Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Relay Path management for IEEE 802.16j Multi-hop Relay Network**
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Re:	IEEE 802.16j-07/007r2:"Call for Technical Comments and Contributions regarding IEEE Project 802.16j"
Abstract	This contribution describes relay path management in IEEE 802.16j
Purpose	Propose the relay path management signalling and procedures in IEEE 802.16j specification
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Relay Path management for IEEE 802.16j Multi-hop Relay Network

0. Introduction

In Multi-hop Relay Network, RS is a part of infrastructural network. To make communication in MR network available and reliable, a functionality of relay path management [1] is required to establish, maintain, and release relay paths when MR network has been operated. This contribution describes the relay path management framework as an initial input for 802.16j task group.

2 Path management proposal

We propose the framework of relay path management as shown in Figure 1.

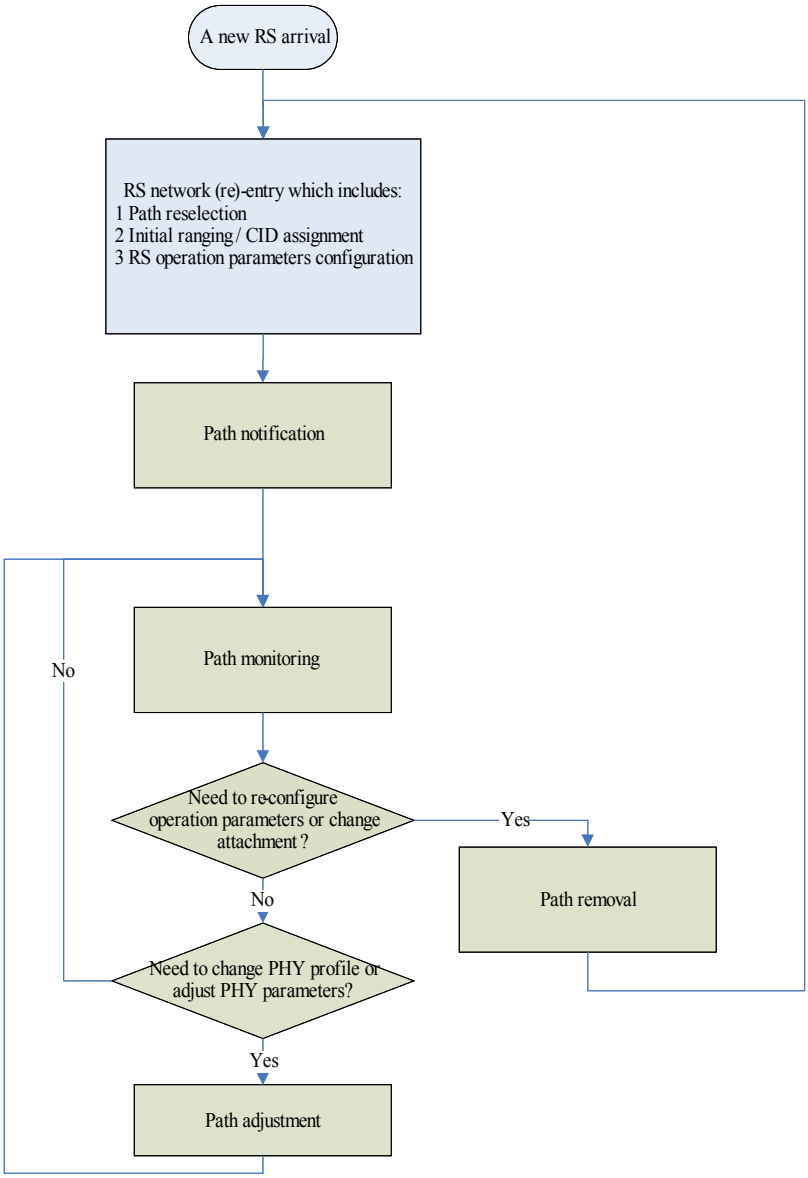

Figure 1, Relay path management

From Figure 1, the relay path management includes:

- Path setup: When a RS entries or re-entries the MR network [2], path setup is used to initialize the associated relay paths. This step could be divided into two sub-steps:
  - Path identification (CID assignment): To assign different types of CID [3], such as Basic CID, Primary CID and Management Tunnel CID, for attaching RS during RS network (re)-entry.
  - Path notification: To notify corresponding RSs about the assigned CIDs to support all types of connection with respect to incoming RS after its entry.

