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A Comparative Study on Profile Based Location Management for Personal Communication Network (Pcs)

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ABSTRACT
Location of the mobile user is registered to the two databases for call tracking and those registration processes basis much network traffic. By this speed of Call delivery reduced and location updating cost improved. In this paper, the first method a new meek location management by registering Representative VLR of group of certain VLRs regionally and broadcasting for searching a mobile user, so called rVLR-B.This The representative VLR of several VLRs and register mobile users' location. When set up the call path between mobile users, the VLR of the caller inquiries callee's rVLR for searching the location of callee instead of demanding to VLR of callee. And then rVLR broadcast the callee's location to all VLR of the region simultaneously. Location registration is only performed when a mobile user visits a new rVLR network area from present area. Using the rVLR-B, the cost of maintaining location of mobile users was abridged. The second technique for reducing the costs during the location tracking and location update is proposed. Taking the regular movement pattern of the users it produces the block and the user registers with the HLR only after crossing the block instead of crossing the single cell. The block register (BR) is introduced between the block and the HLR in two level systems to preserve the blocks, thus creates three level architecture. In this architecture some signaling cost values between the MSC-BR, BRHLR and BR-BR are maintained to get the better enactment. By the rVLR-B and BR the performance of speed of call delivery improved and location updation will be diminished.

Keywords: Home Location Register, Visitor Location Register, Mobile Switching Center, Base Station, Block Register, Mobile Station, r-VLR- Representative VLR

I. INTRODUCTION

1.1 Objective

Mobile and wireless network technologies enables us to communicate each other at any time, any place in the ubiquitous personal communications services (PCS). Mobile users can communicate with voice, data, and multimedia services at any time, any place, and in any format using the personal communications services (PCS). The Personal communication service (PCS) network provides the efficient communication to the mobile subscribers. This kind of network supports cellular architecture. Generally GSM standard is used in our discussion. Location management is one of the major issues in mobile networks and used to manage the movements of the mobile users. When the current Mobile Node (MN) change its location from current MSC (Mobile Switching Center) to the new MSC it has to register with the HLR. The messages are exchanged between the HLR and the new VLR. This process of location update is called the Location Registration process. The messages are exchanged between the HLR and the new VLR and the previous VLR to record the current location of the MS in the databases. This process of location update is called the Location Registrationprocess. Similarly, when the call is initiated the messages are exchanged among the VLR of the calling MS and the HLR and the VLR of the called MS to locate the called MS. This process is called the Location Tracking/Call Delivery.

PCS system architecture consists of two parts. Those are radio network and wireless transport network. First, in radio network, mobile users carry mobile stations (MS) to communicate each other with the base stations (BS). PCS system architecture consists of two parts. Those are radio network and wire line transport network. First, in radio network, mobile users carry mobile stations (MS) to communicate each other with the base stations (BS). Next, in wire line transport network, the mobile switching centers (MSC) are connected to the base station by a special switch tailored to mobile applications. Next, in wire line transport network, the mobile switching centers (MSC) are connected to the base station. In the PCS system architecture, base stations (BS) cover the mobile service area .BSs are responsible for relaying the calls to and from the mobile stations (MS) when MSs are located in their coverage areas. If the number of PCS subscribers are increased then HLR will be overloaded.

In the PCS system architecture, base stations (BS) cover the mobile service area as shown in

Figure 1. BSs are responsible for relaying the calls to and from the mobile stations (MS) when MSs are located in their coverage areas. The BSS are connected to Mobile switching centers (MSC) and the MSC interfaces the MSs with the PSTN (Public Switched Telephone Network). Location management two types of database are used, HLR (Home Location Register) and VLR (Visitor Location Register). HLR (Home Location Register) has information of the mobile users as the home system of the mobile user and VLR (Visitor Location Register) is defined as visitor location register of the visited system contrary to HLR, that is, the VLR is the other location register used to retrieve information for handling calls to or from a visiting mobile user. In the PCS system architecture, the mobile users should be registered the current location of the user when the mobile user moves from a coverage area of BS to the coverage area of another BS. Otherwise, it would be impossible to deliver the services to the mobile user. But those registration operations cause much network traffic because of communicating between mobile systems.

