5G DIVE

H2020 5G Dive Project
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D4.2: Achievements of Y1 and updated CoDEP for Y2 including standardization plan

Abstract

The progress of the project's communication, dissemination and exploitation activities are reported for the first project year. The plan had to be adapted with additional online presence and video material to handle the effects of the Covid-19 crisis when events were cancelled or made online. Project results are disseminated through publications, presentations and interviews. Workshops and other events with a focus on the topics of the project are organised. Contributions to and interaction with standards organisations are reported on, as well as, the engagement in open source software.

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List of Acronyms

3GPP	3rd Generation Partnership Project, uniting several telecommunications standard development organisations
CoDEP	Communication, Dissemination and Exploitation Plan
ETSI	European Telecommunications Standards Institute
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IRTF	Internet Research Task Force
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
OSS	Open source software
SAC	Standardisation Advisory Committee
SDO	Standards Development Organisation

Executive Summary

Achievements in terms of communication, dissemination and exploitation including standardisation are reported for the first project year and compared with the set targets. For each type of activity, the plan for the remainder of the project is updated. The overall purpose with these activities is to fulfil the project's overall Objective 4 on dissemination.

The communication and dissemination plan had to be adapted to handle the effects of the Covid-19 crisis, mainly by enhancing the online presence, for example through videos of presentations and demos. The project consortium set up ambitious dissemination targets, towards which significant progress has been made. Some targets are already met or exceeded.

The project is present online with a public website with information in English and Chinese which has a visit count exceeding 20 000 for the first year. The project also has a twitter channel and is present in other social media. Project members are visible in various video interviews and blog articles. In addition, press releases have been issued, and a project leaflet and poster have been created.

Project results are disseminated with peer-reviewed publications in conferences, workshops, journals and magazines, as well as through various public presentations. Project members engage in the organisation of special issues of journals and the organisation of workshops specialised on the topics of the project, some of which are done in collaboration with other projects. The project also targets exhibition at major events, but some of these have been cancelled.

Contributions to and interaction with five standardisation organisations have taken place during the year, and the number of standardisation contributions already exceed the original target. The main standardisation organisations are 3GPP, IETF, ETSI, IEEE and ORAN Alliance.

Two open source software projects, Zenoh and fog05, are driven by project members in the context of the Eclipse Edge Native WG. These two open source components are central to the development of the 5G-DIVE edge platform.

Updated exploitation plans will be provided as part of an update of this deliverable at the end of the year 2020.

1. Introduction

This deliverable reports on the project achievements during the first project year in terms of communication, dissemination, and exploitation including standardisation. The achievements are compared with the targets set in the communication, dissemination and exploitation plan (CoDEP) defined in Deliverable 4.1 [5]. The deliverable finally updates the plans for the remainder of the project.

The achievements reported in this deliverable are the progress towards fulfilling the project's overall Objective 4 to disseminate and contribute 5G-DIVE results into international research and innovation venues, and to pave the way for their successful exploitation. This overall objective is broken down into three sub-objectives: (1) To develop an outreach communication and dissemination of 5G-DIVE results to all stakeholders including researchers, industrials, and general public; (2) To develop a proactive standardization plan including roadmaps, intellectual property creation, and contribution in relevant standards; and (3) To develop a plan for exploitation of 5G-DIVE results into value creation for all stakeholders during the project lifetime and beyond.

The progress on fulfilling the first sub-objective is largely reported in Sections 2 and 3 on communication, public activities, dissemination and collaboration. The progress on the second sub-objective is addressed in Section 4 on standardisation and open source activities. The progress on the third sub-objective will however be reported later, in project month 15, with a new version of this deliverable (D4.2b) containing an updated Section 5 on exploitation activities. This is part of the updated plans made to handle the impact of the Covid-19 crisis (project amendment approved 06/22/2020), most importantly the delay of some experimental project activities due to lock-down causing lab facilities to be closed, resulting in delays in the identification of main project results to consider for exploitation. Each section of the deliverable also presents updated plans for the remainder of the project.

The following two subsections comments on the handling of the Covid-19 crisis and summarises the achievements reported in the deliverable.

1.1. Covid-19 Crisis Management

The CoDEP plans of the project (Deliverable 4.1 [5]) were finalised during the beginning of the Covid-19 crisis outside China, but most of the plans were made before the extent of the crisis was known. The project had to make new plans to handle cancelled events, for example, the Mobile World Congress, and to handle the change to online events, for example, the European Conference on Networks and Communications (EuCNC). It currently seems as most events are offering online substitutes, making it possible to participate, albeit in a different way.

It is unavoidable that the communication and dissemination plan for the project is affected and, in some instances, delayed. To enable better online presence, videos of presentations and demos are being recorded. In addition to cancelled and online events, we are affected by delayed schedules in several of the standardisation organisations we participate in. We therefore adjusted some of the dissemination targets in the project amendment approved 06/22/2020. More details on updated plans are presented below in each main section of this document.

1.2. Overview of achievements

Table 1 provides a summary overview of dissemination achievements the first project year. The partners set up ambitious dissemination targets. Significant progress has already been made in the first project year, with some targets already exceeded, especially considering that results dissemination is expected to increase during the second project year.

TABLE 1: OVERVIEW OF ACHIEVEMENTS AND PROGRESS TOWARDS TARGETS.

Category		Current count	Target	Comment
Peer-review publication		15	24	Published or accepted
Presentation/talk		10	12	Demos not included
Press release		9	N/A	
Organisation of workshops and conferences		4	2	
Trade fair (booth, exhibition, etc)		2	2	
Patent		0	3	Results expected second year
Activities with other EU projects		6	4	
Demonstrations		4	4	Some online
Videos		4	N/A	Including presentations and demos
Open source projects		2	1	Fog05 and Zenoh
Standard contribution	adopted	9	5	
	total	32	15	

2. Communication and Public Activities

This section reports communication activities undertaken the first project year until September 30th 2020. The tables include all activities since the beginning of the project, but the text does not repeat what has already been described in D4.1.

2.1. Report on Activities Undertaken and Achievements

Communication and Public activities undertaken until September 30th 2020 are reported in Table 2,

Table 3, Table 4, and Table 5 respectively for activities relating to (1) project portal and social networks, (2) video interviews and blog articles, (3) Video Interviews and Blog articles, and (4) Videos with presentations and demos of project results.

TABLE 2: PROJECT PORTAL AND SOCIAL NETWORKS.

#	Month	Description	Lead partners
1	Oct'19	Release of 5G-DIVE project portal at www.5g-dive.eu.	UC3M
2	Oct'19	Set up of a Twitter account @Dive5g, 5G-DIVE LinkedIn group (https://www.linkedin.com/in/5g-dive-project/) and Instagram account (5g_dive).	UC3M
3	Throughout Y1	Constant update of the project website with contents on the talks, workshops, demonstrations, and events undertaken and planned. Free access has been given to download public presentations and materials from the partners, subject to partner permission.	UC3M, RISE
4	Throughout Y1	Synchronicity between project website and the social media news shared on the project Twitter and LinkedIn accounts.	UC3M, RISE

TABLE 3: VIDEO INTERVIEWS AND BLOG ARTICLES.

