Mapping Interoperable EU PPDR Broadband Communication Applications and Technology

EU Interoperable Broadband Communication Applications and Technology for Public Safety

Transition Roadmap and Pre-Commercial Procurement Specification

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Changes Made	Who Changed	Date
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Additional Finnish example in 2.2	SEMSB	9 April 2017
Improved clarity of wording throughout	DGFLA	10 April 2017
Clarity of the Belgian situation in section 2.1 and 2.2	BEMOI, CRMOI	12 April 2017
Clarification of non-buyers as supporting partners who may be practitioners, or those supporting coordination, networking and legal aspects of procurement in section 5	CRMOI, PSCE	12 April 2017
Improved clarity of wording throughout and reordering for the executive summary	ILMDA	12 April 2017
Added the FirstNet award to AT&T to section 3.1	NODNK	19 April 2017
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Overall clarity of terms and quality cross checking	PSCE, ITMOI, NODNK, CRMOI, ROSTS, IEAGS	20 April 2017
Final Corrections, Improved presentation for public release	PSCE, ROSTS, IEAGS	23 April 2017

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Acronyms

3G	3rd Generation of wireless mobile telecommunication technology
3GPP	3rd Generation Partnership Project
4G	4th Generation of wireless mobile telecommunication technology
5G	5th Generation of wireless mobile telecommunication technology
AC	Countries associated to Horizon 2020 program
AGA	Air Ground Air
API	Application Programming Interface
AVL	Automatic Vehicle Location
BB	Broadband
BDBOS	German Federal Agency for Public Safety Radio
BEMOI	Belgium Ministry of the Interior
COW	Cell on Wheels
CJEU	Court of Justice of the European Union
BHMOS	Bosnia and Herzegovina Ministry of Security
BYOD	Bring Your Own Device
CG	Communication Group
CO	Contractor Owned
COTS	Commercial Off The Shelf
CRMOI	Croatia Ministry of the Interior
CSA	Coordination Support Action
DB	Database
DEBRK	Germany Bavarian Red Cross
DG Connect	European Commission Directorate General for Communications Networks, Content & Technology
DGFLA	De Gaulle Fleurance et associés (Law firm)
DG Home	European Commission Directorate General for Migration and Home Affairs
DMO	Direct Mode Operation
EE	Network Operator in the UK
E2EE	End-To-End Encryption
EAFIP	European Assistance For Innovation Procurement
EC	European Commission
EGTC	European Grouping of Territorial Cooperation
ePCR	Electronic Patient Care Record
ERCC	Emergency Response Coordination Centre
ESMIR	Spain Ministry of the Interior
ESN	Emergency Services Network (UK PPDR broadband network)
EUE	End User Equipment
ETSI	European Telecommunications Standards Institute
EU	European Union
EUROPOL	European Police Office
FEU	Federation of the European Union Fire Officer Associations
FIMOI	Finland Ministry of the Interior
FirstNet	USA PPDR broadband network
FRMOI	France Ministry of the Interior
Galileo	European satellite navigation system
GBER	Commission regulation (EU) No. 651/2014 of 17 June 2014

GCC	General Clauses and Conditions
GO	Government Owned
Glonass	Russian satellite navigation system
GOCO	Government Owned Contractor Operated
GOGO	Government Owned Government Operated
GPS	Global Positioning System
GRMOI	Greece Ministry of the Interior
GW	Gateway
HMI	Human Machine Interface
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICT	Information and Communications Technology
IEAGS	An Garda Siochana (Police Service Republic of Ireland)
IFPOC	International Fleetmap Proof of Concept
ILMDA	Israel Magen David Adom
IoT	Internet of Things
IP	Intellectual Property
IPR	Intellectual Property Right
ISI	Inter System Interface
ISITEP	Inter System Interoperability for TETRA-Tetrapol Networks
ITMOI	Italy Ministry of the Interior
LEWP	Law Enforcement Working Party
LPWA	Low-Power Wide Area
LTE	Long Term Evolution
M2M	Machine to Machine
Mic	Microphone
MC	Mission Critical
MCDATA	Mission Critical Data
MCPTT	Mission Critical Push to Talk
MCVIDEO	Mission Critical Video
MDM	Mobile Device Management
MFCN	Mobile/Fixed Communications Networks
Mgt	Management
MNO	Mobile Network Operator
MOLO	Mobile Other Licensed Operator
MS	Member State of the European Union
MVNO	Mobile Virtual Network Operator (or MOLO): a wireless communications services provider that does not own the wireless network infrastructure over which the it provides services to its customers
NAKIT	The Czech National Agency for Communication & Information Technologies
NB	Narrow Band
NODNK	Norway Directorate for Emergency Communication
OSP	Outsourced Service Provision
P25	Project 25, a suite of standards for digital radio communications for use by PPDR organizations, common in North America
PCP	Pre-Commercial Procurement
PMC	Preliminary Market Consultation
PPDR	Public Protection and Disaster Relief (All Safety and Security Agencies)
PPI	Public Procurement of Innovative solutions

PSRG	Public Safety Radio Group
ProSe	Proximity Services
PTT App	Push to Talk Application
Roaming	Utilization of a device in a network other than the home network where the subscriber is registered but on which the device/subscriber can still be located and operated by agreement between the respective network operators
Q&A	Quality & Assurance
QoS	Quality of Service
RAN	Radio Access Network
RCEG	Radio Communications Expert Group
R&D	Research and development
RF	Radio Frequency
RFID	Radio Frequency Identification
ROSTS	Romania Special Telecommunications Service
SafeNet	South Korean PPDR broadband network
SD card	Secure Digital card
SDA	Short Data Applications
SDS	Short Data Service
SEC/2007/1668	Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe. Example of a possible approach for procuring R&D services applying risk-benefit sharing at market conditions, i.e. pre-commercial procurement
SEMOI	Sweden Ministry of the Interior
SLA	Service Level Agreement
SME	Small and Medium Enterprise
SpiceNet	Standardised PPDR Interoperable Communication for Europe
TEA-1	TETRA Encryption Algorithm #1
TEA-2	TETRA Encryption Algorithm #2
TETRA	Terrestrial Trunked Radio
Tetrapol	Digital, purpose-built professional mobile radio (PMR) technology
TFEU	Treaty on the Functioning of the European Union
TG	Talk Group (communication group for voice)
TMO	Trunked Mode Operation
TVC	Technical Validation Committee
UNB	Ultra Narrow Band
VIRVE	"Viranomaisradioverkko", Government official radio network in Finland
UOAB	User Organisation Advisory Board
WAP	Wireless Application Protocol
WiFi	A technology for wireless local area networking with devices based on the IEEE 802.11 standards
WPx	Work Package number x
WRC15	World Radio Conference 2015
WS	Workstation

Executive Summary

Background

The BroadMap Project implements a Coordination and Support Action (CSA) and was approved by the European Commission based on proposal made under Horizon 2020, the EU framework program for research and innovation. On the 1st May 2016 the most extensive team of EU public safety end users commenced their task to validate requirements, build specifications, identify solutions and produce roadmaps to enable the public procurement of Research and Development (R&D) leading towards new interoperable broadband capabilities being deployed in a time period of eight to ten years.

The main goal of work package 5 (WP5) was to define a transition roadmap to a Pan European PPDR mobile broadband network in the framework of the current EU legal environment (chapter 5).

Current Situation and Strategies

The key findings of the current situation (chapter 2) and strategies (chapter 3) described in deliverable 5.2 clearly indicate the need for broadband services over the current narrow band capabilities. However, to date, only few countries have formalized a strategy towards mission critical broadband services. The starting point and the environment vary strongly from country to country leading to the need for several transition roadmaps from the current legacy – mainly narrow band – systems to a broadband solution.

Objectives of a Mission Critical Broadband System

The final solution (chapter 4) must be cost effective, needs to be very adaptive to different national implementations whilst still maintaining the key objectives of cross-agency interoperability and cross-border interoperability, security, availability, system management and open standard compliance

Legal Findings

Chapter 5 describes the key legal findings on how to organize joint procurements between countries / public entities in accordance with adapted procedures to implement innovative public contracts, and in addition, the key elements of the future procurement documents to be used to select the target architecture/companies (i.e. criteria and contractual elements such as IPR, standards, price etc.).

In the short term, a Pre-Commercial Procurement (PCP) and contractual joint procurement organization is recommended (i.e. conclusion of public entities consortium agreement). The organization should include a validation committee and a procurement committee. Such an organization could be developed in the mid-term for providing further Public Procurement of Innovative services (PPI) activities and evolved in the long-term to an organization with legal entity as an EGTC (EU-level PPDR telecommunication entity).

The sharing of Intellectual Property Rights (IPR) needs to be carefully defined in the public tendering documents as part of the negotiation procedure between the public entities of the buyer groups as well as with the selected companies.

Consolidated Reference Architecture – SpiceNet

The **key finding of consolidated reference architecture** – the Pan European PPDR interoperable and harmonized solution – is that it consists of three layers as described in Chapter 6:

1. Harmonization,

2. Interoperability and Governance

3. Networks and Users.

On the harmonization layer, each country needs to be able to use their own organization schemes to provide PPDR services. Flexible harmonization will be obtained by using 3GPP and other standardized technology as well as commonly agreed harmonized radio frequency bands.

The interoperability with Governance layer defines SpiceNet (**S**tandardised **P**PDR **I**nteroperable **C**ommunication for **E**urope), a common PPDR Pan European cross-border interoperability solution. This enables each country to use a set of common services for Pan European interoperability. Each country will have their own unique operational solution to achieve and guarantee national interoperability.

On the Networks / user layer, common services provided by SpiceNet can be used in all participating countries. These common services can be further extended via multilateral agreements between interested countries.

Transition Roadmap for Mission Critical Communication

As a result of the work done during the project, a **transition roadmap** has been defined (Chapter 7).

The roadmap has been designed in a stepwise manner taking into account several aspects – including legal, regulatory, technical and operational – and encompass both PCP and PPI phases. The roadmap provides PPDR-specific R&D requirements (i.e. Pan European security, service continuity roaming, and interoperability) for public procurements. As part of this, joint public procurement will be organized and will include several committees, functions and PCP pilot definition.

The PCP may be followed by a PPI phase that is focused on rolling out the benefits of the procured R&D services.

1 Introduction

1.1 Purpose of the document

Deliverable 5.2, encompassing the tasks 5.1 (legal aspects of the roadmap) and 5.3 (transition roadmap) of WP5, is the BroadMap deliverable that directly prepares the PCP (Pre-Commercial Procurement) phase foreseen by the H2020 process for developing European interoperable broadband communication systems on behalf of the PPDR community.

1.2 Previous tasks and materials contributing to this deliverable

D4.1 defines **three** candidate solutions for the next generation of radio systems for PPDR. The three solutions converge to a unique one, based, at the radio network level, on the 3GPP Release 15 mission critical standards, but propose three different migration ways, starting from the legacy narrow band networks which are in operational use today.

Moreover, D4.1 describes **five** possible organisational schemes for implementing the **three** solutions, resulting in a **matrix of thirteen** candidate solutions and organisation schemes.

A ranking of these possibilities has been performed in deliverable 5.1 (i.e. task 5.2). The potential solution architectures have been described taking into account the technology maturity, matching user requirements and implementing costs and timetable for PCP/PPI.

The study points out the importance to integrate the legacy networks with the target solution in the migration phase to de-risk the transition period.

Task 5.1 was led by DGFLA. A legal workshop organized by DGFLA in Madrid on 18th August 2016 on the following items are the legal basis of this task: conducting a public procurement procedure with R&D needs, European joint procurement, criteria in public contract and sharing intellectual property rights.

Based on the feedbacks of the legal workshop, a brainstorming session was organized during the WP5 kick-off on 1st December 2016 in Rovaniemi to gather the members' consortium opinions on the legal roadmap and ensure its efficiency.

An oral presentation of the main findings of this deliverable was given during the workshops in Brussels on 13th January 2017 and in Copenhagen on 10th February to the WP5 attendees. Brainstorming sessions were organized in Paris on 21st to 23rd February 2017. The feedback has been taken into account in this deliverable.

1.3 Scope and activities related to this deliverable

Deliverable 5.2 describes target architectures that incorporate the solutions created in WP4 (Deliverable 4.1) and evaluated in Task 5.2 (Deliverable 5.1), describes the legal aspects of the roadmap, and points out the legal and technical activities of the subsequent PCP, PPI and long-term activities.

The activities are finally integrated into a plan in order to constitute a roadmap.

The main Deliverable 5.2 activities or "streams" are:

- Stream 1: the legal aspects (chapter 5)
  - Constitution of a group of joint public buyers in order to draw up the PCP and PPI activities
  - Governance and functioning of such a joint organization with dedicated committees (Technical validation committee, Procurement committee and Specific committee)
  - Steps of the future PCP and PPI procedures

- o Main administrative and technical contractual aspects in the future public PCP and PPI contracts (IPRs, price)

- o Sustainability of the PCP and PPI processes in the long term, including the establishment of a European PPDR communications legal entity

- Stream 2: the definition of the current situation and of the target

  - o The "as is" situation

    - A. Description of the current situation (chapter 2)

    - B. Status of national strategies for mission critical communication in the society (chapter 3)

  - o The "to be" situation

    - C. Objectives for mission critical communication (chapter 4)

    - D. Consolidated target architecture for mission critical communication (chapter 6)

- Stream 3: The global transition roadmap, with a focus and complementary developments related to the PCP and PPI technical and functional aspects (chapter 7)

  - o PCP and PPI joint procurement

  - o Transition solution flexibility

  - o PCP and PPI key functionalities

    - Security

    - Interoperability

    - Priority and pre-emption

    - Location-based MC features

    - Spectrum

    - Applications for PPDR

    - Subsequent PCP setup recommendations

  - o Technical Validation Committee (TVC) missions scope definition

    - Tight contacts with standardization bodies 3GPP, ETSI…

    - Describing the technical architecture of the requirements that are not (yet) developed at standardization institutes level (PCP design phase)

    - Testing and evaluating the PCP prototypes and pilot systems

  - o Specific functional PPDR Committee

  - o Step by step plan and timing

2 Description of the current situation of the PPDR radio networks

2.1 Introduction

This chapter describes the present situation in Europe in relation to the PPDR legacy and broadband networks and their capabilities. It is based on work package 4.

Today's PPDR networks in Europe are based on legacy systems - TETRA and Tetrapol technology. A single P25 network exists which is likely to be phased out within a number of years. In Europe, there are more TETRA networks deployed compared to the number of deployed Tetrapol networks. In total, there are 27 legacy PPDR networks in Europe: 22 TETRA, 4 Tetrapol and one P25 network. In some countries there are more than one PPDR network architecture, e.g. Latvia has both a P25 and a TETRA network, and Spain and France have TETRA and Tetrapol networks. See Figure 1 for more information.

The PPDR mission critical legacy networks in Europe became operational in Belgium, Finland, Netherlands and the UK around the year 2000. In 2017, mission critical narrowband networks continue to be deployed across European countries.

TETRA and Tetrapol networks vary in size, from the German BDBOS network, which is the world's largest TETRA network with some 500.000 users, down to non-PPDR networks consisting of just a few hundred users. The total number of PPDR subscribers in Europe is approximately 2.1 million, and there are around 23 000 PPDR base stations deployed across Europe.

The transition from legacy systems to broadband systems will vary from country to country, but predominately these legacy networks will be decommissioned or reach end of life and be replaced by LTE or similar technology for broadband communication. During an interim period, the broadband networks will be used in some countries as data-overlay to the existing legacy networks that are mainly used for mission critical voice.

The PPDR networks are mainly used by police, fire brigade and health departments, but, depending on the country, are also utilized by e.g. the Red Cross, sea rescue, military, customs, prison, power companies, transport, utility, commercial, or oil & gas, etc.

When it comes to network ownership and operation (organisation schemes) the networks can be divided into GOGO (government owned, government operated), GOCO (government owned, contractor operated), and COCO (contractor owned, contractor operated). There are also networks that use the COCO set-up, but where the governments supervise the contracting companies. From the basic information at hand we can see that most the networks are government owned (GO), but there is a split of government (GO) and contractor (CO) operation of the networks. The reason for this may be that the countries have different conditions, e.g. economy, already existing network operator or own organizational resources.

Some countries and user organizations mandate that the network shall be owned and operated by the government. One reason for selecting this type of organisation scheme would be to secure users' anonymity and user data.

Commercial operators may not have the same view on network performance as PPDR organizations. For commercial operators, not adhering to SLA levels may result in loss of revenue, while for the PPDR organizations it may end up in a life and death situation. The solution has been to use commercial operators to build a network that is solely dedicated to providing PPDR communications and that is government owned or controlled.

The existing TETRA and Tetrapol networks are built around dedicated spectrum and separate network infrastructures to ensure network integrity and availability. When migrating towards 3GPP broadband networks there are different network structures to choose from: dedicated, hybrid and commercial. Until these networks have been established, PPDR users in most countries in Europe use normal data subscriptions over commercial networks. However, there are today a few exceptions to this:

1. Astrid in Belgium who have deployed an MVNO solution, based on a roaming hub delivered by the commercial public (incumbent) operator Proximus with the possibility to roam to all Belgian MNO providers (Proximus, Telenet, Orange) to increase global availability (coverage and capacity) of the solution. Priority and pre-emption for the PPDR users will be supported on the Proximus network.

2. VIRVE in Finland has implemented a secure MVNO solution for PPDR broadband non-critical communication. The solution is based on a dedicated, government-owned LTE core providing control of the broadband subscriptions as well as common subscriber management for narrowband VIRVE TETRA service and secure MVNO broadband services. For broadband radio access, VIRVE has contracted currently two MNOs. The user data flow is immediately routed to the dedicated LTE core via a secure backbone and further to the state information networks in a controlled manner. End user equipment, mostly vehicular multi-access routers, are provided as part of the service. The multi-access routers increase the connection availability in terms of coverage and connection redundancy. Overall, the dedicated LTE core solution is part of the transition roadmap towards the ultimate goal to provide critical level mobile broadband over the entire Finnish territory.
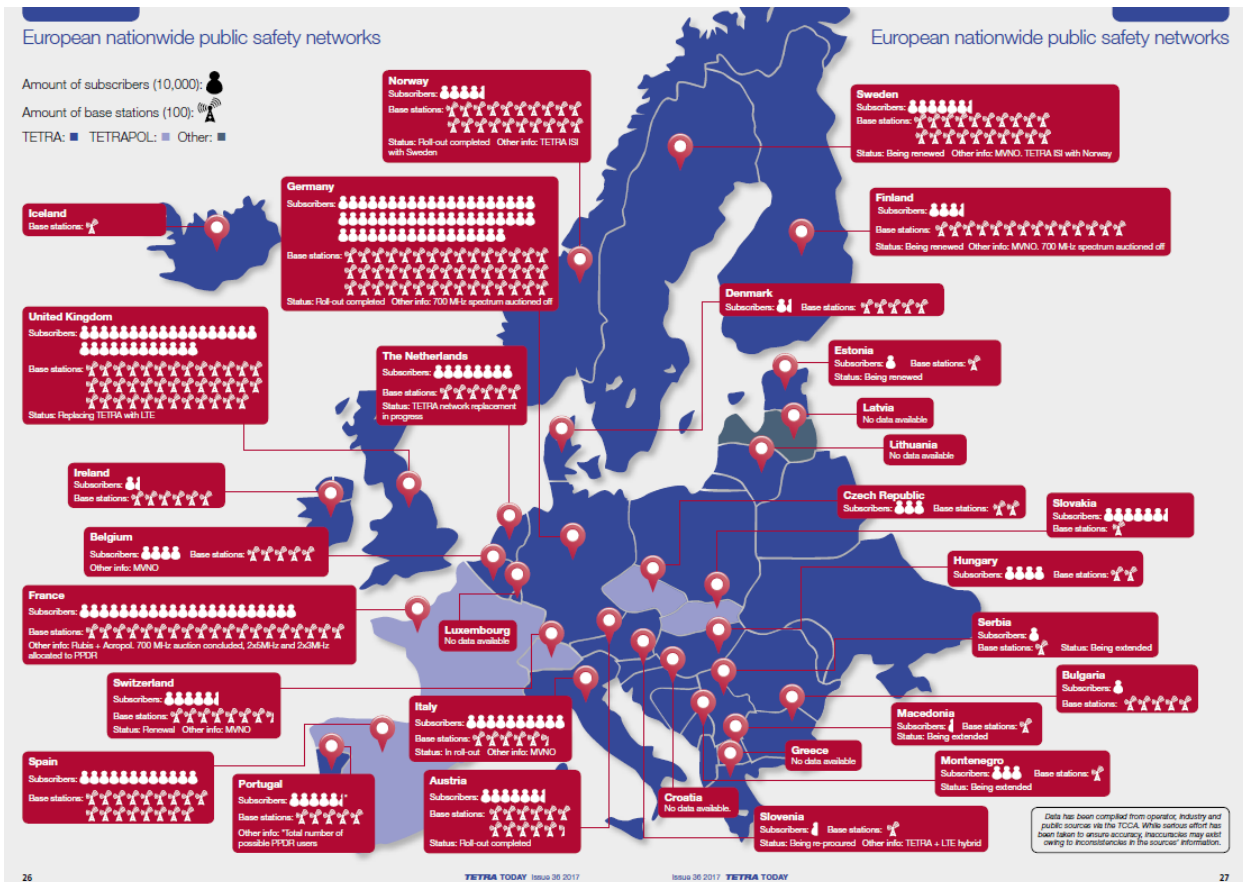

Figure 1: From the magazine Tetra Today Issue 36, 2017

2.2 Spectrum situation

Almost all PPDR organizations in Europe are using TETRA and Tetrapol networks for their narrow band mission critical voice and messaging.

The spectrum used for these networks is harmonized across Europe, predominantly in the 380 to 400 MHz range, but also higher frequencies can be used for increased capacity and to provide non-emergency services.

When it comes to broadband services, most of the European PPDR organisations currently use commercial mobile operator networks that may offer high data throughput but come with no guarantee on the quality of service, priority or pre-emption. Therefore, contention for network capacity can be an issue during busy periods (and emergency incidents) on commercial broadband networks.

However, despite the looming quality of service issues, European PPDR organizations continue to use applications such as mobile office, instant messaging, video transmission, internet access, positioning, database queries and remote controlled cameras over standard commercial networks.

As mentioned in the previous chapter, Belgium has an example of a government operated PPDR network, which is already up and running, using an MVNO model, based on three commercial networks and their licensed spectrum.

Another example is VIRVE in Finland who have a dedicated LTE core to which two commercial operators' RAN have been connected to provide broadband services.

There is an LTE PPDR network used by the local police of Rivas Vaciamadrid (a town close to Madrid known for innovative solutions) that is in operation (not just as a pilot). The network is working in the 2,6 GHz band, exclusively allocated to PPDR users, and it is operated by a non-governmental organisation. The core network is installed in the data centre of the local police. Today, there are approximately 100 users on the network, which is operational since October 2016.

2.3 Coverage

There are two different methods of defining coverage availability: geographical and population coverage. Coverage varies from country to country, and is very much dependent on whether mobile or handheld units have been used as basis for coverage calculations. It is also vital to understand if figures given are based on "at the door" or also include "indoor coverage".

This is valid for both legacy PPDR and broadband networks.

For example, in Norway the TETRA network Nødnett has a geographical coverage at 86 % and population coverage close to 100 %. These estimates are based on mobile (i.e. not handheld) outdoor coverage. There is a network infrastructure dedicated for TETRA Air-to-Ground service, to support aircrafts/helicopters. However, to date, only a few countries (approximately 5) have implemented AGA coverage. Normally, the TETRA networks also include the AGA base stations, but these are dedicated for AGA.

For areas with no TETRA coverage, during emergency disaster situations or planned events (when additional capacity is required), mobile units (deployable units or COWs – Cell on Wheels) can be used for backhaul. These mobile units can use any backhaul solution, i.e. satellite, microwave, etc. to connect to the core network.

Commercial broadband networks are deployed to maximize business in the framework defined by the regulation. In some countries, the government has demanded coverage based on population, while other countries left it open. Commercial broadband networks are generally capacity driven instead of coverage driven. For PPDR organizations the focus is on availability, which comprises of mainly coverage and capacity. Today, PPDR organizations cannot rely on commercial broadband networks due to the risk

associated with aspects of the network design such as coverage, availability (e.g. redundancy), power backup and priority.

Similar to the legacy solutions in use today, PPDR broadband networks require deployable solutions in areas of limited coverage or capacity, and to provide service at unplanned (disasters) and planned events. The solution can be an autonomous system with or without connection to the core network, depending on the service needed. Additional to this it is possible to use drones.

For AGA support in broadband networks it might be necessary to use a different frequencies to avoid interference with the terrestrial network.

2.4 Capacity

The capacity in legacy networks is normally defined as the number of carriers, number of talk groups, and number of direct calls (individual calls) that can be used simultaneously. However, the number of users in a talk group is normally indefinite. The system should be designed with sufficient capacity to avoid contention of the PPDR operation.

A group call will take one timeslot in a narrowband system, which can provide service to any number of users registered on a base station. This is a very efficient in terms of capacity and spectrum usage.

A challenge in narrowband networks is the limited packet data throughput. This is the main reason for using complementary commercial broadband networks.

Another throughput problem that needs to be managed in narrowband networks is the capacity of the control channel. Small messages (GPS location, SDS, data queries, status) go through the control channel instead of a packet data channel. If there is an amount of these messages, the control channel can become overloaded and result in problems with voice communication.

In 3GPP broadband networks, all users share the available bandwidth. Bandwidth varies depending on where in a cell a user is located. An application is typically assigned a certain QoS, including bandwidth required. As more users access the network there might be a need for the network to reprioritize the capacity requirements for applications and users.

2.5 Priority and pre-emption

To make sure the PPDR users involved in a mission critical activity get the required capacity, it is essential to implement priorities. For legacy systems there are several different types and levels of priorities used for voice calls and messages. These types and levels vary between different network suppliers.

Priorities can be assigned to users, talk groups, organizations and services, where services are divided into group calls, broadcast calls, direct calls, messaging, packet data etc.

The objectives of the priority and pre-emption functionality is to ensure that important calls, such as emergency calls and messages, are established in emergency situations when networks are congested, overriding lower priority users when necessary.

Priority and pre-emption are basic functionalities in legacy networks and are commonly used. This is contrary to commercial broadband networks where these mechanisms are rarely used today.

So far, the only way for the PPDR organizations to implement priority and pre-emption has been to build their own dedicated networks, which is prohibitively expensive.

There is an EU net neutrality regulation (EU) 2015/2120[1] stating that each user should be treated equally, resulting in difficulties in introducing priority. However, a network without priority can never reach mission critical status.

2.6 Security

In TETRA and Tetrapol networks there are several levels of security, which can be implemented to secure communication, users, devices, etc. It is important to know that TETRA and Tetrapol networks use different encryption algorithms and solutions.

The security is achieved by the TETRA European network algorithm TEA-1 and TEA-2 air interface encryption, E2EE, authentication of devices, system management, logging, etc. Additional to this the physical security is of essence. European public safety organizations generally use TEA-2, but there are also some countries that use TEA-1 due to the fact that they started to build their narrow band network before joining the EU.

Security was the main driver when upgrading the analogue systems to digital, as the analogue systems were very easy to tap and intercept.

End-To-End encryption (E2EE), air interface encryption and device authentication can all be used in the same network, where E2EE and air interface encryption can handle direct calls, group calls as well as text (SDS, status and alarm).

Lost or stolen devices can be detected and blocked from the networks to avoid malicious use. This is used as a service from the network and not the device. Additional to this the device can be protected with a code to access the network.

Not many of the European countries have introduced E2EE in their legacy systems. The French Police National (for some of their users), Sweden, Belgium, Norway, Germany, Romania and Finland are some countries who have implemented E2EE for all or some of their users.

Network security is not strong enough in the 3GPP broadband networks, thus E2EE is required for PPDR users. Additional to this there would be requirements on network management, network logging, device authentication, physical security, etc., both when using commercial networks and when implementing a dedicated broadband network.

For device security it is possible to use mobile device management, sandboxing (separation of applications), secure VPN, slit tunnelling (a dedicated VPN for certain applications), encryption of sensitive data and security keys, installation of applications in a secure container, and many more functions and features.

2.7 Interoperability

The as-is situation provides good national cross-agency interoperability, but limited cross- border interoperability.

The interoperability levels vary in the different European countries when it comes to users, organizations, national and cross border interoperability and technology interoperability.

The only cross border Inter System Interface (ISI) network integration already in place, and the first ISI integration in the world, is between the Sweden and Norway TETRA Networks[2]. A similar integration between Finland and Norway has recently been announced.

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[1] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R2120&rid=1
[2] http://www.tetratoday.com/news/isitep-enabling-cross-border-comms

It is important to understand that cross-border interoperability is not just dependent on the technical aspects. Legal and working processes are equally important.

At the moment, Sweden uses TMO (Trunked Mode Operation, back-to-back) towards Denmark and Finland. There is a DMO (Direct Mode Operation, back-to-back) integration between the Serbia and Croatia border crossings.

Romania uses a TMO back-to-back solution towards Moldova, and an ISI implementation between two of its own TETRA systems, provided by different vendors.

The Republic of Ireland and Northern Ireland have a TMO gateway solution which enables cross border radio communication between the police forces in both countries.

Between Belgium and Netherlands there is a back-to-back solution to support border operation and for cross border pursuits, based on TMO, DMO or both.

In today's commercial broadband networks there are no real technical problems when it comes to interoperability as they are all 3GPP compliant and technically compatible. However, to achieve cross border interoperability for data services there is a need for bilateral agreements between data service providers and operators.

2.8 Devices

There is a wide range of purpose-built legacy radio devices to meet the unique requirements of mission critical communications users, ranging from rail and metro to oil and gas, and utilities to public safety. The most common functions supported by the devices are voice and short messages. For TETRA there are several manufactures of devices, compared to Tetrapol where there is only one manufacturer.

In Europe, all legacy networks and devices support the harmonized PPDR spectrum.

Devices can be designed with different functions and features, like GPS, encryption, personal alarm buttons, etc.

There are hand held devices that are designed for different environments, such as intrinsically safe, ruggedized and water proof. There are also devices aimed for vehicle installation. The range of accessories vary between legacy and commercial broadband devices. However, ear piece and headsets are the main accessories used.

In the as-is situation for commercial smart phones there is a multitude of manufacturers supporting a multitude of frequency bands.

Also for broadband devices, there are many accessories to choose from. However, the main area of concern for PPDR devices today is the security aspect. As most of the broadband devices for PPDR run over commercial networks, it is crucial that they have security functions implemented to stop mission critical data from being intercepted or manipulated.

Dual-mode TETRA/LTE devices and multi-access routers have recently reached the market. The main purpose of dual mode devices is to increase coverage. Dual mode devices are mainly two separate technologies supported in one device, without any deeper integration. Dual mode devices are today available from Airbus, Hytera and Leonardo and probably some additional vendors.

Multi-access routers are also available in the marketplace, with the purpose to increase the availability by accessing several commercial broadband networks without relying on national roaming.

2.9 Applications and services

Mission critical voice has traditionally been used as the primary method of communication within PPDR organizations and between PPDR organizations. The various mission critical voice services, like direct

(individual), group, emergency, broadcast, and telephony calls are supported in real time and based on the legacy LMR technology (TETRA, Tetrapol and P25).

2.9.1 Applications over mission critical narrowband

Data services used on legacy networks are GPS location, short data service (text), status messaging, and narrowband data (mainly for telemetry), and are supported in real time. Applications on legacy networks are oriented to provide more data on the device side but due to the narrowband networks and types of devices, the actual data-related service capability is very limited.

One of the most utilised applications on legacy networks is data query, for example using a device to check a vehicle's registration plates. The device sends a limited amount of query data to a server and the returned data is also very limited, mostly in abbreviations.

If a packet data service is used on legacy networks, larger amounts of data can be transferred, but data rates are very low in comparison to services available on commercial networks. Although there is the option to use more voice channels for packet data, this will result in a reduced capacity available to the end user. One of the features using packet data is WAP (Wireless Application Protocol), which allows information browsing from TETRA devices.

On the control room side there are applications like AVL (automatic vehicle location), ambient listening (ambient listening is maybe more of a basic function in legacy systems like individual calls, etc.), PSTN calls and messaging systems (additional to SDS).

GPS functionality is integrated into TETRA devices using the Location Information Protocol (LIP) to support positioning information which provides the control with enhanced communication and administration of resources. With the use of a geographical mapping system and GPS information, the control room can track the positions of the TETRA devices on the mapping system displaying the speed of a device or vehicle, the location of a device or user in a certain geographical area, and send an immediate GPS positioning to the mapping system upon the activation of the device emergency button.

2.9.2 Applications over commercial broadband

Today's PPDR applications can be used on devices as well as on the control room side with unreduced scope. Today's applications have the possibility to distribute high-resolution images and video, remote database access, mobile office etc.

European PPDR organizations are using services over the commercial broadband networks, but totally separated from the legacy services and dispatch systems. These applications are for example mobile office, picture and video transmission, internet access, messaging, instant messaging, positioning, database queries, remotely controlled cameras, remotely controlled gates, etc.

Out of necessity, security, and for operational reasons, many PPDR organizations develop their own applications while waiting for new functionality to become standard. These applications are usually only used within an organization, rather than across organizations. It must be mentioned that today PPDR organizations, who use commercial networks, do not have adequate QoS, priority, etc. to support mission critical data.

2.10 Conclusion

It is clear that 3GPP Release 15 will become the main release to provide mission critical broadband services and applications for PPDR users.

It is also clear that the majority of the current legacy PPDR networks will be operational for a long period of time, but investment will start to move towards broadband.

The first common application to be used by both networks seems to be voice, MCPTT.

Joint progress should be accelerated and promoted through collaboration between those organisations operating and using mission critical networks for PPDR, *i.e. BroadMap partners, depending on political interest, financial resources and the possibility to deploy networks.*

Internet of Things (IoT) applications and use cases are being defined and determined, and these are very well suited for 5G (3GPP Release 15).

Most PPDR organizations are today using commercial networks for their broadband services, despite the lack of support of priority and pre-emption for the PPDR users.

Most countries use DMO and TMO (back-to-back) integrations between the TETRA networks, except Sweden and Norway (between their two national TETRA networks, in the cross-border region), and Romania (between two of its own TETRA systems, provided by different vendors) who have made an integration based on ISI.

Dual mode devices (TETRA/LTE), are in an introduction phase and not yet widely used by PPDR organizations.

3   Status of national strategies for mission critical communication

This chapter describes the status of PPDR broadband strategies and broadband frequency allocation for PPDR in Europe.

3.1   Status of PPDR broadband strategies

The NAKIT (the Czech National Agency for Communication & Information Technologies) survey was answered by 12 EU member states out of 28. The survey concludes that half of the states expect to keep narrow-band networks in operation beyond 2026, one member state targets to shut down their narrow-band legacy PPDR network in 2020, and three member states aim to shut down their legacy PPDR network around the middle of the next decade. Two states didn't answer. Similar results were found in the study that was part of the Finnish Strategic Guidelines to Critical Broadband report in 2014.

Fundamentally, a PPDR strategy towards broadband has been formulated or the work is on-going in Belgium, Finland, Italy, Norway, Romania, Sweden, Switzerland and the United Kingdom. A 700 MHz band frequency strategy has been developed in France and Germany and now also in Finland whilst Sweden has taken a time-out with their 700 MHz frequency auction to align it with their greater PPDR broadband strategy. Currently only France has allocated any dedicated broadband frequencies for PPDR.

Largely, it can be said that most countries do not have a concise strategy to move to broadband. The majority of countries with a strategy will use a gradual step by step approach utilising the commercial broadband networks, first for complementary data services whilst mission critical voice and messaging will remain in the narrow band networks. Only when proven that LTE technology can fulfil all the mission critical requirements, implemented as well as deployed, can the current narrow band networks be turned off. The time window for the transition begins with the availability of the compliant LTE products and comes to an end when reaching the end of life of narrow band network hardware – a few countries are currently in the process of renewing their narrow band networks after more than ten years of operation.

The United Kingdom is the exception targeting to shift from the current Airwave TETRA based network to the Emergency Services Network (ESN) based on LTE using commercial radio access by 2020. UK has accepted that ESN will not have all the required functionalities standardised (as the network will be based on 3GPP Release 12). Instead these functionalities will be implemented using proprietary mechanisms at the application layer. The project is very ambitious and contains high risk as concluded by the UK's National Audit Office report. Plan B in the UK is to extend the use of TETRA beyond 2020 in areas required, in the event that user agencies are not confident to exclusively use the ESN service. This may come with significant cost implications to the agencies.

A report from Finland (''Strategic Guidelines for Critical Communications'', Published in 2014 by Tietopiiriis) is being updated and made more precise following the 700 MHz commercial band auction at the end of 2016. This work is complemented by the Finnish police mobile broadband strategy from 2015 that sets expectations to the national PPDR mobile broadband capabilities.

Figure 2 presents a summary of the strategies and respective timelines across Europe.
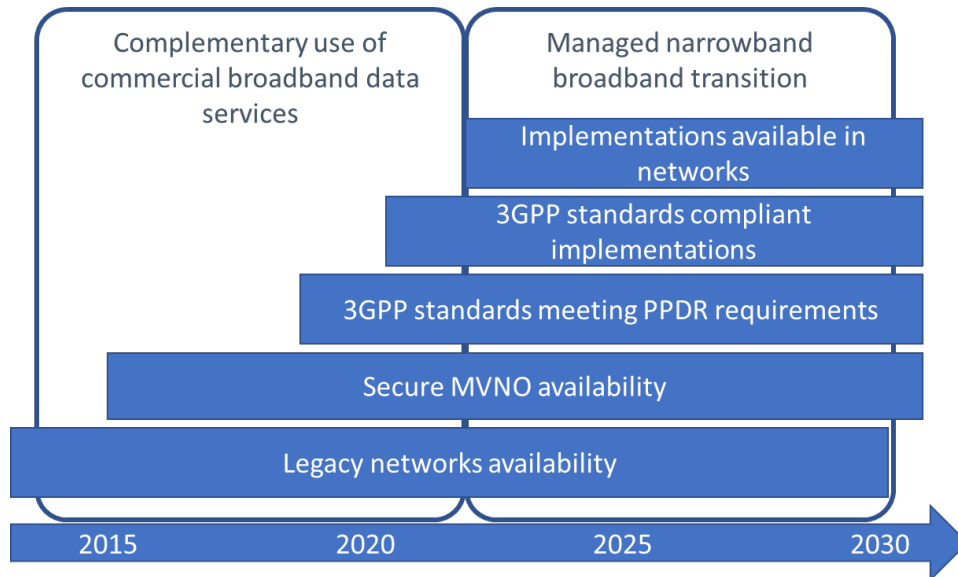
Figure 2: Stepwise technology transition strategy to mobile PPDR broadband services

Outside Europe, the most significant mobile broadband project is FirstNet that has been allocated 2x10 MHz of spectrum (band 14) and some 7 billion USD funding to establish nationwide PPDR communication service across the USA. Currently, the FirstNet agency is conducting consultations with all the stakeholders as it will be the first time that US agencies will share a service. In parallel, a tendering process has been on-going for some time, and recently a consortium led by AT&T was nominated as prime contractor. Whilst the spectrum is dedicated, it is likely that there will be several different implementation modes in different parts of the country. PPDR users can be directed to the contractor's other frequency bands in order to increase the overall PPDR performance. Major funding is expected to come from allowing the contractor to let its commercial subscribers use excess band 14 air interface capacity. If FirstNet reaches its vision, it will be the only broadband network providing seamless coverage from coast to coast.

