ISSN 2278 - 3091

International Journal of Advanced Trends in Computer Science and Engineering (IJATCSE), Vol.3 , No.5, Pages : 01-03 (2014)
Special Issue of ICETCSE 2014 - Held during November 03, 2014,Mysore, India

Optimal Contention Window Selection in IEEE 802.11 MAC Protocol for better performance of Wireless Networks

Mrs. Meenakshi
Assistant Professor, Computer Science & Engineering Department,
Nitte Meenakshi Institute of Technology, Bangalore 560064
kmeenarao@gmail.com

Abstract*:* The goal of this work is to investigate the impact of network size and contention window on the performance of the IEEE 802.11 MAC protocol. The performance of any network needs to be evaluated on certain criteria, these criteria then decide the basis of performance of any system. Study on wireless networks' simulation and measuring performance metrics, mainly Packet Delivery Ratio has been done using NS-2 and AWK scripts. The effect of variations in number of nodes on the network performance is analyzed over a wide range of their values. Results are shown in terms of graph and table.

Key words: About four key words or phrases in alphabetical order, separated by commas.

INTRODUCTION

Wireless networks are computer networks that use radio frequency channels as their physical medium for their communication. There are basically three different basic types of wireless networks – WAN (Wide area Networks), LAN (Local Area networks) and PAN (Wireless Personal Area Networks)**.** [1]

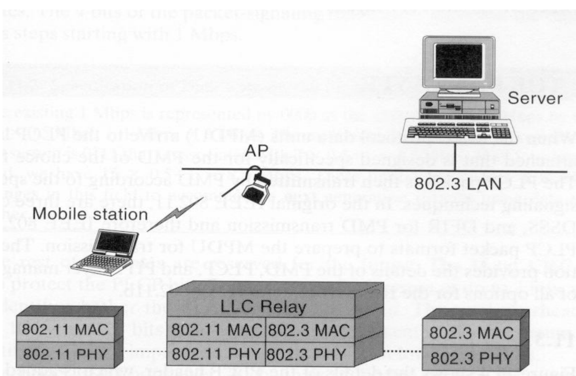

Fig 1: Layered Protocol Architecture

Wireless WANs are created through the use of mobile phone signals typically provided and maintained by specific mobile phone (cellular) service providers. WWANs can provide a way to stay connected even when away from other forms of network access. Wirelesses LAN are wireless networks that use radio waves. The backbone network usually uses cables, with one or more wireless access points connecting the wireless users to the wired network. The range of a WLAN can be anywhere from a single room to an entire campus. Wireless PANs are short-range networks that use Bluetooth technology. They are commonly used to interconnect compatible devices near a central location, such as a desk. A WPAN has a typical range of about 30 feet.

The IEEE 802.11 standard defines a detailed medium access control (MAC) and physical layer (PHY) specification for wireless LANs. Figure1 shows Layered IEEE 802.11 Protocol Architecture. [2]

The data link layer of OSI model comprise the MAC Medium Access Control) protocol. The main job of the MAC protocol is to regulate the usage of the medium, and this is done through a channel access mechanism. A channel access mechanism is a way to divide the main resource between nodes, the radio channel, by regulating the use of it. It tells each node when it can transmit and when it is expected to receive data. The channel access mechanism is the core of the MAC protocol. TDMA, CSMA and polling are the 3 main classes of channel access mechanisms for radio.

All stations compatible with the 802.11 standard are able to perform carrier sensing and can observe activities taking place on the channel. Before transmission, each competing station defers its attempt to access the channel a random time to avoid collisions.

The term 'contention' refers to 'competition for resources'. This term is used especially in networks to describe the situation where two or more nodes attempt to transmit a message across the same wire or channel at the same time. A type of network protocol that allows nodes to contend for network access is called contention protocol. That is, two or more nodes may try to send messages across the network simultaneously. The contention protocol defines what happens when this occurs. The most widely used contention protocol is CSMA/CD, used by Ethernet. Also see polling and token passing.

The contention window decides the frequency and order of the channel access and therefore performs a critical role in both channel utilization and fairness of bandwidth share among stations.

CW is initially assigned the minimum contention window size CWmin. Then, the CW is doubled each time the station experiences a collision until the CW reaches to CWmax which is the maximum contention window size. When the CW is increased to CWmax, it remains the same even if there are more collisions. After every successful transmission, CW is reset to the initial value CWmin. A packet will be discarded if it cannot be successfully transmitted after it is

ISSN 2278 - 3091

International Journal of Advanced Trends in Computer Science and Engineering (IJATCSE), Vol.3 , No.5, Pages : 01-03 (2014)
Special Issue of ICETCSE 2014 - Held during November 03, 2014,Mysore, India

retransmitted for a specific retry times. In 802.11, increment is done as CW=2^n-1; Initialization as CW = CWmin and CW increase with every retry. CW increases up to CWmax.

SIMULATION

This section presents the simulation scenarios done to find the impact of contention window size on the performance of the IEEE 802.11 MAC protocol. NS2 [3][4] is used to simulate this scenario. In the topology considered, all nodes are involved in two Constant Bit Rate (CBR) conversations: one as source, and one as destination.

Packet Delivery Ratio (PDR) is the ratio of number of packets received at the destination to the number of packets generated at the source. A network should work to attain high PDR in order to have a better performance. PDR shows the amount of reliability offered by the network. The greater value of packet delivery ratio means the better performance of the protocol. [5]

PDR= (Σ NR / Σ NG) * 100

NR – Number of Received Packets,

NG – Number of Generated Packets,

Unit – Percentage ratio (%).

