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PRACTICAL ANALYSIS OF COMMON RADIO RESOURCE MANAGEMENT SCHEME IN HETEROGENEOUS WIRELESS NETWORKS

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Abstract-*Mobile communication has become an essential part of the human life. On the other hand, there is a increasing in the developed technologies. So, people are facing lots of problems for best utilizations of the operation of existing radio access technologies (RATs) that they may have. Radio Resource Management (RRM) refers to a mechanisms that are responsible for best utilization of Radio Resource Units (RRUs) within a Radio Access Technology (RAT) to provide services with an acceptable level of Quality of Service (QoS). A major issue of the heterogeneous network is the Radio Resource Management (RRM) strategy. None of the RRM scheme is suitable for the heterogeneous network, because each RRM strategy only considers the situation of one and only particular RAT. The Common Radio Resource Management strategy, also known as Joint Radio Resource Management (JRRM), is used to coordinate RRU utilization among a number of RATs in an optimized way. CRRM is used to increase the selection of the suitable RAT in the heterogeneous wireless networks (HWN). Selection of the suitable radio access technology maximizes the performance of heterogeneous wireless network and its Quality of Service (QoS). CRRM is deployed in order to collectively manage radio resources among different Radio Access technologies (RATs) in an optimized way. This paper can bring significant benefits in the heterogeneous network, such as improving throughput and packet delivery ratio, reduction of delay and jitter (packet delay variance).*

Keywords*—CRRM, RAT, RAM, QOS, HWN etc.*

I. INTRODUCTION

Now a days next generation wireless system is providing several access networks to the user. So the mobile user will have several interfaces and can access a wide range of applications provided by multiple wireless networks [3]. So when the mobile user migrate from one place to another there is a need to handover the communication channel from one network to another by considering its features and user requirements. Vertical handover taking place between two different networks . This leads to the need of mechanism which will select the best network among different existing networks. Vertical handover decision plays important role in selection of best network. The emergence of multiple wireless technologies supporting high data rate, multimedia services and coverage, smart mobile terminals with interoperable interfaces and the IP based applications produced anytime, anywhere, any type service connectivity platforms for mobile operators. Global wireless connectivity is aimed by the (4G) fourth generation wireless systems. Global roaming and high data rate services elevated 4G service from the former versions of wireless networks [1]. The design goal of the 4G systems is to provide seamless movement of mobile terminals across the (HWN)heterogeneous wireless networks by offering continuous services while maintaining quality of service (QOS). Extremely conciliatory and adaptive convergence of multiple mobile terminals or network technologies backing built-in potentiality for seamless wireless access drives the architectural goals of 4G systems. Long Term Evolution (LTE) and Worldwide Interoperability for Microwave Access (WiMAX) are the two wireless broadband technologies are ready to dominate next generation networks. Worldwide Interoperability for Microwave Access (WiMAX) is a new technology and it is in deployment phase [2]. In all these wireless technologies, we have very limited resources and we have to make best use of them by proper management.

Radio Resource Management (RRM) is a mechanism for the overall system which is being used to manage radio resources in the air interface inside a cellular network. The main goal is to utilize the available spectral resources as efficiently as possible.

The main objective is to use them in the best possible way to maximize the performance and spectral efficiency in such a way that we have maximum number of users in our network and Quality of Service (QoS) is up to the mark Vertical handoff takes place when a mobile terminal moves in between various network technologies are suitable for connectivity reasons depending upon the type and quality of service demanded by the operators. The challenge of vertical handoff management is Seamless network switching. The existence of different cellular networks in the same and different geographical area required Common radio resource management (CRRM) for enhanced quality of service provisioning and efficient radio resource utilization. The concept of CRRM arises in order to efficiently manage the common pool services radio resources that are available in each of the existing radio access technologies RAT [6]. In heterogeneous cellular networks, the radio resource consists of resources that are available in a set of cells under the control of a radio network controller (RNC) and a base station controller(BSC).

In this paper we are presenting the new approach for VHD which is based on common radio resource management scheme (CRRM) for taking the accurate decision for vertical handover. In section II we are presenting the literature survey over the various methods of VHD techniques. In section III, the proposed system algorithm and design is presented. In section IV, the simulation and practical analysis is presented. Finally conclusion is presented in section V.

