MATILDA

A Holistic, Innovative Framework for the Design, Development and Orchestration of 5G-ready Applications and Network Services over Sliced Programmable Infrastructure

DELIVERABLE D7.2

5G-PPP INTERACTION, DISSEMINATION, CLUSTERING & STANDARDISATION ACTIVITIES REPORT - HALFWAY

Due Date of Delivery:	M15 _Mx_ (31/08/2018 _dd/mm/yyyy_)
Actual Date of Delivery:	25/09/2018 _dd/mm/yyyy_
Workpackage:	WP7 – Dissemination, Communication, Exploitation and Business Planning
Type of the Deliverable:	R
Dissemination level:	PU
Editors:	AALTO, CNIT
Version:	1.0

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1 Executive Summary

This deliverable presents a concise and comprehensive report on the scientific and technical dissemination, clustering, standardization and 5GPPP programme interaction activities which are the direct outcomes of Tasks 7.1 and 7.2 of the MATILDA project. In this deliverable, the focus shall be on reporting the above-mentioned activities carried out within the context of the MATILDA project until the end of the fifteenth month (M15 – August 2018), thereby making it a midway report on the progress attained since the beginning of the project. The reported dissemination activities are those specific to the scientific and technical results generated within the scope of the project and tailored to a range of potential users which include both academic and non-academic researchers, such as the industrial research and development bodies. While many of the activities are interactive (i.e., they involve giving presentations and discussions), others are non-interactive (i.e., involves submission of the generated results to the scientific community in the form of conference, journal and magazine papers).

In addition, clustering activities organized by the MATILDA partners alone or in collaboration with partners from other 5GPPP peer projects, which are used as avenues to further facilitate the dissemination of MATILDA results to the targeted audience in the form of interaction activities such as scientific and technical workshops for the academic and industrial communities, are also reported in this deliverable. Moreover, target standardization bodies and standardization activities emanating from the research outcomes of the MATILDA project are also detailed.

2 Introduction

In the MATILDA technical context, a 5G-ready application is the highest-level entity from a top-down perspective, and fully enabling it by enhancing application developers' tools and their network awareness is one of the most essential priorities of the project. The MATILDA consortium members will actively and closely collaborate to achieve this important goal and other minor ones. Apart from closely working together to achieve those technical goals, another crucial fact that the members are keen on is to proactively share, inform and disseminate the project's results – technical, scientific and in all other respects – within the open source communities, both in academia and industry. These project results are expected to be beneficial and relevant to the different solutions of the stakeholder communities. Therefore, to make these results available for their use, a significant number of activities are planned for their dissemination through different communication channels. Also, within the context of this deliverable, the consortium members will adequately address already ongoing standardization efforts and contribute to them through the different activities of the project.

To this end, the main aims of this deliverable shall be to extensively report on the outcomes of the activities of the interaction within the 5G-PPP framework, as well as with standardization bodies, on clustering, and on scientific and technical dissemination for the benefit of the wider MATILDA stakeholders and the international community at large. Within the MATILDA project organization, this deliverable is developed to capture a major aspect of WP7, which is responsible for dissemination, communication, exploitation and business planning within the project development activities. In particular, this deliverable shall comprehensively report the activities of the following WP7 tasks:

Task 7.1 Dissemination, Clustering and Standardization Activities

The primary objective of this task is to report and disseminate the **scientific and technical knowledge** generated within the scope of the MATILDA project. This S&T knowledge shall be effectively diffused among and used to address the need of the wide range of potential users of the outcomes of the project, including the academics, the research and development bodies on the industries as well as other open source communities and other relevant stakeholders. The dissemination activities within the project are carried out both in an iterative and non-iterative manner.

The iterative **dissemination activities** are carried out in the form of project meetings (plenary, review, virtual bi-weekly) which involve human interactions aimed at fostering and strengthening the relationship and building more trust among the consortium members. This will bring about a better collaboration amongst the project partners and ultimately yield better project results.

The non-iterative **dissemination activities** are targeted towards local, regional and international scientific conferences, as well as topic-specific journals such as Magazines and Transactions, and carried out in the form of submission of published manuscripts revealing the results gathered from the activities and tasks within the MATILDA project. In addition, to further widen the reach of these activities and broadcast the project results, **clustering activities** will be carried out in the form of scientific and technical workshops, either alone or in collaboration with other relevant projects where the scientific and technical outputs from MATILDA will be presented to the scientific community and discussed. In order to realize these objectives, partners from within the MATILDA project shall organize at least one

scientific and technical workshop where results from MATILDA will be presented to the scientific community and two industrial workshops targeted at the vertical industries.

Also within the scope of this task, MATILDA aims to identify important **standardization activities,** closely monitor their progress and participate actively in standardization meetings. Moreover, whenever appropriate, the results stemming from the activities within MATILDA will be discussed for feedback with relevant standardization organizations.

Task 7.2 5G PPP Programme Interaction

The primary responsibility of this task is to closely coordinate, collaborate and execute notable interactions with the peer projects of the 5G Infrastructure Public Private Partnership programme and the 5G Infrastructure association in order to build global consensus on important approaches and ultimately achieve the global programme's KPIs.

This deliverable is organized as follow: Firstly, the dissemination organization and plan is described in Section 3, identifying the target scientific and industrial groups, as well as the definition of different dissemination activities and steps envisioned during the MATILDA project. The main communication channels are also described with a detailed workplan schedule of envisioned dissemination activities. Secondly, Section 4 depicts the scientific and industrial dissemination, and clustering activities carried out since the beginning of the project until the M15. Thirdly, the 5G PPP interaction, relevant standardization activities and potential contributions are described in Section 5. Finally, the deliverable is concluded in Section 6.

2.1 Notations, abbreviations and acronyms

The list of abbreviations and acronyms used throughout in this deliverable is presented in the Table 1 below.

Table 1 – List of abbreviations and acronyms

Abbreviations	Definitions
5G-PPP	5G Infrastructure Public Private Partnership
3GPP	3rd Generation Partnership Project
EC	European Commission
ETP	European Technology Platform
ETSI	European Telecommunications Standards Institute
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IoT	Internet of Things
ISO	International Organization for Standardization
ITU	International Telecommunication Union
KPI	Key Performance Indicator
NFV	Network Function Virtualization
RFC	Request For Comments
SDO	Standards Developing Organization
SME	Small Medium Enterprise
S&T	Scientific and Technical
SG	Study Group
TC	Technical Committee
TS	Technical Specification
WG	Working Group
WI	Work Item

3 Dissemination organization and scope of the work

3.1 Responsibilities

All MATILDA partners are expected to contribute actively towards the development of the dissemination activities by:

➢ identifying and creating awareness about possible dissemination opportunities for the benefit of other consortium members such as journals, conferences, publications, workshop events etc.

➢ promoting the project and its results within relevant information sharing circles and other organizations

➢ providing useful contents towards the promotion of the scope, activities and results of the project through different information dissemination items and avenues

➢ creating enabling relationships that could bring about collaboration with appropriate standardization bodies

➢ presenting technical papers as well as project results at appropriate international conferences

➢ helping promote the events of MATILDA at international project workshops and display of banners at conferences

All dissemination activities conducted, organized and promoted within this project shall be accompanied with the enactment of the **Article 29.4** (Information on EU funding – Obligation and right to use the EU emblem) of the grant agreement.

Article 29.4 – Unless the Commission requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:
(a) display the EU emblem and
(b) include the following text:
"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731558".
When displayed together with another logo, the EU emblem must have appropriate prominence. For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the Commission. This does not however give them the right to exclusive use. Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

3.2 Goals of dissemination, clustering and standardization activities

One of the major goals of the MATILDA project in this WP is to maximize the results of the activities and tasks within the scope of the project through the use of multiple essential communication tools and channels. Therefore, in order to maximize the coverage and reach of the dissemination activities for the results generated within the project, MATILDA intends to use wide varieties of communications avenues to reach out to its stakeholders.

