Deliverable D7.8

Innovation and exploitation activities

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LIST OF ACRONYMS

Acronym	Meaning
BKM	Best Known Methods
ID	Invention Disclosure
IPR	Intellectual Property Right
KPI	Key Performance Indicator
QoE	Quality of Experience
QoS	Quality of Service
WG	Working Group

Executive Summary

This deliverable, D7.8 "Innovation and exploitation activities", reports the project-wide actions in two important aspects of the work done in the first eight months of the project, i.e., exploitation actions and innovation program.

The concluded activities, their charter and the obtained results are described, as well as a plan for the next steps is provided.

A clear distinction is made between what are the activities performed in the first eight months of the project and what is the plan of action for the next quarters.

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1. INTRODUCTION

This deliverable reports the activities of the first eight months of the 5GENESIS project lifetime regarding two important project-wide activities, i.e., exploitation actions and the consortium wide innovation management program.

The content of the deliverable reflects the mentioned two main pillars and is structured as follows.

Section 2 introduces the innovation management program, its scope, and charter. The activities concluded during the first eight months of the project are discussed and a plan of action for the next quarters is provided.

Section 3 reports on some key aspects related to the exploitation activities in the project. Specifically, the focus is on updating the exploitation plan of each partner, on briefly reporting how the project interacted with the ecosystem and on describing some key assets that the consortium think will be the main added value of the project, once it will be concluded. Finally, a first important exploitation activity, i.e. the impact and the engagement with regulatory bodies, is presented.

At the end, Section 4 concludes the deliverable and provides some main outcome of the project in the innovation management and exploitation areas.

2. INNOVATION MANAGEMENT PROGRAM

This chapter reports on the activities performed in the first eight months of the 5GENESIS project lifetime regarding the innovation management program, as well as proposing a plan of actions for the months to come. The chapter is composed of three main sections:

- *Section 2.1* (*Rationale and scope of the innovation program*) clarifies what is meant with innovation management program, what are its targets, means of implementation, intended audience, and expected outcome;
- *Section 2.2* (*Platform-focused activities*) elaborates on the activities of the innovation management program that suit the needs of a whole Platform (i.e., each one of the five Platforms that are part of the 5GENESIS project). Both the work done so far and the plan of future actions are elaborated;
- *Section 2.3* (*Partner-focused activities*) finally describes partner-specific innovation program activities, i.e., activities that fulfil the requests of filling a lack of knowledge in innovation management methodologies or tools, of nurturing a particular interest area of a specific 5GENESIS consortium partner. Both the work done so far and the plan of future actions are described.

2.1. Rationale and scope of the innovation management program

According to the description of action of the 5GENESIS project, one of the set objectives of Work Package 7 (*Innovation, Standardization, and Dissemination*) is:

> "Run among the consortium partners an ***innovation [management] program*** focusing on enhancing the consortium members' business acumen and capabilities of handling innovation in the most effective way."

Specifically, Task 7.5 (*Innovation management and Exploitation*), led by Intel, is in charge of steering and running the 5GENESIS innovation management program. The focus of Task 7.5 is mainly twofold:

a) Run throughout the project lifetime an ***innovation management program***, made of a set of actions that will enhance the business acumen of the consortium members and will foster, in the daily activities of the project, the adoption of the latest and most effective project management techniques (e.g., Lean[1] or Agile[2] methods). For instance, courses or focused workshops will be run on demand by trained personnel from Intel on Best Known Method (BKM), i.e., state-of-the-art and well-documented techniques and procedures on how to best execute a given process. In the context of a collaborative research project as 5GENESIS, a BKM can, for instance, be very effective in helping a team, made of different partners, to quickly remove 'unknowns' in the definition of a new common solution to a research problem. Another example of the benefit of the

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[1] For more info on the Lean concept: https://www.lean.org/balle/DisplayObject.cfm?o=4741.
[2] For more info on the Agile concept and more in general to different methodologies that are covered by the ‚agile' term: https://kanbanize.com/blog/right-agile-methodology-for-your-project/.

application of BKMs could be to speed up, using the most recent knowledge management methods, decision processes on which direction to take, among a set of possible ones that can lead to a solution to the posed research problem statement.

b) *Maximize the business potential and the commercial exploitation of the project results*, thanks to the learnt innovation management methods, so to best monetize the created innovations and the obtained project results. That is obtained, in parallel to the more traditional exploitation activities, for instance by running on demand workshops and internal courses on how to move ideas into real patents, how to bring novel ideas into products and services.

All the mentioned above innovation management activities will then be linked to the exploitation part of the project work, as discussed in Section 3 of this deliverable.

2.1.1. What is meant with 'innovation management program'?

The innovation management program, as foreseen by Intel, is a set of activities that aim at enhancing specific non-technical aspects of the expertise of the 5GENESIS consortium partners, that participate to the program. The person in charge of the innovation program for the whole 5GENESIS consortium is Dr. Valerio Frascolla, who, in his role of Director of research and innovation at Intel Munich, has a set of different expertise, as briefly described below, that make him a good candidate to dynamically adjust the program to the need of the participants. Dr. Frascolla has been trained in different aspects of tools, techniques and BKM to foster innovation within and outside the company he works for. For example, he obtained the CSM (Certified Scrum Master) and the CSPO (Certified Scrum Product Owner) certifications for agile project management techniques using SCRUM[3], which can be defined as "*a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value*" [2]. He ran a so called 'innovation management program' within a central division clustering different system engineering teams of Intel, with the scope of fostering, nurturing, and working on, through brainstorming sessions, new ideas, so to make them become real in-feeds into future products. He has also been trained within the Intel Learning program in communication strategies, in effective communications, in netiquettes, and serves as an internal mentor and coach for his colleagues. He had been working as well for external projects as mentor (e.g., for several teams within the activities of the WEARSustain EU-funded project [3]) and technical coach for the Fashion Fusion initiative [4], an open innovation hub led by Deutsche Telekom.

The innovation management program envisioned for the 5GENESIS project aims mainly at enhancing methodologies and soft skills of the project partners, in different areas, according to the partners need and depending on the specific interest of each consortium partner who asks for taking part to the innovation program. Different aspects can be worked on, from techniques to improve project management skills, to novel methodologies for project management (also known under the name of Agile and Lean techniques, or SCRUM), from patents protection and IPR generation to improved presentation and communication skills, from team-management to multi-cultural and geo-dispersed team management skills.

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[3] For more info on what SCRUM is: https://www.scrum.org/resources/what-is-scrum.

All the above-mentioned enhancements of the soft skills of a researcher or a developer taking part to the innovation management program in the project will indeed help the universities, the research centers, the SMEs and the industrial partners to deliver in faster way better results and products, so to increase the market potential and impact of all the consortium partners.

Finally, it is worth mentioning that the innovation management program helps in creating awareness of the fact that actually people 'don't' know what they do not know', to report a famous motto. That means that people are made aware of the unknowns they have in their area of expertise and can therefore better cope with the uncertainty of developing a new technology, a prototype, or a new algorithm. Luckily enough research-related activities involve a certain risk of failure (otherwise they won't be doing the right thing, i.e. pushing ahead the state-of-the-art in a consistent matter) and how to best cope with the failure is something that one can learn. This last point is probably the most important added value of the innovation management program.

The preferred means to instruct the interested consortium partners to the selected expertise within the innovation management program is the ***workshop***, which is offered in different lengths and content, as better described in the next section.

2.1.2. The workshop as the main means to discuss, exchange and learn about innovation management

Experience has shown that a workshop is the most suitable format to contain a diverse palette of knowledge base and to share it with a team of interested people. Such workshops can last a minimum of half a day to a maximum of two consecutive days.

The workshops are held by the Innovation Manager of the 5GENESIS consortium and are shaped according to the needs of the participating partners. Workshops are run in the most dynamical way, so to best accommodate the needs of the participants, as highlighted by a set of preliminary activities at the beginning of each workshop. Such activities have the scope of understanding the requests of the participants and of creating a common ground on what are the expectation regarding the workshop outcome, what will be considered and what will be taken out. All decisions are taken with the most open attitude and fostering the broadest possible consent, so to have right at the beginning people willing to proactively participate to the workshop-specific set program.

Each workshop has some rules, as better explained below, and it sets at the beginning some scope, or a set of scopes, that are to be achieved at the end of the workshop, and can be continued also afterwards, in self-organizing manner by the participants, or in a second round of the workshop, if requested by the participants, held sometime after the first one.

