5G-Xcast Project Overview

Dr. David Gómez-Barquero

Mobile Communications Group

Institute of Telecommunications and Multimedia Applications

Universitat Politècnica de València

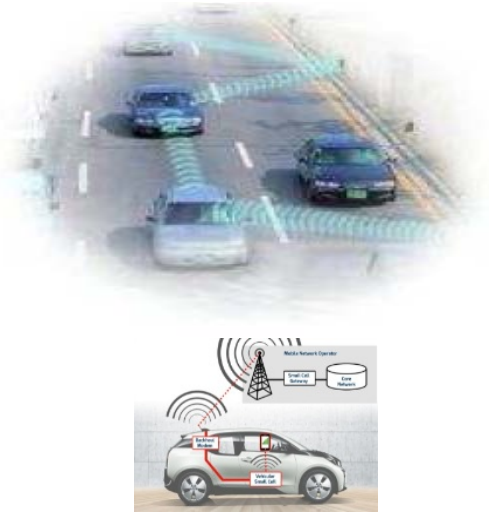
Point-to-Multipoint (PTM) Applications in 5G

- Broadcast/multicast **PTM transmissions are key in many 5G use cases**
- PTM transmissions fit very well with **network and device caching** for NRT popular content
- **3GPP is improving PTM capabilities of LTE** for **TV**, **V2X**, **IoT** and **Critical Communications**

Multimedia & Entertainment

- UHDTV delivery
- VR and AR

Connected Automotive



- infotainment
- Safety applications

Internet of Things

- Software Updates
- Common control messages to devices

Public Warning and Safety

- Public Warning System
- Tsunami and Earthquake Alert

Multicast and Broadcast in 4G LTE

- **eMBMS (LTE Broadcast)** adopted in Rel'9, re-using many features of **3G MBMS (Rel'6)**
  - Initially conceived as an add-on **TV-like service**, with a rather **statical configuration**

- eMBMS has been **enhanced** in all subsequent releases up to the latest Rel'14
  - Recent developments have started to conceive PTM as an internal delivery optimization tool rather than a service, improving the flexibility (e.g. resource allocation)
    - E.g. MooD (MBMS operation on-Demand) and SC-PTM (Single-Cell PTM)
  - Keeping **backwards-compatible** design and hence it **carries a long legacy from older releases**!

