Project	IEEE 802.16 Broadband Wireless Access Working Group <***http://ieee802.org/16***>	
Title	An ARQ ~~with Cooperative Relays~~ in IEEE 802.16j	
Date Submitted	~~2007-03-06~~	
Source(s)	Sunggeun Jin, Chulsik Yoon, Young-il Kim, Byung-Jae Kwak Electronics and Telecommunications Research Institute 161 Gajeong-dong, Yuseong-gu, Daejeon, 305-700, Korea	Voice: +82-42-860-1757 Fax: +82-42-861-1966 sgjin@etri.re.kr
	Kyu Ha Lee Samsung Thales San 14, Nongseo-Dong, Giheung-Gu, Yongin, Gyeonggi-Do, Korea 449-712	Voice:+82-31-280-9917 Fax: +82-31-280-1620 Email: kyuha.lee@samsung.com
	Chindapol Aik Siemens	Email: aik.Chindalpol@siemens.com
	Yousuf Saifullah Nokia	Email:yousuf.saifullah@nokia.com
Re:	This is a response to Call for Technical Proposals regarding IEEE Project P802.16j	
Abstract	The document contains technical proposals for IEEE P802.16j that would provide an ARQ scheme by using multiple cooperative relays	
Purpose	The document is submitted for review by 802.16 Working Group members	
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 material 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 <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of 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:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

An ARQ ~~with Cooperative Relays~~ in IEEE 802.16j

Sunggeun Jin, Chulsik Yoon, Young-il Kim, Byung-Jae Kwak, Su Chang Chae
ETRI

Kyu Ha Lee
Samsung Thales

Aik Chindapol
Siemens

Yousuf Saifullah
Nokia

Introduction

ARQ is one of key technologies that provide reliable transmissions. In IEEE 802.16 standard, an ARQ connection may exist between Base-Station (BS) and Mobile Station (MS). If either a BS or an MS as a receiver having an ARQ connection fails to receive a block, it requests a sender to retransmit the missing block by transmitting ACKnowledgement (ACK) message. Due to the overhead for retransmission, it takes longer to complete transmission when utilizing ARQ. In case that Relay Stations (RSs) are deployed, a block on an ARQ connection should be passed through multiple RSs with increased hop counter, which makes transmission latency longer accordingly. Since a transmitter possibly fails to transmit a block in each wireless link, an RS may receive an erroneous block, where only a single bit can be incorrect. Nevertheless, the whole bits of the block are useless because it is impossible to recover the block. Therefore, it does not need to forward the entire corrupt block to the next destination even on an ARQ connection.

For this reason, in order to reduce the overall latency when using an ARQ connection through multiple RSs over multi-hop, RSs should provide fast recovery of an erroneous block. In this proposal, we provide new scheme called fast recovery to make block retransmission for an ARQ connection fast.

Proposal

An ARQ connection is assumed to be established through multiple RSs over several hops. When an RS receives an erroneous block from either MR-BS or RS, it does not need to forward the corrupt block to the next destination. Instead, it requests the transmitter to retransmit the corrupt block by sending a retransmission request at the next UL relay zone as soon as possible. For this purpose, a transmitter may keep the transmitted blocks for a while. On successful reception of a block, it continues to relay received block to the next destination. This scheme called fast recovery allows each RS supporting an ARQ connection to recover corrupt block fast, and thus, resulting in reducing retransmission latency when an ARQ connection is established. Both MR-BS and RS shall be aware of the fast recovery, which accelerate ARQ operations intermediately when block transmission failures occur at the wireless links. All of RSs do

not need to provide fast recovery necessarily, and so, both MR-BS and MS can establish ARQ connection successfully without providing fast recovery.

