Macro Diversity Handover and Fast Access Station Switching for MMR Networks – Initiation to Termination

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Propose new MAC management messages for MDHO and FASS topology acquisition for a mobile multi-hop relay network

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Motivation

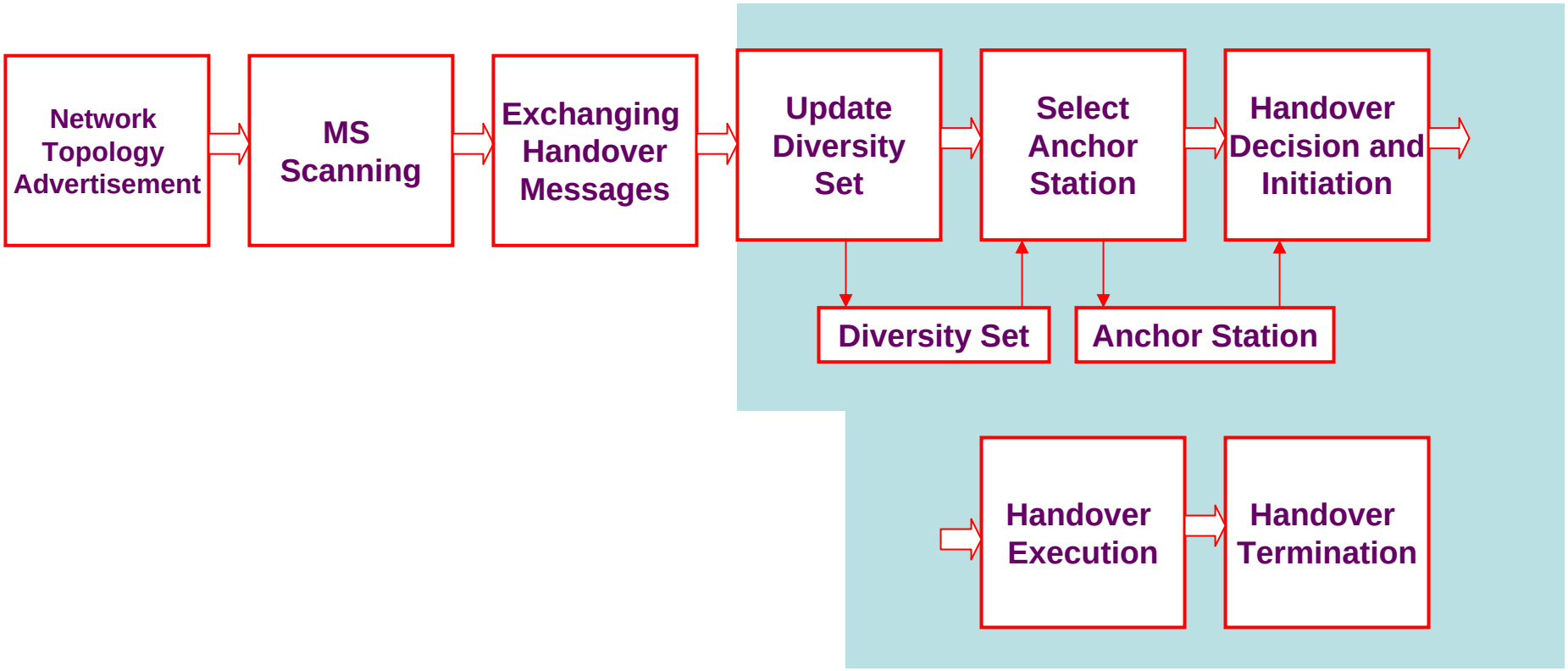
- Current MDHO and FASS (FBSS) initiation, decision, execution and termination procedures do not include the relay stations
- Current coordination and communications among BSs is done through the network backbone
  - Coordination and communications among BSs and RSs would have to done through the relay links and the network backbone
  - Additional MAC commands are needed to assist in this coordination and communications to reduce unnecessary overhead

Introduction

- MDHO and FASS provides seamless and better handover performance for MS with higher speed mobility
- MDHO and FASS handover initiation, decision, execution and termination procedures are described for nine main classes of topology
- New MAC management messages over relay links are introduced
- Handover procedures are backward compatible to an IEEE802.16e compliant MS

- Note:
- MDHO (macro diversity handover): MS can communicate simultaneously with all active stations in diversity active set. In uplink (downlink), active stations (MS) are capable of diversity combining of received signals
- FASS (fast access station switching): The data are sent to all active stations in diversity active set but without diversity combining.

