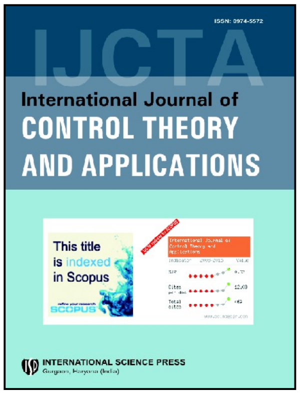

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QoS Enhancement and Modernizing Load Balancing Algorithm for Integrated Networks 802.11n and 802.11g

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Abstract: The IEEE 802.11g and IEEE 802.11n protocols are widely used standards in the unlicensed space which really attracted by researchers and technology providers. The commendable improvement and sustainability of the desired QOS is very important for the service providers and also by the users. The capability of 802.11g does not meet with QOS requirement for most of the users as the usage and applications are highly bandwidth consuming in the day to day usage of the users in a global scope. The WLAN 802.11n standard establishes the wide access for mobile users in geographical spread over an area and also offers comparatively high QoS over 802.11g. The legacy standards are not addressed with dynamic load of the access point (AP). Hence, degradation of the Quality of Service (QoS) is unavoidable. This paper deals with the possible solutions for enhanced QoS and maintenance of the balanced load irrespective of the dynamic load conditions. This research mainly focused on analyzing the system performance during the distribution of load among work station based on requirements. This research also focused on proposal of the algorithms to maintain QoS and load balancing between integrated network 802.11n and 802.11g address a diversified applications like IOT and video and multimedia applications of the mobile users which is distributed a wide geographical area. We are interested to analysis system performance in a diversified data consumption such an IOT applications and video and multimedia applications together under a single roof.

Key words: Integrated Network, QoS, Access Point, Work station, IOT

1. INTRODUCTION

In this decades the IEEE 802.11g and 802.11n standard becomes very attractive for smart phone users really offload the data usage consumed from service provider. As the digitization of every aspects of emerging in different forms such as banking, IOT, vehicle to vehicle (V2V), Machine to Machine (M2M). It is really created a requirement to establish a network which will enable a data service in diversified applications. Hence, a need for low cost IOT infrastructure promoting to provide efficient wireless device arises. This requirement made to perform our research works in this area proved that more effort is still required to build the system with a high Quality of service (QoS).The System QoS and security are the most important criteria for MAC layer performance analysis. The below mentioned WLAN Parameters such as packet delay, BER, loss of frame. Furthermore, the

WLAN characteristics are not constant and vary with time and location. In spite of the mobility of the WLAN user either in idle or roaming, the QOS should remain unaltered. In practical situation, it's not possible to provide consistent data rate. The existing load balance algorithm is used to maximize the Received Signal Strength and minimize the number of work stations [8]-[10]. Riverbed modeler consists of predefined Physical layers such as Frequency Hopping, Direct Sequence Spread Spectrum [1]. Riverbed Modeler does not offers customized Physical layer parameters. The riverbed modeler is having efficient design and modeling features as inbuilt subsystems for the different WLAN Standards. Our research focus on 802.11g and 802.11n performance in an integrated scenario. Hence, Riverbed Modeler library is selected. The Riverbed WLAN model includes WLAN Work station, WLAN server and WLAN Access point. The WLAN Work station node model is an IEEE 802.11 wireless LAN station. The node model consists of Enabled/Disabled traffic source, a destination, data rate, Transmit power, RTS, CTS, WLAN interface. The WLAN server node model is a server with applications running over TCP/IP [6]-[7]. Work station nodes and server node support IEEE 802.11 connections at 18 Mbps, 26 Mbps and 240Mbps etc. The operational speed is determined by the data rate of the link. WLAN Access point node model is a wireless LAN based router with an Ethernet interface. It is used as a router in wireless LAN networks and it connects the wireless to wired networks [11].