2.1.3. Workshops rules

Workshops are run as a set of face-to-face activities (no participation from remote is possible) that follow specific rules. For instance:

- The usage of mobile phones by the workshop participants is not allowed. Only in case of very urgent need a person can leave the room where the workshop is held and take or make a call;
- The usage of laptop or PCs is not allowed;
- Workshop attendees are supposed to participate to the workshop from the beginning till the end;
- The workshop assumes a pro-active participation of all the attendees but is organized, steered and run by the Innovation Manager, an Intel trained person in agile methodologies, mentor and coach with experience in running internal innovation workshops for Intel.

2.2. Platform-focused activities

Each one of the five 5GENESIS Platforms has its own specific set-up, equipment, focus, and subset of consortium partners that collaborate on its development. Therefore, each Platform has its own specific needs and characteristics. For that reason, the innovation management program, even though based on the same principles and run following a common pattern, is run in slightly different ways, depending on the needs and the requests of the specific Platform in focus.

The innovation management program is driven by the 5GENESIS Innovation Manager. It first starts with implementing a come-together event in the form of a workshop, which can last, depending on the case, between half a day and two days. These workshops are held at the premises of one of the partners belonging to that specific Platform in focus. Each Platform will run at least one such workshop, at each one of the five locations where Platforms are running (i.e., Limassol, Guildford, Athens, Malaga, and Berlin). After the first round or workshops will be completed, the need for a second round will be assessed according to the outcome of the first one and based on the time availability of the participating partners.

The next section reports on the Platform-focused activities performed during the reporting period of the first eight months of the project lifetime.

2.2.1. Report of the activities

2.2.1.1. Workshop @Fraunhofer premises in Berlin

At the beginning of August 2018 the first workshop was held at the Fraunhofer premises in Berlin.

The workshop participants were all the partners working in the Berlin Platform who are based in Berlin, i.e.:

- Fraunhofer;
- IHP;
- Humboldt Universität, as subcontractor of IHP.

In total ten people attended the workshop.

The workshop started with a presentation of each participant (see *Intro game* further below), who were asked to briefly (2 minutes sharp) introduce themselves. That activity has the scope of getting to know one another (as especially at the beginning of the project partners are most probably not so familiar with one another).

The presentation part is also a means to discuss communication techniques, do's and don'ts of presentation, and to make each one of the participants aware of the difference between what they think they have communicated and what actually they managed to communicate (feedback to each presenter was provided at the end of the presentations).

Figure 1. The room where the Workshop was held in Berlin

Figure 2. Half of the Workshop participants

Figure 3. A pause during the workshop. In the white board the result of one of the brainstorming sessions

The intended main scope of the workshop, as communicated at the beginning, was to remove as many unknowns around the Berlin Platform as possible, and making aware the testbed contributing partners of the problems they were going to face when starting to work together.

After the introductory presentation part, the workshop continued with a brainstorming session elaborating on what were the most important open topics related to the Berlin Platform. Following the creation of a set of topics identified by each attendee, a poll followed and a ranked list of topics to be addressed was created. Along the workshop the attendees discussed in open and constructive way in a series of always more refined discussion what the main issues of the Platform were.

In between, two games were run among all participants. Games are important in such workshop as they de-stress, create the sense of the team, relax, and finally focus on highlighting a selected aspect that the workshop organizer want to discuss.

The games run at the workshop were the following.

0. Intro game

Time:

- 125 seconds of presentation of the speaker (2 minutes sharp + 5 second buffer) x number of participants;
- 1 sum-up minute at the end;
- 3 minutes to stick a note with the name of the preferred presenter and a sentence on why;
- 5 minutes discussion at the end;

Procedure:

- Each participant has to introduce him/herself to all the others in sharp 2 minutes. The intro cannot be done only verbally, it shall include some graphical element (a slide, writing on a white board, etc. …);
- No comments during presentations;
- Ask members to vote the best presentation (no ranking, just the preferred one, adding one sentence of justification why it has been selected as the preferred one);
- Each member has to write the name of the presenter of the preferred presentation + a sentence of justification and stick it to the white board.

Discussion:

Show a presentation that is structurally wrong and which contains lots of common mistakes from a proficient communication strategy point of view, and engage with the team a discussion to spot what are the main errors:

- Too many things displayed;
- Why adding a photo to your presentation if you are there physically and people can see you?;
- Using statements that might appear wit is dangerous, as each person has his/her own sense of humor;
- Which kind of message does the presentation deliver? (confusion, lack of focus, lack of important info, etc …);

---> Scope is to understand the following:

- Consider constraints whatever you do;
- Focus on the most important thing first;
- Do not assume that your audience take the same assumptions you take when presenting on the items he/she presented.

Even though some of the scopes mentioned above might seem obvious or trivial, often people do not actually take them into consideration at all, when asked to perform such presentations.

1. Game 1 - 'how high can you get?'

Time:

- 10 min per round (2 rounds are possible).

Scope:

- Build the highest possible tower that is capable of standing by its own for 10 seconds.

Available Items:

- 2 journal paper pages;
- 30 cm sticky band;
- Scissor.

Alternatives:

- Team members cannot talk among themselves;
- Sticking to the ceiling is not allowed.

---> *Scope is to understand the following:*

- Discuss how people interact among themselves in a situation of stress;
- Highlight winning strategies;
- Understand what went wrong and elaborate why.

The main learning out of this game is the after-the-fact analysis of the root cause (or causes) of failure. Learnings about what went wrong and why it went so are always very precious, however difficult to obtain in a real working environment. The game allows people to think about the added value of running such 'retrospectives', so to be more willing to adopt such techniques in their daily work. Direct experience and internal studies show that team results – measured through some Key Performance Indicators (KPI) like error-free lines of code, speed of execution and conflict mitigation – improve in a consistent way (around 15%)[4] when deploying such awareness and open-discussions techniques.

2. Game 2 - 'Lightning Ball'

Time:

- 5 min.

Scope:

- A tennis ball is to be brought in the shortest possible time from point A to point B within a room (e.g. corner-to-corner).

Available Item:

- A tennis ball.

Game with Rules:

- Each team member has to touch the ball at least once;
- The ball cannot be thrown towards Point B, it has to be put in a stable state on Point B.

Alternatives:

- The game can be repeated two times (phase 1 and Phase 2), so to include learnings;
- Team members cannot talk among themselves;
- The ball cannot be thrown at all, not even among team members.

---> *Scope is to understand the following:*

- Discuss on the role rules play;

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[4] According to an Intel internal statistic, based on running a similar innovation management program along three years in different internal divisions and teams.

- Analyze participants' reactions to rules and to potential immediate change of them;
- Discuss what is taken as assumption vs. what is clearly spelled out.

In the daily work of a developer or of a scientist, following internal procedures, e.g. those needed to ensure a certain quality of software, or to report on a company-defined innovation management specific procedure, are always perceived as an 'unnecessary burden', 'something one can avoid doing', without actually compromising the expected results'. The game aims at providing first-hand evidence that such assumptions are mostly wrong. Following set procedure as a matter of fact improve the quality and the speed of execution in average by 12%[5].

Reflections for all the games

a. What was not successful?
b. How did you like it?
c. Have you learnt anything from this game?
d. How does the game relate to the issues you face in the project?

Following the introductory part and in between the above mentioned games, the workshop focused on refining what one can call a ‚Normative space' part. The scope of this part is to brainstorm all together (or split in sub-groups, depending on how many participants there are) on specific aspects that are seen as issues or problems to be solved. That is done by asking the participants to select some questions that they already have and that they would like to find an educated answer, e.g.:

- What is the biggest innovation you see in the Testbed?
- What is the biggest unknown to you?
- What is the biggest risk?
- What is not clear to you?
- …

Participants have to provide written and short answers in cards (just one or more of them, it's up to each one to decide) that are then stuck to a wall. All cards can be read by all participants and then a sub-set of them is selected as the most interested ones to discuss and refine. In this way, two or three problems, as perceived as the main problems by the team, are chosen and are refined in a series of similar round, each one digging into more details of the problem statement, each one providing a more refined answer to the posed (set of) questions.

Takeaway of the Berlin Workshop

The main outcomes of the Berlin workshop, according to a survey done at the end of the workshop, were:

- High fun factor;

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[5] According to an Intel internal statistic, based on running a similar innovation management program along three years in different internal divisions and teams.

- Lots of learnings on different aspects of the intra-people communication and interaction;
- Better understanding of the issues to be faced in the Berlin Platform in the next months;
- Creation of first solution to addressed the most important problems;
- Backlog of issues that was not possible to tackle due to lack of time.

