The 5G Infrastructure Public-Private Partnership

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LTE Summit, Amsterdam, June 25th 2014

Outline

1. 5G PPP in Horizon 2020 of the EU
2. Expected time plan
3. Implementation of 5G PPP and Call 1
4. How to participate?
5. International activities towards 5G research
6. Conclusions

5G Infrastructure PPP
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EU Commissioner Kroes called industry to join EU Commission in a PPP on 5G

- Vice-President & Commissioner Neelie Kroes called industry at Mobile World Congress 2013 in Barcelona, Spain

> *"… And today I call on EU industry and other partners to join us in a Public-Private partnership in this area. An open platform that helps us reach our common goal more coherently, directly, and quickly. European 5G is an unmissable opportunity to recapture the global technological lead. And I hope you will be able to support and join us. …"*

Source: Commissioner Neelie Kroes, Smashing barriers and thinking big. Address at Mobile World Congress, 26 February 2013, Barcelona, Spain, http://europa.eu/rapid/press-release_SPEECH-13-159_en.htm?locale=en .

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Major milestones towards the 5G PPP implementation

- 5G PPP is a new instrument in Horizon 2020
- First Call for Proposals published on December 11, 2013
- Contractual Arrangement on 5G PPP signed between EU Commission and private side on December 17, 2013

- 5G PPP industry launch at Mobile World Congress on February 24, 2014
- Submission deadline of proposals on November 25, 2014
- Project start first half of 2015

Source: 5G Infrastructure Association.

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5G Launch Event at Mobile World Congress, February 24, 2014

Source: 5G Infrastructure Association.

Key challenges

- PPP Programme that will deliver solutions, architectures, technologies and standards for the ubiquitous 5G communication infrastructures of the next decade
- Programme 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

Source: 5G PPP Annex to contractual arrangement.

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Proposed research program

- Faster, More Powerful and More Energy Efficient Solutions for integrated High Capacity Access and Core Networks for a Wider Range of Services
  - Wireless Networks
  - Optical Networks
  - Automated Network Organisation - Network Management and Automation
  - Implementing Convergence Beyond the Access Last Mile
- Re-Designing the Network
  - Information Centric Networks
  - Network Function Virtualisation
  - Software Defined Networking
  - Networks of Clouds
- Ensuring availability, robustness and security
- Ensuring efficient hardware implementations

Source: 5G PPP Annex to contractual arrangement.

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5G PPP Contractual Arrangement Activities, Investment and Outputs

- Research and innovation activities co-funded under Horizon 2020 in the scope of the partnership.
- Subject to Horizon 2020 Rules for participation and dissemination
- **Commission intends to allocate from Union budget an indicative financial envelope of EUR 700 million for the period of 2014-2020**
- Private Side commits to engage the stakeholder community to invest funds in research and innovation activities specific to the partnership domain
- Expected leveraging factor of 5, bringing total investment value of initiative to 3.5 billion €

Source: 5G PPP Contractual Arrangement.

5G PPP Contractual Arrangement Monitoring – KPIs

- **Business-related KPIs:**
  - Leverage effect of EU research and innovation funding in terms of private investment in R&D for 5G systems in the order of 5 to 10 times;
  - Target SME participation under this initiative commensurate with an allocation of 20% of the total public funding;
  - Reach a global market share for 5G equipment & services delivered by European headquartered ICT companies at, or above, the reported 2011 level of 43 % global market share in communication infrastructure.
- **Performance KPIs:**
  - Providing 1000 times higher wireless area capacity and more varied service capabilities compared to 2010;
  - Reducing the average service creation time cycle from 90 hours to 90 minutes (as compared to the equivalent time cycle in 2010);
  - Very dense deployments to connect over 7 trillion wireless devices serving over 7 billion people;
  - Secure, reliable and dependable Internet with a "zero perceived" downtime for services provision.
- **Societal KPIs:**
  - Enabling advanced User controlled privacy;
  - Reduction of energy consumption per service up to 90 % (as compared to 2010);
  - European availability of a competitive industrial offer for 5G systems and technologies;
  - New economically-viable services of high societal value like U-HDTV and M2M applications;
  - Establishment and availability of 5G skills development curricula in partnership with the EIT.

Source: 5G PPP Contractual Arrangement.

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Proposed budget for financial period 2014 - 2020

- Public contribution around 700 million €
- Private contribution around 700 million €

Year of call for proposals	2014	2015	2016	2017	2018	2019	2020	Total [million €]
Global budget	140	160	180	200	220	240	260	1 400
Estimate research actions	110	120	140	140	150	160	160	980
Estimate innovation actions	30	40	40	60	70	80	100	420

Source: 5G PPP Annex to contractual arrangement.

