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Euro-5g – Supporting the European 5G Initiative

D4.1: International, national and peer Initiatives Strategy and plan

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Abstract

This deliverable describes the objectives of international cooperation in 5G PPP, and the status of the international environment of 5G research and main initiatives, which will have a relevant impact on standardisation and on the regulatory process. The 5G Infrastructure Association already signed MoUs with major international counterparts, which will be the basis for international cooperation. Finally, the strategy and steps to implement the international cooperation activities are described.

[End of abstract]

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This report is based in parts on 5G Infrastructure Association documents and activities.

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Executive Summary

Mobile and wireless communications are based on global standards and globally harmonised frequency spectrum, to the greatest possible degree. The research projects in 5G PPP will develop information, which will be relevant to contribute to international standardisation and the preparation of WRC 2019.

International cooperation with major international counterparts, especially from regions and countries, which are influential in global standardisation bodies and ITU-R, will support consensus building for the preparation of future standards. This international cooperation activity is therefore critical for achieving the objective of ensuring a leading role for Europe within the development of 5G.

Therefore, the 5G Infrastructure Association has already signed MoUs with IMT-2020 (5G) Promotion Group (China), The Fifth Generation Mobile Communications Promotion Forum (Japan), 5G Forum (Korea) and 4G Americas. These MoUs were signed in parallel to government agreements between the EU Commission and the Chinese, Japanese and Korean government. This is the basis to exchange information with other regions and to facilitate consensus building.

In addition, a multilateral MoU has been signed between the 5 organisations to organise jointly a series of Global 5G Events. The first event in the first half of 2016 will be hosted by IMT-2020 (5G) Promotion Group in China and the second meeting in the second half of 2016 will be hosted by 5G Infrastructure Association in Europe, with the support of the Euro-5G CSA.

The 5G Infrastructure Activity on International Cooperation will be supported by the Euro-5G CSA. This activity has developed a specific strategy and necessary steps to implement in cooperation with Association policy-oriented Working Groups, 5G PPP projects and 5G Initiative technology-oriented Working Groups necessary documents and material for information exchange and meetings with international counterparts.

With its strong 5G PPP project portfolio, 5G PPP is in a good position to cooperate with international counterparts and to support consensus building on global level.

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Abbreviations

CSA	Coordination and Support Action
EC	European Commission
EU	European Union
ICT	Information and Communication Technology
IoT	Internet of Things
IP	Internet Protocol
IT	Information Technology
ITU	International Telecommunications Union
ITU-R	International Telecommunications Union – Radio Sector
MoU	Memorandum of Understanding
R&D	Research and Development
TCP	Transmission Control Protocol
WP5D	Working Party 5D
WRC	World Radiocommunications Conference
3GPP	Third generation Partnership Project
5G	Fifth Generation
5G PPP	5G Public Private Partnership

1 Objectives of International Cooperation

Mobile and wireless communications are based on global standards in order to ensure international roaming between different networks and countries, economy of scale for affordable cost of systems and services, as well as interworking of systems and devices for different vendors by means of standardised interfaces (multivendor capability). In addition, new systems will require internationally harmonised frequency spectrum, to the greatest possible degree.

International standardisation will start, e.g. in 3GPP, in the beginning of 2016 in particular for new radio systems. Some important preparatory meetings have already taken place in ITU (July 2015) and 3GPP (September 2015). In addition, in the core network IT-related standards/specification bodies will play a major role.

The global harmonisation of frequency spectrum is discussed and agreed in World Radiocommunications Conferences (WRC) in the framework of the International Telecommunications Union (ITU), which is a United Nations organisation. WRC 2015 will take decisions for spectrum below 6 GHz, and it will fix the agenda for the next WRC 2019, where the identification of additional frequency spectrum for mobile and wireless communications is envisaged, in particular above 6 GHz.

Research programs as 5G PPP shall contribute to these global activities with concepts and system solutions towards standardisation, as well as studies towards the preparation of WRC 2019 based on the agenda items, which will be agreed at WRC 2015.

Therefore, international cooperation between research-oriented organisations in major regions will play an important role for 5G PPP, in order to place the European research program on the global landscape. Research results from 5G PPP projects will contribute to the global 5G debate via established channels to the international standardisation and regulatory process.

