Sleep Mode with RS

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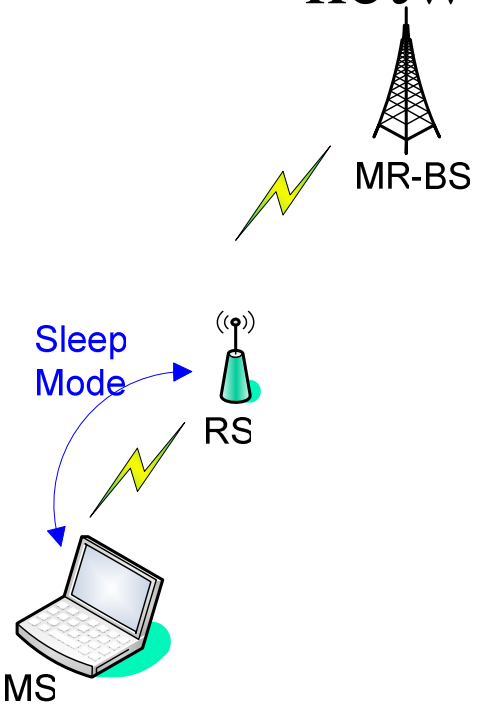
Purpose:

This contribution proposes MS sleep mode interworking with RS. It also proposes RS sleep mode procedure.

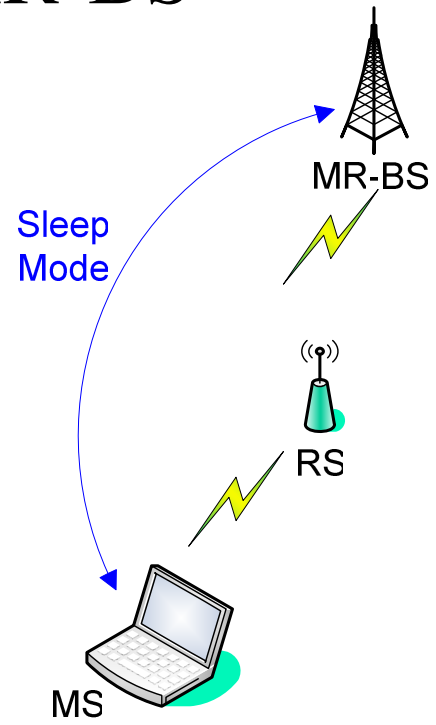
Introduction

- Sleep mode is essential for conserving power
- This contribution discusses
  - RS working for supporting MS sleep mode with the introduction of relays
  - Proposing RS Sleep Mode for conserving RS power

Where to keep MS Sleep Mode state in the network? RS or MR-BS



- Overall RS is more complex
- Buffering according to listening/sleep intervals is moved to RS.
- SLPID and TRF-IND Management
  - Either move them to RS
  - Or keep them on MR-BS, adds coordination signaling b/w MR-BS and RS
  - Both options will make RS more complex
- Need coordination between RS and MR-BS for handover



- Overall RS is simple
- Buffering etc. stays on MR-BS
- No change from 16e model

