PERFORMANCE ANALYSIS OF DISTRIBUTED AND POINT COORDINATION FUNCTIONS IN WLAN UNDER MEAN FIELD REGIME

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ABSTRACT*—Wireless local area networks (WLANs) are used to cover a small geographical area. It's been developed to provide mobility, low cost installation and used to provide access to the internet. As their usages is increasing more and more accurate and efficacy is required to gain this WLANs ultimate goal. Now a days WLANs are not only used for non-real time traffic, but also for real time traffic (multimedia) which required more efficient and error free transmission that can be achieved by improving the quality of service. The IEEE (abbreviation of Institute of Electrical and Electronics Engineers) developed an international standard for wireless local area networks which is called the IEEE 802.11 WLAN standard; IEEE introduced other standards of WLANs, which are IEEE802.11 [a/b/g/n] to enhance the quality of service of the network. In this research IEEE802.11b is chosen due to its extensive use in massive amount of applications use it. Quality of services is affected by a number of parameters which are the part of this research like Delay, Throughput, Queue Size and Retransmission Attempts.*

In this paper the IEEE802.11b standard is used for comparison of two wireless medium accesses. The MAC sub layer functions; DCF (abbreviation of distributed coordinated function) uses Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol to access the wireless medium (WM) and PCF (abbreviation of point coordinated function) contention free protocol is used in the research. These parameters are investigated for comparison. The simulation shows the implementation of these two functions DCF and PCF, with two implemented networks and after comparison of the results the conclusion shows that the medium access function is better in which traffic condition.

Keywords- Distributed Coordination Function, Point Coordination Function, Network Allocation Vector, Frequency Hopping spread spectrum and Direct Hopping spread spectrum

I. INTRODUCTION

Beside Wireless Communication is nowadays used everywhere in the business sector and even in social life. Due to its flexibility and mobility many origination used it. Institute of Electric and Electronic Engineers (IEEE) outline its first standard in 1996 and become widespread in 1999 than they introduced many other Wireless standards for effected communication like IEEE 802.11 a/b/g/n. The IEEE 802.11 is emerging standard in which the main issue is sharing the wireless communication medium. Coordination functions are the protocols that are used to share the medium. There is the basic coordination functions DCF (Distributed Coordination Function and PCF (Point Coordination Function). **[17]**

The Basic DCF is a function of Carrier Sense Multiple Access with collision Avoidance (CSMA/CA). Physical and virtual mechanisms are used to do the carrier sensing. When any station wants to send the data first is sensible if the medium is free then it will send the data otherwise it will wait until the medium is free for transmission. [17] "Point Coordination Function (PCF) is a centralized, polling-based access mechanism which requires the presence of an AP that acts as Point Coordinator (PC)." [17, p. 2].

II. BACKGROUND AND LITERATURE REVIEW

Over the last decade, in the field of communication a lot of development done and the internet is behind all the communication is fundamental element. This development also improves the QoS and improvement in the field of the wireless networks, it has the bold advantage of the mobility that wireless networks provide. Although other factors play important roles in improving the performance of the wireless networks like hardware and operating systems, but the channel access mechanism has a more important role in communication, and to share it with multiple stations is a big challenge. To perform this task, there are two access mechanisms that are used to access wireless medium (WM) in the MAC sub layer are DCF and PCF.

WLAN is called the wireless area network that is used widely these days in all sectors. The idea behind this just same like mobile connected base station same like that laptop is connected to the internet without wire or called wireless connection. Due to recent improvement and improve the QoS support to the wireless network, it makes possible to share all kinds of data including voice and multimedia and real time traffic. *S.* A. Rasheed, K Masnoon, N Thanthry and R Pendse point out that "Quality of Service in a wireless LAN is affected by a number of parameters like channel access method, physicaUenvironmenta1 conditions, number of nodes, distance etc." [15]. Although there is a lot of work is done in IEEE 802.11 wireless standard for improving the QoS point of view, but in the given paper the authors analyze the effect of channel access approaches to voice traffic. And his research shows that PCF protocol is better for multimedia traffic results in better QoS results.

