A Study of Multimedia Broadcast and Multicast Service

Venkateswarulu Naik B1, E. Jhansi Rani2

1Pursuing M.Tech (CS), Nalanda Institute of Engineering & Technology, Siddharth Nagar, Sattenapalli, Guntur, Affiliated to JNTUK, Kakinada, A.P., India.

2Asst. Professor, Department of Computer Science Engineering, Nalanda Institute of Engineering & Technology, Siddharth Nagar, Sattenapalli, Guntur, Affiliated to JNTUK, Kakinada, A.P., India.

b.v.naik681@gmail.com

Abstract - Multicast and broadcast service (MBS), or multimedia broadcast/multicast services (MBMS), is one of the important services to be supported by the next generation cellular systems. MBMS is an IP datcast (IPDC) type of service that can be offered via existing GSM and UMTS cellular networks. The infrastructure gives the possibility to use an uplink channel for the interactions between the service and the user. MBMS has been standardized in various groups of 3GPP (Third Generation Partnership Project), and the first phase standards are to be finalized for UMTS release 6. The service seems to be rather attractive, as quite a lot of operators, equipment manufacturers and other representatives have participated in the standardization work. It can consequently be assumed that there will be several services offered via MBMS in the near future. MBMS is a solution for transferring light video and audio clips, although real streaming is also possible via the system. This paper presents Architecture, functioning, and applications of multimedia broadcasting and multicasting.

Keywords - Multicasting, Broadcasting, Multimedia.

1. Introduction

Multicast and broadcast service (MBS), or multimedia broadcast/multicast services (MBMS), is one of the important services to be supported by the next generation cellular systems. MBS is a point-to-multipoint service, where data packets are transmitted simultaneously from a single source to multiple destinations [1]. MBS provides an efficient usage of radio/spectrum resources via transmitting the same data through a common broadcast or multicast channel. Potential MBS services include streaming services, file download services, and carousel services (combination of streaming and file download services aspects with repetition and update to reflect changing circumstances) [2].

MBMS has been standardized in various groups of 3GPP (Third Generation Partnership Project), and the first phase standards are to be finalized for UMTS release 6. The service seems to be rather attractive, as quite a lot of operators, equipment manufacturers and other representatives have participated in the standardization work. It can consequently be assumed that there will be several services offered via MBMS in the near future. MBMS is a solution for transferring light video and audio clips, although real streaming is also possible via the system. MBMS provides both multicasting and broadcasting of multimedia. A broadcast service can be generalized to mean a unidirectional point-to-multipoint service in which data is transmitted from a single source to multiple terminals (UE, user equipment) in the associated broadcast service area. In the other words, broadcast services can be called push-type services. On the other hand, a Multicast Service can be defined as a unidirectional point-to-multipoint service in which data is transmitted from a single source to a multicast group in the associated multicast service area. Only the users that are subscribed to the specific multicast service and have joined the multicast group associated with the service can receive the Multicast Services. As a difference, a
Broadcast Service can be received without separate indication from the customers. [3] In practice, multicast users need a return channel for the interaction procedures in order to be able to subscribe to the desired services.

MBMS is thus a unidirectional point-to-multipoint service in which data is transmitted from a single source entity to a group of users in a specific area. As its name indicates, MBMS has two modes in practice: broadcast mode and multicast mode. MBMS provides a new method for transferring data for the number of users simultaneously. As a general rule of the evolution path of GSM (Global System for Mobile communications) and UMTS (Universal Mobile Telecommunications System) networks and terminals, backwards compatibility issues apply also to MBMS. This means that MBMS will not interfere with already existing GSM and UMTS services, and mobile terminals not supporting MBMS will work in networks that offer MBMS for customers with MBMS capable terminals [4]. This paper presents dynamic Channel Allocation schemes, by considering the condition for enabling the MBS zone technology.

