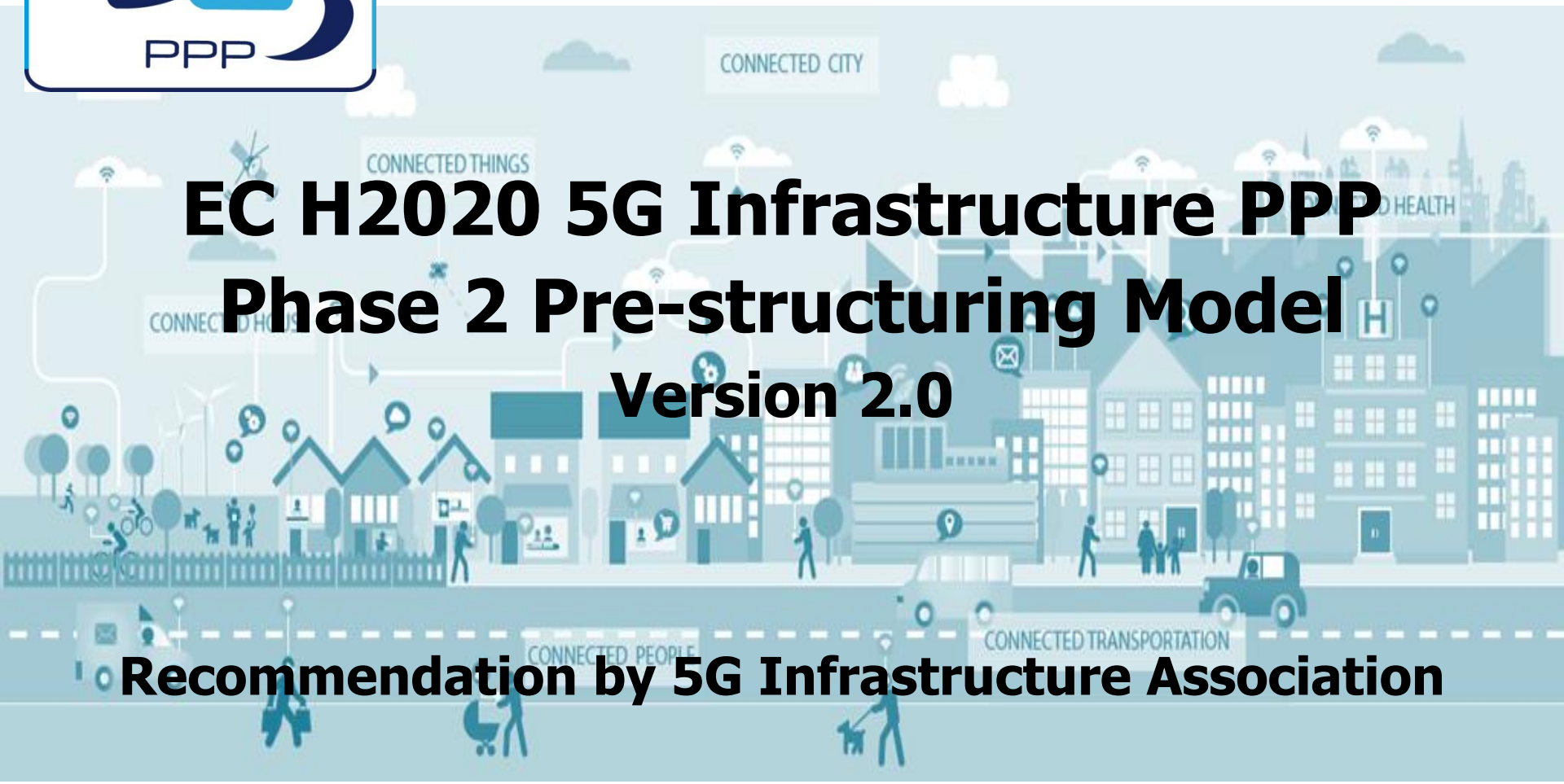


EC H2020 5G Infrastructure PPP Phase 2 Pre-structuring Model

Version 2.0

Recommendation by 5G Infrastructure Association

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model Approach

- 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 PPP 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

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model Scope & Coverage

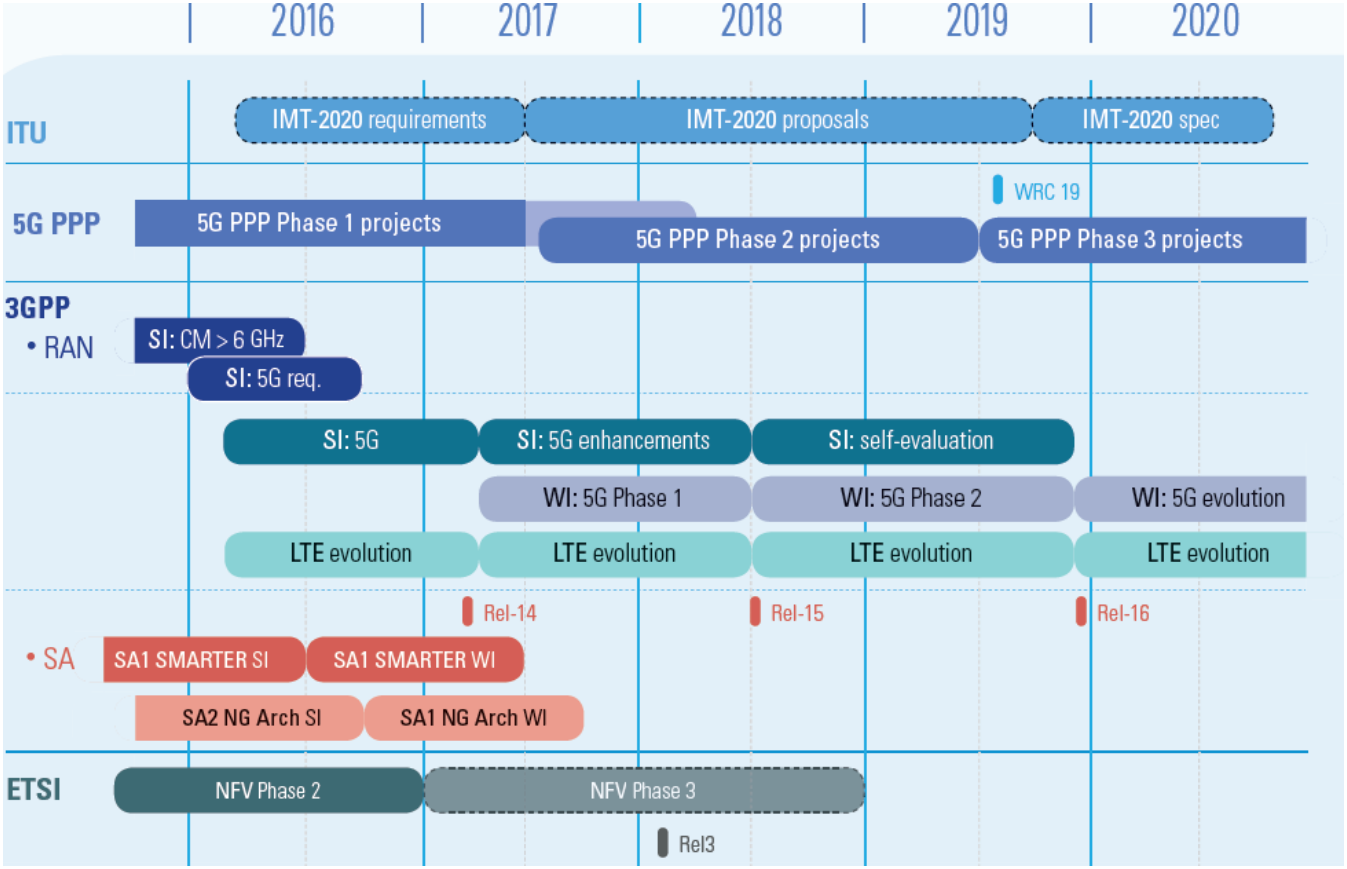
- Model addressing EC WP2016-17 5G Infrastructure PPP Strategic Objectives (http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-ict_en.pdf)
- ICT-07-2017: 5G PPP Research and Validation of critical technologies and systems
  - RIA Strand 1: Wireless Access and 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