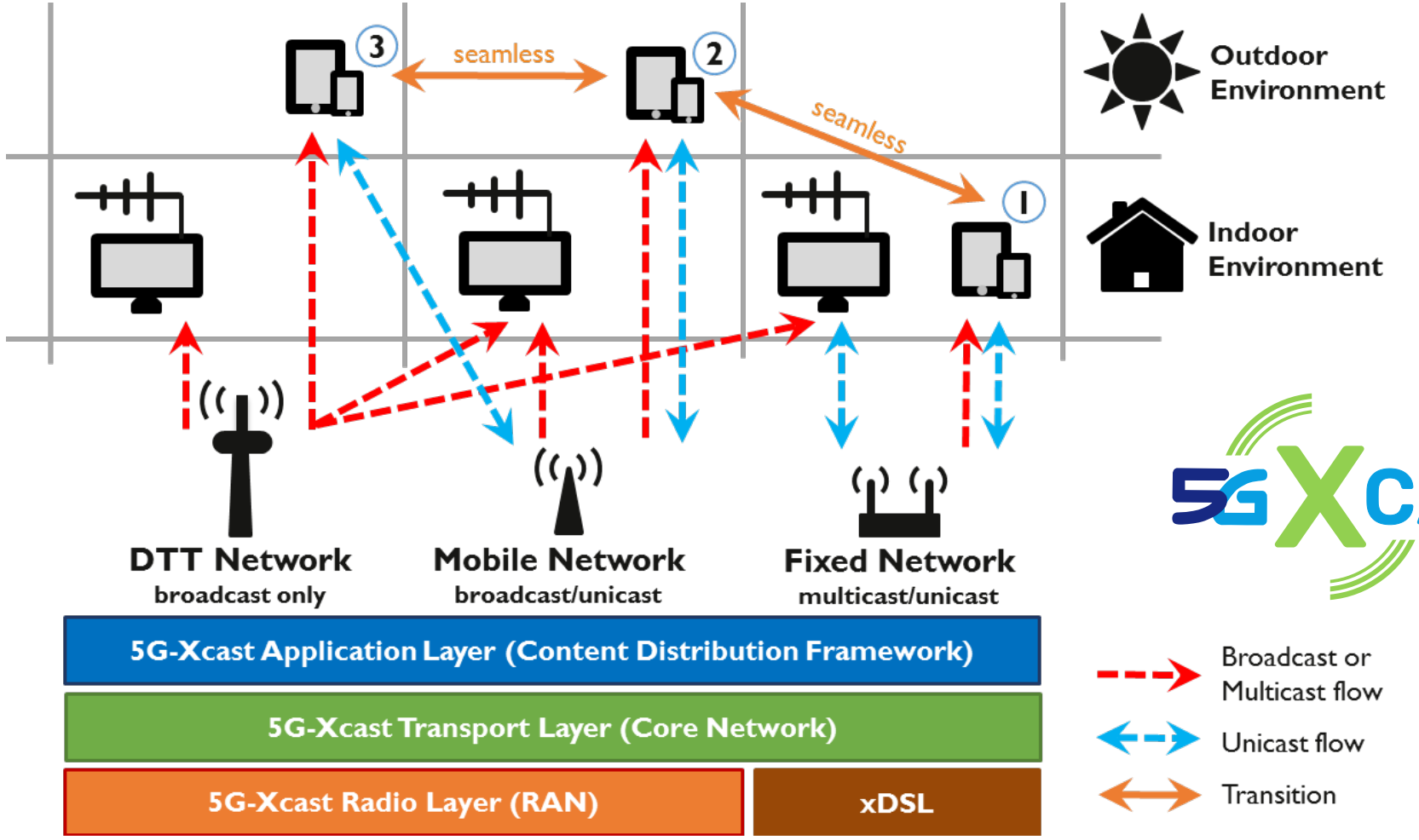
- But still **5G requires a change of paradigm compared to 4G eMBMS**:
  - Treat multicast, broadcast and caching as **built-in internal network delivery optimisations**, not as a service to be offered to content service provider
  - **Network slice broadcast service** that uses PTM capabilities at the RAN and core network

5G-Xcast Main Technical Challenges

- Identify **use cases** and define requirements and KPIs for **5G PTM** transmissions
- Devise a comprehensive and holistic **5G PTM RAN solution**, including the **radio interface**, **RAT protocols** and **RAN architecture**
- Design a **5G converged core network architecture** which combines **fixed, mobile and broadcast networks** and uses a **mixed of unicast, multicast, broadcast transport and caching capabilities** to achieve optimal network efficiency
- Produce a **network-agnostic content distribution framework** which can combine unicast, multicast, broadcast and caching to optimise network resources dynamically, keeping the interface between the content service provider and the network operator as simple as possible
- Develop **proof-of-concept prototypes** of the **5G-XCast radio, transport and application layer** key components
- To **experimentally demonstrate the 5G key innovations** developed in the project for the **M&E and PWS verticals**

5G-Xcast Convergence Vision

- Example of one user moving between three different environments each of which has different combinations of networks available. The **converged media delivery architecture of 5G-Xcast over fixed broadband, mobile broadband and terrestrial broadcast networks** allows a seamless, uninterrupted service to be offered to the users as they move.



Thank you for your attention.

Questions?

Dr. David Gómez-Barquero

Mobile Communications Group

Institute of Telecommunications and Multimedia Applications

Universitat Politècnica de València

dagobar@iteam.upv.es

Back-Up Slides

- 5G-Xcast Basic Information
- Consortium
- Advisory Board
- M&E Value Chain in 5G-Xcast
- WPs Structure
- Management Structure

5G-Xcast Basic Information

- **Title:** Broadcast and Multicast Communication Enablers for the Fifth-Generation of Wireless Systems
- **Acronym:** 5G-Xcast
- **Duration:** 24 months
- **Starting date:** June 2017 (5G-PPP phase-2)
- **Budget:** ~8 M€
- **Call:** H2020 ICT-07-2017: 5G PPP Research and Validation of critical technologies and systems
- **Project Coordinator:** UPV (Spain)
- **Technical Coordinator:** Nokia (Finland)
- **Number of Partners:** 18
- **Number of Countries:** 9