- Path maintenance: After path setup, path maintenance is used to optimize the performance of relay path. This step could be divided into two functionalities:
  - Path monitoring: To monitor the quality of relay path and collect related measurement results.
  - Path adjustment: To change PHY profiles or adjust PHY parameters for providing best performance during transmission.

- Path removal: When a RS or a MR-BS decides to change the attachment, path removal [4] is used to release the existing relay path with associated connections.

3 Proposed text

----------Start text proposal----------

6.3.25 Relay path management and routing

[Insert the following sub-clauses and texts into this section]

6.3.25.1 Relay path management

After MR-BS makes decision regarding the path selection during RS network (re)-entry, The MR network shall perform relay path management to establish, maintain, and release associated relay paths. The procedures of relay path management are shown in Figure XXX.

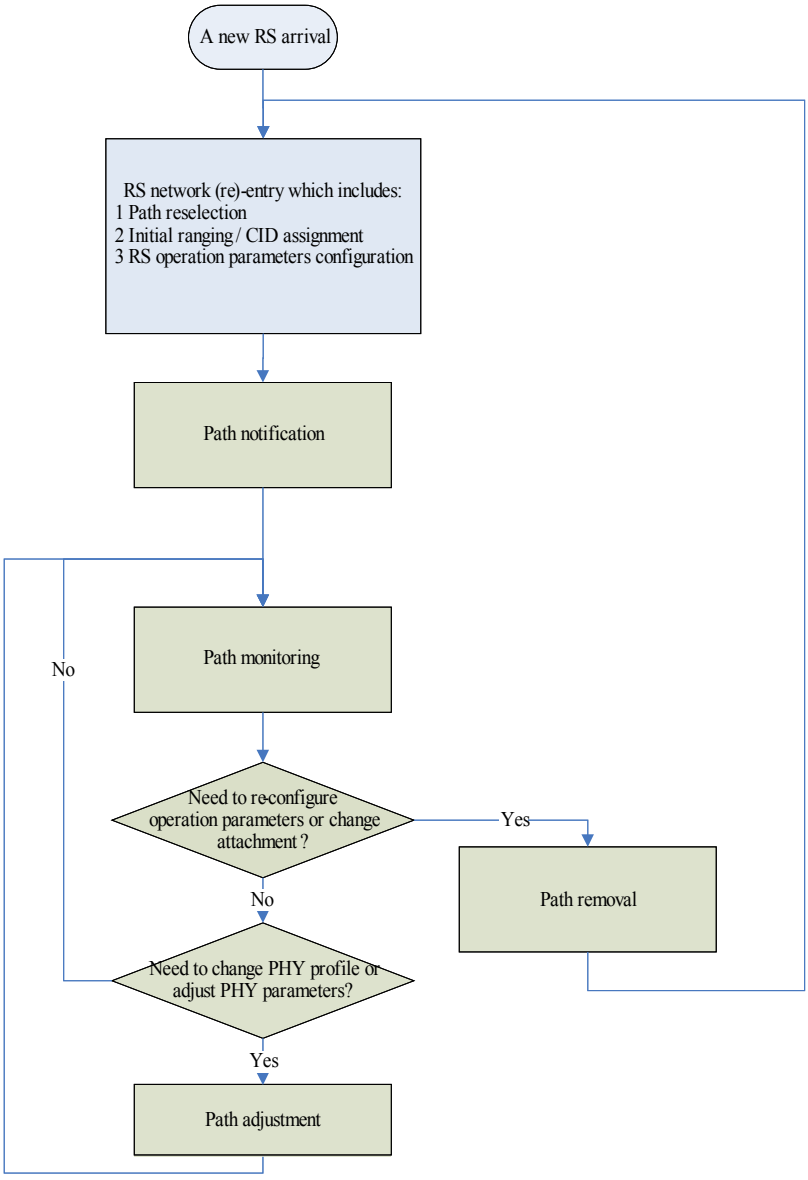

Figure XXX Relay path management in MR network

6.3.25.1.1 Path identification and notification

In MR network, except the basic and primary management connections will be initialized between MR-BS and RS, an additional type of connection called tunnel connection shall be initialized. For RSs, there are three unique identifiers: Basic CID, primary CID, and Management Tunnel CID needed to be assigned during its network entry. These CIDs will be assigned by MR-BS through RNG-RSP when receiving a RNG-REQ message.

