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Re:	IEEE 802.16m-07/047, "Call for Contributions on Project 802.16m System Description Document (SDD)", specifically as related to: - Reference Model and potential System Architectures - Protocol Architecture and main functionalities per protocol layer
Abstract	This contribution describes proposed system and protocol architecture for the IEEE802.16m System Description Document.
Purpose	For discussion and approval by TGm.
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Proposal for IEEE 802.16m System and Protocol Architecture

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Fujitsu

1. Introduction

This contribution describes proposed system architecture and protocol architecture for the IEEE 802.16m SDD (System Description Document). For the system architecture, network reference model is shown as informative and network architecture considering legacy support is proposed. Air-interface protocol architecture is based on the IEEE 802.16 standard, and proposed protocol stack and main functionalities per protocol layer are also described.

2. Reference Model and potential System Architectures

2.1. Network Reference Model (Informative)

Figure 1 shows the network reference model for the 802.16m system. It's the same as the model defined by WiMAX Forum NWG [2]. Detailed network architecture of ASN (Access service network) is described in the next section.

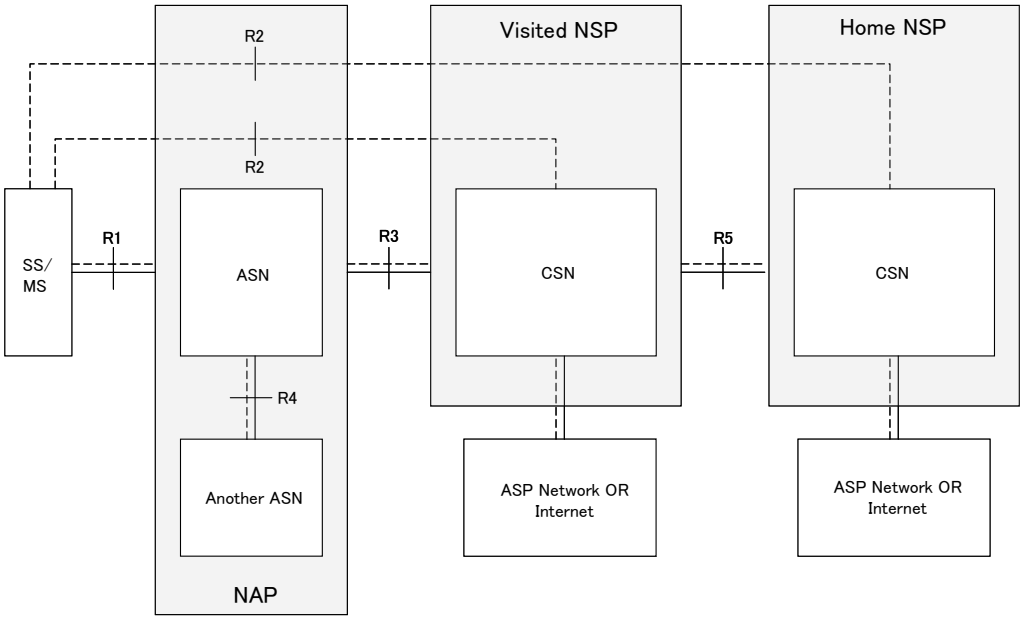

Figure 1 Network Reference Model

2.2. Network Architecture

Figure 2 shows the proposed network architecture.

