Load Balancing in Wlans with Optimal Use of Bandwidth (A Study Based on Cell Breathing Approach)

Ramandeep Kaur
PG Department of Computer Science & IT
Lyallpur Khalsa College, Jalandhar, Punjab, India

Abstract- The increasing demand for Wireless Local Area Network (WLAN) introduces efficient utilization challenge. To address this challenge, Cell Breathing Technique (CBT) is emerged as the key technology; which enables opportunistic access to the WLAN. IN CBT, there is a challenge for poor performance is when a number of users increases in a particular access point then the WLAN is sometimes chocked. To remove this problem there is already a research done for having the bandwidth limitation so that no user can access data more than the specified limit for a particular access point. But in this, the problem is, for what time the user can wait for accessing the WLAN. In this paper we proposed the new concept, so that the required user not to wait for long time for accessing WLAN and all the users who accessing WLAN can access the network with sufficient bandwidth.

Keywords- Access Point, Bandwidth, Cell Breathing, Load Balancing, WLANs

I. INTRODUCTION

Recent studies on operational IEEE 802.11[1], [2] wireless LANs (WLANs), in wireless LANs the traffic load is unevenly distributed among the Access points (APs). In WLANs by default, a user scans all available APs and associates itself with the AP who have the strongest received signal strength indicator (RSSI), while being forgetful to the load of APs. As users are typically, not evenly distributed, some APs have to suffer from excess load, while their adjacent APs may carry minimum load. Such load imbalance among APs is undesirable as it cramp the network from fully utilizing its capacity and providing fair services to users. To improve the load unbalancing, cell breathing technique is introduced. But this technique was also faces many hurdles by which bandwidth utilization were not properly balanced. In this paper, we present a new load balancing scheme that reduces the load of congested APs and also the required user not to wait for a longer time to access the available AP.

II. CELL BREATHING (CBT)

Cell breathing technique [1],[2],[7] is commonly used in cellular network such as code-division multiple access (CDMA) and Wide Code Division Multiple Access (WCDMA) to overcome load congestion by expanding or shrinking the cell coverage. Transmission power of AP is adjusted dynamically to modify its cell boundaries for balancing the AP load. When the transmission power is going to increase, the cell will become enlarge and due to reducing the transmission power the boundaries will shrink. So controlling the size of cell is kown as cell breathing. It is the constant change of the range of the geographical area covered by a cellular network transmitter based on the amount of traffic currently using that transmitter. When a cell becomes heavily loaded, it shrinks. Subscriber traffic is then redirected to a neighboring cell that is more lightly loaded, which is called Load balancing. Cell breathing is a common phenomenon of 2G, 3G, CDMA, CDMA200 and WCDMA wireless systems. Here firstly we are studying about some factors in which cell breathing used for load balancing in WALNs, Cognitive radios etc. and then we will relate our new idea to that previous work done. [9], [10]

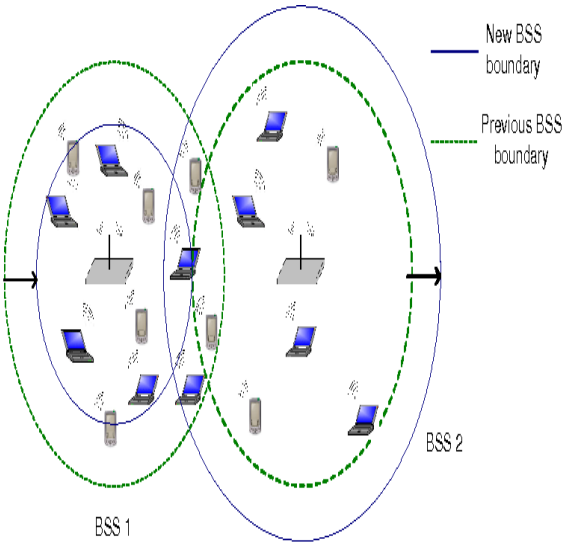

Fig.1: Cell Breathing Technique [7]

A. Load Balancing

One of the key challenges [3] in WLANs is maximizing network throughput and this can be achieved, when load of the APs is balanced. In this paper, cell breathing scheme focus on the user-APs association and APs coverage range. Fairness and load balancing in WLANs can be determine by using association control and this user-APs association will be efficient by max-min fair bandwidth allocation. The load of the APs is balanced using load balancing algorithm of cell breathing approach. where adjustment of APs cell boundary by setting the threshold. In the network, Association (User-APs) can be integral and multiple, due to this some APs faces load, and neighboring APs may carry light load, now load imbalance is there. This asymmetry in load between AP cause high probability of packet loss. Then APs increase their cells to attract further stations. The novel load balancing approach reduces the load of the congested APs by forcing the users

near the boundaries of congested cells to move to the adjacent less congested cells to overcome this congestion problem.[9], [10]