2.2.1.2. Workshop @Guildford for the Surrey Platform

The workshop at Guildford for the Surrey Platform was supposed to take place on Monday the 12th of December 2018 in the afternoon, a half day workshop like in Berlin.

Due to a misunderstanding with another commitment taken in the morning of Monday in London, as better explained in Section 3, it was not possible anymore to run the workshop as planned, due to the lack of presence of the Innovation Manager an of the Surrey Platform responsible person, both supposedly attending in London a meeting with the regulatory authority on behalf of the project.

The workshop was cancelled on short notice and will be re-scheduled in the next quarters.

2.2.2. Plan for next quarters

Following the first successful workshop in Berlin, and based on the unfortunate need for postponing the Workshop in Guildford, a re-plan of the workshops in 2019 was deemed necessary. The new plan is as follows:

- Malaga Platform planned in March 2019;
- Limassol Platform planned in October 2019;
- Surrey Platform planned in November 2019;
- Athens Platform plans to organize the workshop in the framework of a dissemination event for 5G new market, together with the startup community in Athens. The event is scheduled for early 2020.

2.3. Partner-focused activities

In addition to the Platform-specific activities, the innovation management program also aims at improving the consortium partners' abilities in the areas:

- From idea to patent - Intellectual Property Right (IPR), Invention Disclosure (ID);
- From idea to product - best practices and BKM from an industrial point of view on productization;
- Communication and presentation strategy;
- Innovation management;

- Ecosystem engagement;

- Lean and Agile project management methodologies. For example, regarding SCRUM, among other topics, it is possible to elaborate and deep-dive on the following points:
  - Agile, Lean, and Scum approach - basics;
  - Roles (team member, product owner, etc.);
  - How can a team self-organize itself at best;
  - The reason for a story-telling - User Stories;
  - Product Backlog;
  - estimating and planning activities;
  - what are sprints and how to make use of them;
  - the meeting: your daily SCRUM;
  - Reviews and retrospectives;

- Business cases and techno-economic analysis;

- Team building activities and focus on removing technical unknowns (Games, World Cafe', …);

- On-demand, workshops can be held at partners' premises;

- Partner-specific activities tailored on selected needs;

- Option to invite professionals, external to the project, for dedicated topics.

All of the above will be achieved organizing focused workshops on the specific subset of the mentioned areas of interest. Such workshop will be held at partners' premises and might also be extended to relevant local ecosystem of the partner, so to strengthen its impact on the local scene and at the international level as well.

2.3.1. Report of the activities and plan for the next quarters

In the first eight months of the project the Innovation Manager mainly talked to the project partners to get to know them, their working practices on innovation matters, and to understand what the most appropriate means of working together with each one of them on the partner-specific innovation management program would be.

As a matter of fact, it turned out that all partners would be interested to take part to the innovation management program, and therefore a priority decision was to be made, regarding with whom to start first.

Considering that the bigger research centers and the industrial partners have a higher probability to have their own internal innovation-related activities and courses, mainly not in all the set of topic areas listed above, but at least in a sub-set of them (mainly related to patents, ID, and IPR issues), those partners were left out of the set of the frontrunner participants to the partner-specific innovation program. That decision also stemmed from the consideration that it would be simply too much time consuming to run more than 25 workshops in 25 different locations in just few months.

Therefore, it was considered a priority to address first the SMEs, the universities and the smaller research centers, which actually have less opportunities, due mainly to budget constraints, to have personnel trained in innovation-related matters.

Following that approach the Innovation Manager illustrated the scope and methods of the innovation management program to the following partners, all of which expressed a strong interest for running a focused workshop at their premises:

- ATHONET SRL;

- AVANTI HYLAS 2 CYPRUS LIMITED;

- FON TECHNOLOGY SL;

- INSTITUTO DE TELECOMUNICACOES;

- KARLSTADS UNIVERSITET;

- NEMERGENT SOLUTIONS S.L.;

- PRIMETEL PLC;

- SIMULA RESEARCH LABORATORY AS.

In the next months of the project lifetime also other consortium partners will have the opportunity to take part to the partner-specific innovation management program, and advancement and lesson learnt on the program will be described in the forthcoming deliverables D7.9 (due in month 18) and D 7.10 (due in month 36).

OF course, the requests have also to take into consideration the time availability of the Innovation manager and the related travel budget needed for all those workshops.

The content of each workshop and its focus will be defined in the next quarters.

3. EXPLOITATION ACTIVITIES

3.1. Rationale and scope

In this section each consortium partner reports the changes, the amendments, or the enhancements to the initial exploitation plans compared to what was originally written in the project proposal.

It is worth mentioning that further updates, related to the evolution of the work done in the project by each partner, will be reported in the Deliverables 7.9 and 7.10, which are due respectively in month 18 and month 36. That stems from the fact that it's very important to assess whether the original plans for exploitation are up to the changed condition of the market, are still aligned to the internal latest roadmap of each single partners, to the newer specifications issued by standards bodies, to the latest decision taken by the country-specific regulatory bodies, and finally of course to the latest outcome of the project work, taking into consideration the main technical results.

3.2. Partner-specific exploitation plans

Below are reported the partner-specific exploitation plans, updated to the latest status – when the case - following the first eight months of the work done in the project.

NCSRD

NCSRD sees the participation in 5GENESIS as a clear step towards the establishment of a high research and scientific status in the area of future network architectures and management systems. 5GENESIS will be the vehicle to build on the experience and excellence on novel 5G network infrastructures and respective technologies (software networks, monitoring and management) acquired by the participation of NCSRD in numerous EU funded projects as well as the strategic research interests as defined by the Centre. NCSRD will make use of 5GENESIS results in its research activities and in introducing new topics for PhD theses and dissertations for new graduate students interested to deepen the knowledge on the main issues addressed by the project. In addition, NCSRD hosts the Technological park of "Lefkippos" - in which several private companies in the field of IT and Telecommunications are established. 5GENESIS results will be disseminated to those companies with the objective to establish mutually beneficial collaborations and transfer obtained knowledge. Market exploitation of possible value-added outcomes and foreground knowledge will be considered.

UMA

UMA has a strong activity in building testbeds for supporting research in mobile technologies (projects FLEX, Fed4FIRE and Fed4Fire+, TRIANGLE, Q4Health). UMA is now coordinating EuWireless, a project to design the European Mobile Operator for research in Europe. The specific exploitation plan of 5GENESIS results for UMA includes positioning Malaga as one of the reference Platforms to support the validation activities by SMEs, researchers and verticals in general. UMA will define different access/business models depending on the user profile,

their requirements and the funding approach. One specific target will be the collaboration with other stakeholders to define H2020 and National projects to be run in Malaga Platform. It is worth noting that the Spanish government is promoting now these joint projects towards the demonstration of 5G networks and services. In addition to providing experimental facilities, UMA expects to use scientific results to be part of their usual activities in advance course, PhD thesis and MsC thesis and collaboration with industry.

INT

Internally Intel will exploit the main project results providing quarterly readouts (e.g. elaborating on the main outcomes and novelties proposed in finalized deliverables) to relevant system architects, product engineering and product development teams. Especially the teams in European R&D sites will be the main beneficiaries of this activity. Moreover, the assessments done in the different 5GENESIS Platforms of the 5G KPI (regarding the feature set of 3GPP Release 15 and successor releases) will be very valuable for the Intl teams, to be able to offer to the markets future products that will fulfil real requirements and that will be closer to real final users' needs. Finally, Intel will be able, leveraging on the key obtained research results, to better impact standards bodies, and to engage in a more effective manner with regulatory bodies and with the other stakeholders of the ecosystem, e.g., with the 5GPPP association and the related Working Groups and with the NGMN.

TID

TID is the R&D branch of Telefonica, thus TID has plans to introduce the results of this project to Telefónica Operating Businesses, by running demonstrators and trials, seeking to find applications within their businesses. Furthermore, TID will present the results in internal events (e.g. TEFCon) and meetings with relevant managerial and technical staff in the target Operating Businesses.

LMI

To achieve a strong impact of the 5GENESIS research results, we plan to disseminate our findings internally, to engineers, managers and product leaders, to significantly contribute to the increase of the technical know-how of our experts. Ericsson is a world leader in developing a distributed network management solution for 5G networks (ENM) and the impact of the 5GENESIS research results will be considered in the context on ENM. In parallel with the above steps, Ericsson is exploring contributing use case policies to ONAP's policy framework project (Apex). We are expecting this to have a positive impact on the ever-extending range of ONAP use cases.