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Indicative timeline

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Call 1 published December 11, 2013

Submission deadline November 25, 2014

Start of first projects mid 2015

2013 | 2014 | 2015 | 2016

Exploratory phase:
- Detailed requirements
- Identify most promising functional architectures and technologies
- Build on previous research work

- Detailed **system research and development**
- Basis for Pan European experimental infrastructure

- **Detailed system optimization**
- Consensus building on globally to be identified frequency bands (consider result of WRC15)
- Validation of concepts and early trials
- Contributions to **initial global standardization** activities
- **Preparation of WRC18/19**

2017 | 2018 | 2019 | 2020

- Support of **initial international standardization**
- Support of regulatory bodies for allocation of newly identified frequency bands
- Implementation of large trials for validation under close to real world conditions

- Extension of trials to non ICT stakeholders
- **Detailed standardization process**

- **New frequency bands available** for trial network deployment and initial commercial deployment
- **Close to commercial systems deployment** under real world conditions to prepare economic exploitation on global basis

Large scale demonstrations and trials, scalability testing, etc.

Source: 5G Infrastructure Association.

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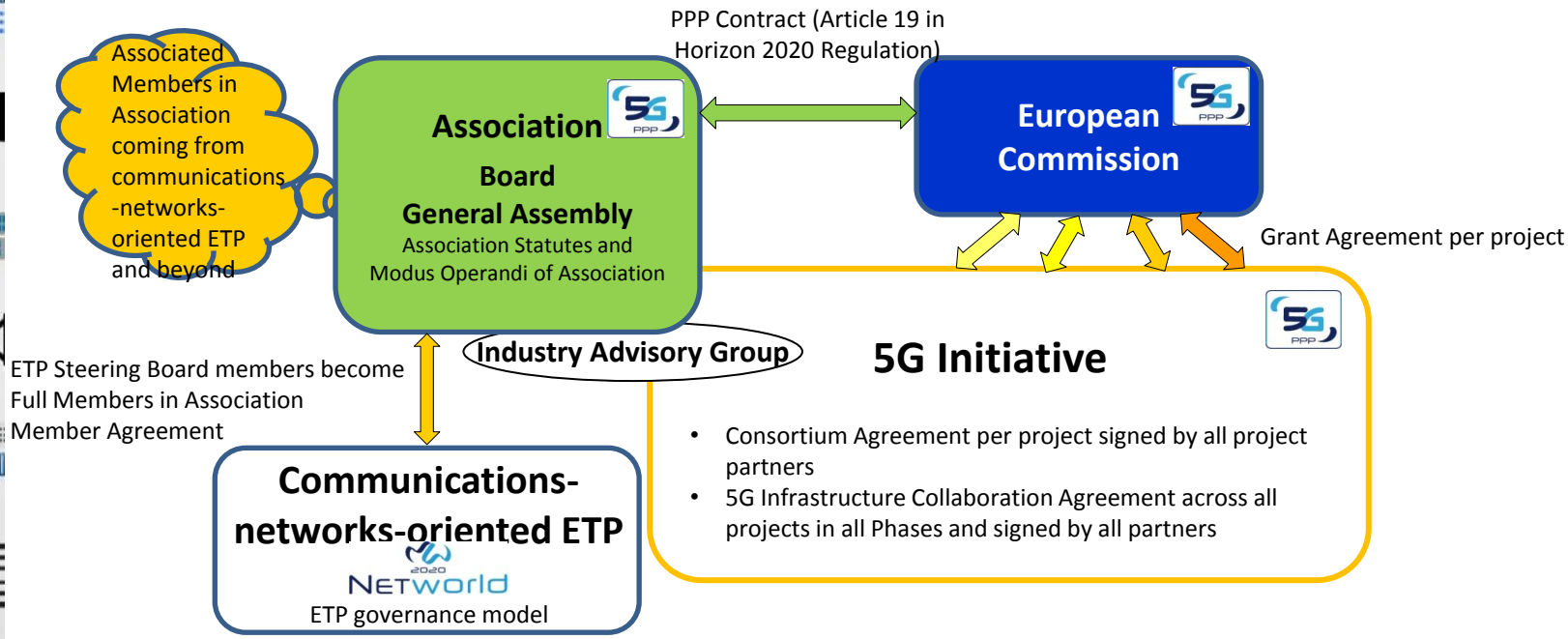
Governance model – Basic approach
Relation of new ETP to 5G PPP

- NetWorld 2020 will support the 5G PPP by
  - the direct relation to the PPP Association and
  - the development of the SRIA for the 5G-PPP



- The Association is an international non-profit association, named "The 5G Infrastructure Partnership" under Belgian law. It is the contractual counterpart of the European Commission for signing the 5G-PPP contract, done on 17 December 2013, see http://europa.eu/rapid/press-release_IP-13-1261_en.htm.

