

# **5G Infrastructure PPP**

**Purpose, current status, next steps**

**23/04/2014**

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

# Agenda

- 1) *5G Infrastructure PPP : a bit of history*
- 2) *5G Infrastructure PPP :*
  - *Contractual agreement*
  - *Objectives & purpose*
  - *Major KPI's*
- 3) *5G Infrastructure Association*
  - *Structure & purpose*
  - *Governance*
- 4) *5G Infrastructure PPP :*
  - *Call 1*
  - *Pre-structuring model*
- 5) *Q& A*

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

- First discussion on a potential PPP in July 2012 raised by EC
- EC - Industry interactions in November 2012 - January 2013
- Commissioner Kroes called industry at Mobile World Congress 2013 in Barcelona, Spain - “Invitation” to an Industrial group to make a proposal

*“... 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. ...”*

## Industry Proposal



## Advanced 5G Network Infrastructure for the Future Internet

An Industry Proposal for a Public Private Partnership in Horizon 2020

"Creating a Smart Ubiquitous Network for the Future Internet"

Supported by: ADVA Optical Networking, Alcatel-Lucent, ATOS, CEA Tech, Coriant, CTTC, Ericsson, ETNO, Eurescom, France Telecom / Orange, Fraunhofer HHI, Huawei, IMEC, iMinds, INRIA, INTEL, Intracom, NEC, Net!Works ETP, Nokia, Nokia Solutions and Networks, Portugal Telecom, Samsung Electronics, Telecom Italia, Telefonica, Deutsche Telekom - Telekom Innovation Laboratories, Telenor, Thalés, Turk Telekom, University of Surrey, VTT.

### In Brief

The communication network and service environment of 2020 will be infinitely richer and more complex than that of today. Our expectation is that in 2020 the network infrastructure will be capable of connecting everything according to a multiplicity of application specific requirements: People, things, processes, computing centres, content, knowledge, information, goods, in a flexible, truly mobile, and powerful way. The future will encompass connected sensors, connected vehicles, smart meters and smart home gadgets way beyond our current experience of tablet and smartphone connectivity.

There is urgency to properly address the novel infrastructure that will be needed to cater for these challenging and unprecedented growth and performance characteristics. Manufacturers, service providers and also internet players, that are operating data centres, are involved in this evolution. This will lead to redefining the value chains, reinventing the roles and relationships between the players, whilst opening new innovation opportunities. In parallel, a turning point is coming in communications networks with the progressive introduction of virtualisation and of software based network functionalities to offer the required flexibility and reactivity.

These novel network requirements, technologies and architectures will introduce a wide range of industrial opportunities for both established and new actors and also for SME's. Europe must take this golden opportunity to drive the changes and position European vendors, service providers and innovative SME's in new markets and with new offers.

Europe need to take action now to stimulate the development of this advanced network infrastructure for Future Internet to ensure the long term competitiveness of the European network industry at large and of all the industrial sectors requiring advanced ICT services as part of their competitive profile.

We propose a Public Private Partnership Programme that will deliver solutions, architectures, technologies and standards for the ubiquitous 5G communication infrastructures of the next decade. The following high level Key Performance Indicators (KPI's) are proposed to frame the research activities:

- 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.

- 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

- 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

# Complementary PPPs

- Progress on services (e.g. FI-PPP) is accelerating the already high pressure for improved Infrastructure(s)
- Need to advance networks (e.g. 5G Infrastructure PPP) to ensure the optimal user experience and EU Leadership










## 5G-Infrastructure PPP

- About Us
- How to participate
- Plans & Papers
- Events
- European 5G Actions
- Global 5G Actions
- Contact

- History
- Our Vision
- ETP
- Association
- PPP Structure
- PPP Contract
- KPIs



February 24, 2014

### Industry launch of the EU Partnership for 5G research

5G-Infrastructure PPP

February 24

#### INDUSTRY LAUNCH OF THE EU PARTNERSHIP FOR 5G RESEARCH

Search for:

Search

# 5G Infrastructure Association – Structure & purpose

- The Association : international non-profit association, named “The 5G Infrastructure Partnership”
  - Founded under Belgian law, Nov. 27 2013 with 5 founding members (ALU, Ericsson, NSN, Orange, SES)
  - 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](http://europa.eu/rapid/press-release_IP-13-1261_en.htm)
- To enter into the PPP Contract with the EC
  - To execute the PPP Contract
- To promote R&D in the networks industry in order to strengthen the networks industry in the European Union
  - To foster technology skills in Europe by attracting students
  - To increase the competitiveness of the European industry by providing new tools and capabilities for manufacturing in Europe.

