Horizon 2020 Call 2
ICT 7 & ICT 8
From Phase 1 to Phase 2

5G PPP Phase 2 Information day and Stakeholders event, Bologna 17 March 2016

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Context

5G Public Private Partnership (PPP) under EU Horizon 2020 R&I programme - 5G PPP dedicated to 5G system

- **Phase 1 ➔ Phase 2 of 5G PPP implementation**
- **Vision and technological requirements:**

  https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf
- **Verticals papers, see 5G-PPP web site**
- **Working Groups**
- **Multiple side developments, standards, spectrum**
- **More than just projects – it's a Programme!**

5G Vision

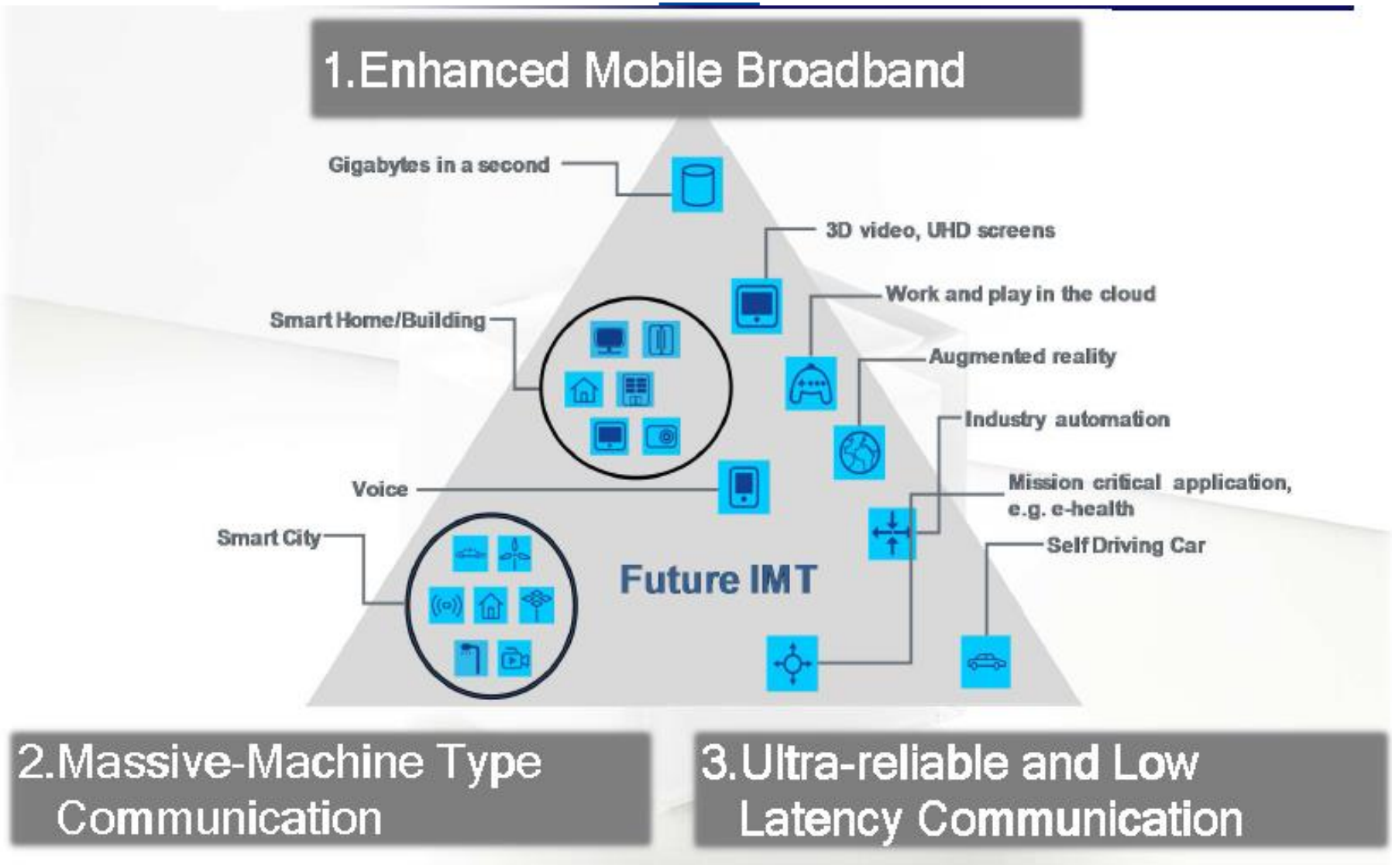
What 5G is about

5G PPP

- **Public Private Partnership (PPP) Research Programme**
  - Up to 700 million € public funding
  - To be matched by expected private funding of about 3.5 billion €
- **Covers policy areas as well:**
  - Pre-standardisation
  - Spectrum
  - International cooperation
- **Implementation through 5G Infrastructure Association**
- **3 Phases until 2020**

5G PPP Context

European Commission



What is new since Phase 1?