For simplicity and clarity, the dissemination activities herein are divided into the **interactive and non-interactive dissemination** activities targeted towards disseminating the scientific and technical results generated within the context of the MATILDA project.

As for the **interactive dissemination activities**, this shall include but not be limited to the submission of scientific and technical publications accompanied with physical participation (for example presentation) of members from the consortium in regional and international conferences and workshops, and the organization of events solely for widening the dissemination of the results garnered within the project in order to increase the project's visibility both locally and internationally.

The **non-interactive dissemination activities**, on the other hand, include the dissemination of scientific and technical information through the submission of the outcomes of the project in the form of manuscripts publication in topic-specific journals, magazines and transactions in order to maximize the outreach of the project results. Also, this includes contribution of technical and scientific results addressing technical needs of the scientific as well as the open source communities' materials and contents to the MATILDA website. Active and systematic utilization of mainstream social media platforms for the dissemination of important project information and the use of additional information dissemination tools to share updates emanating from the project, results and other important news with both the immediate stakeholders and the general MATILDA's audience also fall in this category.

Regarding the **clustering activities**, MATILDA will organize events in the form of workshops where activities carried out in conjunction with other peer projects will be presented and discussed. These workshops could either be organized alone by MATILDA or co-organized with the concerned relevant peer projects. The main objective of these activities shall be for the promotion of intensive interaction between relevant projects with interesting and complementary ideas that could help stimulate innovation and drive creativity for the projects to achieve higher productivity. This will foster the full maximization of the outcomes of the scientific and technical results from MATILDA.

Concerning the **standardization activities**, they will cover the exploitation of open and organized standardization meetings, both virtual and physical, for the execution of a close collaboration and coordination with the peer projects of the 5G infrastructure public private partnership programme and the 5G infrastructure association and ensuring that the project reaches its set KPIs.

Within the scope of this deliverable, there are a number of quantitative yardsticks specified to measure the efficiency of the dissemination activities and verify their progresses, by way of enlisting a certain number of publications that has to be attained or a particular number of standards that has to be contributed to. The consortium has however, stipulated a number of measurable Key Performance Indicators (KPI) addressing different areas of dissemination and standardization activities presented in Table 2 below.

**Table 2 – KPIs for dissemination and standardization activities achieved
in the scope of deliverable D7.2 up to M15.**

KPIs	Overall Target value	Achieved Value
Participation in MWC 2019	Yes	The Consortium intends to participate
Contribution to EU booth at MWC 2019 with demo/testbed showcasing MATILDA's results	Yes	Proposal in preparation
White papers and contribution to roadmaps	≥5	1
Journals	≥10	2
Conferences	≥20	8
Posters	≥3	1
Scientific and technical workshops	3	2

4 MATILDA dissemination work plan

In order to achieve and possibly surpass the dissemination objectives described above including the KPIs mentioned in Table 2, the consortium partners hope to adopt a dissemination workplan which is aimed at establishing strong communication presence and essential dissemination channels with the potential audience. The dissemination workplan will provide the project with clear and effective guidelines on the best and optimal ways of communicating the objectives and achievable scientific and technical results of the project using efficacious message dissemination means that will drive interest towards the project developed technologies, as well as other recognizable and remarkable achievements. In the light of this proposed work plan, the MATILDA consortium members have specified and recognized a number of target groups which are described below in Table 3 below.

Table 3 – Identified target groups and their definitions

Target areas	Potential audience	Technical level	Main focus
Business	Industry, Investors, SMEs	Extent of revealing business opportunities and potentials of the technology for societal benefits	Identification of business opportunities, Identification of potential derivable societal benefits, Extraction of business-related projects, Identification of resultant scientific and technical innovations.
Legislative	Public administrators, Policy-makers	Extent of revealing legislative and possible social implications	Implementation of the new EC law on privacy and security legislation.
Scientific	Research community, International forums	Extent of revealing the main scientific and technical innovation and discoveries of the project	Exposure of the community to the generated technical and scientific knowledge through the submitted journal articles as well as conference papers focusing on novel scientific innovations and ideas.
Social	General public, Public administrators	Extent of being easily understandable by the vast majority of non-specialist public	Focus on the economic impacts and societal implications and derivable benefits, General project presentation and Personal data protection and human privacy assurance.
Technical	System developers	Extent of revealing deep systems knowledge understandable by system developers and managers	Specific project presentations, Software development paradigms and user requirements.

4.1 Dissemination work plan description

The MATILDA dissemination plan consists of different activities and is based on an iterative process to improve the effectiveness of communication activities during the project timespan. The overall view of the dissemination plan is provided in the description enlisted and explained below.

The following activities are envisioned in the MATILDA's dissemination plan:

➢ **Definition of the project identity**: The consortium members have provided clearly visible and recognizable information content that can effectively communicate the vision, objectives and results generated within the scope of the project, as well as other possible technological discoveries to the potential end users. This information content shall be definitely unique in conveying the core values of MATILDA through the use of the logo, with which the project can be uniquely identified, as well as of an advertising slogan and a list of keywords – such as *5G-ready*, *cloud-native*, etc. – which will be recurrent on all the dissemination material that will be used in the project. The project has a clear identity which is always conveyed on all of its dissemination materials including those related to the dissemination of scientific, technical, clustering and standardization activities.

➢ **Definition of target groups:** The MATILDA's dissemination plans and activities shall be defined in such a way that will target a particular set of interest groups both in the industry, e.g. software developing experts, software service providers, system architects and designers, smart city planners, IoT device designers and developers, and academic researchers, as well as the general tech consumers. Specifically, within the scope of this deliverable, the target group shall cut across individuals as well as groups of people who will find useful the scientific and technical, clustering and standardization activities of MATILDA.

➢ **Scope of the dissemination materials**: Varieties of materials will be developed towards the conveyance and dissemination of activities within MATILDA. Such materials may include: project brochures, PowerPoint presentation material, leaflets, promotional pamphlets, technical workshop proceedings, industrial demonstrators, vertical use case descriptions, developed software resulting from the project and project deliverables.

➢ **Target of the dissemination activities:** The dissemination activities will be carefully planned, designed and aimed at the abovementioned target groups in order to maximize the potential impact and outreach of the dissemination of the project's results.

➢ **Evaluation of the performed dissemination activities**: The consortium members intend to regularly collect useful feedback regarding all the dissemination activities that will be carried out within the confines of the project. This feedback could entail both qualitative and quantitative information from the target MATILDA stakeholders and the general audience through the use of opinion gathering tools such as electronic questionnaires and forms. From the collected information, useful performance indicators will be derived that could be used to improve the dissemination activities even better for future purposes.

MATILDA hopes to explore various communication channels and dissemination avenues to broaden its information dissemination outreach and maximize its audience coverage capacity. For this reason, MATILDA will exploit most if not all of the information dissemination avenues listed in Table 4 below.

Table 4 – Information dissemination avenues

Dissemination avenues
Organization of conferences
Organization of technical workshops
Press releases
Exhibitions
Trainings
Social media presence
Website
Mainstream media campaigns e.g., on TV and Radio stations
International conference participation
International workshop participation
Pitch event
Trade fairs
Participation in expositions organized by other H2020 peer projects
Brokerage events
Flyer
Others

4.2 Dissemination, clustering and standardisation activities performed

4.2.1 Dissemination activities

In order to enable and expand the outreach of the MATILDA's results and further guarantee a wide spread of the dissemination activities which will help maximize the impact and benefits derivable from the project, the consortium partners have agreed to carry out dissemination activities throughout the entire lifespan of the project.

Therefore, in this section, we present a highlight of the dissemination activities conducted up until the moment of compiling this deliverable since the beginning of the project. The overview presented herein includes for dissemination activities that concern mostly scientific publications, technical workshops, press releases, online web portal and media briefings. Table 5 below shows the complete list of these dissemination activities up to now. This table will keep growing as the project evolves.

