5G PPP newsletter #2

This second edition of the 5G PPP newsletter covers the following topics:

- A summary of the past events including Multi-lateral MoUs for "global events", workshops and white papers,
- A presentation of the Pre-structuring model for the 5G-PPP Phase 2,
- A section dedicated to 5G and verticals.

1 Past events wrap-up

A number of actions have been pursued since the launch of the 5G PPP projects (most of them started on the 1st of July, 2015). This last quarter, October to December 2015, has been rich in events and promotional activities. This section provides a global overview and reports in particular on major past events.

Memorandum of Understandings (MoUs) paved the way to a global harmonised 5G promotion and workshops allowing close and smooth cooperation among the various 5G PPP projects and effective dissemination actions to be orchestrated.

1.1 Multi-lateral MoU for "global events"

First and foremost, the leading regions pushing 5G in the world signed a multi-lateral Memorandum of Understanding for "global events" in October 2015 at the ICT event in Lisbon. The parties include organisations with which 5G PPP had signed agreements earlier in 2014 or 2015: 4G Americas (Americas), The Fifth Generation Mobile Communications Promotion Forum (5GMF) (Japan), 5G Forum (Republic of Korea), IMT-2020 Promotion Group (5G) (non-profit organisation, China) and the 5G Infrastructure Association Public Private Partnership (5G PPP) (Europe).

They all acknowledged the need of a global and common 5G promotion as 2020 approaches. The parties have agreed to jointly organise two "*Global 5G Events*" per year in the coming years to focus their efforts and leadership. The first two "*Global 5G Events*" will be in the first half of 2016 in China under the responsibility of IMT-2020 (5G) Promotion Group and in the second half of 2016 in Europe under the responsibility of the 5G Infrastructure Association.

The "*Global 5G Events*" intend to support multilateral collaboration on 5G systems across continents and countries. Basic areas of interest for the "*Global 5G Events*" include, but are not limited to:

- Vision and requirements of 5G systems and networks
- Basic system concepts
- Spectrum bands to support the global regulatory process
- Future 5G global standards
- Promotion of 5G ecosystem growth

Previously, the 5G Infrastructure Association Public Private Partnership, 5G PPP, had signed bi-lateral partnerships with each of the four leading organisations in 2014 or 2015 (June 2014: European Commission/South Korean Ministry of Science; March 2015: 5G PPP/4G Americas and 5G PPP/5GMF; September 2015: 5G PPP/IMT-2020 (5G) Promotion Group).

The first Global 5G Event will take place in Beijing on May 31-June 1, 2016.

1.2 Workshops and white papers

Both specialised and more general workshops were organised by the 5G PPP in the last quarter. Often white papers were written, which supported the workshop dissemination actions.

- **Digitalisation of verticals is a key topic.** Two workshops on vertical industries were co-organised by the European Commission and the 5G PPP.

   The first one took place at the EUCNC 2015 in Paris on the 1st of July 2015. Inputs from the media, the car manufacturing and health industries were highly appreciated. The state of the art of vertical industries digitalisation was clearly explained. Requirements for 5G and potential benefits from 5G for verticals rank among the hottest issues.

   The second workshop (click here for additional material) was held on the 9th and 10th of November 2015 in Brussels. This 2-day workshop focused on the five white papers released by the 5G PPP on verticals (eHealth, Factories of the Future, Energy, Automotive, specialised services/Network management). A large panel of companies and institutions in each vertical industry contributed to this first-of-this-kind of workshop and contributed with many valuable insights. The first panel highlighted that new data-driven business models are likely to emerge with 5G for the verticals and disrupt current ecosystems. The key role of regulation and policy was also mentioned. The second panel dealt with use cases and technical requirements in each vertical industry considered. 5G services and use cases in METIS-II were presented at this stage. The needs and requirements from vertical sectors were detailed by key representatives. The third discussion panel was more focused on pre-standards work. On-going reflexion within the 3GPP SA (Service & Architecture) attracted much attention.

- 5G is expected to come to reality quite soon. It is time to talk about research beyond 5G. The NetWorld2020 Expert Advisory Group issued a draft white paper on Research beyond 5G. It was advertised on the 5G PPP web site with the objective to collect feedback from the whole community before being finalised. NetWorld2020 is the European Technology Platform for communications networks and services. The white paper followed the Paris June 29th, 2015 workshop, organised jointly by the 5G Infrastructure Association and the NetWorld2020 Expert Advisory Group. The NetWorld2020 Expert Group has drafted a white paper (click here to download) on the topic of experimental facilities in Europe. The Expert Group invites the NetWorld2020 community, and any interested stakeholder, to participate in a public consultation on this whitepaper. Comments should be submitted via this webform. Deadline is 15 January 2016.

