Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	A proposal for timing compensation of sleep mode in MR
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Re:	IEEE802.16j-07/007r2: “Call for Technical Comments and Contributions regarding IEEE Project 802.16j”
Abstract	This contribution proposes the method of timing compensation for sleep mode in MR.
Purpose	Text proposal for 802.16j Baseline Document
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A proposal for timing compensation of sleep mode in MR

[***This contribution propose a harmonization text proposal on Sleep Mode Timing Compensation in MR***]

Introduction

This contribution proposes a method of timing compensation for timing-related control function, such Sleep mode. In 802.16e specification, several messages such as MOB_TRF-IND are received at the pre-notified timing. However, in a non-transparent RS system[1], the message processing delay in RS makes it hard to fulfill that reception timing requirement. In order for MS to receive messages at the pre-notified timing, MR-BS compensates the timing when MS can receive messages with taking account of RS processing delay.

Details

In this proposed method, based on the following assumptions:

- The MR system is a non-transparent RS system [1].

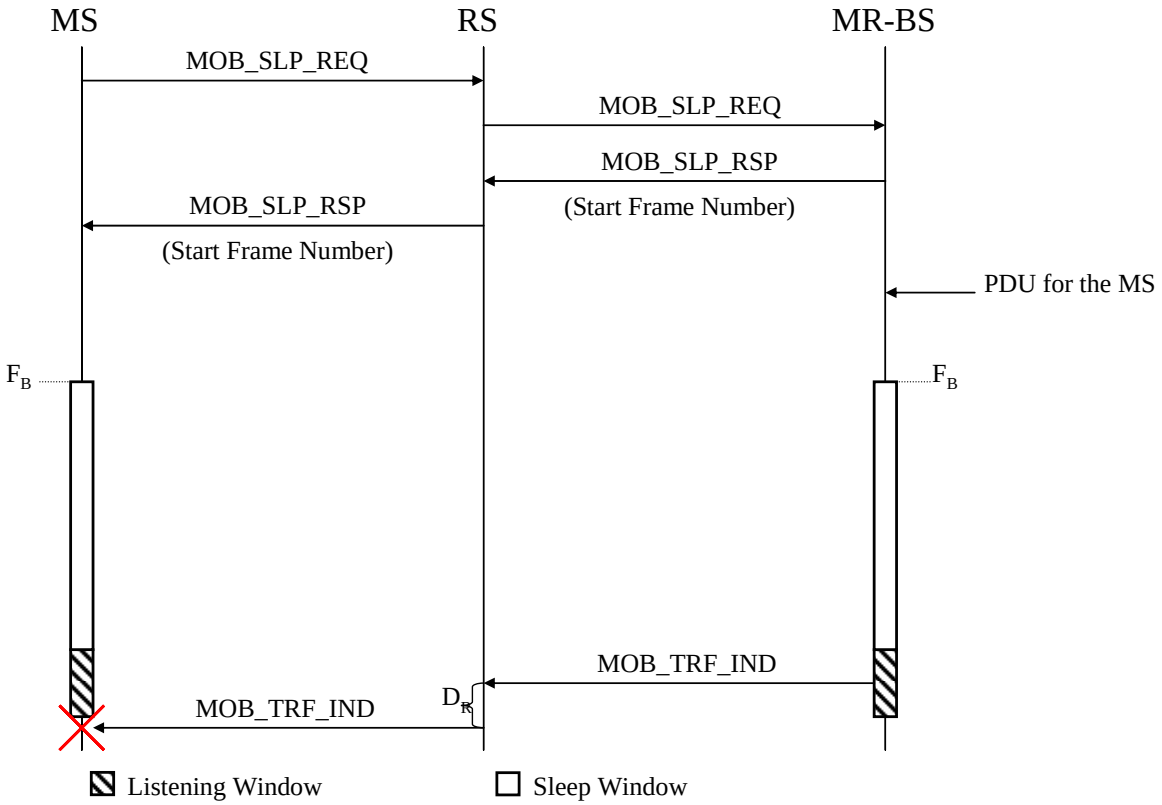
- The RS can not relay message and data within the current frame. The message is delayed for fixed duration on account of relay processing in the RS.

- Each frame sent by MR-BS and RS are synchronized and has same frame number.

