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Re:	IEEE 802.16j-06/027: "Call for Technical Proposals regarding IEEE Project P802.16j"
Abstract	This proposal clarifies the service flow management in MR with distributed RS.
Purpose	Discuss and adopt proposed text.
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Amendment to Service Flow Management in MR Network with Distributed Scheduling

1. Introduction

The service flow management procedure defined in baseline document describes the general admission control procedure in the MR networks. However, there are three aspects that are not correctly addressed. This contribution identifies these three aspects and proposes amendment to the related text.

- The DSx-REQ/ACK messages are sent from the MR-BS to all the RSs on a path. With the scheme defined in the baseline document, these messages are first sent from MR-BS to the first RS on the path using its primary CID, and then that RS sends the message to its subordinate neighbouring RS using its subordinate neighbour's primary CID. However, with embedded path management scheme, a RS may not know the primary CID of its subordinate neighbour unless the CID is locally assigned by RS, which is only an optional feature. In such case, we propose to add a Path Info TLV (which carries order list of the primary CID of all the RSs on the path) in the DSx-REQ message. The intermediate RS use such information to obtain the primary CID of its subordinate RS.
- In order to obtain the admission control decision from all the RSs on the path that a service flow will traverse, the DSx-REQ/ACK messages should follow the same path as the service flow. However, current baseline document doesn't provide mechanism to ensure this. To solve this problem, we propose to include the following information in the DSx-REQ, depending on different path management schemes.
    - With explicit path management scheme, a path id that the MR-BS chooses to route the service flow is included in the DSA-REQ and DSA-ACK. The intermediate RSs should use path id to decide the next hop to forward the DSA-REQ and DSA-ACK.
    - With embedded path management scheme, the intermediate RSs should use the systematic CID carried in the service flow parameters to determine the next hop to route the DSA-REQ and DSA-ACK, until the access RS is reached.
- A service flow may be mapped into a tunnel or not. The CID carried in the DSx-REQ/RSP/ACK message may be tunnel CID or individual MS CID. Some text is added to clarify when CID should be included in tunnelling and non-tunnelling cases.
- When an intermediate RS receives a DSA or DSC-REQ, but cannot support the minimum requirement of the service flow (e.g., the minimum bit rate), there is no need for forwarding the message to the next hop. It can directly send a response back to the MR-BS. However, the current baseline document doesn't provide such mechanism. We propose to add this process into the service management procedure.

2. Specific Text Change

6.3.2.3.10 DSA-REQ message

[Change the first two paragraph in 6.3.2.3.10 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.10:

In MR system, ~~B~~before admitting a service flow, the MR-BS may~~shall~~ send a DSA-REQ to all the RSs on the path. This DSA-REQ is processed by each RSs on the path and forwarded to its subordinate RS using the primary CID of the subordinate RS. The CID ~~associated with the service flow needs to be~~ is included in the Service Flow CID TLV field and ~~The CID~~ could be ~~a~~ transport CID for ~~an individual MS~~the service flow or ~~a~~the ~~-~~tunnel CID, into which the service flow is mapped.

This DSA-REQ sent over relay link shall contain the following TLVs:

Service Flow Parameters (see 11.3)

Specification of the service flow's traffic characteristics and scheduling requirements

HMAC/CMAC Tuple (see 11.1.2)

The HMAC/CMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC/CMAC Tuple attribute shall be the final attribute in the DSA message's attribute list.

This DSA-REQ sent over relay link may contain the following TLV, if explicit path management is used:

Path ID (see 11.22.4)

Specification of the id of the path that the service flow will traverse

This DSA-REQ sent over relay link may contain the following TLV, if embedded path management is used and the systematic CID is not assigned locally by the RS:

Path Info (see 11.22.10)

Specification of the ordered primary CID list of the RSs on the path that the service flow will traverse

6.3.2.3.11 DSA-RSP message

[Change the first two paragraphs in 6.3.2.3.11 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.11:]

In MR system, ~~U~~upon receiving a DSA-REQ from ~~MR-BS~~its superordinate neighbor, an intermediate RS or the access RS may reply~~ies~~ with a DSA-RSP directly to MR-BS using its ~~basic~~primary CID. This DSA-RSP sent over relay link follows the same structure of the DSA-RSP sent over access link except that the CID used in the MAC header is the primary CID of the RS.

