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Source(s)	Kanchei (Ken) Loa, Yung-Ting Lee, Yi-Hsueh Tsai, Heng-Iang Hsu, Chih-Chiang Hsieh, Shiann-Tsong Sheu Institute for Information Industry 8F, No. 218, Sec. 2, Dunhua S. Rd., Taipei City 106, Taiwan, ROC. G.Q. Wang, Wen Tong, Peiying Zhu Hang Zhang, David Steer, Gamini Senarath, Derek Yu Nortel 3500 Carling Avenue Ottawa, Ontario K2H 8E9 add co-author here	Voice: +886-2-2739-9616 Fax: +886-2-2378-2328 loa@nmi.iii.org.tw Voice: 1-613-763-1315 wentong@nortel.com
Re:	IEEE 802.16j-06/027: "Call for Technical Proposals regarding IEEE Project P802.16j"
Abstract	This document is to define Network Entry procedure in 6.3.9.16 of IEEE 802.16j-06/026 for mobile station (MS) to join Multihop Relay network.
Purpose	Adopt the text proposal in this document
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MS Network Entry with RS

Introduction

The purpose of this document is to define Network Entry procedure in 6.3.9.16 of IEEE 802.16j-06/026 for mobile station (MS) to join Multihop Relay network.

Explanation of Problem

There are two scenarios of MS Network Entry in a Multihop Relay system. In the scenario of MS entering the network by communicating with MR-BS directly, legacy network entry procedure as defined by IEEE 802.16e-2005 shall be applied. Whereas, the other scenario of MS entering the network via RS requires modified network entry procedure that is depicted in the following sections.

Design Objectives

1. The Network Entry procedure shall support MS to join Multihop Relay network without any modification on MS.

2. The Network Entry procedure should support MS to enter and register the Multihop Relay network via various RS modes.

3. The Network Entry procedure executed by the RS should be centralized controlled by the MR-BS.

4. The modifications to legacy Network Entry Procedure should be minimized.

Proposed Remedy

Figure 1 depicts the legacy procedure for initialization of MS. We propose the following modifications such that the procedures of Network Entry and Initialization defined in IEEE 802.16-2004 and IEEE 802.16e-2005 could be adopted for MS to enter and register to a Multihop Relay network via RS.

1. Relaying messages are defined to transport the information in the relay path required for completing the Network Entry procedures.

2. The phase of "Ranging & Automatic Adjustment" in Figure 1 should be modified to facilitate the Network Entry procedure with various RS modes.

Two examples are given in the following figures to illustrate the relaying messages and the modified procedure for performing ranging with various modes of RSs.
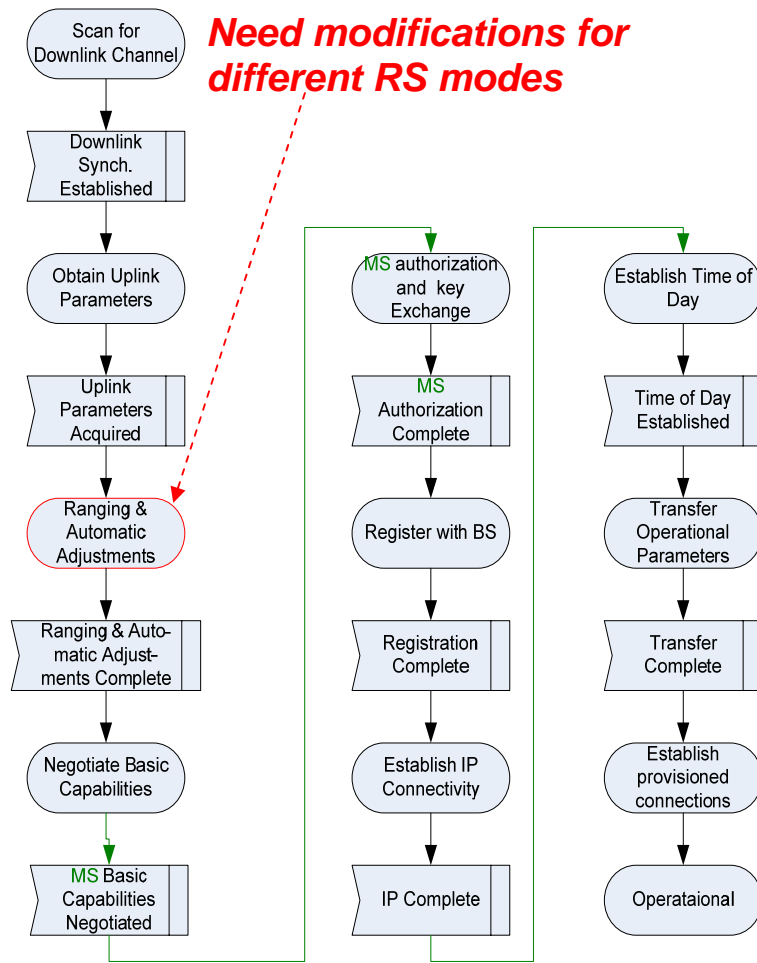
Scan for
Downlink Channel