Table 5 – Initial dissemination activities

#	Dissemination activity and contribution	Date	Location
1	Participation in a Workshop **SDN Security Workshop at CODE-Jahrestagung 2018** Invited Keynote, Panel Discussion *Network Softwarization* N. Stasinopoulos (INC)	11/07/2018	Munich, Germany
2	Participation in a Conference **24th ICE/IEEE ITMC International Conference on Engineering, Technology and Innovation** Paper presentation *First Steps for a 5G-Ready Service in Cloud Manufacturing* K. Burow (BIBA)	18/06/2018 - 20/06/2018	Stuttgart, Germany
3	Participation in a Conference **EuCNC 2018** Demo presentation *MATILDA – Orchestrating 5G Ready Emergency Services* N. Stasinopoulos (INC)	18/06/2018 - 21/06/2018	Ljubljana, Slovenia

#	Dissemination activity and contribution	Date	Location
4	Participation in a Conference **IEEE WCNC** Paper presentation *Efficient Virtual Evolved Packet Core Deployment Across Multiple Cloud Domains* M. Bagaa (AALTO)	15/04/2018 - 18/04/2018	Barcelona, Spain
5	Participation in activities organized jointly with other H2020 projects **Article on European 5G Annual Journal** Short MATILDA presentation MATILDA Consortium	04/2018	Europe
6	Participation in a Conference **Mobile World Congress MWC 2018** Supporting 5G IA booth *Project activities presentations* J. Sterle (ININ)	26/02/2018 - 1/03/2018	Barcelona, Spain
7	Participation in a Conference **MWC 2018** MATILDA Video presentation ORO	25/02/2018 - 28/02/2018	Barcelona, Spain

#	Dissemination activity and contribution	Date	Location
8	Participation in a Workshop **Business School Politecnico di Milano, Italy** Project presentation *Workshop on Cyber-Physical Systems in Production and Logistics* Klaus-Dieter Thoben (BIBA)	01/02/2018	Milan, Italy
9	Social Media **MATILDA @ ININ Twitter** Project activities presentations ININ	2017 - 2018	Internet
10	Social Media **MATILDA @ ININ LinkedIn** Project activities presentations ININ	2017 - 2018	Internet
11	Website **Networld - Find the SME you need!** SME expertise presentation and interest indication ININ	2017	Internet

#	Dissemination activity and contribution	Date	Location
12	Participation in an Event other than a Conference or a Workshop **Lectures in Polytechnic University** Presentation *Introduction to 5G communication* ORO	22/11/2017	Bucharest, Romania
13	Brokerage Event **ICT Proposers' Day 2017** Presentation *Quality Assurance and PPDR in 5G* J. Sterle (ININ)	9/11/2017 - 10/11/2017	Budapest, Hungary
14	Participation in an Event other than a Conference or a Workshop **MATILDA Project** Project activities presentations for A1 Slovenia mobile operator J. Sterle (ININ)	11/2017	Ljubljana, Slovenia
15	Participation in an Event other than a Conference or a Workshop **MATILDA Project** Project activities presentations for Telekom Slovenije J. Sterle (ININ)	11/2017	Ljubljana, Slovenia

#	Dissemination activity and contribution	Date	Location
16	Participation in a Conference **INFOCOM WORLD CONFERENCE 2017 Greece** Project presentation *MATILDA: An innovative framework for designing, developing and orchestrating 5G ready applications and network services over programmable infrastructures* Anastasios Kourtis (NCSRD)	25/10/2017	Athens, Greece
17	Participation in a Workshop **Visions for Future Communications Summit, organised by NetWorld2020** Presentation *5G and Beyond: Perspectives on Fixed/Mobile/Cloud/Fog Integration, Network Management and Control, and Services' Deployment* F. Davoli (CNIT)	23/10/2017 - 24/10/2017	Lisbon, Portugal
18	Participation in a Conference **CISCO CONNECT 2017 Romania** Paper presentation *System and networks evolutions for the next 5G business services* ORO	18/10/2017	Bucharest, Romania

#	Dissemination activity and contribution	Date	Location
19	Brokerage Event **5G PPP Phase 3 Information day and Stakeholders event** Presentation *Quality Assurance in 5G – SME engagement* J. Sterle (ININ)	17/10/2017	Ljubljana, Slovenia
20	Participation in a Conference **Panel "An overview to H2020 calls in Simulation, Physiological Computing and Robotics" at SIMULTECH 2017** Presentation in Panel discussion *H2020 Projects in Network Virtualization and 5G: Some Application Scenarios* F. Davoli (CNIT)	27/07/2017	Madrid, Spain
21	Participation in a Conference **7th Int. Conf. on Simulation and Modeling Methodologies, Technologies and Applications (SIMULTECH 2017)** Invited Keynote *Modeling Performance and Energy Efficiency of Virtualized Flexible Networks* F. Davoli (CNIT)	26/07/2017 - 28/07/2017	Madrid, Spain

#	Dissemination activity and contribution	Date	Location
22	Participation in a Conference **Panel "Challenges and Directions in Modeling and Simulation of Computer Networks and Systems" at SIMULTECH 2017** Presentation in Panel discussion *Modeling and Emulation of Computer Networks* F. Davoli (CNIT)	26/07/2017	Madrid, Spain

4.2.2 Relevant Journals

In this section, we present a potential list of relevant journals in which the MATILDA's consortium members may submit the results of their research findings and possibly explore in furthering the non-interactive dissemination strategies in Table 6.

Table 6 – List of possible relevant journals

Journal name
IEEE JSAC Series on Network Softwarization & Enablers
IEEE Transactions on Mobile Computing
IEEE Transactions on Cloud Computing
IEEE Access
IEEE Network
IEEE Communications Magazine
Computer Networks
IEEE/ACM Transactions on Networking
IEEE Transactions on Network and Service Management

4.2.3 Relevant Conferences

Also in this section the list of the potential relevant conferences is presented. In the present list of conferences, some of the MATILDA's consortium members have already submitted their manuscripts while others are yet to explore from the listed conferences. Table 7 shows the potential list of the conferences where results generated from the different work packages from MATILDA can be openly presented interactively.

Table 7 – List of possible relevant conferences

Event name	Submission date	Publication date
IEEE NETSOFT	December 2017	June 2018
IEEE NFV-SDN	May 2018	November 2018
IEEE CSCN	April 2018	September 2018
IEEE Globecom	April 2018	December 2018
IEEE Infocom	July 2018	May 2019
IEEE ICC	October 2018	June 2019
IEEE NETSOFT	December 2018	June 2019
IEEE NFV-SDN	May 2019	November 2019
IEEE CSCN	April 2019	September 2019

Event name	Submission date	Publication date
IEEE Globecom	April 2019	December 2019
IEEE Infocom	July 2019	May 2020
IEEE ICC	October 2019	June 2020
IEEE NETSOFT	December 2019	June 2020
IEEE NFV-SDN	May 2020	November 2020
IEEE CSCN	April 2020	September 2020
IEEE Globecom	April 2020	December 2020
IEEE Infocom	July 2020	May 2021
IEEE ICC	October 2020	June 2021

4.2.4 Publications

So far within the scope of the MATILDA project, the consortium members have collectively published a total of 8 conferences, 2 journal papers and registered to 1 scientific workshop. The details of the list of scientific publications are provided in table 8 below.

