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Re:	Revised text for sections 8
Abstract	This contribution proposes several changes to the 16m SDD
Purpose	Accept the proposed specification changes into IEEE 802.16m SDD
Notice	
Release	
Patent Policy	

Proposed Modifications to the IEEE 802.16m SDD, Section 8

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NextWave

Introduction

This contribution proposes several editorial and technical modifications to the 802.16m SDD (IEEE C802.16m-08/003)

The technical modifications are mainly in the section 4 and section 8. We also proposed several editorial modifications throughout the SDD. Added text is marked with Blue underlined text. Deleted text is marked with ~~red strikethrough~~ text.

The technical modifications are as follow:

- Section 8
  - The SDD document describes the 802.16m protocol structure as an extension to the 802.16e protocol structure. We do not see a value in elaborating about 802.16e protocol architecture in the 802.16m SDD. Many of the descriptions of the 802.16e protocol architecture are interpretations of what should have been included in 802.16e standard, if we were to write an 802.16e SDD. There is no need to spend any time in the 802.16m SDD on what is the 802.16e architecture. Let's focus on what 802.16m should be. We also see several flaws with using this approach. Several places in the SDD correctly describe functional capabilities of 802.16e, but we should not presuppose that these capabilities should necessarily be supported by 802.16m. For example, several places in the SDD describe the use of sub-headers and extended sub-headers. Another example is the use of MAC level CRC. It is too early to determine if such capabilities need also be supported in 802.16m. Furthermore, we believe that this level of details in the SDD is inappropriate. The content of the SDD should be kept at a sufficiently high level so as to not constrain the 802.16m protocol design work.
  - We propose the partition of the MAC CPS into two sublayers: Resource Control and Management (RCM) and Medium Access control MAC). These terms are already used in the SDD but the SDD does not call them out specially as distinct sublayers

Proposed Text

8 IEEE 802.16m Air-Interface Protocol Structure

8.1 IEEE 802.16m~~e~~ Protocol Structure

The following Figure 1 shows the protocol architecture of IEEE 802.16m~~e~~ which will be used as reference system. The MAC layer is composed of ~~two~~ three sub-layers: Convergence Sublayer (CS), Resource Control and Management (RCM) Sublayer and Medium Access Control (MAC) Sublayer~~MAC Common Part Sublayer (MAC CPS)~~.