#	Month	Description	Lead partners
1	Dec'19	Interview with RNE (Public Spanish Radio) Radar 3.0 program. http://www.rtve.es/alacarta/audios/radar-30-en-radio-5/radar-30-radio-5-fake-news-arma-para-desmoralizar-combatiente-01-02-20/5504059/	UC3M, TID, TELCA
2	Jan'20	Article in "The Conversation" a scientific Spanish blog. The article titled "Como controlar drones y robots industriales gracias al 5G", published. https://theconversation.com/como-controlar-drones-y-robots-industriales-gracias-al-5g-130652	UC3M
3	Feb'20	Video interview provided by the Project Coordinator to Zoom NET TV show by RTVE (Public Spanish TV). https://www.rtve.es/alacarta/videos/zoom-net/zoom-net-5g-dive-entrevista-shou-zi-chew-dreams/5526638/	UC3M
4	May'20	Milan Groshev has participated in What makes it tick? - Community that brings European science & tech to the world with the video	UC3M

		"Networks of robots	5-Minute Science You Never Knew", [Online] https://youtu.be/pPDaB8fRep8	
5	Sep'20	Arturo Azcorra participated in the 34th meeting for the Digital Economy and Telecomunications, organised by Ametic, Santander and UIMP. [Online] https://economiadigitalsantander.es/agenda/	UC3M

TABLE 4: PRESS RELEASES AND LEAFLETS.

#	Month	Description	URL	Lead partners	Platform
1	Nov'19	Press release	http://ir.interdigital.com/file/Index?KeyFile=400974728	IDCC	Corporate website
2	Nov'19	Press release	https://www.adlinktech.com/en/News_19112702534513426	ADLINK	Corporate website
3	Dec'19	Press release	https://www.sdxcentral.com/articles/news/adlink-tackles-industrial-iot-as-latest-5g-drive-member/2019/12/	ADLINK	SDX CENTRAL
4	Dec'19	Press release	https://www.networks.imdea.org/whats-new/news/2019/5g-dive-presents-its-technology-cooperation-project-national-chiao-tung	UC3M	IMDEA Networks
5	Dec'19	Press release	https://www.networks.imdea.org/es/actualidad/noticias/2019/proyecto-cooperacion-tecnologica-europataiwan-5g-dive-ha-sido-presentado	UC3M	IMDEA networks
6	Dec'19	Press release	https://www.uc3m.es/ss/Satellite/UC3MInstitucional/es/Detalle/Comunicacion_C/1371282496565/1371215537949/Implantacion_de_tecnologia_5G_en_drones_y_robots; https://www.uc3m.es/ss/Satellite/UC3MInstitucional/en/Detalle/Comunicacion_C/1371282498910/1371215537949/Deployment_of_5G_technology_in_drones_and_robots;	UC3M	UC3M
7	Dec'19	Press Release	https://www.uc3m.es/ss/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadername2=Cache-Control&blobheadervalue1=attachment%3B+filename%3D%225G_DIVE_%28Chinese_version%29.pdf%22&blobheadervalue2=private&blobkey=id&blobtable=MungoBlobs&blobwhere=1371568627153&ssbinary=true	UC3M	Alpha Galileo
8	Jan'20	Leaflet	https://5g-dive.eu/wp-content/uploads/2020/03/Leaflet-MWC20_compressed.pdf	UC3M/IDCC/RISE	5G-DIVE.eu
9	Jan'20	Poster	https://5g-dive.eu/wp-content/uploads/2020/03/Poster-MWC20_compressed.pdf	UC3M/IDCC/RISE	5G-DIVE.eu
10	Jan'20	Press release	https://money.udn.com/money/story/10860/4270484	ASKEY	UDN/經濟日報

TABLE 5: VIDEOS WITH PRESENTATIONS AND DEMOS OF PROJECT RESULTS.

#	Month	Description	Lead partners
1	May'20	Networks of robots | 5-Minute Science You Never Knew. What makes it tick? - Community that brings European science & tech to the world	UC3M
2	Jun'20	Assessing 5G need for Digital Twin Applications. 5G end-to-end experimentation by verticals in EU projects. Online workshop. [Online] https://5g-dive.eu/wp-content/uploads/2020/06/12.30-13.00-MilanG-Assesing-5G-need-for-Digital-Twin-applicaitons_v2-1.pdf	UC3M
3	Jun'20	EagleEYE: Aerial Edge enabled Disaster Relief Response System. 5G end-to-end experimentation by verticals in EU. Online Workshop. [Online] https://www.youtube.com/watch?v=mauaciCHuVA&feature=youtu.be	NCTU
4	Jun'20	Object Detection Zooming - Remote User. Augmented remote robot control. [Online] https://www.youtube.com/watch?v=vQnLiYmd6vA	IDCC

2.1.1. Web, social media, and project communication material

The project website has been established at the beginning of the project and it is reachable at the following URL: https://5g-dive.eu/. The landing page is reported in Figure 1. In addition, 5G-DIVE is trying to provide Chinese translation to key content in order to improve the visibility and impact of the project, an example of the landing page for the 5G-DIVE site can be found in Figure 2.

FIGURE 1: 5G-DIVE MAIN WEBSITE.

FIGURE 2: 5G-DIVE MAIN WEBSITE (CHINESE).

Statistics until September 2020 have been gathered for the website. They are reported in Figure 3. It can be observed that, since the beginning of the project (i.e., "last 365 days" statistics), the website had almost ten thousand visitors, bringing the total to 21 594 visits.

	Visitors	Visits
Today:	7	13
Yesterday:	22	69
Last 7 Days (Week):	177	400
Last 30 Days (Month):	625	1,420
Last 365 Days (Year):	9,826	21,594
Total:	9,826	21,594

FIGURE 3: OVERALL WEB PAGE HITS.

In detail, as shown in Figure 4, the most popular subpages are the ones related to the consortium events and to project deliverables.

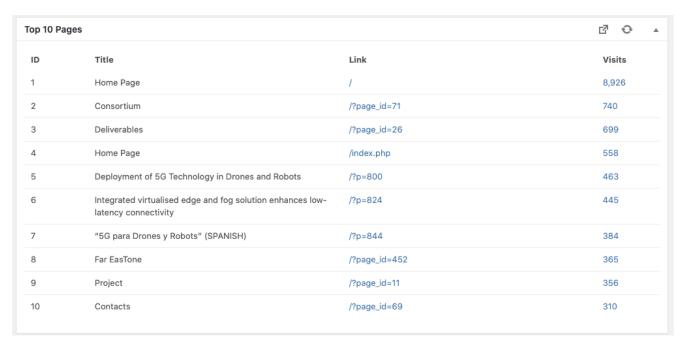| ID	Title	Link	Visits
	Top 10 Pages		
1	Home Page	/	8,926
2	Consortium	/?page_id=71	740
3	Deliverables	/?page_id=26	699
4	Home Page	/index.php	558
5	Deployment of 5G Technology in Drones and Robots	/?p=800	463
6	Integrated virtualised edge and fog solution enhances low-latency connectivity	/?p=824	445
7	"5G para Drones y Robots" (SPANISH)	/?p=844	384
8	Far EasTone	/?page_id=452	365
9	Project	/?page_id=11	356
10	Contacts	/?page_id=69	310

FIGURE 4: DETAILS OF VISITED WEBSITE PAGES.