Timing compensation for sleep mode

As shown in Fig. 1, MS enters Sleep mode by receiving MOB_SLP-RSP message involving “Start Frame Number” parameter from MR-BS. F_B, the beginning frame of first Sleep Window(SW), is decided by the Start Frame Number.

According to the above assumption, MOB_TRF-IND message sent from MR-BS will delay of “D_R” in RS, it is received at MS D_R frame later. Therefore, it depends on the size of Listening Window(LW) and the timing of that MOB_TRF-IND message is sent from MR-BS, MOB_TRF-IND message does not reach within LW of MS correctly and MS fails to receive the message.



D_R : Relay processing delay of RS
F_B : The beginning frame of Sleep Window

Fig. 1 LW slipping problem of sleep mode in MR

To avoid this problem, the timing of LW managed in MR-BS and MS should be compensated. Proposed method is shown in Fig. 2.

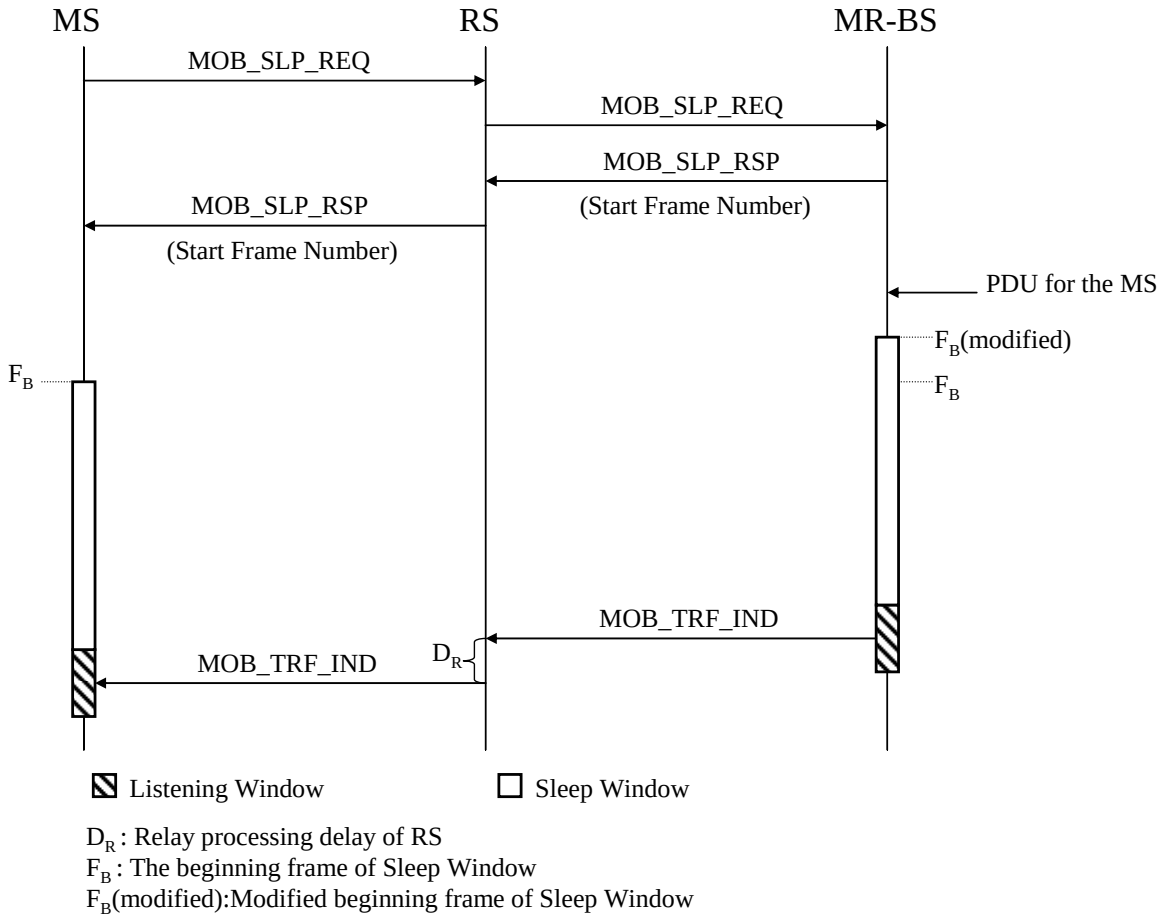


Fig. 2 Compensation for timing of LW

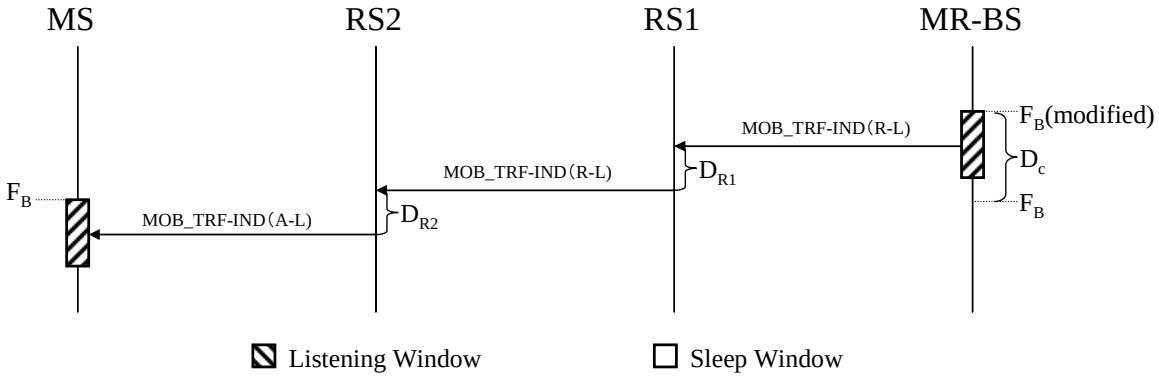
When MR-BS receives MOB_SLP-REQ message and decides Start Frame Number, MR-BS decides normal Start Frame Number value with regular manner at first and notifies MS of it by MOB_SLP-RSP message. And, MR-BS also decides modified Start Frame Number value for itself. Modified value will be decided to that the SW and LW managed internally in MR-BS are just shifted D_R earlier from the SW and LW of MS.

With this compensation method, MOB_TRF-IND sent over the R-DL at any frame within LW managed in MR-BS is received successfully within MS' LW via RS relaying.

In order to decide the modified Start Frame Number value in MR-BS, MR-BS needs to know D_R of RS. The value of RS's delay is given to MR-BS as a capability parameter of SBC-REQ message.

Consider the case that multiple RSs exist between the MR-BS and MS, as shown in Fig. 3.

