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Title	Reduced Signaling Overhead for Retransmissions on the UL of 802.16m
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Re:	IEEE 802.16m-07/040 - Call for Contributions on Project 802.16m System Description Document
Abstract	A mechanism that allows implicit allocation of bandwidth for UL retransmissions, thereby reducing allocation overhead.
Purpose	Inclusion of a new resource allocation mechanism for UL retransmission in the relevant chapter in the SDD on PHY-related signaling messages.
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Reduced Signaling Overhead for Retransmissions on the UL of 802.16m

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Summary

The requirements [1] for the IEEE 802.16m project include spectral efficiency higher than that currently supported by WirelessMAN-OFDMA [2,3]. The overhead for signaling resource allocations takes away valuable resources that can be used to increase the spectral efficiency. In this contribution, we propose a mechanism for implicit allocation for UL resources for retransmission, thereby saving the resources for explicit allocation of UL resources using the UL-MAP mechanism.

Background

The WirelessMAN-OFDMA system allocates bandwidth to MS on the UL using the UL-MAP mechanism. It also supports H-ARQ mechanisms with Chase combining. Once the MS transmits a PDU on its uplink allocation, it typically receives an HARQ ACK/NACK message on the downlink indicating the status of reception of the sent PDU. If a NACK is received, the MS needs to retransmit the PDU on resources identified by the BS in a new UL-MAP message.

Proposal

We propose that the NACK message implicitly assign the same resources to the MS that were used for the initial transmission. Thus, when a MS receives a NACK corresponding to a HARQ packet sent, it re-sends the packet on the same sub-channels that it used for the original transmission. Thus, the BS can avoid sending a UL-MAP IE to the MS for the retransmission, thereby saving bandwidth. The BS ensures that it does not allocate the specified resources to any other MS for transmission.

Signaling Issues

The normal UL-MAP message uses a cumulative allocation of resources for PUSC. With PUSC, if implicit allocation is used as per this contribution, the BS can assign resources up to that identified for the implicit allocation, and then use an UL Allocation Start IE to skip over these resources for allocations to other users. In the AMC case, it is possible to include a Slot Offset in the UL-MAP IE itself to avoid the resources that have been allocated using the implicit message. An alternative mechanism for resource allocation on the UL is the HARQ UL MAP IE. Here also, the possibility of specifying an allocation start indication (and offset) exists for each individual allocation, thus the implicitly allocated resources can be avoided.

Backward Compatibility Issues

No issues are seen with backward compatibility. Legacy MS can be allocated retransmission resources using existing mechanisms. As long as the BS takes care not to allocate the implicitly signaled retransmission resources to other MS, no problems will arise. Also, as discussed above, the signaling can be done using legacy methods, thereby transparent to legacy users.

Recommendation

It is proposed that the mechanism for implicit allocation of retransmission resources on the UL be included in the section of the SDD pertaining to signaling and bandwidth allocation mechanisms.

Proposed SDD Text

[Section] MAC layer functions

[Sub-Section] Implicit allocation of resources for retransmissions

The BS may choose to implicitly allocate resources for retransmission to a particular MS using the NACK message. In this case, the MS uses the same resources used in the original transmission to retransmit the message. If such implicit allocation is used, the BS should not allocate those resources to any other MS.

References

- [1] IEEE 802.16m System Requirements IEEE 802.16m-07/002r4
- [2] IEEE Std 802.16-2004: Part 16: IEEE Standard for Local and metropolitan area networks: Air Interface for Fixed Broadband Wireless Access Systems, June 2004
- [3] IEEE Std 802.16e-2005 and IEEE Std 802.16-2004/Cor1-2005 (Amendment and Corrigendum to IEEE Std 802.16-2004), "IEEE Standard for local and metropolitan area networks, Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems, Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in License Bands," Feb 28, 2006