The project has been active in other social media such as LinkedIn and Twitter. LinkedIn and Twitter accounts are the following:

- LinkedIn: https://www.linkedin.com/in/5g-dive-project/
- Twitter: https://twitter.com/dive5g

The Linkedin profile is mainly used to advertise the technical work of the project and to follow other activities from different project. Currently Linkedin profile shows 242 connections, and we are involved in 8 communication groups.

To show the activities of the Twitter account, we present Figure 5 with the impressions earned from March 31st to June 8th and Figure 6 from June 8th to September 6th.

Your Tweets earned **28.4K impressions** over this **91 day** period

YOUR TWEETS
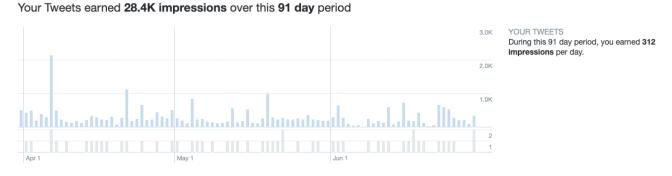During this 91 day period, you earned **312 impressions** per day.

FIGURE 5: TWEET IMPRESSIONS FROM MARCH 31ST TO JUNE 8TH.

During the first period (March 31st 2020 to June 8th 2020) the project tweets gathered 28 400 impressions, with a total of 103 links (mostly directed to 5G-DIVE website), 40 retweets and 97 likes.
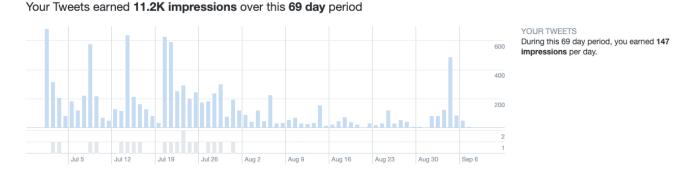
Your Tweets earned **11.2K impressions** over this **69 day** period

FIGURE 6: TWEET IMPRESSIONS FROM JUNE 8TH TO SEPTEMBER 6TH.

During the period from June 8th 2020 to September 6th 2020, the project Tweets earned 11 200 impressions, with a total of 22 links clicks, 10 retweets and 38 likes. This low activity is typical in the summer period.

2.2. Updated Work Plan

During the second half of the first year, the project communication activities have been severely impacted by the COVID-19 pandemic. During this time, we have tried to push forward online communication activities, fostering the dissemination of the different events we have organised. We have tried to push the dissemination work on webinars and joint activities with other projects.

One of the key upcoming milestones is the demonstration of our developments in an industrial venue, such as MWC. Due to the pandemic we are not sure if this will be possible. Nevertheless, we have already organised one webinar showcasing initial prototype of AI running in a drone and the digital twin software.

The plan for Year 2, considering Communication and Public Activities, include (as also reported in D4.1 [5]):

- Communication of the panel and workshops organised in IEEE Globecom 2020.
- Video and a press release for the first trial scheduled in M14. Videos for subsequent trials are also to be considered.
- Video interviews and second leaflet in time for MWC 2021 in Barcelona if it is to be held.
- Additional video interviews and blog articles more focused on the innovations outcome of the project as they occur in year 2.
- Continuous communication through the project portal, the social networks, and the 5G-PPP communication and dissemination working group.

3. Dissemination and Collaboration Activities

Dissemination and Collaboration activities were undertaken in the first year of the project in order to promote the 5G-DIVE project concepts and initial results to the international R&D community. The activities were also designed to trigger synergy with other related projects and activities. In this chapter, we present the achievement during the first year of the project.

3.1. Report on Activities Undertaken and Achievements

The dissemination and collaboration activities and achievements for the first year of the project, from October 2019 to September 2020, are reported in the following sub-sections.

3.1.1. Peer-reviewed Publications

Table 6 and Table 7 list all the peer-reviewed publications since the start of the project. Only published or accepted publication materials are reported. The project has published or accepted for publications 9 peer-reviewed articles in conferences and workshops, 6 peer-reviewed articles in journals and magazines, and organization of 1 special issue of journals and magazines.

TABLE 6: PEER-REVIEWED PUBLICATIONS IN CONFERENCES AND WORKSHOPS.

#	Type	Month	Description	Lead Partners
1	Workshop	November 2019	Carlos Guimarães, Antonio de la Oliva, Arturo Azcorra. 5G-DIVE: eDge Intelligence for Vertical Experimentation. Global Experimentation for Future Internet – 2019, Coimbra, Portugal.	UC3M
2	Conference	April 2020	Luis M. Contreras, Javier Baliosian, Pedro Martinez-Julia, Joan Serrat. Computing at the Edge: But, what Edge? IEEE/IFIP Network Operations and Management Symposium (NOMS), Budapest, Hungary.	TID
3	Conference	February 2020	Saptarshi Hazra, Thiemo Voigt, Bengt Ahlgren, Chenguang Lu, Daniel Cederholm, Gyanesh Patra. Demo: Multi-Radio Access Technology IoT Gateway. International Conference on Embedded Wireless Systems and Networks (EWSN), Lyon, France.	RISE, EAB
4	Workshop	June 2020	Hergys Rexha, Sebastien Lafond, Jani-Pekka Kainulainen, Giovanni Rigazzi: Towards Very Low-Power Mobile Terminals through Optimized Computational Offloading, CLEEN Workshop at ICC'20, Dublin, Ireland.	IDCC

5	Conference	June 2020	Muhammad Febrian Ardiansyah, Timothy William, Osamah Ibrahiem Abdullaziz, Li-Chun Wang, Po-Lung Tien, Maria C. Yuang. EagleEYE: Aerial Edge-enabled Disaster Relief Response System. EuCNC 2020, Online (Dubrovnik, Croatia)	NCTU
6	Workshop	Sep 2020	Milan Groshev and Carlos Guimarães. Demo: Assessing the need for 5G driven Edge and Fog solution for Digital Twin systems. In ACM WiNTECH, Online (London, UK).	UC3M
7	Conference	Nov 2020	Kiril Antevski, Milan Groshev, Gabriele Baldoni, Carlos J. Bernardos. DLT federation for Edge robotics. IEEE NFV-SDN'20, Online (Madrid, Spain)	UC3M, ADLINK
8	Workshop	Dec 2020	Luigi Girletti, Milan Groshev, Carlos Guimarães, Antonio de la Oliva, Carlos J. Bernardos. An Intelligent Edge-based Digital Twin for Robotics. IEEE GLOBECOM 2020 Workshops on Advanced Technology for 5G Plus (AT5G+), Taipei, Taiwan and Online	UC3M
9	Workshop	Nov 2020	José Takeru Infiesta, Carlos Guimarães, Luis M. Contreras, Antonio de la Oliva. GANSO: Automate Network Slicing at the Transport Network Interconnecting the Edge. NFV-SDN'20 Workshop on Mobility Support in Slice-based Network Control for Heterogeneous Environments (MOBISLICE III), Online (Madrid, Spain)	UC3M, TID

TABLE 7: PEER-REVIEWED PUBLICATIONS IN JOURNALS AND MAGAZINES.