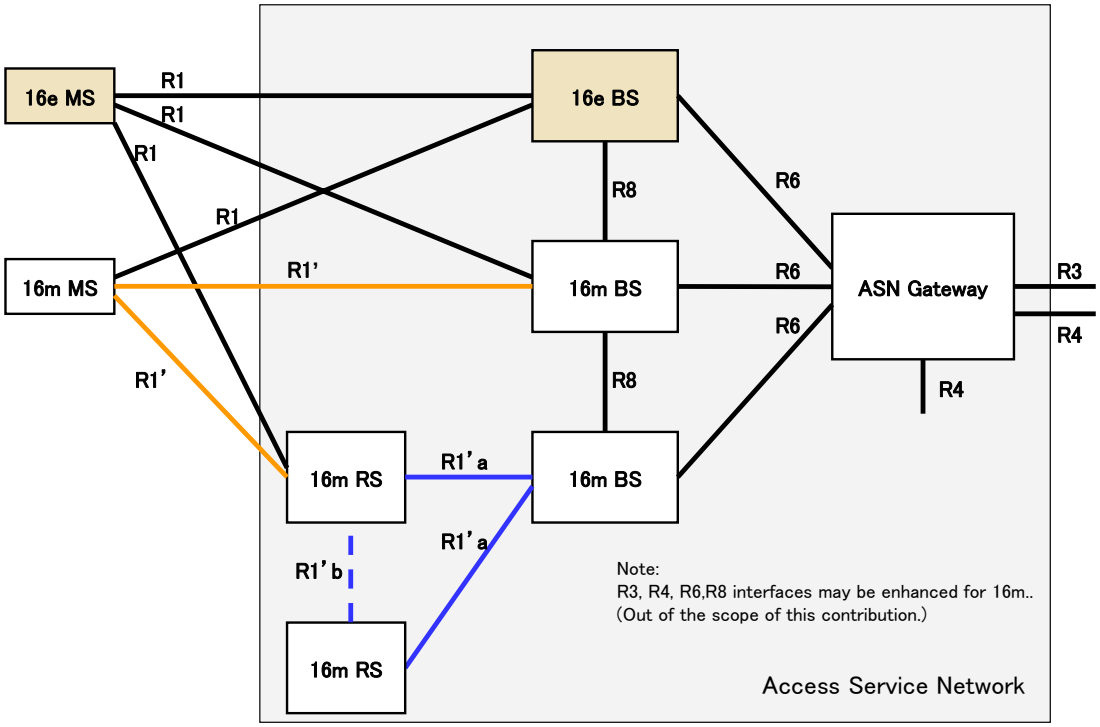

Figure 2 Proposed IEEE 802.16m network architecture

The 16m MS communicates with the 16m BS via R1' interface which is defined by the 802.16m specification. The 16m MS can also communicate with 16e BS via R1 interface to meet the 16m requirements for legacy support [1]. The R1 interface is defined by WirelessMAN-OFDMA Reference System as identified in the 16m System Requirements Document (SRD) [1]. In the latter case the 16m MS performance will naturally be constrained to that of the 16e MS. Similarly 16e MS can also communicate with 16m BS using the R1 interface.

For multi-hop relay support defined in the 16m SRD [1], it is proposed that the 16m MS also communicates with the 16m RS (Relay Station) via R1' interface. The 16m RS relays data and control/management messages to/from the 16m BS via R1'a interface which will be defined in the 802.16m specification. The 16m RS shall also be able to communicate with the 16e MS for legacy support via R1 interface.
The above figure shows two-hop connection case between MS and BS. When more than two-hops are present in the link between MS and BS, the 16m RS can communicate with another 16m RS via the R1'b. Whilst for reasons of low latency it may be desirable to optimize the relay support in a 16m system for 2 hops, the 16m design should not preclude more than 2 hops as many rural deployments can potentially benefit from such functionality.
Note that R3, R4, R6, R8 interfaces may be enhanced for support the 802.16m. (Out of scope of this contribution.)

3. Air-Interface Protocol Architecture

3.1. Protocol Architecture

The proposed 802.16m protocol architecture model is shown in Figure 3 which is the same as the IEEE Std. 802.16 protocol architecture model.

