5GIA-TSDSI Webinar on “5G Trials and Pilots”

22 September 2021 1100-1300 CET / 1430-1630 IST

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5G Broadcast

5G Broadcast Status in 3GPP and EU project progress.

By

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INTRODUCTION

- There are two modes of transmission in wireless communication: **point to point (PTP)** and **point to multipoint (PTM)**.
- Point-to-multipoint transmission is more efficient compared to point-to-point whenever a service or an application requires the same content to be delivered to multiple users or devices at the same time.
- This is why point to multipoint is considered to be an essential feature for 5G applications in a number of vertical sectors, namely Media & Entertainment (M&E), Public Warning (PW), Automotive (Auto) and Internet of Things (IoT). For these use cases the number of served UEs would be too high to be supported using point to point transmissions.
- Point to multipoint transmissions are further split into two categories:
  - Multicast: where the base station is aware of the mobiles that receive the service because of prior expression of interest following a service announcement.
  - Broadcast: where the base station transmits a service that can be received by a multitude of UEs, some of which have not expressed interest.

SCOPE

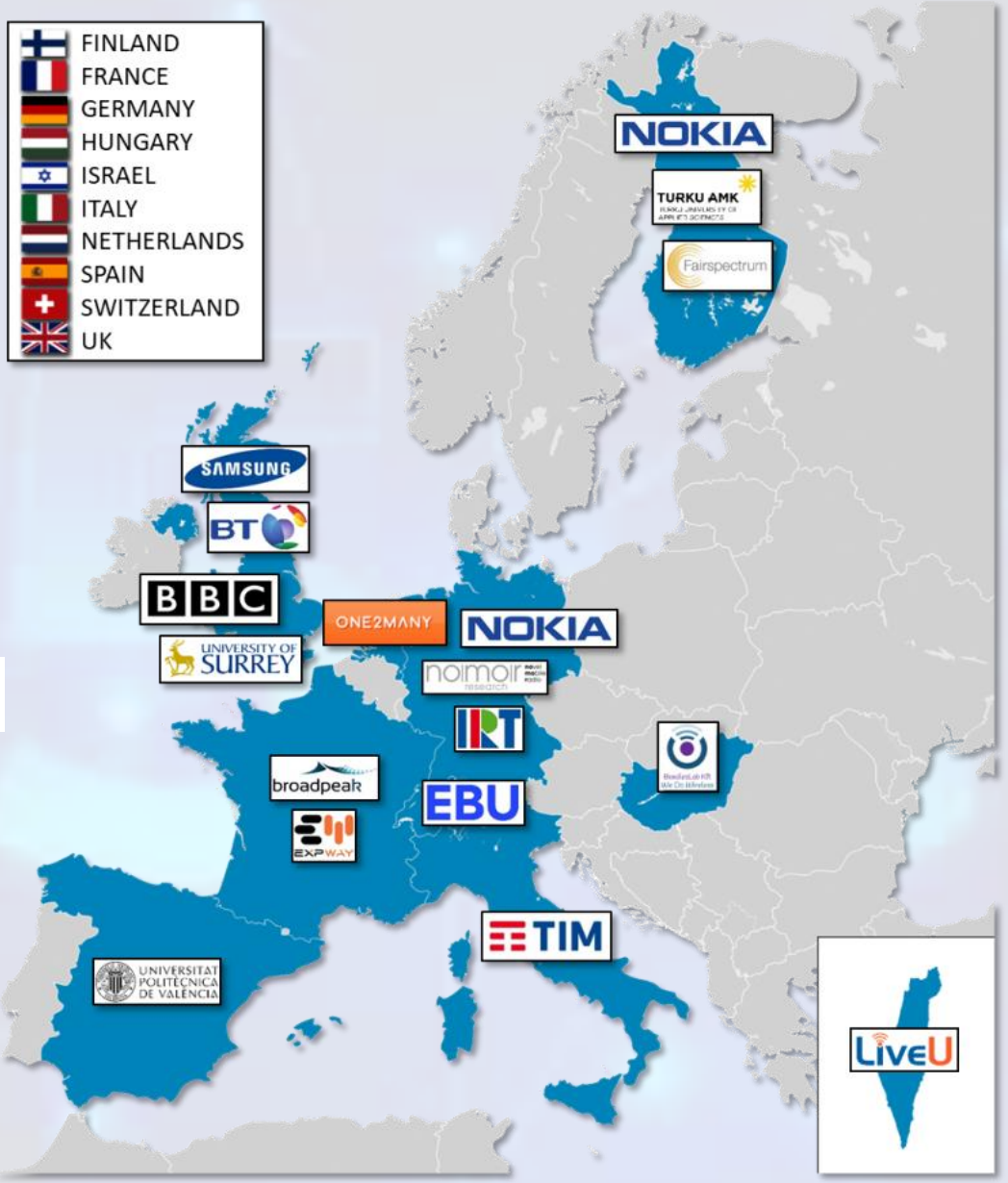
Broadcast and Multicast Communication Enablers for the Fifth Generation of Wireless Systems

