



# The 5G Infrastructure Public-Private Partnership

Phase 2 Pre-structuring Model  
EC Info Day - 21.01.16 - Brussels  
Dr. Didier Bourse

# Outline



- Model Approach
- Model Scope & Coverage
- Model Specificities
- Model Roadmap
- Model TAs Portfolio
- Model Public Consultation
- Phase 2 Pre-definition Plan Up-dates

➔ <https://5g-ppp.eu/5g-ppp-phase-2-pre-structuring-model/>

# Phase 2 Pre-structuring Model Model Approach (1/4)



- 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 (portfolio) will work together
    - Intra-phase and through phases (70+ projects in the full programme)
    - Model presenting features to guarantee smooth integration of new projects in existing coordinated programme
  - Model focused on Phase 2 projects portfolio and related projects, not on proposals
  - Model defining Targeted Actions (TAs)
    - Rationale, Objective, Scope and Expected Impact
    - Model specific (added value) but not prescriptive
- Model to be widely accepted by the Community and to be recommended by Association and EC as « reference » platform and guidelines for the further development of proposals
- Evaluation of proposals to consider the model as input to the evaluation process
  - Avoiding duplication (“hype effect”) and coverage gaps issues in the portfolio

# Phase 2 Pre-structuring Model Model Approach (2/4)

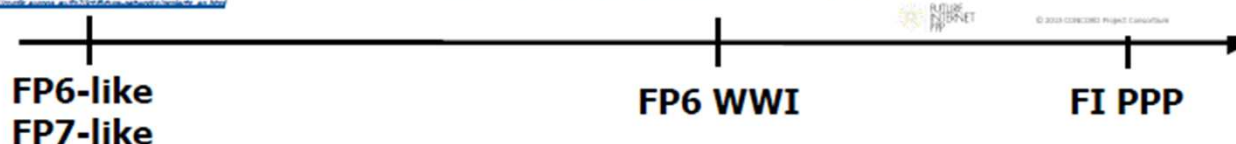
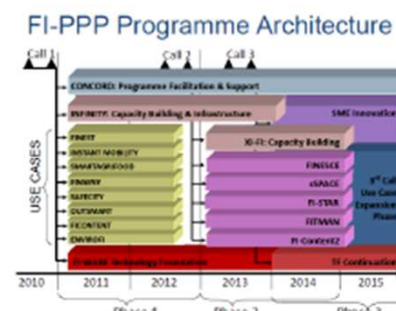
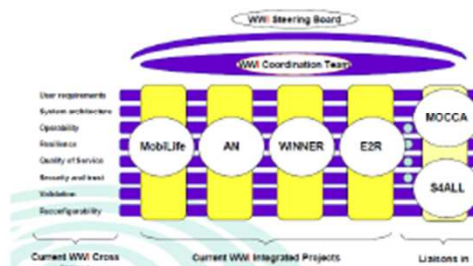
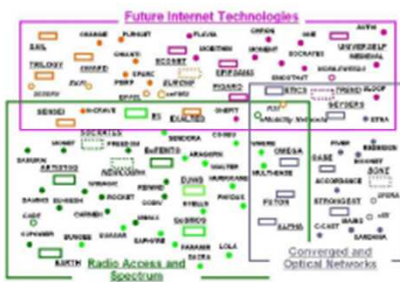


