



#### **5G-Xcast Tutorial** Broadcast and Multicast Communications Enablers for 5G

**5G-Xcast Overview** 

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#### Contents



- Point-to-Multipoint (PTM) Transmissions
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### Point-to-Multipoint (PTM) Wireless Transmissions



- Suitable to deliver the same content to an unlimited number of people/devices within the covered area with a defined and stable quality of service
  - without substantially increasing network capacity requirements, energy consumption, costs
- Can offer huge capacity gains and sustainable operation of services, ensuring a cost effective high quality delivery mechanism<sub>5G-Xcast</sub>: enabling point-to-
  - This also allows valuation network resourcest to do the second second



# 5G Driven by New Use Cases and Designed for New Vertical Industries



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### Broadcast in 5G?



Broadcast/Multicast Point-to-Multipoint (PTM) transmissions are key in many 5G use cases

Also airborne communications



**MULTIMEDIA &** 

UHDTV delivery VR, AR, 360° video Content prepositioning Push to X (talk/video)



Autonomous driving information, Infotainment Safety applications, Signage information

Software Updates Common Control Messages

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PUBLIC WARNING AND SAFETY

Disaster alerts (e.g. tsunami, earthquake) Emergency alerts (e.g. hazar, amber alerts)

# PTM in LTE

eMBMS: evolved multicast broadcast multimedia service enTV: enhanced TV MooD: MBMS operationon-demand SC-PTM: Single Cell PTM



- Originally included in Rel'9 (eMBMS), based on 3G MBMS from Rel'6
- It has been significantly enhanced in the latest releases of LTE-Advance Pro for different types of communications:
  - **Television services** (EnTV) based on broadcasters' requirements
  - Critical communications
  - Vehicular communications
  - Machine-type communications
- Two major trends and main technology enhancements:
  - Dedicated broadcast networks for TV services
    - Receive only, shared network infrastructure, external interface towards content providers, ...
  - PTM as delivery optimization feature
    - MooD, SC-PTM, ...
- But built on top of an initially conceived basic and static TV-like service
  - Following LTE backwards-compatibility design principle

# PTM Evolution in 4G





- Two major trends from Rel'12:
  - Dedicated broadcast networks for TV services
  - PTM as RAN delivery optimization feature \_



### Rel'14 EnTV - towards stand-alone eMBMS broadcast networks



- Radio Access Enhancements
  - Dedicated carriers with up to 100%
  - MBMS allocation

**Non-backwards** 

compatible

- Self-contained system information and synchronization signals
- 200 µs long cyclic prefix to support large inter-site distances
- Architecture Enhancements
  - Receive-Only Mode (ROM) for devices without SIM card or 3GPP subscription
  - New service types to enable free-to-air content broadcast that can be received by ROM devices and also interactive services
  - Open standardized broadcasting application programming (xMB) external interface towards the TV content providers to simplify access to complex eMBMS procedures
  - Transport-only (pass-through) MBMS bearer service type to use the eMBMS network as content delivery platform in the native format without transcoding
  - Shared networks among several MNOs to avoid broadcasting the same content at the same time over different networks



#### **5G Broadcast Outlook**



- Broadcasters interest in 3GPP technologies is increasing
  - EBU broadcast requirements taken into account in Rel'14 (EnTV)
  - Rel'14 has a long legacy from Rel'8
  - 5G is an **opportunity** for broadcasters to define a **5G broadcast mode** using the latest 3GPP technology
- Many 5G use cases require PTM transmissions, not just TV broadcast
  - Treat **PTM transmissions** as **delivery optimization tool**
  - Unified framework for multiple verticals
- 5G Broadcast **not included** in the first 5G release (Rel'15)
  - Currently under discussion for Rel'16, but it is not one of the priority topics
    - Terrestrial Broadcast (based on LTE enTV)
    - Mixed Mode Multicasting (based on 5G NR)
  - Eventually there would be Terrestrial Broadcast mode in NR



#### 5G WILL OFFER UNPRECEDENT COMMUNICATION CAPABILITIES

OPPORTUNITY FOR THE CONVERGENCE OF FIXED, MOBILE AND BROADCAST NETWORKS

# **XCAST 5G Broadcast** Vision

#### Non-official definition! efficient mix of uni-, multiand broad-cast

PTM AS BUILT-IN NETWORK DELIVERY OPTIMISATION, NOT AS A SERVICE,



### **Basic Information about 5G-Xcast**



- Title: Broadcast and Multicast Communication Enablers for the Fifth-Generation of Wireless Systems
- Acronym: 5G-Xcast
- **Call:** H2020 ICT-07-2017: 5G PPP Research and Validation of critical technologies and systems (5G-PPP phase-2)
- **Grant number:** 761498
- Duration: 24 months\*
- Starting date: June 2017
- End date: May 2019\*
- **Budget:** ~8 M€
- **Project Coordinator:** UPV (Spain)
- Number of Partners: 18



Website: <u>www.5g-xcast.eu</u>

### Consortium

- 18 partners from 9 countries
  - 2 broadcasters & associations
  - 5 telecom operators & vendors
  - 8 SMEs
  - 3 universities
    - PM UPV (Spain)TM Nokia(Finland)/Samsung (UK)IM Samsung (UK)

Balanced and strong consortium between the telecom and broadcast world



### **Consortium and M&E Value Chain**



• The 5G-Xcast consortium covers the complete M&E Value Chain





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.