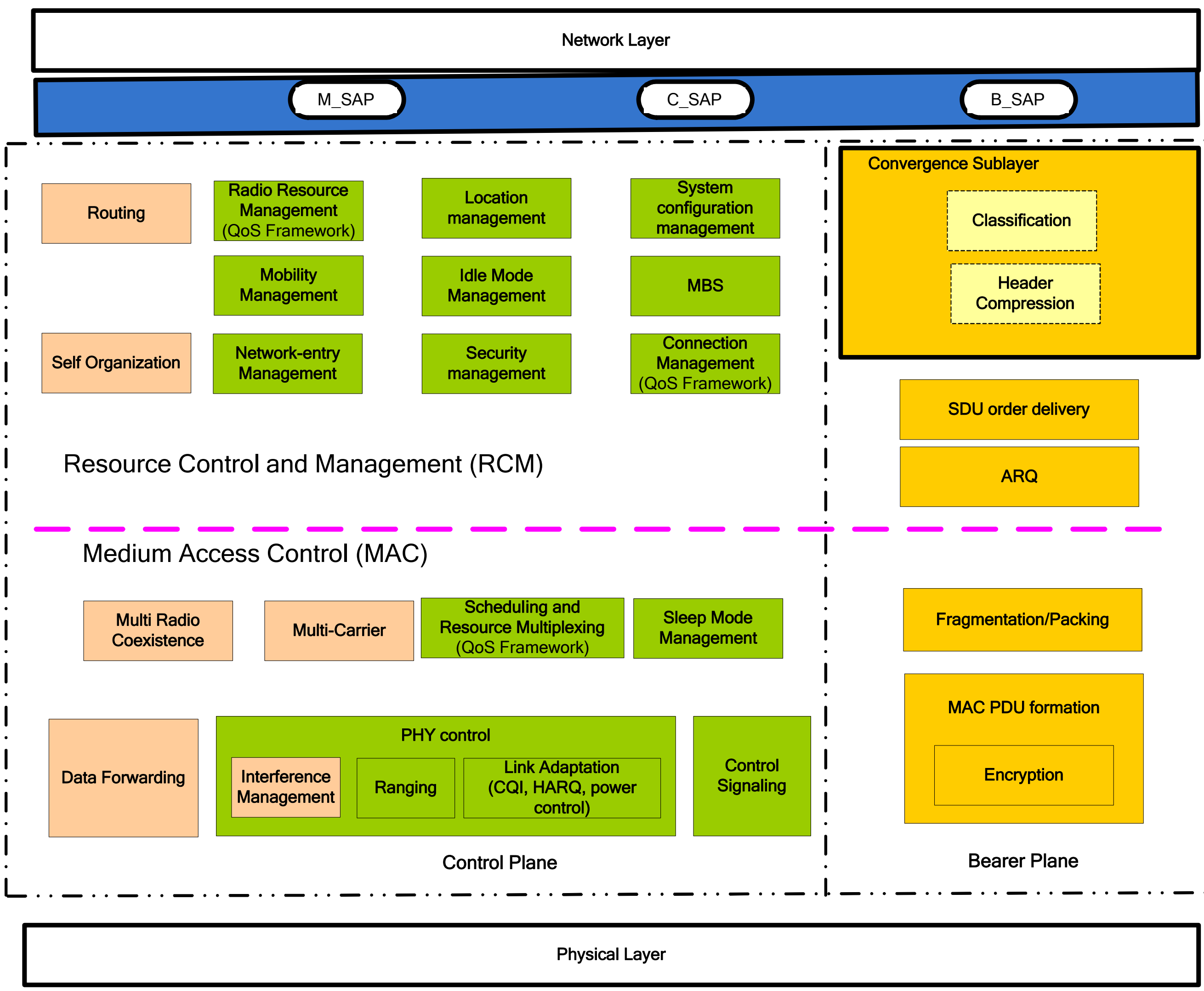


Figure 1 ~~The~~ IEEE 802.16m~~e~~ MS/BS protocol architecture

~~For convenience, the MAC CPS functions are classified into two groups based on their characteristics. The upper one is named as resource control and management functions group, and the lower one is named as medium access control functions.~~ Also the control plane functions and ~~data~~ bearer plane functions are also separately classified.

The Convergence Sublayer (CS) includes two functional blocks:

- Classification
- Header Compression

The R~~r~~esource C~~c~~ontrol and M~~m~~anagement (RCM) ~~functional~~ Sublayer ~~group~~ includes several functional blocks that are related with radio resource functions such as:

- Radio Resource Management
- Mobility Management
- Network-entry Management
- Location Management
- Idle Mode Management
- Security Management
- System Configuration Management
- MBS
- ~~•~~ Connection Management
- ARQ (bearer plane function)
- SDU Order Delivery to the upper layer (Bearer plane function)
- Routing
- Self Organization

Radio Resource Management block adjusts radio network parameters related to the traffic load, and also includes function of load control (load balancing), admission control and interference control.

Mobility Management block handles related to handover procedure. Mobility Management block manages candidate neighbor target BSs based on PHY signaling report, and also decides whether MS performs handover operation.

Network-entry Management block is in charge of initialization procedures. Network-entry Management block may generate management messages which needs during initialization procedures, i.e., ranging (this does not mean physical ranging, but ranging message in order to identification, authentication, and CID allocation), basic capability, registration, and so on.

Location Management block is in charge of supporting location based service (LBS). Location Management block may generate messages including the LBS information. The Location Management block also manages location update operation during idle mode.

Idle Mode Management block controls idle mode operation, and generates the paging advertisement message based on paging message from paging controller in the core network side.

Security Management block is in charge of key management for secure communication. Using managed key, traffic encryption/decryption and authentication are performed.