## H2020 5G Infrastructure PPP PPP Pre-structuring Model Approach (3/5)

### 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



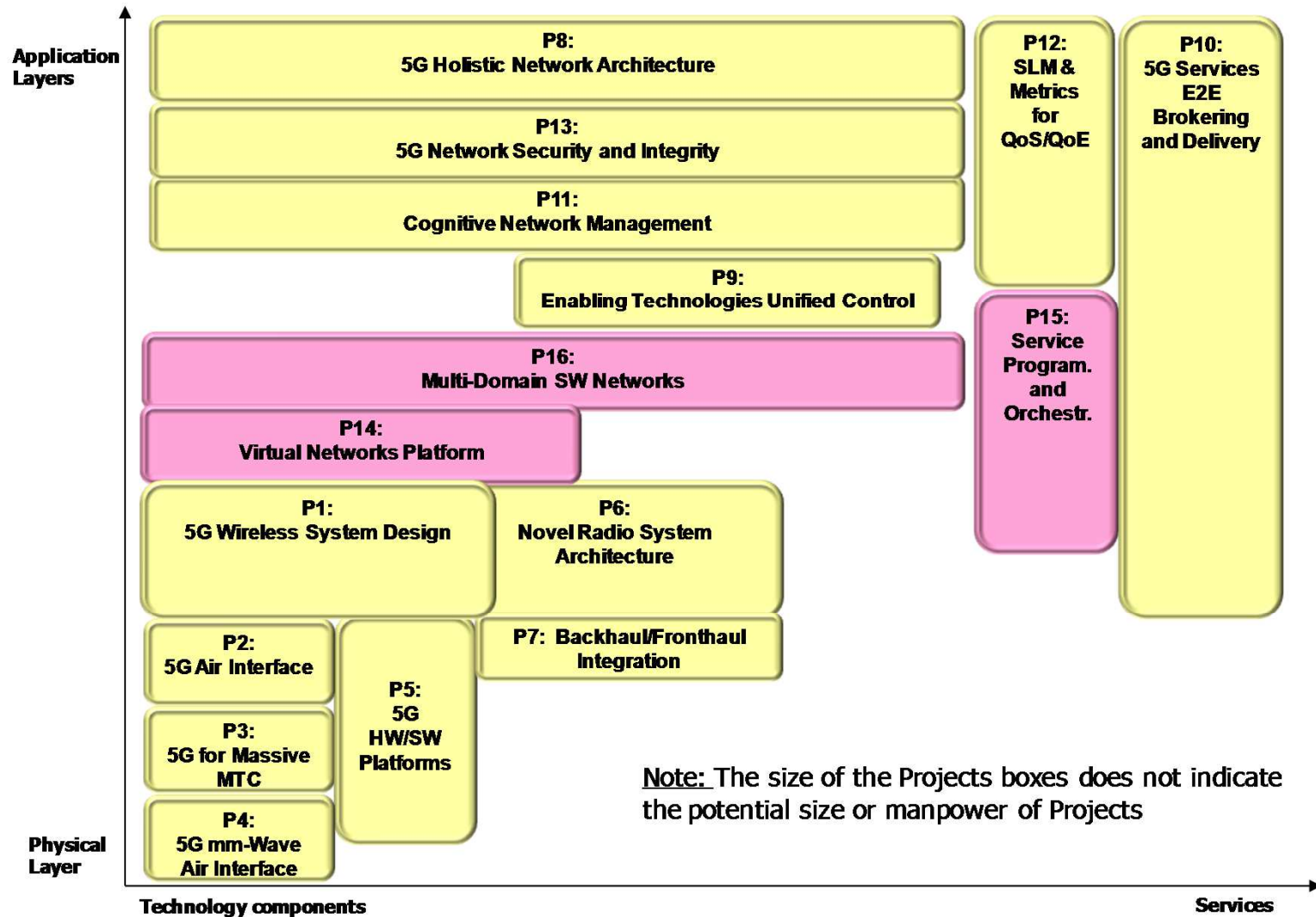
5G Infrastructure PPP  
The European path towards global next generation communication networks



# Phase 2 Pre-structuring Model Model Approach (3/4)



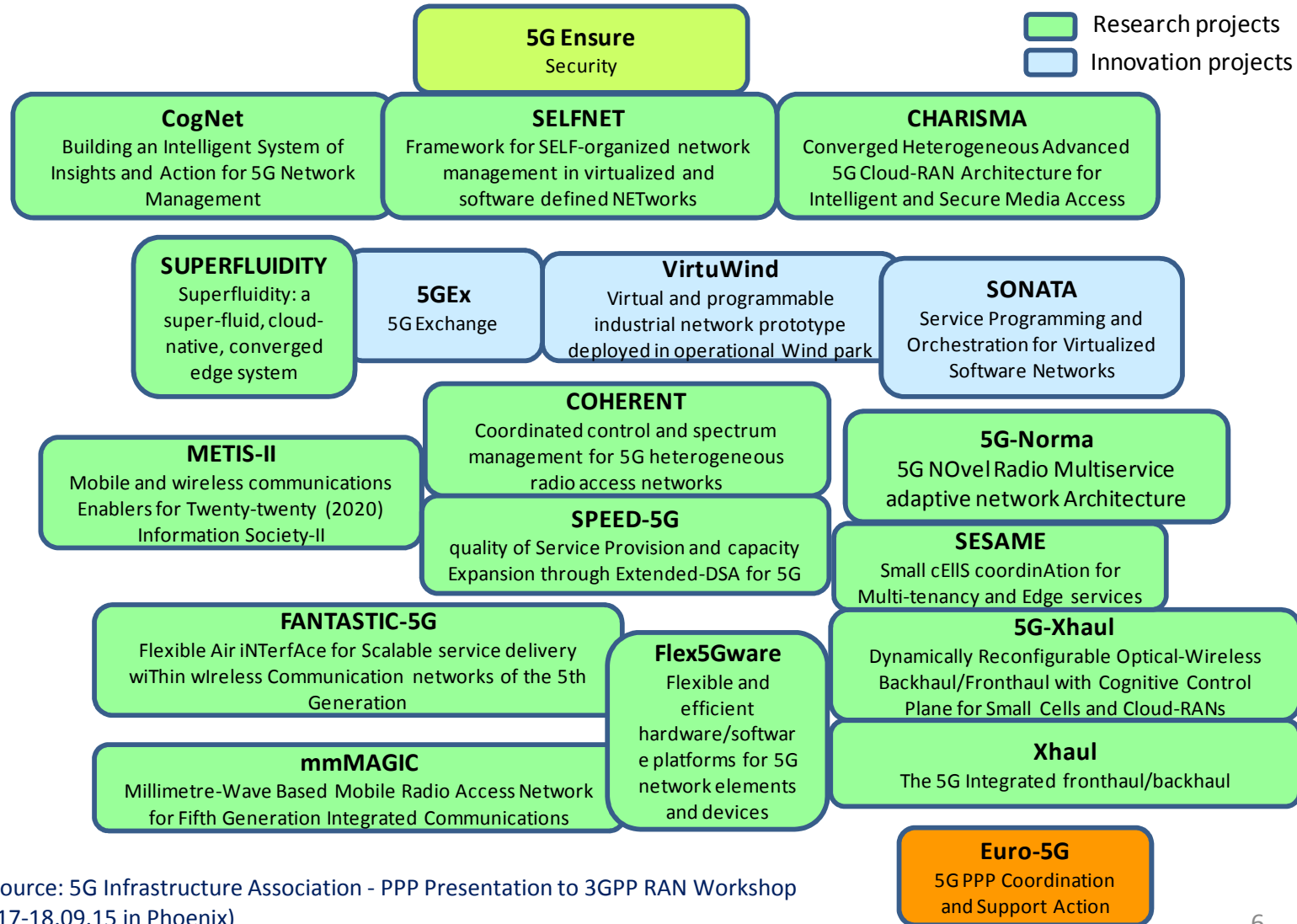
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# Phase 2 Pre-structuring Model Model Approach (4/4)



