



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

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**1.12 Location Update**

In GSM, the paging information cannot be sent in the whole network due to the capacity limit of the paging channel. Therefore, the definition of location area (LA) is introduced. LAC contains many cells. The paging for the MS is carried out through the paging in all the cells within the LA of the MS. The size of the LA is of vital importance to the system performance in network design.

The registration management for the LA is required since the paging for the MS is carried out through the paging in all the cells within the LA, which brings about the definition of location update. Location update is divided into generic location update, periodic location update, and IMSI attach.

**1.12.1 Generic Location Update (Inter-LA Location Update)**

When the MS moves from one LA to another LA, registration is required. If the LAI stored in the MS is different from the LAI of the current cell, the MS informs the network to change the location information it stores. This procedure is called generic location update.

In idle mode, if cell re-selection occurs when the MS moves within the LA, the MS will not inform the network immediately but implement cell re-selection without location update or network involvement. If the MS moves to another LA after re-selection, the MS informs the network of this LA change, which is called forced registration.

According to whether the VLR changes or IMSI involves, generic location update is divided into the following types:

**I. Intra VLR Location Update**

It is the simplest location update that requires no IMSI. It happens in the current VLR without informing the HLR.

In the initial message carried by SABM frame, the access cause is MM LOCATION UPDATING REQUEST that carries the MS TMSI and LAI. The generic location updating is indicated. MSC receives this message and forwards it to VLR. VLR updates the MS location information and stores the new LAI, and then sends a new TMSI to MS if required (MS uses the former TMSI if no TMSI is carried in the TMSI re-allocation command). After receiving the TMSI re-allocation complete message, MSC sends location updating accept message and releases the channel. Location updating completes.

**II. Inter-VLR Location Updating, Sending TMSI**

After the MS enters a cell, if the current LAI is different from the LAI it stores, it sends its LAI and TMSI to VLR through MSC in location updating request. VLR deduces the former VLR based on the LAI and TMSI it received and sends a MAP\_SEND\_IDENTIFICATION to the former VLR to request for IMSI and authentication parameter. The former VLR sends the IMSI and authentication parameters to the current VLR. If the current VLR cannot obtain the IMSI, it sends MS an identity request message to request for the IMSI. After receiving the IMSI, VLR sends HLR the location updating message that contains the MS identity information for the data query and path establishment of HLR. After receiving this message, HLR stores the number of the current VLR and sends MAP/D\_CANCEL\_LOCATION to the former VLR if the current MSC/VLR has the normal service rights. After receiving this message, the former VLR deletes all the information about this MS and sends the HLR a MAP/D\_CANCEL\_LOCATION\_RESULT message to confirm the deletion. The HLR will send MAP\_INSERT\_SUBSCRIBER\_DATA message to provide the current VLR with the information it requires (including authentication parameters) after the procedure for authentication, encryption, and TMSI reallocation is over, and confirm the location updating after receiving the response from the VLR.

**III. Inter-VLR Location Updating, Sending IMSI**

The procedure is similar with the procedure above but easier because it requests for authentication parameter from the HLR through IMSI directly.

**1.12.2 Periodic Location updating**

The network and the MS lose contact when:

The MS is switched on but moves out of the network coverage area (dead zone). The network lost contact with the MS and regards it still in attach status.

The MS sends IMSI detach message and the uplink quality is bad due to interference, the network may not be able to decode this message correctly. The MS is still regarded in attach status.

The MS is power off. It cannot inform the network of its status and the contact is lost.

If the paging for MS happens when the contact is lost, the system sends paging information in the LA that the MS registered before. The network cannot receive the response from the MS. The system resource is wasted. To solve this problem, the implicit detach timer is introduced in the VLR for the IMSI status management. In addition, measures are taken in BSS to force the MS to report its location periodically. Therefore, the network is informed of the status of MS. This kind of mechanism is called periodic location updating. The network sends a periodic location updating time T3212 to all the users in the cell through BCCH to force the MS to send location updating request with the cause of periodic location updating after T3212 times out.

Before the T3212 times out, if the timeout value is changed (for example, the service cell changes and the T3212 timeout value is broadcast), the MS uses the time when the change happens as the initial value and keep on timing.

If the T3212 times out when the MS is in NO\_CELL\_AVAILABLE, LIMITED\_SERVICE, PLMN\_SEARCH, or PLMN\_SEARCH-NORMAL\_SERVICE status, the location updating is initiated after the MS is out of these service status.

Periodic location updating ensures the close contact between network and mobile users. The shorter updating period leads to better network performance. But the frequent location updating will increase the signaling flow and reduce the utilization of the radio resources, or even affect the processing ability of MSC, BSC, and BTS. On the other hand, it will greatly increase the power consumption of MS and reduce its standby time. The T3212 setting should be based on comprehensive consideration.

The procedure for periodic location updating is the same as that for generic location updating.

## Live

03 ДЕНЬ	724 195
07 ДНЕЙ	136 47
24 МЕСЯ	47 8
СЕГОДНЯ	47 8
НА ПИНИИ	38 3

## Hit

0	0	6	1	2	8
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## Постоянные читатели

## 1.12.3 IMSI Attach and Detach

IMSI attach and detach means to attach a binary mark to the subscriber record in MSC/VLR. The former one is marked as access granted, and the latter one is marked as access denied. When the MS is switched on, it informs the network of its status change by sending an IMSI ATTACH message to the network to inform. After receiving this message, the network marks the current user status in the system database for the paging program.

