	IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>
Title	**Reduced Neighbor Information Generation and Customized Delivery**
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Re:	IEEE 802.16j Technical Contribution
Abstract	This contribution proposes methods for facilitating efficient delivery of the neighborhood information in the MR network.
Purpose	Discussion and Adoption in IEEE 802.16j
Notice	
Release	

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Reduced Neighbor Information Generation and Customized Delivery

Problem Statement

According to IEEE802.16e-2005, a BS broadcasts information about the neighboring BSs using a MOB_NBR-ADV message to facilitate the operation of MAC layer handover procedures. In order to maintain backwards compatibility in the MR networks, an RS acts like a BS from the view point of the attached MSs , and thus needs to broadcast the MOB_NBR-ADV message .

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The introduction of fixed, mobile and nomadic relay stations into the 802.16 based networks is likely to result in an increased number of neighbors. This in turn means that the neighbor list containing the number of neighbors will be longer and the corresponding neighbor information present in the MOB-NBR-ADV messages is likely to become larger. It is clear that the larger the number of neighbors, the longer the neighbor list, the larger the neighbor information message and therefore (a) the larger the overhead in distributing the neighbor information and (b) the longer it is likely to take an MS to scan the neighbors (increasing scanning time may result in higher power consumption). Therefore, the key issue addressed in this contribution is how to perform the network topology advertisement functionality efficiently

Providing the access stations with information and means that can aid in composing reduced and meaningful information customized to fit individual RS's neighborhood would result in increasing the efficiency of the system. The current 802.16 specifications, however, does not provide the access stations with a standardized mechanism for querying and/or delivering the information about the other access stations. Moreov er, the current mechanism for delivering neighbor information (i.e. MOB_NBR-ADV message which is sent as a broadcast message by the BS to the MSs) is based on a broadcast delivery, and does not cater to the possibilities of customized messages to specific RSs.

Suggested Remedy

In this contribution, we suggest mechanisms for (a) composing neighbor information messages that are customized to individual RS's needs and (b) messages that facilitate the composition of reduced information neighbor advertisements and customized delivery to RSs.

Proposed Text

[Editor's note: If any]

[Insert the following at the end of subclause 6.3.22.1.1]

The MR-BS and the RS shall broadcast information about the infrastructure stations that are present in the network using the MOB_NBR-ADV message defined in 6.3.2.3.47. The MR-BS and the RS may obtain the information to be included in the MOB_NBR-ADV message over the backbone network or over the relay links. Each RS can broadcast a different MOB_NBR-ADV message that is suitable for its service area.

To facilitate each RS to transmit a MOB_NBR-ADV message suitable for its service area, the MR-BS shall transmit a MR_NBR-INFO message to the RSs. The MR_NBR-INFO is a customized, unicast message that is composed by the MR-BS according to the specific neighborhood of the receiving RS. The MR_NBR-INFO message is transmitted by the MR-BS to the RSs over the relay links. In order to compose the MR_NBR-INFO customized for the subordinate RSs, the MR-BS can use location information or the interference measurement reports received from the infrastructure stations.

An RS, depending on its capability and depending on the messages that it receives, can choose between one of the following options in generating the MOB_NBR-ADV message:
(a) An RS can broadcast the MOB_NBR-ADV message without modifying the neighbor list of the MR_NBR-INFO message, received from the MR-BS.
(b) An RS can further customize and compose a MOB_NBR-ADV message that is suitable for its service area by utilizing the information present in the MR_NBR-INFO messages received from the MR-BS.

Insert new subclause 6.3.2.3.62

6.3.2.3.62 MR_NBR-INFO message

The MR_NBR-INFO shall be transmitted by the MR-BS to an RS. The message shall be transmitted on the primary management CID. The message format for the MR_NBR-INFO message shall be in accordance with Table 3.

Syntax	Size	Notes
MR_NBR-INFO_Message_format(){	—	—
Management Message Type=TBD	8 bits	—
Action Type bitmap	4 bits	Bit [0]: if set to 1, information about all the neighboring stations is present Bit [1]: if set to 1, the neighbors listed here should be appended to the existing neighbor list. Bit [2]: if set to 1, neighbors listed here should be deleted from the existing neighbor list. Bit [3]: if set to 1, information about neighbors listed here should be updated as indicated.
If (Action Type bitmap [0]= =1){	—	—
Skip-optional-files bitmap	8 bits	Bit [0]: if set to 1, omit Operator ID field. Bit [1]: if set to 1, omit NBR BS ID field.

