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The Reorganization of the Load Associated with Base Stations in Mobile Communication Networks

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***Abstract*—The technique that enables mobile nodes to move to a base station with a lower load, provided that their signal-to-noise ratios are comparable or identical to one another. In wireless and mobile networks, this strategy enables the base station to initiate the handover process, which in turn enables a fairer distribution of the load created by mobile nodes among the base stations that are located in close proximity to one another. The proposed change of the approach involves the addition of a threshold value for the use of the uplink channel's capacity, as well as the addition of a function that evaluates the bandwidth at which the uplink channel operates. Therefore, when the current value of bandwidth hits the threshold, the base station begins sending out a message to all mobile nodes and checks that there are open regions in the surrounding area for switching over mobile nodes. It is the responsibility of the base station to inform all possible candidates about the requirement of moving over to the new location if there are neighbouring locations with a lower load. In the event that the base station's available bandwidth falls below a certain level, the handover procedure is initiated. Therefore, it is feasible to optimize the functioning of the WiMAX network with regard to the criteria of the total bandwidth capacity of the base stations. This objective may be accomplished. In addition, the findings of the comparative examination of the handover process in networks that are based on the WiMAX technology are shown. These results were achieved via the use of the OpNet simulation environment. wireless network, mobile communication network.**

***Index Terms*—Base stations, Wireless network, Mobile communication network, Bandwidth capacity.**

1. INTRODUCTION

First and foremost, the fast expansion of wireless and mobile communication networks is the predominant feature that distinguishes the contemporary evolution of information and communication technologies. The creation of such networks necessitates the combination of mobile and conventional land-line communications networks, each of which has a different design. In order to facilitate the movement of data, the use of wireless environments puts extra constraints on the technologies that are utilized. The most significant distinction between these networks and wired ones is that wireless networks are far more susceptible to interference and assaults than wired networks at the same level. Additionally, the mobility of a user makes the process of data transfer more complicated. This is due to the fact that the position of a subscriber might vary while the data packet is being delivered (it travels through numerous transit nodes), which means that a variety of issues that are associated with routing can occur [1]. Mobile networks are characterized by the continual mobility of subscriber systems, which makes the development of an effective data delivery mechanism one of the primary responsibilities of management. This mechanism is becoming more vital and crucial in mobile networks.

Therefore, when there is a mechanism for the transmission of data, there is also the potential of free movement of nodes and the continuation of their connections in the event that such a move takes place. The node allocation tables are adjusted in accordance with the movement of a node from one area to another area in access servers. This adjustment is carried out. In addition to the many other elements that have an impact on the quality of mobile networks, the handover procedure is not an exception.

Not only does the success and efficiency of such a procedure result in the evaluation of the quality of services provided by a user, but it also results in the overall operability of the network [3]. Currently, there are a variety of approaches that are offered to support the mobility of a user. Some of these methods are H MPLS [4], MM-MPLS [5], and those discussed in the literary sources [6, 7]. Despite the fact that these approaches make it possible to quickly determine the location of the area that will be switched over, they are not capable of supporting the needed level of service quality. The shortest amount of time that data may be sent inside a network should be assured. This is especially important for mobile networks, whose structure is always shifting since nodes are moving around.