(https://5g-xcast.eu/)

- 5GPPP Phase II Project from H2020-ICT-2016-2 call
- 18 partners from 9 countries
- June 2017 – July 2019

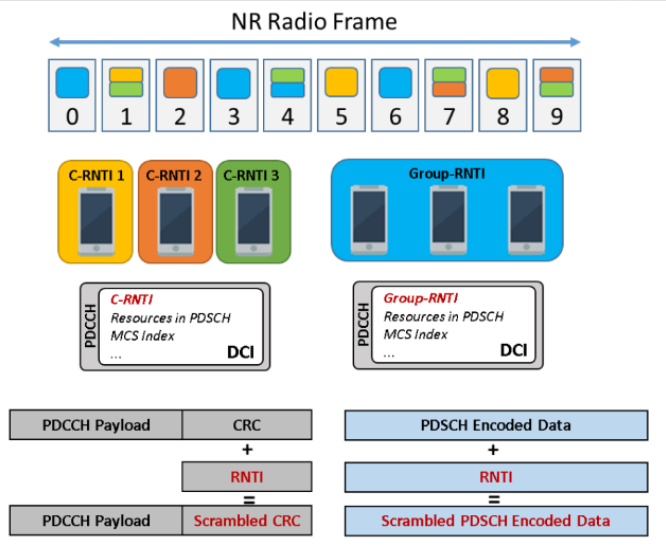
Main Objectives

1. **To develop Point-to-multipoint capabilities for 5G considering M&E, automotive, IoT and PWS use cases**
   - First project to work on 5G multicast/broadcast.
   - Reference work for 3GPP Release-17
2. **To design adaptable and converged network architecture**
   - One solution for all verticals, including terrestrial broadcast
3. **To demonstrate innovative use cases**
   - Demonstrations EUCNC 2018, IBC, MWC, EUCNC 2019

