif Mahmood, Telenor • Kennet Nomelan • Carlos Barjau • Jose Costa Requena • Jose Lucena • Wint Yi Poe • Daniele Munaretto
Attendance	40

Agenda

13:15-15:20 CET

Presentations

- Introduction, Kashif Mahmood
- Private 5G Uses Cases for Defence, Kennet Nomeland
- FUDGE-5G private Use Cases, Carlos Barjau
- 5G NPN open, new roles and business models, Jose Costa Requena
- On the Operation of Non-Public Networks – An MNO's Perspective, Jose Lucena
- Network Slicing in PNI-NPNs, Wint Yi Poe
- User Provisioning and Roaming in Private 5G, Daniele Munaretto

5.2.4.2. *EuCNC Workshop 6: 5G Private Networks*

Table 32 - "EuCNC Workshop 6: 5G Private Networks" description.

Field	Details
Workshop name	Workshop 6: 5G Private Networks
Entity	2021 EuCNC & 6G Summit
Type	Organized
Date	Tuesday, June 8th 2021
Responsible partner	UPV
Webpage	https://www.eucnc.eu/workshops/workshop-6/
Location	Online
Keywords	Private Networks
Description	This workshop was organized by 12 5G-PPP projects working on 5G NPNs, recognized experts in this area. The workshop will provide a holistic view of NPNs, covering from vertical use cases, operation aspects, business models, trials and emerging technologies.
Workshop Chairs	• David Gomez-Barquero (moderator), UPV, Spain • Kashif Mahmood Telenor Research, Norway • Nikolaos Tzanis ADMIE (Greece) • Niels König Fraunhofer Institute for Production Technology (IPT), Germany • Manuel Fuentes Fivecomm, Spain • Jordi J. Gimenez European Broadcasting Union (EBU), Switzerland • Kennet Nomeland Norwegian Defence Material Agency (NDMA), Norway • Ki Won Sung KTH Royal Institute of Technology, Sweden • Jose Ordonez-Lucena Telefonica, Spain • Daniele Munaretto Athonet, Italy • Simon Fletcher Real Wireless, UK • Håkon Lønsethagen Telenor (Norway) • Jose Costa-Requena Cumucore, Finland • Sebastian Robitzsch InterDigital, UK • Dirk Trossen Huwei Technologies Duesseldorf GmbH, Germany • Sergio Gonzalez ATOS, Spain
Attendance	80

Agenda

9:30-11:00 Vertical Use Cases for 5G Private Network

Presentations

- 5G-ACIA: Shaping the Industrial 5G Revolution (Xueli An, Huawei, 5G-ACIA)
- 5Growth NPN Deployment Solutions & Industry 4.0 Pilot Examples (Xi Li, NEC, 5Growth
- 5G NPNs for Process Monitoring (Niels König, Fraunhofer IPT, 5G-SMART)
- Autonomous Edge 5G Private Network Requirements for Smart Factories (Nikolaos Tzanis, University of Patras, 5G-VICTORI)

Coffee Break

11:30-13:00 Vertical Use Cases for 5G Private Networks

Presentations

- 5G-enabled AGVs for NPN Production Lines in Manufacturing (Manuel Fuentes, Fivecomm, 5G-INDUCE)
- 5G for Military Use (Kennet Noland, Norwegian Defence Material Agency, 5G-VINNI+FUDGE-5G)
- On the Role of 5G NPNs for Mission Critical Services (Ki Won Sung, KTH, PriMO-5G)
- The role of 5G Non-Public Networks for Media Production (Jordi J. Gimenez, EBU, 5G-RECORDS)

Lunch

14:00-15:30 Operation of 5G Private Networks

Presentations

- Outlook for operator adoption of 5G Private Networks (Jose Ordonez-Lucena, Telefonica, 5G-VINNI+5Growth+5G-Clarity)
- High-Tech and Affordable 5G Private Network Roll-Out to Every Corner (Sergio Gonzalez, Atos, Affordable 5G)
- Towards efficient 5G NPN Readiness and Testing, addressing the Industry 4.0 challenges of SMEs (Hakon Lonsethagen, Telenor, 5G-Solutions)
- Operation of 5G NPNs: Industry Sector Considerations for Deployment and Sustainability (Simon Fletcher, Real Wireless, 5G-TOURS)

Coffee Break

16:00-17:30 Emerging Technologies for 5G Private Networks

Presentations

- Seamless integration of TSN into 5G NPNs for Industry 4.0 (Jose Costa, Cumucore, 5G-SMART+FUDGE-5G+5G-RECORDS)

- Cloud Deployments of 5G NPNs: the Athonet Connectivity Platform (Daniele Munaretto, Athonet, FUDGE-5G)
- Cloud Native Service-Based Architecture Deployment Considerations for NPNs: An Evolution of NFV (Sebastian Robitzsch, InterDigital, FUDGE-5G)
- Making (Virtualized) Service Interactions More Flexible Within and Across 5G Private Networks (Dirk Trossen, Huawei, FUDGE-5G)

5.2.4.3. 5G-MAG Remote Production Follow-up workshop

Table 33 - "5G-MAG Remote Production Follow-up" workshop description.