The 5G PPP Contractual Arrangement in Article 6 “Specific Commitments of the Private Side” provides a mandate to the 5G Infrastructure Association to “Implement an international cooperation strategy in support of global standards and harmonized spectrum allocation.” This strategy will be supported by 5G PPP projects and will be facilitated by Association Working Groups and the Euro-5G CSA in 5G PPP.

The overall strategic objective of international cooperation is to support harmonisation activities on the 5G vision, requirements, design goals, system concepts, and architectures in order to build consensus ahead of future standardisation, along the following operational objectives:

- To establish liaisons with other national and European R&D programs (e.g. Eureka clusters) for the inclusion of the 5G related topics as appropriate, and foster the creation of synergies.
- To analyse international activities on 5G and ensure proper positioning of the European 5G PPP initiative so as to identify and pursue collaboration opportunities e.g. by means of MoUs.
- To establish and maintain necessary contacts and cooperation on global level with similar initiatives in other regions and countries like China, Japan, Korea, North America and others, if new initiatives emerge.
- To ensure coherence and maximum impact of the 5G PPP and its projects through liaisons with other relevant R&D programs, including related EC-driven initiatives like for instance the FIRE programme.

In addition, joint events between 5G Infrastructure Association / 5G PPP projects and activities in other regions and countries for information exchange and consensus building activities will be organised and supported.

2 Status of international activities

5G has reached huge global momentum since 2014. In particular, regions and countries with strong ICT industry have launched research programs and fora to promote 5G concepts, systems and solutions. There is a reasonable level of common views reached between different regions. However, certain application domains for 5G, such as support of vertical sectors (IoT) and/or mobile broadband, is more problematic to a certain extent, and therefore need more attention. 5G research in Europe is on-going in an international context. The following sections summarise briefly the major initiatives, but this list is however not exhaustive.

2.1 ITU-R

ITU-R (International Telecommunications Sector – Radio Sector) has launched a Visions Group as part of Working Party WP5D to develop a global vision of IMT-2020, as 5G is called in the ITU context. The vision is described in Recommendation REC-M 2083 [1] (http://www.itu.int/rec/R-REC-M.2083). It describes use cases and a basic set of requirements. This is an important input document to the preparation of WRC 2019.

2.2 European Union

The European Union has a long tradition of providing collaborative research programs. First 5G research projects were already launched in Framework Program 7 like the following projects, which were addressing certain aspects of future systems:

- **METIS**: **M**obile and wireless communications **E**nablers for **T**wenty-twenty (2020) **I**nformation **S**ociety
  - METIS
  - [2], https://www.metis2020.com/
  - **Overall objective:** Lay the foundation & Ensure a global forum & Build an early global consensus for beyond 2020 "5G"mobile & wireless communications.
- **5GNOW: 5**th **G**eneration **N**on-**O**rthogonal **W**aveforms for Asynchronous Signalling
  - 5GNOW
  - [3], http://www.5gnow.eu/node/5
  - **Overall objective:** 5GNOW will develop new PHY and MAC layer concepts being better suited to meet the upcoming needs with respect to service variety and heterogeneous transmission setups.
- **iJOIN**: **I**nterworking and **JOIN**t Design of an Open Access and Backhaul Network Architecture for Small Cells based on Cloud Networks
  - iJOIN
  - [4], http://www.ict-ijoin.eu/
  - **Overall objective:** iJOIN introduces concept RAN-as-a-Service (RANaaS), where RAN functionality is centralised through an open IT platform based on cloud infrastructure. Joint design and optimisation of access and backhaul, operation and management algorithms and architectural elements, integrating small-cells, heterogeneous backhaul and centralised processing.
- **Tropic** Dis**Tr**ibuted computing, storage and radio resource allocation over cooperative femtocells

- [5], http://www.ict-tropic.eu/
- **Overall objective:** The project aims at exploiting the convergence of pervasive femto-network infrastructure and cloud computing paradigms for virtualisation/distribution of applications and services.