Dubai has chosen to aim for a fully dedicated, government-controlled mobile broadband network. 2x15 MHz of spectrum has been allocated and a network technology contract is granted to Nokia. The network is intended to serve firstly PPDR field operatives, secondly all government agencies and thirdly companies with their IoT needs. The network is to be kept isolated from the Internet, thus enabling the formation of a secure intranet. The business model is based on the user fees collected from the companies.

SafeNet in South Korea is looking forward to establish a nationwide unified LTE network for 333 agencies in eight departments belonging to rescue, police, coast guard, military, local government, medical services, electricity and gas utilities. SafeNet is to be based on 3GPP LTE release 13. A pilot project has been concluded, and the continued project aims to establish a nationwide operational network by the end of 2018. The network will use dedicated 2x10 MHz in the 700 MHz frequency band. The radio access network will be shared with railway and maritime broadband networks, whereas commercial operators' backbone will be used as backhaul. The main concern is the ability to provide sufficient coverage.

3.2   Status of Broadband frequency allocation for PPDR

There are on-going efforts in various EU countries to try to agree on harmonized spectrum for broadband PPDR services. To realize a dedicated or hybrid network it is generally accepted that a bandwidth of at least 10 + 10 MHz is required. The two main spectrum bands considered are the 400 MHz and the 700 MHz bands, where the 700 MHz spectrum is clearly the best option. The 400 MHz

band has insufficient available spectrum and the available spectrum parts are not well harmonized between countries.

France is the only country which has allocated parts of the 700 MHz to PPDR in the guard band, whilst having auctioned out the commercial 700 MHz frequencies to commercial operators without any PPDR requirements.

Also, Germany and Finland have concluded their commercial 700 MHz auctions.

Sweden has decided to take a timeout to thoroughly study the situation in order to ensure that the needs of PPDR are properly addressed. A report released in March 2017 recommends the establishment of a hybrid network with significant dedicated PPDR radio coverage based on 2x10 MHz in the 700 MHz band.

All other countries are in the process of completing the legally binding Commission Implementing Decision EU 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union[3]. This decision also specifies that PPDR mobile broadband service must be in the 700 MHz band, however the way of implementation has been left open to the member states.

In Finland, PPDR shall have access to all commercial frequency bands including 700 MHz through commercial networks. However, the 700 MHz band suffers currently under TV broadcast interference from Russia reducing its usability in the eastern part of the country. There are still many open questions related to commercial mobile broadband networks services.

The United Kingdom has opted to use the mobile broadband network of EE. Currently it is being deployed on foremost 1,8 GHz and on 800 MHz frequencies.

Outside Europe Dubai has chosen to allocate 2x10 MHz in band 28 and an additional 2x5 MHz in the 700 MHz guard band in band 68. In USA FirstNet has been allocated 2x10 MHz in band 14.

3.3 Concluding Remarks

Currently there is no harmonised EU-wide strategy on how to provide PPDR mobile broadband services. In the majority of the countries no strategy has been formalised. The same applies for frequencies. A few EU member states have auctioned the 700 MHz (band 28) frequencies, whilst the majority of countries are still considering what to do with the 700 MHz band. So far only France has allocated 700 MHz spectrum to PPDR, but in the less attractive guard bands that are generally not supported by commercial devices.

This leads to a conclusion that pan European mobile broadband solution needs to be designed in a way that adapts to various national conditions whilst still maintaining the capability to enable cross-border cooperation, service continuity and a European-wide market for products and solutions. EU-level support in agreeing on harmonised tuning ranges is required to ensure cross-border interoperability in terms of comparable services for all users.

[3] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016D0687&from=EN

4 Objectives of a Mission Critical Broadband System

This section describes the European vision, proposed by the BroadMap project, for the development of a European interoperable mission critical broadband system, and common PPDR objectives based on the output from the BroadMap project.

4.1 European vision

The main purpose of the EC Horizon2020 Call and the BroadMap project is to establish the foundation for a European Interoperable PPDR Broadband communication solution. Major incidents, cross-border operations and global issues such as terrorism require increased cooperation between PPDRs across borders, as well as interoperable communication systems to support this. A main target is to align the PPDR vision with the European roadmap for 5G deployment, priorities and early trials (5G for Europe Action Plan)[4].

The solution must cover network, interoperability, devices and applications and meet the actual requirements for European end users. The requirements have been collected and evaluated in BroadMap, but the solution also needs to be flexible to account for revised end user specifications, changing technologies and security requirements due to changing threats or geopolitical situations. PPDR-specific requirements for availability, robustness, resilience and priority mechanisms are of high importance, especially when commercial or hybrid models are included in the solution. The commercial parts of the solution must be audited to ensure that these requirements are fulfilled.

Analysis of requirements and specifications has shown that the technology for a European PPDR communication solution is best based on 3GPP Release 15 which includes mission critical standards and which has been labelled 5G by 3GPP. This encompasses 4G LTE technology and opens for use of new 5G radio solutions. In order to include European PPDR requirements, the proposed technology solutions go beyond 3GPP, are heterogeneous in nature and should integrate with complimentary alternative radio networks (e.g. satellite, short range (Wi-Fi, Bluetooth), ad hoc mobile deployments, and LPWA technologies such as UNB). While 3GPP Release 15 mission critical standard has the best compliance rate with end user requirements, gaps in 3GPP for network, applications and devices have been identified. An objective for the future European communication solution is to address these gaps and propose additions to the 3GPP set of standards and other standardisation bodies. The solution must be future proof to include innovations to support new 3GPP releases. One direction is to pursue these objectives as part of a pre-commercial procurement (PCP) process in the EC. This is a valuable approach for closing identified gaps and provides validation processes for applications and devices.

Another target is to include most European countries (more than BroadMap participating countries) as well as all relevant PPDRs (police, ambulance, army, fire, customs, coast guard, etc.) in a common solution. It will however be beneficial for an economy of scale and ecosystem for applications and devices if the solutions are adopted on a global scale. Therefore, a key objective is to support multiple vendors to deliver interoperable networks, devices and applications.

The solution to network, devices, and applications must cover a Pan European collaboration between PPDR forces. An essential objective is for European countries to avoid proprietary or non-standard systems and adopt standardized services and devices that ensure technical interoperability. The experience from the TETRA and Tetrapol interoperability projects (i.e. FP7 ISITEP) shows that the configuration layer of the systems must also be harmonized. The objective is to ensure a full EU interoperable system taking into account all layers of interoperability (technical, configuration, process, organizational, legal, etc.), and requires EU wide acceptance.

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[4]https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document

Future solutions must be based on the security requirements defined by end users, as well as comply with European laws and regulations. If commercial elements are part of the solution, a strict regime of agreements, regulations and audits must handle and enforce the security specifications and management of the system. Governmental control is essential, but the form of this control may vary based on the chosen solution and organization scheme. The level of governmental control may vary between the countries and the geo-political situation at hand, and this must be accounted for when interoperation is established. It must be possible to operate with national autonomy when the current situation so demands.

Concerning radio spectrum for PPDR broadband use, there are dispersed national strategies in European countries. As described in Chapter 3, some countries have already allocated radio spectrum in the 700MHz band for commercial use, while other countries are in the evaluation phase for how to best utilise the available 700MHz and 450MHz frequencies. A harmonized dedicated European spectrum plan for PPDR broadband seems unachievable and a European solution must therefore to some extent include commercial mobile radio networks. Given that the spectrum situation varies from country to country, the solution must support different radio plans and a possible mix of dedicated radio networks and radio networks shared with commercial users. A benefit to utilizing commercial radio networks is that it provides access to additional commercial radio bands and hence an increased capacity. To meet the requirements of European users, national strategies and spectrum plans, usage of heterogeneous networks (as mentioned above) must be considered.

When introducing new PPDR mobile broadband solutions, interoperability with the current narrowband PPDR networks (TETRA and Tetrapol) must be ensured on a national level (at least for MC voice services). This can be realized either in the control room or in the network and must be supported until the narrowband networks are taken out of use. The BroadMap project has considered the pros and cons associated with employing different organization schemes on these transition solutions. The transition to an EU-interoperable mobile broadband system must take account of the different timelines, plans and procurement power for each European country.

4.2 Common PPDR objectives for mission critical broadband

The common PPDR objectives are based on the document "D4.1 High Level Specifications, Solutions & Potential Organisation Schemes" and thus derived from European end users requirements in the BroadMap workshops carried out in Work package 3.

4.2.1 Interoperability

One of the main motivations for the PPDR Broadband Network is to create a Pan European public safety communication solution that allows interoperation across national borders, with participants from different public safety user groups, sharing a wide set of applications and common talk groups. PPDR users must be allowed to stay connected and continue to use their network services and applications when roaming to other countries. Applications shall support access and data sharing between users from various PPDR user groups (agencies), and from different countries. Devices must support standardised interfaces including the relevant radio bands to ensure such interoperability. All layers of interoperability (technical, configuration, process, organizational, legal, etc.) need to be in place to ensure real collaboration between European PPDRs. This entails procedural harmonization, development of European guidelines for communication (e.g. single point of contact) and practical training on cross-border solutions to ensure successful implementation during emergencies.

4.2.2 Security

Physical security and management of all PPDR broadband network components are of equal importance and must be in line with PPDR user requirements as well as European security laws and regulations.

Any future solution/standard should be capable of the following :

1. Provide security solutions using industry standards (3GPP specifications), European end users' requirements and EU and country specific regulations to ensure data and user confidentiality, integrity of the solution, and to protect the PPDR broadband network and its components.

2. Provide standard and certified encryption capabilities to support MC (voice, data, video) and security and control mechanisms (i.e. authentication) as specified in Deliverable 4.1 Section 2.4.2, 2.4.3 and 2.4.4.

3. Data should be encrypted from end-to-end to ensure confidentiality and integrity across the heterogeneous network solutions. This should include the capability to scale to the appropriate context (local, country, Pan European) and include multiple levels of security to account for different PPDRs.

4. Devices must be secured and contain mobile device management (MDM) functionality to protect the device itself including its content and applications, and allow remote 'temporary disable' and 'permanent disable' of devices.

5. The radio part of the network must be designed to withstand jamming, e.g. by spreading the traffic on various frequency bands.

4.2.3 Availability

Secure communication requires that the PPDR Broadband Network is available when needed, for routine day-to-day use as well as when major incidents and disasters occur. Without the services from the PPDR Broadband Network, the efficiency or even the capability of PPDRs and other critical communication users to do their work may be limited or even impossible. Availability of the system entails coverage, capacity, priority, resilience and redundancy.

Radio coverage must be ubiquitous, to ensure geographic coverage as well as population coverage. The coverage can be supplied with dedicated PPDR radio frequencies in the home network using deployable, temporary radio base stations, by direct communication between radio devices, by commercial radio network providers, with heterogeneous radio solutions and when roaming to another country's PPDR radio network.

The radio network must provide the capacity to accommodate all the users and their applications, both in the daily situations and when the number of users and amount of data traffic peak, e.g. in situations of major incidents or disasters. Sufficient radio spectrum must be available to a growing number of users. To cater for limited radio capacity, applications must be handled with the relevant quality of service.

Pre-emption and priority mechanisms such as radio access priority are essential to ensure that MC traffic is prioritized over other users' traffic, and real-time high-priority services are prioritized over less important background traffic.

PPDR Broadband Network availability relies on resilient and redundant network solutions. Single points of failure must be avoided. Critical network components such as transmission lines must be duplicated and core networks should be implemented with geographic redundancy. The network must be able to withstand extreme natural and electromagnetic environments. Fallback solutions (e.g. base station, satellite, data backup) can be implemented to increase reliability.

4.2.4 System management

System management shall ensure correct and efficient operation of the PPDR Broadband Network 24/7. The management of the PPDR broadband networks shall include a full set of both operational (e.g. subscriber, fleet map, user groups) and technical capabilities (e.g. maintenance, configuration) for networks, devices and applications in accordance with PPDR specifications for management systems (see D4.1 sections 2.4.14-15). The management system shall provide remote diagnostics and remediation of problems, and will be based on standard network management protocols.

Mobile device management systems will be used to distribute applications and software upgrades as well as permanently disable and wipe devices in a managed manner.

While system management will be performed nationally and by local agencies, some level of European coordination will be necessary to ensure interoperability in the configuration and application layer. In addition there will be a need for a coordinative function for the common technical and administrative layers of the solution. System logging of network behaviour and user events must be available for authorized agencies.

4.2.5 Device ecosystem

PPDR organizations require a wide range of device types to fulfil their tasks. A target is an ecosystem of devices that fulfill the specific and evolving requirements of European PPDRs (see Deliverable 4.1, section 3.4) and ensure economies of scale. It is foreseen that devices can range from BYOD / COTS to specialized, hardened devices, as long as security concerns from not only the user organisations but also the network operators are satisfied. A sustainable and future proof device ecosystem must narrow the PPDR device development cycle and promote state-of-the-art technical solutions by adopting products and technology from the commercial markets. Standardised radio interfaces and harmonized tuning ranges are necessary to support a common ecosystem and seamless roaming between PPDR networks in Europe. Devices must support the application ecosystem.

Devices must fulfill PPDR requirements to function under different climates, conditions and operations (e.g. ruggedized, portable, covert, support of operational wearing of gloves) and with standard interfaces to connect to external devices. The ecosystem shall also cover external accessories for devices to cover user needs. Devices shall support central device management systems with reconfiguration and software upgrade online, which is a costly manual operation today in TETRA and Tetrapol.

Devices for control room and dispatch functionality shall be a part of the devices ecosystem.

4.2.6 Application ecosystem

PPDR organizations require a wide range of applications to provide all types of relevant information to fulfil their tasks. The target is an ecosystem of applications that fulfil the specific requirements for European PPDR organisations (see Deliverable 4.1, section 2.5.4) and ensure economy of scale. The application ecosystem must support sharing of common applications (e.g. PPDR app store) and take care of the users' evolving requirements to services and applications. A sustainable and future proof application ecosystem must narrow the PPDR applications development cycle and promote state-of-the art technical solutions. This will be a vast improvement from the situation with current PMR systems where it seems impossible for PPDR to follow the state-of-the art technical solutions. Control room and dispatch applications are also a part of this ecosystem and standards for information exchange (e.g. situational awareness data) and open APIs must be specified. PPDR requirements for network applications (e.g. group call, ambient listening, etc.) must be realized in the network layer and/or the application layer.

4.2.7 Financial sustainability and marketplace

A competitive international marketplace encompassing the network solution as well as the device and application ecosystems must be encouraged. Development of cost effective common applications for European PPDR users must be ensured. Applications must be made easily available for European users e.g. in an application store for PPDR. Network solutions shall be based on common standards (3GPP Release 15 mission critical standard) to ensure multi-vendor systems availability. A Pan European market for devices in relevant frequency ranges for supply of equipment and devices in large scale must be facilitated.

4.2.8 System documentation

System documentation shall be available to operators and third parties (within regulated IPR restrictions) to ensure a competitive market and interoperable device and application ecosystem. System documentation includes network, device, application and interoperability specifications and user manuals.

4.2.9 Health, safety and environment (HSE)

The solution must be in accordance with regulations and PPDR requirements regarding health, safety and environment (see Deliverable 4.1, section 2.4.21). The solution must apply applicable RF safety and ICNIRP guidelines and relevant regulations for emission limits and non-ionizing radiation as well as ensure that devices cannot cause noise induced hearing loss. A secondary target is to optimise energy consumption and to be environment friendly.

5 Legal Aspects of the transition roadmap

After presenting the objectives related to legal aspects of the transition roadmap, recommendations are made based on a timeline divided in three main timeframes. Guidelines to complete loopholes in the EU current regulation are also proposed.

Legal aspects are more detailed in Annex 2 ("*LEGAL ASPECTS*") which contains the legal roadmap elaborated by partner DGFLA during task 5.1, the legal booklet presented during a legal workshop, PCP national regulation and EU legislation tending to harmonize PPDR communications.

5.1 Objectives to procure a new generation of PPDR communications systems through a public organization

Two main objectives have been identified. They are issued from the analysis realized during task 5.1 (See Annex 1 chapter 1 Legal roadmap).

5.1.1 Objective 1 – Implement further PCP and PPI activities by public joint-procurement

The solutions which will be developed based on the results of the BroadMap project which are foreseen to be implemented through PCP and PPI activities due to the level of technical innovation required. Indeed, if public buyers need to be provided with a technical solution ensuring the interoperability of the PPDR / critical communications systems which is not 'on' or 'close to' the market, PCP activity should be used. Once such an interoperable system is developed, a PPI should be used to commercialize it at a larger scale.

PCP is the most adapted procuring tool to further R&D on an interoperable solution due to the flexibility of this procedure. The PCP procedure is based on soft law developed by the EC based on a 2007 communication[5] and / or a national law regulating PCP (i.e. Spanish or Lithuanian law for now). Due to the technical complexity of the subsequent PCP activities of BroadMap, conducting a procedure based on a global contract (i.e. without division in lots) is recommended. Moreover, if companies do not bid in consortium to the PCP tender call, subcontracting should be authorized to allow SMEs to participate. The possibility of allowing variants in the public tender is also interesting to encourage creativity from bidders.

PPI is the most useful procurement tool to commercialize this innovative interoperable solution with possibilities of customization for certain buyers. PPI could also allow technical solution(s) of others to ensure the migration from the legacy national systems to the new interoperable system. PPI enter in the framework of the 2014 Directives on public procurement[6] and procedures as a competitive procedure with negotiation and competitive dialogue are recommended because they allow a negotiation phase during the tendering. Moreover, if an innovation with limited R&D and commercial scale is simultaneously needed, an innovation partnership could be an adapted procedure.

Both PCP and PPI activities require that an organization is created to facilitate joint-procurement between public authorities at EU / Pan European level to give them a strong purchase power and ensure the coherence of the solutions procured. Thus, any MS and AC interested in procuring an interoperable critical communications system could join an organization of public buyers for leading and implementing future PPI and PCP activities.

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[5]SEC(2007) 1668 communication
[6] Mainly EU Directive 2014/24 of the European Parliament and of the Council of 26 February 2014 on public procurement

The level of involvement of the public authorities, whatever the national entity involved, and their financial participation must be determined. In any case, and for sovereignty reasons, the PCP and PPI contracts will have to be directly concluded by the countries and not by the joint-procurement organization. As a first step, this organization will have only a contractual form as detailed below and should evolve at the long-term stage to a dedicated entity for PPDR communications system. The modalities to do so are detailed in sections 5.2, 5.3 and 5.4 below.

5.1.2 Objective 2 – Define the content of future PCP and PPI tender documents

The content of the public tender documents will define the contractual obligations between public buyers and their suppliers. Then, the drafting of tender documents will have to reflect these elements to estimate the global cost of the public contract including both build (i.e. construction/ manufacture) and run (i.e. operation / maintenance) requirements but also, governance of the public contract (e.g. technical validation specific and procurement committees).

The content of the tender documents must be defined before the tender call because it cannot be amended once the tender is launched (i.e. only a limited number of clauses could be negotiated and amended during the procurement procedure). These documents have to precisely define the selection and award criteria to choose the best solution(s) and define the main administrative and technical clauses of the future PCP / PPI contracts in relation with the innovative character of these activities.

Selection criteria request candidate companies to submit a bid in relation with their suitability to professional activity (e.g. legal status and nationality of companies or assurance liability), economic / financial standing (e.g. financial weight affected to R&D projects) and technical /professional activities (e.g. references in the field of radio communications including PPDR or existence of licenses). For PCP, the EC guidelines require to select at least 3 companies. However, this is soft law; then, if only one or two companies submit a bid and no breach in procurement rules occurred, the PCP should continue (i.e. at the opposite, this would mean that no R&D could be done). Moreover, in limited and justified cases in particular for security reasons (e.g. traceability of the products / information), a company can be excluded (e.g. in reason of its nationality)[7].

Award criteria should include performance criteria which are used to evaluate the technical solutions (e.g. service level agreement, key performance indicators). For PCP projects, these performance criteria could be defined in general in the PCP framework and detailed in each PCP contract.

Key clauses in innovative projects are the share of IP rights which directly relate to the price and the referential used to control contract execution (i.e. performance criteria). To implement PCP, sharing IP rights is strongly encouraged[8] due to the potential application of the R&D results for next generation of radio communications systems during the commercialization phase (i.e. future PPI activities). It is recommended, as a matter of principle, to share IP rights so that the public buyers would be entitled to use the IP rights for themselves and to grant license entitling other companies to use and exploit the IP rights (i.e. partially exclusive or nonexclusive license) for the next PPIs activities.

Among other benefits, such a model would avoid the buyers to be locked-in with the companies participating to the PCP. In addition, it mitigates the risk of having non-participating companies trying to challenge the procurement proceeding based on an alleged breach of competition rules.

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[7]However, the goal of reinforce EU industries cannot be the single reason to exclude non-European companies.
[8] Please note that to obtain EU funding, it is mandatory to share IP rights as requested by the EC in its 2007 communication on PCP.

Public buyers may find it appropriate to organize a more restrictive regime regarding the assignment of the IP rights related to a specific part of the R&D results (e.g. exclusivity limited to a piece of the technology as the network core system for security reasons). For the PPI activities, IP rights could be shared as for PCP or exclusively granted to the public authorities. This will depend on the content of the PPI activities (i.e. existence and / or importance of R&D). In any case, the background and the foregrounds of each public and private party have to be precisely defined in the PCP / PPI contract and license could be given to one party to another if it is required for R&D activities.

In any case, the sharing of IP rights will have a direct consequence on the public budget and then the price of the public contracts due to the sharing of risks / benefits which include financial participation by the company to develop solutions they could then reuse (i.e. if benefits of the public contract are at the only profit of public authorities, the price will be higher because the risk weighs only on the companies). The public authorities cannot fix a price which will exceed the market price (i.e. in this case, it will be considerate as illegal State aids or its compatibility will have to be justified). Financial penalties in case of delay or non-compliance with performance criteria should also be provided.

Moreover, the label / standards applicable to PCP and PPI activities should be previously planned to ensure the interoperability of the critical communications system and avoid future lock-in. If they do not exist, 'pre-standards' will have to be defined as detailed below. The applicable EU regulation on the PCP and PPI activities to procure a new generation of radio communication systems (e.g. security by design for data protection) but also, operate them (e.g. reinforcement of the cyber security of communication systems by concerned Operators of Essential Services) will have to be mentioned in tender documents.

5.1.3 Objectives implemented pursuant a defined timeline

Considering these two main objectives, recommendations are made in a long-term view with proposals which could be implemented at short-term (i.e. 1 to 3 years), mid-term (3 to 7 years) and long-term (more than 7 years). Recommendations at short-term could be used for the next EC PCP tender referenced SEC-04-DRS-2017 on Broadband communication systems[9], mid-term recommendations for PPI projects and long-term recommendations for implementing a dedicated entity.

To establish these recommendations, answers are required for the following questions:

1. Who are the public purchasers?
2. Who are the beneficiaries of the public procurements?
3. Who could lead the public procurements?
4. Who own the results / products / services of the public contracts?
5. What legal instrument to benefit EU and national funding's?
6. How R&D results comply with standardization even if there are not standards already defined?
7. Who and how third parties (e.g. independent experts) could be part of PCP / PPI activities?
8. Why and how sharing intellectual property rights?
9. How to award companies solutions in a public contract?
10. Why, how and what public procurement procedures could be implemented?
11. How and who could follow-up public contract execution?

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[9]http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/sec-04-drs-2017.html

12. What is the role of a common organization for PCP / PPI activities?

13. What is the role of the EC in implementation of PCP / PPI activities?

14. What countries could be involved?

15. How companies could be selected?

These recommendations are in accordance with the following validation criteria previously defined in task 5.2[10]:

1. Acceptability to key decision makers, stakeholders and opinion leaders,

2. Relevance to the topic,

3. Technical feasibility,

4. Life cycle costs (across different organizational schemes),

5. Technical maturity,

6. Client or user impact,

7. Security issues,

8. Coordination or integration with other strategies, programs and activities,

9. Socio-economic impact,

10. Risk assessment and

11. Timing.

Therefore, the objectives of the legal aspects of the transition roadmap aim to propose a legal and contractual framework at short, middle and long-term for an organization of joint and cross-borders procurements implementing PCP and PPI activities.

The Figure 3 below synthesizes these objectives and their timeline:

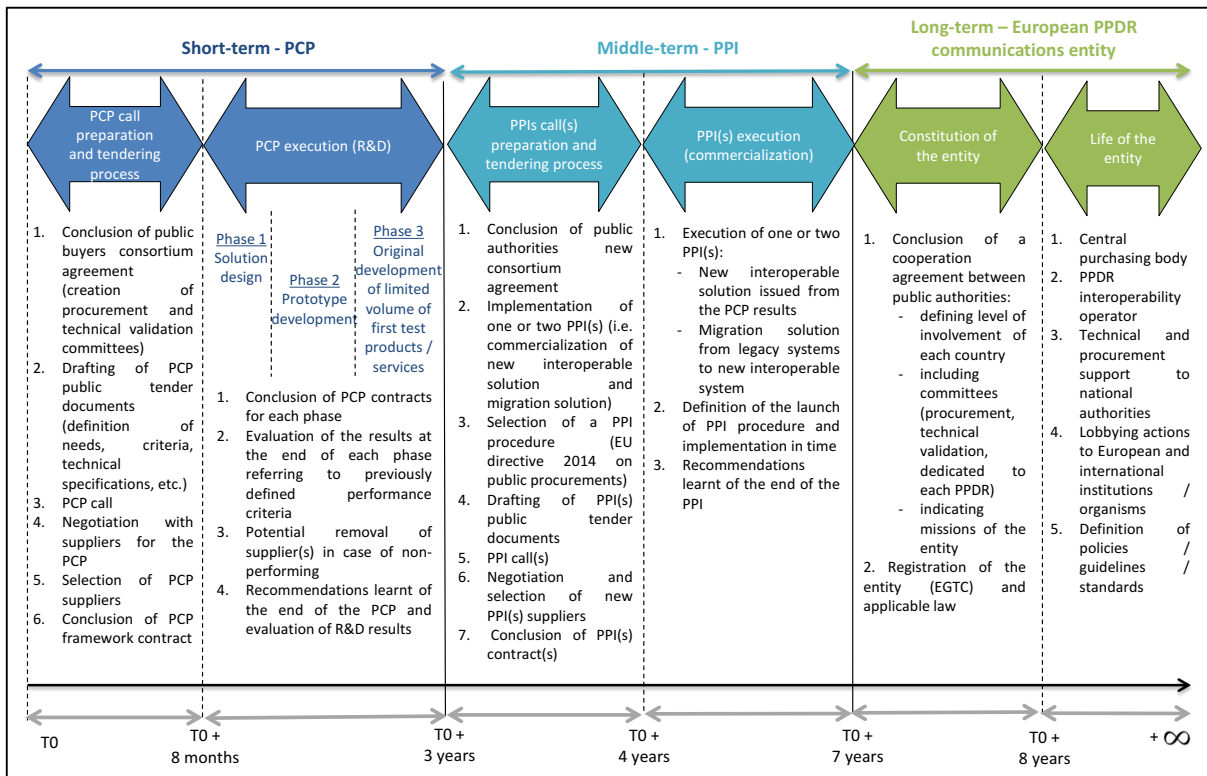[10] Deliverable 5.1 "Conclusion of solution evaluation"

Figure 3: Timing of further PCP and PPI activities on legal aspects

5.2 Contractual organization of public buyers for PCP joint-procurement at short-term

To ensure efficient governance of the PCP activities, two contractual levels will be organized. A first contractual level for joint-procurement between public buyers including two functional committees which activities are funding by the EC and a second contractual level after tender process with companies selected for the PCP phase.

5.2.1 Conclusion of a buyers consortium agreement with support parties

To implement interoperable solution for critical communications, as soon as possible and due to short-time delay (i.e. in the next PCP tender SEC-04-DRS-2017 on Broadband communication systems), we recommend to conclude a consortium agreement (i.e. which imply contractual relationships and their attached rights and obligations). This agreement will include public buyers and also practitioners (i.e. non-buyers bringing logistical and technical support for example). They will not create a legal entity. Thus, these modalities of organization are not considered as a public procurement organization in charge of the PCP after its transfer. In any case, the modalities to organize relationships between public authorities and eventually support party / parties assisting them for the activities at short-term has to be defined by a buyers consortium agreement.

These public buyers could be MS or AC whatever the national entity involved (e.g. Ministry and / or dedicated national or local agency for critical communications). Such an agreement will define (i) the countries buying the results of the PCP (e.g. the countries financing the PCP who could use the pilots for radio-telecommunications system once implemented) and (ii) the countries buying but also, hosting prototypes pilots in their territory (i.e. cross-borders countries to ensure efficiency of the future interoperable solution). Supporting non-buyers' partners (from MS and AC) could also participate to the PCP and this has to be defined in the consortium agreement. Supporting non-buyers

may be represented by practitioners who may define test requirements and ultimately use the resultant systems, or by other supporting partners who may handle coordination, networking and legal aspects to support procurement.

Moreover, the PCP procedure has to respect the soft law defined by the EC in particular in its 2007 communication on PCP. All the modalities to organize / define relationship between public authorities (i.e. buyers and non-buyers) and eventually support party as experts involved in the same project has to be defined in a consortium agreement (e.g. for the BroadMap project, the members of the project have defined their relationship into a consortium agreement).

Such a common governance of the PCP execution allows assurance of a strong ownership from public authorities, optimization of the public purchase and operational cooperation to fulfil PPDR end users needs.

5.2.2 Creation of functional procurement and technical validation committees

The functional governance of the PCP activities are essential to ensure that the defined administrative (e.g. IP rights, price, delay) and technical (e.g. legal environment) clauses will be respected. We recommend creating two committees which are functional tools inside the buyers' consortium agreement: a procurement committee and a technical validation committee (i.e. they are not established by another contract or do not have a proper legal entity).

As the buyers consortium agree to go through a same tendering process (i.e. sharing the same procurement procedure by joint-procurement), it means only one procurement department will be dealing with the PCP tender rather than several countries procurement departments. Either, the consortium agree to devolve it to one of them (e.g. procurement service of country A), or they agree to entrust a support independent entity (e.g. law firm) to fulfill the tendering process.

This mission will be done by a "procurement committee" which will be in charge of all the follow-up and coordination of the tendering process but also the drafting of tender documents in relation with the technical validation committee detailed below. It will launch the call tender and coordinate it until the signature of the PCP contract (i.e. the PCP framework and contract for each R&D phase). It will also ensure the respect of each party contractual obligation during the PCP execution.

Moreover, all countries involved will share technical skills within a "technical validation committee" whose mission is to validate the results of the PCP and ensure its compatibility with current or drafting standards. It is recommended to grant this technical validation committee with a full role of activity including at least:

1. draft the technical specifications in tender documents (i.e. the objectives that the results of the PCP phases have to complete) referring to current standards;
2. based on the current discussion within standardization organisations (e.g. 3GPP), ensure that solutions developed by companies throughout the 3 phases of the PCP are in accordance with such current or in discussion standards for PPDR radio communications;
3. evaluate, at the end of each PCP phase (i.e. design, prototype and first tests), that R&D results fulfil with the technical requirements;
4. establishment of pre-standards / guidelines if they do not exist;
5. lead operational process management;
6. operation of data network / pilots at the end of the PCP.

5.2.3 PCP grant agreement between public buyers and the EC

In the framework of Horizon 2020 program, a grant agreement, pursuant to the tender SEC-04-DRS-2017, will be concluded with the EC including funding support. As for BroadMap project, this PCP grant agreement is concluded between the consortium of buyers / supporting non-buyers and the EC. However, the EC is not part of the PCP contract(s) signed with companies.

As a PCP implies the financial participation of the suppliers / companies to the R&D, the total cost of such phase will be shared between public buyers, EC and the companies. Such a mechanism, encourages each party to successfully execute the PCP and reduce the public price of the contract.

5.2.4 PCP framework and contracts between buyers and companies

Public buyers should select within the buyers' consortium a lead procurer who will coordinate and lead the joint PCP. This lead procurer is part of the buyers group (i.e. the lead procurer is the beneficiary of the EU grant who represents the buyer group for the funded procurement and is also part of the PCP framework and contracts). The lead procurer could also be a support party but due to the fact that in this case it has to be part of the PCP contract (i.e. which is concluded for public needs), it is not recommended.

The award criteria identified to select the suppliers tendering for the PCP activities are the following[11]:

7. Price (public budget) – 30%;
8. Understanding of the public needs / requirements – 60% with the following sub-criteria:
   - Capacity to take into account national technologies;
   - Technical maturity / level of innovation of the solution;
   - Standardization / interoperability;
   - Possibility of upgrade / open source;
9. Schedule / delay – 10%.

On selection of the successful tenderers, the lead procurer will sign the PCP framework contract and each specific contract for all phases of PCP on behalf of the buyers' consortium. However, the share of such responsibility is defined between public buyers within the buyers' consortium agreement. Supporting non-buyers could also be part of the PCP framework and PCP contracts.

The PCP contract is a framework contract signed with companies (e.g. Company A, company B and company C) and for each phase (i.e. phase 1, phase 2 and phase 3), a dedicated PCP contract is concluded with each company. The EC recommend contracting with at least 3 companies to implement a PCP. Thus, in case if after evaluation by the technical validation committee, the results of company A are not convenient, the contracts for the phase 2 will only be concluded with companies' B and C.

As mentioned above, the first contractual level for public joint procurement is represented by 1 and the second contractual level after tender's selection of companies for the PCP by 2. See Figure 4. Such an organization of public buyers could also be reproduced for other PCP projects.

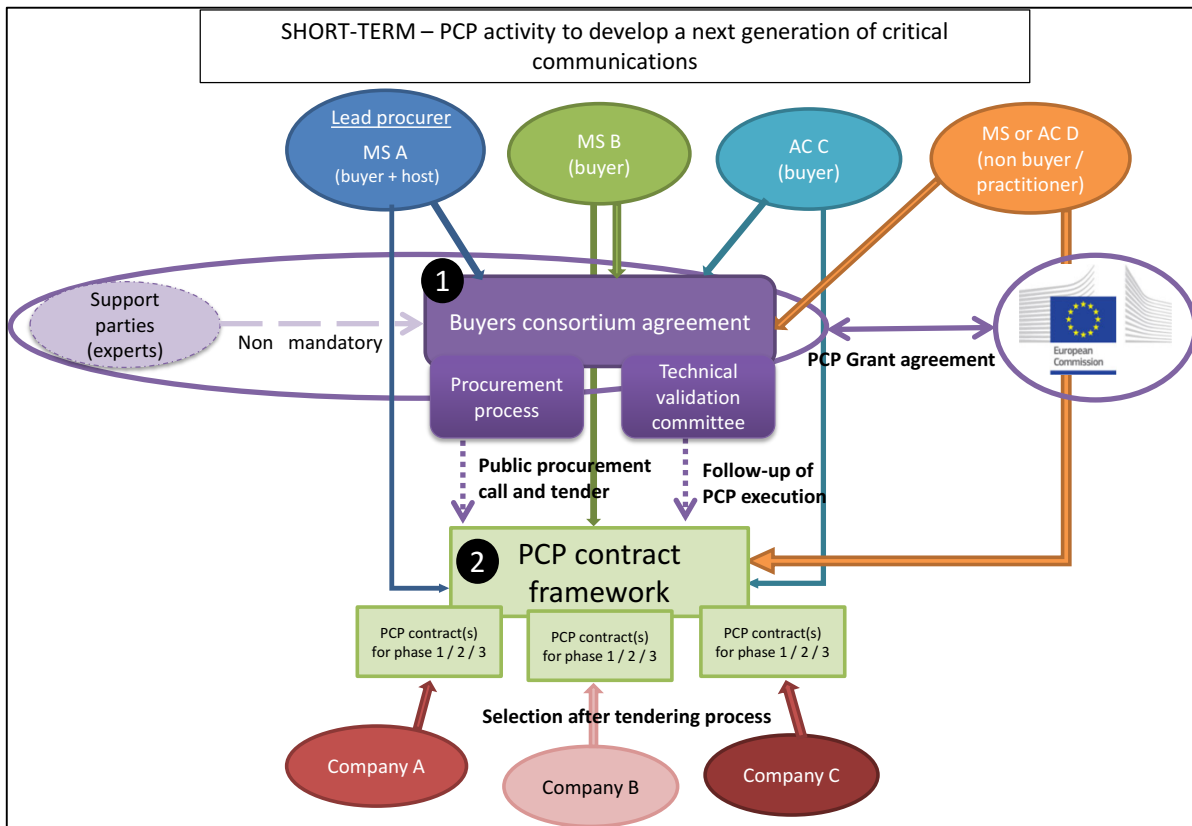[11]Proposals made pursuant to WP5 kick-off in Finland on December 2016

Figure 4: PCP activity to develop a next generation of critical communications

5.3 Consolidation of public joint-procurement for PPI procurement(s) at mid-term

Similar to the proposal to PCP and to ensure efficient governance of the PPI activities, two contractual levels will be organized. A first contractual level for joint-procurement between public buyers and funding by the EC or others institutions and a second contractual level after tender with companies selected for the PPIs.

5.3.1 Conclusion of a new authorities consortium agreement with support parties

Based on the lessons learned at short-term and to commercialize the results of the PCP to a larger scale (i.e. with more public buyers and / or for bigger volumes), a new consortium agreement between public buyers will be concluded. Its members could be the same countries involved in the PCP and / or other interested countries. Its purpose will be to pursue PPI activities (i.e. commercialization of products / services resulting from R&D). Thus, a new consortium agreement will be concluded between authorities (i.e. different from the PCP buyers' consortium agreement). Public authorities within this consortium agreement could be assisted by supporting non-buyer parties as for the PCP (e.g. experts, law firm).

If a country wants to be associated with the PPI activities without financial participation (i.e. as non-buyers), it could bring material, technical or logistical support in exchange. These modalities of participation to the authorities' consortium have to be defined contractually in the agreement above mentioned. In any case, a public authority who participates financially to the PPI is a public buyer.

5.3.2 Reinforcement of procurement and technical validation committees missions

Similar to the proposal to PCP, a functional organization of the authorities' consortium is recommended. Based on the same figure, the procurement committee will be dedicated to pursue that tender phase of the PPI and fix any problem during its execution. First, it will define the best procedure for the PPI (i.e. competitive dialogue, competition with negotiation or innovation partnership) depending on its purpose. Then, it will support the consortium to launch the PPI call until the signature of the PPI contract.

