Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	A proposal for synchronous MBS transmission in MR
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Re:	IEEE802.16j-06/034: “Call for Technical Proposals regarding IEEEP802.16j”
Abstract	This contribution proposes the method of synchronization for MBS transmission among BS and RS.
Purpose	Text proposal for P802.16j Baseline Document.
Notice	
Release	
Patent Policy and Procedures	

A proposal for synchronous MBS transmission in MR

[This contribution propose a harmonization text proposal on MBS transmission in MR]

Introduction

This contribution proposes the method of synchronization for MBS transmission among MR-BS and RS.

Details

As mentioned in section 6.3.23.2.2 “Performance enhancement with macro diversity” of 802.16e specification [1], from the receiving performance point of view, transmission of broadcast data from MR-BS and RS should be synchronized.

In order to synchronize the timing of MBS data sent from both MR-BS and RS in the presence of possible processing delay in RS, there are three steps for MBS transmission, as shown in Fig. 1 and 2. Also, it assumes that frame synchronization among MR-BS and RS is established in a same MBS zone.

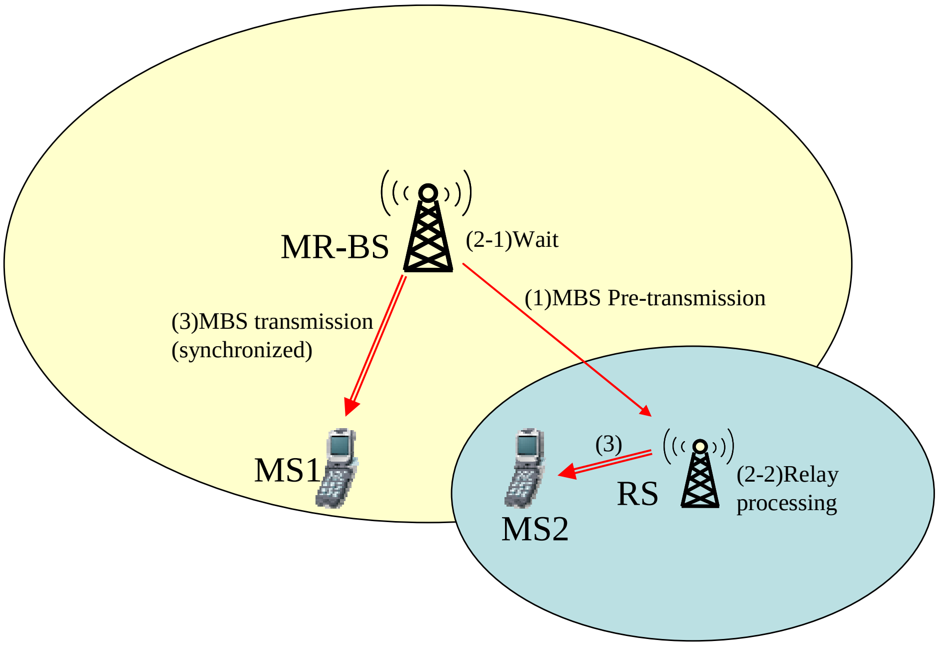

Fig. 1 Synchronized transmission for MBS traffic in MR

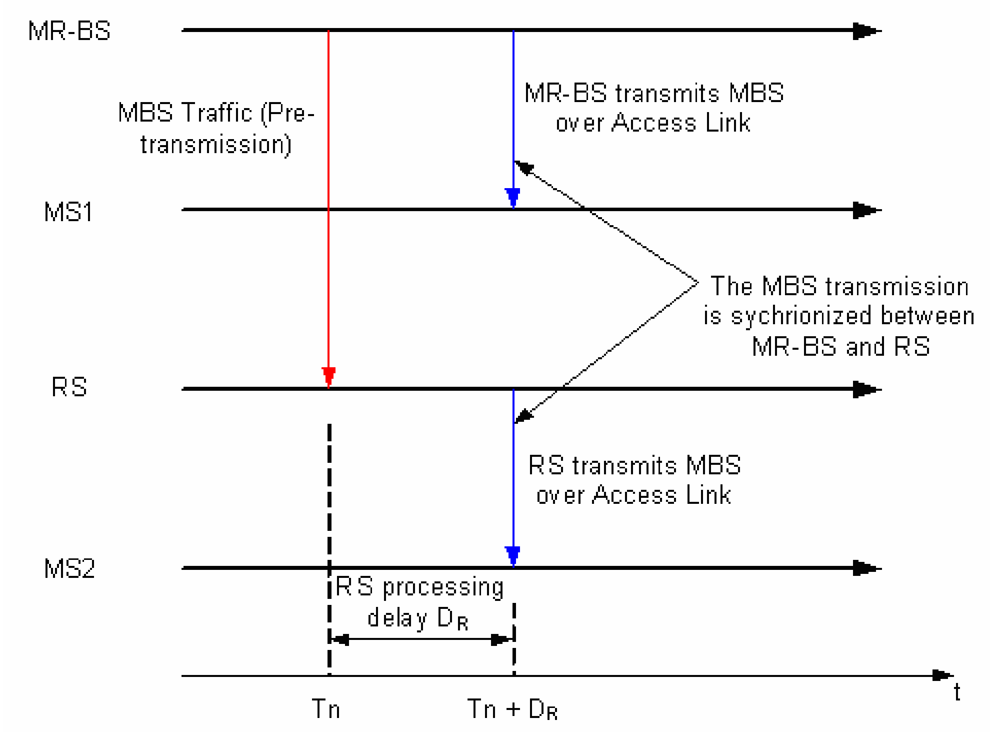

Fig. 2 Transmission sequence of MBS traffic in MR

Step 1: Pre-transmission from MR-BS to RS

Firstly, the MR-BS sends MBS data to the RS as a pre-transmission over the relay link before transmitting it over the access link. Assume the MBS pre-transmission time is Tn and the processing delay at the RS is D_R, then the time when the MR-BS should transmit the MBS over the access link is Tn+D_R (as shown in Fig. 2)