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

Members of 5G Infrastructure Association

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Industry

- ADVA Optical Networking SE
- Alcatel-Lucent
- Astrium Satellites
- Atos
- Deutsche Telekom
- DOCOMO Communications Laboratories Europe GmbH
- Ericsson
- Huawei Technologies Düsseldorf GmbH
- IBM Research
- Intel Mobile Communications
- NEC Europe Ltd., NEC Laboratories Europe
- Nokia
- Orange Labs
- Portugal Telecom
- Samsung Electronics Research Institute Ltd.
- SES
- Telecom Italia
- Telefónica I+D
- Telenor ASA
- Telespazio
- Thales Alenia Space
- Turk Telekomünikasyon A.Ş.

Research

- CEA-LETI
- Centre Tecnologic de Telecomunicacions de Catalunya (CTTC)
- Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT)
- Fundacion IMDEA Networks
- Instituto de Telecomunicacoes
- IST – University of Lisbon
- TNO
- University of Bologna – DEI

SMEs

- Integrasys SA
- INTERINNOV
- M.B.I. S.R.L.
- Nextworks s.r.l.
- Quobis
- Sequans Communications

Source: 5G Infrastructure Association.

H2020 5G PPP Call 1 objectives
125 million € Funding

5G Infrastructure PPP

Radio network architecture and technologies

Support anticipated 1000 fold mobile traffic increase and very different classes of traffic/services

- Network architecture, protocols and radio technologies capable of at least a ten times increase in frequency reuse and new frequency ranges above 3,6 GHz
- Versatile low cost ubiquitous radio access infrastructure equally supporting low rate IoT and very high rate (>> 1 Gbit/s) access
- Flexible and efficient radio, optical or copper based backhaul/fronthaul with low latency
- Innovative architectures for 5G transceivers and micro-servers
- Experiment based research preparing for large scale demonstrator and test-beds

Convergence beyond last mile

Support integration of a ubiquitous access continuum composed of cooperative, cognitive fixed and heterogeneous wireless resources, with fixed optical access reaching at least the 10 Gb/s range

- Solving the management heterogeneity of different fixed and heterogeneous wireless networks
- Architectures to optimize reuse and sharing of functionality across heterogeneous access technologies and networks

Network management

Challenge to radically decrease network management Opex through automation whilst increasing user perceived quality of service, of experience and security

- Novel simplified (low Opex) approaches to overall management of the network (e.g. Self-organizing networks –SON) and service level management
- Combination of software defined network implementations with autonomic management of resources
- Network security across multiple virtualized or SDN domains