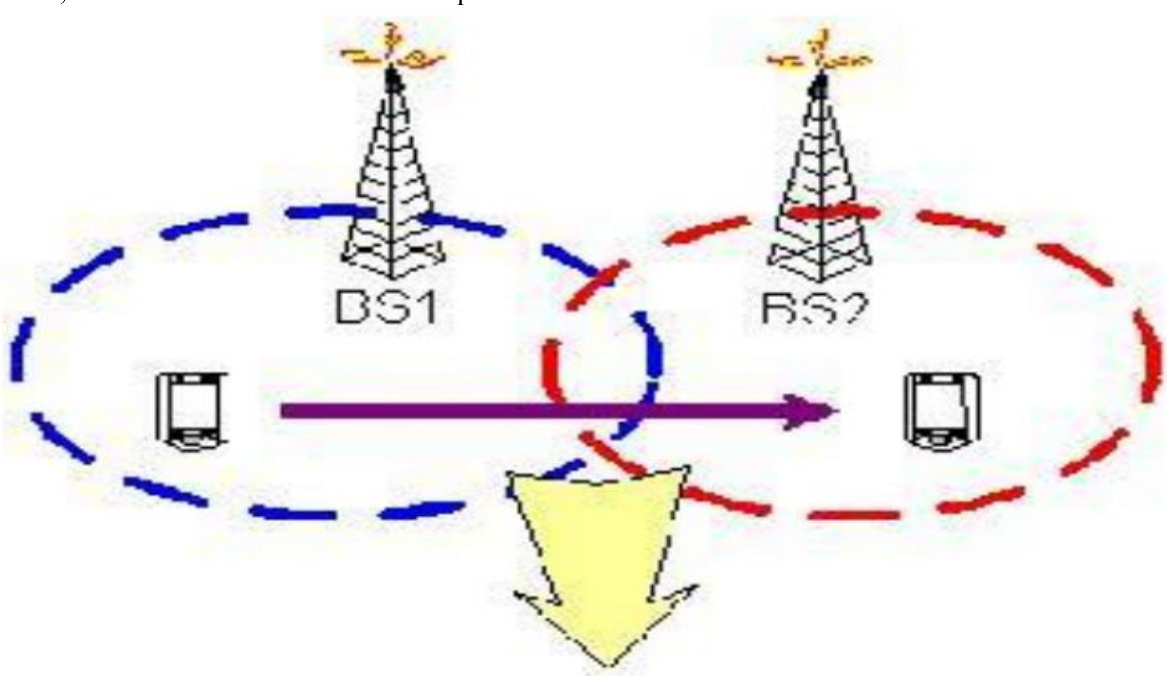
Developing a system for dispersing the load across adjacent locations for mobile nodes is the objective of this article, which aims to accomplish this purpose. Aside from that, the base stations that are being examined are intended to have signal-to-noise ratios that are comparable or comparable to one another [8].

2. THEORETICAL PART

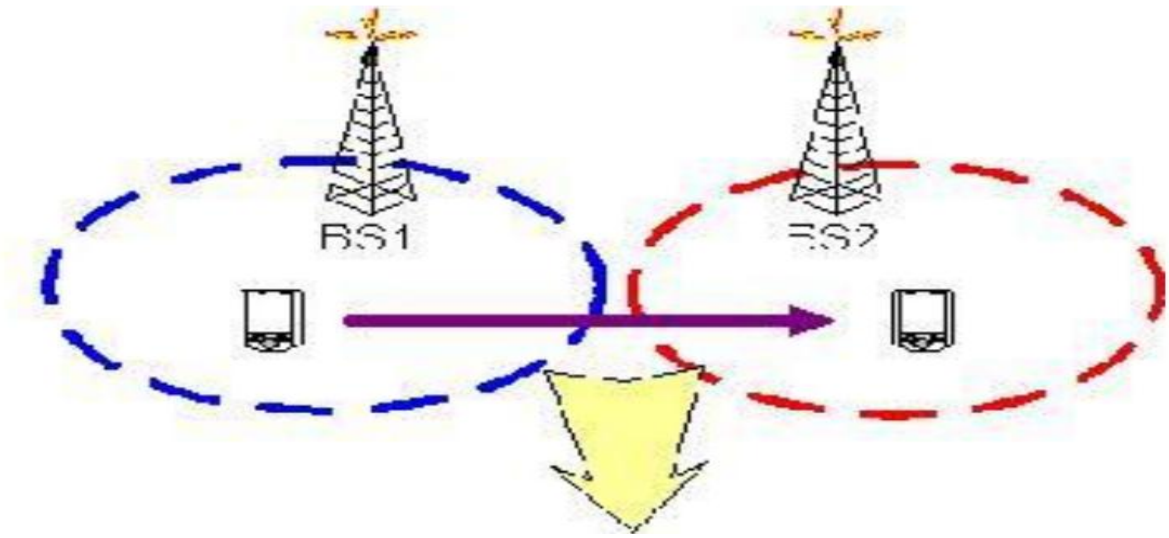
Characteristics of the handover procedure in mobile and wireless environments In wireless and mobile networks, the characteristics of the handover process are highlighted.

