

5G PPP newsletter #1



1 5G PPP cooperation with similar international programs

Recently, the 5G Infrastructure Public Private Partnership, 5G PPP, signed partnerships with similar 5G programs outside Europe.

- In June 2014, the European Commission and the South Korean Ministry of Science signed an agreement to "*deepen discussions in the area of Net Futures*". They agreed to work together towards a global definition for 5G. They also decided to cooperate on R&D for 5G. A cooperation framework was settled by a Memorandum of Understanding signed in June 2014 by the 5G Infrastructure Association. The MoU for the 5G vision defines requirements, concept, frequency and global standards preparation.
- Early March 2015, a MoU was signed between 5G PPP and 4G Americas (www.4gamericas.org/en/). Both organisations will share information on 5G concepts and on spectrum.
- Also in March 2015, the 5G PPP and the 5GMF (<http://5gmf.jp/en/>) signed a Memorandum of Understanding for 5G in which both organisations stated they will collaborate in road mapping and developing 5G.
- At the end of September 2015, the 5G PPP and IMT-2020 (5G) Promotion Group (<http://www.imt-2020.cn/en/>) in China signed a MoU.

The South Korean 5G Forum, the 5G Mobile Forum of Japan, 4G Americas, and the IMT-2020 (5G) Promotion Group are described below.






Program	Launch date	Country of origin
	May 2013	South Korea
	September 2014	Japan
	January 2002 February 2014 (for 5G)	USA
	February 2013	China
	December 2013	Europe

Table 1: 5G programs around the world

These agreements on joint 5G research programs follow key strategic partnerships settled between the EU Commission and concerned countries. More globally, the European Union concluded bi-lateral S&T agreements with a number of individual countries. These agreements constitute a framework and a privileged forum to identify common interests, priorities, policy dialogue, and the necessary tools for S&T collaboration.

- Cooperation between South Korea and the EU on research and innovation is governed by an agreement which began in 2007. In June 2014, the European Commission and the South Korean Ministry of Science signed an agreement to "*deepen discussions in the area of Net Futures*".

- The USA has been a partner of the European Union since 1990. Cooperation on research and innovation is governed by an 5-year agreement signed in 1998 and renewed three times.
- Japan has been a strategic partner since March 2011 when an agreement on cooperation in Science and Technology (S&T) between the European Community and the Government of Japan entered into force. In May 2015, the third meeting of the Joint S&T committee assesses the progress achieved and adopted a joint vision on a new EU-Japan strategic partnership in Research and Innovation.
- Scientific cooperation between the EU and China is governed by a specific agreement signed in December 1999 and renewed lastly in November 2009. The agreement is implemented by a joint committee. The European Commission and the Chinese Government (department responsible for spectrum) signed a joint declaration on 5G strategic cooperation just one day before the 5G IA / IMT-2020 (5G) Promotion Group MoU.

1.1 5G Forum South Korea (www.5gforum.org)

In South Korea, the 5G mobile strategy was defined early in January 2014 by the Korean Government (Ministry of Science, ICT and Future Planning). The program will run over the 2014-2020 period (7 years) with a 1.6 trillion KRW joint investment from both the Government and the private sector. The partnership was established on May 30th, 2013 in Seoul.

Pre-5G services are scheduled for December 2015, trial 5G services are scheduled for December 2017 while the official commercial launch is expected in December 2020. The Winter Olympics to be held in PyungChang (South Korea) early 2018 are obviously a key target for the project.

26 companies/institutions are part of the project including private companies (operators, equipment vendors), research institutes and universities:

- The three MNO (SK Telecom, KT, LGU+) are contributing, as well as LG, Intel, Nokia, National Instruments, Ericsson, Samsung, KCA, Rohde & Schwarz, Huawei
- ETRI, IITP, GiGa Korea are the research institutes involved.
- KAIST and Yonsei are the universities involved.

