GSM Mobile Originated SMS

This scenario describes the session setup for a GSM originating SMS. This sequence diagram describes the SMS signaling and data transfer between the mobile subscriber and the SMS service center. [SMS is implemented by sending Short message transported via a GSM SDCCH (Standalone Dedicated Control CHannel) signalling channel. Thus they can be received while the user is talking. The MS establishes an SDCCH using RR establishment procedure.

SMS Protocol stack consists of (1) SM Application layer (AL) (2) SM Transfer layer (TL):SM-TL transfers SM-AL messages. SM-TL messages are called Transfer Protocol Data units (TPDUs). (3) SM Relay layer (RL):SM-RL provides services to transfer TPDUs and corresponding delivery report for the SM-TL. SM-RP is the protocol between peer SM-RL entities at MS and MSC. SM-RP messages are Relay Protocol Data Units (RPDUs). (4) SM Connection Management sub-layer (CM-sub). CM-sub layer protocol, Short Message Control Protocol SM-CP provides services to SM-RL and communication between peer Short message Control entities, SMCs. (5) SC talks to MSC via TCAP/MAP.

Before any message of CM-sub layer is delivered, a Mobility Management MM connection must be established between MS and MSC. Then RPDU is transferred over the connection. Then MM-connection is released by SMC with a flag indicating whether or not the transmission was successful.

Key in the Short Message and Send SMS Button

.. presses the "Send SMS" button.

SMS session related information needs to be transported from the mobile phone to the SMS Service Center (SC). This requires the establishment of a Radio Resource (RR) connection to the BSS. The first phase of the session setup just sets up this RR connection.

The MS establishes an SDCCH using the standard RR establishment procedure.

RR and MM Setup

Begin RR Connection Establishment

RR CHANNEL REQUEST

RACH

RR connection establishment is triggered by sending the Channel Request message. This message requests the Base Station System (BSS) for allocation for radio resources for the RR connection setup. The mobile now waits for an assignment on the Access Grant Channel (AGCH). At this point the mobile is listening to the AGCH for a reply.

RR IMMEDIATE ASSIGNMENT

AGCH,
Radio_Resource =
(SDCCH, Frequency,
Timeslot),
Time Correction,
Frequency Correction

The BSS transmits the radio resource assignment to the Mobile via the AGCH channel. The message also contains the time and frequency corrections. The time corrections allow the mobile to time it's transmissions so that they reach the BSS only in the specified slot. The frequency corrections correct for the Doppler shift caused by the mobile's motion.

RR SABM + MM CM SERVICE REQUEST

SDCCH,
CM Request = SMS

This is the first message that is sent after tuning to the channel. The CM Service Request is sent to the MSC.

RR UA

SDCCH

The BSS replies with Unnumbered Acknowledge (UA) to complete the LAPm setup handshake

SCCP CONNECTION REQUEST + MM CM SERVICE REQUEST

SS7

The BSS receives the CM Service Request message from the mobile and forms a "BSSMAP COMPLETE LAYER 3 INFORMATION". The BSS then piggy backs the message on the SCCP connection request message.

LEG: Initiate Authentication Procedure

Obtain the tuple of (RAND, SRES, Kc)

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MM AUTHENTICATION REQUEST

RAND

MM AUTHENTICATION RESPONSE

SRES

Enable Ciphering

BSSMAP CIPHER MODE COMMAND

Since the subscriber has been successfully authenticated, the MSC initiates ciphering of the data being sent on the channel. The channel is ciphered so as so protect the call from eavesdropping.

RR CIPHERING MODE COMMAND

mode = CLEAR

The BSS sends the CIPHERING MODE COMMAND to the mobile. The mobile will be able to receive this message as the transmission from the BSS is still in clear.

RR CIPHERING MODE COMPLETE

mode = CIPHERED

Ciphering has already been enabled, so this message is transmitted with ciphering. The BSS will receive this message as it is already expecting ciphered data in the receive direction.