The mobile node is able to transmit and receive data independent of its location as a result of the fast qualitative and quantitative expansion of various access to wireless media (including the Internet) that is occurring at the present time. In global networks, any device is identified by its Internet Protocol (IP) address, which is also used for routing. In this manner, the IP address is associated with a particular location within the network. As a result, it is necessary to change the IP address whenever the node moves between networks in order to guarantee that the connection will remain uninterrupted. As a result of the fact that higher tiers of the TCP/IP protocol stack make use of an IP address to identify the session, the alteration of the address need to be invisible for these levels.

It is possible for the handover to occur in a wireless network due to the mobility of a node. Because the IP address of a node is immediately tied to its position, it is necessary to notify the network whenever the mobile node changes its access point to the network. This is because the IP address is directly related to the location of the node. An event known as the handover may take place whenever a mobile node leaves the coverage area of an access point as a result of its movement toward another location.



BHO – Soft Handover



HHO – Hard Handover
Fig. 1. Probable scenarios of soft and hard handover

It is possible for the mobile node to keep the connection intact when it is moving about and changing the access points to the network if it processes such an event in the correct manner. In general, there are two kinds of handovers, the soft handover and the hard handover [9]. Each of these handovers is distinguished from the other by its capacity to link a node to a specific access point.

A number of potential situations that illustrate such occurrences are shown in figure 1.
It is possible for a mobile node to experience packet loss in the event of a hard handover because the connection between the mobile node and the prior access point is severed before the mobile node is linked to the new access point. In the event of a soft handover, the connection to the prior access point is not severed until after the connection has been established with the next available access point. Because of this, a mobile node is able to engage with both access points at the same time during the soft handover. In the event that a node relocates to a different access point that is part of the same subnet, the handover of the L2 link layer is able to take place. The detection of a new access point and subsequent authentication at the link layer are both required elements of this kind of handover.

There is a possibility that the hangover of the L3 network layer will take place if a mobile node travels across the subnets. This hangover is a supplement to the handover of the link layer and involves the assignment of a new IP address to a mobile node that is located in a different subnet.

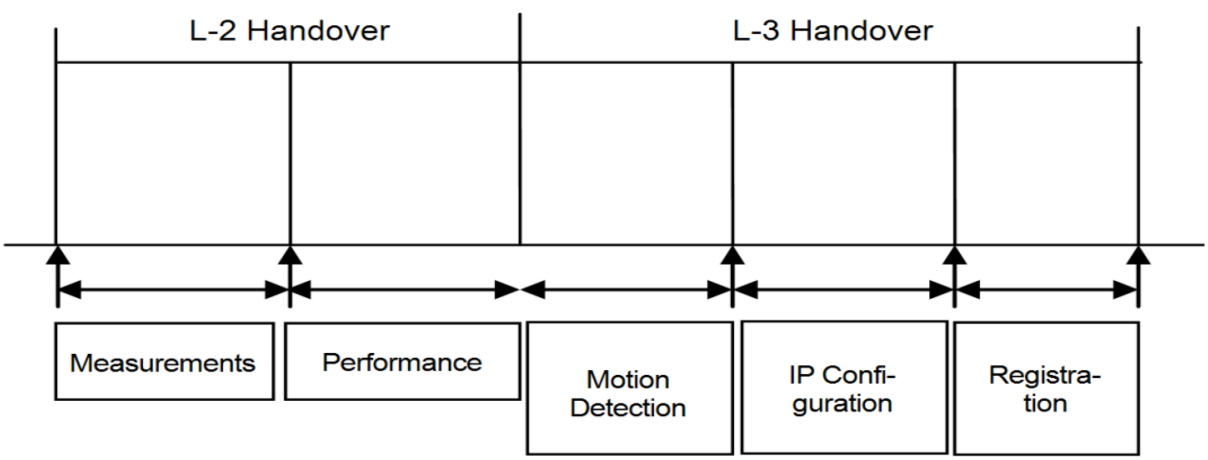


Fig. 2. Content of link (L-2) and network (L-3) handovers

The information that is included inside the link and network layer handovers is seen in figure 2. The kind of handover has a significant impact on both the rate at which information is sent and the quality of that transfer.

