



**Research Manuscript Title**

## **ENCHANCED LOCATION MANAGEMENT IN WIRELESS CELLULAR NETWORK**

**G.SUJATHA, M.E, A. MONICA SELES, M.E**

Assistant Professor, P.G Scholar,  
Department Of ECE,  
Arunai Engineering College, Thiruvanamalai, Tamilnadu, INDIA.

E-Mail: [sujijes@gmail.com](mailto:sujijes@gmail.com), [monicantony2992@gmail.com](mailto:monicantony2992@gmail.com)

**March – 2016**

**[www.istpublications.com](http://www.istpublications.com)**

## ENHANCED LOCATION MANAGEMENT IN WIRELESS CELLULAR NETWORKS

G.SUJATHA, M.E, A. MONICA SELES, M.E

Assistant Professor, P.G Scholar,  
Department Of ECE,  
Arunai Engineering College, Thiruvanamalai, Tamilnadu, INDIA.

E-Mail: [sujijes@gmail.com](mailto:sujijes@gmail.com), [monicantony2992@gmail.com](mailto:monicantony2992@gmail.com)

### ABSTRACT

Location management enables the networks to track the locations of mobile nodes. In cellular communication location management refers to location update (LU) and location search (LS) (or, commonly known as *paging*). LU requires occasional update of the entries corresponding to an MT in its location registers (LRs), namely home LR (HLR) and visiting LR (VLR). A recent paper [1] has reduced the LU cost by a novel pointer forwarding mechanism, wherein the previous VLR keeps as the forward pointer to the current VLR instead of the updating the HLR when an MT changes the VLR. To deliver services to the mobile users, the cellular network is capable of tracking the locations of the users, and allowing user movement during the conversations. These capabilities are achieved by the location management. Location management in mobile communication systems is concerned with those network functions necessary to allow the users to be reached wherever they are in the network coverage area. In a cellular network, a service coverage is divided into smaller areas of hexagonal shape, referred to as cells. The cellular concept was introduced to reuse the radio frequency, continued expansion of cellular networks coupled with an increasingly restricted mobile spectrum has established the reduction of communication overhead as a highly important issue.

**Keywords---** *cellular network; location management; location search; location update.*

### 1. INTRODUCTION

Location management process is used to enable communication with a mobile terminal (MT) within the service area of a cellular network. The service area of the cellular network is typically large and hence is divided into a number of smaller areas (LAs). LA could be as small as the area covered by a cell or as big as the area covered by a mobile switching centre (MSC) in the network. Cellular networks maintain home location register (HLR) and visitor location register (VLR) to keep location information of each MT in its network [1]-[5]. Each MSC has its associated VLR. Usually, one HLR is associated to the whole network. But there may be many VLRs.

The existing standard IS-41 [6] for location management uses HLR and VLR to perform location search (LS) and location update (LU) operations in the following manner. During an LU, the current LA address is updated in the VLR and the current VLR address is updated in the HLR. When an MT, on the move, changes its LA without changing its MSC, only a VLR update is made. However, when the MT changes its MSC (and hence LA too), both HLR and VLR updates corresponding to this MT are made. So LU cost consists of HLR update cost and VLR update cost, between which HLR update is relatively more costly [2]-[5].

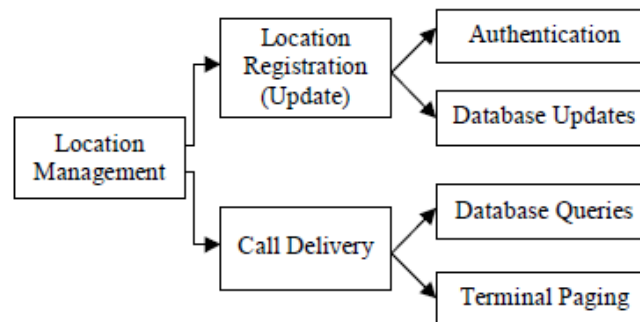


Fig.1 Location management operations.

LS is needed when a calling MT tries to establish a connection with a called MT. LS process consists of two sub-processes: (i) pre-paging-probe (PPP) – to identify the paging area (PA) [3], in which the MT currently resides, using the HLR/VLR entries created by LUs, and (ii) paging – to page the identified PA. For the sake of simplicity, in this work, we consider a PA to be equal to an LA i.e., we use LA instead of PA in LS process. Using HLR and VLR entries of the called MT, the network first finds the LA (aka PA) of the called MT. Subsequently, the paging is performed within the LA for locating the called MT in a cell.