6.3.2.3.12 DSA-ACK message

[Change the first two paragraphs in 6.3.2.3.12 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.12:

In MR system, ~~U~~upon receiving a DSA-RSP from an access RS, the MR-BS may send a DSA-ACK to all the RSs on the path. This DSA-ACK is processed by each intermediate RS on the path, and forwarded to its subordinate RS using the primary CID of the subordinate RS. The CID ~~associated with the service flow needs to be~~ is included in the Service Flow CID TLV field in this DSA-ACK message together with the admitted service flow parameter. The CID could be the transport CID for ~~an individual MS~~the service flow or ~~a~~the tunnel CID, into which the service flow is mapped.

This DSA-ACK sent over relay link shall contain the following TLVs:

Service Flow Parameters (see 11.3)

Specification of the traffic characteristics and scheduling requirements of the admitted service flow

HMAC/CMAC Tuple (see 11.1.2)

The HMAC/CMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC/CMAC Tuple attribute shall be the final attribute in the DSA* message's attribute list.

6.3.2.3.13 DSC-REQ message

[Change the first two paragraphs in 6.3.2.3.13 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.13:

In MR system, ~~B~~before admitting changes to a service flow, the MR-BS ~~shall~~ may send a DSC-REQ to all the RSs on the path. This DSC-REQ is processed by each RSs on the path and forwarded to its subordinate RS using the primary CID of the subordinate RS. The CID ~~associated with the service flow needs to be~~ is included in the Service Flow CID TLV field ~~in this DSC-REQ message~~ and~~. The CID~~ could be the transport CID for ~~an individual MS~~the service flow or ~~a~~the tunnel CID, into which the service flow is mapped.

This DSC-REQ sent over relay link shall contain the following TLVs:

Service Flow Parameters (see 11.3)
Specification of the service flow's traffic characteristics and scheduling requirements
HMAC/CMAC Tuple (see 11.1.2)
The HMAC/CMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC/CMAC Tuple attribute shall be the final attribute in the DSC* message's attribute list.

This DSC-REQ sent over relay link may contain the following TLVs, if explicit path management is used:

Path ID (see 11.22.4)
Specification of the id of the path that the service flow will traverse

This DSC-REQ sent over relay link may contain the following TLV, if embedded path management is used and the systematic CID is not assigned locally by the RS:

Path Info (see 11.22.10)

Specification of the ordered primary CID list of the RSs on the path that the service flow will traverse

6.3.2.3.14 DSC-RSP message

[Change the first two paragraphs in 6.3.2.3.14 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.14:

In MR system, ~~U~~upon receiving DSC-REQ from ~~MR-BS~~its superordinate neighbor, an intermediate RS or the access RS may reply~~ies~~ with a DSC-RSP directly to MR-BS using its ~~basic~~primary CID. The DSC-RSP sent over relay link follows the same structure of DSC-RSP sent over access link except that the CID used in the MAC header is the primary CID of the RS.

6.3.2.3.15 DSC-ACK message

[Change the first two paragraph in 6.3.2.3.15 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.15:

In MR system, ~~U~~upon receiving a DSC-RSP from an access RS, the MR-BS may send a DSC-ACK to all the RSs. This DSC-ACK is processed by each RS on the path and forwarded to it subordinate RS using the primary CID of the subordinate RS. The CID ~~associated with the service flow needs to be~~is ~~in this DSC* ACK message~~ included in the Service Flow CID TLV field together with the admitted service flow parameter, and ~~. The CID~~ could be the transport CID for ~~an individual MS~~the service flow or ~~a~~the tunnel CID, into which the service flow is mapped.

This DSC-ACK sent over relay link shall contain the following TLVs:

Service Flow Parameters (see 11.3)
Specification of the traffic characteristics and scheduling requirements of the admitted changed service flow

HMAC/CMAC Tuple (see 11.1.2)
The HMAC/CMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC/CMAC Tuple attribute shall be the final attribute in the DSC* message's attribute list.

