

MULTICAST 4G

MCPTT PMR, MOOC TEACHING AND TV IN LOCAL LOOP NETWORKS (RTTH)

1- User cases of Multicast

Using IP and with the overhead, the voice service of PMR requires about 50 Kb./sec; the good quality video sharing application (e.g fire scene) requires 2 Mb/sec; an eNodeB using the PPDR band 2x3 Mhz in the 700 MHz side band used in certain countries offers 17 Mb/sec DL close to the antenna, not more than 3G. An economical satellite backhaul link has 128 Kb/sec which is enough for signaling but can at most handle 2 voice 50 kb/sec channels. This means that for the telephone service when all security forces are close to the antenna, one could rely on unicast channels up to about 340 members ($17 / 0.05$), if they are all at the coverage limit, the rate is $\frac{1}{4}$ that is then 85 members which is a good size group and there is no need for multicasting the Down Link. We provide below a better average value assuming a uniform distribution of the security forces in a circle limited by the coverage .

The use of Multicast for the access to MOOC in low development countries should they have 4G radio is a natural application. It provides a much better quality video than the clever setup using satellite TV but with the need to procure the cheap multicast receivers; a low bandwidth UL channels for the interactivity is used but it is the same idea.

In case of use of commercial TV over 4G is often mentioned. The spectators at Roland Garros are seated watching a game, but they are interested also by a simultaneous side game from time to time. Unicast TV broadcasted to several hundred viewers would saturate the 4G: the solution is to setup a few multicast channels for all the simultaneous games streaming.

2- 3 GPP Multicast Architecture

Several implementations, such as illustrated in Figure 1 below, integrate conveniently the MBMS GW in the PGW as it uses also the GTPv2 protocol. This section and two following explains the *first part : the establishment of MBMS bearers* for the Multicast delivery and the joining of a Multicast bearer by a UE using the GC1 unicast bearer with the AS.

