Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Action Item Response for CXP Messages Ad Hoc**
Date Submitted	**2007-05-09**
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Re:	Unresolved comments given to Ad Hoc.
Abstract	Initial suggestions for addressing comments handed off to CXP Messages Ad Hoc.
Purpose	Suggested changes to WirelessMAN-CX over the air messages
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Action Item Response for CXP Messages Ad Hoc Coexistence
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Background

The following comments from [2] regarded the usage of certain messages. There is an action item for an ad hoc to determine what action to take regarding these messages. The associated comments (from the latest comment DB) are:

2157L - The Identify Coexistence Request and Reply messages only appear in section 15.5 with no good explanation of why they get sent. Regardless of whether this is turned into a SAP or not, the usage of these messages needs to be documented.

2158L - The Coexistence Neighbor Topology Request and response are only indirectly referenced in the text. Regardless of whether this is turned into a SAP or not, the usage of these messages needs to be documents.

2159L - The Coexistence Neighbor Topology and the Identify Coexistence messages are largely redundant, adding unnecessary complexity.

2160L - The Registration Request and Reply messages only appear in section 15.5 with no good explanation of why they get sent. Regardless of whether this is turned into a SAP or not, the usage of these messages needs to be documented. Also, they appear to implement a trivial subset of the Identify Coexistence and Coexistence Neighbor Topology messages' functionality.

2161L - The Add Coexistence Neighbor, the Coexistence Neighbor Topology and the Identify Coexistence messages are largely redundant, adding unnecessary complexity. Also, they don't show up in the text outside of section 15.5.1.

2162L - The Update Coexistence messages do not appear outside of section 15.5.1 and only update fields that make no sense - for instance, we have adaptive modulation on a per SS basis, so changing the modulation information is meaningless.

2163L - The Delete Coexistence Neighbor messages do not appear in the text outside of section 15.5.1. There is no information regarding the circumstances that cause them to be sent.

2164L - The get Param For Radio Signature messages do not appear in the text outside of section 15.5.1. There is no information regarding the circumstances that cause them to be sent.

2165L - There are already going to be CMI and/or CSI scheduled during which the known behavior allows measurements to be taken rendering the Evaluate Interference messages unnecessary.

2166L - The Work in Parallel messages do not appear in the text outside of section 15.5.1. There is no information regarding the circumstances that cause them to be sent.

2167L - The concept of telling a slave to reduce power or quit appears in the text but doesn't reference the Reduce Power or Quit Subframe messages.

Comments 2157L through 2163L

Comments 2157L through 2161L are directed at a group of messages that overlap substantially in their content, potentially making some unnecessary. To get a better understanding of the minimal set of messages necessary, we need to understand what entities may need to communicate what information to what other entities using the over-the-backhaul protocol. The entities mentioned in the document are:

1. Base stations (BS)
2. Bases station identity servers (BSIS)
3. Centralized database (DB)

It is not clear if the BSIS and DB can be viewed as the same type of entity.

A BS may determine its neighbors by hearing a SSURF from a neighbor's SS or by one of its own SS hearing a neighbor's BSD message. Similarly, BS_NURBC messages coded in the CSI could be detected. So, a BS knows its own identity and may know its neighbor's identities. This is the information it has available to give to others. This is also the information it wants from or about its neighbors.

A BS should identify itself to its neighbors giving its own information and any information needed for further coexistence mechanisms. The contacted neighbor should respond by returning the same information about itself and about its own known channel status. If a BS becomes aware of a new neighbor, it should send an update to all its neighbors. This update could contain the whole set of information again or just incremental part allowing the use of the original information within the distributed database.

If a BS knows about a BSIS or DB, it should give the exact same information to the BSIS or DB. The BSIS or DB should reply with the information on the BS' neighbors as if they had sent the messages themselves. The BSIS or DB could also include neighbors that are planned, or are known but not currently transmitting so the BS can't hear them, or that may be registered with the BSIS or DB but not CX protocol capable. (Wu Xuyong: Although this centralize server sounds like an assurance of coexistence, but it may allow registration without radio capability and also not ensure the registration from all the exist radio around. So I do not believe BSIS approaches' feasibility and value, unless there is law and specific guardian.)

