



# Message based NAK for HARQ in Multihop Relay System

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## 1. Introduction

In this document, we propose a new MAC messages called HARQ Response message<sup>1</sup>. 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.

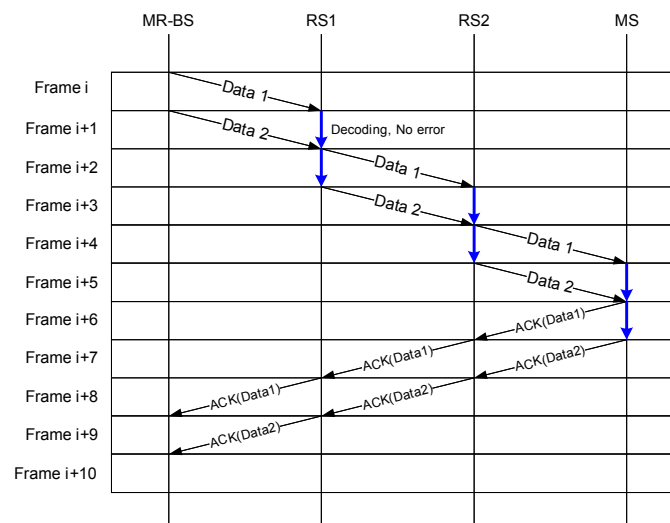


Figure 1. DL non-transparent encoded ACK/NAK scheme in 3 hop case

<sup>1</sup> Two MAC messages, one for Chase combining and one for IR HARQ are proposed.

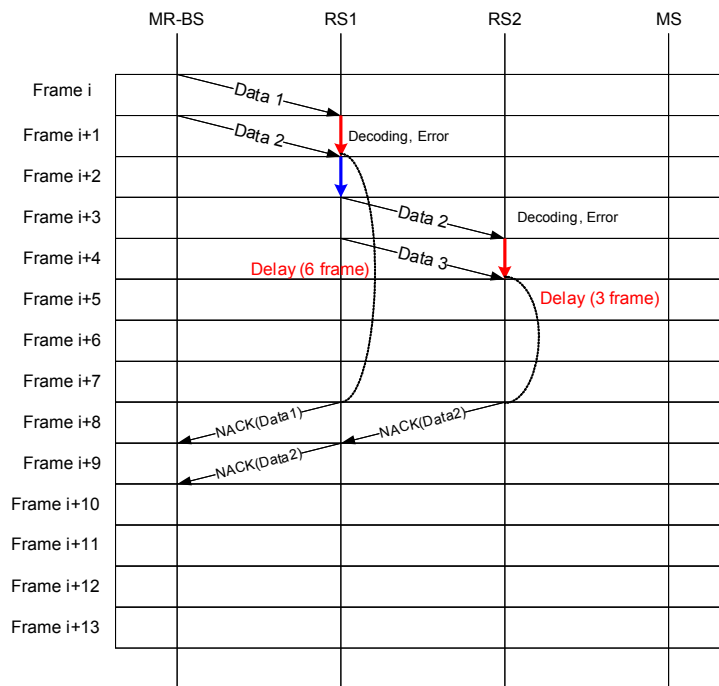


Figure 2. DL non-transparent encoded ACK/NAK scheme when error has occurred

### 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.

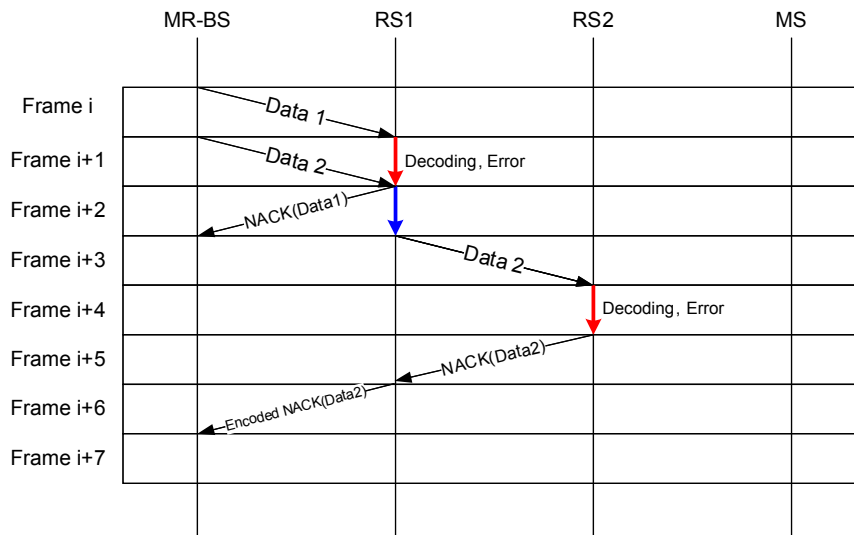


Figure 3. ACK/NAK signaling sequence in asynchronous ACK/NAK manner.

## 4. Proposed Text Change

*[Insert the proposed text at the end of section 6.3.2.3.6I]*

### 6.3.2.3.6x HARQ Response message for multi-hop relay

When an RS receives an HARQ burst in error, the RS may report the error using the HARQ Response 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.

Table xxx shows the HARQ\_CHASE\_RES\_Message. Table yyy shows the HARQ\_IR\_RES\_Message. These MAC messages will be sent in the UL Relay Zone.

Table xxx – HARQ\_CHASE\_RES\_message

| Syntax                            | Size | Notes                              |
|-----------------------------------|------|------------------------------------|
| HARQ_CHASE_RES_message_format() { |      |                                    |
| Management Message Type = xx      |      |                                    |
| Num_HARQ_Data                     | 4bit | The number of bits is same as ACID |
| For(i=0 ;i<Num_HARQ_Data ;i++) {  |      |                                    |
| ACID                              | 4bit |                                    |
| }                                 |      |                                    |
| }                                 |      |                                    |

Table yyy – HARQ\_IR\_RES\_message

| Syntax                           | Size | Notes   |
|----------------------------------|------|---|
| HARQ_IR_RES_message_format() {   |      |   |
| Management Message Type = xx+1   |      |   |
| Num_HARQ_Data                    | 4bit | The number of bits is same as ACID            |
| For(i=0 ;i<Num_HARQ_Data ;i++) { |      |   |
| ACID                             | 4bit |   |
| SPID                             | 2bit | In chase combining HARQ, this value set ='00' |
| }                                |      |   |
| }                                |      |   |

## 5. References

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