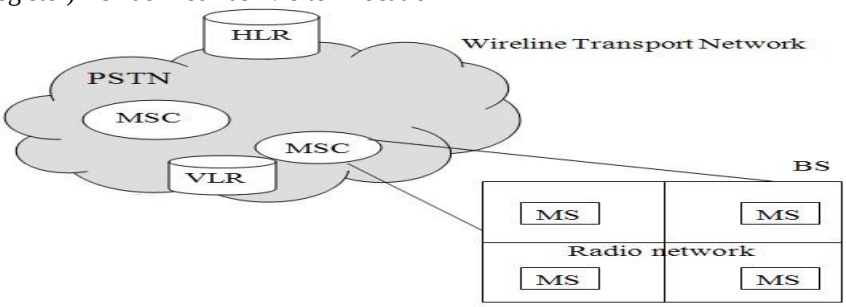

Fig 1-The Basic PCS network architecture

Movement pattern based location management provides a major role in personal communication service (PCS) system. In the conventional two level GSM system, whenever the mobile station (MS) is crossing the present cell it has to register with the Home Location Register (HLR). This involves the use of costly bandwidth between the Mobile Switching Center (MSC) and the HLR. In this paper the technique for reducing the costs during the location tracking and location update is proposed.

Taking the regular movement pattern of the users it creates the block and the user registers with the HLR only after crossing the block instead of crossing the single cell. The block register (BR) is introduced between the block and the HLR in two level systems to maintain the blocks, thus it creates three level architecture. This paper proposed a new simple location management by registering representative VLR of group of several VLRs regionally and broadcasting for searching a mobile user, so called rVLR-B. The representative VLR manages the several VLRs and register mobile users' location when set up the call path between mobile users the VLR of the caller queries callee's rVLR for searching the location of callee instead of requesting to VLR of callee. And then rVLR broadcast the callee's location to all VLR of the region concurrently. Using the rVLR-B, the location updates and network traffic of mobile users are reduced. The second problem is the costs for registration process and call delivery process in standard system are very high. The main aim of our proposed system is to reduce the cost. Several researches are proposed to reduce the costs. The regular movement of the user is repeated day by day.

1.2. Problem Definition

Location management is one of the important issues in personal communications services network. Location management keeps track of the mobile terminals moving from place to place in PCS network. There are two basic problems such as,

- Call delivery
- Location update

Mobile and wireless network technologies enables us to communicate each other at any time, any place in the ubiquitous personal communications services (PCS). Mobile users can communicate with voice, data, and multimedia services at any time, any place, and in any format using the personal communications services (PCS). But for gaining those convenience location registration of the mobile users is always needed because the mobile users have moved here and there at any time. So, first of all location management should be considered in mobile and wireless networks. Location management is one of the most important issues in wireless and mobile networks. That is to manage the movements of the mobile users.

PCS system architecture consists of two parts. Those are radio network and wire line transport network. First, in radio network, mobile users carry mobile stations (MS) to communicate each other with the base stations (BS). Next, in wire linetransport network, the mobile switching centers (MSC) are connected to the base station by a special switch tailored to mobile applications.

In the PCS system architecture, base stations (BS) cover the mobile service area as shown in Figure 1. BSs are responsible for relaying the calls to and from the mobile stations (MS) when MSs are located in their coverage areas. The BSS are connected to Mobile switching centers (MSC) and the MSC interfaces the MSs with the PSTN (Public Switched Telephone Network).

Location management has two types of databases. They are HLR (Home Location Register) and VLR (Visitor Location Register).

HLR (Home Location Register) has information of the mobile users as the home system of the mobile user and VLR (Visitor Location Register) is defined as visitor location register of the visited system contrary to HLR, that is, the VLR is the other location register used to retrieve information for handling calls to or from a visiting mobile user.

In the PCS system architecture, the mobile users should be registered the current location of the user when the mobile user moves from a coverage area of BS to the coverage area of another BS. Otherwise, it would be impossible to deliver the services to the mobile user. But those registration operations cause much network traffic because of communicating between mobile systems.

In this paper first technique, a new simple location management by registering representative VLR of group of several VLRs regionally and broadcasting for searching a mobile user, so called rVLR-B. The representative VLR manages the several VLRs and register mobile users' location when set up the call path between mobile users the VLR of the caller queries callee's rVLR for searching the location of callee instead of requesting to VLR of callee. And then rVLR broadcast the callee's location to all VLR of the region concurrently. Using the rVLR-B, the location updates and network traffic of mobile users are reduced.