Step 2: MR-BS waits for the RS to process the MBS data (step 2-1) and the RS processes the MBS data (step 2-2)

Step 3: Synchronized transmission of the MBS data over the access link by both the MR-BS and the RS at time Tn+D_R.

The value of D_R will be communicated to the MR-BS as a capability parameter in the SBC-REQ message. Note that the additional capability parameter for the RS is proposed in contribution [2].

Consider the case where there are multiple RSs at different hop counts from the MR-BS with different processing delays in an MR network, as shown in Fig.3. The MR-BS and all RSs shall synchronize their MBS transmissions over the access link with the RS that has the maximum cumulative delay. As shown in Fig.4, the cumulative delay of RS3 is equal to $D_R(2)+D_R(3)$, where $D_R(i)$ represents the processing delay of RS #i. In order to synchronize all access link MBS transmissions with the RS that has the maximum cumulative delay, the parameter D_M shall be set to $D_R(2)+D_R(3)$ in this example. The MR-BS examines the waiting time Wi for each RS #i and notifies each RS by sending an SBC-RSP message.

The MR-BS sends MBS data over the relay downlink as a pre-transmission D_M frames before the MBS transmission over the access link. The MR-BS shall wait D_M frames while each RS shall wait Wi frames as notified by the MR-BS before transmitting the MBS data over the access link synchronously.

If the MR-BS detects that the waiting time for some RS needs to be changed, the MR-BS may send an unsolicited SBC-RSP message notifying the RS of the change in waiting time.

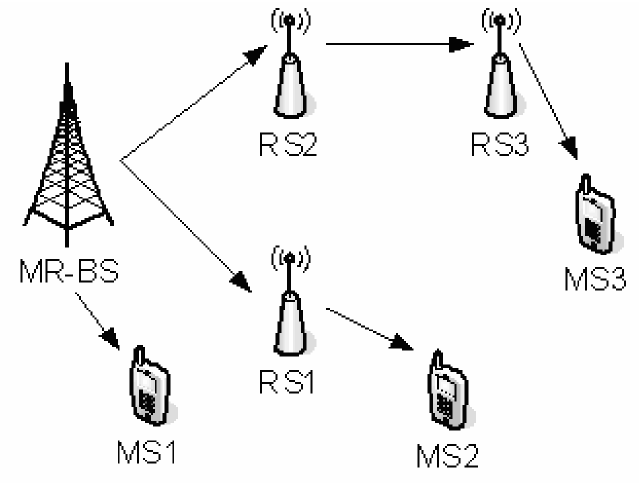

Fig.3 Synchronized transmission for MBS traffic in MR networks with more than 2-hops

