Mobile and wireless communications Enablers for the Twenty-twenty Information Society-II

Deliverable D7.1
Dissemination and exploitation plan

Version: v1.0

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Abstract

This deliverable reports the dissemination, regulation and standardization plan for the METIS-II project. Moreover, it presents the exploitation expectations from the project perspective and the individual partners. Finally, it also shows the visualisation platform to be adopted in the project.

Revision History

Revision	Date	Description
1.0	2015-09-30	Final version after external review

Executive summary

This report describes the project exploitation and dissemination plan that will be implemented to achieve the project ambitions, as well as the activities foreseen towards regulation and standardization fora.

This report informs third parties interested to follow METIS-II outcome to understand where and how the dissemination activities of METIS-II are organized. It provides information about planned coordinated dissemination activities that allow the readers to get the whole picture of METIS-II position.

METIS-II has started exploitation and dissemination organizing and attending events, conferences and workshop in the first phase of its activity. EuCNC participation in July 2015, VTC Fall panel session in September 2015, workshop with 5G PPP projects on 5G use cases and system design are some of the first initiatives. These will be followed by many others in next months, to ensure the widest dissemination of the activities in the project.

Moreover, the deliverable presents some preliminary information on the visualisation platform, which is a distinctive feature of METIS-II dissemination of future achieved results.

Contents

List of Abbreviations and Acronyms

3GPP	Third Generation Partnership Project			Union – Telecommunications standardization sector
5G-PPP	5G Private Public Partnership		**J-SAC**	Journal on Selected Areas in Communications
CAPEX	Capital Expenditures		**JWCN**	Journal on Wireless Communications and Networking
CEPT	European Conference of Postal and Telecommunications Administrations		**LSA**	Licensed Shared Access
CPG	Conference Preparatory Group		**LTE/-A**	Long Term Evolution / -Advanced (3GPP)
CSA	Coordination and Support Action		**METIS-II**	Mobile and wireless communications Enablers for the Twenty-twenty Information Society - II
DoW	Description of Work			
DySPAN	Dynamic Spectrum Access Networks		**MFCN**	Mobile Fixed Communication Networks
ECC	Electronic Communications Committee		**MIMO**	Multiple Input Multiple Output
ETSI	European Telecommunications Standards Institute		**MNO**	Mobile Network Operators
			MWC	Mobile World Congress
EuCNC	European Conference on Networks and Communications		**NGMN**	Next Generation Mobile Networks
EURASIP	European Association for Signal Processing		**OFDM**	Orthogonal Frequency Division Multiplexing
ICT	Information and Communication Technology		**OPEX**	Operational Expenditures
IEEE	Institute of Electrical and Electronics Engineers		**PIMRC**	Personal, Indoor and Mobile Radio Communications
IEICE	Institute of Electronics, Information and Communication Engineering		**PPP**	Public Private Partnership
			RAN	Radio Access Network
IETF	Internet Engineering Task Force		**R&D**	Research & Development
IMT	International Mobile Telecommunications		**SA**	Service and System Aspects (3GPP)
IoT	Internet of Things		**SDO**	Standard Development Organization
ISIT	International Symposium on Information Theory			
I-TEAM	Institute of Telecommunications and Multimedia Applications		**SPAWC**	Signal Processing Advances in Wireless Communications
ITRI	Industrial Technology Research Institute		**UMTS**	Universal Mobile Telecommunications System
ITU-R	International Telecommunication Union – Radiocommunication sector		**UPV**	Universitat Politecnica Valencia
			VTC	Vehicular Technology Conference
ITU-T	International Telecommunications		**WCNC**	Wireless Communications and Networking Conference

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WG	Working Group
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access

WINNER	Wireless World Initiative New Radio
WP	Work Package
WRC	World Radio Conference

1   Introduction

The present deliverable provides a presentation of all the dissemination and regulation activities that will be performed in METIS-II. Moreover, it covers some aspects of the visualisation platform which is studied in WP7 ("Dissemination, Standardization, Regulation, Collaboration and Visualization"). Furthermore, it presents some details on the exploitation intentions that the individual partners and the whole project will put in place during the two years of activity of METIS-II.

1.1   Objective of the document

This report describes the project exploitation and dissemination plan that will be implemented to achieve the project objectives, as well as the activities foreseen towards regulation and standardization fora.

This report informs third parties interested to follow METIS-II outcome to understand where and how the dissemination activities of METIS-II are organized. It will provide information about planned coordinated dissemination activities that allow the readers to get the whole picture of METIS-II position.

The deliverable outlines the plan for disseminating METIS-II results to standards and regulatory bodies. Moreover, the plan for ensuring that the policy decisions and work on defining new standards to take into account the findings in METIS-II and the technologies developed by the project are outlined as well.

The report identifies important organizations, events, meetings and workshops in which the project shall participate and provide contributions. Further, it establishes a strategic plan for the dissemination of the project results.

1.2   Structure of the document

The mentioned objectives are presented in separate sections in this deliverable, together with a visualisation platform short description and the exploitation plans that the individual partners intend to follow to leverage the achievements of METIS-II.

In Section 2 an overview of METIS-II is provided. Section 3 is the section which is related to dissemination and exploitation activities, as planned in the project. Section 4 gives details on the standardization and regulation plans that METIS-II will follow.

Visualisation topics, which represent an important investment in METIS-II, being the "demonstrator" of the project, are briefly described in Section 5.

A summary of the foreseen exploitation of METIS-II is given in Section 6, based on the information provided by each partner in the Annex A, in which the individual exploitation plans are reported. Finally, Annex B reports a list of press releases related to the first phase of the project activity.

2 METIS-II Overview

METIS-II is the project that continues the activity performed from 2012 to 2015 by its parent project METIS [MET15-D84]. As the flagship project on 5G, METIS established a set of scenarios, test cases and KPIS that are globally referred to. [MET13-D11] METIS identified and structured the key technology components that are necessary to fulfil the 5G vision of the all-connected world and was the foundation to strengthen the EU position in 5G landscape.

The METIS-II project will continue the momentum that has been gained in METIS, to ensure that 5G is introduced in a timely and economically attractive form, meeting the user requirements. In particular, METIS-II aims to design the technology for an efficient integration of the many 5G concepts and legacy radio access technology into a holistic 5G system that can efficiently scale to meet all 5G use cases. Moreover, the 5G technology components have to be complemented by all architectural elements that are needed for a comprehensive and detailed radio access network (RAN) specification. Finally, it should be ensured that this overall radio access network design is technically and economically feasible and energy-efficient, to facilitate the forthcoming standardization process.

2.1 Dissemination, Standardization and Regulation objectives

As stated in the Description of Work , the METIS-II objectives are the following:

1. Develop the overall 5G radio access network (RAN) design (where 5G refers to the overall future wireless communications system including evolved legacy and novel radio access technologies), and focusing particularly on designing the technology for an efficient integration of legacy and novel RAN concepts into one holistic 5G system.

2. Provide the 5G collaboration framework within 5G-PPP for a common evaluation of 5G radio access network concepts from both a performance and techno-economical perspective. More specifically, METIS-II will further refine 5G scenarios, requirements and KPIs, develop a performance and techno-economical evaluation framework, and provide consolidation and guidance to other 5G-PPP projects on spectrum and overall 5G radio access network design aspects. Furthermore, METIS-II will develop an open-source 5G evaluation and visualisation tool for illustrating the key use cases of a 5G system, and the benefit of the key radio access network design elements developed.

3. Prepare concerted action towards regulatory and standardization bodies for an efficient standardization, development, and economically attractive roll-out of 5G with a strong European footprint and head-start.

As it can be noticed Objectives 2 and 3 are closely related to dissemination, standardization and regulation activities within METIS-II. In particular, Objective 2 makes reference to both the organization of a 5G collaboration framework, that METIS-II builds and consolidates also by means of ad hoc events and workshops planned throughout the project's lifetime. Moreover, Objective 2 is also mentioning the visualisation tool, which is an innovative way to show and disseminate project results also for other 5G PPP projects.

Regarding Objective 3, METIS-II will use its world recognized brand in the 5G arena to start preparing a framework where future standardization works will be included; METIS-II partners will leverage from the experience gained in the project to influence the standardization of 5G systems in the respective standardization bodies. The consortium will aim to provide input to the 5G requirements work of ITU-R WP5D, will exert a strong influence on 5G related study items and work items in 3GPP Releases 14 and 15 and, through the reports and deliverables from WP3 ("Spectrum") will exert substantial impact on WRC-18/19.

In order to account for the achievement of the mentioned objectives, there are several ways to estimate the impact that METIS-II will exert within 5G PPP. This impact will be quantified by the number of times that METIS-II (or its deliverables) is cited or referred to publicly in any communities or bodies such as NGMN, the extent to which METIS-II was able to influence the ITU-R requirements work and WRC-18/19 (even if this will happen after the conclusion of the project), and the extent of 5G concepts, study and work items in 3GPP that have been influenced through METIS-II.

2.2 Overall project structure

The structure of the METIS-II project is shown in Figure 2-1. The project is structured in the form of technical work packages representing technical layers, and the so-called key innovation pillars.

The technical work packages are organized according to what the partners currently assume to be the most efficient work split. For instance, the control plane design activities have been split into two WPs for a better structuring of these activities, where WP5 ("Synchronous Control Functions and Resource Abstraction Framework")focuses on the synchronous functions (i.e. requiring frame/slot/sub-frame or any time-domain level synchronization such as scheduling, interference coordination, power control, etc.) and WP6 ("Asynchronous Control Functions and Overall Control Plane Design") focuses on the asynchronous functions (e.g. related to mobility, system access, etc.).

Key innovation pillars are always driven by one specific technical work package, but intentionally span multiple technical layers and corresponding WPs, as they require contributions from, or at least alignment among, multiple WPs.

