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Communication networks of the 5th Generation (FANTASTIC-5G)**

## **Deliverable D6.1 Exploitation and Dissemination Plan**

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## Abstract

Deliverable on exploitation and dissemination plan. The deliverable will describe a detailed plan for exploitation and dissemination activities of the project.

## Keywords

3GPP, NGMN, social networks

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<sup>1</sup> CO = Confidential, only members of the consortium (including the Commission Services)

PU = Public

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# 1 Introduction

This document is to collect and present the exploitation plans of the partners and the dissemination activities of the overall project.

## 2 Exploitation plans

### 2.1 Aalborg University

Aalborg University (AAU) intends to present the results from the FANTASTIC-5G project at the main IEEE conferences in communication engineering (IEEE ICC and IEEE Globecom), as well as the main journals in the area (IEEE Trans. Communications, IEEE Trans. Wireless Communications). Furthermore, the concepts will be presented to a wider audience through special issues in IEEE Magazines dedicated to 5G, arranging workshops in conjunction with the main IEEE conferences and presenting at general events on 5G technology. Through the cooperation within the FANTASTIC-5G project, AAU gets the opportunity to contribute to the actual 5G solutions that will be candidates for standardization. This refers particularly to the emerging concepts of massive machine communication, ultra-reliable communication and ultra-dense networks. Through the collaboration with the industries in the project, the AAU researchers can pursue also relevant innovation efforts in addition to the scientific efforts. The AAU students at several levels (undergraduate, master and PhD) within the AAU education programs will be exposed to the scientific results obtained from this project and several master and PhD thesis will be put forward with topics within the scope of FANTASTIC-5G. Finally, national and international industrial research projects will be fostered through the acquired know-how and supported by the built network of contacts within the 5G field.

### 2.2 Alcatel-Lucent Deutschland AG

ALUD (Alcatel-Lucent Deutschland AG) intends to exploit the research work performed in FANTASTIC-5G to strengthen its competitiveness and patent portfolio, in the area of Radio Access Network (RAN) products beyond LTE-Advanced, through the timely development of roadmaps, concepts and algorithms for evolved technology components.

ALUD will conduct internal workshops and readouts of project results, to integrate further groups and to develop the concepts of the project beyond then capabilities of the project. External workshops will be co-organised and contributions will be prepared to spread the project findings to other research groups outside of the project.

A further aim is to consolidate the relevant technology trends by exchanging with project partners, and to prepare and support activities to standardise the identified solutions. In an early phase of the standards evolution, the results will be carried into pre-standardisation or regulatory bodies like NGMN or the WRC, paving the way for standardisation. Results will be internally transferred into standardization teams that follow up and carry the results into bodies like 3GPP.

ALUD will further publish major research results in the form of research papers at tier-one conferences, as overview articles in leading magazines, or in the form of white papers. During the active phase of the FANTASTIC-5G project, the ALUD team will collaborate with academia, as well as supervise master- and doctorate thesis work, thus training young engineers in the practical aspects of evolving new standards and assuring the sustainability of the created knowledge.

## 2.3 Commissariat à l'Energie Atomique et aux Energies Alternatives

CEA-Leti is a worldwide known research centre for its high-quality research activities in the field of electronics and information technology. As a technology provider, CEA's long term objective is to provide to industrial companies relevant solutions which tackle today and future concerns such as sustained development and security for citizens. FANTASTIC-5G project is contributing to increase CEA's know-how on the flexible air interface design of cellular networks both at physical and MAC layers, to better understand current industry needs, and to identify new challenges for its future research activities.

The exploitation plan of CEA-Leti is twofold. At short term, the outcomes of CEA-Leti's investigations on air interface design, having the specific target of flexibility and scalability of service delivery in future wireless cellular networks, will be protected through patents whenever applicable, and they will be disseminated through publications in high-rank international conferences, journals, and workshops. The researches carried in the project will also be promoted in the Leti Days events organized by CEA-Leti once a year in France, Japan and USA. On a longer term, CEA-Leti aims at the integration of the designed flexible air interface in future communication devices with the objective to address a wide range of services. Thus, the results of FANTASTIC-5G will contribute to enhance the offers of CEA-Leti to industrial partners in search of high-performance wireless solutions in the context of telecom applications or ad-hoc proprietary radio solutions.

CEA has a long-lasting relationship with large companies, intermediate and small-medium enterprises of multiple sectors, involved either wireless communications (original equipment suppliers, chip manufacturers) or in other areas as end-users of existing radio solutions. The strategy of CEA is to transfer its knowledge to these European industries through licensing of intellectual property or to foster the creation of spin-offs if applicable.

## 2.4 Centre Tecnològic de Telecomunicacions de Catalunya

The CTTC is a non-profit private research centre established in Barcelona with the funding and support of the Regional Government of Catalonia. The CTTC also receives financial support from industrial and publicly funded R&D projects. Research activities at the CTTC, both fundamental and applied, mainly focus on the physical, data-link and network layers of communication systems.

The CTTC, being a non-profit research institute, focuses its exploitation strategy in terms of dissemination of results through publications in peer-reviewed journals and magazines and presentations at international and national conferences. The participation in FANTASTIC-5G is expected to stimulate a number of technology transfer and IPR generation activities which are at the core of CTTC mission. Furthermore, it aims at raising awareness and dissemination of FANTASTIC-5G results in industrial fora and industrial links following one of the main objectives of CTTC mission to build bridges between academia and industry. The pivotal role of CTTC as leader of the Proof-of-Concept activities will leverage and boost the capabilities of CTTC to accomplish this mission, reinforcing CTTC strategic efforts to develop CTTC's 5G end-to-end experimental platform, towards an SDN/NFV-based multi-tenant network and cloud testbed for end-to-end 5G services. The gained knowledge throughout FANTASTIC-5G will facilitate the establishment of new strategic partnerships with companies (network operators, equipment manufacturers, SMEs, etc.), both at the national and international levels.

