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Call Admission Control (CAC) with Load Balancing Approach for the WLAN Networks

Neetika Lalotra
Department of Computer Science, Punjabi University
neetika.lalotra1@gmail.com

Devasheesh Sharma
Electronics and Communication, UIET (PU)
sharma.devasheesh18@gmail.com

ABSTRACT-- The cell migrations take place between the different network operators, and require the significant information exchange between the operators to handle the migratory users. The new user registration requires the pre-shared information from the user's equipment, which signifies the user recognition before registering the new user over the network. In this thesis, the proposed model has been aimed at the development of the new call admission control mechanism with the sub-channel assignment. The very basic utilization of the proposed model is to increase the number of the users over the given cell units, which is realized by using the sub-channel assignment to the users of the network. The proposed model is aimed at solving the issue by assigning the dual sub channels over the single communication channel. Also the proposed model is aimed at handling the minimum resource users by incorporating the load balancing approach over the given network segment. The load balancing approach shares the load of the overloaded cell with the cell with lowest resource utilization. The proposed model performance has been evaluated in the various scenarios and over all of the BTS nodes. The proposed model results have been obtained in the form of the resource utilization, network load, transmission delay, consumed bandwidth and data loss. The proposed model has shown the efficiency obtained by using the proposed call admission control (CAC) along with the new load balancing mechanism. The proposed model has shown the robustness of the proposed model in handling the cell overloading factors.

KEYWORDS—Call admission control, bandwidth allocation, bandwidth sharing, Multi-cell division.

I. INTRODUCTION

A wireless LAN (Local Area Network) is a communications system that is used as an alternative for a wired LAN. Wireless LANs uses radio frequencies to transmit and receive data over the air, which minimises the requirement of wires. Thus, wireless LANs is used to combine data connectivity and user mobility. Wireless LANs have gained popularity in a many vertical markets, including the sectors like health-care, retail, manufacturing, warehousing, and academia. These industries have gained from the productivity of using hand-held terminals and notebook computers for communication of real-time data or information to centralized computers or hosts for further processing. Today wireless LANs has become more extensively popular as a general-purpose connectivity alternative for a broad spectrum of businesses. Wireless LANs can be used to transmit data, voice and video within single buildings, to different computers, and over metropolitan areas. Some of the information and technology industries leading suppliers have introduced personal digital assistants (PDAs), modems, wireless microprocessors and other such devices and applications to support wireless communications.

Due to the limited bandwidth measure of wireless LANs, a typical channel is usually used for communication between an access point and mobile nodes. Downlink is achieved by broadcasting on this common channel. A lot of exactly, the access purpose broadcasts packets to all or any mobile nodes although there's only 1 destination. Downlink activity could represent up to seventy five or eighty percent of the whole traffic in wireless LANs as a result of that nodes on trendy LANs typically operate during a client-server mode. As an example there can be a high performance workstation or laptop acting as a digital computer. Massive of invitation for file transfer on the transmission may lead to an enormous file on the downlink.

For MAC design of wireless LAN's uplink protocol is the core task. To recognize and register new mobile nodes that be part of the network in any time and place, a form of random access protocol is required. Thus uplink traffic desires a multiple access protocol to arrange the transmissions from mobile nodes. The CSMA i.e. Carrier Sense Multiple Access is used that states listen before sending. After CSMA it is RTS i.e. ready to send. Then comes the CTS i.e. clear to send.

II. LITERATURE SURVEY

Prasanna Shete and R N Awale[1] proposed on the basis that most of the wireless LANs deployed today are IEEE 802. 11b/g compliant. Since IEEE 802. 11 standard they donot support QoS requirements of real-time traffic like voice or video. So WLANs are not worthy for supporting real-time voice traffic.

Joon et al.[2] planned a technique to select a base station for potential soft handover in WLAN and built up a base station choice method that will streamline the delicate handover such that there is no information misfortune; handover decision is taken quickly and thus meliorating overall handover performance. To avoid data loss during handover they have considered soft handovers in this paper.