As an example, the holistic 5G resource management framework will be driven by WP5, which covers synchronous control plane functionality, but it of course has to take spectrum and user plane design aspects into account, covered in WPs 3 and 4 ("Air Interface Harmonisation and User Plane Design") respectively, and it has to be co-designed with the asynchronous control plane functionality covered in WP6.
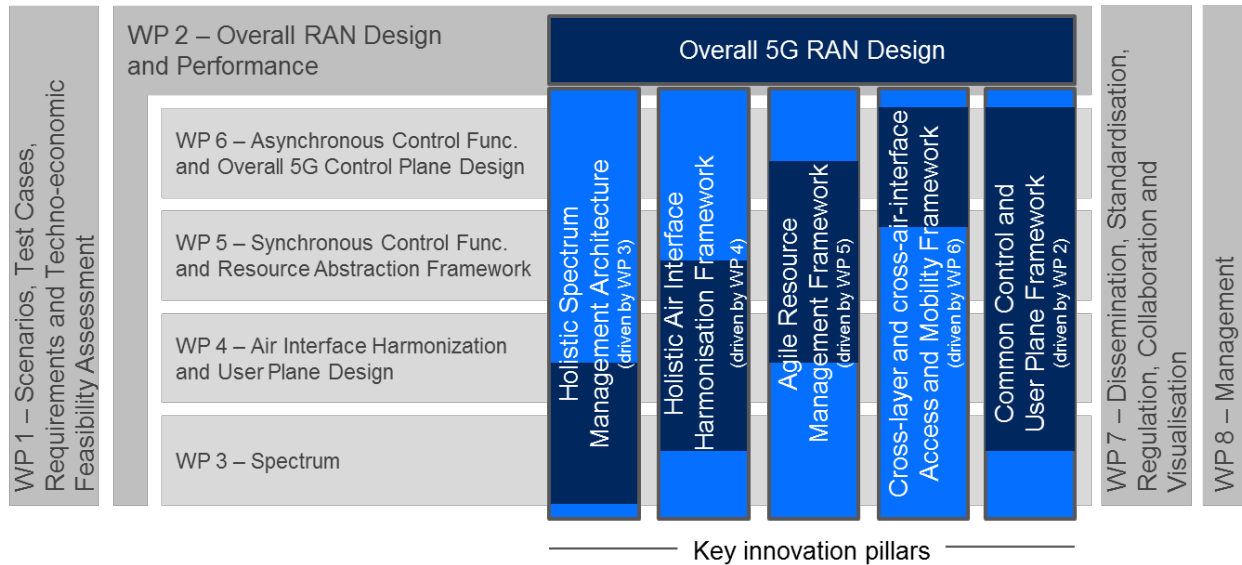
Figure 2-1: METIS-II structure.

In general, the collaboration between WPs 3-6 is orchestrated through WP2 ("Overall RAN Design and Performance").WP2 is also responsible for the overall RAN design and the performance assessment of all compared RAN design hypotheses, and for ensuring that the key innovation pillars are well reflected in the overall 5G RAN design.

WP7 will ensure that the concepts developed in METIS-II are disseminated, and that the impact on standardization and regulatory bodies is maximized. To achieve this, WP7 will organize dissemination events such as open workshops. WP7 will further ensure a strong collaboration with other projects in 5G-PPP phase 1, for instance in the form of various workshops, cf. Section 2.3. Finally, WP7 will develop and make an open source visualisation platform available to other projects to showcase 5G use cases, as well as holistic RAN design concepts that address them.

2.3 Relationship with 5G PPP

The interaction between METIS-II and the other 5G PPP projects, and in particular with all the projects dealing with concurrent or complementary topics, is represented by Figure 2-2, as taken from the Description of Work of the project.
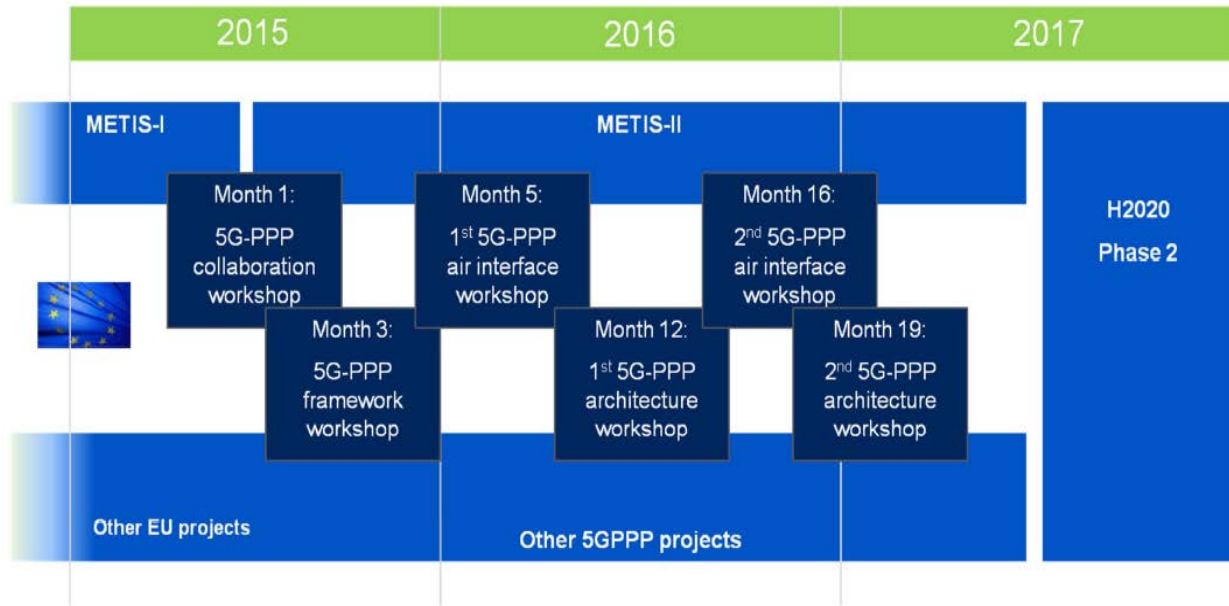
Figure 2-2: Interaction of METIS-II with other projects.

The workshop in Month 1 has been organized with all the other 5G PPP projects to start aligning the respective planned activities. The workshop in Month 3 takes place in September 2015 and is organized by METIS-II. The themes dealt with in that workshop are about scenarios, requirements, performance evaluation, spectrum and RAN design Assumptions. Next workshops will be important moments and opportunities to check the developments of the activities in the respective projects. It's worth noticing that METIS-II shares not only its deliverables to the external community but also the so-called "reports", that are not internal to the project, but available to the whole 5G PPP community, in order to facilitate knowledge distribution and achievements sharing. These workshops aim also to facilitate technical discussions and coordination among the 5G PPP projects in the wireless strand.

3   Dissemination activities

In order to disseminate the results from the project, a number of conferences and journal publications as well as workshops and events have been identified and selected. Publication opportunities can further be grouped into the following areas of interest:

- General communication: there are numerous conferences and publications where wireless communications are addressed in general, e.g., the VTC conference and Communications Magazine. Since the scope of these events is relatively broad, the results from all WPs could be presented, but special interest is for WP1, WP2 and WP7.

- Spectrum management techniques: WP3 deals with novel techniques for managing spectrum. The main conferences focusing on this type of research are DySPAN and Crowncom. There are however no dedicated magazines, but some of the listed journals (see Section 3.2) occasionally have special issues on spectrum management.

- Signal processing: a subset of the listed journals focuses on the signal processing aspect of communication, e.g., IEEE Transactions on Signal Processing and ICASSP. WP4 research topics, which are traditionally considered within the signal processing domain, may be presented in this kind of events.

- Communication networks: many networking aspects are addressed in WP5 and WP6. There are a few conferences that only focus on communication networks, where the results from these work packages could be presented.

3.1   Relevant conference events

The following list highlights the major events relevant to METIS-II. In addition, there are a number of small-scale events where METIS-II results could be also presented, but they are not included here for simplicity. The list is in alphabetical order to avoid any kind of judgement on the relevance of the event.

METIS-II will target these conferences, among others, as opportunities to share the results achieved in the respective area of interest of the conference, with resources from the Work Packages dealing with those activities.

3.1.1   ASILOMAR

The Asilomar Conference on Signals, Systems, and Computers is a yearly conference held on the Asilomar Grounds. It provides a forum for presenting work in various areas of theoretical and applied signal processing. Topics include coding and modulation, MIMO communications and signal processing, ad-hoc and sensor networks, signal processing and adaptive systems, array signal processing, and speech, image and video processing.

3.1.2   European Conference on Networks and Communications

EuCNC is a conference supported by the EU Commission. It is aimed to share experiences and research results, identify future trends, discuss business opportunities and identify opportunities for international research collaboration under the consecutive programmes on R&D and projects

co-financed by European programmes, as well as presenting the latest developments in this area.

3.1.3 International Conference on Cognitive Radio Oriented Wireless Networks

The aim of this conference (Crowncom) is to bring together researchers in both academia and industry to present their new solutions to cognitive radios. Cognitive radio, with the capability to flexibly adapt its parameters also in view of self-organizing RAN, has been proposed as the enabling technology for unlicensed secondary users to dynamically access the licensed spectrum, owned by legacy primary users on a negotiated or an opportunistic basis.

3.1.4 IEEE Conference on Standards for Communications and Networking

The aim of this conference (CSCN) is to bring together researchers, scientists and standards experts from academia, industry and different standardization bodies. Accordingly, the target is to serve as a platform for presenting and discussing standards-related topics in the areas of communications, networking and related disciplines, and, thus, to facilitate standards development as well as cooperation. The conference is a continuation of the *Telecommunications: From Research to Standards* workshop that was organized as part of IEEE ICC 2012, ICC 2013, and GLOBECOM 2014, and has been extended to a full conference as of 2015.