The project is led by Younghan Han, Professor, DoEE from the KAIST University (ynhan@kaist.ac.kr)

The 5G Forum defined its vision and requirements:

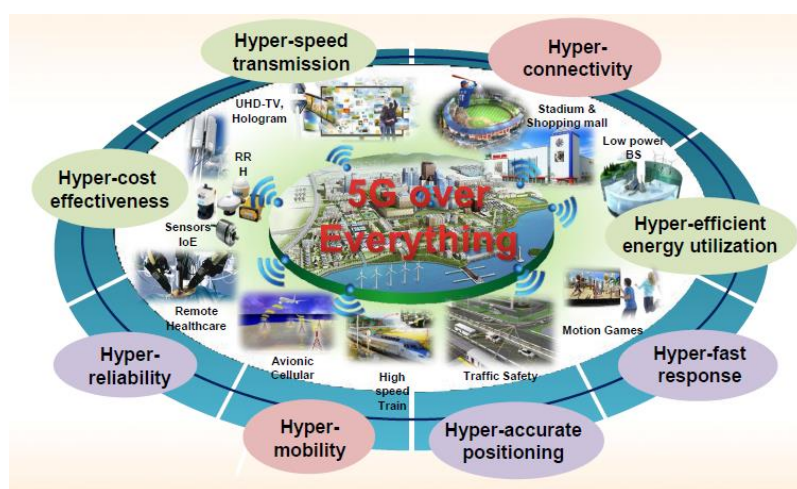


Figure 1: 5G Forum Korea vision

Source: 5G Forum, Dan Keun Sung, Prof. KAIST

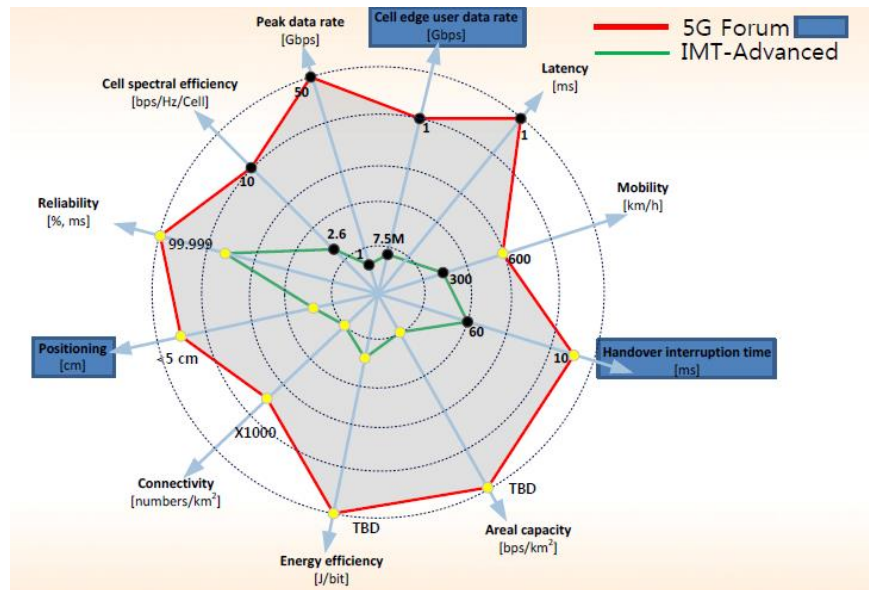


Figure 2: 5G Forum Korea requirements

Source: 5G Forum, Dan Keun Sung, Prof. KAIST

The 5G Forum identified 6 typical services of 5G (Mobile Contents Streaming Services, Social Knowledge Sharing Services, High-Density User Services, Smart Transportation and Robots Services, Public Safety Services, 5G Extension Services for AMSC) with specific challenges to be resolved. Obviously, requirement levels depend on services delivered.

The 5G Forum also considers beyond 5G and the potential of following mobile technologies. According to the 5G Forum, “6G as the network of the 2030s will develop into a ‘My Network’ where the user network environment is synergistically optimized in all dimensions. After the 2040s, mobile communication networks are expected to evolve into a central and autonomic nerve network that is similar to the human body’s biological system. In the era of 7G, things and space will be transformed into artificial intelligence devices with the help of nano and bio technologies. As a living organism reacts in the most efficient manner using minimum energy, the molecules to constitute things will become a means for communications.”