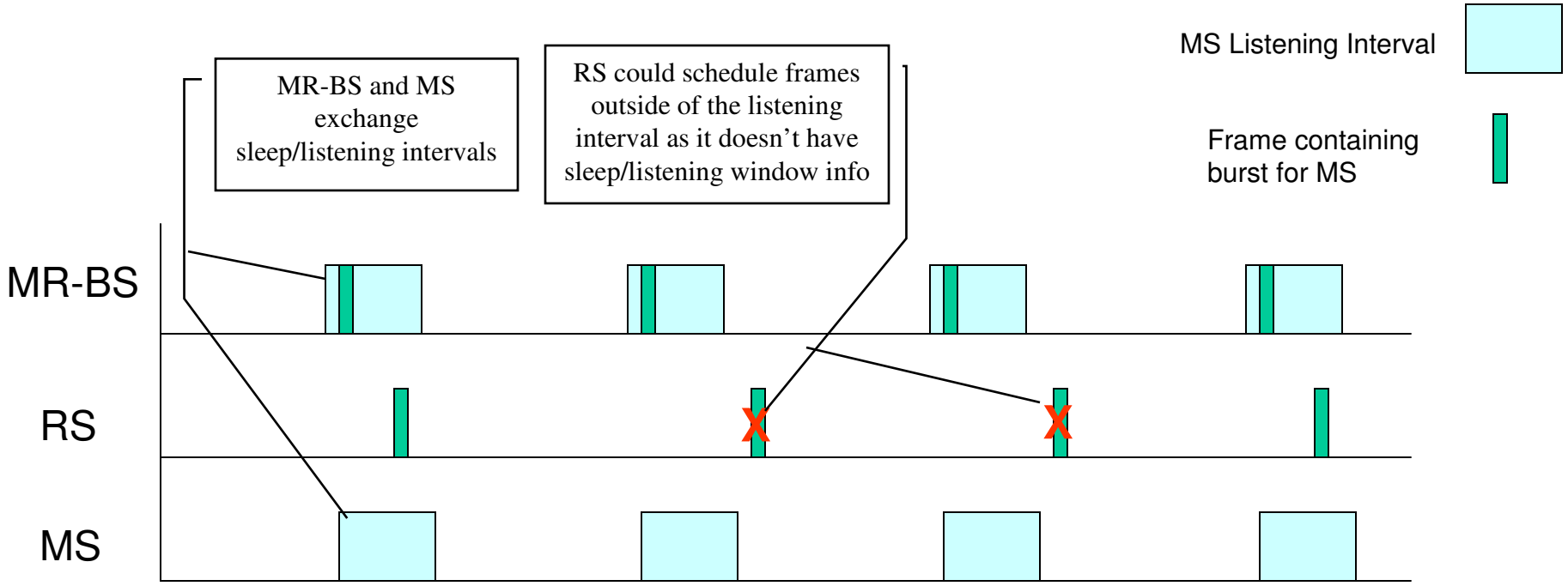
Keep MS Sleep mode function in MR-BS as in 802.16e-2005

MS Sleep Mode in Centralized Scheduling

- Centralized scheduling is characterized by the MR-BS allocating MAP for all the hops
- MS and MR-BS exchanges sleep mode messages
- MR-BS schedules frames for the relay links and the access links considering MS listening interval on the access links
- RS doesn't need any new functionality for supporting MS Sleep Mode in Centralized Scheduling