Comments 2162L and 2163L are related to comments 2157L through 2161L because the Update and Delete messages appear to be intended to modify information already exchanged. While the information regarding a particular BS should virtually never change, a BS may notice new neighbors. As mentioned above, a message containing the information indicating a BS has noticed a new neighbor could be much smaller than sending a message that contained information on all known neighbors. Similarly, a message that specifically announces that a BS no longer considers another system a neighbor is more efficient than one that sends all current neighbors (which would exclude the one being deleted).

So we have a suggested situation where we need 4 requests with responses rather than 6 as is the current case. I propose to keep the names:

1) Identify Coexistence Request/Reply
2) Add Coexistence Neighbor Request/Reply
3) Delete Coexistence Neighbor Request/Reply

And add the new message:

4) Leaving Coexistence Neighborhood Indication/Reply

Protocol:

I.   When a new system enters the scene it listens to determine its neighbors. If it successfully hears one

or more BSD or SSURF messages (or BS_NURBC in CSI), it creates a compilation of what is necessary for further coexistence mechanism between the new neighbor and itself and send to the new neighbor, and the necessary updating information, if any, will be sent to each of it's neighbors in an Identify Coexistence Request message over the backhaul. Each neighbor responds with an Identify Coexistence Reply message containing their necessary information (which may be more complete than the new BS got over the air) and information on all of their neighbors whether they are neighbors of the new BS or not.

II.   After the neighbors respond with the Identify Coexistence Reply message, they then send the information about the new BS to each of their neighbors using the Add Coexistence Neighbor Request message to inform their neighbors of the new BS. The neighbors respond with an Add Coexistence Neighbor Response message confirming receipt of the information.

III.   Similarly, if a new system enters the scene, and there is another system which the new system cannot hear but the existing system can hear the new system, after a certain timeout without the new system initiating an Identify Coexistence Request/Response, the existing system initiates it as stated in I & II above.

IV.   If a system goes a period of time without hearing a neighbor or otherwise determines a neighbor has disappeared (see V, below), it will send a Delete Coexistence Neighbor Request message to its neighbors indicating that it is removing the system from its list of neighbors. This does not affect whether those other systems still think it exists; only that it is no longer considered a neighbor of the first system.

V.   If a system knowingly leaves the scene (different channel, intentional shutdown, etc.) it should courteously send a Leaving Coexistence Neighborhood Indication message to its neighbors who will respond with a Leaving Coexistence Neighborhood Reply message and should also send Delete Coexistence Neighbor Request message to its neighbors as in IV above.

These same messages could also be sent to known DB servers or BSIS if they exist. Obviously, the DB servers and BSIS wouldn't initiate the protocol since they can't hear BSD, SSURF, or BS_NURBC messages.

Once we agree on the protocol then we can do a more detailed analysis of exactly what the contents of each message should be.

Comment 2164L

The Get Param For Radio Signature Request/Reply messages appear to not be used. I suggest deleting them. If anyone disagrees, that person should be tasked to come up with the protocol for their use:

1) Who sends them to whom?
2) Why are they sent?
3) How are they used by the recipient?
4) Etc.

Comment 2165L

The Evaluate Interference Request/Reply messages appear to not be needed since the control channel, CMI, CSI, and existing reporting protocols cover this. I suggest deleting them. If anyone disagrees, that person should be tasked to come up with the protocol for their use:

1) Who sends them to whom?
2) Why are they sent? Why not use an existing mechanism?
3) Etc.

Comment 2166L

The Work in Parallel Request/Response messages bring up an important issue, but fail to completely address it; a fact that was hidden by the lack of adequate documentation on how the messages are used.

Basically, the Master frame is a period of time when a BS is guaranteed that other 802.16h systems will not appreciably interfere with any of its subscriber stations. There may be devices in the slave's system that can communicate in such a fashion at a particular power, but they need to be identified and the power level needs to be established. This can only happen if the Master system listens in both the UL and the DL, knowing which devices the slave is transmitting to or from. This should not use up the Master's master frame. It's the slave's responsibility. Someone should either come up with an easier way to identify the problem BS/SS combinations, or this message needs to be turned into a map indicating where in its master frame system S is transmitting to/from its subscribers to the system M can listen. Then System M needs to tell system S which of System S's devices can transmit to which others and at what power as slaves during System M's master frame.

Whoever cares about maximum use of slave subframes should get this working or the message should be deleted.