# 5G PPP Contractual Arrangement Overview

- Scope
- Activities, Investment and Outputs
- Specific Objectives
- Specific Commitments of the Commission
- Specific Commitments of the Private Sector
- Monitoring

# 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

# Proposed budget for financial period 2014 - 2020

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

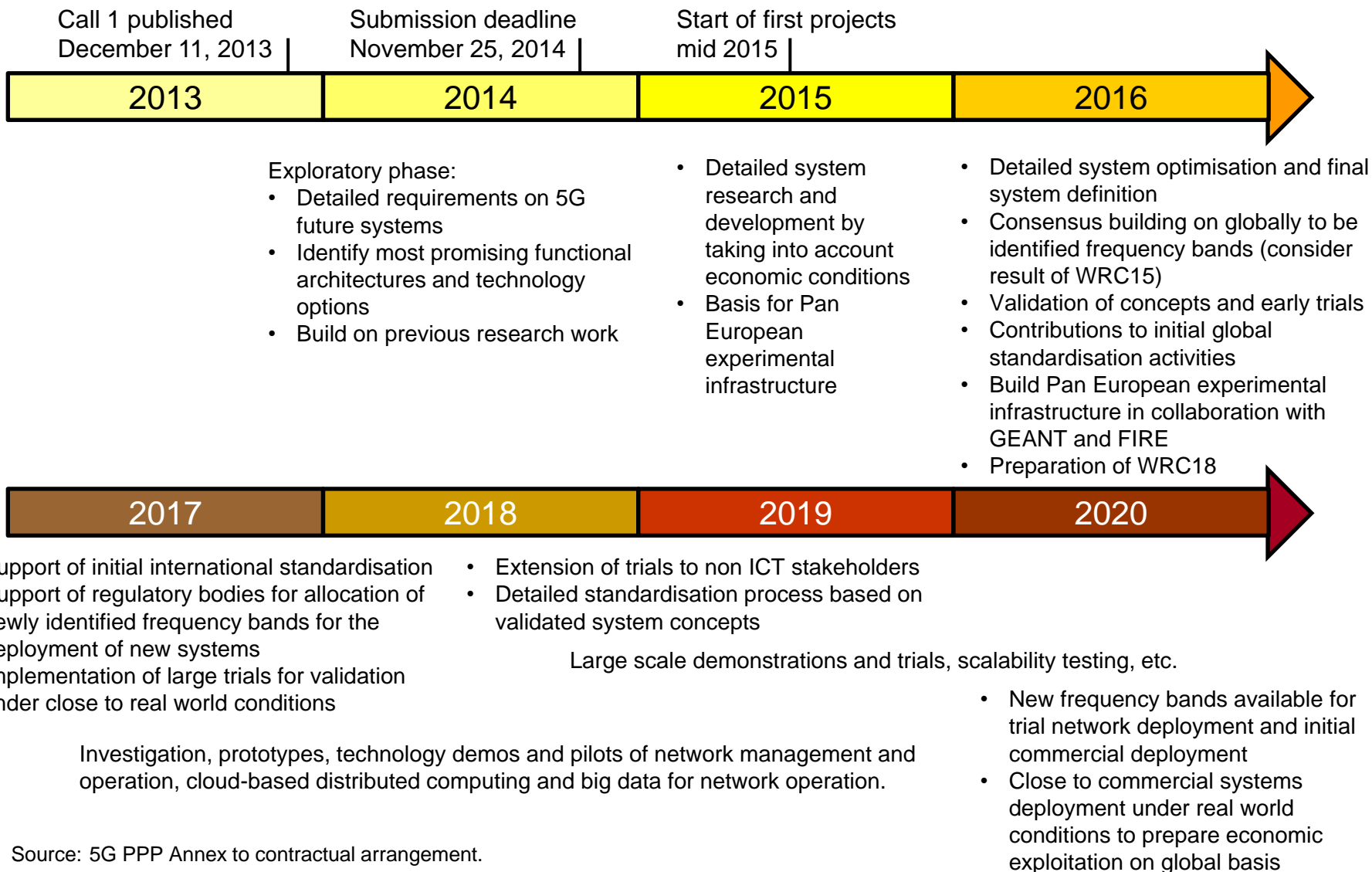
Year of call for proposals	2014	2015	2016	2017	2018	2019	2020	Total [million €]
<b>Global budget</b>	140	160	180	200	220	240	260	1 400
<b>Estimate research actions</b>	110	120	140	140	150	160	160	980
<b>Estimate innovation actions</b>	30	40	40	60	70	80	100	420

# 5G PPP Contractual Arrangement Monitoring

- **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.