2. RELATED WORKS

The performance of WLAN system is influenced by the following parameters as shorter Slot Time (SST) and shorter Short Inter-Frame Space (SIFS) [1]. The next enhanced WLAN used Adaptive back off algorithms in the Medium Access Control layer [2]-[4] by tuning the Receiver to send threshold and Fragmentation [1]. In addition, there are other physical layer parameters such as Adaptive modulation schemes and efficient multiple access schemes.

3. WLAN SCENARIO FOR INTEGRATED NETWORK

Fig. 1 Shows the WLAN Integrated network setup to really understand 802.11g and 802.11n performance with data rate 18 Mbps and 26 Mbps to address IOT and other multimedia applications [12]. The wireless stations are distributed in each cell and entire cluster. Each cell contains 4 WLAN work stations and a cluster contains 24

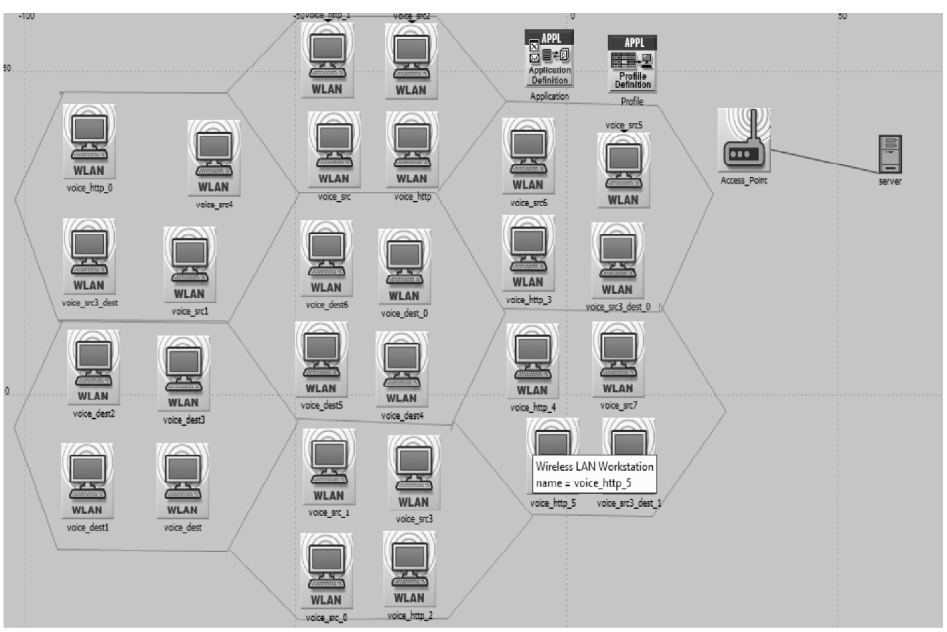

Figure 1: Integrated Network of 802.11n and 802.11g with equal number of work stations of each cell

work stations. IEEE 802.11g and 802.11n Wireless LAN Workstation nodes are used as wireless stations, as well as access points, that are used for transfer data packets with in a cell or within a cluster [13]. We perform our simulations with IEEE 802.11g and 802.11n using the physical characteristics of Extended PHY 2.4GHZ with the data rate 18Mbps and physical characteristics of HT PHY 5 GHz with the data rate 26 Mbps to 240 Mbps [11]. Here the workstations nodes can communicate with each other within a cell and also transferring data packet with in a cluster of WLAN network scenario [5]. In the proposed system model mainly focused on simulation of work stations distributed with diversified low and high data rate scenario. Hence, a equal distribution between work stations are addressed. Similarly, the balancing algorithms are evaluated.

We consider 2 network setup scenarios. In the first scenario each cell contains 4 work destination and the entire cell have the same work station. In this case there is no problem to provide balanced distribution because the entire cell contains equal work stations and distributed equally. When number of work stations increases in the particular cell and the problem arises at this time we have to consider second scenario. Here we have chosen WLAN work station because it has no TCP and Higher Layers. Without being affected by TCP or higher layers, the WLAN work station more accurately reflects the performance of MAC layer protocols.

