



# FUDGE-5G

FULLY DisinteGrated private nEtworks  
for 5G verticals

D5.2

## Dissemination and Communication

Version 1.1

Work Package 5 - Exploitation, Standardization and  
Dissemination

Editor OneSource

Status Finished

Month 12 (originally planned for Month 15, anticipated to Month 12)

Partners



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All FUDGE-5G partners have agreed to the **full publication** of this document.

## Project details

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**Acronym:** FUDGE-5G  
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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 first version of Deliverable D5.2, reporting the activities conducted so far (up to Month 12). A final version of this deliverable is planned for Month 30, reporting all the dissemination and communication activities conducted in the scope of the project.

Finally, it should be noted that this first version of Deliverable D5.2 was originally planned for Month 15, being anticipated to Month 12 to better align with the midterm review of the project.

## Versioning and contributions

### Versioning

#	Description	Contributors
0.1	Table of contents	ONE
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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

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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 Aerial 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 first version of Deliverable D5.2, reporting the activities conducted so far (up to Month 12). A final version of this deliverable is planned for Month 30, reporting all the dissemination and communication activities conducted along the project.

It should also be noted that this first release of Deliverable D5.2 was originally planned for Month 15, being anticipated to Month 12 to better align with the calendar of the midterm review of 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 12).

The FUDGE-5G Communication and Dissemination report is a living document, which will evolve during the project, as the number of produced dissemination and communication artefacts continues to grow. This document is the first version of the Communication and Dissemination report, and it will have one more version to be submitted by the end of the project (Month 30).

### 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) intends 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.

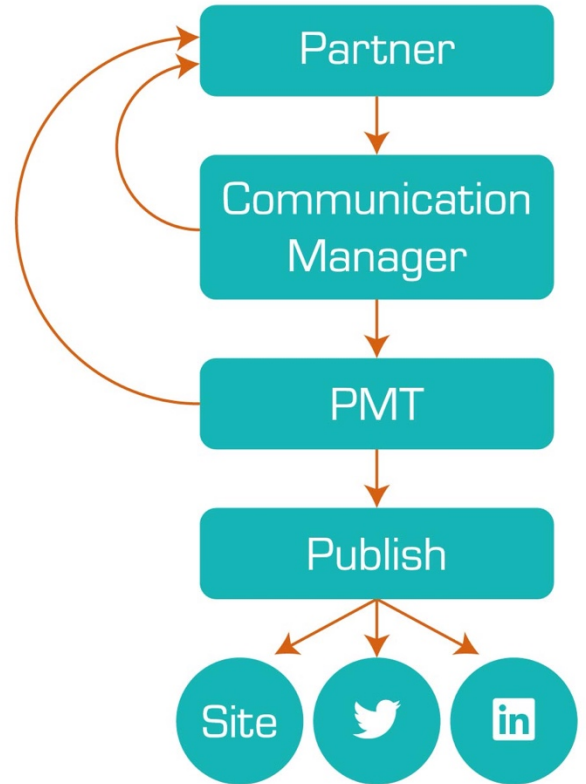


Figure 1 - Internal Content Review Process

## 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<sup>1</sup>. The vertical stakeholders and their corresponding use cases are the Norwegian public service broadcaster NRK<sup>2</sup> (Concurrent Media Delivery), the Norwegian Defence Material Agency<sup>3</sup> (PPDR), the Oslo University Hospital<sup>4</sup> (5G Virtual Office) and ABB<sup>5</sup> (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.

<sup>1</sup> <https://fudge-5g.eu/download-file/365/sq6G3zIXkRBOFWRM3bqO>

<sup>2</sup> <https://www.nrk.no>

<sup>3</sup> <https://www.fma.no/en>

<sup>4</sup> <https://oslo-universitetssykehus.no/oslo-university-hospital>

<sup>5</sup> <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 $\geq$ 200/350/500
Social Media	Established in M2	Ongoing	Ongoing	Followers $\geq$ 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 $\geq$ 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 $\geq$ 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 $\geq$ 3 Full systems $\geq$ 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 $\geq$ 9 PhDs up to Y3 $\geq$ 3 Impacted training programs $\geq$ 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 $\geq$ 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).

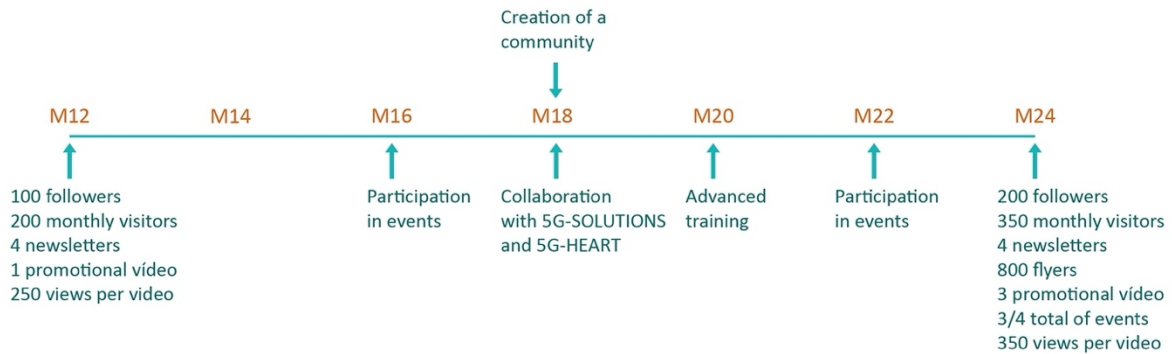


Figure 2 - Timeline of activities and target KPI's for the 1st year.