CTTC's mission also includes educational aspects that involve the preparation and presentation of specialized courses to industrial, pre and post-doctoral audiences, as well as PhD education

supporting research of PhD candidates towards completing their PhD thesis work. On the educational side, CTTC will exploit the results from FANTASTIC-5G and know-how achieved during the project to steer PhD candidates' research work in the direction of 5G networks.

## 2.5 Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e. V.

Fraunhofer HHI will publish multiple conference as well as IEEE magazine articles. HHI will extend and further distribute its Quadriga propagation modeling framework. The MATLAB reference implementation will be continuously extended and maintained under <http://quadriga-channel-model.de>. From the work in WPs 3 and 4, HHI will extend its multi-link and system level simulation platform to develop and evaluate latest link-2-system interface design for non-orthogonal waveforms and non-orthogonal multiple-access schemes. In addition, we will continuously work on interference management concepts for heterogeneous network layouts and supporting for Massive MIMO communication in a multi-cell layout.

From WP5 perspective, we will further develop our SDR prototypes by implementing key algorithms from WP3 and WP4. This work will demonstrate the implementation feasibility of 5G PHY and MAC concepts developed in Fantastic-5G. Furthermore, it will show 5G hardware and implementation aspects and deliver a platform for experiments of novel concepts in a real live testbed. The SDR system will be integrated in other 5G activities at Fraunhofer HHI, especially into the 5G Berlin Testbed. The SDR system will be used by students in their bachelor and master thesis and thus contribute to their education. Results will be published and demonstrated to the public at workshops, conferences and congresses. A live presentation will be given at the Fraunhofer booth at MWC2016 in Barcelona.

Finally, our achievements in the F5G project will serve as a solid basis for new contracts/research projects in the field of 5G and beyond 2020 wireless solutions for the whole chain of conceptual work, simulation studies and prototyping.

## 2.6 Huawei Technologies Duesseldorf GmbH

HWDU (Huawei Technologies Duesseldorf GmbH) plans to develop solutions in the project that will be filed as IPRs to form the technological basis for future products and their further developments. HWDU will disseminate its findings in international scientific conferences, journals and magazines. The global consensus finding, which is facilitated by the stakeholders being represented in the project, is considered a useful means to contributing the most promising technology components to international standardization, which will be actively supported by HWDU through their local experts being involved in standardization activities. Early acceptance of new technology trends by the customers will be achieved by promoting them through Huawei's Customer Innovations Centers located in Germany, UK, France, Spain and Sweden. HWDU's experts initiate and address work in relevant fora such as the ITU-R, as well in national and regional regulatory bodies.

HWDU will also use results obtained from the research work in FANTASTIC-5G to identify the most promising technology trends for beyond 2020 communication and subsequently derive a roadmap for its future products. Algorithms and solutions developed in the project will be filed as IPRs, thereby increasing Huawei's patent portfolio that will form the technological basis for those future products and their further developments.

Finally, HWDU use FANTASTIC-5G to foster its internal research activities. This will lead to new job creations, and further education in the form of PhD studies.

## 2.7 Intel Deutschland GmbH

Intel Deutschland GmbH (INTEL) develops and markets innovative semiconductor products and solutions for mobile communications – most notably it provides mobile platform solutions for all market segments: from cost-efficient 2G/3G single-chip platforms for ultra-low-cost mobile phones, SoCs for entry-level smartphones, IoT and wearable devices, through to leading-edge 3G and 4G slim modem and RF solutions for smartphones, tablets, 2-in-1s and laptops commanding higher prices.

At the same time, INTEL is closely monitoring market trends and users demands and studying the evolution of those technologies which will lead to the definition of 5th generation cellular networks. Special attention will be dedicated to the convergence between communication and computing, and to features such as improved flexibility, scalability, energy and spectral efficiency within networks and platforms for a superior mobile user experience and effective IoT deployment.

An early engagement in collaborative activities like FANTASTIC-5G will support early consensus building among industry players and research organizations. This is crucial to enable that results are timely disseminated to relevant standardization and regulatory organizations. INTEL's involvement in the FANTASTIC-5G project is thus a very important step towards achieving the above mentioned goals.

After project completion INTEL plans to exploit the research results, concepts, algorithms, technology modules and demonstrations widely in its future mobile chipsets, as well as for SoC intended for small- and macro cell station, solutions and products. Research results emerging from FANTASTIC-5G will impact future technologies as part of INTEL mobile solutions portfolio. Moreover, INTEL expects that FANTASTIC-5G results together with other Horizons 2020 results on 5G will allow exploitation of research results in products entering the mass market in 2020 and onwards. Finally, INTEL will drive in collaboration with 5G ecosystem stakeholders FANTASTIC-5G results into standardisation and regulation bodies, in particular identifying key topics to initiate study items together with FANTASTIC-5G partners in 3GPP and support working party topics in ITU-R WP5D.

## 2.8 Nokia

Nokia is actively publishing research papers in various forums, such as scientific conferences with participation from academia and industry. Among others, this include publications at major communications conferences such as the Vehicular Technology Conference, International Communications Conference (ICC), Globecom, etc. Among others, Nokia gave invented presentations at both the VTC-2015 Spring and Fall conferences related to 5G air interface aspects. In the future, this will include also FANTASTIC-5G findings.

Furthermore, Nokia is often invited to workshops and panel sessions to express their views on 5G, wherein pointers to FANTASTIC-5G will be part of the story. Nokia is also active in co-organizing workshops at conferences, and is committed to do so in cooperation with FANTASTIC-5G partners. Nokia is committed to actively participate in FANTASTIC-5G hosted workshops and public events to widely disseminate the project findings.