Field	Details
Workshop name	Follow-up Workshop “Media Production over 5G NPN: Deep dive into protocols"
Entity	5G-MAG
Type	Participation
Date	Wednesday, January 19th 2022
Responsible partner	NRK (Stakeholder)
Webpage	https://www.5g-mag.com/post/follow-up-workshop-media-production-over-5g-npn-deep-dive-into-protocols
Location	Online
Keywords	Remote Production
Description	The 5G Media Action Group (5G-MAG) is organizing a follow-up workshop to the one held in December about “Media Production and 5G Non-Public Networks: Deep dive into media production protocols”. Erik Vold representing NRK, the Remote Production Stakeholder, shared the view that NRK R&D has and the role of 5G in it. Erik shared the experience gathered from using 5G in the trials as part of FUDGE-5G during 2021. Further detail can be found in the following video: https://youtu.be/_tvrlIj7TxE
Workshop Chairs	n.d.
Attendance	n.d.

Agenda

15:00-18:00 CET

Presentations

- Vislink, David Edwards
- Nulink, Laurent Zwahlen
- **NRK, Erik Vold**
- France TV – Globecast, Jacques Donat-Bouillud and Samy Nicolas Bouchalat
- Ross Video, Tom Crocker
- Agile Content, Johan Bolin
- BBC, Sam Hurst

5.2.4.4. Accelerating 5G Innovation in Europe with 5GLOGINNOV, FUDGE 5G and Affordable 5G

Table 34 - " Accelerating 5G Innovation in Europe with 5GLOGINNOV, FUDGE 5G and Affordable 5G " workshop description.

Field	Details
Workshop name	Accelerating 5G Innovation in Europe with 5GLOGINNOV, FUDGE 5G and Affordable 5G
Entity	n.d.
Type	Organized
Date	Thursday June 16th, 2022
Responsible partner	UPV
Webpage	n.d.
Location	Online
Keywords	5G Innovation, CAD, transport & logistics, smart city, manufacturing
Description	The goal is to discuss and contribute to the debate about the advancement in the adoption of 5G technologies in several sectors. The three selected projects matured their 5G-expertises in relation to the optimisation of traffic operations at ports and logistics, the delivery of a solution covering the needs of private and enterprise networks and the definition of a 5G architecture for private networks allowing interoperability and customization for industry verticals.
Workshop Chairs	n.d.
Attendance	n.d.

5.2.4.5. *FUDGE-5G Stakeholder workshop*

Table 35 - FUDGE-5G Stakeholder workshop description.

Field	Details
Workshop name	FUDGE-5G Stakeholder workshop
Entity	FUDGE-5G
Type	Organized
Date	Thursday September 15th, 2022
Responsible partner	UPV/TNOR
Webpage	n.d.
Location	Fornebu, Norway
Keywords	FUDGE-5G
Description	The goal is to showcase the advancements of FUDGE-5G and showcase and demonstrate the multiples Use Cases to the multiple Stakeholders of the project.
Workshop Chairs	n.d.
Attendance	n.d.

5.2.4.6. *5G-EVE Learn and Drive external workshop*

Table 36 – 5G-EVE Learn and Drive external workshop description.

Field	Details
Workshop name	5G-EVE Learn and Drive
Entity	5G-EVE
Type	Attendance
Date	Tuesday, January 26th 2021
Responsible partner	ONE
Webpage	n.d.
Location	Online
Keywords	SME, industry, collaboration
Description	5G EVE Learn and Drive represents a valuable opportunity for SMEs and startups to get to know 5G EVE and understand how to profit from testing and training opportunities, as well as take advantage of the physical and technical resources of 5G EVE. The

	two-hour Learn and Drive event will show you how to get exposure, get to know virtually and obtain essential information to develop potential collaborations with some of the main industrial participants in the 5G Ecosystem, GAMMASG, YBVR, Fivecomm and UTEK. SMEs had the chance to discuss potential use cases and future collaborations in direct contact with key European industry participants during the event.
Workshop Chairs	n.d.
Attendance	n.d.

Agenda

First Session 10:30-11:15 CET - Learn about 5G EVE project

- Welcome and introduction from 5G EVE;
- Overview of 5G EVE objectives and description of 5G EVE facilities;
- How 5G EVE architecture respond to the SMEs demand for an easy-to-use and customisable platform service ready to design, execute, and monitoring extensive validation tests of 5G applications;
- New European funding tools for 5G applications developed by SMEs.

