Handover Scheme for IEEE 802.16m

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE C802.16m-08/774

Date Submitted:

2008-07-07

Source:

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Venue:

IEEE 802.16m-08/024 - Call for Comments and Contributions on Project 802.16m SDD

Topic: Upper MAC concepts and methods (mobility)

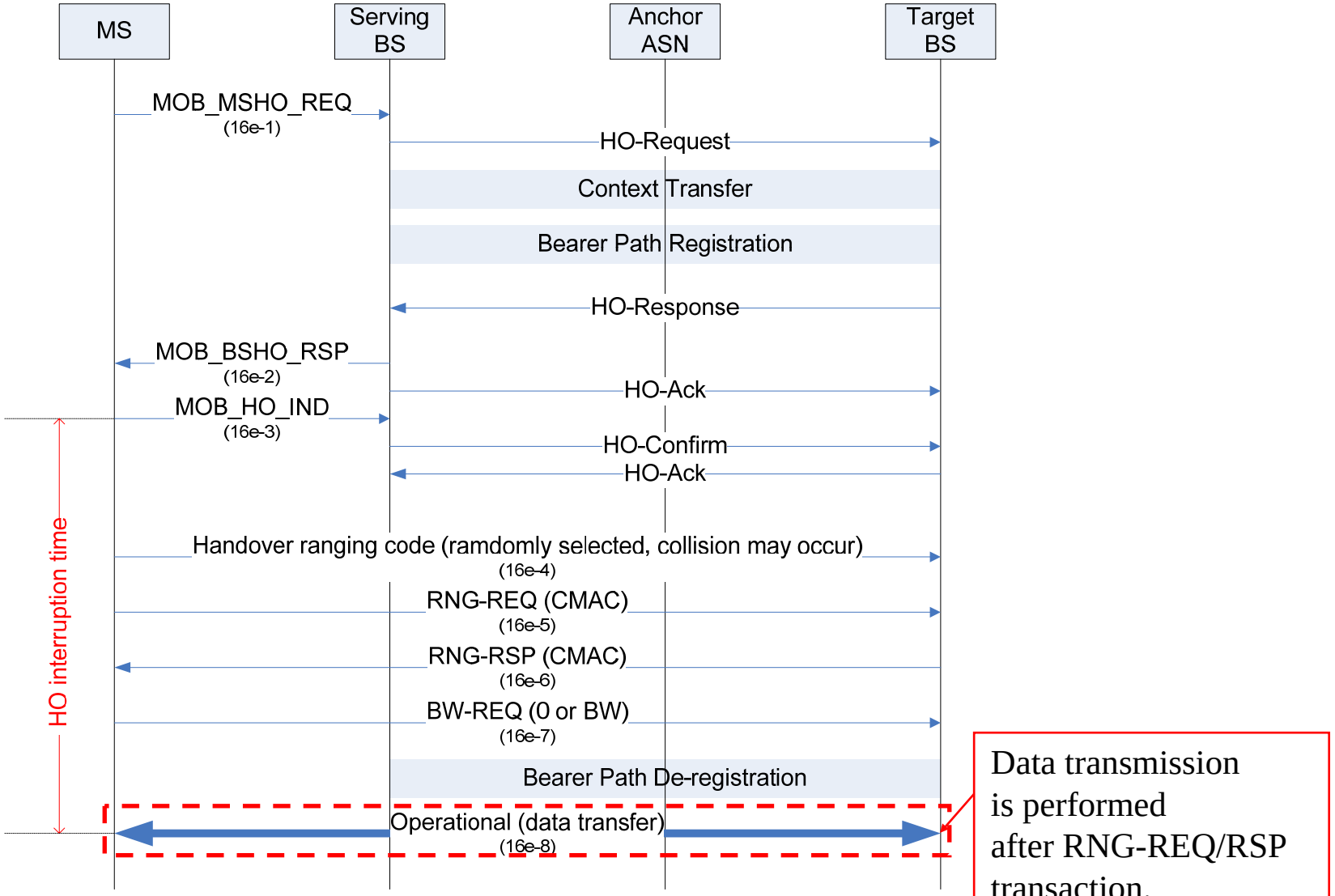
Base Contribution:

None

Purpose:

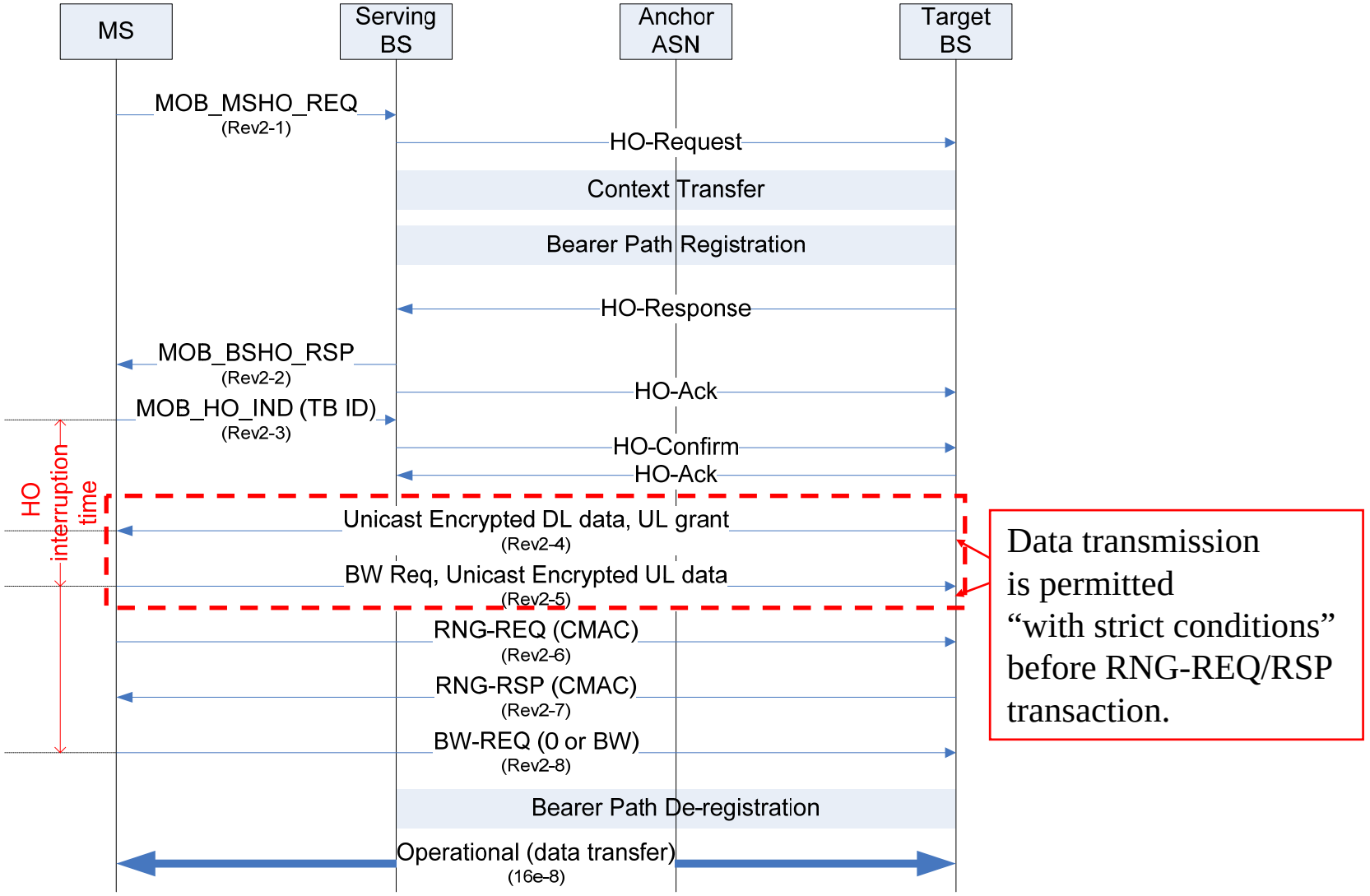
For discussion and approval of proposed text by TGm

Typical Handover Procedure in 802.16e-2005



16e-x represents message number x in the procedure according to protocol specified in 802.16e-2005.

Seamless Handover Procedure in 802.16Rev2



Rev2-x represents message number x in the procedure according to protocol specified in 802.16Rev2.