Table 8 – Initial publication list

#	Authors	Publication
1	R. A. Addad, T. Taleb, M. Bagaa, D. L. C. Dutra, and H. Flinck	Publication in Conference proceedings / Workshop *"Towards A Fast Service Migration in 5G"* **IEEE Global Communications Conference (Globecom 2018)**, IEEE, 2018, Abu Dhabi, UAE
2	P. Gouvas, A. Zafeiropoulos, E. Fotopoulou, T. Xirofotos, R. Bruschi, F. Davoli, A. Bravalheri, D. Simeonidou	Publication in Conference proceedings / Workshop *"Separation of concerns among application and network services orchestration in a 5G ecosystem"* **EuCNC Workshop on "From Cloud ready to Cloud Native Transformation: What It Means and Why It Matters"**, IEEE, 2018, Ljubljana, Slovenia
3	R. Rapuzzi, M. Repetto, D. Tigano	Publication in Conference proceedings / Workshop *"Beyond Transmission Performance: 5G Opportunities for Developing e-Energy Applications"* **Ninth International Conference on Future Energy Systems (e-Energy '18)**, ACM, 402-404, 2018, Karlsruhe, Germany
4	R. Addad, D. Dutra, M. Bagaa, T. Taleb	Publication in Conference proceedings / Workshop *"Towards A Fast Service Migration in 5G"* **IEEE NetSoft**, IEEE, Jun. 2018, Montreal, Canada
5	L. Boero, R. Bruschi, F. Davoli, M. Marchese, F. Patrone	Article in Journal *"Satellite Networks in the 5G Ecosystem: Research Trends and Open Challenges"* **IEEE Network**, IEEE, 2018, Piscataway, USA

#	Authors	Publication
6	B. Rusti, H. Stefanescu, J. Ghenta, C. Patachia	Publication in Conference proceedings / Workshop *"Smart City as a 5G Ready Application"* **COMM2018: The 12th International Conference on Communications**, IEEE, 2018, Bucharest, Romania
7	M. Bagaa, T. Taleb, A. Laghrissi, A. Ksentini, H. Flinck	Article in Journal *"Coalitional Game for the Creation of Efficient Virtual Core Network Slices in 5G Mobile Systems"* **IEEE JSAC**, IEEE, 1-15, 2018, 1
8	M. Bagaa, T. Taleb, A. Laghrissi and A. Ksentini	Publication in Conference proceedings / Workshop *"Efficient Virtual Evolved Packet Core Deployment Across Multiple Cloud Domains"* **IEEE WCNC 2018**, IEEE, 1-6, Apr. 2018, Barcelona, Spain
9	C. Meani, P. Paglierani, A. Ropodi, N. Stasinopoulos, K. Tsagkaris, P. Demestichas	Publication in Conference proceedings / Workshop *"Enabling Smart Retail through 5G Services and Technologies"* **European Conference on Network and Communications (EuCNC18)**, IEEE, 2018, Ljubljana, Slovenia
10	R. Bolla, P. M. Comi, M. Repetto	Publication in Conference proceedings / Workshop *"A distributed cyber-security framework for heterogeneous environments"* **Second Italian Conference on Cyber Security (ITASEC18)**, Proceedings editors, 2018, Milan, Italy
11	E.-M. Oproiu, M. Iordache, C. Patachia, C. Costea, I. Marghescu	Publication in Conference proceedings / Workshop *"Development and Implementation of a Smart City Use Case in a 5G Mobile Network's"* **25th Telecommunication Forum (TELFOR 2017),** IEEE, 2017, Belgrade, Serbia

#	Authors	Publication
12	P. Gouvas, A. Zafeiropoulos, C. Vassilakis, E. Fotopoulou, G. Tsiolis, R. Bruschi, R. Bolla, F. Davoli	Publication in Conference proceedings / Workshop *"Design, Development and Orchestration of 5G-Ready Applications over Sliced Programmable Infrastructure"* **First International Workshop on Softwarized Infrastructures for 5G and Fog Computing (Soft5 2017), co-located with the 2017 29th International Teletraffic Congress (ITC 29)**, IEEE, 13-18, 2017, Genoa, Italy

4.3 MATILDA clustering activities

In this section, we will introduce and discuss the efforts so far put forward by the MATILDA consortium members towards achieving the clustering activities. These clustering activities are carried out in the form of organizing scientific and technical workshops alone or co-organizing them with other peer 5G PPP projects in order to further expand the reach and relevance of the MATILDA project. To this effect, a number of the MATILDA's consortium members have participated in and co-organized multiple workshops in which topics related to the key objectives of the MATILDA project were presented. The workshops were hosted within the framework of the EuCNC conference that took place in June 2018 in Ljubljana, Slovenia. In the conference [1], a number of workshops were organized under the umbrella of different work groups comprising different 5G PPP projects partners including MATILDA. MATILDA members co-organized and participated in a notable number of them. They are [2]:

1. Workshop 2: "**From cloud ready to cloud native transformation: What it means and Why it matters**", which was co-organized under the umbrella of the software network work group by partners from the MATILDA project and other 5G PPP project members participated.

2. Workshop 3: "**Multi-provider, multi-vendor, multi-player orchestration: from distributed cloud to edge and fog environments in 5G** "

3. Workshop 6: "**5th International Workshop on programmable networks: Demystifying software networks for Vertical Industries**", organized under the umbrella of the programmable networks work group.

4. Workshop 7: "**3rd Network Management and QoS for 5G Networks**", organized under the umbrella of the network management work group.

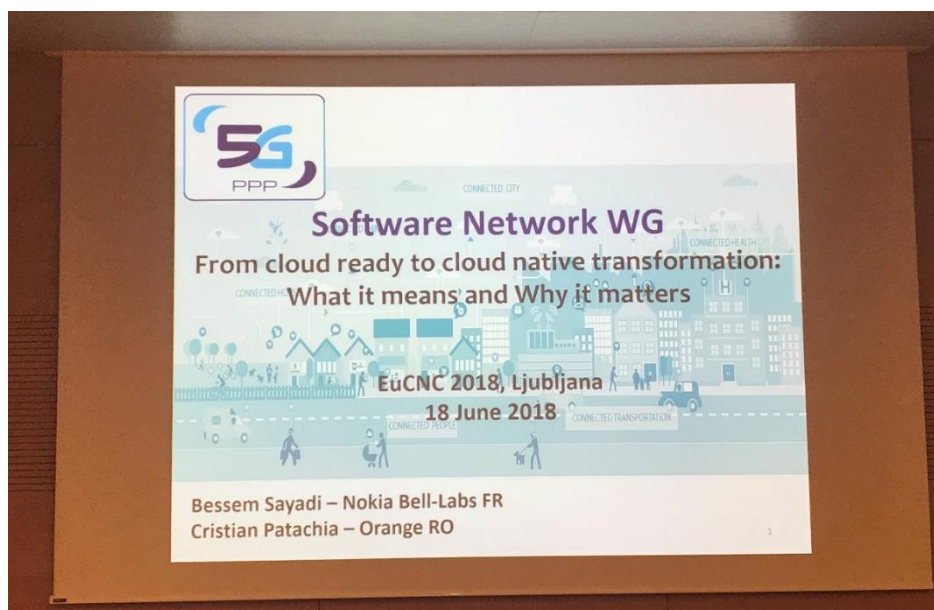Pictures in Figures 1, 2 and 3 were taken during the sessions of the respective workshops.

