Priority topics and actions for Work Programme 2016-17

Answer to EC comments on the paper "Contribution to the orientation paper WP 2016 2017"

1. Comments on budget

- EC comments (Minutes of Partnership Board)
  - Mr Barani reminded the participants about the specific pattern of the (increasing) EU funding between now and 2020 (from one WP to the next one). He drew the attention of the PB to the fact that the last period will be a one-year period (2020).

New proposal :

- Phase I (2014-2015) : 125 M€
- Phase II (2016-17) : 170 M€
- Phase III (2018-19) : 230 M€
- Phase IV (2020) : 175 M€

Motivation for budget growth : we are starting from architecture and technology concepts, going more and more towards implementation, development and validation. As a corollary, the ratio between research and innovation will go in favor of innovation. However, in phase II, we stay on a 80% Research, 20% Innovation ratio. The growth is here more related to the advent of standardization efforts and prototyping activity.

2. Tests / pilots strategy

- EC comments (Bernard Barani's e-mail)
  - On the pilot stuff, our approach as said is to promote two possible types of pilots: either technology/system pilots (e.g pilot of an integrated radio access) or pilot showing applicability of a critical technology factor (e.g 1ms latency) in the context of the specific use case. (e.g. echoing your positive text on the verticals).
  - In terms of implementation, we take note that your preferred approach is to call for R&I or I projects including explicitly a pilot phase, rather than splitting the activities between pure R&I activities and pure pilot activities. We need to better understand the consequences of that.
  - The proposed work does so far not involve verticals visibly

Regarding tests and experiments, we propose to have a phased approach, in line with standardization milestones:

- Phase I (WP 2014-2015): Proof of Concepts focused on individual concepts / technologies on a per R&I project basis
- Phase II (WP 2016-2017) : Prototypes more advanced towards innovation than Phase I Proof of Concepts, which can scale to a certain degree but are still tested by R&D persons
- Phase III (WP 2018-2019) : Pilots showing the convergence of the different systems of 5G, Experiments (but not trials) with end users to improve acceptation, European federated test-bed
- Phase IV (WP 2020) : Trials with real end users if well motivated

Trials with real end users during some months cost a lot of money. We have to think if it is worthwhile to invest in it in phase IV. In addition, large scale trials must be coordinated between European countries. So the objectives of Phase IV have to be worked out during next year to be credible in terms of organization and budget (175 M€ may be short). As a result, we will need an activity to work on use cases and business opportunities for potential trials. We cannot decide now.

Regarding specific performance KPIs / technology factor, it is possible to envisage prototypes during phase II especially on latency, reliability and addressing capability (number of devices). However, we will need an activity to break these generic KPIs into smaller pieces and to bring quantitative measures and tools to make the measurement. This activity need to be done with selected projects for phase I since the measurement tools and approaches to reach the KPIs will be developed by these projects.

Involving vertical sector companies may be a bit difficult in Phase II because it will still be focused on network technologies and it is a big investment without necessary return for them. Vertical sector companies will be more present in Phase III. But, even without involving verticals we can still show the two types of pilots that are proposed by EC.

Regarding verticals requirements, car industry and manufacturing may be interesting for early tests because they seem quite disruptive. However, we need an activity to work on specific vertical requirements to motivate experiments with verticals and choose the most appropriate for early tests.

A single **coordination support action** should coordinate all roadmaps (R&D actions, standardization, prototyping, communication) of all 5G PPP R&I projects to maximize our efficiency.

8 M€ for projects with pilots is not sufficient. We should target 15 M€ for these projects in phase II. Not all projects will have a pilot in phase II.

3. *Comments on topics grouping*

- EC Comments (Minutes of Partnership Board)
  - Mr Barani brought the attention of the PB on the possibility of a high degree of redundancy between research topics appearing under different themes (e.g. between efficient resource management of optical networks and SDN).

We have addressed these redundancies and allocated each R&I topic to only one theme. Novel Network Designs theme then disappears.

Topics	**EC Suggestion (Bernard Barani's mail)**	**Answer**
Wireless Networks / Air Interface a) Advanced Multi Antenna Transceiver techniques b) mmWave RATs and channel model c) Channel Model for 5G	Group b) and c)	No consensus was reached on this proposal. Indeed, channel model goes beyond mmWave.
Wireless Networks / Radio Network a) Novel RAN Architectures b) Machine type Communications c) Intelligent Radio Resource Management d) Highly Flexible Connectivity e) Integrating satellite networks	Group a), d) and e)	Grouping of a) and d) is OK but integration of satellite networks is more difficult. Satellite networks is quite a specific field. E.g. industry involved is quite different and we need to work on some specific characteristics / performance issues of satellite.
Optical Networks a) Programmable petabit networks b) Disruptive approaches for increasing network capacity c) Trans-layer coordination for elastic optical networks d) Optical network virtualisation and network functions virtualization	Group a), c) and d)	Group a) and b) which are dealing with capacity increase and c) and d) which are dealing with inter-layer coordination.

The Software Network	"Efficient RAN sharing for multitenancy", might benefit from closer synergy with the C-RAN type work under the radio research part.	Efficient RAN sharing topic is more innovation oriented than C-RAN topic and includes other aspects such as isolation and management of tenants. It is therefore difficult to merge these activities.

About security, the EC made the following comments:

- Would virtualised and software networks bring new security challenges to the network, either single domain or multi domain? Should it be planned in the R&D work?
- The network management part includes a strong focus on data analytics and big data. Our understanding is that these techniques may also be powerful to address security aspects of networks (e.g real time traffic analysis). So we are wondering why not get it fully integrated with the network management aspects, as security is typically part of the network management functionalities

We thank the EC for this comment. Indeed, software networks bring new security and robustness challenges and yes they should be addressed in software network R&I topics. Security is a very transverse topic and we do not think it should be placed into the network management umbrella only. It is indeed a crucial component in nearly all R&I topics.

In addition to the Commission proposals, we would like to merge the 2 topics on smart orchestration in the Network Management and Automation theme.

New proposal of topics table:

	Research & Innovation	**Innovation**
Wireless Networks	<u>Air Interface</u> Advanced Multi Antenna Transceiver techniques mmWave RATs Channel Model for 5G <u>Radio Network</u> Novel RAN Architectures Machine type Communications Intelligent Radio Resource Management Integrating satellite networks	
Optical Networks	Programmable, elastic and high capacity optical networking	Optical networking for converged and ubiquitous 5G access
The software network	Novel Views on Network Architecture The Software Network: Interface Abstractions and Layering “On the fly” Virtualization and Adaptability	Efficient RAN Sharing for Multi-Tenancy Cloud Orchestration

Network Management and Automation	Smart Orchestration and Use of Network Analytics and Big Data for network management	Agile Management Frameworks
Effective Systems and Networks	Security Privacy and Trust Energy Efficient Devices and Networks Highly Flexible Communication Systems	