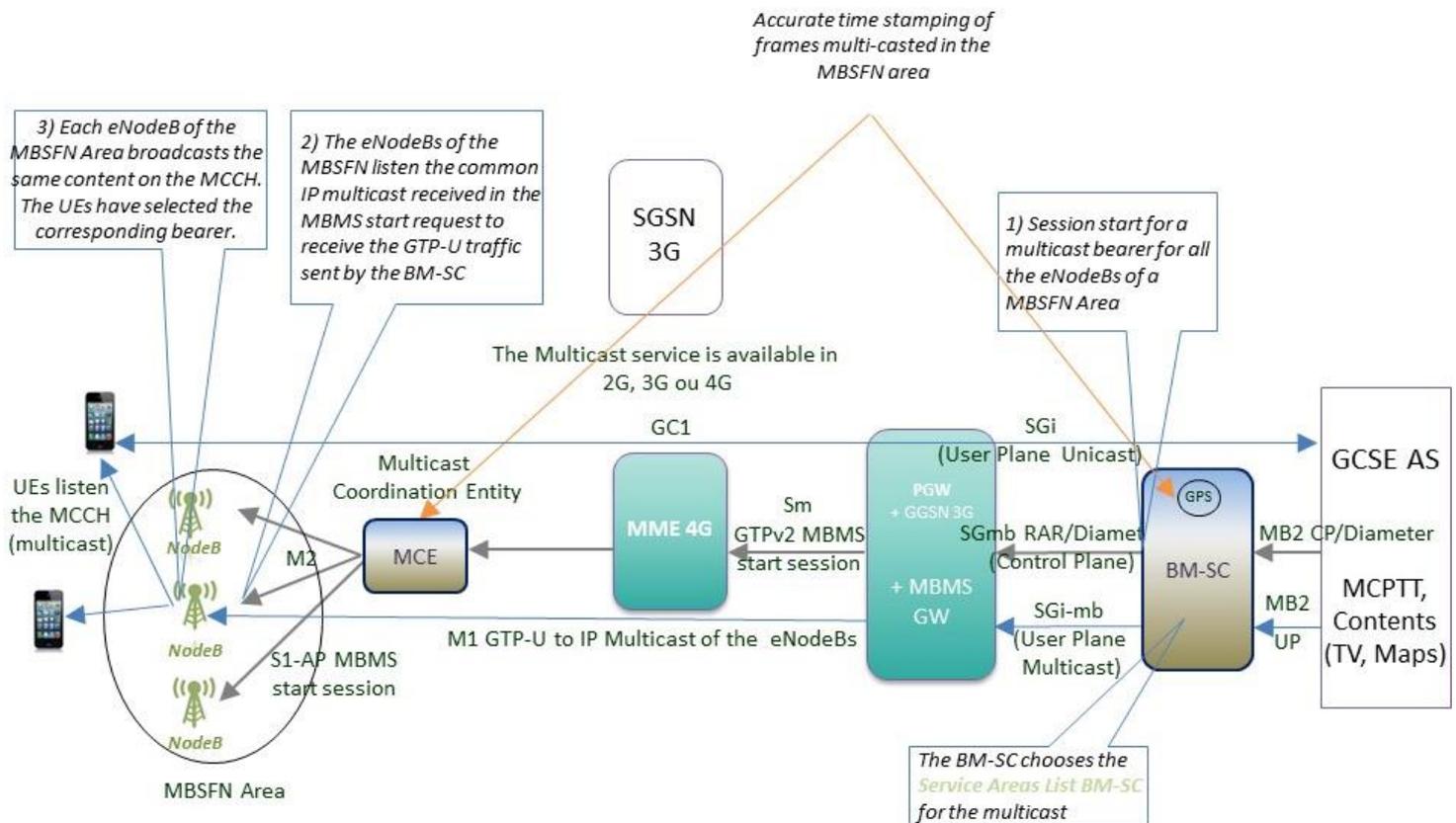


Fig 1: Architecture, equipments and protocols for the 3GPP Multicast service

To deliver contents to a UE, the Application Server on the right has 2 choices: Unicast through the usual Sgi interface, Multicast through the Sgi-mb interface. The UE and the AS interacts through the GC1 interface a normal unicast bearer (GC1 is a proprietary application protocol between the UE and the AS. Example of use: the UE reports the bad coverage for a unicast bearer and requests the creation of a multicast bearer while transmitting its location and the Received Signal Level, or the contrary.

GC1 is also used by the UE application to requests the Temporary Mobile Group Identity(TMGI) and Flow Identifier of the available Multicast bearers so it can attach to the reception of one of the corresponding MCCH.

3- Detailed Call Flow of a MBMS Session

A MBMS Service Area is a small geographical area covered by a multicast service.

A given eNodeB initialises (M2 Setup) the multicast service by sending to the MCE it depends of a List of Service Areas. When it receives it the MCE relays this list to the MCE it depends of.