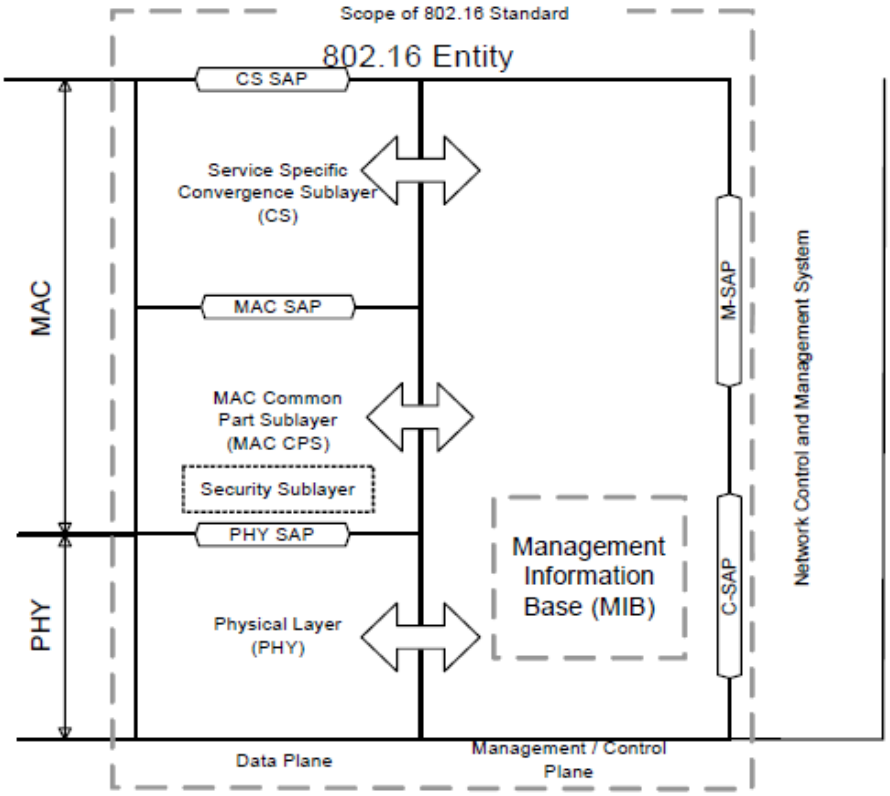

Figure 3 Proposed IEEE 802.16m Protocol Architecture

3.2. Protocol Stack

Figure 4 and 5 show the 802.16m protocol stack for data and control plane based on the layering of proposed protocol architecture as shown in Figure 3.

Convergence Sublayer (CS) is only deployed for the data plane in the BS and MS, not in the RS.

For multi-hop relay support, Security Sublayer may be deployed in the RS for both data and control plane. It depends on the security model and is left for further study.

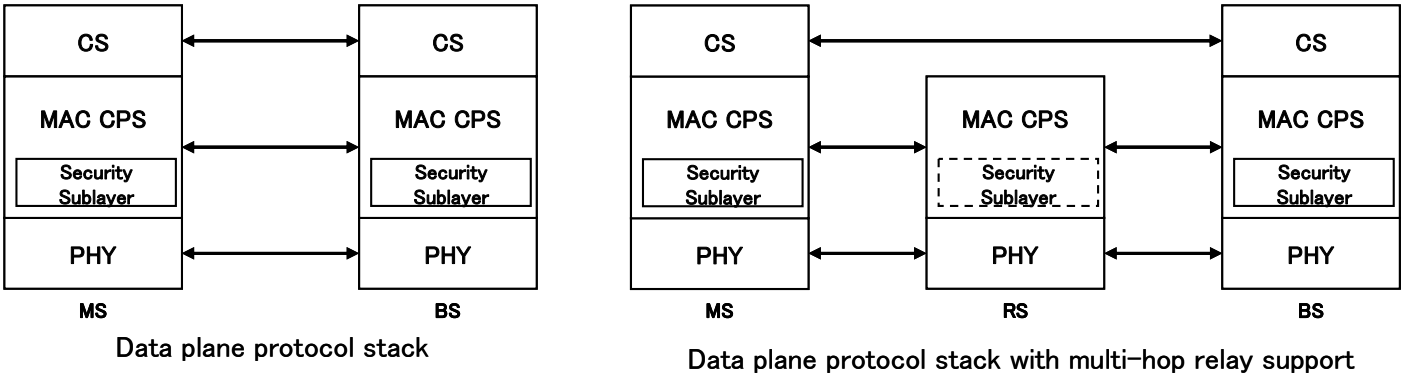

Figure 4 Proposed 802.16m protocol stack (Data Plane)

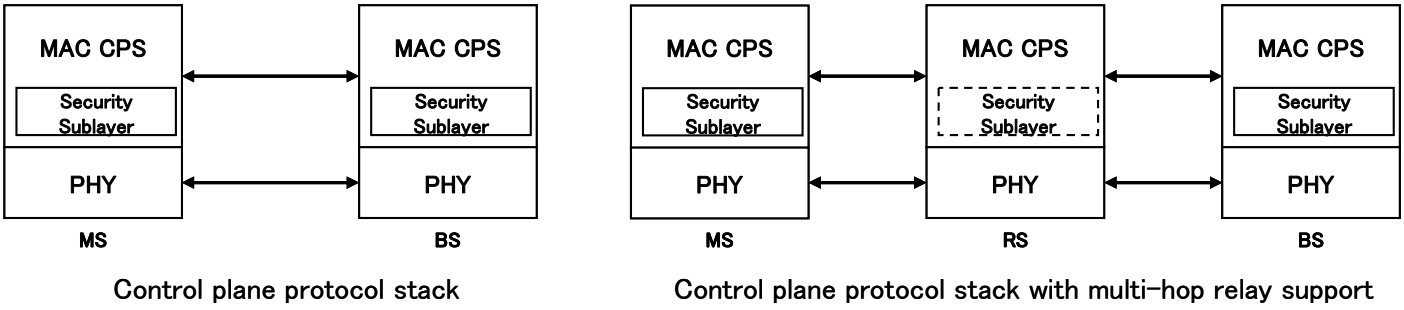

Figure 5 Proposed 802.16m protocol stack (Control Plane)

3.3. Main functionalities per protocol layer

Figure 6 illustrates main functionalities provided by each protocol layer based on the layering of the proposed protocol architecture in Figure 3. The functions are the same as the functions which are defined by WirelessMAN-OFDMA Reference System for legacy support and where necessary are enhanced to satisfy the 802.16m system requirements.