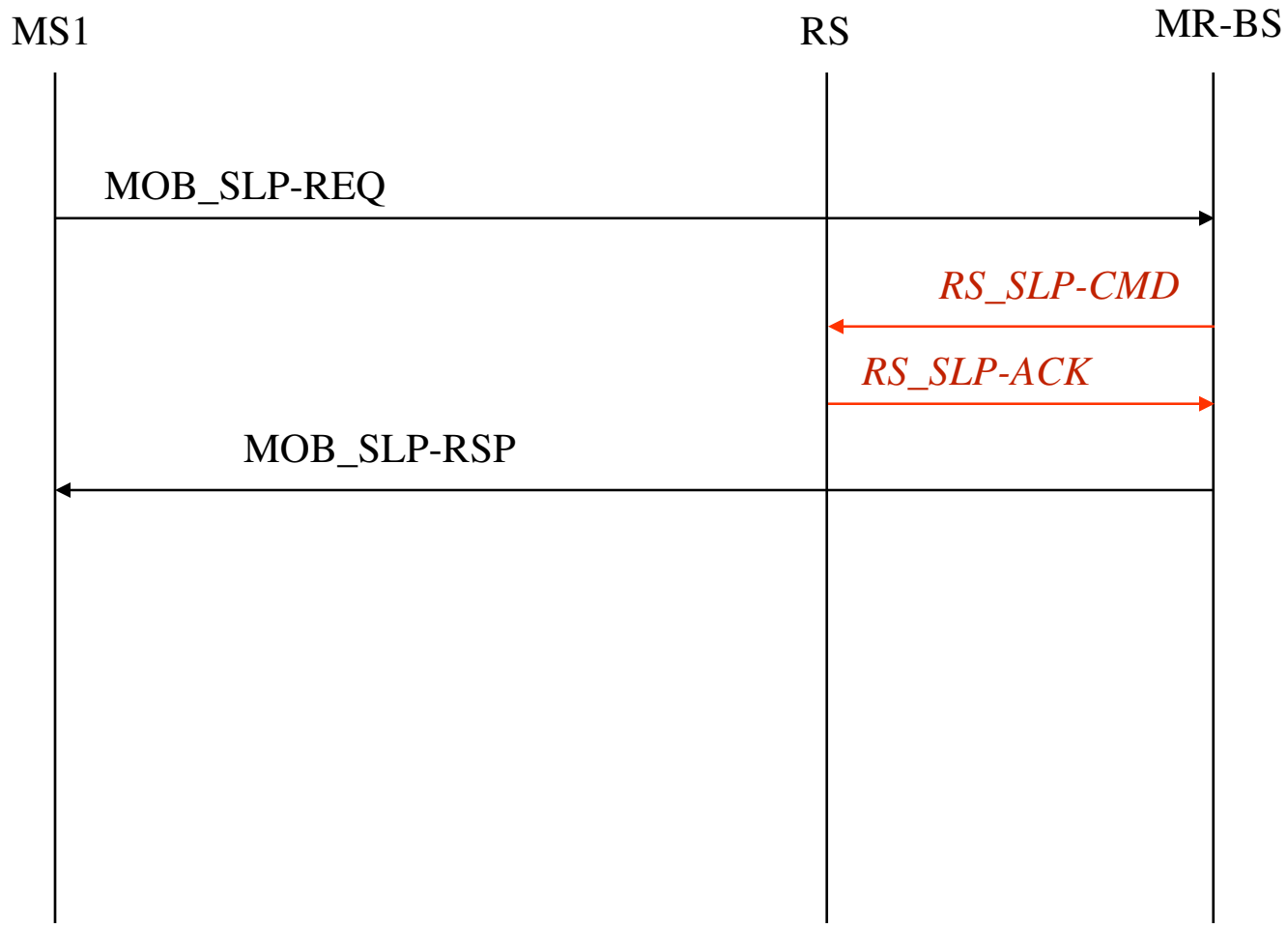
MS Sleep Mode Problem in Distributed Scheduling

- In distributed scheduling RS can schedule frames independent of MR-BS



RSs in the relay path need to be informed about the MS sleep/listening interval

Informing RS about the MS sleep schedule



RS Sleep Mode

Usage Models for RS Sleep Mode

- Mobile RS usage model
  - Mobile RS with the battery
- Fixed/Nomadic RS
  - For client RS, where RS can be placed without power wire connection
  - Low-power RS relying on solar power as primary or backup power source
  - Low-power fixed RS powered by wired power but equipped with the battery-powered UPS

Design Objectives

1. Implementation of RS sleep mode is optional for RS and MR-BS
2. RS sleep mode shall be backward compatible to MS
3. The RS sleep mode should support MS mobility and MS network entry/re-entry/handover
4. The RS sleep mode should support various RS deployment scenarios
5. The RS sleep mode shall be centralized controlled at MR-BS

Design Considerations

- In IEEE Std 802.16e-2005, the trigger methods of MS sleep mode can be initiated by MS or BS.
  - MS initiated: The MS shall send 1) MOB_SLP-REQ or 2) Bandwidth request and uplink sleep control header; the BS shall respond with an MOB_SLP-RSP message or DL Sleep control extended subheader.
  - BS initiated: The BS can directly send 1) unsolicited MOB_SLP-RSP, 2) DL Sleep control extended subheader, or 3) RNG-RSP including the TLV for MS sleep mode.
  - Implementation of MS sleep mode is optional for the MS and mandatory for the BS.