6.3.2.3.16 DSD-REQ message

[Change the first two paragraphs in 6.3.2.3.16 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.16:

In MR system, ~~W~~while deleting a service flow, the MR-BS ~~shall~~may also send a DSD-REQ to all the RSs on the path ~~between the MR-BS and the MS~~. ~~The CID associated with the service flow needs to be included in the Service Flow CID TLV field in this DSD* REQ message.~~ The DSD-REQ message is processed by each intermediate RS and forwarded to it subordinate RS using the primary CID of the subordinate RS.

In addition to the TLVs defined for DSD-REQ sent over access link, this DSD-REQ message sent over relay link may contain the following TLVs, if explicit path management scheme is used:

Path ID (see 11.22.4)
Specification of the id of the path that the service flow will traverse

The DSD-REQ sent over relay link may contain the following TLV, if embedded path management is used and the systematic CID is not assigned locally by the RS:

Path Info (see 11.22.10)

Specification of the ordered primary CID list of the RSs on the path that the service flow will traverse

6.3.2.3.17 DSD-RSP message

[Change the first two paragraphs in 6.3.2.3.17 as following:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.2.3.17:

In MR system, upon receiving DSD-REQ from MR-BS, the access RS replies with a DSD-RSP directly to MR-BS using its primary CID. The DSD-RSP sent over relay link follows the same structure of the DSD-RSP sent over access link, except that the CID used in the MAC header is the primary CID of the access RS.

6.3.14.9.3 DSA
6.3.14.9.3.1 SS-initiated DSA

[Change the first subclasue in 6.3.14.9.3.1 in 80216j-06/026r4 as following]

In MR network with distributed scheduling, before ~~MR-BS~~ admitting the service flow and sending DSA-RSP to the requesting station which could be an MS or ~~an access~~ RS, the MR-BS ~~shall send a DSA*-REQ to all the RSs on the path.~~ may request for admission control decision from the intermediate RSs.

- If the service flow will be mapped to an existing tunnel, the MR-BS may update the service flow requirement for the tunnel, and send a DSC-REQ to all the RS on the path to obtain admission control decision. The CID in the service flow parameter should be the tunnel CID.

- If the service flow is not mapped to a tunnel, the MR-BS may send a DSA-REQ using the requested service flow parameter to all the RS on the path to obtain admission control decision. The CID in the service flow parameter should be the CID of the individual service flow.

~~Such~~ The DSA/DSC-REQ is first sent from MR-BS to its subordinate RS using its ~~basic~~primary CID. Upon receiving the DSA/DSC-REQ, If its resource condition can~~not~~ support the requested SF parameter, the RS simply forwards the message to its subordinate RS using the primary CID of the subordinate RS; otherwise, the RS process the request in the following ways.

- The RS ~~it~~ may update the SF parameter with the one it can support. It then ~~sends~~forwards the DSA/DSC-REQ to its subordinated neighboring RS using the ~~basic~~primary CID of the subordinate RS. This procedure is repeated by each RS, until the DSA/DSC-REQ reaches the access RS. After processing the DSA/DSC-REQ, the access RS replies with a DSA/DSC-RSP using its own ~~basic~~primary CID directly to the MR-BS.

- The RS may directly send a DSA/DSC-RSP back to MR-BS indicating that it cannot support the requested SF without forwarding the DSA/DSC-REQ further to its subordinate RS.

In order to ensure that the DSA/DSC-REQ messages from MR-BS to the RSs follow the same path as the packet associated with the tunnel or individual MS transport connection, the following information is included in the DSA/DSC-REQ depending on different path management scheme.

- With explicit path management scheme, a Path_Id TLV identifying the path that the MR-BS choose to route the connection is included in the DSA/DSC-REQ. The intermediate RSs should use path id to decide the next hop to forward the DSA/DSC-REQ.
- With embedded path management scheme, the intermediate RSs should use the systematic CID carried in the service flow parameters to determine the next hop to route the DSA/DSC-REQ, until the access RS is reached.