3.1.5 IEEE International Symposium on Dynamic Spectrum Access Networks

The main focus of this conference (DySPAN) is the dynamic spectrum access and cognitive radio. The topics covered include regulatory aspects of dynamic spectrum access, theoretical studies, algorithm and protocol design for cognitive radios and networks, as well as application-oriented contributions dealing with architectures, platforms, signalling and multiple access schemes. This is one of the main events for exchanging ideas about spectrum regulation and schemes for spectrum sharing.

3.1.6 IEEE Global Communications Conference

GLOBECOM is the IEEE Communications Society's premier conference. It provides a unique opportunity to explore the leading areas of information and communications technology related to industry, academia, government and other market segments from around the world. It provides opportunities for networking with colleagues, customers and vendors from around the world. The conference offers technical sessions, tutorials, workshops as well as industry fora and exhibitions.

3.1.7 IEEE International Conference on Acoustics, Speech and Signal Processing

The ICASSP conference is the world's largest and most comprehensive technical conference in the field of signal processing and its applications. The conference features tutorials, exhibits, and lecture and poster sessions. Topics typically include image and video signal processing,

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machine learning for signal processing, sensor arrays and multichannel signal processing as well as signal processing theory and methods.

3.1.8 IEEE International Conference on Communications

ICC is one of the flagship conferences of IEEE Communications Society. The conference features a large technical program including several symposia and a number of tutorials and workshops as well as technical presentations. Furthermore, like other conferences, it features keynote speeches, various industry fora and vendor exhibits.

3.1.9 IEEE International Conference on Computer Communications

This conference (INFOCOM) features papers of significant and innovative research contributions to the field of computer and data communication networks. The topics covered include network architecture, design, implementation, operations, analysis, measurement, performance, simulation and ad-hoc networks.

3.1.10 IEEE International Symposium on Information Theory

ISIT is one of the major conferences in the information theory area. The conference covers a broad range of topics related to information theory.

3.1.11 IEEE International Symposium on Wireless Communication Systems

The objective of the International Symposium on Wireless Communication Systems (ISWCS) is to provide a recognised and dynamic forum for researchers and engineers from academia and industry to present and discuss original ideas and contributions in all fields related to mobile wireless communication systems. The program includes panel sessions, keynote speeches, paper and poster presentations as well as showcasing test-bed implementations.

3.1.12 IEEE International Symposium on Personal, Indoor and Mobile Radio Communications

PIMRC is one of the premier conferences in the wireless research arena and has a long history of bringing together academia, industry and regulatory bodies. Today, it has become one of the IEEE Communication Society's most relevant conferences in wireless networking. It includes sessions, tutorials, workshops, technology and business panels. The topics covered include all areas of wireless communications, networks, services, and applications.

3.1.13 IEEE International Workshop on Signal Processing Advances in Wireless Communications

This workshop (SPAWC) is focusing on recent advances in signal processing for wireless and mobile communications, information and network theory. The workshop features poster presentations and invited plenaries on recent advances in signal processing for wireless communications, as well as for communications and networking in general.

3.1.14 IEEE Vehicular Technology Conference

The IEEE VTC conference is a semi-annual event that brings together researchers from academia, industry and government for exchanging ideas. The conference features world-class speakers, tutorial sessions and technical presentation and poster sessions. Submissions include papers in fields of wireless, mobile, and vehicular technology.

3.1.15 IEEE Wireless Communications and Networking Conference

IEEE WCNC is the premier wireless event for researchers, industry professionals and academics interested in the latest development and design of wireless systems and networks. Sponsored by the IEEE Communications Society, IEEE WCNC has a long history of bringing together industry, academia and regulatory bodies.

3.1.16 Innovate, Connect, Transform (ICT)

This annual summit (ICT) is the biggest sector event in the EU calendar, intended for networking and capturing the latest news on the European Commission's new policies and initiatives with regard to research and innovation in ICT. METIS-II participates in the event in Lisbon, in October 2015.

3.1.17 International Symposium on Wireless Personal Multimedia Communications

The symposia series WPMC were inaugurated in 1998, as a global platform which aims at enabling collaboration in the field of wireless information. Held in Asia, Europe and America, WPMC has established itself as a unique global conference dedicated to wireless multimedia convergence. In addition to high-quality technical sessions, the symposium will feature workshops and tutorials.

3.2 Publications in relevant journals

In the following, we list some of the most relevant journals where METIS-II results could be disseminated. The journals are also listed in alphabetical order.

3.2.1 EURASIP Journal on Wireless Communications and Networking

EURASIP JWCN (Journal on Wireless Communications and Networking) aims to bring together science and applications of wireless communications and networking technologies, with emphasis on signal processing techniques and tools.

3.2.2 IEEE Communications Letters

The IEEE Communications Letters provide researchers with an ideal venue for sharing their newest results in a timely manner. Every month this journal publishes 20-25 short (up to 4 pages) high-quality contributions on the theory and practice of communications.

3.2.3 IEEE Communications Magazine

This magazine covers current issues and advances in key areas of wireless, optical and wired communications. Written in tutorial applications-driven style by the industry's leading experts, IEEE Communications Magazine delivers practical and current information on hot topics, implementations and best industry practices.

3.2.4 IEEE Journal on Selected Areas in Communications

Each issue of the IEEE Journal on Selected Areas in Communications (J-SAC) is devoted to a specific technical topic and thus provides to J-SAC readers a collection of up-to-date papers on that topic. These issues are valuable to the research community and become valuable references. The technical topics covered by J-SAC issues span the entire field of communications and networking.

3.2.5 IEEE Signal Processing Magazine

The IEEE Signal Processing Magazine (SPM) publishes tutorial-style articles on signal processing research and applications, as well as columns and forums on issues of interest. Its coverage ranges from fundamental principles to practical implementation. Its mission is to bring up-to-date, emerging, and active technical developments, issues, and events to the research, educational, and professional communities.

3.2.6 IEEE Transactions on Communications

The IEEE Transactions on Communications (TCOM) publishes high-quality papers reporting theoretical and experimental advances in the general area of communications with a broad scope spanning several areas such as wireless communications, wired communications, and optical communications.

3.2.7 IEEE Transactions on Signal Processing

The IEEE Transactions on Signal Processing covers novel theory, algorithms, performance analyses and applications of techniques for the processing, understanding, learning, retrieval, mining and extraction of information from signals. The term "signal" includes, among others, audio, video, speech, image, communication, geophysical, sonar, radar, medical and musical signals.

3.2.8 IEEE Transactions on Vehicular Technology

The IEEE Transaction on Vehicular Technology is dedicated to vehicular technology. The areas covered include mobile communications, vehicular electronics and transportation systems. It is an important arena to share and accelerate research in the mentioned areas. In addition to research papers, it also publishes tutorials and surveys in the areas of interest. Recent special issues included topics such as self-organising networks and moving communication systems from the laboratory into reality.

3.2.9 IEEE Transactions on Wireless Communications

The IEEE Transactions on Wireless Communications is a major journal which is committed to the timely publication of peer-reviewed original papers, that advance the state-of-the art and applications of wireless communications. In addition, papers on specific topics or on more non-

traditional topics related to specific application areas are encouraged. Examples include OFDM, MIMO systems, wireless over optical, and ultra-wideband communications.

3.2.10　　IEEE Vehicular Technology Magazine

This is a quarterly magazine that focuses on mobile communications, vehicular electronics and transportation systems. It features editorial columns, tutorials and survey papers in addition to original papers in these three areas.

3.2.11　　IEEE Wireless Communications Letters

This journal publishes timely, novel and high-quality recent results on wireless communications in letter format. The journal's goal is the rapid dissemination of original, cutting-edge ideas and timely, significant contributions in the theory and applications of wireless communications.

3.2.12　　IEEE Wireless Communications Magazine

This magazine targets researchers working in the wireless communications and networking communities. It covers technical, policy and standard issues relating to wireless communications in all media and at all protocol layers. The topics are interdisciplinary and include regulatory as well as technical aspects of wireless networking and communications.

3.2.13　　Journal of Communications and Networks

This is an international journal published by the Korea Information and Communications Society. It is a bi-monthly publication which spans both theoretical and practical topics in communication and information networks. Examples of topics for special issues include Massive MIMO. This journal has a large impact in Korea.

3.3　　Workshops and events

3.3.1　　5G PPP workshops

METIS-II, as the transversal project for the coordination of wireless access strand in 5G-PPP, will foster cooperation among 5G-PPP projects involved in the radio definition. A set of cross-project workshops are planned during the METIS-II duration. As an example, the 5G-PPP Framework Workshop has been planned to be collocated with the METIS-II second meeting in Kista, Sweden, in September 2015.

3.3.2　　Euro5G

Since most of the industrial partners in METIS-II belong to the 5G Infrastructure Association – the private party of the 5G Public Private Partnership (5G-PPP)–, METIS-II is represented in the Euro5G Coordination and Support Action (CSA) in charge of supporting the coordination between all projects of the 5G-PPP. In this framework, METIS-II participates in Working Groups (WGs) of Pre-standardisation, Spectrum, and Architecture, being the WP leaders in WP7, WP3 and WP4-WP5 the elected representatives in these WGs, respectively. Moreover, the creation of more WGs is currently under discussion. METIS-II will participate in those related to the design of the 5G radio interface.

3.3.3 Industry fora and events

The following fora are of interest for dissemination in industry.

MWC

Once a year, Barcelona hosts the MWC (Mobile World Congress), the biggest industry event in the mobile communications field. The 2015 edition counted 93.000 professional visitors, including 4.500 C-level people coming from all companies worldwide. With more than 2.000 exhibitors, this is the biggest fair in Europe.

NGMN

NGMN organizes regular conferences to provide an in-depth update on the latest status of mobile broadband deployment and operations, upcoming network and device trends, and on technology and service innovations. These conferences include presentations by prominent speakers from the world's leading operators and vendors. This is also a place to showcase the latest mobile broadband technology solutions.