System Configuration Management block manages system configuration parameters, and generates broadcast control messages such as downlink/uplink channel descriptor (DCD/UCD).

MBS (Multicast and Broadcasting Service) block controls management messages and data associated with broadcasting service.

Connection Management block allocates connection identifiers (CIDs) during initialization/handover/ service flow creation procedures. Connection Management block interacts with convergence sublayer to classify MAC Service Data Unit (MSDU) from upper layer, and maps MSDU onto a particular transport connection.

ARQ block handles MAC ARQ function. For ARQ-enabled connections, ARQ block logically splits MAC SDU to ARQ blocks, and numbers to each logical ARQ block. ARQ block may also generate ARQ management messages such as feedback message (ACK/NACK information).

The SDU order delivery block is responsible for delivering SDUs to the CS sublayer in order of arrival at the peer transmitting entity.

Self Organization block performs functions to support self configuration and self optimization mechanisms. The functions include procedures to request MSs to report measurements for self configuration and self optimization and receive the measurements from the MSs.

The M~~m~~edium A~~a~~ccess C~~c~~ontrol (MAC) Sublayer ~~functional group~~ includes function blocks which are related with physical layer and link controls such as:

- PHY Control
- Control Signaling
- Sleep Mode Management
- ~~QoS~~
- Scheduling and Resource and Multiplexing
- ~~ARQ~~
- Multi-Carrier
- Fragmentation/Packing
- MAC PDU formation
- Multi-Radio Coexistence

PHY Control block handles PHY signaling such as ranging, measurement/feedback (CQI), and HARQ ACK/NACK. Based on CQI and HARQ ACK/NACK, PHY Control block estimates channel environment of MS, and performs link adaptation via adjusting modulation and coding scheme (MCS) or power level.

Control Signaling block generates resource allocation messages such as DL/UL-MAP as well as specific control signaling messages, and also generates other signaling messages not in the form of general MAC messages (e.g., DL frame prefix also known as FCH).

Sleep Mode Management block handles sleep mode operation. Sleep Mode Management block may also generate management messages related to sleep operation, and may communicate with Scheduler block in order to operate properly according to sleep period.

802.16m provides QoS as part of a network wide QoS framework encompassing several network elements and functional entities to provide end to end service objectives. Within the 802.16m protocol structure, the functional entities that provide elements of QoS are Radio Resource Management, Connection Management and Scheduling and resource Multiplexing functional entities.

~~QoS block handles rate control based on QoS parameters input from Connection Management function for each connection, and scheduler shall operate based on the input from QoS block in order to meet QoS requirement.~~

Scheduling and Resource and Multiplexing block schedules and multiplexes packets based on properties of connections. In order to reflect properties of connections, Scheduling and Resource and Multiplexing block receives QoS information from ~~QoS block for each~~the C~~c~~onnection Management block and Radio Resource Management block.

Fragmentation/Packing block performs fragmenting or packing MSDUs based on scheduling results from Scheduler block.

~~ARQ block handles MAC ARQ function. For ARQ-enabled connections, ARQ block logically splits MAC SDU to ARQ blocks, and numbers to each logical ARQ block. ARQ block may also generate ARQ management messages such as feedback message (ACK/NACK information).~~

~~Fragmentation/Packing block performs fragmenting or packing MSDUs based on scheduling results from Scheduler block.~~

MAC PDU formation block constructs MAC protocol data unit (PDU) so that BS/MS can transmit user traffic or management messages into PHY channel. MAC PDU formation block may add sub-headers or extended sub-headers. MAC PDU formation block may also add MAC CRC if necessary, and add generic MAC header.