## Future Media Convergence Scenario Scast



- Users do not care about distribution technologies!
  - They care about a seamless experience



### **Project Scope**



**USE CASES** RAN **CONVERGED CORE** NETWORK CONTENT DISTRIBUTION FRAMEWORK **TEST-BEDS** 

M&E, Public Warning, Automotive and IoT

Radio interface, RAT protocols and RAN architecture on top of 5G NR Rel'15. Both "Terrestrial Broadcast" and "Mixed Mode Multicasting" modes

Combining fixed, mobile and broadcast networks Mix of unicast/broadcast/multicast capabilities On top of 5G service-based core network (Rel'15)

Network-agnostic. Combines unicast, multicast, broadcast and caching for dynamic network resource optimization

- Munich, Germany (Hybrid broadcast service)
- Turku, Finland (Public warning)
- Surrey, UK (Object-based broadcast)

### **Work Packages Overview**



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WP1 Management, WP7 Dissemination & Standardization



### **Project Management Structure**







### **External Advisory Board**





The current presentation shows **work in progress**, supported in part by the European Commission under the 5GPPP project 5G-Xcast (H2020-ICT-2016-2 call, grant number 761498).

The content is not yet approved nor rejected, neither financially nor content-wise by the European Commission. The approval/rejection decision of work and resources will take place **at the Mid-Term Review Meeting planned in September 2018 and the Final Review Meeting**, after the monitoring process involving experts has come to an end.

### WP2 Use Cases

#### WP2 Leader Andrew Murray (BBC)



Message Contents

Text [1 or More]

▲) Audio [1 or More]
 ■ Video [1 or More]

Minimal Set Includes

Yideo With Sign Language

Alert

Originator

Other Data Types

Visually Impaired

Message Contents

Broadcast in Area

Handsets

User Devices

TV Sets

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Tablets

Target Area

- Definition of 5G use cases for PTM transmissions for media, PW, automotive and loT verticals, with high-level requirements
  - Hybrid broadcast, AR/VR broadcast, remote live production
- Technology evaluation and use case refinement in cooperation with the technical WPs
- Definition of future use cases



http://5g-xcast.eu/2017/10/31/deliverable-d2-1-definition-of-use-cases-requirements-and-kpis-now-available/

#### WP3 Radio Access Network (RAN)

- Analysis of eMBMS LTE-Advanced Pro (Rel'14)
  - ATSC 3.0

#### • Performance Evaluation of 5G NR (Rel'15)

- Participation in the IMT2020 Evaluation Process via 5G-PPP
- Development of 5G NR link-level and system-level simulators

#### • 5G-Xcast RAN

- Air Interface
- RAN logical architecture
- RAT protocols and RRM



http://5g-xcast.eu/2017/12/07/deliverable-d3-1-lte-advanced-pro-broadcast-radio-access-network-benchmark-now-available/

#### WP4 Mobile Core Network

- Definition of the 5G converged core network architecture combining fixed, mobile and broadcast networks and using a mixed of unicast, multicast and broadcast transport based on 3GPP 5G (Rel'15) service-based architecture
  - Alternative 1:

http://5g-xcast.eu/2018/06/01/deliverable-d4-1-on-mobile-core-networks-available/

#### **WP4 Leader** Tuan Tran (Expway)





### WP5 Content Distribution Framework

- 5G Content Distribution Framework with design principles:
  - PTM and caching as internal network optimization
  - Simple APIs
  - Application layer intelligence over network signaling
  - Network-agnostic
- Relevant technologies:
  - 3GPP MooD
  - DVB ABR multicast



Mobile

Network

eMBMS compliant

eNodeB

http://5g-xcast.eu/2017/12/01/deliverable-d5-1-content-delivery-vision-now-available/

On-the-go

# WP6 Test-Beds

#### **WP6 Leader** Jordi G. Gimenez (IRT)



#### • Test-beds

 IRT (Munich), TUAS (Turku), 5GIC (Surrey)

#### • Trials

- Hybrid broadcasting
- Public warning
- Object-based broadcasting
- Demonstrations
  - EUCNC 2018, IBC 2018, MWC 2019, EUCNC 2019
- Showcase
  - European
     Championships 2018



#### WP7: Dissemination & WP7 Leader Belkacem Mouhouche (Samsung)

Public deliverables, scientific papers, presentations:

Academia

Summer Schools

Panels & Talks

Journal Papers

Conferences

Industry

Exhibitions

Patents

<u>http://5g-xcast.eu/documents/</u>

 <u>https://www.researchgate.net/project/5G-Xcast-</u> <u>Broadcast-and-Multicast-Communication-Enablers-</u> <u>for-the-Fifth-Generation-of-Wireless-Systems</u>

Industry Booths & Forums

Showcase European Championship



- Video
  <u>https://youtu.be/daFOf30NG2U</u>
- News and events
  - <u>@5Gxcast</u>

Dissemination

Exploitation

Standardisation

CAST

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http://5g-xcast.eu/news-events/ 5GPPP Collaboration

Workgroups Architecture Spectrum SME's

One5G 5G CAR ONE5G 5G CAR Phase-2 Projects 5G CITY

5G-MoN&rch 5G MEDIA 5G-Monarch 5G Media

Standards & Regulatory Bodies Participation & Contribution





5**G** 

5G-SAT

CAST



Thank You