ATOS

Atos is an international information technology company, leading the transformation of digital services and telecoms operators to generate more business value from their networks. The involvement on 5GENESIS project will play a vital role to enhance the current portfolio of products and technologies offered to the industry customers. Atos will benefit from the knowledge acquired in the development of innovative technology and the outcomes of the project, to evolve their solutions to provide cutting-edge services and to keep positioning as trending company that will lead on expanding and access new market segments.

ADS

Main expected benefits for Airbus DS SLC are to demonstrate that 5G network slicing technology will further enable Public Safety users with rich and reliable multimedia services and applications, as part of the PMR industry evolution to Broadband beyond 4G. The project outputs will nurture Airbus DS SLC products and solutions roadmap to build a competitive portfolio and to maintain its leadership in the PMR industry.

COS

For mobile network operators to continue meeting customer demands effectively in the coming years, a new, radically improved generation of mobile wireless technology and services is needed. COSMOTE, as leading mobile operator in Greece, continuously invests in network superiority and innovation targeting to remain at the forefront of the technological advancements, and offer high quality of experience (QoE) through an enriched services' portfolio. COSMOTE is interested in solutions that can bring significant competitive advantage in the short term while enabling the proactive preparation and further investigation of technical challenges to come (network architecture evolution, network planning, CAPEX/OPEX savings, etc.).

Given that the project is expected to realize an end-to-end integrated 5G experimentation facility and set up an all-encompassing testing framework to provide valuable 5G KPIs on a number of vertical markets that are of potential interest for COSMOTE (and DT Group) in view of the 5G era, COSMOTE's involvement in the 5GENESIS project is considered a unique opportunity to:

- Further deepen in the expected market/business challenges and opportunities from the Telecom Operator's perspective and contribute to the identification of novel business models.
- Be at the forefront of the 5G trials in Greece and experiment with pragmatic implementations of vertical application use cases in an end to end manner.
- Evaluate potential technical challenges and new network risks at quite an early stage. Work done and expertise gained will become a reference towards 5G network preparations and timely uptake of corrective actions
- Acquire early results on the performed 5G KPIs validations to shape commercial services and safeguard realistic service level agreements.
- Investigate the requirements and conditions for the introduction of the project solutions into COSMOTE network beyond the project's end

Finally, COSMOTE has the ambition, through the dissemination of the project results within the Deutsche Telecom (DT) Group, to pave the way for the exploitation and reuse of the above gains by the other telecommunication operators in the DT Group.PLC

Throughout the duration of 5GENESIS the R&D Department involved in the project will arrange for periodic meetings with the Network Department, Mobile Services Department and Marketing/Business Department of the company. Together Primetel will work in establishing a solid business model on how to best exploit the 5G technological developments achieved by 5GENESIS and establish close cooperation with the manufacturer/vendor partners of the consortium and agreements were necessary for addressing this. Moreover, Primetel is interested in expanding its services in the IoT domain a business direction which could be highly stimulated and supported by 5GENESIS novel systems hence getting both new customers or provide new services for existing customers. Deploying 5G multi-access solutions at an early

stage for service provisioning to mobile, wireless and IoT devices will offer a competitive advantage.

PLC

Primetel PLC has already been exploiting its participation in H2020 5Genesis during the first six months of the project in several ways. Through 5Genesis, Primetel has so far applied and managed to obtain a 5G experimental license and spectrum from the National Department of Electronic Communications (DEC) to be in position to do initial 5G pilot testing in Limassol, Cyprus. This has given the opportunity also to the Mobile Services Department of the company (not only R&D) to be in a solid position to initiate 5G equipment testing as well something which is supported by DEC and the National Regulator (OCECPR). Besides licensing OCECPR has expressed interest in initial tests planned by the 5Genesis Limassol Platform. The project's dissemination manager plans to support dissemination arrangements in Cyprus to further inform parties of interest (including OCECPR). Due to the promotion of the first 5G pilot test plans by Primetel (e.g. through its Primetime Magazine), other stakeholder/partner associates/collaborators (e.g. Manufacturers) have also expressed interest on future business collaborations. R&D wise Primetel PLC has leveraged on its involvement in 5Genesis to be in position to collaborate on the latest cutting edge 5G technology research which resulted in active synergies and also novel proposals in the areas of Advanced 5G and 5G Long Term Evolution. Moreover, the R&D team plans to exploit the work in 5Genesis to further develop its 5G testbed with the latest developments (both commercial as well as prototype developments). This will allow for valuable contributions to research and validation testing in the area of 5G and beyond as well as for the Mobile Services Department to see initial testing in a non-critical environment before any deployments in the operational network. The R&D Department will continue to arrange for periodic internal meetings with the Network Department, Mobile Services Department and Marketing/Business Departments of the company. Together Primetel will work in establishing a solid business model on how to best exploit the 5G technological developments achieved by 5GENESIS and establish close cooperation with the manufacturer/vendor partners of the consortium and agreements were necessary for addressing this. Moreover, Primetel is interested in expanding its services in the IoT domain a business direction which could be highly stimulated and supported by 5GENESIS novel systems hence getting both new customers or provide new services for existing customers. Deploying 5G multi-access solutions at an early stage for service provisioning to mobile, wireless and IoT devices will offer a competitive advantage. Security in 5G, 5G/Satellite and other 5G/x heterogeneous network architectures is also under the scope of Primetel.

FON

Many devices are equipped with WiFi interfaces and not only user devices but also IoT devices. Because of this WiFi is becoming more and more important as another access interface for 5G multi-access networks. Mainly, FON clients are operators and carriers and they will be deploying their own commercial 5G network by 2020. FON needs to adapt its technology to 5G and to be able to integrate its WiFi solutions in multi-access 5G networks to answer the needs of its clients. Moreover, 5G is an opportunity to build innovative business models and FON can take advantage of that if it enables 5G. Because of all that, 5GENESIS is considered a strategic project inside FON and the participation is well justified as 5G is part of the technology roadmap of the company. In the project, FON will integrate its technology in a multi-access 5G testbed. All the lessons learned during the integration and the deployment, all the results of the tests

and all the needed developments in order to obtain a full integrated networks will be directly applied to FON's commercial products and services in order to obtain a 5G enabled portfolio of WiFi solutions.

FhG

The exploitation plans of FhG are all centered on existing and emerging testbeds and toolkits. Specifically, 5Genesis is interesting for FhG because it facilitates research and innovation on the 5G software components especially towards the core network, new radio technology integration, backhauling, multi-slicing support and software network management, as well as the customization towards use cases. Fraunhofer has identified the following key strategic areas of the exploitation of project results.

- Development of the knowledge on the end-to-end 5G system and the further requirements beyond the initial 5G developments, enabling FhG to provide research and innovation capabilities towards the industry
- Development of comprehensive testbed management mechanisms enabling the optimization and the capacity increase of the FhG testbed deployments, which enables ease of distributing licenses testbeds to research and industry.
- Development of extensions and updates towards 5G of the Open5GCore, OpenSDNCore and OpenBaton toolkits for addressing the 5G end-to-end architecture, which will then be distributed to research and industry as part of continuous licensing of the Open5GCore
- Exploiting Fraunhofer FOKUS' Open5GCore and a surrounding concept (blueprint) for a testbed infrastructure towards industry and academia. For that, 5GENESIS allows for the development of knowledge and practical know-how in deployment of customized testbeds dedicated towards the verticals or specific use cases.

ECM

ECM will publicize the development through official communications in the context of OAI Software Alliance events and publications as well as industry-driven events (Mobile World Congress, NGMN Conference and Exhibition, ETSI-sponsored events, ITU conferences). Developments in the context of 5GENESIS will be followed as official projects within the OpenAirInterface Software Alliance and regularly communicated on the OAI developer meetings and mailing lists. Through such communication 5GENESIS will encourage contributions and collaboration on the 5G-NR UE with external parties in order to mutualize development efforts.

IHP

The exploitation plans of IHP will be focused on complementing the 5Genesis Berlin Platform with the required hardware and software towards attracting industry and favouring the end-to-end 5G evaluations. IHP plans as well to exploit the 5Genesis results academically via its annual summer school, and lectures given at Universities in Berlin and the graduate school supporting PhD students at IHP. Together with other institutions in Berlin working on 5G technologies through already existing contacts, a Graduate Workshop on 5G architectures and technologies is envisioned.