Nokia is active in 3GPP standardization, and will utilize FANTASTIC-5G findings in preparation for upcoming 5G standardization activities. The former is considered valuable as 5G standardization is expected to ramp-up in 3GPP radio access network (RAN) working groups during the spring of 2016. Nokia will also utilize FANTASTIC-5G findings in future development of 5G compliant network components such as e.g. base stations.

## 2.9 Orange FT group

Orange is currently rolling out 4G networks and will still be investing in that technology in the short- to mid-term. In parallel, the operator sees the need to be well prepared for the next step, being involved, starting from today, in 5G research and innovation activities. Orange is not considering 5G as 4G+1, but rather as a leap to Future Internet. The work on improving spectral efficiency and throughputs will, of course, have to continue; but this is not enough. There will be 3 major aspects which will have to guide all the 5G research and standardization phases: flexibility, energy and cost efficiency. Indeed, Orange's 5G vision consists of the infrastructure platform which supports a variety of new services for all European citizens and enterprises and not only the next generation of mobile broadband.

In this vision, the 5G air interface plays an important role since it is the key enabler for the above mentioned flexible and scalable support. Orange will first use FANTASTIC-5G to build a common vision among European networking industry players regarding functional and non-functional requirements of the 5G air interface. It is crucial to take into account the needs and concerns of citizens and enterprises in this vision and Orange will propagate the ones of its customers. This vision will be reused by Orange to motivate 5G infrastructure investments on the air interface and build the rolling plan according to related business. FANTASTIC-5G will also be the place to benchmark and select technologies and architectures for future air interface standards and infrastructure enablers. This selection has a strategic importance for Orange to ensure that future network services will offer the best experience to its customers and be sustainable (in terms of energy, costs and social issues).

Orange will exploit the results of the project through several internal and external means, including (1) contribution to standardization and alliances such as NGMN and GSMA, (2) valorization of its IPR on the related topics mainly through standardization, (3) organization and participation to external workshops/panels, (4) production of white papers and publications in prestigious conferences and journals, (5) transfer of the project outcomes/findings to development phase within the internal R&D chain, (6) transfer of information to group affiliates for decisions on possible deployment choices. One of the most important events to highlight is that Orange plans to present the project findings (particularly demonstrations/PoC) during its annual *Orange Labs internal research exhibition* which is a unique opportunity for the project to generate awareness on its innovations for the *whole Orange Group employees and its partners (thousands of visitors)*. Last but not the least, Orange will also use FANTASTIC-5G to foster its internal research activities. It will be the trigger for job creations, especially PhD thesis and post-doctoral funding. It will also allow the operator to take part in algorithm developments that would not be reachable otherwise due to the required critical mass.

## 2.10 Politecnico di Bari

Politecnico di Bari is a technical university, thus, its mission is primarily the education of new engineers together with research activities in its fields of interest. In the context of FANTASTIC-5G, its contribution is related to the development of a network simulator useful to test the new flexible air interface envisioned within the project, as well as to compare its performance with respect to the benchmark radio technology (i.e., LTE and LTE-A).

Thus, its exploitation plan is twofold. First of all, results obtained during the project will be disseminated by publications in international conferences and valuable research journals. In particular, conferences and journals in the field of communication networks will be considered, taking into account all the aspects related to the implementation of the simulation tool and the evaluation task of the whole project.

Regarding the simulation framework, a good opportunity could be the promotion of its adoption among scientific research centers and companies interested in 5G technologies. In this manner,

several aspects of the project could be disseminated in a very broad fashion. Moreover, the possibility to extend the functionality of the simulator will be useful to foster new research activities in future cellular networks and its participation in new international projects. This will help the creation of specific PhD theses on the subject of the present project, the creation of post-doctoral positions, and in the long term also the possibility of stable research positions.

Regarding the educational aspects, starting from the output of the project, it will try to insert new contents in courses already available; new courses will be organized in the context of Masters and Doctoral courses.

## 2.11 Samsung Electronics UK

Samsung considers 5G as a revolutionary generation in mobile communication, which will enable ubiquitous high data rate regardless of the user's location, providing users with a truly immersive and rich experience. Considering the importance of air interface in mobile communications, Samsung will focus on and utilize the outputs of FANTASTIC-5G in the areas of promising new use cases. Performance analysis of different candidates and the design of a harmonized user plane will help inform Samsung's view on the most promising 5G technologies and provide background for its own 3GPP work.

Samsung will use FANTASTIC-5G research activates to further its own 5G application space; findings that FANTASTIC-5G achieves a consensus on will carry significant weight in the European research community (and beyond) and Samsung plans to use them to broaden the scope of its own global 5G R&D activities.

Samsung expects that FANTASTIC-5G will provide a sound rationale for new air interface below 6GHz and will contribute to this important process. Additionally, the consensus-building process which FANTASTIC-5G will stimulate, will lay the foundations for further discussions in national and regional bodies, allowing basic consensus among key players to be reached in advance of key decision-making meetings, helping speed up the process by building consensus from the ground-up.

Samsung plans to exploit finding from the project in development of our roadmap for future products and their developments for 5G systems below 6 GHz. In addition, the findings and solutions will be disseminated through international scientific conferences, journals, magazines. Samsung will use FANTASTIC-5G to foster its internal research activities, which leads to new job creations.

## 2.12 Sequans Communications

Sequans Communications is a 4G chipmaker. The activities undergone in FANTASTIC-5G project will help Sequans to transition from 4G to 5G technologies and to prepare the future platforms for internal development. Actually, several options are currently opened for 5G and the project will provide a fruitful environment to better understand and down-select the various options.

With respect to the contribution of Sequans, it will be an opportunity to develop innovative solutions in context of receiver design with a focus on the terminal equipment. It is expected that the outcomes of Sequans' work will be integrated in products, most likely in the generation of chipset for market availability around 2020.