Research projects  
 Innovation projects



Source: 5G Infrastructure Association - PPP Presentation to 3GPP RAN Workshop (17-18.09.15 in Phoenix)



# Phase 2 Pre-structuring Model Model Scope & Coverage



- Model addressing EC WP2016-17 5G Infrastructure PPP Strategic Objectives ([http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016\\_2017/main/h2020-wp1617-leit-ict\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-ict_en.pdf))
- ICT-07-2017: 5G PPP Research and Validation of critical technologies and systems
  - RIA Strand 1: Wireless Access and Radio Network Architectures/Technologies
  - RIA Strand 2: High Capacity Elastic – Optical Networks
  - RIA Strand 3: Software Networks
  - CSA
- ICT-08-2017: 5G PPP Convergent Technologies
  - IA Strand 1: Ubiquitous 5G Access Leveraging Optical Technologies
  - IA Strand 2: Flexible Network Applications
  - RIA: Cooperations in Access Convergence
- EUJ-01-2016: RIA 5G - Next Generation Communication Networks
- EUK-01-2016: RIA 5G - Next Generation Communication Networks

# Phase 2 Pre-structuring Model Model Specificities



- Model fully capturing the Phase 2 specificities
  - 5G requirements and targets from Verticals markets and stakeholders
  - Experimentation and validation of 5G technologies and developments
  - Cross-projects interworking (/Clause 41.4)
- Model considering Phase 2 impact / outcomes at programme level
  - Coordinated standardisation contribution
  - Projects contributions to WGs to reach the programme KPIs
  - Participation to a demonstration of 5G Infrastructure PPP project functionalities, potentially inside a large EC booth in MWC 2019 (EU flagship Phase 2 demonstration)
- Model considering dedicated open “Blue” TAs that would clearly reinforce the Model, as identified from Evaluators / EC Officers perspectives
  - Inclusion of outstanding / disruptive TA not identified in the Model
  - Inclusion of a second instance of a defined TA in the Model
  - Not creating gap(s) in the Portfolio
- Model capitalising on Phase 1 experience (incl. Phase 1 preparation survey feedbacks)