Table 1
WLAN parameter settings for equal number of work stations of each cell

Attribute	*Value*
BSS Identifier	0
Access Point Functionality	Enabled
Data Rate (bps)	6.5 Mbps(base)/ 60 Mbps (Max)
Transmit Power (W)	0.05
RTS Threshold	256
Fragmentation Threshold	256
CTS to self option	Enabled
AP beacon interval (sec)	0.02
Buffer size (bits)	256000

Table 1 Shows the parameter which are used to create the scenario. The main focus from the table is Fragmentation Threshold (FT). FT is the most important parameter that affects WLAN 802.11n and 802.11g performance. It is used to improve the WLAN integrated network performance when the Bit error rate (BER) is

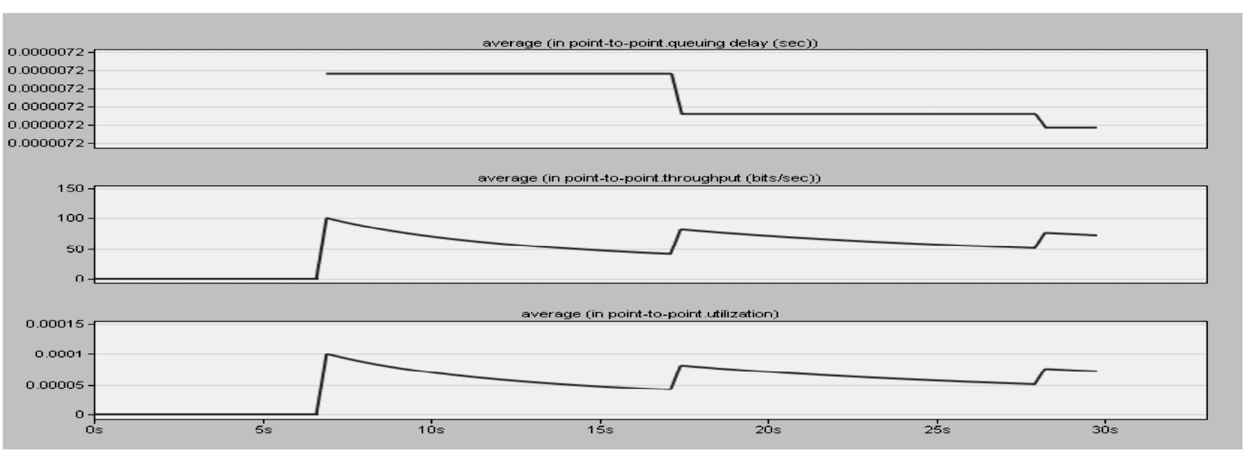

Figure 2: Comparison results of queuing delay, throughput and point to utilization

high. In disabled mode the Packet Error Generator does not introduce errors into the wireless medium. RTS Threshold 256 is enough to balance the load of the WLAN system. Here we have tuned the fragmentation threshold is 256, because less than 256 is degrade the overall performance of the integrated network 802.11n and 802.11g. Buffer size is 256000 to improve the WLAN performance.

The simulation results show that for low Bit Error Rates (BER), a commonly used fragmentation threshold is 256 bytes has no effect on the performance of the network. When the fragmentation threshold is very small, which means that FT value 16 bytes, the WLAN 802.11 n and 802.11g performance degrades because of the heavy data packet overhead. Here we have compared the average point to point queuing delay, point to point throughput and point to utilization. Throughput indicates data packet received on particular time after some delay it receives another packet. Point to point utilization indicates that bandwidth utilized in efficient manner.