In the past 2 years, the 5G Forum Korea signed a number of Memorandum of Understandings (MoU) with other 5G projects:

- IMT-2020 (China) in 2013
- 2020B AH (Japan) in 2013
- 5GPPP (Europe) in 2014
- 5G Mobile Forum in April 2015

The 5G Forum has already published whitepapers on service, enabling technologies and spectrum.

It is conducting joint research projects with IMT-2020 Promotion Group from China.

1.2 The 5G Mobile Forum (5GMF, Japan, www.5gmf.jp)

The Radio Policy Vision Council of the Ministry of Internal Affairs and Communications (MIC) held in 2014 presented the roadmap for the 5G mobile communications system in a report. It stated that strong cooperation among industries, academia and government was essential for 5G early realisation. Following this report, the 5GMF was established late in September 2014.

The 5GMF is chaired by Prof. Susumu Yoshida from the Kyoto University. Members of 5GMF are broken down in individual members in the academic circle, ordinary members (companies paying annual membership fees of 100'000 JPY), special members and advisors. As of August 7th, 2015, there are:

- 14 individual members, all working for Japanese universities except one member working for NTT and another one working for the National Institute of Information and Communications Technology
- 64 ordinary members of which major companies involved in the mobile business including all three MNOs, the National Institute of Information and Communications Technology again, major equipment vendors such as Huawei, Ericsson, Hitachi or Mitsubishi and the likes.
- 3 special members, the Ministry of Internal Affairs and Communications also known as the MIC, the Telecommunication Technology Committee and the ARIB (Association of Radio Industries and Businesses)
- 30 advisors from Japanese universities, and major types of players in the telecom sector:
 - telecommunication associations (the Telecommunications Carrier Association or TCA, the Telecom Services Association, ARIB, Communication and information network association of Japan, Japan Internet providers association)
 - Japanese players (MNO, equipment vendors)
 - business association (Japan Business Federation), or promotion association (YRP R&D Promotion Committee)

The 5GMF aims at achieving the five following major objectives:

- Research & development concerning the Fifth Generation Mobile Communications Systems, as well as research and study pertaining to standardization thereof.
- Collection of information on the Fifth Generation Mobile Communications Systems and exchange thereof with other organizations.
- Liaison and coordination with related organizations concerning the Fifth Generation Mobile Communications Systems.
- Dissemination and enlightenment pertaining to the Fifth Generation Mobile Communications Systems.
- Other activities required to fulfil the objectives of the Forum.

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In March 2015, the 5GPPP and the 5GMF signed a Memorandum of Understanding for 5G in which both organisations stated they will collaborate in road mapping and developing 5G. The agreement will allow EU and Japan to work towards a common understanding and standards of 5G, identify new harmonized radio band frequencies for 5G spectrum and cooperate on future 5G applications in areas like connected cars or e-health. Together, the partners will also invest 12 million EUR during the next two years in 5G-related projects to help develop the IoT, Cloud or Big Data platforms.

The 5G Forum hosted joint meetings with 5G projects all around the world (with the Chinese IMT-2020 (5G) Promotion Group and Future Forum, with 2020B AH and 5GMF of Japan, with the European 5G PPP).

1.3 4G Americas (USA, www.4GAmericas.org)

4G Americas as the major US wireless industry trade association is obviously directly concerned by the 5G technology and its evolution.

4G Americas is a US wireless industry trade association representing the LTE mobile broadband technologies including LTE-Advanced and beyond to 5G throughout the ecosystem's networks, services, applications and wirelessly connected devices in the Americas. The association is composed of leading telecommunications service providers and manufacturers. Its mission is to advocate for and foster the advancement and full capabilities of the LTE mobile broadband technology and its evolution beyond to 5G, throughout the ecosystem's networks, services, applications and wirelessly connected devices in the Americas. Member companies include major American vendors and US telecom players (Alcatel Lucent, Qualcomm, Intel, Sprint, T-Mobile USA, AT&T...).

In February 2014, 4G Americas begun to work on a technical group project on “promoting Americas leadership in 5G mobile broadband”. The output provided was a whitepaper on the world 5G initiatives.