Consortium

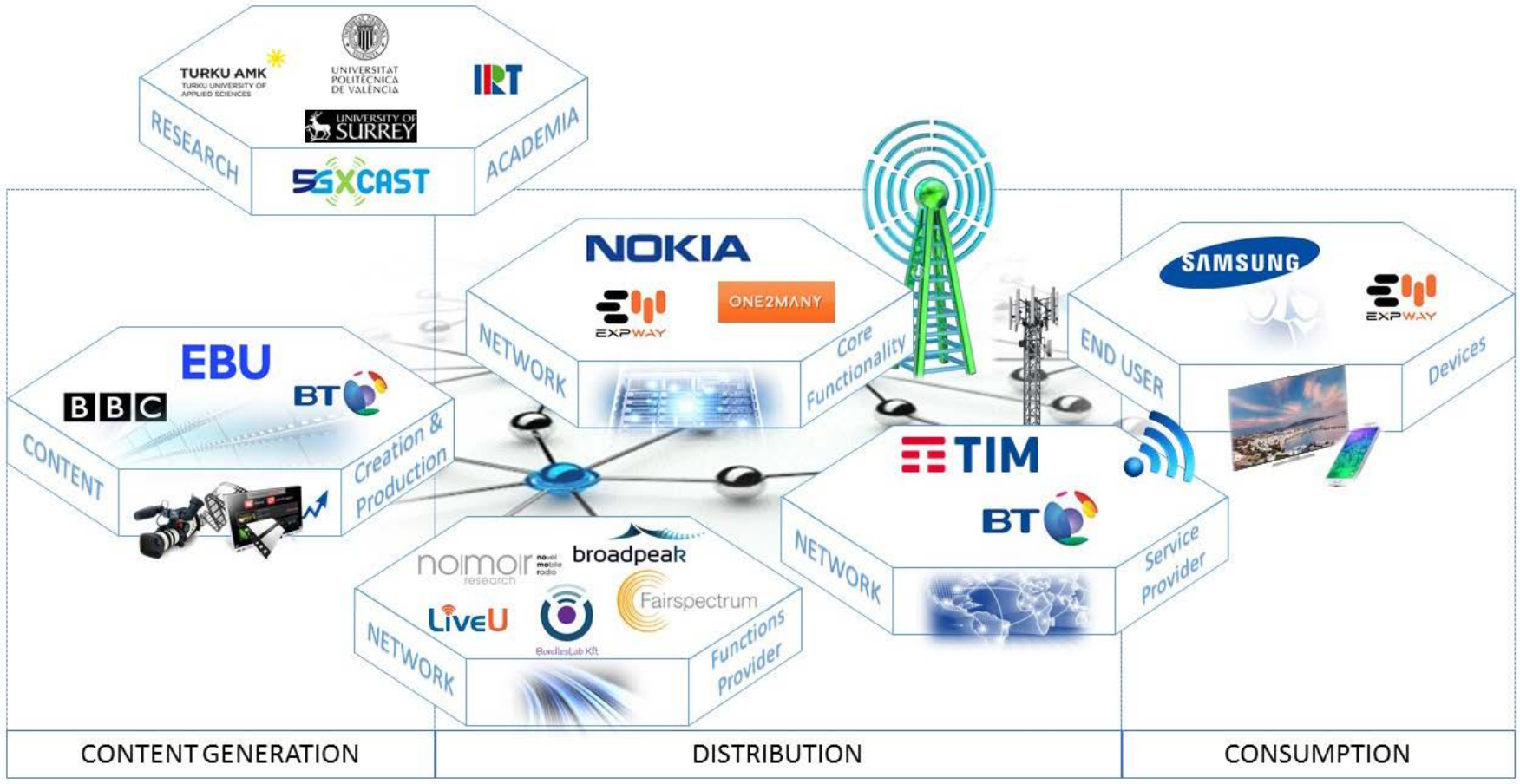
- Universitat Politècnica de València (UPV)
- Nokia Solutions and Networks OY
- Nokia Solutions and Networks Management International GmbH
- British Broadcasting Corporation (BBC)
- British Telecommunications Public Limited Company (BT)
- Broadpeak
- BundlesLab Kft
- Expway
- Fairspectrum OY
- Institut für Rundfunktechnik GmbH (IRT)
- LiveU Ltd.
- Nomor Research
- One2Many
- Samsung Electronics (UK) Limited
- Telecom Italia
- Turun Ammattikorkeakoulu OY (TUAS)
- Union Européenne de Radio Télévision (EBU)
- University of Surrey 5GIC

