



The 5G Infrastructure Public-Private Partnership

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<http://5g-ppp.eu/>

Outline



- International context
- 5G Vision and Requirements
- Time plan and impact
- Overall structure
- Conclusions



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International activities on 5G getting momentum



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ITU-R Visions Group



EU

- Framework Program 7, e.g. METIS and 5GNow projects
- 5G PPP in Horizon 2020



Germany – 5G Lab Germany at TU Dresden



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



US

- Intel Strategic Research Alliance (ISRA)
- NYU Wireless Research Center
- 4G Americas, MoU  -  signed



China

- 863 Research Program
- Future Forum
- IMT-2020 (5G) Promotion Group, MoU  -  under preparation



Japan – The 5G Mobile Communications Promotion Forum, MoU  -  signed



Korea – 5G Forum, MoU  -  signed



Taiwan – TAICS, Ministry of Science and Technology, Ministry of Economic Affairs



Russia – 5GRUS by Russia's Icom-Invest

CJK White Paper



NGMN – White paper on future requirements

- Company internal research

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Source: 5G Infrastructure Association.

Key challenges



- PPP Program that will deliver solutions, architectures, technologies and standards for the ubiquitous 5G communication infrastructures of the next decade
- Program Ambitions: Key Challenges / High level KPIs
 - Providing 1000 times higher wireless area capacity and more varied service capabilities compared to 2010
 - Saving up to 90% of energy per service provided. The main focus will be in mobile communication networks where the dominating energy consumption comes from the radio access network
 - Reducing the average service creation time cycle from 90 hours to 90 minutes
 - Creating a secure, reliable and dependable Internet with a “zero perceived” downtime for services provision
 - Facilitating very dense deployments of wireless communication links to connect over 7 trillion wireless devices serving over 7 billion people
 - Enabling advanced User controlled privacy



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Source: 5G Infrastructure Association.

5G PPP Vision and Requirements

5G new service capabilities



USER EXPERIENCE CONTINUITY

INTERNET OF THINGS

MISSION CRITICAL SERVICES



- 5G needs to support efficiently three different types of traffic profiles
 - high throughput for e.g. video services
 - low energy for e.g. long-living sensors
 - low latency for mission critical services
- 5G covers network needs and contributes to digitalization of vertical markets
 - automotive, transportation, manufacturing, banking, finance, insurance, food and agriculture
 - education, media
 - city management, energy, utilities, real estate, retail
 - government
 - healthcare
- Sustainable and scalable technology to handle
 - anticipated dramatic growth in number of terminal devices
 - continuous growth of traffic (at a 50-60% CAGR)
 - heterogeneous network layouts
 - without causing dramatic increase of power consumption and management complexity within networks

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communication networks



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Source: 5G Infrastructure Association: Vision White Paper, February 2015.