With embedded path management, when the systematic CID is not allocated locally by RS, a Path Info TLV should be included in the DSA/DSC-REQ to inform each RS of the primary CID of its subordinate RS.

If MR-BS receives DSA/DSC-RSP from the access RS within T48, it shall send DSA-RSP to the requesting station. Meanwhile MR-BS shall also send a DSA/DSC-ACK with the admitted service flow parameter to all the RSs on the path, if the embedded routing scheme is used. The path used to route the DSA/DSC-ACK from the RSs should be the same as the path used to route the corresponding DSA/DSC-REQ from the RSs.

6.3.14.9.3.2 BS-initiated DSA

[Change the first subclasue in 6.3.14.9.3.2 in 80216j-06/026r4 as following:]

In MR network with distributed scheduling, before MR-BS sends DSA-REQ to an MS or ~~an access~~ RS to initiate a service flow establishment, the MR-BS ~~shall~~may ~~send DSA-REQ to~~ request all the RSs on the path for an

admission control decision. The procedures of sending and processing the DSA/DSC-REQ and DSA/DSC-RSP are the same as those defined for MS-initiated DSA procedure defined in section 6.3.14.9.3.1.

~~Such DSA-REQ is first sent from MR-BS to its subordinate RS using its basic CID. If its resource condition cannot support the requested SF parameter, it updates the SF parameter with the one it can support. It then sends the DSA-REQ to its subordinated neighboring RS. This procedure is repeated by each RS, until the DSA-REQ reaches the access RS.~~ After processing the DSA/DSC-R~~EQ~~SP, ~~the access RS replies with a DSA-RSP using its own basic CID directly to the MR-BS. T~~the MR-BS then ~~shall~~ send DSA-REQ to the MS or ~~access~~ RS to initiate a service flow establishment. Meanwhile MR-BS ~~shall~~may also send a DSA/DSC-ACK with the admitted service flow parameter to all the RSs on the path, ~~.~~ if the embedded routing scheme is used. The processing procedures of DSA/DSC-ACK message on each RS are the same as those defined for MS initiated DSA procedure.

6.3.14.9.4.1 SS-initiated DSC

[Change the first subclasue in 6.3.14.9.4.1 in 80216j-06/026r4 as following:]

In MR network with distributed scheduling, before ~~MR-BS~~ admitting the changes and sending DSC-RSP to the requesting station which could be an MS or ~~an access~~ RS, the MR-BS shall send DSC-REQ to all the RSs on the path to request for admission control decisions. If the service flow is mapped to a tunnel, the CID in the service flow parameter should be the tunnel CID; otherwise, the CID for the service flow is included. Such DSC-REQ is first sent from MR-BS to its subordinate RS using its ~~basic~~primary CID. Upon receiving such DSC-REQ, ~~I~~if its resource condition can~~not~~ support the requested modified SF parameter, the RS simply forwards the message to its subordinate RS using the primary CID of the subordinate RS; otherwise, the RS process the request in the following ways.

- ~~it~~The RS may update~~s~~ the SF parameter with the one it can support. It then ~~send~~forwards the DSC-REQ to its subordinated neighboring RS. This procedure is repeated by each RS, until the DSC-REQ reaches the access RS. After processing the DSC-REQ, the access RS replies with a DSC-RSP using its own ~~basic~~primary CID directly to the MR-BS.

- The RS may directly send a DSC-RSP back to MR-BS indicating that it cannot support the requested modified SF, without further forwarding it to the next hop.

In order to ensure that the DSC-REQ messages from MR-BS to the RSs follow the same path as the packet associated with the tunnel or individual MS transport connection, the same procedure as defined for SS initiated DSA as defined in section 6.3.14.9.3.1 is applied.

With embedded path management, when the systematic CID is not allocated locally by RS, a Path Info TLV should be included in the DSA/DSC-REQ to inform each RS of the primary CID of its subordinate RS.