Based on the lessons learnt after the PCP, the role of the technical validation committee could be amended with new missions in relation to the commercialization of R&D results. During the commercialization phase, this committee will be the "armed wing" of the authorities consortium for implementing joint procurement in the radio communication PPDR field with volume advantage on the market and then, to obtain a strong weight for negotiation with companies on price, IP rights ownership, etc.

Thus and in addition with its previous missions, the technical validation committee could:

10. be in charge of incidents related management system (e.g. transition from legacy systems to new generation, centralization of services);
11. propose drafting of public tender documents with new technical requirements of new public purchasers and / or end users in relation with the procurement committee;
12. make proposals on new standards (i.e. not pre-standards);
13. depending on the ownership and operation chosen for the interoperable system, coordinate and potentially operate it.

5.3.3 Conclusion of new funding agreements with investors

Unlike for the PCP the price is shared between public buyers and companies, for the PPI, the price will be only supported by public authorities who buy products for their own-use. Moreover, due to the innovative character of PPI, investors support such activities. Thus, funding could be granted by the EU in the framework of Horizon 2020 or other programs (e.g. European structural funds) but also, by other interested investors as the European investment bank or national bank (e.g. the *Banque publique d'investissement* in France).

Some companies could also be interested to participate financially to such activities in exchange of IP rights which do not appear during the PCP phase.

5.3.4 One or more PPI contracts between public authorities and companies

Throughout the authorities' consortium agreement, public entities organize their relationships to procure PPI activities by one or more PPI contract(s). However, and as for PCP phase, this procurement organization is not a legal entity. Thus, PPI contracts will be directly concluded by interested countries (i.e. depending on the purpose of the PPI activity, public contracting authorities could be different) with companies selected after tender procedures. In any case, PPI procedures and contracts have to respect the EU 2014 Directive on public procurement.

Based on the technical issues of the transition roadmap, two types of PPI have been identified:

14. a PPI whose purpose is to commercialize the PCP results related to the interoperability of the PPDR communications systems,
15. a PPI whose purpose is to commercialize a migration solution from the national legacy systems to the interoperable solution.

Depending on the technical characteristics of each national system, one or more PPI will be concluded (i.e. one PPI will be concluded for each country or for a group of countries having the same legacy system).

Regarding the IP rights in a PPI, there is a choice on co-ownership between public authorities and companies or exclusive ownership of public authorities' on the products / services. But, co-ownership reduces the public price of the contract. It could also be provided in PPI contract that after a certain time, the IP rights become property of the public authorities if they are not used by companies. In any case, IP rights and price of the PPI contract will have to be clearly defined and controlled by the authorities consortium.

As provided by the tender SEC-04-DRS-2017 related to PCP activities after BroadMap, we propose the following topic description of a future PPI to commercialize the interoperable solution after the PCP:

Specific challenge: commercialize an innovative solution to ensure interoperability between PPDR radio communications systems which are not compatible between them. The EU has funded a previous PCP project (SEC-04-DRS-2017) to research and develop such solution(s).

Scope:

- Phase 0 – conclude a consortium agreement between public authorities interested to participate defining the level of involvement of each country and defining the missions of procurement and technical committees. Support parties as experts could also be part of this consortium.

- Phase 1 – Define, plan and implement the best tender procedures in the respect of the 2014 Directive on public procurement for procuring: communication equipment's that will constitute the foreseen communication system and instruments for validating its components.

- Phase 2 – Based on the prototype established during the PCP, produce interoperable equipment's and instruments to operate at an international level [to be defined on the number of countries required].

- [To be defined on the financial modalities participation of the countries and investors with an indicative budget].

Expected impact: procure EU-interoperable broadband radio communication system for PPDR to end users at a European and Pan European level and allowing efficiency for related cross-boarding actions at the benefit of the populations. Operational deployment is planned for 2025.

As mentioned above, the first contractual level for public joint procurement is represented by 1 and the second contractual level after tender's selection of companies for the PPIs by 2. See Figure 5
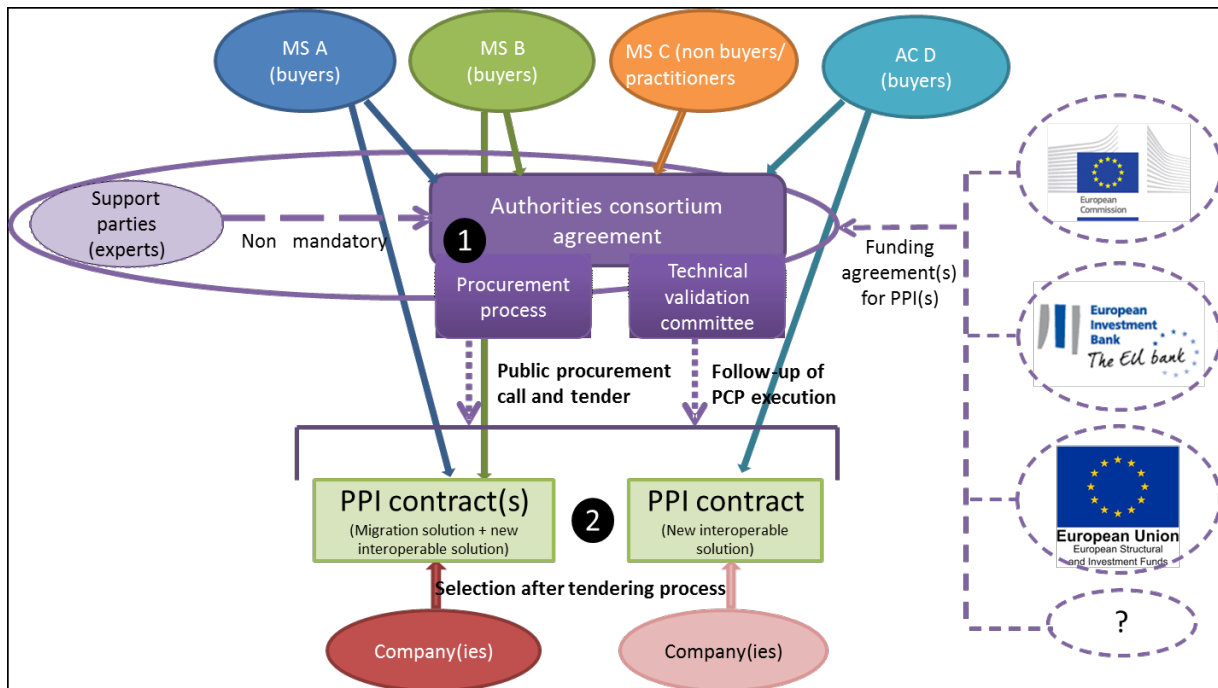
Figure 5: PPI activities to commercialize a next generation of critical communications

5.4 Implementation of a Pan European entity for PPDR communications at long-term

At the long-term stage, the organization between actors is slightly different due to the establishment of a dedicated European PPDR communications entity and the missions given to it by its members.

5.4.1 Creation of a dedicated PPDR communications entity under the legal form of an EGTC

Once the interoperable system is developed at short-term and commercialized at middle-term, we recommend establishing a dedicated public legal entity to ensure its continuity and reinforce European and international cooperation in the PPDR communications sector. The aim of such an organization with legal entity is to establish a broadband-based authority (e.g. as it exists in the Gulf region) with both procurement and operational roles (i.e. procurement and operational cross-border(s) cooperation). It could also be, in case of success, a direct procurement and technical support for national PPDR entities.

Regarding, the legal vehicle currently existing, a European Grouping of Territorial Cooperation (EGTC), should be constituted. Due to the fact that its activities are not carried out in only one country, it is recommended that this entity is submitted to the national law where it has its registered office.

At least two MS are required to create such an EGTC. AC could also be a member if it has international cooperation relations with a MS. A convention constituting the EGTC will have to be concluded defining the level of involvement of members within each country and its missions (e.g. procurement action, follow-up of public contract execution). This entity could be created with a core of countries and its constitutive convention will define the modalities to welcome any new interested public authority.

5.4.2 Procurement, lobbying and technical missions of the entity

For sharing of liabilities and flexibility reasons, this entity must have defined missions in its constitutive agreement. Thus, it allows to identify a clear actor for procurement actions and welcoming funds from public and public investors but also, for further lobbying actions and operate / coordinate the interoperable system. Thus, its role is not limited to the missions of a European central purchasing body but is extended to operational missions.

It is recommended that the entity is composed of the following functional committees with a "common committee" on top to coordinate and ensure the efficiency of each specialized committee:

- "Technical validation committee" whose missions are inspired by those at a short and middle-term and are extended to provide technical support to national and European end users (i.e. national PPDR agencies but also, European institutions as Frontex), operate / coordinate the systems and lead lobbying actions beyond international organisations such as 3GPP;

- "Procurement committee" whose missions are inspired by those at short and middle-term. Its role is to fulfill procurements related to extension / customization throughout PCP or PPI for new needs and provide legal and administrative support to national procurers;

    o For procurement activities, it is recommended that each public contract will be concluded not directly by the entity but by each MS or AC involved to avoid any potential issue regarding surrender of sovereignty by the country involved in the EGTC. Moreover, this allows a country which is not member of the entity to be part of the public contract. For this sovereignty reason, we also recommend that the property of the public contract (e.g. R&D results) belongs only to the countries and not to the entity which will be only in charge of the control / follow-up of public contract execution.

- "Specific committee" for each type of PPDRs concerned (e.g. police, firefighters) which missions are to represent and implement the specific requirements from each PPDR (e.g. police do not need similar services to an emergency medical assistance).

    o This committee will be responsible to establish dedicated guidelines / policies, organize training in conduction with the technical validation committee and propose specific requirements for tender documents / public contracts in relation with both technical validation and procurement committees.

Therefore, this entity should ensure missions in the PPDR communications sector and be a model at a EU and international level but also, stimulate innovation of both public authorities and companies.

As mentioned above, the first contractual level inside the dedicated entity is represented by 1 and the second contractual level between countries and companies, national and European end users and institutions by 2 in the Figure 6.
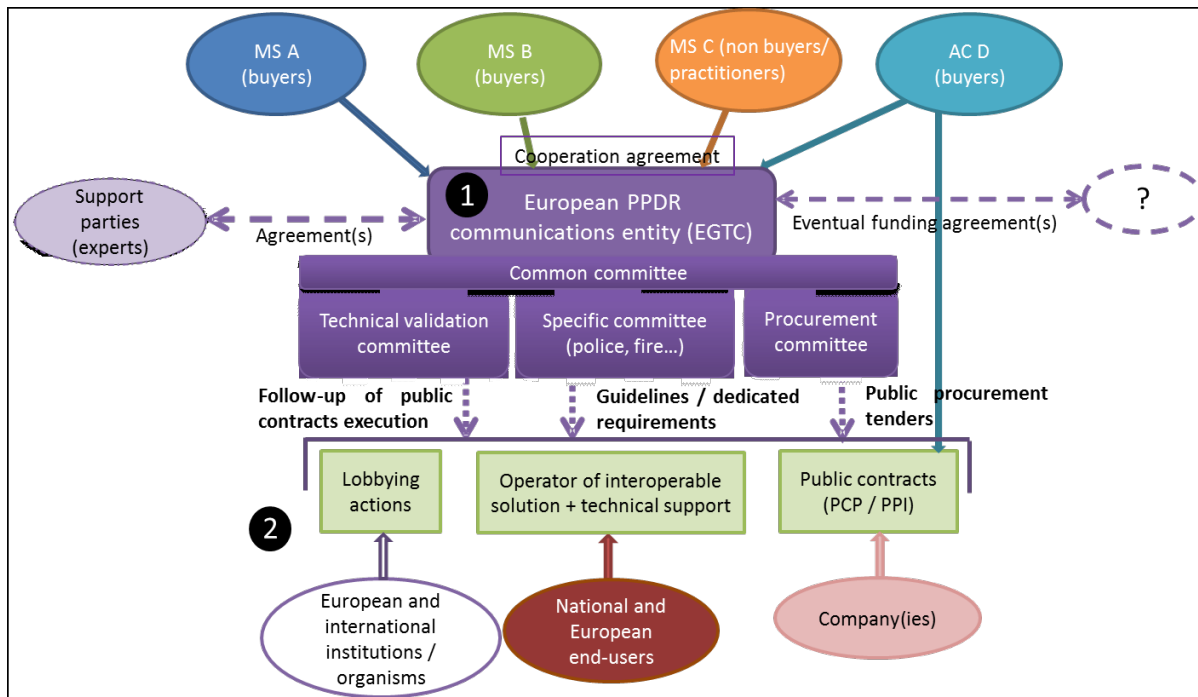
Figure 6: European PPDR communications entity

5.5 Loopholes or incompleteness of existing EU legislations identified

In the framework of the task 5.1 related to the legal roadmap, loopholes or incompleteness of existing EU legislations have been highlighted[12]. Based on this analysis, regulations are proposed. Three main items have been identified and are detailed below. The first aims to strengthen the case for PPDR communication system, the latter 2 deal more with public procurement processes.

5.5.1 EU regulation to harmonize Pan European PPDR communications systems

EU regulation to harmonize radio communications systems at EU and potentially international level is just beginning (for more details, please see part 4 of the Annex 2 "legal aspects"). Currently, there is no regulation (i.e. regulation, directive) to ensure interoperability throughout technical specificity for PPDR communications. Regulations are divided into various texts as the Telecom framework (i.e. including five directives and two regulations[13]), the 2016 NIS Directive[14] (i.e. not transposed in all

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[12] The annex 1 (part A) of the BroadMap Grant Agreement indicates page 17: « *This task will also identify possible loopholes in the existing EU legislations and the step that could be taken at legislative level to pave the way to a better deployment of new interoperable broadband networks and the ecosystems of applications and services to support the PPDR and critical communications community* ».

[13] Framework Directive 2002/21/EC amended by Directive 2009/140/EC, access Directive 2002/19/EC amended by Directive 2009/140/EC, Authorisation Directive 2002/20/EC amended by Directive 2009/140/EC, Service Directive 2002/22/EC and the Citizens' Rights Directive 2009/136/EC universal, Directive on Privacy and Electronic Communications 2002/58/EC, regulation on Body of European Regulators for Electronic Communications (BEREC) and regulation on roaming on public mobile communications networks

[14] Directive 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of Security of Network and Information Systems

national regulations yet) or also and without limitation, the 2012 Decision establishing a multiannual radio spectrum policy program[15].

Then, and in accordance with EU and national strategies for radio communications systems in PPDR (i.e. civil security), regulation regarding this specific field could be created with the main purpose of ensuring cross-borders interoperability. These elements are linked mainly with trans-European networks, area of security and common safety which belongs to shared competence between EU and MS. Moreover, in areas of research and technological development, EU is competent within the respect of national competences in these matters[16]. Therefore, and in accordance with MS regulation, a directive could be the most appropriate EU act to implement legislation on radio communications systems for PPDR. Indeed, and as above-mentioned, directive binds results to achieve by leaving MS to regulate for and methods to transpose it.

Such a binding directive could include, for example and without limitation, (i) harmonized rules on radio communications equipment for PPDR (e.g. type of material, electromagnetic compatibility), (ii) obligations to the national regulators on implementing an harmonized turning ranges for PPDR needs (i.e. not subject to negotiation for few frequencies like mentioned in the Decision 2016/687/EU) based on EU / international standards and if possible, labels.

Nevertheless, and to avoid any opposition with the fact that secure radio communications for PPDR are part of national sovereignty of each country, such a directive requires to leave a large part for national transpositions.

5.5.2 Legal vehicle dedicated to EU public procurement

A legal vehicle dedicated to public joint-procurement at a European or Pan European level does not exist in EU regulation on public procurement. Indeed EU 2014 Directives mention possibilities of joint procurement even at EU or international level. However, an EU central purchasing body which could be created by MS and AC to organize and execute public joint-procurement, in particular, in a dedicated sector as PPDR is not expressly provided.

Based on the regulation (EC) No 1082/2006 of 5 July 2006 amended by regulation (EU) No 1302/2013 of 17 December 2013, an EGTC could be a cross-border legal vehicle adapted to joint-procurement activities but its purpose is not limited to procurement activities. Therefore, and to encourage public purchasers to use joint procurement, a dedicated legal vehicle without (i.e. contractual agreement) or with legal entity (i.e. EU central purchasing body) could be created and ruled by a EU legislation. It may be inspired from EGTC status.

As the EGTC is implemented by a regulation and due to the nature of the shared competency concerned between EU and MS (i.e. internal market[17]), a dedicated regulation to a public purchasing body at a EU level could be voted by the EU Parliament and the Council. A previous proposal on this subject will have to be made by the EC to these institutions[18]. Such regulation will be directly applicable in MS without transposition in the national legislation[19].

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[15]Decision n° 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy program

[16] Art. 4 of the TFEU

[17] Art. 4 and 46 of the TFEU

[18]The ordinary legislative procedure for the adoption of an EU act is regulated by the art. 294 of the TFEU

[19] Art. 288 of the TFEU

5.5.3 EU legislation on PCP activities

There is no EU legislation on PCP procedure and activity. Indeed, PCP projects are realized only under soft law instruments implemented by the EC throughout the SEC/2007/1668 communication and various guidelines (e.g. templates of PCP tender documents). Thus, promulgating a binding act (i.e. regulation, directive or decision) as a EU dedicated directive could be adapted for giving a legal framework of PCP at a EU level. It will also encourage MS to adopt PCP national legislation for implementing it and could contribute to its development.

As public procurements are implemented by directives and due to the nature of the shared competency between EU and MS concerned (i.e. internal market and existence of competitiveness in industry[20]), a dedicated directive to PCP for innovative projects which R&D needs could be voted by the EU Parliament and the Council after previous proposal made by the EC[21]. This directive binding MS within a deadline and will be an adapted tool [22].

A contrario, implementing PCP by a non-binding act could also be pursued to let more flexibility to public purchasers. However, and due to the development of the PCP mainly in the framework of Horizon 2020 program, the EC could update its 2007 communication specifying the modalities to lead the procedure once the criteria for PCP are fulfilled. EU funding of PCP are submitted to rules which are not clearly defined (i.e. resulting from practice) and updated the 2007 communication could be a way to ensure more legal security for public purchasers' projects and thus, encourage them to develop PCP.

Therefore, recommendations on (i) the quality and number of public buyers from MS, AC and other participants, (ii) the quality and number of companies selected and (iii) selection and award criteria during the tendering phase to choose PCP suppliers could be made subject to the specificities of each project. For comparison, it already exists for public procurements (i.e. PPI) in the framework of 2014 Directives, selection criteria to exclude companies for objective reasons but also, award criteria for innovative procurements.

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[20] Art. 4, 46 and 173 of the TFEU
[21] Art. 76 of the TFEU
[22] Art. 288 of the TFEU

6 Consolidated reference architecture for mission critical communication

The BroadMap project has collected the views of end users from EU Member States and associated countries about their PPDR communication systems (Networks, Interoperability, Applications and Devices). The result of this analysis has shown that the legacy solutions are heterogeneous, and that a common harmonized solution is needed to achieve the requirements of PPDR users.

BroadMap is proposing an architecture model, focused on Interoperability, as a basis to provide Standardized PPDR Interoperable Communication for Europe (SpiceNet) services. The solution to this model must be provided by the industry and adhere to 3GPP standards. The future development and implementation of these services will be part of PCP/PPI processes defined by the European Commission on H2020 funding programs.

The transition from current legacy PPDR narrow band systems (TETRA and Tetrapol) to Mission Critical Broadband Services is described in Deliverable 5.1 (Conclusion of Solution Evaluation). The document describes several transition roadmaps that could be employed to migrate from legacy systems to next generation mission critical broadband services. The individual transition roadmap employed by each EU Member State and associated countries will be unique and will be dependent on the status of national decisions, e.g. frequency regulation, status of legacy systems, strategies and funding.

The SpiceNet model proposes a reference architecture for harmonized pan-European PPDR mission critical broadband services which contains three layers (see Figure 7).

- Harmonization
- Interoperability and governance
- Networks and users

In addition, a conceptual level reference architecture SpiceNet model has been developed (Archimate model SpiceNet, Annex 2), which can be used as a starting point for architectural design.

6.1 Key principles of SpiceNet

The SpiceNet model has been developed based on the following key principles:

1. The SpiceNet service allows PPDR users to use pan-European interoperability, cross country interoperability and domestic inter-agency interoperability, based on the availability of mission critical broadband networks.
2. Each country uses their own national roadmap to implement the next generation mission critical broadband services.
3. Each country uses their individual schedule to ramp down legacy PPDR radio communication systems.
4. There is a broad mixture of organisational schemes across countries.
5. Harmonized tuning ranges based on 3GPP frequency bands exist for dedicated and commercial spectrum. According to a WRC15 decision, band 68 can also be used if adopted by the national regulator.
6. All networks, devices and most of the features are based on 3GPP standards.
7. Supported services may vary across countries and for certain network operators based on the system supplier and their supported features and releases.
8. International roaming for almost all commercial services has been available more than 20 years. It is important to note that cross-border interoperability for PPDR services is not synonym with international roaming (a high-level description of cross border interoperability can be found in section 0).

9. A set of common MC services interoperability (SpiceNet services) is necessary to ensure pan-European PPDR cooperation based on 3GPP mission critical specifications.

10. Cross-border and pan-European interoperability can be implemented by mutual bi-lateral and multilateral agreements between MS countries, PPDR organizations and pan-European organisations (e.g. Frontex, Europol and EGTC[23]). The SpiceNet model can be used as reference architecture to provide the interoperability.

6.2 SpiceNet layers

6.2.1 Harmonization layer

In Figure 7, the harmonisation layer describes how the next generation mission critical broadband services for PPDR are provided on a national basis. These services must be based on 3GPP standards and harmonized spectrum tuning ranges in order to develop PPDR cross-border interoperability services on harmonized platforms.

The harmonisation layer has three components as follows:

Organizational schemes:

All MSs are in different phases of the transition towards MC PPDR broadband services. Some member states have developed strategies, some have already started transition (e.g. UK) and some member states are still rolling out narrow band TETRA networks. Thus there is no common organisational scheme which can be used as a general solution. Organizational schemes can vary from dedicated networks and services to full MVNO services and to all combinations between hybrid and OSP (Outsourced Service Provider)[24].

Harmonized tuning ranges:

All networks are based on standardised frequency bands. Depending on national regulations and service models, PPDR can use any combination of (450 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz and 2600 MHz) tuning ranges. Frequencies from standardised bands are also used for direct mode operation (proximity services) when networks are not available. During the transition period from legacy systems, narrow band digital PPDR radio networks can also be used as described on BroadMap deliverable 5.1 (Conclusion of Solution Evaluation).

Harmonised tuning ranges allow commercial devices to operate globally with all tuning ranges used by commercial operators. Chipsets and devices are manufactured based on 3GPP standards. This means that PPDR users can use SpiceNet services in any commercial network adopted for SpiceNet services.

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[23] The European Grouping of Territorial Cooperation (EGTC) function is to assist countries that wish to cooperate to complete agreements and build platforms for interoperability

[24] See BroadMap Deliverable 4.1 (High Level Specifications, Solutions & Potential Organisation Schemes)

An example of cellular connectivity (Lumia 950):

- GSM network: 850 MHz, 900 MHz, 1800 MHz, 1900 MHz

- WCDMA network: Band 5 (850 MHz), Band 8 (900 MHz), Band 1 (2100 MHz), Band 2 (1900 MHz), Band 4 (1700/2100 MHz)

- LTE FDD network: Band 5 (850MHz), Band 8 (900MHz), Band 17 (700MHz), Band 20 (800MHz), Band 1 (2100 MHz), Band 12 (700 MHz), Band 2 (1900 MHz), Band 28 (700 MHz), Band 3 (1800 MHz), Band 7 (2600 MHz), Band 4 (1700/2100 MHz)

- TD-LTE network: Band 38 (2570-2620 MHz), Band 40 (2300-2400 MHz)

An example of cellular connectivity (iPhone 7):

- GSM 850 / 900 / 1800 / 1900

- WCDMA 800 / 1900 / 2100

- WCDMA 850 / 900 / 1700 / 1900 / 2100

- LTE band 1(2100), 2(1900), 3(1800), 4(1700/2100), 5(850), 7(2600), 8(900), 12(700), 13(700), 17(700), 18(800), 19(800), 20(800), 25(1900), 26(850), 27(800), 28(700), 29(700), 30(2300), 38(2600), 39(1900), 40(2300), 41(2500)

Depending on national regulations, non-commercial tuning ranges can be part of PPDR MC broadband services, e.g. spectrum required for AGA (Air Ground Air communication).

Standardized commercial solutions:

All commercial mobile broadband networks, devices and some of the applications are based on 3GPP standards. This allows PPDR organisations to use or develop systems based on commercial off the shelf (COTS) solutions. COTS products are commercially available. By using networks based on 3GPP standards there will be a wide range of possibilities for PPDR users to benefit from all commercial innovations. However, PPDR specific needs of reliability, coverage and security must be guaranteed. Through standardization, for example international roaming has already been enabled for more than 20 years.

6.2.2 Interoperability and Governance layer

In the interoperability layer in Figure 7, <u>the blue coloured box</u> represents a country (A-Z) and their separate solutions for PPDR operations.

<u>The green coloured slice</u> represents the interoperable SpiceNet services and governance across each country and EU PPDR entity.

<u>The other slice colours</u> and the linked arrows describe contractual agreements between separate countries (bi-, tri-, or multi-lateral agreements).

<u>The black coloured slice</u> represents borderless operation of existing EU agencies (e.g. Frontex), who also use their own operational solutions. These solutions allow safe and interoperable use of e.g. intelligence activities.

The interoperability layer has three components as follows:

<u>Standardized MC PPDR solutions:</u>

MC broadband services are now part of the commercial 3GPP standards, although it is important to note that international roaming does not equate to PPDR cross-border interoperability. Current ongoing work of 3GPP enables a set of mission critical features and services. These PPDR-specific services form the foundation to enable versatile and interoperable solutions for PPDR organizations across the EU.

<u>SpiceNet governance:</u>

A pan-European governance function is needed to allow countries and agencies to use SpiceNet services. This function needs to be defined and appointed to some legal entity or organization at the EU level. In addition, each SpiceNet user organization must have a SpiceNet function, which consists of administration, finance, technology and security and maintenance functions.

A global agreement is needed for pan-European organisations to confirm governance above national legislations and in conformity with the current common regulations at the EU level.
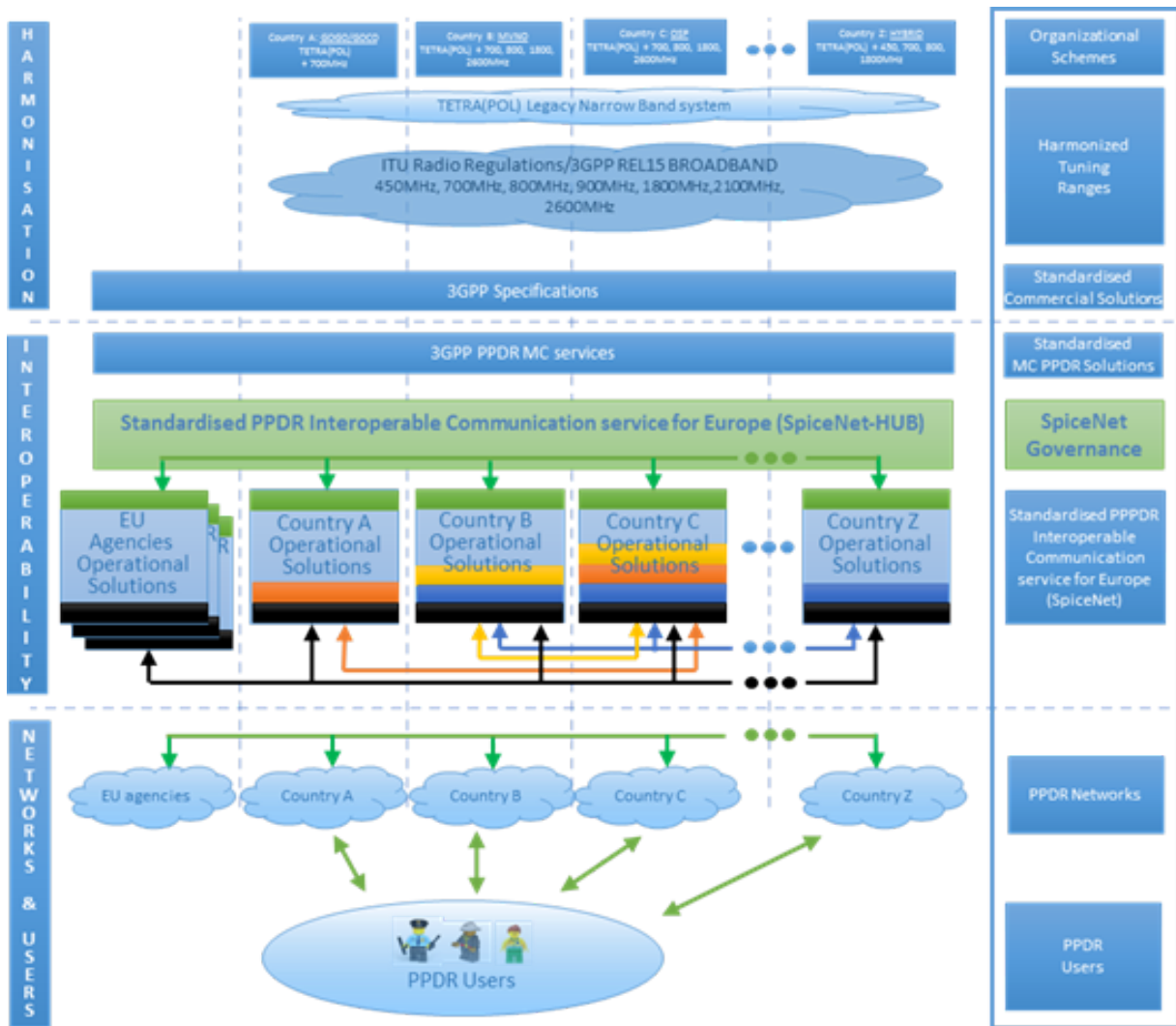
Figure 7: Principle of Pan European layered interoperability reference architecture

Standardized PPDR Interoperable Communication for Europe (SpiceNet):

Due to cross-border interoperability and pan-European PPDR interoperability needs, a set of standardised, basic PPDR services must be defined. To establish these activities, and to maintain cross-border interoperability and preparedness, bi- tri- or multilateral cross-border agreements are also necessary.

Pan-European cooperation and interoperability is based on harmonised 3GPP tuning ranges and standardised infrastructure. Regardless of their location, PPDR users must be able to communicate based on agreements with other users and organizations in different MS's. SpiceNet can provide MC services like for example MC PTT, MC Data, MC Video, status messaging, AVL, alerting, SDS messaging.

No matter the type of national organisation scheme employed, communication with any country and PPDR authority must be possible when the SpiceNet services are developed and established.

Validation and testing for SpiceNet services is mandatory in order to maintain interoperability in multi-vendor environment.

SpiceNet services are based on a distributed model where each country has their own service HUB (SpiceNet HUB), which includes business logic for all interoperability agreements related to each country. In addition to SpiceNet governance also bi-, tri- and multi-lateral interoperability functions shall be provided.

In addition, each European agency (e.g. Frontex, Europol, civil protection mechanism) has their own operational solutions.

6.2.3 Networks and users Layer

PPDR networks:

Each country (A - Z) has its own MC broadband networks and services. EU agencies can use resources from each national network according to the SpiceNet agreements and governance, see Figure 7.

The green coloured arrows linking users and countries describe the availability of common SpiceNet services and governance, while the green coloured common arrow above countries represent the availability of national network resources used by EU agencies.

The integration of SpiceNet services must be established by national network operators and service providers. Depending on organisational schemes, there are variations for implementing the services. More or less they are based on virtualized networks. Virtualization can have variations depending on the level of integration.

PPDR users:

Depending on agreed user specified SpiceNet services, PPDR end users will be able to communicate, using their devices, with PPDR users within their own country and across borders, assuming local PPDR MC broadband service availability.

Next generation PPDR MC broadband services allow new possibilities for all authorities to develop new ways of European cooperation on all levels. This means benefiting from new technology innovations for all areas of PPDR operations to improve efficiency and situational awareness, e.g. augmented reality, sensors, video, robotics, smart clothing, etc. The new technology will offer opportunities to use real time translation of spoken language (SpiceNet translator).

Non-technical governance and operational issues (see SpiceNet governance above) must be solved together with neighbouring countries and other organizations to enable cooperation.

6.3   Reference architecture conclusion

The key principles of a pan-European PPDR interoperability and harmonized operative reference architecture (SpiceNet) are defined. These principles can be used as requirements for future development. A description of a pan-European layered interoperability reference architecture has been produced.

The architecture describes the principles of interoperability between PPDR organizations and agencies, domestically and in cross country situations. The SpiceNet architecture describes the possibilities for PPDR end users to communicate with their device wherever there is a local PPDR MC broadband service available. It is necessary to establish a SpiceNet governance function, which creates an umbrella for administrating the pan-European PPDR MC cooperation.

For an EU-funded PCP project (SEC-04-DRS), the industry must provide solutions fitting the SpiceNet reference architecture. The solutions provided must contain all innovative ways to create MC PPDR broadband interoperability solutions (for networks, devices and applications) to help prevent crime, to save lives and to minimise personnel and economic costs.

The future PPDR MC broadband solution will be a smart part of the commercial market with specific needs. By using commercial networks and devices, PPDR services will be available at reduced costs. The limited size of the PPDR market should be stimulated by the mass market solutions offered to the significantly higher number of consumer users.

7 Transition roadmap for mission critical communication

7.1 PCP and PPI joint procurement for a future dedicated critical communication organisation

7.1.1 Introduction

There are no current standardised technical solutions on the market that provide interoperable mission critical broadband radio communication systems or provide interoperability between legacy PPDR systems and mission critical broadband radio communication systems. Thus, R&D will be required to first create such a solution depending on R&D results, and then develop it as a marketable solution. Based on the Horizon 2020 program, the first step could be implemented by employing PCP, and the second step by employing one or more PPI(s), depending on R&D results. These public procurements are ruled by soft law elaborated by the EC (i.e. 2007 EC Communication on PCP) for the PCP and 2017 EU Directive on public procurement for PPI.

However, and before PCP and PPI activities are pursued, the organization of the governance for such procurements between public authorities at a European level is fundamental. Moreover, the framework of the future procurement (i.e. PPDR communications needs) has to be carefully described in tender documents. Therefore, it is necessary that public authorities focus on "what they need to buy?" (i.e. a functional approach related to the needs of public purchasers) more than on "which products have to be purchased?" (i.e. technical solution approach related to the solution(s) provided by suppliers). As detailed in chapter 5, BroadMap recommends a transition approach for the short term, the middle term and the long term.

7.1.2 Short-term (1 to 3 years) PCP activity to develop next generation MC communication systems

The short term should start creating a public joint procurement governance framework thanks to the conclusion of a consortium agreement between public authorities which will need to govern and operate the new generation of PPDR communications. This agreement has to define the interested countries (i.e. MS and AC), their level of involvement whatever is the entity in charge in each country (i.e. buyers and buyers hosting the pilots but also practitioners and non-buyers). Supporting parties (e.g. experts) should also be part of such a consortium to provide technical, organizational and legal support. To help the functioning of such joint procurement organization, dedicated committees should be created such as a procurement committee (i.e. to organize the drafting of public tender documents and leading the tendering phase but also, to follow-up the PCP execution) and a technical validation committee (i.e. to fulfil the technical requirements on tender documents, validate each phase of the PCP based on defined standards).

Once public authorities agree on how to organize the PCP procurement, the scope of the PPDR requirements must be defined in tender documents focusing on PPDR requirements. Thus, and whatever the above-mentioned solutions resulting from the target architecture for mission critical communication (see chapter 6), the aim of the PCP is to find a technical solution for new EU interoperable mission critical communication. Due to the current situation on the commercial market of critical communications where a small number of suppliers, supply the PPDR communication systems in Europe and to avoid any future lock-in and distortion of concurrence, the PCP and the subsequent PPI(s) will have to ensure competition between companies on as large a scale as possible. Then, more than focusing the PCP tender on technical solutions, we recommend ensuring that technical specifications and award criteria focus on functional needs of the public purchasers (i.e. interoperability between critical communications systems). In any case, if various technical solutions are proposed by suppliers (i.e. some solutions have been identified in deliverable 5.1), one or more

technical solutions could be developed during the PCP phase (i.e. R&D developments). BroadMap also recommends to include the possibility in the tender to allow suppliers to propose solutions not imagined by the public purchasers.

In any case, the PCP involves sharing of risks and benefits. As such a procedure creates R&D, the modalities to share IP rights have also to be specifically defined in the joint-procurement consortium agreement and then, in the PCP framework and contracts. This includes determining the background technology with associated IP rights provided by public authorities on one hand, and on the other hand the selected companies who will own the foreground technology resulting from the PCP and how the different parties would be entitled to use or exploit it (i.e. license for dissemination to the PPI, use for further developments by public authorities by themselves). The modalities according to the IP rights will be shared and will have a direct impact on the PCP price due to the involvement of each party (i.e. if companies are able to reuse all or part of the R&D results for further commercialization against financial participation, thus the price of R&D will decrease for the same quality).

7.1.3 Middle-term (3 to 7 years) PPI activities to commercialize next generation MC communication systems

If the PCP phase provides R&D results which are validated for future use, a PPI procedure will be pursued. If these results lead to the conclusion that two or more of the above-mentioned solutions can be developed at a larger scale, one or more PPIs will be implemented to commercialize them. Indeed, one PPI based on PCP results related to an interoperable technical solution could be concluded to produce this solution at a larger scale. Another PPI related to the migration of such interoperable solution from the national legacy systems could also be implemented by a dedicated PPI. The standardization process for PPDR communications will also be taken into account to ensure that products are in accordance with applicable standards.

Moreover, and based on PCP lessons learned on public joint-procurement governance, a new consortium agreement should be concluded providing, for example, the entrance of new countries, reinforcement of the technical validation committee missions, and amendments on IP rights sharing. Supporting non-buyers providing logistical or technical support could also be part of this new consortium.

Depending on the purpose of the PPI, a formalized procedure will be chosen (i.e. competitive dialogue, competitive procedure with negotiation or innovation partnership) and conducted. Its tender documents will have to include the PCP results to ensure that a company who did not participate in the PCP has the same chance participating and winning the PPI. The PPI, for which sharing of IP rights is not mandatory, will be submitted to negotiation depending of the needs of public authorities.

7.1.4 Long-term (more than 7 years) implementation of a European PPDR communications entity

Based on lessons learned during the PCP and PPI phases, the contractual organization set up between public authorities for joint procurement could evolve into an organization with a legal entity. Its role will be dedicated to purchase and to operate PPDR communication systems for its members' countries. This means that the entity is not only a central purchasing body at an EU and international level, but also operates the interoperable communications system and could provide technical and procurement support to national end users. To do so, and without other legal vehicles currently available, a European grouping of territorial cooperation (EGTC), which is a dedicated legal instrument for MS and AC to implement joint missions, should be created. It is ruled by a dedicated EU regulation and is submitted to a national law previously defined by its members (i.e. Regulation No.1082/2006 amended).