II. RELATED WORKS

In this section we are presenting the different methods for vertical handover decision[4][5][7]:

In [5], the main criteria is (RSS) Received Signal Strength based algorithms . These types of VHD algorithms compare the value of RSS of the current point of attachment against the others to make handover decisions. The algorithm is mainly proposed for vertical handover between 3G networks and WLANs by combining the RSS measurements with the available bandwidth of the WLAN candidate. An algorithm is proposed between 3G and WLAN which is based on comparison of the current RSS and a dynamic RSS threshold when a mobile terminal is connected to a WLAN access point. To avoid the unnecessary handovers which is introduced in this method, a travelling distance prediction based algorithm is developed. The benefit of this method is that it minimizes unnecessary handovers , handover failures and connection breakdowns however its disadvantage is increased in handover delay.

In [4], the main criteria is available bandwidth based algorithms . The algorithm is mainly developed between WLAN and Wideband Code Division Multiple Access (WCDMA), which takes the parameter Signal to Interference and Noise Ratio (SINR) into consideration. Here the main focus is on SINR value, SINR values are compared to determine handover decisions. This algorithm results in a balanced load between the WLAN and the WCDMA networks and gives high overall throughput. But the main disadvantage of this algorithm is it introduced ping pong effect and excessive handovers takes place in the network.

In [5], the main criteria is cost function based algorithm. The idea behind this algorithm is cost of the possible target network is calculated and network with minimum cost function is selected . By using this algorithm high system throughput and user's satisfaction is achieved. The main advantage of this method is the delay of handover decision is reduced, low handover blocking rate and high throughput. But in this algorithm it is difficult to estimate security and interference level and it also require extra co-ordination between mobile terminal and point of attachment.

In [5], the main criteria is authentication based algorithm. The algorithm is mainly developed for handover between Wi-Fi access points. The scheme uses the concept of pre-authorization and when the handover actually takes place it eliminates the need for communication with the remote server. The main advantage of this algorithm is it reduces the packet loss, handover delay, cost. Also it increases the speed of authentication process. But this scheme is developed only for Wi-Fi access point.

In the above existing algorithms limited parameters are used and depending on that parameter only handover decision takes place.

III. PROPOSED SYSTEM

3.1 Proposed Architecture

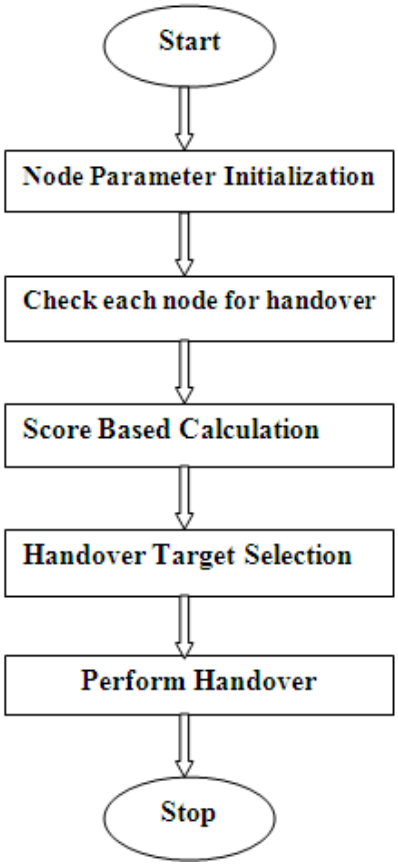

Fig. 1. Flow Chart of Proposed architecture

In the proposed system, two networks as 4G and WiMAX are considered. After network formation all the parameters are initialized and here we have considered maximum number of parameters for making handover decisions. There are total ten parameters of networks on which handover decision is depends- Received Signal Strength Interface (RSSI), User Preferences/Network Interest, Bandwidth, signal network ratio (SNR), Data rate ,network coverage, Link quality, cost per byte, node urgency of usage , size of data. After that each node is check for handoff. Handoff takes place on the basis of Score Based Vertical Handover Algorithm. In this algorithm score of every parameter is calculated and according to scores handoff is performed.

3.2 Proposed Score Based Vertical Handover Algorithm

As appeared in Fig. 1 flow chart of proposed architecture ,the handover decision mainly depends on score based calculation of all parameters in the network. This algorithm is mainly developed for vertical handovers between WiMAX and 4G networks. It makes vertical handover decision between WiMAX and 4G network considering the scores of parameters of the mobile node . It determines whether the incoming requests for vertical handovers between WiMAX and 4G networks will be rejected or accepted. We will check each node for handoff. Initially set the score 0 for N1 and N2.After that scores for all the parameters of the nodes in the network are calculated and handoff decision takes place.