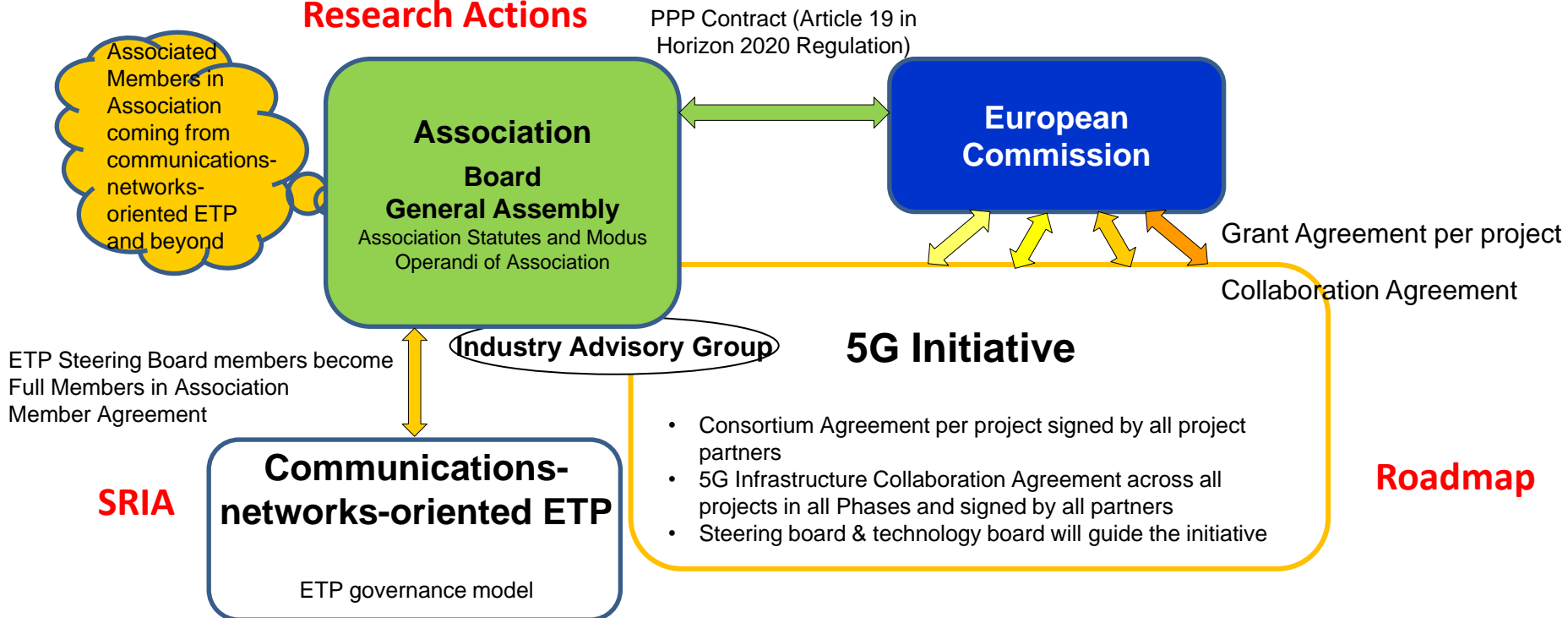
## Indicative timeline



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

- The New ETP will support the 5G PPP by
  - the direct relation to the PPP Association and
  - the development of the SRIA for the 5G-PPP

### Research Questions Research Actions



- 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](http://europa.eu/rapid/press-release_IP-13-1261_en.htm).

# 5G Infrastructure Association Characteristics

- Members:
  - 30 organizations of the different stakeholder groups (industry, SMEs, research) elected by the General Assembly of the new ETP (Net!Works + ISI) to the Steering Board.
  - 6 organizations of missing/not well represented sectors in the new ETP (terminals, IT, microelectronics, optical communication, IoT, security) will be selected by a call for candidature (DL end of Jan. 2014)
- Associate Members:
  - 29 Entities not represented in joined NetWorks + ISI ETP, with additional competences not represented in joined NetWorks + ISI ETP (for ex user groups)

Members **so far not member of the new ETP** have to enter first in the new ETP to ensure that **they are bound on** the decisions of **new ETP, especially** regarding the SRIA (Strategic Research and Innovation Agenda).