#	Type	Month	Description	Partners
1	Journal	November 2019	Osamah Ibrahiem Abdullaziz, Li-Chun Wang, Shahzoob Bilal Chundrigar and Kuei-Li Huang. Enabling Mobile Service Continuity across Orchestrated Edge Networks. IEEE Transactions on Network Science and Engineering.	NCTU, ITRI
2	Magazine	July 2020	Luca Cominardi, Thomas Deiss, Miltiadis Filippou, Vincenzo Sciancalepore, Fabio Giust, Dario Sabella. MEC support for Network Slicing: Status and Limitations from a Standardization Viewpoint. IEEE Communication Standards Magazine.	ADLINK

3	Journal	March 2020	Luca Cominardi, Sergio González-Diaz, Antonio de la Oliva, Carlos J. Bernardos. Adaptative Telemetry for Software-Defined Mobile Networks. Journal of Network and System Management.	UC3M, ADLINK
4	Magazine	March 2020	Mikhail Afanasov and Luca Mottola. The FlyZone Testbed Architecture for Aerial Drone Applications. ACM GetMobile: Mobile Computing and Communications, vol 24, issue 1.	RISE
5	Journal	August 2020	Luis M. Contreras, Carlos J. Bernardos. Overview of Architectural Alternatives for the Integration of ETSI MEC Environments from Different Administrative Domains. Electronics 9(9)	UC3M, TID
6	Magazine	Accepted	I. Sarrigiannis, L.M. Contreras, K. Ramantas, A. Antonopoulos, C. Verikoukis. Application as a Service Function Chain in a Fog-enabled C-V2X Architecture. IEEE Network.	TID

TABLE 8: ORGANISATION OF SPECIAL ISSUES OF JOURNALS AND MAGAZINES.

#	Month	Journal/Magazine	Special issue name	Partners
1	June 2020	Elsevier Pervasive and Mobile Computing	Special issue on Edge Computing in Pervasive Systems	UC3M

3.1.2. Technical Talks

Table 9 lists all presentation activities delivered in the first year of the project including talks and panels. As reported, 9 talks and 1 panel were delivered at 8 different venues.

TABLE 9: TALKS AND PANELS DELIVERED.

#	Type	Month	Venue	Description	Partners
1	Talk	October 2019	EU-TW 5G/B5G workshop	5G-DIVE: eDge Intelligence for Vertical Experimentation	UC3M
2	Talk	November 2019	IEEE CloudNet	Networking the Cloud, Cloudifying the Network	TID
3	Talk	November 2019	Open Workshop on "Research Activities of Mutual Interest" @ IMDEA Networks (Leganés)	5G-DIVE - eDge Intelligence for Vertical Experimentation	UC3M

4	Talk	June 2020	Online workshop "5G end-to-end experimentation by verticals in EU projects"	DEEP: An Intelligence and Automation Platform for Edge and Fog Computing Environments	UC3M
5	Panel	June 2020	Online workshop "5G end-to-end experimentation by verticals in EU projects"	Introductory and concluding panel discussions	UC3M
6	Talk	June 2020	Online workshop "5G end-to-end experimentation by verticals in EU projects"	Assessing 5G need for Digital Twin Applications	UC3M
7	Talk	August 2020	IWPC - International Wireless Industry Consortium www.iwpc.org	Edge Computing and Networking	IDCC
8	Talk	April 2020	5th IEEE International Workshop on Orchestration for Software Defined Infrastructures (O4SDI), co-located with the 2020 IEEE/IFIP Network Operations and Management Symposium (NOMS 2020), Budapest, Hungary, April 2020 (going virtual)	Towards a standardized transport slicing architecture in operator networks (invited talk)	TID
9	Talk	May 2020	Workshop on The role of computing in the post 5G-era: Architectures and enabling technologies co-located with the 24th International Conference on Optical Network Design and Modelling (ONDM 2020), Castelldefels, Spain, May 2020 (going virtual)	Evolutionary trends in operators' networks for beyond 5G (invited talk)	TID
10	Talk	June 2020	Network Slicing 2020 workshop en IFIP Networking 2020, Paris, France, June 2020 (going virtual)	Transport slicing – ongoing work at IETF with a personal view (invited talk)	TID

3.1.3. Workshops and conferences

In the first year of the project, 4 workshop proposal has been submitted. One workshop has been organized and in Year 1 of the project while another 3 have been proposed and accepted to take place in Year 2.

TABLE 10: WORKSHOPS AND CONFERENCES ORGANIZED.

#	Event	Month	Status	Workshop	Country	Partners
1	Online	June 2020	Completed	"5G end-to-end experimentation by verticals in EU projects", workshop arranged in collaboration with the projects 5Growth, 5G-DIVE, 5G-EVE, 5G-VINNI and 5G-Tours.	Online	UC3M, NCTU
2	IEEE SDN-NFV conference	November 2020	Planned	IEEE Conference on Network Function Virtualization and Software Defined Networks (IEEE SDN-NFV)	Online (Madrid, Spain)	UC3M, TID
3	IEEE SDN-NFV	November 2020	Planned	MOBISLICE III – 3rd edition of Mobility Support in Slice-based Network Control for Heterogeneous Environments (workshop)	Online (Madrid, Spain)	UC3M, TID
4	IEEE Globecom	December 2020	Accepted and later Merged	IEEE GC20 Workshop on "Intelligent Fog and Edge Infrastructures for Future Wireless Systems". https://globecom2020.ieee-globecom.org/workshop/ws-03-workshop-intelligent-fog-and-edge-infrastructures-future-wireless-systems Merged into IEEE GC20 Workshop on Advanced Technology for 5G Plus (AT5G+)	Taipei, Taiwan and Online	UC3M, IDCC, RISE, NCTU

3.1.4. Exhibitions and Demonstrations

In the first year of the project, 4 demonstrations have been showcased, as shown in Table 11

TABLE 11: EXHIBITIONS AND DEMOS.

#	Type	Month	Venue	Description	Lead Partners
1	Demo at conference	February 2020	International Conference on Embedded Wireless Systems and Networks (EWSN), Lyon, France.	Demo: Multi-Radio Access Technology IoT Gateway.	RISE, EAB
2	Booth	February 2020	2020 ICF (Intelligent Community Forum) Top7, Taoyan, Taiwan		ASKEY
3	Web exhibition	February 2020	Anritsu Virtual MWC'20 exhibition	Demo: 5G Industry Verticals Test Bed https://www.anritsu.com/zh-tw/test-measurement/technologies/web-exhibit/mwc/pod#pod-3	IDCC
4	Demo at workshop	June 2020	Online workshop "5G end-to-end experimentation by verticals in EU projects"	Live online demonstration: "Assessing 5G need for Digital Twin Applications"	UC3M
5	Demo at workshop	June 2020	Online workshop "5G end-to-end experimentation by verticals in EU projects"	Recorded demonstration: "EagleEYE: Aerial Edge-enabled Disaster Relief Response System"	NCTU
6	Demo at workshop	September 2020	ACM WiNTECH, Online (London, UK)	Demo: Assessing the need for 5G driven Edge and Fog solution for Digital Twin systems	UC3M

3.1.5. EU Cross-projects Collaboration Activities

During the first year of the project, 5G-DIVE has put an effort towards the collaboration with other EU projects as shown in Table 12.