In addition to this direct use of project outcomes to future product generation of the company, Sequans expects that the project will support its know-how and visibility in the standardization and overall 5G ecosystem.

At last, the project could help Sequans strengthening its relationship with key players in the wireless domain, from operators, manufacturer to key universities.

Sequans plans to disseminate the outcome of the project through internal communication and training. Some aspect of the work planned by Sequans may be the opportunity to propose patent ideas, write scientific papers to be submitted to journals and/or international conferences

## 2.13 Institut Mines-Telecom/Telecom Bretagne

Institut Mines-Telecom/Telecom Bretagne, as a graduate engineering school member of the Institut Mines-Telecom group, has exploitation goals that are different yet complementary to those of industrial partners in the FANTASTIC-5G project. Institut Mines-Telecom group aims at exploiting the project results for both educational and research purposes, besides technology transfer to leading-edge spin-offs.

Telecom Bretagne will spread FANTASTIC-5G results among academic and industrial communities by organizing tutorial-style, summer schools and life-long learning courses. Telecom Bretagne will also publish academic papers at international conferences and journals which will improve its international visibility and its position for attracting the best international PhD, Master and graduate level students.

Telecom Bretagne will give Master and PhD students the opportunity to work on cutting-edge research in a European collaborative effort as well as by using the research results in the teaching process of undergraduate and graduate students, allowing courses and seminars related to advanced wireless communication systems and system design to be taught, in addition to student projects.

The proof-of-concept hardware/software platform used for test-bed activities in FANTASTIC-5G has triggered the creation of a group of interest in PRACOM (Advanced Research Center in Communications) at the Institut Mines-Telecom. This group includes several French industrial partners that are willing to define a common cutting-edge platform for rapid proof-of-concept of their emerging activities related to 5G wireless communication systems.

Telecom Bretagne will make sure that the project developments will be carried into future national and international research (e.g. French national competitiveness clusters).

Telecom Bretagne will also contribute to standards through collaborations with FANTASTIC-5G partners participating in 3GPP.

Furthermore, Institut Mines-Telecom group has a long tradition of spin-off creation for the transfer of innovative technologies from national and international projects. Therefore, potential means for Telecom Bretagne is to exploit the scientific and technological results obtained through its participation in the FANTASTIC-5G project. Opportunities for patents will be considered before publications in the course of the FANTASTIC-5G project in order to expand Institut Mines-Telecom's patent portfolio (around 12 patents are filed per year at Institut Mines-Telecom in the telecom area).

## 2.14 Telecom Italia

TI (Telecom Italia) will use the results from FANTASTIC 5G as an input to the Group Technology Plan, an internal document that lists the available technologies and that is the basis to develop the investment plan together with the Strategy Plan. Moreover, the project will be exploited by Telecom Italia by influencing the industry and standardization bodies (e.g. ITU-R, 3GPP) with requirements on 5G radio access technologies. The main areas of interest are: 1) Enhance service quality for mobile broadband, in particular by increasing the user throughput in localized areas, such as stadiums, fairs and sport events where large concentrations of people for

short periods of time are expected. This solution will directly impact customer satisfaction, revenues and customer retention, 2) Improve energy efficiency and general sustainability indicators, 3) Exploit Internet of Things and more in general machine to machine communications as well, 4) provide awareness to technical solutions on 5G radio access technologies, therefore helping Telecom Italia in the RFI and RFQ process for 5G systems, 5) form Telecom Italia's employees to provide the means to understand the new technology. All these areas of activity will have a direct impact on future investments and network operating costs. The standardization activity within the project will be exploited by Telecom Italia by ensuring that standards do take into account the requirements of Telecom Italia, in particular related to user throughput and insurance of Quality of Experience to the customer. The overall activity within the project will be exploited as an opportunity to show to the investor community the sensitivity of Telecom Italia towards innovation and forerunner research.

Telecom Italia plans to exploit the Project's results also through the publication of articles in the Telecom Italia magazines ("Sincronizzando" and "Notiziario Tecnico") distributed within the Group and available for experts in Telecommunication field. Telecom Italia will also organize workshops with national and international scope. These activities will increase the awareness and provide knowledge dissemination within the personnel of Telecom Italia Group (including South America subsidiaries).

## 2.15 University of Bremen

University of Bremen has divided its exploitation strategy in two lines: (i) academic & research exploitation and (ii) Standardisation & industrial exploitation. Regarding the first part, the Department of Communications Engineering publishes and disseminates its technical findings in various international conferences, respected journals and popular magazines, and also participates in organising workshops. Furthermore, it uses the research experience gained in projects for the advancement of knowledge, education, and training in the field. More precisely, the knowledge gained will be used to enhance lecture materials for both undergraduate and postgraduate courses (delivered to a wide spectrum of international and home students). Finally, the experience gained during the course of projects is used to identify new research challenges for on-going and future MSc and PhD projects. Concerning standardisation & industrial exploitation plans, as member of the "Technologiezentrum Informatik und Informationstechnik" the Department of Communications Engineering is active in several (European) research fora such as the NETWORLD2020 platform, WWRF and will actively participate in the recently founded OneM2M forum in the near future. In this framework the Department offers its support to foster the evolution of communication technologies from a strategic perspective by its expertise in the communication technology business. By conducting bi-lateral collaborations with industry partners the Department transfers its expertise and knowledge to support its partner in the exploitation of innovative concepts in standardisation and the industrial development of technologies.

## 2.16 WINGS ICT Solutions

WINGS ICT Solutions is focusing on the development of intelligence, primarily, for managing broadband communication networks and the supported services. In this respect, there are specific exploitation ambitions that will be realized through the involvement of WINGS in FANTASTIC-5G. Firstly, to develop intelligent components that can be integrated at the lower levels of the protocol stack of the air-interface and secondly, to enhance the management solutions portfolio of WINGS, by developing the means that can exploit the overall capabilities of the new air-interface, at the appropriate context (e.g., traffic and mobility conditions, QoS requirements, energy efficiency, etc.).