4G Americas will also define globally 5G from the American perspective. The requirements for the evolution from and compatibility between 4G LTE and 5G systems will be identified, as well as the role of new network architectures, spectral efficiency improvements (e.g., advanced receivers, advanced MIMO schemes (Full Dimension-MIMO), dynamic coordination from Baseband Unit (BBU) pooling, Heterogeneous Networks (HetNets) and densification (cell splitting).

Early March 2015, a MoU was signed between 4G Americas and 5G PPP.

1.4 IMT-2020 (5G) Promotion Group (China, www.imt-2020.cn)

The IMT-2020 (5G) Promotion Group is the major platform to promote 5G research in China.

The MIIT set up a task force called MG2020 in 2013 to lead the development of 5G technologies, and companies such as Huawei, ZTE, Datang Telecom Technology & Industry Group and China Mobile have made significant investment in 5G development.

Based on the original IMT-Advanced Promotion Group, the IMT-2020 (5G) Promotion Group was launched by the Ministry of Industry and Information Technology, the National Development and Reform Commission and the Ministry of Science and Technology in February 2013.

The IMT-2020 (5G) Promotion Group published their initial 5G technology recommendations in February 2014.

The platform's mission is to promote the development of 5G technologies in China and to facilitate cooperation with foreign companies and organisations. IMT-2020 (5G) Promotion Group members include the main operators, vendors, universities, and research institutes in China, including China Mobile, China Unicom, China Telecom, Huawei and Tsinghua University. The Promotion Group is the major platform to promote 5G technology research in China and to facilitate international communication and cooperation. It established a liaison mechanism with the NGMN and shares the research progress on 5G. With the 5GPPP, it signed a MoU at the end of September 2015.

The IMT-2020 (5G) Promotion Group already published whitepapers:

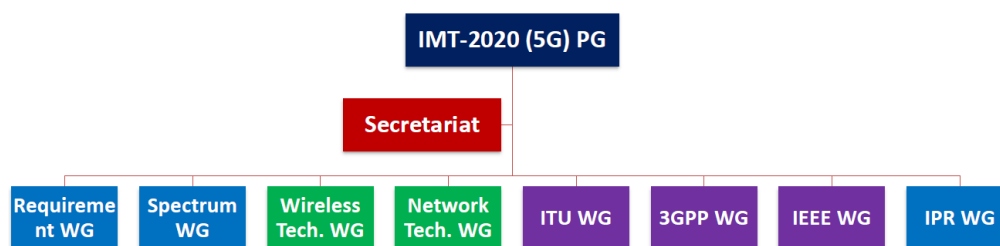
- Initial 5G technology recommendations (February 2014).
- 5G Vision and requirements (May 2014)
- 5G Concept (February 2015)
- 5G Wireless Technology Architecture (May 2015)

It established a liaison mechanism with the NGMN and shares the research progress on 5G.

With the 5G PPP, it signed a MoU at the end of September 2015.

The work plan for 2015-2016 is the following:

- Technology Study
 - 5G wireless and network technical schemes
 - Evaluation of 5G system schemes & key technologies
- Standardization
 - 5G standard framework and time plan
 - The requirements of RAN and SA
 - Standardization of 5G key wireless and network technologies
- Requirements
 - 5G evaluation scenarios, minimum requirements, and evaluation methodology
- Spectrum
 - Promote low-frequency bands for IMT systems in WRC-15
 - Narrow the frequency range of candidate bands above 6 GHz
- Trial Promotion
 - Verification of 5G key technologies and early standards
 - Demos of 5G-based new services and applications, especially in IoT and vertical industries



- **Requirement WG:** study 5G vision and requirements towards year 2020 and beyond
- **Wireless Technology WG:** study 5G enabling wireless technologies and 5G system framework
- **Network Technology WG:** study 5G network architecture and key technologies
- **Spectrum WG:** work on spectrum related topics
- **Standards WGs:** interactive with international standard organizations including ITU, 3GPP, IEEE, etc
- **IPR WG:** deal with IPR issues and relevant policy.