**Need modifications for
different RS modes**

Downlink
Synch.
Established

Obtain Uplink
Parameters

Uplink
Parameters
Acquired

Ranging &
Automatic
Adjustments

Ranging & Auto-
matic Adjust-
ments Complete

Negotiate Basic
Capabilities

MS Basic
Capabilities
Negotiated

MS authorization
and key
Exchange

MS
Authorization
Complete

Register with BS

Registration
Complete

Establish IP
Connectivity

IP Complete

Establish Time of
Day

Time of Day
Established

Transfer
Operational
Parameters

Transfer
Complete

Establish
provisioned
connections

Operataional

Figure 1: Network Entry Procedure for MS

Example 1: MS joins Multihop Relay network via RS. In this example, only RS_1 can decode messages from the MS and vice versa. Moreover, MR-BS assigns the MS to join the network via RS_1. Figure 2 below shows the procedure of performing initial ranging and basic capability negotiation.
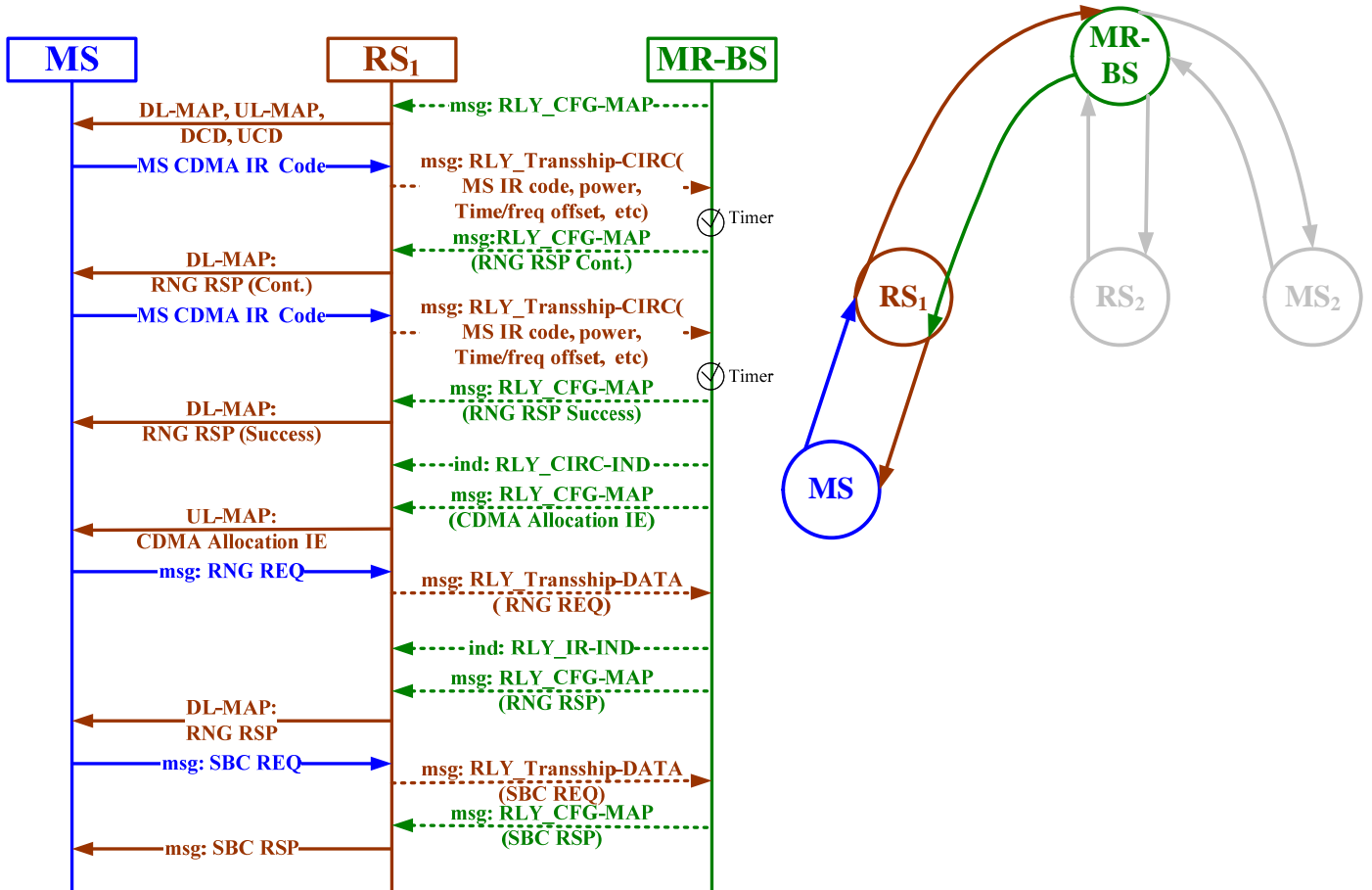
Figure 2: MS joins the Multihop Relay network via RS

