



5-Alive

5G: A Leadership Vision for Europe

D3.1 Recommendations for inter-sectorial collaboration in 5G PPP and beyond

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Abstract

This document provides a report on activities performed and results achieved in the scope of the 5-Alive project WP3 “Strategic Positioning” – Task 3.1 “Introduction of 5G Initiative to vertical application sectors”, with the main objective to inform vertical sectors about opportunities given by the 5G developments, establish links among communities of the vertical sectors and these involved in 5G research and innovation activities, and provide recommendations for further collaboration among 5G PPP and the vertical sectors.

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1 INTRODUCTION AND MAIN OUTCOMES

This document provides a report on activities performed and results achieved in the scope of the 5-Alive project WP3 “Strategic Positioning” – Task 3.1 “Introduction of 5G Initiative to vertical application sectors”. The main purpose of the task was to inform vertical sectors about opportunities given by the 5G developments for further and enhanced development of applications and services for their sectors, to establish links among communities of the vertical sectors and stakeholders involved in 5G research and innovation activities, and to provide recommendations for further collaboration among 5G PPP and the vertical sectors.

In the scope of the Task 3.1 activities, the 5-Alive project organised or supported organisation of two workshops; 5G for Verticals workshop and 6th Usage Areas workshop. Furthermore, 5-Alive provided reports from the workshops and supported creation of five White Papers from different vertical sectors on their requirements on the 5G network infrastructure. Finally, the discussions among the vertical sectors and the 5G PPP will be maintained in the future and next joint workshop is already in preparation, where concrete collaborations among all involved parties in specific research and innovation activities will be discussed, which can be identified as one of the main outcome of this project task.

2 SUPPORTED AND ORGANISED WORKSHOPS

2.1 5G for Verticals workshop

A workshop was co-organized by the European Commission and the 5G Infrastructure Association the 18th of June 2015 in Brussels. This workshop was supported by 5-Alive to reach out stakeholders from the vertical sectors (several contacts were taken to motivate speakers and discussants), build the agenda and write the report of the workshop.

This workshop aimed at fostering the interactions between the traditional ICT sector and new potential users, to further trigger the wide-scale adoption of 5G systems in vertical industries. The goal was to initiate a process whereby closer structured links can be established between the various communities towards a common understanding of the set of requirements of the various sectors, and how these specific necessities can be translated into design, architecture, technology and performance requirements, such that the 5G adoption may become a reality across the largest possible user communities.

It was expected that further developments like the creation of white papers on vertical requirements and business scenarios could be supported, also feeding into i) the preparation of 5G/verticals sessions in the context of Mobile World Congress 2016; ii) the preparation of the response to the ICT 2016-17 5G call for proposal, which is putting more emphasis on use cases and technology demos/PoC's in the context of use cases.

Agenda as well as detailed report from the workshop, provided by the 5-Alive project, are available in Annex A.1 and are published on the 5G PPP (www.5g-ppp.eu).

2.2 6th Usage Areas Workshop

5-Alive decided to organize a session on vertical sectors and 5G in the context of EUCNC 2015 because EUCNC was representing a good opportunity to initiate a dialogue with vertical sectors in order to embark their requirements in 5G design and to leverage on their challenging use cases for future experiments within 5G-PPP work programme.

The 6th Usage Areas workshop agenda was the following:

- The 5G connected car, Alain Serval (Peugeot Citroen)
- Enabling eHealth via 5G networks, Yanis Nahal (Orange Healthcare)
- Media and entertainment in a 5G world, Andrew Murphy (BBC)
- Short overview of the workshop of the 18th of June, Jean-Sébastien Bedo (5G Infrastructure Association)

5-Alive supported the session through invitation of speakers and writing of short papers before the session to be included in EUCNC proceedings. Presentations from the workshop are available on the 5G PPP website and papers are attached to this document (Annex A.2) as separated files.