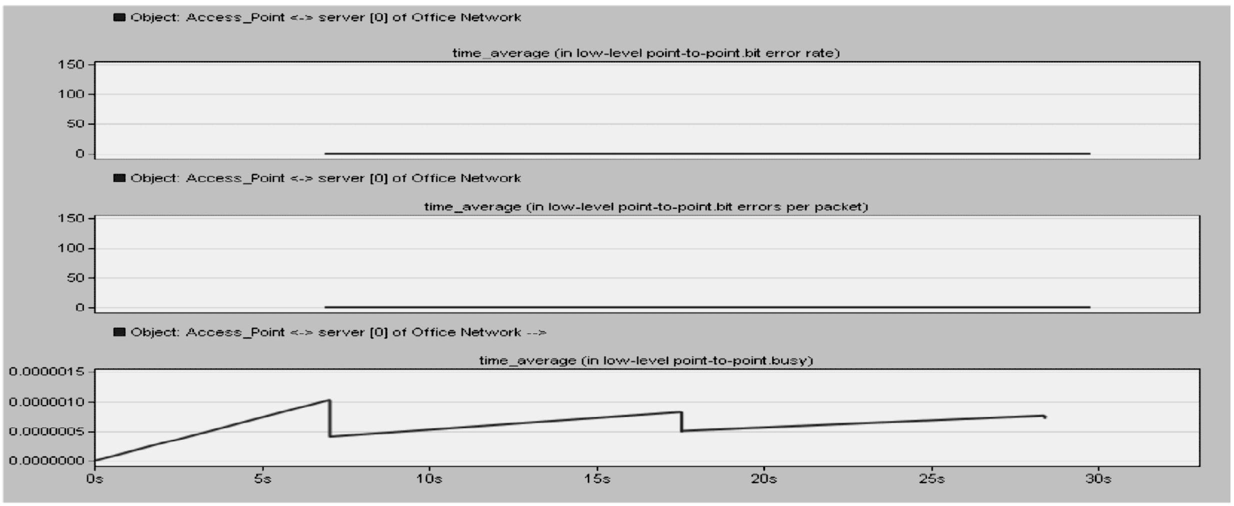

Figure 3: Comparison results of bit error rates, bit errors per packet and low level point to point busy in terms of time average

Fig.3 shows that Bit Error Rate is very low and Bit Error per packet is also very low. Hence the point to point busy line shows that degrades the overall performance of the WLAN 802.11g and 802.11n network. So we have to improve the data rate. Highest data rate will improve the performance of the WLAN integrated network.

Fig. 4 shows that the data packet received at the equal interval. It indicates that highest data packet received in the corresponding delay. All the three peaks show that data packet received without error packet and the

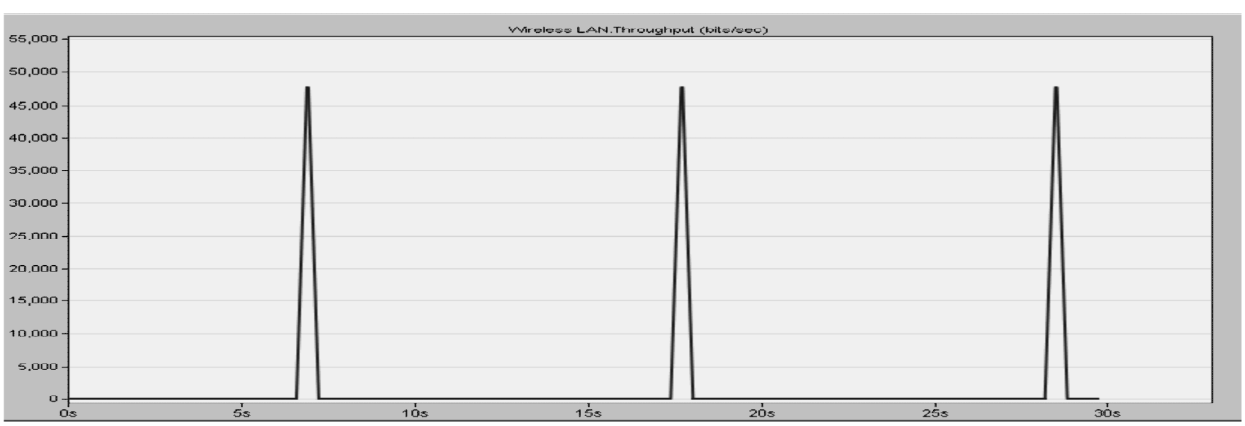

Figure 4: Wireless LAN Throughput

network balance the load when all the cells have the same work station. In this case all the cells are having equal number of work in each cell. Hence distribution among the cells are equal. Fig .4, X axis represents simulation time and Y axis represents actual time. The highest peak indicates highest amount of packet received. Here all the peaks are same, all the packets are received correctly in the balanced distribution system.

