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Re:	IEEE 802.16-08/007: "IEEE 802.16 Working Group Letter Ballot Recirc #28b: Announcement"
Abstract	This contribution describes a mechanism to perform CID to path binding/unbinding efficiently
Purpose	Text proposal for 802.16j Draft Document
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Efficient CID to path binding/unbinding process

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Introduction

In current design, the DSA-REQ/RSP/ACK transaction is employed to establish a new connection between an MS and an MR-BS. After a connection is established, the MR-BS has to initiate another DSA-REQ/RSP/ACK transaction to perform the CID to path binding to all RSs. These two DSA-REQ/RSP/ACK transactions can be merged into a single DSA-REQ/RSP/ACK transaction to save bandwidth and delay. The merged DSA-REQ/RSP/ACK transaction is described as follows.

A service addition attempt may be initiated by an MR-BS or an MS. The operations when an MR-BS attempts to establish a connection with an MS are described below.

- When an MR-BS attempts to establish a connection with an MS, the MR-BS shall send a DSA-REQ carrying the assigned CID, the Path Addition TLV and the Path CID Binding Update TLV along the path to the MS using the subordinate RS's primary CID. The MR-BS adds the HMAC/CMAC derived from the MS's key to the DSA-REQ and the HMAC/CMAC derived from the RS's key (in case of 2-hop relay) or the HMAC/CMAC derived from the RSs' security zone key (in case of multi-hop relay) to the DSA-REQ.

- On receiving the DSA-REQ, the RS first verifies the correctness of the DSA-REQ. If true, the RS binds the assigned CID with the path and then forwards the DSA-REQ to the subordinate station according to the path information and starts a timer T8(wait for ACK, 300ms). If the RS is the last station on the path, it detaches the Path Addition TLV, the Path CID Binding Update TLV and its HMAC/CMAC (in case of 2-hop relay) or the RSs' HMAC/CMAC (in case of multi-hop relay), and then forwards the DSA-REQ to the MS.

- When an MS receives a DSA-REQ, it replies with a DSA-RSP containing the HMAC/CMAC derived from the MS's key. The RSs simply forward the DSA-RSP to the MR-BS.

- On receiving the DSA-RSP generated by the MS, the MR-BS replies with a DSA-ACK containing the Path CID Binding Update TLV. The DSA-ACK contains the HMAC/CMAC derived from the MS's key and also the HMAC/CMAC derived from the RS's key (in case of 2-hop relay) or the HMAC/CMAC derived from the RSs' security zone key (in case of multi-hop relay).

- On receiving the DSA-ACK, the RS first verifies the correctness of the DSA-ACK. If true, the RS stops the timer T8 and then forwards the DSA-ACK to the subordinate station. If the RS is the last station on the path, it detaches its HMAC/CMAC (in case of 2-hop relay) or the RSs' HMAC/CMAC (in case of multi-hop relay) and then forwards the DSA-ACK to the MS.

- On expiration of T8, the RS shall remove the associated CID to path binding.

The operations when an MS attempts to establish a connection with an MR-BS are described below.

- When an MS attempts to establish a connection with an MR-BS, the MS shall send a DSA-REQ to the MR-BS. On receiving the DSA-REQ, the MR-BS replies with a DSA-RSP along with the assigned

CID, the Path Addition TLV and the Path CID Binding Update TLV using the subordinate RS's primary CID. The MR-BS adds the HMAC/CMAC derived from the MS's key to the DSA-RSP and the MR-BS adds the HMAC/CMAC derived from the RS's key (in case of 2-hop relay) or the HMAC/CMAC derived from the RSs' security zone key (in case of multi-hop relay).

- On receiving the DSA-RSP, the RS first verifies the correctness of the DSA-RSP. If true, the RS binds the assigned CID with the path and then forwards the DSA-RSP to the subordinate station according to the path information and starts a timer T8(wait for ACK, 300ms). If the RS is the last station on the path, it detaches the Path Addition TLV, the Path CID Binding Update TLV and its HMAC/CMAC (in case of 2-hop relay) or the RSs' HMAC/CMAC (in case of multi-hop relay), and then forwards the DSA-RSP to the MS.

- When an MS receives a DSA-RSP, it replies with a DSA-ACK containing the HMAC/CMAC derived from the MS's key. The RSs simply forward the DSA-ACK to the MR-BS.

- On receiving the DSA-ACK generated by the MS, the MR-BS sends a DSA-ACK containing the path ID along the path. The DSA-ACK contains the HMAC/CMAC derived from the RS's key (in case of 2-hop relay) or the HMAC/CMAC derived from the RSs' security zone key (in case of multi-hop relay).

- On receiving the DSA-ACK, the RS stops the timer T8 and then forwards the DSA-ACK to the subordinate station if exist.

- On expiration of T8, the RS shall remove the associated CID to path binding.

Similarly, service deletion and the path unbinding operations can be completed by a single DSD-REQ/RSP/ACK transaction.

To facilitate the aforementioned merged DSA-REQ/RSP/ACK transaction, the MS's primary CID should be included in the Path CID Binding Update TLV.

In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the draft standard P802.16j/D3 are listed below.

Spec Changes

[Add the following text at the end of 6.3.27.2.2]

The MR-BS may merge CID to path binding/unbinding with service addition/deletion operations. In which case, the following procedures shall be used.

- The MR-BS shall attach the Path Addition TLV and the Path CID Binding Update TLV to the DSA/DSD-REQ/RSP. The MR-BS shall add the HMAC/CMAC derived from the RS's key (in case of 2-hop relay) or the HMAC/CMAC derived from the RSs' security zone key (in case of multi-hop relay). Upon receiving

the DSA/DSD-REQ/RSP containing binding commands, the RS performs the operation as requested in the message, starts a timer T8/T9, and then sends the message to its subordinate RS using the primary management CID of the subordinate RS obtained from the path information included in the DSA/DSD-REQ/RSP message. If an RS fails to process the request, it sends a DSA/DSD-RSP/ACK directly to MR-BS with the associated confirmation code.

- When the access RS receives the DSA/DSD-REQ/RSP containing binding commands, the access RS performs the operation as requested in the message, and then detaches the Path Addition TLV, the Path CID Binding Update TLV and its HMAC/CMAC (in case of 2-hop relay) or the RSs' HMAC/CMAC (in case of multi-hop relay), and then forwards the message to the MS.

- When the MR-BS receives a DSA/DSD-ACK message, it shall send a DSA/DSD-ACK message along with a Path CID Binding Update TLV to all the RSs on the path.

- When an RS receives the DSA/DSD-ACK with path information, it stops timer T8/T9 and then forwards the DSA/DSD-ACK to the subordinate station if exist. On expiration of T8/T9, the RS shall remove the associated CID to path binding.

[Modify subclause 11.1.13.2 as follows]

11.1.13.2 Path Addition TLV

Name	Type	Length	Value	Scope
Path Addition	132	Variable	Path ID (unsigned 16-bit) Ordered list of RSs (variable)	DSA-REQ, DSA-RSP, RNG-RSP

Ordered List of RSs

The ordered list of RSs' primary management CIDs along the path in the downstream direction. The upstream direction list can be obtained by reverse this ordered list.

[Modify subclause 11.1.13.3 as follows]

11.1.13.3 Path CID Binding Update TLV

Name	Type	Length	Value	Scope
Path CID Binding Update	131	Variable	Path ID (unsigned 16-bit) MS ID (primary CID of MS) List of CIDs (variable)	DSA-REQ, DSA-RSP, DSD-REQ, DSD-RSP, RNG-RSP

List of CIDs

A list of CIDs involved in the binding update operation.