Example 2: MS joins the Multihop Relay network via RS. In this example, both RS$_1$ and RS$_2$ can decode messages from the MS and vice versa. The MS can also decode messages from MR-BS. Moreover, MR-BS assigns the MS to join the network via RS$_1$. The procedures of performing initial ranging and basic capability negotiation is shown in Figure 3.
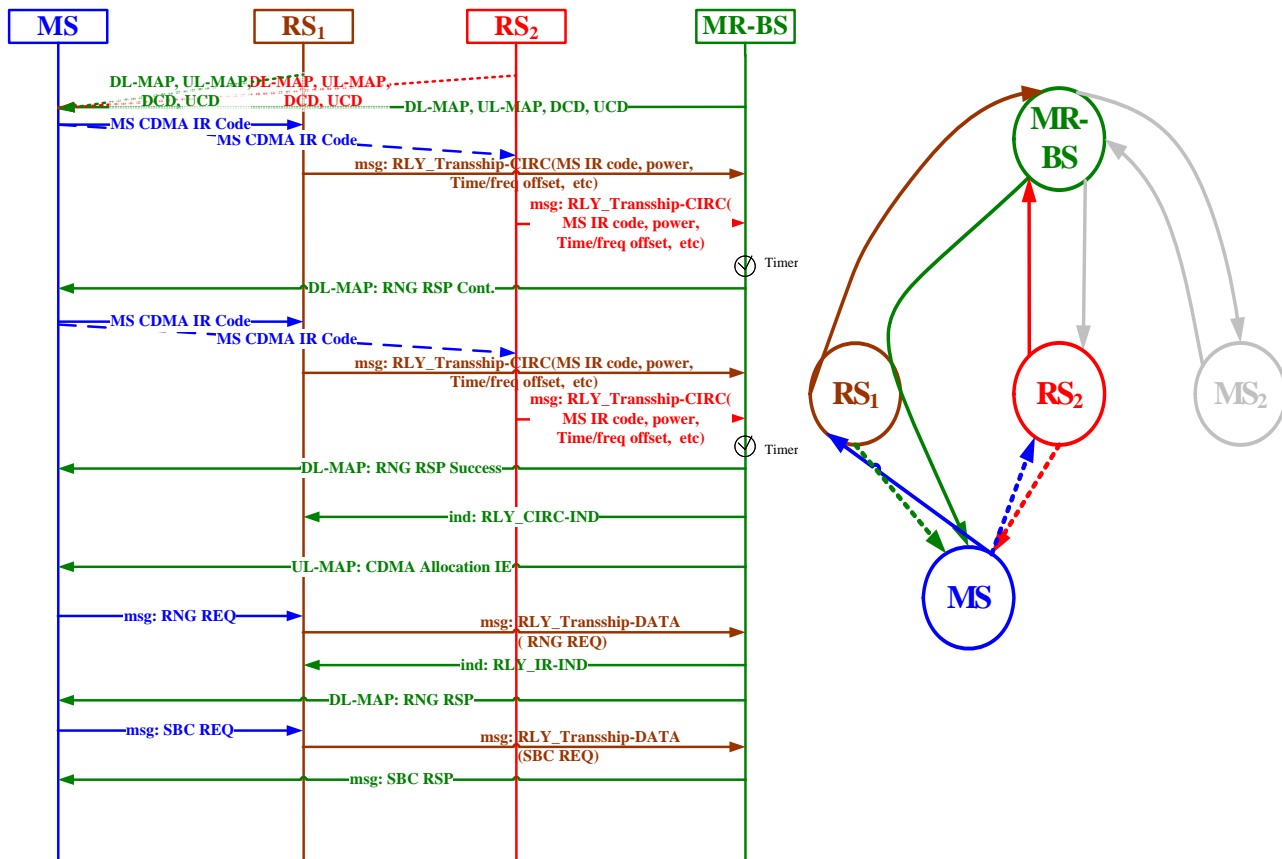