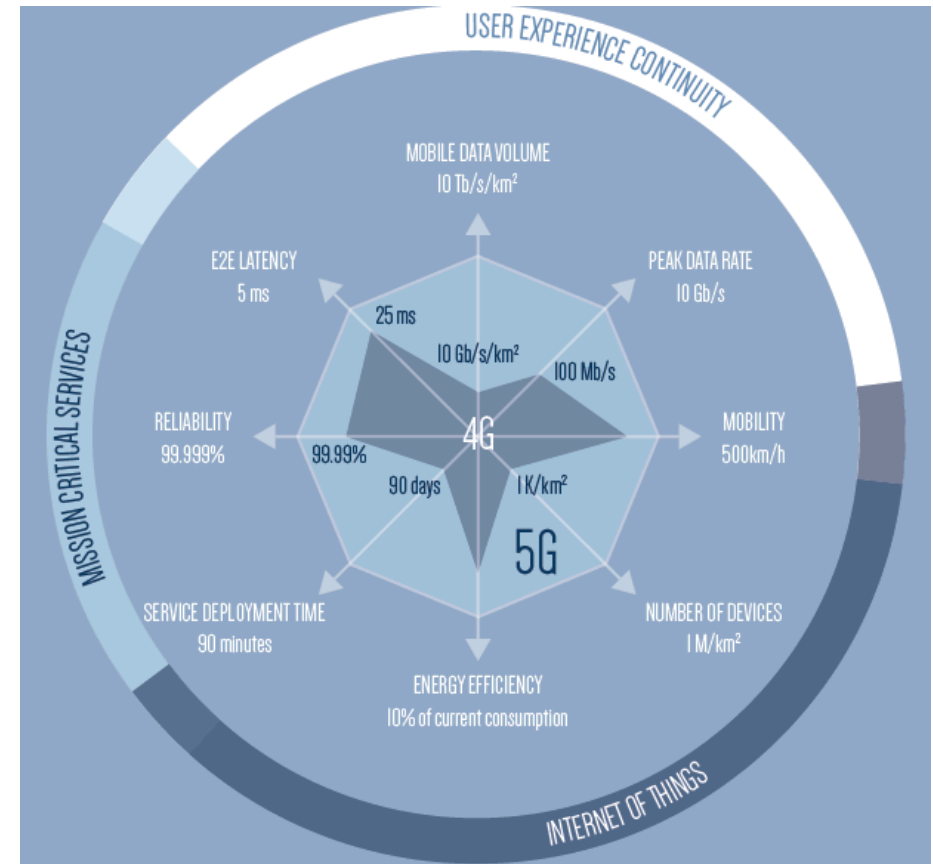
5G PPP Vision and Requirements

5G will have disruptive capabilities



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- 5G will provide an order of magnitude improvement in performance in the areas of more capacity, lower latency, more mobility, increased reliability and availability
- 5G infrastructures will be also much more efficient in terms of
 - energy consumption
 - service creation time
 - hardware flexibility



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Source: 5G Infrastructure Association: Vision White Paper, February 2015.

5G PPP Vision and Requirements

Key requirements



1000 TIMES



20 BILLION
HUMAN-ORIENTED TERMINAL



1 TRILLION



90%



<5MS LATENCY



99.999%



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- 1,000 X in mobile data volume per geographical area reaching a target $\geq 10 \text{ Tb/s/km}^2$
- 1,000 X in number of connected devices reaching a density $\geq 1\text{M terminals/km}^2$
- 100 X in user data rate reaching a peak terminal data rate $\geq 10\text{Gb/s}$
- Guaranteed user data rate $>50\text{Mb/s}$
- 1/10 X in energy consumption compared to 2010
- 1/5 X in end-to-end latency reaching 5 ms for e.g. tactile Internet and radio link latency reaching a target $\leq 1 \text{ ms}$ for e.g. Vehicle to Vehicle communication
- 1/5 X in network management OPEX
- 1/1,000 X in service deployment time reaching a complete deployment in ≤ 90 minutes
- Mobility support at speed $\geq 500\text{km/h}$ for ground transportation
- Accuracy of outdoor terminal location $\leq 1\text{m}$

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Source: 5G Infrastructure Association: Vision White Paper, February 2015.