The second technique for reducing the updating costs, taking the regular movement pattern of the users it creates the block and the user registers with the HLR only after crossing the block instead of crossing the single cell. The block register (BR) is introduced between the block and the HLR in two level systems to maintain the blocks, thus creates three level architecture.

By the rVLR-B and BR the performance of speed of call delivery increased and location updation will be decreased.

II. MODULE DESCRIPTION

The objective is achieved by first gathering the data's about the user such as the movement of the user and Number of call arrival to the user. Based on this data a number of cases will be available.

CASE 1: During the call arrival, the users may have frequent movement.
CASE 2: During the call arrival, the users may have less movement
CASE 3: Call arrival may high, the users have less movement
CASE 4: Call arrival may low, the users have frequent movement

Modules

There are five modules,

1. Data gathering
2. Forming rVLR-B
   - Assume representative
   - Broadcast to sub VLR
3. Registration in rVLR
   - Returning address to rVLR
   - Registered in rVLR
4. Data Learning
5. Registration Process
   - Movement Pattern
   - Location registration

2.1. Data Gathering

In real time environment, there are varieties of peoples and their usage of mobile network is different. For example, some subscriber will have a frequent moving from one place to another but the receiving calls will be very less. So, based on the movement and paging the location management is defined. First collect the profile of the subscriber's and teaches their activities. In Location management, the database will be updated whenever user enters to a new location. In case 1 it leads to unnecessary updation as user is going to change the Base station frequently but the call arrival rate is very low. The database updating can be reduced by updating the Location database only when call arrives.

2.2. Forming rVLR-B

The proposed broadcasting scheme for location management is described in detail as follows: Consider a new simple location management by registering representative VLR of group of several VLRs regionally and broadcasting for searching a mobile user, so called rVLR-B
The rVLR of the callee broadcasts for tracking the callee's location to all VLR of the rVLR coverage area concurrently.
And then the VLR in which the callee resides returns the routable address to the rVLR.
The rVLR registers the mobile phone number and current VLR to the proposed rVLR database.

2.2.1. Assume representative

Assuming representative VLR (rVLR) of several VLR regionally, when set up the call path between mobile users, the VLR of the caller queries callee's rVLR for searching the location of callee instead of requesting to VLR of callee VLR of group of several VLRs regionally.

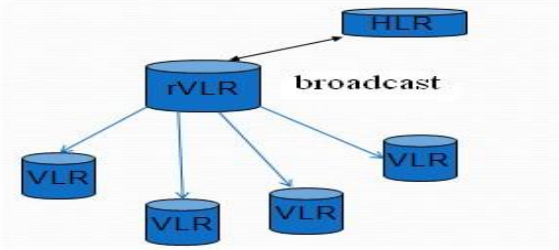

Fig 2: Forming rVLR-B

2.2.2. Broadcast to sub VLR

Whenever a caller make a call to the callee, the queries for tracking the mobile user are send to the VLR of the caller and forwarded to the rVLR through the HLR. These queries are now broadcast from the rVLR to that of the sub VLR. In general the queries are not passed simultaneously to each and every VLR but in proposed system the queries are passed simultaneously to each and every VLR with the help of rVLR so it reduces the network traffic and location update.

2.3 Registration in rVLR

In proposed rVLR, a distributed database is shown in Table 1. The structure of rVLR database is composed of dialed mobile phone number, and routable address of the current VLR. The rVLR database records are updated whenever set up the call path between mobile users.

The rVLR manages and uses 1, 2, …, i, … n, number of mobile phone numbers. And then the set of mobile phone number in a rVLR is defined as PN={pn1, pn2, …pni, … pnn} and set of routable address is represented by VL={vl1, vl2, …vli, … vln}. Let rVLR database table set, rV={pni, vli } and these are denoted as follows:

pni : ith registered phone number in rVLR vli : ith routable address of the phone number

Table 1 - Structure of proposed rVLR database

Registered Phone Number	Routable Address
pn1	vl1
pn2	vl2
……..	…….
pnn	vln

When a mobile user visits a new rVLR's network area from previous area, the mobile phone number is registered to new rVLR database as shown in Table 1. And also the current VLR is registered to the rVLR database as a routable address for call setup. In Table 1, the current VLR means that the mobile user resides in the VLR.