2. Architecture of MBMS

The architectural model of MBMS can be seen in Figure 1 [5][6]

The Gmb reference point (Figure 1) handles the broadcast multicast service center (BM-SC) related signaling, which includes the user specific and bearer service messages. MBMS bearer service specific Gmb signaling includes the following issues:

- The GGSN establishes the MBMS bearer context and registers at BM-SC.
- The GGSN (gateway GPRS support node) or the BM-SC releases the MBMS bearer context and deregister the GGSN from the BM-SC.
- The BM-SC indicates session start and stop to the GGSN including session attributes like QoS or MBMS service area.

User specific Gmb signaling includes:

- The BM-SC authorizes the user specific MBMS multicast service activation at the GGSN.
- The GGSN reports to the BM-SC the successful user specific MBMS multicast activation to allow the BMSC to synchronize the BM-SC UE MBMS context and charging with the MBMS UE contexts in SGSN (serving GPRS support node) and GGSN.
- The GGSN reports to the BM-SC when a user specific MBMS multicast service is released or deactivated (e.g. when the radio contact is lost) to synchronize BM-SC UE MBMS contexts and charging with the MBMS UE contexts in SGSN and GGSN.
- The BM-SC initiates the deactivation of a user specific MBMS bearer service when the MBMS user service is terminated.

The BM-SC (broadcast multicast service center) includes functions for MBMS user service provisioning and delivery. It may serve as an entry point for content provider MBMS transmissions, used to authorize and initiate MBMS Bearer Services within the PLMN, and can be used to schedule and deliver MBMS transmissions. The BM-SC is a functional entity, which must exist for each MBMS User Service. According to the specifications, the following requirements apply to BM-SC:

- The BM-SC shall be able to authenticate 3rd party content providers, providing content for MBMS transmissions.
- 3rd party content providers may wish to initiate an MBMS transmission. In such cases, the BM-SC shall be able to authorize content

Figure 1. The architecture of MBMS.
providers to transmit data over MBMS bearer services depending on operator policy.

- The BM-SC shall be able to verify the integrity of data received from content providers.
- The BM-SC shall be able to generate charging records for content provider transmitted data.
- The BM-SC shall be able to provide service announcements for multicast and broadcast MBMS user services.
- The BM-SC shall be able to provide the UE with media descriptions specifying the media to be delivered as part of an MBMS user service (e.g., type of video and audio encoding).

The following list identifies the most important User Equipment requirements:

- The UE shall support functions for the activation/deactivation of the MBMS bearer service.
- Once a particular MBMS bearer service is activated, no further explicit user request is required to receive MBMS data although the user may be notified that data transfer is about to start.
- The UE shall support security functions as appropriate for MBMS.
- The UE should, depending on terminal capabilities, be able to receive MBMS user service announcements, paging information (non MBMS specific) or support simultaneous services (for example the user can originate or receive a call or send and receive messages whilst receiving MBMS video content). Reception of this paging or announcements may however, create losses in the MBMS data reception. The MBMS user service should be able to cope with such losses.
- Some UE depending upon terminal capability may be able to store MBMS data. This may involve DRM but this is out of scope of this document.
- The MBMS session identifier contained in the notification to the UE shall enable the UE to decide whether it needs to ignore the forthcoming transmission of MBMS session (e.g., because the UE has already received this MBMS session).

The cell broadcast center (CBC) may be used to announce MBMS user services to the users. The SGSN may use CAMEL (customized applications for mobile network enhanced logic) to handle prepaid services, e.g., credit checking for on-line charging. The BM-SC might use OSA-SCS (open service access) to interact with third parties.

3. Functioning of MBMS

As the term Mobile Broadcast/Multicast System indicates, there are two types of service modes included in practical solutions: broadcast and multicast modes.

3.1 Broadcast Mode

The broadcast mode refers to a unidirectional point-to-multipoint type of transmission of multimedia data from a single source to all users that are found in a defined broadcast service area. The broadcast mode uses radio resources efficiently, since the data is transmitted over a common radio channel. MBMS data transmission adapts to the most logical RAN capabilities, depending also on the availability of radio resources. If needed, the bit rate of MBMS data may be varied in order to optimize radio resources. Figure 2 shows the basic principle of the broadcast mode of a MBMS network in order to broadcast several high data rate services within the defined broadcast service area via a packet switched (PS) core network.