Then, such a legal entity could welcome new member states (who were not part of the PCP or PPI phases) and encompass existing national European entities dedicated to PPDR communications. The composition of the procurement and technical validation committees could also be reinforced. In addition, a dedicated PPDR committee (e.g. police, customs, etc.) could also be created, its role will be to establish guidelines and policies, organize training and adopt specific requirements. To allow efficiency in the functioning and governance of these committees, BroadMap recommends that a common committee defines the role and mission of each committee.

This PPDR communications entity will provide procurement, operation of the interoperable system and technical support to national PPDR entities, but also lobby international standards bodies on standardisation requirements. It will implement and follow up, for its members, new PCP and PPI procurement procedures related to new needs of the end users and evolutions required to the interoperable system. It will also be responsible to follow up on the execution of the related public contracts. However, and due to sovereignty reasons, it is recommended that the future public contracts will remain directly concluded by the countries.

7.2 Transition solution flexibility

Live EU Interoperable broadband mobile systems are expected to be developed and released for use by PPDR responders within the 2025 timeframe. The individual roadmap of each country from legacy systems to MC PPDR BB services will be available between 2022 and 2030. See Figure 8.
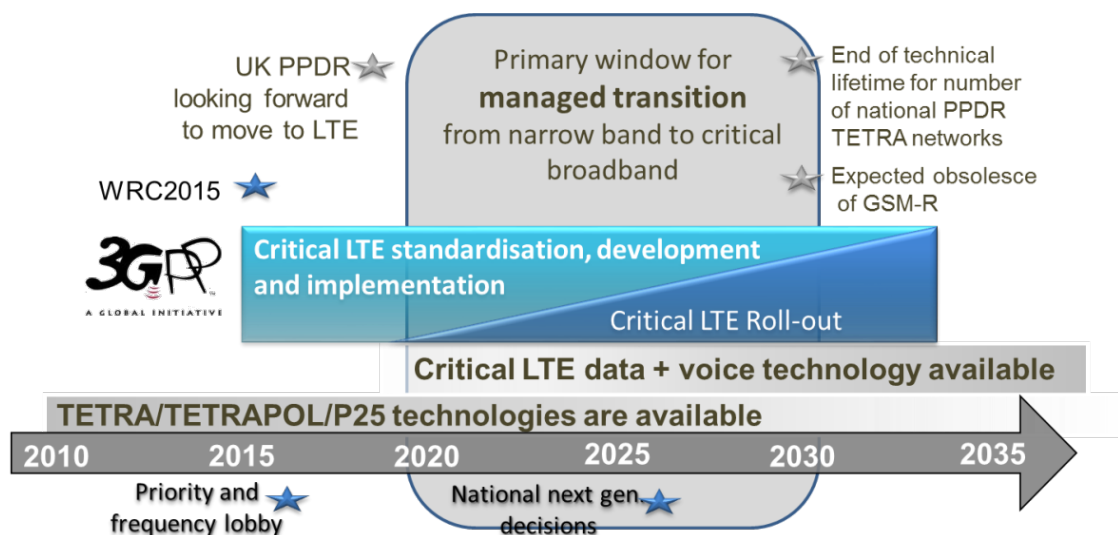

Figure 8: Primary window for PPDR MC BB services transition

As stated in deliverable 5.1, each individual country has their own starting points on how to proceed to MC BB PPDR services. But it is recommended that the transition falls into the proposed timeframe (transition window). The maturity of the PPDR MC BB solution technology allows transition in this timeframe, but to establish pan-European interoperability, EU level regulations are needed.

Transition phases are highly dependent on the transition roadmaps of each country. Identified organisational schemes and mixtures of those generate numerous combinations and variations for EU MS's.

After the transition period the 3GPP MC PPDR broadband system will be the one and only solution. This solution is compatible with all organisational schemes and supports pan-European PPDR interoperability and harmonised operational solutions. See Figure 9.

An example of three solutions towards the broadband network are described deliverable 4.1 (high level specifications, solutions and potential organisation schemes).
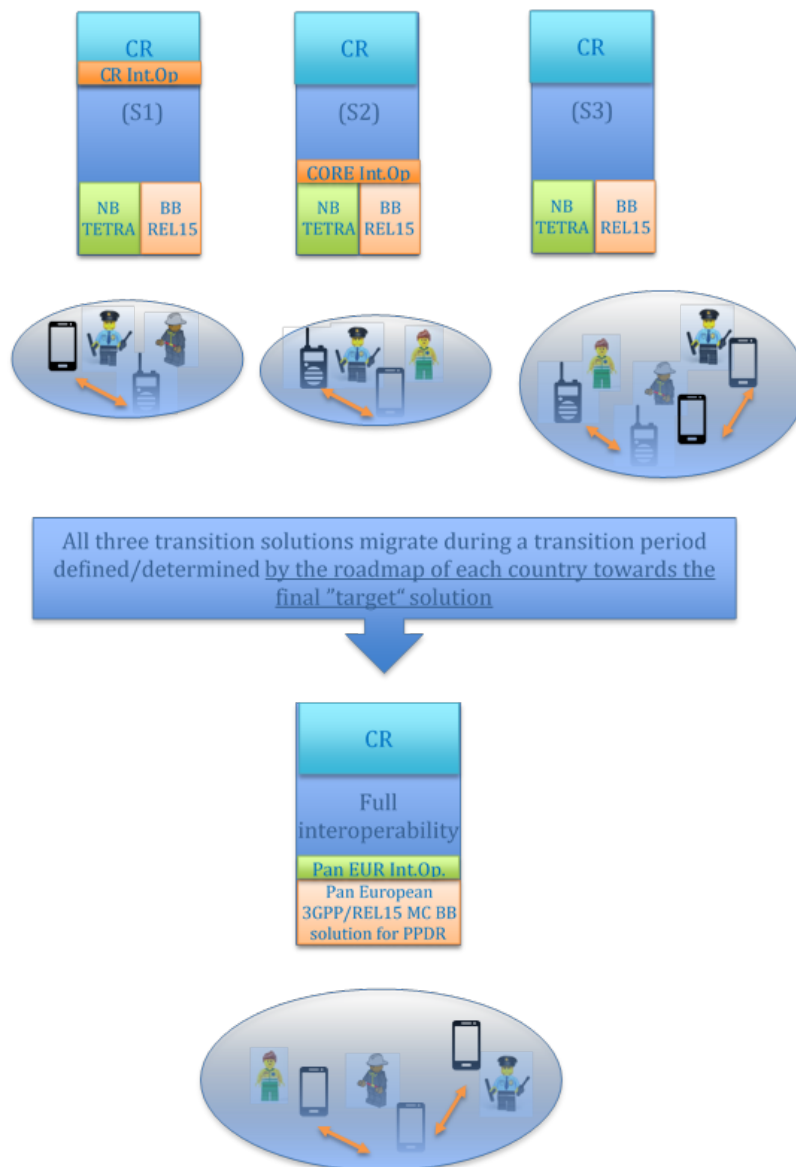

Figure 9: Pan European Harmonised target solution after transition roadmaps

7.3   PCP and PPI technical key functionalities

It is not certain that all the critical needs of the PPDR users and community will be covered by public network technology. Therefore, the validation focus must be put on key and critical functionalities for PPDR that are unlikely to be present in public or main stream MC network technology.

At the end of this section, recommendations are made for the PCP pilot setup configuration so that the technical key functionalities discussed in the following subsections can be verified and demonstrated.

7.3.1 Security

7.3.1.1 Security and BroadMap target architecture

The consolidated target architecture for Mission Critical Communication in BroadMap consists of three layers (see chapter 6):

- Harmonization layer

The harmonization layer creates flexibility towards participating countries regarding the organisation schemes (e.g. dedicated, commercial and hybrid) and the used technologies (proprietary or standard solutions, technology generations, frequency bands, suppliers…).

- Interoperability and Governance layer

The interoperability with governance layer defines SpiceNet , that is the target common PPDR Pan European cross-border interoperability solution. This enables each country to use a set of common services for pan-European interoperability. For national interoperability, each country has their own interoperable solutions.

- Networks and Users layer

On the networks and user layer common services provided by SpiceNet can be used in all participating countries. These common services can be further extended via agreements between nations.

The territory on which BroadMap further activities or SpiceNet could or will be used should be flexible. There could be different trust domains or circles. There could be an ultra-high trust between two specific nations or between specific PPDR services from two specific nations, there could be a very high trust between EU member states, there could be a high trust with associated member states and a limited trust with others. As SpiceNet aims to offer a long term solution and today's geopolitical situation seems to be very uncertain and unstable, further activities beyond BroadMap and its security should be prepared for changing (flexible) trust domains or circles during their existence. The members of a specific trust domain or circle will almost certainly evolve during its lifetime and its implementations.

The three elements considered as the most crucial components of security are:

1. Confidentiality

Confidentiality of information refers to protecting the information from disclosure to unauthorized parties.

Confidentiality involves measures undertaken to prevent sensitive information from reaching the wrong people, while making sure that the right people can in fact get it. Access must be restricted to those authorized to have access to the information.

2. Integrity

Integrity of information refers to protecting information from being modified by unauthorized parties.

Integrity involves maintaining the consistency, accuracy, and trustworthiness of the information over its entire life cycle. Information must not be changed in transit, and steps must be taken to ensure that data cannot be altered by unauthorized people (for example, in a breach of confidentiality).

3. Availability

Availability of information refers to ensuring that authorized parties are able to access the information when needed.

7.3.1.2 Confidentiality and Integrity

To provide user confidentiality and integrity based on the flexible heterogeneous SpiceNet architecture, an end-to-end solution on top of the underlying technical and organisational constituent parts is needed. This solution has to be transparent for the end users and simple to support (and manage) for the organisations operating (the constituent parts of the) SpiceNet solution.

This is clearly a requirement which needs to be considered as a gap in currently available and future planned technologies and solutions. R&D pushed by future partners will be needed to develop this, and it is advisable to make this part of pilot requirements.

Cryptographic algorithms are key components to provide confidentiality and integrity. Encryption ensures that only the right people (people who hold the key) can read the information. Cryptographic hash functions are often used for integrity and authentication. Authentication is the process of confirming an identity, which is needed for confidentiality.

As the trusted domains or circles (countries and PPDR organisations) will vary based on agreements and relations between countries, which vary with time, long term shared secrets should not be used. Cryptographic algorithms are long-term elements (difficult to migrate from) in communication systems. For this reason, secret cryptographic algorithms should be avoided in a SpiceNet solution that is intended to be flexible and long term. Proprietary or secret encryption algorithms are not to be trusted as they typically rely on "security through obscurity" and not sound mathematics. The reliance on the secrecy of the design or implementation of an algorithm as a method of providing confidentiality for a system in a flexible trust domain is very risky. An algorithm relying on obscurity may have theoretical or actual security vulnerabilities known by its owners or designers. These owners or designers may share the vulnerabilities with entities outside the trust domain. Or entities outside the trust domain may have had (in some way) privileged access to the design of these algorithms and may have had access to or discovered the vulnerabilities of the algorithms. For these reasons "secret" algorithms should be avoided for SpiceNet. A crypto system should be secure even if everything about the system, except the key, is public knowledge. (Kerckhoffs' principle: "The system must not require secrecy and can be stolen by the enemy without causing trouble" or "The system should still be secure even if the enemy has a copy"). The SpiceNet solution should use open and standard algorithms.

7.3.1.3 Availability

Availability will depend mainly on the implementation choices of the constituent underlying solutions and organisations in the participating countries.

There could be a need for a common baseline between underlying countries or solutions to provide users with a consistent user experience throughout the SpiceNet trusted domain or circle.

The Internet Protocol is a key component in almost all of today's communication systems. Quality of Service mechanisms are used within systems to provide the underlying transport of every service with the right quality. When the capacity and quality of the underlying systems are not sufficient anymore to provide PPDR users with the wanted availability, they need to be able to invoke priority and pre-emption mechanisms.

To provide users with the necessary availability based on the flexible heterogeneous SpiceNet architecture, an end-to-end solution on top of the underlying technical and organisational constituent parts is needed. This solution must be transparent for the end users and simple to support and manage for the organisations operating (constituent parts of) the SpiceNet solution.

This is clearly a requirement, which needs to be considered as a gap in currently available and future planned technologies and solutions. R&D pushed by future partners will be needed to develop this, and it is advisable to make this part of pilot requirements.

7.3.2 Interoperability

7.3.2.1 Introduction

Interoperability between different networks, devices and applications must be guaranteed. Based on the national roadmaps of different EU member states to implement mission critical broadband services, the different plans to ramp down the legacy narrowband systems and independently of the national organisational schemes in different countries, the transition roadmap for mission critical communication concerning interoperability should take into account the following aspects:

1. Development, procurement and implementation of harmonized and standardized interoperable national PPDR Broadband networks supporting mission critical voice, data and video through a wide variety of end user equipment, such as laptops, notebook computers, smartphones, PDAs, ruggedized hand portable devices for voice and telephony services, ruggedized vehicle devices for voice and telephony services, wireless portable cameras, wireless helmet cameras, wireless lapel cameras, biometric monitors (ePCR), offender bracelets and support any other future innovative devices and associated information.

2. Integration of legacy narrowband networks (TETRA and Tetrapol) for at least mission critical voice must be established by the national operator or service provider.

3. Non-technical issues must be solved between neighbouring countries to enable cooperation based on bi-, tri- or multilateral agreements and conventions. This could be solved in the buyers consortium agreement mentioned above. The technology must however support such agreements in a flexible way.

The PPDR broadband networks shall create a common area of interoperability in order to allow public safety agencies of different types, from different jurisdictions and from different countries across the EU to work jointly and efficiently. The networks shall provide an interoperable infrastructure through which all PPDR organisations, down to the individual practitioner level, shall be able to use their own devices to communicate securely among them, to share applications and information, resulting in greater efficiency, both in day-to-day operations and during major events and emergencies.

7.3.2.2 Product and services for interoperability

The product and services functionalities and features for interoperability are the following:

- Network interoperability:

  - Broadband (BB) PPDR networks (dedicated, hybrid, MVNO), eventually functioning in different frequency bands for PPDR, shall be interoperable between each other for cross-border communications.

  - BB PPDR networks will be made interoperable with existing PPDR radio communications systems, including PPDR networks of different technologies and functioning in different frequency bands.

- Interoperability of systems and devices:

  - It shall be possible to create, based on multilateral agreements, predefined NB or BB logical networks named *Communication Groups* (CGs) among users belonging to multiple agencies from multiple networks or countries, regardless of the types of devices and networks used by different agencies (*multi-network or international Communications Groups*). In principle, predefined CGs are also pre-programmed in the devices that are likely to use them.

- Creating international CGs on the fly, based on geographical criteria or operational criteria, and sending them to devices will be considered, but this will not yet, in principle, be a priority for the PCP phase.

- The user of the device shall be able to set the device roaming mode as manual or automatic (*manual and automatic roaming*).

- Automatic roaming shall ensure service continuity (*service continuity roaming*). This means among others that, depending on the on-going service on the selected CG (voice, video, data) or on the application in use, the systems and devices will choose the right moment to switch between the networks in order to minimize, if any, the service interruption. By minimizing service interruption, the device user shall not suffer from any noticeable operational damage when crossing a border between two BB PPDR networks.

- A corollary of the previous bullet point is that, for safety reasons, a first responder roaming to another BB PPDR network shall be able to further utilise its currently selected CG *even if* this last was predefined as a national one (*CG roaming*). The systems shall allow predefining, for each multi-network CG, if CG roaming is possible or not, following the multilateral agreements.

- Interoperability of applications deployed on devices and across the networks.

  - Features or applications programmed and used by a device in its home BB PPDR network shall still be usable when migrating in another network, following the multilateral agreements.

  - The corollary of the previous bullet is that the air interface standardisation between the system and devices developed by the different manufactures shall not be limited to the pure communication capabilities (voice, video and data, the whole via individual, group or broadcast calls), but will include *all* their related features (end-to-end encryption, group scanning, call queuing, priorities, emergency targeting process, combining of CGs, air to ground, remote selection of group by dispatcher, location based features, device over the air updates programming, re-programming, device deactivation, kill and stun, etc.) and the applications developed in the SpiceNet ecosystem (*full device and system air interface standardisation* and *full inter system interface standardisation*).

  - Interworking shall be possible between air-connected and line-connected devices inside the same network or among different networks, not only for the pure communication capabilities, but also for the related features and the applications developed in the SpiceNet ecosystem (*full device and system air interface standardisation,* and *full device and system line interface standardisation*).

  - The compatibility between the device and its accessories, sensors and peripherals shall be fostered. The fundamental principle is that any peripheral should be compatible with any device aimed to support it *(full device and peripheral standardisation)*. As an example, a combined Mic + PTT should be compatible with any radio device from the SpiceNet ecosystem. Device and accessory technologies evolve, and with the needs from device users being so different, this fundamental principle has to be considered with flexibility, under the control of the technical validation committee (see section 7.4.2) and the PPDR-organisations advising committee (see section 7.4.3).

7.3.2.3 National integration of legacy narrowband networks (TETRA and Tetrapol)

Please, see section 7.2: "Transition solution flexibility".

7.3.2.4 Technical functionalities related to the multilateral agreements implementation

Multilateral agreements defining notably:

- international CGs and their attributes (e.g. areas, access rights for voice, access right for video, access right for data, possibility of roaming…),

- visiting subscribers rights:

  - access to the applications,
  - access to the communications means (individual call, voice, video, and data) and their related features,

These shall be able to be transposed for interpretation and appropriateness for each national management entity in its own BB PPDR network. As a matter of fact, the international interactions between the national networks, like the rights of a subscriber from a country A in a country B, and the creation of international logical radio objects, like international CGs, have to be programmed in the different concerned national networks.

For example, to create an international CG, every country will create its national component of the agreed international CG and define with which other countries this component can be interconnected. When, on both sides, two components are created with the related permissions, the systems activate automatically the link starting to build up the international CG.

An international CG shall be constituted with national components which national identification number will be the same or not. This last option (*heterogeneous international CG*) will be the most used for creating international CGs and shall have no operational impact neither on the manual nor on the automatic roaming mechanism (e.g. no CG reselection needed for the radio user).

In the long term, with the establishment of the PPDR communication entity (see chapter 5 and section 7.1.3) ensuring, among others, the SpiceNet governance (see chapter 6), the national system programming entities will be the national SpiceNet HUB Services.

The international functionalities agreements transposition shall be made as easy as possible to implement. In particular, a country has to be aware (monitoring) of the agreement transpositions carried out by another country that concern it. Therefore, the handled logical objects and functions as well as the interfaces between the management workstations (Mgt WS) in charge of the international agreements transpositions shall be standardized (*full Mgt WS/Mgt WS interface standardisation*).

Moreover, the agreements implementation shall be optimized on DB memory level. As an example, it will be possible to grant the same rights profile to a set of foreign subscribers by defining the corresponding subscriber's numbers range for which this profile is applicable, without that an individual record by subscriber is needed

Eventually, to ensure the consistency of the different national programming activities, it shall be possible for the European Grouping of Territorial Cooperation (EGTC) to monitor the national programming of the international functionalities. It shall be possible besides to grant pre-emption rights to the EGTC on the national programming, if agreed by both parties. The contrary shall not be possible.

In order to:

- allow a rapid data transmission between the national MC Broadband servers enabling the MC Broadband services defined by the commercial 3GPP standards,

- allow a reliable monitoring and control of the European PPDR communications entity (EGTC) on the national MC BB servers,

- simplify the physical links implementation between the national BB PPDR networks.

The option of realising a *SpiceNet European MC Broadband roaming HUB*, to be operated in the long-term by the EGTC according to the SpiceNet governance, is recommended to be analysed, from the early PCP stage.

If this option is finally adopted, MC BB PPDR networks would be interconnected at MC BB application/service level (MC BB servers) by the EU MC BB roaming hub and at commercial RAN level by commercial roaming hub(s). Furthermore, the EGTC would have to operate the EU MC BB roaming HUB facilities next to coordinating the agreements transposition programming.

7.3.2.5 Short term interim solutions for integrating with narrowband systems

In the following paragraphs, the migration to the SpiceNet model using the SpiceNet EU MC Broadband roaming HUB option is illustrated in combination with a short-term proposal using an *EU TETRA roaming HUB* for interconnecting the current legacy networks (Figure 10).

Please, note that the SpiceNet EU MC BB HUB option is totally independent of the EU TETRA HUB proposal. However, the combination of them would offer maximal interoperability continuity at European level to face diverging national migration roadmaps to the MC BB PPDR networks.
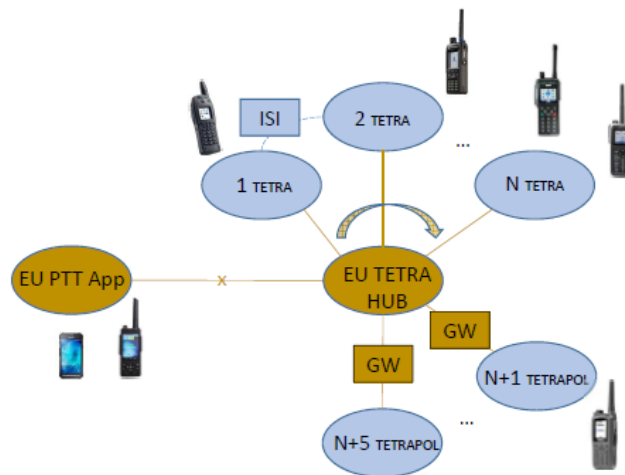

Figure 10: EU TETRA HUB proposal for interconnecting legacy networks (out of PCP scope)

The abovementioned proposal is supposed to be deployed in the short term, in the same timeframe as the PCP phase, as a rapid response from the European authorities against the burning threats like the terrorism and the migration pressure. It must be noted that this is out of the scope of the PCP as defined by EC Secure Societies call SEC-04-DRS-2017, which requests 'Broadband Communication Systems'.

As a matter of fact, national borders are better controlled and protected when, next to sharing operational data, law enforcement services are able to share and to bundle their forces on the ground.

An *EU TETRA roaming HUB* interconnects all the existing European TETRA networks, enabling the creation of international TETRA Talk Groups (TGs) and TETRA device roaming inside the "European

TETRA area". In order to avoid any double loops, TGs integrating countries partly linked by ISIs disable these ISIs.

TETRA and Tetrapol gateways (GW) enable the creation of international TG integrating TETRA and Tetrapol networks. However, there is no roaming possible between Tetrapol networks and from TETRA to Tetrapol networks.

Roaming in the whole EU is well possible for smart phones from all EU countries using the PTT App running on an *EU PTT App server*. International PTT App TGs are patched (symbol: ✳) with corresponding EU TETRA HUB TGs.

In the middle term, a SpiceNet EU MC BB roaming HUB enables the migration to the Standardized PPDR Interoperable Communication services for Europe (SpiceNet), like the creation of (NB or BB) SpiceNet Communication Groups (CGs), by allowing an efficient interconnection between the new incoming national MC Broadband (BB) servers (Figure 11).
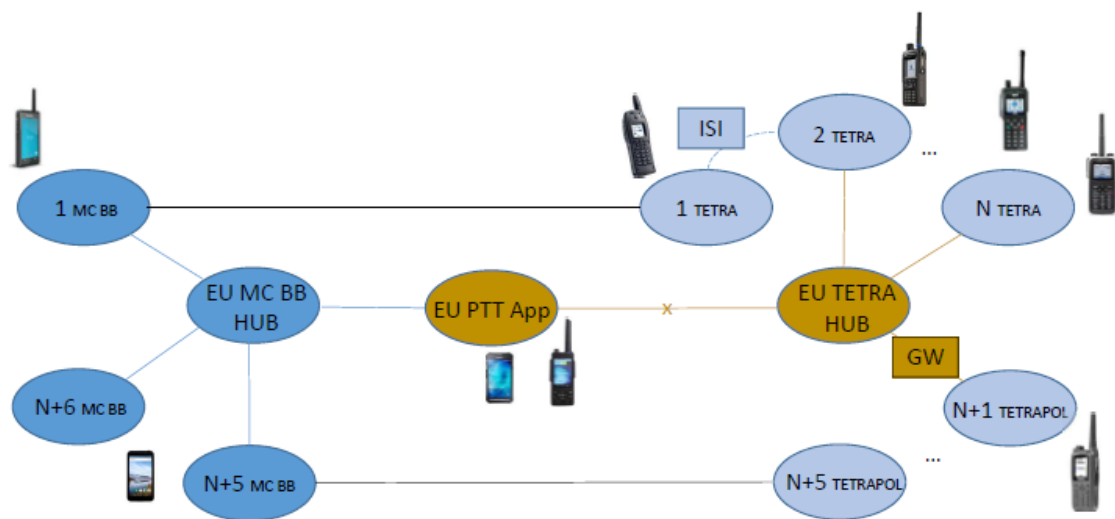

Figure 11: Middle term, PPI: start of the migration to SpiceNet

If the EU TETRAHUB proposal is implemented, the NB SpiceNet CGs (i.e. TGs) are patched with their corresponding TETRA and Tetrapol TGs via the EU PTT App server. Doing so, country N+6 on figure 11, which has no legacy network, and countries that only have a legacy network are interconnected. In order to avoid any double loop, both the incoming 1 and N+5 countries, which have their own national transition solution between their legacy network and their MC BB network, are disconnected from the EU TETRA HUB. Please, note that transition solutions at national level, as described in section 7.2, are in principle richer (more national communication related features duplicated) than interconnections that would be implemented using a TETRA HUB.

In the long term, i.e. at the end of the TETRA and Tetrapol legacy networks (currently foreseen around 2030 in several European countries), all the EU countries that had no legacy network have implemented a new MC BB server and all the EU countries with legacy networks have implemented their MC BB servers (with or without national transition interconnection between the legacy network and the BB PPDR network) → all the remaining phasing out legacy networks and the EU TETRA HUB proposal modules can be dismantled (Figure 12).
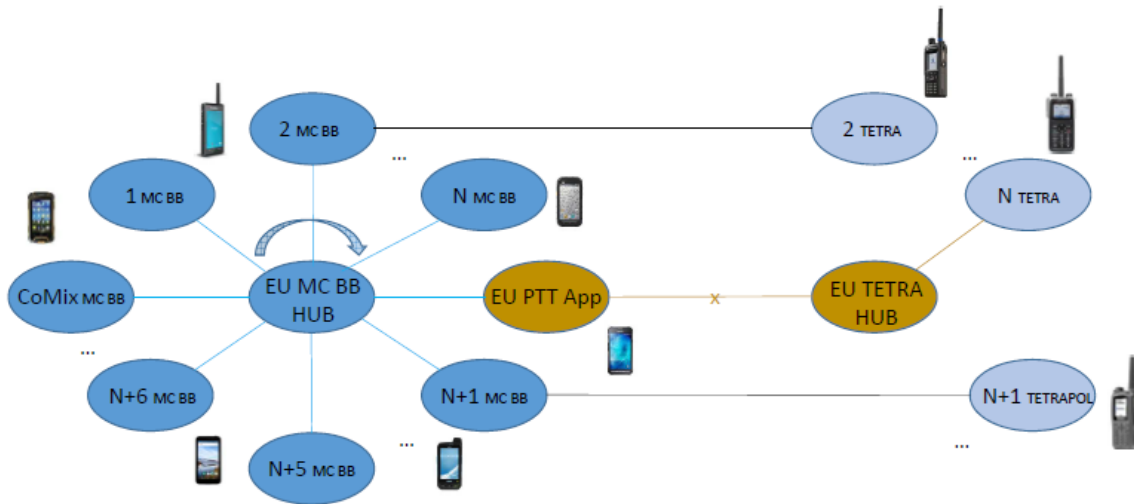
Figure 12: Long term: End of migration to SpiceNet

7.3.3 Priority and pre-emption

Priority and pre-emption for PPDR organizations will guarantee that mission critical (MC) communications can go ahead and that they will not be hampered or hindered by less critical communications when there is an overload of the network resources. PPDR needs specific priority and pre-emption levels for users, groups and missions. The special units and secret services need to have the highest level of pre-emption and priority. Voice can be important but also an image can give more important real time situational awareness information than the spoken words can offer.

There is a difference between priority and pre-emption. Priority gives the possibility to pass other entries into the waiting queue, see Figure 13: Priority in access channel and Figure 14: Priority in waiting row

On the other hand, the on-going communication will not be interrupted by the one with the higher priority. Once a communication resource allocated, one will not be interrupted by a higher priority. Priority communication will from the access channel go directly in front of the queued communications. So in the waiting row the priority communication will displace the other communications. One can enter different levels of priority so as to distinguish between the accesses. Some services may need another priority for operational reasons because their intervention is crucial in a first phase of a crisis. The disciplines (police, fire, emergency services...) must decide between themselves with the operator to which service or communications group they wish to grant a higher priority compared to another.
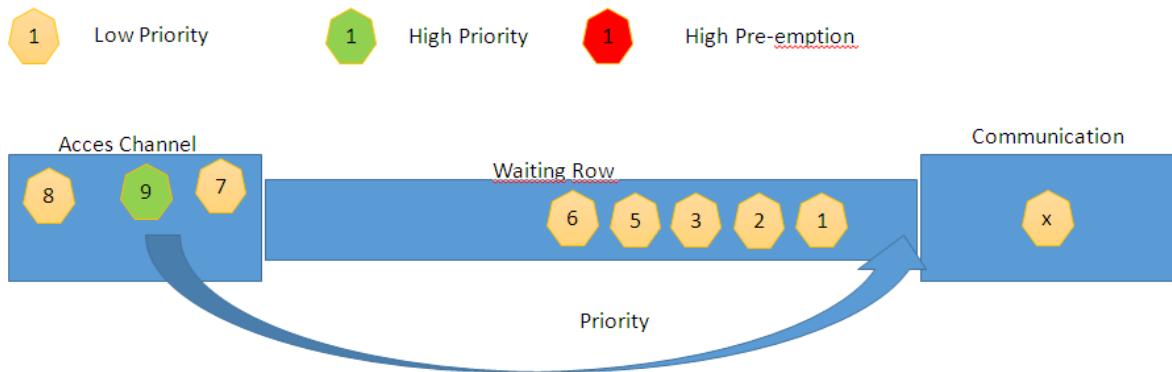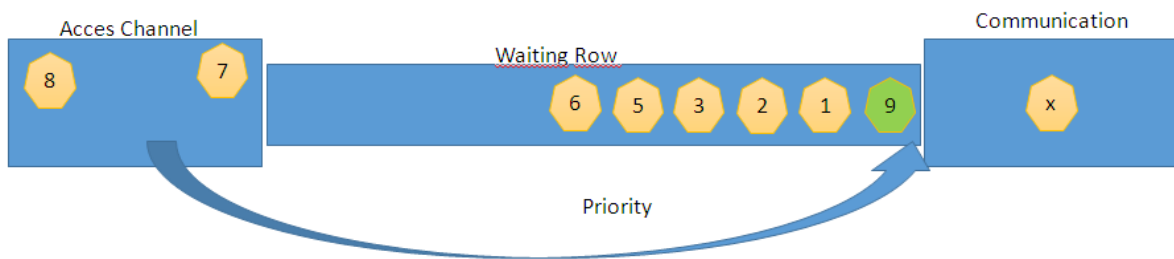
Figure 13: Priority in access channel

Figure 14: Priority in waiting row

On the other hand, pre-emption gives the user the possibility to throw out the on-going communication. See Figure 15: Pre-emption in access channel and Figure 16: Pre-emption in communication
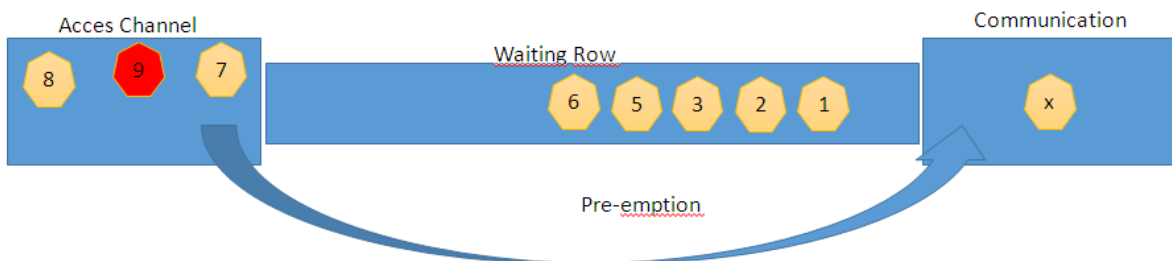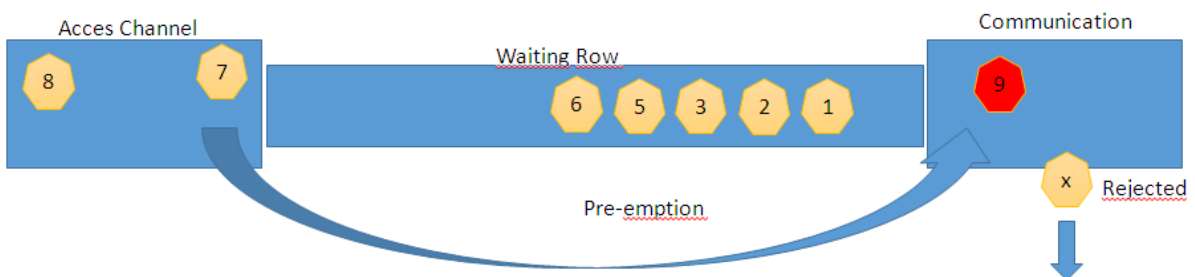

Figure 15: Pre-emption in access channel

Figure 16: Pre-emption in communication

From the access channel one will pass the queue and also take directly the communication resource occupied by an active communication and break off this communication and remove it. Within the pre-emption it is possible to consider different levels by users and communication groups. The users

and their network operator should consider carefully about granting pre-emption and the different levels to do so. The number should be limited to continue to make it possible to manage the network. By remotely monitoring the different active communications they would also need to have the opportunity as an operator to intervene herein. The communication centres have always the highest pre-emption. They have to be able to intervene to interrupt communications or even to modify in real time priorities, if necessary.

7.3.4 Location based MC features

MC BB systems and devices shall largely utilise features based on the location of the device. This is essential when radio users have to select functional CGs or when radio users have to launch an emergency call. In most of these cases, the first responders' operational processes (i.e. the functional model) will require to select the locally competent functional CG or to send the emergency call to the nearest dispatcher.

It is remembered here that a (international) *functional Communication Group* is a CG that a team on the field has to select to obtain a service, following the operational processes. It can be for example an "Alert Group" that you have to select (better via a short key to reduce the manipulations) in case of an unexpected incident requiring a coordinated and immediate response ((cross-border) police hot pursuit, (cross-border) major event…). Please, note that the locally functional CGs can have a wider radio coverage area than its competence circumscription.

7.3.5 Spectrum

The harmonization layer of the target architecture for Mission Critical Communication in BroadMap creates flexibility towards participating countries regarding the organisation schemes and the used technologies.

This flexible harmonisation requires the support of multi frequency band BB-PPDR UE based on common technical standards (i.e. 3GPP release 15 or LTE and its evolutions).

This solution does not need cross-border identical (harmonised) BB PPDR frequency bands.

This solution allows for national flexibility on spectrum amount designated for PPDR within harmonised tuning range(s), according to national needs.

This solution also allows a national choice on implementation model (dedicated, commercial or hybrid) and as such also on national flexibility for the allocation or not of dedicated spectrum.

It can be expected that PPDR services in most of the countries will have specific "niche" requirements which will be very difficult to fulfil based on commercial (shared with public) networks. These services could be Air Ground Air communications, direct device to device communications (DMO, ProSe), Special Coverage Locations, etc.

For these specific "niche" requirements dedicated spectrum will be needed.

The amount and the specific location of the spectrum will depend on the specific "niche" requirements of the specific country. As general guideline can be stated that the more spectrum the better (more capacity) and the lower the spectrum the better (more coverage).

7.3.6 End user equipment (EUE)

7.3.6.1 Emergency target – red button

On narrowband legacy PPDR systems the use of the red button or the emergency button is a known hotkey to a direct contact with an emergency centre. This call is pre-emptive with the highest priority. It allows notifying others (individuals, team members, emergency call takers) as soon as possible and enables to have reinforcement or help on site as soon as possible. For PPDR services fast support (reinforcement or help) is very often critical. This keyboard shortcut or red button will automatically and immediately route towards the dispatcher that was accompanying the operations. The dispatcher is immediately able to see additional information about the team and its composition.

The routing can be done using a cascade system, with different levels to be sure that at last someone will take the call. Another method is to alert in the open communication group of the team of the on-going mission or task. This last procedure will immediately inform all members of the team or other teams with similar tasks or missions. Everyone involved in the operation or similar operations and even the emergency room can be reached by the emergency message.

7.3.6.2 Ruggedized EUE – dust and waterproof

For PPDR it is required to have devices that are sufficiently protected against various external circumstances such as: shocks, water, heat and dust. These are the working conditions of the different PPDR services. Also for commercial public use there is a market for this kind of equipment with potential customers outside those which belong to the PPDR services.

However, not all PPDR services or users need these ruggedized and expensive devices. By using the devices of the public commercial market (COTS, Commercial off the Shelf), prices can be significantly reduced for the EUE of these PPDR services and users, but security has to be satisfied not only from user organisations but also the network operator has to be satisfied. The smaller number of customers for a device, the smaller the market, the higher the price. Another element is the state of the art of the devices. The smaller the market, the slower the technical evolution of the devices. COTS devices evolve very fast because of the big market size and the competition. There were about 1.5 billion smart phones sold in 2016. By using COTS devices PPDR users would have the best devices in terms of state of the art of the technology (processors, memory, batteries, displays, GPS, cameras, etc.) for the lowest price.

7.3.6.3 Direct Mode Operation (ProSe, DMO)

The direct mode operation (ProSe, DMO) and its derived ways of working (dual watch, gateway, and repeater) will be considered. The device/device interfaces shall be compatible not only for the pure communication (voice, video, and data), but also for the related features as the signalling, the security, the priority etc. (*full device/device interface standardisation*). This topic will be in a high priority for the PCP phase.

7.3.7 Applications for PPDR

Voice is the most important mission critical (MC) application on the current networks and will stay MC on the future networks. Data based solutions and especially video are also becoming more and more MC for PPDR. They enable better and faster situation awareness and can help to determine the need for the deployment of responding teams and help to take the right decisions. Aerial photography of incidents and disasters (mass manifestation, fire, explosion etc.) may give a lot more details than speech. Quick and real time and correct situation awareness can avoid casualties and economical losses because of faster application of adequate response actions.

7.3.8 PCP setup recommendation

As developed in the 7.3 subsections supra, security, system/device/peripheral/Mgt WS interfaces full interoperability (remark: full standardisation does not necessarily imply the standardisation of the corresponding human machine interfaces (HMI)), end user operational interoperability (service continuity roaming functionality, including the CG roaming functionality), priority management and location based MC features are recommended to be the technical key functionalities to be implemented and tested for PCP and PPI phases.

BroadMap believes that those functionalities, which are part of the most essential mission critical ones, are maybe commercially less interesting to develop and to implement, hence our recommendations.