Figure 3: MS joins the Multihop Relay network via RS

Text Proposal

1. Adopt the following text in "6.3.9.16 Support for network entry and initialization in relay mode"

2. Insert the following text in "6.3.2.3 MAC management messages".

6.3.9.16   Support for network entry and initialization in relay mode
6.3.9.16.1 Network entry and initialization for MS with RS
Multihop Relay system shall support applicable procedures for entering and registering an MS to the network via RS. The procedures for initialization of MS shall be the same as those defined in IEEE 802.16-2004 and IEEE 802.16e-2005 (see 6.3.9). During the initialization process, the MAC request and response messages defined in IEEE 802.16-2004 and IEEE 802.16e-2005 for Network Entry procedure shall be transmitted and received by the MS. Relaying messages between MR-BS and RS are required to transport the information in order to complete the initialization process.

6.3.9.16.1.1 MS performs initial ranging

1. The MR-BS and/or RS associated with the MR-BS shall broadcast downlink synchronization and uplink transmission parameters.

2. The MS, after acquiring downlink synchronization and uplink transmission parameters, shall choose randomly a Ranging Slot (with the use of a binary truncated exponent algorithm to avoid possible re-collisions) at the time to perform the ranging, then it chooses randomly a Ranging Code form the assigned Ranging Code Sets and sends a CDMA ranging request.

3. After an associated RS received the CDMA ranging request in access link, the RS should send RLY_Transship-CIRC message to the serving MR-BS through the relay path, which includes the CDMA ranging request and measurements on the CDMA ranging request (e.g., time, power, and possibly frequency offset).