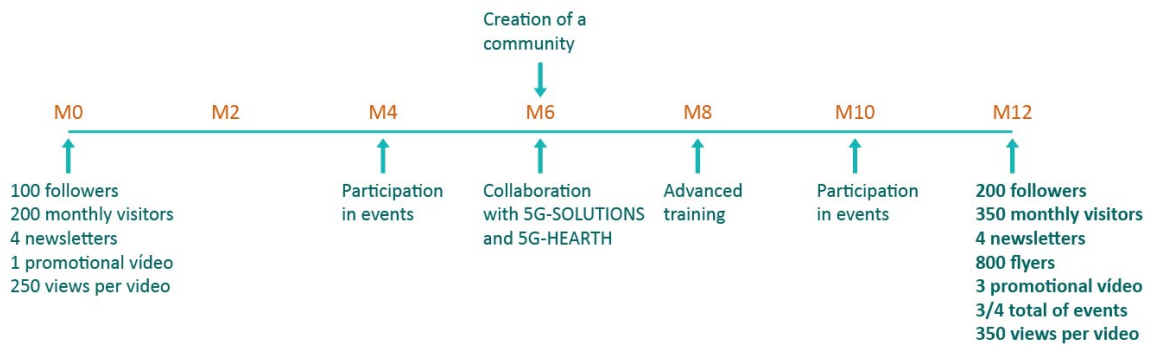


Figure 3 - Timeline of activities and target KPI's for the 2nd year.



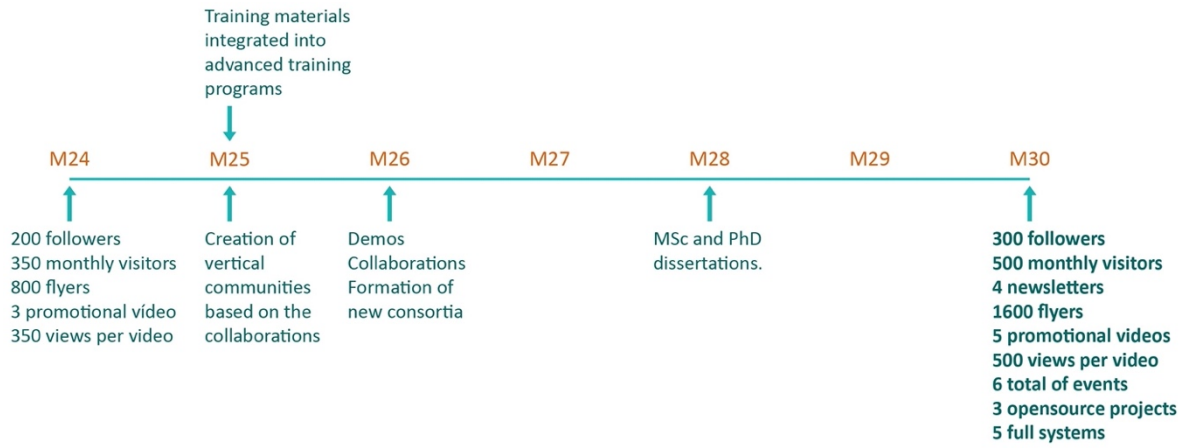


Figure 4 - Timeline of activities and target KPI's for the 3rd year.