## Industry (also “new ETP” members)

- Alcatel-Lucent
- Astrium Satellites
- Atos
- Deutsche Telekom
- DOCOMO Communications Laboratories Europe GmbH
- Ericsson
- Huawei Technologies Düsseldorf GmbH
- NEC Europe Ltd., NEC Laboratories Europe
- Nokia Solutions and Networks
- Orange Labs
- Portugal Telecom
- SES
- Telecom Italia
- Telefónica I+D
- Telenor ASA
- Telespazio
- Thales Alenia Space
- Turk Telekomünikasyon A.Ş.

## Research (also “new ETP” members)

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

## SMEs (also “new ETP” members)

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

## Observers in General assembly :

- EU Commission
- Others may be added at a later stage

# Election of additional 6 members to the 5G Infrastructure Association

- *Sector "Terminal devices, smart cards"*: Samsung Electronics Research Institute Ltd.
- *Sector "Optical communications"*: ADVA Optical Networking SE
- *Sector "IT"*: IST – University of Lisbon
- *Sector "IoT, M2M"*: TNO
- *Sector "Microelectronics"*: Intel Mobile Communications
- *Sector "Security"*: IBM Research

# Associated members in 5G Infrastructure Association

- PPPs with relation to ICT or increasingly will use ICT

- FI-PPP: Invitation of FI-PPP Program Chair
- FoF – Factories of the Future
- EeB – Energy efficient Buildings
- ROBOTICS
- HPC – High Performance Computing
- SPIRE – Sustainable Process Industry
- EGVI – European Green Vehicles Initiative
- PHOTONICS

- Other Commission programs and organisations

- Living Labs program
- EIT ICT Labs
- Committee of the Regions

- Recognised ETPs and JTIs by the EU Commission

- Energy: SmartGrids
- Environment: WssTP
- ICT: ECSEL (new combined JTI based on ARTEMIS, ENIAC and EPoSS), NEM, NESSI
- Transport: ERRAC (rail transport)

- User groups

- OTT
- User groups in the domain of civil society, emergency rescue and resilience

- Other sectors

- Smart Home, e.g. DLNA
- Automotive sector
- M2M/IoT, possibly GMA – Global M2M Alliance
- Internet user association
- ERTICO on transport issues

- Other organisations

- ETSI
- Celtic-Plus
- NGMN



# 5G PPP Call 1 objectives

## 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

# How to participate

- Participate in ETP (<http://new-etp.eurescom.eu/>) and Association (<http://5g-infrastructure-ppp.eu/>)
  - 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
  - Contribute via Associate Members
- 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

# H2020 5G Infrastructure PPP

## PPP Pre-structuring Model Approach (1/5)

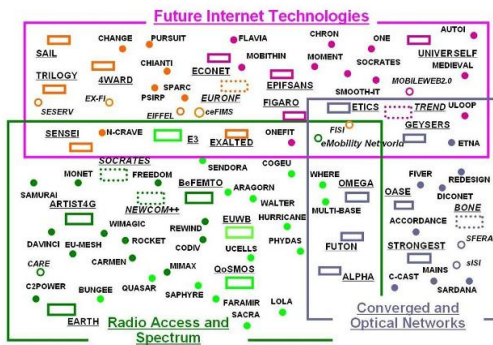
- PPP is an ambitious Programme with ambitious KPIs
- More than a group of standalone projects working together through Concertation & Clusters meetings and activities
- Pre-structuring Model
  - Ensuring that the right set of projects will work together
  - Model focused on projects not proposals as such
  - Possible set of projects scopes, their interfaces and the possible cross-issues between projects (example of Energy Efficiency to be seen as “by design”)
- Possibility to have proposals submitted according to the model (“guideline”)
- Possibility to then have EC reviewers making their best selection to fill one project with the best corresponding proposal (“guideline”)
- Avoiding duplication (“hype”) and gaps issues
- Model to be defined, communicated, enriched, endorsed before end of April 14 (eg Info Day on 28.04.14 in Issy Les Moulineaux /Orange)