IHP might as well exploit the results from 5Genesis via its daughter company IHP solutions.

IT

IT research goals are to sell engineering consultancy to operators and SMEs to improve their competitiveness, and to promote the update of the telecom engineering courses taught at the graduate and undergraduate levels at Portuguese universities. 5GENESIS will be very important to both of these roles: in one hand, as the consortium has many partners from industry, the researchers in IT can bring their knowledge portfolio to help solve the technical challenges that arise in real deployments. On the opposite direction, the industrial partners will for sure help IT researchers to get a better insight on the research needs of the industry, thus guiding IT into future research directions. This would enhance IT ability to adapt their consultancy services to the operators and SMEs needs, and to tailor the contents of the telecom courses to the needs of real word. In brief, 5GENESIS will help IT to bring together the industry and the university.

SRL

Being an academic partner, SRL will use the knowledge gained from 5GENESIS in two ways: (i) to train both undergraduate and graduate students with advances in 5G ecosystem in courses and seminars in communication networks and systems and (ii) to conduct and publish high quality research that will enhance SRL's impact portfolio and develop their reputation and academic profile. These will in turn increase their involvement in future research projects and extend and reinforce their networks of European research partners. Moreover, participation in open source projects and successful standardization is expected to help drive the research agendas and pave the way to further industry-academia partnerships, and to commercial collaboration, exploitation and consultancy via the SRL's Technology Transfer Offices.

SHC

SHC is a well-established ICT systems integrator and wholesale telecom services provider. Via its participation in 5GENESIS, SHC aims to reinforce its reputation in the telecom market and to expand its know-how in heterogeneous multi-RAT 5G systems, thus significantly enriching its network solutions portfolio. Also, via the coordination and integration of the Limassol testbed, SHC aims to acquire a strong reference in a flagship EC 5G integration project, such as 5GENESIS, and thus obtain a competitive advantage for future commercial 5G projects.

ATH

5GENESIS opens the door to several exploitation opportunities for ATH, especially the MEC-oriented approach in the project will offer the added possibility for ATH as an SME to delve more concretely into the mobile edge computing-based market, where the core network functionalities are deployed at the edge to improve the system performance and user perceived quality. The key benefit of ATH to be exploited from the 5GENESIS concepts and development is to extend its core network product series with enhanced mobile edge capabilities. Furthermore, ATH will exploit the possibility of linking the mobile core functionalities to the mobile edge thus allowing PaaS function deployments seamlessly over the dense mobile networks, enabled by 5G. This will give the visibility for ATH to be a key player in the market, together with other stakeholders. Furthermore, the experience of the CTO/CEO in business models and on pre-commercialization campaigns will be leveraged to give a market level visibility for the 5GENESIS concepts and pre-commercial prototypes.

NEM

NEM is fully focused on the development and provisioning of mission critical services over mobile broadband networks, following the new wave of 3GPP MCPTT/MCVideo/MCData

specifications. In 3GPP R13 and R14, it is well specified how these services should be deployed with the required Quality of Service (QoS) and multicasting capabilities over 4G networks. In 3GPP R15 and R16, it is being defined how these services should be deployed over 5G networks. NEM, as a pioneer in MCPTT pilots, wants to lead the experimentation and integration of MC services in 5G networks, being able to provide the required MC basic functionalities as a VNF that might be flexibly deployed at the edge or at central cloud premises. Besides, the integration of different NFV management schemes will provide a competitive advantage to NEM's MC components, which could be exploited in different types of networks.

REL

REL exploitation is focused on the new RAN physical layer and 5G systems implementation. 5GENESIS enables REL to validate its NR technologies and ensure their smooth integration into 5G state of the art networks. Corrective and further enhancement actions, if required, will be carried out before releasing the products. The meetings, discussions with 5GENESIS project teams will enrich and "open doors" for the REL team to deepen its knowhow in the NR and 5G network technologies, enabling better 5G product development, like the Smart RRH. 5GENESIS will enable integrating REL products in a comprehensive 5G network, facilitating an early end to end testing in a semi target environment. The practical engineering experience and know-how related to 5G systems deployment will also be valued by REL.

INF

INF is interested in the business exploitation of the lessons learnt from the 5G KPI validation and verification in 5GENESIS in order to enhance its IoT vGW product line with 5G features and services. According to the marketing plan of INF, there is special interest in the shipping sector for the 5G extension, capabilities and features, focusing mainly on the improvement of IoT services on vessels, as well as on massive IoT opportunities, where interoperability open issues are more intense and in parallel there is great demand for their immediate resolution. In addition, INF through the experience gained from 5GENESIS in 5G advances aims at enhancing its market position in the field of chatbot apps, developing business activities in 5G vertical markets, such as smart cities. Therefore, through the participation in 5GENESIS, INF will gain a significant competitive advantage in the forthcoming 5G market, which will assist INF to expand its portfolio and market share.

AVA

AVA will pursue business opportunities for the delivery of satellite enabled 5G services in specific verticals as part of an integrated heterogeneous 5G ecosystem. The project will allow validation of services in new 5G use-cases enabled by satellite e.g., for efficient content distribution and streaming in converged connectivity scenarios; 5G coverage extension to remote/rural sites; provision of network resilience via alternative backhaul; and backhaul service offerings to mobile Platforms (aero, maritime, rail). Avanti will seek to utilise the capabilities introduced in the E2E facility to support further demos and trials related to satellite to enable these verticals & use-cases.

FOG

FOG is currently designing the FOG Media product to provide QoE monitoring and management services over 5G networks. This product has been strategically selected as the vehicle towards new advances in service monitoring. More specifically, FOG plans to re-design and optimise

functional algorithmic components of the FOG Media product to incorporate the potential of immersive content in SDN/NFV enabled world. In parallel, FOG testbeds and simulation infrastructure will be extended in 5GENESIS, towards being compatible with 5G standards. This is expected to strengthen company's position against the competition in the fields of experimentation and benchmarking. Finally, FOG invests on training and consulting services, and, thus, the know-how acquired by the 5GENESIS project will be exploited by the training and consulting sector in Fogus to devise new courses in this field

OA

OneAccess is always eager to validate its solutions and test more innovations on diverse networks to increase its market credibility. The project is an opportunity to experience our technological innovations on a state-of-the-art testbed into a collaborative environment with experts of the domain. The outcome will allow OneAccess to increase its legitimacy onto the maritime and terrestrial markets.

UNIS

As a higher-education as well as a research-oriented institution, the University of Surrey will exploit the outcomes and results achieved in 5GENESIS in several ways. This includes the targeted inclusion of graduate researchers in high-quality technical work to ensure the education of future research leaders in 5G technologies. The technology knowledge gained and the advances to the state of the art that we anticipate as outcomes of 5GENESIS will be used to enrich the material of relevant courses, including industrial short courses. The intended outcomes of 5GENESIS are highly relevant to the Mobile Communications track of the relevant MSc courses taught at UNIS. The main aim is to educate the next generation of engineers and scientists with the latest information and research outcomes. The University will use the industrial partnership around Surrey's 5G Innovation Centre (5GIC) as vehicle for the exploitation of any IPR generated. The 5GENESIS facility will remain open to all 5GIC members and partners and UNIS will inform 5GIC members that include some of the leading telecommunication providers about the project findings and trial outcomes, thus facilitating a strong exploitation path.

KAU

As an academic partner, the exploitation of 5GENESIS project outcomes is governed through research, education, dissemination and communication activities. It is of utmost importance for KAU to be at the forefront of research in both publications resulting from 5GENESIS project results as well as to integrate new findings into the course curriculum in order to offer interesting courses and subjects as part of the undergraduate and postgraduate education as well as in courses offered to industry. Consequently, we will use 5GENESIS use cases and project results and integrate them into several of our courses to train both undergraduate and graduate students, preparing them as future research leaders in 5G technologies. The project will allow us to conduct and publish high quality research that will enhance our research portfolio on 5G and mobile communication and further strengthen our reputation and academic profile. This will extend and reinforce our networks of European research partners, and ensure that future research is relevant and timely. Scientific networks and results of 5GENESIS have already been exploited for several EU H2020 applications. Moreover, successful standardisation (e.g., within the IETF) is expected to help drive the research agendas and pave

the way to further industry-academia partnerships, and to commercial collaboration, exploitation and consultancy via KAU's Technology Transfer Offices.

