

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	REVd Sponsor Ballot Recirc #1 - Resolution to issues regarding comment 150	
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Re:	Sponsor ballot recirc #1 on document IEEE P802.16REVd/D4-2004	
Abstract	Suggested text to resolve issues with changes implemented for comment 150 in D4 6.3.5. The text is based on IEEE C802.16d-04_42r1 with the alterations specified by the accepted resolutions for comments 150 and 151. Differences from 42r1 (other than section references) are highlighted.	
Purpose	Suggested remedy for issues raised regarding implementation of comment 150.	
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1 *Replace the contents of RevD/D4 section 6.3.5 with the following:*
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4 **6.3.5 ~~Uplink scheduling service~~ Scheduling services**

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 6 Scheduling services represent the data handling mechanisms supported by the MAC scheduler for data
 7 transport on a connection. Each connection is associated with a single data service. Each data service is asso-
 8 ciated with a set of QoS parameters which quantify aspects of its behavior. These parameters are managed
 9 using the DSA and DSC message dialogs. Four services (11.13.12) are supported: Unsolicited Grant Service
 10 (UGS), Real-time Polling Service (rtPS), Non-real-time Polling Service (nrtPS), and Best Effort (BE). The
 11 following text provides a brief description of each of the supported scheduling services, including the man-
 12 datory QoS parameters that shall be included in the service flow definition when the scheduling service is
 13 enabled for a service flow. A detailed description of each QoS parameter is provided in 11.12.
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 15

16 The UGS is designed to support real-time data streams consisting of fixed-size data packets ~~transmitted~~
 17 issued at periodic intervals, such as T1/E1 and Voice over IP without silence suppression. The mandatory
 18 QoS service flow parameters for this scheduling service are ~~Minimum Reserved Traffic Rate (11.13.10),~~
 19 Maximum Sustained Traffic Rate (11.13.7), Maximum Latency (11.13.15), ~~SDU Size (11.13.18),~~ Tolerated
 20 Jitter (11.13.14), and Request/Transmission Policy (11.13.13). If present, the Minimum Reserved Traffic
 21 Rate parameter (11.13.9) shall have the same value as the Maximum Sustained Traffic Rate parameter.
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25 The rtPS is designed to support real-time data streams consisting of variable-sized data packets that are
 26 ~~transmitted-issued~~ at ~~fixed-periodic~~ intervals, such as moving pictures experts group (MPEG) video. The
 27 mandatory QoS service flow parameters for this scheduling service are Minimum Reserved Traffic Rate
 28 (11.13.9), Maximum Sustained Traffic Rate (11.13.7), Maximum Latency (11.13.7), ~~Tolerated Jitter~~
 29 ~~(11.13.15),~~ and Request/Transmission Policy (11.13.13).
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32 The nrtPS is designed to support delay-tolerant data streams consisting of variable-sized data packets for
 33 which a minimum data rate is required, such as FTP. The mandatory QoS service flow parameters for this
 34 scheduling service are Minimum Reserved Traffic Rate (11.13.9), Maximum Sustained Traffic Rate
 35 (11.13.7), Traffic Priority (11.13.6), and Request/Transmission Policy (11.13.13).
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38 The BE service is designed to support data streams for which no minimum service level is required and
 39 therefore may be handled on ~~an~~ a space-available basis. The mandatory QoS service flow parameters for this
 40 scheduling service are Maximum Sustained Traffic Rate (11.13.7), Traffic Priority (11.13.6), and Request/
 41 Transmission Policy (11.13.13).
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44 **6.3.5.1 Outbound transmission scheduling**

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 46 Outbound transmission scheduling selects the data for transmission in a particular frame/bandwidth alloca-
 47 tion and is performed by the BS for downlink, and SS for uplink. In addition to whatever other factors the
 48 scheduler may deem pertinent, the following items are taken into account for each active service flow:
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- 51 — The scheduling service specified for the service flow.
- 52 — The values assigned to the service flow's QoS parameters.
- 53 — The availability of data for transmission.
- 54 — The capacity of the granted bandwidth.

55 56 57 **6.3.5.2 Uplink request/grant scheduling**

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 59 Uplink request/grant scheduling is performed by the BS with the intent of providing each subordinate SS
 60 with bandwidth for uplink transmissions or opportunities to request bandwidth. By specifying a scheduling
 61 service and its associated QoS parameters, the BS scheduler can anticipate the throughput and latency needs
 62 of the uplink traffic and provide polls and/or grants at the appropriate times.
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Table 90 summarizes the scheduling services and the poll/grant options available for each. The following subclauses define service flow scheduling services for uplink operations.

