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Source(s)		
	Yuefeng Zhou; Mike Hart; Sunil Vadgama Fujitsu Laboratories of Europe Ltd Hayes Park Central, Hayes End Road, Hayes, Middlesex, UB4 8FE, UK	Voice: +44 (0) 20 8573 4444 FAX: +44 (0) 20 8606 4539 E-mail: Yuefeng.zhou@uk.fujitsu.com Mike.hart@uk.fujitsu.com Sunil.vadgama@uk.fujitsu.com
	Masato Okuda Fujitsu Laboratories Ltd. Kamikodanaka 4-1-1, Kawasaki, 211-8588, Japan	Voice: +81-44-754-2811 Fax: +81-44-754-2786 okuda@jp.fujitsu.com
	Haihong Zheng, Yousuf Saifullah, Shashikant Maheshwari Nokia Siemens Networks 6000 Connection Drive, Irving, TX 75019 USA	Voice: 972-894-5000 Email: Haihong.Zheng@nsn.com
	Kenji Saito KDDI Corporation 3-10-10, Iidabashi, Chiyoda-ku, Tokyo 102-8460 Japan	Voice: +81 80 5061 9967 E-mail: kenji@kddi.com

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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Service Management in MR with Distributed Scheduling RS

1. Introduction

In MR networks, the RS may use two types of scheduling. Centralized Scheduling is where MR-BS controls all the radio resource scheduling and MAP allocation. Distributed Scheduling is where some functionality of radio resource scheduling and MAC allocation are distributed to RS. This contribution proposes text to clarify the handling of service flow management in distributed scheduling case.

When MR-BS creating/modifying the QoS parameters of service flow, to facilitate the distributed scheduling RS, the MR-BS has to check and then inform the QoS information with the related RS, which include all the RSs on the path. Note that the service flow could be associated with a tunnel connection identified by a T-CID or an MS transport connection identified by a MS CID. Change of service flow parameter for a tunnel connection could be triggered by for example adding of new individual MS connection into the tunnel.

The initial admission control procedure is illustrated in Figure 1. Before admitting a new connection, the MR-BS may first send DSA*-REQ to the RSs on the path, through which the new connection will traverse in order to obtain the admission control decision. Note that the service flow parameter is associated with the tunnel, if the new connection is a tunnel connection. The DSA*-REQ message is sent from MR-BS to the first RS on the path, and then forwarded to the next hop until the access RS is reached. Each RS on the path processes the DSA*-REQ. If the resource condition at the intermediate RS is not able to support the service flow parameter, it may process the message in the following ways:

- In the case that the QoS that can be supported at the intermediate RS could be acceptable by the associated application, the intermediate RS may modify the SF parameter to the value it can support, and then forward the message to the next hop until the access RS is reached. After processing the DSA*-REQ, the access RS sends a DSA*-RSP directly back to MR-BS.
- In the case that the QoS that can be supported at the intermediate RS will not be acceptable by the association application (e.g., the minimum bit rate requirement cannot be reached), the intermediate RS may directly sends a DSA*-RSP back to MR-BS.

After receiving the DSA*-RSP, the MR-BS may send DSA*-ACK to the RSs on the path indicating the admitted service flow parameter. Each intermediate RS obtains the SF parameter from the DSA*-ACK and forwards it to the next hop until the access RS is reached.

In order to ensure that the DSA*-REQ and DSA*-ACK 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 needed depending on different path management scheme.

- With explicit path management scheme, a path id that the MR-BS choose to route the connection 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 following two cases apply:

- With systematic CID 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.
- When CID encapsulation scheme is used, MR-BS should include a complete path information in the DSA*-REQ and DSA*-ACK. The intermediate RSs should use the included path information to decide the next hop to forward the DSA*-REQ and DSA*-ACK.

Figure 1 illustrates an example of the initial admission control procedure. Note that the DSA* messages listed in the figure are only exchanged among MR-BS and RSs on the path. MS is not involved in this process.

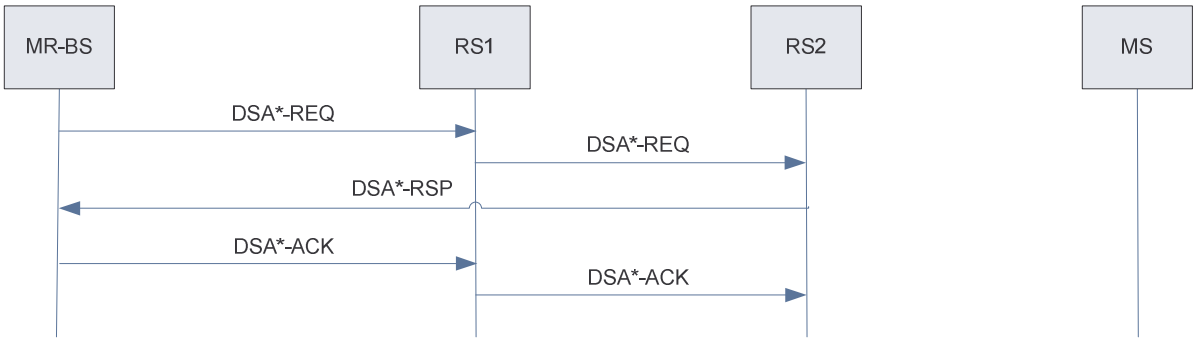

Figure 1: Example Admission Control Procedure between MR-BS and RSs

4. Specific Text Change

6.3.2.3.10 DSA-REQ message

[Insert the following text at the end of subclause 6.3.2.3.10:]

