IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-3, March 2019 E-ISSN: 2347-2693

# Cost Reduction for Mobile communication using Check Manager Method

**Debabrata Sarddar[1*], Pinaki Das[2], Rajat Pandit[3]**

[1]Department of Computer Science & Engineering, University of Kalyani, Kalyani, India
[2]Department of Computer Science & Engineering, University of Kalyani, Kalyani, India
[3]Department of Computer Science, West Bengal State University, West Bengal, India

[*]*Corresponding Author: daspinaki1985@gmail.com, Tel.: +91-8013241364*

DOI: https://doi.org/10.26438/ijcse/v7i3.495501 | Available online at: www.ijcseonline.org

Accepted: 08/Mar/2019, Published: 31/Mar/2019

***Abstract*—** The mobility management of the mobile node are depending on the movement of mobile node, cell channel, handover and frequency reuse. When many MN are connected in a cell or sub cell, according to the TBMM cell are divided in two time phrase those are active and idle phrase. In check manager method the time are dynamic. It is depended on the number of mobile node at that time. When minimum MN are connected in the cell, a new MN are want to established the new connection or make the handover, the cell are check the free channel availability. If the channel is available in main cell then the connection are made through the main cell or generated a request signal to the corresponding sub cell to allocate the channel for new connection or make the handover successfully. The mathematical analysis and simulation result are shown that the check manager are better than the TBMM and standard mobility management methods.

***Keywords*—** Check Manager, Time base mobility management, Handover, Channel Allocation, Frequency Reuse

## I. INTRODUCTION

When a mobile node are moving and the MN are cross one cell area and goes to another cell area. Then the MN are check the signal power level of both cell BTS/ BS, if the MN are cross the ping pong point [1] then the MN are request to the old and new BTS to make the handover. Then the MN request the new tower to create or allocate the channel for makes the new connection.

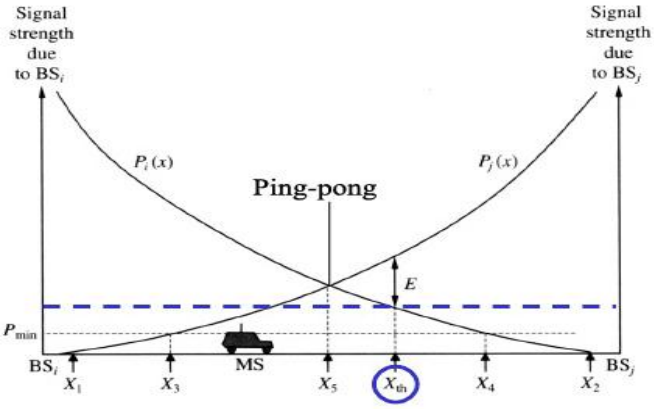


Figure 1. ping-pong point.

The handoff or hand over is 4 types in the GSM architecture.

1. **Intra – BTS Handover:** This type of handover basically performed the optimized and improved the connection quality. In this hand off the load are optimized for a BTS and used the various frequencies to improve the quality of call [2].

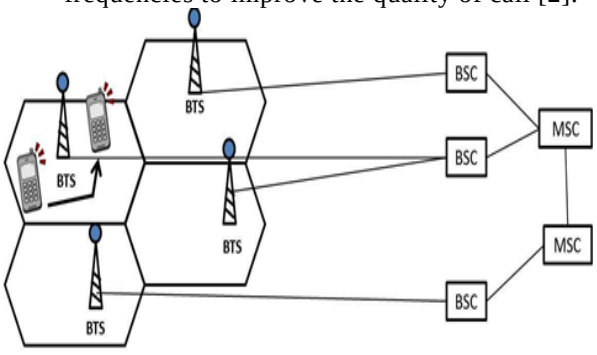


Figure 2. Intra – BTS Handover.

2. **Intra – BSC Handover:** Intra – BSC hand over basically perform one BTS to another BTS within a single BSC. When a MN moves from one BTS to another BTS, after completing the authentication the new BTS assign a radio

 

channel for continuation of connection. Then the old BTS connection is removed [3].

