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Title	**Proposal for a new PDU concatenation scheme to facilitate MAC PDU separation under error conditions**
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Re:	Propose to IEEE 802.16 d or e ad-hoc group
Abstract	This contribution proposes a new PDU concatenation scheme for enhanced PDU separation in IEEE 802.16d/D3-2004.
Purpose	Discuss and adopt enhanced feature of 802.16d/D3.
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Proposal for a new PDU concatenation scheme

to facilitate MAC PDU separation under error conditions

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1. Problem Statement

802.16 MAC allows concatenations of several MAC PDUs having the same MCS level within a single burst. There is no limitation on the number of PDUs, and their sizes are also variable. Therefore, the receiver side does not know the burst information in advance such as the number of MAC PDUs and the size of each PDU.

The receiver separates the concatenated PDUs in the following sequences;

1) Read the first MAC header of the burst – the first 48 bits of the first MAC PDU

2) Check the validity of the MAC header using HCS. If an error occurs, the whole burst is discarded.

3) If the MAC header is valid, extract the size information of the PDU from the length field.

4) Read the first MAC PDU according to the size information and check the validity of the data. If the header is a bandwidth request header, this step is not necessary and will be skipped.

5) Read the next 48 bits. The receiver regards this as the next MAC PDU header.

6) Repeat Step 2) ~ Step 5) until all the MAC PDUs are read.

Figure 1 describes the sequence.