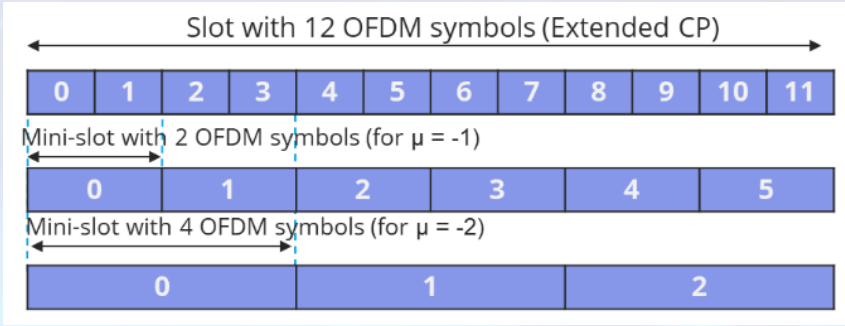


Key Contributions

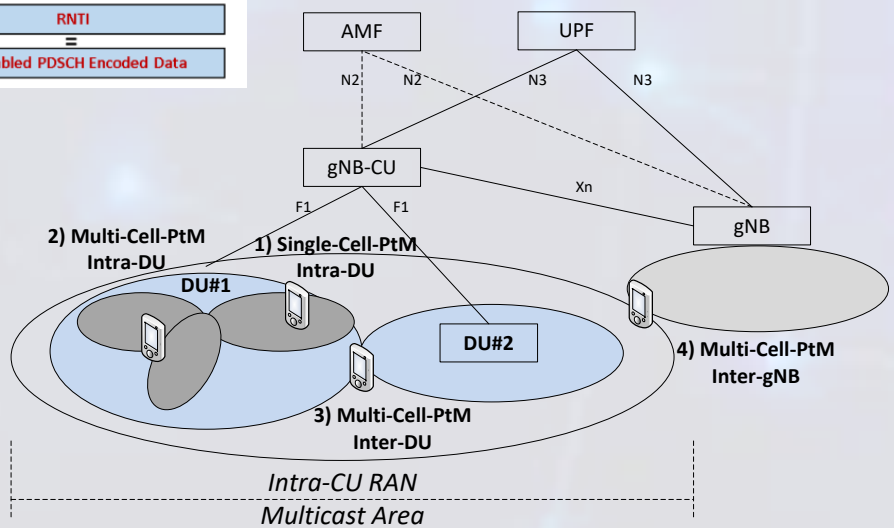
Common radio allocation to group of users



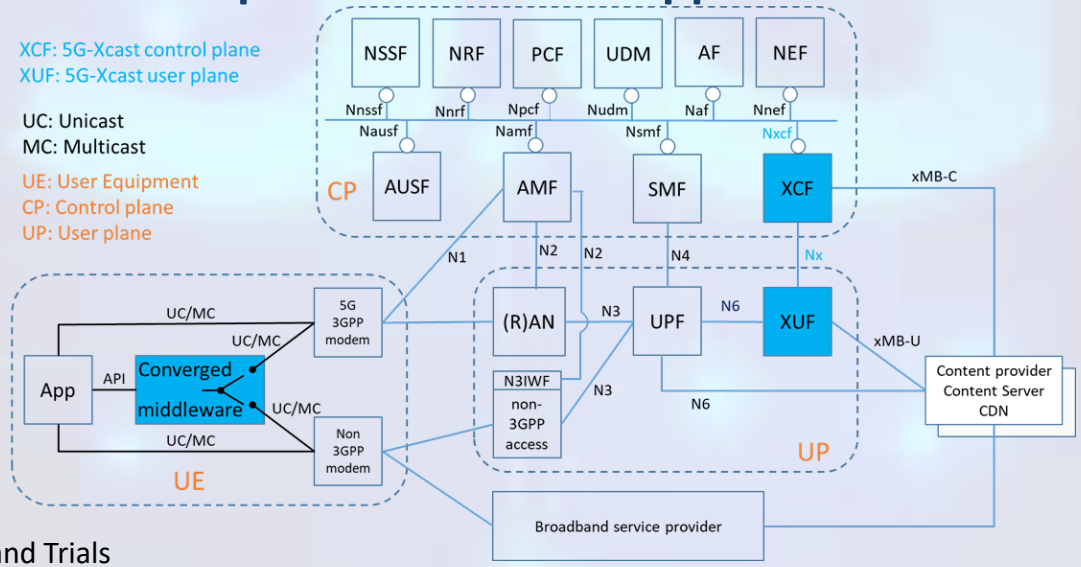
Mini-slots with larger CP / Negative "μ" OFDM numerologies