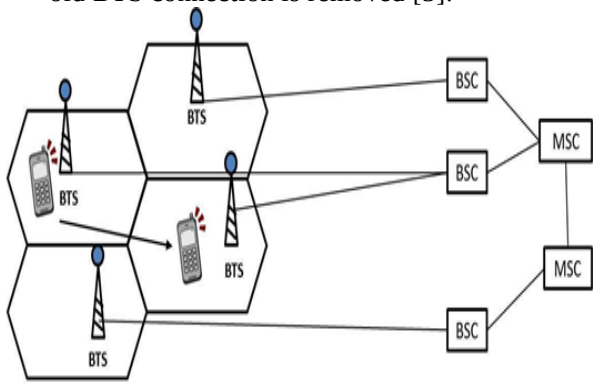


Figure 3. Intra – BSC Handover.

3. **Inter – BSC Handover:** A limited number of BTS or cell can control by the BSC. In inter – BSC hand over, the mobile nodes can moved from one BTS to another BTS, where the two BTS under the two different BSC.

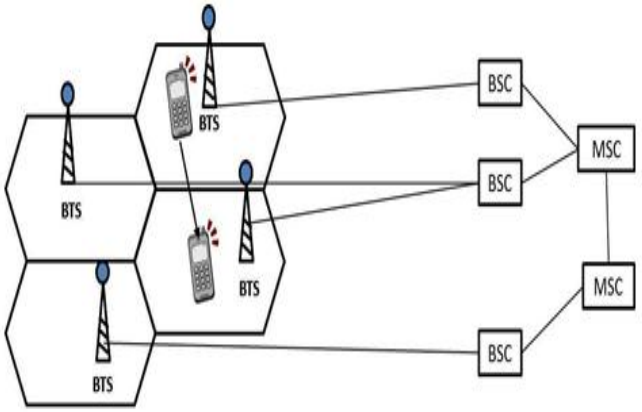


Figure 4. Inter – BSC Handover

4. **Inter – MSC Handover:** When a mobile node is moved from one BTS to another BTS, if the old BTS are belonging one MSC under a BSC and the new BTS belonging another MSC under a BSC then this is called Inter – MSC handover.

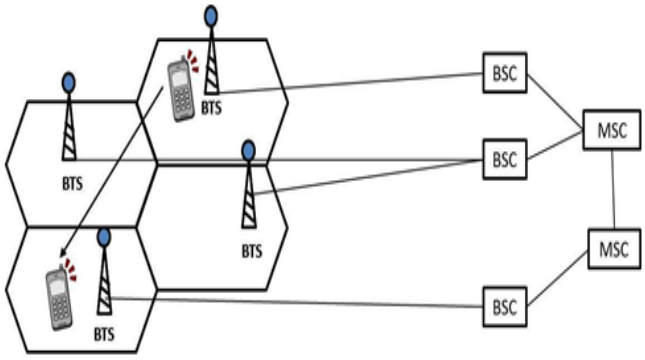


Figure 5. Inter – MSC Hand over

Another two types of handoff are soft handoff and hard handoff based on connection.

1. **Hard handoff:** Break before make, in this type connection with the source channel/ BTS/ BSC is first broken before making connection with target channel/ BTS/ BSC [4].

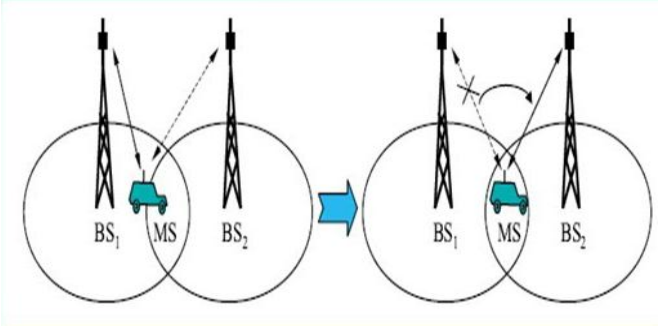


Figure 6. Hard handoff

2. **Soft handoff:** Make before break, in this type connection with the source channel/ BTS/ BSC is retained for some time before connection with the target channel/ BTS/ BSC is established [5][6].