### 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.

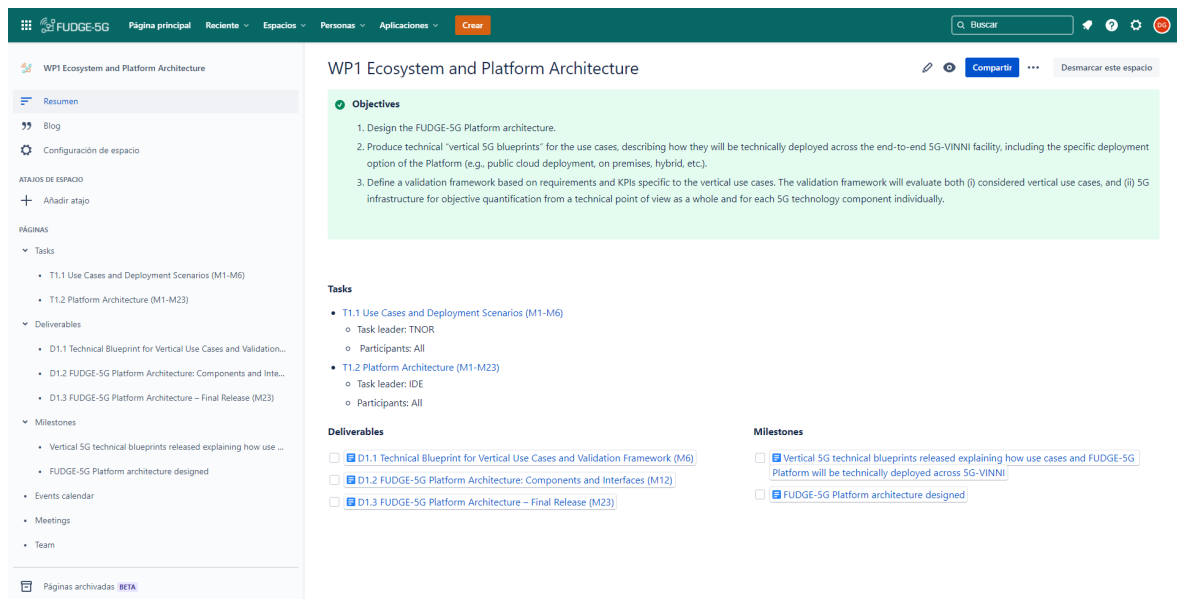


Figure 5 - Initial structure proposal for FUDGE-5G Confluence

## 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.

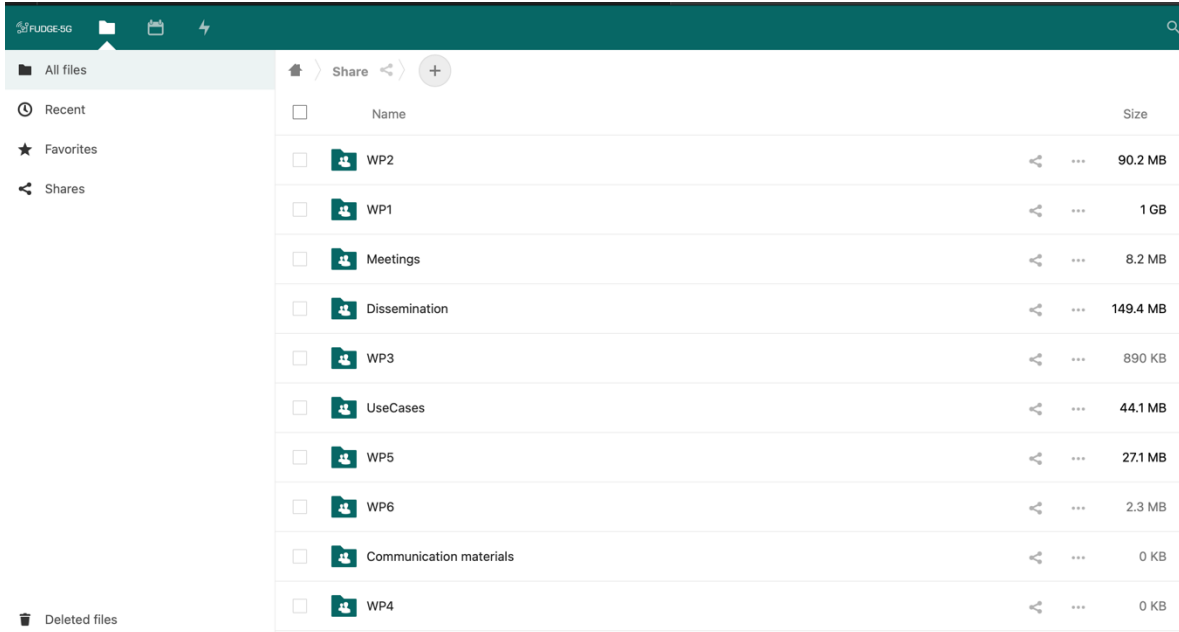


Figure 6 - FUDGE-5G cloud platform

## 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.

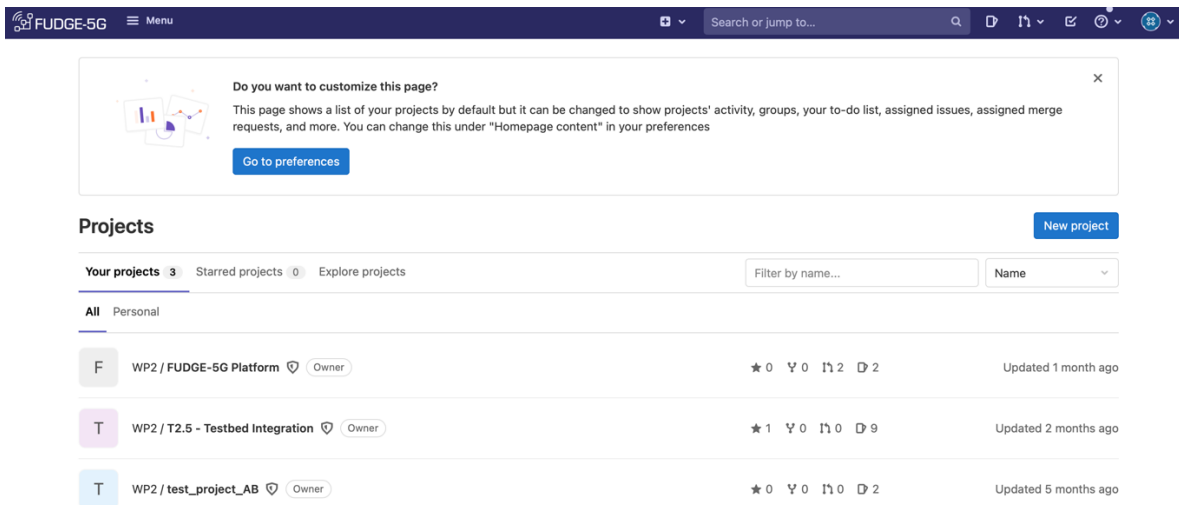


Figure 7 - FUDGE-5G Gitlab Repository

### 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	<a href="mailto:all@fudge-5g.eu">all@fudge-5g.eu</a>
WP1 Ecosystem and Platform Architecture	<a href="mailto:wp1@fudge-5g.eu">wp1@fudge-5g.eu</a>
WP2 5G Core Technologies and Platform Development	<a href="mailto:wp2@fudge-5g.eu">wp2@fudge-5g.eu</a>
WP3 5G-VINNI Integration and Execution	<a href="mailto:wp3@fudge-5g.eu">wp3@fudge-5g.eu</a>