Zhan et al.[3] proposed a velocity-adaptive handover scheme. This plan receives dynamic handover edge as indicated by various speed to skirt some pointless handover stages, lessens handover postpone and improves the system asset usage. The simulation result and performance analysis validate the efficiency of the proposed scheme. As per the current draft adaptation of 802.16e standard, the HO start ought to be performed if the RSSI of the serving BS is lower than the edge. However, it does not consider the velocity's influence on the HO process, and the HO threshold is set as a constant. So the speed badly affects the HO execution. To cope with this problem, our scheme is proposed, the HO threshold is set variably agreeing to the MS mobility.

Becvar and Zelenka[4] focused on the description of full mobile WiMAX and presents an overview of the handover types and the procedures used during movement of users. In this paper they analyze the current handover situation in WiMAX networks.In the primary adaptation of WiMAX principles, the portability was not bolstered by any means. By the time it became a need of user mobility. On account of this reason a few sorts of handover in WiMAX innovation were presented.

Gupta[5] focused upon the relative study of various scenarios of handover technique in order to provide mobility to the WiMAX network along with enhanced QoS. Today in wireless network field Worldwide Interoperability for Microwave Access or WiMAX (IEEE 802.16 standard) has came out as one of the most promising networking technologies. But in order to contend with the present existing other wireless technologies like Wi-Fi (IEEE 802.11), 3GPP/UMTS, Bluetooth (IEEE 802.15); WiMAX has to assure better QoS & cost efficiency. In accompony with the QoS today's greatest network requirement is mobility and mobility has to be bolstered by handover mechanism.

III. EXPERIMENTAL DESIGN

In this section, the experimental design of the proposed model called service call management protocol for the efficient call admission control has been discussed in detail. The proposed model design has been discussed in the form of the various components under the subsections in this chapter. This chapter elaborates the in-depth working of each of the component of the final algorithm designed under the proposed model. The load balancing approach was defined to mark the movement of the birds. With the time, the load balancing approach has been defined, designed or used in several other forms of data applications in the computing world and have proven very good results, which inspired us to use it for our load balancing approach in the sensor networks. The load balancing approach has been designed to calculate per user resource requirement and the total load of the cell in order to calculate the utility, which denotes the resource consumption on the WSN cluster or cell. In this research, the load measurement is the primary concern in order to perform the load balancing using the load balancing approach. In the proposed model, the smart algorithm has been designed for the proposed model. The bandwidth and channel allocation algorithm is the channel capacity algorithm, which analyzes the allocation of each link. The proposed model has been made capable of channel sharing mechanism, which may entertain the higher number of users than the available channel capacity. The proposed model works on the theory of sub-channel, which occurs when the one communication channel is shared among the multiple users. The following algorithm shows the sub-channel allocation to the users:

IV. Bandwidth and Channel Allocation Algorithm

1. Load the topology details.
2. Start the simulation topology.
3. Define the no. of channels (N_C).
4. Define the no. of slots per channel (N_{C_S}).
5. When received the request from user, check the no. of filled per used channels (N).

$$N = N_C \times N_{C_S}$$

6. If $N_A < N_C$ (where N_A is no. of assigned channels), register the user with maximum possible bandwidth for each channel.
7. If $N_A > N_{C_S}$ && $N_A < N$, check and calculate channel ID,

$$K = N - N_A$$
$$K_N = N_C - K,$$

Where K is the no. of available channels and K_N is the channel ID.

8. Check the no. of user on K_N i.e. U_N.
9. If $U_N >= N_{C_S}$, channel is busy, shift to new channel.

$$K_N = K_N + 1$$

10. If $U_N < N_{C_S}$, identify the existing user on K_N.
11. Slice their bandwidth by following formula

$$BW_C = BW / (U_N + 1)$$

12. Assign the channel and bandwidth information with the new node.
13. Assign default time slot and create the sink between node intervals.

V. RESULT ANALYSIS

1.TRANSMISSION DELAY: The end-to-end transmission delay is computed by analyzing the difference between the data arrival time and data departure time. The end-to-end transmission delay shows the network performance in the terms of time, which depicts the capacity of the network to deliver the data as soon as possible it is departed from the sender's side.

$$\text{Delay} = \sum_{t=1}^{n} \frac{\text{time length}}{\text{total no.of packets}} \qquad \text{Eq. (5.1)}$$

Where t is taken as the time interval, n for the number of rotations.