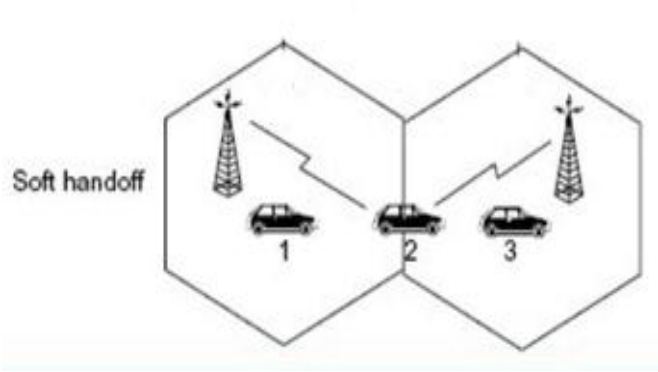


Figure 7. Soft Handoff

**Cause of Handover:** The hand over are makes due to some reasons, that are discuss below.

**Level Triggered Handover:** The receiving signal of MN is weak from another BTS signal then hand over is occurring.

**Intra-cell Handover:** The assigned time slot/frequency is interfered, then initiates the handover and assign the new channel for connection.

**Speed triggered Handover:** This handover basically used for slowing moving MN.

 

**Maintenance Handover:** when a cell is maintained then all MN are move to adjacent cell for making the continuation of connection.

## II. RELATED WORK

### 1. Mobility Management in Mobile Network:

The management of the mobility in mobile node is mainly depending on binding update and data delivery [7].

- **Binding Update:** The binding update depends on the Reachability Identity and Routing Identity.
- **Reachability Identity:** The unique name of the node that has not being change is known as Reachability Identity.
- **Routing Identity:** When a MN are moved inside a cell or one cell to another cell the Routing ID are change and also update the old binding. The location directory (LD) assigning the new routing ID for update the binding [8].

The location management is two types that are Precise Location Management and Loose Location Management.

- **Precise Location Management:** The MN are identified his position by the Routing Identity. If MN moves frequently then the update bind cost is higher [9].

**Loose Location Management:** In this management the identification of MN is based on paging areas. The paging is very costly so this is the disadvantages of that management.

### 2. Time base Mobility Management:

This mobility completely based on the time. From Previous study we know that every MN has a particular pattern for mobility [10]. Maximum mobile nodes are spent the maximum time in a particular cell. This timing (24hours) are divided in two phrase that are Active Phrase and Idle Phrase.

In TBMM method the MN mobility management are depends on the timing phrase.

When am MN are request to connect then cell check the timing period means MN are in active time or idle time. If the MN is in active phrase then use the precise location manages system. If mobile in idle phrase then use the loose location management.

Then find the MN location using the GPS. Then handoff or new connection make using local forwarding scheme [11].

## III. METHODOLOGY

Here we are proposed Check Manager a new method for dynamic time base sub cell activation or deactivation under a main cell. This is the basic concept of Time Base Mobility Management (TBMM) [11] on the depending of various time periods of a day and night. The ideas of the paper are based on the following points.

From other paper we know the mobile node has a particular pattern of mobility depending of time under the various cell and sub cell. In the particular time some cell or sub cell are most active.

Also we know that a particular time when the cell or sub cells are mostly deactivated. If we study the database of Base Transceiver Station (BTS) or Base Station (BS) we find the various time for the busyness and idealness of cell or sub cell. From above points, previously we divide the 24 hours' time in to the two parts. Those are shows below.

- **Active Phrase:** In that time a cell or sub cell are most busy during the handle of call and handoff. In that time the Mobile Node (MN) are accept the maximum call and make the call from foreign cell or foreign sub cell.
- **Ideal Phrase:** In that time the most MN are ideal and the call making and receiving are very least.

### *A. CHECK MANAGER DESIGN:*

The design of check manager is based on database formation, Dynamic timing area making, Movement detection, registration, and connection set up.

