2G, 3G Network Planning and Optimization...

Archives

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1.16 Call Re-Establishment

1.16.1 Introduction

The re-establishment procedure allows MS to resume a connection in progress after a radio link failure, possibly in a new cell or in a new location area (re-establishment in a new location area initiates no location updating).

Whether call re-establishment is allowed depends on the calling status, the cell's allowance of call re-establishment, and activated MM connection (MM is in status 6 "MM connection activated" or status 20 " Waiting for additional MM connection" Call re-establishment can only be initiated by MS. GSM protocol does not specify the implementation mode for the short message service and the independent call supplementary service. In the other end, no voice is heard during the call re-establishment.

During the radio transmission, a connection may be broken suddenly because of the great transmission loss due to obstructions such as bridges, buildings, or tunnels. When the call re-establishment is used, the MS can maintain the conversation by using another cell in a short time, thus improving the network quality. Call re-establishment can be regarded as the HO initiated by MS to save the interrupted call in the current cell.

Call re-establishment is of two types according to the entity that has the radio link failure first.

I. Radio Link Failure Occurs to MS First

The MS sends a call re-establishment request in the selected cell (source cell or target cell). The former channel resource is released after the BTS timer times out.

II. Radio Link Timeout Occurs to BSS First

After the radio link timer in BTS times out, the BTS sends a radio link failure message to the BSC and BSC activates the SACCH. According to the protocol, the network must handle the context for a while after detecting the lower layer faults for the successful call re-establishment. The implementation mode and duration are decided by the equipment provider. After detecting the radio link failure, the MS selects a neighbor cell with the highest RXLEV within five seconds and sends the channel request in the selected cell. This cell should not be barred and the C1 is over 0. In addition, this cell must permit the call re-establishment. If all the neighbor cells are not qualified, the call re-establishment is abandoned.

During the call re-establishment, the MS cannot return into the idle mode. If the MS selects a cell in different LA as the target cell for call re-establishment, it cannot perform location updating until the call ends.

Under normal circumstances, the call re-establishment procedure lasts about 4 to 20 seconds. Most users have hung up the phone before the procedure is over. Therefore, the call re-establishment cannot achieve its goal but wastes a lot of radio resources. For the areas with limited channel resources, the activation of this function is not recommended.

1.16.2 Call Re-Establishment Procedure

1) After the MM connection failure indication is reported to the CM entity, if the MS receives at least one request for MM connection re-establishment from CM, it will initiate the call re-establishment procedure. If several CM entities request for re-establishment, only one re-establishment procedure will be initiated.

2) After the CM sends the request for the re-establishment of MM connection, MM sublayer sends a request for the establishment of RR connection and enters the WAIT FOR REESTABLISH state. This request includes an establishment cause and a CM re-establishment request. When the RR sublayer indicates a RR connection is established (the CM re-establishment request message has been sent through the Um interface), the MM sublayer starts T3230 and indicates to all the CM entities that the MM connection is under construction. The MM sublayer stays in WAIT FOR REESTABLISH state.

The CM Re-establishment Request message contains the MS identity (IMSI or TMSI), Classmark 2, and encrypted sequence number.

Whether the CM entity can request for re-establishment depends on protocol discriminator (PD).

3) After receiving the CM re-establishment request, the network analyzes the request type and starts the MM program or RR program. The network can start the classmark enquiry program to obtain more information about the MS encryption ability. The network can also decide to perform the authentication procedure or ciphering mode setting procedure.

4) When the RR sublayer indicates the ciphering mode setting procedure is over or the CM SERVICE ACCEPT message is received, the MM connection is re-established. The T3230 stops and informs all the CM entities related to the re-establishment to enter the MM CONNECTION ACTIVE state.

5) If the network cannot connect the re-establishment request to the current MS call, it sends the CM SERVICE REJECT with the reject cause to the MS.

The reject cause (value) includes unidentifiable call (#38), unidentifiable IMSI (# 4), unauthorized ME (# 6), network failure (#17), congestion (#22), unsupported service (#32), and temporary service failure (#34)。

6) After receiving the CM SERVICE REJECT, the MS stops T3230 and releases all MM connections and RR connections. If the reject cause if #4, the MS deletes the TMSI, LAI, and CKSN in SIM card, and changes the status from "updating" into "no updating", and then enters the "WAIT FOR NETWORK COMMAND" state. The location updating will be initiated after the RR release.

If the reject cause is #6, the MS deletes the TMSI, LAI, and CKSN in SIM card, and changes the status from "updating" into "roaming inhibit". The SIM is regarded invalid until the MS is switched off or the SIM card is pulled out.

1.16.3 Exceptional Situations

I. Re-Establishment Prohibition or Failure

When MM connection is established, the MM layer may send an indication to the CC layer. If the MM layer is disconnected, the connection may be re-established through CC request.

If the re-establishment is not allowed, and the call is initiated within the establishment or clearing

period, the CC layer shall release MM connections.

If re-establishment is unsuccessful, MM connections shall be released, and a release indication shall be sent to the CC layer.

II. RR Connection Failure

If random access failure or RR CONNECTION FAILURE is detected by the MS, the MS will stop timer T3230, abort the call re-establishment procedure, and release all MM connections.

If RR CONNECTION FAILURE is detected by the MSC, the MSC will abort the call re-establishment procedure and release all MM connections.

III. T3230 Time-out

If the T3230 times out, the MS will stop call re-establishment and release MM and RR connections.

1.16.4 SM Procedure

Short messages can be transmitted either on SDCCH or SACCH. A short message procedure can be classified into short message calling procedure and called procedure. For details, see GSM03.40 protocol.

1.16.5 Short Message Procedure on SDCCH When MS is calling

I. Signaling Procedure

II. Procedure Description

The random access, immediate assignment, authentication, and encryption procedures of short message procedure on SDCCH when MS is calling are the same as general procedures. After encryption, the MS sends SABM again, notifying the network side that this user needs short message service (SMS). Then, BSC provides a transparent-transmission channel for MS to exchange short message information with MSC. In this procedure, the MSCs of some manufacturers are capable to send ASS REQ to BSC, requesting it to assign channel for short message transmission. The time for sending ASS REQ is the same as that for a common call. BSC can provide SMS either by allocating other channels or by using the original SDCCH.

Point to Point short messages protocol is divided into connection management layer (CM), relay layer (RL), transport layer (TL) and application layer (AL).

CP_DATA and CP_ACK are the messages on CM layer, CP_DATA is used to transmit the content of RL and AL message, and CP_ACK is the acknowledgement message of CP_DATA.

The release procedure after message is sent is the same as general ones.

1.16.6 Short Message Procedure on SDCCH When MS is called

I. Signaling Procedure

II. Procedure Description

The paging response and immediate assignment procedures of short message procedure on SDCCH when MS is called are the same as general procedures. For the short message procedure when MS is called, after encryption, the BSC sends EST REQ to MS to establish short message connection. When EST CNF is received from MS, the connection is successfully established. BSC transparently transmits the short message till the end of the transmission.

The release procedure after message is sent is the same as general ones.

1.16.7 Short Message Procedure on SACCH When MS is calling

I. Signaling Procedure

II. Procedure Description

The MS sends CM SERV REQ through FACCH. The MSC responds with the CM SERV ACC message and establishes CC layer connection. Then, it establishes RR layer connection on SACCH, and sends the short message.

1.16.8 Short Message Procedure on SACCH when MS is called

I. Signaling Procedure

II. Procedure Description

The BSC receives the CP DATA message from MSC, and establishes an RR layer connection for SMS. Upon reception of CP ACK from MS, MSC sends the short message.

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