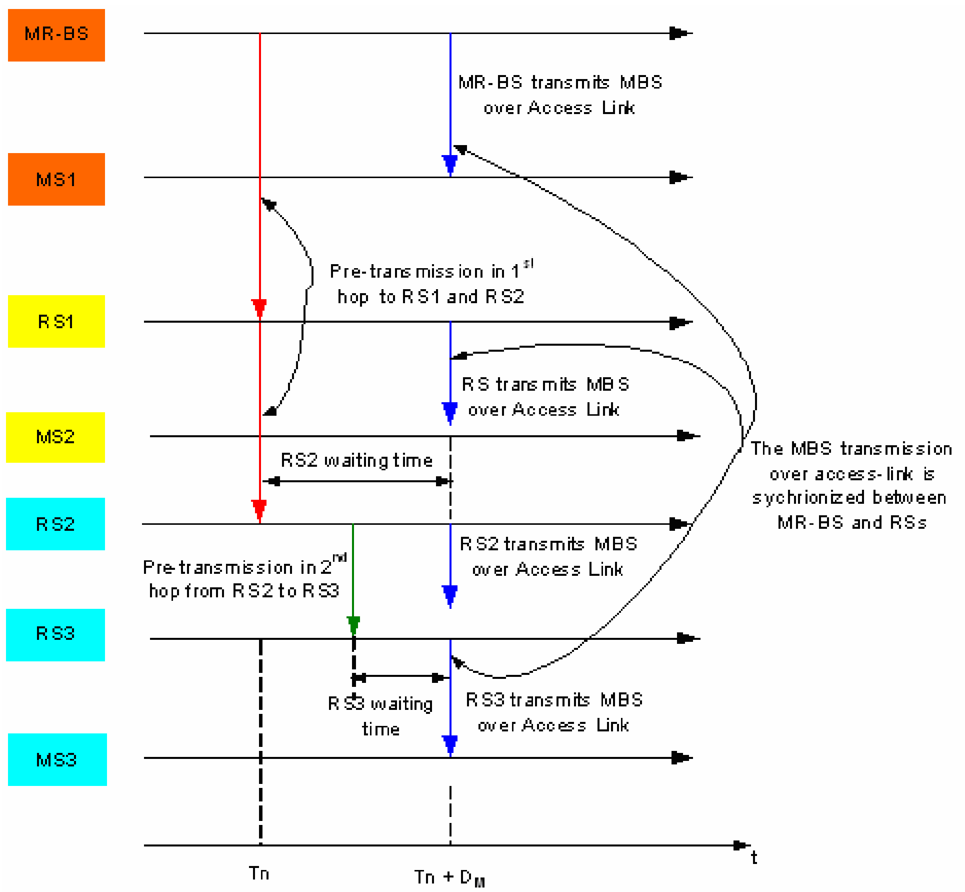

Fig.4 Synchronized MBS transmission from multiple RSs with different processing delay and hop-counts

Conclusion

The method presented in this proposal can guarantee that MBS transmissions can be synchronized in MR networks. By using this method, a roaming MS also can safely receive the MBS data.

Specific text changes

6.3.23.2.2 Performance enhancement with macro diversity

[*Insert the following text at the end of 6.3.23.2.2*:]

For MR networks, MBS transmission within an MBS zone shall be synchronized.

If there is only one RS connecting with the MR-BS, that RS shall report its processing delay (in units of a frame), D_R, to the MR-BS as a capability parameter in the SBC-REQ message. When an MBS transmission is necessary, the MR-BS shall first send the MBS data over the relay downlink as a pre-transmission, and then after D_R frames, the MR-BS and RS shall synchronously transmit this MBS data over the access link.

If there are multiple RSs in the MBS zone at various hop counts from the MR-BS and/or with different processing delays, each RS shall report its processing delay, D_R, to the MR-BS as a capability parameter in the SBC-REQ message. The MR-BS shall determine the maximum cumulative delay, D_M, of all RSs in the MBS zone based on their positions in the tree and their individual processing delays. The MR-BS shall then calculate the required waiting time, Wi, for each RS based on the value of D_M and each RS's cumulative delay and notify each RS of its waiting time via an SBC-RSP message. If the MR-BS detects that the waiting time has changed for a particular RS, it may send an unsolicited SBC-RSP message to that RS to update its waiting time.

When an MBS transmission is necessary, the MR-BS shall forward the MBS data over the relay downlink as a pre-transmission D_M frames before transmitting this MBS data over the access link. Each RS in the MBS zone shall forward the MBS data it receives over the relay downlink. Finally, once the MR-BS has waited D_M frames and each RS has waited its specified waiting time, Wi, the MR-BS and RSs shall synchronously transmit the MBS data over the access link.

11.8 SBC-REQ/RSP management message encodings

[***Insert new subclauses in 11.8.3.7:***]

11.8.3.7.X RS Downlink Processing Delay

Type	Length	Value	Scope
TBA	1	RS Downlink Processing Delay (unit: frame)	SBC-REQ

11.8.3.7.X RS waiting time for MBS

Type	Length	Value	Scope
TBA	1	RS waiting time for MBS (unit: frame)	SBC-RSP

References

[1] IEEE 802.16e-2005

[2] IEEE C802.16j-06/143, "Network entry procedure for non-transparent relay station"