In addition, since WINGS will be focused on the development of system level simulations, it will be possible to exploit the respective tool in the realization of performance evaluations of 5G networks for vendors and operators under various scenarios and use cases. This would be an important asset for the project and WINGS in general, in order to start realizing and evaluating 5G technologies and concepts as well.

As a result, WINGS will capitalize on FANTASTIC-5G for enhancing its value propositions and for realizing exports by doing business with vendors and operators in Europe and beyond.

## 3 Dissemination Plan

FANTASTIC-5G dissemination is based on manifold pillars: activities aim at intra- and inter-project concertation, scientific publications, workshops, special sessions, training activities, industry booths, as well as promoting concepts and results produced by the project through the website <http://www.fantastic-5G.eu> from the outset of the project (as outlined in the contracted description of work). Specifically, FANTASTIC-5G fosters scientific publications which will be decided in conformity with the intellectual property, confidentiality and publication provisions set out in the consortium agreement. The parties concerned will use an open access repository (“green” model), connected to the tools proposed by the European Commission (ArXiv, FANTASTIC-5G webpage, openAIRE,...), to grant access to the publications and to a bibliographic metadata in a standard format including information requested by the European Commission.

FANTASTIC-5G will complement this with strong presence in social media 1) to communicate the strong public/societal impact of the project’s 5G activities particular with respect to the creation of FANTASTIC-5G innovative services and technologies 2) to receive respective feedback to ensure a transparent, interactive research and innovation process 3) to foster the development of marketable products. Press releases from scratch and during the lifetime as well as a “white paper series” will create awareness about FANTASTIC-5G also to the general public.

Moreover, FANTASTIC-5G will actively participate in the EC cluster concertation (e.g. radio access cluster), related 5GPPP initiative coordination and steering activities as well as on-going consultations for upcoming 5GPPP phases and related H2020 program initiatives. In addition, FANTASTIC-5G will make use of 5GPPP-specific (EURO-5G news/events update, see below, 5GPPP webpage, 5GPPP working groups, 5GPPP white papers) and EC-specific communication channels for latest research results (such as EC fact-sheets, EC blogs, EC net-it-be or COST newsletters, research.eu magazine articles etc.) as well as other means such as interviews etc. FANTASTIC-5G will actively participate in ICT-related conferences of the EC.

The overall dissemination plans within the project’s lifetime are described in detail next.

### 3.1 Inter-project concertation

FANTASTIC-5G will be active in the inter-project concertation as part of the 5GPPP initiative as well as EC clusters. Whenever possible, FANTASTIC-5G will propose joint workshops, special sessions, tutorials, invited talks or other joint events, e.g., in international conferences, project meetings or similar forums. FANTASTIC-5G will contribute to relevant white papers or other publications initiated by the clusters or 5GPPP.

The following inter-project concertation activities will be undertaken:

#### **Cross-collaboration workshops series**

FANTASTIC-5G actively participates in the cross-collaboration workshop series in 2016/2017. The 1<sup>st</sup> joint 5GPPP Workshop took place in September 28-29, Kista, Sweden. The next is

scheduled for January 20-22, 2016 dedicated to new air interfaces in Valencia (Spain). There are major follow-up's planned in the lifetime of the project.

### Cross-collaboration conference calls

FANTASTIC-5G actively participates in related conference calls to harmonize use cases and evaluations models, to synchronize research results and to initiate (pre-) standardisation and dissemination activities such as joint workshops at international conferences across the 5GPPP projects accordingly. The conference call series are handled by METIS II and they are scheduled on a per month basis (series started in December 2015).

### Joint workshops series

One outcome of this process is the 1<sup>st</sup> joint 5G RAN international workshop at the IEEE ICC 2016 in Kuala Lumpur, Malaysia. The 2<sup>ed</sup> and 3<sup>rd</sup> edition is planned within IEEE GLOBECOM 2016 in Washington DC, USA, and IEEE ICC 2017 respectively

### Panel sessions

There are several joint panel sessions planned for the upcoming 2016/2017 conference series particular for GLOBECOM 2016, ISWCS 2016, EuCNC 2016/2017. This follows up on several major activities in this direction such as the '5G & Beyond' workshop panel at GLOBECOM 2015, San Diego, USA, and a 5GPPP panel at DySPAN 2015, Stockholm, Sweden.

### Joint demo/video presentations, joint booths

There shall be joint activities towards joint demo, video presentations (first version of FANTASTIC-5G video is available) and joint booths at major ICT-related conferences. This shall follow up on the joint 5GPPP booth at the ICT 2015 (together with Xhaul, Metis II, 5G-Norma), Lissabon, Portugal, and the joint video presentation at the IEEE GLOBECOM 2015, San Diego, USA (together with Metis II, 5G-Norma and others).

