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Title	**Reference Model and Protocol Architecture for Supporting E-MBS in IEEE 802.16m**
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Re:	IEEE 802.16m-07/040 - Responds for Call for Contributions on Project 802.16m System Description Document (SDD)
Abstract	This contribution proposes the IEEE 802.16m reference model and protocol architecture from supporting E-MBS point of view.
Purpose	For discussion and approval by TGm
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Reference Model and Protocol Architecture for Supporting E-MBS in IEEE 802.16m

Chun-Yen Wang, Richard Li, Chun-Yuan Chiu, Chie-Ming Chou, Fang-Ching (Frank) Ren, Ting-Chen (Tom) Song, Wern-Ho sheen

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1. Introduction

In the IEEE 802.16m system requirement document (SRD) [1], it has been agreed that IEEE 802.16m shall support enhanced multicast-broadcast service (E-MBS) in an efficient manner, including to achieve higher spectrum efficiency in multi-cell multicast-broadcast single frequency networks (MBSFN) on both mixed and dedicated frequencies, and to minimize the channel reselection interruption time (especially for the broadcast streaming media services). In addition, IEEE 802.16m shall support switching between E-MBS and unicast services even when they are deployed on different frequencies. Thus, This contribution proposes a reference model and protocol architecture for E-MBS services in IEEE 802.16m to meet these requirements.

2. Discussion

In this section, the reference model and protocol architecture for supporting E-MBS services in 802.16m is discussed. Based on the network architecture in the WiMAX Forum NWG [4], the following E-MBS reference model and functional architecture is proposed.

2.1 Reference Model and Functional Architecture

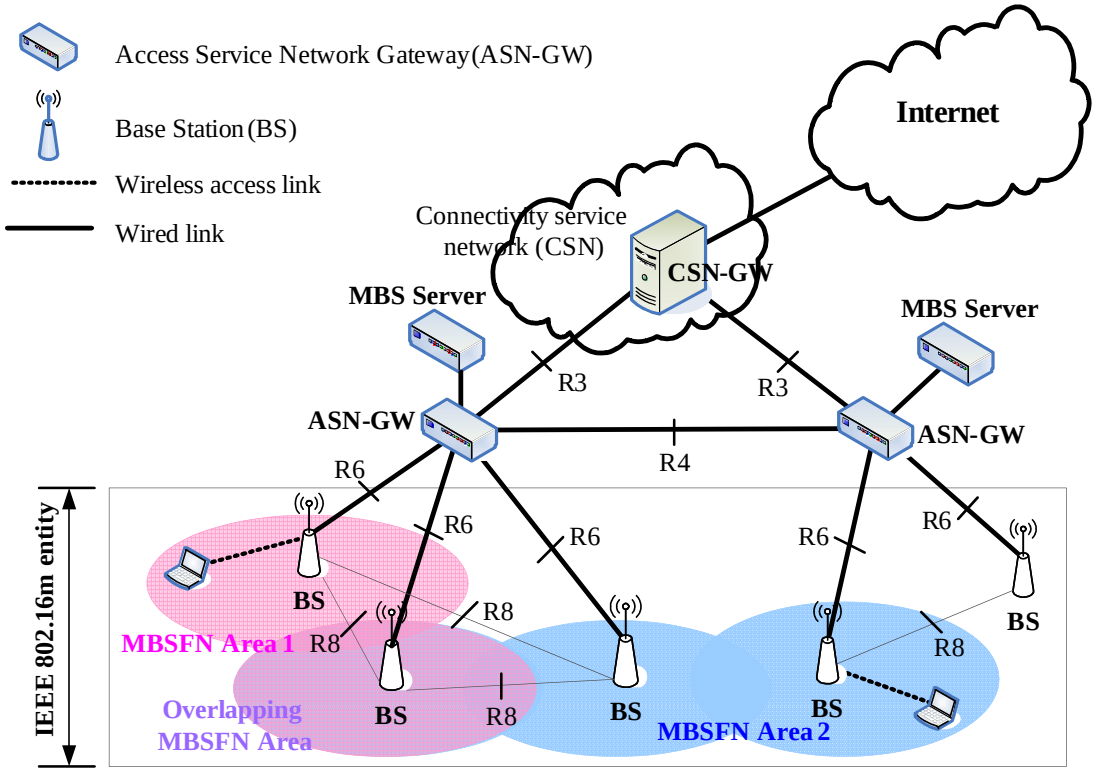

Fig. 1. E-MBS Reference Model

As depicted in Fig. 1, IEEE 802.16m reference model consists of connectivity service network (CSN) and access service network (ASN), with R3 interface being responsible for the communication bridge between CSN and ASN networks. In addition, in order to support E-MBS MBSFN transmission, a logical component called MBS server is necessary to coordinate multiple BSs so as to accomplish macro diversity transmission. Although the detailed design of the network components is outside the scope of TGm task, their functionalities are discussed here as basic assumptions to facilitate the development of the E-MBS services in the 802.16m system.