Figure 1. Presentation during Workshop 2: "From cloud ready to cloud native transformation: What it means and Why it matters".
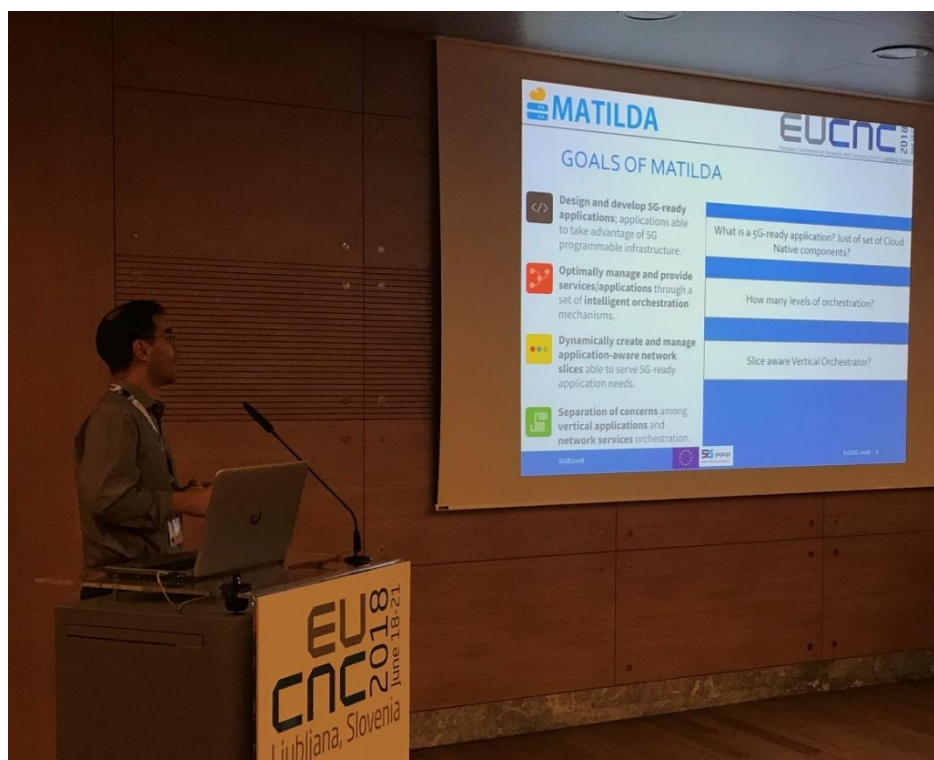
Figure 2. Presentation revealing and explaining the goals of MATILDA.
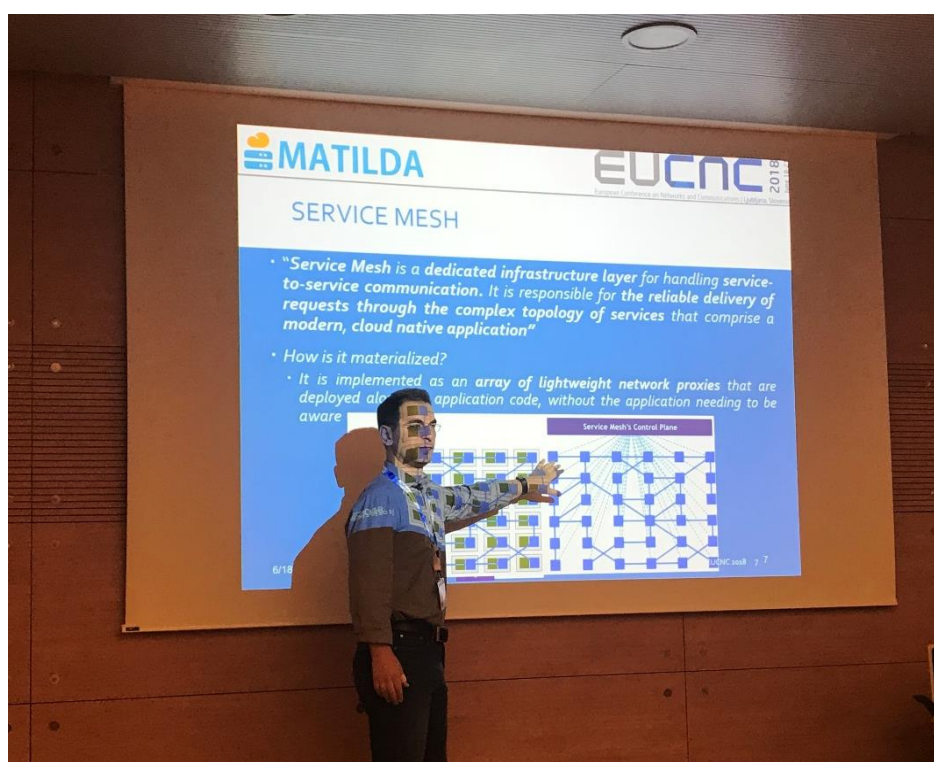

Figure 3. Presentation during Workshop 6: 5ᵗʰ International Workshop on programmable networks: Demystifying software networks for Vertical Industries.

Similarly, another MATILDA consortium member participated in the just concluded *Das Forschungszentrum Cyber Defence (CODE) Jahrestagung 2018* event that took place in Munich, Germany on 11-12 July 2018. During the CyberSecurity event, a MATILDA partner participated and presented a paper detailing the MATILDA project architecture amongst other activities in an SDN security workshop.

Last but not least, in the context of clustering activities, the work on the definition of the Network-aware Application Graph Metamodel that has been performed in the context of MATILDA WP1 has been presented and discussed extensively in the 5G-PICTURE (5G-PPP) project by COSMOTE during 5G-PICTURE plenary meetings - as the company participates in the relevant activities of both projects. This piece of work is planned to be taken into account by the 5G-PICTURE project and adopted to the extent it matches the scope of its work.

4.4 MATILDA standardisation activities

MATILDA plans to utilize the opportunity of having some of its consortium members working actively in Standards Development Organizations (SDOs) in propagating and standardizing technological developments that can be achieved through results from the different aspects of the project. The MATILDA's consortium is made up of partners with varieties of expertise in technology and scientific research with different level of presence in the standardization community. MATILDA will follow a comprehensive standardisation plan to better contribute to important international standardization bodies as well as to benefit of disseminating its results to the technology community at large through a range of dissemination channels.

4.5 Standardisation landscape

This section provides a brief overview of the main standardization initiatives that have been identified as relevant for the MATILDA project, as well as the already ongoing activities and initial future plans on how MATILDA is contributing to them. .

4.5.1 3GPP

3GPP is an international standardization body that is fundamentally responsible for developing standards for mobile networks. Basically, the main focus of the 3GPP is the development and maintenance of mobile network technology standards. Briefly, this implies that 3GPP primarily standardizes all the technologies used in providing mobile network connectivity and the services arising from them. It is also responsible for standardizing the technologies that provide Internet connectivity over mobile networks and their maintenance.

3GPP is a global standardization organisation that develops and produces standard documentations for mobile telecommunications technologies covering all aspects of the mobile networks including the part responsible for providing packet data networks as well as the part for voice over mobile networks. The standard documentation is published in the form of Technical Specifications (TSs) through which a complete mobile network system can be developed and deployed anywhere in the world. However, since the produced technical specifications are often made to be generic with the possibility to be deployable anywhere around the world, regional and European standardization organizations such as ETSI, often endorse the specifications before they are used in Europe.

The fifth working group (SA-WG5 or SA5) of the 3GPP TSG-SA, named Telecom Management is dealing [6] with the requirements, architecture and solutions for provisioning and management of the network elements and network services. Additionally, SA5 will define charging solutions in alignment with the related charging requirements developed by the relevant WGs, and will specify the architecture and protocols for charging of the network and its services. The most relevant 5G studies from the SA5 enabling the first phase in 3GPP Release 15 includes building up a new service-oriented management architecture, network slicing and all the necessary functionalities for management and charging for 5G networks. The current work within SA5 that will influence the next 3GPP Release 16 includes several other work items such as management of QoE measurement collection and new technologies for RESTful management protocols. MATILDA will liaise with SA5 through its partners in order to anticipate the evolution impact and the potential synergies.

Currently, MATILDA through its partners is involved in different relevant aspects towards the realization of the next SA5 tasks and specifications. Particularly, the main interests are in the following standardization efforts:

➢ Network resource models: MATILDA is actively involved in the development of the following technical specifications:
- TS 28.540 Management and orchestration of networks and network slicing; NR and NG-RAN Network Resource Model (NRM); Stage 1
- TS 28.541 Management and orchestration of networks and network slicing; NR and NG-RAN Network Resource Model (NRM); Stage 2 and stage 3
- TS 28.542 Management and orchestration of networks and network slicing; 5G Core Network (5GC) Network Resource Model (NRM); Stage 1
- TS 28.543 Management and orchestration of networks and network slicing; 5G Core Network (5GC) Network Resource Model (NRM); Stage 2 and stage 3
- TS TS 28.540 Management and orchestration of networks and network slicing; NR and NG-RAN Network Resource Model (NRM); Stage 1

➢ Concepts, use cases, requirement and architecture: MATILDA is similarly involved in the development of the following technical specifications:
- TS 28.530 Management and orchestration of networks and network slicing; Concepts, use cases and requirements
- TS 28.533 Management and orchestration of networks and network slicing; Management and orchestration architecture
- TS 32.159 TS template for stage 2 and stage 3 of management service definitions