# Phase 2 Pre-structuring Model Model Roadmap

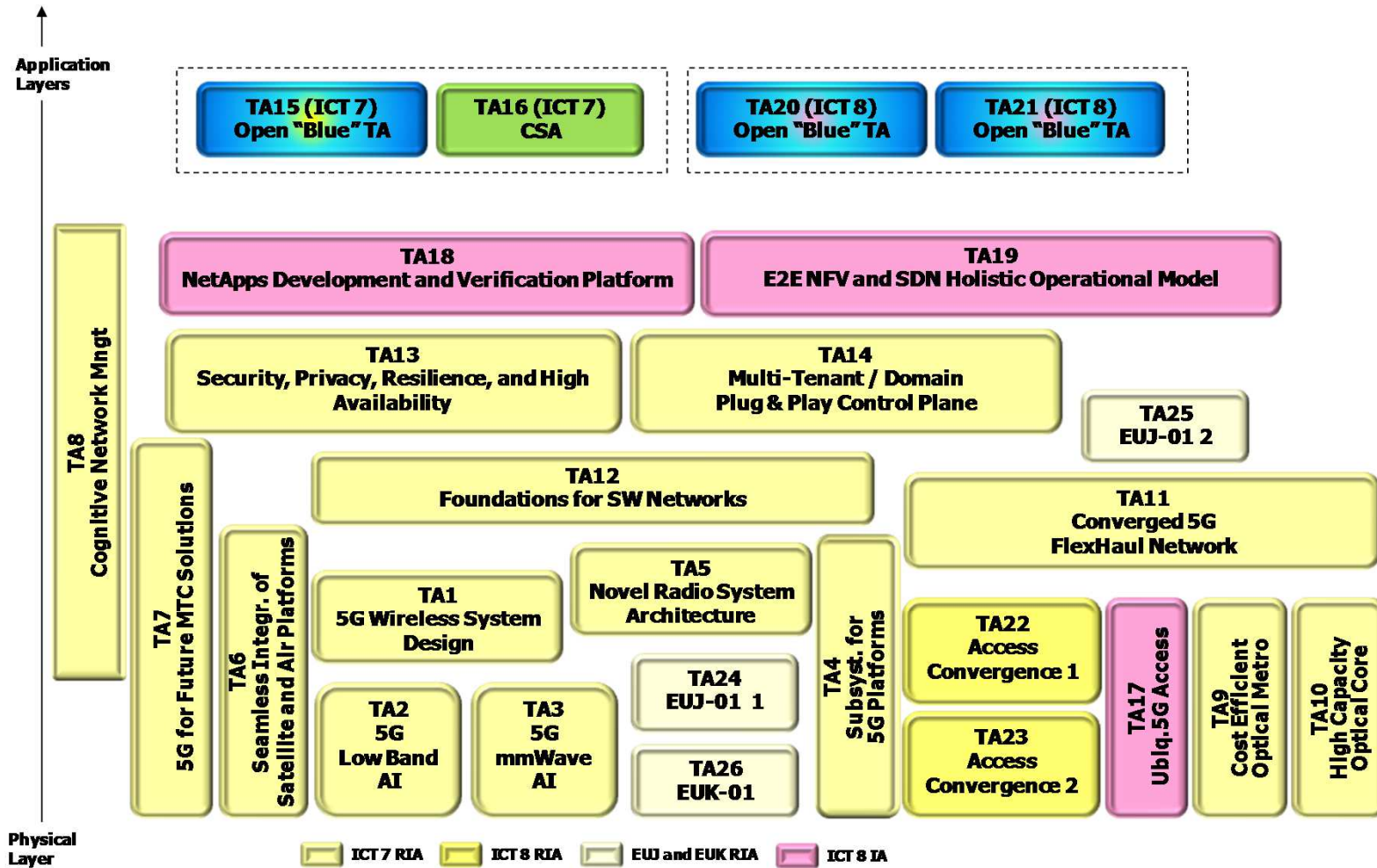


- Model version 1.0 released on 02.11.15
  - Model including 14 TAs defined by Association and 1 « Blue » TA in ICT 7
  - Model including 5 TAs defined by Association and 2 « Blue » TAs in ICT 8
- Open Consultation organised by 5G Infrastructure Association on the basis of Model version 1.0 (DL on 31.12.15)
- Forthcoming PPP Info Days and Awareness events incl. specific discussions on the Model
  - First EC Info Day on 21.01.16. Detailed definition of Info Days and Awareness Events on-going
- Model version 2.0 to be released the latest on 07.03.16
- Model version 2.0 to benefit from the Open Consultation and interactions organised during Info Days and Awareness Events
  - Model to include 14 TAs in ICT 7 (fully defined TAs or also incl. « Blue » TA)
  - Model to include 7 TAs in ICT 8 (fully defined TAs or also incl. « Blue » TAs)
- Phase 2 Call opening on 10.05.16 (20.10.15 for EUJ and EUK)
- Phase 2 Call deadline on 08.11.16 (19.01.16 for EUJ and EUK)

# Phase 2 Pre-structuring Model Model – TAs Portfolio (1/7)



5G Infrastructure PPP  
The European path towards global next generation communication networks



Note: The size and the orientation of the TAs boxes do not indicate the potential size or manpower of future Projects

# Phase 2 Pre-structuring Model Model – TAs Portfolio (2/7)



## TA1: 5G Wireless System Design



### Rationale

Standardisation and introduction of 5G will be done in phases. The TA 5G Wireless System Design addresses forward compatibility, in particular in the radio segment but also for related computation and storage resources. Proposals should address new topologies including D2D and mesh networks, utilisation of different spectrum ranges and paradigms, service-specific C- and U-planes, and support of new services with not yet known requirements.