Moreover, it is recommended to analyse the benefits of developing a SpiceNet EU MC BB roaming HUB for optimal MC BB functionality/services implementation, performances and management.

As regards the PCP pilot communication system setup, it is recommended, in order to test the abovementioned key functionalities, to implement at least three pilot systems with a common radio coverage zone. Please, note that the systems can be geographically located in different places while the overlapping zone can be obtained thanks to remote base stations.

A vivid simple test example could be to show how a device running a video streaming application (like Skype) will roam between the MC BB pilot networks compared to how the same or similar device roams between two or three commercial 3GPP networks.

7.4 PCP, PPI and EGTC Committees

7.4.1 Introduction

The international cooperation between first responders on the ground requires common agreements, procedures and technology.

There are different levels of agreements, from international legislation (European and multilateral treaties) to operational agreements between user organisations (*functional models*). These have to rely on a common interoperable technology (SpiceNet vision) and being translated into *procedures/methods*, directly applicable by the first responders (hand-books).

As the PCP design, prototypes and pilot systems will be constituted with several products and services, which do not exist yet, delivered by different manufacturers, it is essential, from the beginning of the PCP phase, to establish a Technical Validation Committee (TVC) to continuously ensure the technical interoperability of the developed results.

With the establishment of the EGTC on the long term, the TVC could evolve as the technical R&D and validation department of the SpiceNet governance, next to the operating and the purchasing departments.

In parallel with the upcoming technology support, the functional MC BB model and the related procedures, which will be applied during the PCP, PPI and long-term phases, have to be developed. To this end, support parties should integrate the consortiums during the PCP and PPI phases, and integrate the EGTC on the long term.

Eventually, next to the EGTC technical-operational conception entities, the operational supporting tasks at European level should be ensured, better by existing (EUROPOL, ERCC...) or new mono-disciplinary entities. As an operational supporting task example, there will be a need to follow up the reservation of the multi-purpose international CGs in order to avoid that the same CG is utilised at the same time for two or more different operations. Therefore, for each blue light agency (police, civilian

protection…), an entity at European level should host a service containing the list of the international CGs and their calendar of reservation. Before using a multi-purpose international CG, the first responders in charge of an operation or of an event would so be able to reserve it and have the guarantee that the CG will not be squatted in.

As starting point for defining the PCP and PPI functional model and its related procedures, the Norway-Sweden ISI project functional model and hand-book (2017) as well as the International Fleet map Proof of Concept (IFPOC) developed in the framework of the FP7 ISITEP project (2013-2017), D23.3, could be used. It is important to note that, in accordance with the IFPOC *separation principle*, the international fleet map does not interfere with the existing national fleet maps, so that the autonomy of the chapter 6 harmonisation and interoperability layers is ensured.

7.4.2 Technical Validation Committee (TVC) missions scope definition

The *Technical Validation Committee* (TVC) will have technical experts which lead and follow up the whole process (PCP design, prototype, pilot, PPI). They will have tight contacts with standardisation bodies (3GPP, ETSI…). Some of them could be members of the working groups of these bodies.

The TVC will define weights/a process to make a ranking between the candidates respecting the public procurement rules. They will describe the technical requirements and architecture for the solutions of the requirements that are not yet covered by standards and complete the standards that were preconceived (PCP design phase).

At each stage of the solution realisation process (PCP design, prototype, pilot, PPI), the TVC will take the necessary steps and decisions, notably also on basis of the propositions coming from the industry, to guarantee the interoperability and the further developments.

The TVC will test and evaluate the PCP prototypes and pilot systems as well as the PPI systems. To this end, the TVC has to decide if (part of) the needed test and validation instruments have to be acquired and/or if subcontracting with standardisation institute/validation laboratory have to be concluded.

For sustainability reasons, there is a need for a TVC after the PCP and the PPI phases. The TVC should therefore be integrated in the EGTC, for example as a validation and R&D department, to support the SpiceNet governance function.

7.4.3 Specific PPDR Committee

After the PCP and PPI phases, a specific end user representative committee named the *"Specific PPDR committee"* should stem from the PCP and PPI functional TVC and procurement committees (See chapters 5.2.2 and 5.3.2) as an additional committee into the PPDR communication entity. The specific PPDR committee will be competent and taking decision for further developing the multinational PPDR functional model, while giving advice to the SpiceNet governance about technical-operational matters.

With the constitution of European Border and Coast guards agencies under the authority of Frontex (chapter 6 networks and users layer), new original developments have to be made with a view to optimizing the European first responders organisational working. These requirements could also be taken into account by the specific PPDR committee.

7.5 PCP and PPI roadmap

The Pre-Commercial Procurement (PCP) is divided up into two parts:

- The PCP call preparation and tendering process.

  Plan and implement the tender procedures, based on the topic description delivered by the Coordination and Support Action (CSA) launched under Call SEC-04-DRS-2017 on 24-02-217, for procuring:

  - Prototype communications equipment's that will constitute the foreseen pilot communication systems.

  - Prototype instruments for validating the components of the prototypes and pilot systems and/or the services of an existing validation centre.

  Included in the technical requirements, maintenance and sustainability aspects will be addressed. Variants will give the possibility to the tenderer to propose solutions not imagined by the public purchasers. The possibility will also be given to the tenderers to freely offer more than what for which it will paid.

- The PCP execution. This is divided up into three phases:

  - Phase 1: Solution design.

  - Phase 2: Prototype development.

  - Phase 3: Original development of limited volume (pilot) of first test products/services.

  At the beginning of each phase a Q&A meeting will be organised between buyers and suppliers. After the suppliers outputs are received, a selection will be carried out followed by a technical negotiation to maintain the interoperability. At the end of each phase, on the decision of the TVC, technical requirements will be deepened and updated.

The Public Procurement of Innovative solution (PPI) is divided up into two parts:

1. PPI(s) call(s) preparation and tendering process.
2. PPI(s) execution (commercialisation).

The establishment of a PPDR communication entity is also divided up into two parts:

1. Creation of the entity defining the countries members involved and its missions.
2. Life of the entity (procurements, operator, lobbying, technical support to end users).

The PCP and PPI activities and the establishment of the future dedicated entity step by step plan is depicted in Figure 17.
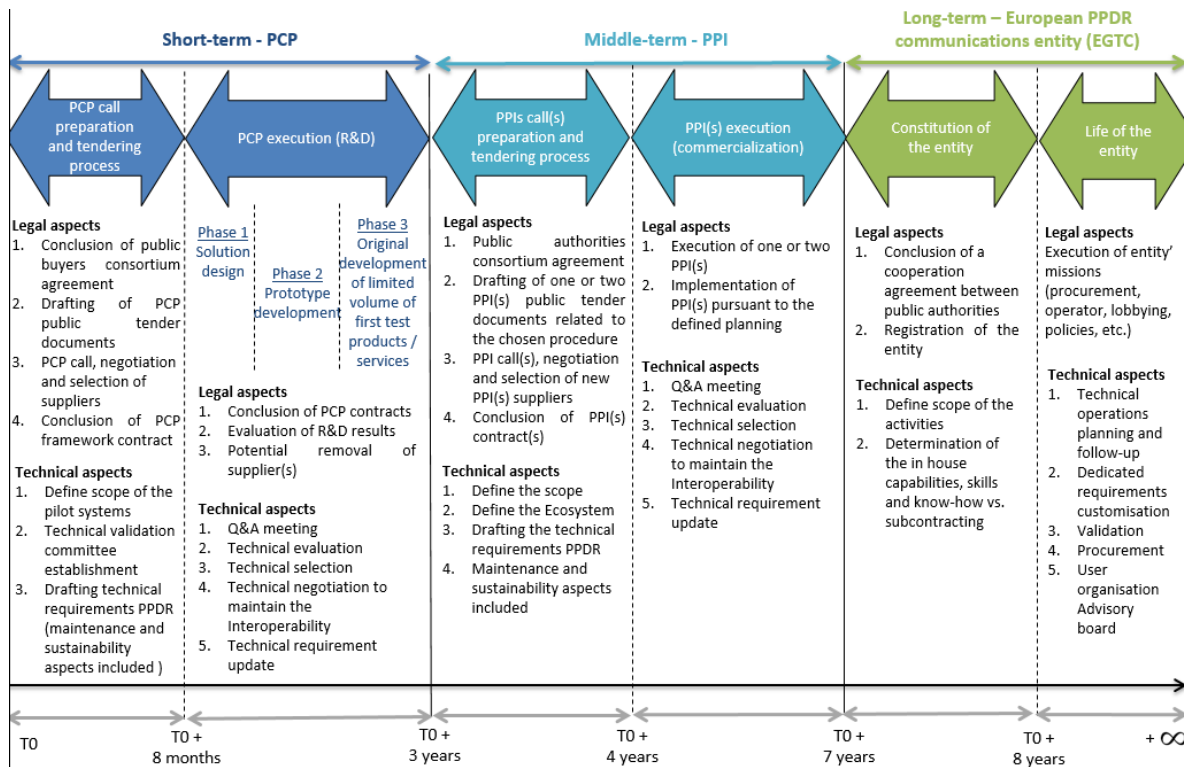
Figure 17: Phases of PCP and PPI

7.6   Conclusion

The transition roadmap consists of the PCP and PPI activities and then, their continuity into a dedicated entity. There are several transition possibilities defined in this chapter which depend on the current existing systems. From the chapter 7.3.8 technical aspects and key functionalities that are important for the pilot for PPDR services have to be taken in account.

Once the Technical and Validation Committee (TVC) is composed they will do the follow-up into the phases with an evaluation and downsize. Planning and timing will be more detailed by the TVC after the start-up of the PCP. Operational needs will be followed up by the specific committee with members of different PPDR backgrounds.

8   List of Annexes

Annex 1 – Archimate SpiceNet model
Annex 2 – Legal Aspects – further detail

9   References

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[5] SEC(2007) 1668 communication

[6] EU Directive 2014/24 of the European Parliament and of the Council of 26 February 2014 on public procurement

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[10] Deliverable 5.1 "Conclusion of solution evaluation"

[12] The annex 1 (part A) of the BroadMap Grant Agreement

[13] Art. 4 and 46 of the TFEU

[14] The ordinary legislative procedure for the adoption of an EU act is regulated by the art. 294 of the TFEU

[15] Art. 288 of the TFEU

[16] Art. 4, 46 and 173 of the TFEU

[17] Art. 76 of the TFEU

[18] Art. 288 of the TFEU

[19] Framework Directive 2002/21/EC amended by Directive 2009/140/EC, access Directive 2002/19/EC amended by Directive 2009/140/EC, Authorisation Directive 2002/20/EC amended by Directive 2009/140/EC, Service Directive 2002/22/EC and the Citizens' Rights Directive 2009/136/EC universal, Directive on Privacy and Electronic Communications 2002/58/EC, regulation on Body of European Regulators for Electronic Communications (BEREC) and regulation on roaming on public mobile communications networks

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[21] Decision n° 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy program

[22] Art. 4 of the TFEU

[23] The European Grouping of Territorial Cooperation (EGTC) function is to assist countries that wish to cooperate to complete agreements and build platforms for interoperability

[24] BroadMap Deliverable 4.1 (High Level Specifications, Solutions & Potential Organisation Schemes)

End of Document

Mapping Interoperable EU PPDR Broadband Communication Applications and Technology

D5.2 Annex 1	
Standardized PPDR Interoperable Communication Service for Europe SpiceNet	
BROADMAP	Mapping Interoperable EU PPDR Broadband Communication Applications and Technology.
Deliverable	D5.2 Annex 1
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1   Introduction

The transition from current legacy PPDR narrow band systems to Mission Critical Broadband Services TETRA/Tetrapol has been described in BroadMap D5.1 (Conclusion of Solution Evaluation). The document describes several Transition Roadmaps that could be employed to migrate from legacy systems to next generation Mission Critical Broadband Services. The individual transition roadmap employed by each EU Member States and associated countries will be unique and will be dependent on the status of national decisions e.g. frequency regulation, status of legacy systems, strategies and funding.

The SpiceNet reference architecture model is designed using the description of D5.2 Chapter 6. The model describes a proposal to provide a foundation for Harmonized Pan European PPDR Mission Critical Broadband services. The reference model also uses findings from D4.1 (e.g Organizational Schemes and provided services).

The design of SpiceNet reference architecture model follows the principles of **ToGAF®** Architecture Development Method as described in BroadMap DOA Part B, page 23 (Phases B,C,D). The design software **Archi®,** which is a free, open source, cross-platform tool to create ArchiMate models. The **ArchiMate®** modelling language is an open and independent Enterprise Architecture standard, that supports the description, analysis and visualization of architecture within and across business domains. ArchiMate is one of the open standards hosted by **The Open Group®** and is fully aligned with **ToGAF®**.

The high level Archimate reference architecture model of the SpiceNet outlines four layers:
1) Harmonisation (Tuning Ranges & Transition Roadmap to Standardized Solutions)
2) Organizational Schemes
3) PPDR End Users
4) Networks and Interoperability

These layers follow the principles described in D5.2 Figure 7 *Pan European Layered Interoperability Reference Architecture* with three layers (Harmonisation, Interoperability, Networks & Users). However, to achieve a better Governance architecture model, the above mentioned layers were defined to describe better the findings of BroadMap project. E.g. PPDR End Users are described in a separate layer and Transition Roadmaps are part of Harmonization layer.

The strategic high level architecture picture can be seen on the next page. A HTML application showing the basic elements and descriptions of the SpiceNet model is available and can be published after consultations by the EU Commission. The details of the descriptions (entities, their documentation and relations) can be seen in **ArchiMate®** -file SPICENET_V1.0 and a PDF report with the same name (both delivered electronically). It is recommended to study the model using the **Archi®** - application, which can be downloaded from: http://SpiceNet.archimatetool.com.

Acknowledgements

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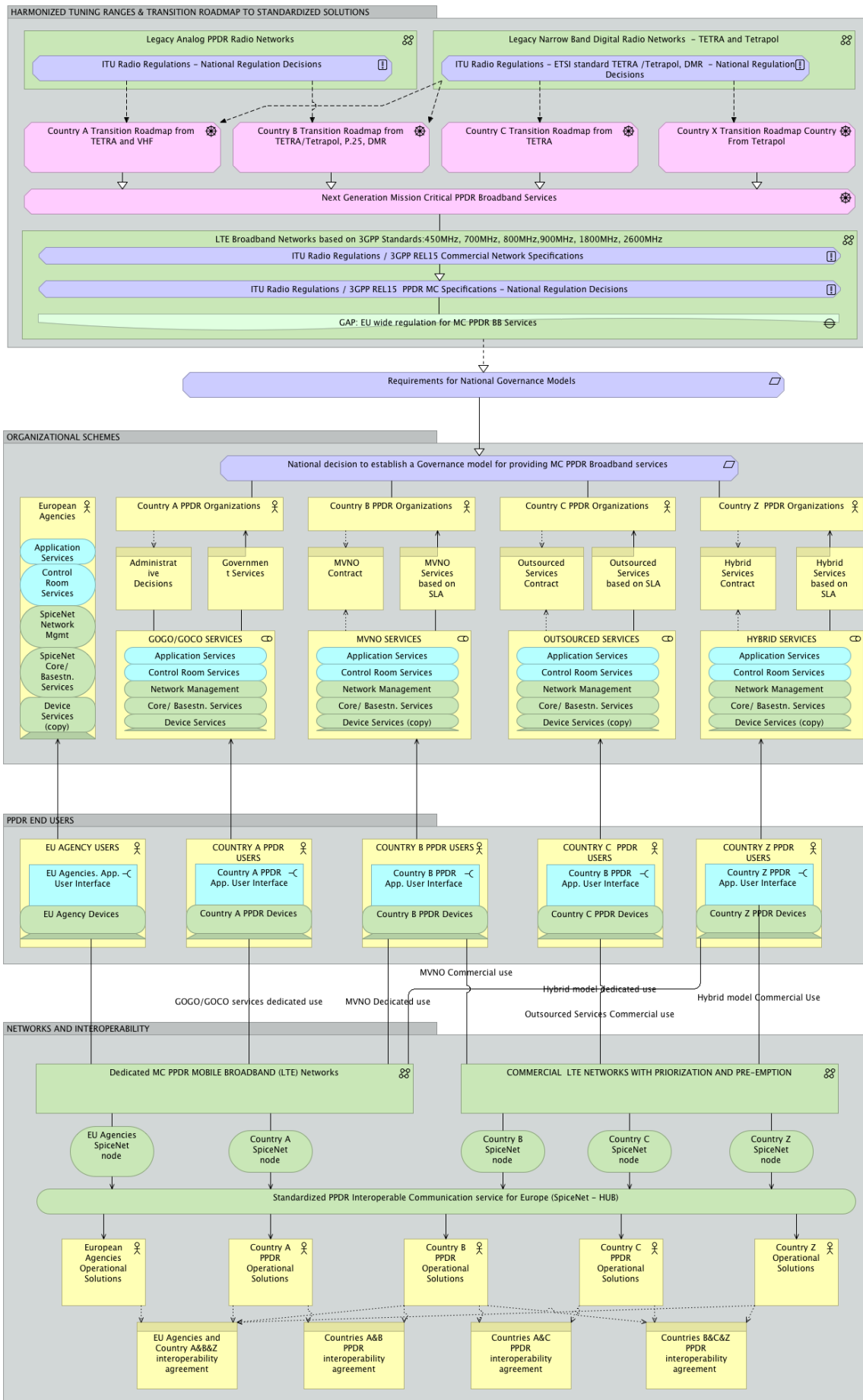
2   References

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[2]   BroadMap D5.1, Conclusion of Solution Evaluation

[3]   BroadMap D5.2, Final Definition of Transition Roadmap and PCP Specification

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End of Document – D5.2 Annex 1

Mapping Interoperable EU PPDR Broadband Communication Applications and Technology

BROADMAP	Mapping Interoperable EU PPDR Broadband Communication Applications and Technology.
D5.2 Annex 2	
Legal Aspects – Further detail	
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List of figures and tables

Glossary

AC	Countries associated to Horizon 2020 program
BEMOI	*Service public fédéral intérieur* (Belgium)
CJEU	Court of Justice of the European Union
CO	Commercial ownership
Co	Commercial operated
CSA	Coordination and support actions (by the European Commission)
D	Deliverable (of the BroadMap project)
DG Connect	European Commission Directorate General for Communications Networks, Content & Technology
DGFLA	*De Gaulle Fleurance et associés* (law firm)
EAFIP	European assistance for Innovation procurement
EC	European Commission
EU	European Union
EGTC	European grouping of territorial cooperation
FIMOI	Ministry of the interior (Finland)
FRMOI	*Ministère de l'intérieur* (France)
GCC	General clauses and conditions
GO	Governmental ownership
Go	Governmental operated
IC**T**	Information and communications technology
IP	Intellectual Property
MS	Member State of the European Union
PCP	Pre-Commercial Procurement
PMC	Preliminary market consultation
PPDR	Public Protection and Disaster Relief (All Safety and Security Agencies)
PPI	Public Procurement of Innovative Solutions
R&D	Research and development
SME	Small and medium enterprise
T	Task (of the BroadMap project)
TFEU	Treaty on the Functioning of the European Union
WP	Work Package

Summary

This annex 2 reports the content of the legal roadmap developed by DGFLA during task 5.1. Other documents drafted in relation with are also reported here: legal booklet (chapter 2), PCP national regulation (chapter 3) and EU legislation tending to harmonize PPDR communications (chapter 4).

Recommendations based on these documents are mentioned on the D5.2 "Final definition of the transition roadmap and PCP specifications" in Chapters 5 and 7.

1. THE LEGAL ROADMAP

The aim of the Work Package 5 (WP5) is to define a transition Roadmap. The task 5.1 consists primarily of the analysis of the legal aspect of the Roadmap (i.e. the "legal roadmap"). Its purpose is to ensure that (i) consultations to identify the best solutions for further procurements are legal and do not breach the equal treatment and transparency principles, (ii) the best public procurement procedure is recommended for the subsequent PCP/PPI actions and (iii) the most common breaches of public procurement procedures are avoided.

Therefore, after a reminder of the context of the legal roadmap on public procurement process (chapter 1.1), the report will detail the modalities to organize joint procurement between interested countries (chapter 1.2). It will also detail relevant aspects of public tender documents to conclude public contracts (chapter 1.3). A dedicated glossary and table of content are also inserted. All documentation used for this legal roadmap is referenced below (0).

1.1. The Context of the legal roadmap: public procurement process

The BroadMap project is the first step towards future procurements of "interoperable next generation of broadband radio communications systems for public safety and security" to improve PPDR's service to European citizens and enhance interoperability across borders. One of its goals is to define a transition roadmap for research and standardization for future evolution of European interoperable radio communication solutions within legal procurement constraints[1].

Based on these elements, the aim of the transition roadmap is to implement operational EU and international cooperation in particular for cross-borders operations. In this context, public procurement is a regulated tool to succeed it.

Indeed, public procurement is a key to:

(i)   Create competition inside the EU and global market,

(ii)   Reinforce EU industries and develop SMEs to create growth and jobs,

(iii)   Implement innovation, technologies and modernizing public sector,

(iv)   Obtain a better price and quality for public,

(v)   Help defining public buyers' needs with a common interest.

The EU, throughout the Horizon 2020 program, assists members State (MS), local authorities and any interested public persons (i.e. association of one or more such authorities or bodies governed by public law) to face the development of innovation implementing[2]:

- **PPI** when solutions are close to the market and would be provided if exists clear requirements / sufficient demand expressed by the market. Incrementing innovation or non R&D innovation can deliver required quality / price.

    In this case, which is quite common, public sector provides seal of approval for innovative solution by acting as launching customer / early adopter (e.g. product adaptation, scaling up innovation).

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[1] 1.1 Project summary of the Annex 1 (part A) of the Grant agreement-700380-BROADMAP
[2] Guidance for public authorities on PPI

- **PCP** when a problem requires radical innovation; there is no available solution 'on' or 'close to' the market yet. There are competing potential solution approaches but R&D is still required to evaluate the risks and compare different technological alternatives before involving a more scale deployment.

In this case, public procurers want to induce step change in market (e.g. moving from vendor / supplier lock in to better open and interoperable systems with multiple vendors including new players).

In any case, all public procurement has to respect the following main principles resulting from the free movement of goods, persons, services and capital regulated by the article 26 of the TFEU (i.e. EU internal market)[3]:

- **Equal treatment** (e.g. mention in the consultation of the minimum and unchanged requirements but also, of the criteria used to select the final bid and their weighing; they remain unchanged throughout the entire procedure),

- **Transparency** (e.g. documentation at all stages of the procedure and writing submission by tenders throughout the procedure)

- **Non-discrimination** (e.g. adaptation of general catalogues of economic operators to the specific procurement procedure)

- **Mutual recognition** (e.g. reference to a European / international standard or if unavailable, to a national standard with equivalent arrangements proved by the economic operator)

- **Proportionality** (e.g. level of security for the electronic communications used for the procedure is correct and reliable identification of the senders).

The purpose of the legal roadmap is to detail the possibility to organize joint procurement between mainly cross-borders countries throughout adapted procedures to implement future PCP and PPI activities (**1.2**). It will also precise the content of the future public procurements tendering documents including the most adapted criteria and their main contractual aspects for (**1.3**).

As the main goal of the transition is to **ensure cross-border activities in EU throughout a new generation of radio communication systems, the regulation analyzed have to refer to EU acts**. Then, the main legal basis of this roadmap is the EU 2014 Directives on public procurement[4] for PPI activities and the EC communications and guidelines for PCP activities[5]. Moreover, national MS legislations which have already implemented PCP are mentioned. Due to the purpose of the BroadMap project, dedicated regulation to radio communications systems, as EU 2016 Directive on measures for a high common level of security of network and information systems[6], is also taken into account.

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[3] For more details, please see DGFLA presentation dated 11 May 2016 on « Legal aspects of the roadmap », whereas (1) and art. 18 of the 2014/24/EU Directive
[4] Directives 2014/24/EU and 2014/25/EU of the European Parliament and of the Council of 26 February 2014
[5] Communication from the Commission dated 6 October 2010 on Europe 2020 Flagship Initiative - Innovation Union and Communication dated 14 December 2007 on PCP
[6] Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016

1.2. The joint-organization of public procurement procedure

Before tendering, the public authorities have to define how to organize their relationships; if they decide joining them for buying the same R&D / products / services (**1.2.1**). Then, once joint procurement organized, they have to choose and fulfill the most adapted procedure to their purchase (**1.2.2**).

1.2.1. The necessity of joint procurement

After a presentation of the form of public procurement organization (a), the applicable law to such an organization will be detailed (b).

a.   The form of a public procurement organization

The BroadMap project integrates 15 potential buyers and end users from 15 countries and 8 of which are responsible ministries[7]. Moreover, the national workshops organized during the WP3 (i.e. requirements consolidation phase) involved all type of PPDR end users (police, ambulance, fire, customs, coastguard, prison, utilities).

Therefore, this project highlighted the existence and necessity of EU / international joint cooperation between countries inside and outside the EU. In such a case, joint procurement is useful to:

(i)   Financing, by the combination of purchasing activities and increasing of the quantities being purchased, the buying power of the public purchasers involved,

(ii)   Reducing administrative costs and saving time as the administrative work of public buyers involved in preparing and carrying out is done in one tender rather than in several tenders,

(iii)   Using dedicated skills and expertise for smaller public buyers with the benefit of capacities of staff in larger public buyers in particular when procuring innovative products and services and therefore, define common products and increase EU interoperability,

(iv)   Sharing risks between public purchasers for wining cost effectiveness and quality.

The modalities to organize join-procurement activities depend mainly (i) of the level of involvement wanted by its participants and (ii) if a legal entity is required for the organization.
Two main types of organizational arrangements exist for joint procurement[8]:

A. A central purchasing body

In this case, a permanent organization with a legal entity is established to provide a centralized procurement function on behalf of the different public purchasers involved in the same project(s). This organization is responsible for all procurement actions for its members: making

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[7] 1.1 Project summary of the Annex 1 (part A) aforementioned
[8] For more details, please see the Part 2 legal booklet (2.3) entitled "*European joint procurement – An approach for multinational public purchasers*"

acquisitions, managing dynamic purchasing systems or awarding public contracts/framework agreements with or without remuneration.

The missions entrusted, in general, to a central purchasing body are to:
- coordinate training for public officials in charge of public procurement;
- establish policies for public purchasers;
- act as a public purchaser aggregating demand and purchasing;
- act as manager of the (national) system awarding framework agreements or other consolidated instruments for the benefit of public purchasers;
- increase potential through aggregation, efficiencies and realizing policy objectives.

Based on the existing EU regulation, it could be created, at a EU level, a European grouping of territorial cooperation (EGTC)[9]. It includes public purchasers from at least two EU MS. Non-MS who have international cooperation relations with a MS can also participate[10]. It is not submitted to a previous adoption by EU national parliaments as it is the case for any international agreement.

B. A collaborative agreement

Joint procurement does not automatically require the establishment of permanent organizations with a legal entity. Public purchasers could directly collaborate in procurement actions, through their existing purchasing departments. Such groups, without legal status or common assets, work according to previous conclusion of agreements with a public purchaser taking lead responsibility for sourcing markets, tendering and arranging contractual documentation for specific procurements all in consultation with other members of the group[11].

Two main level of involvement could be established:

- at the simplest level, public purchasers can choose to combine their activities only for procurement action (i.e. tendering phase);

- at a more complex level, public purchasers could decide to be contractually joint in a public contract and not only for the procurement action; it means that all public purchasers involved will be part of the public contract.

At a EU level, this type of organization requires concluding an agreement and could also involve MS and non-MS. However, if it includes an associated country (AC) and depending of its purpose, its constitutive agreement could be previously submitted to national parliament concerned for ratification as any international agreement.

C. Such a joint procurement organization must not be confused with:

- **a public contract**;

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[9] Ruled by regulation (EC) No 1082/2006 of 5 July 2006 amended by regulation (EU) No 1302/2013 of 17 December 2013
[10] Art. 3 and 3bis of the regulation (EC) No 1082/2006 above-mentioned
[11] Preamble (73) and article 39 of EU Directive 2014/24 of the European Parliament and of the Council of 26 February 2014 on public procurement

Indeed, joint procurement's role is to realize common procurement procedures in order to conclude a public contract and even more to follow-up its execution. It is complementary with national purchasing departments which are directly involved in this organization as technical actors / support.

- **the beneficiaries of the results of the public contract**;

The public authorities participating to a public contract could organize their relationship into a dedicated agreement different from the organisation of joint procurement (i.e. in case if not all joint procurement countries want to be part of a public contract). Moreover, in case of PCP, one or more public entity could use the results of PCP contract (e.g. prototype of radio communications core centre) and others could, in addition, hosting products related in their country (e.g. implementation of a core centre in their territory). These relations have to be previously defined in a consortium of public buyers agreement (for more details, please see the figure 6).

- **the organizational form of the public contract**.

Some public contracts include a sharing of project management for their execution between public authorities and / or private entities (e.g. some activities are realized only by a public entity and others are made by its private contractor). Such organization is related to the execution of the public contract and not the organization in charge of procurement.

The Figure 1bellow illustrates an example of joint procurement based on a convention constituting a EGTC between national and local authority at an international level with MS and non-MS/AC.
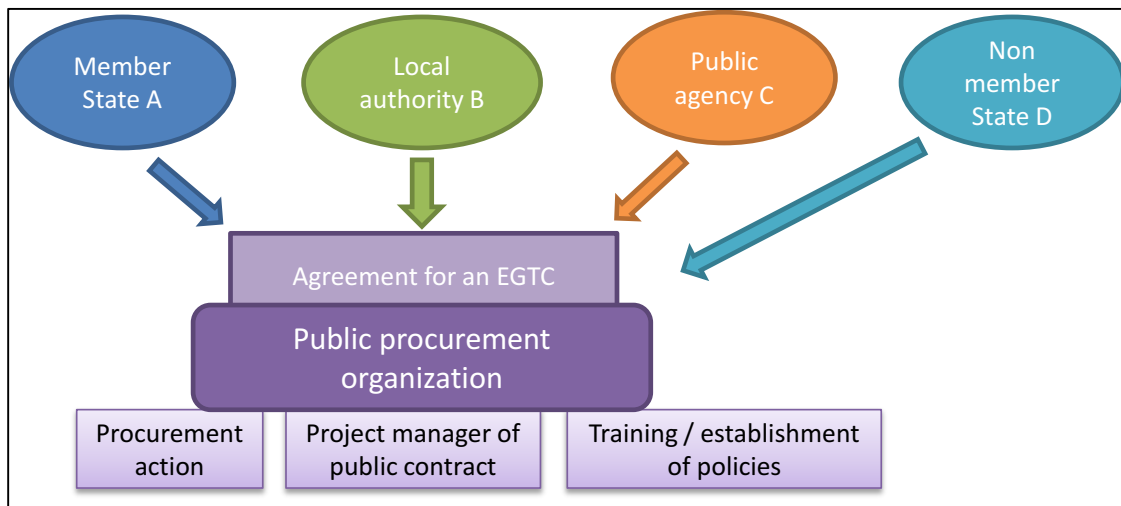

Figure 1 Joint procurement organization with a legal entity

b.   The applicable law to a public procurement organization

According to the legal form of the organization, the **applicable law for public procurement activities** is different[12]:

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[12] Art. 39 of EU Directive 2014/24 above-mentioned

A. **If a EGTC is created** by a convention between its members (i.e. type of central purchasing body with a legal entity), the applicable law is:

   a. either, the national provisions of the MS where the joint entity has its registered office;

   b. either, the national provisions of the MS where the joint entity is carrying out its activities.

Therefore, in case of creation of an organization with a legal entity as EGTC, the applicable law for purchasing activities is always the national law from a MS on which its members agreed.

B. **If a collaborative agreement is concluded**, two main mechanisms could be chosen:

   - the public purchasers use centralized purchasing activities offered by a central purchasing body located in another MS;

     In this first case, the purchasing activities shall be conducted in accordance with the national provisions of the MS where the central purchasing body is located.

   - the public purchasers jointly awarding a public contract, concluding a framework agreement or operating a dynamic purchasing system.

     In this second case, (i) either the parties conclude an international agreement (i.e. which legal force is superior to the national law) defining the applicable law (e.g. provisions referencing the EU procurement rules), (ii) either the parties conclude an agreement mentioning the national applicable law.

C. **The applicable law to the organization must not be confused with the law on which the public procurement will be submitted.**

For example, a public procurement organization with the legal form of an EGCT could be submitted at the French law if its registered office is located in France. However, for PPI activities, the public procurement procedure and then, the public contract concluded could fulfill another national law as Spain regulation on public procurement based on the 2014 EU Directives.

The EC also requires, for **implementing PPI and PCP under Horizon 2020 program**[13], a minimum of three independents participants from three different MS or AC of which minimum two public procurers from two different MS or AC. In addition, other entities can also participate in (i) buyers groups as private / NGO procurers providing services of public interest and (ii) in coordination / networking activities by any private / public type of entity (e.g. experts, end-users, certification bodies) that has no conflict of interest (i.e. no potential suppliers for the PCP / PPI).

The example in the Figure 2 below presents a public joint procurement organization:

   - based on a EGCT,

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[13] Information issued from a presentation "Horizon 2020 support to innovation procurement" (undated) of the DG Connect of the EC Innovation Unit (F2)

- between MS and non-MS, local and national authority,

- which applicable law is the national dispositions where it has its office,

- leading the procurement procedure until the signature of the public contract and in charge to manage and follow-up its execution,

- however, this organization is not the contracting authority,

- each public purchaser involved is a co-contractor to this public contract and has contractual relationship with the company selected at the end of the procurement procedure,

- moreover, due to the purpose of the public contract, the local authority is not part of the public contract even if it belongs to the joint procurement organization.
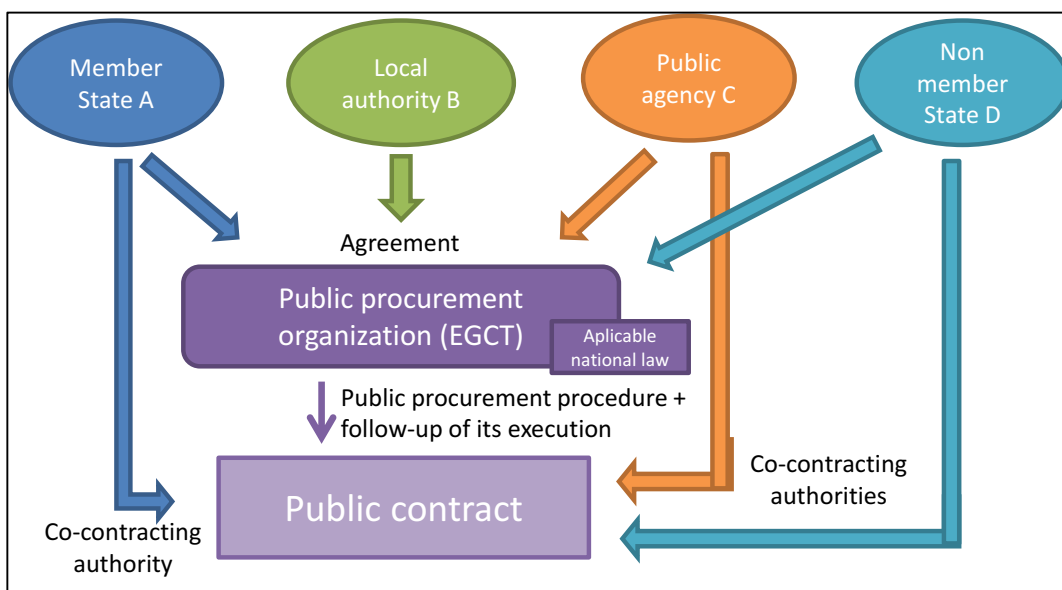
Figure 2 Contractual relations between public buyers (i) inside a procurement organization and (ii) in a public contract

1.2.2. The most adapted procurement procedures

After a presentation of the types of public procurement procedures (a), the modalities for candidates to submit a bid in answer to a procurement procedure will be detailed (b).

a. The types of public procurement procedures

First of all and before implementing a PPI or PCP procedure, a **preliminary market consultation** before tendering (PMC) could be organized by public purchasers. Its objectives are to (i) gather information from the market with a view to later procurement and (ii) inform potential economic operators of the authority's needs. It is not a procurement procedure and thus, not regulated by EU 2014 Directives on public procurement. However, it has to respect the above mentioned main principles of public procurement (i.e. equal treatment, transparency, non-discrimination, mutual recognition and proportionality). This consultation is not mandatory to implement future public procurement.

Then and depending on the purpose of the activities procured, two main types of public procurement procedures[14] can be identified in the transition roadmap:

A. PPI procedures

Due to its purpose, a PPI activity is subject to EU 2014 Directives on public procurement. As public authority(ies) remains project manager(s) of the activity purchased in the transition roadmap, application of EU 2014 Directive on concession is not analyzed here (i.e. in case of concession, the company is in charge of the project management and financing of the activity)[15].

Directives on public procurement define three procurement procedures so-called *"formalized procedures"* which are adapted in case of innovation procurements:

- **competitive procedure with negotiation,**

    The situations in which it could be used are strictly defined (i.e. when flexibility is needed due to complexity and / or technical issues). A public purchaser negotiates to determine the terms of the public contract with the candidates in order to select the final one. It allows an exchange on the content of candidates' bids but, minimum requirements are not subject to negotiation.

- **competitive dialogue,**

    The conditions to use it are the same than for a competitive procedure and the public purchaser enters into a dialogue to determine the terms of the public contract and select the final candidate. However, it is used when the purchaser requires assistance to define the requirements (mainly technically) to adapt them to its needs and the final candidates' bids could be amended. For PPI activity, it could be used when a solution is 'on or close to the market' but the public purchaser is unable to identify it by himself.

- **innovation partnership.**

    It is a new type of procurement procedure to boost the innovation in public contracts introduced by EU 2014 Directives[16]. Indeed, it provides buyers a structured, long term partnership, covering both R&D and commercial phases, without the need to conduct a new competition at the end of R&D phase. It is a **procurement procedure but also, a public contract** with a R&D purpose and acquisition of the innovative solution that results at a commercial scale. The procurement has previously to be recognized as innovative (i.e. products or services are created in order to meet a need not currently available 'on the market'). The recourse to preliminary market consultation (PMC) or a market study is recommended before resort to this procedure. The public contract is concluded with one or more final candidates who could be eliminated at each stage of the R&D and purchase phases.

    Two others formalized procedures also exist under EU 2014 Directives. However, they are not adapted to PPI activities which require innovation. Indeed, these procedures do not allow

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[14] For more details, please see the legal booklet (1/4) entitled "Conduct of a public procurement procedure with R&D needs"
[15] Please see, Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014 on the award of concession contracts
[16] This procedure did not exist under previous 2004 Directives on procurement.

exchanges between the candidates until the selection of the final candidate / bid (i.e. all requirements are previously defined by the public purchaser):

- **open procedure,**

    Any interested candidates may submit a bid.

- **restricted procedure.**

    Only pre-selected candidates by the public purchaser may submit a bid.