3 REQUIREMENTS FROM VERTICAL SECTORS ON 5G

3.1 White Papers from Vertical Sectors

After the 5G for Verticals workshop in June 2015, the vertical industry started to work on the production of 5 whitepapers. 5-Alive ensured that a single leader was designated for each vertical. Namely, Daniel Medina (Huawei) took the lead on the automotive, Wouter Haerick (iMinds) took the lead on the factories of the future, Linus Trybom (ABB) took the lead on the energy, Christoph Thuemmler (Napier University) took the lead on ehealth and Alexander Geurtz (SES) took the lead on media and entertainment. 5-Alive also provided an editorial support for each whitepaper: Halid Hrasnica for automotive, Milon Gupta for factories of the future, Adam Kapovitz for energy, Anastasius Gavras for ehealth, Uwe Herzog for media and entertainment. Finally, necessary mailing lists and secured repositories for the five discussion groups have been provided by the 5-Alive project.

5-Alive worked on a common Table of Contents which was used by all sectors:

- Socio-economic drivers of vertical sectors at the horizon 2020
- How can 5G be a catalyzer for vertical sectors?
- Use cases and technical requirements
- Limitations of existing communication technologies
- Business and regulatory aspects (incl. standards and spectrum)
- Research and Innovation issues

Each whitepaper leader called for contributions towards the participants of the workshop of the 18th of June. 5-Alive extended a bit the list of contributors through promotion of this work especially in 5G Infrastructure Association. Each whitepaper leader organized a few conference calls (at least 3) during 2015 summer to stimulate contributions. September 2015 was dedicated to the review, editorial work (to ensure consistency and simple story line) and completion of missing parts. However, the whitepaper on media and entertainment did not work as well as the other whitepapers. The call for contributions was sent lately in July and only a few contributions were delivered. It took then quite long and some efforts to get more contributions especially from the sector itself. The process was reignited quite recently and 3 calls are planned in the beginning of November.

In parallel, 5-Alive contacted ERTICO, EFFRA, EUTC and NEM as representative Associations of respectively automotive, manufacturing, energy and media for their support. All Associations supported heavily the work by sending contributors, running internal reviews of the whitepapers and allowing using their logos on the publications.

3.2 Summary of Conclusions from the White Papers

Automotive use cases:

- Automated driving - overtaking, cooperative collision avoidance, high density platooning, E-GNSS driving support
- Road safety and traffic efficiency services - See-through, Vulnerable Road User (VRU) Discovery, Bird's Eye View
- Digitalization of transport and logistics - Remote sensing and control, Remote processing for vehicles
- Information society on the road, including connectivity everywhere - anytime and application of nomadic communications nodes

Identified areas for research and innovation in 5G/automotive related actions are mainly on reliable communication in conjunction with low latency and security, but also on the business models.

Energy use cases:

- Power grid protection, control, and monitoring – for existing Transmission and Distribution grid as well as emerging Micro grids, renewables, and energy storage
- Metering, including worldwide access to sensors and data distribution

Related areas for research and innovation are focused on:

- Reliable communication in conjunction with low latency and security
- Efficient management of the scarce spectrum resource
- Business models

Factory of the Future - main use cases:

- Time-critical closed-loop control (collaborative robots, machines, wearables)
- Non-time critical tracking of goods/parts/vehicles/...
- Remote monitoring/diagnostics/maintenance
- Global Value Chains
- Connected Goods

Areas for research and innovation, identified specifically for Factory-of-the-Future use cases are:

- Ultra-high reliability (ultra-low latency/low bitrate, low-latency/high bit-rate, ..)
- Seamless user experience (Heterogeneity, many new technologies)
- Secure network/service management by factory operator
- Innovative new business models

Healthcare use cases:

- Assets and interventions management in Hospitals - Real time end-to-end supply-chain management in hospitals and beyond
- Robotics - Remote surgery / robotics
- Remote monitoring of health or wellness data - Real time integration of multimodal data from different sources across different networks (incl. body area networks for wearables) and integration of formal and informal cares as well as Personalized Medicine and Patient empowerment
- Smarter medication - Smart Pharmaceuticals and Intelligent algorithms for long term behavior change to supplement pharmaceutical therapy in chronically ill patients

The related areas for research and innovation are mainly on deep indoor coverage (and localization), high reliability for safety critical applications and energy efficiency, as well as innovative trial methodologies.

