

## Location Update Procedure in Mobile Computing

Popat K.A.<sup>1</sup>, Sharma P.<sup>2\*</sup>

<sup>1</sup>Faculty of Computer Application, Marwadi Education Foundation's Group of Institutions, Rajkot, Gujarat, India.

<sup>2</sup>MCA Department, ISTAR College, Vallabhvidhyanagar, Gujarat, India.

**Correspondence Address:** \* Priyanka Sharma, MCA Department, ISTAR College, Vallabhvidhyanagar, Gujarat, India.

### Abstract

When we talk about the term mobility it simply means that anything which is in moving condition. When anything which is in moving condition, the information about its current location is the most important. This becomes much more important when we talk about a device which is useful to a person for talking, messaging, texting, web surfing etc. Location management is one of the most crucial thing in mobile computing. Here in this paper we have described the procedure for location update in GSM Mobile Network.

**Keywords:** Mobile Computing, Location Update, GSM Location Update

### Introduction

A GSM network or UMTS network, like all cellular networks, it is a radio network consisting of individual cells, which is known as base stations. Each base station covers a small geographical area. When the integration has been made of each of the base stations, all small areas will be able to cover a much wider area. A group of base stations will be termed as location area or routing area.

Location management is a very important and complex problem in mobile computing [1][2][3]. As a mobile user, a person can be anywhere but a network has to keep track of user, in-case if somebody wants to call him, so the transaction that keeps network updated about the subscriber present location is termed as location update. A mobile phone constantly receives information sent by the network, which includes ID of the VLR area in which

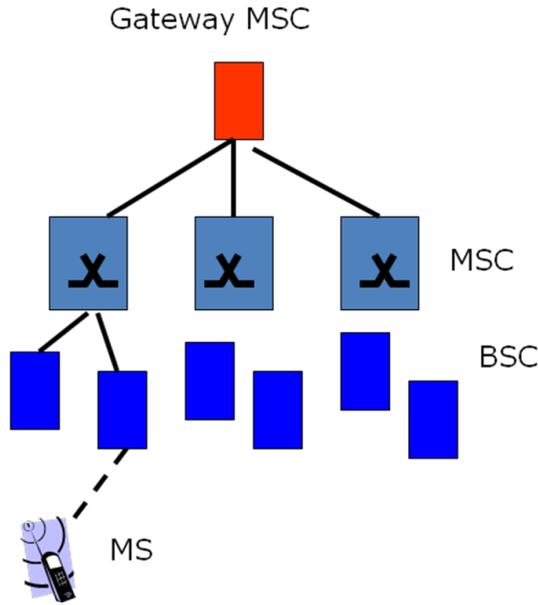
mobile is currently located & mobile stores that ID. In order to make a mobile terminated call, The GSM network should know the location of the MS (Mobile Station), despite of its movement. For this purpose the MS periodically reports its location to the network using the Location Update procedure.

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. Location Area consist of small divisions known as 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.

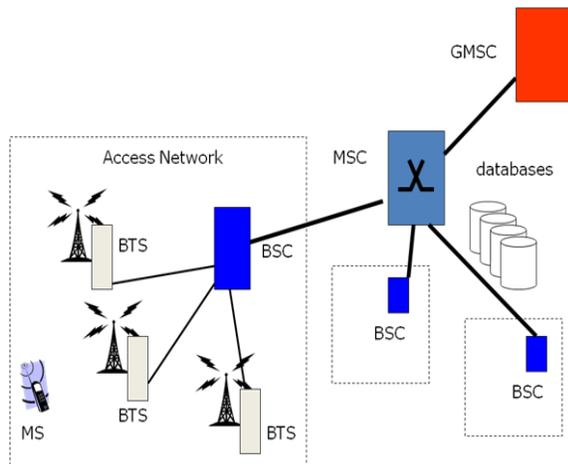
The registration management for the LA is required since the paging for the MS is carried out through the paging in all the cells within the LA, which brings about the

definition of location update. Location update is divided into generic location update, periodic location update, and IMSI attach.

**GSM Infrastructure**



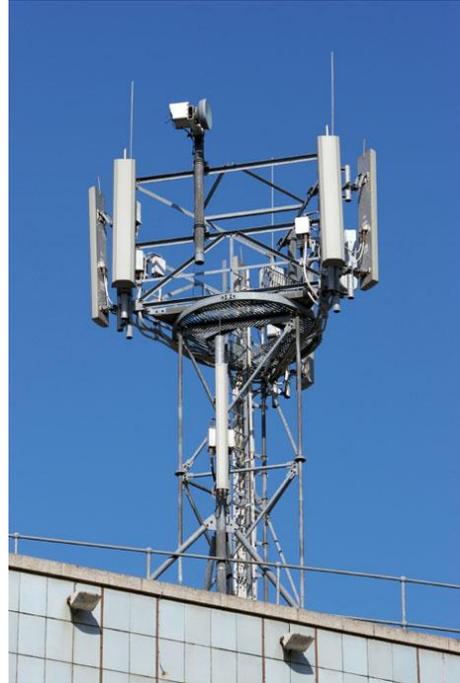
**Fig. 1: Simple GSM Infrastructure**



**Fig. 2: Detail GSM Infrastructure**

Here in the above figure a typical GSM Infrastructure has been given. Here the main thing is the Mobile Station (MS) is directly connected with Base Terminal Station (BTS) i.e. mobile towers. All BTS of the same city will be connected with one

Base Switching Center (BSC). Now all the BSC from different cities will be connected with Mobile Switching Center (MSC). The MSC will be connected with General Mobile Switching Center (GMSC) and the Database for Location Management.