- *Data Base Formation:*

A data base is formed in BTS for storing the data of MN with the following property.

I. This database update itself every day basis.

II. Each day it will calculate the total no of call and call duration with respect to time.

III. When the MN changes the cell or sub cell the database store the cell ID or Sub cell ID and time.

The Billboard manager (BM) [12] or location directory can saved this database.

- *Timing Area Construction:*

In TBMM method the timing area are divided base on the activity of the MN. The main cell are base of the centre of sub cell, the sub cell are enhanced the cellular channel but all

 

time the channel enhancement are not required. So we need the dynamic time area.

In dynamic time area, when the channel necessity are increased the sub cell are active to give the service or enhanced the cellular channel. In which time the demanding of the cellular channels is decreased the sub cells are switched off.

- *Movement Detection:*

A mobile node are sometimes move very fast sometime are very slow or no movement. So these movements are divided in two parts. Those parts are described as below.

I. **Active Part:** This active part the MN is moving or change cell or sub cell or changing the position very quickly and they make registration through binding update. The MN is identified through its SIM no and IMEI no which is store in home location register (HLR).

II. **Idle Part:** In idle part the MN are change the home sub cell within the home cell the registration are no required but when they change the home cell the registration are required.

- *Registration:*

The registration procedure is required for changes of cell or sub cell. A MN are in active stage the registration are required but in idle stage the MN are not change his cell so the registration are not required.

- *Connection Set Up:*

In the proposed Check Manager method the MN location are based on the 'Time'. As in the Active and Idle part, we need to very conscious to handle the connection when make the handoff from cell to cell or sub cell to sub cell in an on-going call. The Check Manager algorithm has preferred to establish a connection and perform the handover perfectly.

*B. CHECK MANAGER ALGORITHM:*

When a MN want a new connection or handoff in any time the Check Manager are check the available channel in cell or sub cell and create a call or handoff. The Checker Manager is managing this channel. The Check Manager algorithm is shown below.

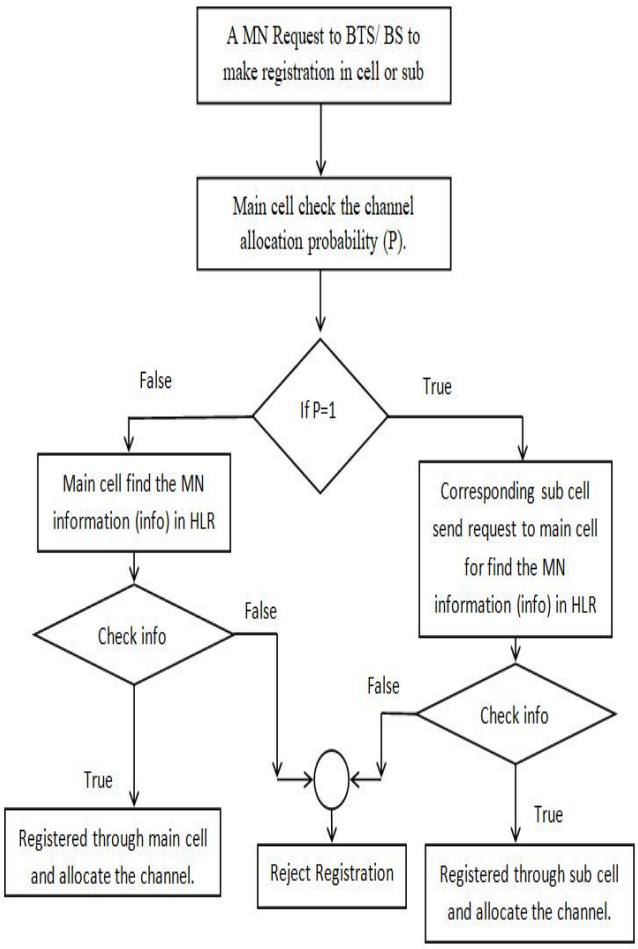


Figure 8. Check Manager Algorithm.

**Step 1:** When a MN are want setup a new connection, they sent the signal to the corresponding cell or sub cell, the BTS/ BS check the busyness of this cell and available channel for connection.