RAN Multicast Areas De-Centralized SFN Area Synchronization



Transparent multicast support in the 5GC



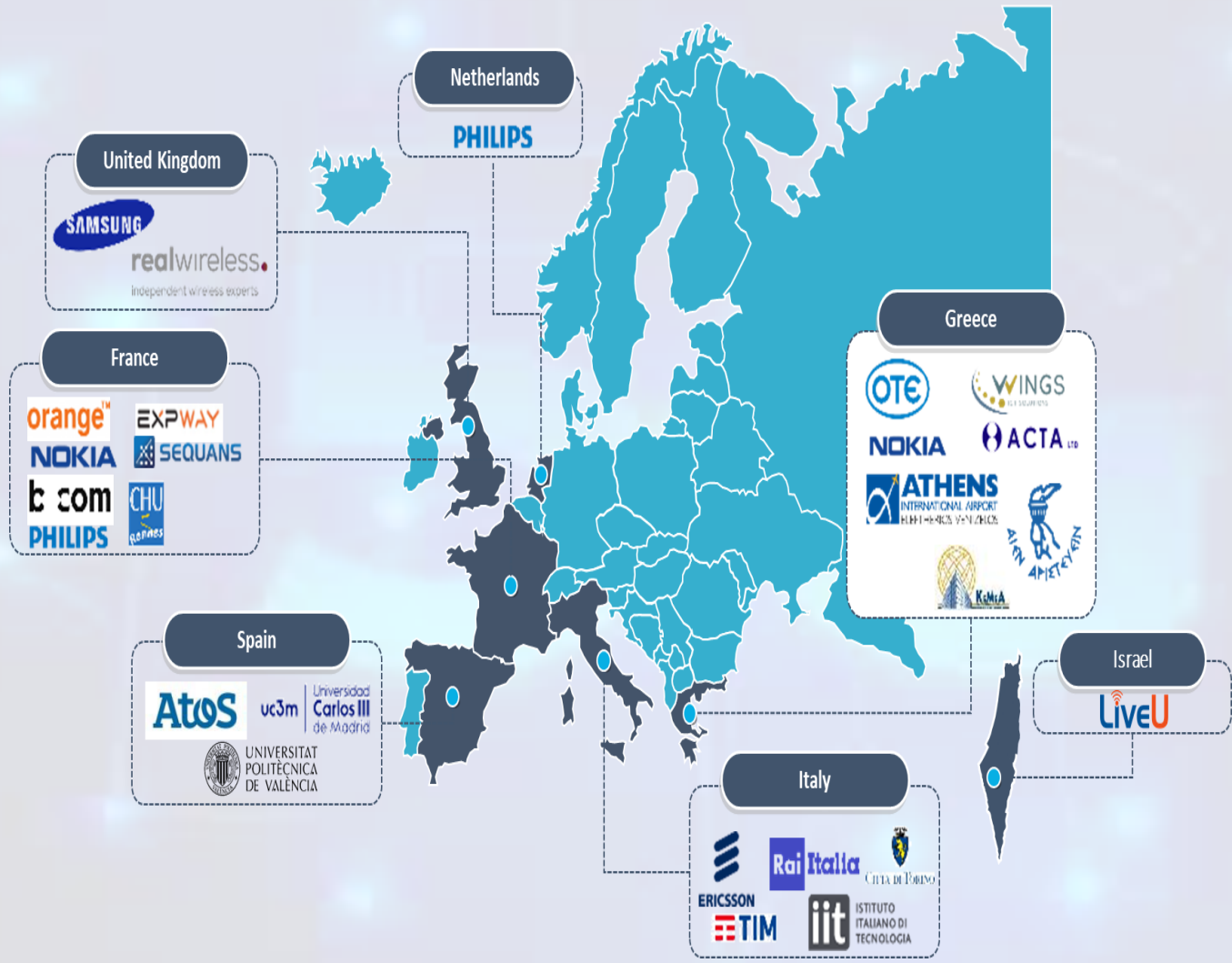
SCOPE

SmarT mObility, media and e-health for toURists and citizenS (https://5gtours.eu/)

- 5G PPP Phase 3 project from EU H2020 ICT-19-2019 call
- 27 partners from 7 European countries
- June 2019 – May 2022

Main Objectives

- **To demonstrate the ability of 5G** to improve the quality of life of citizens and tourists, making cities more attractive to visit, more efficient in terms of mobility and safer for everybody.
- To deploy of trials to evaluate the vertical solutions on top of the 5G-EVE nodes.