FuTURE Forum

FuTURE Forum is a Chinese non-profitable international organization jointly initiated by 26 mobile telecommunication operators, mobile communication equipment manufacturers, research institutes, and universities from both outside and inside of China. The main objectives can be stated as facilitating the vision for future mobile communications system development, promoting research and achieving the sustainable development of mobile communications all over the world. Several METIS-II partners are currently members of the forum, such as Docomo, Ericsson, Huawei, and Nokia. METIS has already organized a 5G Summit in 2013 jointly with FuTURE Forum attracting key industry players globally as well as regulatory bodies from EU and China sides. Future interactions between METIS-II and FuTURE Forum are planned.

IMT-2020 (5G) Promotion Group

IMT-2020 (5G) Promotion Group based on the original IMT-Advanced Promotion Group was jointly established in February 2013 by three Chinese ministries (Ministry of Industry and Information Technology, Development and Reform Commission, and Ministry of Science). The 5G Promotion Group comprises 56 member units including the main operators, vendors, universities and research institutes in China, e.g., China Mobile, China Unicom, China Telecom, Huawei and Tsinghua University. It is the major platform for promoting 5G technology research in China and also facilitates international communication and cooperation. The China IMT-2020 (5G) Promotion Group held the third annual 5G summit in Beijing on May 29, 2015, attended by more than 300 industry experts from both China and across the globe. Experts from EU's METIS, Japan's 5GMF, Korea's 5G Forum, Qualcomm and Ericsson attended at the event. This annual event is a good opportunity to disseminate METIS-II's outcome.

3.3.4 Other events

At many conferences there are usually workshops or tutorial sessions collocated with the main conference the day before (or after) the main event. For METIS-II, following the same good practice in METIS, this provides an excellent opportunity to present the results of the project as well as soliciting feedback on the results and progress of the project.

3.4 Other activities for dissemination

METIS-II has already created and will maintain a web-site where papers, reports and presentations are available to the general public. In addition, there might be other channels that could be used for disseminating results, e.g. it may be suitable to use social media for disseminating results and/or to get feedback on the ongoing research. However, these potential activities will have to be further evaluated as more results become available. We also consider the possibility of using Wikipedia platform for the creation and update of some relevant entries; thus collaborating to the widespread knowledge of the 5G.

4   Standardization and regulation activities

One of the METIS-II objectives is to prepare coordinated actions toward the standardization bodies. A significant part of the telecommunication industry is participating in the project, thus providing a very good basis for standardization pre-alignment and ensuring sufficient scale to have an impact on the standardization bodies.

Research projects are usually not allowed to provide direct input to standards and regulatory bodies, thus the commonly utilized process is to contribute through joint submissions by the partners.

4.1   Regulatory bodies relevant for METIS-II

4.1.1   ITU-R

ITU-R (ITU Radio-communication Sector) has a large role in coordinating the use of radio spectrum and satellite orbits. In the process they create agreements, standards and procedures to ensure interference free operation of radio systems [ITU-R].

For the METIS-II project, the most important activity towards ITU-R is the work on identifying spectrum for 5G.

To allocate spectrum, it is necessary to identify preferred frequency ranges and also to determine how much spectrum will be needed. In addition, it is also necessary to determine if the spectrum can be shared with existing services. In November 2015, the WRC-15 (World Radio Conference) will be held. One of the topics on the agenda will be to discuss which frequency ranges should be studied until the next WRC meeting, so that the spectrum can be allocated in WRC-19. After WRC-15, these studies will start to determine how much spectrum is needed and how sharing can be done with existing services. In the project, the activities in WP3 will be used for supporting these activities.

Another important part of allocating spectrum is to develop the conditions that a system must fulfil in order to be allowed to be deployed in the spectrum identified for IMT-2020. This work will start after WRC-15. The process consists of developing criteria on which technologies will be evaluated followed by the evaluation of technology proposals. The activity to develop suitable criteria is expected to continue until mid of 2017. From METIS-II perspective, this provides the possibility to influence the evaluation criteria. The activities in WP1 (use cases) and in WP2 (evaluation assumptions) will be used as the basis for input to ITU-R.

4.1.2   ITU-T

ITU-T develops international standards known as ITU recommendations. The work is done in study periods where the current period ends in 2016. During a study period, a number of working groups are developing standards for wireline networks and other technologies important in communications. The responsibility of the current study groups include network operations, economics and policy issues, multimedia, security, future networks and cloud and performance.

In addition, a newly established study group is responsible for IoT applications for smart cities. ITU-T is also responsible for coordinating / regulating international numbering, naming, identification, and addressing resources, e.g., deciding on international country codes.

ITU-T has established a focus group to study the requirements on the wireline network imposed by 5G wireless access [ITU-T]. The focus group's results will then provide the basis for further standardization in ITU-T. The aim is to ensure that the developments currently ongoing in ITU-R for standardizing IMT2020 will be matched by corresponding standardization efforts for the wireline network.

4.1.3   CEPT

The European Conference of Postal and Telecommunications Administrations (CEPT) was established in 1959 by 19 countries. Today 48 countries are members of CEPT. Its Electronic Communications Committee (ECC) develops common policies and regulations in electronic communications and related applications for Europe and provides the focal point for information on spectrum use. Its primary objective is to harmonize the efficient use of the radio spectrum, satellite orbits and numbering resources across Europe. Among other things, the ECC designates frequency bands for the harmonized implementation of Mobile Fixed Communication Networks (MFCN) [CEPT-ECC].

The ECC takes an active role at the international level, preparing common European proposals to represent European interests in the ITU and other international organizations. Furthermore, it applies its expertise in partnership with all stakeholders, including the European Commission and ETSI to facilitate the delivery of technologies and services for the benefit of society.

The Conference Preparatory Group (CPG) of ECC is currently working on a proposal for a WRC-19 agenda item to respond to 5G spectrum requirements in frequencies above 6 GHz. The CPG meeting in September 2015 was dedicated to decide on the corresponding European Common Proposal. The final text of the WRC-19 agenda item on 5G will be decided by WRC-15. Relevant for 5G is also the ECC Report 205 on Licensed Shared Access (LSA), as LSA could be a complementary solution for mobile network operators (MNO) for accessing spectrum for MFCN in specific bands, within specified geographical, time or technical limits.

4.1.4   FCC

FCC is regulating communications in the US. Among its responsibilities is the regulation of spectrum. Currently FCC is investigating how more spectrum can be made available in higher frequencies. As a result of these studies they have provided input to WRC-15 on frequency ranges to be studied until WRC19.

4.1.5   MIIT

The Ministry of Industry and Information Technology (MIIT) is the Chinese regulator responsible for among other things spectrum regulations in China.

4.1.6   MIC

In Japan the Telecommunications Bureau of the Ministry of Internal Affairs and Communications (MIC) is responsible for spectrum regulations.

4.2 Standardization bodies relevant for METIS-II

5G will be standardized mainly in 3GPP following on the success of 4G (LTE, LTE-A) and the 3G standards before that. Traditionally the mobile communication systems have been standardized here and at the moment there are no obvious alternatives.

Even though 3GPP has a large impact on the telecoms world, there are bodies which are also important in other application areas and industries. With the broadening scope of 5G into new application areas, it is likely that part of 5G will be handled by other bodies.

4.2.1 3GPP

3GPP is the organization responsible for developing "cellular telecommunications network technologies, including radio access, the core transport network, and service capabilities - including work on codecs, security, quality of service - and thus provides complete system specifications" [3GPP].

Currently 3GPP is planning for standardization of new network technologies in the context of 5G. A RAN 5G workshop was held September 17-18, 2015. Work on requirements will start in December 2015 and technical works start in April 2016. For METIS-II it is important to contribute to the requirements developed during the beginning of 2016.

The METIS-II project will contribute to the process by preparing joint partner contributions to 3GPP based on the work in the project.

4.2.2 IEEE

IEEE is the standards organization responsible for the WiFi and WiMAX standards among many others. In addition to this, there are standards related to machine type communications. Currently work is ongoing to enhance the ability to manage WiFi networks and integrate them in cellular networks.[IEEE-WIFI]

The METIS-II project will monitor the ongoing activities.

4.2.3 ETSI

ETSI is working on standards for dynamic spectrum access. This will be monitored by WP3 to identify relevant activities.

4.2.4 NGMN

NGMN is an industry organization headed by telecommunication operators. Its vision is to bring mobile broadband to everyone. Although strictly not a standards body, NGMN has a large influence on telecommunication standardization by producing white papers and roadmaps.

METIS-II will participate in this work by participating in NGMN workshops and by contributing to white papers etc.

5   Visualisation

In METIS-II, one of the key objectives is to enable the 5G concepts to reach and convince decision makers from non-ICT industries. Thus, it is necessary to have easy to understand illustrations of the scenarios and respective results, targeting the non-experts. This objective is fulfilled by visualisation. This visualisation is a distinctive feature of METIS-II in contrast to other past work.

The standard approach for technology evaluation (that is the basis for subsequent visualization) typically considers hexagonal cell layout. There exist proprietary but calibrated link and system level simulators, typically written in Matlab, C/C++ etc. to evaluate technology. The source code for selected parts might be shared or made public (e.g., channel models in WINNER project, ray tracing results and mobility tracks from METIS project).

However, the hexagonal cell layout might not be sufficient since it is by nature artificial. Furthermore, some of the 5G concepts discussed in METIS-II (and 5G PPP) are abstract and difficult to demonstrate in experimentation without large scale trials (e.g., virtualization, cloudification, etc.). There are also concepts which exploit deployment-scenario and use case-specific context (e.g., context awareness), and are based on an integration of a wide range of technologies, not necessarily developed by METIS-II. This makes it even more challenging to demonstrate the integrated concept in an efficient and effective manner.

METIS-II has adopted the UNITY 3D [UNITY] software to implement visualisation since it can provide solutions to those challenges discussed above, as it will be more clear in following Section 5.1.

5.1   Unity 3D as visualisation platform

Unity 3D is a software platform for rich interactive experiences. Initially considered as a game development engine, it quickly became a powerful tool for creating multiplatform multimedia environments, where the idea of gaming turned into a path of reaching higher goals such as simulation, learning, design and evaluation (which became a strong supporting pillar for the idea of "serious game engineering").