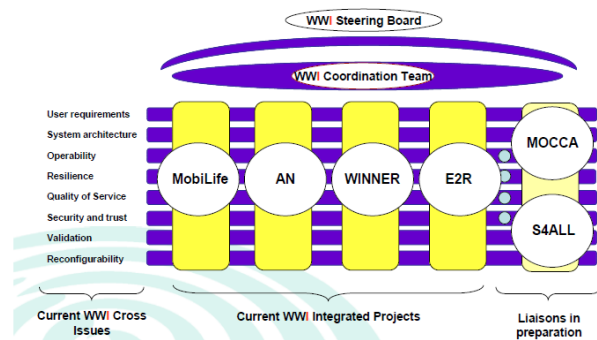
# H2020 5G Infrastructure PPP PPP Pre-structuring Model Approach (2/5)

## Projects Pre-definition & Specification

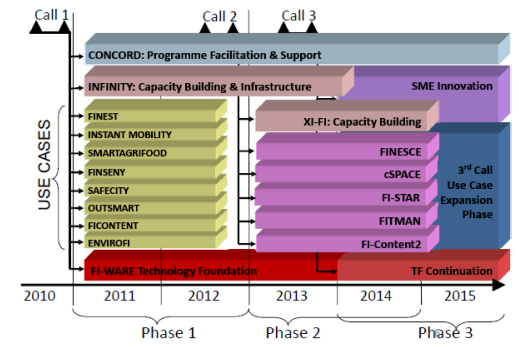
- Standalone Projects
- Potential connections between Proposals
- Clusters and Concertation
- Loose Coupling
- Coordination of set of proposals
- Tight connections between proposals
- Clusters and Concertation for projects outside of the initiative
- Joint events / meetings based on WWI momentum
- No joint technical KPI
- Very tight pre-definition and integration



[http://cordis.europa.eu/fp7/ict/future-networks/projects\\_en.html](http://cordis.europa.eu/fp7/ict/future-networks/projects_en.html)