In this case, the MR-BS calculates the cumulative processing delay of the RSs between the MR-BS and the MS. As shown in Fig. 3, the cumulative delay "D_C" is equal to $D_{R1}+D_{R2}$. The MR-BS decides modified Start Frame Number value for itself. Modified value will be decided to that the SW and LW managed internally in MR-BS are just shifted D_C earlier from the SW and LW of MS.



D_R : Relay processing delay of RS
D_c : Cumulative Relay processing delay of RS
F_B : The beginning frame of Sleep Window
F_B(modified):Modified beginning frame of Sleep Window

Fig. 3 Compensation for timing of LW over multiple RSs

Conclusion

According to this compensation method, the MOB_TRF-IND messages are surely delivered from MR-BS to MS through RS relaying.

Specific text changes

[Insert the following text at the end of 6.3.21.7:]

6.3.21.7 Relay support for MS sleep mode

In MR networks, the sleep mode shall be centrally controlled by the MR-BS in the presence of centralized or distributed scheduling.

For MR, to guarantee the sleep-mode MS receiving traffic indication in time in the presence of processing delay of RS, which is D_R, the MR-BS may transmit MOB_TRF-IND over R-DL and access link separately. If multiple RSs exist, the MR-BS shall find the cumulative processing delay of RSs, which is D_C, for the path between the MR-BS and the MS. The MR-BS sends MOB_TRF-IND over the R-DL as a pre-transmission D_R or D_C frame earlier than the normal MOB_TRF-IND transmission time over access link. The RS delay, D_R, is given to MR-BS as a capability parameter of SBC-REQ message.

References

[1] IEEE 802.16j-06/026r2, “P802.16j Baseline Document”

[2] IEEE C802.16j-07/044, “Sleep Mode Operations in MR network for Centralized Scheduling Approach”