

xMB Interface for eMBMS Content Delivery in Release 14

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Summary

The xMB reference point has been recently specified as a part of the 3GPP Release 14 Work Item on Enhanced TV Services. This document summarizes the background, overview, and capabilities of the interface.

Introduction

3GPP Release 14 [1] specification has been functionally frozen by June 2017, and has since been covered by various publications [2], [3]. This release focuses on enhancing several service scenarios, as outlined by 3GPP TR 22.891 [4]. These use cases were addressed by a number of work-items (WI) within several 3GPP working groups. A list and summary of these WIs can be found in 3GPP TR 21.914 [5].

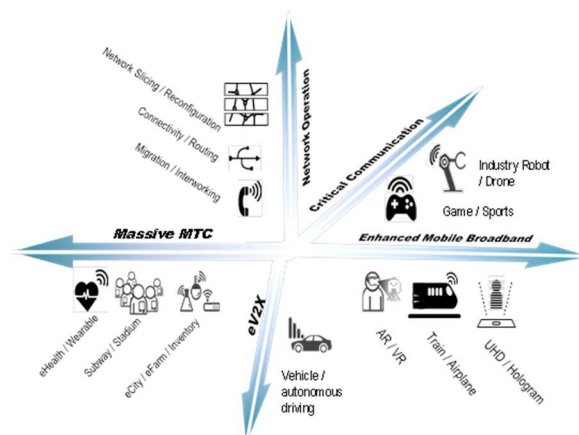


Figure 1: The grouping of the 3GPP Release-14 use cases [4]

One of these WIs covering several of the above use cases is the "Enhancement for TV Service" WI. The main purpose of this WI is making the 3GPP content delivery platform, specifically eMBMS,

more attractive to content providers. This included: providing support for free-to-air services (a use case that involved supporting receive-only eMBMS mode with no operator subscription), define a transparent pass-through mode in eMBMS, and allow flexible usage of an eMBMS carrier ranging up to 100%. Finally, and the main focus here, the WI led to the specification of the xMB reference point, which enables content providers to interface with the Broadcast-Multicast - Service Centre (BM-SC).

3GPP technical specification groups SA1, SA2, SA4, as well as CT1, CT3, CT4, and CT6 worked on specifying various different aspects of this WI. The xMB reference point defined as a part of this WI made it possible to decouple eMBMS transport from content and service layers, in addition to enabling all the considerations of this WI noted above. Also, it assists in setting up the functionality of local eMBMS, single-cell point to multipoint (SC-PTM), as needed by V2X scenario specified in 3GPP TS 23.285 [6].

Details

The xMB reference point is defined between the Content Provider/Multicast Broadcast Source and BM-SC as depicted in Figure 2, highlighted in red. The necessity of this interface is obvious by the fact that any content provider interested in delivering services over eMBMS needs a well-defined interface towards the operator network. In the absence of such a defined interface, the task is essentially left to individual equipment vendors to come up with proprietary interfaces. This lack of a standardized interface has been severely detrimental for content providers' adoption of eMBMS features, since they have to cope with the different interfaces offered by different operators. This is one of the main reasons to specify this interface as a part of the WI in Release 14.

Further, this interface enables the receive-only eMBMS, which allows for delivering services in a way that is closest to the existing broadcast reception terminals. Such traditional terminals (e.g. TV sets) do not require a subscription (in contrast to the traditional UEs that always need a subscription even to receive a broadcast service). In conjunction with the transport mode enabled by the xMB reference point, the resulting system allows broadcasters to deliver their existing services over eMBMS. These factors emphasize the importance of the xMB interface for Enhanced TV Services WI.

At the same time, care has been taken in specifying the xMB reference point as to not hamper some necessary flexibility in the detailed security and user-plane aspects.

In this 3GPP context, the content provider/Multicast Broadcast Source is the source of the discrete and continuous media, as well as service descriptions and control data to the BM-SC, to be offer as the broadcast/multicast services via the operator network. In addition, the content provider can also act as a V2X application server as specified in 3GPP TS 23.285 [6].

