European Future Communications Research

2018-20 and post 2020 challenges

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Lisbon, Oct 24th

Funding 2017

5G PPP Phase 2: 149M€, 24 projects

Research and Innovation Actions ***(101M€)***

- *wireless access and radio network technologies*
- *high capacity elastic-optical networks*
- *software networks*

Innovation Actions ***(40M€)***

- *5G access leveraging optical technologies*
- *flexible network applications*

Coop with Taiwan, CSA **(5+3M€)**

- *Cooperation in access convergence*

Beyond 5G: 18M€, 6 projects (call matching ETP Beyond5G white paper)

THz Com, VLC, D band radio, ng FECs for Tbit/s

Beyond5G Retained proposals

TERRANOVA

To provide reliable connectivity of extremely high data rates in the **Tbit/s** regime and almost 'zero-latency' in networks beyond 5G, TERRANOVA proposes **to extend the fibre-optic systems Quality of Experience and performance reliability to wireless**, by **exploiting frequencies above 275GHz** for access and backhaul links.

EPIC

EPIC aims to develop a **new generation of Forward-Error-Correction (FEC) codes to enable practical wireless Tb/s** link technology—corresponding to a 10x–100x throughput improvement over the SoA

ULTRAWAVE

Ultra capacity layer providing more than **100 Gbps per kilometer square in Point to Multi point at D-band (141 – 174.8 GHz)** over 500 m radius of coverage, fed by novel **G-band (300 GHz) Point to Point** high capacity links with more than 600 m range.

DREAM

The DREAM project, through the **exploitation of the radio spectrum in D-band (130-174.8 GHz) with beam steering** functionality

WORTECS

High-frequency mm-wave (in the band above 90 GHz) radio communications will be combined with **optical wireless communications** in the infrared and visible regions of the optical spectrum, using novel **heterogeneous networking concepts**. An ultra-high **density LiFi/Radio network** providing multi-Gbps to virtual reality terminals will be developed.

TERAPOD

The project will focus on end to end demonstration of the **THz wireless** link within a Data Centre Proof of Concept deployment, while also investigating other use cases applicable to beyond 5G such as wireless personal area networks, wireless local area networks and high bandwidth broadcasting.

Funding 2018-20

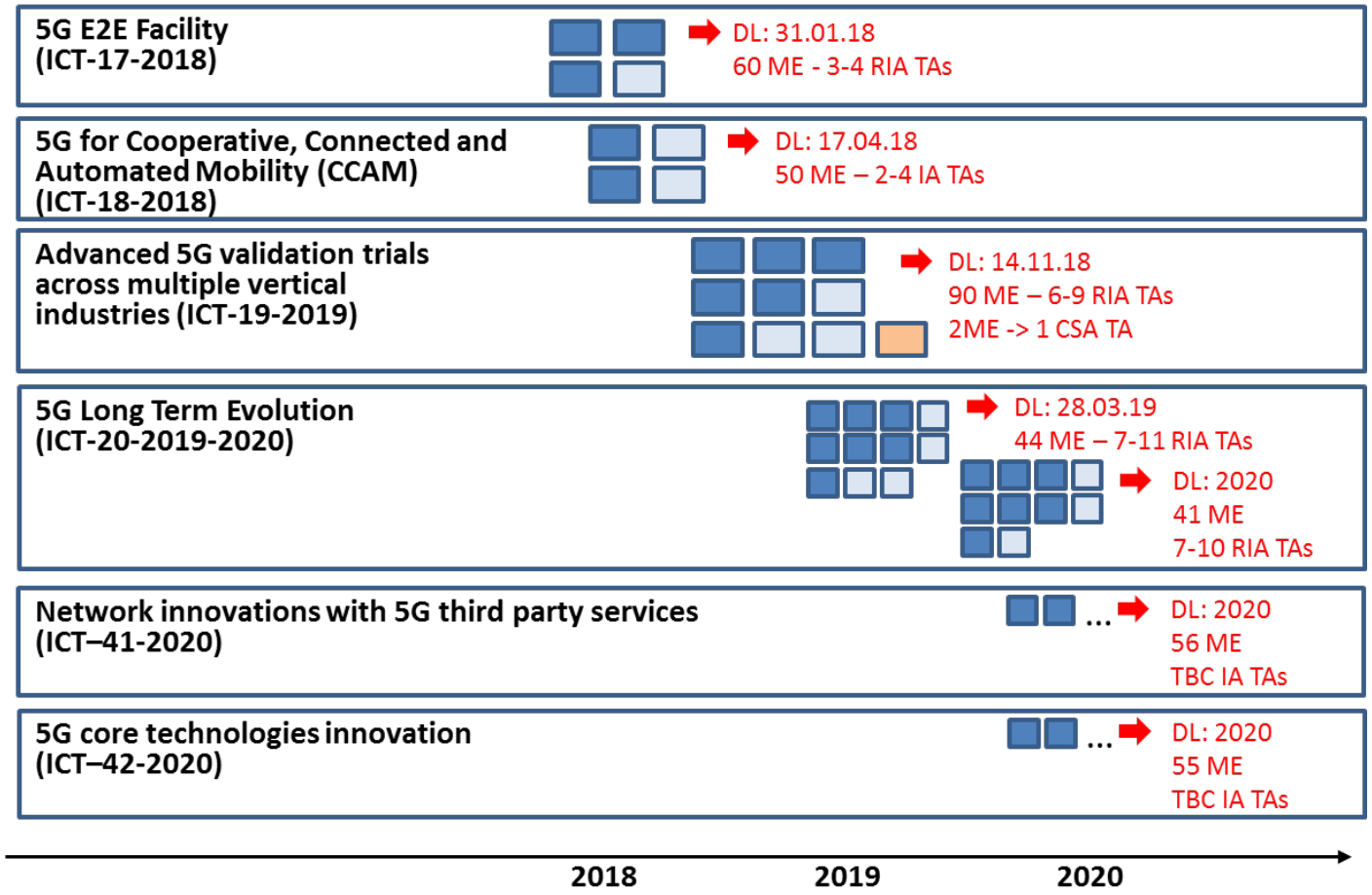
- (https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/h2020-leit-ict-2018-2020_pre_publication.pdf)
  - ICT-17-2018: 5G End-to-End Facility (RIA)
  - ICT-18-2018: 5G for Cooperative, Connected and Automated Mobility (CCAM) (IA)
  - ICT-19-2019: Advanced 5G validation trials across multiple vertical industries (RIA and CSA)
  - ICT-21-2018: EU-US Collaboration for advanced wireless platforms (CSA)
  - ICT-22-2018: EU-China 5G Collaboration (RIA)
  - EUJ-02-2018: 5G and beyond (RIA)
  - EUK-02-2018: 5G (RIA)
- The following Strategic objectives will be addressed by the Phase 3(.II) PSM (targeted in February 2018)
  - ICT-20-2019-2020: 5G Long Term Evolution
  - ICT–41-2020: Network innovations with 5G third party services
  - ICT–42-2020: 5G core technologies innovation
  - ICT-23-2019: EU-Taiwan 5G Collaboration
  - ICT-43-2020: EU-Brazil 5G collaboration