Network virtualization and Software Networks

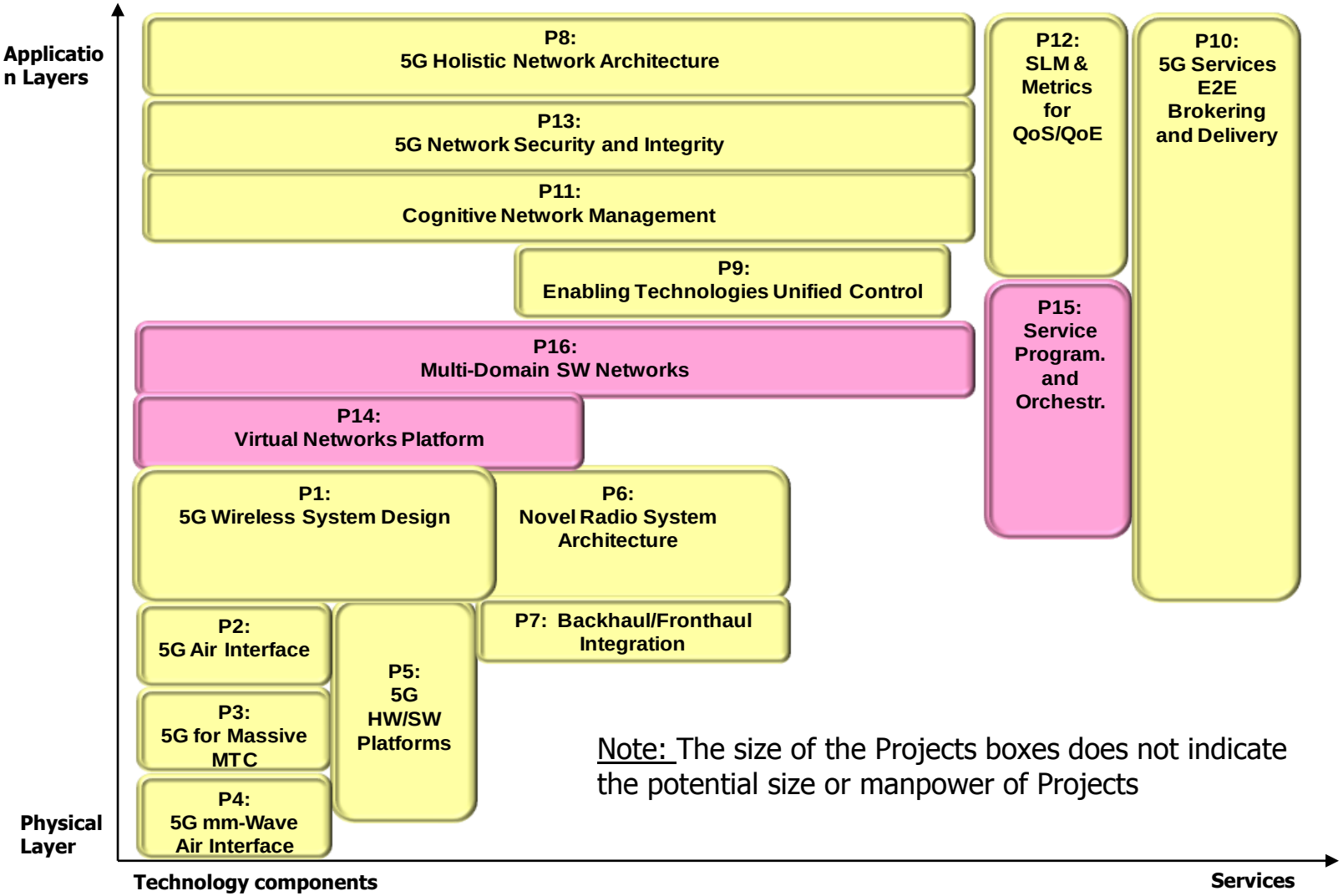
Highly flexible, manufacturer-independent model of controlling reconfigurable resources supporting changing/emerging application requirements

- Virtualization of network functionalities at infrastructure level and implementation of network services
- Orchestration logic (SDN), enabling network programmability, automation of cross domain network configuration, simplification and programmability of devices
- Tighter integration between application/service layers and networking layers
- Support of open network functionalities for dynamic integration with third party and OTT cloud environments

Source: 5G Infrastructure Association.

H2020 5G Infrastructure PPP

PPP Pre-structuring Model – System Perspective



Note: The size of the Projects boxes does not indicate the potential size or manpower of Projects

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How to participate

- Participate in the Networld2020 ETP (http://networld2020.org/) and the 5G-Infrastructure Association (http://5g-infrastructure-ppp.eu/) activities
  - Participation starts with ETP membership
  - Contribute to the Expert Group to update SRIA
  - Support requirements capturing on future networks
  - Members of ETP can be candidates for ETP Steering Board / Association and additional members in Association
- In 5G PPP projects
  - Commission is publishing Open Calls for Proposals
  - Everyone can submit proposals
  - Independent evaluators select proposals based on criteria
    - scientific and technological excellence,
    - impact and
    - Implementation
  - Integration of successful proposals into the PPP program in order to ensure cooperation of projects
- There is no membership in 5G PPP, because participation in PPP projects is open

Source: Association.

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International activities on 5G getting momentum

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

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

US
- Intel Strategic Research Alliance (ISRA)
- NYU Wireless Research Center
- 4G Americas

China
- 863 Research Program
- Future Forum
- IMT-2020 (5G) Promotion Group

Japan – 2020 and Beyond Ad-Hoc Group under ARIB's Advanced Wireless Communications Study Committee

Korea – 5G Forum as PPP (MoU signed on June 16/17 between 5G PPP and 5G Forum)

Taiwan – Ministry of Economic Affairs, National Science Council

Russia – 5GRUS by Russia's Icom-Invest

CJK White Paper

NGMN – White paper on future requirements

- Company internal research

Source: 5G Infrastructure Association.

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Conclusions

- Demand for advanced data services and support of vertical sectors is increasing with challenging requirements on throughput, latency and user experience
- 5G will be a combination of existing and evolving systems, like LTE-Advanced and Wi-Fi, coupled with new, revolutionary technologies designed to meet new requirements, such as virtually zero latency to support tactile Internet, machine control or augmented reality
- 5G research is getting momentum globally
- In Europe 5G PPP launched in December 2013
- Next open event : 5G PPP Workshop at EuCNC 2014 “The 5G PPP: Vision and Opportunities”
  - Bologna
  - June 26, 2014
  - http://eucnc.eu/

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

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http://5g-ppp.eu

Thank you for your attention!