### Objective

- To continue the evolution of the 5G wireless system to ensure forward compatibility for all 5G use cases and enable later deployment of the additional services beyond 2020
- To support new business and service models for the telecom industry, e.g. verticals integration and Over-The-Top providers
- To prepare test-bed environments to show and evaluate first 5G prototype(s)
- To provide close cooperation with relevant 5G-PPP projects and harmonised action towards bodies standardising 5G

### Scope

- A Multi-RAT 5G system that
  - Allows a continuous evolution of 5G wireless systems and provides a smooth migration from current technology
  - Addresses service requirements from mobile broadband, mission-critical services, IoT and verticals
  - Includes innovative spectrum usage concepts (e.g. LAA and LSA), flexible and full duplex system and energy efficient operations
- RAN architecture (radio and RAN interface evolution) and considerations about the CN/RAN logical split e.g. characteristics of RAN/CN interface evolution to support
  - Service-aware access and ultra-low latency Machine-Type communication
  - Advanced aspects of spectrum sharing, handling mobility and small cell discovery in a highly directional environment, sharing of spectrum between mobile access, fronthaul and backhaul
  - Ultra-dense deployments, D2D and mesh topologies
- Ensure overall KPI evaluation by providing an evaluation framework, preparing test-beds, and performing an overall assessment in close collaboration with other relevant 5G-PPP projects
- Study the business models for the 5G design, building on work conducted in METIS-II and other H2020 projects

### Expected Impact

- Demonstrate the feasibility of 5G solutions meeting the requirements for integrated wireless communications well beyond 2020
- Impact on standardisation and regulation, e.g. 3GPP, IEEE, IETF, ITU, ONF, OPNFV, ETSI NFV/MEC
- Evaluation of 5G proposals submitted to the ITU with respect to IMT 2020 requirements from a 5G-PPP perspective
- Contribution to the forecasted EU booth in MWC 2019 showcasing the set of Phase 2 projects functionalities and capabilities

# Phase 2 Pre-structuring Model Model – TAs Portfolio (3/7)



## TA8: Cognitive Network Management

### Rationale

The research area aims to stimulate project proposals that enable the full potential of 5G networks and services to be realised through cutting edge cognitive network management. The research area encompasses the full breadth of 5G management including service-Driven, RAN / Cloud-RAN and SDN/NFV. Contributions should be aligned with overall 5G standardisation trends and will build on the developed concepts and basic architecture developed in Call 1.

### Objective

- Create powerful Cognitive network management solutions for 5G networks, considering all parts of the network (radio, backhaul, core, transport)
- Investigate Cognitive service level management for end-to-end QoS and QoE
- Create Edge Computing configurability, operability and manageability
- Investigate Service driven network management in an SDN/NFV-enabled 5G network

### Scope

- Use adaptive and self-learning methods to exploit big network data for network management
- Coordinate management of mixed environments consisting of physical and virtual network functions
- Leverage unified network management across multiple operator networks
- FCAPS for multiple virtualised networks and "slices"
- Cognitive network management covering self-configuration, self-optimisation, prediction, alarm correlation between physical faults and software failures
- Monetise cognitive insights by making them available to third parties (e.g. smart cities)
- Build a joint model for QoS and QoE that reflects different QoE expectations in different "slices"
- Develop QoE definition, estimation, and prediction methods
- Enable network-aware services and QoE-based management
- Provide mechanisms to apply user-definable data privacy settings

### Expected Impact

- Reducing operational cost in complex and dynamic environments
- Enabling operators to easily deliver satisfying QoE towards their customers
- Increase the experience and service quality as perceived by the users (e.g., industry verticals) in 5G networks
- Management platforms able to manage SDN/NFV-enabled 5G networks and infrastructures, advancing complex deployments of VNFs
- Contribution to the forecasted EU booth in MWC 2019 showcasing the set of Phase 2 projects functionalities and capabilities

# Phase 2 Pre-structuring Model Model – TAs Portfolio (4/7)



## TA9: Cost-efficient Optical Metro Networks for 5G Backhaul



### Rationale

This TA focuses on the next generation of cost-sensitive and dynamic optical metro networks for 5G backhaul. Research on simplified switching nodes offering faster reconfiguration times, new optical amplifiers supporting frequent network, and cost-effective multi-rate/format/reach/flow transponders, terminals with reduced footprint and an optical layer control plane facilitating trans-layer coordination and optimisation for seamless 5G integration is necessary.

### Objective

To develop the next generation of optical metro networks for 5G backhaul, based on:

- Novel architectures in the cost-sensitive 5G backhaul, aggregation and metro access markets, leveraging cost-performance trade-offs possible due to shorter reach and simpler network topologies
- Simplified, more cost-effective switch nodes offering lower latency and faster reconfiguration times
- New optical amplifiers supporting frequent changes of network configurations
- Cost-effective multi-rate/format/reach/flow transponders and terminals with reduced footprint, to enable a flexible and dynamic (re)configuration according to the traffic demand, channel condition and selected path, based e.g., on multicarrier technologies
- Common control plane, leveraging flexibility from elastic interfaces transforming the operation of today's networks infrastructure and reducing over-provisioning and margins, in order to increase overall network equipment utilisation

### Scope

- Definition of a new data plane for the optical metro, backhaul and aggregation network segment (network and node architecture, system design and transmission dimensions)
- Cost-efficient transceivers, amplifiers, multiplexing and switching elements („just good enough optics“), enabling a flexible and dynamic (re)configuration according to traffic demand, channel condition and selected path
- Open and extensible optical layer control plane facilitating trans-layer coordination and optimisation as well as virtualisation for multi-tenancy