**Step 2:** If the MN want a channel and the check manager check the probability of the channel of a main cell. If no channels are available then check the corresponding sub cell channel.

**Step 3:** If the check manager find the probability is 1 then no channel are free in the main cell for connection. Then main cell send the request corresponding sub cell to allocate the channel. If the probability value is not 1 then the main cell has the free channel for make the new connection setup.

**Step 4:** If free channel is fined in the main cell the main cell check the MN information from HLR and check the authentication of this MN. If the authentication is true then allocate the channel or this mobile node migrated from another cell then make the handoff. If the free

 

channel is fined in the sub cell then sub cell send a request to main cell for check the information and authentication. If all are correct then allocate the channel for connection or make the handoff.

**Step 5:** If the information and authentication is false the new connection are not make or handoff are not done.

*C. ADVANTAGES:*

The check manager method has some advantages, that's are following,

- In this method there has no time boundary like active or idle phrase. The main cell always check the channel allocation probability of own channel or his under sub cell channel. If the channel of main cell is free then allocate the channel of main cell otherwise corresponding sub cell channel. For that case when the main cell is busy then only active or allocate the sub cell channel.

- In previous work the 24 hours' time are divided in two part active and idle phrase, in basis of the busyness. But the new method are dynamic, no fixed time limitation for two phrase, so the main cell are always calculate the probability of busyness time and update his phrase in every time. So the cells are intelligent to provide the services to any time period.
- If any time the connection of MN is minimum in sub cell and if any sub cell is free then the sub cell are sleep down, in that moment any new connection is required then main cell check for free channel if no channel are free then corresponding sub cell is wakeup and providing the service. So the cost and power management are reduce for a cell and corresponding sub cells.

*D. COST ANALYSIS:*

In this part we calculate the cost of Check Manager for MN.

**MIP, P – MIP, TBMM and our proposed method for cost Management:** All the costs are show below.

- **Mobile IP:** the binding cost and the handover occurrence is the main cost of MIP [12]. The MIP cost is denoted by $C_{MIP}(t)$.

  $C_{MIP}(t)=M.H_{MNLD}.R_{HO}(t)$

  $H_{MNLD}$ = No of hope between mobile node and location directory.

- **Paging in Mobile IP:** the active MN updates there binding according there handover occurrence in P – MIP [13]. When the MN cross the boundary of a paging at time t, $R_{p\_area}(t)$ is

$$R_{p_{area}} = V_{sat}.L_{p_{area}}.\int_{V_{sat(t-\Delta t)}}^{V_{satt}} DL(V_{sat.t})dt \quad (2)$$

$L_{p\_area}$=boundary length of paging area

The cost of P – MIP $C_{P-MIP}(t)$ is

$$C_{P-MIP}(t)=M.H_{MNLD}.R_{p\_area}(t)+ M.H_{MNLD}.\{R_{HO}(t)-R_{p\_area}(t)\}.\alpha + \{M.H_{ARAR}.(S-1)+M.S\}.n(t).(1-\alpha).\lambda \quad (3)$$

n(t)= At time t the total no of node in coverage area.

α= The ration between active mobile node and total no of nodes.

λ= New connection to a mobile node.

n(t).(1-α).λ= Paging occurrence rate.

- **Time Base Mobility Management** [14]: In this method the total cost are divided in two parts. In active phrase cost is $C_{active}$ and idle phrase cost is $C_{idle}$. The total cost is $C_{tot}$.

$$C_{tot}=\{C_{active}.h+c_{idle}(24-h)\}/24 \quad (4)$$

h= no of hours in active phrase.

$$C_{active}=M.H_{MNLD}.R_{HO}(t) \quad (5)$$

Total rate of binding update is

$$R_{TM}(t)=C.V_{node}.L_{cell}.\int_{V_{node(t-\Delta t)}}^{V_{satt}} D_n(V_{sat.t})dt \quad (6)$$

$V_{node}$= Velocity of node.