For supporting E-MBS transmission, the network control and management system shall provide the following functions:
- E-MBS Authentication and Accounting (AAA)
- E-MBS subscription management
- E-MBS service announcement
- E-MBS session management including session start/update/stop
- Scheduling and radio resource (e.g., time/frequency radio resources) and radio configuration (e.g., MCS) allocation for MBSFN transmission
- Function of content synchronization to coordinate BSs for marco diversity
- Dynamic MBSFN area management
- Payload header compression for E-MBS transmission
- Key management and distribution
- Charging

On the other hand, the IEEE 802.16m network consists of base stations (BSs) and mobile stations (MSs). BSs are under the control of ASN gateway through R6 interfaces. In general, BSs are responsible for radio resource management, mobility management, measurement report configuration for mobility and data scheduling, etc. However, when considering E-MBS transmission, BSs shall further support the following functions:
- Support single-BS access and MBSFN transmission mode
- Support E-MBS transmission via mixed and dedicated carriers
- Transmission mode switching procedure
- Scheduling and resource allocation for single-BS access mode
- Re-keying procedure

In addition to the traditional functions such as measurement report, buffer status report, mobility procedure (including cell selection and cell reselection), etc., 802.16m MSs shall support the following new functions for E-MBS services.
- E-MBS service discovery, subscription and reception
- Support E-MBS reception in sleep and idle modes

2.2 E-MBS Protocol Architecture

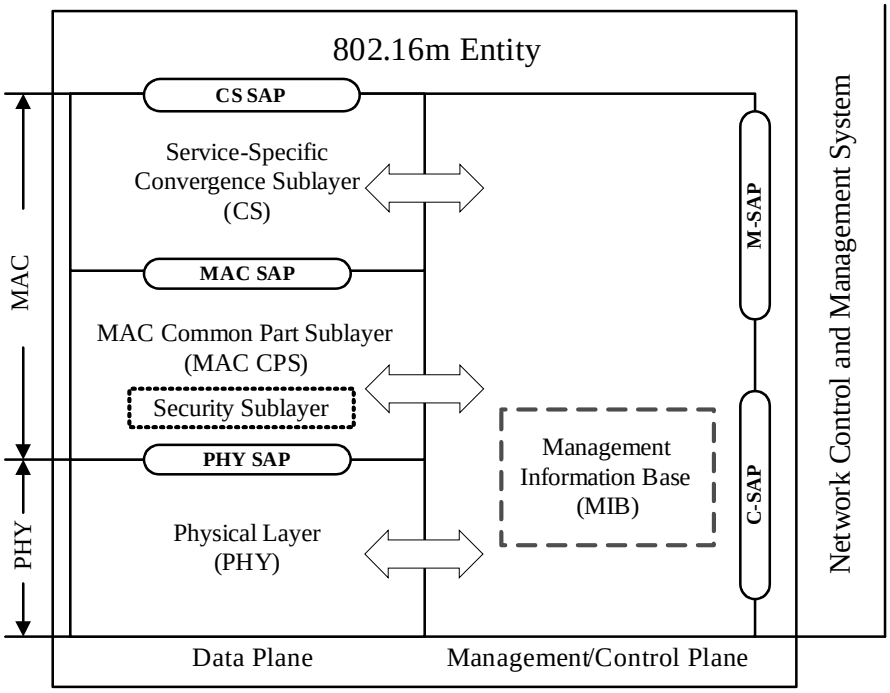

Fig. 2. IEEE 802.16m Protocol Layer

In order to minimize the implementation complexity, the maximum commonality between multicast/broadcast and unicast transmission shall be maintained. As shown in Fig. 2, the proposed IEEE 802.16m protocol stack for E-MBS is similar to that for unicast transmission [3] with some modifications as detailed as follows.

The service-specific CS is responsible for service classification and payload header compression (PHS). However, for E-MBS transmission, payload header compression (PHS) (if required) shall be done in the ASN gateway. That is because we can save many efforts to maintain the header compression context synchronized between multiple BSs to achieve macro diversity transmission. Furthermore, if the PHS is performed in ASN gateway, there is only one compressor context per E-MBS service, so MS's decompressor context can keep the same when moving into a new cell. Therefore, performing PHS in ASN gateway for E-MBS transmission can save E-MBS handover interruption time and reduce extra implementation complexity.

Proposal: The service-specific CS performs payload header compression (PHS) (if required) except for E-MBS transmission.

Most of MAC CPS and PHY functions for single-BS access mode are kept the same as that for unicast transmission to maintain the maximum commonality between E-MBS and unicast transmission. But for MBSFN transmission mode, multiple BSs are mandatory to transmit the same signal at the same time/frequency resource. In other words, some management operations, such as data scheduling in the MAC CPS layer, and the adaptive modulation and coding (AMC) in the PHY layer, shall be controlled by a centralized coordination entity (i.e., MBS server). Thus, we propose to capture the following text into the 16m SDD document.

Proposal:
The MAC CPS shall perform data scheduling except for the MBSFN transmission.

The PHY shall perform adaptive modulation and coding (AMC) except for the MBSFN transmission.

