Reducing the Packets Loss Using New MAC Protocol

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***Abstract*—Data move from one point to another point is very important for any network. A Network is mainly used the Mac protocol for communication. The Mac layer could be a sublayer of the data link layer. It is accountable for providing dependableness to the higher layers for purpose to point connections established by the physical layer. Technically, the Mac sublayer is the bottom part of the data link layer of the OSI model. The Mac protocols to confirm that signals sent from completely different stations across a similar channel do not collide. In this work I have implemented a novel cross layer protocol - SNAPdMAC.The protocol adjusts the upper and lower bounds of the contention window to lower the number of collisions. It also uses a power control scheme, triggered by the MAC layer to limit the packet loss, energy wastage and to decrease the number of collisions. The protocol has been implemented and then compared with two other Mac protocols in ns2 namely: 802.11 MAC Protocol Standard and Sensor MAC (S-Mac) protocol. I will compare the protocols based on the total number of packets received and also compared them based on the network lifetime. The results show that SNAPd MAC performs fairly better than the standard 802.11 protocols.**

Keywords :*-Mac Protocol, NS2, SNAPd MAC, Protocol Standards, Packet Loss, Distance-Sequenced Distance Vector Routing Protocol, Packet Fraction Delay.*

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1. INTRODUCTION

General Overview:

The Media Access control Layer is one among two sublayers that form up the data Link Layer of the OSI model. The mac layer is answerable for moving information packets to and from one Network Interface Card (NIC) to a different across a shared channel. The Mac sublayer uses Mac protocols to confirm that signals sent from completely different stations across a similar channel do not collide.

IEEE 802.11 has become the quality for Wireless LAN's each in infrastructure and in unexpected mode, though originally it absolutely was developed for one access purpose situation. In all probability this can be the most reason for several issues and limitations arising in a very pure wireless multi-hop network, wherever the nodes aren't among the transmission vary of one another and everybody must contend for the access to the radio channel. The quality specifies the medium access control mechanism, DCF (Distributed Coordination Function) that has been developed to use among each infrastructure less and infrastructure network configurations. The DCF relies on CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance).

The Mac Layer could be a sublayer of the data link layer that is accountable for providing dependableness to the higher layers for purpose to point connections established by the physical layer. Technically, the Mac Sublayer is the bottom part of the Data Link Layer of the OSI model. The Mac Layer is accountable for moving information packets from one Network Interface Card (NIC) to a different across shared channel. The Mac Sublayer uses Mac protocols to make sure that signals sent from totally different stations across an equivalent channel do not collide.

Basic Mac Layer protocols

- ALOHA
- CSMA
- CSMA/CD
- CSMA/CA

2. PROBLEM DEFINITION

Problem Definition:

The SNAPd-MAC protocol [10] relies on the present standard IEEE 802.11 [1] and it tackles some basic issues existing within the standard for ad-hoc networks. It permits the flexible adjustment of the upper and lower bounds of the CW to lower the collisions. And second, it uses a power control scheme to reduce the amount of collisions thereby reducing retransmission makes an attempt that cause energy wastage.

We have studied a replacement cross-layer Noise Aware powered Mac protocol, enforced it in ns2 then compared its performance with the other basic Mac protocols together with Mac 802.11 standard and Sensor-MAC.

Protocol Discussion:

The protocol considers three main cases for every transmission:

- Recovery mechanism
- Dropped packet
- CW resetting

Proposed solution Strategy:

The goal of the SNAPdMac protocol is to save energy (which leads to an extension of the period of time of nodes) and to reduce the amount of collisions. However, the SNAPdMac protocol doesn't degrade the throughput performance and fairness in terms of the throughput and sending rate, whereas fulfilling these goals.

The SNAPd-Mac protocol tackles one or two of issues that exist within the current implementation of the standard. It will this by two means that, first it concentrates on the flexible adjustment of the upper and lower bounds of the CW to lower the amount of collisions. Secondly, it uses a power control scheme to limit the waste of energy and additionally to lower the amount of collisions. Hence, it's MAC-PHY cross-layer architecture. To tackle the inefficient use of the back-off window within the standard, we've got used Esb algorithmic rule [9] during the recovery stage. The EsB adjusts the lower and upper bounds of the CW range, taking under consideration the number of retransmissions tries, the 1- hop active neighbors, and therefore the remaining battery level. Every node will estimate how many neighbors it's in its 1-hop neighborhood, based on with success detected signals or using the table that's designed by a routing mechanism. In the utilization rate of the slots (slot utilization) observed on the channel by every station is used for an easy, effective and low-priced load estimate of the channel congestion level.