- **The first 5G Multilateral Workshop between Regional Initiatives on 5G Spectrum and Standards** was held on October 20th, 2015 in conjunction with ICT 2015. A paper was elaborated as an input for discussion. It discusses some open preliminary issues for 5G standardisation. As 5G architectures are intended to integrate different domains (mobile/fixed/satellite, licensed/ unlicensed, IoT) the standards development organisations related to these specific domains will need to work together to define 5G.

- **ICT 2015 in Lisbon** gave also the opportunity to demonstrate the strong cooperation between 5G PPP projects and their intense involvement in dissemination actions. The five projects present in Lisbon showed demos or presented early outputs and innovations. A brochure presenting the 5G PPP phase 1 projects was distributed and can be downloaded from the 5G PP web site (https://5g-ppp.eu/wp-content/uploads/2015/10/5GPPP-brochure-final-web.pdf). The 5G vision brochure and flyers have also been disseminated in Lisbon and are available at https://5g-ppp.eu/flayer-brochure/.

- **5G PPP projects jointly organised workshops** (for example the workshop in Stockholm in September 2015 chaired by METIS-II) or started to combine forces and organise workshops scheduled for next year (for example the IEEE ICC 2016 to be held in Malaysia next May). Papers can be submitted to FANTASTIC 5G (deadline: January 10th, 2016) or METIS II projects (deadline: December 18th, 2015).

- **Above all, there are numerous contributions from 5G PPP projects to 5G-based**

meetings/conferences or workshops. 5G PPP projects actively contribute to pushing 5G PPP ideas worldwide. 5G PPP projects will be present at major worldwide events in the mobile field in 2016. For the first half 2016, three events have been selected: ETSI workshop in January 2016, Mobile World Congress in February 2016, IEEE VTC in May 2016.

2 Pre-structuring model Phase 2

The EC H2020 5G PPP program's funded budget target is 700 MEUR. The number of contractual projects will a priori range in the order of 60-100 (depending on the EC contractual funding and project sizes in the different phases). PPP programs are clearly considered to be more than a group of standalone projects working together through EC Concertation & Clusters meetings and activities. The success of these programs is very much depending on the consecutive portfolio of projects over the phases, the capacity of these projects to interface and cooperate and their ability to jointly impact beyond their individual achievements.

The EC H2020 5G PPP program is organised over three phases (maybe four) encompassing research (Phase 1), optimisation (2016-2017) and large-scale trials (2019-2020).

- On the 1st of July 2015, the projects from the first phase of the 5G PPP began with a joint meeting in Paris (France). The 19 projects for Phase 1 have been retained from the 823 proposals received by the EC in response to the first call of the 5G PPP.

- The definition of the second phase has already started. The 5G Infrastructure Association released a paper on the 5G PPP web site (https://5g-ppp.eu/5g-ppp-phase-2-pre-structuring-model/). The Model version 1.0 is open to a public consultation organised by the 5G Infrastructure Association and discussed during several Info Days and Awareness Events. Detailed information will be provided by the 5G Infrastructure Association in the coming weeks. The Model will be enriched and released in version 2.0 before March 2016. It addresses 26 TAs (Targeted Actions):

    - ICT-07-2017: 5G PPP Research and Validation of critical technologies and systems:
        - ✓ RIA Strand 1 (Research and Innovation Action): Wireless Access and Radio Network Architectures/Technologies.
        - ✓ RIA Strand 2 (Research and Innovation Action): High Capacity Elastic – Optical Networks
        - ✓ RIA Strand 3 (Research and Innovation Action): Software Networks.
        - ✓ CSA (Coordination and Support Action)
    - ICT-08-2017: 5G PPP Convergent Technologies:
        - ✓ IA Strand 1: Ubiquitous 5G Access Leveraging Optical Technologies.
        - ✓ IA Strand 2: Flexible Network Applications.
        - ✓ RIA (Research and Innovation Action): Cooperations in Access Convergence.
        - ✓ EUJ-01-2016: RIA 5G (Research and Innovation Action) – Next Generation Communication Networks.
        - ✓ EUK-01-2016: RIA 5G (Research and Innovation Action) – Next Generation Communication Networks.