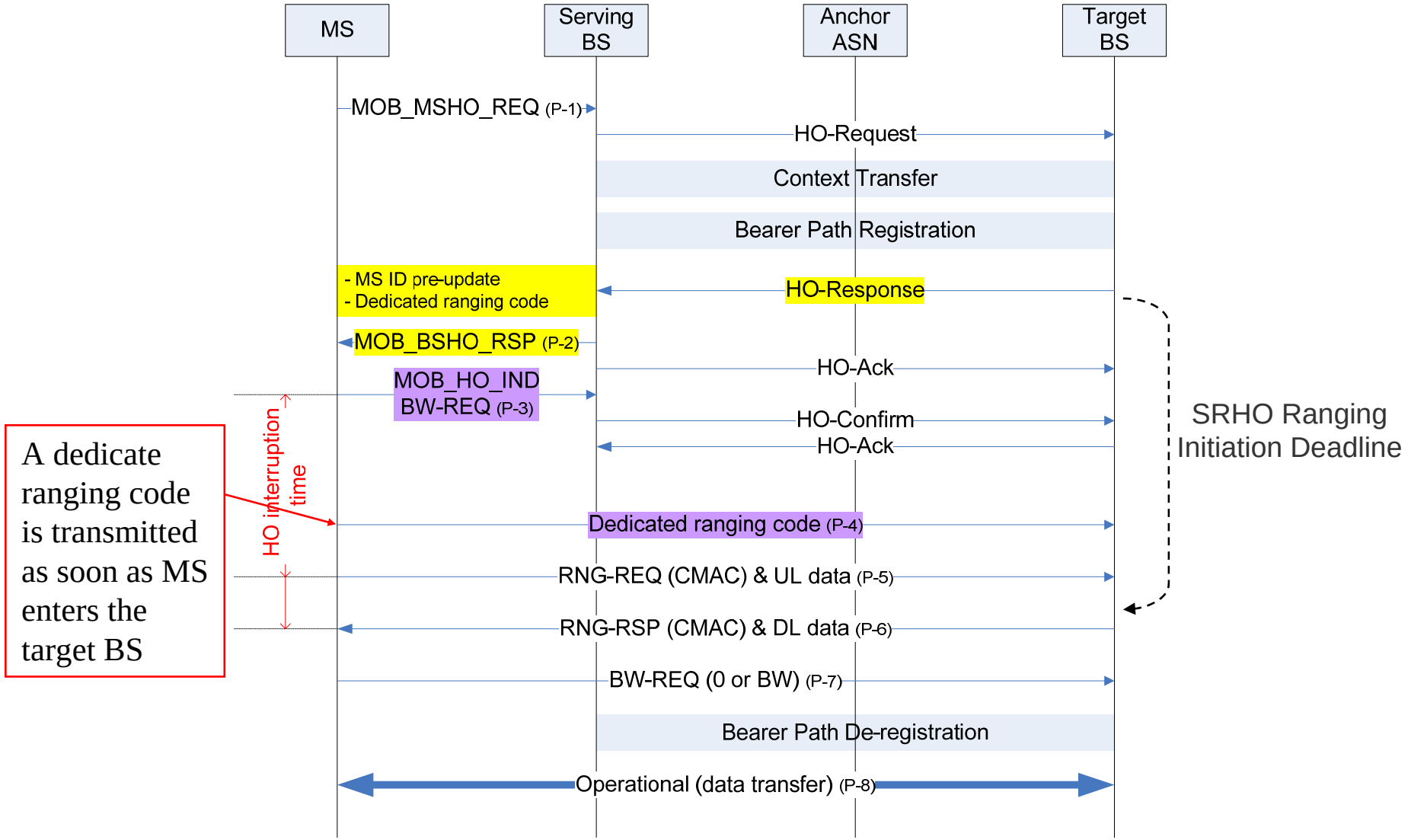
Seamless Handover in Rev2

- Uncertainty about MS's presence at the time of data transmission
  - The T-BS has no way of knowing with certainty whether the MS has entered the T-BS cell prior to data transmission.
    - Consequently, the target BS may allocate DL/UL resource for the MS without any explicit notification.
- Dependence on HO-IND message
  - Seamless Handover operates only if HO-IND message is not corrupted.
    - When the HO-IND is corrupted, Seamless Handover is likely to be unsuccessful.
    - Since HO usually occurs at the cell edge, the likelihood of the failure of HO-IND is not low.
  - If the MS moves to the T-BS not indicated in the HO_IND message, seamless handover is likely to be unsuccessful
- The possibility in Rev.2 of data transmission prior to RNG-REQ/RSP transaction introduces certain complications.
  - TEK needs to be updated whenever the MS performs a HO, in addition to the usual timer based update.