HO Procedures



- Anchored station: provide DL and UL maps, FCH and DL broadcast messages. Map may consists of burst allocation info for the non anchored active stations

- Diversity set: consists of a list of BSs and/or RSs that are involved in MDHO/FASS

New MAC management messages for handover decision and initiation

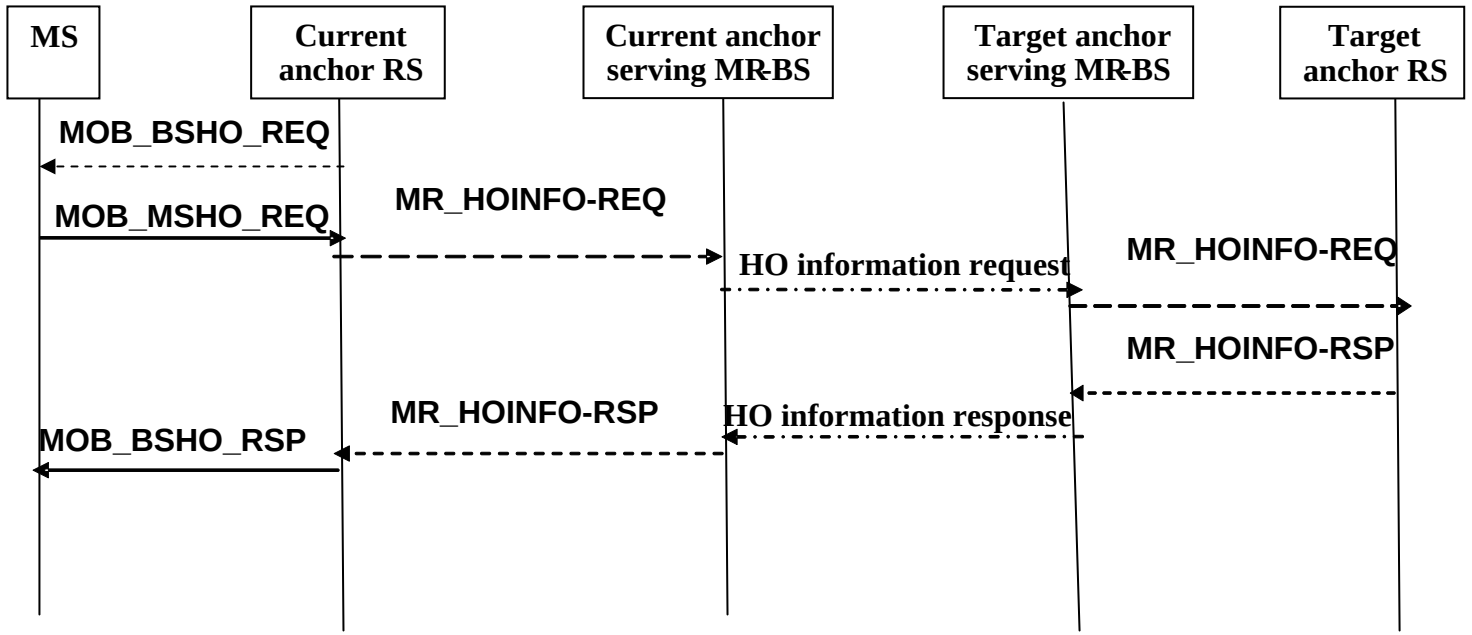
- MR_HOINFO-REQ and MR_HOINFO-RSP
- These two messages are used to pass the handover related information of potential target anchor station to the current anchor station over relay links