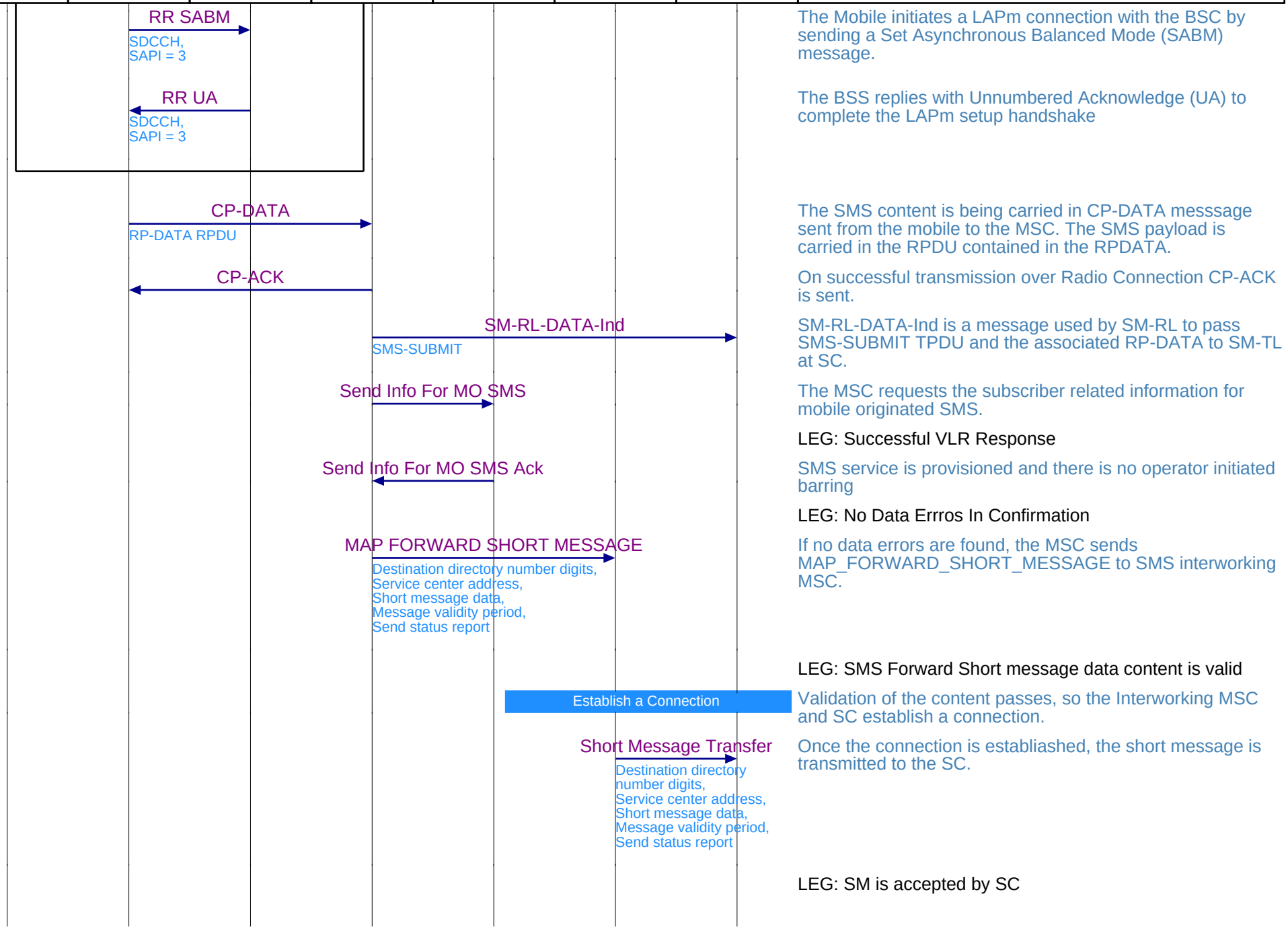
BSSMAP CIPHER MODE COMPLETE

BSS replies back to the MSC, indicating that ciphering has been successfully enabled.

At this point a connection has been setup between the Mobile and the MSC. From this point onward, the BSS is just acting as a conduit for transporting the signaling messages between the Mobile and the MSC.

SMS sent from Mobile to MSC

SAPI 3 Establishment



The Mobile initiates a LAPm connection with the BSC by sending a Set Asynchronous Balanced Mode (SABM) message.

The BSS replies with Unnumbered Acknowledge (UA) to complete the LAPm setup handshake

The SMS content is being carried in CP-DATA messsage sent from the mobile to the MSC. The SMS payload is carried in the RPDU contained in the RPDATA.

On successful transmission over Radio Connection CP-ACK is sent.

SM-RL-DATA-Ind is a message used by SM-RL to pass SMS-SUBMIT TPDU and the associated RP-DATA to SM-TL at SC.

The MSC requests the subscriber related information for mobile originated SMS.