8.1.1 ~~The~~ IEEE 802.16m~~e~~ MS/BS ~~Data~~ Bearer Plane Processing Flow

~~The following figure describes data transmission flow in the 802.16e. On the transmitter side, after a packet arrives from higher layer, Convergence Sublayer classifies a packet according to classification rules, and maps a packet onto a particular transport connection. If a packet is associated with ARQ connection, then ARQ block logically splits a packet into ARQ blocks. After scheduling, a packet may be fragmented or packed, and add sub-header if necessary. A packet including sub-headers may be encrypted if negotiated. MAC PDU formation block adds generic MAC header, then MAC Protocol Data Unit (MPDU) is constructed. Several MPDUs may be concatenated according to the size of the data burst.~~

~~On the receiver side, after a packet arrives from physical layer, MAC PDU formation block constructs MPDU, and Fragmentation/Packing block defragments/unpacks MPDU to make MSDU. After reconstituted in Convergence Sublayer, MSDU is transferred to higher layer.~~

The following Figure shows the user traffic data flow and processing at the BS and the MS. The red arrows show the user traffic data flow from the network layer to the physical layer and vice versa. On the transmit side, a network layer packet is processed by the convergence sublayer, the ARQ function (if present), the fragmentation/packing function and the MAC PDU formation function, to form MAC PDU(s) to be sent to the physical layer. On the receive side, a physical layer SDU is processed by MAC PDU formation function, the fragmentation/packet function, the ARQ function (if present) and the convergence sublayer function, to form the network layer packets. The black arrows show the control primitives among the 802.16m MAC functions and between the 802.16m MAC and the PHY layer that are related to the processing of user traffic data.