➢ Provisioning: MATILDA is also actively participating in the development of the following technical specifications:
- TS 28.531 Management and orchestration of networks and network slicing; Provisioning; Stage 1
- TS 28.532 Management and orchestration of networks and network slicing; Provisioning; Stage 2 and stage 3

- ➢ Fault supervision: MATILDA is also active in the realization of the following technical specifications:
    - TS 28.545 Management and orchestration of networks and network slicing; Fault Supervision (FS); Stage 1
    - TS 28.546 Management and orchestration of networks and network slicing; Fault Supervision (FS); Stage 2 and stage 3
- ➢ Assurance data and Performance Management: MATILDA is also involved in the development of the following standard specifications:
    - TS 28.550 Management and orchestration of networks and network slicing; Performance Management (PM); Stage 1
    - TS 28.551 Management and orchestration of networks and network slicing; Performance Management (PM); Stage 2 and stage 3
    - TS 28.552 Management and orchestration of networks and network slicing; NR and NG-RAN performance measurements and assurance data
    - TS 28.553 Management and orchestration of networks and network slicing; 5G Core Network (5GC) performance measurements and assurance data
    - TS 28.554 Management and orchestration of networks and network slicing; 5G End to end Key Performance Indicators (KPI), performance measurements and assurance data

HTTP Rest solution set: MATILDA is also contributing to the technical specification for realizing a Rest solution set, TS 32.158 Design rules for Representational State Transfer (REST) Solution Sets (SS).

4.5.2 ETSI MEC AND NFV

The ETSI NFV group is the main standardization organization behind the development of requirements and technical specifications for the network functions virtualization (NFV) enabling technology. NFV comprises all enabling mechanisms about network functions softwarization and virtualization; hence, needs a strong standard development organization for developing its functional requirements as well as technical specifications especially for the information and communication technology industry. ETSI Industry Specification Group (ISG) is primarily designated to carry out the standardization functionalities, which include the development of standard architectural frameworks and technical specifications documentation to enable an open concept of NFV that incorporates interoperability between different virtualization technologies and creates a healthy commercial NFV ecosystem.

Along this line, the MATILDA project is using the ETSI NFV specifications as the basis of enabling its cloud-native development approach by utilizing and extending the existing metamodels from the ETSI NFV specifications. This could offer MATILDA the potential opportunity to contribute to the ETSI NFV about the cloud-native approach implementation applied to NFV orchestration..

4.5.3 ITU

The International Telecommunication Union (ITU) is one of the world's most renowned standardization development organization recognized and endorsed by the United Nations. It is a United Nations (UN) agency that serves UN needs in many aspects, particularly in the areas of Information and communications technologies. It is also one of the very few standard

developing bodies recognized by the world trade organization with a public private partnership coverage and presence in over 193 countries all around the world. The Telecommunication standardization sector of the ITU, ITU-T, is basically saddled with the responsibility of developing standardization documentations for telecommunication services through the use of specially created study groups. The different study groups study a particular technology and come up with standard documents (ITU-T Recommendations).

Some relevant activities have been carried out in the area of NFV energy efficiency support within both ETSI and ITU-T. In ETSI most of the actions are focused on the Environmental Engineering Technical Committee (EETC) where two main actions are supported, especially through the participation of CNIT. The first one is related to the evolution of the Green Abstraction Layer (GAL) ETSI Standard (ETSI ES 203 237) for supporting the new virtualized network capabilities, i.e. NFV environment, giving an effective and standard way (interfaces) to manage and possibly optimize the energy consumption. The second one is related to the support of a Huawei initiative for the L.mnNFV standard proposal entitled "Measurement method for energy efficiency of Network Functions Virtualization", which gives a framework for laboratory evaluation of the virtualized network functions.

For what concern the development of the new GAL, MATILDA supported and is supporting this action by driving the activities of the dedicated ETSI WI (Work Item), where Prof. Raffaele Bolla is the rapporteur. In particular, the recent activities stemmed from the editing and presentation of a second draft of the new GAL standard during the joint ETSI-ITU-T session at Genève, Switzerland, on May 14th-22nd, 2017. The presentation was done by Prof. Bolla, and during the session the discussion on the content revealed the relevant interest of Orange both in contributing and on the final potential result. In this context, a first direct collaboration between CNIT and Orange was initiated in order to increase the speed and the quality of the proposal finalization. After this physical meeting, two virtual meetings with partners from Orange started the active collaboration with them for improving the proposal content in both ITU and ETSI context. This activity was the basis for the editing and presentation of a third draft in Sophia Antipolis, France, on the 13th-22th of November 2017, during the joint ETSI EE and ITU-T SG5 general meeting, with a large enhancement developed during the central and final part of 2017. This document (and the corresponding presentation of Prof. Bolla) collected a relevant number of comments, which have been included in the final document for successive processing, but the proposal itself has been anyway approved.

Before the end of the 2017, two joint (ITU-ETSI) virtual meetings have taken place. During these meetings some extensions and re-organization of the document proposed by Orange have been revised and included in the main document. During the first part of 2018 a new version of the proposal has been realized and jointly presented by CNIT and Orange during the ETSI EE meeting EE#51 on the 28th of May -1st of June. The deep discussion ended with the temporary approval of the draft, in which a more extensive integration with the NFV standard and architecture has been introduced.

For what concerns the L.nmNFV, the document has been developed jointly with Huawei during 2017 up to the current final version, which has been approved in the ETSI EE meeting EE#51.

On the ITU-T side, the activity has developed in a synchronized way, due to an agreement between the Study Group 5 of ITU-T and the ETSI EE TC. All the general meetings of the two groups are jointly managed and (when this is possible and acceptable) the proposals are

presented at both sides. This is what is happening to both the new GAL proposal and L.mnNFV, which has a specific WI open also on the ITU side.

4.5.4 TMForum - ZOOM

TM Forum [12] is a global industry association with the focus of driving collaboration and collective problem-solving to maximize the business success of communication and digital service providers and their ecosystem of suppliers.

The TMF ZOOM (Zero-touch Orchestration, Operations and Management) project is in charge of developing best practices to support both the technology and business transformation brought about by the introduction of Network Function Virtualization (NFV) and Software Defined Networking (SDN), and one of the main challenges it has been addressing in the recent years is in relation to the new evolved OSS systems that are being required due to virtualization of networks and to 5G in general [13]. More recently, TMF ZOOM has launched an OSS toolkit [14] that MATILDA will be looking at, especially in relation to the TMF virtualization assets related to OSS, which could be aligned with the work that MATILDA plans to do concerning OSS/BSS functions for slice management and operations within WP4.

4.5.5 OSM

Open Source Mano [15] is an ETSI-hosted project that has developed an open source NFV Management and Orchestration (MANO) software stack aligned with ETSI NFV specification [16]. The baseline implementation took as references RIFT.ware [17], OpenMANO [18] and Juju [19] which were provided by RIFT.io, Telefonica and Canonical respectively. Its first release was in May 2016. The latest one (four) was released in June 2018 with incremental additions with respect to the three other releases.

The ATOS group working in the MATILDA project became participant of OSM in May'17; since then ATOS has been following the OSM work participating in the periodic teleconferences, hackfests and several physical meetings focused on technical discussions and plans for the evolvement of OSM.

OSM has been considered the selected NFV orchestration framework within MATILDA (see WP1 deliverables and WP4 for technical rationale), as a basis to build the overall MATILDA framework. For this purpose, first an important testing work of OSM towards the fulfilment of MATILDA requirements will be necessary, so later extensions or improvements can be proposed. Based on the current available version (release 4) [20], ATOS is planning to evaluate OSM and propose contributions to OSM in relation to two main aspects:

➢ Service multi-site orchestration

➢ Slicing and the corresponding service mapping integration

5 5G PPP Interaction

This section reports on the activities performed by the MATILDA partners in the context of the 5G PPP related activities. Those cover: interaction with the 5G IA (by means of the project coordinator and technical manager in the 5G PPP Steering and Technical Boards), participation in different 5G PPP Working Groups (WGs), contribution to the 5G PPP KPIs and collaboration with other 5G PPP projects.

