

CONNECTED HOUSE

CONNECTED CITY

Public-Private Partnership

ITU GSC-19 Meeting, Geneva, July 15 and 16, 2015

Werner Mohr

Chair of the board of 5G Infrastructure Association

http://5g-ppp.eu/

12/07/2015







- **5G PPP vision**
- Time plan
- 5G PPP research project portfolio
- Exploitation of results
- Conclusions



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5G PPP in Horizon 2020 of the EU



- 5G PPP is a research program in Horizon 2020 of the EU dedicated to 5G system research
- Budget for 2014 2020 time frame
 - Up to 700 million € public funding
 - Matched by private side including leveraging factor 5 of additional private investment results in private value of about 3.5 billion €
- Research program is addressing all building blocks of a future communication network and a huge number of huge cases from vertical sectors
- 5G Infrastructure Association vision paper published at Mobile World Congress 2015 in Barcelona

http://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf



First set of projects started on July 1, 2015



5G PPP Vision and Requirements 5G new service capabilities





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



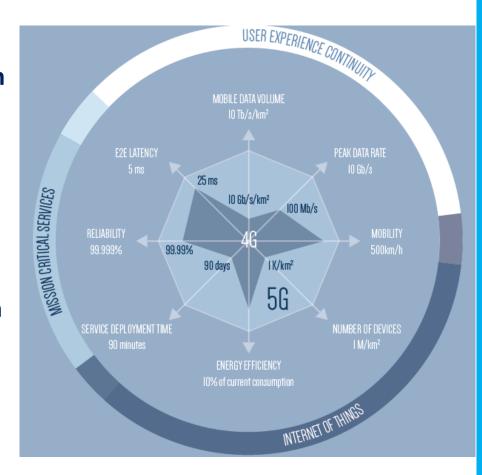
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5G PPP Vision and Requirements 5G will have disruptive capabilities



- The second secon
- 5G infrastructures will be also much more efficient in terms of
 - energy consumption
 - service creation time
 - hardware flexibility



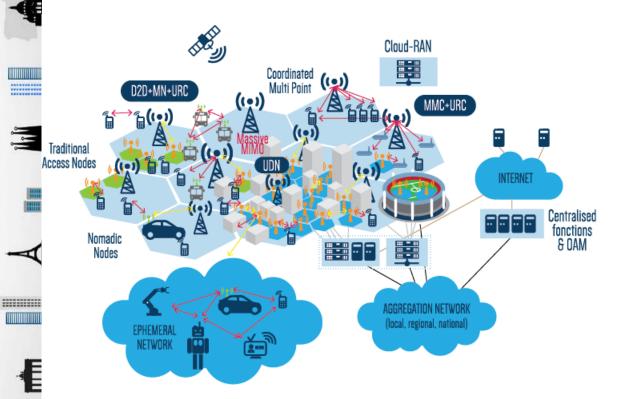


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Source: 5G Infrastructure Association: Vision White Paper, February 2015.

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5G PPP Vision and Requirements 5G networks and services vision





Wireless access

Wired fronthaul

Wired backhaul

Macro radio node*

Small cell radio node*, e.g. micro, (ultra-)pico, femto

* Only Remote Radio Units (RRUs) assumed

D2D MN URC MMC UDN

Moving Networks

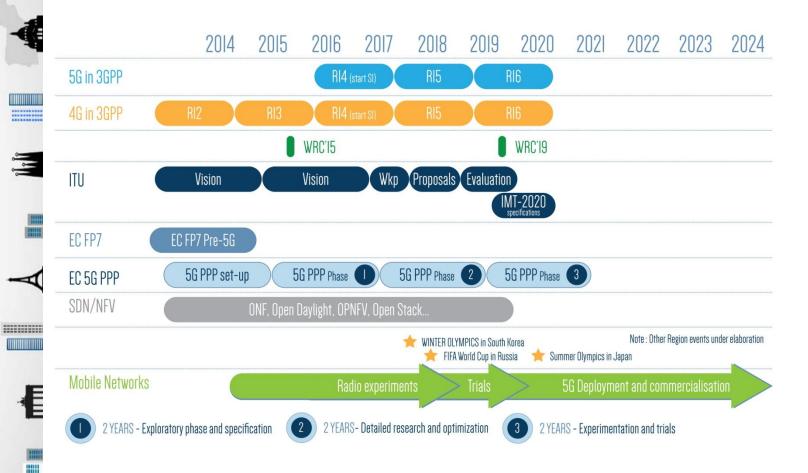


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5G PPP Vision and Requirements 5G roadmap







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Radio-related cluster



Research projects

Innovation projects

he European path towards global next 5G Infrastructure PPP

communication networks









Coordinated control and spectrum management for 5G heterogeneous radio access networks