During the resetting stage, the CW value is reset to a value that depends on the history of collisions. This forms the Mac a part of the SNAPdMac protocol and results in a reduction of the amount of collisions.

The goal isn't only to lower the amount of collisions, however additionally to avoid wasting energy. If we tend to reflect on the reason why messages collide, it becomes clear that this is often as a result of too several nodes are too near one another. They may be positioned a few meters from one another; however their transmission range is much larger than these few meters. Hence, the nodes are too near one another relative to their respective transmission range. This not only results in a better variety of collisions, however additionally in an excessive use of energy to transmit a packet. The SNAPdMac power control part is based on this observation and it lowers its transmission power (while observant too high noise within the vicinity) once it doesn't get the acknowledgment that a packet has been received with success. The final results are going to be that every one node can find their optimal transmission power that ensures that they will reach their neighbors, however not interfere with alternative nodes. However, not receiving an acknowledgment for a sent packet doesn't always mean that the packet was lost or corrupted as a result of there was an excessive amount of interference. It might additionally happen that the transmission power was just too low to reach any of the surrounding nodes. Therefore, the SNAPdMac protocol takes the signal-to-interference-and- noise ratio (SINR) into account. If no acknowledgment has been received, however the noise level (deducted from the SINR) is low, then we tend to assume that the transmission power was too low to reach any of the neighbors. Therein case the transmission power is increased.

3. DESIGN

Network simulator (NS):- is a simulation tool targeted at each wired and wireless (local and satellite) networking research, specifically ns-1, ns-2 and ns-3. NS is a very promising tool and is being used by universities and researchers. NS provides substantial support for simulation of transmission control protocol, routing, and multicast protocols over wired and wireless (local and satellite) networks. It implements network protocols like FTP and Telnet, routing algorithms like SPF and DV, and 'lower' layers like logic link (LL) and media access control (MAC).

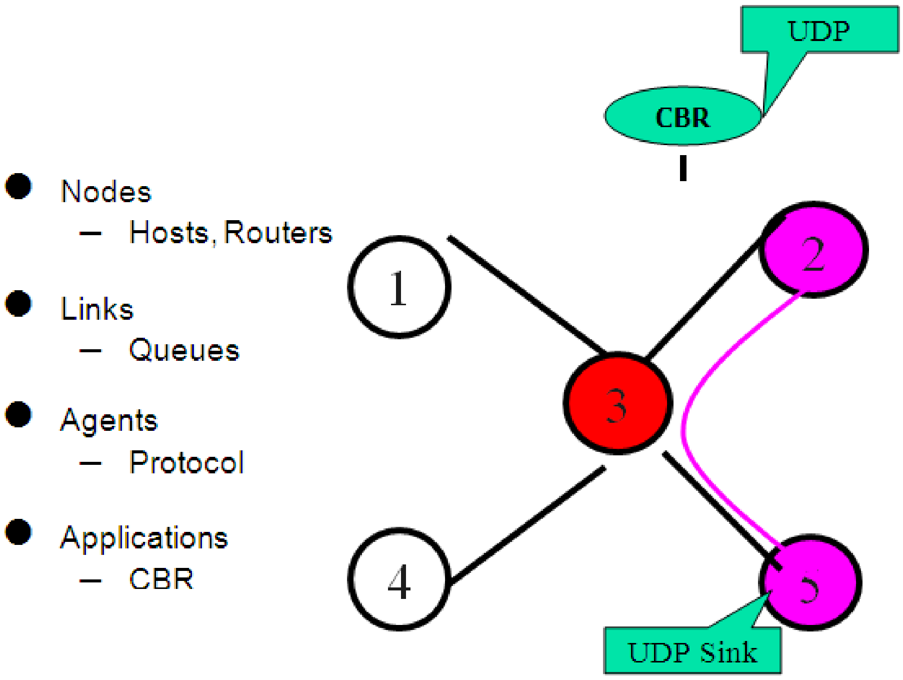

Fig. 3.1: NS Communication Model

Comparison on the Packet Delivery Fraction (PDF):