4. Upon receiving RLY_Transship-CIRC message(s) from associated RS(s) and/or receiving the CDMA ranging request from the MS directly, the MR-BS should select one of associated RS or itself to broadcast the Ranging Response message. In case that MR-BS selects an RS to be the candidate RS, the MR-BS should send RLY_CFG-MAP message to the candidate RS, which may include the associated adjustments for ranging. Afterward, the candidate RS shall broadcast a Ranging Response message. Otherwise, the MR-BS shall broadcast a Ranging Response message by itself. The Ranging Response message advertises the received Ranging Code as well as the ranging slot (OFDMA symbol number, subchannel, etc.) where the CDMA ranging code has been identified. This information is used by the MS that sent the CDMA ranging code to identify the Ranging Response message that corresponds to its ranging request. The Ranging Response message contains all the needed adjustment (e.g., time, power, and possibly frequency corrections) and a status notification.

5. Upon receiving a Ranging Response message with continue status, the MS shall continue the ranging process as done on the first entry with ranging codes randomly chosen from the Initial Ranging domain sent on the Periodic Ranging region.

6. If the MR-BS receives an RLY_Transship-CIRC message that triggers an RNG-RSP message with success status, the MR-BS shall use RLY_CIRC-IND message to notify the candidate RS that the RS Ranging Code is accepted and the MR-BS should send RLY_CFG-MAP message (include the information of CDMA Allocation IE) to candidate RS. Afterward, the candidate RS broadcasts the CDMA Allocation IE to provide BW allocation such that the MS could send an RNG-REQ message.

7. If the MR-BS receives an initial-ranging CDMA code that results in sending an RNG-RSP message with success status, the MR-BS shall broadcast CDMA_Allocation_IE to provide BW allocation such that the MS could send an RNG-REQ message.

8. After the candidate RS received a RNG-REQ message in access link, the candidate RS shall transport the RNG-REQ message to the MR-BS through the relay path.

9. When the MR-BS received the transported RNG_REQ message that triggers a RNG_RSP message with success status, the MR-BS shall use RLY_IR-IND message to notify the candidate RS that the RNG_REQ message is accepted and then the MR-BS sends RLY_CFG-MAP message (include the information of RNG_RSP) to the candidate RS. Afterward, the candidate RS shall broadcast the RNG_RSP message to the MS.

10. Initial ranging process is completed after the MS receiving RNG-RSP message, which includes a valid basic CID (following a RNG-REQ transmission on a CDMA_Allocation_IE). If this RNG-RSP message includes 'continue' indication, the ranging process should be continued using the periodic ranging mechanisms.

11. The timeout required for the MS to wait for RNG-RSP message, following or not following CDMA Allocation IE, is defined by T3.

12. Using the OFDMA ranging mechanism, the periodic ranging timer is controlled by the MS, not the MR-

BS and/or associated RS(s).

6.3.2.3   MAC management messages

[Insert the following text into this section]
Add the columns into Table 14 as indicated.

Table 14—MAC Management messages

Type	Message name	Message description	Connection
69	RLY_CFG-MAP	MR-BS configure associated RS for RS broadcasting	Broadcast/Multicast/Basic
70	RLY_Transship-CIRC	RS transport RS/MS CDMA initial ranging code to associated MR-BS; Its IE shall include IDcell of RS that originates this message. In IEEE802.16-2005, IDcell is defined as 5-bit integer.	Basic
71	RLY_Transship-DATA	RS transport RS/MS data to associated MR-BS. Its IE shall include IDcell of RS that originates this message. In IEEE802.16-2005, IDcell is defined as 5-bit integer.	Primary
72	RLY_CIRC-IND	MR-BS notify candidate RS to accept the new coming RS/MS CDMA initial ranging code	Basic
73	RLY_IR-IND	MR-BS notify candidate RS to accept the new coming RS/MS	Basic

Relay station Configure Map (RLY_CFG-MAP) message
[TBD]

Relay station Transship CDMA Initial Ranging Code (RLY_Transship-CIRC) message
[TBD]

Relay station Transship Date (RLY_ Transship-DATA) message
[TBD]

Relay station CDMA Initial Ranging Code Indication (RLY_CIRC-IND) message
[TBD]

Relay station Initial Ranging Indication (RLY_IR-IND) message
[TBD]

Appendix