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Dynamic Bandwidth Management in 802.11Wireless LAN

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***Abstract*—**Ethernet has been the most dominating network technology since its debut; but in recent times the demand of wireless communication has grown rapidly due to its mobility and portability factors. The IEEE 802.11 Wireless Local Area Network (WLAN) standards, has become eminent technology bridge to the classic Ethernet. The Infrastructure mode of 802.11 uses an Access Point (AP) to coordinate all communications between the wired network and mobile stations. With the emerging real-time applications like VoIP and Video conferencing the access to the Internet through WiFi has become even more interesting and indispensible. Now days in many private as well as public organizations are deploying 802.11 standards to the existing networks availing internet access to its mobile users. In an organization, different users access an AP with different traffic types and different bandwidth requirements. As a matter of fact the categories of mobile users always vary in such networks having more priorities over others on the basis of their bandwidth requirement and purpose of the internet access. Therefore some dynamic and intelligent bandwidth management scheme may be incorporated alongside the current 802.11 so that users of higher priority can be serviced with adequate bandwidth by squeezing some bandwidth from lower priority users as and when needed. In this paper we proposed a dynamic technique for bandwidth management in 802.11wireless LAN. The proposed method has been implemented by means of simulations using OPNET Network Simulator.

***Keywords*—**Bandwidth, 802.11 WLAN, Quality of Service (QoS), Load, Delay, Retransmission Attempts, Traffic.

I. INTRODUCTION

With the increasing demand and popularity of wireless local area network (WLAN), 802.11 Wireless local area network specifications is becoming necessary in home, organization, corporate offices etc. [1]. The WLAN technology has evolved very rapidly and still growing due to its demand and advantages. Due to rapid growing of multimedia data, in almost all places, high bandwidth internet connectivity has becoming important part. To fulfil a smooth and bottleneck free traffic in any organization, bandwidth is the network resource which requires proper management for all users within its end nodes. Bandwidth overload is the reason for why users get frustrated when they are not able to perform their tasks properly. Purchasing of extra bandwidth from the service provider for any organization is not easy for upcoming economics. The running costs for additional bandwidth is beyond reach for most such organizations. Therefore the limited available bandwidth can be optimally managed to solve this problem [2][9].

Wireless networks are superior to wired networks with regard to aspects such as ease of installation and flexibility. They do, however, suffer from lower bandwidth, higher delays, and higher costs than wired networks. With the advent of Wireless Local Area Networks (WLANs), bandwidth has increased and prices have decreased on Wireless networking solutions. For these factors WLANs has becoming a popular wireless networking solution. In an organization there are different types of users. Some users misuses the bandwidth with some unwanted activities like downloading videos, chat etc. Even some user of the organization does not get proper bandwidth for their organizational work. For this problem proper bandwidth management scheme is needed for efficient utilization of bandwidth.

The organization of the paper is as follows. Section I contains the introduction of bandwidth in Wireless LAN, Section II contains the related work of bandwidth management in 802.11 Wireless LAN, Section III contains the some measures on user based bandwidth management system, Section IV contains the proposed bandwidth management scheme, section V explain about the simulation technique of the proposed method, results obtained from the simulation and discussion, Section VI concludes research work with future directions.

II. RELATED WORK

Many Researchers have given the idea of different bandwidth management technique in WLAN. The main goal is to improve the proper bandwidth utilization and achieve better quality of service (QoS) among the users of any organization. In this section we give a brief description on some of the existing bandwidth management schemes.

The Weighted Fair Intelligent Bandwidth Allocation Algorithm (FIBA) has mentioned an idea for improving access to the internet for users who spend most of their time downloading videos [3]. It uses response and reporting mechanism for running video traffic. The algorithm proposed here is computationally less costly and it prevents unnecessary delays. It ensures a lowest rate to all connections that are acknowledged to the network by the network admission control procedure. FIBA monitors the total amount of bandwidth available for allocation. When the connection is choked by a switch along the path to destination, Fair Intelligent Bandwidth Allocation algorithm monitors the situation and reallocates bandwidth fairly. The major demerit of a FIBA algorithm is that it demands a lot of configuration and it has no downloading limit.

In Bandwidth Allocation Algorithm based on cluster, it is mentioned that, bandwidth can be allocated to the clusters and individual users. In a cluster, as only the cluster head receives content from the base station, bandwidth is allocated to the cluster head only. The objective of bandwidth allocation is to maximize the throughput of the entire network [4].