External Advisory Board

- Südwestrundfunk (**SWR**), Germany
- **Avanti**, UK
- **Ericsson**, Germany
- **TDF**, France
- **Technical University of Braunchsweig (TUBS),** Germany
- **Teracom**, Swden
- **Thales Alenia Space**, France
- **Dutch Ministry of Security and Justice** (MSJ), The Netherlands

- Electronics and Telecommunications Research Institute (**ETRI**), South Korea
- Communications Research Center (**CRC**), Canada
- Qualcomm, USA
- National Engineering Research Center (**NERC**), China
- Nippon Hōsō Kyōkai (**NHK**), Japan
- WISSEA, China
- Finnish Communications Regulatory Authority (**FICORA**), Finland

Media & Entertainment Value Chain in 5G-Xcast



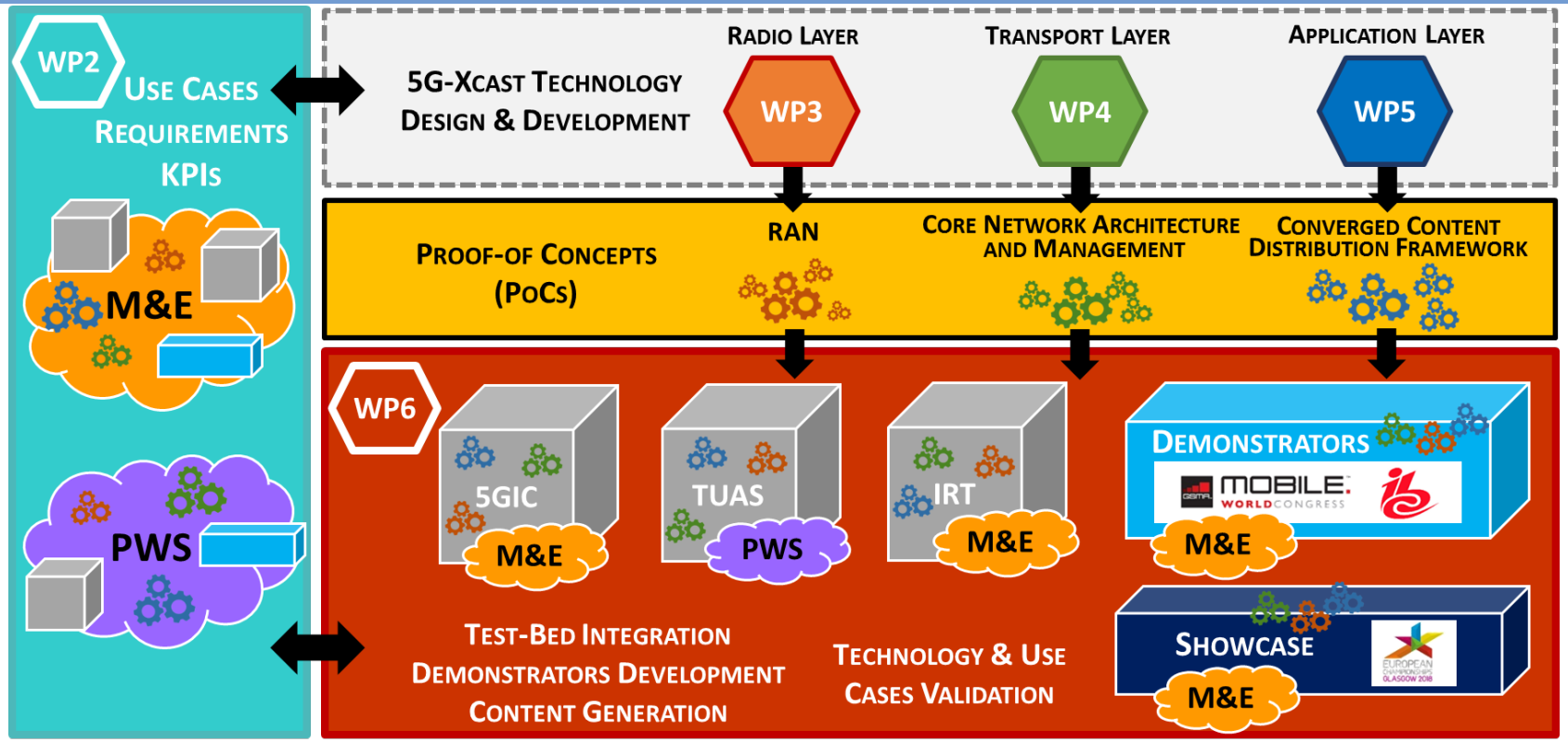
- External Advisory Board: the public service broadcasters **SWR** (Germany) and **NHK** (Japan), the MNO **EE** (UK), the broadcast network operators **TDF** (France) and **Teracom** (Sweden), the telecom vendor **Ericsson** (Germany), the CE manufacturer **Qualcomm** (USA), and the satellite service provider **Avanti** (UK), the aerospace manufacturer **Thales Alenia Space** (France)