**Fig. 3: A Typical Mobile Tower with 90°x4**

**Location Update**

Location update is divided into generic location update, periodic location update, and IMSI attach.

In normal or generic location update procedure MS has to do a location update in new location area when it crosses a LAC border.

In periodic location update procedure The network has to do a periodic location updates to update the subscribers in each location area. This is also known as T3212 timer location update.

In IMSI attach location update When mobile switch ON it has to do a location update or when moving from non coverage area to a coverage area MS has to do a location update if LAC is different from stored LAC

or when mobile switch OFF it has to detached from the network.

### **Generic Location Update**

Generic Location Update will be performed when the MS moves from one LA to another LA, and registration is required. If the LA stored in the MS is different from the LA of the current cell, it is the responsibility of the MS to inform the network to change the location information it stores. This procedure is called generic location update.

In a normal condition, if the MS moves from one cell to another cell within its nearby area at that time the MS will not inform the network immediately but it will change the cell number without location update. But if the MS has been moved from one LA to another LA at that time location update is necessary.

The main steps involved in this process are as follows:

#### **I. Intra VLR Location Update**

It is the simplest location update procedure, in this method there no requirement of International Mobile Subscriber Identity (IMSI). It will work only in current Visitor Location Register (VLR) without informing the Home Location Register (HLR).

At the starting point of this update process the message carried by SABM frame, the access cause is MM LOCATION UPDATING REQUEST that carries the MS TMSI and LAI. 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 Temporary Mobile Subscriber Identity (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 check for 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.

### **Periodic Location Update**

The network and the MS lose contact when:  
(1) The MS is switched on but moves out of the network coverage area i.e. dead zone.

(2) 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.

(3) 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 in its last call. The network cannot receive the response from the MS. and 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 Broadcast Control Channel (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.

### **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 later 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.

### Exceptional Situation

Location update can be done in some Exceptional Situations also. These are the situations which are beyond the above given situations. These exceptional situations are as follows:

(1) MS Access denied because of access level limit:

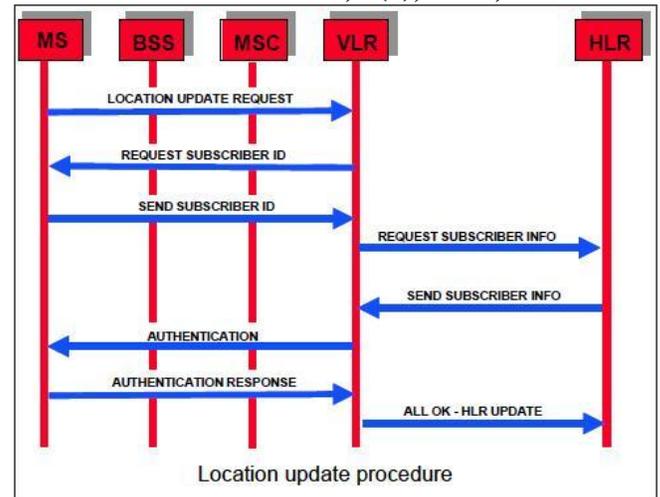
MS stays in the service cell and performs the normal cell re-selection procedure without triggering location updating. When the current cell allows access or other cell is selected, The MS initiates location updating immediately.

IMMEDIATE ASSIGNMENT REJECT message is received during random access and 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.

(2) 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.

All the above three main Location Update Procedures can be summarized in following figure.



**Fig. 4: Location Update Procedure**

Here, as per above figure following steps are involved in Location Update Procedure

(1) MS sends request to VLR for Location Update and also ask for a separate channel to send and receive further information.

(2) VLR accepts the request and request for Subscriber ID from the MS

(3) Now MS will send Subscriber ID to the VLR

(4) After receiving Subscriber ID from MS, VLR will send that Subscriber ID to HLR.

(5) Now HLR will send Subscribers info available in the database of the company to VLR

(6) Now VLR send Authentication request to MS.

(7) MS will send Authentication Response to the VLR.

(8) If everything is fine, VLR sends the request to HLR for Location Update.

### Conclusion

In this paper we have discussed about the procedure for location update in Mobile Computing. Here we have given GSM Infrastructure which gives the idea about the various terms used in GSM infrastructure. All the three Location Update procedures are discussed in detail and at last the whole process is described with simple figure and steps.

## References

- [1] Das SK, Sen SK. 1999. Adaptive Location Prediction Strategies Based on a Hierarchical Network Model in a Cellular Mobile Environment. *The Computer Journal*. 42(6). 473-486.
- [2] Plassmann D. 1994. Location management strategies for mobile cellular networks of 3rd generation. *Vehicular Technology Conference*. 44<sup>th</sup> IEEE. 1. 649-653.
- [3] Xie H., Piscataway NJ, Tabbane, S., Goodman D. 1993. Dynamic location area management and performance analysis. *Vehicular Technology Conference*. 43<sup>rd</sup> IEEE. 536-539.

**IJSAR, 1(2), 2014; 22-27**