WP4 Demonstration of Products	<a href="mailto:wp4@fudge-5g.eu">wp4@fudge-5g.eu</a>
WP5 Exploitation, Standardization and Dissemination	<a href="mailto:wp5@fudge-5g.eu">wp5@fudge-5g.eu</a>
WP6 Project Coordination	<a href="mailto:wp6@fudge-5g.eu">wp6@fudge-5g.eu</a>
Administrative Work	<a href="mailto:admin@fudge-5g.eu">admin@fudge-5g.eu</a>
Project Management Team	<a href="mailto:pmt@fudge-5g.eu">pmt@fudge-5g.eu</a>
External Advisory Board	<a href="mailto:eab@fudge-5g.eu">eab@fudge-5g.eu</a>

Table 3 - Mailing lists.

For a more direct communication, Slack<sup>6</sup>, 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.

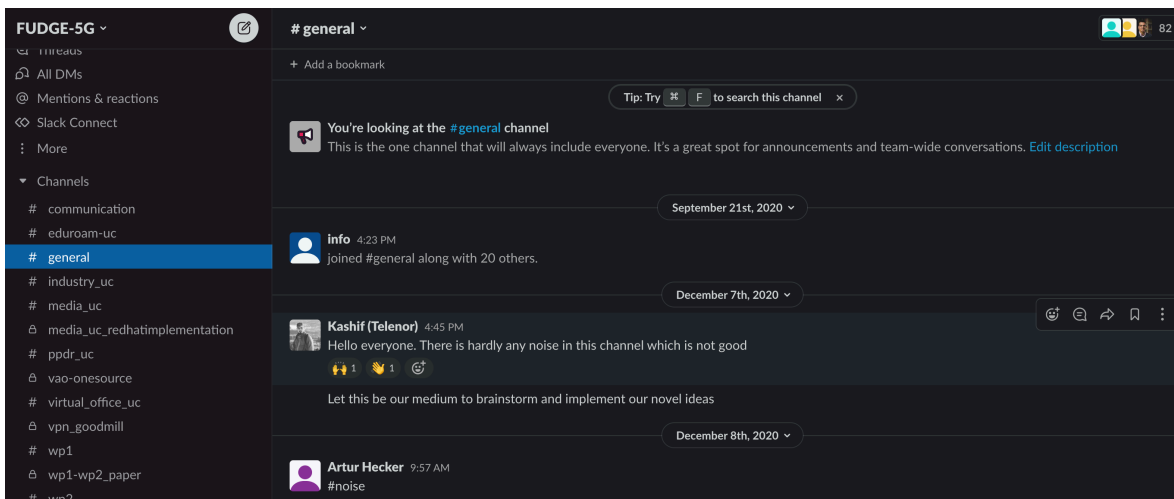


Figure 8 - FUDGE-5G Slack

<sup>6</sup> 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.