When the procedures of RS network entry with respect to incoming RS are finished, MR-BS will send a Path_notify-INFO message to RSs along the new established relay path. In this message, the Management Tunnel CID of new incoming RS is indicated to support the tunnel connection.

Optionally, when the Management Tunnel CIDs are systematic assigned, this notification can be omitted.

6.3.25.1.2 Path monitoring and adjustment

When a relay path is initialized, MR-BS and RSs shall maintain the performance of relay path. To provide information of relay path for maintenance, the operations of path monitoring are used. The monitoring includes DL and UL transmitting qualities, and the interferences measurement from neighboring RSs. For monitoring UL transmitting quality, REP-REQ/RSP messages specified in Section 6.3.2.3.33 would be employed. In centralized scheduling, MR-BS will send a REP-REQ message with tunnel connection to request measurement reports from terminated RS. Terminated RS will respond with a REP-RSP message to report the channel measurements with respect to access station. According to received REP-RSP, MR-BS applies an algorithm to determine the optimal downlink burst profiles for corresponding relay path. Alternatively, in decentralized scheduling, RS will send a REP-REQ message with legacy 802.16 connections to downstream RS for requesting report.

For monitoring UL transmitting quality, periodic ranging process specified in Section 6.3.10 will be applied for access station and RS to adjust associated RF parameters. *[The period ranging process for RS is to be determinated].*

For monitoring the interferences from neighboring RSs, the operations may refer to Section 6.3.26 or Section 6.3.27. The measurement results can facilitate MR-BS or RS configure the operation parameters or MR topology to optimize the MR network.

Based on path monitoring; MR-BS and/or RS can adjust the transmitting parameters or change the profile to maintain a reliable transmission. Furthermore, the procedures of RS network re-entry can be triggered to re-establish another more suitable relay path.

6.3.25.1.3 Path removal

When MR-BS or RS decides to perform RS network re-entry, the associated existing path shall be removed from MR network. MR-BS will send the Path_notify-INFO message to all RSs along the existing path. In this message, the releasing CID of the Management Tunnel connection is indicated.

Optionally, when the Management Tunnel CIDs are systematic assigned, the path removal can be omitted.

6.3.2.3 MAC management messages

[Modify the last row in Table 14 in page 46 as follows]

Table 14—MAC Management messages

Type	Message name	Message description	Connection
xx	Path_notify-INFO	Relay path notification information message sent by MR-BS	Management Tunnel

39

40*[Insert new subclause 6.3.2.3.62]*

416.3.2.3.62 Relay path notification information (Path_notify-INFO) message

42

43This message may be transmitted by a MR-BS to notify the management of relay path.

44

45The message format is described in Table XXX.

46

47 Table XXX, path_notify-INFO message format

Syntax	Size	Notes
Path_notify-INFO format {		
Management message type = xx	8 bits	
Action bitmap	2 bits	Bit[0]: if set to 1, require to create tunnel connection with respect to this management tunnel CID Bit[1]: if set to 1, require to release tunnel connection with respect to this management tunnel CID
Padding	6 bits	--
If (Action bitmap[0]=1) {	--	--
N_CID	8 bits	Number of CIDs to be created for tunnel connection
For (j=0; j<N_CID; j++){	--	--
Management Tunnel CID	16 bits	MT CID of specified RS
}	--	--
}	--	--
If (Action bitmap[1]=1) {	--	--
N_CID	8 bits	Number of CIDs to be released from tunnel connection
For (j=0; j<N_CID; j++){	--	--
Management Tunnel CID	16 bits	MT CID of specified RS

}	--	--
}	--	--
}	--	--

48

49*[Insert the following rows into Table 367 at 11.6 RNG-RSP TLV]:*

50

51 Table 367—RNG-RSP message encodings

Name	Type (1 byte)	Length	Value (variable-length)
Management Tunnel CID	TBA	2	Management Tunnel CID assigned by MR-BS at RS initial access

52

53----------End of text proposal----------

54

55**References**

56[1] IEEE 802.16j-06/017r2, “Table of Contents of Task Group Working Document of Task Group Working
57 Document”.

58[2] IEEE C802.16j-07/097r2, “RS Initial Network Entry and Re-entry”.

59[3] IEEE C802.16j-06/274r6, “Proposal on Address, Identifiers, and Types of Connections for 802.16j”.

60[4] IEEE C802.16j-07/031r1, “Path Management in multi-hop relay system”.