UPV

UPV is a non-profit academic and research oriented institution. UPV plans the exploitation of 5GENESIS results in order to further increase their standings and ranking in the academic area through participation to key scientific conferences and journals. Furthermore, research results from the project will flow into the academic curricula by endorsing solutions and paradigms related to 5GENESIS research in teaching programs. Specifically, lectures can be given during postgraduate semester programs to inspire students towards the design of a 5G architecture extracted from the 5GENESIS project, while advanced research concepts can be incorporated to respective doctoral courses. Last but not least, UPV will use 5GENESIS results for attracting industry consulting contracts and to launch new innovative spin-offs, and to continue the research of 5G technologies being involved in new project that can profit from the 5GENESIS outcomes.

MAR

MAR through the participation in 5GENESIS will have the opportunity to pioneer in the use of novel 5G technologies in vessels, obtaining significant competitive advantage for the development of innovative ubiquitous communication applications. MAR will exploit the experience gain in order to address open issues that are currently existing in the shipping industry in the field of personnel communication from and to the vessel with the coordination centre, pursuing the design and development of novel services.

MoE

MoE through the participation of 5GENESIS will have the opportunity to offer to Egaleo citizens the 5G experience significantly before its market release. The advances that will take place at Egaleo stadium will be further exploited for the development of novel services for the citizens.

MoM

MoM has powerful department devoted to communication and dissemination. This department will help to promote visibility of the Project results in many forums where the city is owner of the main organizers and participants (TRANSFIERE, etc.). 5GENESIS will assist MoM to validate novel mission critical services, which will upgrade the security level of the city and the citizens.

3.3. Project assets

This section briefly reports on what the 5GENESIS consortium thinks are the main assets of the projects. These are defined as the main items that can distinguish the project from other research endeavors, and that have the biggest potential to be exploited, e.g., by embedding them in future products that will be launched in the respective targeted markets of each consortium partner, during the project duration and especially after the project end.

The next subsections list key technology enablers or key technical contributions, according to the first eight months of the project work.

3.3.1. Coordinator

The design and implementation of the Coordination layer will be guided by the implementation of reference test cases devoted to the testing of Key Performance Indicators (KPIs) in 5G networks and also for applications. A key part of these test cases will be definition of the testing scenarios, the measurement collection and the execution of the tests.

One of the targets of the 5GENESIS project is to contribute to a common specification of all these topics in the form of test cases and also provide a reference environment for its implementation. With this objective, the 5GENESIS project will participate actively in the 5G-PPP Test, measurement and validation working group and will promote the creation of open source projects for supporting the implementation and execution of the test cases specified for the validations of 5G KPIs.

3.3.2. Slice manager

As part of the activities of 5GENESIS, a solution for slice management will be designed and implemented and deployed over all the testbeds comprising 5GENESIS facilities. The Slice Manager will be implemented as part of the M&O layer of the overall 5GENESIS architecture. The other components of the M&O layer are the NFV MANO that orchestrates and manages the resources at the NFV/MEC domains and the Network Management System (NMS) that is responsible for managing resources at the network and radio domains.

5GENESIS slice manager will offer the necessary north-bound APIs in order to interface with the 5GENESIS Coordination layer and receive requests for the instantiation 5G network slices. The requests will be mapped to required resources across the available infrastructure, provisioned in order to instantiate network services that constitute one end-to-end communication service according to 3GPP definition. In this respect 5GENESIS slice manager will be in charge of requesting the provisioning of the resources according to placement decisions for the virtual components mapped services components. The slice manager will have full control over the slice lifecycle and resource usage visibility during operation.

5GENESIS Slice Manager will be a facilitator of the testing, experimentation and validation campaigns that will be executed by the experimenters on each facility. Due to the fact that each testbed offers different capabilities, and configuration options for the testing environment, the exposure of all the details at the coordination layer or at the experimenter is not possible. The slice manager will abstract the information required to configure the experiment environment (in terms of resources, configuration of Physical devices, monitoring etc) and will be able to offer via network slice templates pre-configure environment profiles. In this way the Slice Manager will greatly facilitate experimentation and validation of different services using identical experimental environment setups. Moreover, the slice manager will allow experiment repeatability and comparability.

In line with the above, 5GENESIS is anticipated to exploit slice manager features and capabilities also in other communities and projects, exploiting the modular design and the resource provisioning agnostic operation. An already identified area of focus is the NFV based 3GPP service deployment (i.e. deployment of 5G Core Network Functions) and the orchestration of MANO and non-MANO resources in an end-to-end service.

3.3.3. Monitoring Framework for the experimentation

A Monitoring and Analytics (M&A) framework is instrumental for the collection and analysis of network parameters, and aims to uncover the relationship between network status and performance, identifying possible bottlenecks, malfunctioning, security issues, and functions to be optimized. 5G complexity, dynamicity, and heterogeneity exacerbate the need for advanced M&A functionalities, as also highlighted by 3GPP in Release 15 (TS 29.504 and TS 29.520), through the definition of M&A-specific components in the Control Plane (CP) segment of the 5G Core (5GC), e.g., Unified Data Repository (UDR) and Network Data Analytics Function (NWDAF). On the one hand, complexity and dynamicity are due to the introduction of network slicing and NFV/SDN paradigms, on top of computing and storage resources spread among cloud and edge facilities. On the other hand, heterogeneity is a consequence of the definition of several 5G use cases, which find a clear expression in eMBB, mMTC, and URLLC services, and trigger the need for a sliced network architecture.

Within 5Genesis, the goal is the definition and implementation of a M&A framework for 5G, that leverages the functionalities of existing 4G/5G experimental frameworks (e.g. TRIANGLE[6] and MONROE[7]) and of M&A solutions already embedded in the 5Genesis Platforms, and goes beyond toward a unified, full-stack paradigm.

5Genesis Monitoring will combine Network Performance Monitoring (NPM) and Application Performance Monitoring (APM), thus allowing the collection of data related to a) the status of network components and corresponding functional areas, e.g. access network(s), core, cloud/edge, specific slices, and b) application-level performance in an end-to-end (E2E) fashion, aiming to highlight end-user perspective in terms of Quality of Service (QoS) and Quality of Experience (QoE), in the form of Key Performance Indicators (KPIs). To this end, NPM and APM will utilize active and passive monitoring tools (probes), thus verifying network and application performance while either generating on-purpose traffic or by capturing and analyzing the traffic in the network. The probes will be deployed by considering 5G specific use cases and corresponding KPIs to be evaluated; traffic monitoring, in particular, will work at either flow- or packet-level, depending on the targeted analysis. In order to deal with NFV/SDN and cloud/edge functionalities, 5Genesis Monitoring will adopt a mixture of physical and virtual probes, strategically deployed at specific network vantage points, in which bottlenecks and issues may arise, e.g. UEs, particular cloud/edge VNFs, and slice components.

5Genesis Analytics will extend traditional analytics schemes based on statistical approaches, moving toward a Machine Learning (ML) vision, which better copes with the exponential growth of collectable data in the whole network. ML algorithms can help to manage large amounts of heterogeneous data, while enabling the discovery of correlation among them, and possibly pinpointing the ones that significantly affect the KPIs. It is expected that 5Genesis Analytics will trigger the simplification of 5Genesis Monitoring as the project progresses, driving its focus on specific parameters, while also providing predictive analysis; in particular, the application of deep learning techniques will be explored, considering the big data nature of the parameters collected during the experiments in the Platforms.

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[6] https://www.triangle-project.eu/
[7] https://www.monroe-project.eu/

5Genesis M&A will leverage the capabilities in experiment lifecycle management provided by the Coordination layer, and identify a solution for the automatic configuration and activation of APM MONROE probes during the experiments. Such probes, tightly coupled with physical end nodes in the original MONROE framework, are being virtualized in 5Genesis, making it possible to deploy them at different vantage points in the network, in the form of VMs. This solution is in particular envisioned for monitoring purposes of the Berlin Platform. In parallel, in order to cope with heterogeneous use cases, a subset of MONROE physical nodes is being embedded with IoT technologies (NB-IoT and LoRa), and specific probes for mMTC and URLLC monitoring are under discussion for implementation, targeting in particular the experiments in the Surrey Platform. As regards NPM functionalities, a review of tools already embedded in the Platforms, ranging from OpenStack Ceilometer[8] (Surrey) and OpenNMS[9] (Limassol and Athens) to Prometheus[10] (Athens), is being carried out, in order to evaluate their functionalities with respect to the monitoring of different physical/virtual components and functional areas in the Platforms, and thus highlight possible extensions. A similar approach is being initiated for the definition of 5Genesis Analytics, which will leverage on existing big data management functionalities in the Platforms, e.g., Apache Spark[11] in Limassol and Apache Cassandra[12] in Berlin, together with initial analytics tools, in order to trigger the expected advances toward a ML solution. In particular, a review of the analytics tool from SHiELD[13], currently adopted in Limassol, is being carried out, considering that it will be adopted as a starting tool for the definition of the 5Genesis Security framework, and already embeds some ML functionalities, particularly tailored for security aspects.

