Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Refinement of the extended rtPS**
Date Submitted	**2005-05-03**
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Re:	IEEE P802.16e/D7
Abstract	This contribution proposes some refinements of the extended rtPS operation.
Purpose	Discussion and Adoption in IEEE 802.16e
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Refinement of the extended rtPS

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Problem Statement

VoIP service can be supported as a type of UGS or rtPS or extended rtPS (ertPS) in IEEE 802.16. The ertPS was originally proposed to enhance the UL resource usage by considering an intermittent characteristic of the VoIP with silence suppression: alternating talk and silence spurts. During talk periods, the VoIP service consumes variable UL resource depending on its rate change. On the other hand, the re-source allocation can be kept minimal during silence periods. The minimum allocation shall be enough for the VoIP user to send minimum-rate data plus Grant Management subheader.

The additional resource for the Grant Management subheader is required to give the VoIP user a unicast request opportunity at any time. This incurs 2-byte overhead to every UL resource allocation in silence period. Comparing with the size of the minimum-rate data in silence period, e.g. 2 bytes for Rate 1/8 of TIA-IS-127 (EVRC), the overhead from the unicast request opportunity is not ignorable

at all. Moreover, considering a 6-byte generic MAC header, the total overhead is quite large. Moreover, the overhead incurred by the UL MAP IE is quite large, which takes as many as 3.5 slots. Blanking those silence spurts will dramatically enhance the overall realtime traffic capacity.

Suggested Remedy

We suggest two remedies to solve this overhead problem.

Remedy 1: Eliminate the overhead incurred by Grant Management subheader.

To enable this remedy, we should be able to provide another mechanism to request incremental bandwidth up to the ~~maximum-rate, the~~ Maximum Sustained Traffic Rate, when the VoIP user transitions from silence spurt to talk spurt.

One way is to allow bandwidth request on a contention basis. The BR and UL TX power report header can be used for that purpose. Another way is to use CQICH for CQICH-enabled VoIP users by defining a codeword as an indication for the purpose of requesting ~~a maximum-rate~~the bandwidth which corresponds to the Maximum Sustained Traffic Rate.

Remedy 2: Enforce the minimum-rate bandwidth to zero

If the Voice codec supports a discontinuous transmission (DTX), or the data loss during silence period doesn't affect the quality of VoIP service, the data sent during silence period could be omitted altogether. In this case, the allocated bandwidth is reduced to 8 bytes (Generic MAC header + Grant Management subheader) or 6 bytes (BR and UL Tx power report header), or even none when using CQICH-based bandwidth request mechanism proposed in Remedy 1. The last option is surely the best with respect to the UL resource usage and MS power consumption.

Proposed Text Change

[Replace 6.3.5.2.2.1 Page 132 Line ~~30~~25-40]

Extended rtPS is a scheduling mechanism which builds on the efficiency of both UGS and rtPS. The BS shall provide unicast grants in an unsolicited manner like in UGS, thus saving the latency of a bandwidth request. However, whereas UGS allocations are fixed in size, ertPS allocations are dynamic.

The BS may provide~~allocate~~ periodic UL allocations~~resource~~ which may be ~~is~~ used for ~~unicast~~ requesting the bandwidth ~~opportunity~~ as well as for data transfer. By default, size of allocations corresponds to current value of Maximum Sustained Traffic Rate at the connection. The MS may

request changing the size of the UL allocation~~resource~~ by either using an extended piggyback request field of the Grant Management subheader or using BR field of the BR and UL Tx power report header, or sending a codeword (defined in 8.4.5.4.10.13) over CQICH. The BS shall not change the size of ~~allocated~~ UL allocations ~~resource~~ until receiving another bandwidth change request from the MS. When the bandwidth request size is set to zero, the BS may provide allocations ~~assign resource~~ for only bandwidth request header ~~unicast request opportunities~~ or no allocations~~resource~~ at all. In case that no unicast bandwidth request opportunities are available, the MS may use contention request opportunities for that connection, or send the CQICH codeword to inform the BS of its having the data to send. If the BS receives the CQICH codeword, the BS shall start allocating~~allocate~~ the ~~full rate~~ UL grant corresponding to the current ~~its~~ Maximum Sustained Traffic Rate value.

The key service IEs are the Maximum Sustained Traffic Rate, the Minimum Reserved Traffic Rate, the Maximum Latency and the Request/Transmission Policy.

The Extended rtPS is designed to support real-time service flows that generate variable size data packets on a periodic basis, such as Voice over IP services with silence suppression.

[Insert new subclause 8.4.5.4.10.13 Page 306 Line 26]

8.4.5.4.10.13 extended rtPS Bandwidth request

In the case of extended rtPS service, the MS may request ~~a maximum rate~~ bandwidth allocation which is defined as the ~~a~~ Maximum Sustained Traffic Rate in service flow encodings. The ~~reserved 60th~~ codeword ~~(i.e., 0b111011100)~~ is used for that purpose.