In Smart Clustering Based approach**,** a method was anticipated to distribute the bandwidth for wireless network nodes depending on dynamic methodology. This method uses clever clustering techniques which depend on the distribution of students at the university campus, rather than the classical allocation methods. This technique propose a clustering-based approach to solve the dynamic bandwidth allocation problem in wireless networks, enabling wireless nodes to adapt their bandwidth allocation according to the changing number of expected users over time [5].

Dynamic Bandwidth Allocation (DBA) was designed to supervise and control traffic statistics so as to increase benefits to the user. This algorithm distributes bandwidth equally to all users of the network, including those users who are not currently using the network. It ensures QoS by reducing congestions and ensuring a smooth traffic. The advantage of the DBA algorithm is that all users are treated fairly within the network, making sure that all users get equal bandwidth allocation. It uses multiplexing methods to handle multimedia data that require a large range of bandwidth. The major drawback of the DBA algorithm is that it lacks proper feedback and reporting mechanisms. It only supplies bandwidth by demand and consequently this increases bandwidth costs in cases where high volumes of data are downloaded [6].

III. USER BASED BANDWIDTH ALLOCATION MECHANISM

User based bandwidth allocation technique (DBAM) divides the user into three categories, namely, high priority users, regular users and low priority users. High priority users are those users who wish to enjoy better quality of service and are ready to pay more for the improved QoS. Low priority users are those who are ready to settle for lower quality of service even for delay sensitive service classes like Real Time Streaming Protocol (RTSP) and pay less for the broadband access. Regular users are those who do not wish to be associated with any priority levels. Such users would fall between high-priority and low priority users. When a bandwidth request is made for say RTSP data by all the three types of users, the high-priority user will be allocated bandwidth first, followed by regular users and then the low-priority users. This algorithm will have no additional benefit under normal network conditions. But when the network is witnessing heavy traffic there would be limited bandwidth available. In such a situation the high priority RTSP will be allocated bandwidth first and if bandwidth is available then regular RTSP would get the bandwidth and then the low priority RTSP [8].

IV. PROPOSED BANDWIDTH MANAGEMENT SCHEME

As the Internet users are increasing day by day, it should be able to differentiate between users so that the specific needs of different types of users can be met. Some users may misuse the bandwidth in any organization; due to this some users may face slow internet or low bandwidth in their important works. Therefore priority among users is necessary. In this proposed scheme we have categorized the users into mainly two type, high priority and low priority. For each of the MAC id (Physical Address) of the user node, priority will be set. For implementing this, a priority table will be maintained at the Access Point. Using this method, we are trying to give more access priority to highest priority users by reducing the arbitrary inter frame space (AIFS) or the contention window (CW). Based on the priority value decision will be taken by the Access Point (AP). Less the value of AIFS or CW, the priority will be more. Additionally in this technique, bandwidth utilization will be monitored. If any user is misusing the allocated bandwidth then the bandwidth will be decreased for that particular user and this bandwidth will be automatically allocated to the higher priority user, and the higher priority user will get more extra bandwidth which gives more network speed.

We have two ways for supporting service differentiation. One way is to use of AIFS and another is Contention Window. AIFS is calculated as follows-

AIFS= AIFSN x Slot time + SIFS

Here AIFSN is positive integer set by the Access Point. Slot time is dependent on the physical layer. Short Inter Frame Space (SIFS) is the time between a DATA and ACK frame.

Arbitration inter-frame spacing (AIFS), in wireless LAN communications, is a method of prioritizing one Access Category (AC) over the other, such as giving voice or video priority over email. Here we have used this metric to give precedence to high priority users.
CW is an integer within the range of values of the physical characteristics of the medium.
For service differentiation, different CW sizes are allocated for different access category. Assigning a short CW size to a high priority user enables to transmit packets ahead of low priority one.
The following are the steps of proposed bandwidth allocation algorithm:

Step 1:
if the user is high priority then reduce the AIFS or CW.
else
if the user is low priority then assign higher AIFS or CW.

Step 2:
Check for misuse,
If misuse is true then limit the bandwidth to the user
And increase bandwidth for high priority nodes by a factor P where,
P= (Bandwidth taken from misuse/no of high priority nodes-Pmisuse), where Pmisuse is high priority node found to be misusing bandwidth.
Else
if misuse is false then maintain present allocation settings;

V. Simulation And Results

We have simulated the proposed method using the OPNET Simulator Academic version. We have simulated for different traffic like best effort, back ground, video and voice. Following parameters have been taken for analysis the performance which is given in Table 1.