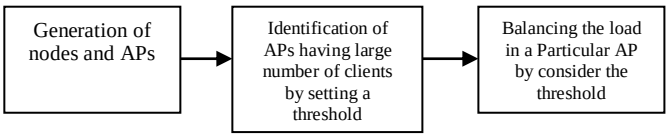

Fig.2: Load Balancing [9]

B. CBT for load balancing in Wi-Fi/Cellular Networks

As the data traffic going to increases on networks, so efficient use of APs together with distinct cellular networks becomes a crucial issue. Cellular networks depend on geographical area wise regions called cell. By increases users there will be more interference between the regions. So CBT approach ensures heavily loaded cells shrink their coverage areas and lightly loaded cells expand their coverage areas to connect users previously associated to heavily loaded cells. Here CBT load balancing algorithms for Wi-Fi network, provides full service availability that enhance the cellular network working in different hot spot areas.CBT apply common phenomenon of 2G, 3G wireless systems included CDMA.[4], [9]

C. Function of CBT

- CBT load balancing algorithms provides full service availability in Wi-Fi Networks.
- Even enhanced algorithms are there for efficient offloading in cellular heterogeneous network.
- Methods to adopt the dynamic environment where users dynamically enter and depart.
- Here simulations to show the performance of provided techniques in terms of fairness of APs Bandwidth Utilization in concerned network.

CBT works so well, but still there is some problems arises, so in this paper we are studying about that problem and further solutions implemented on it.

III. PROBLEMS IN CELL BREATHING TECHNIQUE

Cell breathing technique decrease the congestion but still this technique having the problem of proper utilization of band-width in a particular AP by every user. Suppose if we have a large number of users in a single AP and even AP shrink their boundary but still the numbers of users are large in a number within the boundary (shown in Figure 2.), then not all users get the proper bandwidth or some users might be disconnected from the network and sometimes it may get choked. This situation is like a Leaky Bucket, for example bucket is assume as a AP, users as water and hole in bucket is bandwidth. Now when the number of user's increases in a particular AP and the flow of data is limited then the bandwidth is not properly distributed and some errors like: no internet connection, page cannot display, etc, is start receiving by users. While connected to the AP, user feels like no connection. To avoid such kind of problems, we have a method to resolve this. This method is used for sharing of bandwidth in an efficient and intelligent manner. So that there may not be any adverse effect on the network performance. [4], [5]

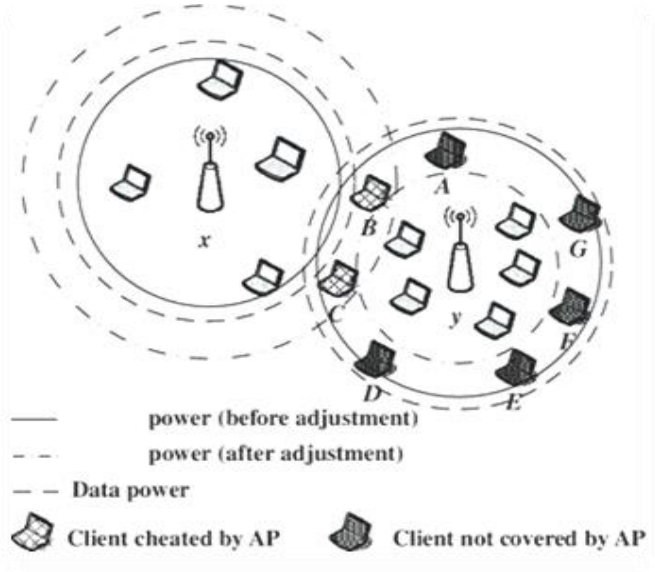

Fig.2: Problem in Cell Breathing

IV. EXISTING SOLUTION FOR THE PROBLEM

The solution for the cell breathing problem in which some studies has been done that is, we can set the limit of bandwidth for the access point. Access point not allows the users to cross the quota of bandwidth. When the assign limit of bandwidth is utilize, then the AP bounce the requests of new user to connect till they have the bandwidth to assign. To understand this concept first we have to know about the bandwidth.[11]

A. bandwidth

By **Vangie Beal**, Bandwidth is defined as a range within a band of frequencies or wavelengths. Bandwidth is also defined as the amount of data that can be transmitted in a fixed amount of time.For digital devices; the bandwidth is usually expressed in bits per second (bps) or bytes per second. For analog devices, the bandwidth is expressed in cycles per second, or Hertz (Hz). The maximum bandwidth of a wireless connection depends on some other technological factors. First, access points are configured to function under one or more wireless protocols. These protocols, named 802.11a, 802.11b, 802.11g and 802.11n, each have characteristic maximum bandwidths.