5G-TOURS Broadcast Use Cases

2 different sub-use cases (aligned with 3GPP):

- **5G Broadcast delivery to massive audiences**
  - **Broadcast-Centric:** Receive-only live content to all users at once, using High-Power High-Tower (HPHT) infrastructure in a 5G Broadcast LTE-Based network.
  - Wi-Fi distribution of live video signal via the broadcasting network of RAI
  - Release 16 compliant equipment from R&S (SDR solution provided by UPV)

November 2021

Partners: Rai, Universitat Politècnica de València, Enensys Expway, Samsung

Nature: Broadcast-centric approach.

Location: Palazzo Madama (Turin)

- **5G Core Multicast development**
  - Multimedia content delivery over the 5GC Multicast (provided by UPV), by means of Enensys Service layer (creating a Broadcast prototype).
  - Implementation of the Rel-17 Network Functions enhancements to support Multicast:
    - Multicast User Function (MUF) and Multicast Control Function (MCF)
    - Modules for multicast/broadcast data plane and control plane (MB-SMF and MB-UPF)
    - TMGI Allocation and MBS Session Creation
    - Network Exposure Function (NEF) update, based on new APIs
    - Secure exposure of broadcast network services towards 3rd party application

January 2022

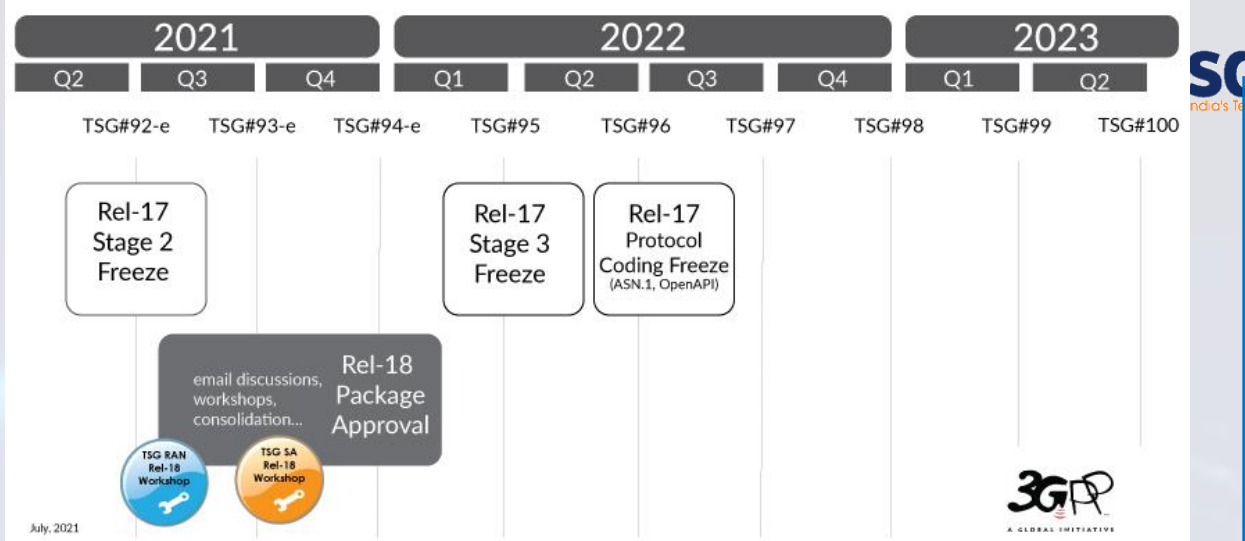
Partners: Universitat Politècnica de València, Enensys Expway, TIM, Ericsson, Samsung

