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Re:	The document was contributed within the process of 802.16REVd Sponsor Ballot comments
Abstract	The document is intended to clarify status of several capabilities of 802.16 compliant devices to help development of PICS document
Purpose	The document must be considered during 802.16REVd comments resolution procedure
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Support of Negotiated Capabilities and QoS Parameters

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1. Goal

Certain functionalities are defined in 802.16REVd as negotiable between BS and SS, at the step of capability exchange or connection setup. It makes many of them actually optional for implementation. Seems reasonable to add explicit clarifications where relevant.

2. Role of Profiles

Currently, standard specifies many of BS/SS capabilities as either mandatory or optional. But there is also section 12 that makes certain capabilities "required" within certain profile(s). To distinguish clearly between mandatory/optional (in the standard) and required/not required in profiles, the following change suggested:

[Change in section 12]

"This subclause defines system profiles that list sets of features to be used in typical implementation cases. Each profile is assigned an identifier for use in such documents as PICS proforma statements. Features, specified in the standard as optional, may be listed in a profile as "required" or "conditionally required". Profiles do not change "mandatory" status if specified in the standard itself ~~Mandatory and conditionally mandatory features are listed for each profile.~~ Any feature, which is specified in the standard as optional and does not appear in certain profile~~, not mandatory or conditionally mandatory for a profile~~ is not "required" ~~optional~~ for the profile, thus absence of this feature in specific implementation does not affect conformance to the profile ~~except where otherwise forbidden by the standard~~. Optional features shall be implemented as specified in the standard."

3. Capabilities Negotiated at Network Entry

This section contains changes suggested for SS capabilities, which should be negotiated during network entry

3.1. Classification Capabilities

3.1.1. Background

Note the following from the Table 327 (Optional feature requirements profM3_PMP):

Optional Feature	Required?	Conditions/Notes
Packet convergence sublayer	Yes	
Payload header suppression	No	
IPv4	Yes	

Optional Feature	Required?	Conditions/Notes
Ethernet	Yes	

The table implicitly defines IPv4 and Ethernet classification capabilities as optional capabilities that become mandatory under profM3_PMP.
Presence of corresponding bits in 11.7.5.1 “Convergence Sublayer Support” TLV in “SS capabilities encoding” section also points to optional nature of every specific classification option.
The suggestion is to specify it explicitly. Suggested changes do not impact actual requirements of profM3_PMP for implementation of IPv4 + Ethernet classification. They will be specified explicitly optional in the standard, but stay “required” for the profile.

3.1.2. Specific Changes

[Change in 802.16-REVd/D3]

5.2.2 Classification

Classification is the process by which a MAC SDU is mapped onto a particular connection for transmission between MAC peers. The mapping process associates a MAC SDU with a connection, which also creates an association with the service flow characteristics of that connection. This process facilitates the delivery of MAC SDUs with the appropriate QoS constraints.

A classifier is a set of matching criteria applied to each packet entering the IEEE Std 802.16 network. It consists of some protocol-specific packet matching criteria (destination IP address, for example), a classifier priority, and a reference to a CID. If a packet matches the specified packet matching criteria, it is then delivered to the SAP for delivery on the connection defined by the CID.

Implementation of each specific classification capability (as, for example, IPv4 based classification) is optional.

3.2. ARQ

3.2.1. Background

In 11.7.6.1 a TLV for “ARQ Support capability “ is defined. This field indicates the availability of SS support for ARQ as a capability.

3.2.2. Specific Changes

[Change in 802.16-REVd/D3]

6.4.4 ARQ mechanism

NOTE—ARQ shall not be used with the PHY specification defined in 8.1.
The ARQ mechanism is a~~n optional~~ part of the MAC, which is optional for implementation. When implemented, ARQ ~~and~~ ~~can~~ may be enabled on a per-connection basis. The per-connection ARQ and associated parameters shall be specified and negotiated during connection creation or change. A connection cannot have a mixture of ARQ and non-ARQ traffic.

3.3. MAC CRC Capability

3.3.1. Background

In the section 11.7.6.3 “MAC CRC support” a TLV is defined to indicate whether or not the SS supports MAC level CRC. As it is now mandatory to add/check CRC in Management MAC PDUs for SCa, OFDM and OFDMA PHYs, the suggestion is to specify this explicitly. TLV stays, but SCa, OFDM and OFDMA devices may skip usage of this TLV as default is “CRC is supported”. For SC devices TLV must be used.