Table 90—Scheduling services and usage rules

Scheduling type	PiggyBack Request	Bandwidth stealing	Polling
UGS	Not allowed	Not allowed	PM bit is used to request a unicast poll for bandwidth needs of non-UGS connections.
rtPS	Allowed	Allowed	Scheduling only allows unicast polling.
nrtPS	Allowed	Allowed	Scheduling may restrict a service flow to unicast polling via the transmission/request policy; otherwise all forms of polling are allowed.
BE	Allowed	Allowed	All forms of polling allowed.

6.3.5.2.1 UGS

The UGS offers fixed-size grants on a periodic basis, which eliminate the overhead and latency of SS requests and assure that grants are available to meet the flow's real-time needs. The BS shall provide Data Grant Burst IEs to the SS at periodic intervals based upon the ~~Minimum Reserved~~ Maximum Sustained Traffic Rate specified for the service flow. The size of these grants shall be sufficient to hold the fixed-length data associated with the service flow (with associated generic MAC header and Grant management subheader) but may be larger at the discretion of the BS scheduler. In order for this service to work correctly, the Request/Transmission Policy (see ~~11.4.9.13~~ 11.13.13) setting shall be such that the SS is prohibited from using any contention request opportunities for this connection.

The Grant Management subheader (6.4.2.2.2) is used to pass status information from the SS to the BS regarding the state of the UGS service flow. The most significant bit of the Grant Management field is the Slip Indicator (SI) bit. The SS shall set this flag once it detects that this service flow has exceeded its transmit queue depth. Once the SS detects that the service flow's transmit queue is back within limits, it shall clear the SI flag. The flag allows the BS to provide for ~~long-long~~ term compensation for conditions, such as lost maps or clock rate mismatches, by issuing additional grants. The poll-me (PM) bit (6.4.6.3.3) may be used to request to be polled for a different, non-UGS connection.

The BS shall not allocate more bandwidth than the Maximum Sustained Traffic Rate parameter of the Active QoS Parameter Set, excluding the case when the SI bit of the Grant Management field is set. In this case, the BS may grant up to 1% additional bandwidth for clock rate mismatch compensation.

6.3.5.2.2 rtPS

The rtPS offers periodic unicast request opportunities, which meet the flow's real-time needs and allow the SS to specify the size of the desired grant. This service requires more request overhead than UGS, but supports variable grant sizes for optimum data transport efficiency.

~~The BS shall provide periodic unicast request opportunities. The time interval between successive request opportunity offerings shall be specified by Nominal Service Interval (11.13.19). Inclusion of this parameter is mandatory in uplink service flow definitions where use of the rtPS is enabled.~~

The BS shall provide periodic unicast request opportunities. In order for this service to work correctly, the Request/Transmission Policy setting (see 11.4.9.13) shall be such that the SS is prohibited from using any contention request opportunities for that connection. The BS may issue unicast request opportunities as prescribed by this service even if prior requests are currently unfulfilled. This results in the SS using only

1 unicast request opportunities in order to obtain uplink transmission opportunities (the SS could still use
2 unsolicited Data Grant Burst Types for uplink transmission as well). All other bits of the Request/Transmis-
3 sion Policy are irrelevant to the fundamental operation of this scheduling service and should be set according
4 to network policy.
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7 **6.3.5.2.3 nrtPS**

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9 The nrtPS offers unicast polls on a regular basis, which assures that the service flow receives request oppor-
10 tunities even during network congestion. The BS typically polls nrtPS CIDs on an interval on the order of
11 one second or less.
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14 The BS shall provide timely unicast request opportunities. In order for this service to work correctly, the
15 Request/Transmission Policy setting (see 11.4.9.13) shall be set such that the SS is allowed to use contention
16 request opportunities. This results in the SS using contention request opportunities as well as unicast request
17 opportunities and unsolicited Data Grant Burst Types. All other bits of the Request/Transmission Policy are
18 irrelevant to the fundamental operation of this scheduling service and should be set according to network
19 policy.
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22 **6.3.5.2.4 BE service**

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24 The intent of the BE service is to provide efficient service for best effort traffic. In order for this service to
25 work correctly, the Request/Transmission Policy setting shall be set such that the SS is allowed to use con-
26 tention request opportunities. This results in the SS using contention request opportunities as well as unicast
27 request opportunities and unsolicited Data Grant Burst Types. All other bits of the Request/Transmission
28 Policy are irrelevant to the fundamental operation of this scheduling service and should be set according to
29 network policy.
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