Project Main Objectives

Nr.	Objective
1	To **develop broadcast and multicast point to multipoint (PTM) capabilities for 5G** considering M&E, automotive, IoT and PWS use cases, and **evaluate 5G spectrum allocation options for 5G Broadcast network deployments**.
2	To design a dynamically adaptable **5G network architecture** with **layer independent network interfaces** capable of **dynamically and seamlessly switching between unicast, multicast and broadcast** modes or use them in parallel and **exploiting built-in caching** capabilities.
3	To **experimentally demonstrate the 5G key innovations** developed in the project for the M&E and PWS verticals.

- M&E (Media and Entertainment); IoT (Internet of Things), PWS (Public Warning Systems)

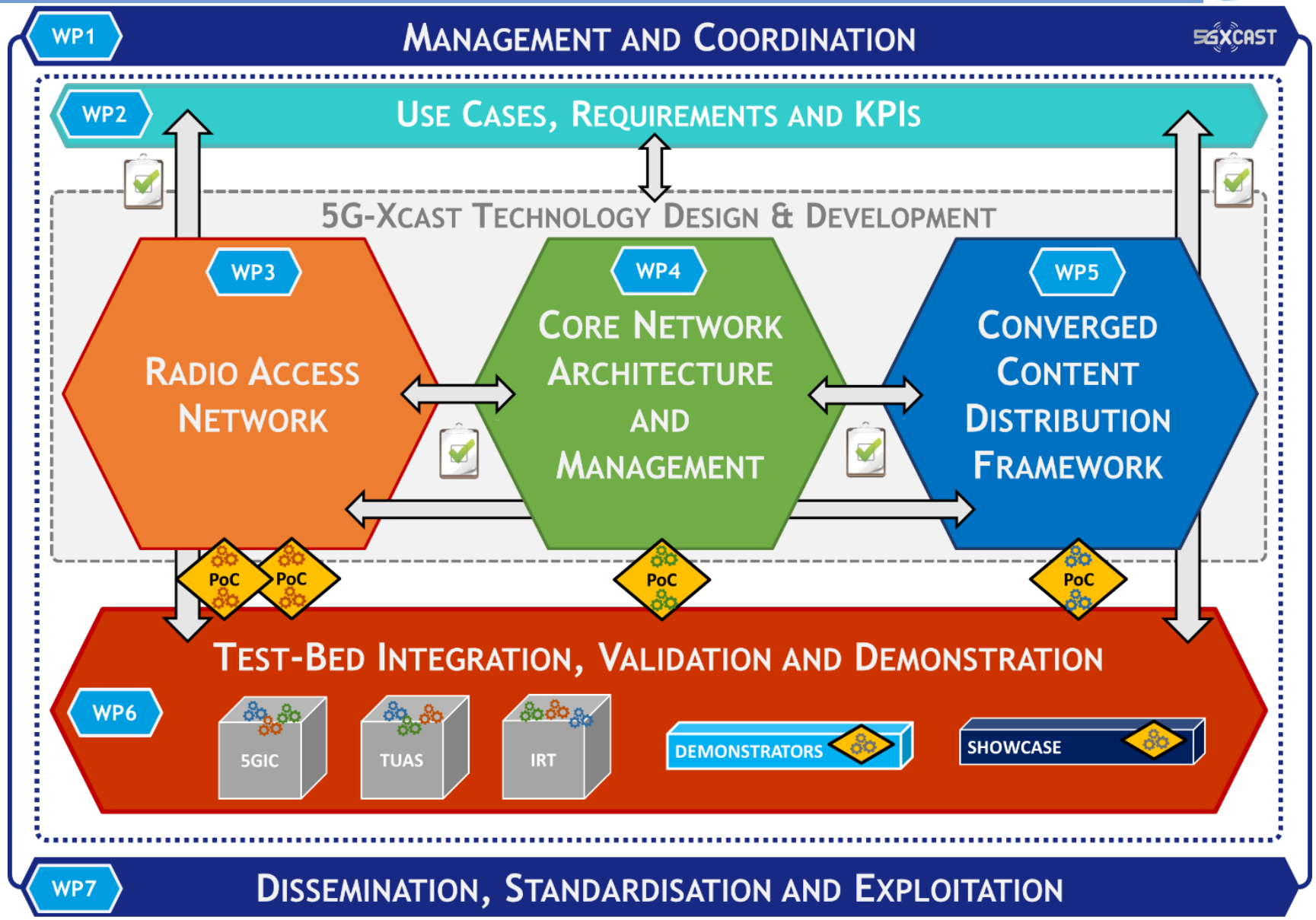
Project Methodology



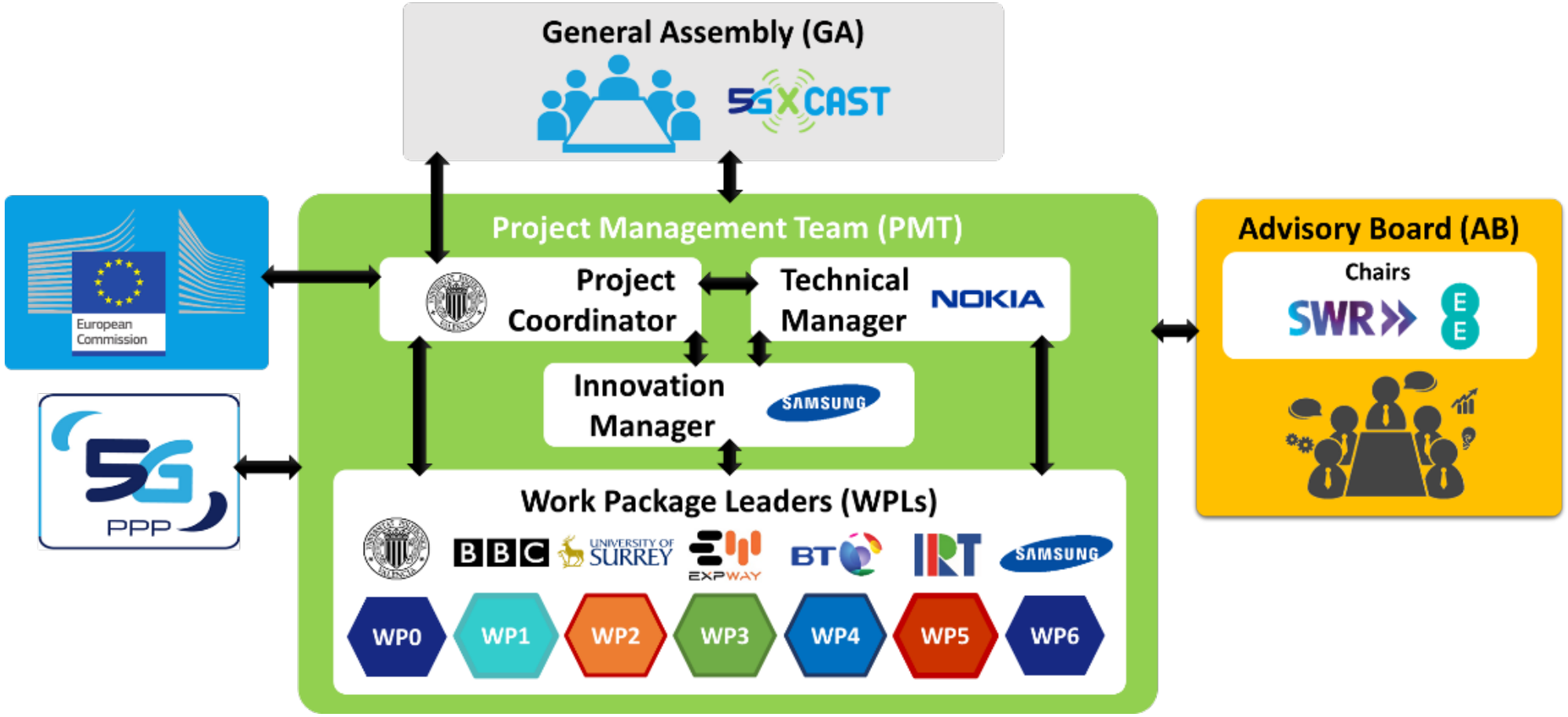
- **3 demonstration use cases**: object-based broadcast service, hybrid broadcast service (HbbTV) and PWS
- **3 test-beds**: 5GIC (Surrey, UK), IRT (Munich, Germany), TUAS (Turku, Finland)
- **Demonstrations**: European Championships 2018 (showcase), IBC 2018, MWC 2019
- **Proof-of-Concepts:** will be built for each 5G-Xcast layer, radio, transport and application