$L_{cell}$= Cell boundary length

$$C_{idle}= M.H_{MNLD}.R_{TM}(t)+M_{HARAR}.R_{HO}(t).\alpha \quad (7)$$

Then the total cost is

$$C_{tot}=\{M.H_{MNLD}.R_{HO}(t).h+ M.H_{MNLD}.R_{TM}(t)+ M.H_{ARAR}.R_{HO}(t).\alpha+ (24-h)\}/24 \quad (8)$$

- **Check Manager Method:**

The total cost is

$$C_{tot}=\{C_{active}.h+c_{idle}(24-h)\}/24 \quad (9)$$

$$C_{active}=\sum_{0.8}^{1} M.H_{MNLD}.R_{HO}(t).h$$

$$C_{idle}=\sum_{0.0}^{<0.8} M.H_{MNLD}.R_{TM}(t)\}+ M.H_{ARAR}.R_{HO}(t).\alpha+(24-h) \quad (10)$$

$$C_{tot}=\{\sum_{0.8}^{1} M.H_{MNLD}.R_{HO}(t).h + \sum_{0.0}^{<0.8} M.H_{MNLD}.R_{TM}(t)\}+ M.H_{ARAR}.R_{HO}(t).\alpha+(24-h)\ \}/24 \quad (11)$$

 

## IV. RESULTS AND DISCUSSION

The Check Manager method finds out the cost and reduces the cost of handover and new connection. The simulation runs on MATLAB 2018 software.
Consider the following data that are used for simulate the problem.

| Sl No | Parameters | Values |
|---|---|---|
| 1 | Velocity of Node($V_{node}$) | 60Km/Hour |
| 2 | Cell boundary length($L_{cell}$) | 7Km |
| 3 | M | 10 |
| 4 | $H_{MNLD}$ | 2 |
| 5 | $H_{ARAR}$ | 1 |
| 6 | α | 15% |
| 7 | Δt | 1sec |
| 8 | Probability(p) | >=0.8($C_{active}$), >0.1 - <0.8($C_{idle}$) |
| 9 | Number of Node | $10^6$ |
| 10 | Total Time | 24 Hours |

Table 1: Simulation Data.

- **Cost Management vs. Distance:**

The node density is calculate as the ratio of total number of node and activated node. The cost is divided in two parts one is cost for active time and second is cost for idle time.

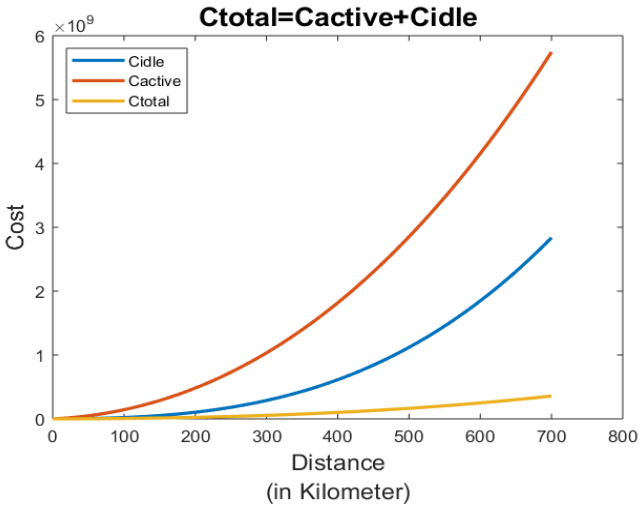


Figure 9. Cost management Vs. Distance

This graph had shown the total cost, active cost and idle cost in respect of the distance. If we increase the distance of service the cost will be high as shown in above figure.