3.3.2. Specific Changes

[Change in 802.16-REVd/D, 6.4.2 “MAC PDU formats]

A MAC PDU may contain a CRC, as described in 6.4.3.5. Implementation of CRC capability is mandatory for SCa, OFDM and OFDMA PHYs.

3.4. Multicast polling group CID support

3.4.1. Background

In 11.7.6.5 “Multicast polling group CID support” a TLV is defined to indicate the maximum number of simultaneous Multicast Polling Groups the SS is capable of belonging to. Minimal value is 0, so implicitly support of Multicast polling groups is optional at SS. At BS, this feature is extremely important for performance. So the suggestion is to request support of Multicast polling groups at BS.

3.4.2. Specific Changes

[Change in 802.16-REVd/D3]

6.4.12 Assigning SSs to multicast groups

The BS may add an SS to a Multicast polling group by sending an MCA-REQ message with the Join command. Upon receiving an MCA-REQ message, the SS shall respond by sending an MCA-RSP message. The protocol is shown in Figure 87 and Figure 88. Implementation of multicast groups capability is mandatory for BS and optional for SS.

4. Support of Service Flow Parameters

4.1. Background

All QoS related Service Flow parameters may be implicitly rejected by refusing creation/change of the connection. So the corresponding capabilities are de-facto optional. It is suggested to fix it explicitly. Specific changes include adding two more values for Confirmation Code to indicate the reason why the connection setup was rejected.

4.2. Specific Changes to Handle DSx Rejection

6.4.2.3.11 DSA-RSP message

…….

Service Flow Parameters (see 11.13)

The complete specification of the service flow shall be included in the DSA-RSP ~~only~~ if it includes a newly assigned CID or an expanded Service Class Name or to point to specific parameter that caused rejection of connection creation (only in the case CC = "reject-not-supported-parameter-value" or "reject-not-supported-parameter".

6.4.13.7.1 Preprovisioned service flow creation

The provisioning of service flows is done via means outside of the scope of this standard, such as the network management system. Configuration of connections enabling service flows for provisioned services follows the transfer of the operational parameters, as shown in Figure 54. When this is complete, the BS passes service flow encodings to the SS in multiple DSA-REQ messages. The SS replies with DSA-RSP messages to complete service flow initialization.

Service flow Encodings contain either a full definition of service attributes (omitting defaultable items if desired) or a service class name. A service class name is an ASCII string which is known at the BS and which indirectly specifies a set of QoS Parameters.

Capability of handling each specific Service Flow parameter is optional.

6.4.13.7.2.1 Dynamic service flow creation—SS-initiated

The SS-initiated protocol is illustrated in Figure 92 and described in detail in 6.4.13.9.3.1.

A DSA-REQ from an SS contains a service flow reference and QoS Parameter set (marked either for admission-only or for admission and activation).

BS responds with DSA-RSP indicating acceptance or rejection. In the case when rejection was caused by presence of non-supported parameter of non-supported value, specific parameter may be included into DSA-RSP.

6.4.13.7.2.2 Dynamic service flow creation—BS-initiated

A DSA-REQ from a BS contains an SFID for either one uplink or one downlink Service flow, possibly its associated CID, and a set of active or admitted QoS Parameters. The protocol is illustrated in Figure 93 and is described in detail in 6.4.13.9.3.3.

SS responds with DSA-RSP indicating acceptance or rejection. In the case when rejection was caused by presence of non-supported parameter of non-supported value, specific parameter may be included into DSA-RSP.

6.4.13.9.4.1 SS-initiated DSC

An SS that needs to change a service flow definition performs the following operations.

The SS informs the BS using a DSC-REQ. The BS checks the integrity of the message and, if the message is intact, sends a message received (DSX-RVD) response to the SS. The BS shall decide if the referenced service flow can support this modification. The BS shall respond with a DSC-RSP indicating acceptance or rejection. In the case when rejection was

caused by presence of non-supported parameter of non-supported value, specific parameter may be included into DSC-RSP.
The SS reconfigures the service flow if appropriate, and then shall respond with a DSC-ACK.

6.4.13.9.4.2 BS-initiated DSC

A BS that needs to change a service flow definition performs the following operations.