Before admitting a service flow, the MR-BS shall send a DSA*-REQ to all the RSs on the path to obtain an admission control decision from the associated RSs. The CID associated with the service flow is included in the Service Flow CID TLV field in the DSA*-REQ message and could be a transport CID for an individual MS or a tunnel CID. The CID used on the MAC header is the basic CID of the correspondent RS.

The DSA*-REQ 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.

The DSA*-REQ message may contain the following TLVs:

Path ID (see 11.21.4)
Specification of the id of the path that the service flow will traverse
Path Info (see 11.21.10)
Specification of the detailed path information

6.3.2.3.11 DSA-RSP message

[Insert the following text at the end of of subclause 6.3.2.3.11:]

Upon receiving a DSA*-REQ from MR-BS, an intermediate RS or access RS may reply with a DSA*-RSP directly to MR-BS using its basic CID. The DSA*-RSP follows the same structure of the DSA-RSP except that the CID used on the MAC header is the basic CID of the correspondent RS.

6.3.2.3.12 DSA-ACK message

[Insert the following at the end of subclause 6.3.2.3.12:]

Upon receiving a DSA*-RSP from an access RS, the MR-BS may send DSA*-ACK to all the RSs on the path to distribute the admitted service flow parameter. The CID associated with the service flow is included in the Service Flow CID TLV field in this DSA*-ACK message together with the admitted service flow parameter, and could be the transport CID for an individual MS or a tunnel CID. The CID used on the MAC header is the basic CID of the correspondent RS.

The DSC*-ACK 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

[Insert the following text at the end of subclause 6.3.2.3.13:]

Before admitting changes to a service flow, the MR-BS shall send a DSC*-REQ to all the RSs on the path. The CID associated with the service flow should be included in the Service Flow CID TLV field in this DSC*-REQ message, and could be the transport CID for an individual MS or a tunnel CID. The CID used on the MAC header is the basic CID of the correspondent RS.

The DSC*-REQ 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.

The DSC*-REQ message may contain the following TLVs:

Path ID (see 11.21.4)
Specification of the id of the path that the service flow will traverse
Path Info (see 11.21.10)
Specification of the detailed path information

6.3.2.3.14 DSC-RSP message

[Insert the following text at the end of subclause 6.3.2.3.14:]

Upon receiving DSC*-REQ from MR-BS, an intermediate RS or the access RS may reply with a DSC*-RSP directly to MR-BS using its basic CID. The DSC*-RSP follows the same structure of the DSC-RSP except that the CID used on the MAC header is the basic CID of the correspondent RS.

6.3.2.3.15 DSC-ACK message

[Insert the following text at the end of subclause 6.3.2.3.15:]

Upon receiving a DSC*-RSP from an access RS, the MR-BS may send a DSC*-ACK to all the RSs on the path to distribute the admitted modified service flow parameter. The CID associated with the service flow should be included in the Service Flow CID TLV field in this DSC*-ACK message together with the admitted service flow parameter, and could be the transport CID for an individual MS or a tunnel CID. The CID used on the MAC header is the basic CID of the correspondent RS.

The DSC*-ACK 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.

6.3.2.3.17 DSD-REQ message

[Insert the following text at the end of subclause 6.3.2.3.17:]

While deleting a service flow, the MR-BS shall also send a DSD*-REQ to all the RSs on the path between the MR-BS and the MS. The DSD*-REQ follows the same structure of the DSD-REQ except that the CID used on the MAC header is the basic CID of the correspondent RS.

In addition to the TLVs defined for DSD-REQ, the DSC*-REQ message may contain the following TLVs:

Path ID (see 11.21.4)
Specification of the id of the path that the service flow will traverse
Path Info (see 11.21.10)
Specification of the detailed path information

6.3.2.3.18 DSD-RSP message

[Insert the following text after the second paragraph of subclause 6.3.2.3.18:]

Upon receiving DSD*-REQ from MR-BS, the access RS replies with a DSD*-RSP directly to MR-BS using its basic CID. The DSD*-RSP follows the same structure of the DSD-RSP, except that the CID used on the MAC header is the basic CID of the correspondent RS.