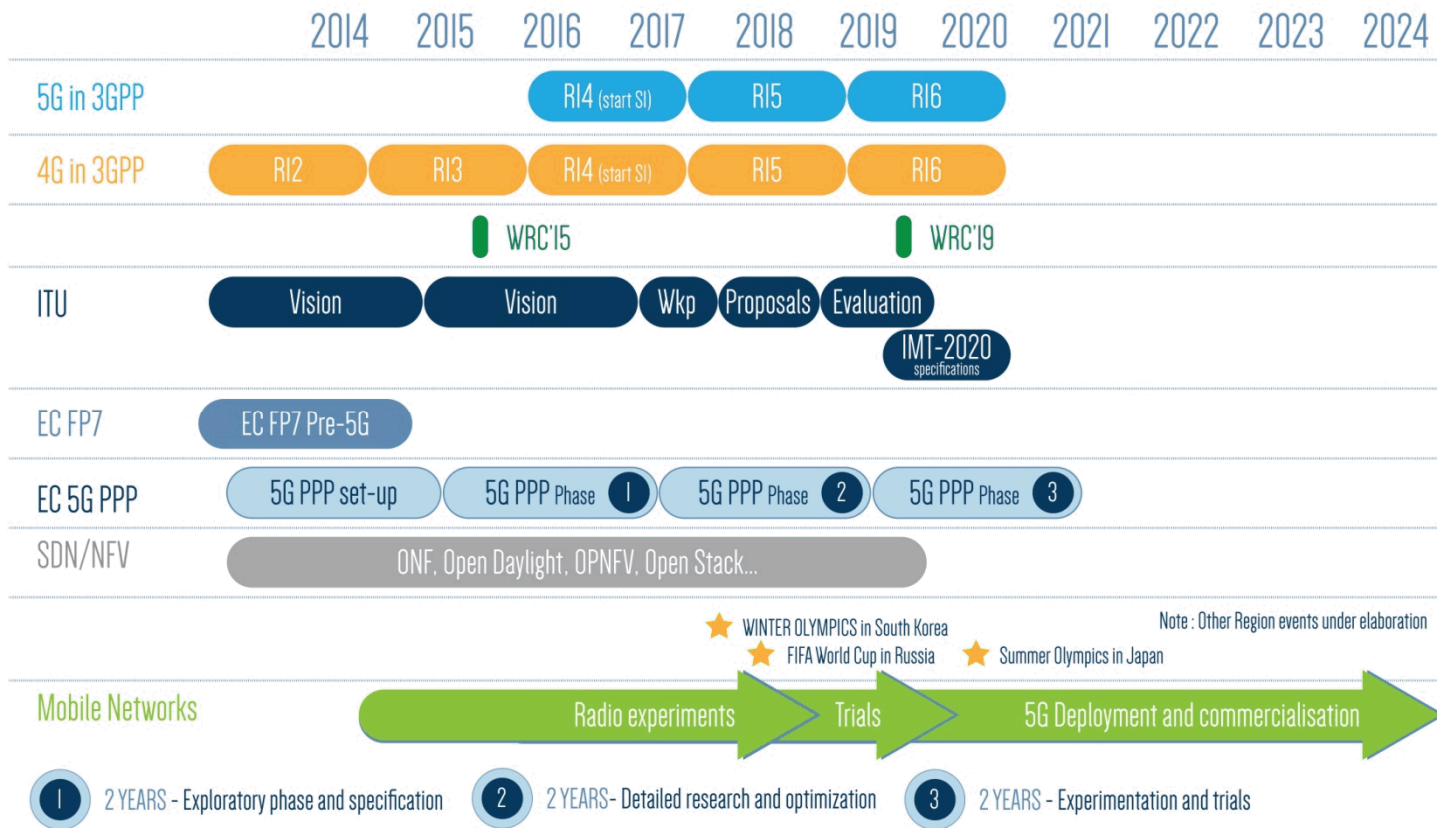


5G PPP Vision and Requirements

5G roadmap



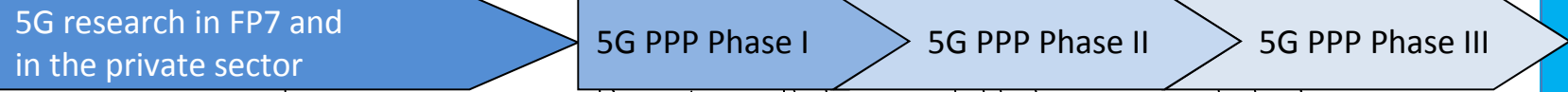
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Source: 5G Infrastructure Association: Vision White Paper, February 2015.

Exploitation of results



5G research in FP7 and in the private sector

Results from FP7 Projects contributed to ITU-R on 5G vision and requirements

3GPP Work Items and 3GPP Releases

3GPP Study Items

ONF, Open Daylight, OPNFV, Open Stack, ...

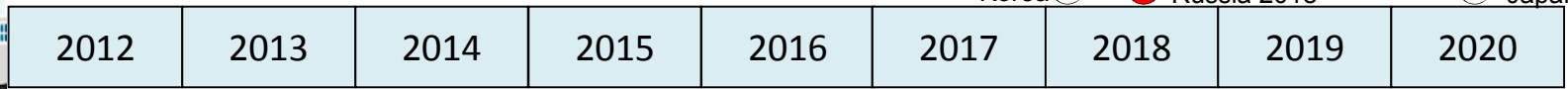
ITU-R Vision and Recommendation

ITU WRC preparatory process

Trials

Prototype and product development

Winter Olympics, Korea; FIFA World Cup, Russia 2018; Summer Olympics, Japan



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3GPP Release 12

3GPP Release 13

3GPP Release 14

3GPP Release 15

FIFA World Cup, Qatar 2022

Source: 5G Infrastructure Association.

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Governance model Working Groups



PPP Contract (Article 25 in Horizon 2020 Regulation)

Associated Members in Association coming from NetWorld2020 ETP and beyond

Association Board
General Assembly
 Association Statutes and Modus Operandi of Association
 Working Groups launched
 5G Infrastructure Association Board

European Commission

Partnership Board

Grant Agreement per project

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- WG 5G Vision and Societal Challenges
- WG 5G Pre-standards
- WG SME support
- WG 5G Spectrum
- Activity Community building and PR (Public Relations)
- Activity 5G International cooperation
- Activities based on the 5G PPP Contractual Arrangement, KPIs

5G Initiative

Steering Board
 (Project Coordinators plus Association representative)

Technology Board
 (Project Technical Managers plus Association representative)

Working Group 1
 Working Group 2
 Working Group n

Euro-5g

5G PPP projects

- Consortium Agreement per project signed by all project partners
- 5G Infrastructure Collaboration Agreement across all projects in all Phases and signed by all partners and the Association

Communications-networks-oriented ETP

NETWorld
 ETP governance model

7/9/2015

Source: NetWorld2020 ETP and Annex to 5G PPP Contractual Arrangement.

Conclusions



- 5G research is getting momentum globally
- 5G PPP Vision and Requirements White Paper published at MWC 2015
- Convergence of global vision and requirements
- Great opportunities to contribute to global 5G development based on European research in 5G PPP
- Overall governance structure based on
 - contract between the EU Commission and the private side
 - wider community in Networld2020 ETP
 - 5G PPP projects
 - Contribution to KPI monitoring via working groups

Acknowledgement: The author would like to thank his colleagues for their contributions.

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Source: 5G Infrastructure Association.



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Thank you for your attention!