- **MiWaveS**: Beyond 2020 **Heterogeneous Wireless Networks** with **Millimeter-Wave Small Cell** Access and Backhauling

- [6], http://www.miwaves.eu/index.html
- **Overall objective:** Demonstrate how low-cost or advanced millimetre-wave (mmW) technologies can provide multi-Gigabits per second access to mobile users and contribute to sustain the traffic growth. Hence, spectrum flexibility and the exploitation of the available mmW spectrum will be key strategies to build high-throughput and low-latency infrastructures for next generation heterogeneous mobile networks.

- **PHYLAWS**: **PHY**sical **LA**yer **W**ireless **S**ecurity

- [7], http://www.phylaws-ict.org/
- **Overall objective:** Design and prove efficiency of new privacy concepts for wireless communications that exploit propagation properties of radio channels. Search for realistic implantations in existing and in future Radio Access Technologies.

- **Combo**: **CO**nvergence of fixed and **M**obile **B**r**O**adband access/aggregation networks

- [8], http://www.ict-combo.eu/
- **Overall objective:** Propose and investigate new integrated approaches for Fixed / Mobile Converged (FMC) broadband access / aggregation networks for different scenarios (dense urban, urban, rural).

- **MOTO**: Evolving **MO**bile internet with innovative terminal-**T**o-terminal **O**ffloading technologies

- [9], http://www.fp7-moto.eu/
- **Overall objective:** Design an integrated operator-managed offloading system and combined offloading algorithms.

- **MCN** **M**obile **C**loud **N**etworking

- [10], http://www.mobile-cloud-networking.eu/site/
- **Overall objective:** Extend the Concept of Cloud Computing beyond data centres towards Mobile End-User. One Service: Mobile Network + Computing + Storage. On-

Demand, Elastic, and Pay-As-You-Go. Enable a Novel Business Actor, the Mobile Cloud Provider. Mobile Network Architecture for Exploiting and Supporting Cloud Computing. Deliver and Exploit the Concept of End-to-End Mobile Cloud for Novel Applications.

In Horizon 2020 the 5G PPP is a dedicated sub-program on 5G research. 5G PPP projects are addressing 5G from a system perspective in an approach as complementary as possible. Major building blocks of future systems are investigated. The set of Call 1 projects is described in Figure 1 [11] (https://5g-ppp.eu/5g-ppp-phase-1-projects/).