A cellular communication system must track the location of its users in order to forward calls to the relevant cell within a network. This will add to the challenge of some fundamental issues in cellular networks. Location management is one of the fundamental issues in cellular networks. It deals with how to track subscribers on the move. The purpose of this paper is to survey recent research on location management in cellular networks. The study of location management aims to reduce the overhead required in locating mobile devices in a cellular network. The frequency spectrum allocated to wireless communications is very limited. The cellular concept has been introduced to reuse the frequency. Each cell is assigned a certain number of channels. To avoid radio interference, the channels assigned to one cell must be different from the channels assigned to its neighbouring cells. However, the same channels can be reused by two cells, which are far apart such that the radio interference between them is tolerable. By reducing the size of cells, the cellular network is able to increase its capacity, and therefore to serve more subscribers.

## 2. RELATED WORKS

The usual strategies for LU are either normal LU (NLU) [6] or periodic LU (PLU) [2]-[5]. Both NLU and PLU schemes are adopted in 3GPP specifications for Universal Mobile Telecommunications System (UMTS) to detect presence of MTs. NLU (or, IS-41 [6]) is a static LU strategy, where the buffered location information of the MT is only updated when the MT crosses an LA boundary. So as long as an MT stays within the same LA, its location information is not changed. On the contrary, PLU is a time-based LU strategy where, the location information is updated periodically in the

location registers. Even if the MT does not change the LA for a considerable period of time, still its location information will be updated regularly, which may cause unnecessary LU overhead.

However, if the MT faces a check point event before the PLU timer (or identification timer maintained in the MT) expires, PLU is not executed. A check point event is a virtual LU action to inform the network whether the MT is attached; for instance, any non-PLU event, such as an incoming call, an outgoing call, abnormal detachment and battery failure, can also help in detecting the MT. Thus, they may be used as check points.



Fig.2. No. of nodes and No. of updates.

Several LU+LS combinations have been proposed in literature [1]-[6]. Increasing the size of LA decreases LU cost but increases the paging (thus LS) cost. Researchers have investigated for optimal location area design to minimize LM cost (= LU cost + LS cost). One interesting contribution is the

pointer forwarding scheme [1] that is different from NLU (aka

IS-41) in the sense that they have preferred VLR update over HLR update. An HLR update is allowed only when the number of VLR updates for an MT reaches a threshold count [1]. When an MT moves from one VLR to another, a forwarding pointer pointing to the new VLR is made in the old VLR and the chain count is increased by one.

When an HLR update is made, count is reset to zero, and a new VLR chain begins. LS process hops through VLRs using the forward pointer chain to reach the current VLR to find the MT's current LA. So here PPP cost amounts to the cost of traversing the chain of pointers (note: LS cost = PPP cost + paging cost). Obviously, the PPP cost increases linearly with the increase of the chain length. Our work aims to arrest the chain length within unity without increasing the number of HLR updates considerably. Thus our method tries to combine NLU of IS-41 [6] with pointer scheme [1] together with various HLR update strategy.

### **3. EXISTING METHOD**

The existing standard IS-41 for location management uses HLR and VLR to perform location search (LS) and location update (LU) operations. When an MT, on the move, changes its LA without changing its MSC, only a VLR update is made. However, when the MT changes its MSC (and hence LA too), both HLR and VLR updates corresponding to this MT are made. Due to successive probing through the chain of pointers, the PPP cost increases. So LU cost consists of HLR update cost and VLR update cost, between which HLR update is relatively more costly.

The usual strategies for LU are either normal LU (NLU) or periodic LU (PLU). Both NLU and PLU schemes are adopted in 3GPP specifications for Universal Mobile Telecommunications System (UMTS) to detect presence of MTs. NLU (or, IS-41) is a static LU strategy, where the buffered location information of the MT is only updated when the MT crosses an LA boundary. So as long as an MT stays within the same LA, its location information is not changed. On the contrary, PLU is a time-based LU strategy where, the location information is updated periodically in the location registers. Even if the MT does not change the LA for a Considerable period of time, still its location information will be updated regularly, which may cause unnecessary LU overhead.

### **4. PROPOSED SYSTEM**

In our LU scheme, we have used cell sojourn time based HLR update strategy because that suits diurnal mobility.

#### **LU of our scheme:**

We define two states for the MT. These two states are HLR-UPDATED and HLR-NOT-UPDATED. A binary flag may be maintained in the MT to indicate its state. Initially, when the MT is switched on, it enters the HLR-UPDATED state and MT's current VLR is designated as its home VLR. It stays in that state as long as it does not change MSC/VLR. The moment it changes MSC/VLR, it goes into HLR-NOT-UPDATED state. During this state, MT sets its cell-sojourn timer in each cell it visits within its VLR area. Now if it changes MSC/VLR (not by moving to its home VLR), MT remains in the same state. If it changes MSC/VLR (by moving to its home VLR), MT changes its state to HLR-UPDATED state. During MT's stay in HLR-NOT-UPDATED state, if MT's cell-sojourn timer expires, an HLR update is made and MT enters the HLR-UPDATED state. When an HLR update is made, a VLR update is also made and the VLR is designated as the home VLR of MT. Thus, in our strategy too, like, when an MT moves to a new VLR, it does not update the HLR always. When the MT changes its MSC/VLR, forward pointer of MT's home VLR is set to MT's current VLR and backward pointer of MT's current VLR is set to MT's home VLR, respectively.

