IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>

Title	**Massage based NAK for HARQ in Multihop Relay System**
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Re:	Call for technical proposals regarding IEEE project P802.16j

Abstract	This contribution proposes the HARQ Error report message in RS. This message is useful that RS want to send NAK to MR-BS or parent RS regarding DL HARQ data in asynchronous manner. Introducing this message, the RS can receive faster retransmission data from MR-BS or parent RS compared with ACK/NAK signaling in synchronous manner.

Purpose	For adopting our proposed text to Relay TG task group baseline document

Massage based NAK for HARQ in Multihop Relay System

1. Introduction

In this document, we propose a new MAC messages called HARQ Error Report message[1]. This message, which is generated by a relay station (RS) is used in situations when an RS wants to send a NAK message to MR-BS or a parent RS concerning the erroneous reception of the downlink (DL) HARQ data. By introducing this message, which is basically an asynchronous NAK scheme, the RS can receive the retransmission data faster from the MR-BS or parent RS compared with the current proposals that deal with synchronous ACK/NAK signaling.

2. Problem statement

In [1], in the DL case, the non-transparent RS uses an encoded ACK/NAK to MR-BS or parent RS. If the data fails at an intermediate RS, the retransmission from MR-BS or parent RS will incur larger delay because the ACK/NAK signaling is transmitted in a predetermined frame.

Figure 1 illustrates the encoded ACK/NAK scheme in a 3-hop scenario. If there is no error at any intermediate RS, then there is no problem. Figure 2 on the other hand illustrates the encoded ACK/NAK scheme when errors occur at intermediate RSs and the delay incurred in the scheme can be seen.
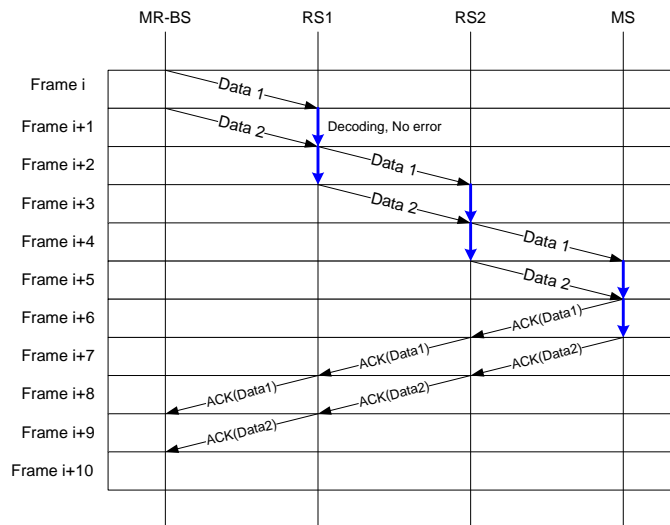
Figure 1. DL non-transparent encoded ACK/NAK scheme in 3 hop case

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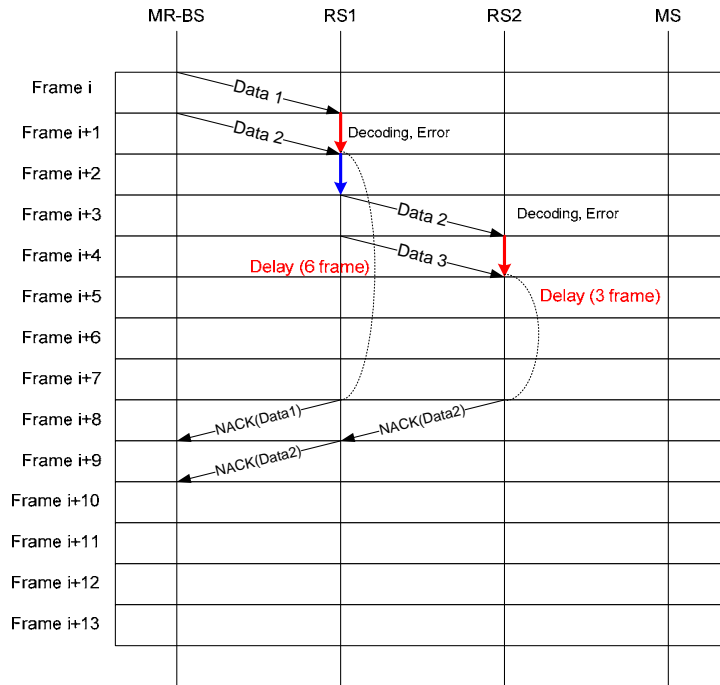[1] Two MAC messages, one for Chase combining and one for IR HARQ are proposed.

Figure 2. DL non-transparent encoded ACK/NAK scheme when error has occurred

3. Proposed Solution

If the data is received correctly, the intermediate RS shall not transmit anything. If, however the transmission is unsuccessful, the RS shall transmit a NAK. The intermediate RS that detects an error can transmit a NAK using a MAC management message. This message shall include ACID (4bits), (and SPID (2 bits) in case of IR HARQ) to indicate the specific data burst that is broken. Using this message, the failed transmission can be reported to the MR-BS without any additional delay as long as there is UL data to be transmitted. Figure 3 illustrates the NAK signaling message sequence.