- Phase 2 = re-inforced programme dimension
- Contractual clause 41.4 added in Grant Agreement
- Towards demonstrators and Proofs of Concept
- Verticals inside
- Increased links towards standards
- SME participation > 20%!
- Satellite, optical

Verticals

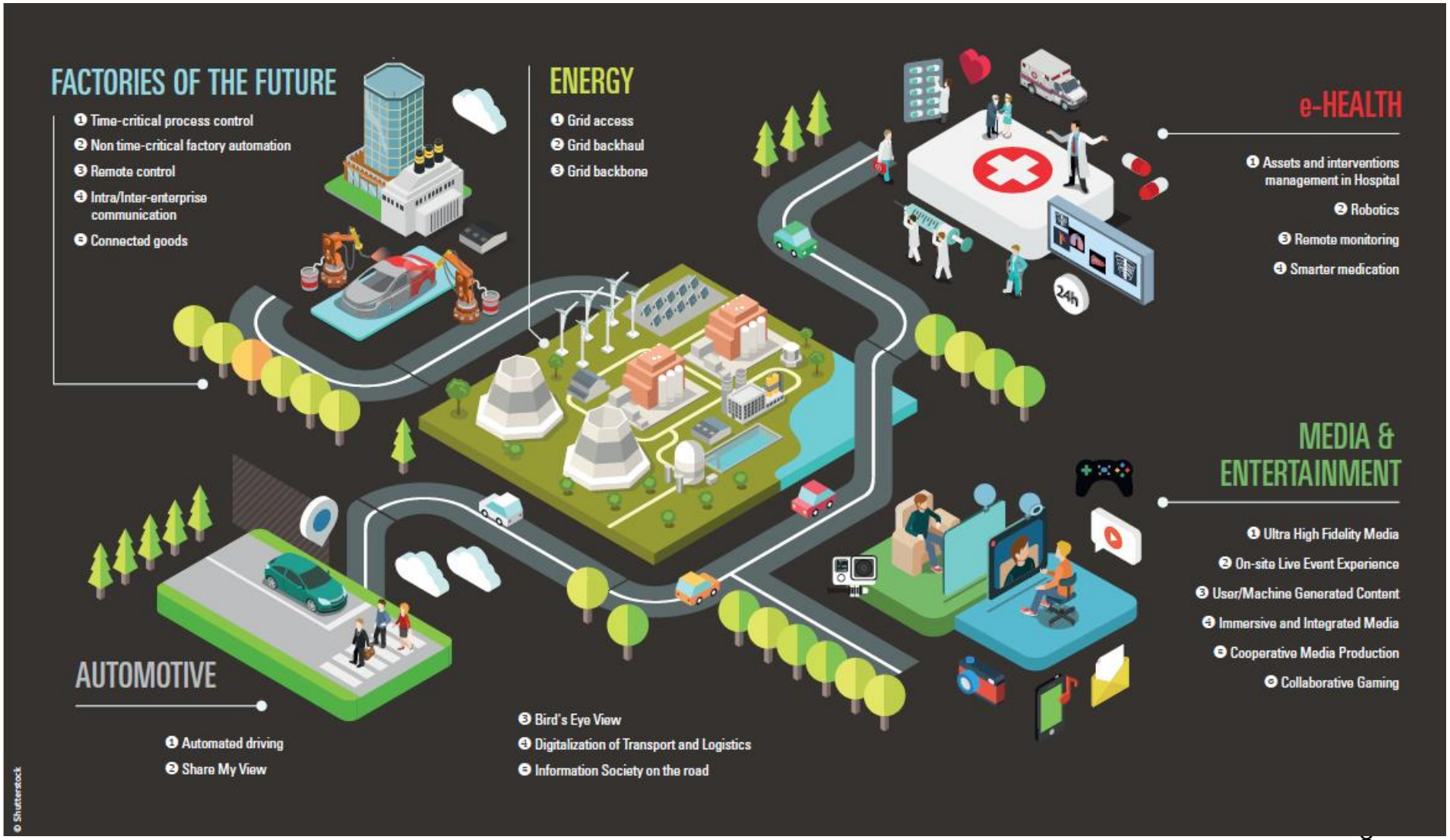
- **White papers on**
  - 5G and Factories of the Future
  - 5G and Healthcare
  - 5G and Energy
  - 5G and Media (under preparation)
  - 5G and Automotive
- **Identification of**
  - Main use cases
  - Requirements and
  - Areas for Research & Innovation
- **Vertical workshops**
  - June 18, 2015
  - November 9, 2015