Today with UNITY 3D's gaming market share of 45% (4 million developers, 600 million gamers) it's safe to state the technology is not only well tailored, but perfectly suited to cater for the users' needs. These needs can cover now also new fields of application, such as the visualization of telecommunications scenarios, as planned by METIS-II.

While it would be risky to name UNITY 3D the standard and universal solution for creating visualisation tools, it most definitely does not have the flaws of the previous "supposed standards" like Flash. It is instantly accessible on mobile devices, its focus on 3D doesn't limit its 2D capabilities, it is already supported by quickly growing communities, and no major security flaws were detected.

Unity 3D's market applications are not limited to gaming. Architecture, interior and industrial design, management, data analysis, training and education are only few areas where UNITY 3D is used and applied nowadays. That's what makes the platform a perfect tool for visualisation and evaluation tasks within METIS-II project.

As METIS-II is strongly aimed at showcasing the impact of future technologies and at educating people on what to expect in the coming years, UNITY 3D is very adequate in this field. It is open to both users and developers, responsive to technological changes (and strongly present in the mobile domain) and compatible with open source programming and modelling software. It guarantees that the outcomes and findings of METIS-II would be easily accessible and usable for future purposes (further development, evolutionary and derivative works etc.). UNITY 3D will also help the models understood by engineers to evolve into beautiful visual experiences accessible to wide audiences. What is more, UNITY 3D will make it possible to turn demonstrations into interactive tools; an example of possible 3D visualization is given in Figure 5-1.
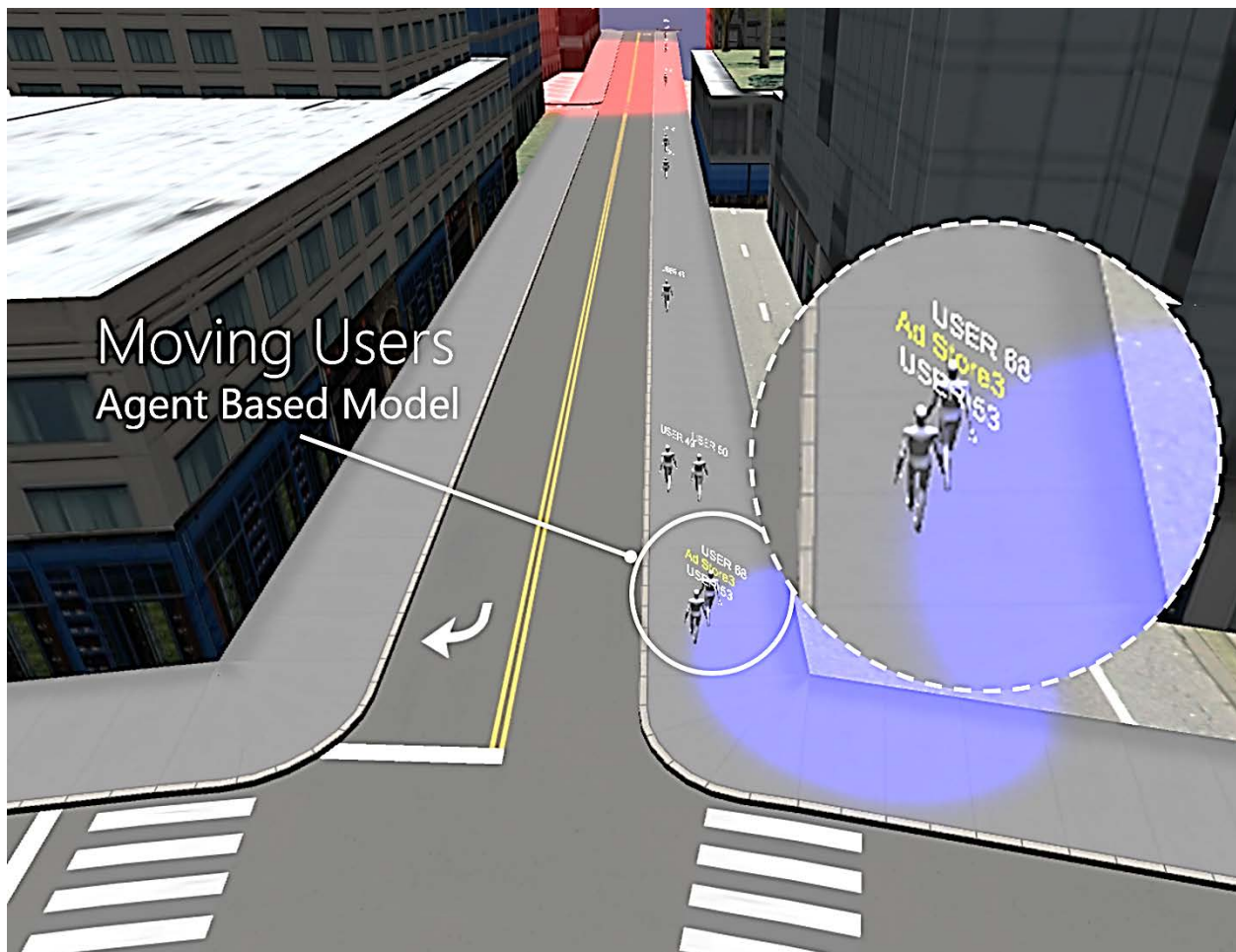

Figure 5-1: 3D realistic visualization of an urban scenario in Unity3D (here with moving users).

5.2 Users of the visualisation platform

METIS-II is by nature a project targeted to both specialists (telecommunications engineers, technology experts) and non-specialists (technology fans, regular people) alike. This has to have an impact on how the project's outcomes are presented and communicated.

It is presumed there will be three distinctive user groups to whom METIS-II's visualisation platform would be addressed. Each group would have their own interaction paradigms as well as behavioural schemes based on their knowledge level and role they would play in the process of METIS-II dissemination.

1. The Viewers - this group would be the main target audience for the visualisation platform. We need to presume it would consist, among the whole audience, of non-specialists (wide audience presentations for end users) and specialists (operators, providers etc.) to whom the METIS-II outcomes would be presented. They would not have any active influence on the test case presentation and it should be presumed they would experience the visualisation platform assisted by an educated presenter. The Viewers' interaction with the platform would thus be limited to picking a test case from a list and being able to pause the presentation should the need arise. The audience could also be able to highlight the important marked presentation areas to get access to the data relevant to the test case being shown. The interface available for the Viewers should then reflect these needs and should not allow them to get access to any editing tools as it could have a negative impact on the presentation flow.

2. The Editors - this group would mainly consist of specialists whose knowledge would allow rebuilding or updating the test cases with additional data or parameters. They could also have the ability to influence the placement or amount of the objects on the scene should a test case require such alterations. Ultimately, in the post-METIS-II future, they could be able to create new test cases within the set of objects and parameters already defined within the platform. The main challenge in defining the role of the Editors would be defining the scope of creative freedom they would be able to have in affecting the defined test cases. The reasonable solution should be based on the presumption that each test case would have ranges in which the amount of elements and the ranges of data could be applied. The Editors' interface would have to give them access to the editing tools as well as object libraries. They would have to be able to save the new test case instances and to test them before making them available for presentation. They would also have to be able to influence the objects' parameters in order to set or test different settings of the test case and its components. The accent in such interface should be put on usability, as it would have to be accessed by different specialization experts and people of different focuses.

3. The Developers - this group will (at least for the duration of METIS-II) be limited to the visual platform's developers. They would not need any interfaces, as they would access the platform from the level of code or scripts of UNITY 3D (or any other relevant or compatible data sources). The developers are responsible for determining the platform's structure, the test case definitions and performance optimization. Their task would be to define the data exchange models and integration schemes. In theory, they would have the unlimited control over the platform as long as it's synchronized with METIS-II's requirements.

6   Exploitation of METIS-II activities

The results of the METIS-II project will be used by the partners in their daily business. A quick summary is provided here, and a detailed plan for each individual partner can be found in Annex A.

A possible exploitation of the results from METIS-II is to use the technologies and solutions developed in their future product offerings. By participating in the project, partners have a possibility to early find the most promising technologies to implement in the future. They also see opportunities for exploitation by strengthening their patent portfolios.

The METIS-II project will be used as a pre-standardization alignment forum. Since the project consists of a large number of stakeholders, any alignment achieved in the project will result in alignment and agreement on the path forward for technology development for a large part of the industry.

A related benefit is that the partners, by participating in the project, gain an early understanding of the future technologies. This understanding can be used for deciding on the industrial strategy for 2020, and the results and tools developed during the project, e.g. simulators, can be used for product units to get an early understanding of the nature and behaviour of future networks.

Linkage between the work done in METIS-II and the further dissemination in the partners' respective organizations has to be ensured. This is solved by ensuring close cooperation between people working in METIS-II and people from other organizational units, who are participating in standardization and other R&D efforts.

One of the important methods of disseminating results from research projects is to ensure that the knowledge created within the project will also be used in future research. A possibility to do this is to ensure that the results are known to the people working in research. Many of the academic researchers involved in METIS-II teach at their respective institutions. Therefore, METIS-II will develop an overall consensus among them in order to coordinate seminars, workshops and special courses. This will ensure that the technologies and new ideas developed in METIS-II will reach master and Ph.D. students, and by this influencing the leaders of tomorrow.

One natural way to do this is to integrate the results into courses taught at universities. This can be done by means of papers or presentations in undergraduate courses or using parts of the METIS-II scenarios and research questions as project work by students. In addition, the results from METIS-II will provide a basic reference for future systems for mobile communications.

7 Conclusions

This deliverable presents all the initiatives that the project METIS-II has planned to disseminate and exploit the results that will be achieved during the two years' work started on July 1st, 2015, within the framework of the 5G PPP initiative.