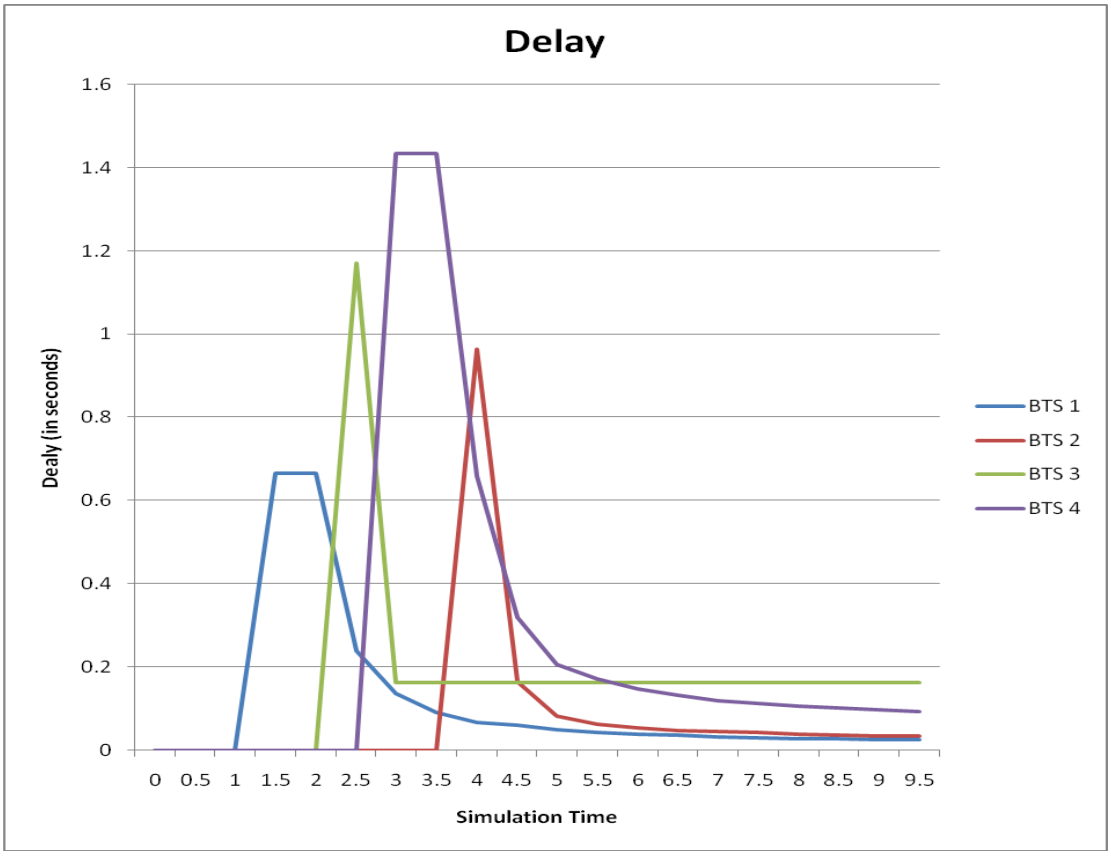

Figure 5.1: The results of transmission delay obtained from the simulation

The above figure 5.1 shows the significant difference between all of the BTS's performance. The proposed model is entirely based upon the dynamic channel allocation and smart bandwidth sharing between the nodes joining the specific BTS node. The performance of the base station is recorded on the basis of the number of nodes connected with the BTS at the given time, when the transmission delay is recorded.

2.RESOURCE LOAD: The network load or resource load is the computation for the percentage of the resource used on the given time. The resource usage is obtained by analyzing the available resources against the total resources, which in turn gives the value of the resource utilization ratio. In our scenario the resource utilization has been obtained in the form of resource availability ratio. The figure 5.2 shows the network resources or resource utilization. The resource utilization factor has been analyzed in the terms of the resource availability ratio. The BTS 1 has been recorded with the lowest resource utilization and the maximum resource availability as per shown in the figure 5.2. The resource availability is inversely proportional to the number of the connected users or the channels assigned. The BTS 4 have the least number of channels, which is why it has been recorded with the highest resource availability, whereas the BTS 1 and BTS 2 have the maximum number of nodes, which significantly lowers the resource availability. There are three nodes, which are connected to the BTS 3, but sending the higher amount of data. The higher amounts of the data increases the resource utilization and hence, drastically reduces the resource availability according to figure 5.2.