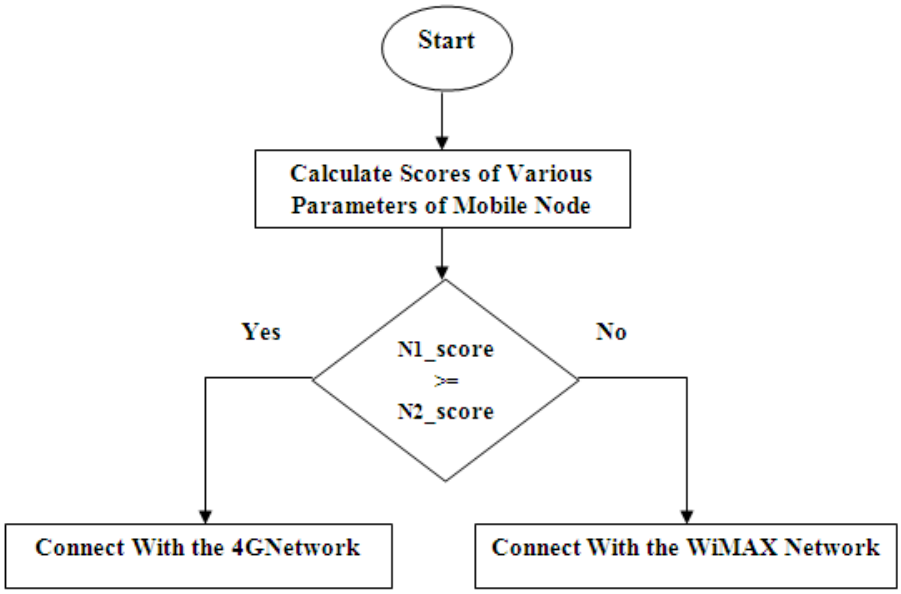

Fig. 2. Score based vertical handover algorithm

Score calculation pseudo code:

```
if { node_network == 4G && node_snr < half of default SNR value of 4G } {
                    set n1_score [expr n1_score-1]
} elseif{ node_network == WiMAX && node_snr < half of default SNR value of WiMAX } {
                    set n2_score [expr n2_score-1]
          }
```

In this way set scores to all parameters . If N1_score of the mobile node is greater than or equal to N2_score of the mobile node then connect the node with the 4G network else connect the node with the WiMAX network.

IV. PRACTICAL ANALYSIS

This simulation study is done using NS2. For practical analysis of proposed VHD algorithm, we used WIMAX and 4G network. The simulation is carried out for 20 Nodes and QoS parameters are calculated for each simulation.

1.Packet Delivery Ratio (PDR)

The ratio of the packet received by the destinations to the packet generated by the sources is known as the packet delivery ratio. It is the measure of successful delivery of packets. The graph shows that maximum packet delivery ratio is 100% and minimum packet delivery ratio is 20%. The mean value of Packet Delivery Ratio (PDR) is 99.063012 %