After launching the IEEE 802.11 WLANs standard its big issue was to improve its quality of services (QoS). As it's wildly adopted many organizations and even used at home based network to access internet services it's also used for real time traffic transmission. Quality of service is required to make sure that data is transmitted without errors. IEEE did

vital intention on this issue and introduced new standards like IEEE8023.11a, IEEE802.11b, IEEE802.11n and IEEE802.11g to enhance the quality of transmission of data. Many researchers and originations did research to enhance the quality of service of these standards and it's also the part of this research. Its following paragraph the relevant research work is shown.

Rasheed S. A., Mason K., Thanthry N. and Pendse R. Did a comparison of DCF and PCF from quality of service point of views; two scenarios were created one in which DCF nodes deployed with voice calls and data traffic nodes are configured with DCF functions. In the second scenarios the nodes with voice calls configure with PCS and data traffic is configuring with DCF. The implementation is executed with OPNET simulations and showed these following results. This research is done just to measure the end to end delay of these two functions. The conclusion is based on the outcome results is PCF can provide a better end to end delay for real time traffic like voice and DCF was not performing well in real time traffic transmission. But in PCF it is vital drawback when some stations are selected in a polling list, but they do not have the data to transfer. They just send Null frame and waste the time of the others station those really want to send some data. **[15]** In **[20]** also refer that PCF is battered from quality of service point of view.

Cheng, S. T. And Wu, M. Propose an enhance contention based DCF model to avoid the collision when there is too much load on the network. Contention-Polling Duality Coordination Function (CPDCF) is a purposed function in which a station can be transmitting without waiting the contention process complication. The basic idea in this research is shown that when the network is busy and too much load on it should adopt the PCF contention free services and when it's running normally it's should use the DCF functionally. In this research it shows the comparison with the built in DCF and proposed CPDCF, the results shows that CPDCF performance is better than DCF IEEE 802.11 MAC sub layer function. **[19]**

Chen Z. and Khokhar A. proposed a model for PCF that will help to improve the QoS and reduce the disadvantage or limitation of PCF. The following steps are shown below.

- Access Point Serially sends the CF-Poll only to the active Stations in the Basic Service Set
- Before starting transmission the data each station need to inform how much data it has for transmission.
- Access Point calculates the assignment based on the collection of reports from the stations.
- Access Point polls the station in order and one data fragment is sent after polled the station.

Based on these points the design implementation is made and shows the results. In this research schedule time efficiently used for the stations those wants to transfer their data and showed that PCF channel capacity up to 14 % increased and for DCF its 90 % increased.

III. Design and Implementation

The main components of the above logical design are as follow:

- The network contains the Main router which is main back bone of the network and it had the communication with the external network (ISP) and overall managing the whole network.
- There are two server FTP and HTTP which are locally running and providing internet and FTP services to the authentic users as per the need of the user and managing the internet and FTP in the network.
- The figure shows the two Subnets one on the right hand side and other on the left hand side and denoted with the red circle.
- Each subnet contains the one access point along the computer/ laptop which is connected with the access point and getting services of the network. The stations are shown in the below figure to give a clear understanding of the network.

There are two more things in the picture one application configuration and other is profile application.

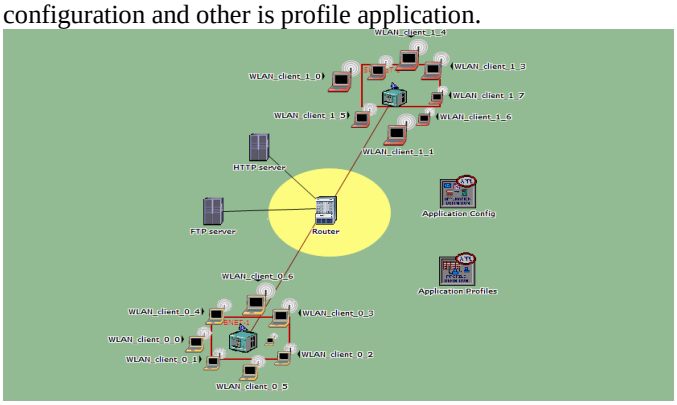

Figure 1. Logical Design of PCF and DCF

The above figure shows that the network contain the Access points which are connected with the the main router and the router had the server which is managing the overall network. along this there are some nodes which are connected with the acess point and runn different application on the network.