TABLE 12: EU CROSS-PROJECTS COLLABORATION ACTIVITIES.

#	Venue	Description
1	5G Annual Journal	Project summary article submitted
2	Submitted Workshop proposal for EuCNC'20 (cancelled)	A workshop proposal to EuCNC'20 as a joint action with a number of projects

3	Submitted a Booth proposal with 5GROWTH for EuCNC'20 (cancelled)	A joint booth application was submitted to EuCNC'20.
4	Online workshop	"5G end-to-end experimentation by verticals in EU projects", workshop arranged in collaboration with the projects 5Growth, 5G-DIVE, 5G-EVE, 5G-VINNI and 5G-Tours. (see details in Table 10)
5	WiNTECH 2020	Organization of Poster/Demo track at workshop. Joint with EMPOWER project.
6	IEEE SDN-NFV 2020	Organization of MOBISLICE III workshop together with 5GROWTH project. (see details in Table 10)

3.2. Updated Work Plan

Due to the COVID-19 global outbreak, the most noticeable change in the workplan is that almost all of the future dissemination and collaboration activities will be executed in virtual form. The main objective of the workplan is still the same, which is to generate the maximum impact of the project on all the stakeholders.

Below are the updated dissemination and collaboration activities for Year 2:

- Demonstration of project proof-of-concepts at least at 2 key events including at least 1 in Taiwan.
- Delivery of at least 6 talks at key R&D events.
- Publication (or acceptance for publication) of at least 12 peer-reviewed articles.
- Organization of conferences and workshops:
  - IEEE NFV-SDN in Madrid, Spain (changed to Online) in November 2020.
  - MOBISLICE III workshop at the IEEE NFV-SDN conference in November 2020
  - A workshop at Globecom 2020 in Taipei, Taiwan in December 2020.
- Organization of at least 2 joint collaboration activities with other EU projects.
  - Plans include the organization of a workshop (MOBISLICE III) and a panel (at Globecom'2020)

4. Standardisation and Open Source Activities

This section reports on the 5G-DIVE activities and relevant developments in standards and open source projects. The activities reported include: 1) an update of the status of relevant topics in relevant standards and open source forums; and 2) a report of the contributions from 5G-DIVE consortium partners disseminating work developed recently within the framework of the 5G-DIVE project.

4.1. Standardization Update

The standardization activities in organizations like the 3GPP, IETF, ETSI, IEEE, have all been impacted by the current COVID-19 pandemic, with all meetings turning virtual. The specification work however is still ongoing but at a slower pace than normal. In the below subsections, we report on the activities 5G-DIVE consortium partners have been following with relevance to 5G-DIVE solution.

4.1.1. 3GPP

In 3GPP, we have been monitoring and contributing to four key studies in the System Architecture Working Group2 (SA WG2) as follows:

- **Enablers for Network Automation (eNA) for 5G [1]:** This study focuses on automation use cases related to UE driven analytics. This covers several areas such as i) how to ensure that slice SLA is guaranteed; and ii) which data from the UPF can be used by NWDAF. This also includes NWDAF architecture enhancements such as i) Multiple NWDAF Instances in one PLMN including hierarchies; and ii) roles and inter-NWDAF instance cooperation. It also covers NWDAF features enhancement for real-time communication including: i) Mechanisms for data collection; ii) Service MOS based NWDAF-Assisted UP Optimization; iii) Minimization of the load generated by NWDAF data collection. The study also addresses the interaction between NWDAF and AI Model & Training Service owned by the operator. The current specification is still incomplete and needs further evaluation by SA WG2.
- **Enhanced support of Non-Public Networks (eNPN) [2]:** This study focuses on the requirements of non-public networks. It covers many areas related to NPN such as: i) enhancements to enable support for SNPN along with subscription, ii) support UE onboarding and provisioning for non-public networks, iii) enhancements to the 5GS for NPN to support service requirements for production of audio-visual content and services, iv) the possibility for customizations or optimizations of 5GS when used for NPN considering different deployment scenarios, v) the need for additional exposure capabilities due to support for NPN, vi) support for SNPN and PLMN sharing the same NG-RAN, vii) support for voice/IMS emergency services for SNPN. Several Solutions have been proposed and under investigation to address the aforementioned features but did not yet result into final solutions.
- **Enhancement of support for Edge Computing (EC) in 5GC:** This study covers two main objectives. The first objective is to study the potential system enhancements for enhanced Edge Computing support, including:
    - Discovery of IP address of application server deployed in Edge Computing environment
    - 5GC enhancements to support for seamless change of application server serving the UE

-   How to efficiently provide local application servers with information on the data path
-   Supporting for traffic steering in N6-LAN deployed in Edge Computing environment
-   Supporting PSA change when the application server does not support notifications of UE IP address change
-   Supporting I-SMF insertion or reselection based on AF request to route the traffic to application server deployed in Edge Computing environment

The second objective is to provide deployment guidelines for typical Edge Computing use cases, e.g. URLLC, V2X, AR/VR/XR, UAS, 5GSAT, and CDN. 5G-DIVE partners noticeably IDCC and ITRI have been active on this topic and participated in the discovery of IP address of application server. However, the current solutions still under evaluation.

-   **Enhancement of network slicing (eNS) [3]:** This study aims at identifying the gaps that need to be filled in providing support in the specifications owned by SA WG2 for the Generic Network Slice Template (GST) attributes. Like abovementioned, eNS is currently working on a complete solution and its evaluation.

4.1.2. IETF and IRTF

Following D4.1, the priorities in IETF/IRTF standardization work did not change. Currently 5G-DIVE is contributing to and/or monitoring progress of the following working/research groups:

-   **Service Function Chaining (SFC) WG.** In 5G-DIVE we are working on fog orchestration control and mobility (function migration) for SFC in fog environments. Despite the relative slow-down of activity of this WG in the period from D4.1 (due to the COVID-19 situation), we have achieved to submit multiple contributions to the SFC WG on this topic, as listed in Section 4.2.
-   **ANIMA WG.** In 5G-DIVE, we continue exploring dynamic monitoring approaches that can be bootstrapped using GRASP extensions in fog environments. This WG has also experienced a slow-down in their progress due to COVID-19.
-   **Distributed Mobility Management (DMM) WG.** The activity of this WG has slowed down quite a bit since D4.1, mainly due to the COVID-19 scenario, but also because the group is in the process of re-scoping its goals and milestones. 5G-DIVE is monitoring and contributing to this WG with SFC mobility solutions (extending the Mobile IPv6 protocol), as listed in Section 4.2.
-   **Reliable and Available Wireless (RAW) WG.** This WG was just created before the COVID-19 situation, and it is one of the few that has made more progress despite of the lack of in-person meetings. Some of the use cases and potential technologies currently considered by the RAW WG are very much related to 5G-DIVE. One example is edge robotics, which is very much in scope of RAW. Different contributions, as listed in Section 4.2, have been made.
-   **Dynamic Host Configuration (DHC) WG.** We continue actively participating to this WG, as some mechanisms explored in 5G-DIVE might make use of DHCP (for local MAC addressing). A couple of contributions from the project have been adopted and are in the process of becoming RFCs.

