

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	A Contribution to the TG3/TG4 MAC: MPDU Formats	
Date Submitted	2001-08-10	
Source(s)	Lei Wang Brian Gieschen Wi-LAN Inc. 2891 Sunridge Way, NE Calgary, AB, Canada, T1Y 7K7	Voice: (403)273-9133 Fax: (403)273-5100 Email: LeiW@wi-lan.com ; BrianG@wi-lan.com ;
Re:	This is a follow-up contribution to a tabled motion in Session #13, regarding the contribution 802.16.3c-01/62.	
Abstract	This document refines two proposed enhancements to the MPDU formats in the previous contribution, 802.16.3c-01/62. First, A new payload type is introduced, called a super MPDU, to directly and efficiently support the concatenation of MPDUs with different CIDs. Second, we propose a new arrangement of the header/payload locations in order for the receiver to process the incoming MPDUs more efficiently.	
Purpose	Enhance the MPDU formats for the TG3 and TG4.	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate text contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE s name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE s sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	

Patent
Policy and
Procedures

The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures (Version 1.0) <<http://ieee802.org/16/ipr/patents/policy.html>>, including the statement IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing the standard.

Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <<mailto:r.b.marks@ieee.org>> as early as possible, in written or electronic form, of any patents (granted or under application) that may cover technology that is under consideration by or has been approved by IEEE 802.16. The Chair will disclose this notification via the IEEE 802.16 web site

<<http://ieee802.org/16/ipr/patents/notices>>.

Acknowledgements

The following people have contributed to this document:

- Paul Rimmer
- Shawn Taylor
- Ron Murias
- Gordon Antonello

Table of Contents

ACKNOWLEDGEMENTS	III
1 INTRODUCTION	1
2 REFERENCE	1
3 A NEW PAYLOAD TYPE: SUPER MPDU	1
3.1 ADD THE SUBCLAUSE 6.2.2.1.3	1
3.2 ADD THE SUBCLAUSE 6.2.3.2.....	2
4 LOCATIONS OF THE PACKING SUB-HEADERS AND THEIR PAYLOADS	4

1 Introduction

This document refines two proposed enhancements to the MPDU formats in the previous contribution, 802.16.3c-01/62. First, A new payload type is introduced, called a super MPDU, to directly and efficiently support the concatenation of MPDUs with different CIDs. Second, we propose a new arrangement of the header/payload locations in order for the receiver to process the incoming MPDUs more efficiently.

This contribution is for TG3 and TG4 MAC.

2 Reference

- (1) [Ref1]: Draft Standard Air Interface for Fixed Broadband Wireless Access System, IEEE 802.16/D2-2001.

[Ref2]: Figures of New MAC Header, IEEE 802.16.1c-01/10r1, 2001-03-13.

3 A New Payload Type: Super MPDU

A new MPDU payload type, called super MPDU, is proposed to efficiently support the concatenation of multiple MPDUs with different CIDs into a single transmission in either the uplink or downlink directions. The following changes are suggested in the document IEEE 802.16ab-01/01r1.

3.1 Add the subclause 6.2.2.1.3

6.2.2.1.3 MAC Header Fields

A new MPDU payload type, called super MPDU, is proposed to efficiently support the concatenation of multiple MPDUs with different CIDs into a single transmission in either the uplink or downlink directions.

The payload type field in the MPDU header is defined in Table 1.

Table 1. MPDU Payload Types

Payload Type	Length=6 bits	000000b=normal payload, no sub-headers or special interpretation;
		000001b=Grant Management sub-header present (UL only code may be reused for some DL only purpose)
		000010b=packing sub-header present
		000011b=both grant management and packing sub-headers present, (UL only, code may be reused for some DL only purpose)
		000100b=Fragmentation sub-header present (not needed simultaneously with packing sub-header)
		000101b=Fragmentation and grant management sub-headers present (UL only, code may be reused for some DL only purpose)
		000110b=super MPDU, with multiple MPDUs concatenated.

3.2 Add the subclause 6.2.3.2

6.2.3.2 Concatenation

Multiple MAC PDUs may be concatenated into a single transmission in either the uplink or downlink directions. Figure 29 illustrates this concept for an uplink burst transmission. Since each MAC PDU is identified by a unique Connection Identifier, the receiving MAC entity is able to present the MAC SDU (after reassembling the MAC SDU from 1 or more received MAC PDUs) to the correct instance of the MAC SAP. MAC Management messages, user data, and bandwidth request MAC PDUs may be concatenated into the same transmission.

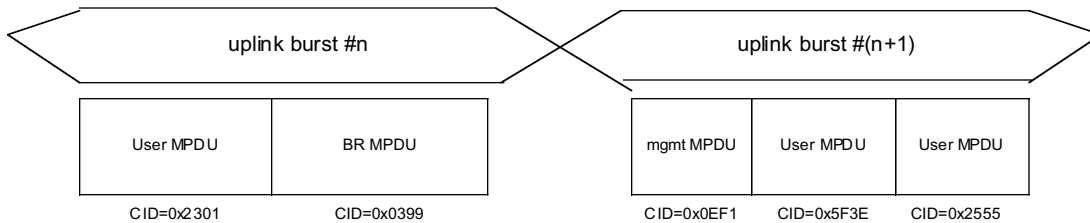


Figure 29 MAC PDU Concatenation showing example CIDs

Multiple MPDUs may also be concatenated into a single super MPDU of a single transmission in either the uplink or downlink directions. FIGURE 1 illustrates MPDU concatenation using the super MPDU concept for an uplink burst transmission.

