Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Round Trip Delay Optimization in 802.16e**
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Re:	The document is submitted in response to "Call for Contributions on Project 802.16e: Mobility Enhancements to IEEE Standard 802.16/802.16a" (IEEE 802.16e-02/01)
Abstract	The document provides tips for decreasing round trip delay for 802.16e OFDM/OFDMA MAC
Purpose	The document is submitted for consideration in IEEE 802.16 WG
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Round Trip Delay Optimization in 802.16e

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1. Acronyms

ARQ	Automatic Repeat Request
ACK	Positive acknowledgement
BR	Bandwidth Request
DL	Downlink
IE	Information Element (e.g. of MAP message)
NACK	Negative acknowledgement
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
MAC PDU	MAC Protocol Data Unit
SS	Subscriber Station
TO	Transmission Opportunity
UL	Uplink
UL-MAP	Uplink MAP message

References

[1] IEEE P802.16/D5-2001 IEEE Draft Standard for Local and Metropolitan Area Networks – Part 16: Air Interface for Fixed Broadband Wireless Access Systems, 2001-10-18

[2] IEEE P802.16a/D7-2002 Draft Amendment to IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems –Medium Access Control Modifications and Additional Physical Layer Specifications for 2-11 GHz, 2002-11-17

2. The Goal of the Document

The document contributes to discussion on changes in 802.16 MAC to service mobile communications. There goal is to provide lower round trip delay by speeding up ARQ and Reservation processes.

3. Fast ARQ

There is a strong need for faster ARQ and bandwidth reservation process in the case of

hand, there still is a need for window-based ARQ algorithm with considerably large window size to provide high bandwidth. This problem can be solved by an additional “Fast ARQ” mechanism.

There is no inherent problem with acknowledgements transmitted in DL direction. For acknowledgements transmitted in UL direction “Fast ARQ” mechanism will use transmission of waveforms of special type instead of sending MAC messages. The signaling may be similar from PHY prospect to the one defined in [2] , 8.4.5.3.3 “Focused Contention Transmission” (OFDM) and/or to the one from [2] , 8.5.7.2 “Periodic-ranging and bandwidth-request transmissions” (OFDMA). Fast ACK/NACK (in UL direction) can be implemented as presence/absence of transmissions at certain symbols/subcarriers allocated to the target MS. Fast ACK acknowledges all DL MAC PDUs addressed to the MS that appear within, say, the latest DL Subframe. Number N of MAC PDUs may be specified by the same UL MAP IE (of new format) that specifies the transmission opportunity (TO).

Absence of transmission means "not all were received" and therefore AU will allocate time for Tx of regular ACK/NACK.

This mechanism differs from “Focused contention” signaling because there is no contention here.

The waveforms as well as location, number of subcarriers and coding are subject of PHY and are not discussed here.

4. Fast Bandwidth Request

The mechanism described above for Fast ARQ can be reused for fast Bandwidth Requests: certain (set of) subcarriers within given time interval is allocated to certain SS; presence/absence of transmissions means presence of transmission demand at the SS. This demand then should be learned by the BS using unicast polling.