RS Sleep Mode

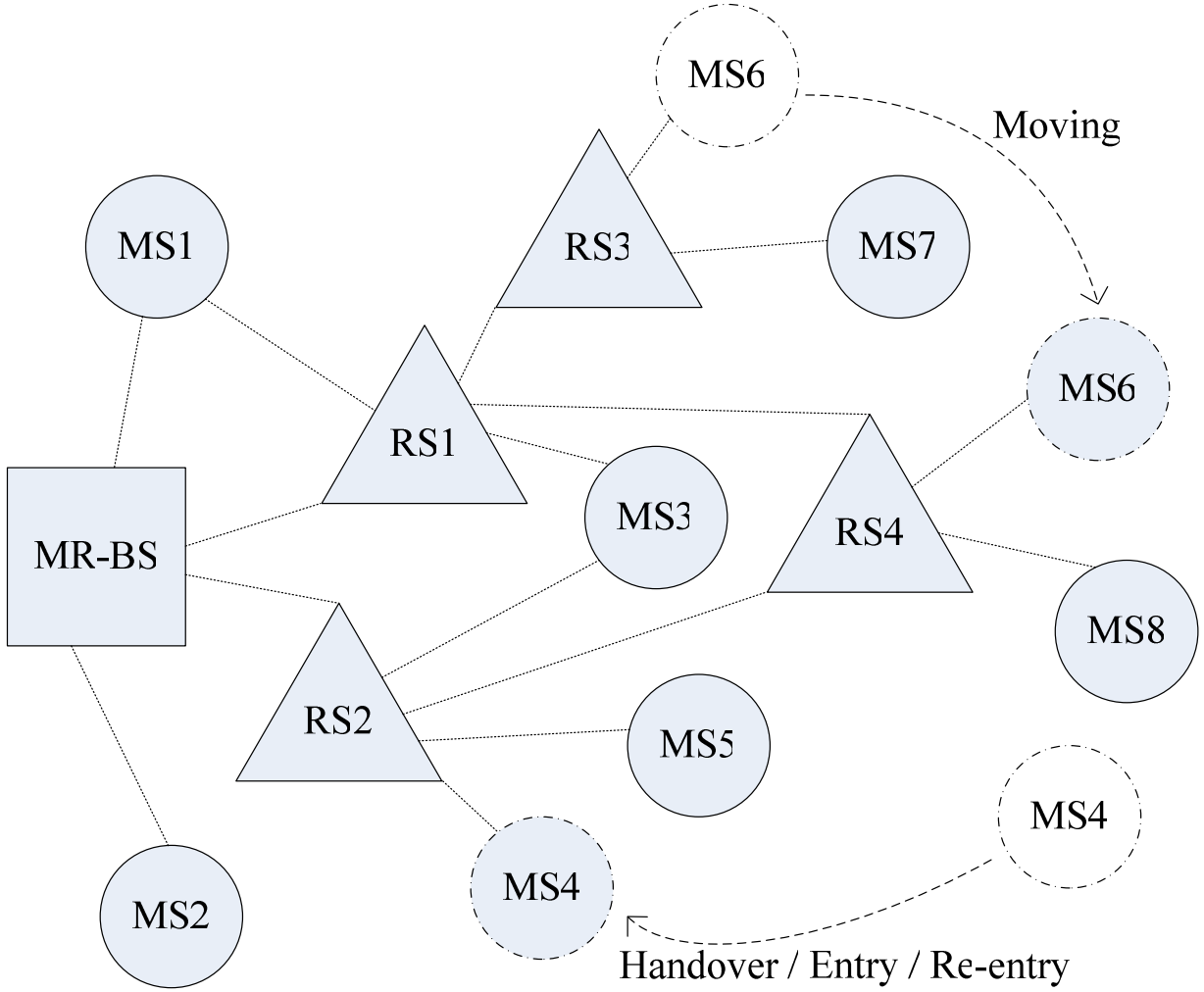
- RS is a relay for traffic to/from MSs
- When MSs are in sleep mode, RS can go into sleep mode and conserve power
- Using the same procedure (RS_SLP-CMD/ACK) as in the previous slide, RS sleep mode can be activated by MR-BS
- Alternatively RS can request the activation of RS sleep mode by exchanging RS_SLP-REQ/RS_SLP-RSP messages with MR-BS
- RS gets the sleep schedules of its attached MS in RS_SLP-CMD message, and it can uses the schedule for its own sleep mode