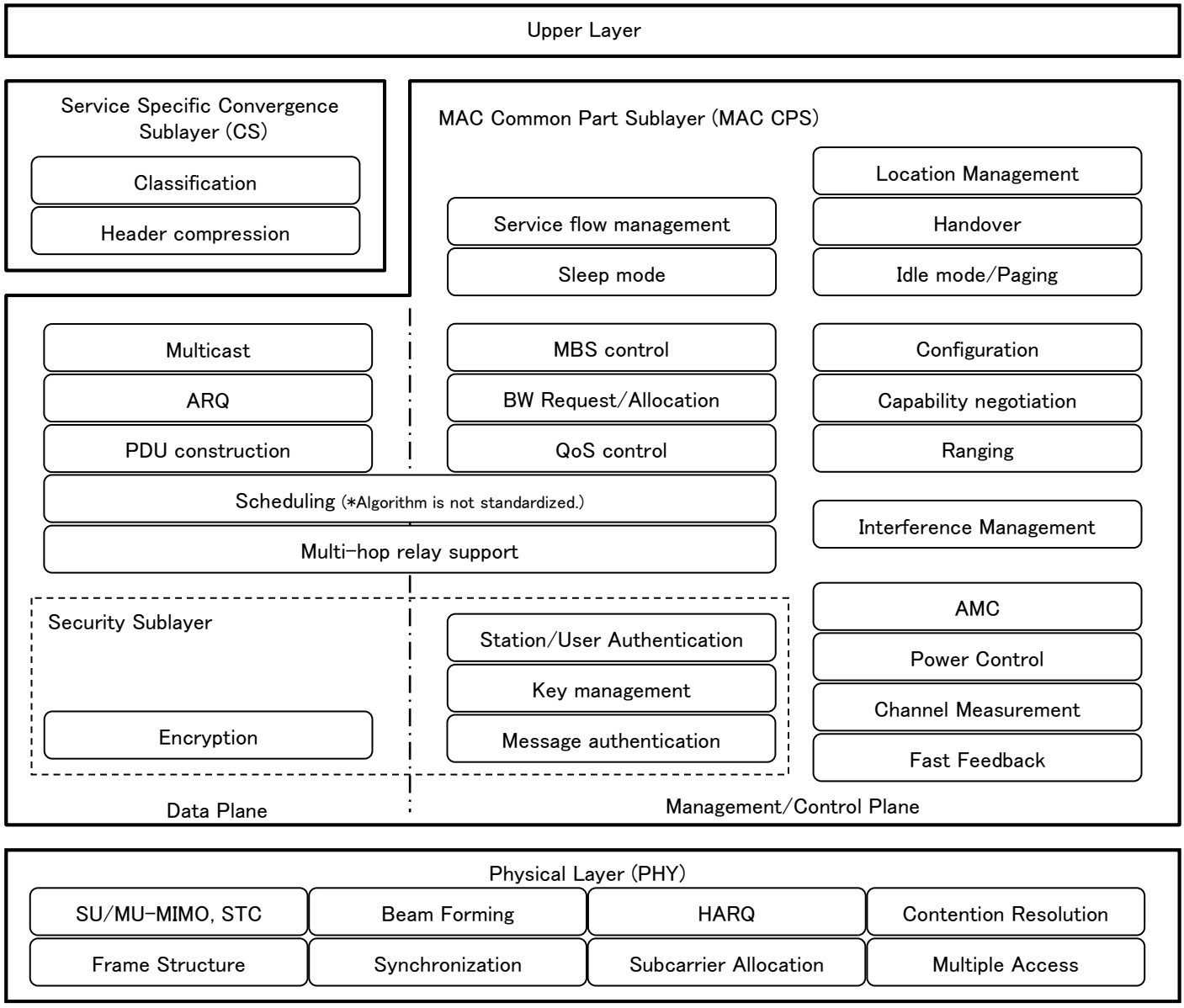

Figure 6 Proposed 802.16m main functionalities

The following is a supplementary explanation for some of the functions in Figure 6 corresponding to the IEEE 802.16e.