### Expected Impact

- Optimised backhaul solutions ensuring that smaller cell sizes demanded by 5G can be connected appropriately
- Optimised optical network and system architectures responding to overall 5G energy savings and service creation goals
- New building blocks for lower cost per bit facilitating a massive deployment of ubiquitous 5G access and CloudRAN
- Contribution to relevant standard bodies (e.g. IEEE, ITU-T, IETF, ONF, OIF)
- Contribution to the forecasted EU booth in MWC 2019 showcasing the set of Phase 2 projects functionalities and capabilities

# Phase 2 Pre-structuring Model Model – TAs Portfolio (5/7)



## TA14: Multi-Tenant & Multi-Domain Plug & Play Control Plane



### Rationale

5G networks will support a concept of "slicing" that allows providing different sets of services to different groups of terminals, such as smart phones, cars, sensors, etc. Proposals should address how to realise the "slicing" concept in a dynamic and multi-party environment.

### Objective

- Develop "plug-and-play" framework for the control plane, that discovers service components owned by multiple players and dynamically composes them into tenant-specific "slices"
- Seamless (horizontal) integration of different domains via dynamic collaborative mechanisms and support multi-tenancy at all layers.
- Provide the technical, economic, and regulatory framework for automatic 5G service negotiation, provisioning, monitoring, and charging with and between providers as needed
- Develop business models based on innovative compensation schemes between different providers of multi-domain infrastructures and services

### Scope

- On demand creation of a control plane that allows different players to effectively slice and share available resources to compose end-to-end services, and to properly monitor them
- Context-aware on demand virtualisation and relocation of services as-a-service across domains
- Analysis of potential business roles, relationships, and barriers to sustainable growth
- 5G service description schema for service matching and brokerage covering the diversity of requirements including vertical specifics. Push outputs to relevant standard bodies
- Support a configurable degree of service exposure according to the confidentiality and dynamic pricing requirements
- Service templates for automatic service instantiation upon composition of a "slice"
- Dynamic delegation of control tasks between controllers
- Automatic multi-party negotiation, contracting, and provisioning of composite 5G services for different business relationships including inter-carrier, SP-to-SP, brokerage, federation, aggregation, etc

### Expected Impact

- Contributions towards an industry standard practice for automatic on-demand 5G service trading
- Foundation of a digital single market of 5G services with SLA guarantees, enabling new types of services and novel business models for more users and sustainable industry growth
- Drive relevant standardisation bodies (ETSI NFV, 3GPP, ONF, IETF) and publish open source software
- Contribution to the forecasted EU booth in MWC 2019 showcasing the set of Phase 2 projects functionalities and capabilities

# Phase 2 Pre-structuring Model Model – TAs Portfolio (6/7)



## TA17: Ubiquitous 5G Access Leveraging Optical Technologies



### Rationale

Optical network technology is key enabler to meet the demanding 5G goals and to realise a true 5G end-to-end vision. This TA focuses on the next generation of optical access networks for 5G fronthaul to enable a massive deployment of ubiquitous 5G radio access and CloudRAN and fixed mobile convergence by integrating radio and optical access technologies.

### Objective

- To conceive efficient hardware for new optical access networks for 5G mobile fronthaul
- To design a unified control architecture of a converged 5G system covering heterogeneous radio, optical access, and optical fronthaul technologies in tandem
- To enable a dynamic and coordinated radio and optical network resource management
- To facilitate a tight optics-wireless integration at equipment, link and network level

### Scope

- New optical access network solutions for fronthaul 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
- Co-operative radio-optical approaches to increase capacity and cancel interference
- Efficient mapping techniques for 5G channels to optical transport
- Novel fiber to the antenna architectures including hybrid cable approaches for remote powering
- Radio and transport resource control and orchestration using SDN approaches
- Methods for sharing limited vBBU resources between multiple antenna sites
- Adaptive modulation transmission
- Operational tools, tests and procedures for simpler fronthaul deployment and service assurance
- Energy efficient infrastructure considering limited power sources and remote powering

### Expected Impact

- 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 supporting the 1000 capacity increase objective
- Demonstrated scalability, close to operational context, of the proposed technological approach
- Contribution to standards, notably 5G and optical access
- Optical access interface with 10 times lower energy consumption
- Definition of fixed mobile convergence services to meet fixed and 5G mobile user needs
- Contribution to the forecasted EU booth in MWC 2019 showcasing the set of Phase 2 projects functionalities and capabilities

# Phase 2 Pre-structuring Model Model – TAs Portfolio (7/7)



## TA19: End-to-End NFV and SDN Holistic Operational Model



### Rationale

Software Networks are a trend that brings multiple benefits but directly impact into the network operation strategy. As there are a variety of SDN and NFV solutions and adoption strategies, it is necessary to elaborate operation models with different maturity levels to leverage the adoption of these technologies.

