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Title	SN_REPORT header for HO	
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Abstract	Draft includes SN_REPORT header to be used in FBSS only. Using this header the MS can provide the Anchor BS with the last good received SDU's which may provide continuity of non-ARQ enabled connections during HO in the downlink. We propose to extend the usage of this header to hard handover, in addition to FBSS	
Purpose	Extend the usage of SN_REPORT header to hard handover, in addition to FBSS	
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SN_REPORT header for HO

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1. Motivation

To maintain continuity of DL traffic when switching from one BS (old Serving BS) to another BS (Target BS or new Serving BS), the last information unit successfully received by the MS needs to be identified and conveyed to the new Serving BS. Otherwise, ARQ DL window will have to be reset or SDU's will be retransmitted, thus introducing additional HO latency.

For FBSS, the standard provides a method to help overcome this problem, based on virtual SDU sequential numbering (SDU SN) for non-ARQ enabled connections and using the SN_REPORT header.

We offer to adopt and extend to the benefit of hard HO systems

2. Proposed Remedy

Items that require no changes to draft as result of extending usage of SN_REPORT from FBSS to hard HO (common for both methods):

- Declaring capability of supporting SDU SN is done exactly like in FBSS (during registration, via REG-REQ/RSP)
- Declaring that a connection is SDU SN enabled is done exactly like in FBSS (during connection provisioning, via DSA-REQ/RSP)
- Definition of SN_REPORT header and its usage remains exactly as in FBSS.

Items that are added to the draft, but are copied from FBSS section without changes:

- The SDU SN numbering method remains the same: Serving BS includes SDU SN extended subheader, at least once every 2^p MAC PDUs (p defined in REG-RSP) during HO.

Items that are added to the draft, but require modifications as result of extending the usage of SN_REPORT from FBSS to hard HO:

- Definition of SDU sequence numbering initiation time:
Upon transmitting MOB_BSHO-REQ/RSP, the (old) Serving BS initiates SDU sequence numbering (in FBSS, this is done upon Anchor SW request).
- Definition of SDU sequence numbering termination time:
Serving BS may terminate SDU sequence numbering not later than "estimated HO time" (in FBSS, this is done upon switching to new Anchor BS)
- Definition of time that MS transmits SN_REPORT:
Upon completion of HO and NW re-entry, the Target BS must provide UL resource and MS must transmit SN_REPORT header (PDU without payload), one or more.
- Definition of CIDs to use in SN_REPORT:
HO may include CID update, thus MS must use updated CIDs in SN_REPORT. MS must not include a CID in the SN_REPORT, if the respective connection was discontinued at the Target BS.
- Definition of optimization support in 'HO process optimization' field:
In RNG-RSP message sent by Target BS during HO, the Target BS may indicate whether it can use SN_REPORT header to optimize HO for SDU_SN or ARQ enabled connections, via optimization bit#11.

3. Changes summary

[In D7, modify text in the first paragraph of 6.3.2.1 (MAC header formats) as shown below]

In the DL, there is one MAC header that is the generic MAC header that begins each MAC PDU containing either MAC management messages or CS data.

In the UL, six MAC header formats are defined.

The first is the generic MAC header that begins each MAC PDU containing either MAC management messages or CS data.

The second is the bandwidth request header used to request additional bandwidth.

The third is the PHY channel report header used for the MS to send a PHY channel report to the BS. The fourth is the feedback header used for the MS to provide its feedback.

The fifth is the bandwidth request and UL TX power report header used for the MS to send a combined bandwidth request and UL Tx power report.

The sixth is the SN report header used by the MS to feedback SDU SN during [handover or](#) fast BS switching. The single-bit header type (HT) field distinguishes the generic MAC header and the rest of the header formats. The HT field shall be set to zero for the generic header and to one for other MAC headers.

[In D7, Insert new subclause 6.3.21.2.3]

6.3.21.2.6.3 MS-Assisted coordination of DL transmission at Target BS for HO

If both Serving BS and the Target BS are involved in HO process and has full service and operational state transfer or sharing, the Serving BS and the MS may perform MS-Assisted coordination of DL transmission during HO as described in this section. The full service and operational state transfer or sharing between the Serving BS and Target BS is identified by bit #6 of 'HO Process Optimization' flag in the RNG-RSP message from the Target BS, which is sent to the MS during HO..

Once the MS has successfully completed handover to the Target BS (now new Serving BS), to maintain continuity of transmission to the MS between the old and new Serving BSs, the last successfully received information unit needs to be identified to the new Serving BS. Depending on whether the connection is ARQ based or non-ARQ based, the identity of the next information unit can be given by the ARQ block sequence number or the MAC SDU sequence number respectively.