Application	Parameters	Units
WLAN	Data Traffic Received	Bits/Sec
	Data Traffic Sent	Bits/Sec
	Dropped Data Packet	Bits/Sec
	Delay	Sec
	Retransmission Attempts	Packets
	Load	Bits/Sec

Table1: Parameters Unit

From the simulation results some graphs have been plotted. In the graph, red colour represents the high priority user and the blue colour represents the lower priority user. In Figure 1, it has been clearly noticed that traffic data received value of high priority user is better than the lower priority users.

In Figure 2, it is also clearly observed that traffic data sent value of high priority user is better than the lower priority user.

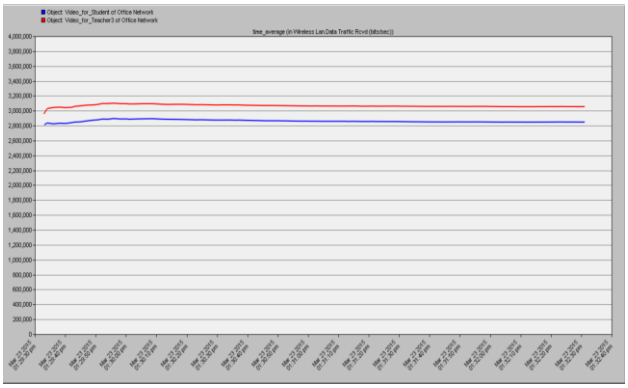

Figure1: Wireless LAN Data Traffic Rcvd

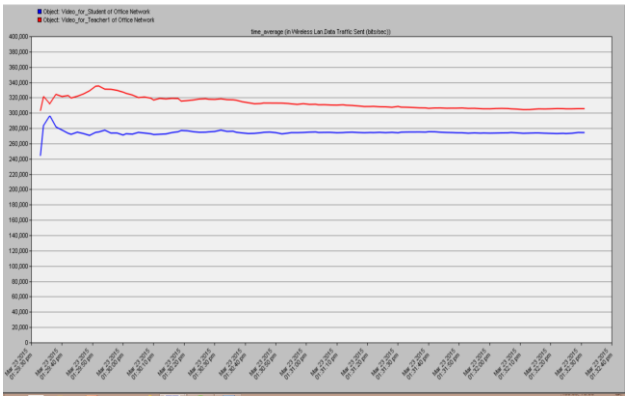

Figure 2: Wireless LAN Data Traffic Sent.

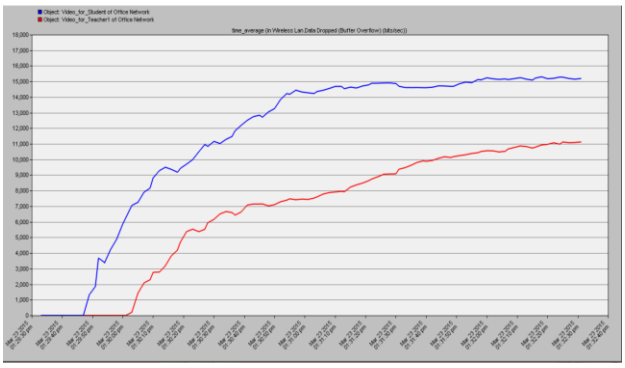

Figure 3: Wireless LAN Data Dropped

In Figure 3, it has been noticed that for the first 30 seconds there is no data dropped for high priority users, after that high priority users have comparatively minimal data dropped than low priority users. In Figure 4, here also the lower priority user has more delay compared to high priority users

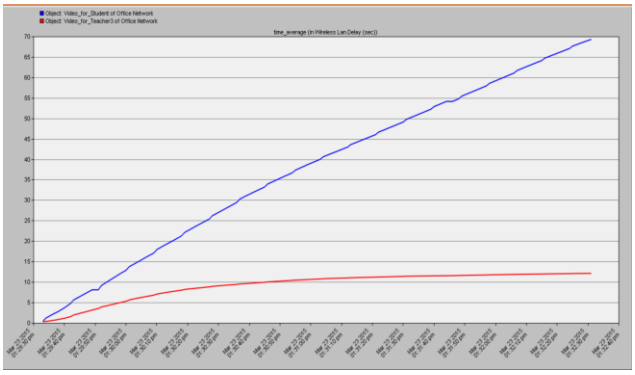

Figure 4: Wireless LAN Delay

In Figure 5, it has been observed that for the first 20 seconds high priority user can handle more load than lower priority user, after that for 70 seconds high priority user remains ups and downs with lower priority user, then for 30 seconds the value of high priority user has same with lower priority user, then again high priority user graph increases for the remaining simulation time.