Activity	Series	Planned time	Planned venue	Topic	Projects
5GPPP Cross-collaboration workshop series covering 2015, 2016 and 2017	1 (done)	September 28-29, 2015	Kista, Stockholm, Sweden	Scenarios, Requirements, Performance Evaluation, Spectrum and RAN Design Assumptions	ALL
	2 (fixed)	January 20-21	Valencia, Spain	5G RAN Design, Air Interface Design and Integration	ALL
	3 (planned)	Feb. 2017	Tba <sup>2</sup>	Tba	ALL
5GPPP Cross-collaboration panel series	DySPAN 2015 (done)	October 1, 2015	Stockholm, Sweden	Spectrum crunch below 6GHz? 5G research trends	FANTASTIC-5G, SPEED-5G, METIS II, COHERENT

<sup>2</sup> To be announced

covering 2016 and 2017				in Europe	
	GLOBECOM 2015( <b>done</b> )	December 6, 2015	San Diego, USA (CA)	5G Enablers: Radio to Architecture	FANTASTIC-5G, 5G-NORMA
	ICC 2016	May 23-27, 2016	Kuala Lumpur, Malaysia	Tba, see <a href="http://www.5G-ran-design.org">http://www.5G-ran-design.org</a>	METIS II, FANTASTIC-5G, 5G-NORMA, mmMAGIC
	ISWCS 2016	September 23-26, 2016	Poznan, Poland	Tba	Tba
	GLOBECOM 2016	December 4-9, 2016	Washington DC, USA	Tba	Tba
	EuCNC	June 2017	Oulo, Finland	Tba	Tba
5GPPP Joint Workshops covering 2016 and 2017	ICC 2016	May 23-27, 2016	Kuala Lumpur, Malaysia	<a href="http://www.5G-ran-design.org">http://www.5G-ran-design.org</a>	METIS II, FANTASTIC-5G, 5G-NORMA, mmMAGIC
	CROWNCOM 2016, CLEEN 2016	May 30–June 1, 2016	Grenoble, France	Tba	Flex5Gware and SPEED-5G
	EuCNC 2016	June 27-30 2016	Athens, Greece	Tba	Tba
	GLOBECOM 2016	December 4-9, 2016	Washington DC, USA	<a href="http://www.5G-ran-design.org">http://www.5G-ran-design.org</a>	Tba
	ICC 2017	May 2017	Paris, France	<a href="http://www.5G-ran-design.org">http://www.5G-ran-design.org</a>	Tba
	EuCNC 2017	June 2017	Oulu	Tba	Tba
Joint booths, Video Demos covering 2015, 2016 and 2017	ICT 2015 ( <b>done</b> )	October 20-22	Lissabon, Portugal	Project demos	XHAUL, METIS II, 5G-NORMA, FANTASTIC5G,
	GLOBECOM 2015 ( <b>done</b> )	December 6, 2015	San Diego, USA (CA)	5G Enablers: Radio to Architecture	METIS II FANTASTIC-5G, 5G-NORMA:
	Global 5G Event	November 2016	Rome, Italy	Tba	Tba
	Some 5G	2017	Tbn <sup>3</sup>	Tbn	Tbn

<sup>3</sup> To be negotiated

	related event				
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### ICT-related EC flagship conference series

FANTASTIC-5G will be participating in major ICT-related EC flagship conference series in 2016/2017 such as ICT 2016, EuCNC 2016, NetFutures 2016 etc.

### 5GPPP working group participation and white papers

FANTASTIC-5G actively participates in the 5GPPP working groups, the 5GPPP steering board as well as related dissemination activities such as white papers (e.g. for the MWC 2016) throughout 2016/2017.

FANTASTIC-5G collaborates closely with 5GPPP EURO-5G coordination action (particularly with David Kennedy, Jacques Magen, Frederic Pujol, Monique Calisti) and the related communication channels, i.e. EURO-5G EVENTS UPDATE [comms@5g-ppp.eu](mailto:comms@5g-ppp.eu), EURO-5G NEWS channel and EURO-5G Twitter account(s). The list of responsible persons for all the dissemination and cross-project interactions (G. Wunder/HHI for FANTASTIC-5G) of each 5GPPP project is available.

The used template is below:

<p><b>Event Name/Title, dates and location:</b> TEXT</p> <p><b>URLs:</b> <a href="http://www.fantastic5g.eu">http://www.fantastic5g.eu</a></p> <p><b>Related Twitter channels / hashtags:</b> <a href="https://twitter.com/fantastic5g">https://twitter.com/fantastic5g</a>; #5gppp, #5G</p> <p><b>Responsible project / organisation / contact person (specify email):</b> NAME</p> <p><b>Promotion:</b> advertisement through 5GPPP channels welcome</p> <p><b>Event's announcement:</b> TEXT</p>
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## 3.2 Pre-standardization/ standardization

### NGMN

FANTASTIC-5G has reached out to NGMN industry forum by connecting to relevant board and office members. As a result FANTASTIC-5G presented "5G Multi-Service Air Interface (<6 GHz)" abstract in the "5G Innovation Session" forum meeting on October 13-14, Montreal, Canada. This process is ongoing and will be fostered in 2016 (e.g. the major event in Frankfurt, September 2016), particularly to connect to the vertical industry (scenarios, use cases, KPIs etc.).

### ETSI

FANTASTIC-5G has been in close interaction with ETSI after VTC Spring workshop in Glasgow/Scotland. One major activity is the ETSI Workshop on Future Network Technologies, January 27-28, 2016, Sophia Antipolis at ETSI Premises/France where FANTASTIC-5G is in the program committee (F. Schaich (CO), G. Wunder (WPL)) and will also present its concept.

### 3GPPP

Members of the consortium have been actively participating in the 3GPP RAN meeting in Phoenix, USA.