- **Cost Management vs. Node**

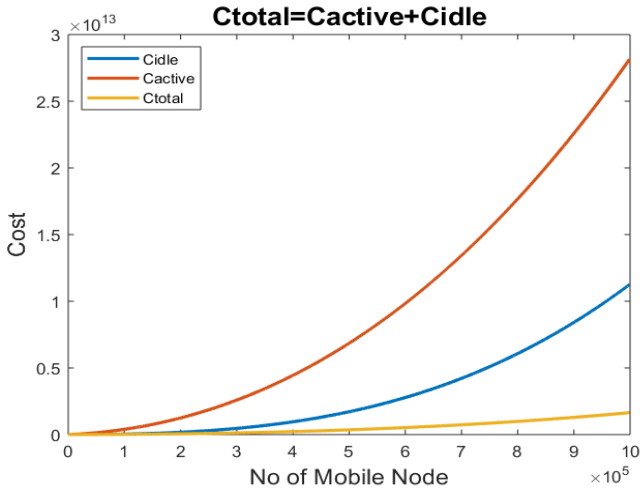


Figure 10. Cost management vs. no of mobile node

This graph had shown the total cost, active cost and idle cost in respect of the no of mobile node. If we increase the no of node the cost will be high as shown in above figure.

## V. CONCLUSION AND FUTURE SCOPE

- **Conclusion:**

The approaches of Check Manager method we are reduce the cost of handover. At first we describe the various type of handoff and that handoff takes the various costs. If the hand off make in busy time the cost will be high otherwise the cost will be reduce.in this method the simulating result is shows the total cost is minimized in 24 hours or a day. This is the based on the dynamic TBMM method. In check manager method, the active and idle time is not fixed, both are variable and that depends on the probable value of busy of main cell. So we can use it in our cell to reduce the cost in future.

- **Future Scope:**

In our future work we will try to reduce cost in active and idle time for every MN when occur the handover using this Check Manager method.

## VI. ABBREVIATIONS

| | |
|---|---|
| MN | Mobile Node |
| TBMM | Time base Mobility Management |
| BTS | Base transceiver station |
| BS | Base Station |
| MSC | Mobile Switching Centre |
| BSC | Base Station Controller |

 

| | |
|---|---|
| LD | location directory |
| GPS | Global Positioning System |
| BM | Billboard manager |
| SIM | Subscriber Identity Module |
| IMEI | International Mobile Equipment Identity |
| HLR | home location register |

Table 2: Abbreviation List


## ACKNOWLEDGMENT

We would also like to acknowledge DST-PURSE-II Programme for their kind co-operation.


## REFERENCES


[1] Dr. Mahdi H. A. Ahmad, "Minimizing Handoff Ping-Pong Effect in 802.11 Data Networks Using Differential RSS and Extrapolation", Journal of Science & Technology, vol. (14), No.(1), 2009.

[2] David Lopez-P ´ erez, Alvaro Valcarce, ´ Akos Lad ´ anyi, Guillaume de la Roche, and Jie Zhang ´ Centre for Wireless Network Design (CWiND), University of Bedfordshire, D109 Park Square, Luton LU1 3JU, UK, "Intracell Handover for Interference and Handover Mitigation in OFDMA Two-Tier Macrocell-Femtocell Networks", Hindawi Publishing Corporation EURASIP Journal on Wireless Communications and Networking Volume 2010, Article ID 142629, 15 pages

[3] David L´opez-P´erez, ¨Ismail G¨uvenc¸, Guillaume de la Roche, Marios Kountouris, Tony Q.S. Quek, Jie Zhang, "Enhanced Inter-Cell Interference Coordination Challenges in Heterogeneous Networks.", Published in**:** IEEE Wireless Communications ( Volume: 18 , Issue: 3 , June 2011 )

[4] Yi-Bing Lin, Dept. of Comput. Sci. & Inf. Eng., Nat. Chiao Tung Univ., Hsinchu, Taiwan Ai-Chun Pang, "Comparing soft and hard handoffs", IEEE Transactions on Vehicular Technology ( Volume: 49 , Issue: 3 , May 2000 )

[5] M. Chopra, Cellular Infrastructure Group, Motorola, Fort Worth, TX, USA, K. Rohani, Cellular Infrastructure Group, Motorola, Fort Worth, TX, USA, J.D. Reed, Cellular Infrastructure Group, Motorola, Fort Worth, TX, USA, "Analysis of CDMA range extension due to soft handoff", IEEE Xplore**:** 06 August 2002, Published in**:** 1995 IEEE 45th Vehicular Technology Conference. Countdown to the Wireless Twenty-First Century.