Seamless Reliable Handover (SRHO) - Key features

- Introduce a dedicated ranging code (P-4)
  - Identifies which MS has entered the BS
  - Specifies when a MS has entered the BS.
  - To make the target BS allocate UL resources to the specific MS only after establishing that a certain MS has entered the cell.
- MS may request bandwidth to the target BS by means of the HO_IND message (P-3) sent via the serving BS to the target BS.
- Secure transactions (P-5, 6)
  - RNG-REQ/RSP transaction is performed after transmitting the dedicated ranging code.
- DL/UL data can be transmitted during the ranging request/response transactions (P-5, 6)
  - This minimizes any additional latency.
  - Validity of data is judged by CMAC in RNG-REQ/RSP
  - DL/UL data transmission can be performed using pre-updated MS ID during RNG-REQ/RSP transaction.

Message Sequence Chart for SRHO



P-x represents message number x in the proposed procedure.

SRHO Operation Summary

- During HO initiation, target BSs allocates MS ID and a dedicated ranging code (through MOB_HO-RSP) (P-2)
  - MS ID and a dedicated ranging code are valid until the *SRHO Ranging Initiation Deadline* timer expires.
- MS may request BW for the residual data in the buffer while transmitting the HO-IND message (P-3)
  - The serving BS may transfer this to the target BS so that the target BS can allocate UL resource for data immediately after receiving a dedicated ranging code
- MS transmits a pre-assigned dedicated ranging code when it enters the target cell (P-4) . The other BSs free the ranging code after a certain time.
- After receiving the dedicated ranging code, which confirms the presence of the MS, the BS allocates UL resources for RNG-REQ.
- MS transmits RNG-REQ (with CMAC tuples). (P-5)
  - MS may send RNG-REQ and UL data simultaneously.
  - BS validates UL data of MS using the CMAC tuples in the RNG-REQ.
- After receiving the RNG-REQ, BS responds with a RNG-RSP (including CMAC tuples). (P-6)
  - BS may send RNG-RSP and DL data at the same time.
  - MS validates DL data of BS using the CMAC tuples in the RNG-RSP.

What has been improved from 802.16Rev2

- Increased reliability of HO leading to reduction in wasted bandwidth
  - The target BS sends DL data only after receiving a dedicated ranging code.
  - Only when the existence of MS is confirmed, the target BS allocates DL/UL resources for the MS.
- Relaxed the dependence on the HO-IND message
  - Even when the HO-IND message is corrupted, the proposed mechanism can deliver seamless handover.
    - The dedicated ranging code, issued by each T-BS is valid during a certain time. All T-BSs are prepared to receive the code regardless of the success of the HO-IND message. After receiving a dedicated ranging code within the specified time, the target BS that actually receives the ranging code may request the serving BS to forward data.
  - If the MS does not move in the T_BS indicated in the HO_IND message, the proposed procedure will still work as long as the MS moves to one of the candidate BSs indicated in the HO_RSP message
- Data transmission resumes only after (or during) the RNG-REQ/RSP transaction.

Conclusion

- This contribution proposes SRHO as HO scheme for 802.16m
  - With respect to 802.16e-2005, SRHO reduces HO latency by
    - transmitting DL/UL data right after receiving a dedicated ranging code
    - requesting bandwidth to the target BS via the serving BS at the moment of leaving the serving BS
  - With respect to 802.16Rev2 , SRHO increases reliability and reduces dependence on HO_IND message
    - Using a dedicated ranging code which is transmitted to the BS immediately after entering the BS cell (the BS is notified).
    - the resource allocation and data transmissions resume only after the presence of the MS in the cell is confirmed.

Proposed Text for SDD

- Following Text should be included into SDD

---------- Start Text ----------

10.X Handover operation

The target BS should allocate a dedicated ranging code to an MS seeking handover via the serving BS. The MS transmits the dedicated ranging code assigned by the target BS immediately upon entering the target BS cell which serves as a notification to the Target BS that the MS has entered the cell. The BS should only do resource allocation after receiving the dedicated ranging code. The dedicated ranging code assigned to MSs seeking handover may be released after TBD s.

MS may request uplink resources to the target BS through the serving BS in anticipation of transmitting the data that is remaining in its buffer at the time of handover.

DL/UL data transmission may be performed together with the RNG-REQ/RSP transaction to reduce handover latency.

---------- End of Text ----------