420M€

H2020 5G Infrastructure PPP
Phase 3(.I) PSM Scope & Coverage (2/3)

5G PPP
The European path towards global next generation communication network

- EC H2020 5G Infrastructure PPP Phase 3 – Strategic Objectives (1/2)



H2020 5G Infrastructure PPP
Phase 3(.I) PSM Scope & Coverage (3/3)

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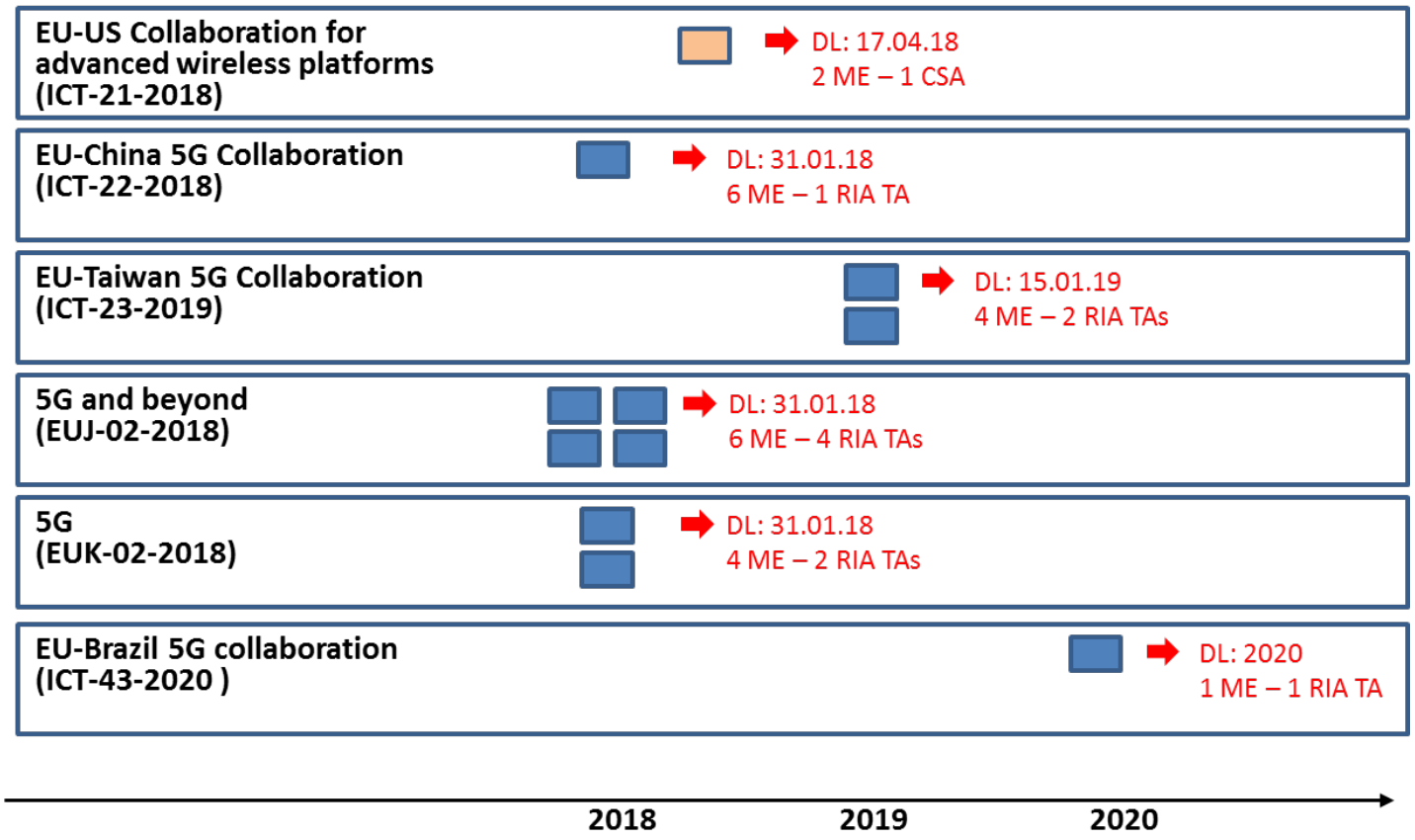

5G PPP
The European path towards global next generation communication network

DG RTD FP9 Programme Concept paper

-The need to invest big

- intensify Int Coop / outreach civil society

- budget options

- evolution, not revolution

- 3 pillars: science; innovation; global challenges

- global challenges: societal and technology driven missions

- centrally managed, agencies, simplification

DG CONNECT Digital in FP9
Programme concept

Digital Missions (scientific, technology, societal)