3 5G PPP and verticals

While earlier network generations have been designed as general purpose connectivity platforms with limited differentiation capabilities across use cases, the situation is changing for the definition of 5G networks. Faced with an ever larger portfolio of applications to serve and with a corresponding skyrocketing number of requirements to satisfy, it is now commonly recognised that future networks will have to consider requirements by vertical sectors from the onset. This newsletter provides an overview of the five key verticals covered by the 5G PPP.

3.1 Health

The e-Health sector is identified as a priority in the European Digital Agenda and subsequently in many national digital agendas. It is expected that 5G will solve many of the current issues such as the aging economy, increasing chronic diseases and the resulting costs of healthcare.

3.1.1 Trends and services

5G is expected to enable some key services, such as decentralisation, moving care closer to the point of need. This can then be combined with virtualisation, required for scenarios like remote surgery and all types of tele-monitoring. Another key trend is mobility: mobile health monitoring services could improve the safety and comfort of patients through the monitoring of vital functions. Advances in mobile diagnostics through multifunctional mobile health devices, are particularly relevant for healthcare provisioning in remote areas without medical infrastructure. Mobility is also crucial for emergency scenarios, when patient information is needed already at the point of care and on the way to the hospital.

3.1.2 Players and business models

New business models will be based on the replacement of highly qualified and scarce medical personnel by machines and less qualified personnel, e.g. in remote health monitoring scenarios. Indeed, the primary interest of healthcare is to reduce and optimise the costs involved.

3.1.3 Challenges

Health data is an extremely sensitive type of data, and thus data management, together with security and security must be guaranteed. The information will come from various sources, like, e.g., sensors, patient files at hospitals and patient files kept by general practitioners.

Liability and regulations is also a critical challenge for health: standards, legislation, non-repudiation, privacy, spectrum management and interoperability are all needed. Coverage is also important to make sure aid is available everywhere, as is backwards compatibility to enable e-health in 4G (and before) as well as 5G. The relationship between uplink and downlink has to also change, as proactive consumers and patients will want to upload their (health) data.

3.2 Automotive

The automotive industry has three main mid- and long- term challenges for society: public (efficient and safe transportation); ecological (reasonable use of natural resources and reduction of CO2 emission and other negative environmental impacts); and economic/business (contribution to sustainable economic growth and creation of new jobs).

3.2.1 Trends and services

With the above challenges in mind, 5 service areas have been identified as main drivers for 5G networks, derived from current trends and interests from the automotive industry: **digital infrastructure in vehicles**, allowing for significant amounts of information in vehicles for both

entertainment and work, and enabling the following four application / services; **smart navigation**, integrating, sharing and processing information not only from operation centres but also between automobiles themselves; **virtual drivers' assistance**, integrating virtual reality such as interactive windscreen display; **cooperative driving**, presenting route and other information to help make the best decisions for all drivers through sharing of data; and **automated vehicle / autonomous driving**, aiming to introduce enhanced autonomous features in situations such as parking and avoiding congestion.

3.2.2   Players and business models

The automobile manufacturers, of course, remain integral in this vertical, but the value chain is expected to involve more players, notably wireless service providers, fleet management companies, car rental and car-sharing services, infotainment content providers and developers of location-based services. In particular, a shared collaborative network infrastructure is required, allowing easy establishment of virtual networks to be used by specific operators offering ITS related services. Business models are expected to shift towards more service-based, recurring fees based models based on such virtual networks and new service platforms (as opposed to one-shot sales).

3.2.3   Challenges

There are various requirements for 5G needed to enable the services mentioned in this automobile industry, such as network coverage, connectivity and reliability. Network coverage is crucial for wide deployment, including low density areas. Connectivity by various types of communication needs to be supported, as it is unrealistic to change technologies already in use in the automotive sector. Reliable communication is also a must, also for uplink when considering the cars themselves will send data. There is also a need to manage human and robot (autonomous) driving concurrently.

3.3   Factory of the future

The factory of the future as part of the fourth industrial revolution, branded as Industry 4.0, is expected to grow by 204% by 2025, offering huge opportunities for Europe.

3.3.1   Trends and services

Industry 4.0 includes a change from mass production to customised production, from make-to-stock to make-to-order. What is important in an Industry 4.0 scenario is the communication between the plants and the monitoring of machines, robots, and material flows. It is no longer just about production, but also about product-related services. In such a factory of the future, mobility is a key element, as employees moving around need to know about the status of processes. There will be a new network scope in the Industry 4.0 world beyond the current connection of providers, manufacturers and customers around smarter products.