Figure 3: Structure of the IMT-2020 (5G) Promotion Group

Source: IMT-2020 Promotion Group, Feb. 2014

2 The 5G PPP programme

The 5G Infrastructure Public Private Partnership, [5G PPP](#) is a 1.4 billion EUR collaborative research program organized as part of the European Commission's Horizon 2020 program, the European Union Program for Research and Innovation. The 5G PPP aims at fostering industry-driven research. Research in 5G PPP is controlled by business-related, performance and societal Key Performance Indicators, KPIs. The 5G PPP was created at the end of 2013 (Dec. 17th, 2013) and scheduled to stop in 2020. The European Commission invested 700 million EUR. Complementary private investment in the order of five times this amount is expected to be provided by Industry, SME, and Research Institutes. The private side in 5G PPP is represented by the 5G Infrastructure Association.

The following parameters or KPIs are indicative operational network characteristics for 5G set at the beginning of the whole 5G PPP initiative:

- 1000 times higher mobile data volume per geographical area
- 10 to 100 times more connected devices
- 10 times to 100 time higher typical user data rate
- 10 times lower energy consumption
- End-to-end latency of below 1 ms
- Ubiquitous 5G access including in low density areas

Currently, the 5G PPP programme comprises 19 funded projects of which 12 were launched in July 2015 at the EuCNC 2015 in Paris (France):

- Euro-5G (www.5g-ppp.eu/euro-5g)
- 5G-NORMA (5G NOVel Radio Multiservice adaptive network Architecture - www.5g-ppp.eu/5g-norma)
- 5g-Xhaul (Dynamically Reconfigurable Optical-Wireless Backhaul/Fronthaul with Cognitive Control Plane for Small Cells and Cloud-RANs - www.5g-ppp.eu/5g-xhaul)
- 5G-ENSURE (5G security requirements - www.5g-ppp.eu/5g-ensure)
- CHARISMA (Converged Heterogeneous Advanced 5G Cloud-RAN for 5G Network Management - www.5g-ppp.eu/charisma)
- CogNet (Building an Intelligent System of Insights and Action for 5G Network Management - www.5g-ppp.eu/cognet)
- COHERENT (COordinated control and spectrum management for 5G HEterogeneous Radio access NeTworks - www.5g-ppp.eu/coherent)
- FANTASTIC 5G (Flexible Air Interface for Scalable service delivery within wireless Communication networks for the 5th Generation - <http://www.fantastic-5g.com/>)
- Flex5GWare (Flexible and efficient hardware /software platforms for 5G network elements and devices - <http://www.flex5gware.eu/>)
- METIS II (Mobile and wireless communications Enablers for Twenty-twenty/2020 Information Society-II - www.5g-ppp.eu/metis-ii)
- mmMAGIC (Millimetre-Wave Based Mobile Radio Access Network for 5th Generation Integrated Communication - www.5g-ppp.eu/mmmagic)
- SELFNET (Framework for Self-Organised Network Management in Virtualised and Software defined networks - www.5g-ppp.eu/selfnet)
- SESAME (Small CEIIS coordination for Multi-tenancy and Edge services - www.sesame-project.eu)

- SPEED-5G (quality of Service Provision and capacity Expansion through Extended-DSA for 5G - www.speed-5g.eu)
- SUPERFLUIDITY (Superfluidity: a super fluid, cloud-native, converged edge system - www.superfluidity.eu)
- XHAUL (X-Haul, the 5G Integrated fronthaul/backhaul - www.xhaul.eu)
- 5GEx (5G Exchange - www.5g-ppp.eu/5gex)
- SONATA (Service Programing and Orchestration for Virtualised Software Networks - www.5G-ppp.eu/sonata)
- VirtuWind (Virtual and programmable industrial network prototype deployed in operational Wind park - www.5g-ppp.eu/virtuwind)

		Timeplan: M1= July 2015																																					
Name		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36		
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I	5GEx	5G Exchange																																					
I	SONATA	Service Programing and Orchestration for Virtualized Software Networks																																					
I	VirtuWind	Virtual and programmable industrial network prototype deployed in operational Wind park																																					

Table 2: Timeplan for the H2020 projects