Message flows for HO decision and initiation: case 9

MS evaluate possible target BS/RS through previous scanning and association

Decision to HO from current to target RS

Request for MS performance at target RS



Provide MS performance at target RS to current anchor RS

MR_HOINFO-REQ

Syntax	Size (bits)	Notes
MR_HOINFO-REQ_Message_format() {	-	-
Management message type = TBD	TBD	
MS_ID	48	MAC address
Network assisted HO supported	1	
Mode	3	Same as MOB_BSHO-REQ
HO operation mode	1	
N_recommended_active_stations	8	
For(i=0;i<N_recommended_active_stations;i++)) {		
Recommended_target_active_station_ID	48	
TLV encoded information	variable	

MR_HOINFO-RSP

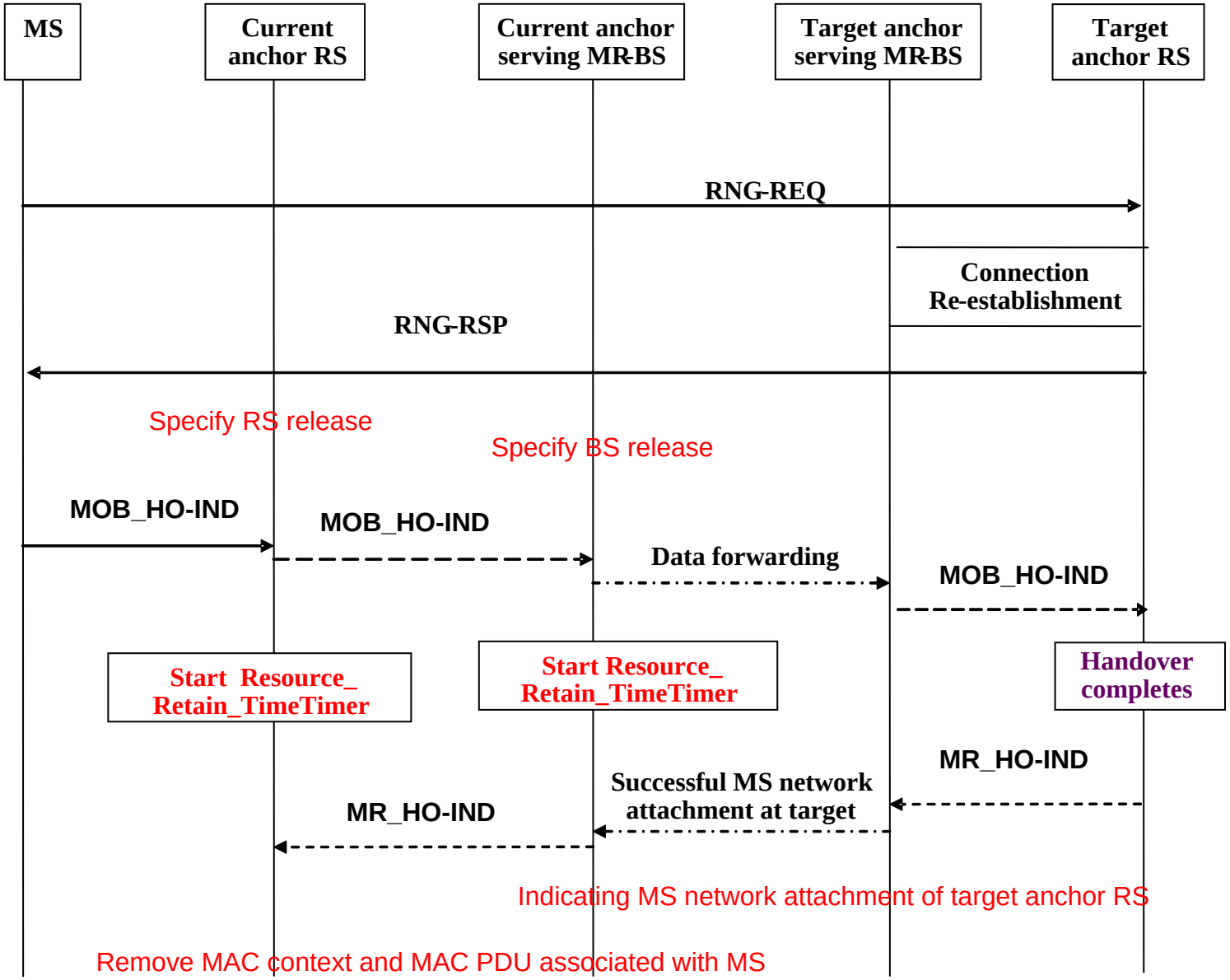
Syntax	Size (bits)	Notes
MR_HOINFO-REQ_Message_format() {	-	-
Management message type = TBD	TBD	
MS_ID	48	MAC address
Network assisted HO supported	1	
Mode	3	Same as MOB_BSHO-REQ
HO operation mode	1	
N_recommended_active_stations	8	
For(i=0;i<N_recommended_active_stations;i++)) {		
Recommended_target_active_station_ID	48	
Service level prediction	8	
HO process optimization	8	
HO authorization policy support	8	
Arrival time difference	4	
Frame offset	3	
TLV encoded information	variable	