IV. RESULT ANALYSIS

a. Network Average Delay

The network delay is the most critical factor which affects the quality of service of the network. In the below mention figure I measure the delay of the both DCF and PCF network with respect to delay and also use the trend line to give more detail about the network delay.

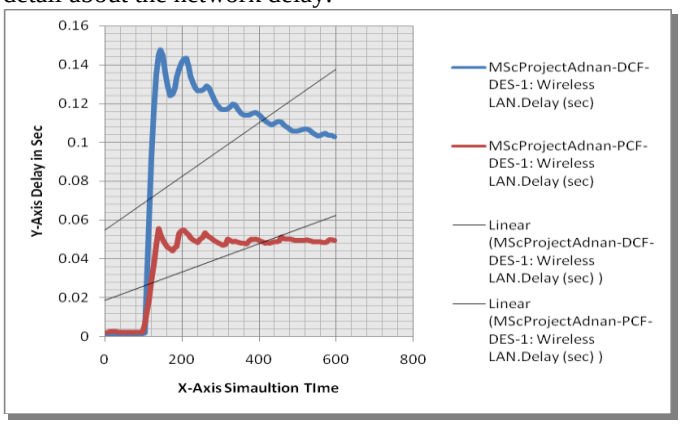

Figure 2 Network Average delay

Figure 2 show the dealy in the PCF and DCF with the help of graph which contain the trend lines. The above higher line showing high delay which is the expliantion of the DCF while the brwon line explaining the delay of the PCF. The X-axis show the simaultion time of the network while the Y-Axis shwoing the overall delay of the network at the specified time interval. The simaultion run for the 10 minutes and above graphs is giving measuremnt with respect to seconds on the x-axis and delay on the Y-axis is also shown in second.

After the one minute of the simaultion the delay of the PCF was at the 0.05 while in the DCF it was 0.15 second , then the delay start decreasing and it become less in the next few minutes but there it big gap of the both graphs which show the performance of the PCF is better as compare to DCF.

As far as trend line analysis the PCF have the trend of the delay started form the 0.2 second and move up continuesly and was at peak at the tenth minute which is 0.6 while in the DCF it started from the 0.6 and remain moving till 0.14 which is quite high and have huge difference with resepct to the PCF delay.

b. Network Retransmisison Attempts

The network retransmission attempts are related with the retransmisison attempts of the network which are make with the passgae of time , it is measure packets per second or packets for the specified time interval.

Figure.3 show the graph which presenting the re transmission attempts in PCF and DCF the X-axis representing the simulation running time and Y-axis is the packet in the particular time slot which are re transmitted , as the figure show that the retransmissions in the PCF is very low and it is near to Zero packets throughout the simulation which are transmitted while on the other hand after the first minute the Packet Retransmission was 0.1 and remain in the range of 0.1 to 0.12 which is also good and low but not as low as the DCF have, it is very clear the retransmission of the PCF is very low while comparing to the DCF.