Second Session 11:15-12:30 CET - "Drive" 5G EVE features

5.2.4.7. 5G-Heart Webinar #1 – Healthcare vertical trials

Table 37 – 5G-Heart Webinar #1 – Healthcare vertical trials description.

Field	Details
Workshop name	5G-Heart Webinar #1 – Healthcare vertical trials
Entity	5G-Heart
Type	Attendance
Date	Monday, October 12th 2020
Responsible partner	ONE
Webpage	n.d.
Location	Online
Keywords	Healthcare, 5G network
Description	During the workshop, it was discussed what are 5G-HEART healthcare experiments and their motivation. These include:

	experiments with wearable video in pilots with Oslo Ambulance Service and Ambulance Zorg Groningen, robotic ultrasound examination over 5G network, challenges and benefits and problems and solutions addressing in the case of congenital heart disease. Finally, there were discussions on the related topics.
Workshop Chairs	n.d.
Attendance	n.d.

Agenda

First Session 9:30-9:40 CET

- What are 5G-HEART healthcare experiments, and why do we do this?;
- Three major use cases for e-health which will challenge the performance and availability of 5G services;
- Early results from Pilots in Oslo and Groningen.

Second Session 9:40-9:55 CET

- Wearable Video for Paramedics;
- 5G Drivers;
- E-health experiments are performed in four locations;
- Next Steps.

Third Session 9:55-10:10 CET

- Clinical Background;
- Technical Aspects;
- Experiment Telepresence setup with;
- Conclusion.

Fourth Session 10:10-10:25 CET

- Use case motivation & assessment;
- Methodology for judging functionality and usability;
- The need for 5G and the 5G-Heart testing facilities why 5G?;
- Conclusions.

5.2.5. Demos and Showcases

For the duration of the project, FUDGE-5G performed the five demonstrations described in the next sections.

5.2.5.1. Mobitrust Platform @TechDays Aveiro 2020

A demonstration of OneSource's Mobitrust platform was presented at Techdays Aveiro on October 17, 2020. It was a joint demonstration of H2020 FUDGE-5G and P2020 M5G (https://5go.pt) projects, with an audience of around 50 people. Figure 16 presents some pictures of this event.

This demonstration was performed in collaboration with Altice Labs and MEO, using one of the first large-scale 5G deployments in Portugal. This network, a Non-Standalone Access 5GNR, runs in band n78. OneSource leveraged its Mobitrust wearable equipment for first responders with 5G modems, real-time video, audio, environmental sensors and bio sensors, to deliver enhanced situational awareness from field teams to command and control centres. Network latency was very low, and the 5G network allowed much higher video quality from the field. This demonstration was attended by various stakeholders from the Public Safety field (e.g., civil protection, firefighters, police units and other first responders), that expressed a strong interest in the platform.

Figure 16 - Mobitrust Platform @TechDays Aveiro 2020

5.2.5.2. FUDGE-5G Service Based Architecture demonstration

Sebastian Robitzsch from IDE, presented a demo with focus on FUDGE-5G SBA platform which implements the Service Communication Proxy and offers cloud-native location-aware orchestration of 5G Cores. Utilising the SBA capabilities, the demonstration allows to deploy the UPF on-premise and all other required 5GC NFs in the cloud and have it operational with a gNB within two minutes. This demonstration took place at the FUDGE-5G booth at EuCNC 2022 (Figure 17), in Grenoble, from 7 to 10 of July, with an estimated attendance of around 30 people. Further detail can be found in the following video: https://youtu.be/6slR4dp8OY8