- MAC Common Part Sublayer (MAC CPS)

MBS control	Multi-BS synchronization
BW Request/Allocation	CDMA code/Grant Management Header/Piggy Back Request/Polling
QoS control	Scheduling type (UGS/ertPS/rtPS/nrtPS/BE) support
Handover	Advertisement/Scan, Intra-RAT (HO/FBSS/MDHO), Inter-RAT (MIH support)
Configuration	System/node configuration parameter setting
Ranging	Timing and power adjustment, Basic CID management
Interference management	Segmentation, Fractional Frequency Reuse(FFR)
Multi-hop relay support	Data/message forwarding

- Physical Layer (PHY)

Contention resolution	CDMA code, Back-off window control
Multiple Access	OFDMA

4. Proposed Text for SDD

[Insert the following text into chapter 4]

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4 Overall Network Architecture (Informative)

4.1 Network Reference Model (Informative)

Figure x-1 shows the network reference model for the 802.16m system. Detailed network architecture of ASN (Access service network) is described in the next section.

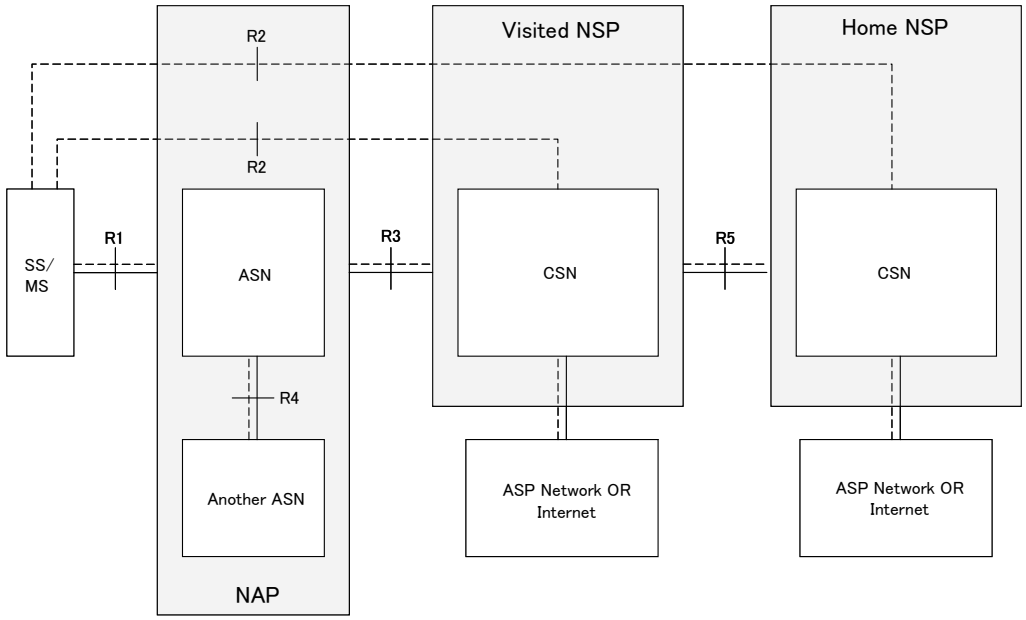

Figure x-7 Network Reference Model

4.2 Network Architecture

Figure x-2 illustrates the network architecture.