3.4. Alignment with other research activities

In this section the main synergy with the surrounding ecosystems that 5GENESIS has realized in the first months of the project are reported.

3.4.1. 5GPPP

Since the project start most of the 5GENESIS consortium partners have been actively participating (and will continue to do so) to the several 5G-PPP organized activities, in order to align, impact and synergize with the 5G-PPP Working Groups (WG). This stream of activities is very important to ensure that the outcomes of the 5GENESIS project are aligned with what is happening in the surrounding international research ecosystem, and that the main achievements, especially the technical ones, get proper visibility in the research community and impact on the society in the broad sense.

An ongoing monitoring activity is being performed by the partners following the most important 5G-PPP working groups, and – when the case – contributions from the 5GENESIS

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[8] https://wiki.openstack.org/wiki/Telemetry
[9] https://www.opennms.org/
[10] https://prometheus.io/
[11] https://spark.apache.org/
[12] http://cassandra.apache.org/
[13] https://project-shield.eu/

project are discussed in the telcos or at the face-to-face workshops organized by the 5G-PPP association.

The 5GENESIS project has appointed several partners to contribute to the following 5G-PPP working groups:

- 5G-PPP Steering board;
- 5G-PPP Technical Board;
- 5G-PPP Comms;
- Pre-Standardization WG;
- Spectrum WG;
- 5G Architecture WG;
- SDN / NDF WG;
- Network Management & QoS WG: The Network management and QoS WG has been inactive since the start of the 5GENESIS project and it is going to restart its activity in 2019;
- Vision and Societal Challenges WG;
- Security WG;
- SME WG;
- Trials WG;
- 5G Automotive WG;
- IMT-2020 Evaluation Group.

Moreover, 5GENESIS partners took part in the following 5G-PPP workshops:

- 5G PPP ICT-19 INFO Day: The 5GENESIS project was presented in the 5G PPP ICT-19 INFO Day which took place in the 14th of September 2018 in Brussels. Dr. Harilaos Koumaras, from NCSR Demokritos (Athens, Greece), was the project's representative and explained the opportunities for ICT-19 proposers in using the five 5GENESIS Platforms.
- 5G PPP Technical Workshop 2018: The 5GENESIS deputy TM Dr. D. Tsolkas (FOG) had the opportunity to meet and discuss with representatives of other 5G PPP projects at 5GPPP Technical Workshop in Kista, Sweden, 20-22 November 2018.

3.4.2. Networld2020

Nemergent participated to the NetWorld2020 GA on the 15th of November 2018:

- Steering broad selection: the election has been organized via electronic voting on Monday, the 19th of November 2018
- Horizon Europe (2021-2027): research and innovation funding program of 100 billion euros for seven years. The aim of strengthening the EU's scientific and technological bases, boosting innovation capacity Europe and sustain the socioeconomic. More than half (52.7%) devoted to industrial competitiveness.

- 5GENESIS: it has been mentioned as one of the achievement examples in supporting vertical pilots with 5GPPP E2E infrastructure. As both partner of 5GENESIS and SME, RunEL (Israel Koffman) has participated in the panel called "The role of SMEs in the new 5G ecosystem". The general opinion is that European projects open gates and new business opportunities for SMEs.

3.4.3. Synergies and supporting activities to other H2020 projects

5GENESIS participates at all the 5G-PPP WG, where in the Trials and TMV WG more effort is given on defining a common 5G KPIs validation framework.

Moreover, 5GENESIS was funded under the call ICT-17-2018, which aimed at deploying the first experimental 5G infrastructure across Europe in order to be further used by vertical industries for test and experimentation of the novel 5G capabilities.

Therefore, 5GENESIS will strongly collaborate with the projects of ICT-19-2019 in order to validate vertical use cases, on top of the 5GENESIS infrastructure. This is based on the plan that the 5GENESIS facility is provided as an experimental asset to the potential vertical industries that are interested to test the performance of their services in the forthcoming 5G system environment.

The following figure represents the process and the steps that an ICT-19-2019 project (and not only) should follow in order to be engaged with 5GENESIS Platforms.

For this purpose, each 5GENESIS Platform has been published a contact email, where the interested parties can send their requests at the 5GENESIS Platform leaders:

- 5GENESIS Athens Facility: athens@5genesis.eu;

- 5GENESIS Malaga Facility: malaga@5genesis.eu;

- 5GENESIS Limassol Facility: limassol@5genesis.eu;

- 5GENESIS Berlin Facility: berlin@5genesis.eu;

- 5GENESIS Surrey Facility: surrey@5genesis.eu.

For each of the five Platforms that realizes the 5GENESIS facility, the responsible Platform leaders from the 5GENESIS consortium act as a point of contact, with which the interested parties or verticals will get in touch in order to express their interest, and submit their requests for experimentation. The Platform leader, upon performing a requirements analysis of the requested experiment, will contact all the involved partners who are needed for the execution of the experiment, and will eventually submit to the interested external party a business offer and pricing for the execution of the experiment. Figure 4 provides a sequence diagram of the steps that should be followed by a vertical industry in order to use 5GENESIS facility for experimentation purposes.
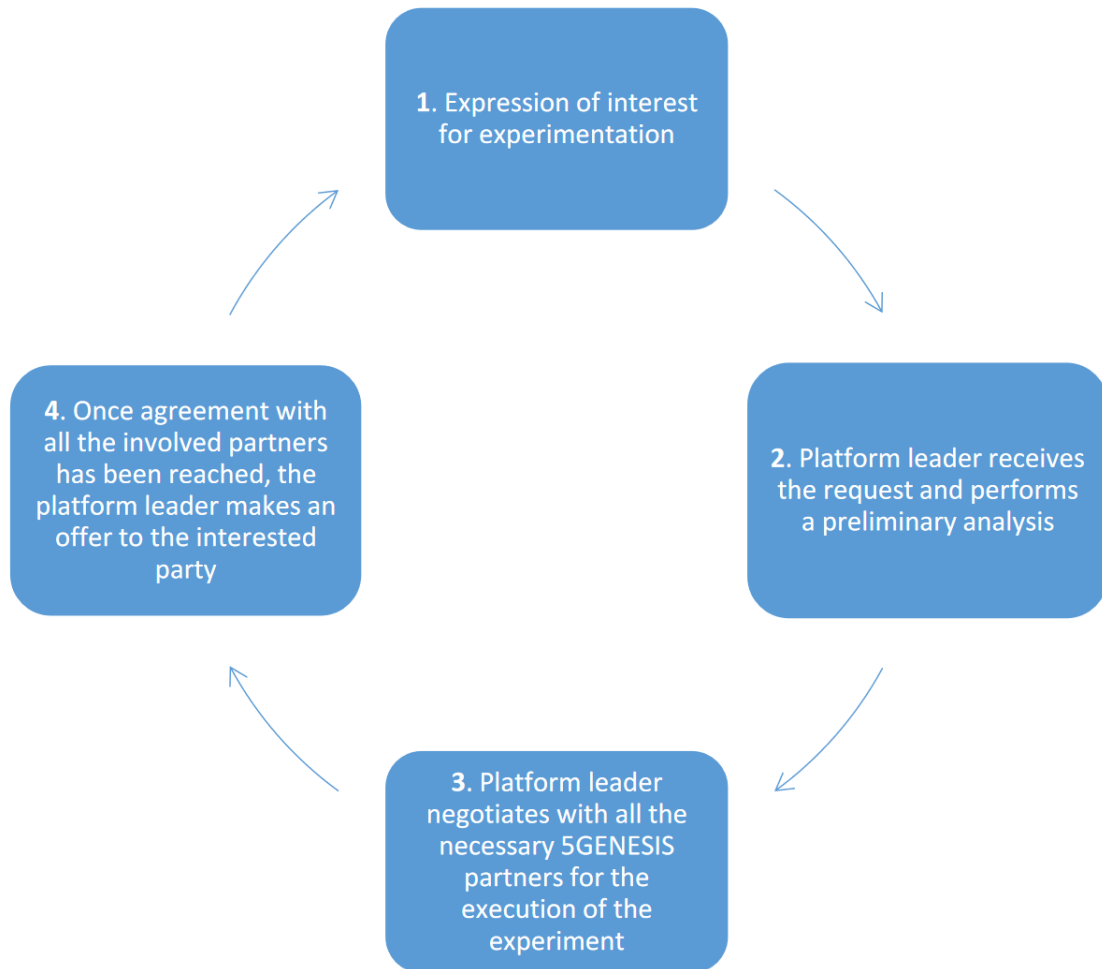
Figure 4. Process diagram of 5GENESIS facility exploitation by a vertical industry.