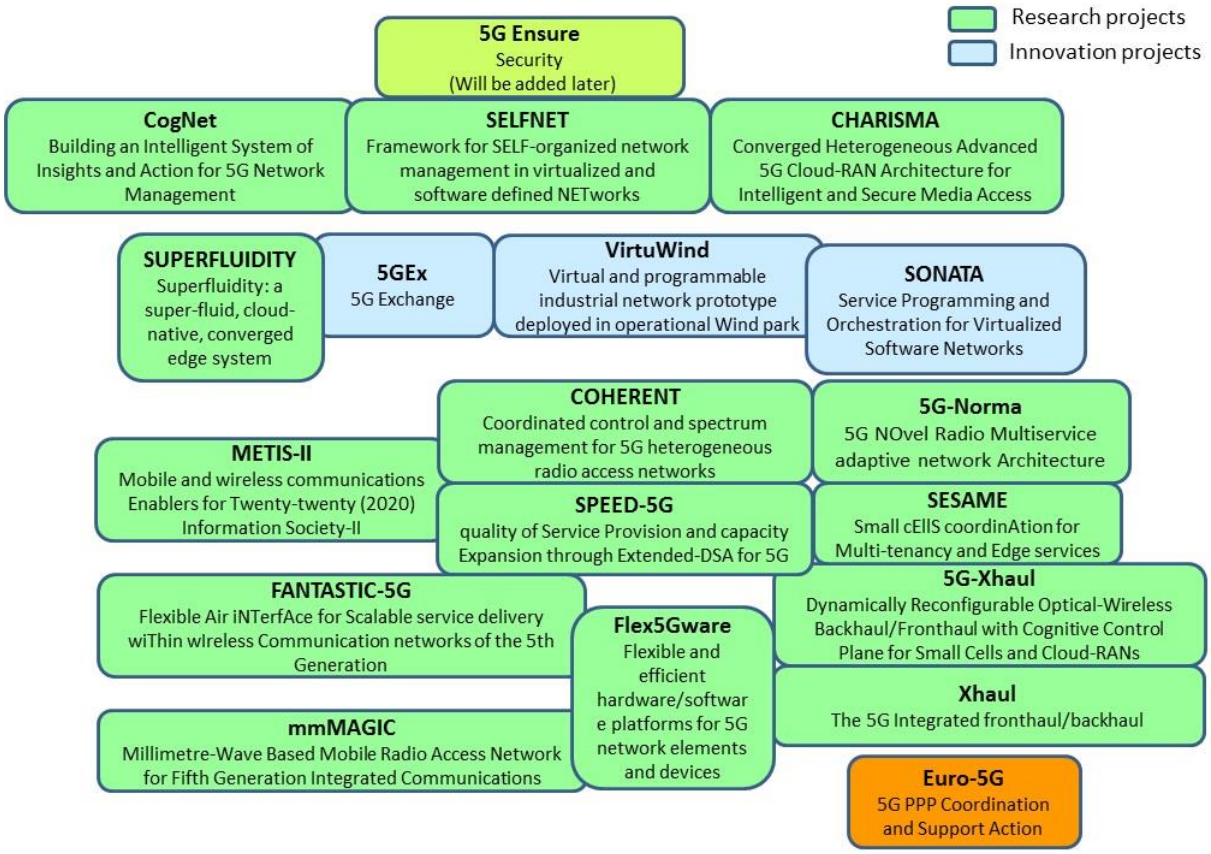

Figure 1: Horizon 2020 5G PPP Call 1 selected projects

These projects, as well as the projects that will be approved in the future 5G Calls, will provide the concrete basis for contributions to international cooperation.

2.3 Examples of national initiatives

2.3.1 Finland – 5G Test Network Finland (5G TNF)

The vision of the 5G Test Network Finland is to enable Finland to provide the best and most appealing 5G test network environment and ecosystem in the world for research and business development. Their mission is to coordinate the integration of 5thGear testbed projects and facilitates the cooperative creation of an open national innovation platform for 5G technology / concept verification and application development [12] (http://5gtnf.fi/).

2.3.2 Germany – 5G Lab Germany at TU Dresden

TU Dresden combined several university institutes to form a joint 5G research initiative in order to look at 5G from a more holistic perspective [13] (http://5glab.de/).

2.3.3 UK – 5G Innovation Centre (5GIC) at University of Surrey

The University of Surrey in UK is following a similar approach as TU Dresden. UK government invested in a dedicated research center, which is also cooperating with industry in the UK [14] (http://www.surrey.ac.uk/5gic).

2.4 China

China is running collaborative research programs, which are now starting to become more accessible for non-Chinese organisations. The main programs are

- 863 Research Program [14] (http://www.most.gov.cn/eng/programmes1/),
- Future Forum 未来移动通信论坛 FUTURE MOBILE COMMUNICATION FORUM [16] (http://www.future-forum.org/en/) and
- IMT-2020 (5G) Promotion Group IMT-2020 [17] (http://www.imt-2020.cn/en/introduction).

In particular, Future Forum and IMT-2020 (5G) Promotion Group have developed white papers on different aspects of 5G. Future Forum is more a private forum, where IMT-2020 (5G) Promotion Group is organised under the Ministry of Industry and Information Technology (MIIT).

2.5 Japan

Japan focused 5G activities in The 5G Mobile Communications Promotion Forum 5GMF [18] (http://5gmf.jp/en/), which is bringing together industry, standards bodies and the academic domain. 5GMF developed white papers in particular on the 5G vision.

2.6 Korea

Similar like in Japan 5G activities in Korea are coordinated by 5G Forum 5G Forum [19] (http://www.5gforum.org/eng/main/), which has members from industry and the research community. This group has developed rather detailed technical reports on the 5G system with a focus on radio systems.

2.7 Russia

In Russia there is mainly a private initiative on 5G: 5GRUS [20] (http://www.rspectr.com/news/aikom28113/) by Russia's Icom-Invest. Russia does not have a telecom industry, which is active on the global market. At the present moment in time no results and contributions have been available internationally.