In particular, Section 3 is thoroughly dedicated to dissemination activities, where there is a list of relevant conference events, publications in relevant journals and workshops and events that METIS-II has foreseen in the next months. METIS-II is also committed to the organization of workshops in the 5G PPP wireless strand community, the first of the series being end of September 2015 on RAN design and 5G scenarios.

Next, the deliverable presents a complete view on the standardization initiatives that the individual partners will take in the next months, with a coordination phase in the project, seen here as a "pre-standardization" framework. This activity will be also linked with the corresponding coordination activities being established within 5G PPP.

One of the important dissemination assets in METIS-II is the visualisation platform developed in UNITY 3D software, briefly described in Section 5.

The exploitation plans of the individual partners are given in Annex A, and synthetically summarized in Section 6. As further information in the early phase of the project, Annex B reports some news on the METIS-II start press releases.

8 References

[3GPP]	http://www.3gpp.org/about-3gpp/about-3gpp 2015-08-01
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A   Individual exploitation plans

A.1   Infrastructure vendors

A.1.1   Alcatel Lucent

Alcatel-Lucent (ALU) is a leader in fixed, mobile and converged broadband networking, IP technologies, applications, and services, and it is committed to eco-sustainability. With Bell Labs, Alcatel-Lucent has one of the largest research, technology and innovation organisations focused on communications technology and conducting fundamental research in this field.

The METIS-II research team at ALU in Stuttgart, Germany, is well connected within Alcatel-Lucent; in particular, it maintains close links to product strategy teams located in Paris, France, and Murray Hill, US, to the standards team and to small cell base station development teams also located in Stuttgart. Further on, it is a common practice at ALU that researchers actively transfer research results into standardization bodies or into product development, e.g. by directly attending a series of standards meetings or by assigning researchers to product development teams providing a "hands-on" transfer of the results. Such transferable results are done in the form of roadmaps, e.g. covering features of a product or standards release, simulation chains or simulated performance results, concept descriptions, specifications or technical documents, or algorithms that can be incorporated into products such as signal processing or radio resource management SW. Standardization and Regulation as supported by METIS-II are considered to be of high importance to strengthen the European position on the definition of 5G and as an enabler for future products in this domain.

Within ALU the definition of 5G is driven by researchers from Bell Labs collaborating with people from the CTO organization. ALU intends to exploit the research work performed in METIS-II 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. A further aim is to consolidate the relevant technology trends by exchanging with project partners, other projects/fora dealing with preparation of 5G respectively IMT 2020, and to prepare and support activities to standardize the identified solutions. In an early phase of the standards evolution, the results will be carried into pre-standardization or regulatory bodies like NGMN or ITU-R, paving the way for standardization. Within METIS-II the main focus of ALU will be on a new disruptive control architecture, more effective integration of multiple RATs, advanced spectrum usage concepts and integration of air interface concepts. Besides that, METIS -II work on further refinement of uses cases and scenarios especially targeting on extreme mobile broadband, very low latency applications and machine to machine communication are considered to be of high relevance to guide the technical work. Also the definition of a 5G performance evaluation framework and metrics is of high value as it gives a common basis for measurements and quantifications performed by different people and organizations. Therefore these results shall be comparable and it can be ensured that everyone applying these agreed procedures considers the results as realistic.

A.1.2 Ericsson

Ericsson is the driving force behind the Networked Society - a world leader in communications technology and services. Our long-term relationships with every major telecom operator in the world allow people, business and society to fulfil their potential and create a more sustainable future. Our services, software and infrastructure - especially in mobility, broadband and the cloud - are enabling the telecom industry and other sectors to do better business, increase efficiency, improve the user experience and capture new opportunities. With more than 110,000 professionals and customers in 180 countries, we combine global scale with technology and services leadership. We support networks that connect more than 2.5 billion subscribers. Forty percent of the world's mobile traffic is carried over Ericsson networks.

Currently Ericsson is in the initial phases of the development and standardization of the next generation technologies for mobile communications, 5G. Currently there is a lot of technology development ongoing as well as planning new platforms and prototyping for the next generation of products. The results from METIS-II will be fed into product development and research and incorporated into the designs. The results will also be used in communications with customers, when influencing regulatory bodies, and when arguing for more spectrum.

Specifically the METIS-II results will be used in preparing contributions to 3GPP and to regulatory bodies such as ITU-R WP5D. Research results will also be disseminated through contributions to international journals and conferences.

A.1.3 Huawei

Huawei will use results obtained from the research work in METIS-II 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. Jointly developed guidelines for the simulation framework will be applied in the simulation tools that are currently used at Huawei. By means of this, Huawei obtains refined evaluation tools that are of high utility for the development and reliable performance assessment of solutions for 5G radio systems.

Huawei is very active in both global and regional regulatory bodies, fora, standardization organizations and alliances, which can be utilized as a broad platform to facilitate the exploitation of project results. To be specific, Huawei is actively involved in international standardization organizations, e.g., ITU-R, 3GPP. Huawei intends to submit co-signed proposals with other members to exploit the latest results of METIS-II, including but not limited to the refined use cases, evaluation framework and methodology, technical solutions, etc. Besides, Huawei hosts and sponsors lots of conferences, summits and workshops each year, especially related to 5G research, e.g., IEEE ICC/Globecom, 5G summit of IMT-2020 Promotion Group in China, Future Forum, etc. Huawei will therefore take advantage of these events by presenting the recent progress and achievements of METIS-II to make them well known and support acceptance by the stakeholders in the 5G eco-system. Acceptance by the customers will further be achieved by promoting these through Huawei's Customer Innovations Centres located in Germany, UK, France, Spain, and Sweden. In addition, Huawei's participation in other 5G-PPP projects can substantially strengthen the role of METIS-II in fostering cooperation, coordination and alignment between those projects within the European H2020 research programme.

A.1.4   Intel

Intel Deutschland GmbH is a subsidiary of Intel Corporation headquartered in Santa Clara, USA. Intel Deutschland possesses comprehensive know-how in the areas of RF, mixed signal and power management, monolithic integration, and mobile phone software. Intel's mobile business has approximately 4,000 employees all over the world, about 1,700 of whom work in Germany where the headcount at the company headquarters in Neubiberg near Munich is approximately 1,200. Whether entry-level mobile phone, smartphone, tablet, or any other device accessing voice and data services over the mobile network—they all need chipsets and software to transmit and process data. Intel Deutschland GmbH provides these mobile platform solutions for all market segments: from cost-efficient 2G and 3G single-chip platforms for ultra-low-cost mobile phones and entry-level smartphones, to leading-edge 3G and 4G slim modem and radio frequency (RF) solutions for smartphones and tablets.

METIS-II results amongst other project results will support Intel Deutschland paving the way toward a fully networked world by providing innovative, fine-tuned mobile communications solutions. Joining forces with the parent company Intel means to integrate mobile communications technology and application processors in intelligent solutions contributing to Intel roadmaps for the Internet of Things (IoT) and 5G. Intel is collaborating with equipment and device manufacturers, network operators, service providers, academic institutions and others to accelerate 5G standards development and solve key technical challenges. Through these collaborations, Intel is applying its unique combination of computing, networking and wireless communications expertise to develop 5G solutions that integrate intelligence across the entire network, end-to-end, from the data center to device and throughout systems in between. This systems-level approach will enable more functional devices, more cost-effective and efficient networks and user experiences that are more intuitive, enriching and immediate than ever before. Intel is developing wireless radio access and device processing technologies for PCs, smartphones, tablets, wearables and many future connected devices and sensors. As part of this effort, Intel is offering an open, general purpose platform for network operators and investing in transforming the network in four key areas, including advancing open source and standards, enabling open networking platforms, building out an open ecosystem on Intel architecture and accelerating trials and deployments. To help accelerate future deployments, Intel is working on a variety of initiatives and proofs of concept with industry leaders to shape future service aware networks and devices.

Intel Deutschland teams have a long track record of successfully completed EU FP6 & FP7 funded projects as well as also several other funded projects at the national and regional level, i.e. projects funded by the German, the Danish, the French and the Austrian authorities. Finally, Intel is a member of NetWorld2020 European Technology Platform and is an elected member of the 5G PPP Infrastructure association, and is currently working on several 5G projects worldwide including MiWEBA, MiWaveS, FANTASTIC-5G, FLEX5GWARE, Speed5G and mmMAGIC. Intel will drive in collaboration with 5G ecosystem stakeholders METIS-II results into standardisation and regulation bodies, in particular identifying key topics to initiate study items together with METIS-II partners in 3GPP and support working party topics in ITU-R WP5D.

A.1.5   Nokia Networks

Nokia invests in technologies important in a world where billions of devices are connected. Nokia is focused on three businesses: network infrastructure software, hardware and services, offered through Nokia Networks; location intelligence, provided through HERE; and advanced

technology development and licensing, pursued through Nokia Technologies. Each of these businesses is a leader in its respective field.

As the world's specialist in mobile broadband, Nokia Networks operates at the forefront of each generation of mobile technology, starting from the first ever call on GSM, to the first call on LTE. Therefore its involvement in the 5G METIS-II project is a straightforward extension of the company culture to deliver innovations in mobile technology that enable people and businesses everywhere to do more than ever before.

Nokia Networks is involved in METIS-II through its Technology & Innovation organization. Researchers from Espoo (Finland), Munich (Germany) and Wrocław (Poland) are directly involved in the project, although they will naturally also share results obtained from all Nokia Networks' research departments. As the creation of a successful 5G standard requires the best ideas to be identified and adopted widely, Nokia Networks is interested in establishing cooperation on a variety of innovation topics related to 5G. The company is already driving numerous collaborative research projects with mobile network operators, vertical industries and academic partners and taking a leading role in regulatory and industry bodies (e.g., ITU-R, 3GPP, NGMN, IEEE). It has also initiated events aiming at global consensus building such as the annual Brooklyn 5G Summit. Further, it is leading or significantly contributing to other 5G-PPP projects like 5G NORMA, FANTASTIC-5G, mmMAGIC and Xhaul.