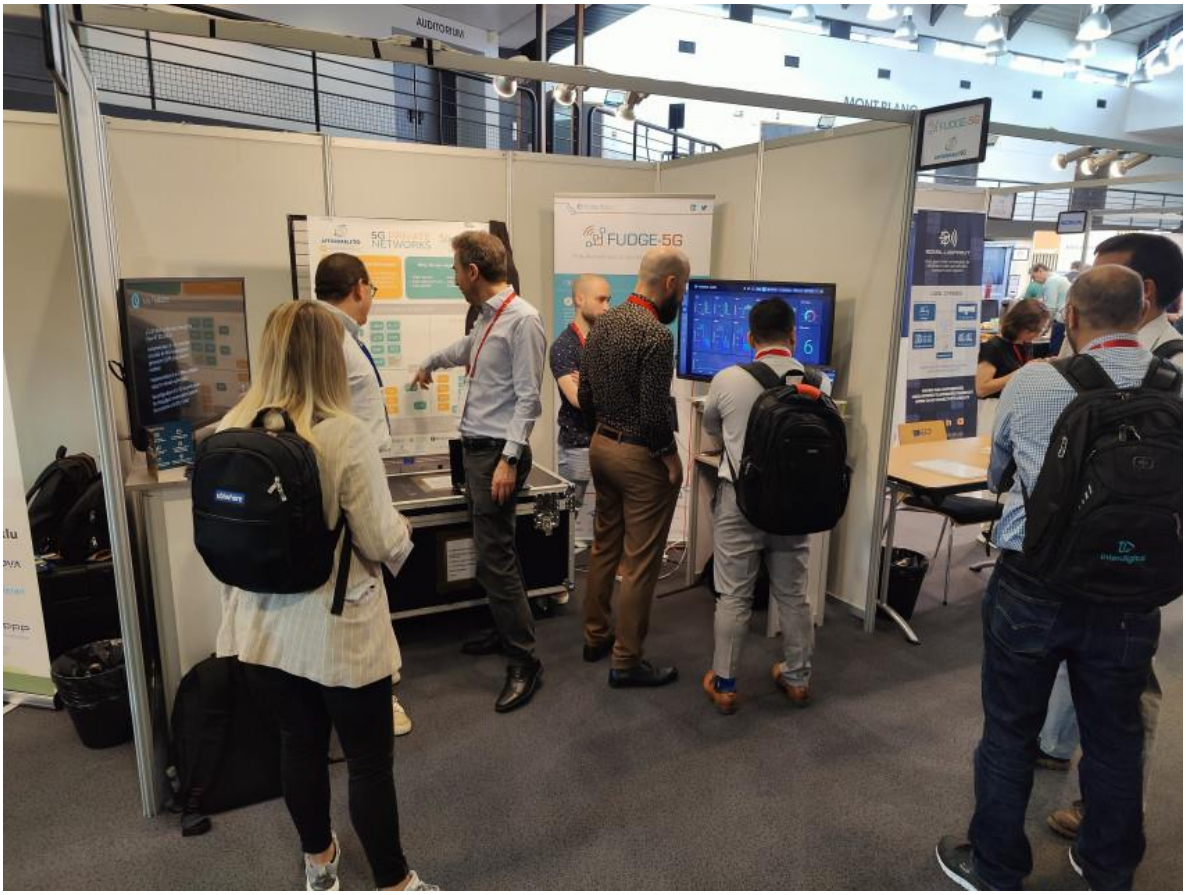

Figure 17 - FUDGE-5G and AFFORDABLE5G booth at EuCNC 2022

5.2.5.3. 5G Virtual Office Use Case demonstration

Leading up to the 5G Virtual Office use case, OneSource, performed multiple demonstrations at the Oslo University Hospital. The main focus of these was to showcase the developments of the project in the context of this use case, and also, to receive feedback from certified medical experts in order to improve the final results. Figure 18 and Figure 19 show some of these demonstrations, where multiple health care experts were present.