B. Bandwidth Utilization

To achieve specific goal in WLANs is that wise use of available bandwidth. The most critical aspects of network management and traffic monitoring software is monitoring bandwidth. Without comprehensive insight into traffic type and bandwidth utilization, it is not possible to ensure proper availability of bandwidth. By monitoring bandwidth utilization, it is possible to:

- Determine the users, applications and hosts taking up critical bandwidth
- Assist with identifying unauthorized applications
- Ensure business-critical applications receive enough bandwidth

V. NETWORK BANDWIDTH CONTROL FOR CONNECTED USERS

Now to provide the proper bandwidth [12], [13] for the users bandwidth control has to be done. In the above figure 1 and 2 it has been shown that after shrink or enlarge the boundary of APs there is still having a problem of bandwidth when the number of user increases. The solution for the optimal use of bandwidth is to limit the bandwidth of APs for the users. Suppose we limit the bandwidth 20Mbps for particular AP. Now the AP allows the users to connect the AP till they have the bandwidth to access. [6]

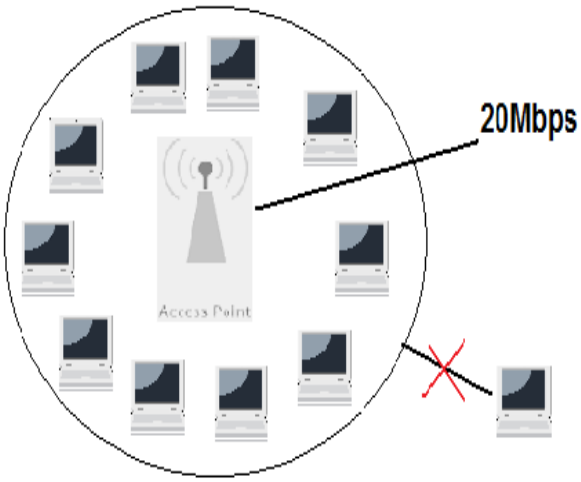

Fig.3: Network Bandwidth control

In the above figure 3, Suppose AP has a bandwidth limit of 20 Mbps and 10 users connected to the network and every user uses 2Mbps. Now when the AP bandwidth is fully consumed then AP will not allowed the another user to connect the network as the connected user will get the optimal bandwidth. If AP allows the user then the bandwidth of connected users share within all the users connected and it affect their working. New user only be connected when the existing user leave the network. Now in this case the connected users will get the optimal bandwidth and the efficiency of the work is high. But, how long the user has to wait for getting access to the network. Suppose the connected users will not leave the network for whole day then the new user will not get access to the network.

VI. SOLUTION FOR MAXIMUM USER CONNECTED WITH OPTIMAL BANDWIDTH

The efficient network is that where users not to wait for a connection for longer time and they also don't have any bandwidth issue for work.

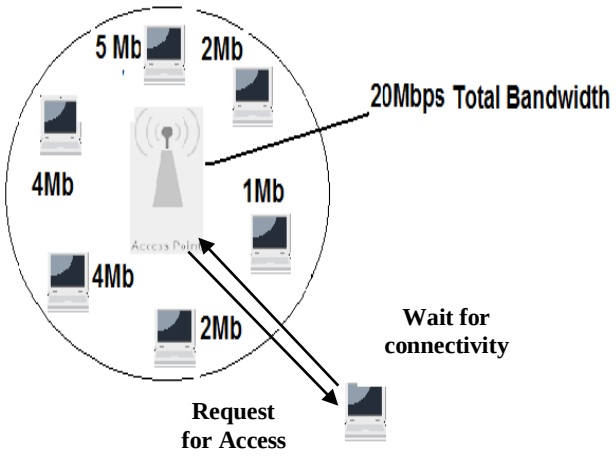

Fig.4: Bandwidth Optimization

In figure 4, the AP has the limit of bandwidth 20 Mbps and the users connected to that AP is consumed 18 Mbps. The AP have 2 Mb spare bandwidth but still they don't allow user to connect directly to the network. Now, we research a new technique so that the desired user not to wait for a long time and bandwidth issue also solve at high level. In this approach, AP has 20Mbps bandwidth and user connected using 18 Mbps, 2 Mbps is hold by the AP. Now when the new user gives request for connectivity then the AP reply to wait for connection, rather not allow user to connect to the network. AP also manages the MAC table for the additional user wants to connect to the network. When the AP received the request for connectivity from the same MAC address for 4 times then the AP allows that user to get the connection for that network. This is because its shown the user desirability for the connectivity. This user is called a wildcard user and wildcard users only get the bandwidth about 500Kbps so that other wildcard user also get connectivity to the network. Further, the earlier connected user leave the network then the first wildcard user get higher bandwidth and its MAC address remove from the additional user MAC table list. In this way the desired users not to wait for the long time to get the connectivity and also after connection they received good bandwidth for their work. [7], [8], [9]