4. WLAN SCENARIO INTEGRATED NETWORK OF UNEQUAL NUMBER OF WORK STATIONS IN A CLUSTER

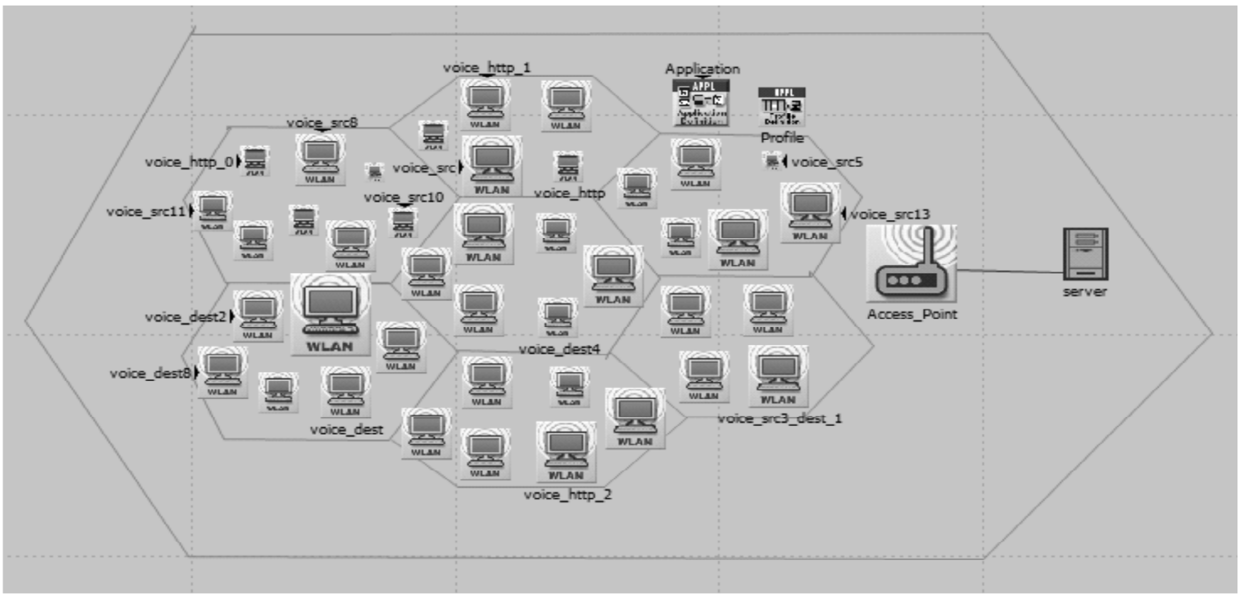

Figure 5: Integrated Network of 802.11n and 802.11g with unequal work stations of a cluster

Fig. 5 shows that each cell having different work station. Few cells having 4 work station and few cells having 5 work stations and some other cells having more than 5 work stations at the time load balancing problem arises. If all the cells are having same work stations there is no problem. But number work station increases in a particular cell; load balancing is the major problem. At this time we distribute based on the request instead of balanced distribution. In balanced distribution bandwidths are wasted. In the proposed system we mainly focused on fragmentation threshold and bit Error Rate. We set the fragmentation threshold is more than 256 bytes, Bit Error Rate is more than $5x10^5$ in bits and beacon interval is 0.02secs. These are all the parameters are used to improve the performance of integrated network.