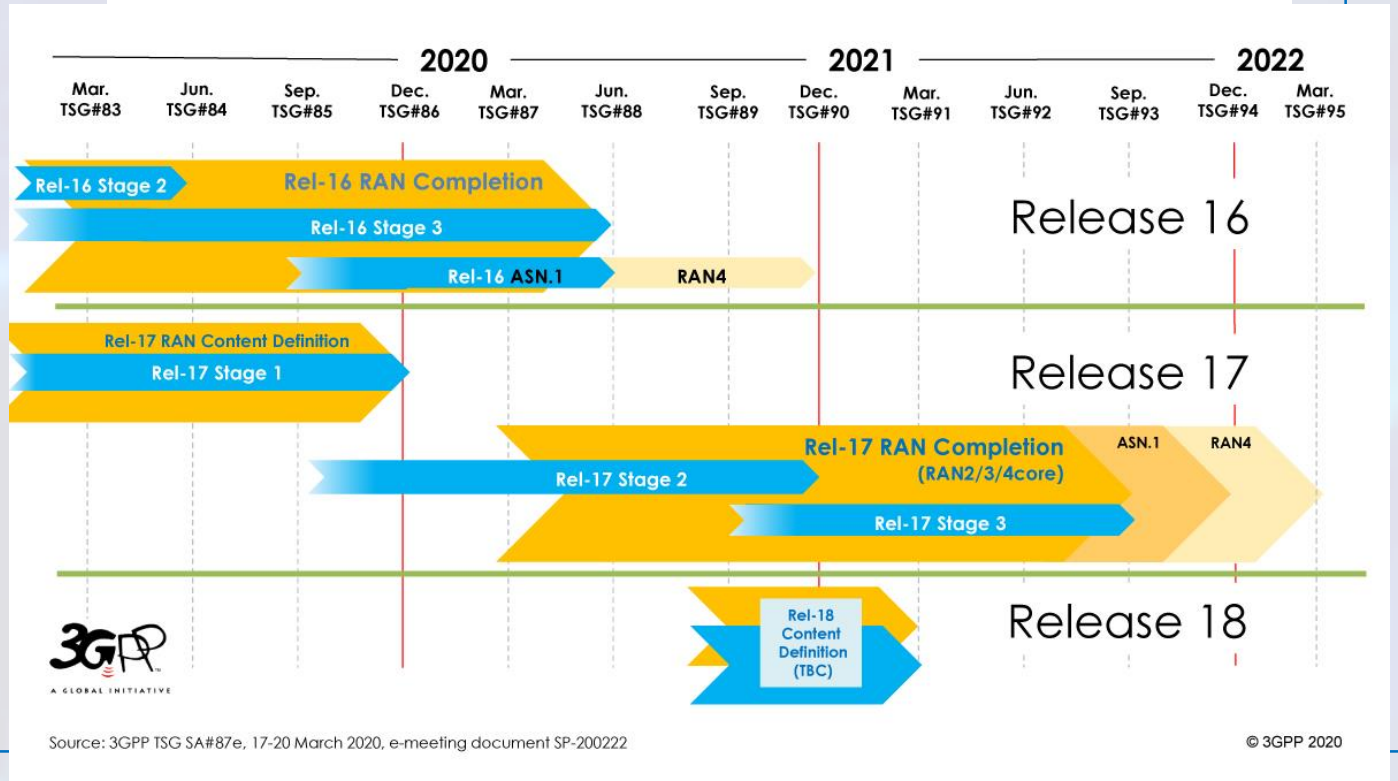
Nature: Mobile Operator Approach.

Location: UPV premises and TIM LAB 5G EVE laboratory.

Multicast Broadcast in 3GPP

- 3GPP has always had a broadcast component in previous releases prior to 5G (prior to Rel-14)
- Rel-15 was dedicated to the 5G main design without many Multicast Broadcast Services.
- Rel-16 contained an upgrade of EnTV services based on LTE (RAN) and the architectural design of MBS (SA).
- Rel-17 has a new RAN WI dedicated to MBS where new paradigms are discussed.
- Rel-18 is currently being prepared. MBS evolution is being discussed.