New MAC management messages for HO execution and termination

- MR_HO-IND

  This message is used to notify successful handover to the current anchor station and to the target anchor station.

Message flows for HO execution and termination



MR_HO-IND

Syntax	Size (bits)	Notes
MR_HO-IND_Message_format() {	-	-
Management message type = TBD	TBD	
MS_ID	48	MAC address

Summary

- New MAC management messages to support MDHO/FASS for nine main classes of topology
- New MAC messages for over the relay link are used for HO initiation, decision, execution

- Backup charts

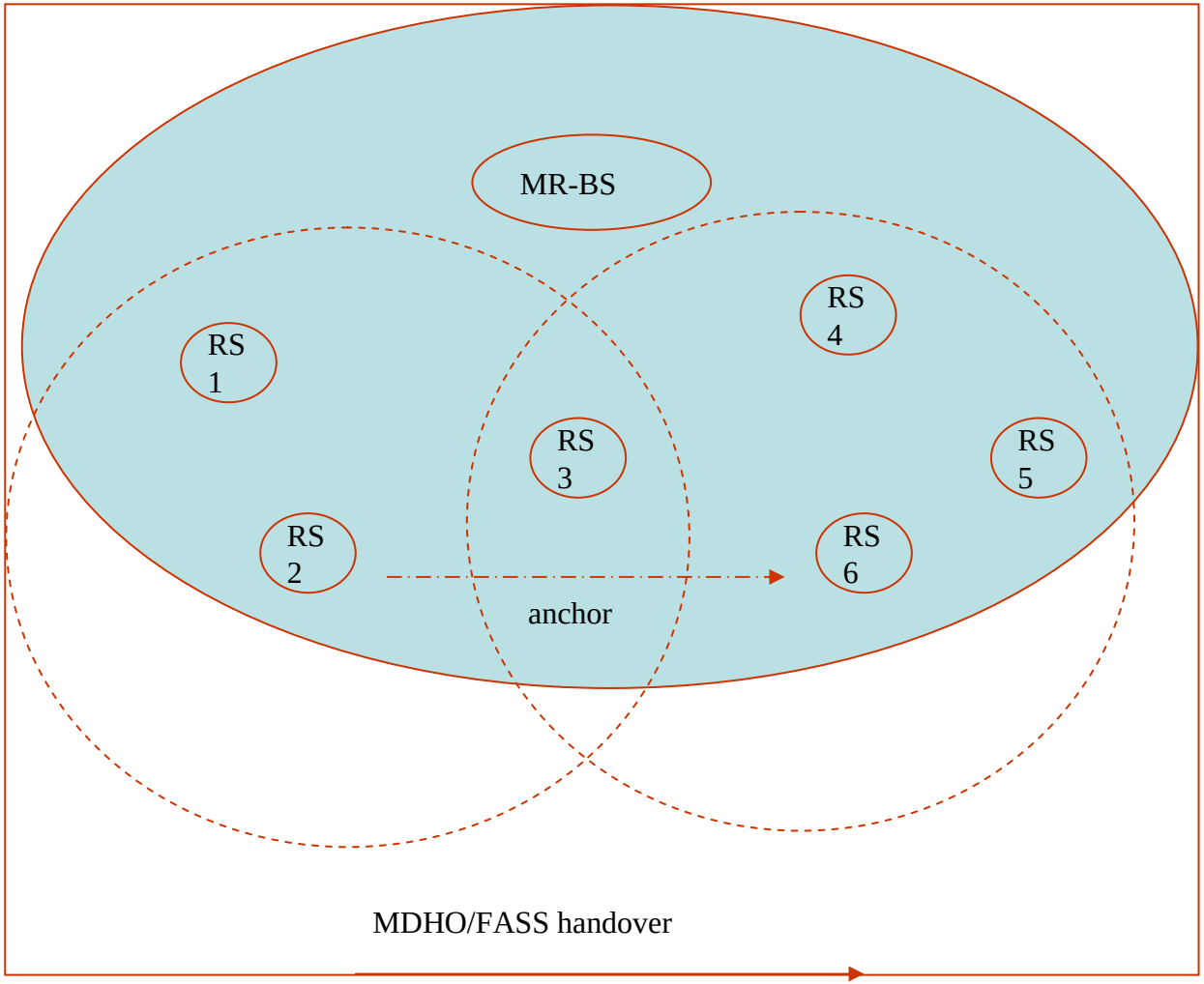
HO process optimization and policy support