#### **Location Update:**

A location update is used to inform the network of a mobile device's location. This requires the device to register its new location with the current base station, to allow the forwarding of incoming calls. Each

location update is a costly exercise, involving the use of cellular network bandwidth and core network communication; including the modification of location databases. A wide variety of schemes have hence been proposed to reduce the number of location update messages required by a device in a cellular network.

### Paging:

While mobile devices perform updates according to their location update scheme, the network needs to be able to precisely determine the current cell location of a user to be able to route an incoming call. This requires the network to send a paging query to all cells where the mobile device may be located, to inform it of the incoming transmission. It is desirable to minimize the size of this paging area, to reduce the cost incurred on the network with each successive paging message.

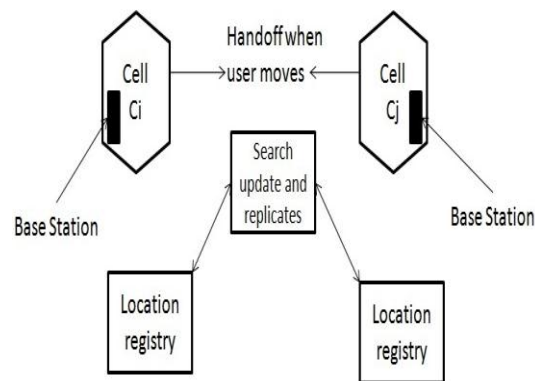


Fig.3. Block diagram

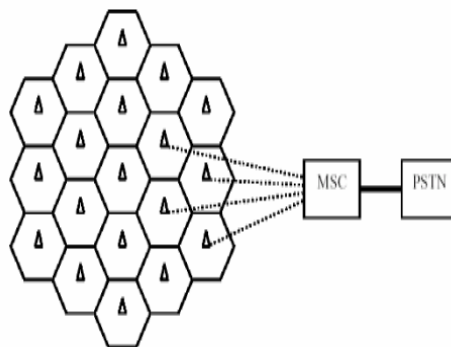


Fig.4. System architecture

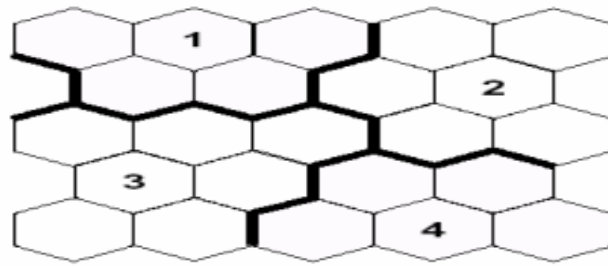


Fig.5. Network partitioned into location areas

Location management involves two operations: location update and paging. Paging is performed by the network to find out the cell in which a mobile station is located so the incoming call for the mobile station can be routed to the corresponding base station. Location update is done by the mobile station to let the network know its current location.

## 5. Results and Discussion

Location update involves reverse control channels while paging involves forward control channels. The total location management cost is the sum of the location update cost and the paging cost. There is a trade-off between the location update cost and the paging cost. If a mobile station updates its location more frequently (incurring higher location update cost), the network knows the location of the mobile station better. Then the paging cost will be lower when an incoming call arrives for the mobile station. Therefore both location update and paging costs cannot be minimized at the same time. However, the total cost can be minimized or one cost can be minimized by putting a bound on the other cost.