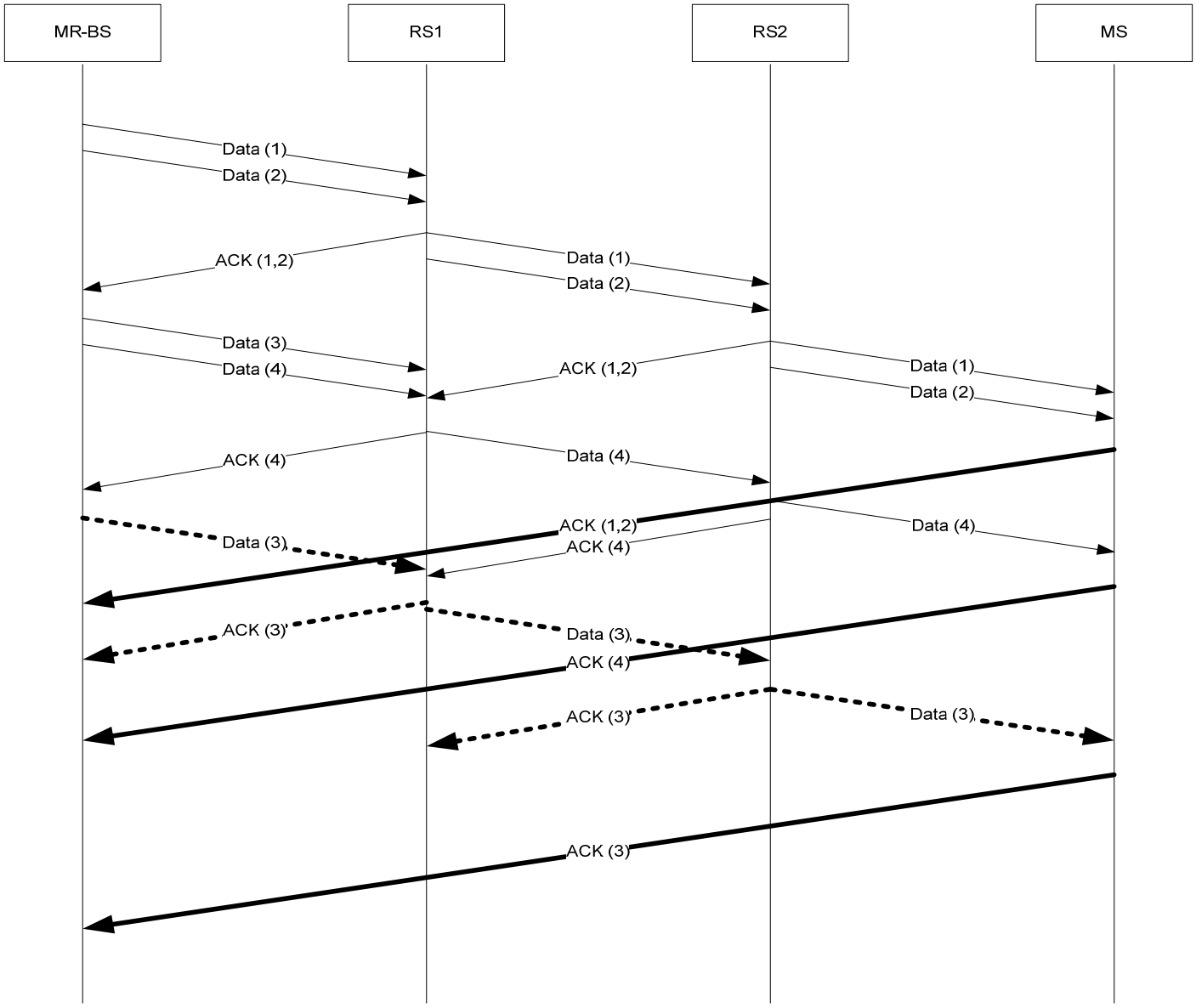


Figure 1 Intermediate ARQ

Fig. 1 shows an example of a Intermediate ARQ. When RS1 recognizes the received block is corrupt by checking CRC, it drops and requests a retransmission of the corrupt block. On reception of the request, MR-BS retransmits the corrupt block to RS1, and then, RS1 forwards the received block to RS2.