### Objective

- Develop an holistic operational support system for end-to-end network service functionalities
- Address the DevOps challenges operators face with the NFV evolution of softwarisation and open sourcing
- Setting Operational Business boundaries including trust, isolation and enforcement
- The sensible SDN/NFV combination, showing pros&cons, tech benchmarks and roadmaps, etc is necessary to speed up the adoption

### Scope

#### Operation

- APIs and monitoring for an NFV SDN Holistic Operational Model
- end to end support for operation of next generation VNFs
- Operation support for network services combined of both physical and virtualised network functions,
- Support for multi vendors, multi-sites and multi VIM, as well as Multi-domain Service Orchestrator towards different domains of NFV Orchestrators
- involve key actors of the value chain in the operational model (not only the operators, but also vendors, OTT and netapps developers, Cloud Service Providers) in the resulting models (shared virtualised infrastructure in slices, multi-operator, 3rd party infrastructure, etc)

#### Development

- Enablement of the testing of new VNFs in an operational networks
- Operationalising the use of Open Source solutions, tackling specific issues such as interoperability, updates, and leveraging the benefits
- Unified programmability models and control abstractions for network functions and network elements

### Expected Impact

The main output will be a Platform As A Service for 5G that will enable these DevOps scenarios

- Enabling the operation of next generation VNFs that would operate in a multi sites, multi VIM platform in conjunction with physical network functions
- Cost reduction and rationalisation of OSS/BSS tools and strategies
- Contribution to the forecasted EU booth in MWC 2019 showcasing the set of Phase 2 projects functionalities and capabilities

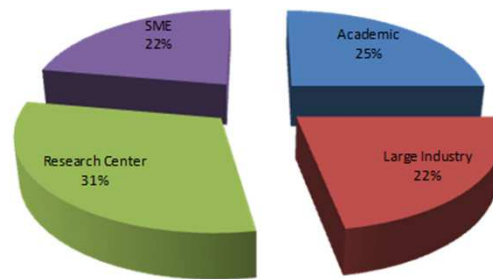


# Phase 2 Pre-structuring Model Public Consultation (1/3)



## Public Consultation in a Nutshell

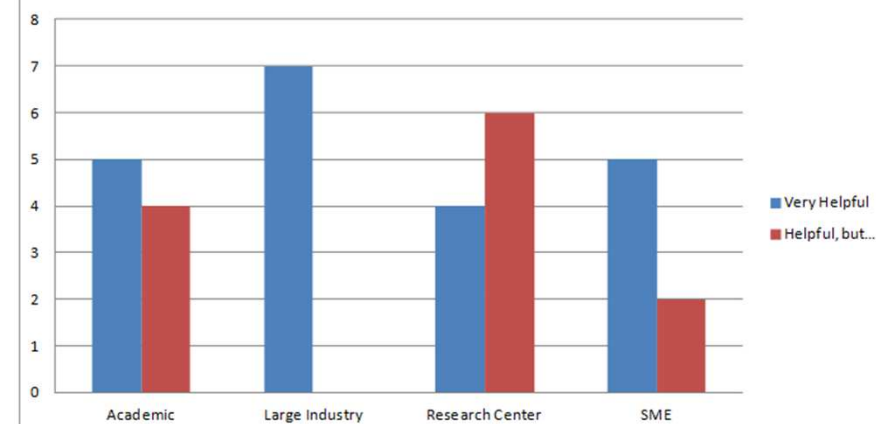
Public Consultation - Contributing Stakeholders



- ✓ Public consultation incl. wide communication
- ✓ 36 individual answers
- ✓ Homogeneous distribution over stakeholders categories

- ✓ Model seen positively (e.g. no single "Not relevant" answer)
- ✓ Few comments incl. (1) Expecting more TAs on SN in ICT7, (2) Challenge for « small » partners to follow the process, (3) Equal chances for applicants, (4) Opening vs existing Projects, (5) Some overlapping TAs and (6) Too many acronyms