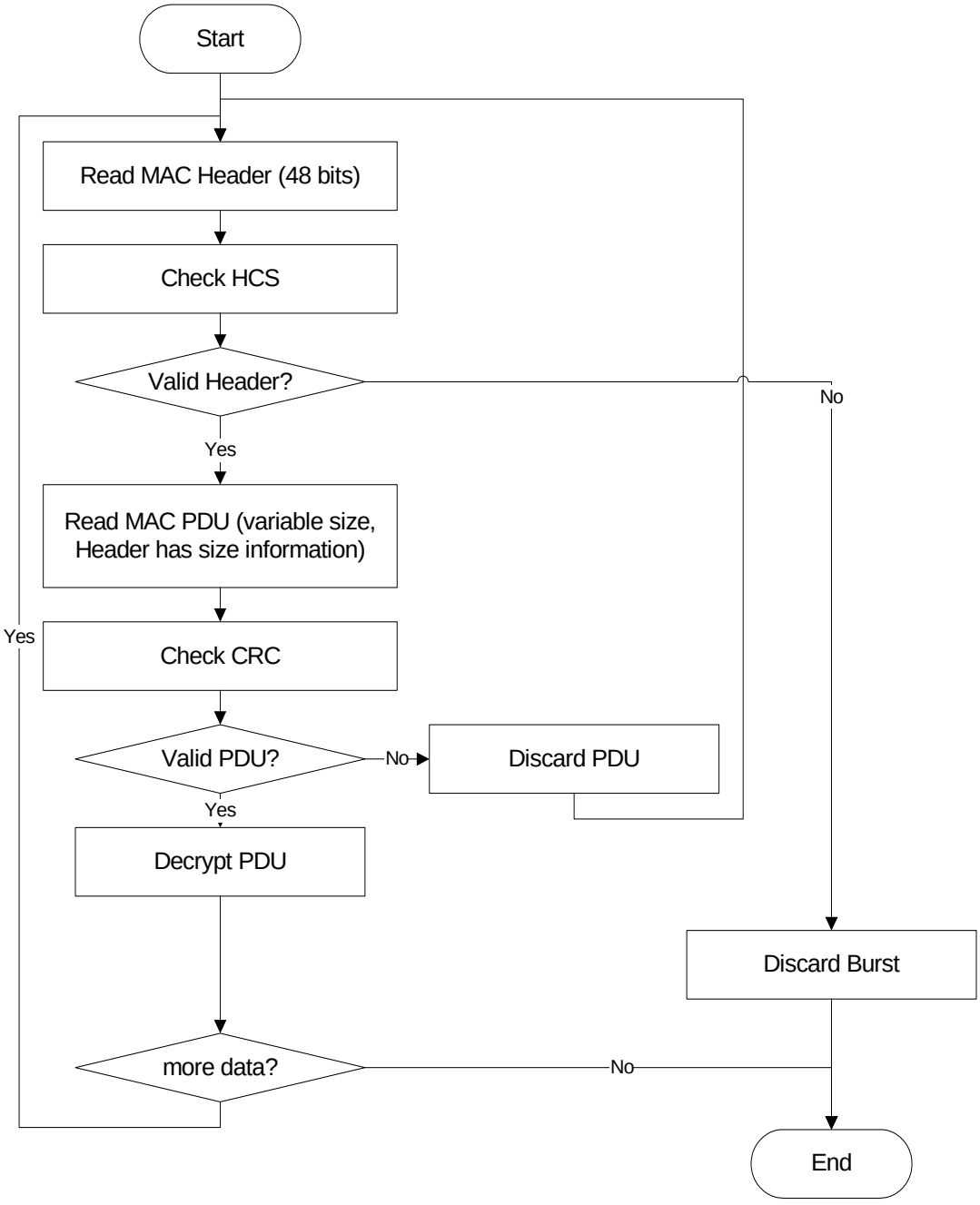

Figure 1 MAC PDU separation algorithm based on IEEE802.16d/D3

In this scheme, the receiver must obtain the size information for the previous PDUs to correctly determine the starting point of the following MAC PDU. Therefore, if there is an HCS error in any of the previous MAC headers, the following PDUs cannot be separated and needs to be discarded.

This contribution proposes a new MAC PDU concatenation scheme that resolves unnecessary PDU destruction in case of MAC header error.

2. Proposed Remedy

Unlike the current PDU separation scheme, the new scheme discards only the erroneous PDUs and continues the PDU separation by finding the starting point of the next PDU header. To accomplish this, it is essential to have a more comprehensive MAC header search mechanism for an arbitrary number of concatenated MAC PDUs. This section shows an example where the following MAC header is found using HCS and CRC for the case where the previous MAC header was in error.

The receiver separates the concatenated PDUs in case of an error in any of the MAC headers in the following sequence;

1) If the MAC Header isn't valid, reads the first 48bit data that may be a MAC header and checks its validity using HCS.

2) If the 48 bit data is deemed validity by passing the HCS check, then the size information of the PDU is extracted from the length field. Otherwise, goes back to step 1)

3) Reads the current MAC PDU using the size information and checks the validity of the data using CRC. If the header is a bandwidth request header, this step is not necessary and will be skipped.

4) Reads the next 48 bit data and checks the validity of the MAC header using HCS.

5) If either the current PDU in step 3) or the next MAC header in step 4) is valid, the MAC Header, which was found in step 2), is considered correct.

6) If neither of them is considered valid, repeats Step 1) ~ Step 5) until the next MAC header is found.

Figure 2 describes the sequences.