Types of RS Sleep Mode

- Full RS Sleep Mode
  - No traffic at Relay Link or Access Link
- Partial RS Sleep Mode
  - No traffic at Relay Link or Access Link except that RS still periodically sends DL Start Frame Preamble, FCH, DCD, UCD, DL_MAP, UL_MAP, and broadcast messages at predefined intervals.
- Depending on the RS functionality adopted by 16j TG, RS in Partial RS Sleep Mode may
  - Send its own broadcast messages
    - No addition in RS sleep mode procedure
  - Relays broadcast messages from MR-BS
    - MR-BS sends the schedule of its broadcast messages to the RS in RS_SLP-CMD

Network Topology

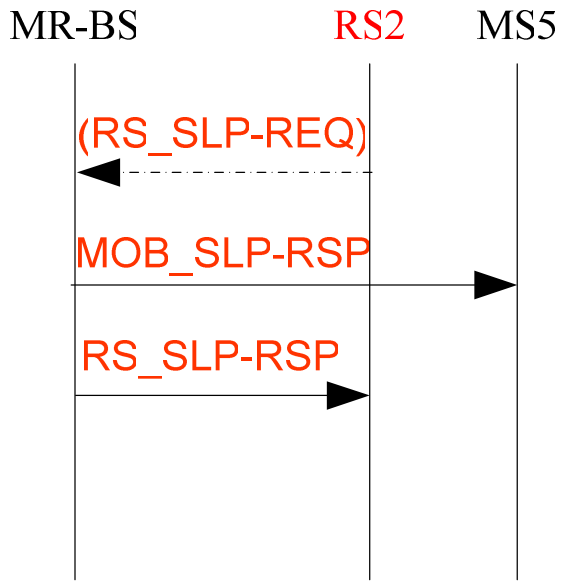
Based on the usage model document, 80216j-06_015



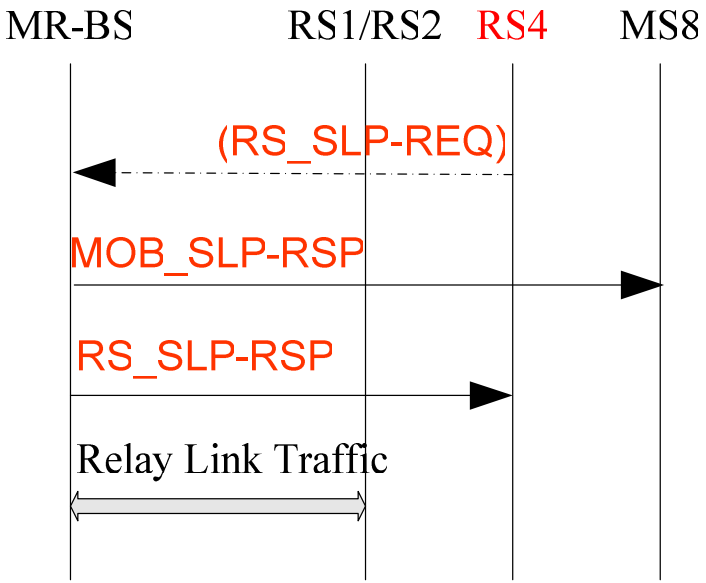
Full RS Sleep Mode

- Full RS Sleep Mode:
  - No traffic at Relay Link or Access Link

Ex 1:

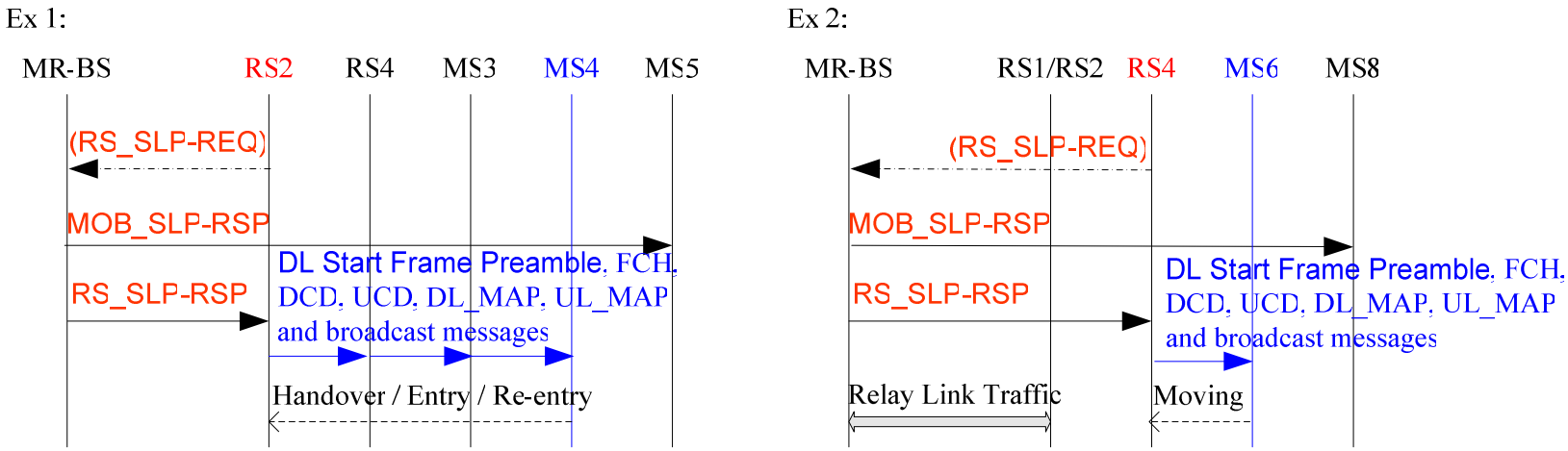


Ex 2:



Partial RS Sleep Mode

- Partial RS Sleep Mode:
  - No traffic at Relay Link or Access Link except that RS still periodically sends DL Start Frame Preamble, FCH, DCD, UCD, DL_MAP, UL_MAP, and broadcast messages.



Conclusion

- Proposes to keep MS Sleep mode function in MR-BS
- No enhancement is needed in RS for supporting MS Sleep Mode in centralized scheduling
- Proposes a procedure (RS_SLP-CMD/ACK) for supporting MS Sleep mode in distributed scheduling
- Proposes a procedure for RS Sleep mode when MR-BS initiate RS Sleep Mode, which helps in conserving RS power
  - The proposal does not change any MS behavior
  - Use the same signaling messages (RS_SLP-CMD/ACK) as needed in the distributed scheduling
- Propose RS_SLP-REQ/RSP management messages between MR-BS and RS to support RS Sleep mode when RS request to initiate RS Sleep mode
- Propose Full and Partial RS Sleep mode procedure.
- The Partial RS Power Saving Mode to support MS mobility (inter MR-BS handover & intra MR-BS handover) and MS network entry (entry & re-entry).
- Provides corresponding spec changes in C80216j-06_209.doc