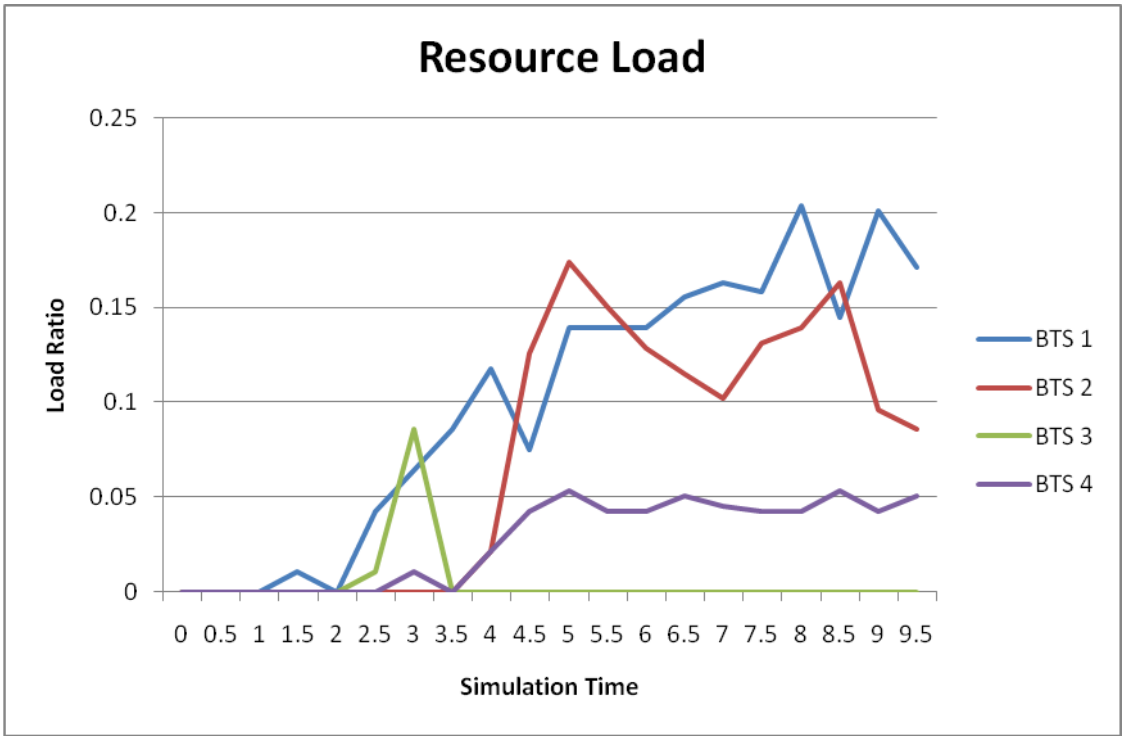

Figure 5.2: The results of resource load obtained from the simulation

3.RESOURCE UTILIZATION INDEX: The utilization of network resources has a straight impact on the performance of the network and its resilience to failure, and thus operational considerations are important aspect of the decision regarding the desired network load and utilization. However, the actual utilization of the network resources is not easy to estimate or control.