2.3.1. Returning address to rVLR

After rVLR has broadcasted the queries to the sub VLR .These sub VLR are in search of the location of the callee. The VLR which finds the callee's location will send the routable address to the rVLR.

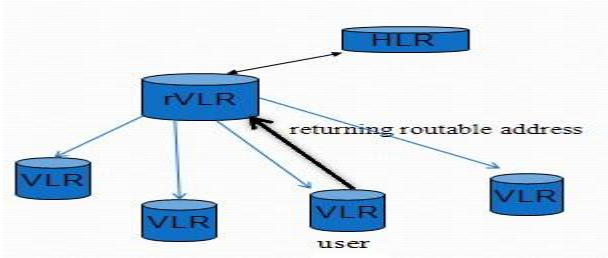

Fig 3: Returning address to rVLR

2.3.2. Registered in rVLR

When the VLR sends the routable address to the VLR, it registers the mobile phone number and current VLR of the callee. Now the rVLR of the callee returns the routable address ti the HLR and the HLR also returns the address to the originating VLR

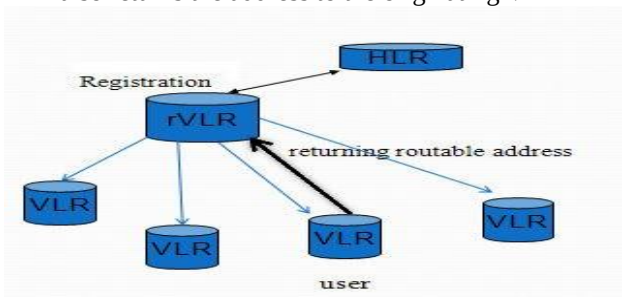

Fig 4: Registered in rVLR

2.4. Data Learning

In this module the regular movement data of the user or MS for training is prepared at HLR for the successive 5 days from the cell crossing data. From those data it is decided that whether the movement is regular or not. If it is found that the movements is regular then collect the MSCs into one block. It is repeated for block size number of times. If the block size is 5 then one block contains 5 MSCs of one user. Then the block register (BR) is assigned for that block.

2.5. Registration Process

2.5.1. Movement Pattern

The regular movement data of the user or MS for training is prepared at HLR for the successive 5 days from the cell crossing data. Then training of data is performed to get the exact performance. This training process is very fast and it is found that the prediction of the correct movement direction is easily achieved.

The multilayer neural network model is used to train the data.

If it is found that the movement is regular then collects the MSCs into one block. It is repeated for BLOCK_SIZE number of times. If the BLOCK_SIZE is 5 then one block contains 5 MSCs of one user. Then the block register (BR) is assigned for that block.

2.5.2 Location Registration

As the MTs move around the network coverage area, to ensure that calls can be delivered successfully, the database is periodically updated through the process called location registration. Location registration is initiated by an MT when it reports its current location to the network (location update). Current systems adopt an approach such that the MT performs a location update whenever it enters a new LA. An LA consists of a number of cells.When an MT enters

There are two kinds of registration: intra-block registration and inter-blockregistration. When the MS moves in the same block it is called the intra-blockregistrationprocess and when the MS moves from one block to another block it is called the inter-block registration. Here, the intrablock and registration processes are described by diagram.