![Figure 2. The basic principle of the MBMS broadcast mode.](image-url)
over an extended period of time. The broadcast mode is an enabler for the broadcasting of multimedia services. It differs, though, from the “traditional” messaging services of GSM or UMTS, being more versatile. Similarly as in cell broadcast functionality, users should be able to control the enabling or disabling of the MBMS broadcast mode service (e.g. the receiving of welcoming notes). The broadcast mode cannot guarantee the error correction of the transmitted data by any means. Nevertheless, the terminal may be able to recognize data loss that occurs during reception.

3.2 Multicast Mode

The difference between broadcast and multicast modes is that the user does not need to subscribe in each broadcast service separately, whereas in multicast mode, the services can be ordered separately. The subscription and group joining for the multicast mode services could be done by the mobile network operator, the user him/herself or a separate service provider. The current understanding about the broadcast mode is that the services are not charged, whereas the multicast mode can provide services that are billed. A multicast service might consist of a single on-going session or may include several simultaneous multicast sessions over an extended period of time. Figure 3 shows the MBMS multicasting mode. One of the examples of the multicast mode service could be sport event result information, which requires a subscription. Logically, the service could mean an extra charge for the subscriber, depending on the service provider’s billing strategies.

As in broadcast mode, multicast services cannot be guaranteed over the radio network. Nevertheless, the reliable data transmission of applications and services can be enhanced using proper higher layer methods for protecting the data.

4. Applications of MBMS

MBMS can be used as an enabler for various data streaming services. In practice, MBMS can be used for any kind of services, regardless of the content, as long as the limitations of the data transmission (data rate, possible errors etc.) do not cause major problems to the quality of service. Compared to the “traditional” broadcast messaging solutions of e.g. GSM (cell broadcast, CB), MBMS provides a multimedia type of transferring method with relatively high data rates and considerably greater capacity than CB is capable of doing. Nevertheless, due to its characteristics, MBMS might not be an optimal solution for providing long-duration broadcasting streams, e.g. complete videos or television programs. Instead, DVB-H type of networks can handle the program type that needs constant streaming more efficiently. The MBMS service scenarios can be divided into three main groups: streaming (continuous data flow), download (and play) and carousel. The latter one means the method to deliver contents repeating or updating the transmission of the data cyclically (comparable to the text television) [4].

Some of the identified applications for MBMS could be the following ones:

- News clips; the contents could be differentiated for separate news channels of MBMS areas (main news, sports results, economics etc.). The stream could be continuous, or it can be ordered separately. The service can be realized e.g. by the text distribution, picture delivery or low quality video.
- Audio stream; as MBMS is offering a method to broadcast data stream for the big audience, the traditional radio type of broadcast with stereophonic sound is also feasible. Via MBMS, the more specialized solutions can be realized, as music clips and important voice notifications. The audio clip could be delivered automatically (“the musical entertainment session of the week”).
- Localized services; there might be e.g. a local tourist information channel offered via
MBMS, showing the most important places, restaurants etc. as a continuous stream.

- Combined audio and picture / video clip services. This service applies to various applications. Some examples are the advertisements, interactive television voting (beauty contests) and real time betting.
- Video distribution services, either via streaming, carousel or downloads methods.

5. Conclusion

Multimedia multicast and broadcast service (MBS) over wireless links, such as mobile TV and IP radio broadcasting, has become a fast growing application. MBMS has been standardized in various groups of 3GPP (Third Generation Partnership Project), and the first phase standards are to be finalized for UMTS release 6. The service seems to be rather attractive, as quite a lot of operators, equipment manufacturers and other representatives have participated in the standardization work. In this paper we present the architecture, functioning, and applications of multimedia broadcasting and multicasting.

References


[3] 3GPP TS 22.146. Multimedia Broadcast/Multicast Service (MBMS); Stage 1 (Release 6).

[4] 3GPP TS 22.246. Multimedia Broadcast/Multicast Service (MBMS) user services; Stage 1 (Release 6).