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model Specificities (1/3)

- Model fully capturing the PPP 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 PPP 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 PPP 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 PPP Phase 1 experience (incl. Phase 1 preparation survey feedbacks)

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model Specificities (2/3)

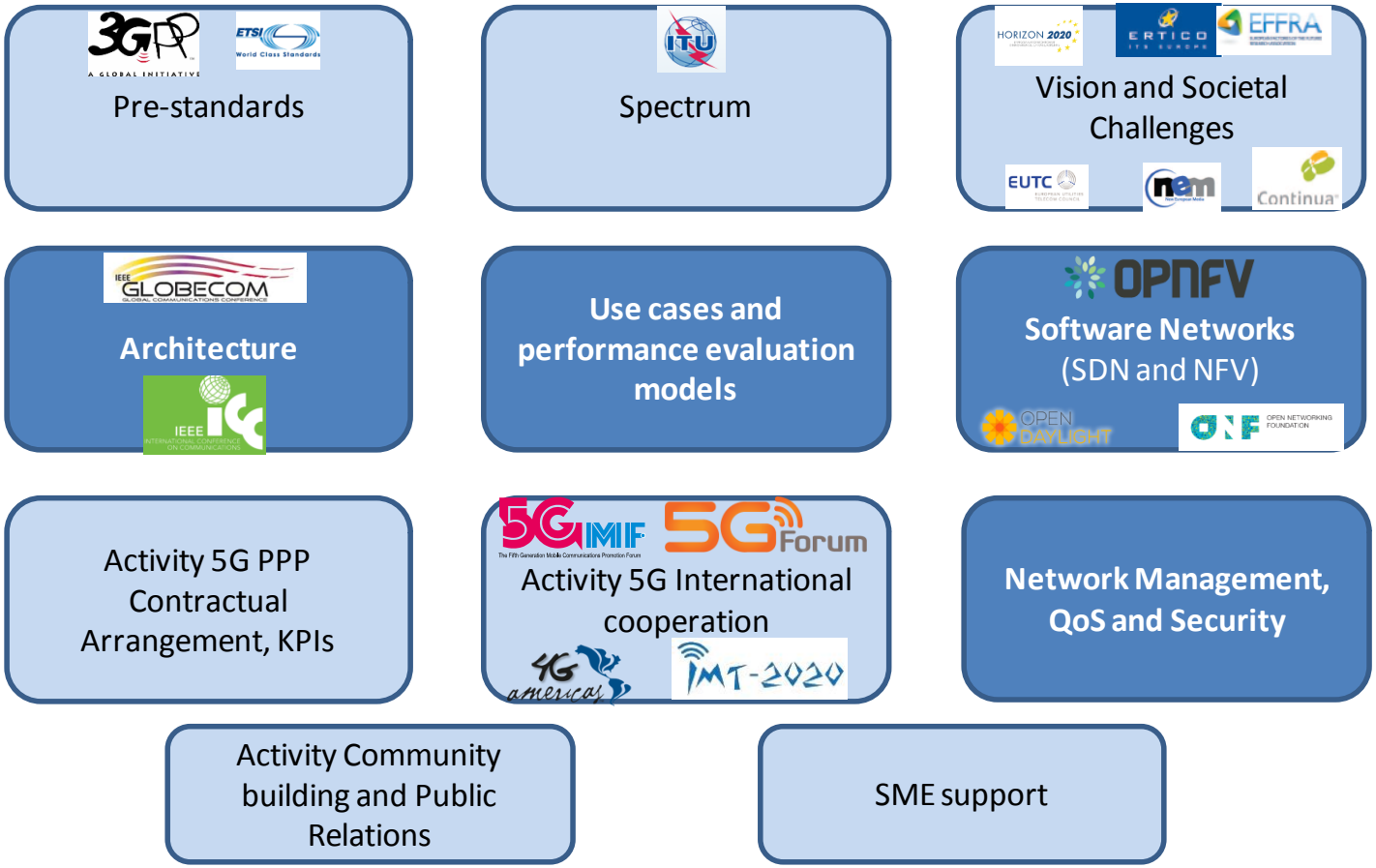
- Model considering PPP Phase 1 experience and running projects start-of-the-art
- Model considering 5G global standardisation roadmap



EC 5G Infrastructure PPP – MWC 2016 White Paper "5G Empowering Vertical Industries"
(https://5g-ppp.eu/wp-content/uploads/2016/02/BROCHURE_5PPP_BAT2_PL.pdf)

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model Specificities (3/3)

- Model considering PPP Phase 1 program experience and running Working Groups

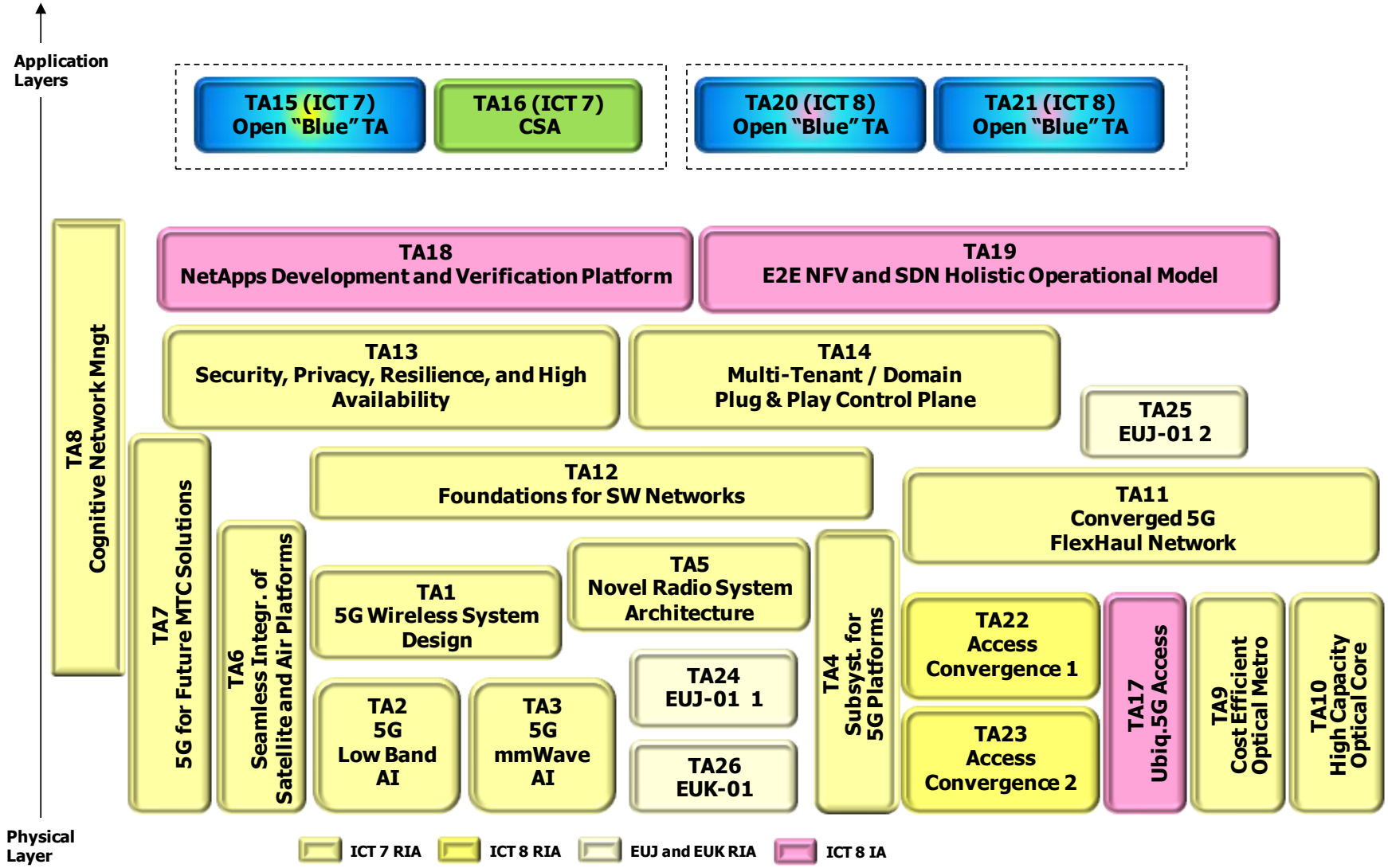


EC 5G Infrastructure PPP – Phase 1 Working Groups – EC Info Day – 21.01.16 – Brussels
(http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=13340)