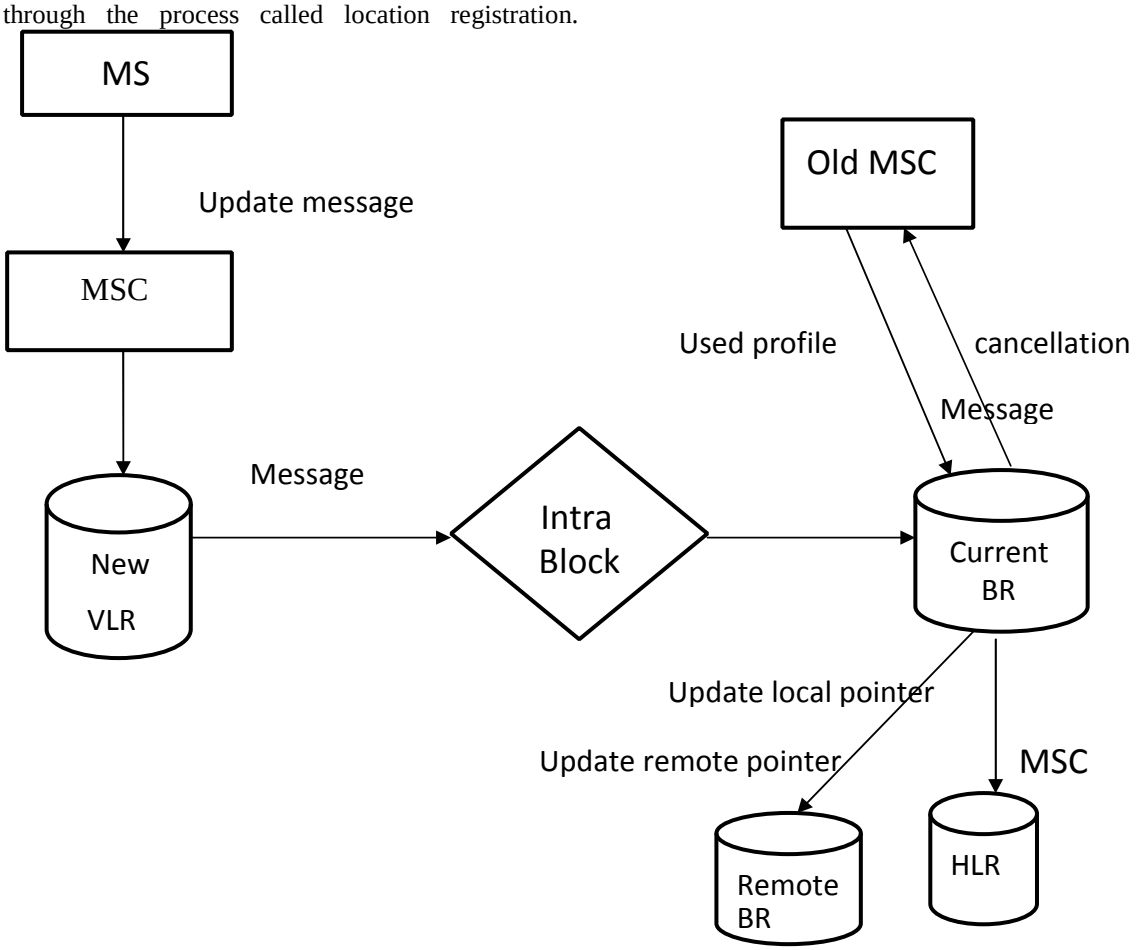

Fig -5 Intra-Block Registration

III. IMPLEMENTATION

To implement this paper , first the cost equations are generated then these equations are used for the comparative study between different sets of values of signaling cost that are generated between different links of the network.

4.1 Cost Equations:

There are some parameters which are required to implement the proposed system. These parameters are explained in the following given table:

Table 2 -Cost Variable Parameters

Cost Variable	Description
cost_hlr	Update or querying HLR
cost_vlr	Update or querying VLR
cost_BR	Update or querying BR
sig 1	Cost for messaging between BR and MSC
sig 2	Cost for messaging between BR and HLR
sig 3	Cost for messaging between two BR Locality of movement

Table 3- Cost Variable Expression

Cost Variable	**Expressions**
x1 (Cost for location registration during intra block movement if sending id of the current MSC to HLR is required)	2cost_vlr+cost_BR+cost_hlr+6sig1+2sig2(e.g.:1.cost of newVLR/MSC(cost_vlr) 2.cost of old VLR/MSC(cost_vlr) 3.costof BR(cost_BR)4.cost of HLR(cost_hlr) 5.six messages exchanged between BR and old VLR/new VLR 6. two messages between BR and HLR
x2 (Same as x1 but when sending id is not required)	2cost_vlr+cost_BR+6sig1
x3 (Cost for location registration after an inter block movement)	2cost_vlr+2cost_BR+cost_hlr+6(sig1+sig2)
y1(cost for location tracking if remote pointer for the called MS is available)	2cost_vlr+cost_BR+4sig1+2sig3
y2(Cost for location tracking / call delivery for the called MS is not available and HLR query is required for current serving BR	2cost_vlr+2cost_BR+cost_hlr+4(sig1+sig2
y3 (Same as y2 but here HLR query is required for current MSC)	2cost_vlr+cost_BR+cost_hlr+4(sig1+sig2)
y4(Same as y2 but here HLR query is required for current MSC)	2cost_vlr+cost_BR+4sig1
z(cost for updating the remote pointer)	Cost_BR+2sig3
for standard GSM system	C'=(rate_call_arrival+rate_mobility)(4(sig1+sig2) +2cost_vlr+cost_hlr+cost_gtt) cost_gtt:cost for global address translation