- **Network Management Research Group (NMRG).** AI-based network management is a topic covered by 5G-DIVE which is relevant to the NMRG WG. While no contributions have made at this point, we continue monitoring the progress and we plan to participate in the future.
- **COIN proposed research group (COINRG).** The project has contributed to this WG on discovery mechanisms at the edge. This is a relevant topic for 5G-DIVE and we plan to continue monitoring and contributing. We expect one contribution from 5G-DIVE in this area to be adopted in the future.

4.1.3. ETSI

5G-DIVE consortium has been monitoring a number of ETSI ISGs relevant to the targeted solution and where applicable contributing to some of these ISGs as reported in section 4.2. The status of these ISGs is reported briefly hereafter:

- **ETSI MEC ISG** is in its third two-year cycle with focus on the evolution towards cloud native paradigm. Importantly for 5G-DIVE, a new study ETSI GR MEC 036 "Study on MEC in resource constrained terminals, fixed or mobile" has launched recently (July 2020). This study focuses on how resource constrained devices, such as terminal units, mobile hosts and personal devices, can be used to support cloud computing at the edge. This study is led by IDCC, and three joint contributions with UC3M have already been made within the 5G-DIVE solution framework.

- **ETSI ENI ISG** is completing its second two-year cycle focused on data and action interoperability. A plan for third two-year cycle is underway and the ISG is anticipated to continue to be active in 2021-2022. The scope of this third cycle is not publicly available at this stage of writing this document. It is also noteworthy a workshop[1] "ENI-Machine Learning in communication networks" organized on 16 March between two ETSI ISGs, namely ENI and SAI (Securing AI), and ITU-T's Q20/13 and FG ML5G "Machine Language 5th Generation", on AI/ML. This workshop was instrumental in enabling synergies between ETSI ENI and SAI and the ITU-T ML5G which are now set on track to collaborate and complement each other.

- **ETSI NFV ISG:** This group is currently running its fourth two-year cycle, complementing the previous work on a number of areas conforming what is referred as "Release 4" specification. There are several aspects from this release relevant to 5G-DIVE. Among them, the support of lightweight virtualization technologies like OS containers, important when considering resource constrained virtual infrastructures as the ones that could be found at the edge and fog. Also, the analysis of enhancements in NFV for accompanying the deployment of 5G networks, or multi-tenancy aspects (such as isolation or resource sharing) of relevance for cloud-based environments.

- **ETSI ZSM ISG:** In this case, the activity on ZSM is in its second two-year cycle of development. The relevant work in ZSM for 5G-DIVE is mainly concentrated in the activities related to the

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[1] https://www.etsi.org/newsroom/blogs/entry/eni-13-progressing-release-2-and-etsi-itu-t-workshop-eni-machine-learning-in-communication-networks

lifecycle management and closed loop design and operations. Also interesting for the project, specifically when looking at potential multi-domain scenarios, is the cross-domain service orchestration and automation that can involve the provision of services through multiple administrative domains.

- **ETSI PDL ISG:** the activity in this group is in its first two-year cycle focused on to address the adoption of blockchain technologies in the telecommunication industry, initially focusing on business use cases, architectures, interfaces and data models. Even it is incipient, it can have an interesting potential for 5G-DIVE use case scenarios extremely sensible to security, robustness and accounting. The idea of leveraging on smart contracts, dealt through distributed ledger mechanisms, as form of relationship among parties is promising when thinking on realistic exploitation of 5G-DIVE outcomes.

4.1.4. IEEE

Following D4.1, the priorities in IEEE standardization work did not change. Currently 5G-DIVE is monitoring progress in three main areas:

- **IEEE 802.1:** 5G-DIVE is monitoring the IEEE 802.1 TSN for possible relevant activities regarding the industrial profile and the IEEE 802.1CQ activity, aiming at the distribution of local MAC addresses to IEEE 802 compliant equipment.
- **IEEE 802.11bc:** Activity within the WLAN group aiming at developing new technologies for the broadcasting of information from the AP or the STAs, relevant for the industrial and drone use cases of 5G-DIVE.
- **IEEE 802.11be:** Activity that will yield to WiFi 7. Apart from the expected increase in the density of users and bandwidth available to end-users, this standard aims at a deeper integration with TSN networks, which may be relevant to the industrial and drone use cases.

4.1.5. ORAN Alliance

The ORAN alliance [4] is promoting the interoperability of disaggregated RAN solutions producing different specifications for virtualization, operation, control and management of them. Apart from the interest in 5G-DIVE for the potential of disaggregated RAN from an architectural point of view, it is of relevance for the project the consideration of AI-based mechanisms for its applicability to radio resource control. Currently 5G-DIVE is monitoring the progress of the following working/research groups:

- **WG1 on Use Cases and Overall Architecture Workgroup.** The architectural approach of disaggregated RAN could be applicable to 5G-DIVE scenarios, where components of the disaggregated RAN could lay on different administrative domains (i.e., vertical premises and operator facilities). The use cases considered so far in ORAN are also inspirational for analyzing additional scenarios in 5G-DIVE, such as for instance RAN sharing cases.
- **WG2 on the Non-real-time RAN Intelligent Controller and A1 Interface Workgroup.** This group considers the introduction of AI/ML mechanisms for the near-RT RAN Intelligent

Controller (RIC), which could be considered as complementary to the same kind of capabilities being developed within 5G-DIVE.

- **WG9 on Open X-haul Transport Work Group.** Because of the fact of disaggregating the RAN, the distinct components of the radio access need to be properly interconnected. This group is specifying the transport connectivity for the full environment and the co-existence with other services in the field, which is important when considering the integration of 5G-DIVE scenarios, leveraging on ORAN, with other services existing in the network.

4.2. Standardization Achievements

Table 13 collects standard contributions associated with the 5G-DIVE project.

TABLE 13: STANDARD CONTRIBUTIONS IN 5G-DIVE.