[6] Yu-Wen Chang, Inst. for Syst. Res., Maryland Univ., College Park, MD, USA, E. Geraniotis Inst. for Syst. Res., Maryland Univ., College Park, MD, USA, "Accurate computations of cell coverage areas for CDMA hard and soft handoffs", IEEE Xplore**:** 06 August 2002, Published in**:** Proceedings of Vehicular Technology Conference – VTC.

[7] J. T. Malinen and C. Williams, "Micromobility taxonomy," Internet Draft, IETF, Nov. 2001

[8] P. Bhagwat, C Perkins and S. Tripathi", Network Layer Mobility: An architecture and survey," IEEE Pers. Commun., vol. 3, no. 3,pp. 54 – 64, June 1996.

[9] A. T. Campbell, J Gomez, S. Kim, Z. Turanyi, C.-Y. Wan and A. Valko, "Comparison of IP micro-mobility protocols", IEEE Wireless Commun. Mag., vol. 9, no. 1, Feb. 2002.

[10] E. Cayirei and I.F. Akyildiz, "User mobility pattern scheme for location update and paging in wireless systems," IEEE Trans. Mobile Computing, vol. 1, no. 3, pp. 236 – 247, 2002

[11] D. Sarddar, "A time base mobility management method for Leo satellite network." International Journal of computer application, vol. 42, no. 2, pp. 33 – 40, March 2012

[12] Jiang Xie, Sch. of Electr. & Comput. Eng., Georgia Inst. of Technol., Atlanta, GA, USA & R. Akyildiz, Sch. of Electr. & Comput. Eng., Georgia Inst. of Technol., Atlanta, GA, USA, Article: An optimal location management scheme for minimizing signaling cost in Mobile IP. 2002 IEEE International Conference on Communications. Conference Proceedings. ICC 2002 (Cat. No.02CH37333), DOI: 10.1109/ICC.2002.997445, 07 August 2002

[13] Xiaowei Zhang, Javier Gomez Castellanos, Andrew T. Campbell. Article: P-MIP: Paging Extensions for Mobile IP, Mobile Networks and Applications, April 2002, Volume 7, Issue 2, pp 127–141

[14] Debobrata Sarddar, Soumya Das, Dipsikha Ganguli, Sougata Chakraborty, Kunal Hui, Kalyan Kumar Das and Mrinal Kanti Naskar. Article: A New Method for First and Low Cost Handover in Leo Satellites. International Journal of Computer Application 37(7): 39 – 45, January, 2012. Published by Foundation of Computer Science, New York, USA.


## Authors Profile


**Dr. Debabrata Sarddar** received his B.Tech degree from NIT Durgapur West Bengal, India in 2001 and M.Tech degree in DAVV Indore, Madhya Pradesh, India in 2006. He is awarded Ph.D. from Jadavpur University, India. Currently he is Assistant Professor in Department of Computer Science and Engineering, University of Kalyani, Kalyani, West Bengal, India. His published journal paper no is 200, books is 3, patent is 1 and the book chapter is 12. His research interests include mobile communication, satellite communication.
Email: dsarddar1@gmail.com

**Mr. Pinaki Das** is currently pursuing his Ph.D. at University of Kalyani. He completed his M.Tech in Mobile Communication and Networking Technology from W.B.U.T (MAKAUT), West Bengal, India in 2015, M.Sc at Vidyasagar University, West Bengal, India in 2010 and B.Sc. at University of Kalyani, Wes Bengal, India in 2008. His research interest includes wireless and mobile communication.
Email: daspinaki1985@gmail.com.

**Rajat Pandit** is an assistant professor in the Department of Computer Science, West Bengal State University, West Bengal, India. He has completed his M.Tech (IT) from West Bengal ,University of Technology, West Bengal, India in 2009. He has completed his MCA from Jadavpur University, West Bengal, India in 2001. His research interest includes Mobile Computing, Wireless Sensor Network and Cloud Computing.
Email: rajatpandit123@gmail.com


 