Media and entertainment use cases:

- High Fidelity media (e.g. Netflix)
- Event retransmission (Digital cinema)
- User Generated Content content & Machine Generated content
- Ambient media & Life coaching
- Cooperative work & remote editing

The areas for research and innovation identified are mainly on high throughput incl. upload, broadcast, security, seamless access, user context collection and universal accessibility.

Finally, requirements from **all involved vertical sectors** include high 5G infrastructure reliability and security as well as very low latency and seamless user experience.

The White Papers are published on the 5G PPP website and provided as Annex to this document (A.3) as separated files.

4 CONCLUSIONS AND RECOMMENDATIONS

The 5-Alive project continued work performed in previous projects and initiatives (EX-FI, NetSoc) on mobilizing both ICT and vertical sectors community, by organizing the 6th edition of the Usage Areas workshop and the 5G for Verticals workshop in June 2015. Based on the outcomes and discussions from the workshops, the 5-Alive project created an initial report about use cases and areas of common research and innovation interests from the following five vertical sectors, initiating the creation of full white papers per sector, to define the sectorial requirements on the 5G network infrastructure.

After the EX-FI project initiated community building among ICT and vertical sectors' individual communities few years ago and NetSoc project established a first set of high-level requirements from the vertical sectors on the future network infrastructures in general (two years ago), the 5-Alive project managed to consolidate the requirements of individual sectors at an appropriate level of details for concrete, currently running research and innovation activities towards 5G network infrastructure (5G PPP).

Along with the requirements definition, the joint workshops and discussions have significantly improved collaboration spirit among different communities and already resulted with several ideas for creation of joint projects in the future, mainly within the 5G PPP programme. Therefore, it is very important to maintain discussions among communities of different sectors and networks related community, which will result with more concrete ideas and project proposals for the 2nd phase of the 5G PPP programme.

Accordingly, the 5-Alive project strongly recommends organization of regular joint events (2-3 yearly), such as the Usage Areas and 5G for Verticals workshops, to encourage creation of research and innovation projects with participation of experts from the networking area and the addressed vertical sectors.

Further activities on mobilization of the ICT and non-ICT communities, definition of the requirements, creation of project ideas, and definition of relevant research items in the Work Programmes will be carried out by Euro-5g project, a support action for the first phase of the 5G PPP programme, which is supporting organization of the next relevant workshop in Brussels, on 9 November 2015 "5G: Serving Vertical Industries – the 2nd 5G for Verticals Workshop".

ANNEX A

A.1 5G for Verticals Workshop

A.1.1 Workshop Agenda – Brussels, 18 June 2015

9:30 – 9:45	Thibaut Kleiner, EC , Welcome, Introduction and objectives		
9:45 – 10:00	Jean Sebastien Bedo, 5G Infrastructure Association, views on verticals and expectations		
10:00 – 12:45 (including 30 mn coffee break)	<p><u>Parallel Session 1, Health</u></p> <p>Convenor: Napier University, Prof Ch. Thuemmler</p> <p>5G Association caretaker: David Soldani, Huawei</p> <p>EC/E1 caretaker: Achilleas Kemos</p> <p>Confirmed participant:</p> <p>Cindy Fedell , UK NHS, NHS Trust IT Director, (confirmed speaker)</p> <p>Stefano Micocci, Cup 2000, dealing with real patient data in mass for the regional government (confirmed speaker)</p> <p>Anastasius Gavras ,Eurescom, Coordinator of FI-STAR, (confirmed speaker).</p> <p>Alex Hryniewicz, Maverick Television, (confirmed speaker).</p> <p>Dr. Philippe Cavallo, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa</p>	<p><u>Parallel Session 2, automotive</u></p> <p>Convenor: Markus Dillinger, Huawei;</p> <p>5G Association caretaker: Jean Sebastien Bedo, Orange</p> <p>EC/E1 caretaker: Eric Gaudillat</p> <p>Firestarter presentations:</p> <p>"Role of communications in future self-driving cars", by ERTICO-: François Fischer</p> <p>"Infotainment in the connected car" PSA : Alain Servel</p> <p>"Towards Self-Driving car" by Volkswagen:- Bernd Rech</p> <p>" Car as a network infrastructure element" by Volvo : Muthanna Abdulhussein</p> <p>"technology requirements" by Jean-Sébasiten Bedo, Orange</p>	<p>11:30 – 12:45</p> <p><u>Parallel Session 5, Media & Entertainment (part 1)</u></p> <p>Convenor: Thomas Wrede, SES</p> <p>5G Association caretaker: Christine Leurquin, SES</p> <p>E1 caretaker: Philippe Lefebvre</p> <p>Participants:</p> <p>Session 5a: "5G – Game changer for Media</p>