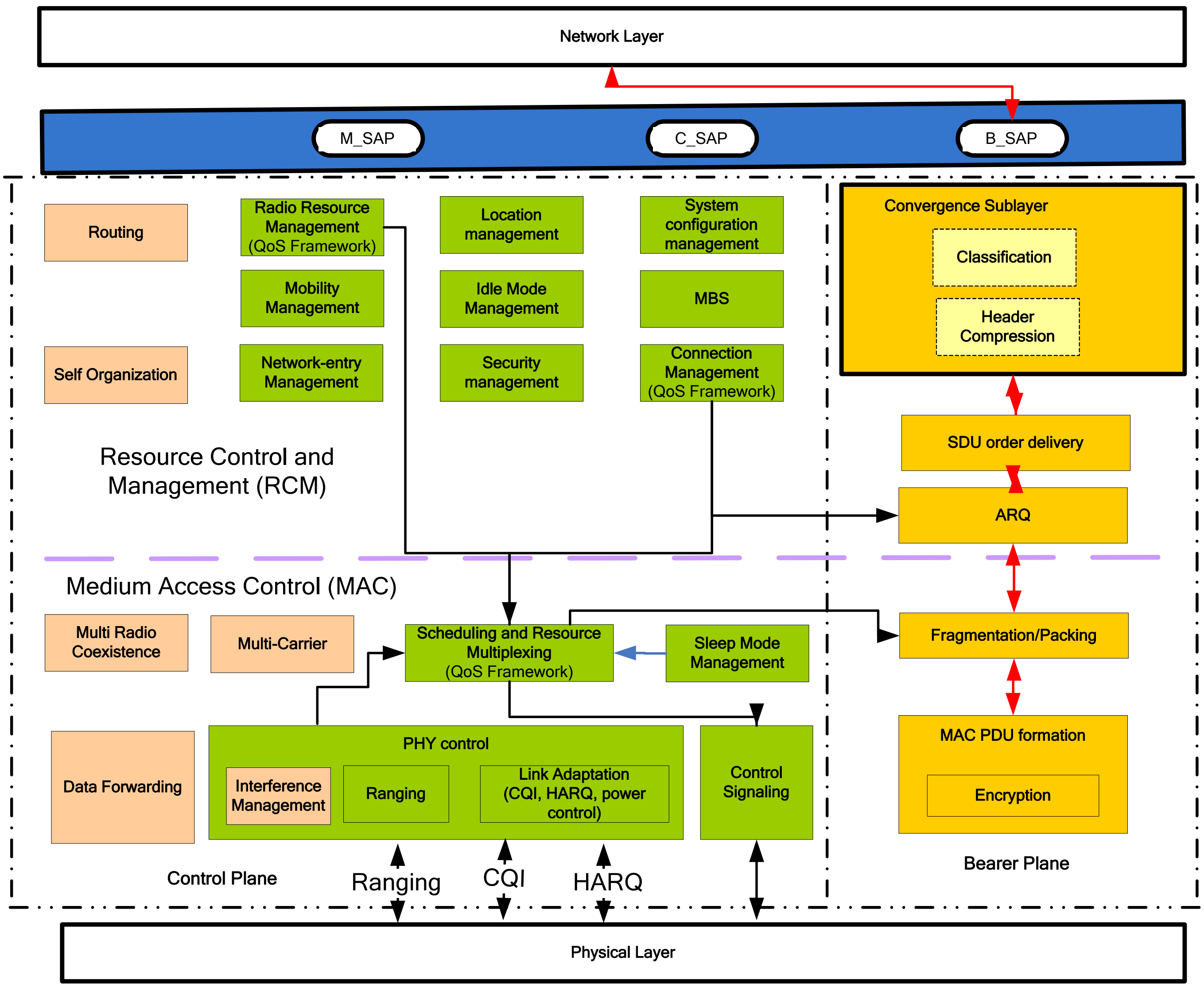


Figure 2 ~~The~~ IEEE 802.16m~~e~~ MS/BS Data Plane Processing Flow

8.1.2 The IEEE 802.16m~~e~~ MS/BS Control Plane Processing Flow

~~The following Figure 6 describes the MAC message transmission flow in 802.16e. Most of the MAC functional block generates its own management messages, and these messages are transported to Fragmentation/Packing block. Basically the MAC management message does not use ARQ block (Management messages will be operated in request-and-response manner, that is, if there is no response, sender retransmits request. Therefore additional ARQ operation is not required). Management message may be fragmented or packed, and authentication information (e.g., CMAC/HMAC in 802.16e) may be appended to the management message if necessary. Some of MAC message may be transmitted via Control Signaling block in the form of control message (e.g., MAP). On the receiver side, most of MAC functional block also receives and handles MAC management messages from the MAC functional block of the opposite side (MS to BS, BS to MS).~~

The following figure shows the RCM and MAC control plane signaling flow and processing at the BS and the MS. On the transmit side, the black arrows show the flow of control plane signaling from the control plane functions to the data plane functions and the processing of the control plane signaling by the data plane functions to form the corresponding MAC signaling (e.g. MAC management messages,) to be transmitted over the air. On the receive side, the black arrows show the processing of the received over-the-air MAC signaling by the data plane functions and the reception of the corresponding control plane signaling by the control plane functions. The black arrows show the control primitives among the 802.16m MAC functions and between the 802.16m MAC and PHY layer that are related to the processing of control plane signaling.