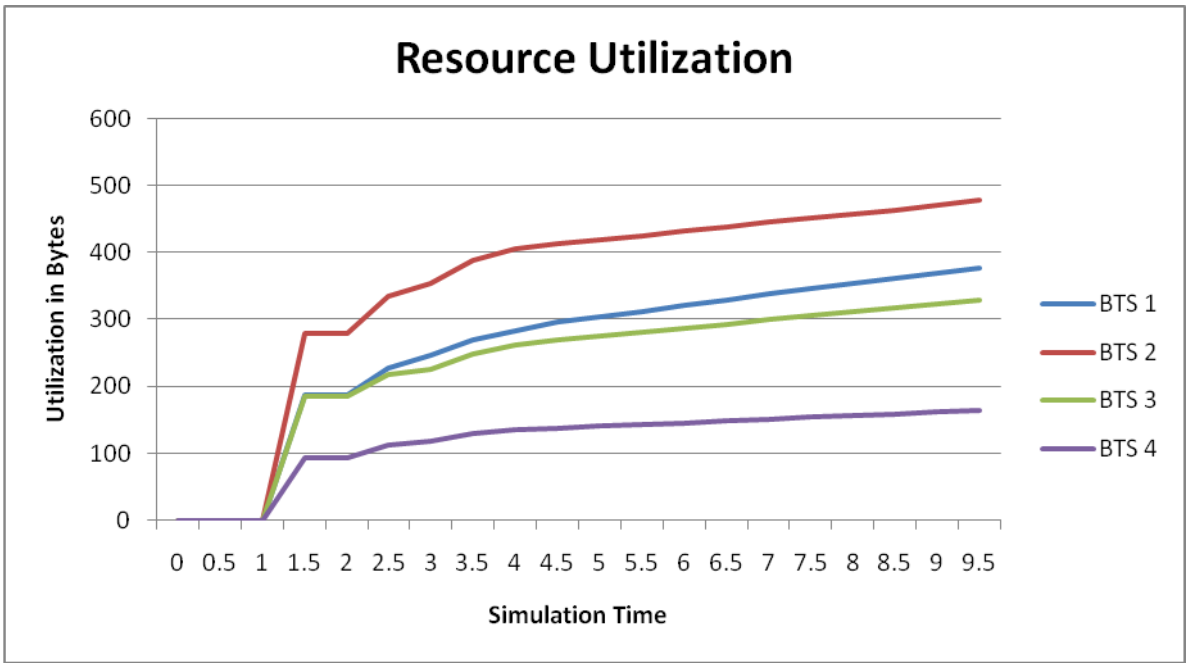

Figure 5.5: The results of resource utilization index obtained from the simulation

The figure 5.5 shows the results of resource utilization, which has again clearly shown the network resource utilization maximum in the case of BTS 1 and BTS 2. The proposed model has been designed to absorb the 2 users on each channel by segmenting the channel into two sub-channels. The primary channel or first channel is the reserved channel and allocate the resource to one user only, whereas all other users are made capable of allocating the sub-channels to the two users. The maximum sub-channel utilization has been achieved on the BTS 1, whereas the BTS 3 has attained 3 users on 3 channels, but the cumulative data amount is higher than the 5 users connected over the BTS 4. Hence the BTS 3 has attained the maximum resource utilization followed by the BTS 1 and comparatively less resource utilization has been recorded for the BTS 1 and 2.

VI. CONCLUSION

The primary aim of the proposed model is to facilitate the service call management from the other base transceiver stations (BTS) in the given networks, while staying connected to the another base station. The proposed model has been improved for the handling of the higher number of the users than the previous models by enabling the latter described service call management protocol over the other base station. The proposed model has been evaluated on the basis of the variety of the performance parameters such as the transmission delay, throughput, network load, etc. The proposed model has bene assessed primarily based upon the resource utiliztaion and data loss for call admission control mechanism. The propsoed model has been recorded with the 376 units and 7186 bytes of data loss during the simulation time of 9.5 seconds over the BTS 1. The proposed model has been recorded with 479, 329 and 164 units over the BTS 2, 3 and 4, whereas the data loss of 7186 bytes, 3210 bytes, 210 bytes and 192 bytes has been recorded over the over the BTS 1, 2, 3 and 4 respectively. The proposed model has been recorded nealry at 5-10% over the tranmsission dealy and network load, wheras the slight change of the 3-5% has been recorded for the throughput and resoure utilziation in the propseod model, which can shows the efficeincy of the proposed model. In the future, the proposed can be enhanced with the incorporation of the artificial intelligent mechanisms such as genetic algorithm, particle swarm optimization or other similar mechanisms for the evaluation of the available channels and dynamic channel allocation in the WLAN networks.

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