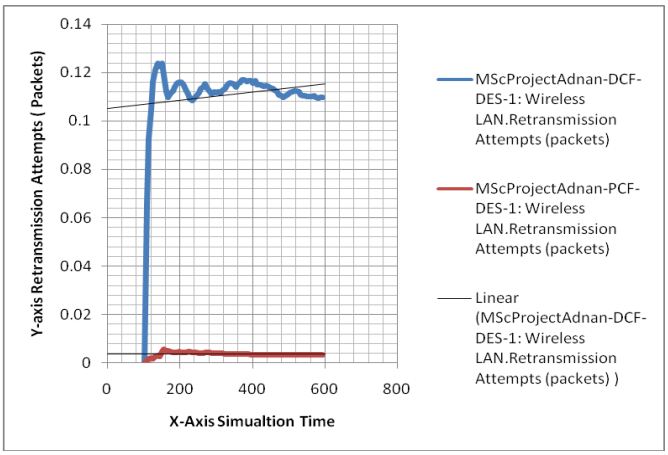

Figure.3. Network Retransmisison Attempts of PCF and DCF

c. Average Network MAC Delay

The delay of the MAC layer is measure in second; it is the measurement which takes place from the entry to exit of the data on the MAC layer.

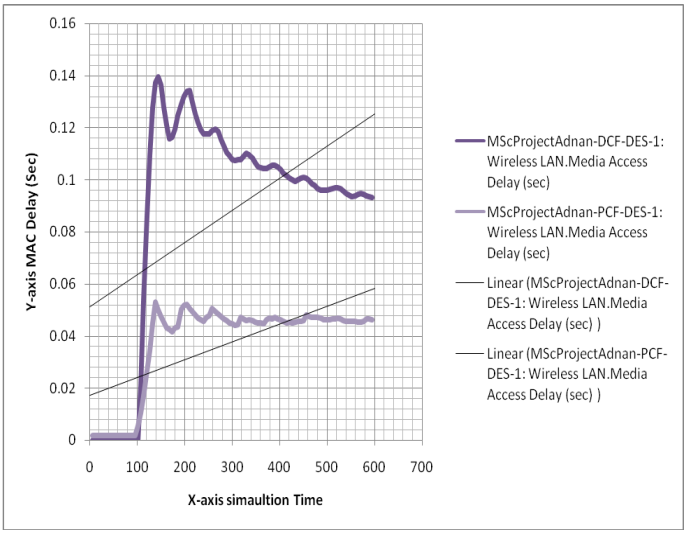

Figure.4. Average Network MAC Delay

Figure.4 shows the simulation time on the X-axis while the MAC delay in Second is shown on the Y-axis.

The blue line is showing the MAC delay of the DCF and PCF delay shown with the help of the Pink line. The delay of the MAC of the PCF started from the 0.05 at the 1.5minute of the simulation and at the same time the delay of the 0.14 which is very high as compare to PCF.

d. Network Throughput

The term throughput is related with the effectiveness and efficiency of the network. The below mention figure 5 shows the throughput of the both PCF and DCF.

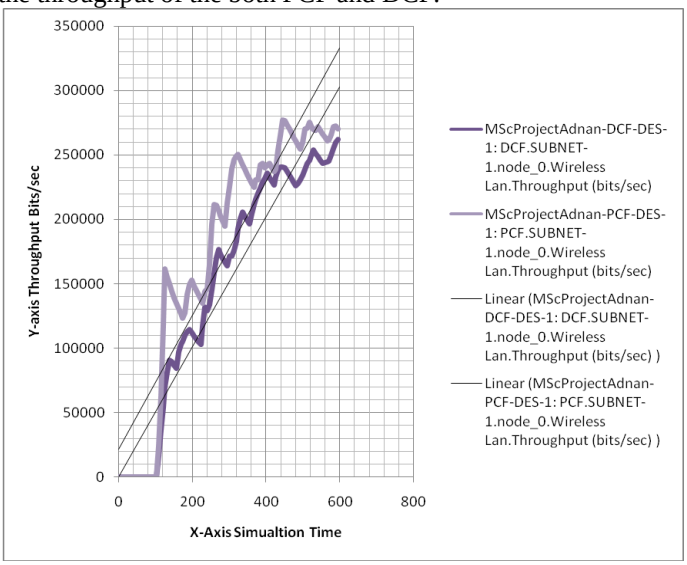

Figure.5. Network Throughput

The Figure 5 shows the throughput of the PCF is higher as comapre to the DCF and it remain high throughput the simaultion which clearly illsutrate that the overall performance of the PCF network remain very high.

e. MAC delay at AP

When the data enter in the Access point and move wan to transmit on the network the access point have to process data from it MAC layer. In this analysis I measure the delay at the MAC layer of PCF and DCF access point.