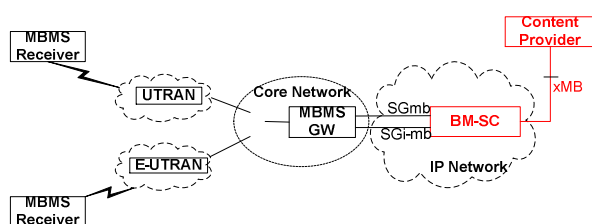


Figure 2: Highlighted xMB reference point within MBMS network architecture [7]

The content provider/Multicast Broadcast Source may reside within the operator's network or may be provided from outside the operator's network.

In the context of the xMB reference point, the BM-SC represents the peer endpoint to the content provider for all the communication on the xMB reference point. The complete functionality of the BM-SC is defined in 3GPP TS 26.346 [7], with the

addition of the V2X services defined in 3GPP TS 23.285 [6].

The xMB API

The stage-2 definition of the procedures on the xMB reference point are specified in 3GPP TS 26.346 [7]. Based on these, the xMB reference point provides the ability for the content provider to:

- authenticate and authorize BM-SC(s).
- create, modify, and terminate (a) service(s).
- create, modify, and terminate (a) session(s).
- query information about the parameters of services/sessions.
- deliver content to/via the BM-SC(s)

Further, the xMB reference point provides the possibility for the BM-SC to send notifications to the content provider about the status of an eMBMS user's service usage. Further, BM-SC can also retrieve content from the content provider using this interface.

The complete stage-3 xMB RESTful API that realizes this interface is specified in 3GPP TS 29.116 [8]. An overview is provided in the following to give a glimpse of the full potential of the API. Although as planned, the technical and functional specification work for this specification was frozen in June 2017, three category F CRs (CRs targeting corrections and bug-fixes) have been integrated in the specification since that time.

The overall API splits the user- and control-plane procedures as xMB-U and xMB-C, respectively, as depicted by Figure 3. The significant part of the stage-3 specification, as expected, deals with the procedures on the control plane.

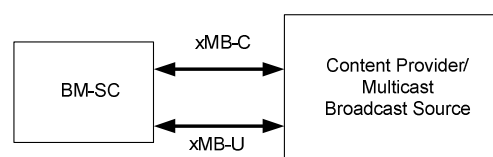


Figure 3: Split of user- and control-plane procedures on the xMB reference point [8]

Resources

The available resources on the xMB reference point API are *services* and *notifications*; *sessions* and *reports* are the sub-resources of the *services* resource.

Available API Operations

The following section provides a high-level overview of the available API operations and the important parameters that can be interacted upon by the API. This section hence provides a fair idea about the capabilities of this API. Further details of the parameters for each operation and the corresponding response codes are specified in 3GPP TS 29.116 [8]. Each operation can only be performed by an authenticated content provider entity after achieving the required authorization.

Creating and modifying Services and Sessions

A service is created by using the HTTP POST message: POST `/services`. A created service can be updated by using the HTTP PATCH or HTTP PUT method with the following syntax: PATCH `/services/{service-id}` or PUT `/services/{service-id}`. Having two methods for the same purpose may seem superfluous, however the purpose of providing the HTTP PATCH method was to handle the case when only a few parameters of a service needed to be modified.

A session for a given service can be created by using either HTTP POST method by providing the ID of the said service (`service-id`) with the following syntax: POST `/services/{service-id}/sessions`. A session with a given session identifier `session-id` of a service can be updated by either HTTP PUT or HTTP PATCH method using the syntax: PATCH `/services/{service-id}/sessions/{session-id}` or PUT `services/{service-id}/sessions/{session-id}`.

Among these, method PUT is more suitable for initial creation of a session while PATCH is more suited for just updating a few parameters of an existing session.

Retrieving Services and Sessions

All the services at the BM-SC created by a content provider can be returned by the operation: GET `/services`. A service for a given identifier `service-id` can be retrieved by the content provider by the operation: GET `/services/{service-id}`.