Scientific Mission: FET flagship, FET proactive (graphene, Hhuman brain, quantum, batteries)

Technology Missions AI, NGI, Key techno (nanoelec,photonics), Open science cloud, HPC

Societal Missions: cybersecurity, health,green, ERC EIC

2.2.2 Next Generation Internet

Mission

To gain a strong European position on the Internet of tomorrow through the **development of a human-centric and disintermediated Internet** where **European actors across the value chain play a prominent role**, can generate value[3] and support a strong European digital economy, both from supply and demand side. This requires a coherent package of strategic responses:

- Maintain our lead in fixed/mobile network infrastructure and architecture[4] and exploit opportunities offered by the connection to the physical world (IoT), powered by the necessary cloud computing capabilities and data infrastructures to deliver an energy efficient Internet as a public service for both individual and business users.
- Empower users control of services and infrastructure through the game changing trends of virtualisation and decentralised management, with increased networking, computing power, interactivity and service provisioning moving closer to the user, with security and privacy by design eventually leading to the zero latency Internet.
- Enable the next wave of advanced applications including i) the development of a positive and safe social media environment where people can be connected with each other through easily accessible technologies, supporting multilingualism, enjoy personalised access to information, new media and cultural experiences online; ii) immersive and interactive applications for full creative and cultural experiences online; and; iii) applications fusing real and virtual world experiences in both consumer and business environments. Delivering machines and interfaces able to understand human languages and interact with humans in the language of their choice.
- Support the emergence of a data economy predicated on the free flow of data and data markets, in which data assets (both open and proprietary/personal) move without undue obstacles, with fair remuneration, control and protection for data subjects and data 'owners'.
- Leverage new technological opportunities to create next generation Internet offers, both at infrastructure, services and application levels. AI and big data analytics can be applied to infrastructure management, data search, processing and delivery; distributed ledgers to secure infrastructures or applications, software architectures and technologies to support new virtualised environments.

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[2] In H2020, around 1.2 Bn€ have been invested in AI-related activities: AI: 50M€, Robotics and Autonomous systems: 700M€, FoF: 50M€, Big Data: 250M€, FET: 120M€, IoT: 20M€.

[3] By opposition to platform based Internet where value is concentrated in a handful of powerful OTT's

[4] This part should be supported by a JU leveraging the results of the 5G PPP

Future Com research in FP9?

EC DG Connect Unit dealing with Communications Research**: FP7** 'Network technologies', **FP8**$_{H2020}$'Future connectivity systems' with leading **topic 5G** and **PPP** instrument

FP9? challenges, narrative, title, instruments? Socio eco challenges? Smart connectivity, Future Networks?, PPP, Joint Undertaking? ..

Consultation: who knows, who does?

ETP Networld2020 (consultation+ vision research workshop, Fora (etsi – NG protocols-, ietf..), 5GIA, Industry/ Academics, new actors for 2025-30 markets? etc..

Consultation: An EU operator recent contribution

Inputs for FP 9 – drivers for network technologies research

- Next **FP9** should address 5G LTE or beyond 5G research, possible key topics could be:
  - **Artificial intelligence/Machine Learning–** Network and service modelling, languages for A.I. and Machine Learning processing (Automated X-as-a-Service provisioning) to leverage the huge data sets generated by high speed networks and support a next generation of digital services (eg. Predictive maintenance based on AI for ultrareliable networks)
  - **Teraherzt** spectrum exploitation for dense networks (https://www.hiroshima-u.ac.jp/en/news/37589);
  - **Reconfigurable Hardware design challenges from RF to THz**: challenge to realise hardware (transceivers, filters, power amplifiers, antennas) at frequencies from 28 GHz to 300 GHz, and beyond, with low manufacturing costs
  - **Complexity management of Ultra-Dense Cells (massive MIMO) Networks** - Scenarios applied as both a backhaul connection to the network and as front-haul to serve multiple small cell base-stations
  - **Optical interconnection for computing** to advance optical communications
  - **Security & Privacy by design**: design a natively secure network infrastructure to mitigate cybersecurity problems and privacy threats both for society and businesses;
  - **Energy Efficient Wireless Communication Protocols** (https://www.dinfo.unifi.it/cmpro-v-p-325.html)
  - **Alternatives to / Beyond TCP/IP and Next Generation Protocols**: IP stack is showing limits for mobile comms , greenfield or brownfield research could be envisaged reflecting ETSI (http://www.etsi.org/news-events/news/1058-2016-01-news-etsi-creates-new-standardization-group-to-pave-the-way-for-next-generation-protocols), ITU-T SG13 (IRTF and IRTF initiatives on Information Centric Networks (ICNs)
  - **RF pollution minimization** in communication and computing

Future Com research in FP9?

Ideas, papers, budgets already on their way and will impact the Communications Research community

➔ Urgent need for ETP Networld2020 FP9 vision with socio eco and strong narrative; technology mission oriented white paper, SRIA with topics

Other open questions

- link to **NGI**, "Connectivity" trends or establish independent narrative?

- Societal challenges: Coverage, verticals Cars Health;sovereignty?

- **Focus on?** Access/ connectivity management/ services/ processors/ terminals? Terabit capacities? Optical? Deeper Reach (bio nano etc..)? Spectrum,Thz, Intelligence and Control?

Stakeholders Information Opportunities

https://ec.europa.eu/digital-single-market/en/events/ict-proposers-day-2017

Find out more

5G Action Plan for Europe

https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan

ICT Work Programme

https://ec.europa.eu/programmes/horizon2020/en/what-work-programme

5G PPP	*http://www.5G-PPP.eu*
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*

Thank you for your attention!