3.3.2   Players and business models

The factory of the future will organise itself and implement the vision of 'design anywhere, produce anywhere', which will lead to new business models. In fact, a new business model is already emerging in the form of 'Manufacturing as a service', where design is completely decoupled from production. In this context, crucial questions in regard to responsibility and liability emerge, e.g.: Who is the owner of the infrastructure? How will co-ownership of network and manufacturing infrastructure be managed? Who will be liable, in case of failure along the communication/production chain? As production becomes network-centric, information will be the main source for value creation in manufacturing. This means information as value driver leads to new business models: competition will be driven by use of information.

3.3.3   Challenges

As touched upon above, Industry 4.0, and manufacturing in general, pose the challenge of a mission-critical environment with high liability. As there will be more and more smart customisation, another challenge is to pre-provision the products. Further, effective coordination of the interaction of humans and robots will be required.

3.4   Energy

The time scale for the implementation of the new generation of energy services in smart grids, as targeted by the EU, is five years (by 2020). Therefore there is urgency within the energy sector to define the 5G requirements now.

3.4.1   Trends and services

In order to establish the next generation energy grid, the establishment of needed energy storage, demand/response based energy consumption management, corresponding controllable energy generation, and new transmission lines are all expected to be introduced into the market. This will lead to the concept of energy as a service, a consequence driven by changes in the energy sector, mainly driven by distributed energy generation, which will significantly increase in the upcoming period, and new requirements of the critical infrastructures, due to their increased importance, where the energy supply chain represents a significant part of these infrastructures.

3.4.2   Players and business models

To ensure the implementation of the smart grid and the next generation energy grid, increased usage of communications and cooperation with ICT sector will be needed as well as the involvement of traditional players within the energy sector. While old and current technologies may seem sufficient for the majority of the aforementioned services, it is not commercially efficient, creating room for cost savings through 5G and potential outsourcing of communication services.

3.4.3   Challenges

One large challenge is on the regulation front, with different regulations and different interpretations of respective EU rules at the Member States level, representing a serious barrier for innovation. Here, an industry driven action at the European level is needed. Another important issue is the interpretation of the network neutrality concept, which does not enable the establishment of the future applications, based on- and supported by- communications, in the energy sector. Network neutrality has to allow priorities and the fulfilment of further requirements in networks, as needed by the energy sector (as well as other vertical sectors).

3.5   Media and Entertainment

Video is a major component of mobile data today and is growing. Thus scalability of networks is important, and 5G must support many more users per cell than 4G.

3.5.1   Trends and services

Devices are becoming personal rather just simply mobile. This personal device creates a *first screen* user habit and usage, i.e. the mobile screen is becoming the primary screen for users to watch.

There are various use cases which fit into media and entertainment, and their requirements also vary greatly. For example, cases such as virtual reality, real-time gaming, and event related video on-site requires low latency and very high bandwidth. However, all other video services do not require such low latency. That said, ubiquitous coverage is definitively a requirement for all cases.

Another trend to be considered is that video content is not only linear TV, especially for the younger

generation. Surveys show that the daily linear TV viewing time per household is 220 minutes on average, but only 70 minutes for households of ages 40 years and younger.

3.5.2   Players and business models

Business models, revenue sources and network costs are still rather unclear at this point in time, and further work is required here. A potential route is that of OTT business models, although such revenue seems to be rather marginal. One thing that appears to be certain is that broadcasting must be a mandatory feature of 5G; a mobile unicast only solution may not be commercially viable.

3.5.3   Challenges

Media solutions over 5G will be required to integrate network capabilities, using all types of technologies, such as terrestrial, fibre, satellite, caching and storage. On top of this, roaming fees and country specific content rights would be potentially hurdles for 5G as people and cars usually cross country borders. Looking further ahead, the role of the car as yet another space for media and entertainment has still to be further developed in cooperation with the automotive vertical; it is necessary to mandate a specific interface and/or protocol to link a media device with the automotive system.

4 Other news

In November 2015 and to avoid confusion with another 5G PPP project, the project Xhaul changed its short name to 5G-Crosshaul.

The short name 5G-Crosshaul will now be used in any public reference to the project.

The web site for the project is now: www.5g-crosshaul.eu