## FI-PPP Programme Architecture



FP6-like  
FP7-like

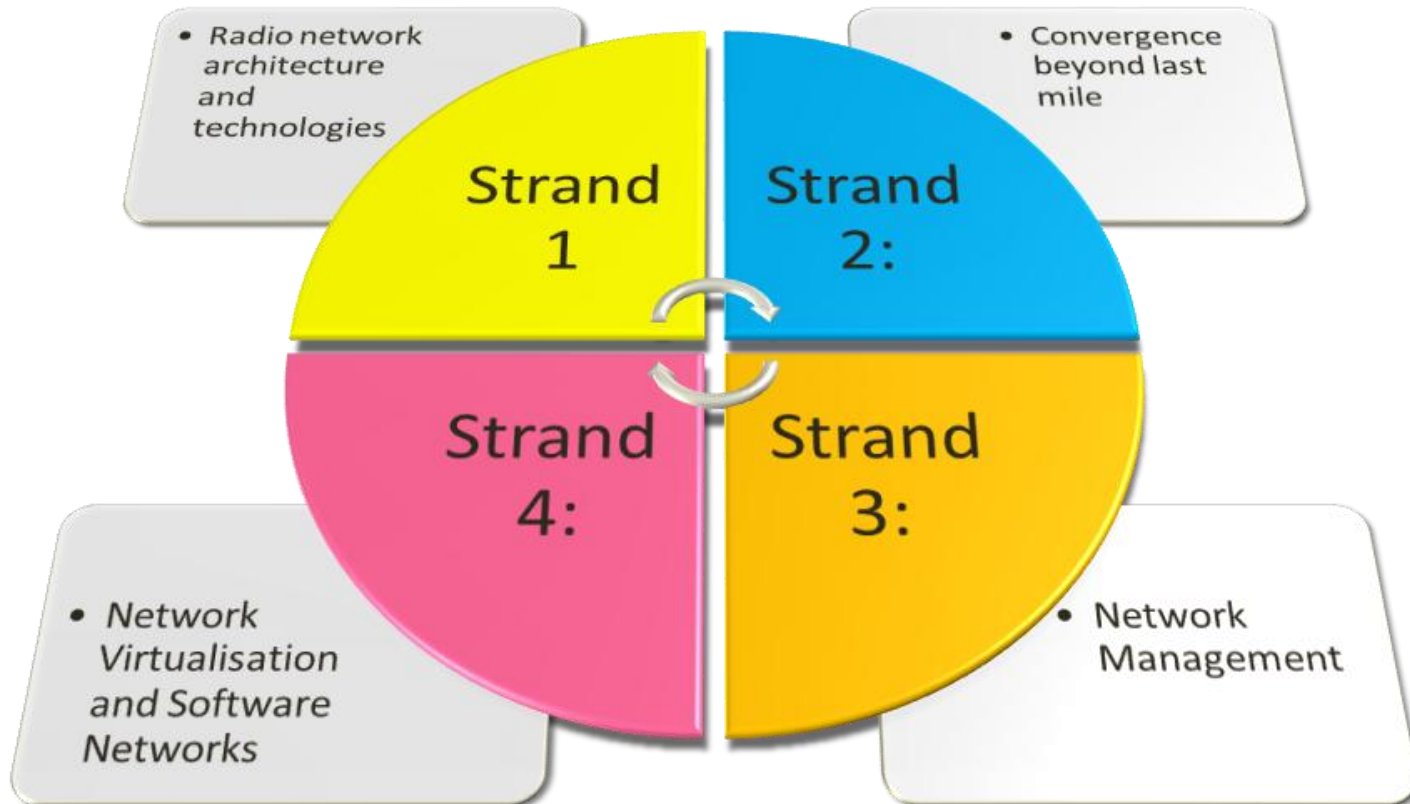
FP6 WWI

FI PPP



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### Pulling Strands Together



# H2020 5G Infrastructure PPP PPP Pre-structuring Model Approach (4/5)

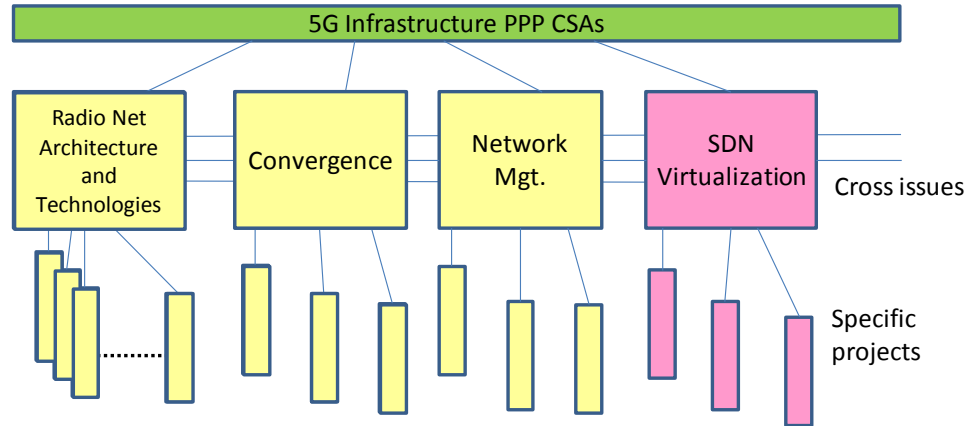
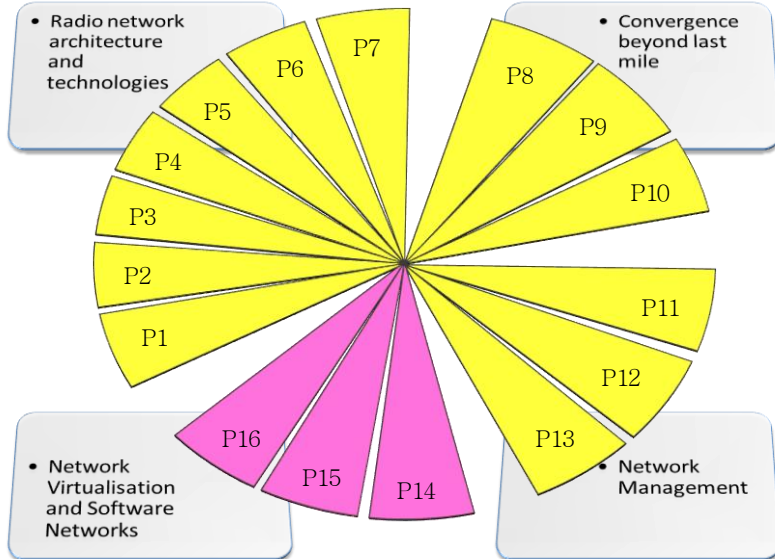
- PPP Pre-structuring Model