BACK UP for ETP Networld2020 GA

European Commission

5G PPP Phase III

Information day and Stakeholders event

5G in the Digital Single Market (DSM)

The 5G Action plan

- Commission Communication: to support European industrial leadership;

- Part of the September 2016 "Connectivity Package"

- Preparing Framework Conditions at EU level for 5G deployment

The 5G Public Private Partnership (5G PPP)

- 700 M€ initiative under R&I H2020 programme

- Technologies, systems, applications

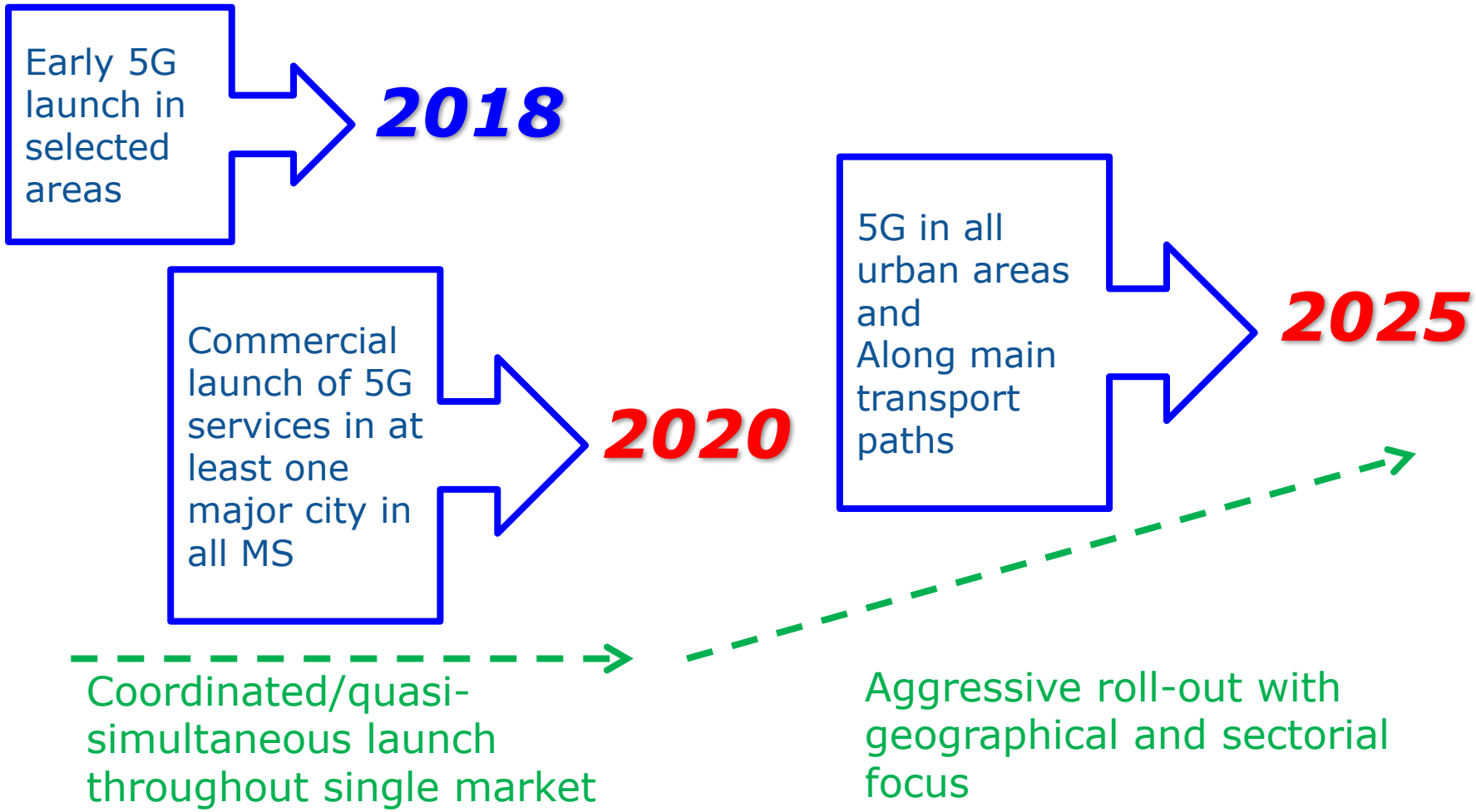
- Programmatic approach

- spectrum, standards, International cooperation

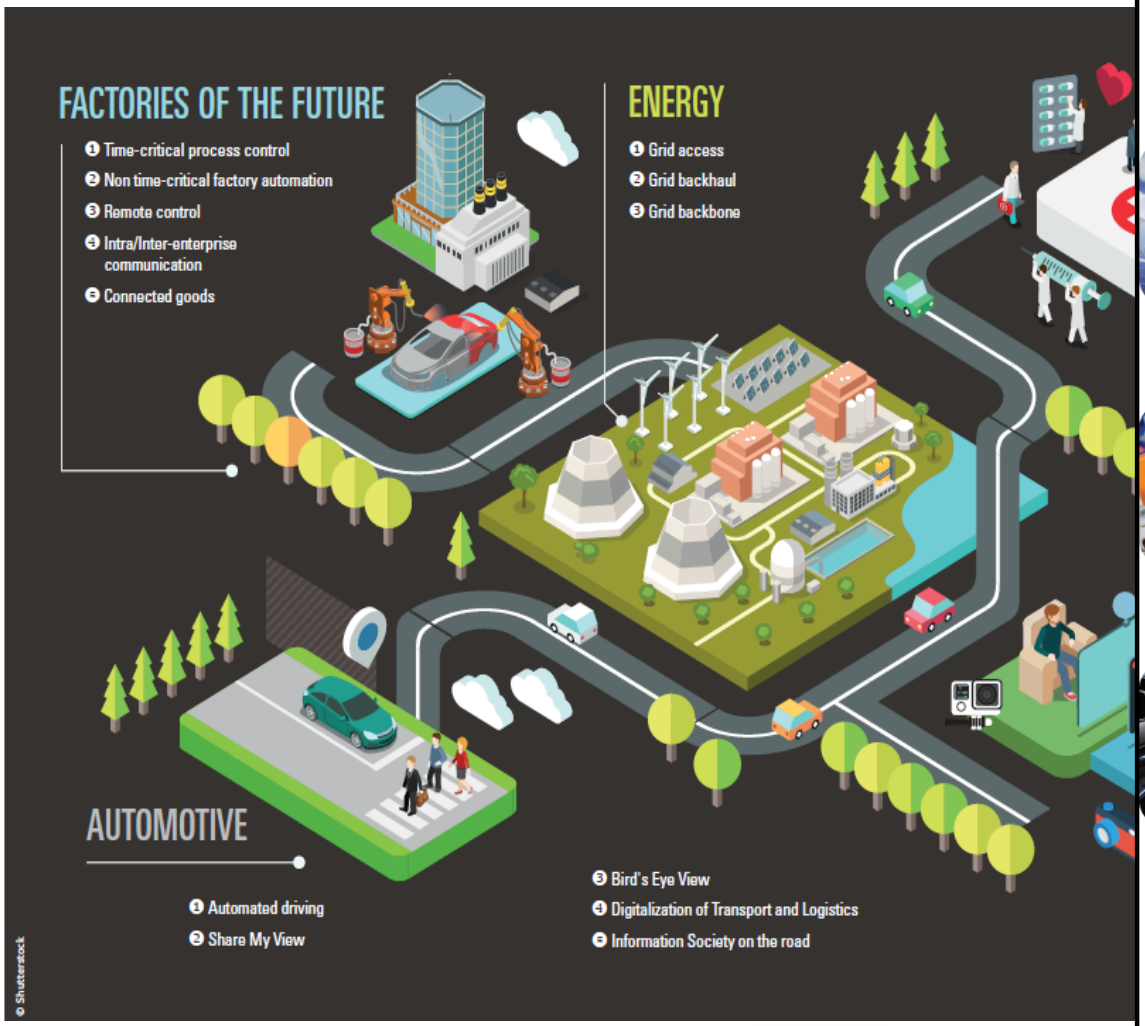
5G PPP: Addressing 5G as a strategic and global issue

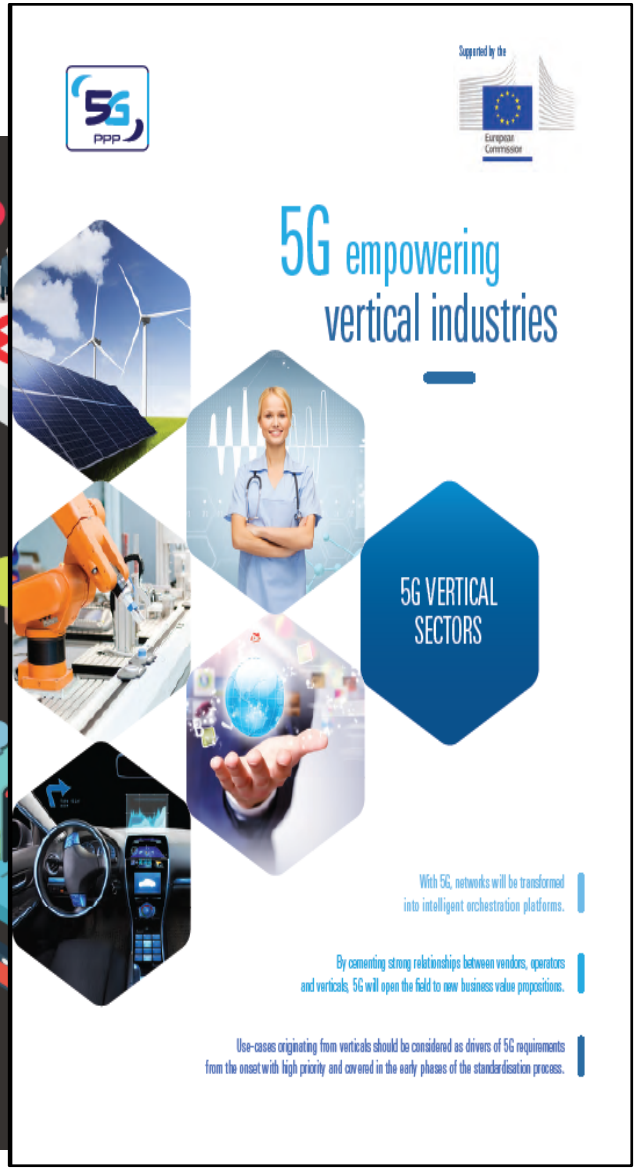
- About 10 years to develop a new network generation, R&I started around 2012 in many countries, Europe at the forefront;
- Today, **huge efforts world-wide** in the context of Public-Private partnerships;
- Critical to maintain Europe at the forefront of 5G, both as a **supply centre of excellence** and as an **early adopter through lead markets;**
- **Europe has developed its own 5G path** on which traction is now being created and needs to reach its objectives.
- **The 5G PPP support the EU 5G Policy goals**

5G AP: "Single Market" approach to EU 5G Introduction



European Vision





European Trials Roadmap

Trials roadmap announced in the 5G Action Plan

- ✓ To help technology and business model validation
- ✓ To prepare for early deployments
- ✓ Top foster partnership with verticals and creation of ecosystem