Through exploitation of its key roles in METIS-II, Nokia Networks will aim at obtaining a pre-standardization consensus on the most relevant 5G RAN design questions, to enable fast rollout of 5G technology, also having in mind the demands of specific geographic regions. Special focus is put on spectrum/regulatory related topics, the agreement on common frameworks for 5G technology performance evaluation, the integration of different 5G air interfaces among each other and with evolved legacy technology, and a detailed overall 5G protocol stack design. Nokia Networks will in particular utilize its role as coordinator of the 5G NORMA project to seek best possible alignment and synergies between the METIS-II and 5G NORMA projects. The company will exploit its position in the ICT community to promote the METIS-II outcome in other 5G-PPP projects, as well as by being (co-)organizer of workshops and through dissemination of technical results (also jointly written with other METIS-II partners) towards major global conferences. Nokia Networks will aim at positioning the main METIS-II outcomes in relevant standardization/regulatory fora, such as ITU-R and 3GPP. The company also intends to promote the project results by actively supporting and contributing to the visualisation platform. The METIS-II project will be also the opportunity to expand company's project portfolio.

A.1.6   Samsung

Samsung will focus on and utilize the outputs of METIS-II in the areas of promising new use cases, 5G spectrum analysis, RAN design and air interface work.

Use-cases: Samsung will use METIS-II use cases to further its own 5G application space and ensure test-beds / demos include these valuable use cases; use-cases that METIS-II 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 our own global 5G R&D activities.

Spectrum: Samsung will use analysis carried out by METIS-II to inform its own preferred spectrum ranges and combine this knowledge with its existing deep understanding of band allocations, to ensure a harmonized 5G offering and avoid fragmented device market space. Samsung views METIS-II spectrum discussions and envisaged quantitative and qualitative

analysis as an important contributor to WRC'15 activities and beyond – looking towards WRC'19. Samsung expects that METIS-II will provide a sound rationale for new spectrum above 6GHz and will contribute to this important process. Additionally, the consensus-building process which METIS-II 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.

RAN design: Results from METIS-II on RAN design will help Samsung understand the views of a wider European community on the technologies that may underpin future device and networking products. Samsung plans to disseminate these results to groups such as various regional communities including the 5G Forum in Korea, Giga Korea projects, ARIB (Japan), as well operator stakeholder groups such as GSMA and NGMN.

Air interface: Analysis of performance 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.

A.2   Operators

A.2.1   Deutsche Telekom

Deutsche Telekom (DT) is in a leading role in worldwide development of 5G within the NGMN Alliance. With the 5G White Paper published at Mobile World Congress (MWC) 2015 and presented in detail during the NGMN Industry Conference & Exhibition in March 2015, the operator community described its vision about the future communication beyond 2020 in a human & machine centric environment. The work of NGMN is ongoing in different follow-up projects, e.g. on business aspects, requirements as well as architectural and spectrum topics.

DT will transfer the output of METIS-II and other projects within the 5G PPP to NGMN working groups (in tight collaboration with other operators involved) as well as to strategic business units within DT Group. As announced in March 2015, DT will also push the 5G development by the launch of "5G:haus", a 5G lab that will provide a platform for developing and testing new technology enablers for the 5G architecture. In cooperation with leading telco equipment vendors, SMEs, start-up companies, research institutes, and vertical industry partners, DT's platform will allow to demonstrate relevant 5G features at a very early stage. It is intended to feed "5G:haus" with corresponding outputs of 5G PPP projects from the beginning.

In addition to METIS-II DT is involved in 3 other 5G PPP projects (5G NORMA, 5GEx, VirtuWind). Especially with respect to the RAN-related topics in METIS-II a tight collaboration with DT's experts in 5G NORMA is foreseen. DT will generally support the cooperation between 5G PPP projects, e.g. by participation in joint workshops and working groups e.g. to provide white papers on 5G visions and architecture.

DT is actively participating in different standardisation bodies. Together with other METIS-II partners and 5G PPP projects a transfer of results is primarily foreseen to 3GPP TSGs RAN (main focus) and SA dedicated to upcoming or already started Study/Work Items on 5G topics (e.g. SI SMARTER of SA1). For 5G aspects like virtualization, cloudification and software-defined networking are of high importance as well, so DT will also address those topics as far as possible at other bodies and fora like ETSI NFV, ONF, IETF, and IEEE.

In view of regulatory activities related to WP3 of METIS-II, DT intends to present results to National Regulation Authorities with focus on German BNetzA as well as to relevant groups in CEPT, e.g. ECC PT1, CPG and WG FM. Also joint inputs to ITU-R WP 5D activities on IMT-2020 will be supported.

Furthermore DT will disseminate results obtained within METIS-II by conference or journal papers. The generation of IPRs is also seen as an important way to exploit the results generated within the project.

DT expects that the METIS-II results will speed up the initial deployment of 5G networks. Their operation will allow DT to provide its customers any kind of innovative telecommunications service based on a single communications platform that comprises fixed-mobile convergent (FMC) access as well as transport networks and cloud platforms for data processing and storage. The flexibility and scalability of the 5G system is a pre-requisite for cost-efficient provisioning of an increased service variety in combination with enabling faster service rollouts compared to existing platforms, meeting the quality and service expectations of the users.

A.2.2 DOCOMO

DOCOMO will continue to endeavour to promote innovations towards 5G in order to enhance how people and things communicate and bring smart life closer to the society around year 2020 and beyond.

The METIS-II project with its strong partnership will enable us to exchange views on how to shape 5G and influence the harmonization/standardization of 5G not only in Europe and Asia but also worldwide.

This will be achieved by contributing and representing METIS-II outcomes to standardization bodies and fora, e.g., ITU-R, 3GPP, 5GMF.

DOCOMO will exploit the outcomes of METIS-II project to identify/ narrow down relevant use cases, integrate potential 5G technologies, and develop the overall 5G radio interface and network design in order to satisfy 5G requirements and support future spectrum bands that will be used for mobile communications in 2020 and beyond.

DOCOMO will also publish METIS-II main outcomes at major international conferences, such as VTC, PIMRC, Globecom, and Japanese domestic and international journals, including IEICE (Institute of Electronics, Information and Communication Engineering) and IEEE.

Furthermore, the project outcomes will be discussed with our own business and network deployment departments to consolidate the future network infrastructure and service roadmaps.

A.2.3 Orange

Orange will first use the METIS-II project to build a common vision among European networking industry players regarding the 5G wireless access design. This vision will be reused by Orange to motivate 5G infrastructure investments and build the rolling plan according to related business. METIS-II will also be the place to benchmark and select technologies and solutions for future standards and infrastructure enablers. This selection is key for Orange to ensure that future network services will offer the best experience to our customers and will be sustainable (in terms of energy, costs and social issues) and operationally manageable.

A.2.4   Telecom Italia

Telecom Italia as an operator is not directly interested in developing technology, but has a high interest in understanding the technology trends to ensure high quality services and high level of satisfaction to its customers. Moreover the continuous increase on traffic demand and user needs require major investments to be fulfilled. Therefore the knowledge gained in METIS-II Project will be paramount in paving the way to the operation in the next decade.

In particular, In Telecom Italia results from METIS will be used 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 with requirements. The main areas of interest are

- Enhance service quality for mobile broadband. This solution will directly impact customer satisfaction, revenues and customer retention
- Reduced cost of deployment, by providing automated solutions and saving OPEX
- Improve energy efficiency
- Exploit Internet of Things

In the procurement process, Telecom Italia will consider the results of METIS-II project to check the consistency of vendors' roadmaps with the evolution of mobile technology.

The standardisation activity within the project can be exploited by Telecom Italia by ensuring that standards do take into account the requirements and scenarios of main relevance to Telecom Italia.

Moreover, the project activity can contribute to the formation of the technicians that will have to design, plan and operate the 5G network.

The overall activity within the project can be exploited as an opportunity to show to the Investor community the sensitivity of Telecom Italia towards innovation and forerunner research.

A.2.5   Telefónica

Telefónica is continuously enhancing its strategic Network investments, adapting it to the foreseen market demand and the envisioned technologies performances. In this sense, the early adoption of appropriate 5G technology will be of key importance in order to create the needed market footprint as a leading operator.

Furthermore, the selection of appropriate operational spectrum, i.e. frequency band, bandwidth and access rights, is of paramount importance for the sustainability of Telefónica mobile access business, currently operating in more than 25 countries.

The investments in new RAN technology or equipment need to be carefully evaluated, in base to the foreseen benefits, and the optimal time to market for deploying new 5G technology could only be addressed based on a deep technology pros and cons. This kind of knowledge is one of the main focus of Telefonica participation in METIS-II project, being the other the opportunity to share views and results with the leading companies in the radio access ecosystem.

A.3   Academic partners

A.3.1   ITRI

The Industrial Technology Research Institute (ITRI) was founded in 1973, has currently about 5,600 employees and is Taiwan's leading research organization. ITRI has played a pivotal role in transforming Taiwan's economy from a labor-intensive industry to a high-tech industry. To date, ITRI holds more than 22,000 patents and has assisted in the creation of more than 260 start-ups and spin-offs, including for instance TSMC and UMC, the world's leading IC foundries. ITRI is focusing on 6 research fields including Information & Communications with 700 employees and focus on Next Generation Communication Technologies, Broadband Convergence System and Integration Technologies, and Smart Internet of Everything.

As a public institution, ITRI receives substantial parts of its funding from public authorities, such as the Ministry of Economic Affairs. In addition ITRI generates funding from industry partners through technology transfer and value added design service and consultation. ITRI also assists in the creation of start-ups and spin-offs through its venture capital subsidiary.

ITRI intends to disseminate the results of the METIS-II project through publications in conferences or by joining workshops. ITRI also participates actively in several standardization forums. In addition ITRI will use the gained expertise for technology transfer to and value added design service and consultation for industry partners, and spin-off of companies. Finally ITRI will use the gained expertise as basis for new research projects.