4.2 Comparative Study:

In the first phase, assuming that the signaling cost dominates so for simplicity taking the database access costs as 0. Some random signaling costs are given in table below. The value of sig1 takes (cost between the MSC and BR) 1 because BR is placed as close as MSC. We are comparing the cost ratios between the different sets for all values of CMR (call-mobility ratio). If plot the cost ratio against CMR where CMR varies from 0-10. Generally the cost ratio increases with the value of CMR. When the CMR is low the mobility rate is high so that the registration cost will be high. In this situation the saving cost will be obtained when the MS changes the BLOCK that means, the MS registers with the HLR only when it is crossing one block. When CMR is high, the mobility rate is low the cost saving will be obtained from the call arrival

Table 4 Cost Variable Parameters

Set1	**Sig1(MSC-BR)**	**Sig2(BR-HLR)**	**Sig3(BR-BR)**
	1	5	2
2	1	5	10
3	1	10	2
4	1	10	10

Cost ratio	**Set1**	**Set2**	**Set3**	**Set4**
	0.56	0.72	0.47	0.61

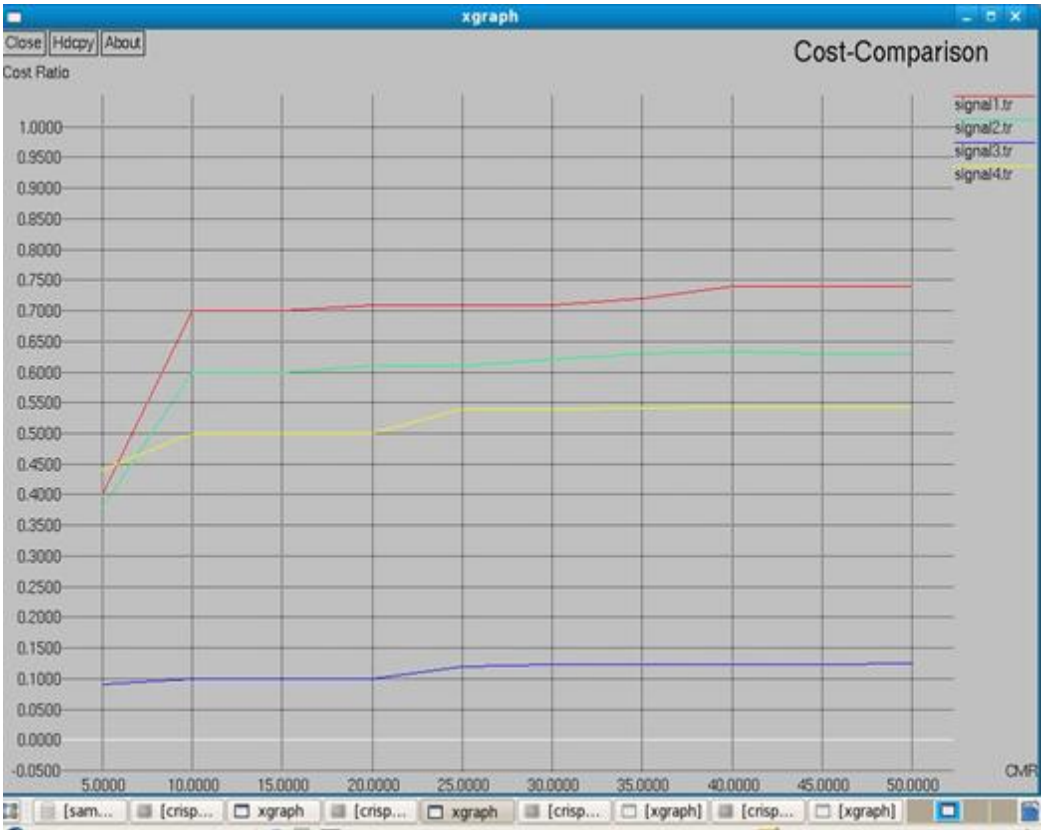

Fig 6: Comparison graph1

If the value between the BR and HLR has increased then the cost ratio will be decreases in our proposed system.