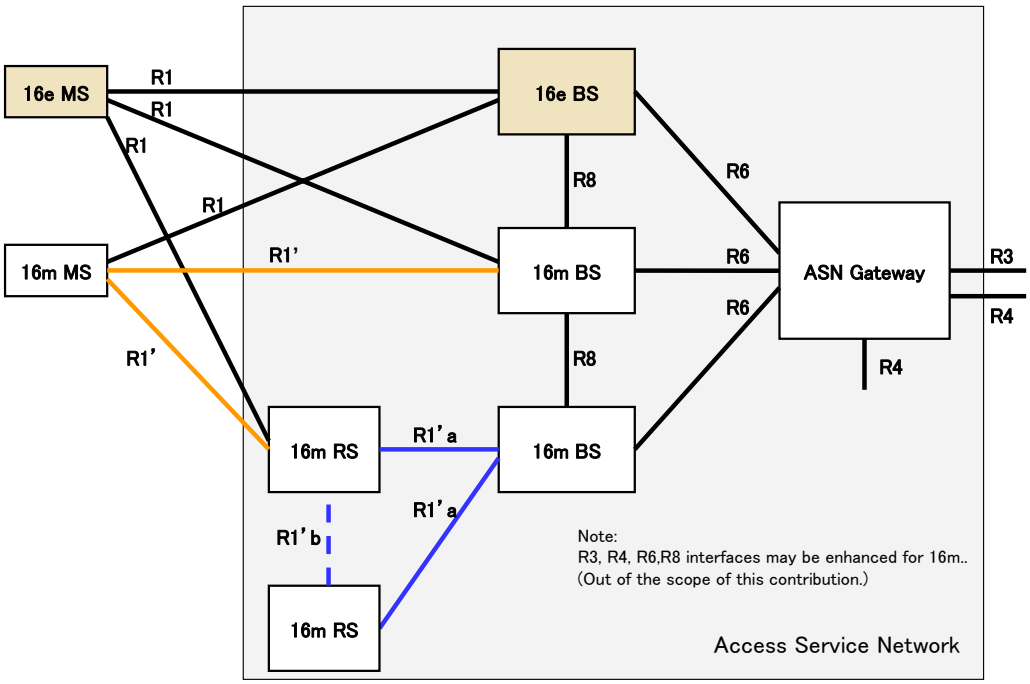

Figure x-8 IEEE 802.16m network architecture

The 16m MS communicates with the 16m BS via R1' interface which is defined by the 802.16m specification. The 16m MS can also communicate with 16e BS via R1 interface to meet the 16m requirements for legacy support [1]. The R1 interface is defined by WirelessMAN-OFDMA Reference System as identified in the 16m System Requirements Document (SRD) [1]. In the latter case the 16m MS performance will naturally be constrained to that of the 16e MS. Similarly 16e MS can also communicate with 16m BS using the R1 interface.

For multi-hop relay support defined in the 16m SRD [1], it is proposed that the 16m MS also communicates with the 16m RS (Relay Station) via R1' interface. The 16m RS relays data and control/management messages to/from the 16m BS via R1'a interface which is defined by the 802.16m specification. The 16m RS shall also be able to communicate with the 16e MS for legacy support via R1 interface.
The above figure shows two-hop connection case between MS and BS. When more than two-hops are present in the link between MS and BS, the 16m RS can communicate with another 16m RS via the R1'b. Whilst for reasons of low latency it may be desirable to optimize the relay support in a 16m system for 2 hops, the 16m design should not preclude more than 2 hops as many rural deployments can potentially benefit from such functionality.

Note that R3, R4, R6, R8 interfaces may be enhanced for support the IEEE 802.16m amendment. However these interfaces are out of scope of IEEE802.16m amendment.

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[Insert the following text into chapter 8]

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8 IEEE 802.16m Air-Interface Protocol Architecture

8.1 Protocol Architecture

Figure x-3 illustrates the 802.16m protocol architecture.