3GPP RAN1 MBS activity:

- On the RAN side, a new Work item proposal on Rel-17 Broadcast and Multicast was approved during the RAN plenary 86 in Sitges, Spain. The proposal captured in RP-193248 (revision of RP-193163).
- The RAN work item aims at providing the support in RAN. Objectives include:
- Specify RAN basic functions for broadcast/multicast for UEs in RRC_CONNECTED state :
  - Specify a group scheduling mechanism to allow UEs to receive Broadcast/Multicast service
  - Specify required changes to improve reliability of Broadcast/Multicast service, e.g. by UL feedback. The level of reliability should be based on the requirements of the application/service provided.
- Specify RAN basic functions for broadcast/multicast for UEs in RRC_IDLE/ RRC_INACTIVE states :
  - Specify required changes to enable the reception of Point to Multipoint transmissions by UEs in RRC_IDLE/ RRC_INACTIVE states, with the aim of keeping maximum commonality between RRC_CONNECTED state and RRC_IDLE/RRC_INACTIVE state for the configuration of PTM reception.

Main novelties of Release 17: Retransmissions for MBS

- 5G Multicast and Broadcast Services (5G MBS) is being standardised in 3GPP Rel-17 where mechanisms to improve the reliability point to multipoint transmissions are studied.
- One of such mechanisms is use of retransmissions. **This is the first time that 3GPP is considering retransmissions for Broadcast and Multicast. Up to release 16 Broadcast and Multicast were always transmitted without any feedback**.
- This means that the base station had to tailor the broadcast service to suit the weakest link that is interested in the service.
- Rel-17 is considering the use of PDSCH to transmit Multicast data. For example the following agreement are already made in RAN1:

Lessons learnt

5G-Xcast

- Integrating different network functions can be challenging
  - (BM-SC from one provider into the core network from another provider)
- Usually Broadcast Multicast is considered in later releases than the main eMBB case
- The availability of devices should be considered before planning the trial.

5G-TOURS RAI Feedback:

- On the Coverage and Planning: system suitable to provide broadcast services by HPHT network to rural and suburban areas. Nevertheless, cooperation from the MNO cellular network is needed for complete coverage of territory and population;
- On the equipment availability: transmission equipment available from limited number of vendors. Mobile terminal supporting releases of eMBMS usually lag behind other features.
- On the commercial business case: different cooperation opportunities between Content providers, BNOs, MNOs are possible, based on cooperation at the network level or at the service level. 5G-MAG is promoting this cooperation.