Table 5Cost Variable Expression

Set2	Sig1(MSC-BR)	Sig2(BR-HLR)	Sig3(BR-BR)
	1	5	2
2	1	5	20
3	1	20	2
4	1	20	20

Cost ratio	Set1	Set2	Set3	Set4
	0.55	0.72	0.42	0.58

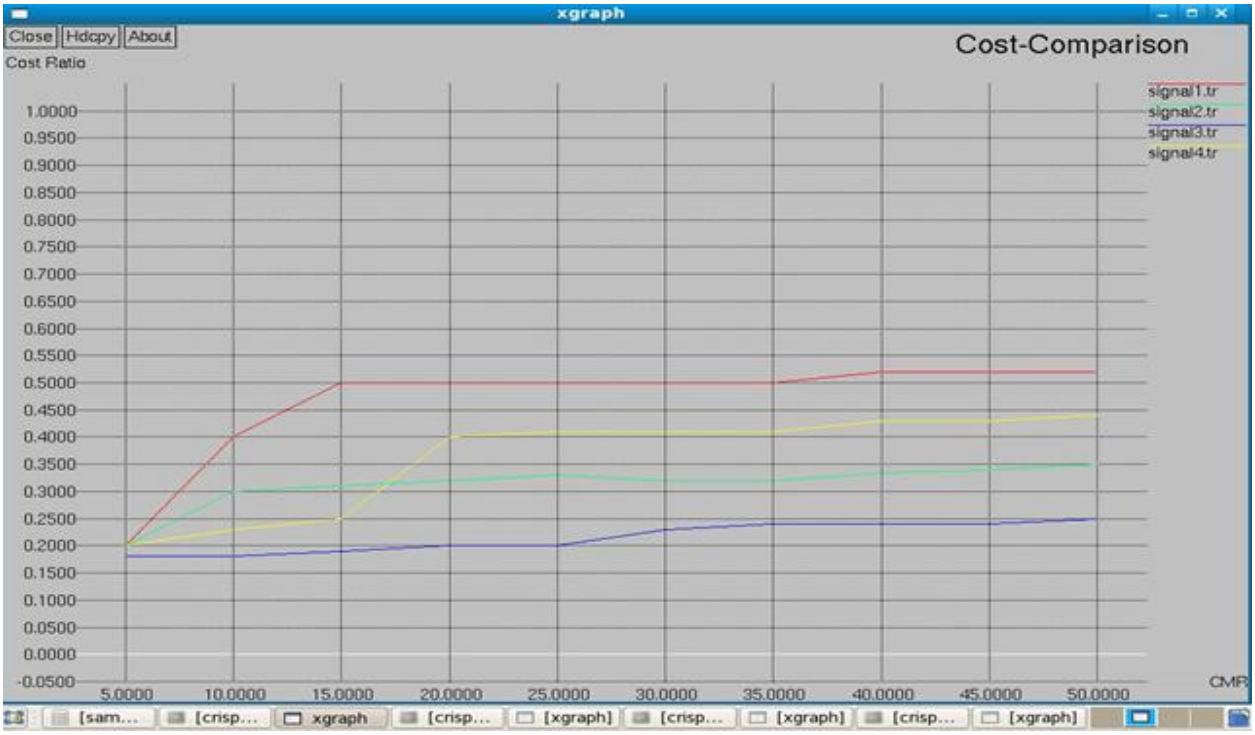

Fig 7- Comparison graph2

Table 6 Cost set ratio

Set3	Sig1(MSC-BR)	Sig2(BR-HLR)	Sig3(BR-BR)
	1	5	2
2	1	5	10
3	1	50	2
4	1	50	10

Cost ratio	Set1	Set2	Set3	Set4
	0.55	0.72	0.4	0.42

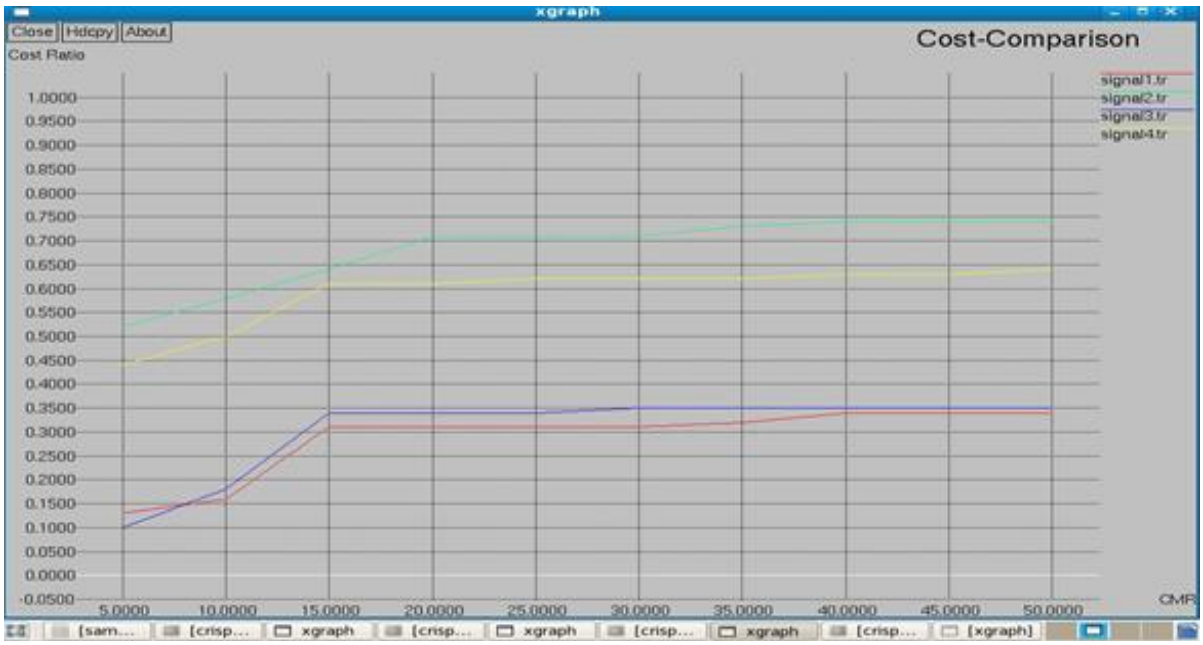

Fig 8-Comparison graph3

4.3 Observation from above Tables:

Comparing between set1 and set2 demonstrates that sig3 is used during the location tracking/call delivery process (during the high CMR). At this time signaling messages are exchanged between the two BR. No signaling messages are sent between the two BR during the registration process. So that the smaller value of sig3 gives smaller cost ratio when remote pointers are used. Cost ratio decreases under all CMR values in case of set3 as compared to set1 because the signaling cost between the BR and the HLR (sig2) has increased to reduce the costly HLR access. In this case cost for the standard system will be higher.

Now, if the value between the two BR is placed according to the table and the value between the BR and the HLR have increased then the result will be in the following:

Set3 gives the better result in set2 than set1

Placing the value between the two BR as 10 and between the BR and the HLR as 50 in set4

Performance improves of set3 from tables:

Performance _improvement = (0.50-0.40)/ (0.50)*100

=17.5%

The performance improvement of set4 using TABLE VI than table gives:

Performance _improvement = ((0.70-0.42)/(0.70))*100

= 40%

IV. CONCLUSION