5.1 5G PPP Working Groups

The MATILDA consortium members participate in a number of 5G PPP Working Groups carrying out the activities described below within each of them.

5.1.1 Software Networks

Orange Romania personnel involved in the MATILDA project is also co-chairing the Software Network WG. Initially this WG focused on demystifying the important role of SDN and NFV as a pillar in the 5G transformation. SDN and NFV could be seen as different expressions of an overall transformation trend, which is deeply impacting Telecom and IT industries. This trend is transforming several Industries, in using "softwarization" on general computing platforms to optimize operational processes and in bringing rapidly and efficiently new values in infrastructures. The expression "softwarization" is often referred to as a general paradigm shift in telecom architecture from "boxes" to "functions", and from "protocols" to "APIs". The softwarization is one of the features of a more powerful transformation named cloudification.

The cloud has disrupted the established order in many sectors. The reason is simple. With it, companies have been able to reduce the investment in their internal data centers in favor of unlimited computing resources, available on demand and billed for use. From now on, the competitiveness of a company depends directly on its capacity to quickly realize new ideas. Start-ups understand this well, so they rely on native cloud approaches to disrupt traditional sectors. It becomes obvious that innovations should be made cloud-native for being successful where the functions are designed for a cloud environment rather than packaged up and deployed onto it (virtualization).

Cloud-native is an approach to build and run applications that fully exploit the benefits of the cloud computing model. It includes things like services architectures, infrastructure as a code, automation, continuous integration/delivery pipelines, monitoring tools, etc.

The current focus of the SoftNet WG, where ORO is co-chairing, is to define what is cloud native in the telco world, where the real-time and the high availability (five-nines) are critical, and define the different design rules and requirements for the system to be qualified as cloud native. To answer this ambitious question, we rely on the technical topics addressed in the different 5G-PPP projects participating in this WG. The following thematic objectives are proposed:

➢ Define the cloud native: from IT to Telco

➢ Define its requirements starting from CCNF (Cloud Native Computing Foundation) proposal

➢ Identify the challenges to move from cloud-ready to cloud-native and prepare the impact toward the standard

➢ Identify how we can manage the scalability and the resiliency of the real-time telco applications in the cloud

➢ What is needed to make real-time Telco applications (e.g. RAN) cloud native?

➢ Share experiences and benchmarking of existing technical open source distributions and/or relevant tools and products

➢ Service programmability including life cycle management, deployability of services on-the-fly, execution of services anywhere in the infrastructure and their transparent migration to different domains

➢ Share experiences on security[1] mechanisms to Share experimental solutions based on SDN and NFV implementing infrastructure slicing, multi-tenancy and differential performance guarantees on shared infrastructures

➢ Large scale experimentation[2] with 5G Software Networking including verification for KPIs, service and networks metrics and non-functional requirements

The focus is not in the elaboration of additional research topics but in analysing efficient and mature solutions within the WG to become a true discussion forum on the relevant topics among projects to maximize the global impact of project outcomes. The solutions adopted for a technical problem in software networks among the different 5G PPP projects should not be contradictory, and ideally, would be compatible.

The 13 phase 2 projects that are participating in the WG are: 5G ESSENCE, 5G City, 5GMedia, 5G PHOS, 5G PICTURE, 5G TANGO, 5G TRANSFORMER, MATILDA, METROHAUL, NGPaaS, NRG5, SAT5G, SLICENET.

As part of its activities' list the 5G PPP Software Network WG hosted the workshop "*From cloud ready to cloud native transformation: What it means and Why it matters*" [3] during the EuCNC2018 conference in Ljubljana. The workshop was not only about 5G technologies and their implementation – with, for instance, Cloud-RAN, functional split and resource management techniques in 5G – but also about the whole service-based technology relevant to 5G in the cloud-native transformation. A service-based technology, by definition, offers hardware and/or software resources provided as a service over a network. UBITECH presentation "*Separation of concerns among application and network services orchestration in a 5G ecosystem*" demonstrated MATILDA innovations alignment with the workshop context. The presentation was also sustained by a comprehensive white paper with the same name, previously accepted by the SoftNet WG workshop Technical Committee. The paper co-authors are UBITECH, CNIT, DITEN and UoB.

Moreover, version 1.0 of the white paper "*From Webscale to Telco, the Cloud Native Journey*" [4] produced by the SoftNet WG was also presented during the workshop, including also contribution from various MATILDA members. The paper highlights what we must do in order to design a cloud-native 5G system and is currently available in the official 5G-PPP

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[1] Security is addressed in Network Management WG.
[2] An Action in 'experimentation' was established and this needs to be linked.

website[3]. More in detail, this white paper aims to provide first insights and trigger discussions about 5G cloud-native design. The shift from the cloud-ready to cloud-native, from VM to container, from MANO to Kubernetes, etc., is a must have to avoid the risk that 5G remains a niche connectivity gap-filler largely ignored by the cloud applications and services boom.

5.1.2 Network Management and QoS

The 5G PPP Software Network WG contributed also to the organization of the aforementioned workshop **"From cloud ready to cloud native transformation: What it means and Why it matters"** in the EuCNC2018[4].

MATILDA members are actively supporting 5G Network Management and QoS (NMQ) working group activities where joint telco meetings, workshops and promotional brochures are prepared. More concretely, UBITECH and ININ contributed in a preparation of a joint 5G PPP NMQ Working Group brochure with the title "TACKLING NETWORK MANAGEMENT CHALLENGES FOR VERTICAL SECTORS". In this brochure 5G PPP projects describe the network management challenges they are addressing in terms of their use cases within different vertical integration sectors. UBITECH and ININ have prepared a short description of the MATILDA working areas that are included in the final release. The NMQ brochure is available in printed and electronic version reachable at [7].

ININ and UBITECH also contributed to the preparation of a workshop for the EuCNC 2018 in June in Ljubljana, with the workshop tittle: "3rd Network Management and QoS for 5G Networks". The workshop proposal was submitted by the Network Management and QoS Work Group (WG) of the 5G PPP and was supported by all projects contributing to the NMQ WG. In particular SLICENET, MATILDA and SELFNET were leading the Workshop proposal. Other supporting projects include: 5G-City, 5G-Essense, IoRL, 5G-Media, One-5G, 5G-Phos, Sat-5G and 5G-Transformer. MATILDA members (UBITECH, ININ and DEMOKRITOS) are also contributing to the Workshop Technical Programme Committee (TPC). The link to the Workshop announcement is available at [8].

5.1.3 SME

Two MATILDA SME partners (ININ and SUITE5) have contributed and still contributing to various 5G PPP SME initiatives in different ways, such as:

➢ Participation in the 5G PPP SME teleconferences

➢ Explanation during the telcos about MATILDA and the role of the company, as well as the anticipated impact for them

➢ Contribution to the new SME 5G brochure titled "SME Expertise and Skills in the 5G Domain"

MATILDA members are also actively supporting SME working groups' activities with the support of joint telco meetings and SME promotional materials and events. In particular ININ contributed to the preparation of an SME WG booth at the EuCNC 2018 event in Ljubljana, called "5G PPP SMEs – SMEs Expertise and Innovation in the 5G Domain", with the aim to

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[3] https://5g-ppp.eu/wp-content/uploads/2018/07/5GPPP-Software-Network-WG-White-Paper-July-2018.pdf

[4] https://www.eucnc.eu/

promote SME activities, expertise and latest achievements in 5G area. European SMEs provide great added value in developing innovative concepts and solutions that are key to boost the establishment of 5G technologies and their adoption across several vertical industries. From the MATILDA consortium INTERNET INSTITUTE LTD and WINGS-ICT Solutions presented their latest's 5G achievements. More information about the SME exhibition and activities at the EuCNC 2018 is available at [9].