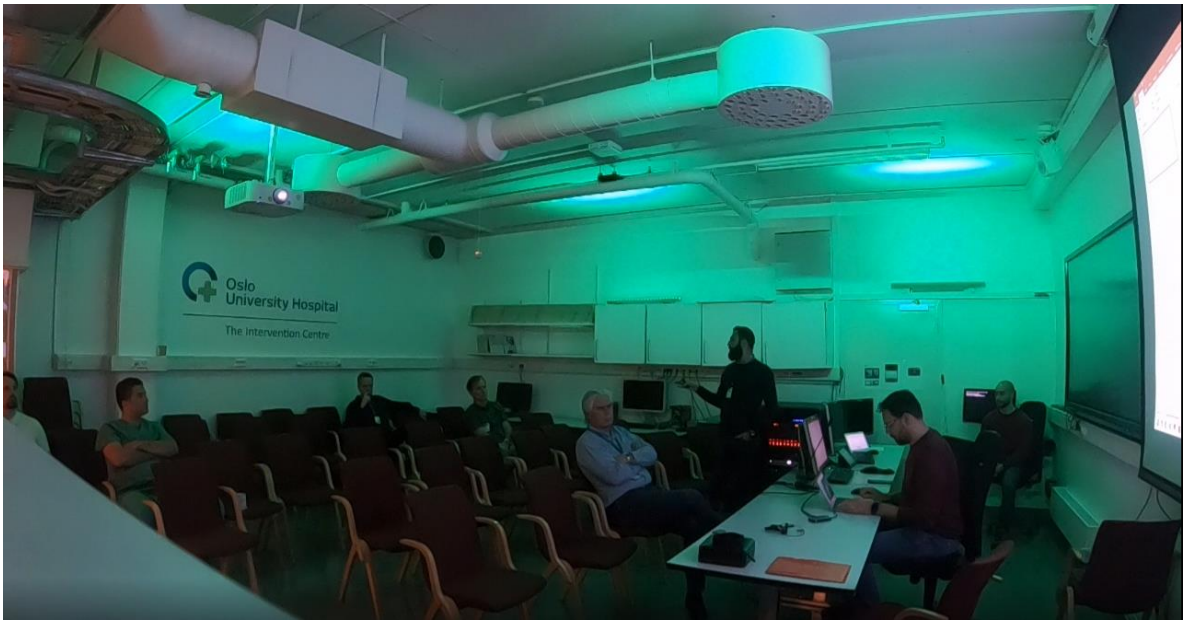

Figure 18 - Oslo University Hospital demonstration, November 17th, 2022

Figure 19 - Oslo University Hospital demonstration, September 6th, 2021

5.2.5.4. Cumucore 5GC SNPN on HPE Edge over ISS

Cumucore and Hewlett Packard Enterprise (HPE) showcased the first 5G Standalone Non-Public Network with the HPE edge running on the International Space Station (ISS). This showcase took place in Houston, Texas, on the 4th of April 2022. Further detail can be found in the following link.

5.2.5.5. CBCF Demonstration

One2many, an Everbridge company and Cumucore have integrated the one2many's Cell Broadcast Centre Function with the Access and Mobility Function of Cumucore's 5G core running on Supermicro E200-8D and performed a successful demonstration at Telenor in Norway using a Huawei gNodeB. The key focus was to demonstrate the mass notification capability of a CBCF that uses an AMF to distribute text messages to cells in gNodeBs. In the trial a Huawei LampSite gNodeB was used. The demonstration at the Telenor campus was attended by the Norwegian Defence and Materiel Agency (NDMA). Both NDMA and Telenor provided 5G mobile phones for the demo. A more elaborate explanation of the trial can be found in this video.

5.2.6. Advanced Training

The FUDGE-5G partners are providing advanced training. Six students (four MSc candidates and two PhD student) were involved in the project research by developing their thesis work within the project's research objectives. Furthermore, impact training was conducted with EXFO. The details are presented in Table 38.

Table 38 - FUDGE-5G Advanced Training Candidates

#	Partner	Name	Type	Start date	End date	Status
1	ONE	António Borges	MSc	2020/09	2021/07	Concluded
2	UPV	Borja Iniesta	MSc	2021/09	2023	Ongoing
3	UPV	Aaron Montilla	MSc	2021/09	2023	Ongoing
4	UPV	Carlos Barjau	PhD	2018	2022/12	Concluded
5	ATH	Arturo Bellin	PhD	2021	2024	Ongoing
6	ONE	Pedro Tomás	MSc	2020	2022	Concluded
7	UPV	Carlos Barjau, Borja Iñesta, Aaron Montilla, Iván Viciedo	Impact Training	2022	2022	Concluded
8	UPV	Carlos Barjau, David Gómez-Barquero	Impact Training	2022	2022	Concluded

5.2.7. Patent Applications

During the reporting period FUDGE-5G partner IDE, has made multiple patent application. This are detailed in Table 39.

Table 39 – FUDGE-5G patent applications

Partner	Patent	Date	Status
IDE	Methods, Apparatus, and Systems for Isolation of Service Chains in a Name-based Routing System	26 November 2020	Provisional Application
IDE	Methods, Apparatus, and Systems for Fully Qualified Domain Name (FQDN) Resolution and Communication	26 November 2020	Non-Provisional Application
IDE	Enabling Service Oriented Principles in the 5GC User Plane through the Integration of Name-based Routing Mechanisms	24 February 2021	Provisional Application
IDE	Methods, Architectures, Apparatuses and Systems for Programmable Interface for Service Communication Proxies	12 November 2021	Non-Provisional Application
IDE	Multicast Delivery of Notifications via Service Communication Proxy Implementing Name-based Routing	25 November 2021	Provisional Application
IDE	Methods, Architecture and Procedures to Enable Non-Access Stratum-as-a-Service (NASaaS)	10 February 2022	Provisional Application
IDE	Addressing Scheme for an End-to-End SBA Control Plane	29 June 2022	Provisional Application
IDE	Authentication for SBA-Enabled UEs Using 3GPP ANs	30 June 2022	Provisional Application
IDE	Authentication for SBA-Enabled UEs Using Non-3GPP ANs	30 June 2022	Provisional Application
IDE	Addressing Scheme for an End-to-End SBA Control Plane - Support for Network Slicing	12 Nov 2022	Update
IDE	Programmable 5G Core Network Function Instance Affinities for Beyond 5G Systems	17 Nov 2022	Update

5.2.8. 5GPPP Events

5G Public Private Partnership (5GPPP) is a joint initiative between the European Commission and the ICT industry, with FUDGE-5G being one of the third phase projects. The 5GPPP events allow projects to share and discuss the developments of their work among 5GPPP members. InterDigital has participated in two of these events, an in-person 5G-PPP Architecture WG meeting to work on a whitepaper, from 20 to 22 of July 2022, and an in-person 5G-PPP Technology Board Meeting, on October 6th, 2022. FUDGE-5G partners, UPV, TNOR, ATH and CMC also participated in a 5GPPP Technical Board eWorkshop, on December 10th, 2020. Lastly, the next section describes the FUDGE-5G participation in a 5GPPP Webinar event that took place in February 2021.