Comment 2167L

The protocol for the Reduce Power and Quit Subframe messages needs to be documented. It appears textually in other sections, but the text needs updated to indicate which messages are sent. Also, explicit documentation needs added for:

1) Who sends them to whom?
2) Why are they sent? Why not use an existing mechanism?
3) Etc.

While these messages can be useful on their own in a simpler scheme, if someone properly develops the Work in Parallel Protocol for comment 166L, these two messages and their responses should be incorporated as part of that solution.

Specific editorial changes

This section provides a list of changes to IEEE P802.16.D2a document [1].

Blue underlined text represents specific editorial additions.

Red strikethrough text is to be deleted.

Black text is text already in the draft.

Bold italic text is editorial instructions to the editor.

These changes do not 100% satisfy all the above comments. For instance, the actual content of the messages still needs to be resolved.

On page 130, lines 48 and 49, replace the remainder of the rows for code entries 3 and 4 with "reserved".

On page 130, lines 50-52, replace the remainder of the rows for code entries 5 and 6 with "reserved".

On page 130, lines 53 and 54, replace the remainder of the rows for code entries 7 and 8 with "reserved".

On page 130, lines 56 and 57, replace the message names for code entries 9 and 10 with "Leaving Neighborhood Indication" and "Leaving Neighborhood Reply".

On page 130, lines 61 and 62, replace the remainder of the rows for code entries 13 and 14 with "reserved".

On page 136, line 8 trough page 137, line 5, delete sections 15.5.1.3 and 15.5.1.4.

On page 137, line 8 trough page 137, line 49, delete sections 15.5.1.5 and 15.5.1.6.

On page 137, line 50 through page 138, line 4, delete sections 15.5.1.7 and 15.5.1.8.

On page 138, line 5 through page 138, line 28, change all occurrences of "De-registration Request" with "Leaving Neighborhood Indication" and all occurrences of "De-registration Reply" with "Leaving Neighborhood Reply".

On page 139, line 14 through page 139, line 46, delete sections 15.5.1.13 and 15.5.1.14.

Insert the following text after the Leaving Neighborhood Indication section:

Protocol:

I.   When a new system enters the scene it listens to determine its neighbors. If it successfully hears one or more BSD or SSURF messages (or BS_NURBC in CSI), it creates a compilation of what is necessary for further coexistence mechanism between the new neighbor and itself and send to the new neighbor, and the necessary updating information, if any, will be sent to each of it's neighbors in an Identify Coexistence Request message over the backhaul. Each neighbor responds with an

Identify Coexistence Reply message containing their necessary information (which may be more complete than the new BS got over the air) and information on all of their neighbors whether they are neighbors of the new BS or not.

II.   After the neighbors respond with the Identify Coexistence Reply message, they then send the information about the new BS to each of their neighbors using the Add Coexistence Neighbor Request message to inform their neighbors of the new BS. The neighbors respond with an Add Coexistence Neighbor Response message confirming receipt of the information.

III.   Similarly, if a new system enters the scene, and there is another system which the new system cannot hear but the existing system can hear the new system, after a certain timeout without the new system initiating an Identify Coexistence Request/Response, the existing system initiates it as stated in I & II above.

IV.   If a system goes a period of time without hearing a neighbor or otherwise determines a neighbor has disappeared (see V, below), it will send a Delete Coexistence Neighbor Request message to its neighbors indicating that it is removing the system from its list of neighbors. This does not affect whether those other systems still think it exists; only that it is no longer considered a neighbor of the first system.

V.   If a system knowingly leaves the scene (different channel, intentional shutdown, etc.) it should courteously send a Leaving Coexistence Neighborhood Indication message to its neighbors who will respond with a Leaving Coexistence Neighborhood Reply message and should also send Delete Coexistence Neighbor Request message to its neighbors as in IV above.

These same messages could also be sent to known DB servers or BSIS if they exist. Obviously, the DB servers and BSIS wouldn't initiate the protocol since they can't hear BSD, SSURF, or BS_NURBC messages.

References

[1] IEEE P802.16h/D2a: *Air Interface for Fixed Broadband Wireless Access Systems Improved Coexistence Mechanisms for License-Exempt Operation*, Draft Standard.

[2] IEEE 80216h-06_068r5: *Letter Ballot #24 Commentary file with resolutions from Session #47.*