3 RTD Strands  
1 INNO Strand  
16 Projects / Focus Areas



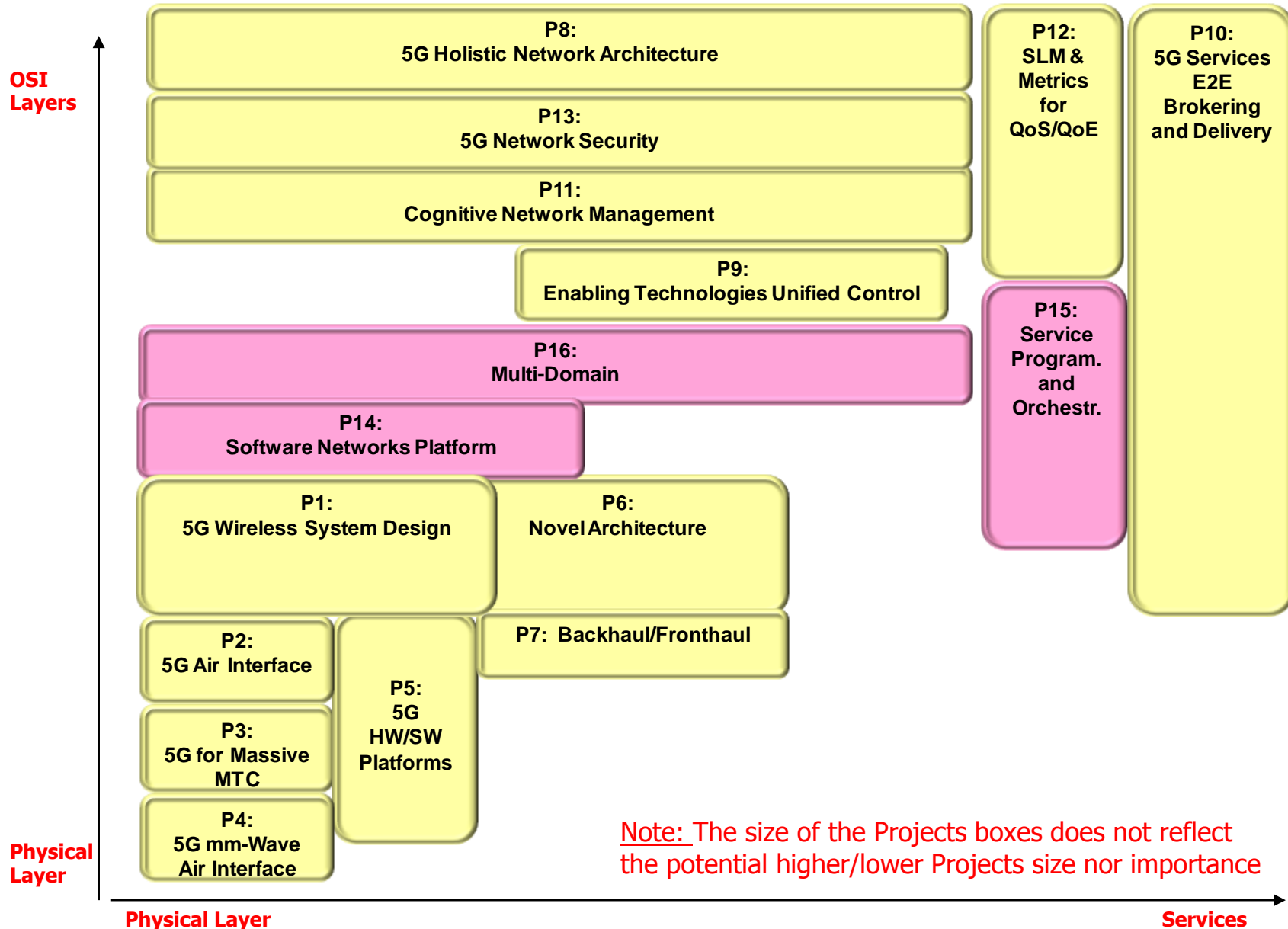
5G PPP

A mapped set of R&I and I Projects



Projects Interfaces  
Projects Cross-Issues  
Overall Coordination





**5G** PPP

**BACK-UP**

# 5G PPP – Major objectives of the projects

## (1/6)

- **Project 1 : 5G Wireless System Design**
  - Design the 5G wireless system that
    - efficiently meets the large variety of use cases and application requirements beyond 2020
    - builds upon a smooth migration from current technology
    - Also considers satellite potential
- **Project 2 : Air Interface and Multi-Antenna, Multi-Service Air Interface below xx GHz**
  - To design a highly flexible and adaptable air interface being able to support efficiently
    - the multitude of service classes (from continuous high rate to sporadic low rate and with an option for very low latency) and service types
    - and device types (from high-end tablet to low-end device)
    - and MIMO capabilities (in both UE and eNB)
    - in various areal settings (from heterogeneous ultra dense urban setting with cooperation to macro cell dominated rural areas)
    - with flexible spectrum usage
- **Project 3 : 5G-MTC for Consumers and Professional Communications**
  - Research, develop and prototype systems for massive machine type communications addressing consumers and professional users in vertical industry like car, energy, public safety, disaster recovery, wireless production, etc.

# 5G PPP – Major objectives of the projects (2/6)

- **Project 4 : New Spectrum, mm-Wave Air Interface, Access, Backhaul and Fronthaul**
  - To research and design mm-wave air interface, its key technology components , and system architecture as an integral component of 5G, enabling
    - Superior user experience of UHD/3D TV, immersive and cloud –based services on future generation mobile devices
    - Flexible and dynamic utilization of wide bands of contiguous spectrum in mmWave region to support economically viable access, backhaul and front haul solutions for ultra-dense deployment
- **Project 5 : Efficient Hardware/Software and Platforms for 5G Network Elements and Devices**
  - Research and evaluation of efficient hardware/software and platforms for 5G: hardware/software complexity, the viability of novel network elements, radio technology, and multi-RAT implementations for different kinds of platforms.
- **Project 6 : Novel Architecture**
  - Design Novel Multi-service 5G Network Architecture which efficiently support a multitude of diverse services; the architecture is to be highly flexible for supporting known and diverse Use Cases as well as easy integration of future unknowns.

# 5G PPP – Major objectives of the projects (3/6)

- **Project 7 : Backhaul and Fronthaul Integration**
  - This project focuses on the analysis and design of heterogeneous backhaul and fronthaul technologies for 5G and their joint optimization with the access, aiming at an energy-efficient, scalable, highly modular, flexible, reconfigurable and with reduced cost 5G design
