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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <**<http://ieee802.org/16>**>** | |
| Title | ***Clarification of topology discovery in reactive operation in GRIDMAN AWD for 802.16.1a*** | |
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| Re: | “IEEE 802.16n-11/0025,” in response to the 802.16n (GRIDMAN) AWD Call for Comments | |
| Abstract | This contribution is to remove ambiguities in the mechanism for topology discovery in reactive operation of multimode HR-MS. | |
| Purpose | To discuss and adopt the proposed text in the AWD of 802.16n | |
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**Clarification of topology discovery in reactive operation in GRIDMAN AWD for 802.16.1a**

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# Introduction

In reactive operation described in subsection 6.12.1.3.2, topology discovery method is introduced when there is no base station. Topology discovery may be needed to make more reliable and effective connections between stations. The current description, however, has some problems.

Problem 1: Modification of frame structure

The suggested method issues the modification of basic frame structure. According to the statement in subsection 6.12.1.3.2.1, the message format consists of PA+SA+A-MAP+AAI-MM-MS-ADV which is drawn in Figure below.

The modified frame structure may cause the additional complexity in implementation. Moreover, there is no explanation why SFH and A-MAP transmission is required in detail.

Problem 2: Ambiguity in the purpose of topology discovery

Due to the lack of information, readers may not fully understand why we need topology discovery process in reactive operation. If this method is to try to find the best HR-MS among all candidates who can change the mode to BS, it should be clearly defined. Whole procedure for topology discovery should be elaborated such as how could we find the best HR-MS after sending MM-ADV messages and so on.

Problem 3: Ambiguities in the collision resolution rules

In wireless random access network, CSMA/CA protocol is the most promising technique. To resolve collisions backoff algorithm is assigned to the proposed scheme. The backoff algorithm, however, does not follow the basic rules described in DCF procedure in IEEE802.11-based systems. Also the algorithm does not deal with the situation where there is no centralized controller such as AP or BS. Here are the lists of uncertain sentences:

* Line 3 in page 129: the size of window can be adjusted if busy channel is sensed
* Line 6 in page 129: When the timer is timeout, HR-MS should sense the channel for the presence of preambles of a duration of four OFDMA symbols
* Line 11: the HR-MS shall double the value of CW if it is less than CWmax and restart the timer
* Line 15: HR-MS should reset the value of CW to CWmin whenever a transmission is made. CWmin is 63 and CWmax is 1023.

In order to help easy understanding, an example of DCF procedure based on CSMA/CA with BEB algorithm is summarized in below.

1) DCF procedure

* A station may transmit if it senses the medium idle for DIFS (DCF Interframe Space)
* If medium is busy, station sets random backoff timer
* Backoff timer starts running when medium has been idle for DIFS, and runs until either:
  + medium becomes busy; station pauses timer
  + timer expires; station can transmit

2) Basic DCF example

B

C

D

DIFS

DIFS

BUSY

A

BUSY

time

* at A, the station senses the medium busy, and calculates a backoff time of 12 slots
* the station’s timer runs from B until the medium is sensed busy, and re-starts at C
* at D, the timer expires and the station transmits

3) Random Backoff Calculation

* The backoff time is a random number of slot times
* The number of slot times is a random number drawn from the Contention Window
* The contention window is the range of values 0 to CW
* After a successful transmission, CW is set to CWmin
* After an unsuccessful transmission, the CW is increased (up to a maximum value CWmax)
* When a frame has not been transmitted successfully after a given number of attempts the frame is dropped

# Proposed Texts

Note:

The text in **BLACK** color: the existing text in the 802.16n Amendment Draft Standard

The text in **~~RED~~** color: the removal of existing 802.16n Amendment Draft Standard Text

The text in **BLUE** color: the new text added to the 802.16n Amendment Draft Standard Text

[-------------------------------------------------Start of Text Proposal---------------------------------------------------]

**[*Remedy1: Modify texts in subsection 6.12.1.3.2.1 in the GRIDMAN AWD for 802.16.1a.*]**

**6.12.1 Multi-mode operation**

**6.12.1.3 Base station function for HR-MS**

**6.12.1.3.2 Reactive operation**

…

**6.12.1.3.2.1 Topology discovery**

Before an HR-MS switches to HR-BS, it may do a topology discovery first by transmitting AAI-MM-MS-ADV as defined in 6.2.3.65.xx for certain period. The AAI-MM-MS-ADV shall be transmitted after SA- preamble, SFH and A-MAP as a management message. A PA Preamble shall be transmitted immediately before SA-preamble.

~~To avoid collision in topology discovery stage, an HR-MS functioning as HR-BS shall transmit AAI-MM-MS-ADV with following rules:~~

~~1) A back-off timer shall be started by HR-MS before transmitting a MM-MS-ADV message. HR-MS should get the value for the duration of back-off from a window [0, CW] based on uniform distribution, the size of window can be adjusted if busy channel is sensed. The value of CW shall be between CWmin and CWmax, and inclusive. The back-off value and size of contention window shall be counted in a time unit of OFDMA symbol duration.~~

~~2) When the timer is timeout, HR-MS should sense the channel for the presence of preambles for a duration of four OFDMA symbols. If no preamble is detected for the selected channel, then the HR-MS should transmit the discovery message. If a preamble has been detected, then the HR-MS shall hold on the transmission. The HR-MS shall detect whether the preamble is from an infrastructure station or from an HR-MS. If it is from an isolated HR-MS that sends discovery messages also, the HR-MS shall double the value of CW if it is less than CWmax and restart the timer. If it is from an infrastructure station or HR-MS associated to an infrastructure station, the HR-MS shall stop the transmission of discovery message on the selected channel.~~

~~3) HR-MS should reset the value of CW to CWmin whenever a transmission is made. CWmin is 63 and CWmax is 1023.~~

~~Topology discovery message shall not be transmitted if it can receive preambles from other HR-BSs.~~

[-------------------------------------------------End of Text Proposal----------------------------------------------------]