2.8 Taiwan

The Taiwanese government is organising 5G research in the TAICS, program under the responsibility

of the Ministry of Science and Technology and the Ministry of Economic Affairs [21] (https://www.itri.org.tw/eng/Content/NewsLetter/Contents.aspx?SiteID=1&MmmID=617731531241750114&MSid=654050566063421363). The government research center ITRI [22] (https://www.itri.org.tw/eng/) is implementing this strategy.

2.9 Different initiatives in the US

The US do not have a comparable collaborative research program as in Europe. 5G activities are mainly undertaken by individual industry companies, industry associations, and the academic domain. The main activities are on-going at

- Intel Strategic Research Alliance (ISRA) [23],
- (http://blogs.intel.com/intellabs/2013/07/15/next-generation-wireless-communication-5g-transforming-the-wireless-user-experience/),
- NYU Wireless Research Center [24] (http://nyuwireless.com/) mainly dealing with the investigation of millimetre wave systems and
- 4G Americas, [25] (http://www.4gamericas.org/en/).

4G Americas involves major industries from the US and has produced several white papers on 5G.

2.10 NGMN

NGMN [25] (https://www.ngmn.org/home.html) as an association driven by major network operators developed its 5G vision and is influencing global requirements. This association is cooperating with international standards bodies and is an Associated Member of the 5G Infrastructure Association in 5G PPP.

2.11 Company internal research

The global ICT industry started significant company internal research on 5G. In particular in Europe Horizon 2020 and national programs are used for collaborative research, which allows the cooperation also among competitors. This is used as a means for consensus building and the preparation of future standards.

3 Establishment of international contacts and relations

With respect to the global 5G research environment according to Chapter 2, 5G PPP established contacts in particular to counterparts in these regions and countries, which are most influential in international standardisation and the regulatory process. Therefore, the target regions and countries are the Americas, China, Japan, and Korea.

The EU Commission negotiated and signed on government level Joint Declarations with

- the Korean government on June 16, 2014,
- the Japanese government on May 29, 2015 and
- the Chinese government on September 28, 2015.

An agreement with the US government is under discussion.

These agreements address mainly cooperation on research and regulatory issues and means of mutual access to research programs.

The 5G Infrastructure Association negotiated and signed in parallel to the EU Commission MoUs with international counterparts. These MoUs are very similar to each other.

3.1 MoU with 5G Forum (Korea)

A MoU was signed with 5G Forum in Korea [19] (http://www.5gforum.org/eng/main/) on June 17, 2014 in Seoul, Korea (Figure 2) after the signature of a Joint Declaration between the EU Commission and the Korean government. As part of the cooperation, 5G Infrastructure Association contributed to the Horizon2020 work program on a joint call EU – Korea.

Figure 2: Signature of MoU in Seoul

The agreed areas of cooperation are

- Vision of 5G communication systems and networks.
- Requirements on 5G communication systems and networks.
- Discussions on basic system concepts.
- Frequency spectrum (spectrum demand estimates and potential frequency spectrum ranges) in order to support the global regulatory process.
- Preparation of future global standards by identification of common interest and consensus building.

3.2 MoU with 4G Americas

4G Americas is the industry association in the Americas, which is dealing with 5G. Therefore, a MoU was signed with 4G Americas [25] (http://www.4gamericas.org/en/) on March 2, 2015 in Barcelona, Spain at Mobile World Congress 2015 (Figure 3). The research community in the US is organised in a different way than in Europe. 4G Americas developed 5G white papers on the view of industry in the

Americas. A press release is available at https://5g-ppp.eu/5g-ppp-and-4g-americas-announce-mou-for-5g/ and https://5g-ppp.eu/wp-content/uploads/2015/03/4G-Americas-Press-Release_5GPPP-MOU_FINAL-2.pdf [27].

Figure 3: Signature of MoU in Barcelona

The agreed areas of cooperation are

- Vision of 5G communication systems and networks.
- Requirements on 5G communication systems and networks.
- Discussions on basic system concepts.
- Frequency spectrum in order to support the global regulatory process.
- Preparation of future global standards by identification of common interest and consensus building.