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model Roadmap

- Model version 1.0 released on 02.11.15
- Open Consultation organised by 5G Infrastructure Association on the basis of Model version 1.0
- Forthcoming PPP Info Days and Awareness events incl. specific discussions on the Model
  - EC Info Days organized on 21.01.16 in Brussels and to be organized on 17.03.16 in Bologna, 18.05.16 in Warsaw and 01.07.16 in Athens
- Model version 2.0 (final version) benefiting from the Open Consultation and all interactions organised during the 1st EC Info Day
  - 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
- Brokerage Platform to be implemented on the basis of the Model version 2.0
- 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)

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model – TAs Portfolio



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

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model – ICT 7 TAs

ICT 7 TAs covering

- **RIA Strand 1: Wireless Access and Radio Network Architectures/Technologies**
- **RIA Strand 2: High Capacity Elastic – Optical Networks**
- **RIA Strand 3: Software Networks**
- **CSA**

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 coexistence and resource allocation of eMBB, mMTC and uMTC, new topologies, e.g. D2D (including V2X) 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 and context-aware access, and ultra-low latency Machine-Type Communication
    - Advanced spectrum management, including access 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, mesh topologies, and D2D including V2X
- 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 EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA2: Air Interface and Multi-Antenna, Multi-Service Air Interface

Rationale

The 5G air interface shall support a large diversity of use cases while staying forward compatible and being able to evolve over a long period. Using existing results, specified configurations are to be developed and evaluated. Respective adjustments and extensions/adaptations of the set of design elements from earlier projects are required. Multi-antenna methods scaling in number of antennas and array dimensions are targeted. Phase 2 extends the design (from Phase 1) to cover efficient support of small packets, localised/isolated networks, natural disaster scenarios and low cost/wide area coverage for low ARPU regions. The inclusion of representatives from verticals is to be envisaged.

Objective

- Moving the multi-service air interface into the next level of maturity. Keeping service flexibility, forward compatibility and efficiency in terms of spectrum, energy and cost
- Expanding the scope of use cases: Flexible spectrum utilisation, seamless mobility enhancements, localised networks, high altitude and satellite
- Expanding the fundamental knowledge related to: Waveform and frame design, advanced receivers, technologies for large-scale multi-antenna arrays
- Backing up standardisation, along the main use cases eMBB, mMTC, uMTC;
- Supporting security mechanisms on the air interface

Scope

- Stress test of main requirement profiles: eMBB, mMTC, uMTC and performance assessment
- Extended design for corner cases/special scenarios (satellite, low ARPU regions, disaster mode, localised/isolated industrial networks)
- Optimisation for small packets: Trade off between data interruption, power saving, signalling load
- Radio frame design for scalable multi-antenna methods – FDD and TDD cases (pilots and feedback)
- Shared spectrum use, flexible (full) duplex, supported by multi RAT measurements
- D2D operation (detection and relaying), local networks
- Support of (indoor) localisation
- Advanced receivers optimised for new air interface concepts and localised signals
- Integrate efficient caching policies leveraging on new 5G air interface with multicast/broadcast capabilities and PHY procedures applied at small base stations and D2D devices or satellite terminals

Expected Impact

- Air interface design for a multi-service 5G system
- Assessment, stabilisation and integration of Phase 1 project findings targeting standardisation
- Validation of the integrated technology elements for the main use cases as a basis for future development
- Create basis for development and realisation of the systems: HW requirements, input for the design process, provide algorithms
- Set directions for future research within the forward-compatible 5G air interface framework
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA3: New Spectrum and mm-Wave Air Interface for Access, Backhaul and Fronthaul

Rationale

Addressing forward-compatible and holistic solutions for new spectrum and "mm-wave" air interface , research should build on and significantly go beyond initial concept design investigation of 5G PPP Phase I, considering in addition to enhanced Mobile Broadband (eMBB) challenges of ultrahigh data-rate ultra-low latency use cases coming from verticals, as well as addressing new self-backhaul and fronthaul technologies to support novel architectural solutions for operators, e.g. 5G cloud-RAN and access SDN

Objective

- To perform detailed system research and final system definition of an air interface for access, backhaul and fronthaul operating in an optimal range of frequencies between 6-100GHz (licensed and unlicensed), in line with previously identified technology components and an overall 5G system architecture
- Developing target requirements for IMT-2020 operating in high frequency bands

Scope

- Research and development of solutions beyond eMBB to vertical use cases, e.g. 5G automotive and 5G broadcast
- Enhanced channel models to incorporate high-mobility use cases, covering the entire 6-100 GHz range
- Transceiver and multi-antenna technologies (e.g. phased and switched array antennas) and prototypes , addressing energy efficiency and energy harvetsting, high mobility, ultra fast beam tracking and beam adaptivity
- Investigation and optimization of cross-layer and higher layer (transport) aspects to achieve a superior user-experience
- Interference management for highly densified mmWave-enabled RANs including self-fronthaul and backahul topologies
- Multi-connectivity aspects for resilient operation of mmWave and below-6GHz RATs operating in licensed and unlicensed bands
- Robust optimization and validation of the developed concept in terms of technology performance, energy efficiency, cost and complexity, complemented by techno-economic analysis
- Medium/large scale trials of developed solutions, demonstrating and validating feasibility of using candidate bands for 5G as input to standards and regulatory bodies

Expected Impact

- Holistic demonstration of mm-wave based 5G RAT feasibility supporting the above-mentioned eMBB and vertical use cases
- Strong European contributions to full IMT-2020 compliant 5G standards
- High impact on a European position in preparation for WRC19 identification of globally to be used frequency bands for 5G
- Developed solutions as an enabler of novel services and capabilities for vertical sector
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA4 : Subsystems(*) for 5G Platforms: Integration of Hardware and Software Aspects

Rationale

TA4 addresses the Work Program scope on "hardware architecture technologies for 5G" and "proof of concepts, demonstrators, experimental testing activities". The importance of research on 5G platforms, both hardware (HW) and software (SW) relies on the fact that new functions are to be implemented, integrated and evaluated, also in coexistence with legacy air interfaces. In this context, HW/SW platforms capacity, complexity, power consumption and cost should be traded-off and optimized. Research, prototyping and testing of key subsystems of 5G platforms is the focus of the action. TA4 targets a holistic look on 5G complexity, including future terminals and network elements facing implementation challenges.