- **White Paper** published at Mobile World Congress 2016:

https://5g-ppp.eu/wp-content/uploads/2016/02/BROCHURE_5PPP_BAT2_PL.pdf

Vertical Use Cases

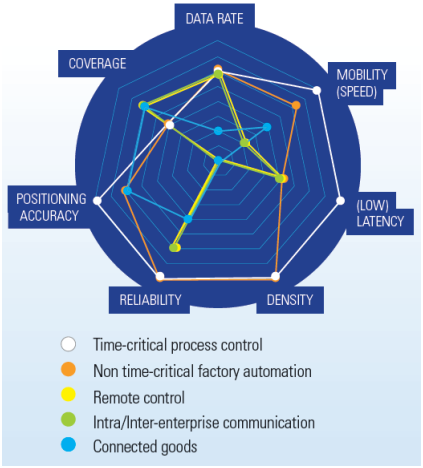
European Commission



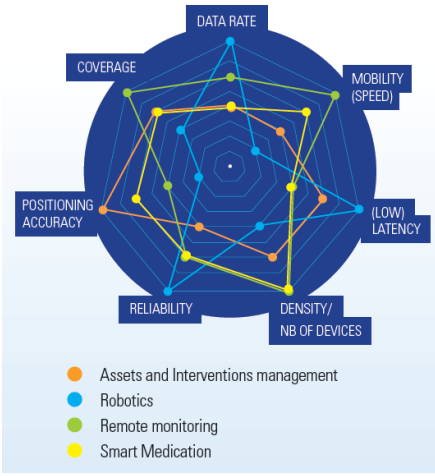
Vertical Requirements Driving 5G

European

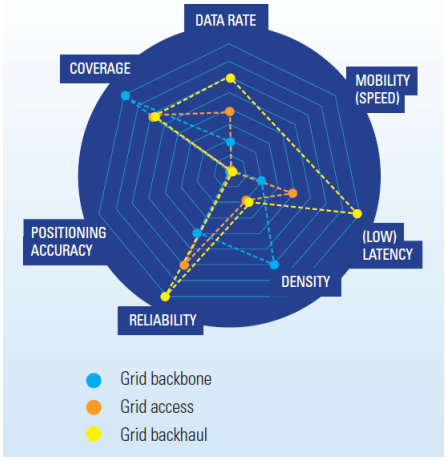
FACTORIES



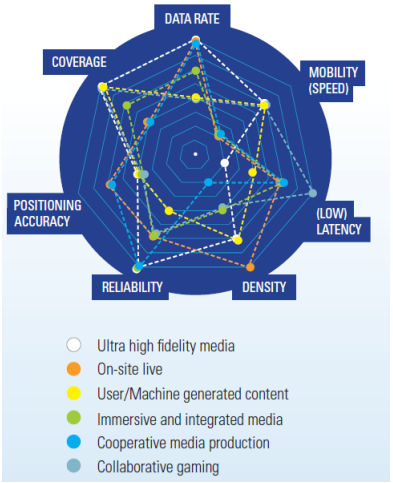
EHEALTH



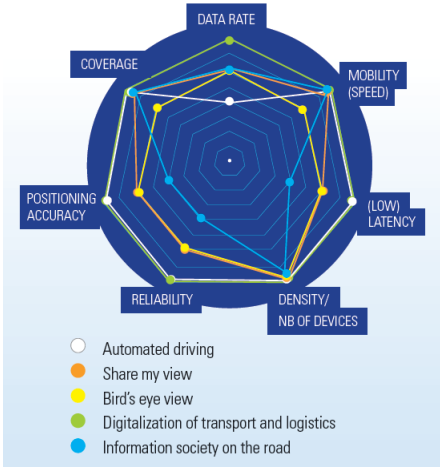
ENERGY



MEDIA & ENTERTAINMENT



AUTOMOTIVE



5G R&I Context (Phase 1)