Apart from formalized procedures, 'proper procedure' could be implemented when the estimated amount of the products / services is above a certain threshold (e.g. €135.000 for products and services purchased by State entities). In such a case, the public purchaser is free to organize its procedure under the respect of the main public procurement principles.

B. PCP procedure

The EU PCP communication is inspired by the USA Small Business Innovation Research program (SBIR) set up since 1982. However and due to EU specific rules, PCP and SBIR have differences (e.g. SBIR is legislative act either a binding instrument and PCP is soft-law and non-binding; SBIR is supervised by a centralized independent agency but PCP starts to implement cross-border projects) [17].

Some projects with R&D needs could be completed without formalized procedure when: (i) the benefits accrued are not exclusively for the contracting authority and (ii) the provided service is remunerated by the public authority and the economic operator / company. In these cases, the PCP procedure is used and the R&D services are procured at market price (i.e. to avoid State aid regulation) after a proper competitive procedure. PCP does not mean fundamental research but for R&D with certain applications in sight. It also does not include commercial development activities.

PCP procedure is not submitted to the EU 2014 Directive on public procurement but has to respect the main principles of public procurement (i.e. legal exemption)[18]. PCP is defined by a EC 2007 communication[19] and EC guidelines[20]. However, EC communication has a legal non-binding nature (i.e. the content of a EC communication is a recommendation and does not bind the MS and their jurisdictions)[21]; it is a **soft-law instrument**[22]. As it is not regulated by EU Directives on public procurement and thus, outside of national procurement legislation, the DG Connect considers that there is no need for specific national legislation on PCP to enable public procurers to carry out PCPs[23].

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[17] See Chapter 3 of the doctoral thesis « Pre-commercial procurement – regulatory effectiveness » dated 23 October 2014
[18] Preamble (47) of the Directive 2014/24/EU above-mentioned
[19] Communication dated 14 December 2007 on PCP above-mentioned
[20] PCP Staff working document dated 14 December 2007
[21] Judgment of the CJEU (Second Chamber) C-226/11 of 13 December 2012, Expedia Inc. v *Autorité de la concurrence* and Others.
[22] For more details, please see the doctoral thesis « Pre-commercial procurement – regulatory effectiveness » dated 23 October 2014
[23] Email from the Unit F3 – Start-ups and innovation unit of the DG Connect dated 16 January 2017 answering to our request on the existence of national legislation dedicated to PCP.

Therefore, at this stage, PCP projects are mostly implemented throughout EU under Horizon 2020 program and MS have created dedicated buyers group and /or adopted specific strategy / guidelines to develop it (e.g. Austria, Germany, Italy, Netherlands, Finland, Norway, Belgium, United Kingdom, France Hungary, Denmark, Greece, Ireland, Estonia and Poland)[24]. **Only two MS adopted a national legislation dedicated to PCP: Spain and Lithuania**. The references of these national legislations and their main provisions are detailed below[25].

The PCP procedure as currently foreseen is the following:

- one tender provides the conditions for competitive R&D under a PCP framework (i.e. content and choose of suppliers),

- R&D is divided into three phases (i.e. solution design, prototype development and original development of a limited volume of first products / services in the form of a test series) and a PCP contract is signed for each phase,

- evaluation moments are implemented at the end of each step (i.e. suppliers could be eliminated at the end of each phase),

- thus, the final solution(s) is /are ready for commercialization in the framework of a PPI.

The Figure 3 below describes the PCP procedure. The timelines mentioned are based on current PCP and PPI projects.
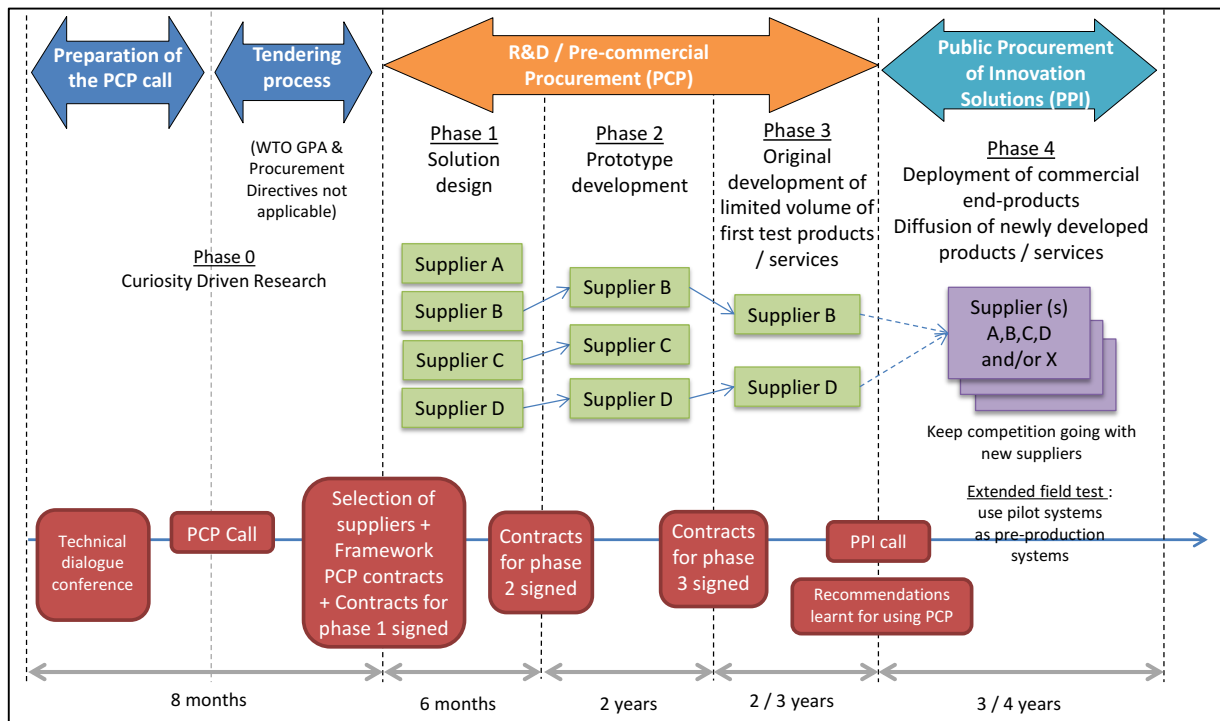
Figure 3 PCP and PPI procedures timeline

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[24] For more details, please see on the EC website, « Innovation procurement initiatives around Europe » dated 20 November 2014
[25] Please, see Part 3 « PCP national regulation in EU »

C. Distinction between PCP and PPI

In comparison with PPI, sharing of risks and benefits is a crucial element of PCP. Indeed, on one side, sharing risks between collaborating public authorities and between the contracting authorities / suppliers provides incentives for each party to assume the inherent risks of R&D and enhances the chances of wide commercialization of the new solutions. On the other side, sharing benefits with the public authorities through publication of the results and participation of the PCP in standardization activities ensures spill-over of knowledge[26].

In PPI limited R&D is involved (i.e. industrial R&D). Public authorities act as a launching customer / early adopter for innovative products and services that are newly arriving on the market. Establishing a buyers group who could purchase critical mass triggers industries encourages them to scale up their production chain and then, to bring products on the market with desired quality / ratio price within a specific time. This group could purchase a significant volume of products after a test and / or certification[27].

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[26] PCP Staff working document above-mentioned
[27] Please, see SMART PCP project

The Table 1 below indicates the **most adapted procedure depending on public purchasers needs**.

Existence of sufficient knowledge on the market to define requirements for end-solutions?			
No		Yes	
Preliminary market consultation		-	
Need of R&D phase prior to procurement?			
Yes		No	
Acquisition of innovative products or services on a commercial scale as part of the same procedure?		Can a specification of the end-products/services to be procured be developed?	
Yes	No	Yes	No
PPI Innovation Partnership	**PCP procedure**	**PPI Competitive procedure with negotiation**	**PPI Competitive dialogue**

Table 1 - Most adapted procedure depending on public purchasers needs

b.   The types of modalities to submit a bid to a public procurement procedure

Whatever the type of procurement procedure, the modalities to submit a bid by companies (i.e. candidates) have to be previously defined by public buyer(s) in the tender documents[28]. More precisely, the following items have to be fixed:

A. The form of the response to the procedure: global contract or lots

In a global contract, candidates have to fulfill all the requirements defined. Their bid answers to the entire purchase. *A contrario*, if the public buyer divides a contract in lots, candidates could answer either to one lot, either to two lots or more, either to all the lots[29]. The decision to use lots is made when products / services / works procured can be distinctly identified. The division in lots encourages SMEs to bid to public tenders because the object purchased is smaller than in a global contract.

Sometimes, it is not possible to divide a public contract in lots due to the complex nature of the purchase (e.g. technical issues). In such a case, participation of SMEs could be assured throughout the allowance of consortium or subcontracting.

B. The economic operators organizations for answering a public tender: consortium and subcontracting

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[28] EU 2014 Directives on public procurement
[29] Art. 46 of the 2014/24/EU Directive on public procurement

A public buyer can authorize candidates to bid throughout a consortium of companies / suppliers[30]. The services provided by each member of the consortium have to be identified in its bid. Depending on the nature of the services, each member can be either responsible for everybody, either responsible only for himself. In both case, a representative of the consortium sign the public contract with the public buyer (i.e. each member of the consortium give a special power to the representative to engage the consortium and then, all its members). Moreover, the representative can engage its liability for the consortium; it could be prohibited for some suppliers (e.g. a law firm based on the independency principle). Consortium is often used when a single company cannot fulfill all the public contract requirements / skills required.

Subcontracting could also be authorized when the contractor of the public buyer needs to complete its bid with a competence it does not have. Its field must be defined and it is prohibited to subcontract all the execution of a public contract[31]. Any subcontractor has to be declared and accepted by the public purchaser. Not declaring a subcontractor is prohibited. Such a declaration is either part of the public contract (i.e. mentioned in the candidate bid), either done during its execution (e.g. the contract execution require special competences which were not previously identified). For complex contract, subcontracting is a tool for SMEs participating to public procurement. The contractor is responsible for the services realized by its subcontractor. In case of the subcontractor does not fulfill its commitments, the supplier has to compensate it. It could then engage the liability of its subcontractor but outside the framework of the public contract.

C. The possibility of other tender bids: variant

Public purchaser may (i) authorize or (ii) require tenderers to submit variants (i.e. obligation or possibility)[32]. Variants shall be linked to the subject-matter of the contract and specific award criteria have to define their minimum requirements. Then, a public contract could be concluded on the basic base or on the variant if the public purchaser estimates that it is more adapted to its requirements. Variant could concern the entire bid or only a part of it.

For more complex contracts, variant are useful to propose a solution which was not imagined by the public purchaser and then, not mentioned in the tender documents.

D. The procedure duration: time to submit a bid

Depending on the procedure used, delays have to be respected at various steps of formalized procedures. The duration of bids have also to be fixed (e.g. three months). In any case, the time to conduct a procedure has to be taken into account by the public buyer in its project. An undervaluation of procedure duration could have negative effects on the contract execution and then, all the project.

The Figure 4 below describes the above mentioned options offered to public authorities for organizing candidates' answers to a public tender:

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[30] Art. 19 of the 2014/24/EU Directive
[31] Art. 71 of the 2014/24/EU Directive
[32] Art. 45 of the 2014/24/EU Directive
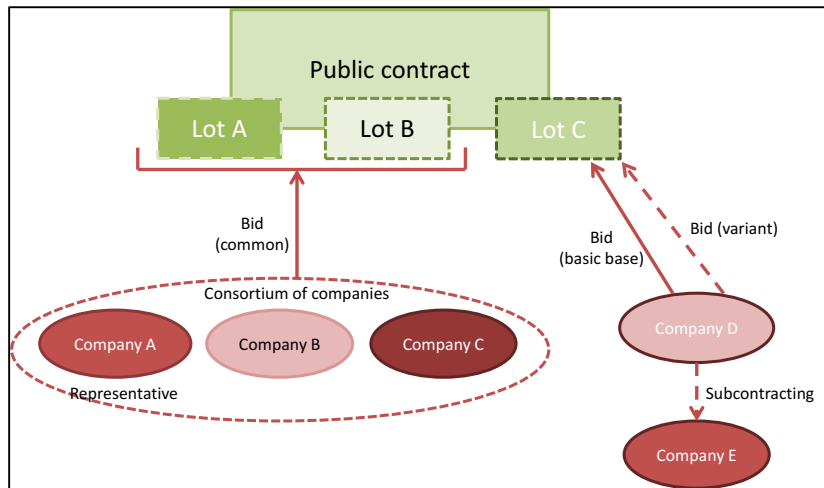
Figure 4 Companies organization and bids modalities in a procurement procedure

The example in the Figure 5 below illustrates a general view of contractual arrangement to conclude a PCP conducted by a joint procurement organization. In this case, public purchasers from MS (i.e. A and C) and AC (i.e. D) are members of the procurement organization but conclude directly the framework of PCP contract with companies A, B and C (i.e. the joint procurement organization is a tool for procuring but not a contracting authority).
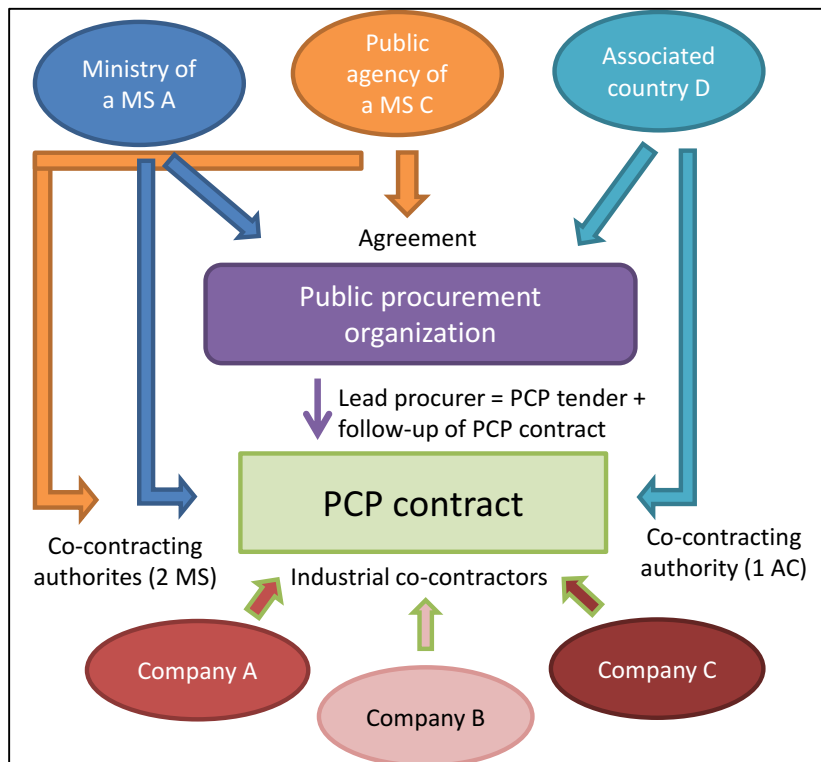
Figure 5 General view of contractual relations (i) between public authorities in a joint procurement organization and (ii) with companies in a PCP contract

1.3.   The main aspects of public tender documents

For the tendering phase, the public authorities have to choose and define the criteria to select companies and solutions (**1.3.1**). Moreover, clauses which need attention in the content of the future PCP and PPI public contracts will be presented (**1.3.2**).

1.3.1.   The selection and award criteria in innovative public procurement procedures

Criteria are a key notion in public procurement to select the candidate companies to a public tender depending to their bids (a) and then, the solutions contract (b). In both cases, criteria have to be defined in the tender documents and tender call and cannot be amended during the procedure or in the public contract (c).

a.   Selection criteria for choosing candidates

At the first stage of the tender process, selection criteria are used to ensure public buyers that companies who submit their candidature are able to perform the contract. If the candidates do not comply with these criteria, they will be excluded. If public purchasers have doubt on the capacity for a company to satisfy one or several of criteria (i.e. the documents communicated are incomplete, missing or unclear), additional information could be requested[33].

Whatever the procedure pursued, these criteria relates to[34]:

A. Suitability to pursue the professional activity

The public purchaser may require that the company is enrolled in a professional registers. For some public contract, the company has to prove that it has a specific authorization to pursue an activity (e.g. registration at a bar for a lawyer in France for providing legal advice or emission authorization for a commercial telecommunication operator delivered by the regulation authority).

B. Economic and financial standing

The objective is to ensure that the companies selected possess the necessary and economic financial capacity to perform the contract. Accordingly, the candidate companies may have to prove a minimum yearly turnover (i.e. in particular in public contract with an important amount). Information on annual account showing the ratio between assets and liabilities could also be required.

For PPI, the EU 2014 Directives mentions limit which have to be respected in case if requirements on economic and financial standing are imposed to companies (e.g. having a certain minimum yearly turnover in the area covered by the contract).

C. Technical and professional abilities

The candidate companies have to prove that they possess the human and technical resources and experience to perform the contract according to an appropriate quality standard. For example, the public authorities can require candidate companies to provide references relating to previous

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[33] Art. 56 of the 2014/24/EU Directive
[34] Art. 58 of the 2014/24/EU Directive

contract. Such a criteria may also aim at eliminating a company who would have a conflict of interest.

For new companies (i.e. SMEs) who have no reference, the public authority has to check the skills, efficiency, experience and reliability of their teams of employee.

For PCP, the EC indicates[35] that these criteria could be more general as, for example, the ability to perform R&D up to original development of the first products or services and to commercially exploit the results of the PCP, including intangible results in particular IP rights. Moreover, a list of evidence to prove criteria are fulfilled must be communicated by companies to public purchasers (e.g. description of the capacity, materials and equipment that are available to the tenderer for research, prototyping and limited production and supply of the first set of products or services or description of the financial and organizational structures that are available to the tenderer for management, exploitation and transfer of IP rights and for generating revenue by marketing commercial applications of the results).

D. Excluding criteria

Some companies are automatically not allowed participating to a tender due to the illegality of their activities or behaviour (e. g. participation in a criminal organization, corruption, fraud, terrorist offences, breach of its obligations related to payment of taxes or social contributions, breach of public procurement regulation)[36].

Moreover, in some sector, public procurement could be limited by the nationality of the candidate company. For example in PCP, a company could be excluded if a conflict of interest exists according to its national law and a declaration of honor could be requested to the candidate to certify it[37].

b.   Award criteria for selecting bids and solutions

To select one or more final bids which will be the solutions chosen by public authorities, the tender documents have to define award criteria. These criteria are related to needs and requirements of public buyers and their content is directly associated to the level of performance that the solutions have to satisfy[38].

A. Types of award criteria

The goal of award criteria is to ensure that public buyers get the best value for money. Then and due to their innovative purpose, the lowest price cannot be the sole criterion for PCP and PPI activities, without taking quality into account. Moreover, the quality criteria cannot be the sole criterion and the price as always to be taken into account (i.e. price can be the sole criterion only in few cases not applicable for R&D projects)[39].

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[35] PCP templates for request tenders made by EC
[36] Art. 57 of the 2014/24/EU Directive
[37] PCP templates for request tenders made by EC
[38] For more details, please see the Part 2 legal booklet (2.4) entitled "Criteria in public contract - a tool to choose and evaluate a R&D solution"
[39] Art. 67 of the 2014/24/EU Directive

Such criteria must be related to the purpose of the contract and may comprise for example:

> B. Quality (e.g. technical merit, accessibility, design for all users);
>
> C. Performance of the staff (e.g. organization, qualification, experience);
>
> D. Technical assistance after-sales (e.g. extended warranty);
>
> E. Delivery modalities (e.g. date, process, period).

Additional sub-criteria may be added if they do not substantially change the existing criteria.

Due to the innovative character of PCP and PPI projects, including performance criteria is recommended to evaluate if the candidate solutions satisfy contractual requirements (i.e. these criteria are not only useful for public purchasers to award a final bid but also to evaluate the solutions at the end of the contract or after each phase of it)[40]. They are part of the award criteria and can include innovation-related or environmental considerations.

B. Weighing of award criteria

The weighing or prioritization / thresholds of criteria are used to choose the most economically advantageous bid(s). These elements have to be previously defined in tender documents for each criteria and allowing discrimination between them (e.g. a price criteria at 50% and a technical criteria at 50% is prohibited because it cannot allow discrimination)[41].

Moreover, the weighting related to the price should be sufficiently high to avoid this criteria being neutralized in the evaluation (e.g. a weighting of less than 20% for price may be too low for having a significant effect on the result)[42].

C. Focus on PCP criteria

For PCP, EC recommends to apply criteria that focus on quality and degree of innovativeness. As a consequence, the following list of award criteria could be used[43]:

- ability to address the problem posed in the tender,
- technological quality & innovativeness of the proposal,
- added value for society/economy of the proposal (i.e. plain cost aspects also take into account the added value the proposal brings with regards to improving public services and the associated benefits for the whole society and economy).

Moreover, the EC indicated that compliance criteria could be required to companies (i.e. compliance with the definition of R&D services, compatibility with other public financing, compliance with ethics and security requirements and compliance with the requirements regarding the place of performance of the contract). They will be evaluated at the end of each phase of the PCP[44]. These criteria are related to the fact that a lot of PCP are concluded with the financial assistance of EU which funding requires to be in accordance with these compliance rules.

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[40] Art. 70 of the2014/24/EU Directive
[41] Art. 67 above-mentioned
[42] PCP templates for request tenders made by EC
[43] EC 2007 communication on PCP
[44] PCP templates for request tenders made by EC

Award criteria are generally defined in the PCP framework contract and then, detailed in each PCP contract' phase. These criteria could be[45]:

- Potential of solving the societal problem which is the subject of the tender call against a reasonable cost;
- Entrepreneurship (whether the company (and its project partners) is/(are) capable of bringing the product to the market: vision, ambition, experience etc.);
- Degree of innovativeness (originality and inventiveness of the proposed solution);
- Economic perspective (the chances that the product will be commercialized);
- Environmental and social aspects (whether the developed product constitutes by itself a polluting or resource intensive solution);
- Quality of the proposal and of the project (if the proposal is clearly drafted and has the potential to achieve the proposed solution).

c.   <u>Publicity of all criteria and requirements in tender documents</u>

All criteria (i.e. selection and award) but also, requirements have to be published in the tender documents both for PPI projects which are submitted according to EU 2014 Directive[46] but also for PCP which are submitted to TFEU main principles[47]. Selection criteria have to mention minimum levels of ability with the appropriate documents to justify them[48]. However, when reference is made to a European standard / label or, in the absence thereof, to a national standard / label, tenders based on equivalent arrangements should be considered.

Due to the above-mentioned principles of transparency and equal treatment, these elements cannot be amended during the tender process (i.e. tender documents and public contract). Indeed, they have to be understandable, quantifiable and verifiable by the candidates.

However and due to the specificity of PCP, the EC considers that the tender specifications (i.e. technical / scientific minimum requirements) could be flexible and specified before each PCP phase[49].

The Figure 6 below describes the selection of a solution starting from the submission of a request to participate by candidates companies until the submission of final bids and conclusion of a public contract:

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[45] These criteria were used in SBIR projects - Chapter 4 of the doctoral thesis « Pre-commercial procurement – regulatory effectiveness » dated 23 October 2014
[46] Art. 48 and seq. of the 2014/24/EU Directive
[47] CJEU case C-226/09 Commission v Ireland of 18 November 2010
[48] Art. 58 of the 2014/24/EU Directive
[49] EC Staff working document
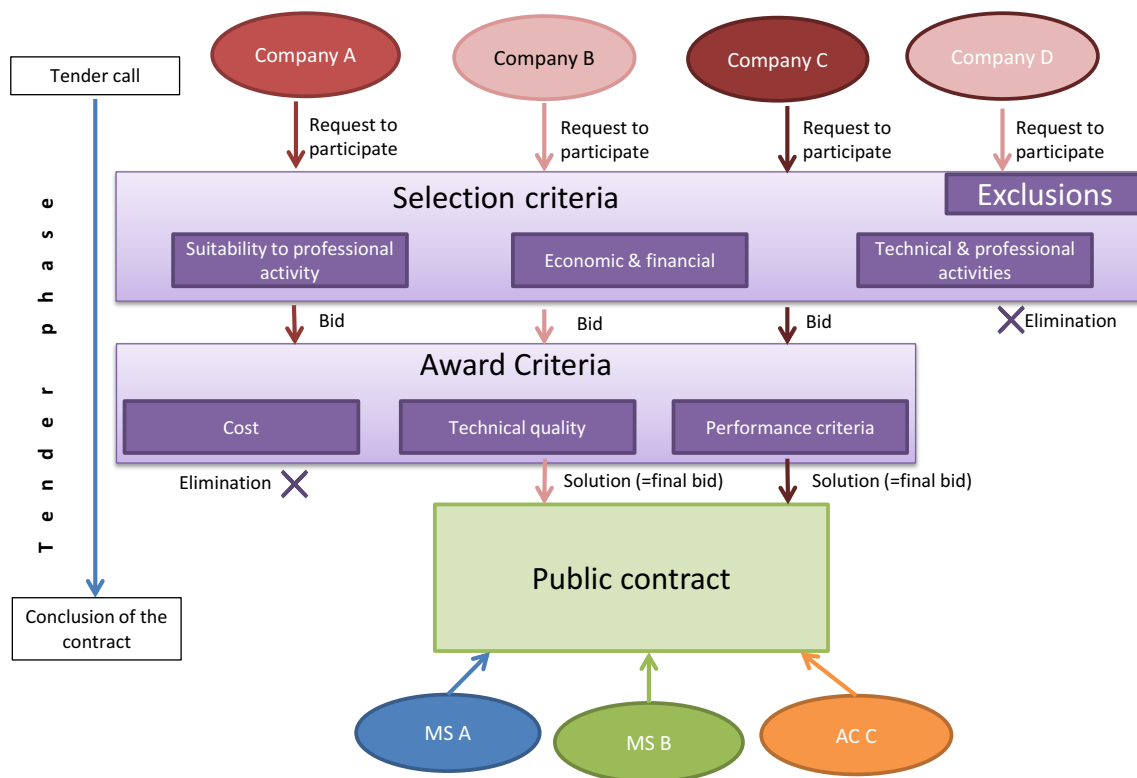
Figure 6 Criteria to select solutions during the tender phase

1.3.2. The most relevant clauses in innovative public contracts

Once the criteria defined, the public contract has to be drafted. In a public contract, the general clauses and conditions (GCC) define the modalities to execute it. GCC could be divided in two main categories: administrative clauses related to the modalities of contractual relationship between public buyer(s) and company(ies) (a) and technical clauses related to the specifications the products / services procured have to fulfill (b). For innovative contract, both types of clauses could be submitted to negotiation between buyers and companies during the tendering phase and then, amended in the public contract.

a. <u>Administrative clauses related to the risks and benefits</u>

The content of administrative clauses is depending mainly of each type of public contract (e.g. works, products, services). However, mainlines of these clauses are often the same. In some countries they are provided for by a regulation (e.g. in France, an administrative decree defines the administrative clauses for the Information and communications technology – ICT - sector). Procurement service and / or legal advisor will draft them in relation with technical services / experts who will draft the technical clauses.

The main administrative GCC are:
- General provisions (e.g. languages, parties' representatives, entry into force);
- Execution of the work (e.g. subcontract, changes of key personnel);
- Delivery (e.g. time-limits for the provision of deliverables and services, acceptance and rejection, penalties / incentives);
- Liabilities (e.g. for damage to staff and goods, after acceptance);
- Warranty (e.g. scope, period, procedure applied);

- Compliance with statutory and other obligations (e.g. disclosure and use of information, infringements of the law);
- Prices and payments (e.g. pricing, payments modalities);
- Termination (e.g. without fault of the company, with fault of the company, special cases);
- Law (e.g. applicable law, dispute resolution);
- IP rights (e.g. information to be provided, disclosure, ownership, use, exploitation).

For PCP and PPI contracts and due to their specificity in terms of risks and benefits, two main clauses have to be analyzed before drafting in tender documents:

i. IP rights

1. IPR in public contract is a crucial issue :

The determination of the ownership of the IPR in a public contract for innovative goods (i.e. R&D) between public purchasers and economic operators is a crucial issue[50]. The EU regulation provides that: "*In the procurement documents, the contracting authority shall **define the arrangements applicable to intellectual property rights**.*"[51]

Especially, when drafting procurement documents, particular attention has to be done to the intellectual property regime governing the foreground technology that may issue from a project, and, in particular:

- Who should have the ownership of the IPRs; whether there should be any co-ownership and if any, at which level (for instance each work package? or sub work package?) and according to which criteria (according to the respective contributions of the parties concerned? other allocation rules?) and under which conditions (generally subject to the signature of a separate co-ownership agreement);

- How, under which conditions and by whom patents the results of the R&D Project should be filed and maintained (in case of a co-ownership, one co-owner is generally designated to act on behalf of the others to proceed with such tasks subject to specific reporting and coordination obligations);

- How and under which conditions those patents shall be assigned to the other co-owners or the other parties or even third parties, should the initial owner or one of the initial co-owners decide to assign its rights in the same (scope, option and negotiation deadlines, procedure for the assignment etc.);

- What exploitation rights are to be granted to each party on the foreground technology of the other parties; the R&D agreement will generally stipulate a license option for the benefit of other partners framed in a given time schedule and refer to the necessity to negotiate separate licenses agreements under fair financial conditions, again within a given time schedule; when to be granted on an exclusive basis, these license options and licenses are

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[50] Please note that for the purpose of this section, IPR must be understood as the intangibles assets resulting from a R&D project that may give rise to intellectual property rights and/or other types of rights.
[51] Art. 31 of Directive 2014/24/EU related to innovation partnership

generally limited to specific exploitation domains corresponding to the intervention market and expertise of the future licensee.

2. How does sharing IPR in a public contract work?

The co-ownership, also called joint ownership, refers to a situation in which two or more persons have proprietary shares of an asset. Joint ownership of IPR, in particular, frequently arises in collaborative projects when the results have been jointly generated by the partners and the share of work is not easily ascertainable[52]. To the contrary, exclusive ownership "means that the public purchaser reserves all the results and benefits of the development (including Intellectual Property Rights or IPRs) exclusively for its own use. The companies that have developed the product/service then cannot reuse for other potential customers"[53].

It is worth noting that if no joint ownership regime is agreed the default one will therefore apply, in line with the respective national laws. To this regard exploitation rights on jointly owned assets may vary in the different jurisdictions. In the context of transnational research consortia, joint ownership need to be carefully addressed in contractual arrangements by co-owners.

Once they have defined the expected joint results, partners should deal with co-ownership taking into account the following main factors:
- Identification and conditions of use of background technology;
- Allocation of the foreground shares between joint owners;
- Conditions of use and exploitation of the joint results (IP);
- Management of the jointly owned results (IP);
- Licencing of the joint results (IP) to third parties ;
- The rules of governance.

For more details, please see the Part 2 legal booklet (2.5) entitled "Sharing IP rights - a tool to encourage innovation".

3. As regards PCP, sharing IPR is strongly encouraged by the EC

According to the EC, PCP involves a co-ownership approach where "the public purchaser shares the R&D results with other public authorities and industry through publication and standardization, as well as through their commercialization".

The main reasons leading the EC to encourage such an approach is related to the fact that IPR exclusivity are often not indispensable for public purchasers representing only one of many potential users of the developed solution. Also, the EC emphasizes that public purchasers tend to overlook the additional costs and efforts needs to reap the benefits of the results and are not

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[52] European IPR Helpdesk - Fact Sheet IP joint ownership - https://www.iprhelpdesk.eu/sites/default/files/newsdocuments/Fact-Sheet-IP-Joint-Ownership.pdf
[53] COM(2007) 799 final, 14.12.2007, Communication from the commision « Pre-commercial Procurement : Driving innovation to ensure sustainable high quality public services in Europe »

well-suited to pursue commercialization by themselves of the solutions developed in a PCP contract[54].

4. As regards PPI, sharing IPR may also be a valuable option

In PPI, it is possible to either share IPR between both parties (i.e. as it is the case for PCP) or to assign IPR to **the exclusive benefit of the public authority** (i.e. exclusive ownership of the IP rights).

However, in the 2nd option, it must be stressed that the price of the public contract will be more expensive than in the 1st case due to the fact that the contracting company would not be entitled to use nor to exploit the results of the project. As a result, it turn out that the exclusive assignment of IPR to the public authority create less incentive for the contracting company.

To mitigate this drawback, it is possible to provide that the contracting company would be granted a license to use and commercialize the IPR against payment of royalties (i.e. companies are allowed to use IP results as public authorities do in PCP but without right of dissemination).

ii. Price and prohibition of non-compatible State aides

- **Application of State aids rules**

The price of a public contract is both an award criteria and an administrative clause (i.e. it is one element to select a final bid but also, one of the key contractual element). The price in a PPI or PCP contract needs to be the same than on the market to avoid the qualification of State aids.

Indeed, a State aid is an advantage in any form which is conferred on a selective basis to undertakings by public authorities (e.g. subventions, loans, warranties); thus it is considerate as a breach in the EU internal market. State aid is prohibited by the TFEU where it does not fall within a defined exemption[55]. A specific framework exists for State aids in the area of research, development and innovation (i.e. Commission regulation (EU) No. 651/2014 of 17 June 2014 named "**GBER**"). Industrial research and experimental development is compatible if they fulfill the criteria defined by this regulation (i.e. category of the aid, eligible costs, threshold aid intensity)[56].

However, as a matter of principle, if a PPI or PCP contract is awarded at market conditions and a tender procedure is led in accordance with the applicable procurement directives there shall be no risk related to the existence of a State aid[57]. Then, the above mentioned regulation and its exemption of notification to the EC does not apply.

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[54] EC 2007 communication on PCP
[55] Art. 107 of the TFEU
[56] Art. 25 of EC 2014 regulation on State aids
[57] Art. 69 of the 2014/24/EU Directive and EC 2007 Communication on PCP

However, if the price paid by the public authority as a result of the public contract is superior to the market price, this would constitute a State aid. The amount of such a State aid would correspond to the difference between both prices (i.e. price paid by the public authority minus market price) [58]. It is important to note that such a State aid may potentially not be illegal subject to the criteria as applicable under the GBER above-mentioned.

- **Specificity of price in R&D projects**

Others elements as sharing of IP rights or environmental criteria could also be used to lead to the better cost for public authorities.

In PCP, risks and benefits are shared between parties. Thus, the total cost of R&D is paid by both public authorities and companies and this reflects its market value. Indeed, if the developed technology / service by companies is not in conformity with the expected quality levels, the investment throughout PCP will be lost for both parties[59].

If in PPI, the public purchasers could retain all the benefits as IP rights full property. Then, they pay the exclusive costs of development and the price of the public contract will be more expensive than in case of sharing of IP rights.

- **Existence of delay and penalties**

When a delay of execution for delivering products / services is mentioned in the contract and further more when such a delay is one of the award criteria[60], penalties have to be indicated in tender documents in case of non-respect of the delay.

Then, if the companies do not deliver the products / services in time and cannot justify / prove this is not due to their fault, penalties may apply. In general, penalties are defined by day or month (e.g. €100 by day after the contractual delivery date). Then, they will be deduced from the total amount paid by public authorities for the public contract at the moment of its payment. Penalties are a way to reduce the contract price when companies do not fully completed their obligations in time.

For R&D projects, penalties have to be used carefully. Indeed, due to the innovative / experimental character of these contracts, delays are sometimes difficult to impose with risk that no company will answer / accept them. Moreover, in PCP, as risks are shared between parties, the companies have no interest spending too much time in development process and are then, automatically encouraged to respect the planning previously defined.

The Figure 7 below indicates a case of State aids when a public contract is not paid at a market price by public funds:

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[58] For details, see the analysis in Chapter 5 of of the doctoral thesis « Pre-commercial procurement – regulatory effectiveness » dated 23 October 2014
[59] EC PCP staff working document
[60] Art. 67 of the 2014/24/EU Directive

State aids (prohibited in principle
and submitted to compatibility)
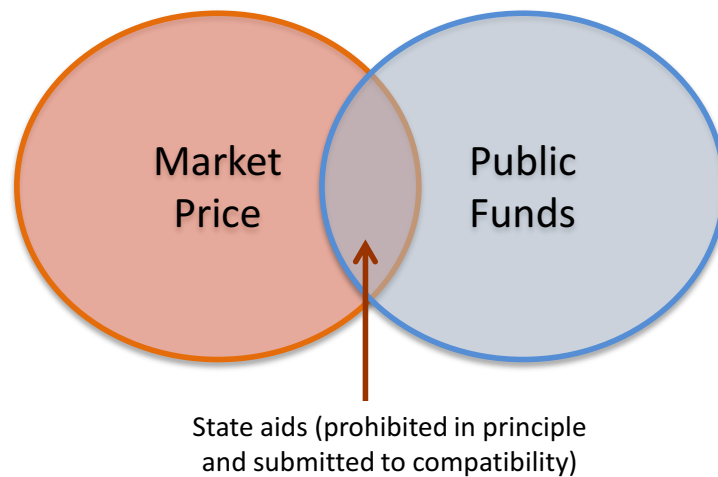
Figure 7 Case revealing State aids

b.   Technical clauses related to the specifications

Technical clauses are directly linked with the purchase activity. Depending on the service / product purchased, these clauses are different and have to be adapted. Technical services / experts will draft them in relation with procurement service and / or legal advisor who are in charge to draft the administrative clauses. A framework could be defined as follow for the ICT sector:

- General provisions (e.g. context of the project, nature of products / services, regulation / legal environment);
- Description of the project (e.g. objectives, data related to the system, description of the current system);
- Planning of the project (e.g. duration, deadlines);
- Technical requirements (e.g. security, interoperability, use);
- Detail of desired functionalities (e.g. content, needs to fulfill, reference to standards)
- Technical documentation (e.g. manual);
- Maintenance services (e.g. duration, content, modalities);
- Training (e.g. days, number of attendees, topics, levels of education depending on the attendees);
- Hosting of the system (e.g. location, modalities to access);
- Data (e.g. transfer at the end of the contract, modalities);
- Operation of the system (e.g. public / company personnel, modalities)
- Organization of the follow-up of the execution (e.g. technical validation committee, periodicity of meetings).

For PCP and PPI contracts and due to their innovative purpose and in addition with the target architecture for mission critical communication defined in the transition roadmap[61], two main types of technical clauses are here enlighten for being taken into account in tender documents:

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[61] See Chapter 7 of the transition roadmap D5.2

A. EU legal environment on radio communications systems[62]

The technical specifications have to respect and refer to mandatory accessibility requirement adopted by a legal act of the EU. Then, technical rules have to fulfill both national and EU regulation[63].