3.3 MoU with The Fifth Generation Mobile Communications Forum (Japan)

A MoU was signed with The Fifth Generation Mobile Communications Promotion Forum in Japan [18] (http://5gmf.jp/en/) on March 25, 2015 in Frankfurt, Germany at the NGMN Industry Conference (Figure 4). The EU Commission and the Japanese government signed a joint declaration on May 27, 2015. However, the text was already agreed between both governments in March 2015. A press release is available at https://5g-ppp.eu/5g-ppp-5gmf/ and https://5g-ppp.eu/wp-content/uploads/2015/03/Press-release_Final.pdf [28].

Figure 4: Signature of MoU in Frankfurt

The agreed areas of cooperation are

- Vision of 5G communication systems and networks.
- Requirements on 5G communication systems and networks.
- Basic system concepts.
- Technologies for 5G communication systems and networks.
- Frequency spectrum in order to support the global regulatory process.
- Preparation of future global standards by identification of common interest and consensus building.

3.4 MoU with IMT-2020 (5G) Promotion Group (China)

On the day after the signature of the Joint Declaration between the EU Commission and the Chinese government the MoU was signed on September 29, 2015 in Beijing between the IMT-2020 (5G) Promotion Group in China [17] (http://www.imt-2020.cn/en/introduction) and 5G Infrastructure Association (Figure 5). The press release is available at https://5g-ppp.eu/imt-2020-5g-promotion-group-and-5g-ppp-announce-memorandum-of-understanding-for-5g/ [29].

Figure 5: Signature of MoU in Beijing

The agreed areas of cooperation are

- Vision of 5G communication systems and networks.
- Requirements on 5G communication systems and networks.
- Discussions on basic system concepts.
- Frequency spectrum in order to support the global regulatory process.
- Preparation of future global standards by identification of common interest and consensus building.

3.5 Multilateral MoU between all five organisations to organise a series of Global 5G Events

These five organisations IMT-2020 Promotion Group (China), The Fifth Generation Mobile Communications Promotion Forum (Japan), 5G Forum (Korea) and 4G Americas and 5G Infrastructure Association agreed to organise a series of Global 5G Events in the coming years in order to rationalise the number of 5G events. This multilateral MoU was signed on October 20, 2015 during the EU ICT 2015 Conference in Lisbon in the presence of EU Commissioner H.G. Oettinger (Figure 6). The press release is available at https://5g-ppp.eu/leading-5g-visionary-organizations-in-europe-usa-japan-south-korea-and-china-sign-multi-lateral-memorandum-of-understanding-for-global-5g-events/ [30].

Figure 6: Signature of MoU in Lisbon

It was agreed to organise two events per year. The first event in the first half of 2016 will be hosted by IMT-2020 (5G) Promotion Group and the second event will be hosted in the second half of 2016 by 5G Infrastructure Association in Europe. There will be a joint program committee between all five organisations. These meetings will rotate between continents.

3.6 Further international collaboration partners

5G Infrastructure Association is reviewing further potential international counterparts and may enter into further MoUs if appropriate. Such partners may also enter the Multilateral MoU, if all signing parties agree.

4 Approach and core strategy

4.1 Main steps

The main steps of the strategy are:

- To establish liaisons with other national and European R&D programs (e.g. Eureka clusters) for the inclusion of 5G related topics as appropriate and foster the creation of synergies.
- To analyse international activities on 5G and ensure proper positioning of the European 5G PPP initiative so as to identify and pursue collaboration opportunities e.g. by means of MoUs.
- To establish and maintain necessary contacts and cooperation on global level with similar initiatives in other regions and countries like China, Japan, Korea, North America and others, if new initiatives emerge.
- To ensure coherence and maximum impact of the 5G PPP and its projects through liaison with other relevant R&D programs, including related EC-driven initiatives like for instance the FIRE programme.

4.2 Cooperation with 5G PPP bodies

In order to implement these steps the International Cooperation Activity will closely cooperate with

- the 5G Infrastructure Association and its policy-oriented Working Groups (the Association has launched the Working Groups and Activities according to Figure 7)
    - Vision and Societal Challenges Working Group on research work programs, vision and requirements,
    - Spectrum Working Group to contribute to the preparation of WRC 2019 and
    - Pre-standards Working Group to coordinate research contributions towards respective standards bodies.
- 5G PPP projects and
- technology-oriented Working Groups in the 5G Initiative:
    - Architecture Working Group to contribute technical results,
    - Network Management WG to contribute technical results and
    - SDN/NFV WG to contribute technical results.