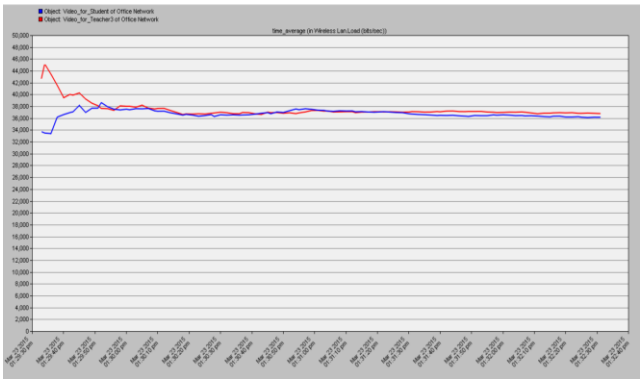

Figure 5: Wireless LAN Load

In Figure 6, it has been noticed that retransmission attempts for high priority user is fairly more than the lower priority user.

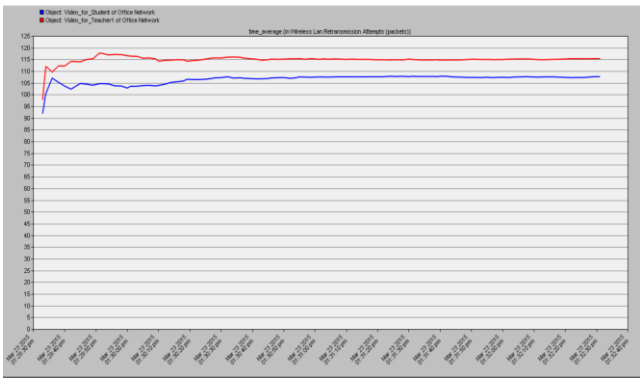

Figure 6: Wireless LAN Retransmission Attempts

VI. CONCLUSION

In this paper, we presented a bandwidth management scheme for 802.11 WLAN. The proposed bandwidth management scheme improves the performance of proper bandwidth utilization. We developed an algorithm for managing the bandwidth based on user priority. The proposed algorithm can give fair bandwidth to the high priority user. From the simulation results we have seen that the high priority users achieve good quality of service in every aspect compared to lower priority users. The proposed method is simulated using the OPNET simulator and the performance of the same is evaluated using the graph generated from the simulation results. From the simulation result we have seen that irrespective of the traffic, always higher priority users are gainer and lower priority users are looser. A low priority user may not get access though he has a very important application. For this reason, as a future work, we can think of a dynamic mechanism by integrating user priority and traffic priority together so that lower priority user also can get privilege in their essential application.

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REFERENCES

[1] Brian P. Crow, Indra Widjaja, Jeong Geun Kim, Prescott T. Sakai, "*IEEE 802.11 Wireless Local Area Networks*".

[2] Adalbert Engel,"*Bandwidth Management And Quality Of Service*", Edith Cowan University,2000.

[3] Xiaomei Yu, Doan B. Hoang, David D. Feng, "*Weight-Based Fair Intelligent Bandwidth Allocation for Red Adaptive Video Traffic*", 2006.

[4] Bo Fan ; Supeng Leng ; Kun Yang, "*A dynamic bandwidth allocation algorithm in mobile networks with big data of users and networks*", IEEE Network, Volume: 30, Issue: 1, January-February 2016.

[5] Mohammed Awad, Abdelmunem Abuhasan, "*A Smart Clustering Based Approach to Dynaic Bandwidth Allocation in Wireless Networks*", International Journal of Computer Networks & Communications (IJCNC) Vol.8, No.1, January 2016.

[6] Elias, F. Martignon, and A. Capone, "*An Efficient Dynamic Bandwidth Allocation Algorithm for Quality of Service Networks*".

[7] Niharika Kumar, K N Balasubramanya Murthy, Amitkeerti Mahaveer, "*User Oriented Network Aware Bandwidth Allocation in WiMAX*", Bangalore, India, Int. J. on Recent Trends in Engineering & Technology, Vol. 05, No. 01, Mar 2011.

[8] Vikas Sharma1, Vikram Kumar, Balvir Singh Thakur, "*Need of bandwidth management and formulation of policy framework for effective utilisation of internet services within a university campus*", Himachal Pradesh University, India, International Journal of Computer Science and Communication Vol. 2, No. 1, January-June 2011, pp. 173-178.

[9] S. Rawat1, P. Chaturvedi, "*Performance Analysis of QoS Parameters in OFDM Based Network*", IJSRNSC,Volume-5, Issue-3, June 2017.

Authors Profile

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