If the current LAI and the LAI the MS stores are the same, IMSI attach is initiated. The procedure is similar to the intra VLR location updating only that the location updating request message is marked as IMSI attach and the initial message contains IMSI of the MS.

If the current LAI is different from the LAI stored, generic location updating is initiated.

When the MS is switched off, the IMSI detach is triggered by a key-press. Only one command is sent to MSC/VLR from the MS. This is an unacknowledged message. After receiving this message, MSC informs VLR to do detach mark to this IMSI while the HLR is not informed of the no-radio of this user. When the paging for this user occurs, HLR requests for the MSRN from the VLR and is informed of the no-radio of this user by this time. Therefore, no paging program is implemented. The paging message is handled directly, such as playing the record: "The subscriber is powered off."

The procedure above is explicit IMSI detach. There is also implicit detach. The implicit detach happens before the implicit detach timer times out. If the contact between MS and network is not established, the VLR sets the IMSI status as detach. The implicit detach timer is set longer than the periodic location updating timer T3212 to avoid "abnormal" implicit detach. The implicit detach is denied during the establishment of radio connection. The implicit detach timer is reset after the release of radio connection. Implicit detach timer is also called IMSI delete time.

VLR deletes the IMSI marked as detach periodically (The period is adjustable) and reports the user status to the HLR.

## 1.12.4 Exceptional Situations

## I. MS

Access denied because of access level limit

MS stays in the service cell and performs the normal cell re-selection procedure without triggering location updating. When the current cell allows access or other cell is selected, The MS initiates location updating immediately.

IMMEDIATE ASSIGNMENT REJECT message is received during random access

MS stays in the service cell and starts T3122 based on the value in the immediate assignment reject message. The normal cell selection and re-selection procedure is performed. If the cell that the MS stays changes or T3122 times out, the MS initiates location updating.

Random access failure

If the random access fails, T3213 is started. After the T3213 times out, the random access procedure is initiated. If two successive random accesses fail, the location updating is terminated. For the subsequent processing, see the following description.

RR connection failure: Location updating procedure is terminated. For the subsequent processing, see the following description.

T3210 timeout: Location updating fails. For the subsequent processing, see the following description. The completion of RR connection is abnormal: Location updating fails. For the subsequent processing, see the following description.

Location updating reject due to reasons other than #2, #3, #6, #11, #12, or #13: MS waits for the release of RR connection. For the subsequent processing, see the following description.

# 2 (IMSI unknown in HLR)

# 3 (Illegal MS)

# 6 (Illegal ME)

# 11 (PLMN not allowed)

# 12 (Location Area not allowed)

# 13 (Roaming not allowed in this location area)

Subsequent processing: If the T3210 is still timing, stop it; If T3210 times out, RR connection fails. Add 1 to the location updating attempt timer. The following processing depends on the LAI (stored and received from the service cell) and the value of the location updating attempt timer.

If the location updating status is UPDATED, the stored LAI and the received LAI are the same, and the location updating attempt timer is less than 4, MS keeps the UPDATED status. After the release of RR connection, the sub status of MM IDLE becomes NORMAL SERVICE. The MS also stores the information about the former location updating type. The T3211 is started after RR connection release. After it times out, the location updating procedure is started again.

If the location updating status is not UPDATED, or the stored LAI is different from the received LAI, or the location updating attempt timer is equal to or less than 4, the MS deletes the ciphering key sequence, LAI, TMSI stored in SIM card and sets the location updating status as NOT UPDATED. After the release of RR connection, the sub status of MM IDLE becomes ATTEMPTING TO UPDATE. After the RR connection release, if the location updating attempt is less than 4, T3211 is started. Otherwise, T3212 is started. After the T3211 or T3212 times out, the location updating procedure is started again.

After the sub status of MM IDLE becomes ATTEMPTING TO UPDATE, the MS will do the following:

If T3211, T3213, or T3212 times out, perform location updating.

If LA changes, perform generic location updating

If the cause for the status change is (3), (4), (6) (the cause is not the abnormal release with unknown reason), or (7) (cause "retry in the new cell"), perform location updating when entering the new cell.

If the cause for the status change is (5), (6) (the cause is abnormal release with unknown reason), or (7) (the cause is not "retry in the new cell"), location updating is not performed when entering the new cell.

No IMSI detach.

Support emergency call request

Respond the paging with IMSI

Perform generic location updating triggered by the request from CM layer (if the location updating succeeds, the MML connection request will be accepted. For details, see section 4.5.1 of the Protocol 0408).

## II. Matching Between IMSI Delete Time and T3212

If the periodic location updating fails for four times, T3212 will be started for the next update. In the bad coverage area, especially in the area where the uplink and downlink do not match (downlink is better than uplink), after the periodic location update fails,

Another location updating is initiated after T3212 times out. Therefore, the T3212 is set to be shorter in the bad coverage area. In addition, if the IMSI delete time is less than twice of the T3212, the users stay in the service area but cannot be called. So the IMSI delete time should be more than twice of the

T3212 and based on LAC.

### III. Network

#### RR connection failure

Among all the sub procedures attached to the location updating procedure, if the RR connection fails, it is handled according to the exception handling of other common procedures.

If no other common procedure is attached to the location updating procedure, the MS location updating is terminated.

#### Protocol error

If the network detects protocol error after receiving LOCATION UPDATING REQUEST, it sends LOCATION UPDATING REJECT message to the MS with the following cause if possible:

#96 required IE error

#99 IE error or no IE exists

#100 Conditional IE error

#111 Protocol error, undefined

After sending LOCATION UPDATING REJECT to the MS, the network initiates channel release procedure.

Автор: ourdot на 1:14

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