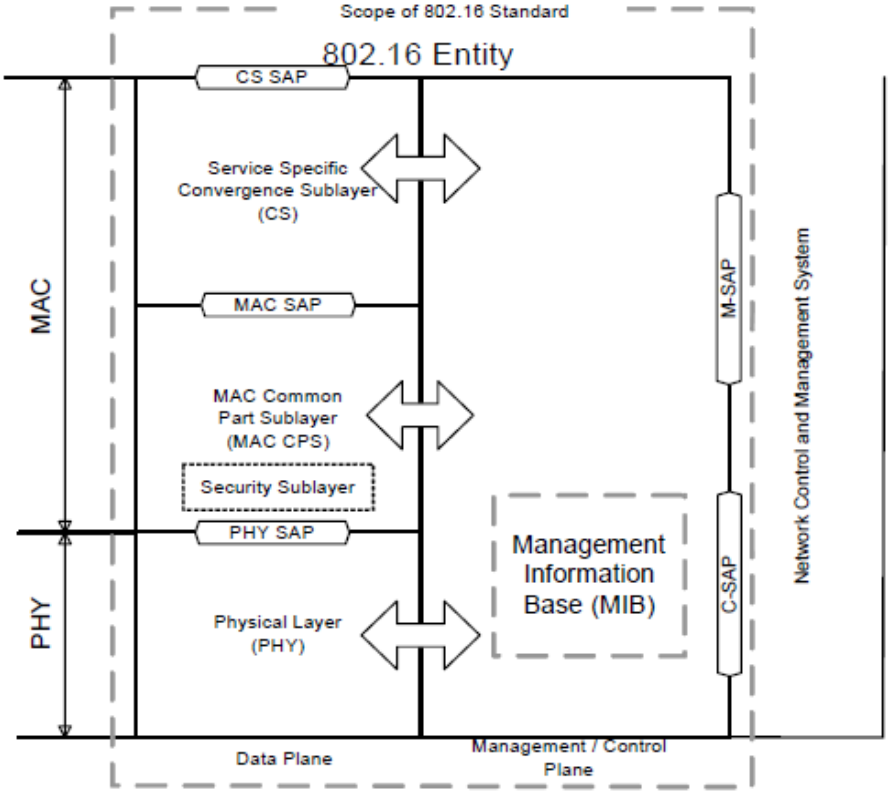

Figure x-9 IEEE 802.16m Protocol Architecture

8.2 Protocol Stack

Figure x-4 and x-5 show the IEEE 802.16m protocol stack for data and control plane based on the layering of protocol architecture in Figure x-3.

Convergence Sublayer (CS) is only deployed for the data plane in the BS and MS, not in the RS.

For multi-hop relay support, Security Sublayer may be deployed in the RS for both data and control plane. It depends on the security model and is left for further study.

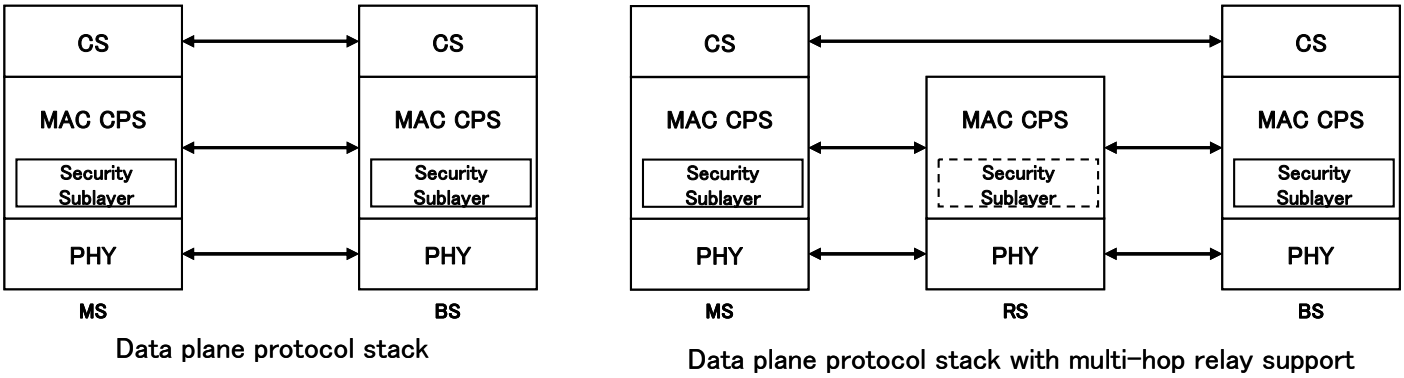

Figure x-10 IEEE 802.16m protocol stack (Data Plane)

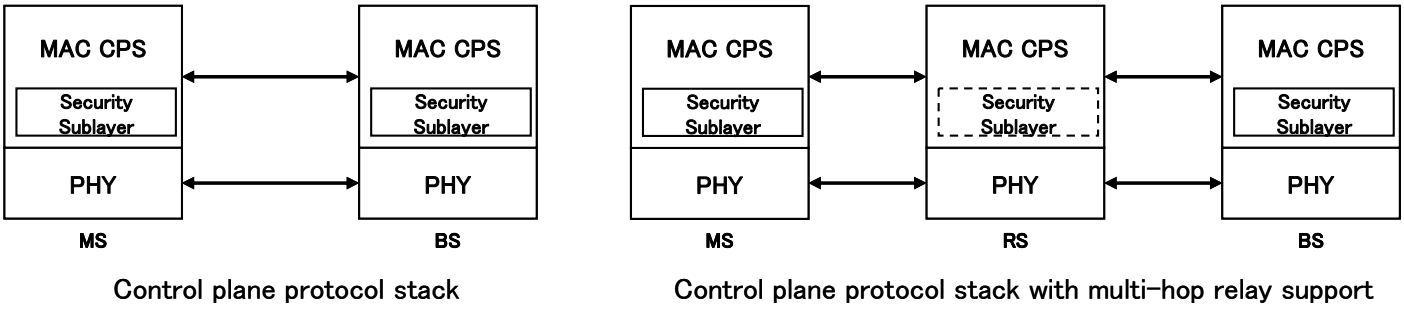

Figure x-11 IEEE 802.16m protocol stack (Control Plane)

8.3 Main functionalities per protocol layer

Figure x-6 shows main functionalities provided by each protocol layer based on the layering of protocol architecture in Figure x-3. The functions are the same as the functions which are defined by WirelessMAN-OFDMA Reference System for legacy support and where necessary are enhanced to satisfy the 802.16m system requirements.

