Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Resolve DSx and HO interfere issues**
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Re:	IEEE 802.16 Letter Ballot Recirculation #26d, on P802.16Rev2/D5, as per IEEE 802.16-08/029
Abstract	The DSx transactions, which are not transparent and could not be continued on new serving BS need to be terminated before HO. The proper termination mechanism is not present in the specification. The DSx Transactions Update TLV sent by HO initiator will help to terminate outstanding DSx transactions and provide Service Flow configuration synchronization between all devices involved into HO process.
Purpose	Discuss and adopt
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Resolve DSx and HO interfere issues

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Background

Handovers are not transparent DSx transactions, i.e., a transaction started at the serving BS cannot continue at the target BS, even in the case of a full optimization handover process. First, the standard does not address any synchronization of the transaction state between the serving and the target BS (although it does address many other so-called dynamic state attributes). Secondly, the target BS manages its own resources and may not have the same resources available as the serving BS. The current DSx transactions are not flexible enough to handle such situations. Thirdly, messages sent by the MS or the serving BS may or may not be received by the other party. Therefore, although a transaction may seem to be completed by one entity it may not be completed at the other entity.

This synchronization problem will cause different problems. First, for DSA and DSD transactions, the BS and the MS may end up with different lists of service flow in the Nominal state. In this a case, the compressed CID update or seamless HO, which is based on the assumption that both devices have the same service flow list, can not be used.

The other problem is that the DSC transaction completed at serving BS may be terminated at MS and vice versa. This situation should be recovered when MS returns to normal operations with target BS. The proposed recovery mechanism is the same already used for repetitive DSC-ACK lost rare case. In this case the SF involved into DSC transaction has also different configuration in both devices. The spec today does not have the mechanism to revert SF configuration after DSC-ACK was sent or received. This situation is resolved in current spec by issuing DSD-REQ for such service flow, because there is not any other way to synchronize SF settings.

Proposed Changes

The DSx transaction completion mechanism (similar to “DSx Ended” event processing) and DSx termination mechanism (similar to DSX-RSP/ACK with erred confirmation code processing) is introduced to handle DSx transaction during HO. Both mechanisms are already used by DSx SMs.

For each service flow belonging to an MS, the serving BS provides the DSC termination status over backbone. The MS keeps the same status. In the CID Update Encodings TLV or the Compressed CID Update Encodings TLV, the target BS includes the DSC transaction termination indication for each SF involved into DSC transaction. This allows the MS to recover from SF synchronization problems.

Proposed Changes in 802.16Rev2/D5

[On page 99, Section 6.3.2.3.8, line 25-57, modify as follows:]

For mobile stations, when the information is available to create the CID update TLV, the target BS shall include the CID_update and SAID_update TLVs in the REG-RSP for an MS recognized by the target BS as performing HO, network reentry from idle mode or location update for MBS update. The BS may include the Compressed CID Update TLV instead of the CID_update TLV in REG-RSP message if the CID update procedure is required. The target BS recognizes

an MS performing network reentry from idle mode by the presence of a serving BSID or paging controller ID and ranging purpose indication with Bit #0 set to 1 in the RNG-REQ message. The target BS recognizes an MS performing location update for MBS zone update by the presence of a paging controller ID, ranging purpose indication with Bit#1 set to 1, and an MBS update in the RNG-REQ.

CID_update

The CID_update is a compound TLV value that provides a shorthand method for replacing the active connections used by the MS in its previous serving BS. Each CID_update TLV specifies a CID in the target BS that shall replace a CID used in the previous serving BS. Multiple instances of CID_update may occur in the REG-RSP to facilitate recreating and reassigning admitted or active service flows for the MS from its previous serving BS. If any of the service flow parameters change (including target SAID, see 11.13.17), then those service flow parameter encoding TLVs that have changed will be added. If the BS cannot reestablish a particular service flow, it shall not include an instance of CID_update for that service flow. These TLVs enable the target BS to renew connections used in the previous serving BS, but with different service flow management encodings settings. If there were ongoing and incomplete DSC transactions at the serving BS that were transitioned to the End state as per section 6.3.14.9.6, this compound TLV shall include the DSC transaction termination indication TLV.

Compressed CID_update

The Compressed CID_update TLV also provides a method for replacing the active connections used by the MS in its previous serving BS as CID update TLV. It can diminish the length of REG-RSP message.

Compressed DSC transaction termination indication

If the Compressed CID update TLV is included and there were ongoing and incomplete DSC transactions at the serving BS that were transitioned to the End state as per section 6.3.14.9.6, this TLV shall be included.