5-Alive Deliverable D3.1

	<p>Wojciech Dymowski, ITTI Poland</p> <p>Dr. Ing. Armin Schneider, Klinikum rechts der Isar, Munich,</p> <p>Altaf Sadique, Gane Data</p> <p>Dirk Colaert AGFA, representing also the Bordeaux e-health cluster.</p> <p>Denis Abraham, Mines-Telecom, Scientific Direction/Innovation, Paris</p> <p>Titus Zaharia Telecom-sud, Paris</p>	<p>Confirmed Participants:</p> <p>Henrik Abramowicz Ericsson</p> <p>Maziar Nekovee Samsung</p> <p>Vincent Bonneau, tbc iDate</p> <p>Silvia Castellvi Catala and Josep Martrat ATOS</p> <p>Mikio Iwamura Docomo Lab</p> <p>Didier Bourse Alcatel Lucent</p> <p>Ardito Luigi, tbc Qualcomm</p> <p>Asimakis Kokkos Nokia</p> <p>Tahar Cherif, Mines-Telecom</p> <p>Toktam Mahmoodi, King's College London</p> <p>LinusThrybom, ABB</p> <p>Jani Valtari, ABB</p>	<p>& Entertainment?"</p> <p><u>Firestarter:</u> Maziar Nekovee, Samsung</p> <p><u>Panel:</u></p> <p>Maria Guta, ESA</p> <p>Roland Beutler, SWR/EBU</p> <p>Robert Amlung, ZDF</p> <p>Gerard Faria, Teamcast</p> <p>Session 5b: "Towards new business models?"</p> <p><u>Speaker:</u> Vincent Bonneau, IDATE</p> <p><u>Panel:</u></p> <p>Maria Guta, ESA</p> <p>Roland Beutler, SWR/EBU</p> <p>Gerard Faria, Teamcast</p>
12:45 – 13:45	Lunch break (sandwiches)		
13:45-16:30 (including 30 mn coffee break)	<p><u>Parallel Session 3, Factory</u></p> <p>Convenor: Haerick Wouter, iMINDS</p> <p>5G Association caretaker: Isabelle Korthals, Deutsche Telekom</p> <p>EC/E1 caretaker: Jorge Carvalho</p> <p>Firestarter presentations:</p>	<p><u>Parallel Session 4, Energy</u></p> <p>Convenor: Linus Thrybom</p> <p>5G Association caretaker: Benoit Miscopein</p> <p>EC/E1 caretaker: Ari Sorsaniemi</p> <p>Firestarter presentations:</p> <p>Gilles Robichon, Alliander / Utility Connect</p> <p>Jani Valtari, ABB</p>	<p>13:45- 15:00</p> <p><u>Parallel Session 5, Media & Entertainment (Part 2)</u></p> <p>Convenor: Thomas Wrede, SES</p> <p>5G Association caretaker: Christine Leurquin, SES</p> <p>E1 caretaker: Philippe Lefebvre</p> <p>Continued from the morning session</p> <p>Session 5c: "Broadcast/multicast – le must</p>