MS can optionally support the feedback of ARQ block sequence number or the virtual MAC SDU sequence number after the MS has successfully completed handover to the Target BS. The capability and the support for each connection are defined in the REG-REQ/RSP and DSA-REQ/RSP TLVs respectively.

For the connections that have SN Feedback enabled, the following procedures shall be performed by the BS and the MS: For ARQ connections, the ARQ block sequence number is already available at the MS.

For non-ARQ connections, the old Serving BS shall include a SDU SN Extended subheader at least once every 2p MAC PDUs, where p is specified in the SN Feedback support TLV (11.7.8.9). Upon transmitting MOB_BSHO-RSP (in response to receiving MOB_MSHO-REQ, in case of MS initiated HO) or upon transmitting MOB_BSHO-RSP (in case of BS initiated HO), the old Serving BS shall include SDU SN Extended subheader in MAC PDU at least before "Estimated HO time" (the first time that MS is expected to communicate with the Target BS). The MS shall maintain MAC SDU sequence number based on the information received from the BS. When the MS receives a MAC PDU without SDU SN Extended subheader, the MSS shall increment the MAC SDU sequence number by one for every SDU received. When the MS receives MAC SDU sequence number from the BS, it shall reset the MAC SDU sequence number based on the value included in SDU SN Extended subheader.

During HO, if the Target BS transmits a RNG-RSP message (in response to RNG-REQ from the MS) with 'HO process optimization' bit#11 set to 1, then this is an indication that the Target BS is able to provide continuity of ARQ or SDU_SN enabled connections, should SN_REPORT be provided by the MS.

Upon completion of HO and NW re-entry, the Target BS (now new Serving BS) should assign UL resource for the MS to transmit the LSB of the sequence number(s) of ARQ block or virtual MAC SDU on the SN Report MAC header (6.3.2.1.5). The MS subsequently sends up to two SN Report MAC headers that include the next ARQ Block (or virtual MAC SDU) sequence number that it is expecting for each of its connections that have SN feedback enabled. The MS shall send the sequence number in numerical ascending order of the values of the CIDs values. MS must use CIDs as assigned by the new Serving BS during HO via REG-RSP TLV's and include in the SN_REPORT only CIDs for connections that are continued at the new Serving BS.

Acknowledgement and/or retransmission of any outstanding ARQ blocks is handled per the ARQ mechanism defined in 6.3.4

[In D7, subclause 11.6 (RNG-RSP TLVs), modify table 367a, page 516 as follows:]

Name	Type (1 byte)	Length	Value (variable-length)
Service Level Prediction	17	1	This value indicates the level of service the MS can expect from this BS. The following encodings apply: 0 = No service possible for this MS 1 = Some service is available for one or several service flows authorized for the MS. 2 = For each authorized service flow, a MAC connection can be established with QoS specified by the AuthorizedQoSParamSet 3 = No service level prediction available.
Global Service Class Name	18	4	-
QoS parameters	[145/146] <i>Variable</i>	<i>variable</i>	Compound TLV incorporating one or more 11.13 QoS Parameter Set definition encodings
SFID	[145/146].1	4	-
Resource Retain Flag	20	1	This value indicates whether the former serving BS retains the connection information of the MS. 0 = the connection information for the MS is deleted 1 = the connection information for the MS is retained
HO Process Optimization	21	2	For each Bit location, a value of '0' indicates the associated re-entry management messages shall be required, a value of '1' indicates the re-entry management message may be omitted. Bit #0: Omit SBC-REQ management messages during current 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 Network Address Acquisition management messages during current reentry processing Bit #4 : Omit Time of Day Acquisition management messages during current reentry processing Bit #5 : Omit TFTP management messages during current re-entry processing Bit #6 : Full service and operational state transfer or sharing between Serving BS and Target BS (ARQ, timers, counters, MAC state machines, etc...) Bit #7 : post-HO re-entry MS DL data pending at Ttarget BS Bit #8 : BS shall send an unsolicited SBC-RSP management message with updated capabilities information during current re-entry processing Bit #9 : BS shall send an unsolicited REG-RSP management messages with updated capabilities information during current re-entry processingBit Bit #10 : BS shall send an unsolicited REG-RSP management messages with updated capabilities information during current re-entry processingBit Bit #11 : BS can use SN_REPORT, if sent by MS upon HO completion, for continuation of SDU SN or ARQ enabled connections #11 12-15 : <i>Reserved</i>
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