During the collaboration in the SME WG a new edition of SME brochure was also prepared. The SME brochure aims at showing the expertise and skills from selected European SMEs in 5G and related domains. It is focused on the expertise that could be useful in various industry vertical sectors. From the MATILDA project INCELLIGENT, INTERNET INSTITUTE LTD, SUITE5 DATA INTELLIGENCE SOLUTIONS LIMITED, UBITECH and WINGS ICT SOLUTIONS contributed with their company profiles and activities and expertise in the 5G domain. The brochure is available in printed and electronic version and is downloadable from the 5G PPP website in [10].

The SME brochure is complemented with a 5G PPP web page providing details on SME expertise in relation with 5G PPP Phase 3 actions, entitled "Find the SME you need!", that is available at [11].

5.1.4 Trials

ATOS is participating regularly in theTrials WG teleconferences.. On behalf of MATILDA, ATOS provided a contribution explaining the verticals pilots and verticals partners within MATILDA, and their mapping into the different types of 5G services (URLLC, eMMB, mMTC). This was included in the "5G Pan-European Trials Roadmap (version 3.0).

5.1.5 Architecture

MATILDA is also part of the 5G PPP Architecture working group. This WG was launched during the Phase 1 of the 5G PPP Initiative with the result of publishing two White Papers in June 2016 and January 2018 respectively. The work is now continuing with the Phase 2 projects with special focus on understanding the requirements from vertical industries involved in the Phase 2 projects and then drive the required enhancements of the 5G Architecture able to meet them. ININ and UBITECH, as the MATILDA representatives, are actively supporting WG activities where they collaborated in bi-weekly telcos (from April to June 2018) where architectural aspects of 5G systems are discussed, along with synchronies between various 5G PPP phase 2 projects. ININ and UBITECH also contributed to a preparation of a special session which was held at the EuCNC 2018 in Ljubljana, titled "5G Architecture towards Verticals". They actively collaborated at the session with the prepared short pitches targeted to the views and 5G requirements of the verticals. The results of the session and Working Group activities will contribute to the Rel.16 and 17 in 3GPP. More information about the special session held at the EuCNC is available at [21].

5.1.6 Communications

ATOS and ERICSSON have participated in the different coordination teleconferences that the 5G PPP Communications group has organized in order to synchronize in relation to promotional, dissemination and stakeholders' engagement activities. The following main actions have been performed:

- ➢ Presentation of overview of MATILDA in relation to communication and dissemination activities

- ➢ Involvement of MATILDA in the 5G PPP booth at the Mobile World Congress, being in charge of sending the corresponding material, e.g. leaflets and video.

- ➢ Providing the information about a MATILDA demo to be submitted as part of the 5G PPP booth at the ICT'2018.

5.2 Collaboration with other 5G PPP projects

MATILDA puts emphasis on the collaboration with other 5G PPP projects in different contexts, which ranges from collaboration regarding specific technologies to potential collaboration regarding exchange of information for implementation and experimentation with different applications / use cases. During the first year of the project, several interactions with 5G PPP projects have been initiated. Additional information about the two more relevant ones at this stage follows in the subsections below.

5.2.1 MATILDA synergy with 5GTANGO

Researchers in MATILDA focusing on graph recommendations towards the application developers have been obtaining information regarding the use cases / applications of 5GTANGO as additional data / application graphs that can be utilized by the proposed recommendation engine (based on machine learning tools). Moreover, the way monitoring data are collected and aggregated in 5GTANGO (through Prometheus) has been analysed and compared with the MATILDA approach with an emphasis on how these can be analysed in runtime in order to trigger infrastructure adaptations. Furthermore, as explained in the clustering activities, several workshops have been co-organized between MATILDA and 5GTANGO.

5.2.2 MATILDA synergy with SliceNet

ORO is one of the use case leaders in the SliceNet [5] 5G PPP project. In both projects, MATILDA and SliceNet, ORO is leading the development of the Smart City vertical focusing on Smart Lighting component. SliceNet is seeking to define a 5G network slicing architecture and to expose the services to the consumers represented by the public administration team.

In general, a Smart City services solution consists in metering (gas, energy, water), remote monitoring of city infrastructure (pollution, temperature, humidity, noise), real-time traffic information and control, city or building lights management and public safety alerts for improved emergency response times, besides aggregation of these services with very different characteristics (which have to be combined in a common communication and interworking framework).

MATILDA aims to define a holistic, innovative framework for the design, development, life-cycle-management and orchestration of 5G-ready apps and the related network services based on a programmable infrastructure, the 5G-ready applications and application components, VNFs and network services available through a 5G marketplace. SliceNet defines an E2E slicing-friendly 5G network architecture, vertical-oriented, with cognitive network management, control and orchestration, with an innovative one-stop-solution to meet the service requirements, enabling the verticals to Plug & Play (P&P) their use cases, as an integrated FCAPS framework, which provides QoS and QoE service assurance, analytics,

AI/ML and enhanced control. SliceNet also defines the roles and responsibilities in the 5G environment: the Digital Service Customer (DSC), the Digital Service Provider (DSP) and the Network Service Provider (NSP). The DSC is in charge of consuming the offered digital services, the DSP manages and expose digital services and also is monitoring and orchestrating the service, while the NSP exposes the network infrastructure services and maintains the relation with the DSP, including monitoring, inventory, orchestration and analytics capabilities.

As leader of the Smart City Smart Lighting use case, explored in both SliceNet and MATILDA project, Orange Romania plays the role of the DSP and the NSP, exposing services to the end consumer, the digital customer, based on the development activities done in the two 5G PPP research projects. The infrastructure is based on several deployed servers, managed and orchestrated through the OpenStack framework, that host a series of scalable VNFs and applications used for the Smart Lighting use case (vEPC, OAI-RAN, IoT Apps, lighting lamps) and 5G-ready application.

We identified a constructive collaboration opportunity between the two projects that can be wisely managed through ORO, as an active member in both consortiums. The communication service is based on a sliced network deployed using the Slice Intent Model described in MATILDA and the service instantiation is expected to be done from the cloud 5G Market Place, as the integration point with the One-Stop-API from SliceNet proposal, currently in design phase. All functions and integration activities will be applied to ORO testbed components. In addition we expect to extend the Smart City use case capabilities with specific components developed in SliceNet, such as P&P function, QoE optimizer, QoS CP (Control Plane) control, monitoring metrics, sensing and actuation through cognition.

5.3 Contribution to 5G PPP KPIs

The 5G PPP programme has identified some prominent 5G KPIs, e.g. business, societal and performance KPIs [22]. This section describes the main 5G PPP KPIs that MATILDA is contributing and how:

- *P2: Reducing the average service creation time cycle from 90 hours to 90 minutes*: the MATILDA development and profiling environment is expected to be an important catalyst in the service creation time.

- *P4: Creating a secure, reliable and dependable Internet with a "zero perceived" downtime for services provision:* MATILDA intelligent orchestration mechanisms, including the runtime policies enforcement and the machine learning mechanisms adopted will be improving the downtime service perceived by the users, due to the increase of automation in the orchestration.

- *S3: European availability of a competitive industrial offer for 5G systems and technologies*: MATILDA plans to release most of its components as open source code, contributing in this way to increase availability of 5G systems and technologies in Europe.

6 Conclusions

This deliverable has presented different scientific and industrial dissemination activities carried out since the beginning of the project until M15 of the project. The deliverable provides main guidelines and visions adopted by the project. Different targeted groups have been also defined within this document, as well as a detailed schedule for the future different scientific and industrial dissemination activities.

Also, this deliverable presents the main standardization bodies that MATILDA is monitoring in order to be aligned whenever possible, describing the initial potential expected MATILDA results that could be pushed to them. The more relevant ones are 3GPP, ETSI, ITU-T and, considering standards de facto, open source solutions as OSM, which will be the primary orchestration framework in MATILDA. Finally, the interaction with the 5G PPP, including participation in working groups and collaboration with other 5GPPP projects, is reported. .

The dissemination plan uses an iterative process in order to improve the effectiveness of communication activities during the project timespan. In fact, the dissemination and 5G PPP activities and strategies will be updated on the successive versions of this deliverable taking also into account the dissemination activities effectively carried out during the periods covered.

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