SPEED-5G

quality of Service Provision and capacity Expansion through Extended-DSA for 5G

FANTASTIC-5G

Flexible Air iNTerfAce for Scalable service delivery wiThin wIreless Communication networks of the 5th Generation

METIS-II

Mobile and wireless communications

Enablers for Twenty-twenty (2020)

Information Society-II

mmMAGIC

Millimetre-Wave Based Mobile Radio Access Network for Fifth Generation Integrated Communications

5G-Norma

5G NOvel Radio Multiservice adaptive network Architecture

5G Infrastructure PPP

Radio-related cluster



Objectives

- Radio interface below 6 GHz
- Radio interface above 6 GHz
- Overall RAN design
- Heterogeneous radio access networks (RAN)
- Novel adaptive 5G mobile network architecture
- Spectrum access



Fronthaul/backhaul



Research projects

Innovation projects

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5G-Xhaul

Dynamically Reconfigurable Optical-Wireless Backhaul/Fronthaul with Cognitive Control Plane for Small Cells and Cloud-RANs

Xhaul

The 5G Integrated fronthaul/backhaul

12/07/2015 Source: xHaul, 5G-xHaul.

Fronthaul/backhaul



Objectives

- 5G integrated backhaul and fronthaul transport network
- Fronthaul and backhaul solutions between RAN and packet core
- Demonstration and validation of xHaul technology components will be integrated into a software-defined flexible and reconfigurable 5G Testbed
- Flexible backhaul/fronthaul network for serving current and future
 RAN deployments in a dynamic, service oriented, and cost-effective way
- Seamless integration of future-proof technologies in the optical and wireless (Sub-6 GHz, mm-Wave) metro/access domains, through a converged software-based control plane



Source: xHaul, 5G-xHaul.

Hardware implementation



Research projects

Innovation projects

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Flex5Gware

Flexible and efficient hardware/softwar e platforms for 5G network elements and devices

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The 5G Integrated fronthaul/backhaul

12/07/2015 Source: Flex5Gware.

Hardware implementation



Objectives

- Increasing the HW versatility and reconfigurability
- Providing HW-agnostic, flexible and cost-effective SW platforms
- Increasing the overall capacity of 5G communication platforms
- Decreasing the energy consumed by 5G communication platforms
- Identifying and prototyping key building blocks

Areas to be addressed

- RF front-ends and antennas (versatility, TRX > 6 GHz, antennas, ...)
- Mixed-signal technology (broadband DAC/ADC, full duplex, ...)
- Digital front-end + HW/SW split (HW for new waveforms, MIMO ...)
- SW modules and functions (SW re-configurability, energy savings)



Source: Flex5Gware.

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Network automation



CogNet

Building an Intelligent System of Insights and Action for 5G Network Management

SELFNET

Framework for SELF-organized network management in virtualized and software defined NETworks

Research projects Innovation projects

5GEx

5G Exchange

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12/07/2015 Source: CogNet, SELFNET, 5GEx.

Network automation



Objectives

- Automated and fast provisioning of infrastructure services in a multidomain/multi-operator 5G environment
- Innovative framework for the **automated management** and rapid deployment **of self-configuring next-generation networks and services**
- Extending the state-of-the-art network management within the Software-Defined Networking and Network Function Virtualization (SDN/NFV) arena
- Network Management at the **5G/IOT** scale



Source: CogNet, SELFNET, 5GEx.

generation he European path towards global next 5G Infrastructure PPP munication networks

SDN, NFV, Cloud and Virtualisation



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SESAME

Small cEllS coordinAtion for Multi-tenancy and Edge services

Research projects Innovation projects

SUPERFLUIDITY

Superfluidity: a super-fluid, cloudnative, converged edge system

5GEx

5G Exchange

VirtuWind

Virtual and programmable industrial network prototype deployed in operational Wind park

SONATA

Service Programming and Orchestration for Virtualized **Software Networks**

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12/07/2015 Source: SESAME, SONATA, SUPERFLUIDITY, VirtuWind.

SDN, NFV, Cloud and Virtualisation



Objectives

- Network Functions Virtualisation (NFV) and Edge Cloud Computing;
- Substantial evolution of the Small Cell concept
- Consolidation of **multi-tenancy** in communications infrastructures, allowing several operators/service providers to engage in new sharing models of both access capacity and edge computing capabilities.
- Reduce time to market for networked services by shortening service development (Programming model and SDK)
- Optimizing resource utilization and reduce cost of service deployment and operation
- Converged cloud-based 5G concept that will enable innovative use cases in the mobile edge, empower new business models, and reduce investment and operational costs
- To develop a SDN & NFV ecosystem for industrial domains, based on open, modular, and secure communication framework, leading to a prototype demonstration for intra-domain and inter-domain scenarios in real wind parks as a representative use case of industrial networks, and quantify the economic benefits of the solution



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Security



5G Ensure

Security (Will be added later)

CogNet

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Framework for SELF-organized network management in virtualized and software defined NETworks

CHARISMA

Converged Heterogeneous Advanced 5G Cloud-RAN Architecture for Intelligent and Secure Media Access

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12/07/2015 Source: CHARISMA, 5G-ENSURE.