The BS shall decide if the referenced service flow can support this modification. If so, the BS informs the SS using a DSC-REQ. The SS checks that it can support the service change, and shall respond using a DSC-RSP indicating acceptance or rejection. In the case when rejection was caused by presence of non-supported parameter of non-supported value, specific parameter may be included into DSC-RSP.
The BS reconfigures the service flow if appropriate, and then shall respond with a DSC-ACK. This process is illustrated in Table 105.

11.13.1 CC

The CC indicates the status for the dynamic service (DSx-xxx) messages. The value may appear in the Confirmation Code field of a DSx message or as the value of a TLV-encoded error parameter.
The CC values are specified in Table 309.

Table 309—CC

CC	Status
…	…
16	reject-not-supported-parameter
17	reject-not-supported-parameter-value

In the case CC = “reject-not-supported-parameter” or CC = “reject-not-supported-parameter-value”, the corresponding TLV(s) may be returned to caller in DSP-RSP message.

12.3.1.1.1 Conventions for MAC Management Messages

The following rules shall be followed when reporting parameters in MAC Management messages:
—Service Class Names should not be used.
—No TLVs besides Error Encodings and HMAC Tuples shall be reported back in DSA-RSP and DSC-RSP messages. The exception is the case when Service Flow creation or change was rejected because of presence of non-supported parameter of non-supported value.
—No TLVs besides HMAC Tuples shall be reported back in DSA-ACK messages.

4.3. Uplink Polling Services

4.3.1. Background

Assignment of certain UL polling service type to a connection, as all Service Flow parameters, might be rejected by DSA-RSP with non-zero CC (Confirmation Code). So the corresponding capability is de-facto optional

Note the following from the Table 327 (Optional feature requirements profM3_PMP):

Optional Feature	Required?	Conditions/Notes
Unsolicited grant service functionality	No	
Real-Time Polling services	No	
Best effort services	Yes	
Non-Real-Time Polling services	Yes	

It means that within the profM3_PMP Best effort services and Non-Real-Time Polling services are required.

Therefore, under that profile also implementation of relevant QoS parameters is required. As specified in 6.4.5.3 concerning nrtPS, "The key service elements are Minimum Reserved Traffic Rate, Maximum Sustained Traffic Rate, Request/Transmission Policy, and Traffic Priority." So within the profile, capabilities associated with named parameters is mandatory; similarly, for BE service (6.4.5.4) " The key service elements are the Maximum Sustained Traffic Rate, and the Traffic Priority".

4.3.2. Specific Changes

[Change in 802.16-REVd/D3]

6.4.5 Uplink scheduling service

Scheduling services are designed to improve the efficiency of the poll/grant process. By specifying a scheduling service and its associated QoS parameters, the BS can anticipate the throughput and latency needs of the uplink traffic and provide polls and/or grants at the appropriate times.

The basic services, as summarized in Table 90, are UGS, rtPS, nrtPS and BE. Each service is tailored to a specific type of data flow. The following subclauses define the basic uplink service flow scheduling services and list the QoS parameters associated with each service. A detailed description of each QoS parameter is provided in 11.13.

Implementation of all Uplink scheduling service types is optional. In the case when creation of connection with unsupported Uplink scheduling service type is requested by other side, the creation of connection shall be rejected by DSA-RSP with the corresponding CC value.

4.4. Capability of Payload Header Suppression

4.4.1. Background

Note the following from the Table 327 (Optional feature requirements profM3_PMP):

Optional Feature	Required?	Conditions/Notes
Payload header suppression	No	

Assignment of PHS to the connection might be rejected by DSA-RSP with non-zero CC (Confirmation Code). So capability associated with this feature is de-facto optional

4.4.2. Specific Changes

[Change in 802.16-REVd/D3]

5.2.4 PHS

In PHS, a repetitive portion of the payload headers of the higher layer is suppressed in the MAC SDU by the sending entity and restored by the receiving entity. Implementation of PHS capability is optional. On the uplink, the sending entity is the SS and the receiving entity is the BS.

11.13.22.3.6.2 Error code

This parameter indicates the status of the request. A nonzero value corresponds to the CC as described in 11.13.1. A PHS Error Parameter Set shall have exactly one Error Code within a given PHS Encoding.

Type	Length	Value
[145/146]. cst.5.2	1	CC except OK(0) as specified in Table 309