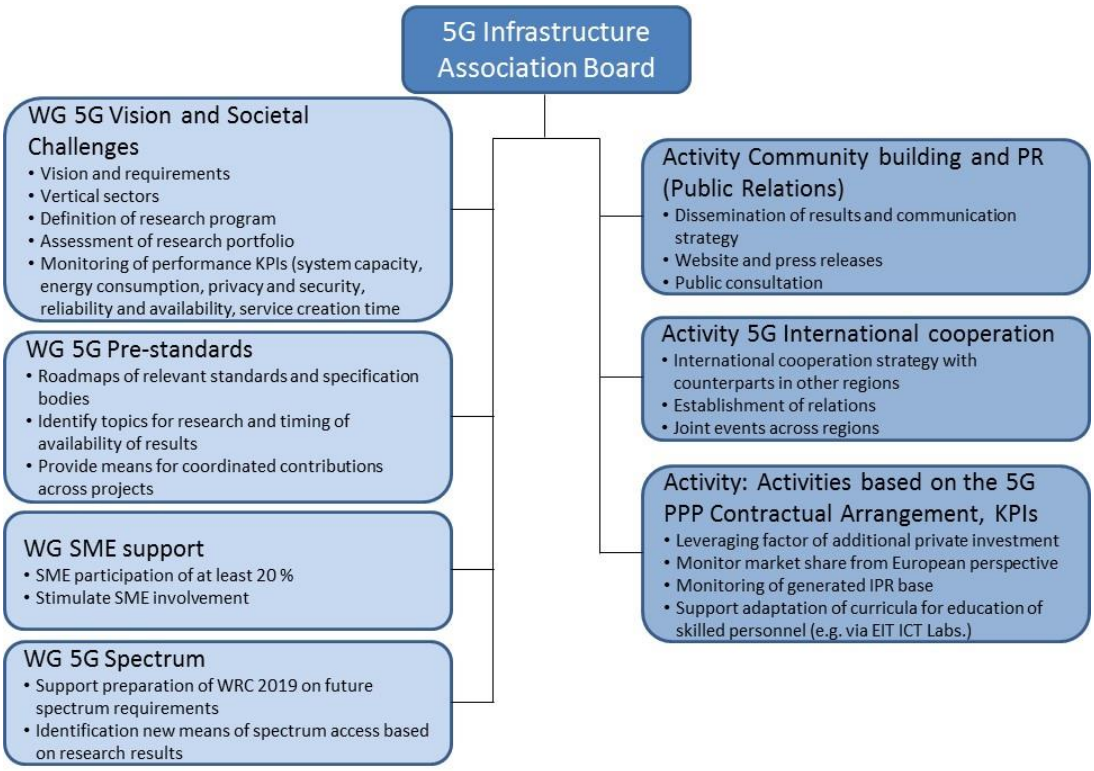

Figure 7: 5G Infrastructure Association policy oriented Working Groups and Activities

In addition, the International Cooperation Activity will cooperate with future activities in 5G PPP, which is dealing with test beds and benchmarking.

4.3 Development of material

The International Cooperation Activity will not develop own policy and technology positions. The material and documents for international cooperation will be developed based on contributions by the Working Groups and 5G PPP projects in Section 4.2, which will be used for meetings and information exchange with similar activities in other regions and countries according to the signed MoUs.

The means for international cooperation are

- general topics as defined in MoUs,
- exchange of documents where appropriate,
- joint workshops and events,
- the Global 5G Event and
- contributions to the Horizon 2020 work program for joint calls EU with other regions and/or countries.

These activities are supported logistically and administratively by the Euro-5G CSA project to organise international meetings and to provide a working environment such as

- website support,
- mailing list,
- document storage like BSCW server,
- meeting organisation and
- provision of designed printed material.