- **HO process optimization**
- HO Process Optimization is provided as part of this message is indicative only. HO process
- requirements may change at time of actual HO. For each Bit location, a value of ‘0’ indicates
- the associated reentry management messages shall be required, a value of ‘1’ indicates the
- reentry management message may be omitted. Regardless of the HO Process Optimization TLV
- settings, the target access station may send unsolicited SBC-RSP and/ or REG-RSP
- management messages:
- Bit #0: Omit SBC-REQ/RSP management messages during re-entry processing
- Bit #1: Omit PKM Authentication phase except TEK phase during current re-entry processing
- Bit #2: Omit PKM TEK creation phase during re-entry processing
- Bit #3: Omit REG-REQ/RSP management during current re-entry processing
- Bit #4: Omit Network Address Acquisition management messages during current reentry
- processing
- Bit #5: Omit Time of Day Acquisition management messages during current reentry processing
- Bit #6: Omit TFTP management messages during current re-entry processing
- Bit #7: Full service and operational state transfer or sharing between serving BS and target BS
- (ARQ, timers, counters, MAC state machines, etc…)

- **HO_authorization_policy_support**
- To indicate if authorization negotiation is used in the HO procedures. If this encoding is not
- presented, the same EAP authorization and the same value of the MAC mode field of the
- current access station are applied as authorization policy. Otherwise, the following values are
- applied:
- 0: RSA authorization
- 1: EAP authorization
- 2: Authenticated-EAP authorization
- 3: HMAC supported
- 4: CMAC supported
- 5: 64-bit short-HMAC
- 6: 80-bit short-HMAC
- 7: 96-bit short-HMAC