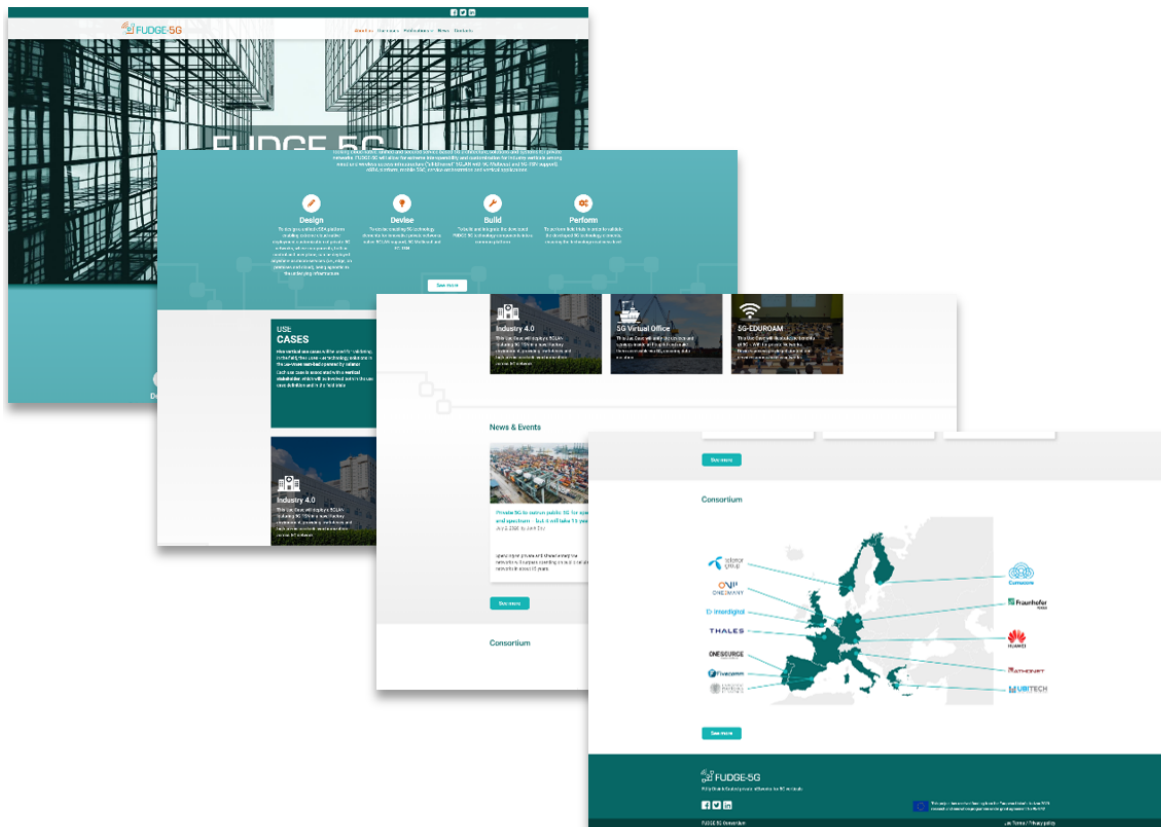


Figure 10 - FUDGE-5G Website Pages.

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.

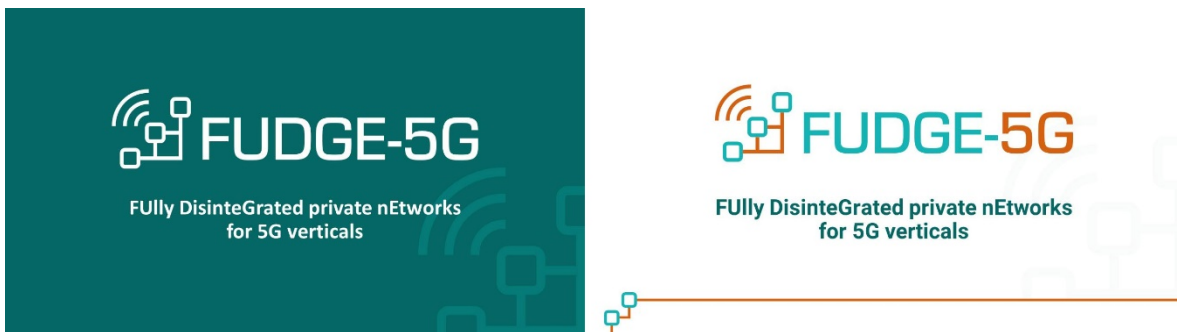


Figure 12 - Presentation template.

## 4.3. Communication Activities

Throughout the first year 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

For the first year, reported in this document, 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	2765 visits total, 251 per month
Twitter	183 followers, 53 tweets
LinkedIn	109 followers, 52 publications
YouTube	44 visualizations
News	41 published news
Newsletters	1 published newsletter

### 4.3.2. Website Statistics

The FUDGE-5G website<sup>7</sup> is the main channel for the project communication, as described in Section 4.1.2. Google analytics<sup>8</sup> was used to monitor the website’s usage statistics. Figure 13 showcases the report for the website from September 1<sup>st</sup>, 2020, to July 26<sup>th</sup>, 2021. Table 5 presents the FUDGE-5G website usage data, with the total and monthly values.

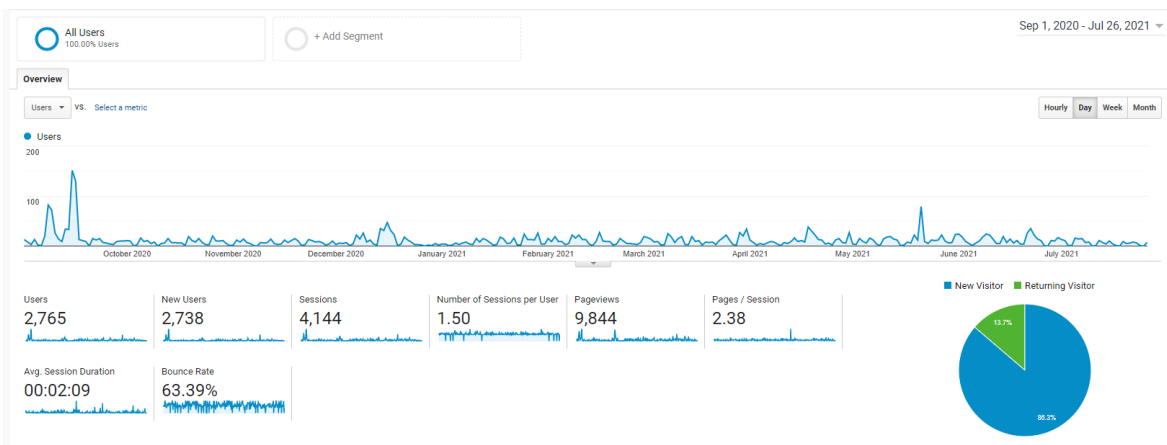


Figure 13 - Website Google Analytics Report, from Sep 1<sup>st</sup>, 2020, to Jul 26<sup>th</sup>, 2021.