4.4 Organisation of work

The facilitator of the International Cooperation Activity is Werner Mohr (werner.mohr@5g-ppp.eu or werner.mohr@nokia.com). Participants in the activity are from the 5G Infrastructure Association and 5G PPP projects and in particular from University of Bologna – Giovanni Corazza (giovanni.corazza@unibo.it or giovanni.corazza@5g-ppp.eu).

Meetings will be organised as regular phone conferences or physical meetings. Physical meetings should be collocated with other 5G PPP/Working Group meetings with respect to efficiency of time and use of budget.

At start of the Activity the following actions will be performed:

- Re-freshen contacts to the main international partners, which have already been established by signing of MoUs.
- A 5G PPP internal kick-off meeting will be organised after the signature of all major MoUs.
- The following practical steps are needed:
    - prepare a list of participants,
    - prepare mailing list,
    - agree a meeting schedule,
    - decide envisaged documents and
    - common activities with international partners including the Global 5G Events.

The terms of reference of this Activity will be reviewed at the end of 2016 based on progress and status of 5G systems developments.

4.5 Milestones and deliverables

The following milestones are envisaged:

- Kick-off meeting with all participants from 5G PPP beginning of 2016 after Association

Working Groups and 5G PPP projects have developed first material, which can be used in international cooperation.

- First quarter 2016: Identification of national and other European 5G research initiatives and establishment of contacts.
- First quarter 2016: Establishment of contacts with European initiatives by means of liaisons with the Idealist NCP.
- First half of 2016: Alignment on the 5G vision and requirements in discussions with other research initiatives based on the ITU-R vision.
- First half of 2016: Common understanding on 5G system concepts.
- First quarter of 2016: Initial documents about how 5G PPP can support the preparation of WRC 2019 for discussion at international level based on the agenda, which will be agreed at WRC 2015.
- First quarter 2016: Initial documents about how international standardisation can be supported for discussion at international level.
- Preparation of the first two Global 5G Events in 2016 together with the international counterparts based on the Multilateral MoU.

4.6 Liaisons with other European R&D Programmes

Related to the international cooperation activities and directly relevant to the aims of the Euro-5G project, is the establishment of close cooperation with European programs in Member States and at European level. As already mentioned in Section 2.3, several national initiatives focusing on 5G innovation are being closely monitored, as well as related EC-driven activities, including ongoing 5G PPP projects and related ones in other related domains like the FIRE programme.

Initial coordination activities include establishment of contacts with key players, including EC representatives and active members of other relevant projects, to achieve a cohesive and stronger reach of all relevant stakeholders. This is being pursued by trying to co-locate meetings, identify common goals and activities, foster remote collaboration via conference calls and emails, as well as coordinate on promotional efforts. A first concrete example was the organisation of the presence of the 5G PPP projects at the ICT2015 event held in October in Lisbon.

In addition to that, a dedicated Communication Mailing List has been established by the Euro-5G consortium in order to facilitate information exchange with all 5G PPP projects about dissemination and promotional activities. This enables for more effective collaborations and contributes building a European view on 5G, which can be used in discussions as appropriate with other regions and players.

Specific attention is being devoted to the definition of regular and durable liaisons with regional and national efforts all across Europe. In particular, in addition to the 5G PPP projects, also the wider community by means of the 5G Infrastructure Association and the Networld2020 European Technology Platform is being involved.

Workshops between different projects, programs and other activities are being discussed and organised for information exchange and the development of white papers and other relevant documents, in close coordination with WP2, WP3 and WP5. Such documents like on 5G vision, requirements, architecture, pre-standardisation and frequency spectrum are the basis for international cooperation.

5 Conclusions

5G PPP is a major research initiative to contribute to the development and standardisation of 5G on global basis. International cooperation is an important means to support consensus building ahead of future standardisation. In order to facilitate this consensus building 5G Infrastructure Association has signed MoUs with major international counterparts in China, Japan, Korea and the Americas in parallel to government agreements between the EU Commission and governments in China, Japan and Korea.

In this document Euro-5G together with the 5G Infrastructure Association has developed the strategy and necessary steps to implement activities towards international cooperation. This document describes the overall 5G environment of major research activities and how 5G PPP will contribute to these international activities.

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