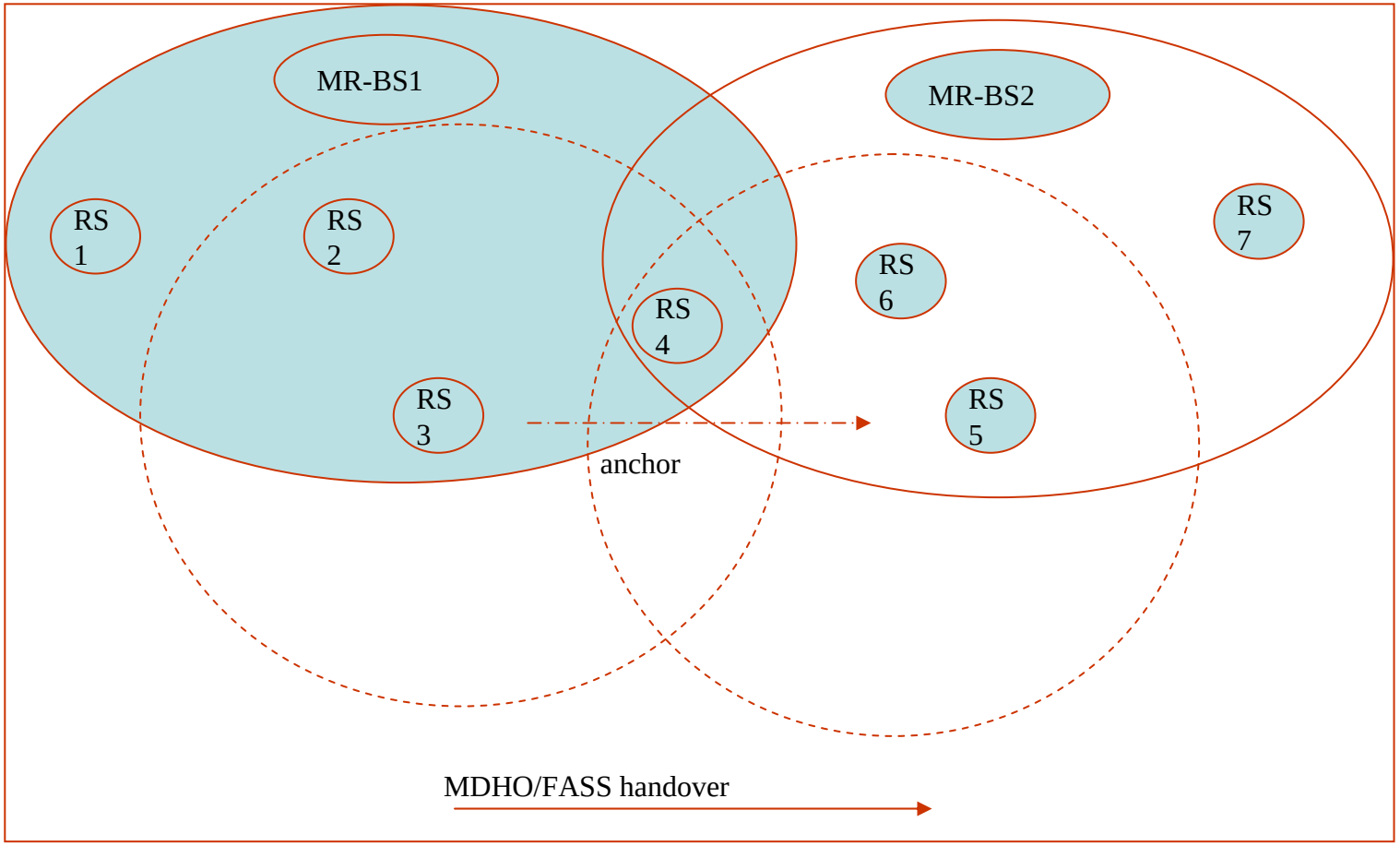
Intra MR-BS handover

Case 5: the current anchor station and target anchor station is MR-BS

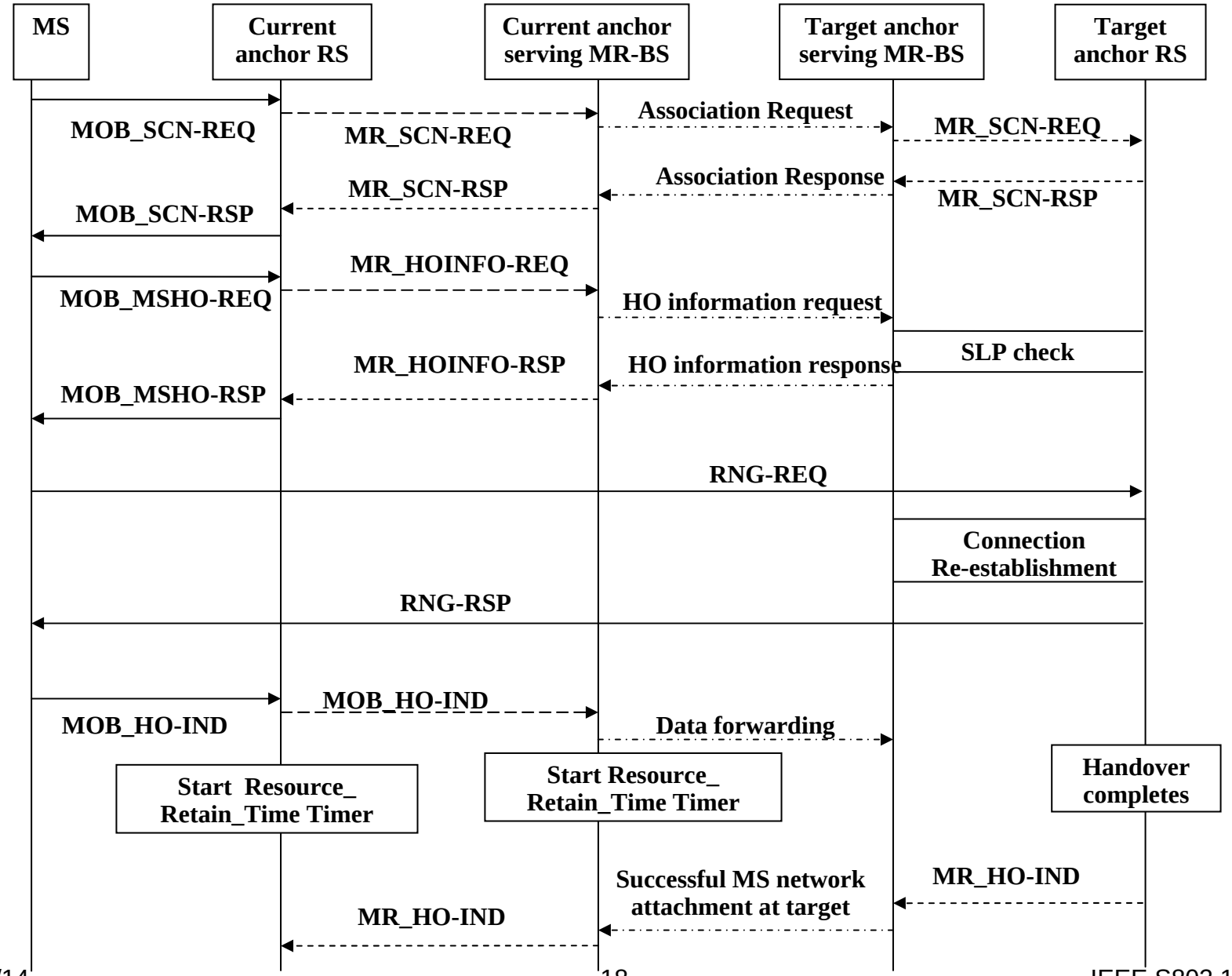


Inter MR-BS handover

Case 9: Inter MR-BS handover, the current anchor station RS 3 and the target anchor station RS 5



Case 9 Handover Procedures and New MAC Messages



MAC management messages over relay links

New MAC messages	MS handover phase	Descriptions
MR_HOINFO-REQ MR_HOINFO-RSP	MDHO/FASS decision and initiation	These two messages are used to pass the handover related information of potential target anchor station to the current anchor station over relay links
MR_HO-IND	Handover termination	This message is used to notify successful handover to the current anchor station and to the target anchor station.

Topology of MDHO and FASS

- Nine cases and classified into two categories:
  - (1) Intra MR-BS handover
    - Case 1: the current anchor station and target anchor station is MR-BS
    - Case 2: the current anchor station is RS and target anchor station is MR-BS
    - Case 3: the current anchor station is MR-BS and target anchor station is RS
    - Case 4: the current anchor station and target anchor station is the same RS
    - Case 5: the current anchor station and target anchor station is the different RSs
  - (2) Inter MR-BS handover
    - Case 6: the current anchor station and target anchor station is the different MR-BSs
    - Case 7: the current anchor station is MR-BS and target anchor station is RS controlled by the different MR-BS
    - Case 8: the current anchor station is RS and target anchor station is MR-BS in a different MR-cell
    - Case 9: the current anchor station and target anchor station are the different RSs and also they are located in different MR-cells

- Note:
- Intra MR-BS HO: handover among group of RSs or the MR-BS controlled by the same serving MR-BS
- Inter MR-BS HO: handover among group of RSs and two or more MR-BSs controlled by the two or more MR-BSs