The consortium partners, with their diverse and complementary research and business contexts and capabilities, can indeed provide all potential exploitation modalities and routes to attract all interested vertical industries.

3.5. Regulatory bodies impact

In the first months of the 5GENESIS project lifetime activities aimed at impacting the regulatory bodies already started. In the following, more details are shared w.r.t. the meetings held in UK, Spain and Greece with the respective national regulatory bodies, and a first engagement in Cyprus w.r.t. the Limassol Platform.

For the other Platforms, engagements are ongoing and are planned to take place in the first half of 2019.

3.5.1. Surrey Platform: meeting with Ofcom (UK)

The 5GENESIS consortium contacted Ofcom personnel in Q4 2018 to ask for a meeting at their premises. The rationale for the meeting was to present the 5GENESIS project, its uses cases and objectives, its Testbeds and the planned Facility, and finally to elaborate on how the project intends to impact the wireless ecosystem, especially w.r.t. 5G spectrum usage in the mmWave bands.

It was agreed that a meeting at Ofcom premises in London would take place before the 5GENESIS Consortium meeting planned in Guildford (13-15.12.2018), i.e. on Monday morning the 12th of December 2018. The plan was that at the meeting two people from the 5GENESIS team, i.e. Prof. Klaus Moessner and Dr. Valerio Frascolla, would meet a delegation of Ofcom personnel.

First try

Prof. Klaus Moessner and Dr. Valerio Frascolla met as planned at Ofcom premises in the late morning of the 12th. After some waiting time at the Ofcom entrance, it was finally possible to reach the Ofcom contact in the early afternoon. The 5GENESIS team understood that, due to a trivial misunderstanding on the day chosen for the meeting, it would have not been possible anymore to meet – as planned - the Ofcom delegation on that day. Notwithstanding the unplanned issue, the Ofcom contact person was so kind to offer to run by himself the meeting, but the 5GENESIS team preferred to postpone to the next day the meeting, so to have the whole delegation of Ofcom attending the 5GENESIS presentation, and not a single attendee.

That unfortunately change of plan, which caused a substantial delay in the schedule of the planned 5GNESIS activities of the day, made it impossible to run the innovation workshop at Surrey University premises, which was planned in the afternoon of Monday the 12th.

Second successful try

On Tuesday morning the 13th of December, Dr. Valerio Frascolla travelled to London from Guilford to represent the 5GENESIS consortium in front of the Ofcom delegation, composed of 4 people. Prof. Moessner couldn't join on the 13th as he was the host of the consortium meeting that started at 09:00 the 13th at the University of Surrey premises.

The meeting with Ofcom on the 13th was very successful. Dr. Valerio Frascolla discussed a presentation composed of 35 slides [1], focusing on explaining what the scope of the 5GENESIS project is, what are the main use cases, shortly describing the 5 Testbeds and the forthcoming planned project Facility. Also the main research topics regarding spectrum management were briefly discussed. An open conversation followed the presentation and several questions were posed by the Ofcom personnel, mainly targeting at understanding in what the project could help in having better spectrum management capabilities, especially for spectrum above the 6GHz bands (lower mmWave domain).

The slides were shared with the Ofcom personnel and in case of questions Ofcom will come back to the 5GENESIS consortium for further clarifications.

As unfortunately the Surrey Platform owner, Prof. Moessner couldn't attend the meeting, some specific questions on the detailed planned set of actions related to the Surrey Platform enhancements and refurbishing for the 5G deployment at Guildford couldn't be answered. Due to that, Ofcom personnel was invited to Guildford to meet the people actually working on the

Surrey Platform, so to have a live demo of the existing capabilities and to be educated on what are the next steps for enhancing the Testbed with the novel proposals coming out of the 5GENESIS proposal. Such meeting is planned to take place in the first half of 2019.

Finally, the Ofcom personnel expressed its interest to have updates, mainly from the Surrey Platform work, in the forthcoming quarters of the project duration.

3.5.2. Malaga Platform: regulatory bodies engagement

On 21st of November 2018 Pedro Merino had a meeting with the staff of the Dirección General de Telecomunicaciones in Madrid to explain de objectives of 5GENESIS and the potential use of non-licensed spectrum in the Malaga Platform. The regulatory body personnel expressed its willingness to provide 500Mhz in the range 24250- 24750 or 26500 MHz for experimental use in the project.

Following the meeting, Pedro Merino submitted the official Handbook presented at ICT-19. The Spanish regulator is interested in having periodic updates on the project results, and specifically in the use of 26GHz band as a candidate for further deployments in Europe.

3.5.3. Athens Platform: regulatory bodies engagement

NCSR Demokritos, as owner of the 5GENESIS Athens Platform, has got in touch with the representatives of the Ministry of Digital Governance, where a physical meeting took place in January 2019. The representatives of the ministry were informed of the activities and plans of the 5GENESIS tests in Athens and the discussion focused on the provision of band 42 (3.4-3.6GHz) with 80MHz bandwidth for the needs of the project.

Upon this meeting further communication has been followed and an official process has been initiated in order the clarify and agree upon the specific frequencies to be provided in the selected areas and for the period that the project foresees.

3.5.4. Limassol Platform: regulatory bodies engagements

Contacts have been established through the Primetel partner with the Director of the Telecommunications Authority of Cyprus, and a meeting is planned to take place in the first half of 2019.

The scope of the meeting is to make aware the Cyprus community and the regulation authorities about the scope and ambition of the 5GENESIS project. Important local impacts, like the benefits of the Testbed in Limassol on the overall ecosystem of Cyprus, are also planned to be discussed in that meeting.

3.5.5. Plan for further actions

3.5.5.1. Berlin Platform

In the first half of 2019 also the BundesNetzAgentur (DE) will be contacted to ask for a meeting or a telco, to explain the 5GENESIS vision and proposal and to elaborate on the 5GENESIS project use case, scenarios and Platforms.

3.5.5.2. Further regulatory bodies

The French authority ANFR and the Swiss authority Ofcom (CH) will be both addressed in 2019 to ask for their willingness to have a call or a meeting at their premises to discuss the 5GENESIS project, similarly to what has already been done with the other regulatory bodies in UK, Spain and Greece.

3.6. Patents and IPR

In the first eight months of the project duration no patents have been filed from any of the project partners. It is expected that such activities will take place once more technical results will be made available, following the timeline of the research and implementation activities in the Testbeds.

4. CONCLUSION

This deliverable presents the achievements and proposes a plan of actions for the next quarters of the lifetime of the project.

Two are the areas in focus, the innovation management program and the exploitation activities.

With regard to the former, the scope of the innovation management program is clarified, the chosen methodology and the means of running the program are analyzed. Moreover, the Innovation Manager of the consortium successfully run the first innovation workshop at a Platform premises (Berlin). The workshop was instrumental in clarifying among the partners working at the Berlin Platform some key open aspects of the work to be done, and in removing some of the un-knowns that were related to specific technical aspects of the SW, HW and interfaces of the components of the Platform. Finally, a timeline and a plan for the Platform-specific workshops is provided, as well as the identification of consortium partners interested to a partner-specific innovation management workshop.

With regard to the exploitation activities, each partner in the consortium provide and update, an enhancement or restate its original exploitation plan, devised more than one year from now, during the phase of the proposal preparation. The impact of the project on the ecosystem, especially on the 5G-PPP Work Groups, on other relevant research projects and on the forthcoming ICT-19 ones, is described. Finally, a list of achievements w.r.t. regulatory bodies engagement, steering and aligning is described. UK, Spain, and Greece regulators have been already impacted, talks are ongoing in Cyprus and in 2019 the same is planned to happen in Germany.

In summary, this deliverable not only reports on the finalized activities I the first few months of the project lifetime, but also provide concrete plans for the next actions to be run w.r.t. the innovation program and the exploitation activities of all the project partners.

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