Thus to calculate PDR, need to know the number of packets sent and number of packets received. In this study, to get the number of packets sent and received, following pattern matching code is written in AWK script. [6]

$0 ~/^s.* AGT/ and

$0 ~/^r.* AGT/ respectively.

RESULT

Expected plots are the aggregate Packet Delivery Ratio (PDR) vs CW size for different node values; is given below. This shows correlation between the CW size and network size/density. For all considered network density, result shows 63 are the optimal CW size. If this experiment done for density beyond 36 numbers of node, optimal size may vary and may or may not be very clear due to factors like interference with increase in density etc.

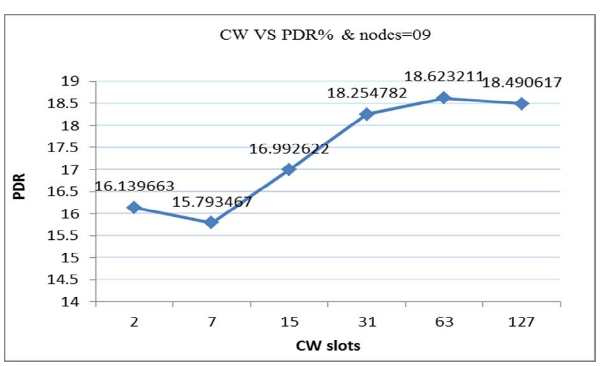

Fig2: CW slots Vs PDR % for nodes=09

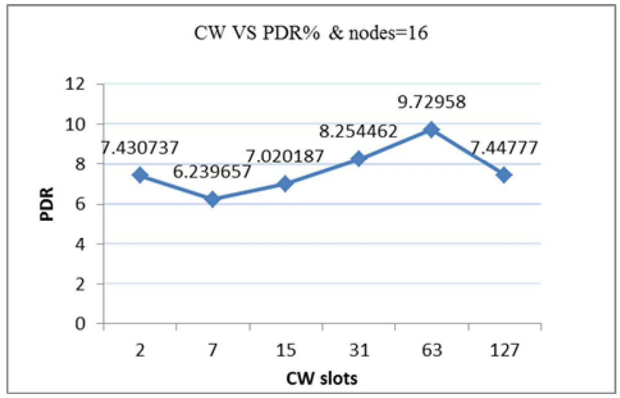

Fig3. CW slots Vs PDR % for nodes=16

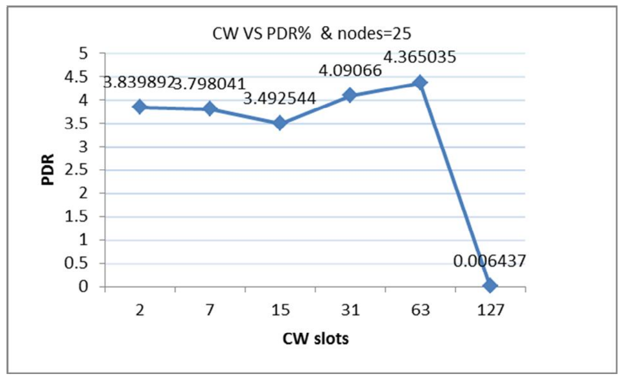

Fig4: CW slots Vs PDR % for nodes=25

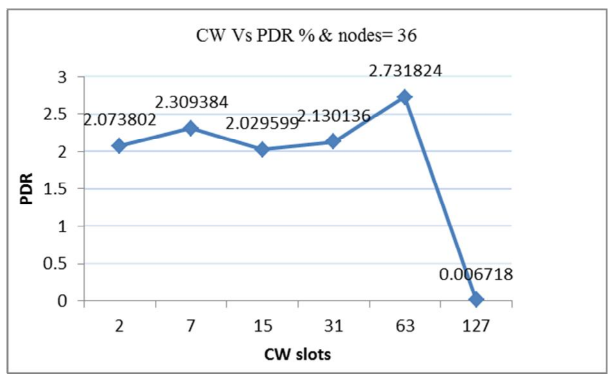

Fig5: CW slots Vs PDR % for nodes=36

CONCLUSION

Packet Delivery Ratio decreases with increase in network density. For some extent, performance increases with increase in contention window size. Beyond that it may not predictable. Thus the above described procedure helped to correlate the CW size and network size/density.

Future work of this study is to see the effect of RTS/CTS, or virtual carrier sending. Case study can be done to learn how RTS is helpful to battle the hidden node problem; where the receiver senses the channel is busy, but the transmitter cannot sense anything.

ISSN 2278 - 3091

International Journal of Advanced Trends in Computer Science and Engineering (IJATCSE), Vol.3 , No.5, Pages : 01-03 (2014)
Special Issue of ICETCSE 2014 - Held during November 03, 2014,Mysore, India

ACKNOWLEDGEMENT

I would like to express my gratitude and appreciation to '2nd International Conference on Emerging Trends in Computer Science and Engineering' team who gave me the opportunity to present and publish this report. Special thanks to Nitte Meenakshi Institute of Technology Bangalore, management and all staffs whose stimulating suggestions and mainly encouragement helped me in this work. I would also like to acknowledge with much appreciation my family members especially my husband Mr.Ajith and my sons Aadithya and Abhirama for their cooperation and support.

REFERENCES

[1] Computer Networks, Text Book by Andrew S. Tanenbaum.

[2] http://wmnlab.ee.ntu.edu.tw

[3] Teerawat Issariyakul and Ekram Hossain, Text Book ―Introduction to Network Simulator NS2, Second Edition.

[4] The ns manual, Kevin Fall and Kannan Varadhan.

[5] Performance Measurements and Metrics, http:// webstaff.itn.liu.se /~davgu/tnk087/Fo_8 .pdf.

[6] Unix concepts and applications 4th edition, Text book by Sumitabha das.