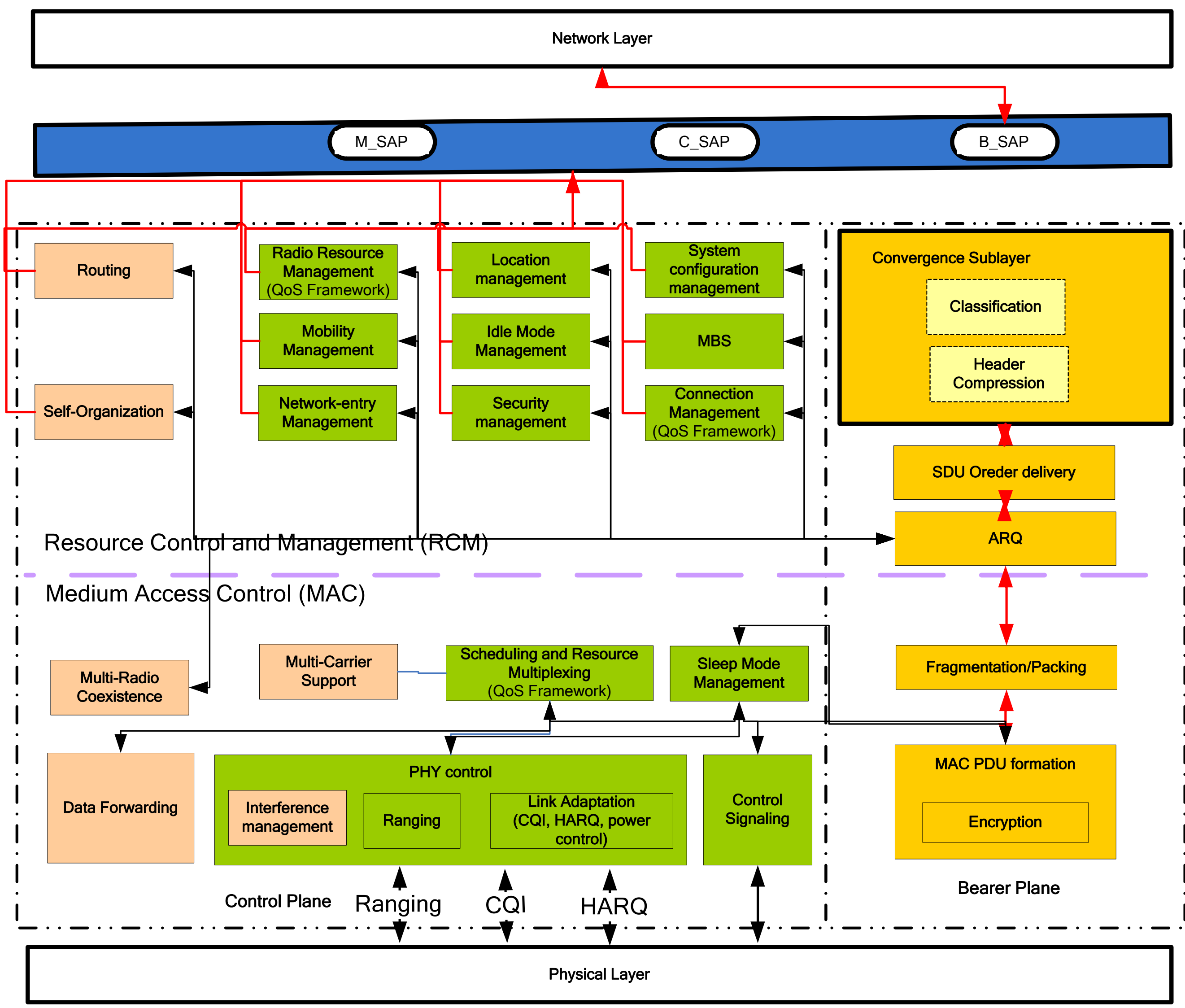


Figure 3 ~~The~~ IEEE 802.16m~~e~~ MS/BS Control Plane Processing Flow

1.1The IEEE 802.16m Protocol Structure

The IEEE 802.16m follows the MAC architecture of current IEEE 802.16e and includes additional functional blocks for 802.16m specific features (see Figure 7). The following additional functional blocks are included:

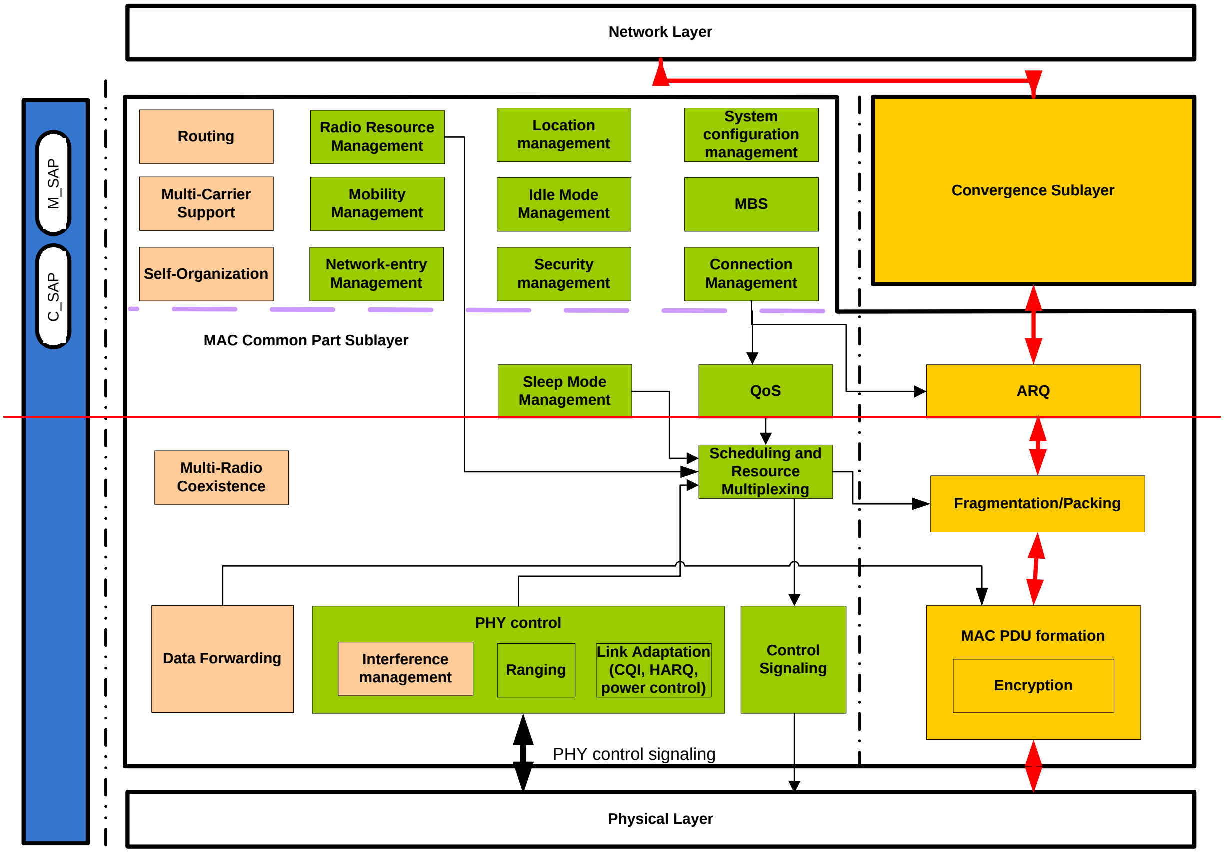
- Routing
- Self Organization
- Multi-Carrier
- Multi-Radio Coexistence

Self Organization block performs functions to support self configuration and self optimization mechanisms. The functions include procedures to request MSs to report measurements for self configuration and self optimization and receive the measurements from the MSs.