[On page 415, Section "**6.3.14.9 Service flow management**", add the new subsection at the end of the section:]

6.3.14.9.6 Service flow management during HO

When the MS starts HO (sends a MOB_HO-IND message with HO accept indication or attempts reentry to another BS), all ongoing DSx transactions at the MS shall transit to the "End" state. When the serving BS receives the MOB_HO-IND message with HO accept indication from the MS or is informed over the backbone about the MS's attempt to execute HO, all ongoing DSx transactions at the serving BS shall transit to the "End" state. The MS and the BS shall not initiate a new DSx transaction after a HO has started. At each device, a DSA or DSC transaction is considered to have successfully *completed* if the transition to the "End" state occurred after the corresponding DSx-ACK message with a successful confirmation code was sent or received, and the device shall update the state of the service flow accordingly. Otherwise the transaction is considered to have been *terminated*, and the device shall revert the state of the service flow to the state before the transaction begun. A DSD transaction is always successfully completed during HO, however, the MS shall retain the service flow ID associated with a non-confirmed DSD transaction in case the serving BS did not receive the DSD-REQ message from the MS and the serving BS initiates Seamless Handover or the target BS uses the Compressed CID update TLV.

As a result of lost messages during HO, a DSx transaction may complete at one device and be terminated at the other device. To prevent the service flow synchronization problems between MS and target BS, the serving BS shall not use Seamless HO if there is an ongoing transaction and is assumed to inform the target BS over the backbone about ongoing DSx transaction(s) terminated or completed just before HO. If the target BS receives such information from the serving BS and one or more of the transactions is a DSA or DSD transaction, the target BS should not use the Compressed CID update TLV (11.7.10.1) in RNG-RSP message and should use the CID_update TLV (11.7.10) instead. If one or more transaction in the received indication is a DSC transaction, the target BS should use the DSC transaction termination indication TLV to inform the MS about

the completion or termination at the BS of that transaction.

If the MS discovers that there is some active or admitted service flow in the CID_update TLV or Compressed CID update TLV that is unknown or deleted at the MS, the MS shall issue a DSD-REQ for this service flow. If the CID update TLV does not contain some active or admitted service flow that is in use at the MS, the MS shall delete this service flow internally.

If the MS discovers that the DSC transaction termination indication stored at the MS is different from such indication received from the target BS for some specific service flow, the MS shall issue a DSD-REQ for this service flow. The MS should ignore DSC transaction termination indications received from the target BS for which it does not have any corresponding stored termination or completion information.

[On page 458, Section "6.3.22.2.8.1.6 Service flows settings", add the new subsection at the end of the section:]

6.3.22.2.8.1.6.8 Service flows - dynamic context, connection involved in DSx

MS context with Serving BS: All DSx transactions are ended in accordance with rules defined in 6.3.14.9.6 and become part of the static context.

MS context with Target BS: Only Service flow static configuration context is in use.

MS shall end (terminate or complete, in accordance with rules defined in 6.3.14.9.6) all service flow modification activity to perform HO.

When the MS cancels HO and returns to normal operation with its previous serving BS or successfully completes network reentry with its target BS, it may restart any terminated DSA or DSC transaction.

[On page 1205, section 11.7.10, apply the following changes:]

11.7.10 CID Update Encodings field

The CID Update Encodings field provides a translation table that allows an MS to update its service flow and connection information so that it may continue service after an HO to a new serving BS.

Name	Type (1 byte)	Length	Value	Scope
CID_update	24	*variable*	Compound	REG-RSP

These TLV values shall appear in each CID Update TLV.

Name	Type (1 byte)	Length (1 byte)	Value (variable length)
New_CID	24.1	2	New CID after HO to new BS
SFID	24.2	4	Service flow ID

The following TLV element may appear in a CID Update TLV.

Name	Type (1 byte)	Length	Value (variable length)
Connection Info	24.3	*variable*	If any of the service flow parameters change, then those service flow parameter encoding TLVs that have changed will be added. Connection Info is a compound TLV value that encapsulates the service flow parameters that have changed for the service. All the rules and settings that apply to the parameters when used in the DSC-RSP message apply to the contents encapsulated in this TLV.

The following TLV indicates whether a DSC transaction that was ongoing the time a HO started was completed successfully at the serving BS.

Name	Type (1 byte)	Length (1 byte)	Value (variable length)
DSC transaction termination indication	24.4	1	0-successfully completed DSC transaction 1-DSC transaction unsuccessfully terminated

11.7.10.2 Compressed DSC transaction termination indication

This TLV identifies DSC transactions that were ongoing at the time a HO started and whether they completed successfully. It is used only in combination with the Compressed CID update encodings TLV.

Name	Type	Length	Value	Scope
Compressed DSC transaction termination indication	26	*variable*	The value is composed of several fields as described in the following table.	REG-RSP

Name	Length	Description

Ongoing Transactions	*variable*	A bitmap, where a '1' in the n'th position starting from the MSB indicates that there was an ongoing DSC transaction for the SF identified by the n'th least SFID. The length of this bitmap, in multiple of 4 bits, is the value of the TLV's length field.
Completed Transactions	*variable*	A bitmap. For each bit set to '1' in the Ongoing Transactions bitmap the corresponding bit in this bitmap is set as follows: 0-successfully completed DSC transaction 1-DSC transaction unsuccessfully terminated The length of this bitmap, in multiple of 4 bits, is the value of the TLV's length field.