Security



Objectives

- End-to-end security across all layers of the converged and virtualised open access network
- Physical layer low-latency security for both wireless and optical, in open, dynamic, multi-user, highly connected and decentralized 5G networks
- Build two secure end-to-end pilot demonstrators



Source: CHARISMA, 5G-ENSURE.

5G Infrastructure PPP he European path towards global next gener communication networks

5G Infrastructure Association Working Groups and Activities



5G Infrastructure Association Board

WG 5G Vision and Societal

Challenges

- Vision and requirements
- Vertical sectors
- · Definition of research program
- · Assessment of research portfolio
- Monitoring of performance KPIs (system capacity, energy consumption, privacy and security, reliability and availability, service creation time

WG 5G Pre-standards

- Roadmaps of relevant standards and specification bodies
- Identify topics for research and timing of availability of results
- Provide means for coordinated contributions across projects

WG SME support

- SME participation of at least 20 %
- Stimulate SME involvement

WG 5G Spectrum

- Support preparation of WRC 2019 on future spectrum requirements
- Identification new means of spectrum access based on research results

Activity Community building and PR (Public Relations)

- Dissemination of results and communication strategy
- Website and press releases
- Public consultation

Activity 5G International cooperation

- International cooperation strategy with counterparts in other regions
- Establishment of relations
- Joint events across regions

Activity Activities based on the 5G PPP Contractual Arrangement, KPIs

- Leveraging factor of additional private investment
- Monitor market share from European perspective
- Monitoring of generated IPR base
- Support adaptation of curricula for education of skilled personnel (e.g. via EIT ICT Labs.)



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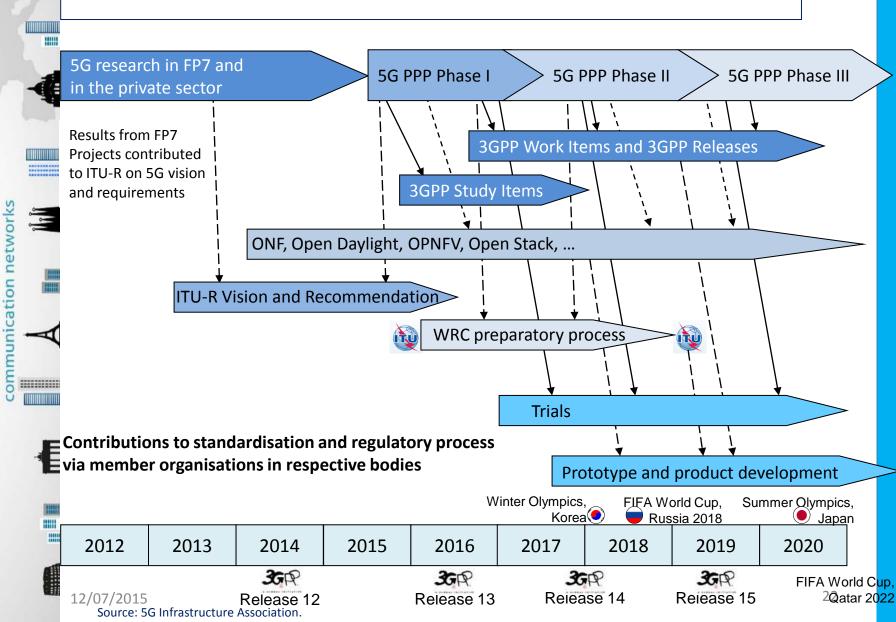
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Source: 5G Infrastructure Association.

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Exploitation of results





Conclusions



- 5G PPP is a research program in Horizon 2020 of EU Commission dedicated to 5G system research and development
- Collaborative research as means for consensus building to prepare future standards
- 5G PPP vision and requirements similar to views in other regions and international bodies and associations
- Large project portfolio or cooperating projects, which are addressing major elements and building blocks of a future communication network
- 5G PPP Working Groups and Activities support project cooperation and contributions to international standardisation and the regulatory process
- Research results are expected to be contributed by project participants to the international standardisation and regulatory process



Source: 5G Infrastructure Association.

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



http://5g-ppp.eu



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