4. RESULTS

Results and Discussion

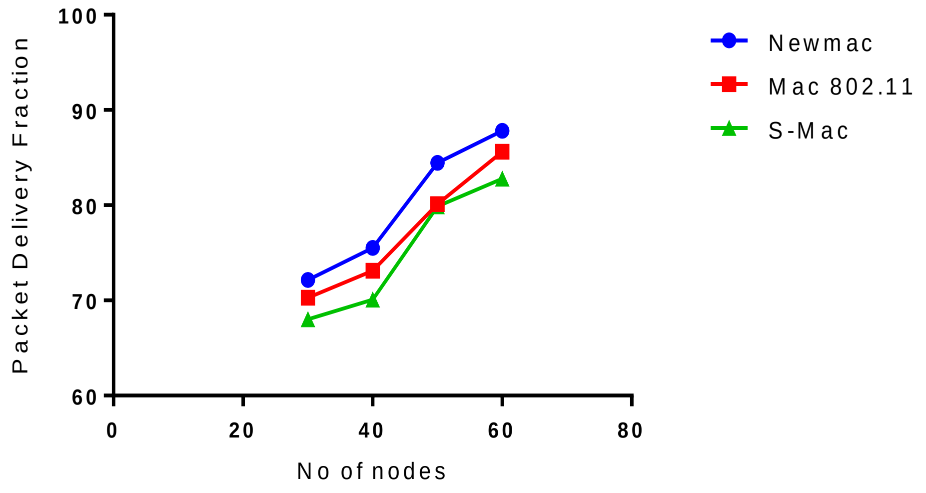

Fig 4.1 Comparison of MAC protocols based on Packet Delivery Fraction

In Fig 4.1, I compare performance of MAC protocol based on the ratio of the number of delivered data packets to the destination. The result clearly shows that Newmac is better than other two protocols.

Similarly, Fig 4.2 show the performance of MAC protocols based on the Average (e-e) Delay. The X-Axis notes the number of nodes and Y-Axis show the average (e-e) delay.