5.2.8.1. 5GPPP Webinar: New 5G Core Technologies Innovation Projects

The 5GPPP Webinar "New 5G Core Technologies Innovation Projects" took place on February 16, 2021. On the webinar, the eight new "Core Technologies" projects joining the 5GPPP were presented. These projects started on the second half of 2020 and have already started to develop advances in 5G. FUDGE-5G participated on the webinar, with David Gomez-Barquero (UPV) presenting an overview of FUDGE-5G project, including the project partners, objectives and the work developed until then.

5.2.9. Advisory Board Meetings

The FUDGE-5G advisory board encompasses the following members:

- Vertical Stakeholders
  - NRK, Norwegian government-owned radio and television public broadcasting company
  - NDMA, Norwegian Defence Materiel Agency.
  - OUS, Oslo University Hospital.
  - ABB, formerly ASEA Brown Boveri
- Technical Experts
  - Nokia Bell-labs
  - Deutsche Telekom
  - British Telecom
- Cloud Solution Providers
  - Microsoft
  - Intel
  - RedHat
  - HPE
- Vertical Technology providers
  - Goodmill Systems
  - Nemergent Technologies

In the next sections, the AB meetings are described, including the AB members attendance, the meeting content, and discussions.

5.2.9.1. AB Meeting on December 14, 2020

This meeting was attended by the technical experts Bessem Sadayi (Nokia Bell-Labs), Steve Appleby (British Telecom) and Hans Einsiedler (Deutsche Telekom) and by the advisory board members Bjorn Runaker (Intel), Fredrik Tjenberg (Intel) and Ewald Scharp (Microsoft). The meeting took place on-line, as was part of the FUDGE-5G general assembly #2.

On the meeting each of the Use Case champions presented the work that had been developed so far on the Use Case(s) blueprint. The technical experts and AB members were able to provide their feedback and technical expertise. The meeting resulted in a set of changes and adaptations to be applied to the UC blueprints.

5.2.9.2. AB Meeting on March 9, 2021

This meeting was attended by the technical expert Steve Appleby (British Telecom) and by the advisory board members Bjorn Runaker (Intel), Fredrik Tjenberg (Intel) and Ewald Scharp (Microsoft). The meeting took place on-line, as was part of the FUDGE-5G general assembly #3.

The meeting was focused into WP1 and WP2. By the time of the meeting, D1.1 was almost completed and ready for submission and was presented to the technical experts and AB members. They provided their opinion on the deliverable and the final review of the document was based on it. For the second part, the meeting was focused on WP2, with the FUDGE-5G platform being presented and discussed. Finally, the meeting ended with the overview and discussion of the five tasks of WP2.

5.2.9.3. AB meeting on June 21st, 2021

The meeting was attended by the technical experts Steve Appleby (British Telecom) and Hans Einsiedler (Deutsche Telekom) and by the advisory board members Bjorn Runaker (Intel), Fredrik Tjenberg (Intel), Ewald Scharp (Microsoft), Timo Jokiaho (RedHat), Charlotte Bekkevold (HPE) and Ignacio Garcia-Carrillo (HPE). The meeting took place on-line, as was part of the FUDGE-5G general assembly #4.

By the time of the meeting, each of the Uses Cases blueprint had already started to be implemented. A balance of the previous work, the planned future work and schedule was presented to the technical experts and AB members. The second part of the meeting was focused into WP2, with the update and discussion of the FUDGE-5G platform and with a detailed status presentation of each of the WP2 five tasks.

5.2.9.4. AB meeting on August 31st, 2021

The meeting was hosted by the technical expert Hans Einsiedler (Deutsche Telekom) and was attended by the advisory board member Timo Jokiaho (RedHat). The meeting took place on-line and had also the participation of Deutsche Telekom team members.

FUDGE-5G partners presented the updated overview of the project focusing on the FUDGE-5G platform architecture and its components. Hans Einsiedler team had provided a group of questions, that were answered in the meeting. The questions encompassed orchestration, API implementation efforts, and the FUDGE-5G platform underlying infrastructure.

5.2.9.5. AB meeting on July 9th, 2022

At the EuCNC event in Grenoble, a meeting took place, where the FUDGE-5G SBA platform and other topics where discussed. The meeting was attended by the advisory board member Bessem Sadayi from Nokia.

5.2.9.6. AB meeting on September 14th, 2022

The Advisory Board members were invited to come for the 8th GA plenary in Oslo. Use Cases, FUDGE-5G Platform and Technical Tasks were presented as part of a small workshop for the Stakeholders and feedback was gathered. Erik Vold from NRK, Kennet Nomeland from NDMA and Waqas Ikram from ABB, attended the meeting.