Activity	Series/Contributio	Plan ned	Planned venue	Topic
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	<b>n co-signed by partners</b>	<b>time</b>		
3GPP RAN SID on 5G Scenarios and Requirements	3GPP TSG RAN Meeting #70 ( <b>done</b> )	December 7-10, 2015	Sitges, Spain	SI on Scenarios, Requirements, Performance Evaluation, Spectrum and RAN Design Assumptions
	R2-156695			Fast UL evaluation for Mission Critical / Real Time applications
	R2-156706			Fast UL evaluation for Uu based V2V
	Partner contributions aligned with FANTASTIC IR2.1 planned	Tbn	Tbn	Tbn
	3GPP TSG RAN Meeting #71	Planned March 2016	Tba	RAN high-level requirements and high-level deployment scenarios completed (to provide guidance to the technical work to be performed in RAN WGs)
	3GPP TSG RAN Meeting #71	Planned June 2016	Tba	approval of the TR (requirements is expected to be agreed)
3GPP RAN SID on Next Generation New Radio Access Technology	3GPP TSG RAN Meeting #71	Planned March 2016	Tba	SI approval (planned)
	RP-151922			New SID Proposal: Study on Next Generation New Radio Access Technology
	Partner contributions aligned with FANTASTIC IR3.1, IR4.1 and respective deliverables	Tbn	Tbn	Tbn
ETSI	ETSI	Janua	Sophia	<a href="http://www.etsi.org/news-events/events/1005-">http://www.etsi.org/news-events/events/1005-</a>

	Workshop on Future Network Technologies	January 27-28, 2016	Antipolis, France	<a href="#">workshop-on-future-radio-technologies-air-interfaces</a>
	FANTASTIC5G in ETSI SCN WG meeting in Sophia Antipolis (26-28th January)	January 27-28, 2016	Sophia Antipolis, France	Presentation about the selected use cases, 5G network architecture and protocols, as well as the possible integration of satellite systems in the 5G architecture and the possible re use of 5G network elements and/or protocols in future satellite systems
	Partner contributions planned for 2016/17	Tbn	Tbn	Tbn
NGMN	NGMN Forum meeting ( <b>done</b> )	October 13-14, 2015	Montral, Canada	Presentation of FANTASTIC-5G by Coordinator in “5G Innovation Session” on the second day
	Interaction with NGMN Work-stream P1 WS3 BBTS team “Requirements for Better Mobile Broadband and Telco Services”	Tba	Tba	<a href="http://www.ngmn.org/uploads/media/151204_Liaison_NGMN_P1_to_3GPP_RAN_v1.pdf">http://www.ngmn.org/uploads/media/151204_Liaison_NGMN_P1_to_3GPP_RAN_v1.pdf</a>
	NGMN Industry Conference & Exhibition	October 12-13 2016	Frankfurt, Germany	Tba

The industry partners have (and will continue to do so) actively contributed to the definition of NR in 3GPP. For this more than 30 Tdocs (3GPP terminology for technical contribution) have been produced by the industry partners of the project being related to the work in FANTASTIC-5G (for details please refer to the annual and periodic report). For details on the schedule of

3GPP the interested reader is referred to <http://www.3gpp.org/DynaReport/Meetings-R1.htm>. The main series of RAN meetings being relevant for the project is as follows:

- 3GPPRAN1#88 in Athens (February 13. 2017)
- 3GPPRAN1#88bis in the US (April 03. 2017)
- 3GPPRAN1#89 in China (May 15. 2017)

### 3.3 Scientific publications

The project will disseminate its innovation results in high quality scientific journals and conferences. One major contribution will be a white paper at the end of the project based on the concepts and ideas giving a solid overview of the project, aimed to be published in high-impact journals **such as IEEE Communications Magazine** and other IEEE magazine paper (following on the major contributions of METIS and 5GNOW in 5G special issues). In the course the project also overview papers in conferences and workshops will be targeted (such as follow-ups on the recent GLOBECOM'14 workshop on Telecommunication Standards, or other 5G related workshops). Partners will also address special journal issues from IEEE societies (particularly IEEE COMSOC) and EURASIP. Major scientific journal contributions are planned in IEEE Transaction on Wireless Communications (and related journals) and also open access journals (IEEE Access and EURASIP journals).

High-quality conference papers will also ensure dissemination of results and will promote the PHY and MAC layer concepts within the scientific and industrial research community. Envisaged IEEE conferences include frontrunner communication-related conferences such as GLOBECOM, ICC as well as VTC for the industrial track. More European-focused conferences such ISWCS, EW are also in the scope of FANTASTIC-5G. It is worth noting that the partners will particularly disseminate their research results including demonstration events in the EC ICT EuCNC conference series.

### 3.4 Workshops, Special Sessions, Tutorials

The project aims to organize international workshops and tutorials. The purpose of these workshops will be to provide a platform for researchers working around the globe on beyond 4G networks to interact with each other and in particular to benefit from the expertise developed in the project. These workshops will aim at spreading our findings and collecting feedback on the results' relevance and quality, from the scientific community. The participants of the workshop will cover a wide spectrum of research scientists, PhD students and the engineering practitioners in the industry. The consortium is currently targeting conferences VTC, GLOBECOM, and ISWCS, EW, EuCNC for organizing a special session, workshop or tutorial on 5G new air interfaces, e.g. GLOBECOM at the end of each year, VTC Spring at the beginning of each year of the project's lifetime. Apart from workshops, panel sessions will be organized in reputable conferences. A training school shall also be organised co-located with some conferences.

The following activities are planned:

#### **New Air Interface workshop series within VTC Spring conference series**

FANTASTIC-5G has initiated a **New Air Interface** workshop series as part of the VTC Spring conference cycle which started with VTC Spring 2015, Glasgow/Scotland. The next major workshop will take place in May 2016, Nanjing, China. The websites for the workshop series will be located here:

<http://workshop2015.fantastic5g.com/>, <http://workshop2016.fantastic5g.com/> etc.

#### **5G RAN workshop series within IEEE GLOBECOM and IEEE ICC conference series**

Three editions of the major 5G RAN workshop series are planned: GLOBECOM 2016 and ICC 2016/2017. The workshop series has been described in section 3.1 and is a joint activity of mainly METIS II, FANTASTIC-5G, mmMAGIC, and 5G (and other). The website is located here: <http://www.5G-ran-design.org>

#### **New Air Interface workshop series within VTC Spring conference series**

Beside the 5G New Air Interface and 5G RAN activity there is a EuCNC 2016/2017 workshop series for PHY&HW (physical and hardware layer) aspects planned.