		Bit [2]: if set to 1, omit HO process optimization field. Bit [3]: if set to 1, omit QoS related fields. Bit [4]–[7]: Reserved.
If (Skip-optional-fields-[0]=0){	—	—
Operator ID	24 bits	Unique ID assigned to the operator.
}	—	—
Fragmentation Index	4 bits	Indicates the current fragmentation index.
Total Fragmentation	4 bits	Indicates the total number of fragmentations.
N_NEIGHBORS	8 bits	Number of neighbors for this RS
For (j=0; j< N_NEIGHBORS;j++){	—	—
Length	8 bits	Length of message information within the iteration of N_NEIGHBOR in bytes.
PHY Profile ID	8 bits	Aggregated IDs of Co-located FA Indicator, FA Configuration Indicator, FFT size, Bandwidth, Operation Mode of the starting subchannelization of a frame and Channel Number.
If (FA Index Indicator = =1){	—	—
FA index	8 bits	This field, Frequency Assignment Index, is present only the FA Index Indicator in PHY Profile ID is set. Otherwise, the neighbor Station has the same FA Index or the center frequency is indicated using the TLV encoded information.
}	—	—
If (Station EIRP Indicator = =1){	—	—
Station EIRP	8 bits	Signed Integer from –128 to 127 in unit of dBm This field is present only if the Station EIRP indicator is set in PHY Profile ID. Otherwise, the Station has the same EIRP as the serving Station.
}	—	—
If (Skip-optional-fields[1]=0){	—	—
Neighbor BSID	24 bits	This is an optional field for OFDMA PHY and it is omitted or skipped if Skip optional fields Flag = 1.
}	—	—
Preamble Index/Subchannel Index	8 bits	This parameter defines the OFDMA PHY specific preamble
If (Skip-optional-field[2]=0){	—	—
HO Process Optimization	8 bits	HO Process Optimization is provided as part of this message is indicative only. HO process requirements may change at time of actual HO. For each Bit location, a value of '0' indicates the associated reentry management messages shall be required, a value of '1' indicates the reentry management message may be omitted. Regardless of the HO Process Optimization TLV settings, the target Station may send unsolicited SBC-RSP and/ or REG-RSP management messages: Bit #0: Omit SBC-REQ/RSP management messages during re-entry processing Bit #1: Omit PKM Authentication phase except TEK phase during current re-entry processing Bit #2: Omit PKM TEK creation phase during re-entry processing Bit #3: Omit REG-REQ/RSP management during current re-entry processing Bit #4: Omit Network Address Acquisition management messages during current re-entry processing Bit #5: Omit Time of Day Acquisition management messages during current reentry processing Bit #6: Omit TFTP management messages during current re-entry

		processing Bit #7: Full service and operational state transfer or sharing between serving station and target station (ARQ, timers, counters, MAC state machines, etc…)
}	—	—
If (Skip-optional-field[3]=0){	—	—
Scheduling Service Supported	8 bits	Bitmap to indicate if Station supports a particular scheduling service. 1 indicates support, 0 indicates not support: Bit #0: Unsolicited Grant Service (UGS) Bit #1: Real-time Polling Service (rtPS) Bit #2: Non-real-time Polling Service (nrtPS) Bit #3: Best Effort Bit #4: Extended real-time Polling Service (ertPS) If the value of bit 0 through bit 4 is 0b00000, it indicates no information on service available. Bits #5–7: Reserved; shall be set to zero.
}	—	—
DCD Configuration Change Count	4 bits	This represents the 4 LSBs of the Neighbor Station current DCD configuration change count.
UCD Configuration Change Count	4 bits	This represents the 4 LSBs of the Neighbor Station current DCD configuration change count.
TLV Encoded Neighbor information	variable	TLV specific
}	—	—
}		
If (Action Type bitmap [1]= =1){	—	—
Skip-optional-files bitmap	8 bits	Bit [0]: if set to 1, omit Operator ID field. Bit [1]: if set to 1, omit NBR BS ID field. Bit [2]: if set to 1, omit HO process optimization field. Bit [3]: if set to 1, omit QoS related fields. Bit [4]–[7]: Reserved.
If (Skip-optional-fields-[0]=0){	—	—
Operator ID	24 bits	Unique ID assigned to the operator.
}	—	—
Fragmentation Index	4 bits	Indicates the current fragmentation index.
Total Fragmentation	4 bits	Indicates the total number of fragmentations.
New_N_NEIGHBORS	8 bits	Number of new neighbors for this RS
For (j=0; j<New_N_NEIGHBORS;j++){	—	—
Length	8 bits	Length of message information within the iteration of New_N_NEIGHBOR in bytes.
PHY Profile ID	8 bits	Aggregated IDs of Co-located FA Indicator, FA Configuration Indicator, FFT size, Bandwidth, Operation Mode of the starting subchannelization of a frame and Channel Number.
If (FA Index Indicator = =1){	—	—
FA index	8 bits	This field, Frequency Assignment Index, is present only the FA Index Indicator in PHY Profile ID is set. Otherwise, the neighbor Station has the same FA Index or the center frequency is indicated using the TLV encoded information.
}	—	—
If (Station EIRP Indicator = =1){	—	—
Station EIRP	8 bits	Signed Integer from –128 to 127 in unit of dBm This field is present only if the Station EIRP indicator is set in PHY Profile ID.