This solution assumes that the bandwidth is available for sending the error report. It is possible that there is no UL bandwidth available for an RS to send this message. This contribution provides a faster mechanism for requesting bandwidth for sending the HARQ error report. This proposed bandwidth allocation mechanism is efficient compared to allocating UL ACK channel, because, it is only allocated when there is a need for sending error report.

It suggests using a pre-allocated CDMA code for sending bandwidth request. When an RS needs to send HARQ error report, it sends this specific code. As the code is unique, so it doesn't collide with any other station. The MR-BS recognizes that the code is for sending HARQ error report, so it can give a higher priority for the bandwidth allocation.
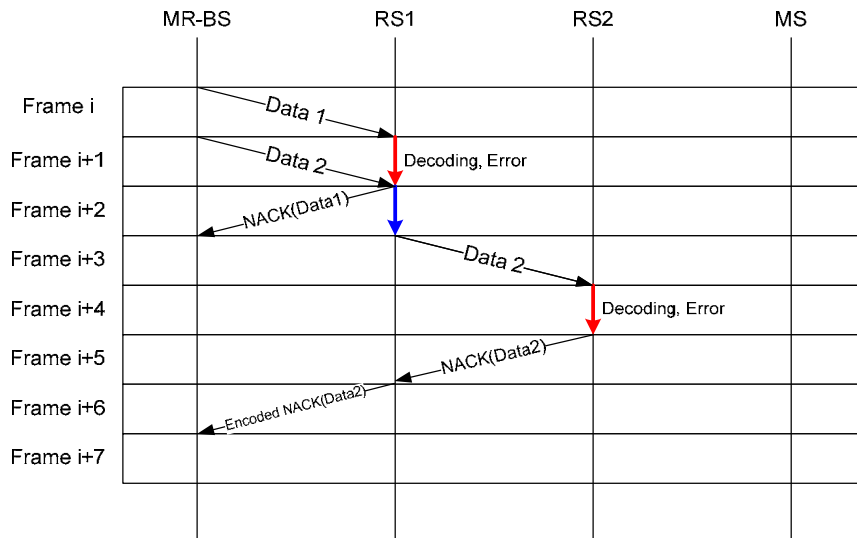
Figure 3. ACK/NAK signaling sequence in asynchronous ACK/NAK manner.

4. Proposed Text Change

[Insert the proposed text at the end of section 6.3.2.3.61]

6.3.17.5.x Resource Request for HARQ Error Report

The HARQ Error Report is sent by an RS as an unsolicited manner using HARQ Error Report message in any available UL bandwidth grant at the moment. When the RS may not have any bandwidth for sending the error report, bandwidth ranging method is used for requesting the UL bandwidth from the MR-BS.

The MR-BS allocates a specific RS CDMA ranging code to a RS during initial ranging by sending RS_CDMA_Codes TLV in RNG-RSP. The code is allocated for requesting UL resource for sending HARQ Report. When an RS needs to send a HARQ Error Report, it sends the allocated CDMA ranging code toward the MR-BS. The MR-BS recognizes the RS with the help of the assigned RS code. It assigns uplink allocation for sending the report.

[Insert the proposed text at the end of section 6.3.2.3.61]

6.3.2.3.6x HARQ Error Report message for multi-hop relay

When an RS receives an HARQ burst in error, the RS may report the error using the HARQ Error Report message which is essentially a NAK message. To specify the burst that is in error, the RS shall include ACID in case of Chase HARQ, and include ACID and SPID in case of IR HARQ, in the MAC message. The message may be repeated for robust transmission.

HARQ Error Report messages are shown in Table xxx and Table yyy. Table xxx is the HARQ_CHASE_ER_RES_Message. Table yyy is the HARQ_IR_ER_RES_Message.

Table xxx – HARQ_CHASE_ ER_REP _message

Syntax	Size	Notes
HARQ_CHASE_ ER_REP _message _format() {		
Management Message Type = xx		
Num_HARQ_Data	4bit	
For(i=0 ;i<Num_HARQ_Data ;i++) {		
ACID	4bit	
}		
}		

Table yyy – HARQ_IR_ ER_REP_message

Syntax	Size	Notes
HARQ_IR_ ER_REP_message _format() {		
Management Message Type = xx+1		
Num_HARQ_Data	4bit	
For(i=0 ;i<Num_HARQ_Data ;i++) {		
ACID	4bit	
SPID	2bit	
}		
}		

[Add the following parameter to table in 11.19.1]

11.19.1 CDMA Codes TLV

Name	Type	Length	Value
RS CDMA Code	-	4	- Resource Request for HARQ Error Report (UL)

5. References

[1] C80216j-07/203r1, "*DL HARQ for non-transparent Relays*", 18 January, 2007.