3. Conclusions

In this contribution, a reference model and protocol architecture is proposed for IEEE 802.16m in order to meet the E-MBS requirements, specified in the IEEE 802.16m SRD. Functionalities of each of network components are discussed as basic assumptions to facilitate the development of the E-MBS services in IEEE 802.16m. New functions needed for the E-MBS protocol are pointed out and elaborated. . It is proposed to capture the reference model and protocol architecture into the IEEE 802.16m system description document (SDD).

References

[1] IEEE 802.16m-07/002r4, “802.16m System Requirements”
[2] IEEE 802.16m-07/037r1, “Draft 802.16m Evaluation Methodology”
[3] P802.16Rev2/D1, “Part 16: Air Interface for Broadband Wireless Access Systems”
[4] WiMAX Forum NWG Release 1.0.0

Proposed Text

The following text is proposed to be captured in the IEEE 802.16m system description document (SDD).

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1.1 Reference Model and Functional Architecture

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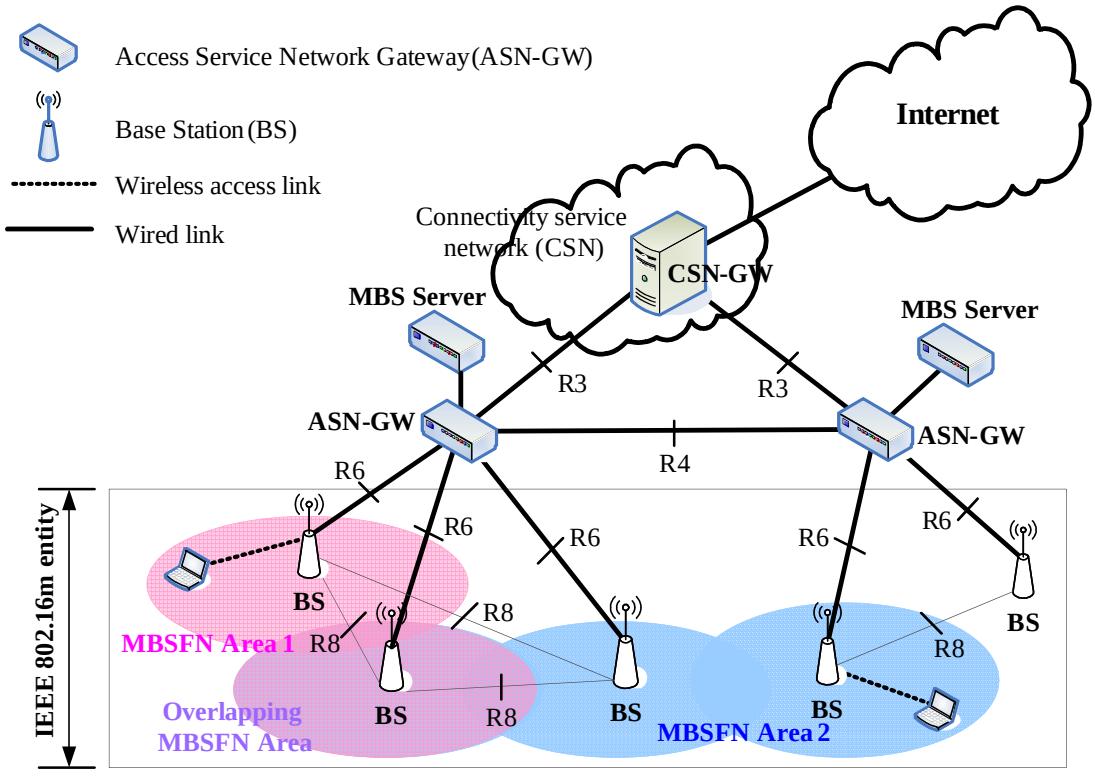

Fig. X. E-MBS Reference Model

As depicted in Fig. X, IEEE 802.16m reference model consists of connectivity service network (CSN) and access service network (ASN), with R3 interface being responsible for the communication bridge between CSN and ASN networks. In addition, in order to support E-MBS MBSFN transmission, a logical component called MBS server is necessary to coordinate multiple BSs so as to accomplish macro diversity transmission. Although the detailed design of the network components is outside the scope of TGm task, their functionalities are discussed here as basic assumptions to facilitate the development of the E-MBS services in the 802.16m system.

For supporting E-MBS transmission, the network control and management system shall provide the following functions:
- E-MBS Authentication and Accounting (AAA)
- E-MBS subscription management
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- Charging

On the other hand, when considering E-MBS transmission, BSs shall further support the following functions:
- Support single-BS access and MBSFN transmission mode
- Support E-MBS transmission via mixed and dedicated carriers
- Transmission mode switching procedure
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- Re-keying procedure

In addition, 802.16m MSs shall support the following new functions for E-MBS services.
- E-MBS service discovery, subscription and reception
- Support E-MBS reception in sleep and idle modes

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---------- *Start of the proposed text* ----------

1.2 Overview of Protocol Layers

[Insert the following text into this section]

The service-specific CS performs payload header compression (PHS) (if required) except for E-MBS transmission.

The MAC CPS shall perform data scheduling except for the MBSFN transmission.

The PHY shall perform adaptive modulation and coding (AMC) except for the MBSFN transmission.

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