5-Alive Deliverable D3.1

	<p>Castellvi Silvia, ATOS</p> <p>Gil Aguirrebeitia Guillermo, TECNALIA</p> <p>Van der Horst Tom, TNO</p> <p>Confirmed participants:</p> <p>Abraham Denis, Mines-Telecom, Scientific Direction/Innovation</p> <p>Frascolla Valerio, INTEL</p> <p>Iwamura Mikio, DOCOMO</p> <p>Larrabide Ibai, Zabala</p> <p>Lazaro Oscar, Innovalia</p> <p>Martrat Josep, ATOS</p> <p>Titus Zaharia, Telecom-sud, Paris</p> <p>Wollschlaeger Martin, TU Dresden</p>	<p>Johannes Riedl, Siemens</p> <p>Fiona Williams, Ericsson</p> <p>Confirmed participants:</p> <p>Linus Thrybom, ABB (convenor)</p> <p>Benoit Miscopein, CEA-LETI (5G)</p> <p>Duncan Botting, EUTC</p> <p>Toktam Mahmoodi, King's College London</p> <p>Joseph Eichinger, Huawei</p> <p>Werner Mohr, Nokia</p> <p>Tahar Cherif, Mines-Telecom</p> <p>Didier Bourse Alcatel Lucent</p>	<p>for 5G?"</p> <p><u>Firestarter:</u> Ralf Neudel IRT</p> <p><u>Panel:</u></p> <p>Henrik Abramowicz, Ericsson, Roland Beutler, SWR/EBU</p> <p>Steve Beck, Sony</p> <p>Vincent Bonneau, IDATE</p> <p>Gerard Faria, Teamcast</p> <p>Karl Josef Friederichs, Nokia</p> <p>Robert Amlung, ZDF</p> <p>Luigi Ardito, Qualcomm,</p> <p>Maziar Nekovee, Samsung</p> <p>Session 5d: "5G cross-vertical opportunities - Media & Entertainment in the Automotive vertical"</p> <p><u>Firestarter:</u> François Fischer, ERTICO</p> <p><u>Panel:</u></p> <p>Henrik Abramowicz, Ericsson, Roland Beutler, SWR/EBU</p> <p>Karl Josef Friederichs, Nokia</p> <p>Mircea Oiada, FUJITSU-TEN</p> <p>Steve Beck, Sony</p> <p>Ralf Neudel, IRT</p> <p>Robert Amlung, ZDF</p>
16:30-17:15	Plenary, presentation of conclusions of sessions (Convenors/moderators)		
17:15-17:30	Conclusions and follow up (EC, Association)		

A.1.2 Workshop Report

Provided as separated file - ReportFrom5GforVerticalsWorkshop-v1-0.pdf

A.2 Papers from the 6th Usage Areas Workshop

A.2.1 Vision from Orange Healthcare on 5G

Provided as separated file - 5GandHealthcareEUCNCpaper.pdf

A.2.2 Making 5G a real booster for vertical markets

Provided as separated file - 5GandVerticalSectorsEUCNCpaper.pdf

A.2.3 The 5G connected car

Provided as separated file - 5Gconnected-carEUCNCpaper.pdf

A.3 White Papers from Vertical Sectors

A.3.1 5G-PPP White Paper on eHealth Vertical Sector

Provided as separated file - eHealthWP.pdf

A.3.2 5G-PPP White Paper on Factories-of-the-Future Vertical Sector

Provided as separated file – FoF-WP.pdf

A.3.3 5G-PPP White Paper on Energy Vertical Sector

Provided as separated file - EnergyWP.pdf

A.3.4 5G-PPP White Paper on Automotive Vertical Sector

Provided as separated file - AutomotiveWP.pdf

A.3.5 5G-PPP White Paper on Media and Entertainment Vertical Sector

Provided as separated file - MediaWP.pdf – in its recent final draft version (not yet available for the wide public)