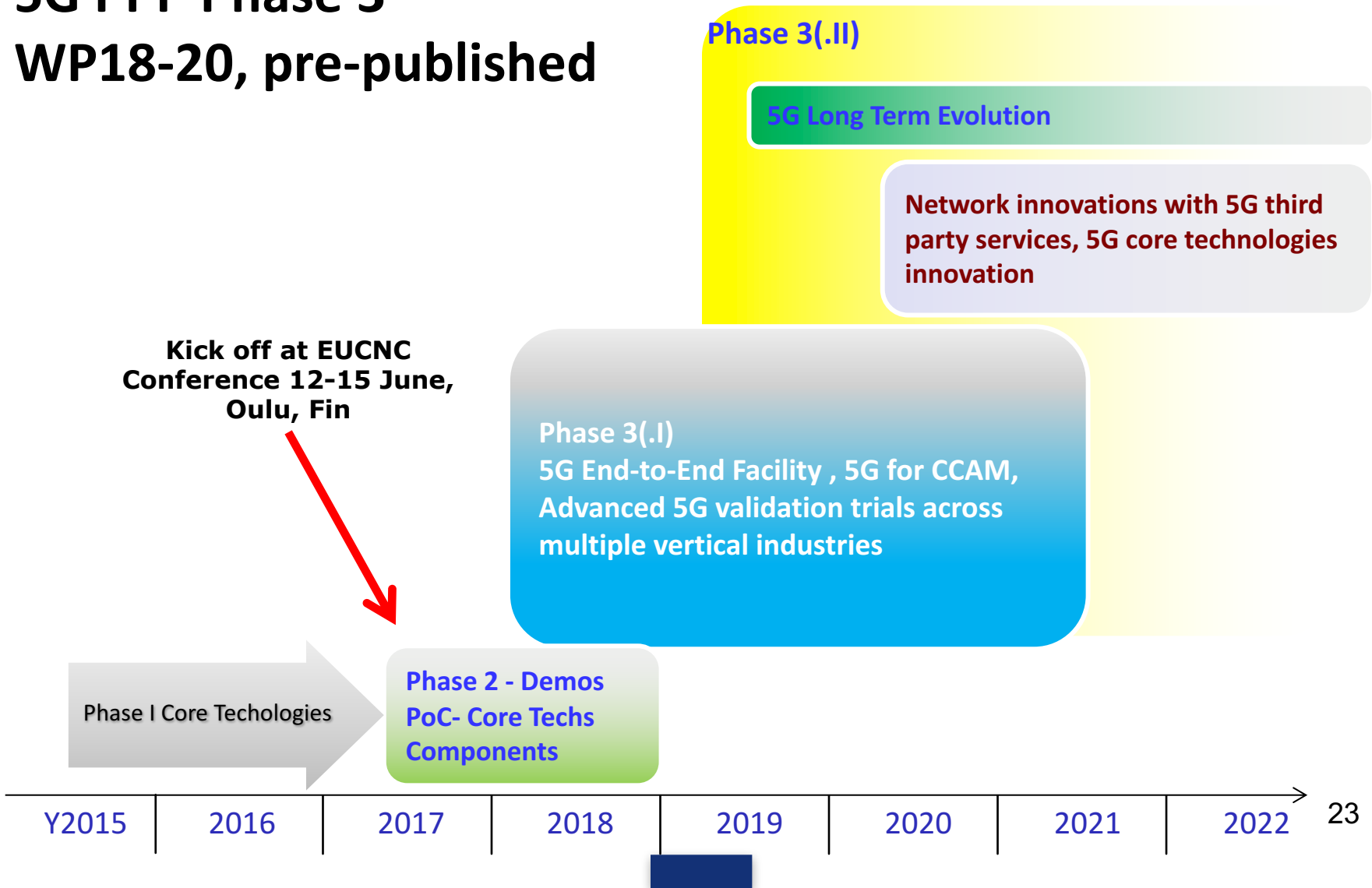
Roadmap announced in MWC in Barcelona

- ✓ Support by key players of 5G in Europe
- ✓ Attraction towards verticals and cities

5G Pan-European Trials Roadmap v1: 3rd 5G Global Event, Tokyo

- ✓ **Part of this implementation is supported by the EC through the 5GAP, 5G PPP Phase 3.**
- ✓ Very important to implement the roadmap in time

5G PPP Phase 3
WP18-20, pre-published



5GPPP Phase 3 Objectives

Reinforce 5G PPP as an industry Driven impactful initiative support EU positioning in the global 5G competition through :

- Support implementation of EU Vision https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf
- Reinforce links with new players, especially Verticals industries
- Reinforced trend towards demos and pilots with high industrial impacts
- Integration to and contribution towards international cooperation and developments, e.g. standards, spectrum
- Preparing for deployment, trial support and longer term needs
- Programmatic approach through collaboration agreement between projects

Collaboration matters!

- **The projects are the engine of the 5GPPP:**
  - Support implementation of EU Vision and policies
  - Populating the 5G association's working groups and collaboration structures
  - Providing substantial inputs (ex: standardization, spectrum, KPIs)
  - Integration to and contribution towards international developments and deployment
- **Collaboration agreement between projects through Complementary grants, Art 41.4 MGA (in the model of Phases 1 and 2)**
  - Joint definition of issues of common interests
  - Sharing of results
  - common approaches to standardization
  - common dissemination and awareness raising activities
  - …

More than just projects – it's a PROGRAMME!