- #### EU harmonization tending to radio communications systems

Due to the inherent cross-border nature of the transition roadmap, EU regulations on radio communications systems have to be respected by the future solutions. There is no current common regulation on the field of radio communications systems for PPDR[64]. However, throughout different EU legal binding acts, harmonization has already started. The main acts are the following:

o Directive 2016/1148/EU of 6 July 2016 concerning measures for a high common level of Security of Network and Information Systems;

It is built around four strategic lines which are:

- the enhancement of national cybersecurity capacities through new obligations for all Member States aiming at adopting a national strategy on the Security of Network and Information Systems (i.e. SNIS), new obligation for EU MS to designate national competent authorities, single points of contact and a Computer Security Incident Response Teams (i.e. CSIRT) with tasks related to the SNIS;
- the reinforcement of the cybersecurity of Operators of Essential Services by the implementation of new common security and notification requirements;
- the establishment of a framework for voluntary cooperation between MS through the creation of new entities such as the Cooperation Group (to support and facilitate strategic cooperation between MS and the CSIRTs network);
- implementation of specific penalties applicable to infringements of national provisions adopted pursuant to the Directive[65].

MS may adopt or maintain provisions with a view to achieving a higher level of SNIS as a minimum harmonization is intended as of 10 May 2018 (i.e. the deadline for its transposition)[66]. This Directive is not specific for PPDR.

o Directive 2014/53/EU of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment;

o Its main concern is the protection of the health and safety of humans and domestic animals and an adequate level of electromagnetic compatibility. It modifies the scope of the

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[62] For more details, please see the Part 4 of this document entitled "EU harmonization tending to radio communications systems for PPDR"
[63] Art. 42 of the 2014/24/EU Directive
[64] TCCA study dated January 2017 entitled « A discussion on the use of commercial and dedicated networks for delivering Mission Critical Mobile Broadband Services »
[65] Article 21 of Directive 2016/1148
[66] Article 25 of Directive 2016/1148

previous Directive 1999/5/CE and adapts the existing framework applicable to innovative equipment. Thus, it is not specific for PPDR.

o Decision 676/2002/EC of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community;

o Decision 243/2012/EU of 14 March 2012 establishing a multiannual radio spectrum policy program enables the Commission to submit legislative proposals establishing multiannual radio spectrum policy programs setting out policy orientations and objectives for the strategic planning and harmonization of the use of spectrum;

o Such policy orientations and objectives should refer to the availability and efficient use of the spectrum necessary for the establishment and functioning of the internal market. It should be highlighted that, this Decision specifically addresses the need for interoperable solutions for PPDR.

o Decision 2016/687/EU of 28 April 2016 implemented by the EC on the harmonization of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union. It further makes harmonised spectrum available for priority sectors of EU spectrum policy – PPDR, audio PMSE and the Internet of Things.

The content of these regulation are detailed at the part 4 of this document.

- **EU regulation on personal data treatment**

As radio communications systems are used, in particular, to share / exchange data, the EU regulations on data protection have to be respected. The main applicable EU regulations in this case are the following:

o Regarding the treatment of personal data in general, the Regulation 2016/679/EU on the protection of natural persons with regard to the processing of personal data and on the free movement of such data repeals Directive 95/46/EC (i.e. General Data Protection Regulation) which transposition deadline is 25 May 2018 ;

o Its application for communications systems is specified in:

- Directive 2009/136/EC of 25 November 2009 amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services,

- Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector, and

- Regulation 2006/2004/EC on cooperation between national authorities responsible for the enforcement of consumer protection laws;

o Moreover, have to be taken into account to permit the protection of personal data:

- By the radio communication equipment themselves in accordance with the above-mentioned Directive 2014/53/EU,

- By dedicated measures in case of breaches of personal data in the framework of Regulation 611/22013/EU of 24 June 2013.

This legal environment will be then declined in technical and security requirements at the stage of the drafting of tender documents. One of the main questions to answer throughout technical requirements is if the radio communications systems will fulfill these regulations by themselves (i.e. security by design) or if any adapted measures will have to be implemented to respect it. Depending of the results of the R&D, both solutions could be required.

B. Interoperability throughout references to standards and labels

- **Standards**

The characteristics required for the products / services refer to specific process or method of production. They shall afford equal access of companies and not have the effect of creating unjustified obstacles to the opening up of public procurement to competition. In any case, the technical specifications have to be formulated in one of the following ways:

D. In terms of performance or functional requirements when the parameters could be sufficiently precise (i.e. see above the award criteria);

E. By reference to standards, in order of preference, national standards transposing EU standards / technical assessments, common technical specifications, international standards, other technical reference systems established by EU standardization bodies or, when none of those exist, national standards / technical approval / specifications or their 'equivalent';

F. Both terms of performance / functional requirements and reference to standards.

Public buyers have to accept, with previous justification from the candidate companies, references which are equivalent to those mentioned in the public tender. Moreover, technical specifications shall not refer to process / products / services / specific origin which are provided only by one company. This is allowed only in exceptional cases, with previous justification, and the acceptance of 'equivalence'[67].

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[67] Art. 42 above-mentioned

- **Labels**

Public authorities may also require, in technical specifications, a specific label to prove that services / products fulfilled the required characteristics. It is then, one way to ensure the respect of standards.

This label shall be related to the matter of the contract and non-discriminatory (i.e. any 'equivalent' to labels has to be accepted). When a company cannot obtain a specific label, public buyer has to accept any proof indicating that products / services comply with such a label[68].

In the transition roadmap, one of the key elements of specifications is to ensure interoperability (i.e. the R&D results could be used with current and future different technologies / systems in EU and outside). Then, the technical specifications of future PCP and PPI contracts have to (i) refer to on standards / labels or (ii) in case if do not exist due to the very innovative matter of PCP contracts mainly, defined by a group of public buyers with enough weight to impose to companies their requirements which could be used for future standardization (i.e. 'pre-standards' based on the work of a standardization organism as 3GPP).

In any case and to obtain interoperability, the standards have to be as much detailed as possible. Indeed, if standards defined are too general, the risks are that products / services purchased fulfill with standards but not ensure interoperability (e.g. a standard can mention that the material has to be connected to the public electric grid but not mention the voltage of connection; then, there is a risk that products furnished do not have the same voltage connection).

The Figure 8 below illustrates an example of IP rights sharing between public buyer(s) and company(ies) in an innovative contract with R&D:
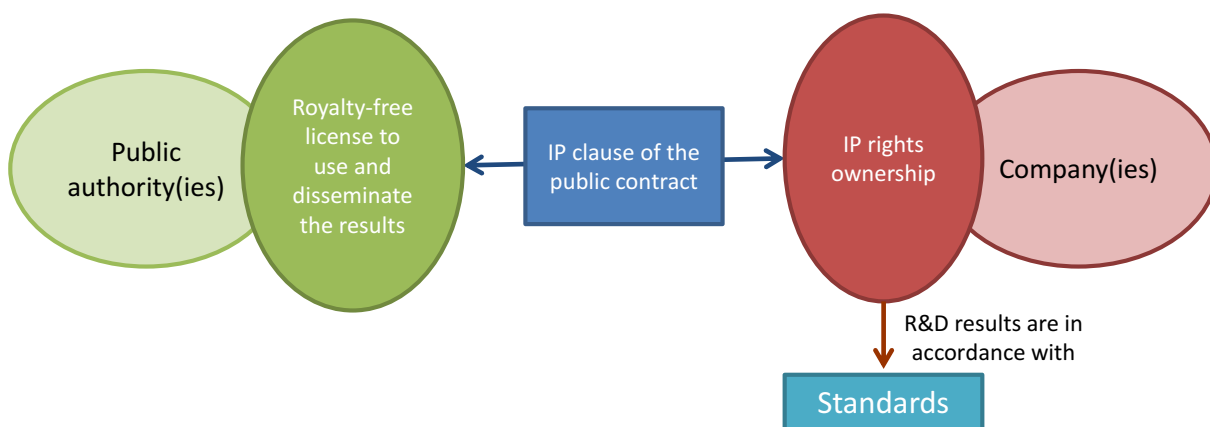

Figure 8 Sharing of IP rights and importance of standards in a R&D contract

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[68] Art. 43 of Directive 2016/1148

2. LEGAL BOOKLET - PUBLIC PROCUREMENT FOR R&D PROJECTS

This legal booklet was presented during the legal workshop in Madrid on mid-August 2016.

2.1. Introduction and glossary the role of innovative procurement

Why public procurement is important to develop innovation in Europe?

1. *Some facts about the public procurement:*

- the demand from the public sector is the most important instrument to develop new markets for innovative products and services as healthcare or civic infrastructure;

- the purpose of innovation is finding new and better way for doing things such as improving productivity, reducing environmental impact, enhancing the efficiency of administration and avoiding waste of public money;

- the EU program for innovation "Horizon 2020" represents a total investment of €70.2 billion mostly in research and development (R&D) ;

- in comparison with EU, United States public sector spends $50 billion (€45.4 billion) in procurement of R&D per year which is 20 times higher than the EU.

2. *Possible explanations for the lack of interest to innovation by procurement:*

- risk-aversion due to the convenience of buying established products from long-standing suppliers rather than buying innovative solutions from a new company;

- lack of awareness, knowledge, experience, or capabilities in connection with the new technologies and market developments;

- public procurement rules are often reduced to administrative and financial roles only;

- public procurement markets are fragmented which prevents fostering more standardized or interoperable solutions;

- it is difficult for innovative SMEs to be involved in public procurement as direct providers.

3. *News tools and incentives for public procurement development:*

- new EU Procurement directives 2014 such as Directive 2014/24/EU on public procurement, Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors and Directive 2014/23/EU on concession contracts;

    => Directive 2014/24/EU is the regulation set out for the future of the BroadMap project.

- the main goals of these Directives is (i) to open up a number of opportunities for PPI (ii) while maintaining the basic requirements of competition, transparency, equal treatment and (iii) compliance with EU state aid rules

    => creation and clarification of procedures (i.e. innovative partnership, competitive procedure with negotiation and competitive dialogue), facilitation on joint procurement, detail of the use of criteria and simplification of documentation requirements.

- the enforcement of such rules throughout the EU program for innovation "Horizon 2020" with more than 7.500 projects;

- the addition of guidelines from the EU commissions and its projects supported as the Communication from the commission SEC(2007) 1668 dated 14 December 2007[69], the Commission staff working document – Guide on dealing with innovative solutions in public procurement dated 23 February 2007[70] or the Guidance for public authorities on PPI[71] (www.innovation-procurement.org).

4. ***Main aspects to take into account to implement public procurement with R&D needs:***
   - What is the appropriate procedure for the project?
     See, legal booklet entitled "*Conduct of a public procurement procedure with R&D needs*"
   - How to implement a joint procurement?
     See, legal booklet entitled "*European joint procurement*"
   - How to select the criteria for the project?
     See, legal booklet entitled "*Criteria in public contract*"
   - What is the intellectual property rights strategy for the project?
     See, legal booklet entitled "*Sharing intellectual property rights*"

Glossary

Definitions of the main terms and notions mentioned in this legal booklet, see Table 2.

Candidate	economic operator that has sought an invitation or been invited to take part of a restricted procedure, competitive procedure with negotiation, innovation partnership, etc.
Contracting authority (or public entity)	the State, regional or local authorities, association of one or more such authorities or bodies governed by public law
Economic operators	Natural or legal person – private or public entity which offers the execution of works / supply of products / provision of services on the market
Innovation	implementation of new or significantly improved product / service / process
Intellectual property	property which is the result of creativity and to which exclusive rights can be asserted, for example, copyright, patents, trademarks or industrial design rights. Intellectual property may be licensed for use by another party, exclusively or non-exclusively.
Label	any document, certificate or attestation that works/ products / services / processes / procedures meet certain requirements
Performance criteria / indicators	a set of measure used to assess performance against agreed expectations. They may relate to any aspect of a contract and may be associated with points or other systems under which incentives and / or penalties are allocated.
Public purchaser	Contracting authority whose roles that of a purchaser.
Standards	a technical specification approved by a recognized standardization body for repeated or continuous application, with which compliance is not mandatory. International, European and national standards may be referenced in procurement specifications provided they are accompanied by the words 'or equivalent'. Standardization may also be the culmination of the R&D process for a new product or method.
State aid	an advantage in any form which is conferred on a selective basis to undertakings

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[69] http://ec.europa.eu/invest-in-research/pdf/download_en/com_2007_799.pdf
[70] http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%206920%202007%20INIT
[71] http://www.innovation-procurement.org/about-ppi/guidance/

	by public authorities. State aid is prohibited by the Treaty of the Functioning of the European Union where it does not fall within a defined exemption. If a fully competitive procedure has been conducted in compliance with the procurement directives this will normally create a presumption that state aid does not arise. A specific framework exists for state aid in the area of research, development and innovation: Commission regulation (EU) No. 651/2014 of 17 June 2014.
Tenderer:	economic operator that has submitted a public tender.

Table 2 - Definitions of the main terms and notions mentioned in this legal booklet

2.2. <u>Conduct a public procurement procedure with R&D needs - A way to encourage innovation</u>
What could be the best procurement procedure(s) for projects involving R&D?

The selection of the best procurement procedure for a project could be a challenge, especially when R&D developments are needed. The procurement procedure has an impact on the selection of a candidate and its solution which could have more or less incentive effects for innovation. Competition between economic operators in public procurement procedures to select the final candidate(s) is not just a formality.

> **The choice of the best procedure is highlighted in various PCP/PPI guidelines**:
>
> - Communication from the commission SEC(2007) 1668 dated 14 December 2007;
>
> - Commission staff working document – Guide on dealing with innovative solutions in public procurement dated 23 February 2007;
>
> - Guidance for public authorities on PPI (www.innovation-procurement.org);
>
> - Sigma – Brief 30 public procurement – 2014 EU Directives: Public sector and utilities procurement dated July 2014[72];
>
> - Driving energy efficient innovation through procurement (smart-spp project)[73].

Five public procurement procedures so-called "*formalized procedures*" may be used under EU regulation:

- ➢ **open procedure**

- ➢ **restricted procedure**

- ➢ **competitive procedure with negotiation**

- ➢ **competitive dialogue**

- ➢ **innovation partnership**

These procedures are required when the estimated amount of the products / services is above a certain threshold during a two year period. For public contracts of the State entities related to products and services, this amount is €135.000. Below this threshold, a **proper procedure** could be fulfilled (i.e. the public purchaser is free to organize its procedure under the respect of the main

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[72] http://www.sigmaweb.org/bytopic/publicprocurement/
[73] http://www.smart-spp.eu/

public procurement principles as equal treatment, non-discrimination, mutual recognition, proportionality and transparency).

Focus to R&D projects:

- Some R&D projects could be completed without formalized procedure when; (i) the benefits accrued are not exclusively for the contracting authority, and (ii) the provided service is remunerated by the public authority and the economic operator. In these cases, the **PCP procedure is used and the R&D services are procured at market price** (to avoid state aid regulation).

- For other R&D projects, the competitive procedure with negotiation, competitive dialogue and **innovation partnership are recommended due to their flexibility**. These procedures permit interaction between the candidates and the public purchasers to define requirements and award a public contract which is not allowed in open or restricted procedures.

In any case, the main principles regarding public procurement rules (equal treatment, transparency, non-discrimination, mutual recognition and proportionality) must be respected.

The Table 3 below could be used to choose the procedure the most adapted to public purchasers needs.

Sufficient knowledge of the market to define requirements for end-solutions?			
Yes		No	
-		Preliminary market consultation	
Need R&D services prior to procurement?			
Yes		No	
Do you wish to acquire innovative products or services on a commercial scale, as part of the same procedure?		Can a specification of the end-products/services to be procured be developed?	
Yes	No	Yes	No
Innovation Partnership	PCP procedure	Competitive procedure with negotiation	Competitive dialogue

Table 3 - The preliminary market consultation before tendering

The two objectives of a preliminary market consultation are:

- **to gather information from the market with a view to later procurement;**
- **to inform potential economic operators of the authority's needs**.

It is not directly regulated by the procurement directives, but by the main principles of public procurement apply (transparency and non-discrimination, etc.).

The main steps are (See *Figure 9*):

Preparation stage	
Define scope of the consultation (area of focus and specific user needs)	Analyze the market to determine the targets
Choose the format (seminars and workshop, written proposals, closed discussions and anonymous questionnaires)	Plan the consultation (timelines and documentation circulated)

Consult and collect information	
Publish a prior notice information (PIN) in the Official Journal of the EU	Record the information of the respondents
Be sensitive towards the confidentiality and any information provided	If a procurement procedure is then engaged, share with the tenderers the information collected by the preliminary market consultation to avoid any distortion of competition

Figure 9 Open or restricted procedures

Articles 27 and 28 of Directive 2014/24/ EU

These procedures can be open or restricted:
- open procedure is where all interested candidates may submit a bid;
- restricted procedure is when only pre-selected candidates by the public purchaser may submit a bid.

In any case, **no interaction between the candidates and the public purchasers are allowed until the selection of the final candidate**. This procedure is recommended when all requirements are already defined by the public purchasers.

These procedures are divided into several phases (see *Figure 10*):

Selection stage	
Open procedure	**Restricted procedure**
Publication of a public tender	
Submission by economic operators of a request to participate and a bid	Submission by economic operators of a request to participate
	Selection of the candidates invited to submit an initial bid
	Sending of invitation to tender to selected candidates

Award stage	
Open procedure	**Restricted procedure**
/	Submission of bids
Selection of the bid / candidate	

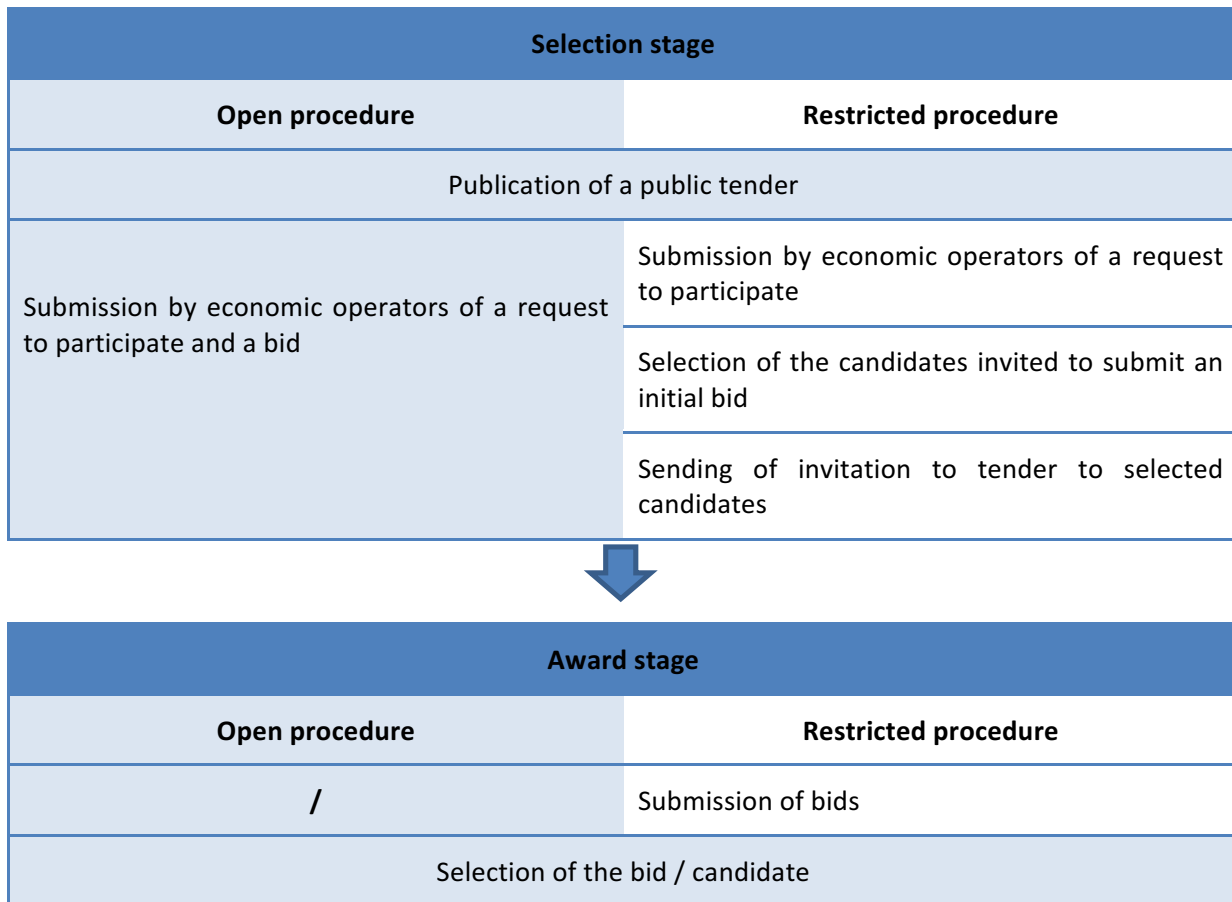Figure 10 Competitive procedure with negotiation and Competitive dialogue

Articles 29 and 30 of Directive 2014/24/ EU

These two types of procedures are allowed when flexibility is needed. The situations in which it could be use are strictly defined as follow:
- the needs of the public purchaser cannot be met without adjustment or readily available solutions;
- the procedure includes design or innovative solutions;
- the contract cannot be awarded without prior negotiations because of specific circumstances related to the nature of the contract including; the complexity or the legal and financial make-up or the risks attaching to them;
- the technical specifications cannot be established with sufficient precision by the public purchaser without reference to a standard;
- when a previous open or restricted procedure has been made and only irregular or unacceptable tenders were submitted.

In such a procedure, **public purchasers negotiate / enter into a dialogue to determine the terms of the public contract with the candidates in order to select the final one**.

These procedures are quite similar but the **following differences** will be noted:
- the competitive procedure with negotiation allows an exchange of the content of the candidates' bids but, minimum requirements are not subject to negotiation;
- the competitive dialogue is used to help the public purchaser to define the requirements (mainly technically) to adapt to its needs;
- the final candidates' bids could be amended, but only in a competitive dialogue.

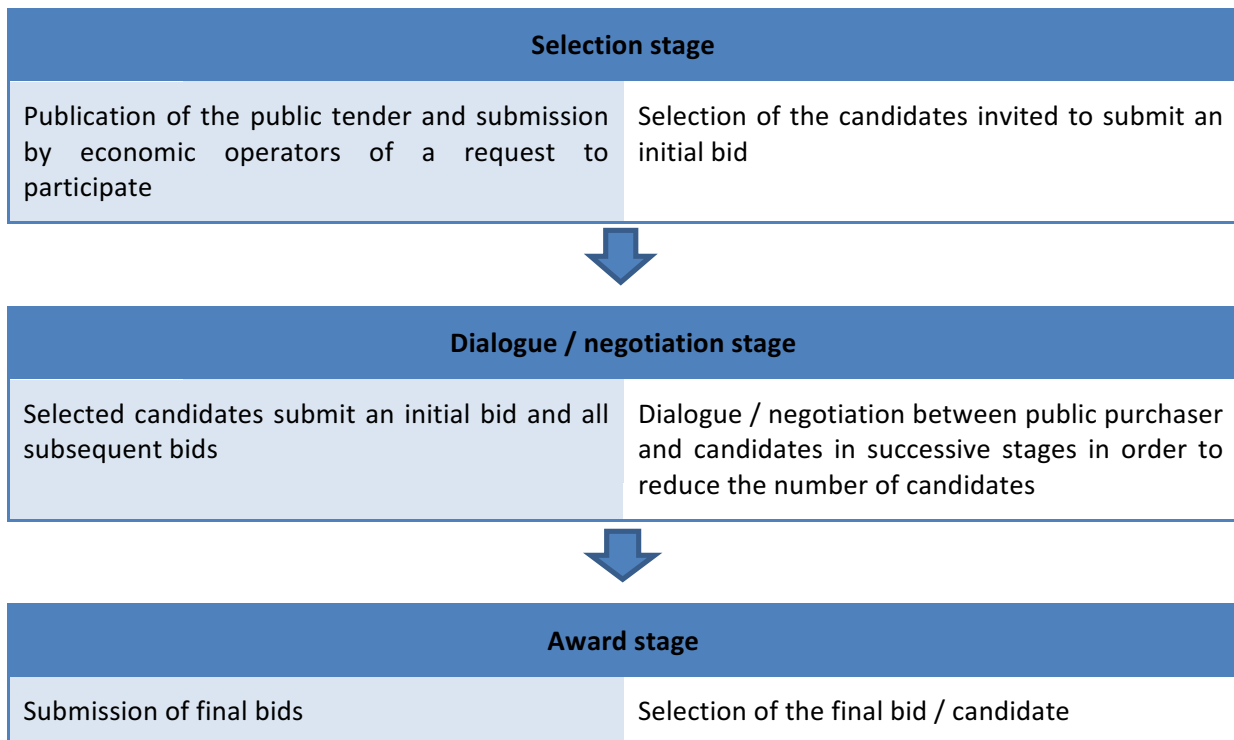These procedures are divided into several phases (see Figure 11):

Selection stage	
Publication of the public tender and submission by economic operators of a request to participate	Selection of the candidates invited to submit an initial bid

Dialogue / negotiation stage	
Selected candidates submit an initial bid and all subsequent bids	Dialogue / negotiation between public purchaser and candidates in successive stages in order to reduce the number of candidates

Award stage	
Submission of final bids	Selection of the final bid / candidate

Figure 11 Innovation partnership

Article 31 of Directive 2014/24/ EU

The innovation partnership is a new type of procurement procedure. Its main goal is to **boost the innovation in public contracts**.

The traditional public procurement procedures mentioned above would not be sufficient when R&D is required:
- economic operators may be reluctant to participate in a R&D procedure because they have no assurance that they would be awarded the contract for the acquisition of the solution at the end of the R&D phase.

- economic operators must re-compete at the end of the R&D phase, even if the result of this phase corresponds fully to the needs of the public purchaser;
- the public purchaser must beware to reveal on this occasion, technical solutions developed by R&D whose property belongs to the owner of the R&D contract.

These problems largely explain the lack of success of traditional public procurement procedure for R&D contracts

The innovation partnership aims to **overcome these difficulties** by providing buyers with a structured, long term partnership, covering both R&D and purchase phases, without the need to conduct a new competition. Thus, innovation partnerships are public contracts with a R&D purpose and acquisition of the **innovative solution that results**.

Therefore, **there is incentive for innovation and R&D**, as the suppliers are assured to be paid and that their solutions will be duly examined.

With this new type of procurement procedure, the structural defect of R&D procedure disappears: acquiring innovative solutions can be achieved without reopening of competition.

The risks of the economic operator are reduced to the question of the goals in the R & D phase, such as jointly defined with the public purchaser during negotiations.

To be considered as **innovative:** products or services that are new or significantly improved, and are created in order to meet a need that cannot be met by the products or services currently available on the market.

The selection of the candidates is made after negotiation with selected candidates based on an adapted competitive procedure with negotiation. However, **one or more final candidates could be chosen** to start the partnership. Then, a public contract is signed.

At any step of this partnership and as defined in the public contract, **the economic operator(s) could be eliminated in case of non-compliance with deadlines or performance indicators**.

> **It is both a procurement procedure and a public contract.**

These elements allow the identification of differences between the innovation partnership procedure and the competitive dialogue:

- when using the competitive dialogue procedure, a public buyer know that there are solutions on the market which are likely to meet its needs, but it is unable to identify them alone;
- when he decided to use innovation partnerships, the public purchaser has conducted a specific market study and is confident that its needs cannot be met by an available solution on the market.

In case of complex projects with PCP and PPI phases, traditional procedures will be applied as follow (see Figure 12**):**
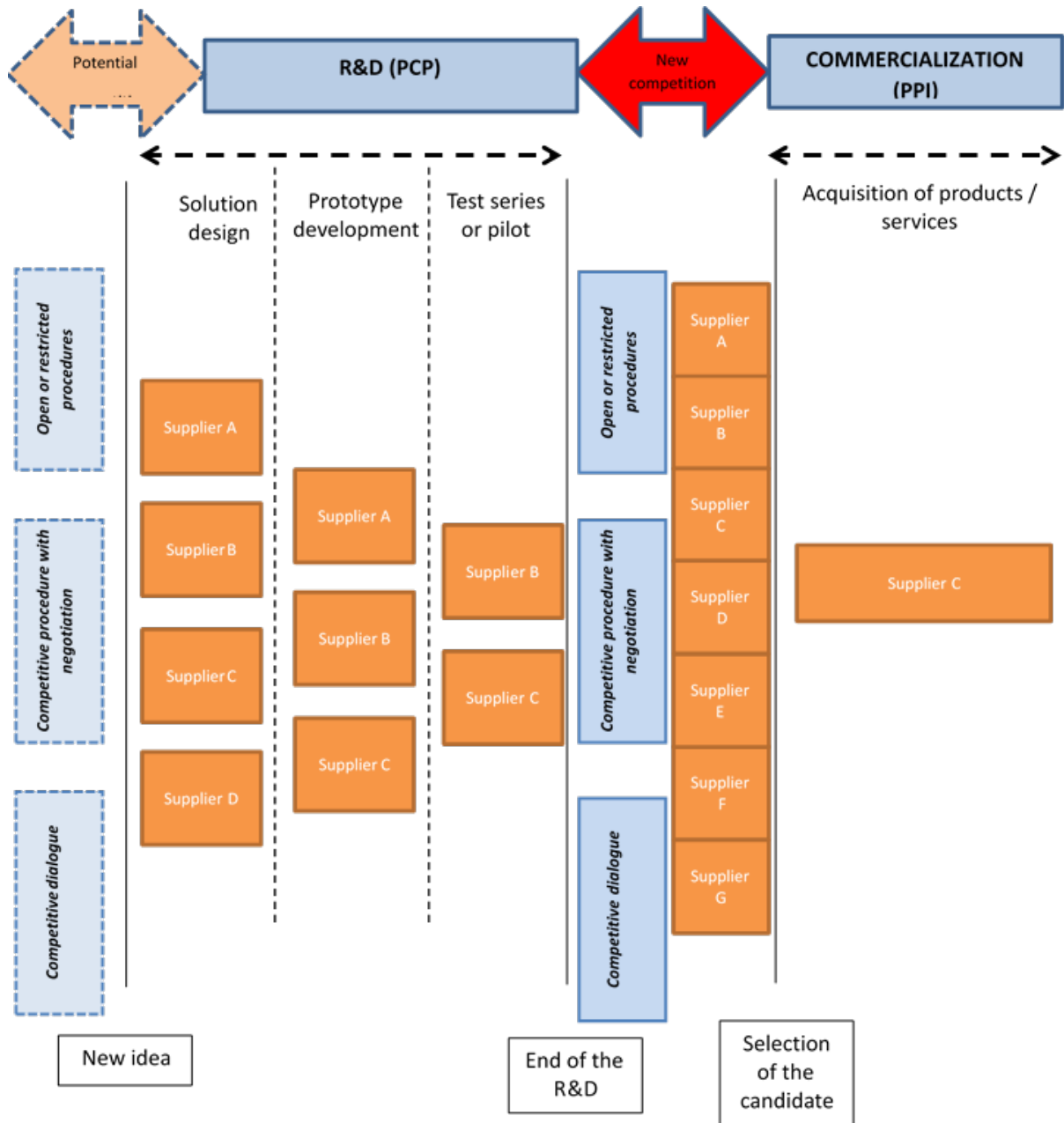

Figure 12 In case of complex projects

An innovation partnership concluded between a public purchaser and three economic operators will be conducted as follow (see Figure 13**):**
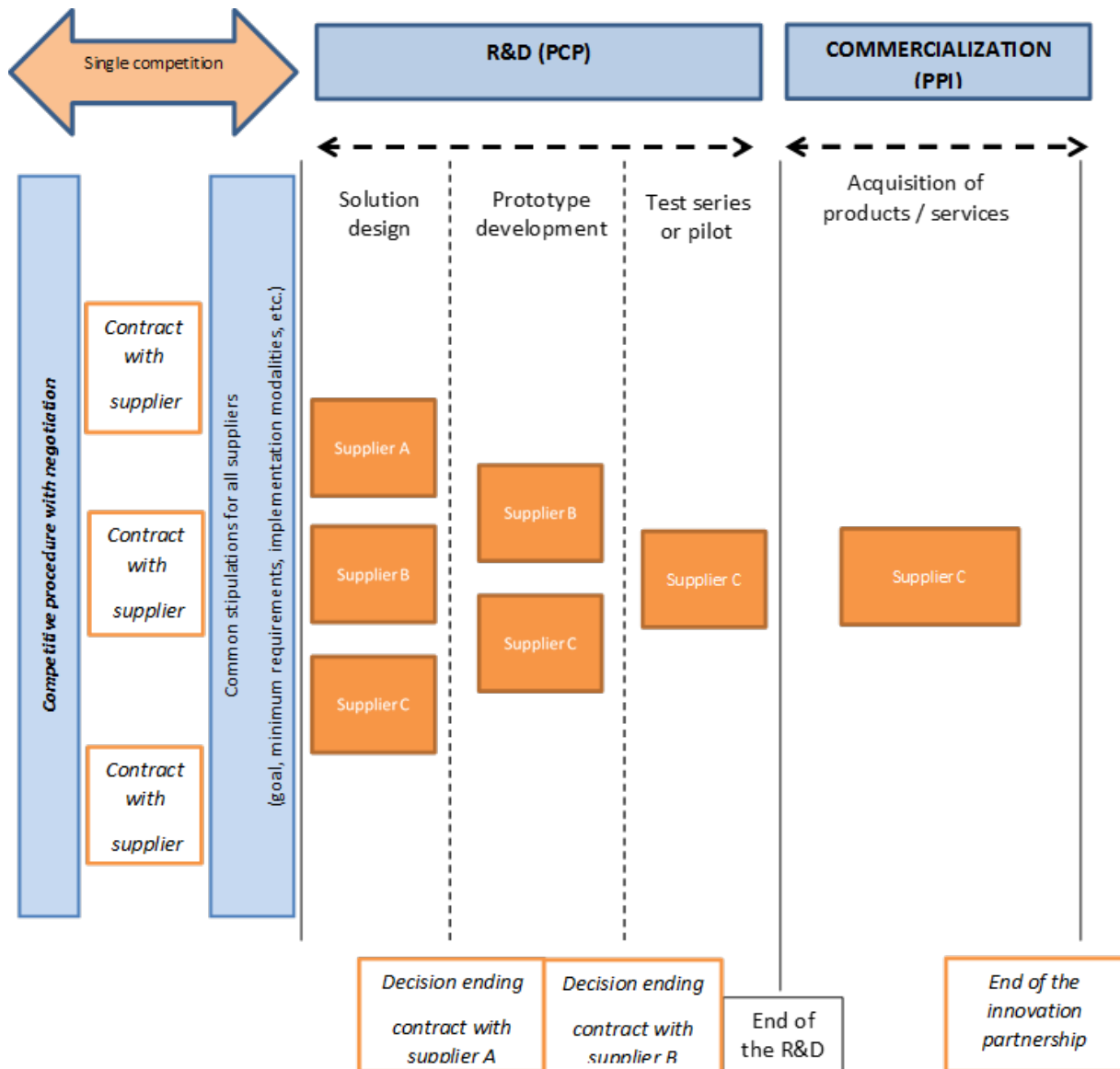

Figure 13 An innovation partnership

2.3. European joint procurement - an approach for multinational public purchasers

Why using joint procurement?

The different existing forms of procurement:

- **Full Centralization**: procurement is carried out for several public purchasers throughout joint procurement as central purchasing bodies;

- **Full Decentralization**: each public purchaser carries out its own procurement;

- **Hybrid Models**: combine both centralized and decentralized purchasing. Some procurement activities are carried out by joint procurement or by each public purchaser.

Developing innovative solutions involves high costs and risks. Bundling of demand by joining the procurement actions of several public purchasers is recommended to reduce risks and costs for individual procurers and is also beneficial for sharing knowledge;

Therefore, the main benefits of joint procurement are:

➢ **Financial** – The combination of purchasing activities increases the quantities being purchased, and thus the buying power of the pubic purchasers involved. More attractive bids from suppliers could respond to tenders. For small public purchasers these advantages can be quite significant.

➢ **Administrative costs** – The administrative work of public purchasers involved in preparing and carrying out one rather than several tenders can be substantially reduced.

➢ **Skills and expertise** – Procurement skills need a dedicated expertise. Smaller public purchasers in particular can benefit from the capacities of staff in larger public purchasers. This is particularly useful when procuring innovative products and services.

The use of joint procurement is recommended in PCP/PPI guidelines:

- Guidance for public authorities on PPI (www.innovation-procurement.org);

- Sigma – Brief 30 public procurement – 2014 EU Directives: Public sector and utilities procurement dated July 2014;

- Driving energy efficient innovation through procurement (smart-spp project);

- ICLEI LEAP GPP Toolkit[74].

How organizing joint procurement?

There could be several modalities to organize joining activities dependent upon the level of involvement wanted by the participants.

The existing two main types of organizational arrangements for joint procurement:

1. **Central purchasing bodies**

    An organization is established to provide a centralized procurement function on behalf of the different public purchasers involved in the project. This organization is responsible for all procurement actions for its members: making acquisitions, managing dynamic purchasing systems or awarding public contracts/framework agreements with or without remuneration.

    The missions of a central purchasing body are to:
    -   coordinate training for public officials in charge of public procurement;
    -   establish policies for public purchasers;
    -   act as a public purchaser aggregating demand and purchasing;

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[74] www.leap-gpp-toolkit.org

- act as manager of the national system awarding framework agreements or other consolidated instruments for the benefit of public purchasers;
- increase potential through aggregation, efficiencies and realizing policy objectives.

2.   Collaborative agreements

Joint procurement does not automatically require the establishment of permanent organizations. Public purchasers could directly collaborate in procurement actions, through their existing purchasing departments.

Such groups, without legal status or common assets work according to previous conclusion of agreements with a public purchaser taking lead responsibility for sourcing markets, tendering and arranging contractual documentation for specific procurements all in consultation with other members of the group.

At the simplest level public purchasers can choose to combine their activities only for procurement action.

At a more complex level, public purchasers could decide to be contractually joint in the public contract and not only for the procurement action; it means that all public purchasers involved will be project manager of the public contract.

The following Table 4 **indicates the solutions of joint procurement existing under EU regulation:**

Institutional type	Contractual type
National level	
Central purchasing bodies: - purchasing of products / services by a public purchaser from a central purchasing body; - the use of dynamic purchasing systems and framework agreements by a public purchaser established by a central purchasing body. *Article 37 of EU Directive 2014/24*	**Occasional joint procurement**: - conclusion of an agreement between many public purchasers with joint responsibility between the participating contracting authorities; - conclusion of an agreement between many public purchasers with individual responsibility to different contracting authorities. *Article 38 of EU Directive 2014/24*
International / European level	
Cross-border entity Creation by public purchasers of a European grouping of territorial cooperation (EGTC) *Preamble (73) and article 39 of EU Directive 2014/24* *Ruled by regulation (EC) No 1082/2006 of 5 July 2006 amended*	**Cross-border joint procurement**: - a public purchaser use of centralized purchasing activities offered by a central purchasing body located in another Member State; - public purchasers jointly awarding a public contract, concluding a framework agreement or operating a dynamic purchasing system. *Preamble (73) and article 39 of EU Directive 2014/24*

Table 4 - The solutions of joint procurement

Why a European central purchasing body (EGTC)?

Public purchasers from several Member States can create a European central purchasing organization through the use of an EGTC. It will be based on the form of the joint procurement with all the benefits of centralization.