<sup>7</sup> <https://fudge-5g.eu>

<sup>8</sup> <https://analytics.google.com>

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

Field	Global Value	Average Monthly Value
Users	2765	251
New Users	2738	248
Sessions	4144	376
Page Views	9844	894

### 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 July 26, 2021, had a total of 183 followers and 52 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 quarter.

Period	# New Followers	# Tweets	# Impressions
Sep – Nov 2020	34	16	1855
Dec 2020 – Feb 2021	54	13	3553
Mar – May 2021	76	16	7796
Jun – Jul 2021	11	7	1832

#### 4.3.3.2. LinkedIn

FUDGE-5G LinkedIn (cf. Figure 14) aims to fill the role described in Section 4.1.3.2. By July 26, 2021, FUDGE-5G LinkedIn had a total of 109 followers. As for Twitter, LinkedIn impressions also are at the thousand’s degree for each quarter, despite lower that with Twitter. Table 7 showcases the available usage data for LinkedIn.

Table 7 - LinkedIn statistics overview, for each quarter.

Period	# New Followers	# Publications	# Impressions
Sep – Nov 2020	62	16	2080

Dec 2020 – Feb 2021	13	13	2011
Mar – May 2021	20	16	2374
Jun – Jul 2021	6	7	1325

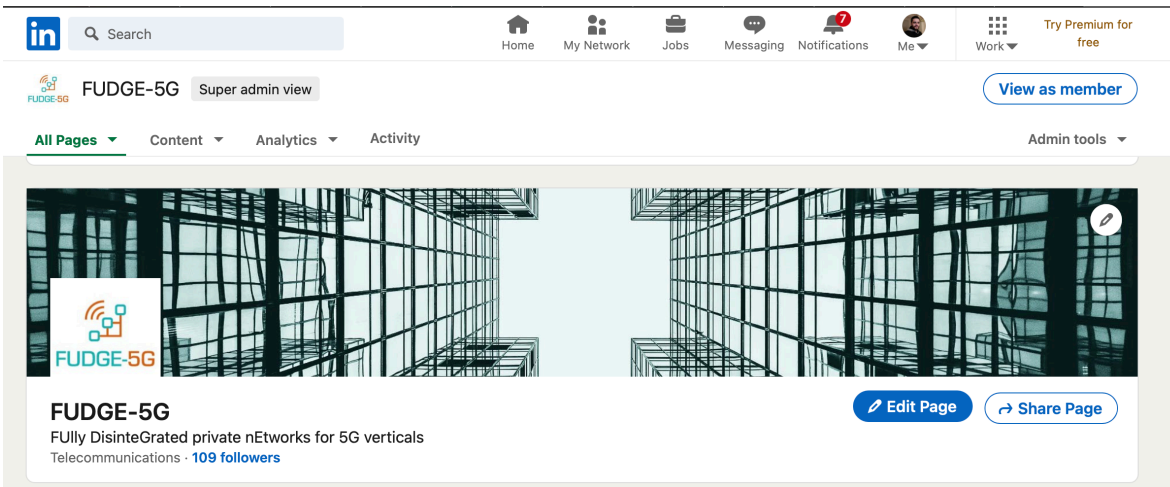


Figure 14 - FUDGE-5G LinkedIn Homepage

### 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 two videos. The first one is the keynote presentation by David Gomes-Barquero at the Global5GEvolution<sup>9</sup> event. The second one is the presentation of the “FUDGE-5G: Fully Disintegrated Private Networks for 5G Verticals” poster at the 2021 EuCNC & 6G Summit<sup>10</sup>. By the end of July 2021 the channel has 3 subscribers and a total of 44 video views.