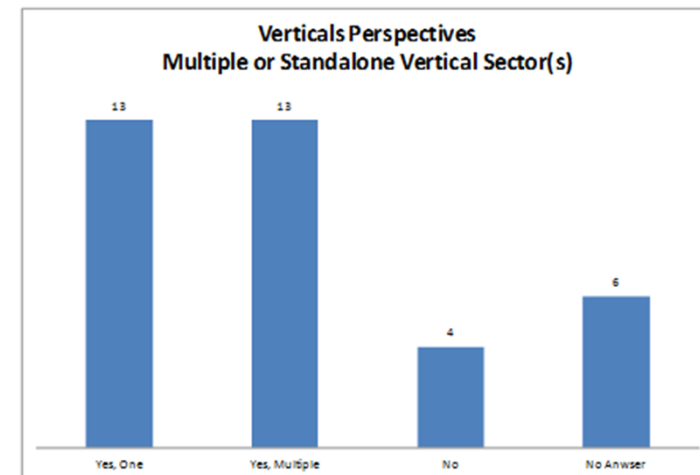
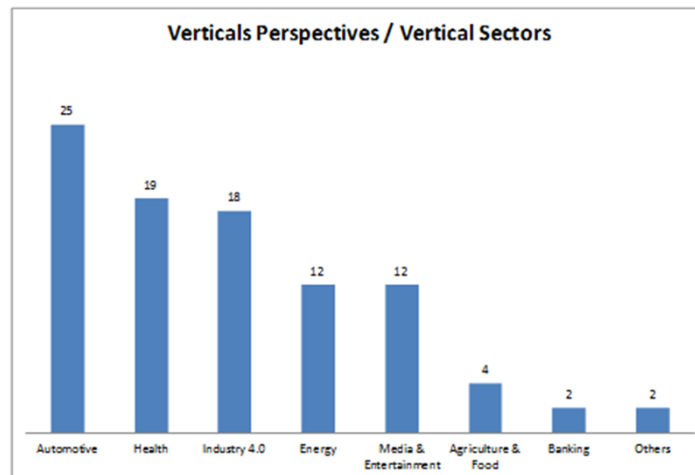
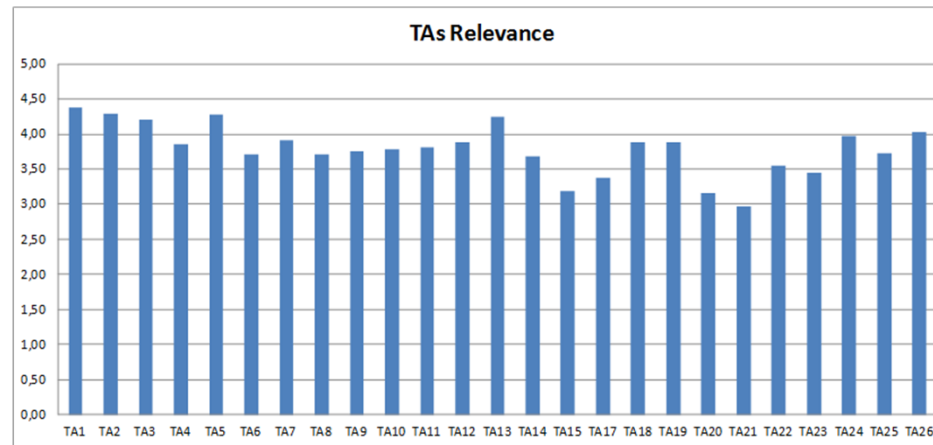
Model Approach - Global Perspective



# Phase 2 Pre-structuring Model Public Consultation (2/3)



## Public Consultation TAs Statistics



# Phase 2 Pre-structuring Model Public Consultation (3/3)



## Public Consultation TAs Comments (Highlights)

- TA1: *“D2D is mentioned, what about V2X for connected cars operations as D2D technologies can be directly leveraged (and expanded) to cover V2X PC5 side link...”*
- TA5: *“Consider Energy Efficiency supervision layer...”*
- TA6: *“TA6 objectives should be the starting point, rather than the specific technology “satellite and air platforms”. Hence, we propose to change the TA6 title to “ultra-low cost 5G for low density and very low ARPU scenarios”. These scenarios should include emerging countries...”*
- TA8: *“Scope should include coordination of ultra dense deployments to increase network capacity and assure different levels of QoE...”*
- TA12: *“If this includes communication/theoretic investigation of the data/control relationship, then it becomes very interesting as a new academic research area...”*
- TA13: *“Good idea to put high availability and resilience here with security, as they can be seen as means to counter DDoS”, “Covers too much. Would suggest to split: 1) Security, Privacy 2) Resilience, High Availability”*
- TA21: *“The virtualisation of the functions and services from infrastructure implementation brings opportunities for cities and nations in coordinated manner (...) requires some business experimentations and large scale demonstrators across advanced cities; demonstrating the integration of business and technologies”*

# Phase 2 Pre-structuring Model

## Phase 2 Pre-definition Plan Up-dates



### Up-to-date Phase 2 Pre-definition Plan Roadmap

- PPP Phase 1 Portfolio analysis
- PPP Phase 1 Post-mortem analysis (incl. survey)
- PPP Phase 2 Recommendations definition
- PPP Phase 2 Pre-structuring Model definition version 1.0 and public consultation
- PPP Experimentation Strategy definition
- PPP Phase 2 Info Days and Awareness events
- PPP Phase 1 synchronization during EuCNC 2016
- PPP Phase 2 Pre-structuring Model Version 2.0 to benefit from the public consultation and interactions organised during Info Days / Awareness Events
  - Model to be widely accepted by the Community and to be recommended by Association and EC as « reference » platform and guidelines for the further development of Proposals
  - Model to be provided as input to the Evaluation
- Brokerage Platform definition, design and implementation, to benefit from discussions during Info Days / Awareness Events
- Solid FAQ webpage to be developed and up-dated until the Call 2 deadline so that all Community members have access to the latest information





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

