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Title	Proposal for differentiating bandwidth request based on service class and retry attempts	
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Re:	Call for Comments on IEEE 802.16m-09/0010r2 IEEE 802.16m Amendment text/Area: Chapter 15.2.11.1.1. (Bandwidth Request)	
Abstract	Proposal for differentiating bandwidth request based on service class and retry attempts	
Purpose	For inclusion in AWD	
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Proposal for differentiating bandwidth request based on service class and retry attempts

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Introduction:

The 802.16m contention-based BR protocol proposed in Amendment Working document ([1]) provides an asynchronous access opportunity to each AMS on a common BR channel. Contention causes BR collisions, and the colliding AMS must retry (possibly more than once) after waiting for the BR response until the retry timeout (backoff) interval. The current backoff scheme is common to all service classes. However, the contending AMS may be negotiating BR for flows belonging to different service classes. Thus the BR protocol must take into account the priority or service class of each contending flow. This need for differentiation in the BR protocol has been acknowledged in the current AWD. However, it does not include a specification of the differentiation method.

We propose a differentiation method that may be used by the ABS to improve BR performance for higher service classes and reduce the BR failure rate. We define a term “connection priority” which the ABS uses to set the BR contention window parameters for each flow.

The standard way of incrementing contention window is to double it with each retry. This means standard scaling factor is two. However, it is possible that other scaling factors are optimal – depending on the contention load and available resources. A differentiation protocol should allow the ABS to advertise the scaling factors based on condition of its resources. We introduce scaling factors for contention window in the DSx message to perform this operation.

Connection Priority:

Connection priority is a function of a flow's service class and the number of retries the AMS has performed in BR for this flow. In order to achieve service differentiation for users with different service classes and reduce the BR failure probability, we propose that the contention window should be set based on 'connection priority'.

The motivation for including service class in connection priority is that high priority flows (e.g. delay sensitive flows) should be given access before other low priority (delay insensitive) flows. The number of retries in connection priority function enables a way to reduce the failure probability of the BR mechanism by giving more preference to flows with more number of retries. This proposal allows dynamic setting of these parameters per flow, thus enabling the ABS to optimize performance.

Tables 1 and 2 give examples of contention window parameters based on service class. Please note that these values are to just show the dependence of contention window on the service class; actual values of contention window are advertised by ABS.

Service Class	0 (High)	1	2	3 (Low)
Initial Window	1	2	4	4
Max Window	16	128	256	512
Scaling Factor	2	2	2	2
Window Size (Retry #1)	2	4	8	8
Window Size (Retry #2)	4	8	16	16
Window Size (Retry #4)	16	32	64	64
Window Size (Retry #8)	16	128	256	256
Window Size (Retry #12)	16	128	256	512
Window Size (Retry #16)	16	128	256	512

Table 1: Contention window parameters for truncated binary exponential backoff with priority

Service Class	0 (High)	1	2	3 (Low)
Initial Window	16	24	48	64
Max Window	16	24	48	64
Scaling Factor	1	1	1	1
Window Size (Retry #1)	16	24	48	64
Window Size (Retry #2)	16	24	48	64
Window Size (Retry #4)	16	24	48	64
Window Size (Retry #8)	16	24	48	64
Window Size (Retry #12)	16	24	48	64
Window Size (Retry #16)	16	24	48	64

Table 2: Contention window parameters with no backoff, but with priority

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15.2.11.1.1(Line 38):

The connection priority is defined by the tuple of contention window parameters and the number of retries. The ABS advertises initial connection priority parameters - initial and maximum window sizes and backoff window scaling factor - in DSx-REQ messages. The BR timer value for the next BR attempt is a random number chosen uniformly from the window specified by the connection priority.

Corresponding DSx-REQ message parameters:

Connection priority/Service class	4 bits
Initial window size	11 bits
Maximum window size	8 bits
Contention window scaling factor	4 bits

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References:

- [1] IEEE 802.16m-09/0010r2, “IEEE 802.16m Amendment Working Document”