<sup>9</sup> <https://global5gevolution.com>

<sup>10</sup> <https://www.eucnc.eu>

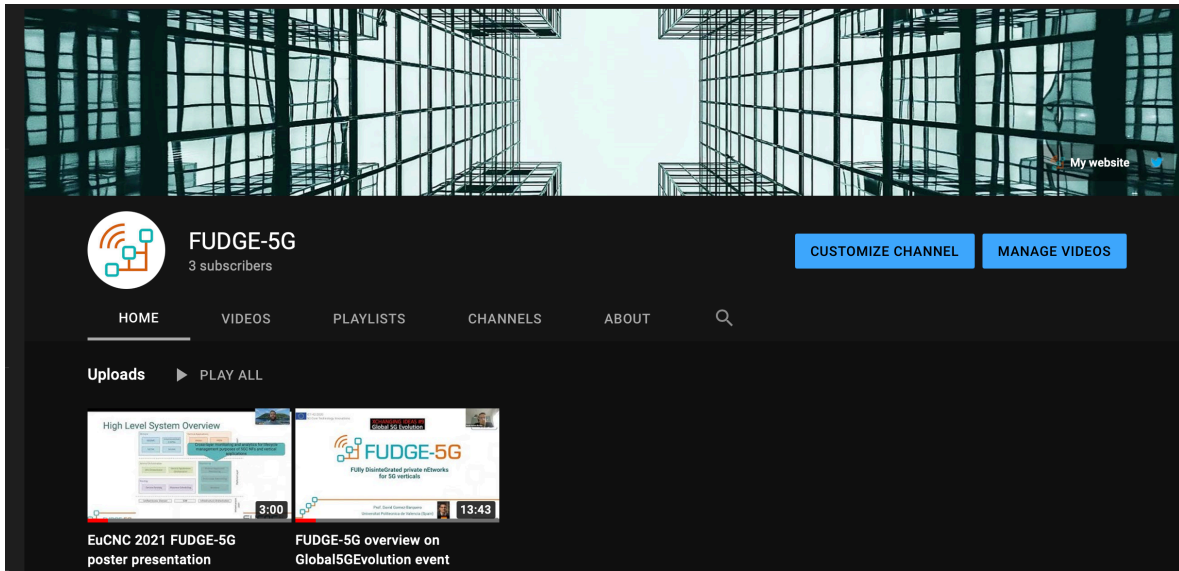


Figure 15 - FUDGE-5G YouTube channel homepage.

### 4.3.4. News Publications

Up until the submission of this deliverable, the project has published a total of 41 news related directly or indirectly to the FUDGE-5G project. The news list can be found in Table 8. Those news were published on the FUDGE-5G website and spread across FUDGE-5G social media accounts LinkedIn and Twitter.

Table 8 - 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 than 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

### 4.3.5. Newsletter Publications

At the date of submission of this deliverable, FUDGE-5G has published a newsletter with two more ready to be published in the following months, Table 9 provides the details.

Table 9 - FUDGE-5G Newsletters

#	Title	Status	Link
1	5G Non-public Cellular Networks on Demand	Published	<a href="https://fudge-5g.eu/download-file/438/pAXSpuOGGNYlim0Fbqm3">https://fudge-5g.eu/download-file/438/pAXSpuOGGNYlim0Fbqm3</a>
2	5G Private Networks and Slicing	Ready	n.d
3	FUDGE-5G announces a Cumucore’s 5G core into the OpenShift Ecosystem	Ready	n.d



## 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 12, 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, FUDGE-5G first year, the project partners engaged into the set of dissemination activities summarized into Table 10. The details of these activities are provided in the following sections of the document.

Table 10 - Dissemination Overview

Dissemination activity	#
Collaboration with other projects	4
Journal and Conference Papers	5
Organized Workshops	2
Demos and Showcases	1
Advanced Training	4 (MSc – 3; PhD – 1)
Patent Applications	1
5GPP Events	1
Advisory Board Meetings	4
Keynote Presentations	2
Participations in 5GPPP working groups	2



## 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. Up until the submission of this document, collaboration with four specific projects has started, as detailed in Table 11.

Table 11 - Collaborations with other 5GPPP projects.

Project	Collaboration Description
5G – VINNI <a href="http://5g-vinni.eu">5g-vinni.eu</a>	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 <a href="http://5gheart.org">5gheart.org</a>	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 <a href="http://5gdrones.eu">5gdrones.eu</a>	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 <a href="http://affordable5g.eu">affordable5g.eu</a>	The collaboration will involve work on a MCPTT solution to be used on the PPDR use cases for both projects. A strict collaboration will take 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.

## 5.2.3. Journal and Conference Papers

In the reporting period (up to Month 12), 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

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

Table 12 - "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	<p>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).</p> <p>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. Compared 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.</p>
Status	Published
Link	<a href="https://doi.org/10.23919/CNSM50824.2020.9269087">https://doi.org/10.23919/CNSM50824.2020.9269087</a>

Table 13 - "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	<a href="https://zenodo.org/record/5137741#.YP696C1Q1QI">https://zenodo.org/record/5137741#.YP696C1Q1QI</a> (Extended Abstract) <a href="https://zenodo.org/record/5139613#.YP_k8y1Q1QI">https://zenodo.org/record/5139613#.YP_k8y1Q1QI</a> (Poster)

Table 14 - "5G Non-Public-Networks (NPN) Roaming Architecture" conference paper description.

Field	Details
Title	<i>5G Non-Public-Networks (NPN) Roaming Architecture</i>
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 and Luis Cordeiro
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 backhails. 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	Accepted
Link	n.d.

Table 15 - "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	<p>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).</p> <p>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.</p>
Status	Published
Link	<a href="https://doi.org/10.1109/TNSM.2021.3076503">https://doi.org/10.1109/TNSM.2021.3076503</a>





Table 16 - "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.

#### 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. For the first year, FUDGE-5G has organized two workshops that are detailed in the next sections.

5.2.4.1. 5GPPP Technical Board eWorkshop

Table 17 - "5GPPP Technical Board eWorkshop" description.