Objective

- To research, evaluate and showcase highly efficient HW/SW platform subsystems for 5G supporting relevant scenarios and use cases, and considering existing and new frequency bands and air interfaces (potentially coexisting)
- To study the tradeoffs that are associated with the scalability, versatility, energy efficiency, and cost of 5G platform subsystems while also achieving the capacity, intelligence, and user experience expected from the 5G network

Scope

- Highly flexible, reconfigurable, modular, and scalable subsystems for future 5G RAN platforms (terminals and network elements) including research, evaluation and prototyping of analogue and digital HW and SW subsystems
- Energy-, spectrum-, and cost-efficient transceiver and SW subsystems for network elements and terminals, including aspects of virtualisation, air interface, low-complexity sensor nodes, array design for scalable multi-antenna methods, etc.
- Test, measurement and assurance methodologies to assess KPIs of subsystems (data rate, latency, energy efficiency…) and their trade-offs (e.g., versatility versus cost or energy efficiency), considering 5G use cases like ultra-high-definition services, mobile gaming, virtual reality and augmented reality
- Trials and demonstrations of selected subsystems of network elements and devices targeting a high technology readiness level
- Alignment to 5G systems considered in other TAs and coordination of joint demonstrations

Expected Impact

- Ensure viability for 5G platform subsystems to support 5G concepts and functions
- Demonstrate/showcase of subsystems featuring re-configurability, modularity, scalability and improved energy- and spectrum-efficiencies, as reference designs for 5G. Show HW/SW solutions for emerging 5G technologies
- Maintain Europe at the forefront of HW/SW subsystem developments and overall knowhow for 5G technologies
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

(*) A defined complex part (i.e. combination of key components) for a 5G system element (e.g. 5G Terminal, Network element) in a 5G network

TA5: Novel Radio System Architecture

Rationale

Phase 2 addresses the integration of the 5G architecture building blocks developed in Phase 1 as well as new architecture building blocks needed to meet the requirements of future 5G services into an overall mobile network architecture from an end-to-end perspective. The e2e mobile network architecture for the 5G era shall be validated through prototyping leveraging on building blocks already developed in Phase 1.

Objective

- Design a flexible reconfigurable E2E mobile network architecture that satisfies all the considered 5G use cases by exploiting flexible function allocation and placement, leveraging centralised (Cloud) and distributed (Edge) computing and networking resources
- Further develop architecture building blocks from 5G-PPP Phase 1 into an overall E2E mobile network architecture
- Implementation of the baseline architecture and evaluation in a large-scale test-bed
- Build consensus on the mobile network architecture design in 5G-PPP
- Enable scalability in proposed 5G architectures to also support the growth beyond 2020
- End-to-End Mobile Network Architecture for the 5G era ensuring longevity of 5G investments

Scope

- Analyse user and service requirements for 5G
- Architecture design that supports multi-context awareness, multi-service and multi-tenancy
- Flexible service creation, building on service decomposition and chaining (given a selected/derived function split) through slicing
- Optimal adaptation to the underlying networking and computing infrastructure, taking into account the bandwidth and delays of the topology and leveraging cloud computing techniques and virtualisation. Study of centralisation/distribution trade-off for control functions
- Integration of control and user plane and management functions developed by other architecture projects. Study of centralisation/distribution trade-off for control and management functions
- Dynamic and energy-efficient RAN and CN function deployment, holistic coordination of mixed deployments
- Interaction with transport network including satellite backhauling
- Incremental deployment of the proposed architecture and co-existence with legacy equipment
- Specification of functional, logical and deployment architecture as well as protocols

Expected Impact

- Influence NGMN and standardisation bodies like 3GPP, ETSI, ITU, IETF. etc.
- Implementation and evaluation of the specified architecture
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA6: Seamless Integration of Satellites Networks and Air Platforms into 5G

Rationale

Satellite and high altitude platform solutions, thanks to their inherent characteristics will contribute to augment the 5G service capability and address some of the major challenges: multimedia traffic growth, ubiquitous coverage, M2M communications and critical telecom missions whilst optimizing the value for money to the end-users.

Objective

- Coverage increase of 5G services (including rural areas, emerging countries,…) including ultra low cost and low ARPU scenarios
- Improvement of terrestrial network resiliance
- Improvement of overall network capacity (satellite backhauling, traffic offloading,…)
- Fast reaction time of global communication networks in emergency situations
- IoT applications when there is not terrestrial coverage
- Consider also aerial platforms beyond satellites (micro-sats in low-orbits, high altitude platforms, low latitude platforms)
- Provide technology recommendations on the usage of spectrum across satellite and terrestrial 5G
- Seamless selection of access technology to preserve connectivity
- Softwarisation of satellite networks via adoption of SDN and NFV techniques

Scope

- Identify the scenarios and business cases in which the satellite/aerial coverage plays an essential role for 5G
- Design an hybrid system to integrate both terrestrial and satellite/aerial schemes focusing on Wireless mobile backhauling networks, Content-delivery networks over broadcast towards edge cellular network, Satellite component for MTC and public safety communications, Wireless access based on Low Altitude Platforms and Energy-efficiency
- Perform feasibility studies/demonstrations to validate the seamless integration
- Development of adequate network and service interfaces to fast deployment of satellite-enabled services
- Exploit the satellite/aerial communication networks capability to reach both the final users and/or to feed the terrestrial networks towers/cabinets/infrastructures
- Analyze and assess the role of satellites in the 5G network (global) management/signaling thanks to the broadcast capabilities
- Exploit the satellite communications teleports capability to assure access to several satellite constellations
- Efficient hierarchical backhauling, with integrated access and backhauling and ultra reliable use cases

Expected Impact

- Increase 5G network performance: meeting the requirements of ubiquity and resilience
- Demonstrate that the resulting KPIs for the hybrid networks are increased with respect to only terrestrial networks
- Inclusion of the satellite technologies in the "5G" ecosystem with seamless usage of integrated terrestrial and satellite communications
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA7: 5G for Future MTC Solutions

Rationale

The vertical industry is expected to be supported by 5G networks in highly efficient manner. These vertical industries have a diverse set of usage scenarios and it will be required to meet new challenging KPIs , e.g. very low latency, ultra high reliability, low energy consumption, support of massive connections, etc. The main driver for this action is to acquire realistic requirements from the vertical industries and provide integrated subsystem (e.g. latency, reliability, power...) solutions embedded in 5G cellular networks or network slices. Related business models will be considered for the design of adequate network and transport functions.

Objective

- To design a 5G Network capable of handling scalable guaranteed latency and scalable reliable end-to-end communications between machines and humans
- To design a 5G Network capable of handling scalable low-power and low bandwidth IoT services
- To provide network concepts for cellular, cellular-assisted and non-coverage (ad-hoc, satellite) IoT scenarios and their integration to the new 5G cellular architecture

Scope

- Vertical Requirements / use cases / Traffic calculations / spectrum demands / QoE and QoS demands
- Scalable reliable, low latency and low bandwidth, power L1 /2 design for data/control plane
- Defining new MTC UE capabilities / functions (e.g. distributed car terminals, low power IoT devices, etc.)
- SDN architecture /functions for MTC support like MEC (Mobile Edge Clouds), etc.
- Integration with legacy MTC radios, networks (e.g. WiGRID (WiMax for smart grids), 802.11p in cars, Tetra, satellite…)
- Interface design between vertical and 5G sub-system for e2e KPIs
- Validation / demo with integrated testbed solutions
- Industry forum / regulatory alignments (e.g. NGMN, ITU,…)
- Technical standardisation for aligned IEC/ETSI-ITS/ETSI-SES/C2C-CC/CENELEC/Health…3GPP (area is specific for each sector!)

Expected Impact

- Enabler for full autonomous driving, automatic control of the Smart Grid, automation, ehealth
- Support of low-power IoT devices like wearables, ehealth devices, etc. - low cost high volume 5G MTC devices
- Input for hybrid (cellular+D2D+satellite), cellular, D2D, ONF/IETF, 3GPP, ETSI, MEC, NFV standardisation
- Demonstration in large scale testbeds
- Enabler for new applications based on instantaneous sensoring and actuation (remote control like teleoperated driving, surgery, remote hands, etc.)
- Synergies with TA1,TA2 and TA5 for transforming results for specific vertical requirements
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

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 though 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 5G-PPP Call 1. Proposals addressing this TA may be focused on a limited number of use cases or particular network components eg RAN in order to avoid too wide a scope.