Particularly noteworthy is the fact that this is the case when mixing different kinds of traffic (for instance, data and multimedia traffic) that have distinct needs for the quality of service.

A total of three phases are involved in the process of handover, which are detection, rectification, and registration [10]. The beginning of the detection phase occurs when a mobile node moves into a new location. Next, it is able to get a message from the access point that is located closest to the region in question. The phase of correction starts when a mobile node gets a message from a new access point and continues until the network interface setup is finished in accordance with the new IP address. This phase continues until the new IP address is fully implemented. The verification of the fact that a mobile node has been assigned an IP address is the primary function of the registration step.

Given that T_d represents the time of the detection phase, T_c represents the duration of the correction stage, and T_r represents the duration of the registration stage, it is possible to compute the total period of handover T_h by using the following expression:

$$T_h = T_d + T_c + T_r \, .$$

3. RESULTS OF SIMULATION MODELING

The following is a presentation of the findings that were acquired via the use of the OpNet simulation environment with regard to the comparative examination of the handover process in the networks that are based on WiMAX technology [13]. There were three potential WiMAX service zones that were taken into consideration, in addition to the positioning of mobile nodes and base stations. The first region has seven mobile nodes, whereas the second and third regions each have four nodes. The first region is the most populous. Voice communication is sent to the server concurrently from each and every mobile node. With the exception of the nodes that are fixed in the first region, the other two areas move in the direction of the first area.

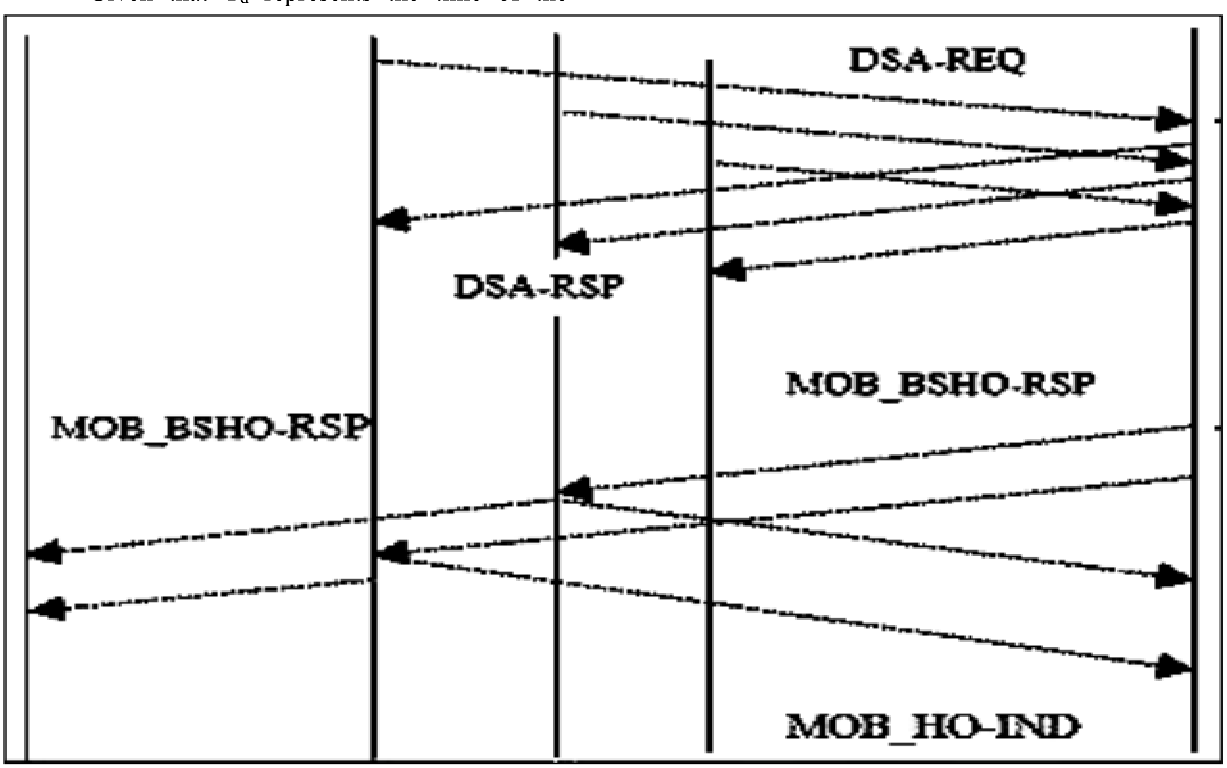


Fig. 3. The handover diagram

During the handover process, nodes from the second and third regions migrate towards the first area. This is the beginning of the process.