International cooperation, moving forward

	R&D , 2018-20 Work-programme	Policy
JAPAN	- Applications and trials with 5G networks - Beyond 5G, applicability of spectrum >275 GHz	- Spectrum, interoperability at different bands
REPUBLIC OF KOREA	- Application trials at mmwave bands - Interoperability and integration of 5G vertical testbeds in heterogeneous environments	- Standards, validation of specs
CHINA	- eMBB trials at 3,5 Ghz and trials in the V2X context	- Spectrum co-operation - Standards, preparing 5G phase 2 through trial results
TAIWAN	- 5G trials addressing End to End Testbeds for specific applications	
USA	- Coordination of EU-NSF projects relevant to the Advanced Wireless Platform programme	
BRAZIL	- Trials	- Spectrum co-operation - Standards - Trials

5G PPP Phase 3 topics closing in 2018

	Title	Closing Date
ICT-17-2018	5G End to End Facility	**31 January 2018**
ICT-22-2018	EU-China 5G Collaboration	
EUJ-02-2018	EU-Japan Joint Call - 5G and beyond	
EUK-02-2018	EU-Korea Joint Call - 5G	
ICT-18-2018	5G for cooperative, connected and automated mobility (CCAM)	**17 April 2018**
ICT-21-2018	EU-US Collaboration for advanced wireless platforms	
ICT-19-2019	Advanced 5G validation trials across multiple vertical industries	**14 November 2018**

ICT-17-2018: 5G End to End Facility - General Context

- Availability of Pan European platforms that can be used to validate in end to end manner the 5G KPIs, from the 5G PPP and beyond
- Critical to go beyond capabilities that can be demonstrated with running pre commercial trials of industry
- Novel features in relation to vertical, notably end to end slicing are of particular importance
- Platforms are to be reused by ICT 19 projects, in support of trials
- Open to support implementation of 5G AP trial roadmap.
- Impact on standards critical
- Open to support different stakeholders constellations

ICT-17-2018: 5G End to End Facility - Scope

- The target 5G end to end network facility covers fixed/multi radio access, backhaul, core network, service technologies and architectures targeted for 5G including end to end virtualisation and slicing as key component
- The objective is
  - to validate the 5G network KPIs through representative network trials, as defined by the 5G PPP;
  - to prepare an extensive validation platform for verticals use cases

ICT-17-2018: 5G End to End Facility - Scope

The targeted facility

- allows to validate early versions of the standards and to prepare for later "forward compatible" versions
- may be based on the interworking of several experimental platforms existing in Europe
- requires availability of an openness framework (both legal and technical, e.g. open APIs) enabling "vertical" projects to access and use it
- requires a methodology to consistently compare technologies where appropriate

ICT-17-2018: 5G End to End Facility - Expected Impact

- Demonstrated feasibility of **5G PPP KPIs beyond 4G evolution**. It requires clear analysis of the state of the art and how 5G goes beyond
- Demonstration of **innovative radio spectrum use** and sharing applicable to 5G spectrum: (un)-licensed, licensed-shared access
- Validation of a representative **end to end 5G architecture** including end to end service provisioning with slicing capabilities
- Impactful contribution to **standards**. Participation of key European industrial partners with high standardisation impact is desired
- Availability of 5G facility that may be further used for validation through specific **vertical use cases** and/or for **large scale showcasing** events

ICT-17-2018: 5G End to End Facility

- Opening 31/10/2017
- **Closing 31/01/2018**
- Target is 3 to 4 projects
- Type of action: Research and Innovation action
- **Special conditions!**
  - The limit for a full proposal is 100 pages
  - Complementary grant agreements will be implemented across projects originating from 5G-PPP Phase 3 topics

up to 60 M€

ICT-18-2018: 5G for cooperative, connected and automated mobility (CCAM) - General Context

- Connected and Cooperative Assisted Mobility (CCAM) identified as a strategic industrial sector in the EU
- 5G identified as the connectivity platform of choice (long term) for CCAM use cases, as per the 5G Action Plan
- European Alliance of Telecom and Automotive (EATA) launched by Commissioner Oettinger in September 2016
- Industry has launched the 5GAA
- Member State Support with Letter of Intent, signed at ministerial level in March 2017
- In the short term, non-cellular technology (G5) expected to develop in the EU for early C-ITS requirements

➔ ICT 18 aims at validating 5G for CCAM in this wider techno-policy context

ICT-18-2018: 5G for cooperative, connected and automated mobility (CCAM) - Scope

- Validation of 5G in a broad CCAM context is realised through cross border trials along 5G corridors
- Core technological innovation expected from 5G, such as (but not limited to):
  - New Radio, new frequency bands
  - C-RAN
  - Mobile Edge Computing
  - network virtualisation
  - new network architecture
  - cross domains data flows

ICT-18-2018: 5G for cooperative, connected and automated mobility (CCAM) - Scope

- define options for deployment, taking into account the evolution from earlier cellular technology (e.g. LTE-V2X), and possible co-existence with other technologies (e.g IEEE 802.11p)
- Includes cost/complexity assessment of the various technology deployment options. Identifies who has to invest and who will benefit commercially

ICT-18-2018: 5G for cooperative, connected and automated mobility (CCAM) - Expected Impact

- Validation of 5G technologies and architecture in an "extended CCAM" context
- Validated cost/benefit analysis of **cross border** 5G deployment enabling CCAM along 5G corridors potentially including several operator's domains
- Availability of deployment scenarios and strategies with broad base industry and administration consensus
- Identification of spectrum and standardisation gaps. Participation of key European industrial partners of both the ICT and the automotive sectors and with high standardisation impact is desired

ICT-18-2018: 5G for cooperative, connected and automated mobility (CCAM)

- Opening 31/10/2017
- **Closing 17/04/2018**
- Target is 2 to 4 projects
- Type of action: Innovation action
- **Special conditions!**
  - The limit for a full proposal is 100 pages
  - Complementary grant agreements will be implemented across projects originating from 5G-PPP Phase 3 topics

up to 50 M€

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries - General Context

- Trials and demonstrations are key to demonstrate 5G applicability to vertical industries and to prepare for mature cross sector business cases
- Trials may also be considered in support of the 5G AP Trial Roadmap developed under the 5G PPP
- 5G technology can only be validated in its fullest extent if used by several applications at the same time with different requirements (cloud like behaviour and isolation)
- Multi domain management of resources is important in such shared technology environments, including strong isolation and security aspects
- Trials expected to support later releases of 3G PP standards enabling full coverage of vertical requirements

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries – Scope

RIAs:

- Trials of various scales, depending on the target technology, demonstrating that performance conforming to 5G PPP KPIs requirements are met in the context of specific vertical use cases
- Technology/architecture trials targeting concurrent usage of resource by multiple verticals, addressing eMBB, mMTC, URLLC use cases
- To demonstrate that 5G architecture and technologies enabling multi domain management of resources are in line with concurrent vertical performance requirements
- Vertical use cases may focus on those outlined in the 5G PPP White paper "5G empowering vertical industries"; High density location and very high data volumes applications should be covered
- Preferably implemented over the 5G end to end platforms developed under ICT-17-2018 and contribute to 5G demonstration in the context of large showcasing events

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries – Scope

CSAs:

- Cooperation of the implemented 5G Research and Innovation Actions (RIA) and Innovation Actions (IA) towards joint leveraging of results:
  - Management and orchestration of 5G PPP project cooperation for horizontal issues of common interests (e.g. KPIs, security, energy efficiency, spectrum, standardisation, societal impact of 5G)
  - Portfolio analysis, coverage, mapping and gap analysis, roadmaps
  - Support to key international co-operation activities (standards, spectrum)
  - Organisation of stakeholder events
  - Monitoring of the openness, fairness and transparency of the PPP process
  - Maintenance of the "5G web site"

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries - Expected Impact

RIAs:

- Validated core 5G technologies and architectures in the context of specific vertical use cases and deployment scenarios and for differentiated performance requirements
- Viable business models for innovative digital use cases
- Impactful contributions towards standardisation bodies, involving vertical actors. Participation of key European industrial partners with high standardisation impact is desired
- Validation of relevant KPIs linked to specific vertical sectors
- Europe 5G know how showcasing

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries - Expected Impact

CSAs:

- Organisation of the 5G PPP as a programme
- Maximised output and exploitation of 5G PPP project results in key domains (standardisation, spectrum)
- Constituency building, stakeholder support, support to key international cooperation events and activities; dissemination, support to relevant stakeholder events; definition of future R&I actions

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries

- Opening Early September 2018
- **Closing 14/11/2018**
- Target is 6 to 9 projects
- Type of action: RIA (90 M€), CSA (2 M€)
- **Special conditions!**
  - The limit for a full proposal is 100 pages
  - Complementary grant agreements will be implemented across projects originating from all 5G-PPP Phase 3 topics

up to 92 M€

ICT-21-2018: EU-US Collaboration for advanced wireless platforms (closing 17 April 2018)

- To establish EU US collaboration on advanced wireless research beyond 5G
- To develop notably research roadmaps, workshops, scientific exchanges, tools for experimentation, cross atlantic trials
- Proposals to foresee projects entities twinning, including NSF PAWR projects
- **Expected impact:** reinforced cooperation with the US in Wireless research towards beyond 5G connectivity systems and services
- **Target: 1 CSA project (EU) with total funding up to 2 M€**

ICT-22-2018: EU-China 5G Collaboration

5G PPP Project

5G trial infrastructures

6M€

Twinning of projects

unified trial specifications
unified trial frequency bands
Sharing of data
Joint deliverables, tests reports, white papers, publications and standard contributions

NSTMP Project

5G trial infrastructures

6M€

The National Science and Technology Major Project (NSTMP) is a main 5G research program in China

ICT-22-2018: EU-China 5G Collaboration (closing 31 January 2018)

- Conduct 5G trials addressing two specific scenarios: enhanced Mobile Broadband (eMBB) and Internet of Vehicles (IoV)
- Both scenarios shall be implemented in both regions (EU and China)
- Not restricted to 5G radio access, also for network slicing, virtualisation, cross-domain orchestration
- In EU, trials are preferably implemented over the 5G end-to-end platforms developed under ICT–17-2018.
- Expected Impact: Global interoperability demonstrations for 5G networks, Joint contributions to global 5G standards specifications, joint demonstrations across regions
- Target: 1 RIA project (EU) with total funding up to 6 M€

EUJ-02-2018: 5G and beyond (closing 31 January 2018)

- Part of the 4th EU-Japan Joint Call between EC, MIC and NICT
- Area 1: Large-scale demonstrations and trials towards 5G applications
  - Focus on trials and demonstrations of 5G applications in eMBB and Broadband Access in Dense Areas
- Area 2: Joint research on enabling technologies for beyond 5G
  - Focus on the enormous capacities foreseen to be needed in the backhaul and fronthaul networks
- Target: 2 RIA projects (1/area) with total funding up to 3 M€ (EU)
- **Check the special conditions!**

EUK-02-2018: 5G (closing 31 January 2018)

- Part of the 2nd EU-Korea Joint Call between EC and MSIP/IITP
- Area 1: mmwave and super broadband services
  - should include demonstration of 5G technologies for Access networks, Core networks
- Area 2: interoperability and integration of 5G vertical testbeds on heterogeneous environments
- Target: 2 RIA projects (1/area) with total funding up to 4 M€ (EU)
- **Check the special conditions!**

Future Foreseen Topics after 2018

ICT-20-2019-2020: 5G Long Term Evolution (closing March 2019)

- The longer term vision targets the realisation of pervasive mobile virtual services
- 3 strands:
  - Extension of virtualisation technologies and architectures for Network Management
  - Security
  - Radio network enabling technologies, architectures and advanced signal processing
- RIA projects

ICT-23-2019: EU-Taiwan 5G collaboration (Closing 15 January 2019)

- Conduct 5G trials addressing technology and business validation of 5G end-to-end connectivity and associated management from applications in Taiwan
- Expected Impact
  - Validation of core 5G technologies and architectures in the context of specific vertical use cases.
  - Leverage cooperation towards industrial consensus between EU and Taiwan
  - Accelerate the pre-commercialization trials of the use cases introduced by IMT-2020 (eMBB, mMTC, URLLC)
- RIA projects with total funding up to 4 M€