5.2.10. Keynote Presentations

5.2.10.1. Global5Gevolution

The Global5GEvolution is a platform providing engineers with informative content to help them innovate in the 5G technology domain.

David Gomez-Barquero presented the FUDGE-5G overview on December 18, 2020. The presentation took place on-line and was part of the Global5GEvolution event #9, focused on 5G Private networks. The event was attended by 5G technical experts, one of FUDGE-5G target dissemination groups.

5.2.10.2. UPTIME

UPTIME is an event which brings together the private network community consisting of end-users, mobile operators, application providers, device manufacturers, and infrastructures providers. In January 2021, the first edition was hosted by ATHONET from the Marconi Foundation at Villa Griffone, Italy.

During this event, held on January 27, 2021, Daniele Munaretto (ATH) presented the FUDGE-5G overview to an audience of 835 people, comprising both in presence and remotely connected participants.

5.2.10.3. eBPF based UPF (User Plane Function) for 5G

This presentation took place at the Cloud Native Computing Foundation Telco conference, held on May 16, 2022, in Valencia, Spain. Presented by Aapo Poutanen, CMC, and Eric Lajoie, Red Hat, a novel design of the User Plane Function (UPF) based on eBPF framework available in Linux OS was described. Including Initial implementation and performance results of the eBPF based UPF. The session can be found in this video.

5.2.11. Participation in 5GPPP Working Groups

5GPPP working groups[9] join the 5GPPP projects and their activities to enable the project to converge, share and discuss the work being developed individually. FUDGE-5G is represented into the "5G Architecture" and "Software Networks" working groups, as detailed next.

5.2.11.1. 5G Architecture WG

This WG is focused on the 5G systems architecture. The WG provides a common platform that facilitates the discussion and consensus for 5GPPP projects developing architectural concepts and components. FUDGE-5G is represented by Sebastian Robitzsch and Zoran Despotovic. Both representants are contributing for the WG discussions bringing the FUDGE-5G architectural approach for the project platform and the enhanced Service-Based Architecture.

5.2.11.2. Software Network WG

The Software Network WG aims to analyse and address unification and applicability of relevant research topics related to Software Networks. It includes discussions around Software Defined Networks and Network Function Virtualization. Thanos Xirofotos represents FUDGE-5G. The FUDGE-5G representant brings the FUDGE-5G platform concepts to the discussion, namely the FUDGE-5G platform Software networking approach and the platform orchestration tools and concepts.

5.2.12. Open source repositories

The following table contains the details on the open source activities done in the context of FUDGE-5G.

Table 40 – FUDGE-5G Open Source Repositories

Partner	Project	Type
ABO	github.com/hubblo-org/scaphandre	Energy Efficiency work in 5G Core

[9] https://5g-ppp.eu/5g-ppp-work-groups/

ABO	github.com/nghttp2/nghttp2	nghttp2 - HTTP/2 C Library and tools
FHG	github.com/OpenAPITools/openapi-generator	OpenAPI Generator for 5G Core

5.2.13. Tutorials/summer schools

FUDGE-5G partner, UPV, organized a tutorial called "Transmisión de Contenidos Multicast/Broadcast en Redes Móviles", on November 30, 2021, presented by David Gómez-Barquero. The attendants got the chance to learn about the problem of the transmission of multicast/broadcast content in mobile networks and its main use cases, including the connected vehicle. Multiple other topics were discussed, as examples the evolution of point-to-multipoint transmissions in 3GPP, current work on 3GPP as well as future work on 5G-Advanced.

Furthermore, on the 12th of December 2023, OneSource delivered a presentation and a hands-on workshop on 5G Networks, as part of the advanced training program for master's students from the Computer Science Department of University of Coimbra. The presentation focused on describing the multiple use cases of FUDGE-5G and their innovations. This talk was followed by the hands-on workshop, where the students had the chance to program and interact with PPDR mobile devices and a 5G Network, as shown in Figure 20.

Figure 20 - ONE hands-on workshop at University of Coimbra

5.2.14. Other dissemination activities

Many other dissemination activities were carried out by the FUDGE-5G partners that didn't follow the planned dissemination groups. Such activities are described in the following tables.

Table 41 – "Mobile World Congress 2023 booth" details

Field	Details
Title	Mobile World Congress 2023 booth
Responsible Partner	ATH
Entity	Mobile World Congress 2023
Date	From February 27th to March 2nd,2023
Details	Athonet was present at MWC, the largest and most influential event for the connectivity ecosystem. Projection of project's videos on screen at ATH's booth and distribution of project's flyers, as represented in the following figures. 
Link	www.mwcbarcelona.com

Table 42 - "Panel Discussion at 5G World 2021" details

Field	Details
Title	Panel Discussion at 5G World 2021
Responsible Partner	IDE
Entity	5G World
Date	September 22nd,2021
Details	**Agenda** • Enterprise perspectives: Would you work with an MNO for your private networks, and what are your requirements that an MNO wouldn't be able to meet? • How important is IoT leadership for an MNO in private networks? • MNOs, versus network vendor, versus SIs, versus industrial vendors – who is your best partner in the long run? • Is there an opportunity for private networks specialists? • What works best? Standalone, telco-led and hybrid models for private network connectivity • Edge computing models: private, hybrid or public scenarios for different network models **Attendance** • Pablo Tomasi, Omdia • Chris Allen, Vodafone UK • Antje Williams, Deutsche Telekom • Alon Arnon, ASOCS
Link	n.d.