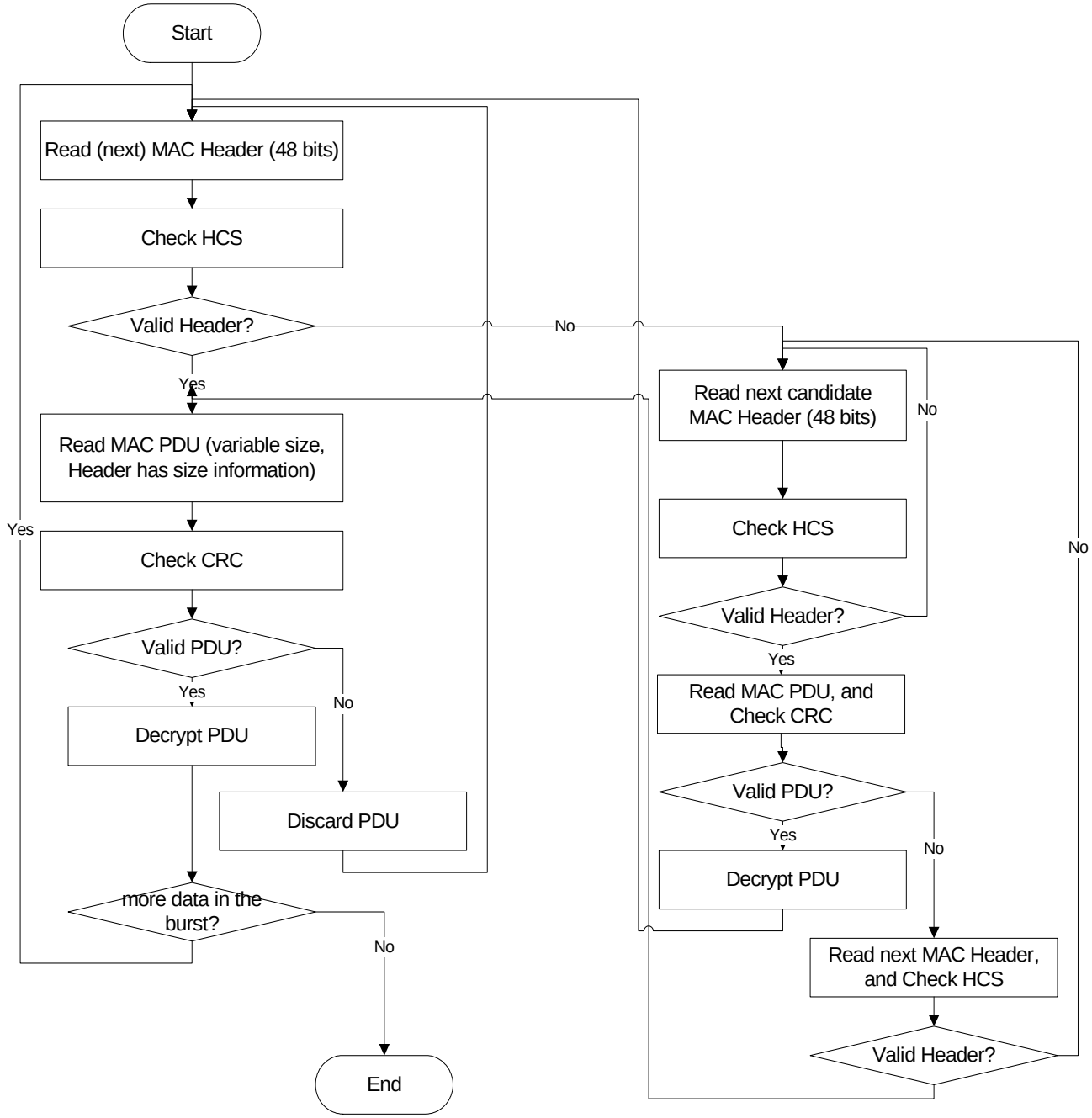

Figure 2 MAC PDU separation algorithm based on the new proposal

In the current concatenation scheme, because the size of the MAC PDU is arbitrary, the consecutive MAC PDUs can be located at any bit position in a burst. So when errors occur in a MAC header, in order to find the next MAC header, the validity is checked by using HCS at all positions. This increases processing complexity.

To resolve the issue with minimal processing complexity, we propose to restrict the MAC PDUs' starting point to be a multiple of 48bits in the burst. For the case where the connection does not allow fragmentation or packing, the size of the PDUs' may not be a multiple of 48 bits. In this case, zeroes padding is required from the end of the previous PDU to the start of the next PDU.

Figure 3 describes the proposed concatenation scheme.