METIS-II provides ITRI the opportunity to collaborate with the most relevant industry and academic partners on the development of a 5G system.

A.3.2   KTH

As an academic partner, KTH will utilize METIS-II primarily for strengthening its research and education capability such as creating novel lectures on 5G, publishing papers to the prestigious journals and conferences, and exploring more collaboration projects. Above all, the education of doctoral students is considered important at KTH. The outcome of the doctoral education, i.e. PhD graduates, will be instrumental not only for KTH's knowledge accumulation but also for European mobile communications industry. Besides the research and education, KTH will also exploit the results of METIS-II for innovation. Being one of the collocation centers of EIT Digital, the knowledge and expertise obtained through METIS-II will be put into an input to various innovation attempts. KTH will also exploit METIS-II to influence spectrum policies and regulations in Sweden through a close collaboration with Swedish regulator PTS.

In detail, KTH's exploitation plan can be categorized as follows:

- Academic and research exploitation plans:
  - KTH will disseminate METIS-II results by publishing research papers to relevant journals and conferences as listed in Section 3.
  - KTH will exploit METIS-II for educational purposes. First, KTH will involve doctoral students in the project so that they can be at the forefront of wireless systems research. PhD graduates will be KTH's one of most important outcomes because they will be invaluable resources for European universities and industry

in the field of mobile communications. KTH will also utilize METIS-II results for creating new course materials in order to teach undergraduate and graduate students.

- Industrial and innovation exploitation plans
  - o KTH will use the METIS-II results as inputs to other collaboration projects. The Center for Wireless Systems at KTH (Wireless@kth) runs several small projects with industry, particularly with local SMEs. Thus, the knowledge obtained from METIS-II will be effectively disseminated and exploited in the industry.
  - o KTH is a core partner of EIT Digital and hosts Stockholm node. EIT Digital is a leading European open innovation organization to foster digital technology innovation and entrepreneurial talent for economic growth and quality of life in Europe. Thus. KTH will contribute to converting METIS-II results to innovations through EIT Digital.
- Spectrum policy and regulation
  - o KTH has a close relationship with the Swedish regulator PTS. METIS-II results will be given as inputs to PTS for them to plan spectrum policies and regulations for 5G.

A.3.3   UKL

As a public university, the University of Kaiserslautern receives parts of its funding from the State of Rhineland-Palatinum. In addition, the University of Kaiserslautern extensively acquires third party projects funded by EU programmes, German national research programmes. state and federal excellence initiatives, the German National Science Council (DFG), as well as from a wide range of industrial partners. In addition, the Department of Electrical and Information Engineering receives funding for collaborations in education with European and international partners by the Erasmus Mundus programme, European Networks of Excellence, the German excellence in education initiative, as well as trilateral German-French-African programmes.
UKL will provide key findings of METIS-II to other projects as the German spectrum management project CoMoRa and its broad range of spectrum related collaborations with operators and administrations. Other areas where already existing collaborations and research projects will directly benefit are networks for dependable services and "beyond cellular" next generation network concepts.
UKL has divided its exploitation strategy in two lines:

- Academic & research exploitation plans:
  - o UKL will support the dissemination of METIS results by publications and tutorials on key concepts and scientific results. Results of METIS-II will help to steer the research directions, Master and PhD work and it will be reflected in lectures.
- Standardisation & industrial exploitation plans
  - o UKL is active in several (European) research and standardisation fora such as the Net!Works and NEM platforms and ETSI. In this framework and based on its association with the DFKI, the CWCN offers its support to foster the evolution of communication technologies from a strategic perspective by its expertise in the communication technology business.

- o By conducting bi-lateral collaborations and consulting with industry partners, UKL transfers its expertise and knowledge to support its partner in the exploitation of innovative concepts in standardisation and the industrial development of technologies.

First steps in the exploitation plan

According to the general exploitation strategy, short term actions comprise the following steps:

- Publishing results in conferences and specialised journals.
- Support the organisation of METIS-II workshops.
- Develop dissemination material as video clips / visualisation tool that help to explain key METIS-II ideas.
- Introduction of seminars and courses on Beyond 2020 wirless infrastructure and 5G.
- Support METIS-II dissemination in regulatory bodies (in collaboration with WP3).

A.3.4   UPV

As a public educational institution, the UPV receives part of its funding from public authorities. On the other hand, the Institute of Telecommunications and Multimedia Applications (iTEAM) is a research centre integrated in the Polytechnic University of Valencia with direct management of its funds. The Institute performs its research and development (R&D) activities in the field of the Information Society Technologies (IST). Within iTEAM, the former structure of small research groups in being transformed into Areas of Research. Fifty percent of the iTEAM's funds come from national and international research projects. It is worth noting that the iTEAM has taken part in project summons of I+D+I belonging to the National Plan from 1996 and the three last EU Framework Programs.

On the other hand, the iTEAM is also very close related to national and international companies and entities of the Telecommunications Sector. This transfer of technology has been carried out in diverse forms, which go from technical studies up to contracts of certain importance.

UPV has divided its exploitation strategy in two lines:

- Academic & research exploitation plans:

  - o Pertinent knowledge must be disseminated through publications in journals and conferences and the participation in trials.

  - o UPV can make use of the METIS-II branding platform in other to foster cooperation in high level research projects with manufacturers, operators and other industrial/research partners

- Standardisation & industrial exploitation plans

  - o UPV is willing to take part of ITU-R IMT-2020 discussions. In this framework UPV can be seen as a valuable partner for other companies participating in these forum since our know-how about beyond 2020 technologies could help in the standardisation phase.

  - o Development of the simulation and visualisation capabilities of the group with the possibility of acting as external consultancy group for big operators and end companies interested in a fair evaluation of system performance.

o Owners of a patent on non-coherent communications, we aim at further developing this idea by ensuring its integration. Partnership with other groups in METIS is necessary to reach the market. In this sense, UPV is looking for synergies with other METIS partners for joint protection of future results.

A.4 SMEs

A.4.1 IDATE

IDATE has established itself over the years as one of the leading centers for exchange and analysis in Europe, specializing in the Telecommunications, Internet and Media Industries and markets.

IDATE's vocation is to lead a number of original initiatives, a European Forum furthering the debate of ideas and the exchange of experiences between the players in these domains.

Highly reputed teams of consultants and analysts conduct numerous reports and consultancy missions and participate in the continual investment in a worldwide observatory on the markets and strategies of those players in the Information Technology and Communication sectors.

IDATE has established its credibility and independence in leading consultancy and study missions on behalf of its clients, for whom, its multi-disciplinary teams of economists and engineers are in a position to analyse the impact of market, regulatory and technological evolutions on their business and strategies. The intervention of IDATE's consultants relies on their in-depth knowledge of the markets and players, their extensive access to precise data as well as on their mastering of the specific methods of survey and analysis.

With its market reports and publications, IDATE provides a truly global Observatory on the Communications and Information Technology sectors. IDATE relies on its specialized teams and continuous investment in its information and strategic monitoring system in order to publish a thorough portfolio of sectorial and thematic reports, which are regularly up-dated.

In METIS-II, IDATE will mainly be involved in techno-eco assessment. In Task 1.2, IDATE will participate to business model investigation and feasibility assessment from a qualitative and (partially) a quantitative perspective, considering roles of both "usual" players in wireless communication like end users, network operators and service providers as well as new vertical industry players like car manufacturers, automation, health care providers etc.

IDATE will exploit the results of the METIS-II project to better understand how flexibility of 5G networks will increase competeveness of mobile actors in the coming years. It will help us to provide detailed inputs in our 5G market analysis and forecasts.

METIS-II will be an opportunity to develop our understanding of the new radio technologies, and will help us to analyse their impact on the ecosystem. We will also be in a position to better understand future evolutions in spectrum management.

We will consolidate our expertise in these fields and this will help us for our consulting and research activities. Dissemination will be made through our research activities (market reports), our conferences (DigiWorld Summit) and our other publications (newsletter, blog, Communications & Strategies).

A.4.2 Janmedia

Janmedia Interactive (JME) is a quickly expanding new media development consultancy and studio with specializations in advanced graphic development, web development (including Responsive Web Design and mobile websites), custom web application programming (with focus on XML, J2EE, PHP), database engineering (Oracle, PostgreSQL, MySQL), Flash and UNITY 3D development, graphics and animation, logo development and branding, image enhancement, print collateral, online management system development, mobile apps, hosting and other related activity.

In METIS-II Project Janmedia concentrates on visualisation and creative support for test case generation. The participation in METIS-II would allow Janmedia to spread the idea of 5G and the overall network evolution between their current and future customers. In effect understanding of the network evolution would help to understand the fast growing market allowing for faster idea implementation. As even today infrastructure vendors and operators are present among Janmedia's customers, it is clear being a part of METIS-II would help us understand our clients better and support their needs more effectively.

In addition Janmedia is a partner and an organizer of important IT events (like TEDx), and through them the awareness of 5G and the network evolution can be communicated as well as the knowledge spread initiated.

B   METIS-II Press Releases

The start of the METIS-II project has been announced to the press with a press release issued on July 15th, 2015, and available on the METIS-II public website at this link https://metis-ii.5g-ppp.eu/wp-content/uploads/METIS-II-Press-release-July-2015.pdf.

Many companies have announced the start of the activities in the new project with separate press releases. Here are some examples

http://www.ericsson.com/news/1936238

http://www.upv.es/noticias-upv/noticia-7605-metis-ii-es.html

http://networks.nokia.com/sites/default/files/document/nokia_statement_metis_ii.pdf

http://www.huawei.eu/press-release/eu-project-metis-ii-lead-next-phase-5g-radio-access-network-research

https://www.alcatel-lucent.com/press/2015/alcatel-lucent-adds-another-first-it-drives-broad-range-5g-industry-development-programs-toward-its

http://eu.janmedia.pl/company/news/4695.xml

http://www.janmedia.pl/aktualnosci/4671.xml