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
- Enhance performance by developing methods that exploit context awareness and location awareness

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 EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

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 multi-layer architectures in the cost-sensitive 5G backhaul, aggregation and metro markets, leveraging cost-performance trade-offs possible due to shorter reach and simpler network topologies
- Simplified, more cost-effective switch nodes (e.g. new ROADMs) 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 new and efficient data plane architectures for the optical metro, backhaul and aggregation network segment (network and node architecture, system design and transmission dimensions) improving e.g., the resilience, bottlenecks or energy-efficiency
- 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 (e.g. Traffic offloding in IP/WDM) and optimisation (e.g. efficient optical routing) as well as virtualisation for multi-tenancy
- Integration with the IP/MPLS backbone for 5G services

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 EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA10: High-capacity Optical Core Networks for 5G Transport

Rationale

This TA focuses on the next-generation of elastic optical core networks to support 5G traffic requirements. Research on switching nodes with enhanced flexibility and Pb/s capacities, software-programmable transceivers, spectrally efficient transmission, terminals and amplifiers facilitating multi-megameter distances, and integrated optical layer control plane is required.

Objective

To develop the next generation of optical core networks to support 5G traffic requirements, based on:

- Optical core nodes with enhanced flexibility, involving switch fabrics with high capacity, low latency and low performance penalty. Seamless integration with higher switching layers. Support of full programmability by SDN and QoS management as well as high service granularity and capacity enabled by wavelength division, spatial division and statistical multiplexing approaches. Software-programmable flex-grid, flex-rate and sliceable optical interfaces and transceivers offering 1 Tb/s and beyond speeds, leveraging multiple dimensions and innovative technologies to enhance system capacity, while enabling rate elasticity and scalability and multiple granularities. Exploitation of modulation and multiplexing domains for high spectral efficiency in excess of 10b/s/Hz
- Terminals and optical amplifiers facilitating multi-megameter distances without regeneration, possibly with the help of advanced DSP (e.g. nonlinear compensation), with power consumption targeting less than 0.1W/(Gb/s)
- Efficient optical core network architectures in terms of e.g., energy, cost, or resilience for optimal deployment in 5G scenarios
- Unified SDN control plane solutions leveraging all forms of flexibility of variable transceivers, and programmable optical devices for multi-domain multi-layer (e.g. IP over WDM) multi-vendor networks, addressing aspects such as multi-technology, network segmentation, and scalability

Scope

- Definition of a new data and control planes for the optical core network segment (architecture, system design, transmission)
- Open control and configuration interfaces for seamless control framework integration
- Abstraction of optical layer and vendor specifics enabling multi-domain/operator/vendor interoperability
- Disruptive approaches to capacity scaling employing new fibre types
- Integration with the IP/MPLS backbone for efficient IP traffic offloding in optical transport networks.

Expected Impact

- 100x capacity increase and fine-grain capacity management in next-generation core networks on regional/national scale in support of 5G traffic requirements
- Control framework for transport resources facilitating integration and operation of elastic optical networks in overall 5G architecture
- Contribution to relevant standard bodies (e.g. IEEE, ITU-T, IETF, ONF, OIF)
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA11: Converged 5G FlexHaul Network

Rationale

A Software Network system to support an access agnostic converged core network and control framework is a key 5G component to enable next generation services. This 5G key subsystem should be designed targeting specific services for vertical sectors and integrating next generation access and devices. The integration of the different front/mid/back haul networks has already started, but it should be further researched in order to arrive to sound standardised solutions.

Objective

- Advance the creation of an integrated transport network substrate that integrates virtual network functions of core functionality at the edge of the network. The transport network substrate serves all 5G inter-function communication needs, serving current and future 5G use cases by supporting all functional split options. It must integrate wireless and optical technologies for fronthaul, midhaul, and backhaul and it is optimised for extremely low latency, high scalability and resiliency. The goal is to create an end-to-end software defined transport network architecture for extremely low delay applications scaling a thousand times more connected nodes to the network

Scope

- End-to-end connectivity across all transport network segments (wireless, optical metro and core networks)
- Abstraction and virtualisation of heterogeneous transport resources (wireless and optical)
- Hierarchical orchestration of multi-domain wireless and optical transport networks
- Common control orchestration protocol definition between parent-child controllers
- Convergent core network architecture, procedures and protocols for heterogeneous access integrations
- Integration with network-wide optimisation applications implemented on virtual function management frameworks: use cases such as vEPC and vCDN
- Virtualisation and incorporation of core network functionality at the edge to the transport substrate
- Optimisation of the transport substrate for extremely low delay applications with an unprecedented level of scalability (x1000) on the numbers of nodes served and resiliency
- Self-configuration of Point of Attachment to backhaul/fronthaul connectivity, including multi-tenancy scenarios
- Advanced control plane for optical systems remotely reconfigurable, enabling high-capacity and flexible connectivity
- Cost effective (access/aggregation) optical solutions leveraging existing infrastructure

Expected Impact

- Transport network for applications with extremely low delay constraints
- Transport network and e2e connectivity for Smart Grid, sensors/actuators networks, safety, M2M and IoT
- Standard functions and interfaces, and open source reference implementations
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA12: Foundations for Software Networks

Rationale

Beyond the mere traffic steering, in the future, the software networks will need to enable on-the-fly integration of heterogeneous compute, storage and network resources into carrier-grade, networked environments. Given such software-driven composition of resources, the dynamic provision of control means becomes the fundamental, open question for the networking community.

Objective

- Design and evaluate methods, algorithms and protocols to support dynamic, unplanned composition of heterogeneous compute, storage, and communication infrastructure entities (local/remote, physical/virtual, fixed/mobile, wireless/wired/satellite, etc.) to coherent carrier-grade networked platforms featuring programmability
- Provide viable solutions for the in-resource control problem (i.e. in-band, in-storage, in-compute), where the control entities of a controlled system are themselves using resources of the above-mentioned system

Scope

- Self-organising unified control plane for the 5G resource pool with support for heterogeneous technologies, e.g., relying on the concept of unified cloud and network operating system (controllability domain)
- Agile cloud/network control systems able to seamlessly integrate and control a wide range of technologies (VMs, containers, switches, routers) across a wide range of networks and virtualisation platforms (control domain)
- Unified and Integrated network, compute and storage control abstractions, common control beyond interworking
- Support for unconstrained provision of arbitrary user abstractions across multiple segments
- Short loop caching, scheduling, processing, offloading, self-stabilisation methods to embrace the technological diversity of the realisations

Expected Impact

- Agile composition of 5G infrastructures allowing new, light business models for ownership, deployment, operation and amortisation
- New degrees of freedom in both infrastructure composition and usage that not only widens the suitability of legacy infrastructure but also enables truly new use cases across currently separate vertical industries
- Addressing overprovisioning by allowing both just-in-time compositions and excess resource reuse
- Enabling a high dynamicity in integrating previously unknown resources into the controlling realm of a particular operator
- New open source platforms enabling multi-tenancy support and true network virtualisation going beyond server virtualisation
- Testing and experimentation of such open source platforms, potentially at pan-European scales and beyond
- Standardisation of crucial protocols, architectures and interfaces and/or extensions of the latter
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA13: Security, Privacy, Resilience, and High Availability

Rationale

Security, privacy, resiliency, and high availability are mandatory for 5G success and adoption both in general, and specifically by verticals (Automotive, Industry, Smart Energy, Smart Health, Smart City, Smart Transport, …). Existing methods of assuring these aspects fall short of delivering the required levels of reliability, thus require further research and innovation for enabling 5G deployments.

Objective

- A resilient & secure dynamically configurable, adaptive and highly available virtualised/sliced infrastructure supporting end-to-end 5G services as well as critical vertical services
- Secure (and privacy-preserving) and reliable solutions for setting up services across multiple domains

Scope

Research & Innovation actions related to 5G requirements towards high guarantees of resilience and security of infrastructure & virtualised/sliced infrastructures:

- Designing and implementing high availability of 5G services and solutions to deal with extreme reliability requirements under unprecedented system complexity, involving heterogeneous networks, services and devices. This includes reliability of: SDN control, architecture and deployment of network functions, and software updates
- End-to-end security of 5G services and solutions in virtualised and softwarised deployments that include multi-domain services and service-chains deployed over on-demand infrastructure. This includes security across all software lifecycle, security in the control plane, adaptation of security mechanisms to different verticals, and evolution of relevant regulation and liabilities aspects
- Integrate security risks into availability considerations by extending reliability models by cyber attacks as causes for failure
- QoS/QoE control in the presence of transport encryption: Means for QoS/QoE control of encrypted communication
- Supporting 5G MTC with specific protocols and critical requirements, dynamic, scalable and self-adaptable monitoring mechanisms supporting integrated and predictive monitoring of 5G IoT stack implementation

Expected Impact

- Technologies and methodologies for resilient, secure and highly available end-to-end deployments of Software Networks
- A resilient execution and usage framework on top of dynamically composed infrastructures
- Standard functions, interfaces, and reference implementations
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

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 with multiple heterogeneous access domains.