#	Date	SDO	WG	Title	Authors	ID	Status	Partners involved
1	Nov'19	IETF	ANIMA	Autonomic setup of fog monitoring agents	CJ. Bernardos, A. Mourad	draft-bernardos-anima-fog-monitoring-01	ID-Exists	UC3M, IDCC
2	Nov'19	IETF	RAW	RAW use cases	G. Papadopoulos, P. Thubert, F. Theoleyre, CJ. Bernardos	draft-bernardos-raw-use-cases-01	ID-Exists	UC3M
3	Nov'19	IETF	ALTO	Use of ALTO for Determining Service Edge	LM. Contreras, D. Lachos, C. Rothenberg	draft-contreras-alto-service-edge-00	ID-Exists	TID
4	Nov'19	IETF	TEAS	Considerations for defining a Transport Slice NBI	LM. Contreras, S. Homma, J. Ordonez-Lucena	draft-contreras-teas-slice-nbi-00	ID-Exists	TID
5	Nov'19	IETF	TEAS	Transport Network Slice YANG Data Model	X. Liu, J. Tantsura, I. Bryskin, L. Contreras, Q. Wu	draft-liu-teas-transport-network-slice-yang-00	ID-Exists	TID
6	Mar'20	IETF	RAW	RAW use cases	G. Papadopoulos; P. Thubert; F. Theoleyre; CJ. Bernardos	draft-bernardos-raw-use-cases-03	ID-Exists, Update	UC3M
7	Mar'20	IETF	DHC	SLAP quadrant selection options for DHCPv6	CJ. Bernardos; A. Mourad	draft-ietf-dhc-slap-quadrant-05	ID-Exists, WG adopted	UC3M, IDCC
8	Mar'20	IETF	SFC	Service Function discovery in fog environments	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-discovery-04	ID-Exists	UC3M, IDCC
9	Mar'20	IETF	SFC	Service Function Chaining Use	CJ. Bernardos, A. Rahman, A. Mourad	draft-bernardos-sfc-fog-ran-07	ID-Exists	UC3M, IDCC

				Cases in Fog RAN				
10	Mar'20	IETF	SFC	Distributed SFC control operation	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-distributed-control-operation-00	ID-Exists	UC3M, IDCC
11	Mar'20	IETF	SFC	NSH extensions for local distributed SFC control	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-nsh-distributed-control-00	ID-Exists	UC3M, IDCC
12	Mar'20	IETF	DMM	SFC function mobility with Mobile IPv6	CJ. Bernardos, A. Mourad	draft-bernardos-dmm-sfc-mobility-00	ID-Exists	UC3M, IDCC
13	Mar'20	IETF	DHC	SLAP quadrant selection options for DHCPv6	CJ. Bernardos, A. Mourad	draft-ietf-dhc-slap-quadrant-06	Standards Track (update)	UC3M, IDCC
14	Jul'20	IETF	SFC	Distributed SFC control for fog environments	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-distributed-control-02	ID-Exists	UC3M, IDCC
15	Sep'20	IETF	intarea	IPv6-based discovery and association of Virtualization	CJ. Bernardos, A. Mourad	draft-bernardos-intarea-vim-discovery	ID-Exists	UC3M, IDCC
16	Sep'20	IETF	SFC	NSH extensions for local distributed SFC control	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-nsh-distributed-control	ID-Exists, Update	UC3M, IDCC
17	Sep'20	IETF	SFC	Distributed SFC control operation	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-distributed-control-operation	ID-Exists, Update	UC3M, IDCC
18	Sep'20	IETF	DMM	SFC function mobility with Mobile IPv6	CJ. Bernardos, A. Mourad	draft-bernardos-dmm-sfc-mobility	ID-Exists, Update	UC3M, IDCC
19	Apr'20	3GPP	SA2	23.501 CR2269R2 (Rel-16, 'F'): Enablers for multiple SCPs (23.501)	Oracle Corporation, Verizon UK Ltd, Nokia, Nokia Shanghai-Bell, Samsung, Ericsson, ITRI, CATT, AT&T, ZTE, InterDigital	S2-2003269	Accepted	ITRI, IDCC
20	Apr'20	3GPP	SA2	23.502 CR2208R2 (Rel-16, 'F'): Enablers for multiple SCPs (23.502)	Oracle Corporation, Verizon UK Ltd, Nokia, Nokia Shanghai-Bell,	S2-2003270 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_138e_Electronic/Docs/S2-2003270.zip)	Accepted	ITRI, IDCC

					Samsung, Ericsson, ITRI, CATT, AT&T, ZTE, InterDigital			
21	Sep'20	3GPP	SA2	23.748: Update to Solution #39: EAS relocation coordinated with PSA change.	Huawei, HiSilicon, InterDigital Inc., Apple, ITRI	S2-2005982 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_140e_Electronic/Docs/S2-2005982.zip)	Accepted	ITRI, IDCC
22	Oct'19	3GPP	SA2	23.748: Application server discovery for enhanced Edge Computing	ITRI	S2-1909645 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_135_Split/Docs/S2-1909645.zip)	Merged into S2-1910422	ITRI, IDCC
23	Oct'19	3GPP	SA2	23.748: Key Issue for the discovery of edge application server	Huawei, HiSilicon, Ericsson, Nokia, Futurewei, Sandvine, ITRI, Toyota, CATT, vivo, Deutsche Telekom, OPPO, Tencent, Samsung, LG Electronics, Alibaba Group	S2-1910422 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_135_Split/Docs/S2-1910422.zip)	Accepted	ITRI, IDCC
24	Nov'19	3GPP	SA2	23.748: Key Issue on edge relocation (FS_enh_EC)	Qualcomm Incorporated, NTT DOCOMO, AT&T, Nokia, Nokia Shanghai Bell, Samsung, Ericsson, LG Electronics, Sandvine, Interdigital, ITRI, Deutsche Telekom, Lenovo	S2-1912612 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_136_Reno/Docs/S2-1912612.zip)	Accepted	ITRI, IDCC
25	Nov'19	3GPP	SA2	23.748: New key issue on 5GS enhancements to	InterDigital Inc., ITRI	S2-1911795 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TS	Merged into S2-1912354	ITRI, IDCC

				support Edge and PSA Relocation		GS2_136_Reno/ Docs/S2-1911795.zip)		
26	Nov'19	3GPP	SA2	23.748: New key issue on deployment consideration to enable seamless change of EC Application Server, serving UEs	InterDigital Inc., ITRI	S2-1911794 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_136_Reno/Docs/S2-1911794.zip)	Posted	ITRI, IDCC
27	Nov'19	3GPP	SA2	23.748: Solution for application server discovery based on NEF registration.	ITRI	S2-1911919 (https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_136_Reno/Docs/S2-1911919.zip)	Posted	ITRI, IDCC
28	Jul'20	ETSI	MEC	MEC036 Update to Section 4 Overview	Debashish Purkayastha, Alain Mourad, Carlos Bernardos, Marco Liebsch	MEC(20)000258	Accepted	IDCC, UC3M
29	Jul'20	ETSI	MEC	MEC036 Use case Zero Defect Manufacturing	Debashish Purkayastha, Alain Mourad, Carlos Bernardos , Marco Liebsch	MEC(20)000259	Accepted	IDCC, UC3M
30	Jul'20	ETSI	MEC	Use case Mission critical vehicular and mobile node application	Debashish Purkayastha, Alain Mourad, Carlos Bernardos , Marco Liebsch	MEC(20)000261	Accepted	IDCC, UC3M
31	Sep'20	IETF	SFC	Service Function Chaining Use Cases in Fog RAN	CJ. Bernardos, A. Rahman, A. Mourad	draft-bernardos-sfc-fog-ran-08	ID-Exists, Update	UC3M, IDCC
32	Sep'20	IETF	SFC	Service Function discovery in fog environments	CJ. Bernardos, A. Mourad	draft-bernardos-sfc-discovery-05	ID-Exists, Update	UC3M, IDCC

4.3. Open Source Activities

This section describes open source activities relevant to 5G-DIVE project.