Table 2
WLAN parameter settings for unequal work stations of a cluster

Attribute	*Value*
BSS Identifier	Auto Assigned
Access Point Functionality	Enabled
Data Rate (bps)	26 Mbps(base)/ 240 Mbps (Max)
Transmit Power (W)	0.15
RTS Threshold	256
Fragmentation Threshold	1024
AP beacon interval (sec)	0.01
Buffer size (bits)	64000

Table 2 Shows the parameter which are used to create the balanced distribution based on the requirements scenario. Here we have set the parameters which are helpful to distribute among work station based on requirements. The data rate is 26 Mbps in base and 240 Mbps in Max is very useful to improve the overall performance of WLAN and the fragmentation threshold is 1024 instead of 256. Hence the data rate and fragmentation threshold plays on important role in the load balancing and Enhanced QoS of WLAN integrated network.

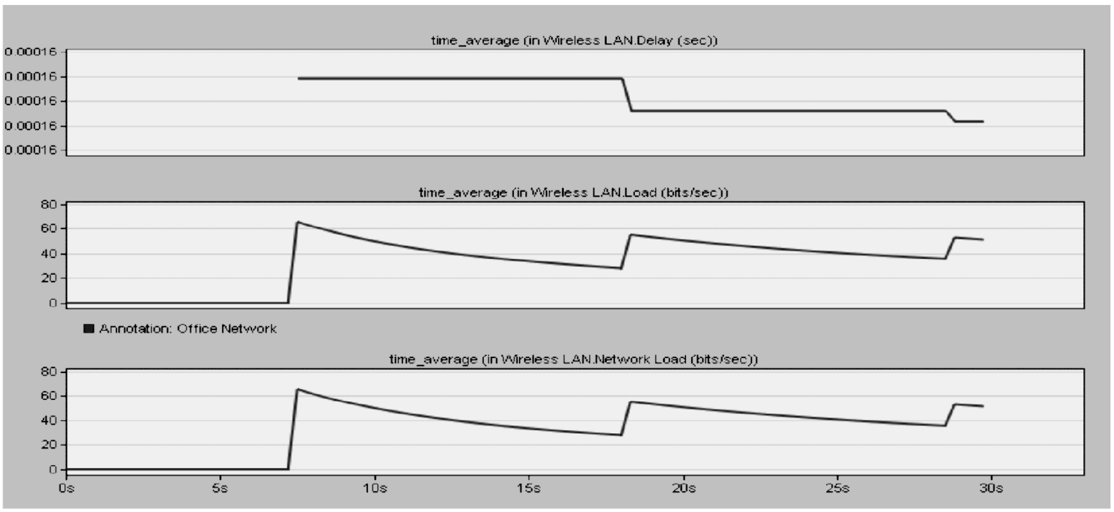

Figure 6: Comparison results of Wireless LAN delay, load and Network load of dynamic work stations of a cluster

Fig. 6 simulation result shows the comparison among the time average wireless LAN delay, wireless LAN load and Wireless LAN network load. Observation from the figure is Wireless LAN load and Wireless LAN network load shows the same result it means that load balance between the work stations are same.