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. 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"
- Overhead and performance optimization for dynamic slicing
- 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 EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA15: Open Portfolio Targeted Action

Rationale

Though the Pre-structuring Model provides a comprehensive analysis of the research needs to realize 5G systems, it is possible that 5G would benefit from inclusion of technologies not identified in the other TAs. This (optional/supplementary) TA provides an opportunity for 5G-relevant research that does not fit the other TAs. This should build on or expand expected 5G technology roadmap.

Objective

- Open Portfolio Targeted Action for
  - Inclusion of an outstanding / disruptive Targeted Action not identified in the Phase 2 Pre-structuring Model
  - Inclusion of a second instance of a Targeted Action of the Phase 2 Pre-structuring Model
- Have the potential of a significant impact on 5G evolution in 2020 time horizon

Scope

- Addressing the ICT 7 scope
- Considering the general constraints set forth on slide 5 (Pre-structuring Model Specificities considering state-of-the-art and overall 5G roadmap, including standardisation)
- Build on or expand expected 5G technologies as opposed to just expand the current state of the art
- Two possible approaches for this TA, namely single-technology approach or multiple-technology approach

Expected Impact

- Significant contribution to realisation of 5G systems through technologies that do not fit the other TAs
- Potential for enabling radically new business models and applications for 5G

TA16: CSA

Rationale

The 5G Infrastructure PPP is a programme organised over 3 phases. The CSA is supporting the development of the programme from both perspectives of PPP Initiative (projects and related Steering Board, Technology Board, Working Groups) and 5G Infrastructure Association (Association Board and General Assembly, Working Groups and Activities)

Objective

- Ensure a sound programmatic view of the implemented 5G RIA and IA results. The proposed CSA shall liaise with the 5G RIA and IA actions to exploit synergies in the implementation of the activities
- The CSA will support the development of the PPP Programme for both 5G Infrastructure Association and 5G Initiative and related Working Groups and Activities

Scope

- Programme level integration through management and orchestration of 5G PPP projects 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 for key PPP technologies and for experimental requirements and facilities, also taking into account national developments
- Proactive support to the emergence of a 5G PPP "5G vision", to key international co-operation activities. A clear proactive strategy is expected to channel relevant 5G PPP project outcomes towards key SDO's like 3GPP (standardisation work expected to start in 2016) and to valorise relevant spectrum work in the context of future WRC's
- Organisation of stakeholder events, including reaching out to users and key verticals
- Support of the communication strategy of 5G PPP
- Maintenance and animation of the 5G PPP web site and social networks tools
- Monitoring of the openness, fairness and transparency of the PPP processes
- Monitoring of 5G PPP KPIs including sector commitments and leveraging factor

Expected Impact

- Maximised output and exploitation of 5G PPP project results in key domains (standardisation, spectrum) through managed projects cooperation
- Constituency and consensus building
- Support to key international dissemination events, to core international cooperation activities, to relevant stakeholder events
- Definition of future R&I actions through roadmapping

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model – ICT 8 TAs

ICT 8 TAs covering

- **IA Strand 1: Ubiquitous 5G Access Leveraging Optical Technologies**
- **IA Strand 2: Flexible Network Applications**
- **RIA: Cooperations in Access Convergence**

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 multi-vendor 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. Integration with femto/small cells
- 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 EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA18: Development and Verification Platform for Industry-specific Network Services and Apps

Rationale

5G initiative needs to offer an agile platform and a repository to create, run and operate netapp services with examples so that operators, vendors and third parties can take advantage of and experiment with the creation of new 5G service. This will support 'verticals' in order to build show cases.

Note: It is explicitly "out of the scope" the federation of experimental platforms (FIRE testbeds) nor their sustainability models.

Objective

- Offer an agile programming and verification platform for network services & applications (NFV building blocks, VNFs and its managers) tailor made for distinct industry verticals
- Provide the tools and repository to third party developers in order to create, assemble and package chains of virtualised functions and control the deployment over network points of presence

Scope

- Open-source NFV development and verification platform to build, test and deploy vertical-specific network services and applications, for third-party service developers. NetApps will indicate respective end-to-end QoS/QoE and SLA aspects across network domains.
- Development of a library concept with enabling basic services for different application classes and traffic types such as mobile media distribution, IoT sensoring, etc
- Recognition of network slices and diverse requirements for a granular customisability of platform per vertical.
- Management of the service lifecycle and standard infrastructure monitoring for dynamic feedback to adapt execution service policies at VNF Managers. Support for deployments across several network domains.
- Repository availability with building blocks and demonstrator services to facilitate uptake and development
  Note: *To leverage on existing open NFV initiatives (OPNFV, OSM, ODL, etc) and existing R&D project outcomes (APIs, common descriptors and friendly distribution licensing) is key in the approach*

Expected Impact

- Quicker development, validation of vertical-specific network services and applications (time-to-market).
- Accelerate the adoption of NFV with necessary roadmap and blueprints for operators and vendors. Enable a NFV marketplace.
- Better integration of industry verticals into 5G networks by providing the customisable platform for developers to service specific industries (e.g. Media, Automotive, Industry 4.0, etc.) rather than generic services that do not fully exploit new network capabilities for each vertical
- Repository of open building blocks (microservices approach) to catalyse third-party developer efforts
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

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 theses technologies.

Objective

- Develop an holistic operational support system for end-to-end virtualised network service functionalities
- Address the DevOps challenges operators face with the NFV/SDN 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 across multiple domains keeping trust levels, requested QoS in sharing various data types across networks and service applications
- Operation support for network services combined of both physical and virtualised network functions,
- Support for multi vendors, multi-sites, as well as Multi-domain Service Orchestrator towards different domains of NFV Orchestrators and SDN Controllers
- 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)
- Address the SLAs across domains and also the interconnection to OSS (i.e configurations) and BSS functions (i.e. billling)

Development

- 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 virtualised 5G networks 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 towards total service continuity and reduce perceived downtime
- Contribution to EU booth at MWC 2019 with demo / testbed showcasing the set of 5G PPP Phase 2 projects results

TA20: FNA - Open Portfolio Targeted Action 1

Objective

- Open Portfolio TA for
  - Verticals Applications
  - Applications, Experimentation, Innovation

- TA left open in the Model and to consider the overall EC 5G Infrastructure PPP work and experience on 5G / Vertical, including the 5 Vertical Sectors White Papers and the latest MWC 2016 White Paper
  - 5G and the Factories of the Future (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White-Paper-on-Factories-of-the-Future-Vertical-Sector.pdf)
  - 5G Automotive Vision (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White-Paper-on-Automotive-Vertical-Sectors.pdf)
  - 5G and Energy (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White_Paper-on-Energy-Vertical-Sector.pdf)
  - 5G and e-Health (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White-Paper-on-eHealth-Vertical-Sector.pdf)
  - 5G and Media & Entertainment (https://5g-ppp.eu/wp-content/uploads/2016/02/5G-PPP-White-Paper-on-Media-Entertainment-Vertical-Sector.pdf)
  - 5G Empowering Vertical Industries (https://5g-ppp.eu/wp-content/uploads/2016/02/BROCHURE_5PPP_BAT2_PL.pdf)

TA21: FNA - Open Portfolio Targeted Action 2

Objective

- Open Portfolio TA for
  - Verticals Applications
  - Applications, Experimentation, Innovation