4.3.1. OSM

Open Source Management and Orchestration (OSM) is an open-source project for the development of a network orchestration framework. It was originally focused on NFV MANO, but the scope of the OSM is currently more ambitious. The OSM is the orchestrator of choice in several networks and the OSM is only OSG in ETSI.   The OSG provides a reference architecture in advanced network orchestration and it has strong connection with European research projects. Most relevant modules of OSM are service orchestrator, VIM plugin, slicing modules and monitoring system

Contributions to the OSM are made as source code commits or as documentations to the open source project. Each contributing party needs to provide a Contribution Agreement acknowledgement (Apache 2.0 License).

The OSM Releases are done every six months and the releases are named with a number name in capital letters: (ZERO, ONE, TWO.) Current version is OSM Release SIX. The project developers agree on a blueprint for each coming release by deciding on priorities over different evolution proposals

Given the size of the community of active developers and the user plans, continuity till the end of 2022 is practically assured

4.3.2. Eclipse Edge Native WG

Following D4.1, the activities in the Eclipse Edge Native Working Group did not change. Currently 5G-DIVE is contributing with two projects to this working group. The Eclipse fog05 is a main part of the 5G-DIVE's Edge and Fog System (EFS) and will contain the implementation of the Orchestration and Control System (OCS). Eclipse fog05 is an open source project that aims at providing a decentralised infrastructure for provisioning and managing compute, storage, communication and I/O resources available anywhere across the network. Eclipse fog05 addresses highly heterogeneous systems even those with extremely resource-constrained nodes. The latest release of Eclipse fog05 at the time of writing this deliverable is the v0.2.1 and was done in July 28, 2020[2]. For more information please refer to the 5G-DIVE deliverable D2.1 [6].

Another project that is part of the Eclipse Edge Native Working Group is Eclipse Zenoh. The purpose of the Eclipse Zenoh project is to unify data in motion, data in use, data at rest and computations. Eclipse Zenoh carefully blends traditional pub/sub with geo-distributed storages, queries and computations, while retaining a level of time and space efficiency that is well beyond any of the mainstream stacks. The current version of the Eclipse Zenoh contains and initial implementation of the Data Analytic Support Stratum (DASS) inside the DEEP component. Its goal is to bring data-centric abstractions and connectivity to devices that are constrained with respect to the node resources, such as computational and storage, power and network. The latest release of Eclipse Zenoh at the time of

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[2] https://github.com/eclipse-fog05/fog05/releases/tag/v0.2.1

writing this deliverable is the v0.4.2 and was done on June 19, 2020[3]. For more information please refer to the 5G-DIVE deliverable D2.1 [6].

ADLINK is founder member of the Eclipse Edge Native Working Group, which is expected to have a pivotal role in establishing the open source Edge Native reference platform and, as such, accelerate the adoption of edge native architectures. Additionally, ADLINK is the leader contributor to the Eclipse **fog05** as well as the Eclipse **Zenoh** projects. In the coming EclipseCon conference to be held virtually in October 19-22, 2020, there is an approved session regarding the integration between Edge robotics with ROS2 and Eclipse Zenoh[4]. This presentation will provide with a clear descriptions of the challenges posed by the current ROS2 and MicroROS2 data-plane and illustrate how these challenges can be addressed by leveraging Eclipse Zenoh to (1) bring peer-to-peer to MicroROSs applications and (2) scale-out ROS2 applications and enable Edge Robotics management monitoring and control by means of a DDS-plugin for the Zenoh routing network. Finally, we will demonstrate edge management, monitoring and control of a robot swarm.

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[3] https://github.com/eclipse-zenoh/zenoh/releases/tag/0.4.2-M1
[4] https://www.eclipsecon.org/2020/sessions/edge-robotics-ros2-and-eclipse-zenoh

5. Exploitation Activities

A preliminary exploitation plan for the project was defined in Deliverable 4.1 [5]. The purpose of the exploitation plan is to create value for all stakeholders during the project lifetime and beyond. Several forms of exploitation are planned with a focus on the components developed as part of the project's field trials.

The project's Description of Action was updated to handle the effects of the Covid-19 crisis. One change in the plan is that the elaboration of the preliminary exploitation plan is postponed until December 2020. A second version of this deliverable, D4.2b, will be issued at that time, where this section on exploitation activities will be updated.

The preliminary work plan includes activities relating to all aspects of the exploitation strategy as outlined in the following paragraphs.

Identify commercial opportunities in prototypes

A large project effort is spent on prototype systems and their components implemented for the field trials. Commercial opportunities will be identified in these systems and components.

Identify innovations from technology development

Innovations will be identified as they emerge from the technology development undertaken by the technical work packages (WP1/WP2/WP3) and their suitability for patenting will be assessed.

Map innovations to products and services

The innovations will be mapped onto identified products and services, existing as well as new, of industrial stakeholders with the per-partner exploitation plans [5] as a starting point.

Promote exploitation

The exploitation of the project's innovations will be promoted by the various stakeholders, including through the arrangement of an exploitation workshop towards the end of the project.

6. Conclusions

This deliverable reported on the execution and overall achievements of the project's communication, dissemination and exploitation plan (CoDEP) that was defined in project Deliverable 4.1 [5]. The Covid-19 crisis made it more difficult and required the adaptation of the plans for more online presentation. Despite this, a significant progress has been made towards the dissemination targets.

The project has been active during the first year with communication and public activities. The Covid-19 replanning meant that we put effort into producing videos of presentations and demos. The statistics show that the project has a quite active website where the consortium events and deliverables are the most popular content.

The project partners have published several scientific papers during the year. These efforts will be increased during the second project year, when more results become ready. The plans for participating in exhibitions have not been completely fulfilled due to cancelled events, but some have been replaced with online substitutes. The project has engaged in several cross-project collaboration activities, not least for organising workshops and other events. Several of these activities have been subject to replanning due to Covid-19, but despite some difficulty, have largely been following plan.

The standardisation activities of the project cover the standardisation bodies 3GPP, IETF, ETSI, IEEE and ORAN Alliance. Several contributions have already been made to 3GPP, IETF and ETSI. Releasing and contributing to open source software are very important means of disseminating the project results. Project partners are driving two such projects.

A second version of this deliverable (D4.2b) will be issued at the end of the year, with updated reporting on the exploitation activities.

7. References

[1] 3GPP TR 23.700-91, 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Study on enablers for network automation for the 5G System (5GS); Phase 2 (Release 17).

[2] 3GPP TR 23.700-07, 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Study on enhanced support of non-public networks (Release 17).

[3] 3GPP TR 23.700-40, 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Study on enhancement of network slicing; Phase 2 (Release 17)

[4] O-RAN Alliance. website: https://www.o-ran.org/

[5] B. Ahlgren (ed.). Y1 CoDEP including standardization plan. 5G-DIVE project Deliverable 4.1, March 2020.

[6] A. Mourad (ed.). 5G-DIVE Innovations Specification. 5G-DIVE project Deliverable 2.1, September 2020.