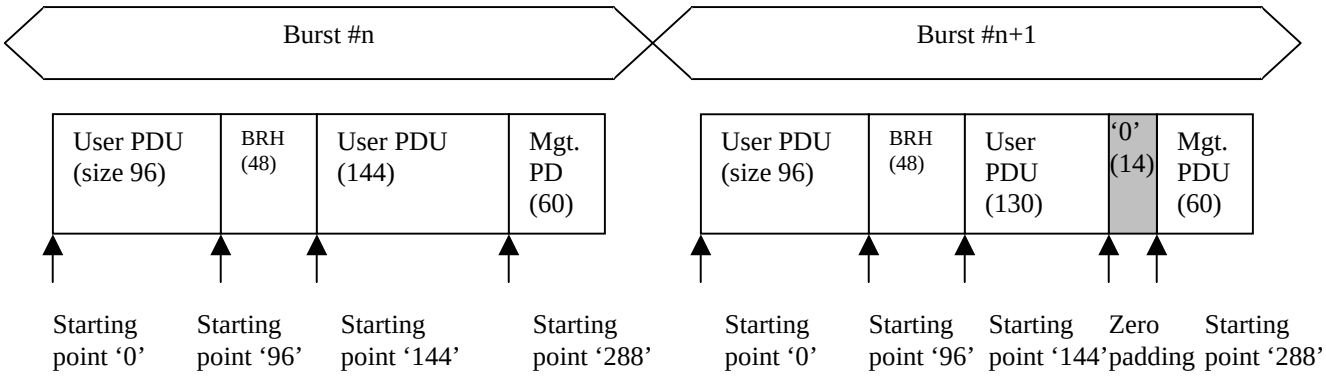

Figure 3 MAC PDU concatenation based on the new proposal

3. Proposed text changes

6.4.3.2 Concatenation

Multiple MAC PDUs may be concatenated into a single transmission in either the uplink or downlink directions. When multiple MAC PDUs are concatenated into a single transmission, the starting position of each of the MAC PDUs have to be located at a multiple of 48bits position from the start of the burst. If necessary, zeros will be padded between the end of the previous PDU and the start of the next PDU. Figure 26 illustrates this concept for an uplink burst transmission. Since each MAC PDU is identified by a unique CID, the receiving MAC entity is able to present the MAC SDU (after reassembling the MAC SDU from one 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.

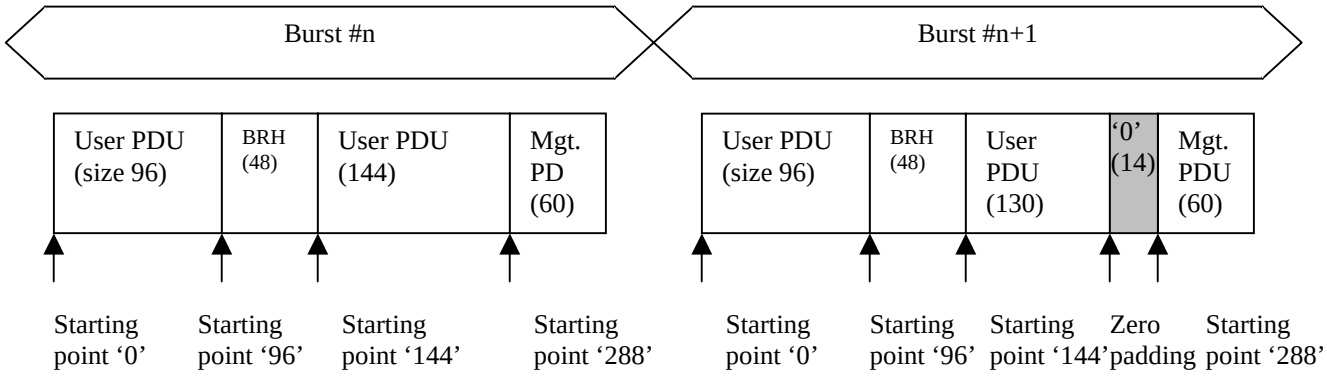

Figure 26-MAC PDU concatenation showing example CIDs