Field	Details
Workshop name	Session 6: Integrating Public and Private Networks
Entity	5GPPP
Type	Organized
Date	Thursday December 10 <sup>th</sup> 2020
Responsible partner	TNOR
Webpage	<a href="https://5g-ppp.eu/tb-eworkshop-dec-2020/">https://5g-ppp.eu/tb-eworkshop-dec-2020/</a>
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	<ul style="list-style-type: none"> <li>• Kashif Mahmood, Telenor</li> <li>• Kennet Nomelan</li> <li>• Carlos Barjau</li> <li>• Jose Costa Requena</li> <li>• Jose Lucena</li> <li>• Wint Yi Poe</li> <li>• Daniele Munaretto</li> </ul>
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 18 - "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, 8 June 2021
Responsible partner	UPV
Webpage	<a href="https://www.eucnc.eu/workshops/workshop-6/">https://www.eucnc.eu/workshops/workshop-6/</a>
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	<ul style="list-style-type: none"> <li>• David Gomez-Barquero (moderator), UPV, Spain</li> <li>• Kashif Mahmood Telenor Research, Norway</li> <li>• Nikolaos Tzanis ADMIE (Greece)</li> <li>• Niels König Fraunhofer Institute for Production Technology (IPT), Germany</li> <li>• Manuel Fuentes Fivecomm, Spain</li> <li>• Jordi J. Gimenez European Broadcasting Union (EBU), Switzerland</li> <li>• Kennet Nomeland Norwegian Defence Material Agency (NDMA), Norway</li> <li>• Ki Won Sung KTH Royal Institute of Technology, Sweden</li> <li>• Jose Ordonez-Lucena Telefonica, Spain</li> <li>• Daniele Munaretto Athonet, Italy</li> <li>• Simon Fletcher Real Wireless, UK</li> <li>• Håkon Lønsethagen Telenor (Norway)</li> <li>• Jose Costa-Requena Cumucore, Finland</li> <li>• Sebastian Robitzsch InterDigital, UK</li> <li>• Dirk Trossen Huawei Technologies Duesseldorf GmbH, Germany</li> <li>• Sergio Gonzalez ATOS, Spain</li> </ul>
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)

### 5.2.5. Demos and Showcases

During the reporting period FUDGE-5G performed a demonstration of one of the vertical applications to be used on the project use cases (the Mobitrust platform).

#### 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

### 5.2.6. Advanced Training

The FUDGE-5G partners are providing advanced training. By the submission of this deliverable, 5 students (four MSc candidates and one PhD student) were involved in the project research by developing their thesis work within the project’s research objectives. The details are presented in Table 19.

Table 19 - FUDGE-5G Advanced Training Candidates

#	Partner	Name	Type	Start date	End date	Status
1	ONE	António Borges	MSc	2020/09	2021/09	Ongoing
2	UPV	Borja Iniesta	MSc	2021/09	2022	Ongoing
3	UPV	Aaron Montilla	MSc	2021/09	2022	Ongoing
4	UPV	Carlos Barjau	PhD	2018	2021	Ongoing

## 5.2.7. Patent Applications

During the reporting period FUDGE-5G has made a provisional application for a patent intitled “Enabling Service Oriented Principles in the 5GC User Plane through the Integration of Name-based Routing Mechanisms”. The partner submitting the patent application is IDE, and it was submitted by March 15, 2021.

## 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. 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 21<sup>st</sup>, 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 Jokiahho (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 31<sup>st</sup>, 2021

The meeting was hosted by the technical expert Hans Einsiedler (Deutsche Telekom) and was attended by the advisory board member Timo Jokiahho (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.

## 5.2.10. 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.

## 5.2.11. Participation in 5GPPP Working Groups

5GPPP working groups<sup>11</sup> 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. On-going Dissemination Activities

### 5.2.12.1.5G World Summit

FUDGE-5G is a marketing partner into the 5G World Summit to take place in September 2021. Furthermore, Sebastian Robitzsch will be giving a keynote presentation on FUDGE-5G behalf. The presentation will be focused into the FUDGE-5G platform and its architectural approaches, including the platform layers and features.

### 5.2.12.2. PPDR, Media Showroom and 5G Virtual Office September Trials

During September 2021, FUDGE-5G trials will start on three of the five use cases including:

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<sup>11</sup> <https://5g-ppp.eu/5g-ppp-work-groups/>

- PPDR Use case: A mobile cell on wells (CoW) constructed during the summer in partnership with the Norwegian Material Defence Agency will be showcased. The CoW will provide an independent communication bubble providing connectivity for the field operatives devices. Furthermore, the CoW functionalities are supported by an HPE server with RedHat OpenShift, the GOODMILL systems router, Nokia Radio and the Athonet 5G Core.
- Media Showroom: The trial will be part of the NRK innovation day and will demonstrate the 5G capabilities for remote production. The trial is supported by and HPE server running RedHat OpenShift, with the Cummucore 5G Core.
- 5G Virtual Office: The 5G NPN capabilities will be showcased in Oslo University Hospital, demonstrating the advantages of a private 5G network for patient monitoring. The 5G network is supported by an HPE server with RedHat OpenShift, Nokia radio and Fraunhofer Open 5G Core. The patient monitoring will be accomplished with Mobitrust<sup>12</sup> and its devices.

### *5.2.12.3.5GPPP White Paper on 5G NPNs*

The white paper aims to develop architectural concepts to integrate the vertical consumer communication with the 5G network infrastructure ensuring that the 5G network becomes integral part of the vertical services. The focus is to build a concept of infrastructure provisioning around the verticals. The document covers use cases mapped to development scenarios, enabling technologies and, benefits and opportunities. Kashif Mahmood is the paper editor with contributions from different FUDGE-5G partners.

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<sup>12</sup> <https://mobitrust.onesource.pt>

## 6. Conclusions

During this 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 dissemination 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.

As already mentioned, the dissemination and communication activities will be further carried out as the project goes on, in order to achieve the intended communication and dissemination goals. Those activities will be reported in the next version of this deliverable, due for Month 30.