European Commission

Requirement / Project	Peak data rate	Mobile data volume	E2E Latency	Reliability	Service deployment time	Energy efficiency	# of devices	Mobility
CHARISMA		√	√	√				
SESAME		√	√					
SPEED-5G	√	√		√			√	√
CogNet				√	√	√		
SELFNET				√	√			
SUPERFLUIDITY		√			√			
METIS-II	√	√	√	√	√	√	√	√
5G-NORMA	√	√	√	√	√	√	√	√
FANTASTIC-5G	√	√	√			√	√	√
5G-Xhaul		√			√			
COHERENT		√		√		√	√	√
Flex5Gware		√		√		√	√	
mmMAGIC	√	√	√	√		√	√	√
Xhaul -> 5G-Crosshaul!	√	√	√	√	√	√		√
VirtuWind		√	√	√				
SONATA				√	√			
5GEx					√			
5G-Ensure		√	√	√	√	√	√	√

5G R&I Phase 2: 2017-2019

Focus on *Proofs of Concept, Experiments, Verticals*

Critical technologies and Systems (101 M€)

- **Radio network architecture & technologies**
- **Optical core**
- **SDN/NFV, architecture, net mgt;**

Convergent technologies (46 M€)

- **Optical support to ubiquitous 5G access**
- **Flexible network applications**
- **Research cooperation in access convergence (w/ Taiwan)**

***+ International cooperation* (*6 M€ for 5G with SK and JP*)**

Coordination & Support Action (3 M€)

Main 5G Call 2 planning

European Commission

ICT-07-2017 & ICT-08-2017:

Opening: 10 May 2016

Closing: 08 Nov 2016

(at 17:00 CET)

ICT-07-2017:

5G PPP Research and Validation of critical technologies and systems

High level Objectives

- **To leverage work and results of phase 1 (WP 2014-15) and to accelerate on proofs of concept and demonstrators → 3GPP, WRC 19 milestones**
- To support a much wider array of requirements than today, and with capability of **flexibly adapting to different requirements by "vertical" applications**
- To cover a wide range of services from different use cases and application areas/verticals, for increasingly capable user terminals, and for an extremely diverse set of connected machines and things
- To support a **shift from the "Client-Server" model to "Anything" as a Service** (XaaS), no need for own HW/SW
- **Network elements will become "computing equivalent" elements** that gather programmable resources, interfaces and functions based on virtualisation technologies
- **Optimisation of CAPEX/OPEX and of scarce resources** (e.g. energy, spectrum), as well as migration towards new network architectures

ICT-07-2017:

5G PPP Research and Validation of critical technologies and systems

a. Research & Innovation

101 M€

a.1. Strand: Wireless access and radio network architecture/technologies

- **Novel air interface technologies**
- **Hardware architectures,** building blocks
- **(Radio) Network functional architectures** and interfaces leading to a reference architecture for 5G in support of the forthcoming standardisation work
- **Co-operative operation of heterogeneous access networks** integrating virtual radio functions into service delivery networks
- **Support of numerous devices** with different capabilities, with unified connectivity management capabilities, in terms of security, mobility and routing
- **Coordination and optimization of user access to heterogeneous radio accesses**
- **Multi-tenancy for Radio Access Network (RAN) sharing**, covering ultra-dense network deployments
- **Integration of Satellite Networks**

ICT-07-2017:

5G PPP Research and Validation of critical technologies and systems

a. Research & Innovation

a.2. Strand: High capacity elastic - optical networks

Key: core and metro transport capacity/flexibility

- New **spectrally efficient, adaptive transmission, networking, control and management approaches** to increase network capacity by a factor of > 100
- To provide **high service granularity, guarantees for end-to-end optimization and QoS - reducing power consumption, footprint and cost per bit and maintaining reach**
- **Integration of such new optical transport and transmission designs with novel network control and management paradigms** (e.g., SDN)

ICT-07-2017:

5G PPP Research and Validation of critical technologies and systems

a. Research & Innovation

a.3. Strand: Software Networks

- **Software network architecture** to support an access-agnostic converged core network and control framework enabling next generation services
- A **unified management of connectivity**, with end to end security mobility and routing for flexible introduction of new services.
- Solutions (e.g API's and corresponding abstractions) that allow re-location or anycast search of services and their components
- **Scalability and efficiency** related to increasing deployment of software-based network equipment and functions as well as corresponding more diverse services and usages
- Realisation of the **"plug and play vision" for computing, storage and network resources** through appropriate abstraction, interfaces, and layering, targeting a **Network Operating System (NOS),** integration of experimental facilities
- **Management and security** for virtualised NWs (incl. across multiple virtualised domains) and services to support service deployment decisions

ICT-07-2017:

5G PPP Research and Validation of critical technologies and systems

b. Coordination and Support Actions

3 M€

Activities to ensure a sound programmatic view of the implemented 5G Research and Innovation Actions (RIA) and Innovation Actions (IA) results:

- **Programme level integration through management and orchestration of 5G PPP project cooperation** for horizontal issues of common interests in support of the commitments of the 5G PPP contractual arrangement
- **Portfolio analysis, coverage, mapping and gap analysis, roadmaps**
- Support to the emergence of a 5G PPP "5G vision", to key **international co-operation activities, SDO's (e.g. 3GPP), WRC..**
- **Organisation of stakeholder events**, e.g. to reach out to users & key verticals
- **Monitoring of the openness, fairness and transparency of the PPP process**
- **Maintenance of the "5G web site"**

ICT-07-2017:

5G PPP Research and Validation of critical technologies and systems

Expected Impact

RIA at macro level:

- 40% of the world communication infrastructure market for EU headquartered companies; Demonstrated progress towards core 5G PPP KPI's; EMF < LTE; Novel business models through innovative sharing of network resources across actors

RIA at operational level:

- Flexibility of optical resource management; Optimised optical backhaul architectures and technologies; Ubiquitous 5G access, Definition of 5G network architecture, Proactive contribution to the standardisation activities on 5G, Proof-of-concept and demonstrators beyond phase one/specific use cases with verticals, Novel connectivity paradigms (edge), Network function implementation through generic IT servers, OS like capabilities to orchestrate network resources, Trustworthy interoperability across multiple virtualised operational domains and management of multi domain virtualised networks

CSAs:

- Maximised output and exploitation of 5G PPP project results, Constituency building, stakeholder support, support to key international cooperation events; dissemination, Definition of future R&I actions

ICT-08-2017: 5G PPP Convergent Technologies

High level objectives

- To tackle **scalability and usability of mixed network technological approaches** that can benefit from previous research, towards validation of deployment at scale
- **For IAs:** work draws on existing scientific and research results in the field and includes **scalable demonstrators** validated through typical usage scenario (s1); openness to 3rd party developers (s2)
- **For RIAs: collaborative research in 5G access leveraging Taiwan testbed offers**

ICT-08-2017: 5G PPP Convergent Technologies

a. Innovation Actions

41 M€

a.1. Strand Ubiquitous 5G access leveraging optical technologies

- **to develop and assess new optical access network solutions based on integrated optical device prototypes**
- **new optical transmission, switching and information processing techniques** to support key access functionalities such as beam forming, high accuracy cm/mmWave generation and massive MIMO deployments
- **Co-operative radio-optical approaches**
- **Techniques to map 5G channels to optical transport** and a co-design of the optical and wireless interfaces and protocols

a.2. Strand Flexible network applications

- targets development of a **multiplicity of Virtualised Network Functions (VNF) for deployment of Network Applications**
- Targets a Cloud-like 5G infrastructures, supporting network services, resource and service orchestration
- open source development framework for control functionalities and application development, open platforms to third parties

ICT-08-2017: 5G PPP Convergent Technologies

b. Research and Innovation Actions

5 M€

Cooperation in access convergence

To take advantage of the supporting 5G research and demonstration facilities offered by Taiwan towards collaborative 5G research with the EU

- **Test beds making use of facilities offered by Taiwanese partners**
- **Development and demonstration** of an integrated convergent access across different air interface technologies and the fronthaul/backhaul/core network and capabilities of new spectrum access schemes
- A **system demonstrator showing applications potential** is favoured

ICT-08-2017: 5G PPP Convergent Technologies

Expected Impact

Innovation Actions:

- Validated access network architecture with integrated optical technologies for the realisation of critical access and transport control function
- Demonstration of technological applicability to dense access scenarios
- Demonstrated scalability, close to operational context. Contribution to standards, notably 5G and optical access
- Optical access interface with 10 times lower energy consumption
- Open environments for creation of network apps and Open repository of network apps that may be validated and leveraged by third party developers
- Validation at scale of the VNF aggregation capability

RIA at operational level:

- Contribution to the ITU-R objectives for the next generation mobile network
- Contribution to the 1000 fold mobile traffic increase per area
- Contribution to the 1ms latency objective
- Results exploitation in the context of standardization and spectrum requirements

Find out more!

Horizon2020 web site:

- http://ec.europa.eu/programmes/horizon2020/

Participants portal:

- http://ec.europa.eu/research/participants/portal

***H2020 Helpdesk**, including FAQ:*

- http://ec.europa.eu/research/index.cfm?pg=enquiries

5G PPP: http://www.5g-ppp.eu/

Thank you
for your attention!