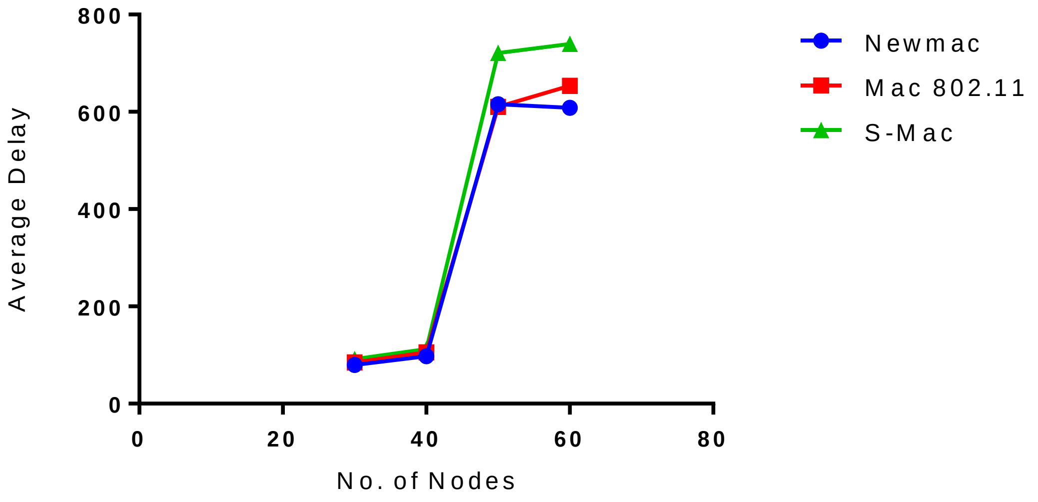

Fig 4.2 Comparison of MAC protocols based on Average (e-e) Delay

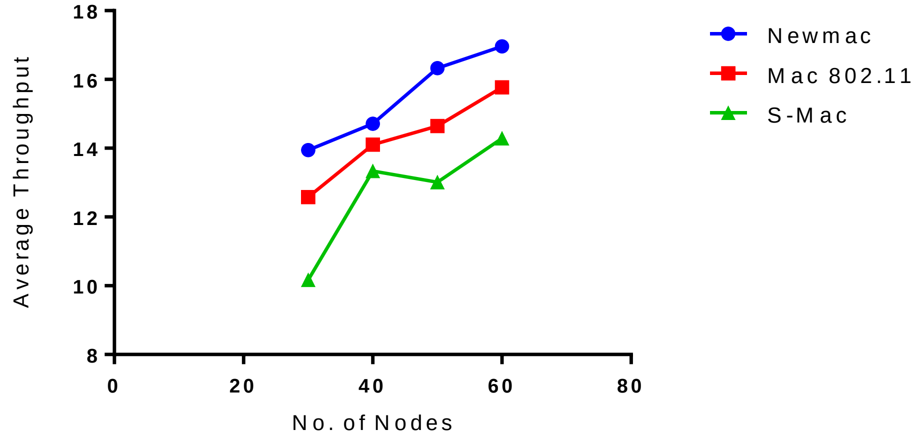

Fig 4.3 Comparison of MAC protocols based on Average Throughput

Finally in Fig 4.4, I compare the MAC protocols that are based on the total number of packets dropped during the simulation.

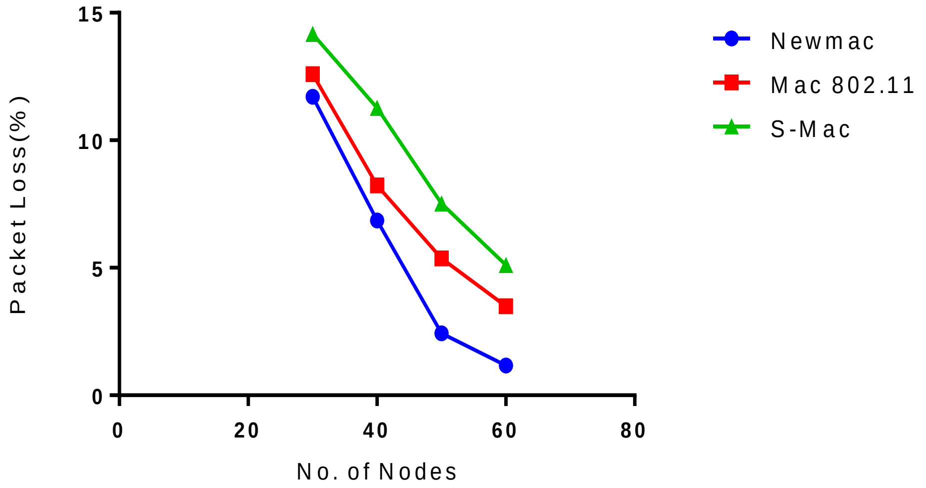

Fig 4.4 Comparison of MAC protocols based on packet loss

The above results show that the SNAPdMAC (Newmac) protocol much better than the two other existing protocol.

5. SUMMARY AND CONCLUSION

Main Difficulties Encountered

The lack of a proper tutorial for understanding the creation of a MAC protocol was the main problem encountered. There were tutorials for implementing routing protocols in ns2 but none for MAC protocols.

Even though ns2 almost shows the simulations perfectly, but time is a constraint in ns2.

Waiting for the simulation to end for a long time, especially in case of large networks is not possible. The problem is however solved as using grep, awk, perl, and xgraph tools

For analyzing the trace file instead of the nam trace. Though the trace file (in .tr format) is a bit long, with filtering provided by grep tool one can filter only the relevant data required and discard the unnecessary.

The syntax for using grep command in Linux is:

grep “parameter” input-file>output-file

e.g suppose I want only those lines in trace file say out.tr concerning only the tcp packets that went from node 0 to node 2, then type the following in the terminal:

grep “0 2 tcp” out.tr>out.txt

After filtering the trace files with grep and awk, I can use xgraph and other graph tools to plot the graph.

Xgraph takes input as a two column file (corresponding to the x and y coordinates) say a text file and gives output as a two-dimensional graph as output.

The good thing about these tools is that all of them are available in ns2 and Linux.

Future Scope of Work

Till now I have compared the protocol implemented only with the standard 802.11, and I have not compared this with other new protocols currently implemented. So this work should be compared with the new MAC protocols implemented by others.

Conclusion

In this work, I have implemented a novel cross layer protocol-SNAPdMAC(Newmac).The protocol adjusts the upper and lower bounds of the contention window to lower the number of collisions. It also uses a power control scheme, triggered by the MAC layer to limit the energy wastage and decrease the packet loss. The protocol has been implemented and then compared with two other Mac protocols in ns2 namely: 802.11 MAC Protocol Standard and Sensor MAC protocol.

First, I have compared the packet fraction delay. Secondly, I have compared the average (e-e) delay. After this, I have compared the average throughput. Finally, I have compared the packet loss. The results show that SNAPdMAC (Newmac) performs fairly better than the standard 802.11 protocols.

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