At the 110th second of simulation time, the movement begins. This occurs when the simulation process begins. During the time span spanning from the 115th to the 120th second, each and every mobile node comes into contact with the initial region (figures 4 and 5).

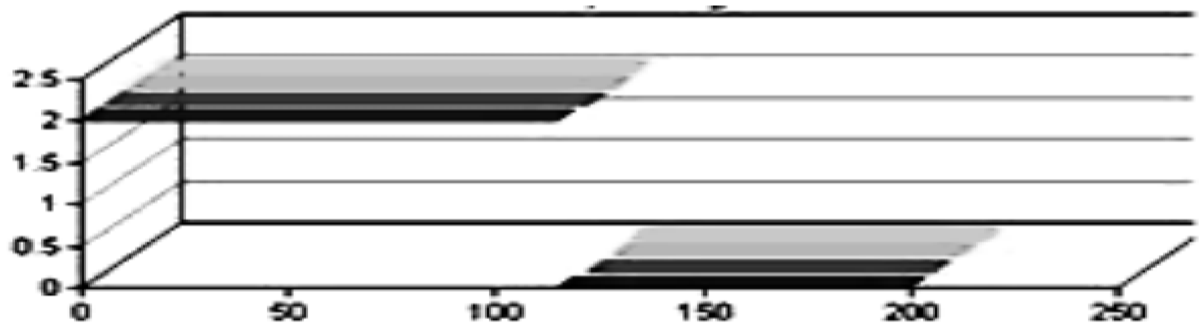


Fig. 4. Time dependence of assigning mobile nodes to the service area when they move from the third area to the first one

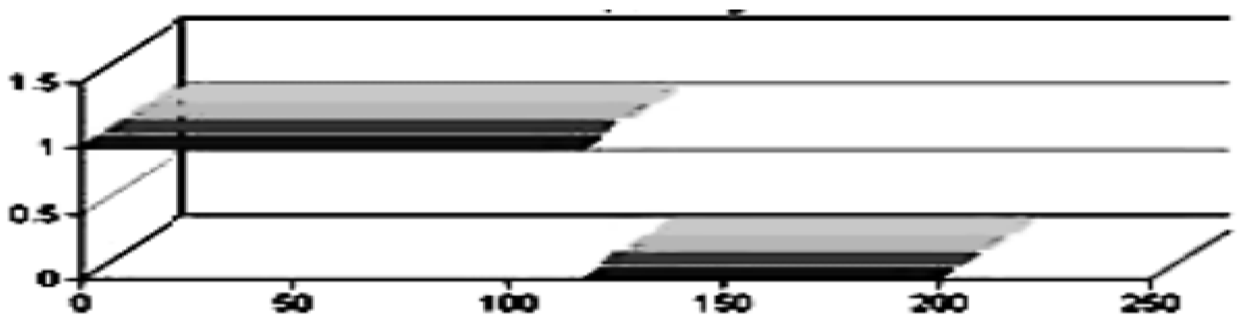


Fig. 5. Time dependence of assigning mobile nodes to the service area when they move from the second area to the first one

When nodes move into the first region, a portion of the bandwidth of the uplink channel is allotted to newly emerged mobile nodes once the nodes have moved into the first area. The uplink channel of the first region has a drop in bandwidth as a consequence of this, while the load experiences an increase. After the mobile nodes have departed the remaining two regions (the second and third areas), the bandwidth of the channel improves, as shown in figure 6. This occurred after the mobile nodes had left the network.

Based on the findings of the study that was conducted for the uplink channel, it was discovered that the bandwidth rises for the second and third regions when the number of mobile nodes that are served in those areas drops.