Table 43 - "Cloud meets Telco" details

Field	Details
Title	Cloud Meets Telco
Responsible Partner	IDE
Entity	Mobile World Congress LA
Date	October 26th, 2021
Details	Sebastian Robitzsch, from InterDigital, details what happens when "Cloud Meets Telco" on a presentation at Mobile World Congress LA. Such topics as the current state of the cloud ecosystem, pillars of cloud principles in 5G, and the emerging challenges for 5G and beyond are the main focus of the presentation.

Link	https://youtu.be/iwT2D-LxOIo

Table 44 - Presentation at the 2021 4th IEEE 5G Workshop on First Responder and Tactical Networks details

Field	Details
Title	Presentation at the 2021 4th IEEE 5G Workshop on First Responder and Tactical Networks
Responsible Partner	ATH
Entity	IEEE 5G WFRTN 2021
Date	December 14th, 2021
Details	Athonet gave a presentation on their solutions for PPDR and tactical networks, acknowledging FUDGE-5G's use case on PPDR. Several hundred people from industry and academia registered to the event. A total of 25 people attended the live broadcast of ATH's presentation during the event.
Link	futurenetworks.ieee.org/conferences/2021-first-responder-and-tactical-networks-workshop

Table 45 - "5G Networks in Action – The Private Mobile Era" webinar details

Field	Details
Title	"5G Networks in Action – The Private Mobile Era" - Webinar of the 5G Academy
Responsible Partner	ATH
Entity	Federico II University of Naples
Date	May 11th, 2022
Details	Athonet gave a 90-minute presentation on 5G requirements, use cases, enabling technologies, differences and commonalities between private and public networks, network slicing, research topics and trends. Mentioning some results that are at the core of Athonet's contribution to FUDGE-5G and referencing the project in the slides. The seminar was open to master and PhD students/professors, with a total of 45 attendances.
Link	n.d.

Table 46 - "5G Networks in Action – The Private Mobile Era" webinar details

Field	Details
Title	"5G Networks in Action – The Private Mobile Era" - Webinar
Responsible Partner	ATH
Entity	Bicocca University of Milan
Date	May 13th, 2022
Details	Athonet gave a 2-hour presentation on 5G requirements, use cases, enabling technologies, differences and commonalities between private and public networks, network slicing, research topics and trends. Mentioning some results that are at the core of Athonet's contribution to FUDGE-5G and referencing the project in the slides. The seminar was open to master students, with a total of 35 attendances.
Link	

Table 47 - NGMN Exhibition details

Field	Details
Title	NGMN Exhibition
Responsible Partner	IDE
Entity	NGMN Industry Conference & Exhibition
Date	From 7 to 9 September, 2022
Details	InterDigital was one of the exhibitioners at the NGMN IC&E 2022.
Link	ice2022.ngmn.org/exhibition/

Table 48 - 50th Anniversary of InterDigital

Field	Details
Title	50th Anniversary of InterDigital
Responsible Partner	IDE
Entity	InterDigital
Date	From 14 to 18 November, 2022
Details	Sebastian Robitzsch conducted a series of presentations and showcases about the advancements of FUDGE-5G. These were targeted to

	InterDigital Executives and Senior Leadership, at the “50th Anniversary of InterDigital”.
Link	n.d.

6. Conclusions

During the initial reporting period, the FUDGE-5G project designed and published its website representing the main channel for the project dissemination activities hosting all the project deliverables, dissemination items, and formal content of the project. Furthermore, the FUDGE-5G project prepared its graphical identity. Based on the defined graphical identity, various templates have been created.

Furthermore, an initial communication and dissemination strategy of the FUDGE-5G project has been laid down, including the identification of the main targeted stakeholders' groups and the target KPIs to achieve.

With the implementation of the initially defined strategy, the project produced distinct types of content to be disseminated by the project communication channels, including news, journal and conference papers, organization of workshops in relevant conferences and participation in the 5GPPP communities.

Finally, the reach and performance of the dissemination content and communication channels were measured, accomplishing most of the targets defined in the initial strategy. Even though FUDGE-5G published more than double the videos planned, the metrics regarding views and YouTube subscribers were not on par with the expectation. More videos are planned for publication in the following months with the intent to improve these numbers.