LEG: Successful VLR Response

SMS service is provisioned and there is no operator initiated barring

LEG: No Data Errros In Confirmation

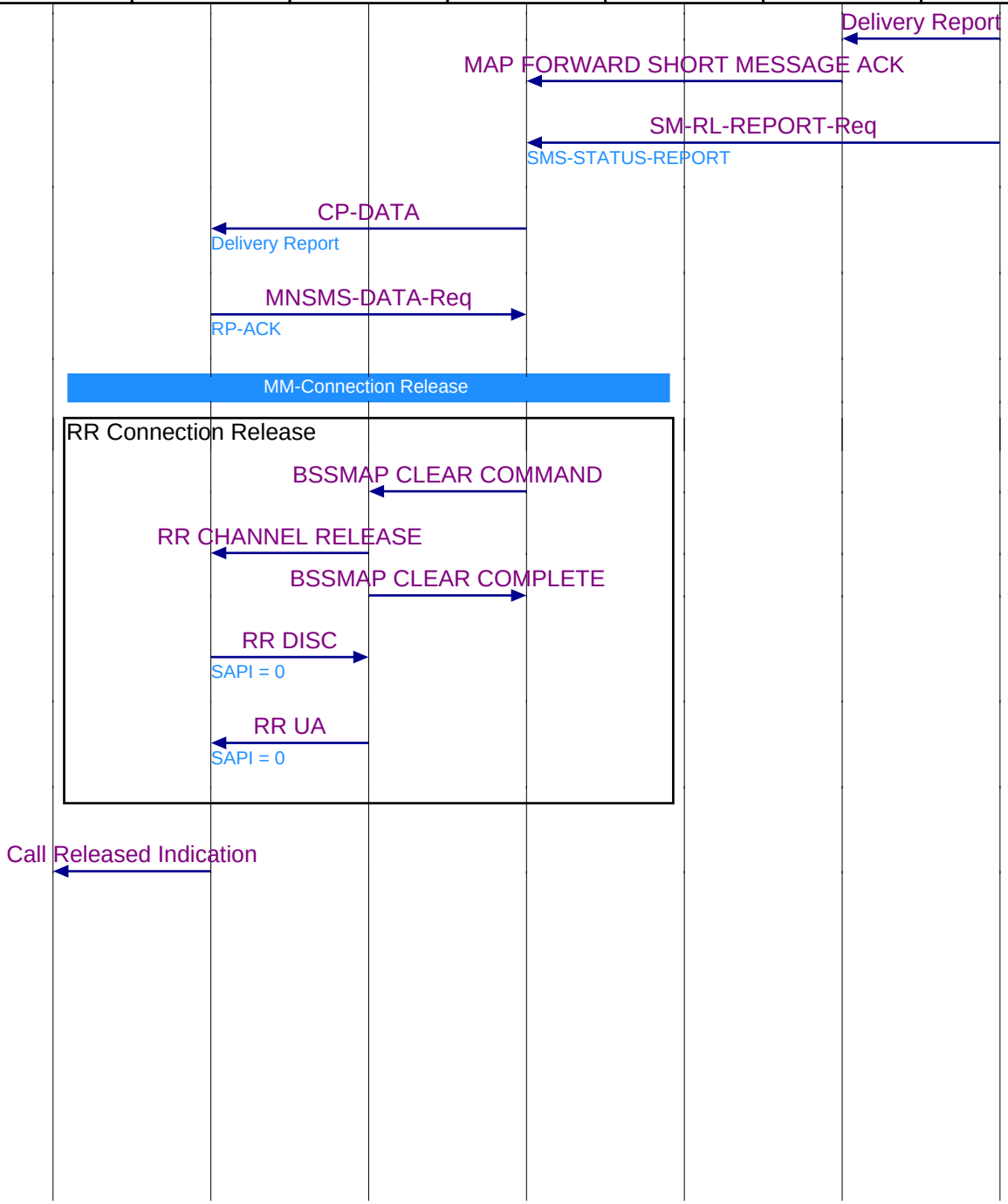
If no data errors are found, the MSC sends MAP_FORWARD_SHORT_MESSAGE to SMS interworking MSC.

LEG: SMS Forward Short message data content is valid

Validation of the content passes, so the Interworking MSC and SC establish a connection.

Once the connection is estabiashed, the short message is transmitted to the SC.

LEG: SM is accepted by SC



SC signals successful delivery of the SMS.

SMS-IWMSC informs MSC about the successful delivery of the SMS to the SC.

SM-RL-REPORT-Req message is a request used by SM-TL to relay RP-ACK containing the SMS STATUS REPORT.

The MSC now sends a Delivery Report to the Mobile, informing it about the successful delivery of the SMS.

Call release has been completed, now the RR connection is released by the MSC.

The BSS initiates RR release with the mobile.

The BSS informs the the MSC that the RR connection has been released.

The mobile sends a disconnect message to release the LAPm connection.

The BSS replies with an Unnumbered Acknowledge message.

Mobile goes back to the default display to indicate that SMS session has been completely released.