Work Packages (WPs) Structure

- WP Leaders
  - WP1 **UPV**
  - WP2 **BBC**
  - WP3 **5GIC**
  - WP4 **Expway**
  - WP5 **BT**
  - WP6 **IRT**
  - WP7 **Samsung**



5G-Xcast Management Structure



5G-Xcast Management Structure - PMT

- **Project Coordinator:** Dr. David Gómez-Barquero (UPV)
- **Technical Manager:** Dr. Athul Prasad (Nokia)
- **Innovation Manager:** Dr. Belkacem Mouhouche (Samsung)
- **WP1 Leader** Prof. Narcis Cardona (UPV)
- **WP2 Leader** Andrew Murphy (BBC)
- **WP3 Leader** Dr. Pei Xiao (5GIC)
- **WP4 Leader** Dr. Tuan Tran (Expway)
- **WP5 Leader** Dr. Steve Appleby (BT)
- **WP6 Leader** Dr. Javier Mogarde (IRT)
- **WP7 Leader** Dr. Belkacem Mouhouche (Samsung)
- **Advisory Board Chair:** Dr. Roland Beutler (SWR)
- **Advisory Board Vice-Chair:** Matt Stagg (BT)

5G-Xcast and 5G-PPP

- **Phase-2 5G-PPP projects**
  - Projects that intend to define PTM 5G technology components
    - **5G-SAT**
  - Projects that define use cases that require or could benefit of PTM transmissions
    - **5G CAR**, **5G CITY**, others?
  - Projects working on 5G network slicing: broadcast service as a network slide!
    - **5G Monarch**
  - Projects aiming to impact 3GPP Rel'16 and Rel'17 New Radio and New Core
    - **One5G**
  - Projects developing new media services
    - **5G Media**
- **5G-PPP Work Groups**
  - **Architecture:**
    - Convergence of fixed and mobile networks, and broadcast networks for large scale media delivery
  - **Spectrum:**
    - Spectrum possibilities for 5G broadcast deployments: 700 MHz (including duplex gap with SDL), wideband and frequency re-use 1 for broadcasting, future 600 MHz in USA
  - **SMEs**:
    - 8 SMEs 45% of budget