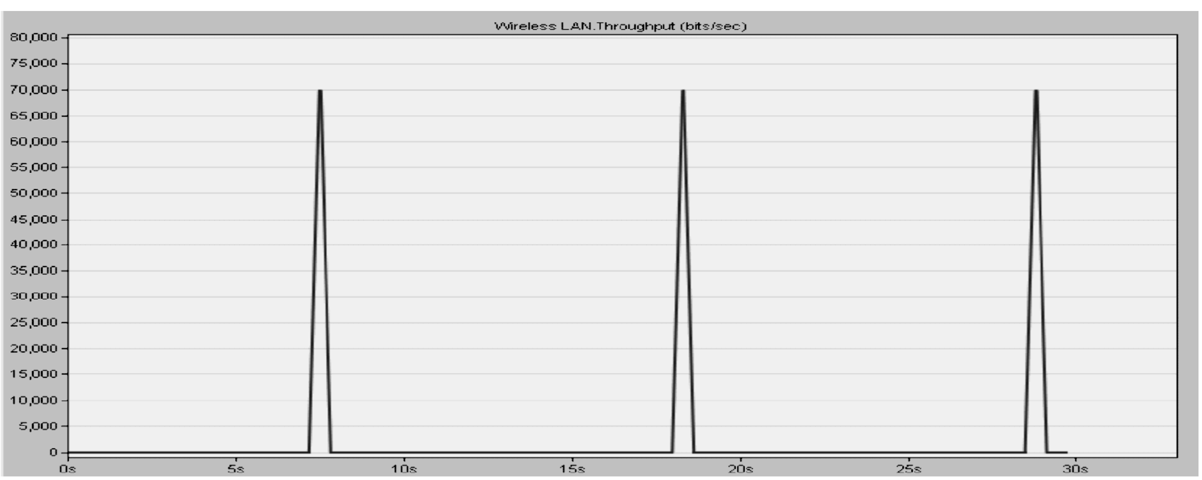

Figure 7: Wireless LAN Throughput for dynamic workstations of a cluster

Fig. 7 Shows that data packet received at the equal interval even though the number work station increases in the particular cell. The peak signal indicates that highest data packet received in the corresponding interval. All the three peaks are shows that data packet received without error and the network balance the load when all the cells are not having the same work station.

5. RESULTS AND DISCUSSIONS

As we have mentioned earlier in this paper, we proposed the modernizing load balance algorithms to maintain QoS and load balancing between integrated network 802.11n and 802.11g which is suited for the WLAN applications like IOT and video and multimedia applications of the mobile users. Enhanced QoS and modernizing load balance algorithm is used for analyzing the performance of the Wireless LAN standards 802.11G and 802.11N. In Media Access Delay MAC parameter is useful because many real time applications have a maximum delay that can be tolerated using Riverbed modeler 17.5. In this integrated network MAC delay is very less compared to the existing system. The reduced MAC delay is very important for real time applications to provide high quality of WLAN. According to Riverbed Modeler documentation, these MAC delay is calculated as the duration from the time when it is inserted into the transmission Queue. In this integrated network, we have represented the simulation results for each scenario. First we have considered the data rate 18Mbps and 26 Mbps to address IOT and multimedia applications. The wireless stations are distributed in each cell and entire cluster. Each cell contains 4 WLAN work stations and a cluster contains 24 work stations. We performed our simulations with IEEE 802.11g and 802.11n using the physical characteristics of Extended PHY 2.4GHZ with the data rate 18Mbps and physical characteristics of HT PHY 5 GHz with the data rate 26 Mbps to 240 Mbps. In the proposed system model focused on simulation of work stations distributed with diversified low and high data rate scenario. Hence, a equal distribution between work stations are addressed. Similarly, the balancing algorithms are evaluated.

In the second scenario we have considered some of the cells having 4 work station and few cells having 5 work stations and some other cells having more than 5 work stations at the time load balancing problem arises. In the proposed system we mainly focused on fragmentation threshold and bit Error Rate. We set the fragmentation threshold is more than 256 bytes, Bit Error Rate is more than $5x10^5$ in bits and beacon interval is 0.02secs. These are all the parameters are used to improve the performance of integrated network. Hence a balance distribution between un equal number of workstation of each cells are measured, similarly the balancing algorithm evaluated for unequal number of workstations of a cluster.

6. CONCLUSIONS

This paper addressed the possible solutions for enhanced QoS and dynamic load conditions in the WLAN environment. We used Riverbed Modeler 17.5 simulator to show the better performance of the integrated network 802.11n and 802.11g. We analyzed the system performance during the distribution of load among work station. We also proposed the modified load balancing algorithms by the modernizing way of tuning the parameter settings in work station using Riverbed Modeler 17.5.

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