If MR-BS receives DSC-RSP from the access RS within T48, it shall send DSC-RSP to the requesting station. Meanwhile MR-BS ~~shall~~may also send a DSC-ACK with the admitted service flow parameter to all the RSs on the path, if the embedded routing scheme is used. The processing procedures of DSC-ACK message to the RSs are the same as those for the DSC-REQ as described above. The path used to route the DSC-ACK should be the same as the path used to route the corresponding DSC-REQ.

6.3.14.9.4.2 BS-initiated DSC

[Change the first subclasue in 6.3.14.9.4.2 in 80216j-06/026r4 as following:]

In MR network with distributed scheduling, before ~~MR-BS~~ sending DSC-REQ to an MS or ~~an access~~ RS to modify an existing service flow, the MR-BS ~~shall~~may first send DSC-REQ to all the RS on the path to request for

admission control decision. The procedures of sending and processing the DSC-REQ and the correspondent DSC-RSP are the same as those defined for MS-initiated DSC procedure defined in section 6.3.14.9.4.1. After receiving DSC-RSP from the access RS, ~~T~~the MR-BS then shall send DSC-REQ to the MS or ~~access~~ RS to modify an existing SF. Meanwhile MR-BS ~~shall~~may also send a DSC-ACK with the admitted modified service flow parameter to all the RSs on the path, if the embedded routing scheme is used. The processing procedures of DSC-ACK message on each RS are the same as those for MS initiated DSC procedure.

6.3.14.9.5 Connection release

6.3.14.9.5.1 SS-initiated DSD

[Change the first subclasue in 6.3.14.9.5.1 in 80216j-06/026r4 as following:]

In MR network with distributed scheduling, upon receiving a DSD-REQ from an MS or ~~an access~~ RS for an existing service flow, the MR-BS shall delete the service flow on relay link ~~(MR-BS ~ RS)~~ as well as the access link ~~(RS-SS)~~. The MR-BS ~~shall~~may send DSD-REQ to all the RSs on the path if the service flow is not mapped into a tunnel. Such DSD-REQ is first sent from MR-BS to its subordinate RS using its ~~basic~~primary CID. The RS processes it and forwards it to its subordinate neighboring RS using the primary CID of its subordinate RS. This procedure is repeated by each RS, until the DSD-REQ reaches the access RS. After processing the DSD-REQ, the access RS replies with a DSD-RSP using its own ~~basic~~primary CID directly to the MR-BS.

In order to ensure that the DSD-REQ messages from MR-BS to the RSs follow the same path as the packet associated with the tunnel or individual MS transport connection, the same procedure as defined for SS initiated DSA as defined in section 6.3.14.9.3.1 is applied here.

6.3.14.9.5.2 BS-initiated DSD

[Change the first subclasue in 6.3.14.9.5.2 in 80216j-06/026r4 as following:]

In MR network with distributed scheduling, the MR-BS shall delete the service flow on relay link ~~(MR-BS ~ RS)~~ as well as the access link ~~(RS-SS)~~. In addition to sending DSD-REQ to the MS or RS, ~~T~~the MR-BS shall also send DSD-REQ to all the RSs on the path if the service flow is not mapped into a tunnel. ~~Such DSD-REQ is first sent from MR-BS to its subordinate RS using its basic CID. The RS processes it and forwards it to its subordinate neighboring RS. This procedure is repeated by each RS, until the DSD-REQ reaches the access RS. After processing the DSD-REQ, the access RS replies with a DSD-RSP using its own basic CID directly to the MR-BS.~~ The procedures of sending and processing the DSD-REQ and the responding DSD-RSP are the same as those defined for MS-initiated DSD procedure as defined in section 6.3.14.9.5.1.

Insert new subclause 11.22.10

11.22.10 Path-Info TLV

This field contains a compound attribute whose subattributes identifies the direction of the path, the number of RSs on the path and an ordered list of RSs on the path as listed in Table S1.

Type	Length	Value	Scope
TBD	variable	Compound	DSA*-REQ, DSC*-REQ

Table S1 – Path-Info Subattributes

Attribute	Content
Number of RS	The number of RSs in the ordered list of RSs
Ordered list of RSs	An ordered primary CID list of RSs on the path.