Figure 7 The IEEE 802.16m Protocol Structure

8.2.1The IEEE 802.16m MS/BS Data Plane Processing Flow

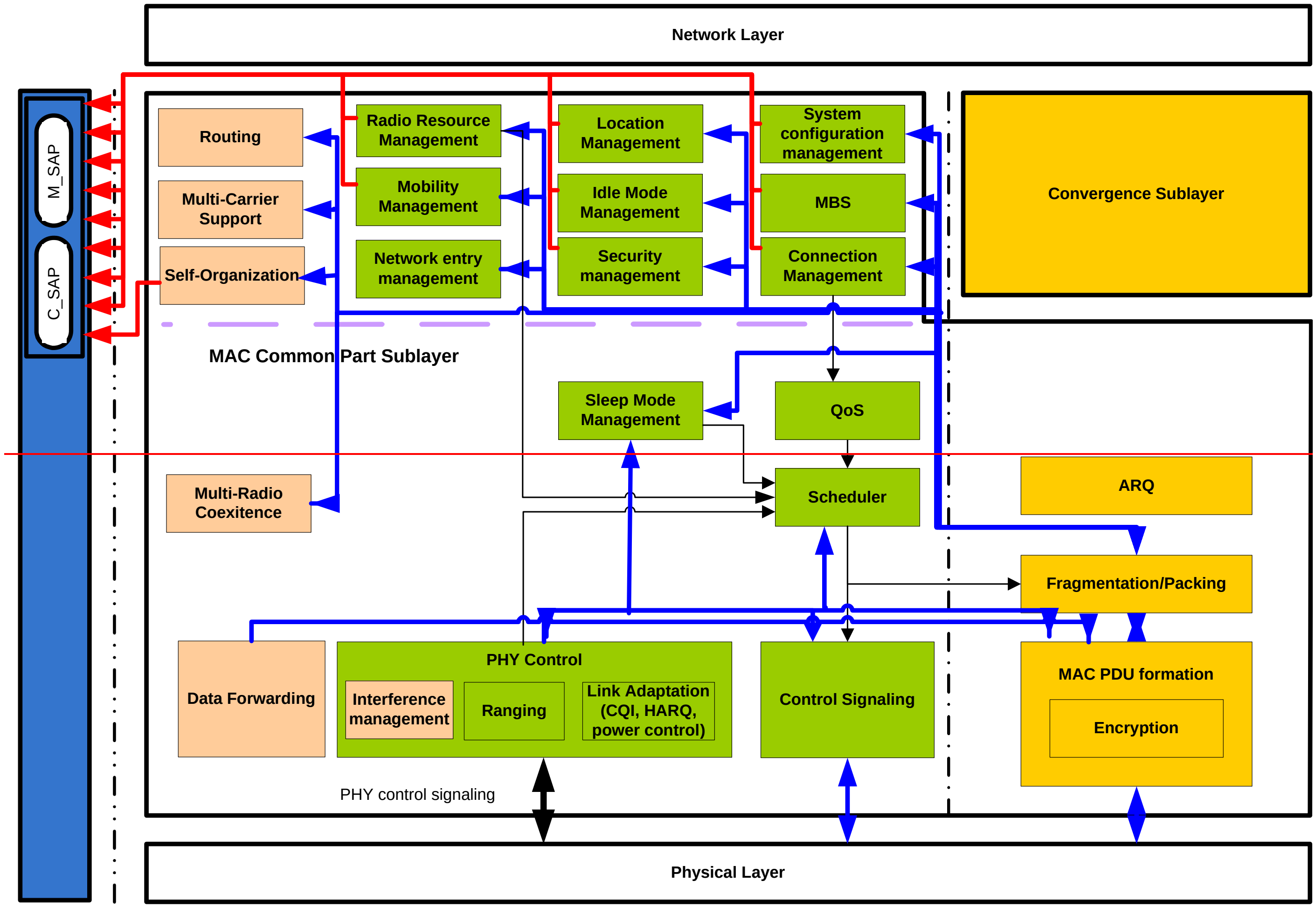
The following Figure 8 shows the user traffic data flow and processing at the BS and the MS. The red arrows show the user traffic data flow from the network layer to the physical layer and vice versa. On the transmit side, a network layer packet is processed by the convergence sublayer, the ARQ function (if present), the fragmentation/packing function and the MAC PDU formation function, to form MAC PDU(s) to be sent to the physical layer. On the receive side, a physical layer SDU is processed by MAC PDU formation function, the fragmentation/packet function, the ARQ function (if present) and the convergence sublayer function, to form the network layer packets. The black arrows show the control primitives among the MAC CPS functions and between the MAC CPS and PHY that are related to the processing of user traffic data.



~~Figure 8 The IEEE 802.16m MS/BS Data Plane Processing Flow~~

~~8.2.2The IEEE 802.16m MS/BS Control Plane Processing Flow~~

~~The following figure shows the MAC CPS control plane signaling flow and processing at the BS and the MS. On the transmit side, the blue arrows show the flow of control plane signaling from the control plane functions to the data plane functions and the processing of the control plane signaling by the data plane functions to form the corresponding MAC signaling (e.g. MAC management messages, MAC header/sub-header) to be transmitted over the air. On the receive side, the blue arrows show the processing of the received over-the-air MAC signaling by the data plane functions and the reception of the corresponding control plane signaling by the control plane functions. The black arrows show the control primitives among the MAC CPS functions and between the MAC CPS and PHY that are related to the processing of control plane signaling.~~



~~Figure 9 The IEEE 802.16m MS/BS Control Plane Processing Flow~~