- TA left open in the Model and to consider the overall EC 5G Infrastructure PPP work and experience on 5G / Vertical, including the 5 Vertical Sectors White Papers and the latest MWC 2016 White Paper
  - 5G and the Factories of the Future (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White-Paper-on-Factories-of-the-Future-Vertical-Sector.pdf)
  - 5G Automotive Vision (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White-Paper-on-Automotive-Vertical-Sectors.pdf)
  - 5G and Energy (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White_Paper-on-Energy-Vertical-Sector.pdf)
  - 5G and e-Health (https://5g-ppp.eu/wp-content/uploads/2014/02/5G-PPP-White-Paper-on-eHealth-Vertical-Sector.pdf)
  - 5G and Media & Entertainment (https://5g-ppp.eu/wp-content/uploads/2016/02/5G-PPP-White-Paper-on-Media-Entertainment-Vertical-Sector.pdf)
  - 5G Empowering Vertical Industries (https://5g-ppp.eu/wp-content/uploads/2016/02/BROCHURE_5PPP_BAT2_PL.pdf)

TA22: Cooperation in Access Convergence 1

Rationale

Network Driven Device to Device is a key element for 5G that requires significant research. Market potential is very large, and it is of specific interest for the European and Taiwanese ICT sectors. Significant contributions to standards are expected because of the current dispersion of solutions.

Objective

- A 5G Network with edge consisting of Small cells and Network Driven D2D in offloading scenarios
- To provide high capacity, low latency, and high reliability to meet 5G requirements
- To provide the flexibility to instantiate services on-the-fly and transparently in the network

Scope

- Address challenging very dense user scenarios: very high capacity/low latency/high reliablity demands
- Very small cell and D2D transconnected network control, with optimal radio resource allocation
- Network-driven D2D to offload traffic from the radio access and the core
- Optimised network network-assisted and non-network-assisted radio links for inter-vehicles communications
- Define the basic building blocks of this type of network for extra flexibility and future expansions of its services
- Emphasis on its application for Edge network computing and M2M/IoT, with related verticals

Expected Impact

- Contributions to maintream standards bodies
- Converged technology to provide seamless user access over Network controlled D2D and multi-RAT small cells in very dense user/traffic scenarios
- Novel integrated fronthaul/backhaul architecture for Low latency/high reliable for moving cells or inter-vehicular communications
- Demonstration in real scenarios
- Increased cooperation between EU and Taiwan industry and academia

TA23: Cooperation in Access Convergence 2

Rationale

The high capacity demands of 5G, and the dispersion of user needs, will imply a multi RAT access network. Telecom operators need to manage this diversity with low complexity, by integrating the control of the different radio/optical access technologies, both in licensed and unlicensed scenarios.

Objective

- Harmonise the operation of licensed and unlicensed, optical and wireless access networks towards a seamless 5G access network

Scope

- Resources and Spectrum Management (incl. licensed and unlicensed)
- Smooth coexistence at the architectural level of licensed and unlicensed technologies
- Self-optimisation capabilities for smooth access convergence
- Integration of wireless and optical access
- Design of 4G/5G in unlicensed without the assistance of the licensed band

Expected Impact

- Optimal utilisation of spectrum (licensed and unlicensed)
- Optimal allocation of resources in the wireless and optical planes

H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model – EUJ and EUK

EUJ-01-2016 and EUK-01-2016 TAs covering

- **EUJ-01-2016: 5G – Next Generation Communication Networks (RIA)**
- **EUK-01-2016: 5G – Next Generation Communication Networks (RIA)**

TA24: EUJ-01-2016 - 5G Technology Assessment (RIA)

Rationale

There are ongoing industrial collaboration initiatives on 5G in both EU and Japan. These can be further strengthened by developing common positions and common standards initiatives. A joint evaluation of candidate technologies for 5G will provide a solid basis for such efforts.

Objective

- Develop common positions, standards, and interoperable systems for 5G networks

Scope

- Develop evaluation methodology for candidate technologies in 5G standardisation with focus on 3GPP
- Define technology evaluation criteria based on 5G requirements and architecture proposals
- Cover 5G radio access, ultra-lean signalling design, new spectrum and access methods, massive MIMO, a new air interface, and SON
- Provide guidelines for interoperability testing
- Develop open source testing tools for 5G component technologies
- Build local test environments using existing experimentation infrastructure
- Define required inter-operation capabilities between the open lab initiatives in Europe (e.g. FIRE) and Japan
- Leverage and extend existing open test facilities to strengthen interworking between EU and Japan
- Initiate new joint EU-Japan test facility for roaming and long-distance testing
- Provide platform for tracking standards activities and for sharing results of technology assessment
- Define common EU/Japan standardisation roadmap

Expected Impact

- Strengthen, simplify, and speed-up 5G standardisation process, particularly in 3GPP
- Improve the position of European and Japanese members of standards bodies
- Intensify and improve efficiency of collaboration between universities and research centers in EU and Japan
- Provide SMEs with open advanced test capabilities to pre-assess promising enabling technologies

TA25: EUJ-01-2016 - 5G SDN/NFV Platform Assessment (RIA)

Rationale

There are ongoing industrial collaboration initiatives on 5G in both EU and Japan. These can be further strengthened by developing common positions and common standards initiatives. A joint evaluation of 5G SDN/NFV platform technologies will provide a solid basis for such efforts.

Objective

- Develop common positions, standards, and interoperable systems for 5G computing platforms

Scope

- Develop evaluation methodology for candidate 5G platform technologies in 5G standardisation and in open source development
- Define platform evaluation criteria based on 5G performance requirements, particularly considering high dynamicity of traffic volume and characteristics
- Assess improvements that can be achieved by applying SDN and NFV in 5G platform
- Focus on standardisation at ONF, ETSI NFV, and ETSI MEC
- Develop platform performance testing tools and make them available as open source SW
- Provide guidelines for platform interoperability testing
- Set-up platform test environments using existing experimentation infrastructure
- Initiate joint EU-Japan test facility for multi-domain testing
- Provide platform for tracking SDN and NFV standards activities and for sharing results of technology assessment
- Define common EU/Japan SDN and NFV standardisation roadmaps

Expected Impact

- Strengthen and speed-up 5G platform standardisation and development process
- Improve the position of European and Japanese members of standards bodies

TA26: EUK-01-2016: 5G – Next Generation Communication Networks (RIA)

Rationale

Demonstrate an integrated architectural approach towards heterogeneous accesses (including mmWave), high capacity/resilient backhaul, and an NFV/SDN based packet core, high precision/integrity positioning techniques for advanced location based services/timing and satellite communication and navigation technologies where appropriate. Verticals will be incorporated as well as IoT services and showing ubiquitous 5G services. Prototyping and proof of concept will be shown in the 2018 Olympic Games of Pyungchang.

Objective

- Technology demonstration of the feasibility of an ntegrated architectural approach towards a heterogenous access including mm-wave access and satellite technologies (communication and navigation)
- Targetting most challenging 5G requirements, e.g. in terms of latency, very dense use environment and location
- Proof of concept are expected to be implemented and demonstrated, e.g. in the context of the 2018 Olympic Games of Pyungchang