		Otherwise, the Station has the same EIRP as the serving Station.
}	—	—
If (Skip-optional-fields[1]=0){	—	—
Neighbor BSID	24 bits	This is an optional field for OFDMA PHY and it is omitted or skipped if Skip optional fields Flag = 1.
}	—	—
Preamble Index/Subchannel Index	8 bits	This parameter defines the OFDMA PHY specific preamble
If (Skip-optional-field[2]=0){	—	—
HO Process Optimization	8 bits	HO Process Optimization is provided as part of this message is indicative only. HO process requirements may change at time of actual HO. For each Bit location, a value of '0' indicates the associated reentry management messages shall be required, a value of '1' indicates the reentry management message may be omitted. Regardless of the HO Process Optimization TLV settings, the target Station may send unsolicited SBC-RSP and/ or REG-RSP management messages: Bit #0: Omit SBC-REQ/RSP management messages during re-entry processing Bit #1: Omit PKM Authentication phase except TEK phase during current re-entry processing Bit #2: Omit PKM TEK creation phase during re-entry processing Bit #3: Omit REG-REQ/RSP management during current re-entry processing Bit #4: Omit Network Address Acquisition management messages during current re-entry processing Bit #5: Omit Time of Day Acquisition management messages during current reentry processing Bit #6: Omit TFTP management messages during current re-entry processing Bit #7: Full service and operational state transfer or sharing between serving station and target station (ARQ, timers, counters, MAC state machines, etc…)
}	—	—
If (Skip-optional-field[3]=0){	—	—
Scheduling Service Supported	8 bits	Bitmap to indicate if Station supports a particular scheduling service. 1 indicates support, 0 indicates not support: Bit #0: Unsolicited Grant Service (UGS) Bit #1: Real-time Polling Service (rtPS) Bit #2: Non-real-time Polling Service (nrtPS) Bit #3: Best Effort Bit #4: Extended real-time Polling Service (ertPS) If the value of bit 0 through bit 4 is 0b00000, it indicates no information on service available. Bits #5–7: Reserved; shall be set to zero.
}	—	—
DCD Configuration Change Count	4 bits	This represents the 4 LSBs of the Neighbor Station current DCD configuration change count.
UCD Configuration Change Count	4 bits	This represents the 4 LSBs of the Neighbor Station current DCD configuration change count.
TLV Encoded Neighbor information	variable	TLV specific
}	—	—
}		

If (Action Type bitmap[2] = =1){	—	—
Delete_N_NEIGHBORS	8 bits	Number of neighbors shall be deleted for this RS
For (j=0; j< Delete_N_NEIGHBORS;j++){	—	—
Preamble Index	8 bits	Indicates the deleted neighbors
}	—	—
}	—	—
If (Action Type bitmap [3]= =1){	—	—
Update_N_NEIGHBORS	8 bits	Number of updated neighbors for this RS
For (j=0; j< Update_N_NEIGHBORS; j++) {	—	—
Length	8 bits	Length of message information within the iteration of Update_N_NEIGHBOR in bytes
Preamble Index	8 bits	Indicates the updated neighbor
TLV Encoded Information	variable	TLV specific
}	—	—
}		

The following TLV parameters can be included.:

DCD Configuration Change Count
Represents the 4 LSBs of the Neighbor access station current DCD configuration change count.

UCD Configuration Change Count
Represents the 4 LSBs of the Neighbor access station current UCD configuration change count.
For each advertised Neighbor access station, the following TLV parameters may be included:

Mobility Feature Supported
Same as in 11.7.14.1.
When Mobility Feature Supported bit indicate support for idle mode, following TLV parameters may be included :

DCD_settings
The DCD_settings is a TLV value that encapsulates a DCD message (excluding the generic MAC header and CRC) that may be transmitted in the advertised access station downlink channel. This information is intended to enable fast synchronization of the MS with the advertised access station downlink. The DCD settings fields shall contain only neighbor's DCD TLV values that are different from the current access station corresponding values. For values that are not included, the MS shall assume they are identical to the corresponding values of the current access station. The duplicate TLV encoding parameters within a Neighbor access station shall not be included in DCD setting.

UCD_settings
The UCD_settings is a TLV value that encapsulates a UCD message (excluding the generic MAC header and CRC) that may be transmitted in the advertised access station downlink channel. This information is intended to enable fast synchronization of the MS with the advertised access station uplink.
The UCD settings fields shall contain only neighbor's UCD TLV values that are different from the current access station's corresponding values. For values that are not included, the MS shall assume they are identical to the current access station's corresponding values. The duplicate TLV

encoding within a Neighbor access station shall not be included in UCD setting.

PHY Mode ID (see 11.18.1)
a 16-bit value that specifies the PHY parameters, including channel bandwidth, FFT size, cyclic prefix, and frame duration.

Insert new subclause 11.xx

11.XX MR_NBR-INFO Management Message Encoding

Name	Type (1bytes)	Length (bits)
DCD Configuration Change Count	1	4
UCD Configuration Change Count	2	4
DCD_settings	3	variable
UCD_settings	4	variable
Neighbor BS trigger	5	variable
PHY Mode ID	6	8