6.3.14.9.3 DSA
6.3.14.9.3.1 SS-initiated DSA
Insert the following table the end of 6.3.14.9.3.1:

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 to obtain the admission control decision from the intermediate RSs. 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, the RS process the request in the following ways.
- The RS may update the SF parameter with the one it can support. It then sends the DSA*-REQ to its subordinated neighboring RS using the basic CID of the subordinate RS. This procedure is repeated by each RS, until the DSA*-REQ reaches the access RS. After processing the DSA*-REQ, the access RS replies with a DSA*-RSP using its own basic CID directly to the MR-BS.
- The RS may directly send a DSA*-RSP back to MR-BS indicating it cannot support the request SF without forwarding the DSA*-REQ further to its subordinate RS.

In order to ensure that the DSA*-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*-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*-REQ. The intermediate RSs should use path id to decide the next hop to forward the DSA*-REQ.
- With embedded path management scheme, the following two cases apply:
    - With systematic CID 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, until the access RS is reached.
    - When CID encapsulation scheme is used, MR-BS should include a complete path information in the Path_Info TLV in the DSA*-REQ. The intermediate RSs should use the included path information to decide the next hop to forward the DSA*-REQ.

If MR-BS receives DSA*-RSP from the access RS within T48, it shall send DSA-RSP to the requesting station. Meanwhile MR-BS shall also send a DSA*-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*-ACK message on each RS are the same as those for the DSA*-REQ as described above. The path used to route the DSA*-ACK should be the same as the path used to route the corresponding DSA*-REQ.

6.3.14.9.3.2 BS-initiated DSA

Insert the following table the end of 6.3.14.9.3.2:

- In MR network with distributed scheduling, before MR-BS sending DSA-REQ to an MS or an access RS to initiate a service flow establishment, the MR-BS shall first send DSA*-REQ to all the RSs on the path to obtain the admission control decision from the intermediate RSs. The procedures of sending and processing the DSA*-REQ and the responding DSA*-RSP are the same as those defined for MS-initiated DSA procedure as defined in section 6.3.14.9.3.1.

After receiving the DSA*-RSP, the MR-BS then send DSA-REQ to the MS or access RS to initiate a service flow establishment. Meanwhile MR-BS shall also send a DSA*-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*-ACK message on each RS are the same as those for the DSA*-REQ as described above. The path used to route the DSA*-ACK should be the same as the path used to route the corresponding DSA*-REQ.

6.3.14.9.4.1 SS-initiated DSC

Insert the following table the end of 6.3.14.9.4.1:

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 may send DSC*-REQ to all the RSs on the path to obtain the admission control decision from the intermediate RSs. Such DSC*-REQ is first sent from MR-BS to its subordinate RS using its basic CID. If its resource

condition cannot support the requested changed SF parameter, the RS process the request in the following ways.

- The RS may update the SF parameter with the one it can support. It then sends 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 CID directly to the MR-BS.
- The RS may directly send a DSC*-RSP back to MR-BS indicating it cannot support the request changed 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.

If MR-BS receives DSC*-RSP from the RS within T48, it shall send DSC-RSP to the requesting station. Meanwhile MR-BS shall also send a DSC*-ACK with the admitted changed 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 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

Insert the following table the end of 6.3.14.9.4.2:

- 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 send DSC*-REQ to all the RSs on the path to obtain the admission control decision from the intermediate RSs. The procedures of sending and processing the DSC*-REQ and the responding DSC*-RSP are the same as those defined for MS-initiated DSC procedure as defined in section 6.3.14.9.4.1.

The MR-BS then may send DSC-REQ to the MS or access RS to modify the service flow parameter for an established service flow. Meanwhile MR-BS shall also send a DSC*-ACK with the admitted changed 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 the DSC*-REQ as described above.

6.3.14.9.5 Connection release

6.3.14.9.5.1 SS-initiated DSD

Insert the following table the end of 6.3.14.9.5.1:

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 as well as the access link. The MR-BS shall send DSD*-REQ to all the RSs on the path. 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.

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

Insert the following table the end of 6.3.14.9.5.2:

In MR network with distributed scheduling, the MR-BS shall delete the service flow on relay link as well as the access link. TheMR-BS shall send DSD*-REQ to all the RSs on the path. 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.

10.1 Global values

[***Add one row in table 342 as indicated***]

System	Name	Time reference	Minimum value	Default value	Maximum value
MR-BS	T48	Time the MR-BS waits for DSA*-RSP from RS	TBD	TBD	TBD

Insert new subclause 11.21.10

11.21.10 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.

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

Table S1 – Path-Info Subattributes

Â Attribute	Â Content
Â Path Direction	Â The direction of the path

À Number of RS	À The number of RSs in the ordered list of RSs
À Ordered list of RSs	À An ordered list of RSs that identifies the path in the case of non-presence of the Existing Path ID; or a ordered list of RSs that identifies the difference between the new path and the existing path in the case of presence of the Existing Path ID