Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	Changes in the 802.16 Fragmentation and Packing Function
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Re:	This document is submitted for a discussion on the “Advanced Packing” section of TG3 MAC Document
Abstract	This document figures the suggested changes in the 802.16 Fragmentation and Packing Function
Purpose	The document is submitted as a part of development of 802.16a and 802.16b MAC sections. It is for the discussion on the specific details of Fragmentation and Packing requested by the TG3/TG4 applications
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Changes in the 802.16 Fragmentation and Packing Function

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References

[1] IEEE 802163c 01/60. Detailed ARQ Proposal for 802.16a and 802.16b MAC. V.Yanover
[2] IEEE P802.16/D3d2-2001. IEEE Draft. Local and Metropolitan Area Networks— Part 16: Standard Air Interface for Fixed Broadband Wireless Access Systems. 2001-05-03

1. General

This document contains the suggestion for the change in the 802.16 Fragmentation and Packing functions. It is suggested

- to enlarge the FSN fields
- to employ Partial Payload Type
- to add Partial Payload Addressing function.

The section 2 describes the FSN problem. Further sections figure the exact changes proposed to do in the Air Interface Document (version D2-2001).

2. Fragmentation Control Function

There is certain problem of consistency of the assembling of MSDUs at the receiver side. If two MSDUs were transmitted as two fragments each and if we have only FC information (10, 01, and again 10, 01) then the failure in the transmission of the 2nd and 3d fragments may imply wrong assembling of the remaining fragments.

The FSN fields were employed in TG1 MAC to decrease the probability of wrong assembly, because now for wrong assembly exactly 8 consequent fragments should be lost. The BER is believed to be very low in TG1 applications and the probability of wrong assembling becomes much negligible.

For TG3 / TG4 applications BER is not expected to be that as low, there may be bursts of errors, so we need more strong mechanism that would encounter errors in the delivery of segments. Such a mechanism can be built simply by enlarging the number of bits in the FSN. In the document [1] it is proposed to use (for the needs of ARQ) the following new format of sub-header

FC (2)	FSN (6)

Figure 1. Fragmentation Sub-header

If we follow certain rules (transmit window restrictions) we can ensure absolutely secure algorithm of reassembling.

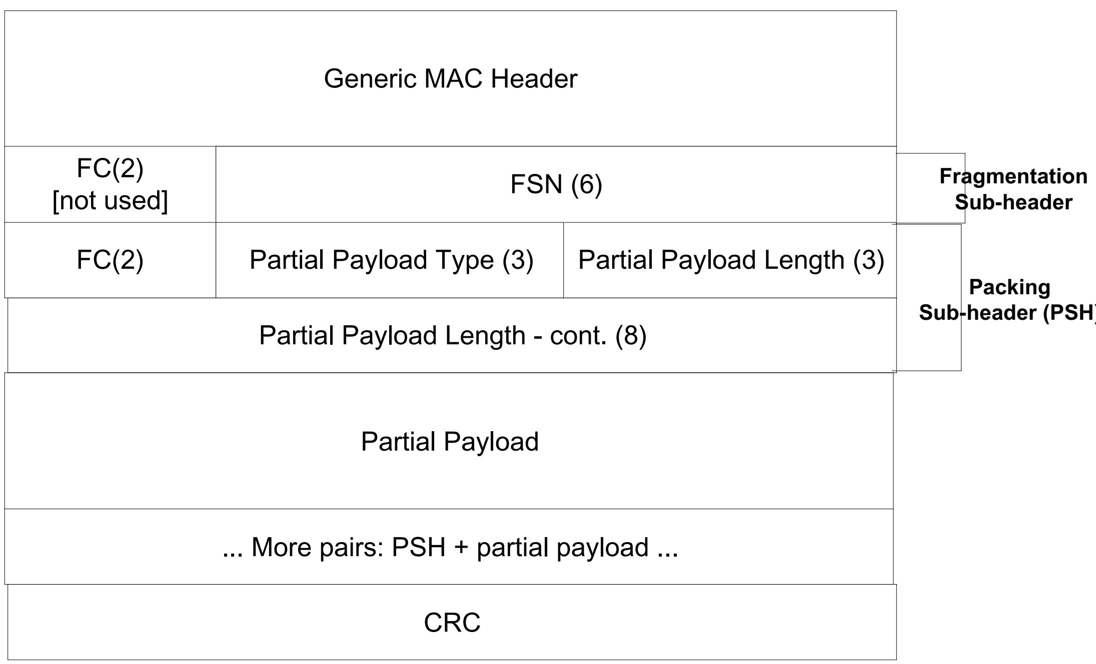
It is suggested to replace the format of the Fragmentation Sub-header from the section 6.2.2.2.1 Fragmentation Sub-header [2] to the figured above so that such format would be valid also for the connections with ARQ disabled.

In the case of ARQ enabled, this field may either remain a Fragment Sequence Number or have another meaning (depends on ARQ definition which still is TBD).

3. Packing Function

The abovementioned problem may have influence also on the packing functionality. There is still a motive to enlarge the FSN, but it may impact the MAC efficiency being present at every PSH.

The suggested solution is to enlarge FSN but put it only at the Fragmentation Sub-header at the beginning of the packed MAC PDU. In this case we have to restrict the packing to the case of the fragments with consequent numbers. In this case we may reuse the 3 bits of PSH for the Partial Payload Type field that would allow e.g. piggybacking of ARQ information onto the data messages



The invocation of the ARQ includes the definition of ARQ feedback (ACK, NACK) format(s). The packing functionality may be used for piggybacking ARQ related information (as well as another types of MAC signaling in the future) onto the data messages transmitted over the 802.16 wireless connection. So an indication needed for the type of partial payload that appears in the packed MAC PDU..

4. Partial Payload Addressing Function

According to the Functional Requirements for the TG3 Air Interface, the VoIP applications should be supported effectively.

The VoIP applications over 802.16 wireless network face a specific problem of the high MAC header overhead. Having VoIP packets (IP datagrams) transmitted DL to different SSs, we have to add to each one 6 bytes MAC header simply because we have only one function of addressing located in the MAC Header. Actually we need only specify CID for each one.

For example, the H.323 payload of 20 bytes (G.729 with CS-ACELP coding) coming from the Ethernet network might be, using headers compression, translated into, let s say 22 bytes MAC payloads. Each payload should be encapsulated into a separated MAC messages to provided different CIDs resulting in 28 bytes MAC messages (without CRC). The MAC overhead involved at this step is 6/28 = 33%.

Now, suppose we apply the packing function to a number of VoIP channels payloads with the change that we add the CID to each partial payload. Then effectively (for several tens of connections) the overhead entered by MAC will be of order

4 (Packing Header + CID) / 26 = 15%.

That still is high but twice less.

This example shows that for a large number of small payloads addressed to different stations may be better handled if we add CID to the Packing Header.

The following structure is suggested for the Extended PSH:

FC(2)	Partial Payload Type = 001	Partial Payload Length (3)
Partial Payload Length - cont. (8)		
CID (8)		
CID - cont. (8)		