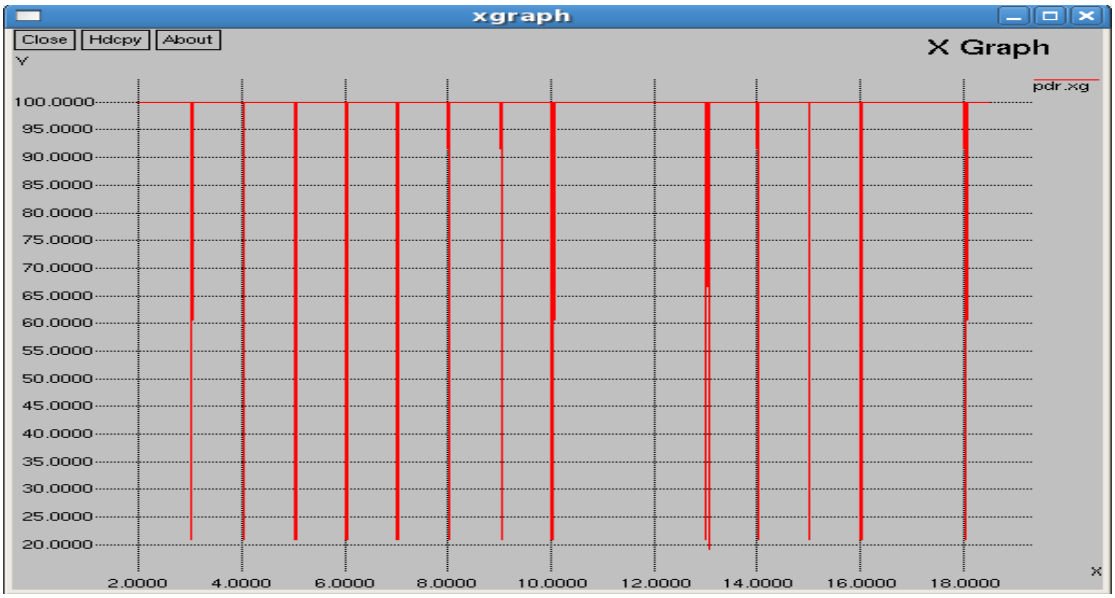

Fig. 3. Packet delivery ratio vs Number of nodes

2) Throughput

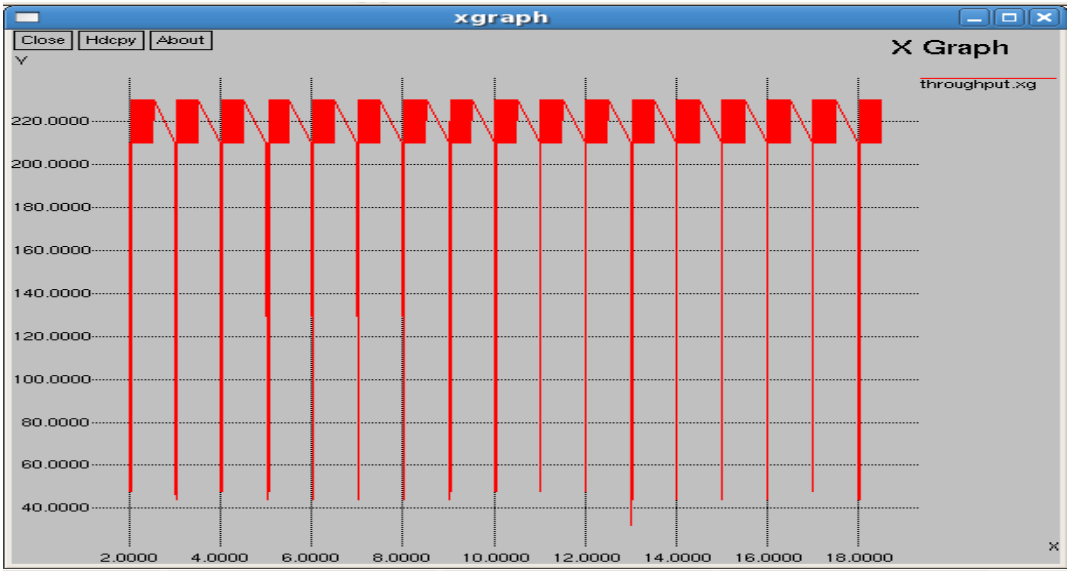

Fig. 4. Throughput vs Number of nodes

Throughput is a measure of successful delivery of packets in a given interval of time. It depicts that as the number of mobile nodes increases, throughput increases as well .The mean value of throughput is 210.509397 Kbps.

3) Delay

It consist of the average delay of all type of time delay required to reach the data packet to destination. The network end-to-end packet delay is defined as the delay consisting of encoding delay, decoding delay, compression delay and decompression delay. The graph shows that as the number of node increases, the delay increases up to a certain point due to high network traffic but then it becomes constant up to an average value. The proposed method leading to reduce the time delay. The mean value of delay is 0.000853 sec.