Scope

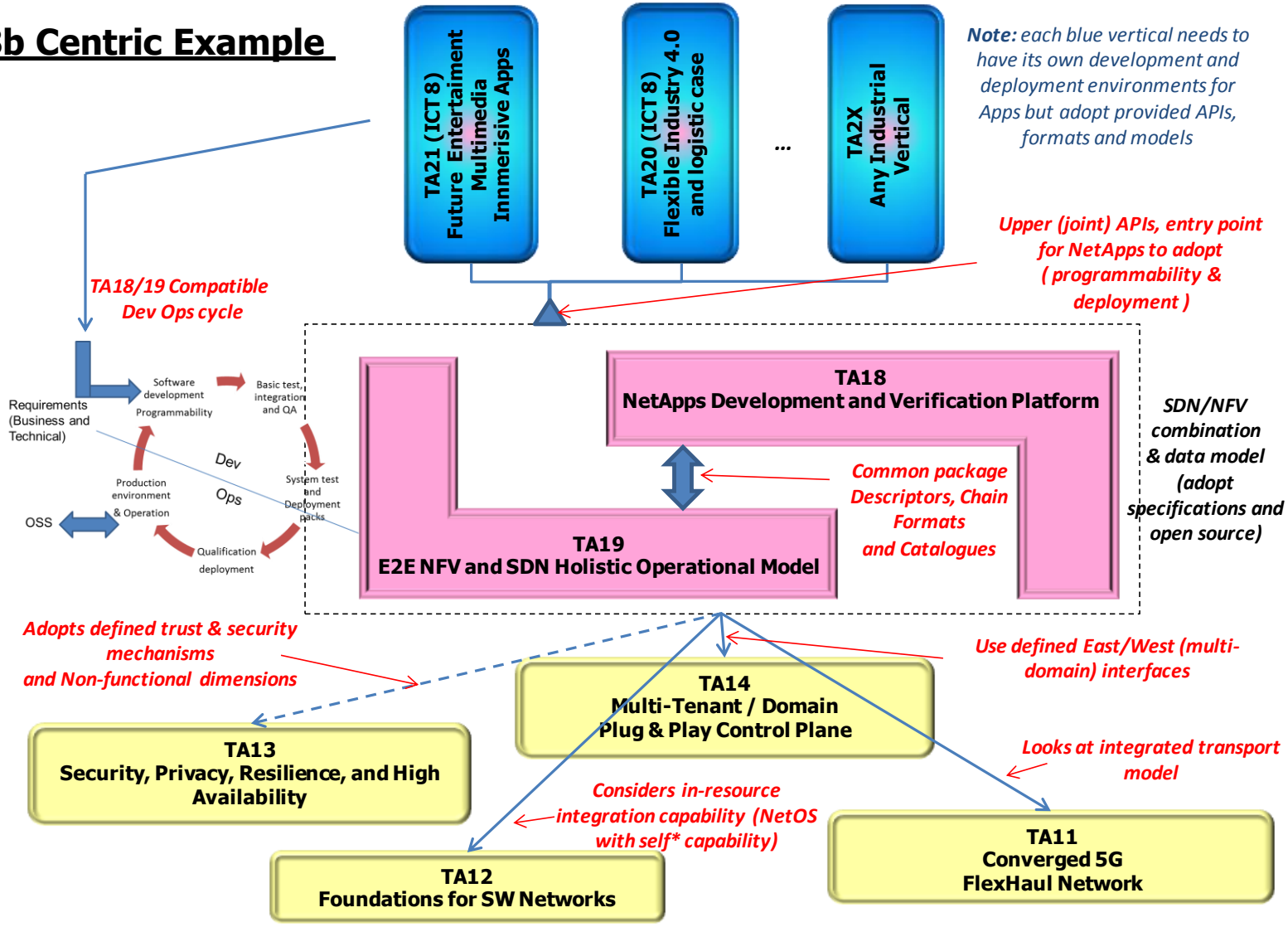
- RF/Antenna, Relay, Base Station and Terminals technologies
- High capacity and dynamic backhaul
- Evolved core withs SDN/NFV functionalities
- Interoperability/architecture framework
- mmWave waveform optimisation for joint wireless power and information transfer
- Integration of satellite communication and navigation technologies for advanced location based services and service continuity beyond cellular coverage

Expected Impact

- Contribution to the definition of a 5G interoperability architectural framework
- Contribution to the identification of key interfaces to standardise
- Contribution to the integration framework towards access and core
- Support to related standardisation activities (e.g. 3GPP)
- Global 5G service coverage
- Accuracy of outdoor terminal location ≤ 1m

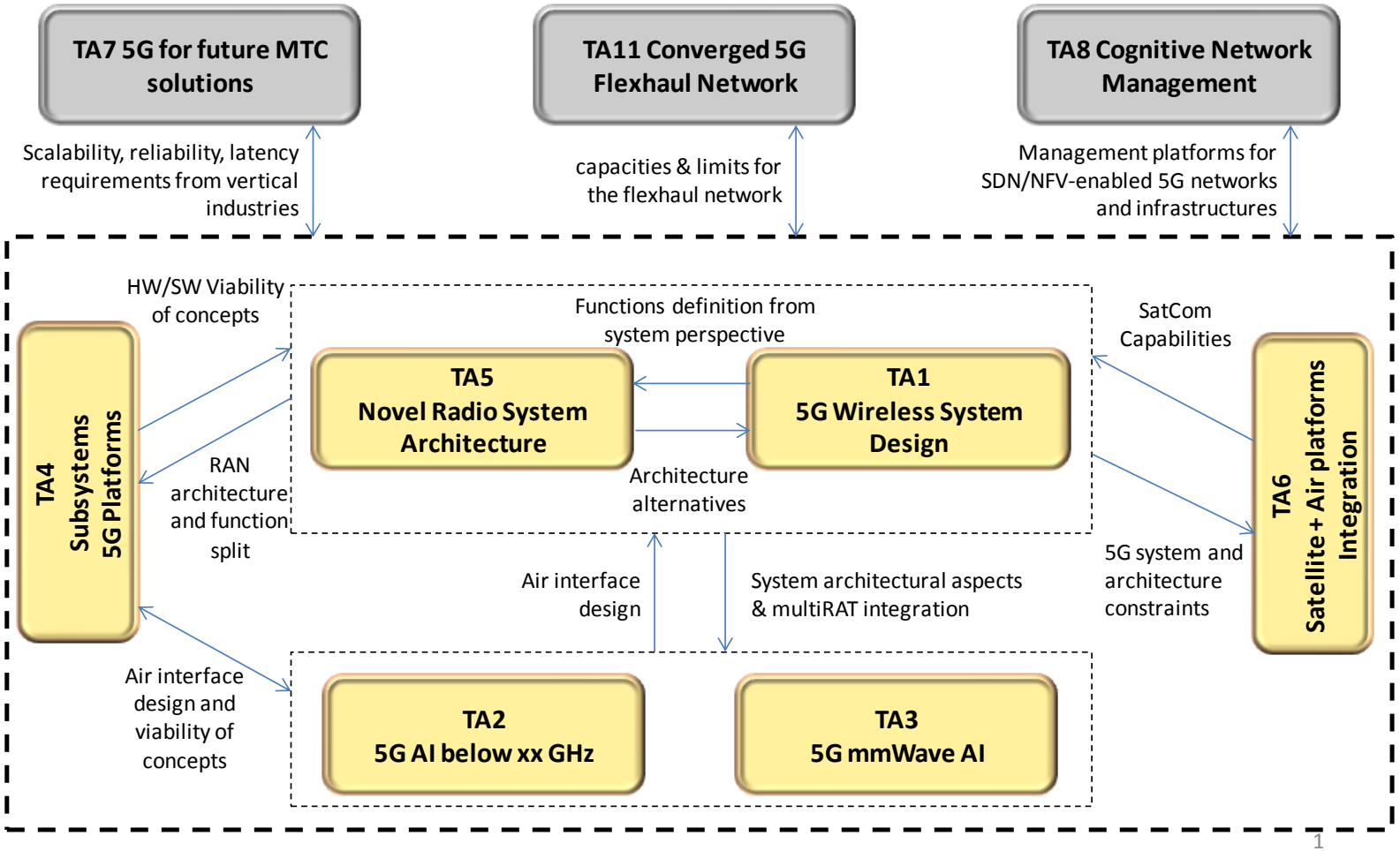
H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model – TAs Interfaces (1/2)

ICT-8b Centric Example



H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model – TAs Interfaces (2/2)

ICT-7a Centric Example



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H2020 5G Infrastructure PPP
Phase 2 Pre-structuring Model - Next Steps

- Forthcoming PPP Info Days and Awareness events incl. specific discussions on the Model
- 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
- 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

➡ Stay tuned and join us in implementing a very successful PPP Phase 2 with impact!

http://5g-ppp.eu

The 5G Infrastructure Public-Private Partnership