All the sessions of a given service with the identifier `service-id` can be retrieved by the operation: GET `/services/{service-id}/sessions`. A specific session with the identifier `session-id` for a service can be retrieved by the operation: GET `/services/{service-id}/sessions/{session-id}`.

Highlighted Services and Sessions Parameters

Although it's not possible to deem any of the parameters (specified in 3GPP TS 29.116 [8]) of the services and sessions resource to be less important than the others, there are a few important parameters worth highlighting here.

A content provider can configure a free-to-air service by the receive-only-mode `Services` parameter. The parameters of the `Sessions` sub-resource provide the possibility to configure the start and stop times of a given session, the bitrate and delay parameters, its geographical area etc.

Four important session types are defined:

- Transport-mode session is where the content provider delivers a service in a transparent fashion using BM-SC provided IP interface.
- An application session is for example DASH services, and a list of parameters for this session type enables such a service, details can be found under the application-session `Sessions` parameter in [8].
- Streaming session are focused on e.g. RTP streams while files session is provided to deliver typically a number of files.
- Finally, local-mbms-delivery parameters are used for setting up local MBMS for V2X scenario.

Deleting Services and Sessions

A service with a service identifier `service-id` can be deleted by the authorized content provider entity using the operation: DELETE `services/{service-id}`. Correspondingly, a session can be deleted using

the operation: DELETE /services/{service-id}/sessions/{session-id}.

Retrieving Reports and Notifications

All the reports of a service and correspondingly session can be retrieved by the operations: GET /services/{service-id}/reports and GET /services/{service-id}/sessions/{session-id}/reports, respectively. A specific report with the identifier report-id for a session or service can be retrieved by the operation: GET /services/{service-id}/reports/{report-id} and GET /services/{service-id}/sessions/{session-id}/reports/{report-id}, respectively.

Notifications pertaining to the content provider stored at the BM-SC can be retrieved by the operation GET /notifications. The xMB API also provides the possibility of push notifications from the BM-SC to the content provider. This is configured by the content provider using the push-notification-configuration property of the Services resource, along with the provided HTTP URL to be notified by the property push-notification-url. The BM-SC then pushes the said notifications to the content provider using HTTP POST method. The push method of notification is not a part of the RESTful API documented preceding this.

xMB Security

SA3 provided the security guidelines for securing the stage-2 and correspondingly the stage-3 of the xMB reference point in 3GPP TS 33.246 [9]. According to this, xMB-C and xMB-U traffic is mandated to only be sent over secured transport channels that are established after successful authentication and authorization. These procedures are specified in 3GPP TS 29.116 [8]. On a high-level, (D)TLS (specified in 3GPP TS 33.246 [9]) is mandated to be used to authenticate the BM-SC and the content provider. Authorization shall be performed after the successful completion of (D)TLS authentication. Domain- and user-based authorization, as specified by 3GPP TS 33.246 [9] provide the coarse- and fine-grain level of authorization, respectively. As indicated before, the detailed aspects of the fine-grain security are beyond the

scope of the xMB specification to allow for the necessary flexibility of realization.

References

- [1] 3GPP Release 14, [Online] Retrieved Dec. 2017: www.3gpp.org/release-14
- [2] "Wireless Technology Evolution Towards 5G: 3GPP Release 13 to Release 15 and Beyond," 5G Americas, February 2017.
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- [4] 3GPP TR 22.891 V14.2.0, "Feasibility Study on New Services and Markets Technology Enablers; Stage 1 (Release 14)", Sep. 2016.
- [5] 3GPP TR 21.914 V0.9.0, "Summary of Rel-14 Work Items (Release 14)," Nov. 2017.
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- [8] 3GPP TS 29.116 V14.2.0, "Representational State Transfer over xMB Reference Point between Content Provider and BM-SC; (Release 14)," Sep. 2017.
- [9] 3GPP TS 33.246 V14.2.0, "Security of Multimedia Broadcast/Multicast Service (MBMS)," Sep. 2017.

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