- **Project 8 : Holistic 5G Network Architecture**
  - Define and design an overall system concept (functions, interfaces and characteristics of protocols) which covers different fixed-mobile-convergence scenarios and considering broadcast and multicast services. The system concept for 5G will describe a converged control plane taking into consideration different user/data plane concepts and the management of next generation devices and the support of current and future services
- **Project 9 : Enabling Technologies for Unified Control of Converged 5G system**
  - Conceive and design novel enabling technology elements for a unified control and data plane infrastructure of the future fixed-mobile, software-hardware, composed of heterogeneous devices, etc. 5G System, fulfilling the new requirements of scale (a large number of devices per human user), latency (for delay-critical applications), energy efficiency, ultra reliability, security, dependability and distributed mobility

# 5G PPP – Major objectives of the projects (4/6)

- Project 10 : 5G Services E2E Brokering and Delivery
  - Define and study 5G innovative services and related mechanisms squeezing the most out of the converged 5G architecture
- Project 11 : Cognitive Network Management
  - The Cognitive Network Management project will develop a **new management paradigm** and investigate, develop and verify processes, algorithms and solutions that enable future 5G networks to be self-managed
- Project 12 : Service Level Management & Metrics for QoS & QoE
  - To develop the E2E service level management for 5G based on metrics and techniques that map the state of the underlying network infrastructure and the terminal capabilities to the user perceived quality of services

# 5G PPP – Major objectives of the projects (5/6)

- Project 13 : 5G Network Security and Vulnerability
  - To investigate the 5G network specific vulnerabilities and develop solutions to overcome the security and vulnerability threats
- Project 14 : SW Networks Platform
  - Develop a new generation of control and management solutions supported by innovative network technologies such as SDN and NFV
    - Operation platforms
    - Related business solutions
    - Advanced virtualized networking models
  - Enable smart software-based innovations in future carrier-grade networks



# 5G PPP – Major objectives of the projects (6/6)

- Project 15 : Service Programming and Orchestration
  - A programming interface to services for fast and flexible service development and deployment
  - Orchestration of services and service composition
- Project 16 : Multi-domain SW Networks
  - Enable e2e network orchestration over multiple administrations
  - Solve network scaling
  - Enable orchestration over heterogeneous technological layers (multi-layer)