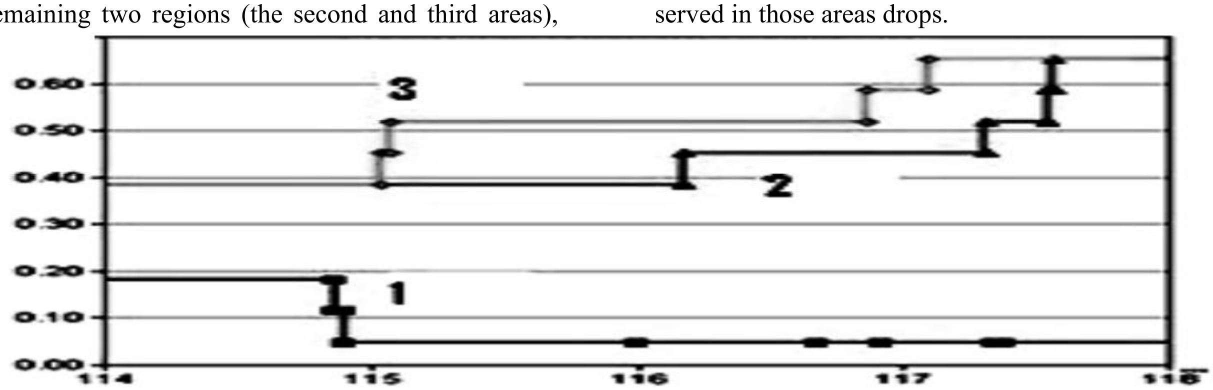


Fig. 6. Change in the bandwidth of the uplink channel of each area during the handover

4. DISCUSSION OF RESULTS

Figure 7 indicates that in the first region, the handover adversely impacts the channel's bandwidth, which experiences frequent reductions.

This results from the interference generated by the mobile nodes from the second and third areas as they approach and then enter the border of the first region. Upon relocation, the load in the initial region escalates, and if it above the threshold value, the base station of that area initiates the selection and reallocation of mobile nodes that fulfill the criteria to alternative locations (fig. 8).