Thank You

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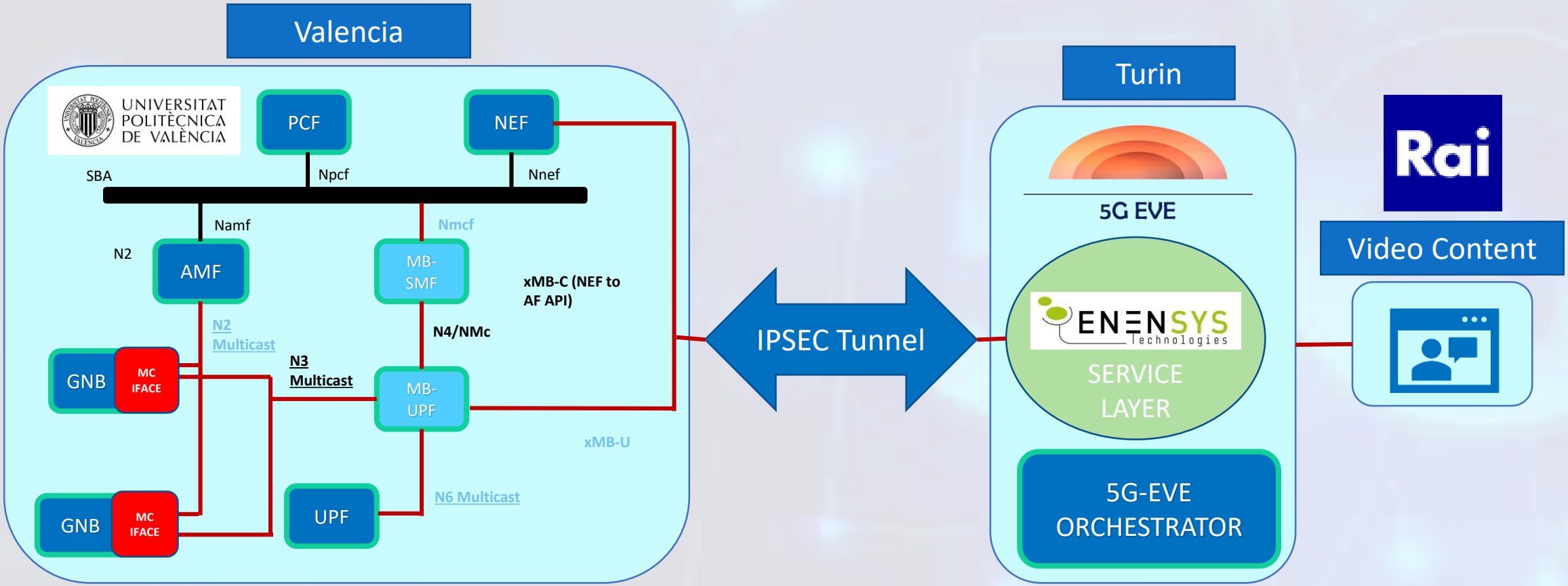
Back-up Slides

5G Core Multicast Trials (Phase-4)



Rel-16 and Rel-17 MBS content

- A new Work item proposal on Rel-17 Broadcast and Multicast was approved during the RAN plenary 86. The proposal captured in **RP-193248 (**revision **of RP-193163).**
- Between RAN #78 and RAN #80, partners from 5G-Xcast have worked with other proponents to propose a new work item on Broadcast/Multicast evolution for NR for Rel-16. After many rounds of discussion and splitting the evolution into “terrestrial broadcast” (covering EnTV like MBSFN transmission) and “mixed mode multicast” (covering Single Cell Point To Multipoint, SC-PTM). The discussions were summarised by Qualcomm who suggested to proceed in two steps:
- Study on “terrestrial broadcast” in Rel-16
- Leave the standardization of “mixed mode” multicast/broadcast to further releases.
- The LTE Rel-16 WI on enhanced EN-TV was approved in RAN #83. The goal of this WI is to design new frame structure with new CPs in order to meet the 5G requirement, but using LTE (Thus the name 5G LTE Broadcast). The main attributes of “terrestrial broadcast” are broadcast only, DL-only, large and static transmission areas typically achieved with High-Power High-Tower deployments and usually used for large areas TV transmissions.
- Apart from EnTV work, no broadcast/multicast feature support is specified in the first two NR releases, i.e. Rel-15 and Rel-16. However, a 5G NR solution would not be complete without a broadcast/Multicast solution to address the many use cases for which one to many transmissions could provide substantial improvements, especially in terms of efficiency.

Rel-16 and Rel-17 MBS content

- 3GPP SA2 is a group responsible for system architecture. A study item on the Architectural enhancements for 5G multicast-broadcast services has been approved in SP-190625. This Study became a work item for Rel-17 (see SP-201106))

- Objective A of the SA2 WI is about Enabling general MBS services over 5GS and the uses cases identified that could benefit from this feature include (but are not limited to) public safety and mission critical,. V2X applications, transparent IPv4/IPv6 multicast delivery, IPTV, software delivery over wireless, group communications and IoT applications.
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- The RAN work item aims to provide the support in RAN for Objective A, consistently with TR 23.757.
- Support of Objective B (e.g. linear TV, Live, smart TV, and managed and OTT content, radio services) is not in scope of this WI. However it is possible that solutions designed for Objective A would enable efficient radio resource utilization for services supported in Objective B, and we aim for forward compatibility towards Objective B were possible.