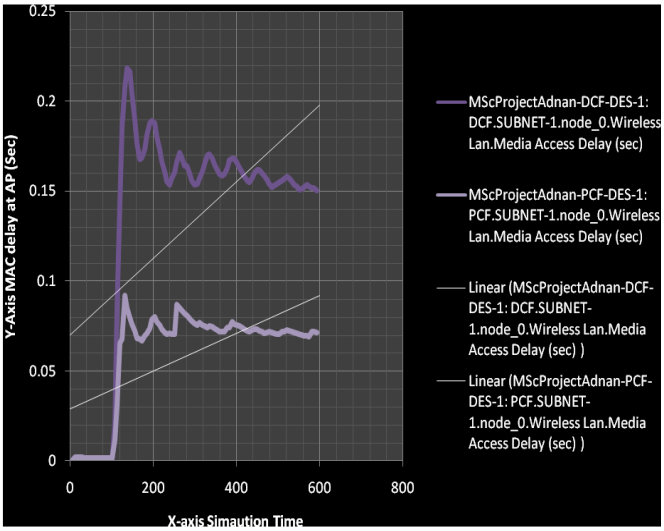

Figure.6. MAC delay at AP

The figure 6 shows the MAC delay with the help of Pink and Off-white lines with the help of trend line as shown above. When the simulation started the network MAC delay was 0.075 in the PCF and at the same time it was more the 0.25 in DCF and then starts decrease in the DCF and remains in the range of the 0.15 to 0.175. While on the other hand the delay of the PCF remains study and was even below the 0.75 throughout the simulation analysis.

f. Queue Size

As previous discuss that the Queue Size of the network is the measurement of the data which remain in the queue due to limited bandwidth and remain in the waiting stage. The below figure 7 explain the detail.

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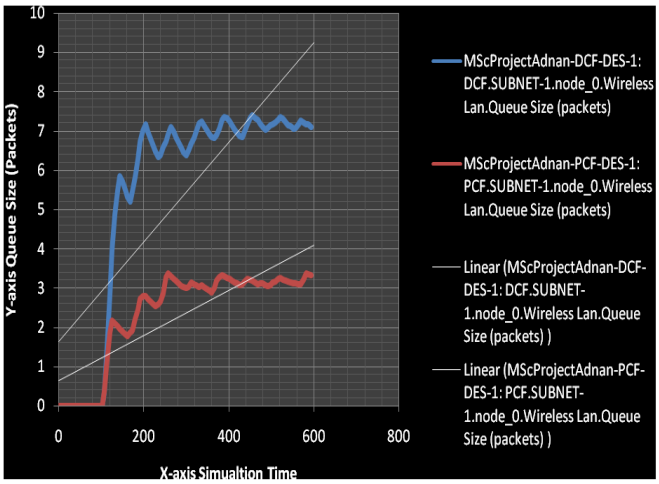

Figure.7. Queue Size

Queue size at the AP level is shown in the above figure 7 with the help of blue and red lines along the trend line. As far as trend line is concern the queue size of the PCF was 0.5 packets and keep moving up and was 4 packet after the 10 minute of the simulation while on the other hand in the DCF it started from the 2 packets and was 7 packets at the end of the simulation which is quite high as compare to the PCF.

V. CONCLUSION

In this research paper we explore the IEEE 802.11 Wireless Protocols and compare and analysis of the QoS of DCF and PCF. This research is to get sound knowledge of the wireless technologies which are used in business and social life improvement, and give the recommendation which network is batter based on the implementation of two networks will be purpose and also describes the analysis of QoS of the DCF and PCF.

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