Mobile users move anywhere in mobile networks, and then location registration for call tracking is always needed. The location management is performed by using two registers HLR (Home Location Register) and VLR (Visitor Location Register). And those registration operations cause much network traffic and more location update.

In this paper, a new simple location management by registering representative VLR of group of several VLRs regionally and broadcasting for searching a mobile user, so called rVLRB. It manages the representative VLR of several VLRs and register mobile users location. When set up the call path between mobile users, the VLR of the caller queries callee's rVLR for searching the location of callee instead of requesting to VLR of callee. And then rVLR broadcast the callee's location to all VLR of the region concurrently. Location registration is only performed when a mobile user visits a new rVLR network area from current area. Using the rVLR-B, the speed of the call delivery in location management can be increased.

In this paper a new concept has been developed to reduce registration cost of user. Movement based location scheme helps to create block which is the group of MSCs so that the registration with HLR will be performed only after crossing the block. The principle assumption here is that the user's mobility pattern has recorded for some few days and from that record next day's prediction has been generated.

After training, the blocks are created for particular numbers of MSCs. In standard GSM system the registration is performed only after crossing the location area that is group of cells. After creation of block a block register is maintained to control each block using local and remote pointers. So, the two levels GSM standard system is now three level systems in which a block register is introduced between MSC and HLR.

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