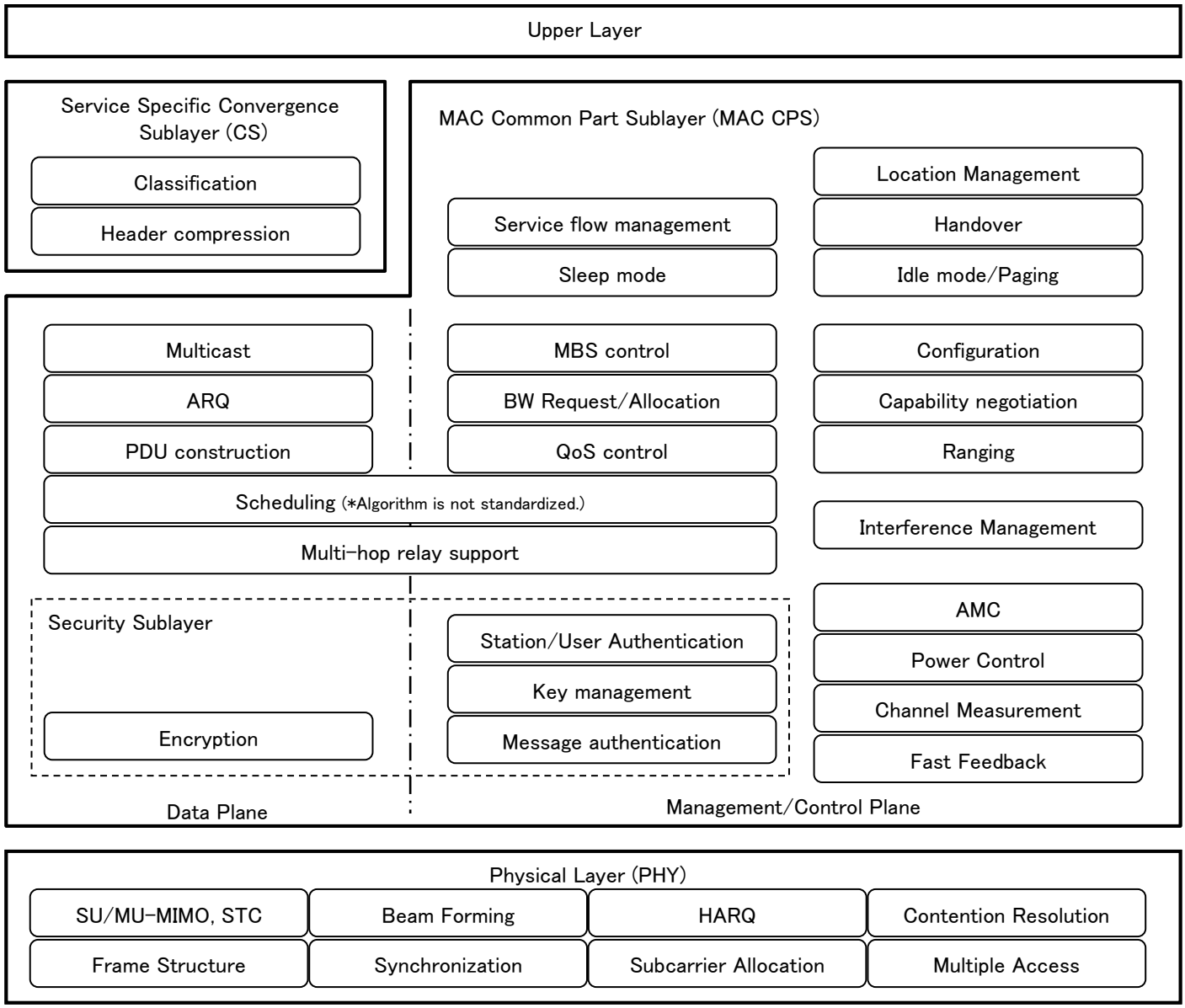

Figure x-12 IEEE 802.16m main protocol functions

---------- Text End ----------

5. References

[1] IEEE 802.16m-07/002r4, “IEEE 802.16m System Requirements”
[2] WiMAX Forum NWG stage2 document, “WiMAX End-to-End Network Systems Architecture”