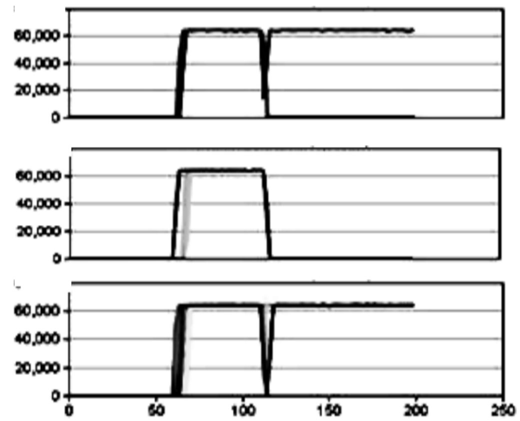


Fig. 7. Channel bandwidth dependence on the handover time

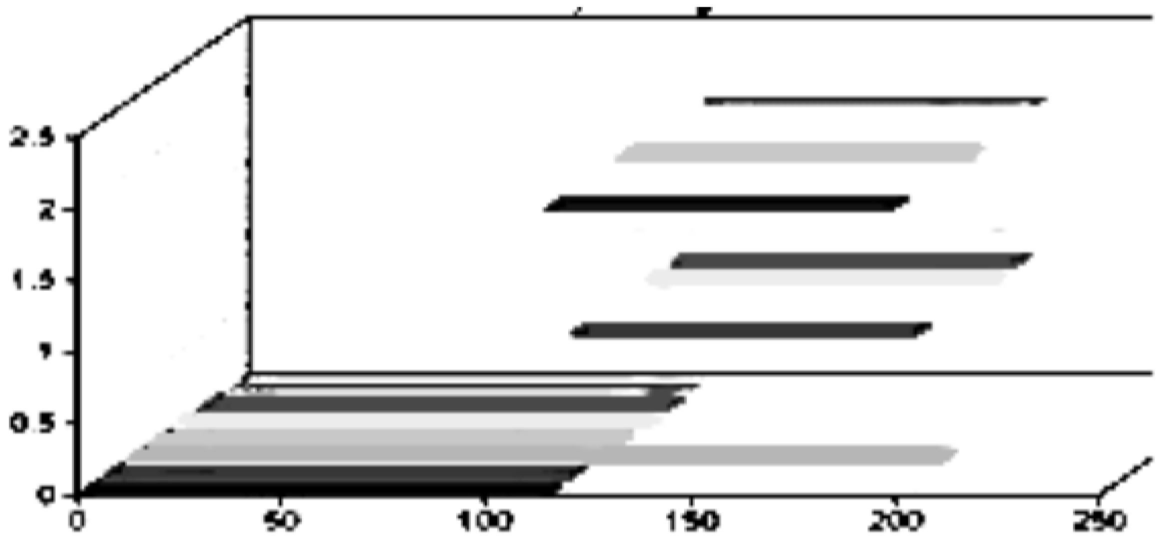


Fig. 8. Time dependence of assigning mobile units to the coverage area

5. CONCLUSIONS

It is recommended that mobile nodes migrate to a base station that has a lower load density if they have a signal-to-noise ratio that is comparable to or near to that of the base station.

In wireless and mobile networks, this strategy enables the base station to initiate the handover process, which in turn provides a more equitable distribution of the load originated from mobile nodes among the base stations that are located in close proximity to one another.

In the event that the base station's available bandwidth falls below a certain level, the handover procedure is initiated. As a consequence of this, the operation of the WiMAX network may be optimized in accordance with the criteria of the total bandwidth capacity of the base stations.

REFERENCES

[1] "Site for calculating radio coverage zone", available at: http://lrcov.crc.ca.

[2] "Mobile complex of satellite communication 1.1.", available at : www.datagroup.ua/uk/uslugi/mobilnyie-kompleksyi/mobilekomplekt-sputnikovoj-svyazi-11

[3] Zhang, Q., Guo, C., Guo, Z., Zhu W. (2003), "Efficient mobility management for vertical handoff between WWAN and WLAN", IEEE Communications, No. 11, pp. 102–108.

[4] Yang, T., Makrakis, D. (2011), "Hierarchical mobile MPLS: Supporting delay sensitive applications over wireless internet", Proceedings of ICII 2011, Beijing, China.
[5] Yang, T. Dong, Y., Zhang, Y., Makrakis, D. (2002), "Practical approaches for supporting micro mobility with MPLS", Proceedings of ICT 2002, Beijing, China.
[6] Chiussi, F. M., Khotimsky, D. A., Krishnan, S. (2002), "A Network Architecture for MPLS-Based Micro-Mobility", Proceedings of IEEE WCNC'02, Orlando, USA.
[7] Um, T. W., Choi, J. K. (2011), "A Study on Path Rerouting Algorithms at the MPLS based Hierarchical Mobile IP Network", Proceedings of TENCON'11.
[8] Ala'a, Z. Al-Howaide, Ahmad, S. Doulat, Yaser, M. Khamayseh (2011), "Performance evaluation of different scheduling algorithms in WiMax", IJCSEA International Journal of Computer Science, Engineering and Applications, Vol. 1, No. 5, pp. 81–94.
[9] Manner, J. (2004), Mobility Related Terminology, Network Working Group, RFC 3753, 224 p.
[10] Kuchuk, G. A., Kovalenko, A. A., Mozhaev, A. A. (2010), "An Approach to Development of Complex Metric for Multiservice Network Security Assessment", Statistical Methods of Signal and Data Processing (SMSDP – 2010): Proceedings of Int. Conf., NAU, RED, IEEE Ukraine section joint SP, Kyiv, pp. 158–160.
[11] Kuchuk, G., Kharchenko, V., Kovalenko, A., Ruchkov, E. (2016), "Approaches to Selection of Combinatorial Algorithm for Optimization in Network Traffic Control of Safety-Critical Systems", Proceedings of IEEE East-West Design & Test Symposium (EWDTS'2016), pp. 384–389.
[12] IEEE 802.16 TGe Working Document: Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, 802.16e/D4 (2014).
[13] "OpNet simulator", available at: http://www.opnet.com.