VII. CONCLUSION

This paper present the WLAN network, load balancing between access points (APs) which can be done by the cell breathing technique. But the main aim is to control the bandwidth with maximum user's connectivity to the network. We present a new approach in this paper to minimize the problems such as Low throughput, high packet loss rate, transmission delay for packets, increased retransmissions, and increased loss due to collisions. This can be done with limit the range of the bandwidth and hold spare bandwidth for the desired users. Existing solutions for handling the APs load balancing in cell breathing fall short since they either result in inefficient utilization of bandwidth, or user have to wait for other to leave the network for their connectivity. Our proposal,

for the users to get sufficient bandwidth and not the desired users wait for a long time to get the connectivity in network. This approach resolve the issue of bandwidth in the network and the maximum users should get the connectivity. We have highlighted concerns and opportunities for performance enhancement of bandwidth used in WLANs with maximum users connectivity.

VIII. REFERENCES

[1]. A. Jalali, "On Cell Breathing in CDMA Networks" IEEE International Conference on Communication", Volume 2, Pages(s) 985-988, 7-11 June 1998.

[2]. G. Judd and P. Steenkiste, "Fixing 802.11 Access Point Selection," ACM SIGCOMM Poster, Aug. 2002K. Elissa, "Title of paper if known," unpublished.

[3]. H. Velayos, V.Aleo and G.Karlsson, "Load Balancing in Overlapping Wireless LAN Cells", IEEE International Conference on Communications,Vol.7,Page(s):3833-3836, 2004.

[4]. Md Sirajul Huque, P V Subbarama Sarma, and A Thirupathaiah, "Load Balancing on Multi Channels Through Gateways", International Journal of Computer Science and Technology, Vol.3, Issue 3, July-Sept 2012.

[5]. Olivia Brickley, Susan Rea, Dirk Pesch, "Load Balancing for QoS Enhancement in IEEE802.11e WLANs Using Cell Breathing Techniques", Centre for Adaptive Wireless Systems Department of Electronic Engineering Cork Institute of Technology, Cork, Ireland

[6]. P. Bahl, M.T.Hajiaghayi, K. Jain, V.S. Mirrokni, L.Qiu, A.Saberi,"Cell Breathing in Wireless LANs: Algorithms and Evaluation", IEEE Trans. Mobile Computing, Vol. 6, No. 2, pp. 164-178, Feb. 2007.

[7]. Parminder Kaur, "On the Cell Breathing Technique to Reduce Congestion applying Bandwidth Limitation", International Journal of Grid Computing and applications (IJGCA), Vol.3, No.1, March 2012.

[8]. Rishikesh B.Pansare and I.R.Shaikh, "Min-Max and Limited Knowledge Algorithmic Approach for Load Balancing" International Journal of Computer Sciences and Engineering, Vol-2, Issue-11, E-ISSN: 2347-2693, Nov-2014.

[9]. R. Latha and S. Radhakrishnan, "cell breathing for load balancing in wireless Lan" International Journal of Wireless Communications and Networking, Vol. 3(1), 2011, pp. 21-25

[10]. S.Tamilarasanl and P.Kumar, "Dynamic Resource Allocation in Cognitive Radio Networks- Priority Scheduling Approach: Literature Survey" International Journal of Computer Sciences and Engineering, Vol-4, Issue-8, E-ISSN: 2347-2693, August 2016.

[11]. Shaik Farzana, K.Supriya, T.Sharief and Ch.Shashikala "Cell Breathing Mechanism using Networks with Load balancing Approach" International Journal of Innovative Research and Decelopment, Vol.2, Issue 5, ISSN: 2278-0211, May 2013.

[12]. Techniques Olivia Brickley, Susan Rea and Dirk Pesch, "Load Balancing for QoS Optimisation in Wireless LANs Utilising Advanced Cell Breathing" Center for Adaptive Wireless Systems, Department of Electronic Engineering, IEEE cork Institute of Technology, Cork, Irelend.0-7803-8887(c)2005.

[13]. T. Togo, I. Yoshii, and R. Kohno, "Dynamic Cell-Size Control According to Geographical Mobile Distribution in a DS/CDMA Cellular System," Proc. IEEE Personal, Indoor, and Mobile Radio Comm. Symp. (PIMRC '98), pp. 677-681, 1998 .

[14]. Y. Bejerano and S. J. Hen "Cell Breathing Techniques for Load Balancing in Wireless LANs", IEEE Transactions on Mobile Computing, Vol. 8, No.6, 2009.