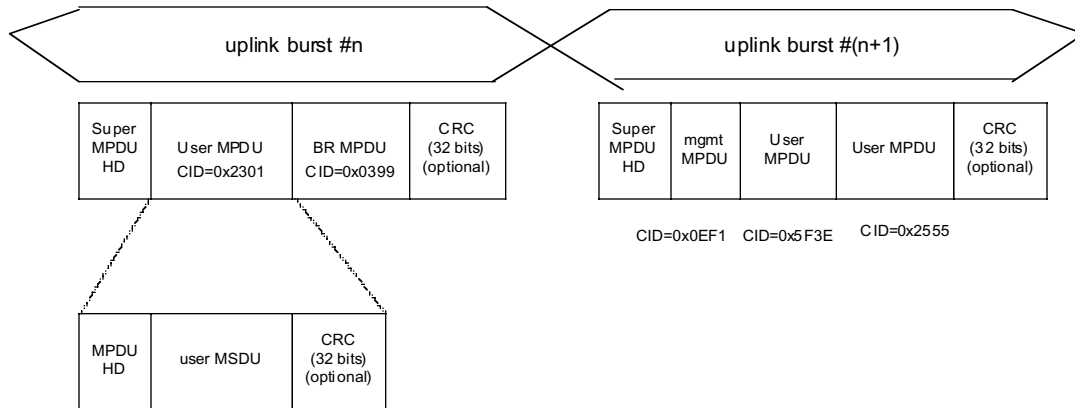


FIGURE 1. MPDU Concatenation Using Super MPDU

The super MPDU header is shown in FIGURE 2. Two fields have specific interpretations: the 11-bit length field is changed to specify the number of MPDUs concatenated in the super MPDU; and the 16-bit CID field is changed to specify the super MPDU length in bytes.

Super MPDU Header (HT=0 and PT=000110)

HT =0 (1)	EC (1)	Payload Type =000110 (6)	rsv (1)	CI (1)	EKS (2)	rsv (1)	# of MPDUs MSB (3)
# of MPDUs LSB (8)				Super MPDU Length (8)			
Super MPDU Length (8)				HCS (8)			

FIGURE 2. Super MPDU Header

The super MPDU header describes a single transmission. The transmission information, such as, the number of concatenated MPDUs and the total length of the transmission, are delivered to the receiver at the beginning, so that the receiver can process the received the data more efficiently.

The super MPDU scheme provides more flexible CRC arrangement for MPDU concatenations. With CI=1 in the super MPDU header, all the MPDUs concatenated in the super MPDU can have a single CRC calculated and appended at the end of the

transmission. In addition, each MPDU in the super MPDU has its own choice of the CRC by setting or resetting the CI field in the MPDU header.

Similarly, the super MPDU scheme provides flexible encryption choices for the concatenated MPDUs in a super MPDU.

The super MPDU is different from the packing MPDU, although both of them are defined to have multiple payloads concatenated into one MPDU. A super MPDU carries multiple MPDUs with different CIDs, while the packing MPDU carries multiple MSDUs or MSDU segments with the same CID. Each MPDU contained in a super MPDU can have its own choices of the encryption and the CRC, while all the MSDUs/segments in a packing MPDU share the choices of the encryption and the CRC. A super MPDU may contain a packing MPDU.

4 Locations of the Packing Sub-Headers and their Payloads

Packing is the mechanism described in TG1 document, section 6.2.3.4, to have multiple MSDUs packed into a single MPDU. In order to improve the efficiency of processing packing MPDUs with variable-length MSDUs at the receiver side, we propose an enhancement to the locations of the packing sub-headers and their payloads, as shown in FIGURE 3.

Packing MPDU with Variable-Length MSDUs (PT=000010, multiple MSDUs for the same CID)

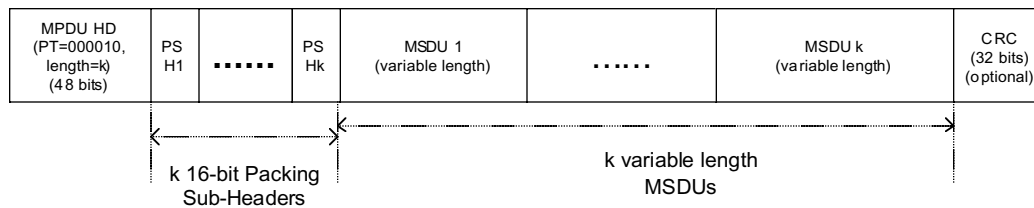


FIGURE 3. Proposed Locations of the Packing Sub-Headers and Payloads

In order to integrate this proposal into the document IEEE802.16ab-01/01r1, the following changes are required:

- add the subclause: 6.2.3.4.2 Packing Variable-Length Packets; with the TG1 context;
- replace Figure 30 in the original context with Figure 3 given in this document;
- add the following paragraph right after the new Figure 30:

The multiple packing sub-headers are gathered together and located before their payloads. At the receiving side, the headers become available to be processed before their payloads arrive, so that such a packing sub-header/payload location arrangement allows more prompt and efficient header processing for the packing MPDUs.