Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
Title	Relay Station Neighbor Discovery
Date Submitted	11/07/2006
Source(s)	Shyamal Ramachandran shyamal.ramachandran@motorola.com Aparna Pandey aparna.pandey@motorola.com Motorola, Inc. 1064 Greenwood Blvd. Ste. 400 Lake Mary, FL 32746
Re:	Call for Technical Proposals regarding IEEE Project P802.16j (IEEE 802.16j-06/027)
Abstract	Proposal to enable RSs to discover the presence and routing characteristics of other RS in the P802.16j context.
Purpose	Adoption of the proposed text into P802.16j baseline document 80216j-06/026.
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>.

Relay Station Neighbor Discovery

Shyamal Ramachandran, Aparna Pandey
Motorola, Inc.

1 Introduction

This contribution proposes a method for RSs to discover the presence of other RSs in the multihop relay (MR) cell.

In order to facilitate the incorporation of this proposal in to IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026 are listed in Section 3.

2 General Description

A RS may enter the MR network either directly through the MR-BS or through another RS that is already a part of the MR cell. The RS makes this decision based on the end-to-end (ETE) path metric between itself and the MR-BS for the paths through each of the access station candidates. A proposal to select the ideal access station at RS network entry is presented in C80216j-06_158. After selecting an access station, the RS proceeds go carry out the rest of the network entry procedure with the access station's assistance, and joins the MR cell.

The path selected by the RS to reach the MR-BS might have been the best available at the time of network entry. However, due to constantly changing physical link characteristics and network traffic load, the current path to the MR-BS might no longer be the best. It is possible that a path through a different access station might prove to be a better choice. Therefore, it is essential that each RS be continuously aware of its neighbors and path options to the MR-BS through them.

Once a RS has joined a MR tree network rooted at the MR-BS, its transmissions towards the MR-BS (on the uplink) are conditioned in order to be received correctly at the BS. This conditioning of the transmission might involve selecting a timing advance, power correction and frequency correction. These corrections and offsets are determined during network entry using the ranging procedure. However, if the RS were to decide to switch its next hop, and reach the MR-BS through another RS, it would have to determine the new set of transmission parameter corrections and offsets in order to condition its transmissions to be correctly received at the new next hop RS.

This proposal enables a RS in a MR cell to

1. Continuously monitor the presence of neighboring RSs,
2. Determine the ETE path cost of reaching the MR-BS through these neighbors, and
3. Determine transmission parameter corrections and offsets ahead of time

These capabilities enable an RS to continuously attempt to improve the QoS provided to the connections it handles and to speed up path changes.

2.1 Network Support for RS Neighbor Discovery

The MR-BS and RS transmit the Routing_Advertisement_IE on the downlink. The format of this information element is included in C80216j-06_158. The Routing_Advertisement_IE includes the following information.

1) The path metric to the MR-BS that the advertising station is associated to.

2) The hop count to the advertising station's MR-BS.
3) The ID of the advertising station's MR-BS.
4) The ID of the node next hop towards the advertising station's MR-BS.

The MR-BS and the RS may transmit the Routing_Advertisement_IE in the MAP message transmitted in the MMR-BS-to-RS or RS-to-RS control zone (as shown in the frame structure defined in C80216j-06_155) immediately following the RS preamble.

The MR-BS informs all the RSs in its MR cell, the time scheduled for a certain RS to transmit the RS preamble and the RS-to-RS control information. This information is conveyed to all the RSs in the MAP message transmitted by the MR-BS, by including an RS_Advertisement_Allocation_IE.

RSs that receive an RS_Advertisement_Allocation_IE in the MAP message from their upstream node, forward the IE to RSs further downstream. In this manner, RSs multiple hops from the MR-BS are informed of the time when a certain RS will transmit its RS preamble and the RS-to-RS control information.

If a RS determines that the "CID" in the RS_Advertisement_Allocation_IE is its CID, it transmits the RS Preamble at the scheduled time, followed by its own MAP message comprising the Routing_Advertisement_IE.

2.2 RS Actions for Neighbor Discovery

The RS that receives a MAP message comprising an RS_Advertisement_Allocation_IE, from an upstream node, prepares to receive the RS preamble at the allocation start time. The RS shall use the RS preamble received, to measure the CINR and propagation delay to the station transmitting the RS Preamble. The RS also receives the Routing_Advertisement_IE transmitted immediately following the RS Preamble.

A RS may specifically request either the MR-BS that it is associated to, or its access station, for a scanning interval, to scan for RS Preambles and Routing_Advertisement_IEs on the downlink. Alternatively, an RS's access station, or the MR-BS may direct it to scan the downlink for RS preambles and Routing_Advertisement_IEs in an unsolicited manner.

3 Proposed Text Changes

[Insert the following text in section 6.3.26]

[Insert new sub clause 6.3.26.1]

6.3.26.1 Network Support for RS Neighbor Discovery

[Insert the following text in section 6.3.26.1]

The MR-BS and the RS shall transmit the Routing_Advertisement_IE in the MAP message transmitted in the MMR-BS-to-RS or RS-to-RS control zone immediately following the RS preamble.

The MR-BS shall inform all the RSs in its MR cell, the time scheduled for a certain RS to transmit the RS preamble and the RS-to-RS control information. This information is conveyed to all the RSs in the MAP message transmitted by the MR-BS, by including an RS_Advertisement_Allocation_IE. The RS_Advertisement_Allocation_IE is defined in section 8.4.5.9.1.

RSs that receive an RS_Advertisement_Allocation_IE in the MAP message from their upstream node, shall forward the IE to RSs further downstream. In this manner, RSs multiple hops from the MR-BS are informed of the time when a certain RS will transmit its RS preamble and the RS-to-RS control information.

If a RS determines that the “CID” in the RS_Advertisement_Allocation_IE is its CID, it shall transmit the RS Preamble at the scheduled time, followed by its own MAP message comprising the Routing_Advertisement_IE.

[Insert new sub clause 6.3.26.2]

6.3.26.2 RS Actions for Neighbor Discovery

[Insert the following text in section 6.3.26.2]

The RS that receives a MAP message comprising an RS_Advertisement_Allocation_IE, from an upstream node, shall prepare to receive the RS preamble at the allocation start time. The RS shall use the RS preamble received, to measure the CINR and propagation delay to the station transmitting the RS Preamble. The RS shall also receive the Routing_Advertisement_IE transmitted immediately following the RS Preamble.

A RS may specifically request either the MR-BS that it is associated to, or its access station, for a scanning interval, to scan for RS Preambles and Routing_Advertisement_IEs on the downlink. Alternatively, an RS’s access station, or the MR-BS may direct it to scan the downlink for RS preambles and Routing_Advertisement_IEs in an unsolicited manner.

[Insert new sub clause 8.4.5.9]

8.4.5.9 Relay Station MAPs and IEs

[Insert new sub clause 8.4.5.9.1]

8.4.5.9.1 RS_Advertisement_Allocation_IE

Syntax	Size	Notes
RS_Advertisement_Allocation_IE() {	-	-
CID	16 bits	Primary Management CID of the RS for which this opportunity is meant
PSID	8 bits	ID of the RS Preamble Sequence that the RS should transmit
}	-	-