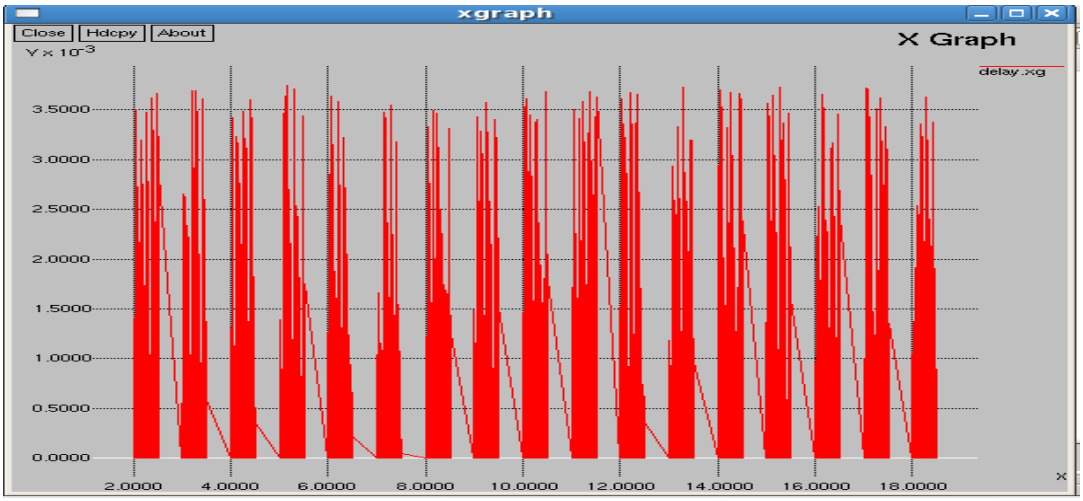

Fig. 5. Delay vs Number of nodes

4) Jitter

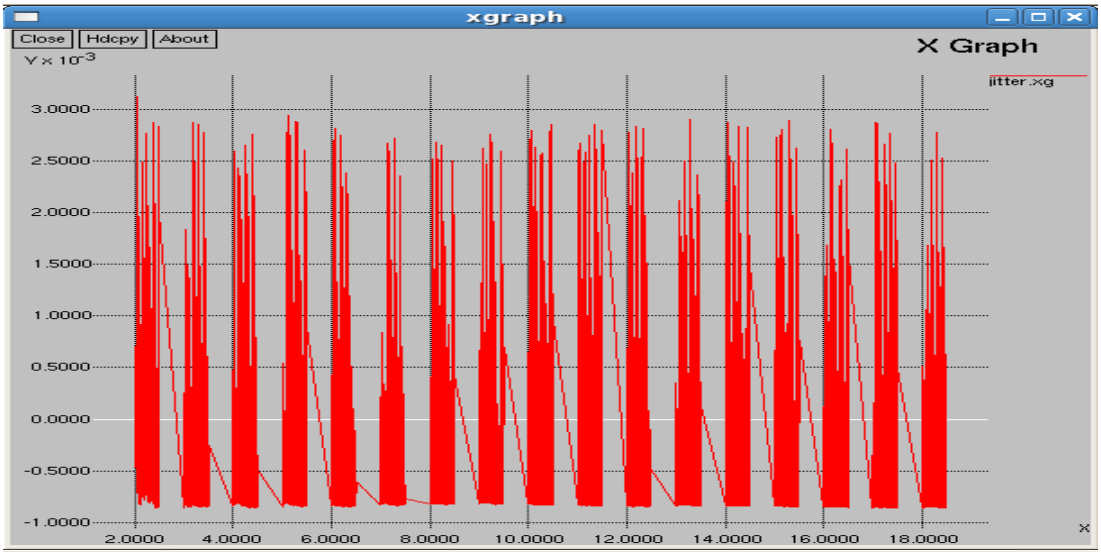

Fig. 6. Jitter vs Number of nodes

Jitter is also known as Packet Delay Variance (PDV). Jitter is the difference between the end-to-end delays between packets. Jitter could be termed as the variation in delay or packet delay variation. The value of jitter increases with increase in number of nodes but reaches an optimum level. The mean value of jitter is 0.000023 sec.

Mean Value Table:

These are the mean values for 20 nodes. The table indicates that improvement in Quality of Service parameters like Packet Delivery Ratio (PDR) ,Throughput, Delay and Jitter.

Sr. No	Quality Of Service Parameters	Mean Value
1	Packet Delivery Ratio (PDR)	99.063012 %
2	Throughput	210.509397 Kbps
3	Delay	0.000853 sec
4	Jitter	0.000023 sec

Table1. Mean value of QOS parameters

Comparison Table:

Following table shows comparison of QOS parameters for different number of nodes. Here we have take different number of nodes and find its values of quality of service parameters like Packet Delivery Ratio (PDR) , Throughput, Delay and Jitter. For all the nodes Packet Delivery Ratio (PDR) is approximately 99% , Delay is near to 0 sec, Jitter (Packet Delay Variance) is also approximately 0 sec and Throughput is maximize up to 200 Kbytes/sec .

Sr. No.	Number of Nodes	Packet Delivery Ratio (%)	Throughput (Kbytes/sec)	Delay (sec)	Jitter (sec)
1	10	99.478568	214.825464	0.000872	0.000031
2	20	99.063012	210.509397	0.000853	0.000023
3	50	98.786895	202.346482	0.000680	0.000074
4	100	98.987107	200.697443	0.000584	0.000034

Table 2 .Comparison of QOS parameters for different number of nodes

V. CONCLUSION

Existing schemes perform the necessity of handoffs, and trigger the process of network selection based on a single parameter such as RSS. These schemes are not efficient and intelligent enough, so they do not take into consideration the traffic characteristics, user preferences, network conditions and other important system parameters. In this paper, the focus is on the design and implementation of a scheme that can perform efficient and intelligent vertical handovers in heterogeneous wireless networks. The main objective of the developed scheme is to maximizing the throughput and packet delivery ratio of the network while minimize the end-to-end delay, jitter, resulting in increased mobile users' satisfaction levels. From the results it is interpreted that as the mobile nodes keep on increasing, an optimum value of Quality of Service (QoS) parameters is obtained.

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