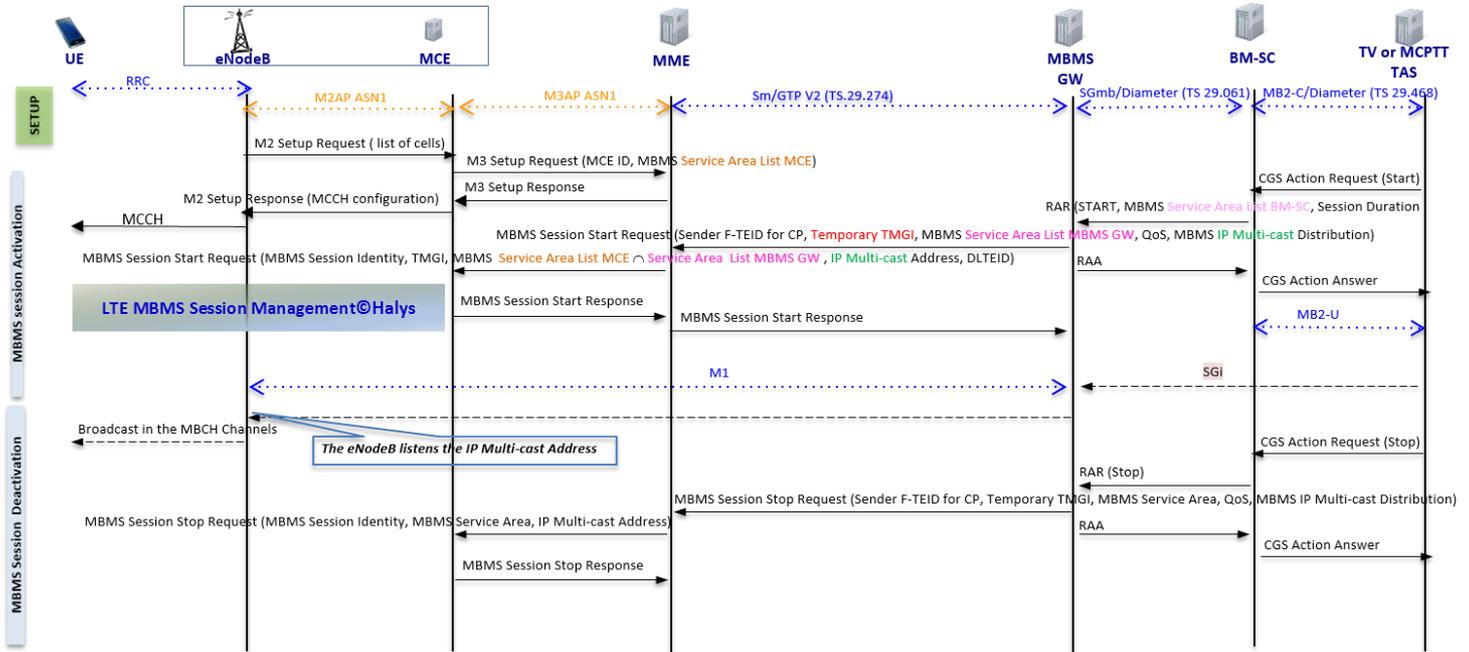


Figure 2 : Call Flow of the 3GPP Multicast MBMS service

To initiate a Multicast session, there is a list of Service Areas which may be over several MMEs. The MBMS GW has a map and is able to select the MMEs which cover them. The MBMS GW selects the MMEs for each Service Area from that list and sends a MBMS Session Start containing a sub list of Service Areas to each MME.

For each MCE, the MME extracts the intersection of the list received from the MBMS GW and the list received from each MCE and sends it to each MCE in a M3 Session Start.

After the creation of the MBMS bearer all the concerned eNodeBs are set in a multicasting state with the data being multicast as soon a member has joined the Multicast group. Any UE under coverage may request through its client GC1 from the Application Server to join a list of Multicast channels, which are returned with: their **TMGI x Flow Identifiers**, the **IP Multicast** and a commercial name. The user can then select to receive a particular MBMS bearer and become a member of that multicast group. If the selected channel is not yet opened, there is a request to the AS to create it with a RAR/Sgmb. Halys provides a total solution with partner for the MCE and the BM-SC.

References

- [1] TS 23.246 V14.1.0 (2017_05), "Universal Mobile Telecommunications System (UMTS); LTE; Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description", Rel 14.
- [2] 3GPP TS 29.468 v14.2.0 (2017-07), «Universal Mobile Telecommunications System (UMTS); LTE; Group Communication System Enablers for LTE (GCSE_LTE); MB2 reference point; Stage 3». This Rel 14 standard for AS MCPTT over LTE support «push file and streaming for the multicast coming from MCPTT». => Rel 13 supports "push through" ciphered on the MB2 .Interface between the CGS AS and the BM-SC.
- [3] TS 29.061 V14.3.0 (2017-04), "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)", Rel 14. The Sgmb Diameter interface between the BM-SC and the MBMS GW.
- [4] TS 29.274 V14.4.0 (2017-07), "Universal Mobile Telecommunications System (UMTS); LTE; 3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3", Rel 14, Interface GTP v2 between the MBMS GW and the MME".
- [5] 3GPP TS 36.344 V14.1.0 (2017-08), «LTE; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); M3 Application Protocol (M3AP)», Rel 14, Protocol M3AP ASN1 based between the MCE and the MME.