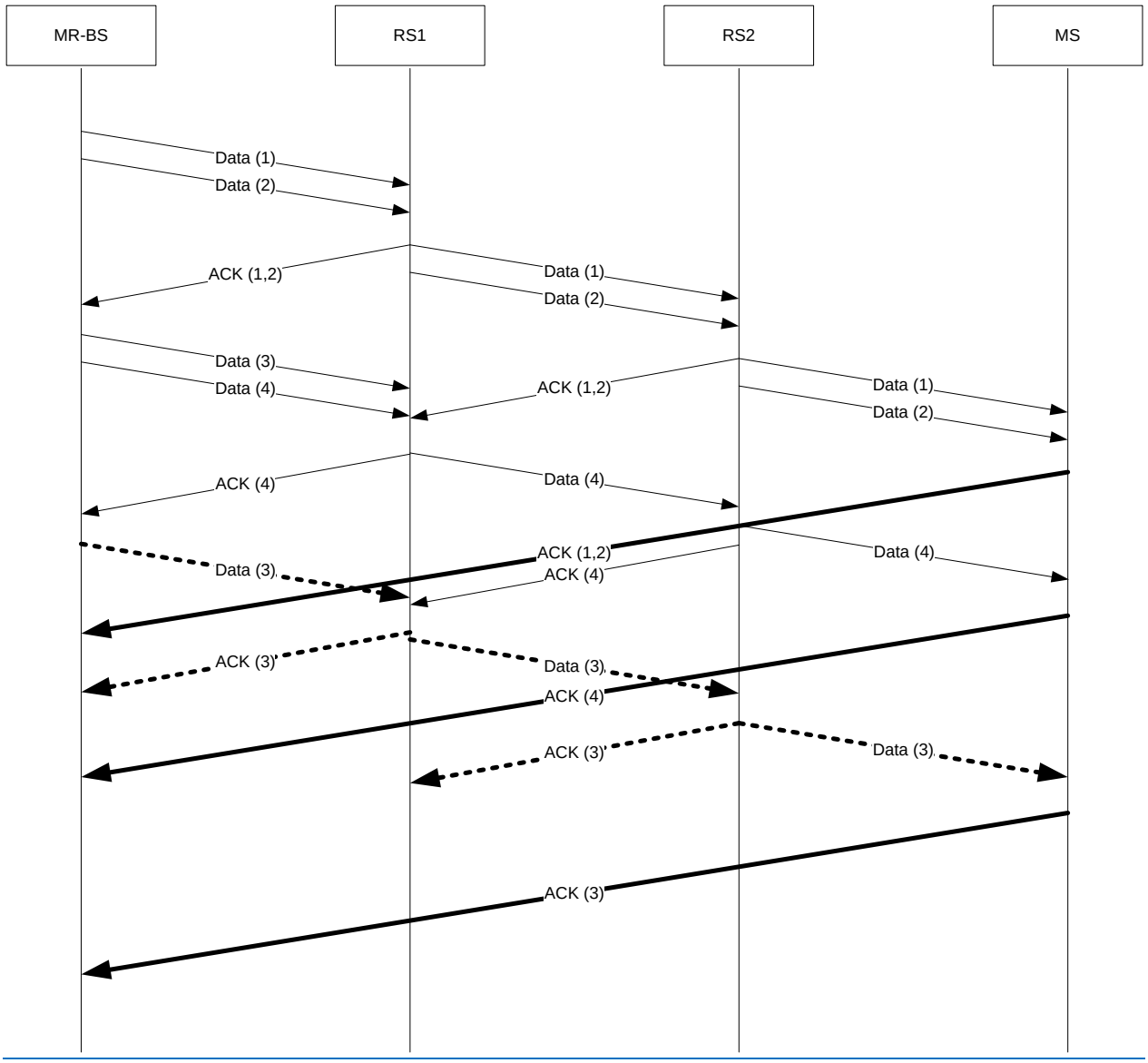
In order to configure RSs for ARQ connection establishment, MR-BS utilizes the path management scheme provided by [1]ARQ connection can be configured by using DSA-REQ..

Text Proposal

[Insert the text at the section 6.3.4.6.4 as follows]

Either an MR-BS or an MS may establish an ARQ connection between them across multiple RSs through multi-hop (as defined in 6.3.25). In this case, intermediate RS may request missing ARQ block to the MR-BS or other intermediate RS, which is located at one-hop distance in a relay zone by transmitting ACK management message represented by ARQ Feedback IE (as defined in 6.3.4.2). This scheme is called intermediate ARQ. The intermediate ARQ operations provided by intermediate RSs and MR-BS follow the procedures for normal ARQ operations defined in Section 6.3.4.6 except managing ARQ window. They shall be complementary for the normal ARQ operations (as defined in 6.3.4.1~6.3.4.3) established between both the MR-BS and the MS, and thus, being conducted with it. For intermediate ARQ operations, an intermediate RS can contain unacknowledged ARQ block until at least one of three conditions is satisfied. (1) a timer for ARQ_BLOCK_LIFETIME is expired; (2) ARQ block is acknowledged by ARQ Feedback IE transmitted for intermediate ARQ; (3) ARQ block is acknowledged by MR-BS or MS for the normal ARQ operations. Intermediate RS can recognize whether an ARQ block, which is temporarily contained in it, is acknowledged from ARQ Feedback IE for normal ARQ operations. Intermediate ARQ shall not influence ARQ windows for normal ARQ operations managed by both the MR-BS and the MS. An MR-BS does not retransmit an ARQ block acknowledged by intermediate RS even when the ARQ block is unacknowledged by an MS.

Figure XXX shows an example of intermediate ARQ. In this figure, an ARQ block with BSN set 3 is corrupted. RS1 transmits ACK with BSN set 4 so that MR-BS retransmits the corrupted ARQ block. Each RS can remove acknowledged ARQ block while RS2 can flush the ARQ block with BSN set 3 by receiving ARQ Feedback IE for normal ARQ operation from the MS.



Fiture XXX

References

[1] IEEE 802.16j baseline document, 802.16j-06/2026r3.