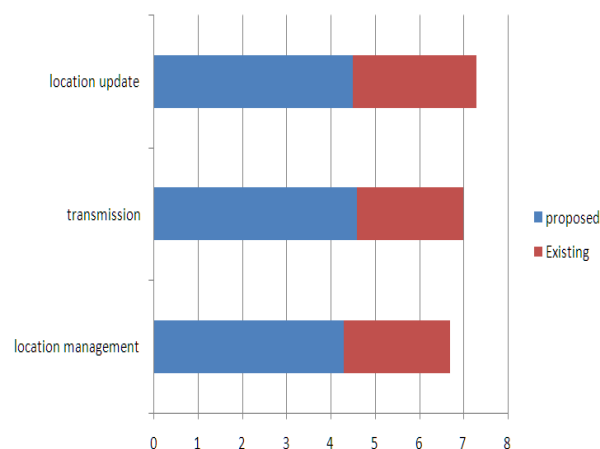


Fig. 6 Comparison of existing and proposed system

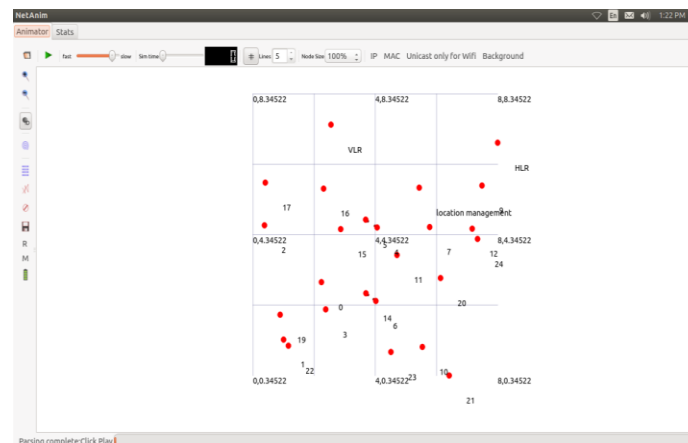


Fig. 7 Nodes Deployment

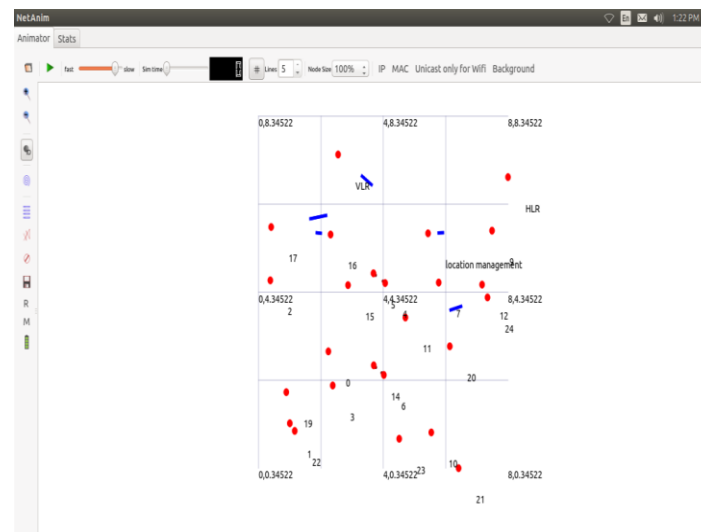


Fig.8 Location Update

## 6. CONCLUSIONS

The existing LM method reduces HLR update without significant increase in PPP compared to forwarding strategy. They have restricted the chain length to unity by introducing the concept of home VLR. The home VLR tracks the mobility of the MT using dual pointers. Our proposed method is based on location management in cellular networks. Paging is performed by the network to find out the cell in which a mobile station is located so the incoming call for the mobile station can be routed to the corresponding base station. Location update is done by the mobile station to let the network know



its current location. There are three metrics involved with location management: location update cost, paging cost, and paging delay. The overall conclusion of this study is that static Location Management schemes are becoming increasingly out of date. While they are still used where cost or resource availability is an issue, upgrading to dynamic schemes is preferable.

#### REFERENCES

- [1] I-R Chen and B. Gu, “Quantitative Analysis of a Hybrid Replication with Forwarding Strategy for Efficient and Uniform Location Management in Mobile Wireless Networks”, IEEE Trans Mobile Computing , Vol. 2. No. 1. January-March, 2003.
- [2] Y. Xiao and H. Chen, “Optimal Periodic Location Area update for Mobile Telecommunications Networks.” IEEE Trans on wireless communications, vol 5, no 4, pp. 930 – 937, April 2006.
- [3] X.Wang, X. Lei, P. Fan, R. Q. Hu, “Cost Analysis of Movement-Based Location Management in PCS Networks: An Embedded Markov Chain Approach”, IEEE Trans. Vehicular Technology, Vol:63, Issue: 4, pp. 1886 – 1902, May 2014.
- [4] X. Wang, W. Jiang, W-N Yuan, H-W Ferng, “Modeling and Cost Analysis of an Improved Movement-Based Location Update Scheme in Wireless Communication Networks”, Wireless Personal Communications, Volume 75, Issue 4, pp 2607-2622, April 2014.
- [5] J. S. M. Ho and I. F. Akyildiz, “Local Anchor Scheme for Reducing Location Tracking Costs in PCNs”, Proc. Mobicom, 1995, pp 181-193.
- [6] EIA/TIA, “Cellular Radio Telecommunication Inter System Operations”, Technical Report IS-41 (Revision B), 1991.
- [7] S. K. Sadhukhan, S. Mandal, P. Bhaumik, D. Saha, “A Novel Direction- Based Diurnal Mobility Model for Handoff Estimation in Cellular Networks”, In Proc IEEE INDICON, Kolkata, India, December 2010.
- [8] C. E. Perkins, “Mobile IP”, IEEE Communications Magazine, Vol:35, Issue:5, pp. 84 – 99, May 1997.