The advantages of a European central purchasing body are the same as the ones expressed above:
  ➢ **Reduce the costs by lowering the prices for products and services**;
  ➢ **Reduce administrative costs** by combined actions;
  ➢ **Pool the skills and expertise** of participating public purchasers.

In case of joint procurement, European regulation warns that:

  ➢ public purchasers should not use the possibilities of cross-border joint procurement to avoid public procurement rules;

  ➢ the joint procurement entity has to be ruled under defined national law or Union law.

2.4. Criteria in public contract - a tool to choose and evaluate a R&D solution
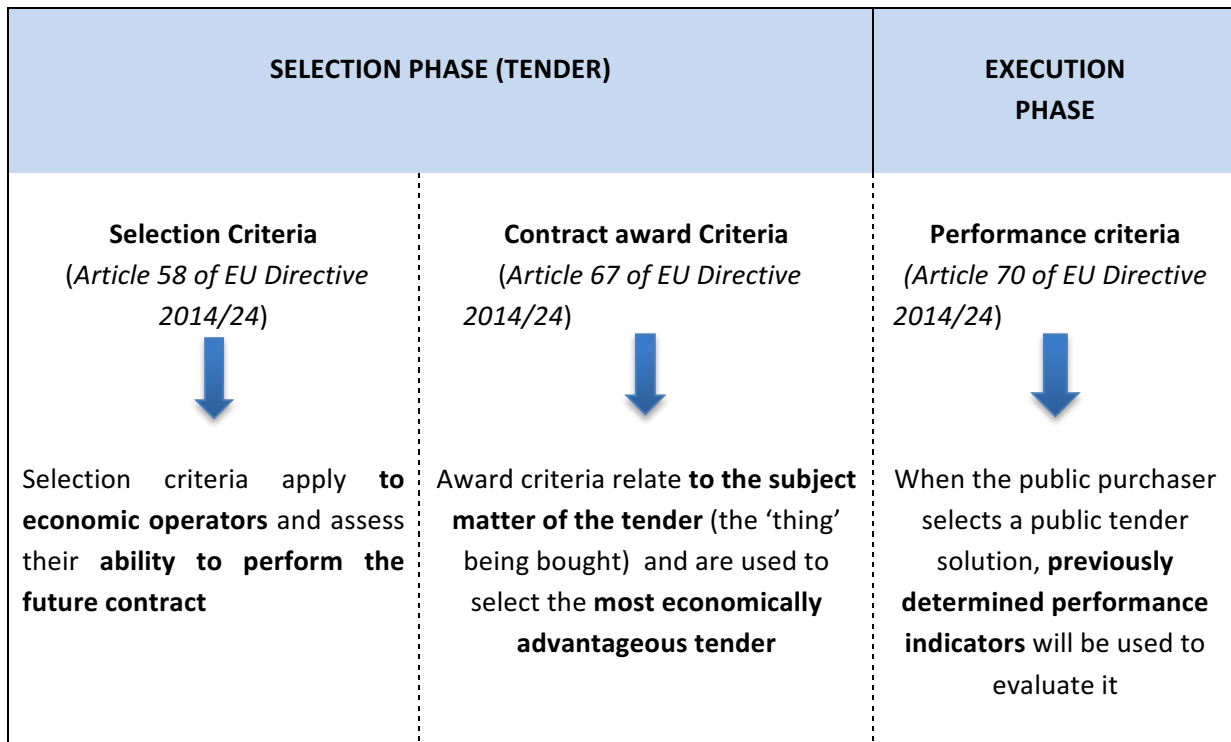
What would be the most appropriate criteria?

To achieve innovative solutions, economic operators need to be able to offer them under the tendering conditions. By not prescribing a solution but instead, specifying the public purchaser's performance or functional requirement needs and by accepting differing bids, public purchasers give them the opportunity to propose innovative solutions.

Therefore, the way in which the technical specifications are drawn up determines the variety and quality of the bids.

The importance of the determination of criteria is highlighted in various PCP/PPI guidelines:

  • Guidance for public authorities on PPI (www.innovation-procurement.org);

  • Commission staff working document – Guide on dealing with innovative solutions in public procurement dated 23 February 2007;

  • Sigma – Brief 30 public procurement – 2014 EU Directives: Public sector and utilities procurement dated July 2014;

  • Driving energy efficient innovation through procurement (smart-spp project).

Public procurement rules defined three main types of criteria.

SELECTION PHASE (TENDER)		EXECUTION PHASE
Selection Criteria (*Article 58 of EU Directive 2014/24*)	**Contract award Criteria** (*Article 67 of EU Directive 2014/24*)	**Performance criteria** (*Article 70 of EU Directive 2014/24*)
Selection criteria apply **to economic operators** and assess their **ability to perform the future contract**	Award criteria relate **to the subject matter of the tender** (the 'thing' being bought) and are used to select the **most economically advantageous tender**	When the public purchaser selects a public tender solution, **previously determined performance indicators** will be used to evaluate it

Each of these criteria has to be defined **before the publication of the public tender** and included in the calling for competition and the procurement documents. **They cannot be amended during the procedure.**

1. *Selection criteria*

Selection criteria are used to select the economic operators qualified to submit tenders (for restricted procedures) or to have their tenders evaluated (for open procedures).

The call for tenders must provide information on those criteria to ensure that a candidate has the legal and financial capacities and the technical and professional abilities to perform the contract to be awarded.

Therefore, **selection criteria relate to:**

➢ **suitability to pursue the professional activity** (*for example: diploma, authorization, membership,…*);

➢ **economic and financial standing** (*for example: financial balance sheets of the last three years…*);

➢ **technical and professional abilities** (*for example: labels, certificates,…*).

Where reference is made to a European standard or, in the absence thereof, to a national standard, tenders based on equivalent arrangements should be considered.

Public purchasers may require that economic operators have a sufficient level of experience demonstrated by suitable references from contracts performed in the past.

Criteria excluding candidates also exist, such as: participation in a criminal organization, corruption, fraud, terrorist offences or offences linked to terrorist activities, money laundering or terrorist financing, child labor and other forms of trafficking in human beings.

All requirements shall be **related and proportionate to the subject-matter of the contract**.

2. *Award Criteria*

These criteria, in connection with the value of offers, should not be confused with the selection criteria:

- *The evaluation of tenders must allow the buyer to choose the <u>most economically advantageous solution </u>(and not the lower tender except in limited cases),*
- *The choice of the economically most advantageous tender in fact depends on the proper definition of its need by the purchaser,*
- *The selection of the relevant <u>award criteria</u> in terms of market subject is of crucial importance.*

Award criteria relate to:

- **price or cost**, using (i) a best price-quality ratio which shall be assessed on the basis of criteria, including qualitative, environmental and/or social aspects or (ii) a cost-effectiveness approach such as life-cycle costing with cost of acquisition, cost of use, maintenance costs and end-of-life costs;

- **quality**, including technical merit, aesthetic and functional characteristics, accessibility, design, social, environmental and innovative characteristics;

- **organization, qualification and experience of staff** assigned to performing the contract, when the quality of the staff assigned can have a significant impact on the level of performance of the contract;

- **after-sales service and technical assistance**, delivery conditions such as delivery date, delivery process and delivery period.

How to choose the award criteria:

▪ The minimum requirements to be set by the public purchaser are the conditions and characteristics (particularly physical, functional and legal) that any tender should meet or possess.

▪ The use of a single criterion of price is reserved only for contracts for the purchase of standardized services or supplies whose quality is not subject to variation from one supplier to another.

➡ **Chosen aw ard criteria have to translate to the needs of the buyer. They must allow the public purchaser to determine the best tender to meet their needs.** Many qualitative, environmental or social criteria may be justified in the light of the object of the contract.

> The chosen award criteria should not confer an unrestricted freedom of choice on the public purchaser.
>
> Technical specifications should be drafted in such a way as to avoid artificially narrowing down competition through requirements that favor a specific economic operator by mirroring key characteristics of the supplies, services or works habitually offered by that economic operator.
>
> They should ensure the possibility of effective and fair competition and be accompanied by arrangements that allow the verification of the information provided by the tenderers.

Weighting of the criteria:

Public purchasers have to indicate the contract award criteria and the relative weighting given to each of those criteria. Two criteria classification methods can be used (see Table 5):

- **weighting,** or

    The weighting affects each of the criteria with a coefficient. The economically most advantageous offer is then globally evaluated. Weighting is the rule in formalized procedures. The weighting is left to the buyer, based on the nature of his need. **The price** may not be assigned the highest weighting in case of complexity, or if the nature of services requires that this criterion has a lower weighting than others.

- **prioritization**.

    Public purchasers are permitted to derogate from the obligation to indicate the weighting of the criteria in duly justified cases, where the weighting cannot be established in advance, in particular because of the complexity of the contract. In such cases, they should indicate the criteria in a decreasing order of importance.

Award Criteria	Weighting factor (%) (*1*)	Criterion Mark (*2*)	Weighted mark (*3*) = (*1*) x (*2*)
Criterion 1 (*price*)	20	7.5 / 10	15
Criterion 2 (*innovation of the solution*)	35	10 / 10	35
Criterion 3 (*technical quality*)	45	5 / 10	22.5
Total evaluation mark for the award criteria of the contract			72,5 / 100

Table 5 - Example of selection by award criteria with weighting

Award criteria and their weighting should remain stable throughout the entire procedure and should not be subject to negotiations, in order to guarantee equal treatment of all economic operators. The principles of public procurement should be observed at every step of the procedure.

➔ Contracts should be awarded on the basis of objective criteria that ensure compliance with the principles of transparency, non-discrimination and equal treatment.

For R&D projects, allowing variants from the economic operators is recommended. A variant is an optional solution proposed by the economic operator and linked to the subject-matter of the contract; the award criteria are used to select it.

3. *Performance criteria (Strategic validation criteria)*

These performance criteria (or strategic validation criteria or performance-based specification) must not be confused with the selection criteria of a public tender. The role of performance indicators is the ***evaluation of the selected public tender solution****.*

Performance criteria:
- are fixed on minimum objective requirements that have no impact on the assessment of tenders ;
- have to be previously determined in the procurement and contractual documents;
- their time of evaluation and monitoring instruments have also to be defined;
- could be the level of quality or the timeframe for the project.

➡ **For R&D projects**, intermediate evaluations at the end of each R&D phase could be organized.

How to choose the performance criteria:

- ensure that they are understandable and comparable (i.e. terms used on the market as accepted indicators, norms, test procedures, etc.);
- assure neutrality however specifications require the use of some technically prescriptive criteria;
- ask for proof of technical ability;
- indicating that matter subject to tendering is "innovative".

Example of technical specification versus performance-based specification (see Table 6**)**

Technical specification	Performance-based specification
X type of insulation or lighting for a building	The building must achieve a X minimum energy-rating
Replacement of oil-fired boiler providing a heating capacity of X	Heating system designed to heat Room X to a temperature of X for X hours per day and Room Y to a temperature of Y for Y hours per day
Purchase of petrol-driven cars with X seats and X brake horsepower	Purchase of a car with X seats and storage volume of X with a top speed of at least, a range of X before refueling, a refueling time is no more than X and an average primary energy consumption per km of X.

Table 6 - Technical specification versus performance-based specification

Performance indicators are often not enough defined by the public purchaser. A particular attention has to be done on these criteria. If the definition of these indicators is well done, the solution chosen for the public contract will meet as better as possible with the public purchasers needs.

Such criteria must not have a too high technical degree to leave the economic operators to submit innovative bids.

2.5. Sharing intellectual property rights - A tool to encourage innovation

Why sharing intellectual property rights (IPR) in a public contract?

The determination of the ownership of the IPR in a public contract for innovative goods (i.e. R&D) between public purchasers and economic operators is a crucial issue. Please note that for the purpose of this note, IPR must be understood as the intangibles assets resulting from a R&D project that may give rise to intellectual property rights and/or other types of rights.

The EU regulation provides that:

"*In the procurement documents, the contracting authority shall **define the arrangements applicable to intellectual property rights**.*" (art. 31 of Directive 2014/24/EU related to innovation partnership – see legal booklet 1/4)

Sharing IPR in R&D projects is promoted by the EU commission in various guidelines:

- Communication from the commission SEC(2007) 1668 dated 14 December 2007;

- Commission staff working document – Guide on dealing with innovative solutions in public procurement dated 23 February 2007;

- Commission C (2014)4995 of 22 July 2014 – Horizon 2020 – Work program 2014-2015[75];

- Introduction to IPR in public procurement of innovation (www.innovation-procurement.org)[76].

Most of the time, public purchasers tend to opt for **exclusive development of the IPR** which means that they **retain the intellectual property rights exclusively** for their own use.

However in most cases, according to the guidelines provided by the EU, "exclusiveness" of the IPR may have negative effects:

1. **Market fragmentation**
   If different public purchasers in the same sector develop their own solutions to a similar problem without sharing information with each other, then a multitude of solutions are developed, which are unlikely to address the global market.

2. **Higher price for a solution**
   As the companies have developed the product / service only for a public purchaser, they cannot reuse them for other potential customers. This can also lock this public purchaser to one supplier.

3. **Missed opportunities for more innovative solutions**
   As all R&D benefits but also R&D risks are on public purchasers, they tend to focus on near to market development and miss more innovative solutions.

In the R&D phase (or pre-commercial procurement), sharing IPR can be considered mainly for two reasons[77]:

1. **Risk-benefit sharing**
   Public purchasers and economic operators share risks and benefits of the R&D market such that both parties have an incentive to set up innovative solutions.

2. **Price market and exclusion of State aids regulation**
   If parties agree on a price equal to market price for IPR, this would avoid application of European State aids regulation (i.e. if this price is higher than market price, the difference is

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[75] http://ec.europa.eu/transparency/regdoc/rep/3/2014/EN/3-2014-4995-EN-F1-1.Pdf
[76] https://www.innovation-procurement.org/fileadmin/editor-content/Guides/Intellect_Property_Rights_guide-final.pdf
[77] Communication from the commission SEC(2007) 1668 dated 14 December 2007

likely to be considered as a State aid which must be notified and assessed by the EU Commission or reimbursed).

⇨ **In essence, co-ownership of IPR is a great way to incite economic operators to invest on a R&D project while avoid State aids regulation**

<div align="center">How does sharing IPR in a public contract work?</div>

The co-ownership, also called joint ownership, refers to a situation in which two or more persons have proprietary shares of an asset. Joint ownership of IP, in particular, frequently arises in collaborative projects when the results have been jointly generated by the partners and the share of work is not easily ascertainable[78].

It is worth noting that if no joint ownership regime is agreed the default one will therefore apply6, in line with the respective national law. To this regard exploitation rights on jointly owned assets may vary in the different jurisdictions. In the context of transnational research consortia, joint ownership need to be carefully addressed in contractual arrangements by co-owners.

Once they have defined the expected joint results, partners should deal with co-ownership taking into account the following main factors:
- Identification and conditions of use of background technology;
- Allocation of the foreground shares between joint owners;
- Conditions of use and exploitation of the joint results (IP);
- Management of the jointly owned results (IP);
- Licencing of the joint results (IP) to third parties.

1. The background technology
The background technology of each partners need to be determined when entering in a collaborative research project. The parties can identify their respective background in a separate list, which could be part of their consortium or joint ownership agreement. It is of particular importance to clearly define what will be considered modifications/improvements to the background. Indeed, the distinction between derivative work and new work made under collaborative effort is not always obvious. Therefore, ownership of the background modifications should be defined contractually.

2. The foreground technology
The jointly owned results generated in a collaborative project (foreground technology) could be allocated by several ways to each joint owner. One of the most common options in case of joint ownership is the equal share between partners.

Ownership of intellectual property rights
1. Each Party retains exclusive property of its background.
2. The modifications to or derivative works of the Parties' background shall be the sole property of the contributing party.
3. Foreground developed in connection with the collaboration project hereof shall be jointly owned

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[78] European IPR Helpdesk - Fact Sheet IP joint ownership - https://www.iprhelpdesk.eu/sites/default/files/newsdocuments/Fact-Sheet-IP-Joint-Ownership.pdf

Of course the partners could split the shares in proportion to their involvement of the development of the results.

3. The conditions of use and exploitation of the jointly owned IP

The right of use of the jointly owned IP granted in co-ownership arrangements to each party is usually unrestricted. Should, however, restrictions on one party's use be necessary due to the interests of other partners or its use in further research activities, two options can be envisaged:

Either the joint ownership regime will be maintained with the provision of mutual restrictive conditions on the joint results use;

Right of use
1. A Party shall be entitled to use the results only as strictly necessary to [field of use];

[sample clause]

Or one party will be assigned the property of the entire asset – hence supporting all the related costs – and grant licenses to other partners on an as-needed basis, according to the interests in the balance.

Ownership of intellectual property rights
1. Results developed in connection with the collaboration project hereof shall be solely owned by Party [...], who shall bear all the costs related.

Right of use
1. Party […] shall grant – through a separate agreement – to the other Party a non-exclusive, royalty-free, non-transferable right to use results where necessary to enable the other Party to dispose of the result within the scope of its business activity;

[sample clause]

Provisions on the use of background, brought to the project as part of the collaborative effort, should also be part of contractual arrangements. Each party should therefore grant access rights to the other parties to allow them to use its background in accordance with the project scope (usually royalty-free), and in their business activities (usually royalties-bearing).

Right of use
1. Each party hereby grants to the other party the non-exclusive right to use its background free of charge, but only as strictly necessary to perform the collaboration project hereof;

2. Each party hereby grants to the other party a non-exclusive, royalty-bearing, non-transferable right to use its background, but only as strictly necessary to enable the other party to make, sell or otherwise dispose of the product within the scope of its business activity;

3. No right to use any background is granted by one party to other parties independently of the results use. Any other sub-licence or third parties agreement will oblige the parties concerned to abide by such a limitation.

[sample clause]

The rights of exploitation (assignment, licence, etc.) of the jointly owned results by each co-owner should be defined under the ownership arrangements. Such activities can be done with or without the consent of the other parties, depending on the partners' interests. One important issue to be agreed from the outset is the compensation that the other partners will have in respect of the exploitation of the joint results.

Right of exploitation – first option [consent required]
1. A Party shall not pledge, assign, sell or otherwise dispose of its interest in the results to third parties without the other Party's prior written consent;
2. Licensing of results to third parties shall require written agreement between the Parties, setting out their respective rights and obligations, including but not limited to, the distribution of licensing costs and income.

Right of exploitation – second option [consent required]
1. Each Party shall have the right to pledge, assign or otherwise dispose of its interest in the results to third parties as they may desire notifying its intention to the other Party […] days prior the activity concerned;
2. Each Party shall have the right to grant [type of licenses] on the results to third parties as they may desire without accounting to the other Party;
3. The total income after deducting costs as derived from the licencing of the foreground shall be distributed […%] to Party […] and […%] to Party […]. According to the type of license granted, said distribution ratio may be adjusted upon written agreement by the Parties.
[sample clauses]

[sample clause]

4. Management of the jointly owned results

The dissemination of the project research results could be settling by an agreement between the parties to appoint the limit and means to disclose data and research materials, bearing in mind that disclosures can be an impediment to future IP rights registration (i.e. patents, utility models and industrial design).

When dissemination activities take place, careful attention should be paid to confidential information used to carry out the research. More precisely, partners might want to keep secret the know-how and other knowledge related to the collaboration project. By virtue of contractual clauses, parties should therefore abide by confidentiality rules.

Starting with the assumption that the IPR protection and maintenance costs can be equally shared between joint owners, parties need also to agree on:

- How the IP generated will be protected;
- When protection is to be obtained through registration, who will file application and then follow the procedure; where the designated party might fail to, or decide not to, file an application for the granting of IP rights, contractual provision should allow other parties to take steps in place of the unfulfilling party;
- Who will bear the costs of the IP protection and maintenance.

Joint owners should agree who will be responsible for monitoring and policing the joint IP and pay the expenses for any infringement in connection with it. The latter can arise either because the jointly owned IP infringes third party IPR, or because it is the third party who infringes the co-owned IP.

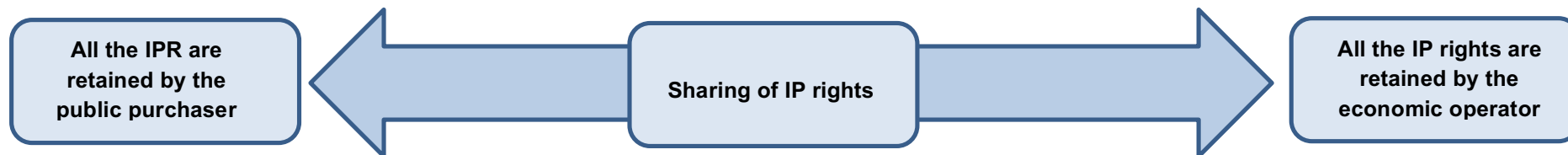### 5. Licensing of the joint results (IP)

There are several examples related to the way to share the IPR which would be defined in the public contract (see Table 7) :

- **Exclusive licence** gives the right of use the IPR to a sole licensee ;
- **Non-exclusive licence** gives the right of use the IPR to multiple licences ;
- **Cross licences** when IP holders swap the right of use of their respective IPRs ;
- **Open licence** gives the right of use the IPR to anyone who request it for free or a fair and reasonable price.

The focal points of the public procurement documents:

- The distribution of rights and obligations of the parties related to IP shall be clearly published upfront in the tender documents by the public purchaser;

- Such distribution of IP shall not involve contract renegotiations on rights and obligations taking place after the choice of the economic operator.

All the IPR are retained by the public purchaser	Sharing of IP rights	All the IP rights are retained by the economic operator
Ownership of all the IPR by the public purchaser can be necessary when: ➢ he needs exclusive rights on the product / service for the defence or security reasons; ➢ he is the only interested customer due to the specificity of the product / service developed.	Considering how to share intellectual property rights is relevant when: ➢ new IPR will be created by the collaboration between a public purchaser and an economic operator, and; ➢ both parties have a stake in the application of the IPR (either directly or in the future). The main elements to take into account in such case are : ➢ to arrange sufficient rights between both parties to ensure that their future procedures / contracts will not be hindered in any way; ➢ to ensure that both parties agree on a price for sharing IPR under market conditions.	Ownerships of all the IP rights by the economic operator can be considered when: ➢ he wants to reuse and resale its innovations to several purchasers; ➢ he wants to keep control over its innovation.
But retaining all the IPR to the benefit of the public purchaser can have some disadvantages when an innovative solution is needed (see above)	**But** a needs and risk assessment is first recommended to define such sharing: • *Could new IP be developed as part of the tender?* • *Is there market opportunity to commercialize IP?* • *Are there other risks for keeping the IPR with the public purchaser?* • *Are there any other risks for the public purchaser not retaining IPR?*	**But** the public purchaser is dependent on the economic operator.

Table 7 - Sharing of IP rights

3. PCP NATIONAL REGULATION IN EU

The Table 8 below references the national regulation of EU countries on PCP. For the moment, only Spain and Lithuania implemented a national legislation on PCP.

As PCP is not regulated by EU Directives on public procurement and therefore, is outside of national procurement legislation, the DG Connect estimates that there is no need for specific national legislation on PCP to enable public procurers to carry out PCPs (ref. - email from the Unit F3 Start-ups and innovation unit of the DG Connect dated 16 January 2017 answering to our request on the existence of national legislation dedicated to PCP).

However, public procurement regulation is a competence shared between EU and MS (art. 4 of the TFEU) and MS are freely able to regulate at a national level PCP (for more details, please see section 1.2.2.a above).

Country	Regulation	Provisions	Comments
Spain	Spanish laws: - *"Ley de Economía Sostenible 2/2011"* dated 4 March 2011: article 37.1 and final provision No.6-One ; - *"Texto refundido de la Ley Contratos del Sector Público 3/2011"* (TRLCSP) dated 14 November 2011: articles 4.1, 22.2 and "final provision No.5".	Corresponding provisions of laws 2/2011 and 3/2011 implemented PCP into Spanish national Law related to public contracts. *"Specific rules are established for PCP, considered by the European Commission as an essential tool to boost innovation and provide quality and sustainable public services, allowing a greater involvement of public procurement in the implementation of research policy, development and innovation"*. (Recital of Law 2/2011). Key measures : - Contracting authorities shall value innovation in public procurement procedures; - R&D contracts are out of TRLCSP's law scope; - Specific amounts will be allocated to the financing of PCP, some being reserved to innovative small and medium-sized enterprises.	Entered into force
Lithuania	The main legal acts regulating issues on procurement of R&D services are (Soloveičik, 2015):	The Ministry of Economy in cooperation with the Lithuanian Agency for Science and Technology (MITA) has drafted the description of pre-commercial procurement and it come into force in 2015. It intends to implement pilot actions of pre-commercial procurement and	Entered into force

	- Decree No.709 of the Government of the Republic of Lithuania of 1 July 2015 on the Approval of the Procedures for Pre-Commercial Procurement - Resolution No.VII-85 of the Research Council of Lithuania of 21 November 2011 on the Approval of the Procedures for the Evaluation of the Technical Part of the R&D Supplies, and the Selection of the R&D Services and the Suppliers of such Services. - Decree No.772 of the Government of the Republic of Lithuania of 22 April 2011 on the Approval of the Procedures for Procurement of R&D Services other than those where the Benefits Accrue Exclusively to the Contracting Authority for its Use in the Conduct of its own Affairs, on Condition that the Services Provided are Wholly Remunerated by the Contracting Authority	to conduct a survey of other ministries on the demand for the innovative public procurement as well as for the pre-commercial procurement. In July 2015, the Government approved the procedure of pre-commercial procurement, which allows three types of such process – when only a trial run of the product is ordered, when prototype creation is also ordered, and when in addition to the two mentioned stages, developing of the concept is also ordered by the buying organization. The document also presumes that MITA (contracting authority) is entrusted with organizing and implementing pre-commercial procurement. it should co-finance pre-commercial procurement, consult potential beneficiaries, and disseminate the information about this instrument. Accordingly, PCP shall be organized when: - there is no innovative product on the market which the contracting authority needs or there is no evidence that market players in the nearest future (in less than a year) will produce such a product, or the contracting authority cannot acquire the product and R&D services are essential to create such an innovative product ; - product on the market does not meet the need of the contracting authority, therefore they need significantly improve functional properties of the product and there is no evidence that market players in the nearest future (in less than a year) will produce such a product, and R&D services are required to improve the functional properties of the product. Under the legislation valid in Lithuania, PCP might be treated as innovation procurement, however, not as the public procurement as it is understood under the law on public procurement of Lithuania.	

Table 8 - The national regulation of EU countries on PCP

4. EU HARMONIZATION TENDING TO RADIO COMMUNICATIONS SYSTEMS FOR PPDR

The following measures initiate a harmonization tending to a common European security policy applicable in the radio communications systems field.

Nota bene: The telecom package is not included in this analysis; such regulations apply mainly to commercial telecommunications operators which systems could be used for PPDR depending on the modalities of their governance. Thus, this analysis is limited to regulations referring explicitly to PPDR. But, in case of lobbying actions to ensure evolution of these regulations, the telecom package has to be taken into account.

4.1. EU harmonization on Cybersecurity Policy (Directive 2016/1148)

In brief, provisions of the Directive 2016/1148 of the European Parliament and of the Council of July 6th, 2016 concerning measures for a high common level of Security of Network and Information Systems («**SNIS**»), currently in force, are applicable as of May 10th, 2018[79] which is the deadline for its transposition.

Directive is built around four strategic lines which are:

- the enhancement of national cybersecurity capacities through new obligations for all Member States aiming at adopting a national strategy on the SNIS, new obligation for EU Member States («**MS**») to designate national competent authorities, single points of contact and a Computer Security Incident Response Teams (« **CSIRTs** ») with tasks related to the SNIS;
- the reinforcement of the cybersecurity of Operators of Essential Services («**OES**») by the implementation of new common security and notification requirements;
- the establishment of a framework for voluntary cooperation between MS through the creation of new entities such as the Cooperation Group (to support and facilitate strategic cooperation between MS and the CSIRTs network);
- Implementation of specific penalties applicable to infringements of national provisions adopted pursuant to the Directive[80].

MS may adopt or maintain provisions with a view to achieving a higher level of SNIS as a minimum harmonization is intended.

This Directive is not specific for PPDR.

Details:

The cybersecurity policy is not a recent issue. Since 2001, the European Commission adopted a « Communication on Network and Information Security: Proposal for A European Policy Approach »

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[79] Article 25 of Directive 2016/1148
[80] Article 21 of Directive 2016/1148

(COM(2001)298)[81]. Also, the European Network and Information Security Agency (ENISA) was established in 2004[82]. Moreover, in 2006, a Strategy for a Secure Information Society (COM(2006)251) was adopted.

Since 2009, the Commission has also adopted an Action Plan and a Communication on Critical Information Infrastructure Protection (CIIP) (COM(2009)149, endorsed by Council Resolution 2009/C 321/01 and COM(2011)163, endorsed by Council Conclusions 10299/11)[83]. Moreover, the revised regulatory framework for electronic communications, in force since November 2009, imposes security obligations on electronic communication providers[84].

The European Institutions, agencies and bodies have set up their own Computer Emergency Response Team, called CERT-EU.

Representing a straight continuation of the above policies, the Directive 2016/1148 of the European Parliament and of the Council of July 6th, 2016 concerning measures for a high common level of **SNIS** across the Union acknowledges the increasing threats of network and information systems and addresses the fact that their security is essential for internal market[85]. Therefore, the Directive implements measures in order to ensure the security and protection of such systems by reaching a global approach at Union level covering common minimum capacity building and planning requirements, exchange of information, cooperation and common security requirements OES and Digital Services Providers («**DSP**»)[86].

Accordingly, each MS shall adopt a national strategy on the SNIS based on strategic objectives and appropriate policy and regulatory measures to provide a high level of security of such systems[87].

The Directive specifies and enhanced security requirements, specifies the notification of incidents, the implementation and the execution of the SNIS for both OES and DSP. For harmonization purposes, criteria of identification of OES[88] are set out by the Directive. MS are also required to establish a list of OES fulfilling such criteria and a list of the services which are considered as essential[89]. National measures will be required to determine which entities are subject to obligations regarding the SNIS[90].

National competent authorities responsible for fulfilling the tasks linked to the SNIS of OES and DSP under the Directive[91] will be appointed. Cross-border cooperation will be facilitated by the

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[81] Source : Proposal for a Directive of the European Parliament and of the Council concerning measures to ensure a high common level of network and information security across the Union /* COM/2013/048 final - 2013/0027 (COD) */ and Cybersecurity Strategy of the European Union: - An Open, Safe and Secure Cyberspace, 7 February 2013, Council of the European Union

[82] Regulation (EU) N° 526/2013 of the European Parliament and of the Council of 21 May 2013 concerning the European Union Agency for Network and Information Security (ENISA) and repealing Regulation (EC) N° 460/2004 (Text with EEA relevance)

[83] See reference 1

[84] Articles 13a and 13b of the Framework Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services

[85] Recital (3) of Directive 2016/1148

[86] Recital (6) of Directive 2016/1148

[87] Article 7 of Directive 2016/1148

[88] Article 5 of Directive 2016/1148

[89] Recital (22) of Directive 2016/1148

[90] Recital (25) of Directive 2016/1148

[91] Article 8 of Directive 2016/1148

designation, by MS, of a national single point of contact[92] which will coordinate SNIS' issues and cross-border cooperation at Union level. MS shall also designate one or more CSIRTs responsible for risk and incident handling which should receive notifications[93] of incidents.

4.2. EU harmonization on radio equipment movement with focus on health and safety (Directive 2014/53)

Unlike the previous Directive 2016/1148, no common security policy is reached out by the measures set out by the Directive (EU) 2014/53 for which the main concern is the protection of the health and safety of humans and domestic animals and an adequate level of electromagnetic compatibility.

This Directive is not specific for PPDR.

Details:

Indeed, Directive (EU) 2014/53 of the European Parliament and of the Council of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC[94] harmonizes the conditions for the movement of radio equipment. Therefore, the Directive modifies the scope of the previous Directive 1999/5/CE and adapts the existing framework applicable to innovative equipment.

In this regard, it lays down the essential requirements[95] to be applied to such products, ensuring the protection of the health and safety of humans and domestic animals and an adequate level of electromagnetic compatibility. Moreover, it regulates the product conformity's assessment[96] by their manufacturers or importers on the European market. Also, the Directive lays down the applicable requirements in terms of markings[97] and information to be provided to users in the package leaflet[98].

This Directive does not aimed at implementing a global civil security policy throughout the Union nor to apply to radio equipment exclusively used for activities concerning public security, defence, State security, including the economic well-being of the State in the case of activities pertaining to State security matters, and the activities of the State in the area of criminal law[99].

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[92] Article 8 of Directive 2016/1148
[93] Article 9 of Directive 2016/1148
[94] Text with EEA relevance
[95] Article 3 of Directive 2014/53
[96] Article 17 of Directive 2014/53
[97] Articles 19 and 20 of Directive 2014/53
[98] Article 10.8 of Directive 2014/53
[99] Article 1 of Directive 2014/53

D5.2 Annex 2 : Legal Aspects

4.3. Coordination and interoperability of radio spectrum (Decision n° 243/2012/EU and decision n° 676/2002/EC)

4.3.1. In general

> The Decision n° 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy program enables the Commission to submit legislative proposals establishing multiannual radio spectrum policy programs setting out policy orientations and objectives for the strategic planning and harmonization of the use of spectrum. Such policy orientations and objectives should refer to the availability and efficient use of the spectrum necessary for the establishment and functioning of the internal market.
>
> It should be highlighted that, this Decision specifically addresses the need for interoperable solutions for public safety and disaster relief.

Details:

Indeed, it is provided that « *the Commission shall, in cooperation with the Member States, seek to ensure that sufficient spectrum is made available under **harmonized conditions to support** the development of safety services and the free circulation of related devices as well as **the development of innovative interoperable solutions for public safety and protection, civil protection and disaster relief*** »[100]. Thus, European Commission is « *setting out policy priorities and long-term objectives for wireless broadband, including public safety*»[101].

Apart from that, the considerations principally raised among the Decision are related to the management and use of the spectrum, sufficient and appropriate spectrum's allocation, development of the internal market, promotion of competition and innovation, definition of the technical conditions of the use of spectrum[102].

Accordingly, Member States shall apply the policy orientations and objectives set out in this Decision as of July 2015[103].

Moreover, in principle, radio frequencies are allocated by international bodies, particularly the World Radiocommunication Conferences (**WRC**) of the International Telecommunication Union (**ITU**) and, in Europe, by the European Conference of Postal and Telecommunications Administrations (**CEPT**)[104].

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[100] Article 8.3 of Decision n° 243/2012/EU
[101] Presentation «Regulatory activities towards enabling a harmonised implementation of Broadband PPDR : the state of play in CEPT/ECC », nov. 2013
[102] Articles 2 to 5 of Decision n° 243/2012/EU
[103] Article 14 of Decision n° 243/2012/EU
[104] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV%3Al24218a

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Through the Decision n° 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community[105], the EU assumes a role in ensuring the optimal use of the radio spectrum by reaching the coordination of policy on the availability of radio spectrum and technical conditions for its efficient use.

Details:

Nevertheless, a common EU security policy is still not the purpose of this Decision but rather to preserve the functioning of the internal EU market and implement technical measures.

Actually, the objective of the Decision is to ensure the coordination of policy approaches and, where appropriate, harmonized conditions with regard to the availability and efficient use of the radio spectrum necessary for the establishment and functioning of the internal market in Community policy areas such as electronic communications, transport and research and development (R & D)[106].

In this regard, the decision applies the allocation of radio and wireless communication frequencies, including GSM, third and fourth generation mobile communications (3G, 4G) for frequencies between 9 kHz and 3000 GHz relevant for the internal market.

Besides, actions under the decision shall be consistent with actions and activities of the ITU and CEPT.

Particularly, the Radio Spectrum Committee will assist the Commission in defining, developing and implementing EU radio spectrum policy, building on the general principles contained in the radio spectrum policy program adopted by Decision n° 243/2012/EU in 2012[107]. The Radio Spectrum Committee will be also in charge of approving Commission's draft measures before their adoption and mandatory application throughout the EU.

Those Decisions are not specific for PPDR.

4.3.2. Decision for PPDR (Commission Implementing Decision (EU) 2016/687)

The European Commission adopted an Implementing Decision on the harmonisation of the 694-790 MHz (700 MHz) frequency band for wireless broadband[108]. This implementing decision contributes to the spectrum target set out in the Radio Spectrum Policy Programme (RSPP) of achieving 1200 MHz for wireless broadband in the Union. **It further makes harmonised spectrum available for priority sectors of EU spectrum policy – PPDR,** audio PMSE and the Internet of Things (IoT) – also in line with the objectives of the RSPP. Consequently, it also meets the overarching objective of

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[105] The « Radio Spectrum Decision»
[106] Article 1 of Decision n° 676/2002/EC
[107] Decision n° 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy program (Text with EEA relevance)
[108] Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union

ensuring efficient spectrum use in this valuable spectrum range[109].

4.4. Conclusion

Apart from the above Commission Implementing Decision (EU) 2016/687 of 28 April 2016, legal researches generally converge to the conclusion that no harmonized policies regulating either encryption of PPDR communication throughout the EU nor technical security requirements/standards for PPDR are currently in force at Union level (excluding soft law regulations).

Confirming such statement, the Decision (16)02 of the Electronic Communication Committee of the CEPT (ECC) concerning « Harmonised technical conditions and frequency bands for the implementation of broadband Public Protection and Disaster Relief (BB-PPDR) systems» dated 17 June 2016 provides that «*PPDR is a sovereign national matter and that each CEPT administration shall decide how to organize and use their radio spectrum for public order and public security purposes*»[110].

Accordingly, it is thereof recommended to harmonise frequency ranges for broadband «*PPDR radio systems to the maximum extent possible, taking into account the national and regional requirements and also having regard to any needed consultation and cooperation with other concerned countries/regions*»[111].

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[109]https://ec.europa.eu/digital-single-market/en/news/commission-sets-out-technical-conditions-allocate-more-radio-frequencies-mobile-internet
[110] Recital « e)»
[111] Recital « h) »

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[6] Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union

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[7] Directive (EU) 2014/53 of the European Parliament and of the Council of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment

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[8] Decision 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community

http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32002D0676

[9] Decision 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy program enables the Commission to submit legislative proposals establishing multiannual radio spectrum policy programs setting out policy orientations and objectives for the strategic planning and harmonization of the use of spectrum

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[10] Regulation 2016/679/EU on the protection of natural persons with regard to the processing of

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[11] Regulation 2006/2004/EC on cooperation between national authorities responsible for the enforcement of consumer protection laws

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[12] Regulation 611/2013/EU of 24 June 2013 on the measures applicable to the notification of personal data breaches under Directive 2002/58/EC on privacy and electronic communications

http://www.anacom.pt/render.jsp?categoryId=349250

[13] Directive 2009/136/EC of 25 November 2009 amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services

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[14] Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32002L0058

[15] Decision (EU) 2016/687 implementing by the EC of 28 April 2016 on the harmonization of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.118.01.0004.01.ENG

[16] Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty

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End of Document – D5.2 Annex 2