The “5G New Air Interface” / “5G RAN” / “5G PHY&HW” workshop series will be a major dissemination line of FANTASTIC-5G.

#### **Special session series**

FANTASTIC-5G has initiated a special session series dedicated to specific core services such as massive machine-type communication (MMC), mobile broadband etc. The first FANTASTIC-5G special session on MMC took place within ASILOMAR 2015, November 8-11 2015, Pacific Grove, USA: <http://www.asilomarssc.org>. Major follow up is planned for the EuCNC 2016 conference.

The special session series is a major dissemination line of FANTASTIC-5G.

#### **Tutorial series**

FANTASTIC-5G is planning tutorial activities on **5G New Waveforms** for EuCNC, GLOBECOM conference series (following up on the GLOBECOM 2015 tutorial).

#### **Training**

As indicated in the exploitation plans of individual partners, the academic partners (higher education institutes) are eager to reflect the scientific achievements in post-graduate degree courses (PhD and MSc) that are offered by them. This will enlighten post graduate students with the latest developments in new 5G air interface thereby helping them in their taught and research studies, and will also be a secondary source of dissemination of ideas and results when the fresh graduates will pursue their respective careers in industry and academia.

<b>Activity</b>	<b>Series</b>	<b>Planned time</b>	<b>Planned venue</b>	<b>Topic</b>
Major workshop series covering the years 2015, 2016 and 2017	VTC Spring 2015 <b>(done)</b>	May 2015	Glasgow, Scotland	5G RAN Design, Air Interface Design and Integration
	VTC Spring 2016	May 2016	Nanjing, China	5G RAN Design, Air Interface Design and Integration
	ICC 2016	May 2016	Kuala Lumpur	5G RAN 1 <sup>st</sup> edition
	EuCNC 2016	June 2016	Athens, Greece	5G PHY and HARDWARE 1 <sup>st</sup> edition
	GLOBECOM 2016	December 2016	Washington DC, USA	5G RAN 2 <sup>ed</sup> edition
	ICC 2017	May 2017	Paris, France	5G RAN 3 <sup>rd</sup> edition
	EuCNC 2017	June 2017	Oulu, Finland	5G PHY&HW 2 <sup>ed</sup>

				edition
Special session series covering the years 2015, 2016 and 2017	Asilomar 2015 <b>(done)</b>	November, 2015	Pacific Grove, USA	MMC
	EuCNC 2016	June 2016		MBB
	EuCNC 2016	June 2016		MCC
	EuCNC 2017	June 2017	Oulu, Finland	MCC/MMC
	EuCNC 2017	June 2017	Oulu, Finland	CRAN
Tutorial series covering the years 2016 and 2017	EuCNC 2016			5G Waveforms
	GLOBECOM 2016	December 2016	Washington DC, USA	5G Waveforms
	EuCNC 2017	June 2017	Oulu, Finland	5G Air Interface Design Primer

### 3.5 Booth at industry expositions

All partners in the consortium periodically participate in different self-organised and externally organised public events, industry trade shows and other marketing and public relation actions. Among these events, the consortium will target the **Mobile World Congress** in order to demonstrate the technological achievements of the project (e.g. 5GNOW/METIS results have been showcased there by the respective industry partners).

Eventually, FANTASTIC-5G will produce **videos** whenever possible which are to be presented at ICT-related conferences or expositions and to be distributed over the various social network channels, blogs, webpages etc. (or even specific video channels). First FANTASTIC-5G video presentation has been presented at the GLOBECOM 2015 in San Diego, USA. This shall be followed in the upcoming conference series 2016/2017, particular a booth with first demonstrations is planned for the **EuCNC 2016 in Athens, Greece**, and the **EuCNC 2017 in Oulo, Finland**. Participation in the industry program of **IEEE GLOBECOM 2016 in Washington DC, USA**, and the **IEEE ICC 2017 in Paris, France**, is under discussion.

### 3.6 Public website, flyers, newsletters

FANTASTIC-5G will host a comprehensive public website updated timely to cover all relevant activities. The website will contain all relevant information about the project, such as the project vision and objectives, the relation of the project to the funding programme and other projects in the same domain and the consortium details. The site will be updated over the lifetime of the project with the public deliverables, publications, and public materials, such as flyers ('factsheets') and posters. It will provide an overview of the project's events and other relevant events.

The website is up and running. It has dedicated sections for:

- [About](#) (start page with embedded Twitter account)
- [Project](#) (project description)
- [Documents](#) (document section: important papers/fact sheet ....)
- [News](#) (latest news)

- [Events](#) (latest event with detailed information about date/location/time/venue/"Who will join"/"How to join")
- [Supervisors](#) (PMT)
- [Contact](#)

The website is constantly (on time) updated particularly due to the embedded Twitter messages (Twitter updated online from panels etc. possible).

### 3.7 Social Media and YouTube representation

Different social networking groups (e.g., twitter, LinkedIn and Facebook) will complement FANTASTIC-5G's website. Through social networks, the project will advertise its results, announce events, inform about the most recent results and reports, and will provide a platform for discussion. Specifically, FANTASTIC-5G has set up the following social media channels:

#### **Twitter account**

The Twitter account is constantly used for online messaging of news (like NGMN participation etc.). FANTASTIC-5G has already 36 followers and is following 6. The account is also a good means for the cross-project interaction (Re-Tweets by 5GPPP and EURO-5G related Twitter accounts).

#### **LinkedIn group**

The FANTASTIC-5G LinkedIn group is used to spread technical and workshop/panel announcements and technical content among stakeholders, academia, industry etc. The group has already 461 members!

#### **Cooperation with independent media**

FANTASTIC-5G will further collaborate with news agencies and will, in addition to its newsletter, also periodically issue press releases informing about the project and its results. This will help to increase the public awareness of European research in general, and FANTASTIC-5G and its partners in particular.