

802.11 Mac Protocol Improvement Technique

Vipin Shankarrao Bhure
Department Of Electronics & Telecommunication
G.H.Raisoni College of Engineering Nagpur

ABSTRACT

Wireless networking is the mostly used networking technique in this era of telecommunication. When the term wireless comes, it reminds the importance of 802.11 mac protocol. For the rural areas like villages, 802.11 mac protocol plays an important role for networking because of its cost, which is very low as compared to the other networking. Moreover the mac protocol provides higher rate of data transfer. This paper shows the works for improvement of performance of 802.11 mac protocol. The simulation of new model is done using ns-2. The network simulator ns-2 is frequently used for simulation of wireless LAN IEEE 802.11 protocol. About half of the publications are based on results which ns-2 has produced. Here the project works are done using version 2.33 of ns-2 which contains more extensions as compared to the previous version.

Keywords

Linux, NS-2, MAC 802.11

1. INTRODUCTION

Wireless telephony has been successful because it enables people to connect with each other regardless of location. This new technology targeted computer networking, and now the internet connectivity is implemented successfully by wireless networking technology. In 1997, the IEEE adopted the IEEE 802.11 standard which is used for wireless computer communication. The IEEE 802.11 defines two layers, (PHY) which specify the modulation scheme used and signaling characteristics for the transmission through radio frequencies. The second layer is the media access control (MAC). This layer determines how the medium is used. In this project we are focusing more on the MAC layer.

2. ABOUT MAC

The MAC is set of rules to determine how to access the medium and data link components. The MAC rides on every transmission of user data into the air. It provides the core framing operations and the interaction with a wired network backbone.

2.1 MAC LAYER

The MAC sub-layer is the lower sub layer of data link layer, and it sits below the LLC sub layer. As the name suggests, the main function of MAC sub layer is provide media access control. As media includes all the pictures, videos etc, this layer is used to transmit or receive media contents or information.

2.2. Working of MAC

First come, first served. Carries sense multiple accesses with collision detection (CSMA/CD). If no one is transmitting, a workstation can transmit. If someone else is transmitting, a workstation "back off" and waits. If two workstations transmit at the same time, the collision occurs. When the two workstations hear collision, stop transmitting immediately. Each workstation back off a random amount of time and tries again.

CSMA/CD: an example of a nondeterministic protocol.

3. IMPLEMENTATION USING NS2

NS-2 stands for Network Simulator version 2. It is a discrete event simulator for networking research. It works at the packet level. Provides substantial support to simulate bunch of protocols like TCP, HTTP, FTP, UDP, DSR. It simulates wired and wireless network. It is primarily UNIX based system. It uses TCL as a scripting language. NS-2 is a standard experiment environment in research community.

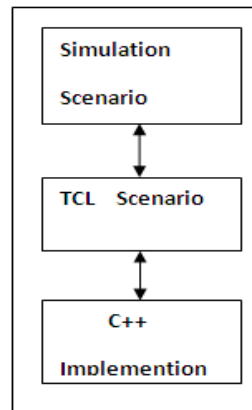
3.1 Why two languages?

C++: Detailed protocol simulation requires system programming language. Byte manipulation. Packet processing, algorithm implementation, run time (run simulation, find bug, fix bug, recompile, re-run) is slower.

TCL: Simulation of slightly varying parameters or configurations is possible easily. Quickly exploring a number of scenarios. Is easy iteration time (change the model and re-run) is very less.

3.2 NS-2 environment:

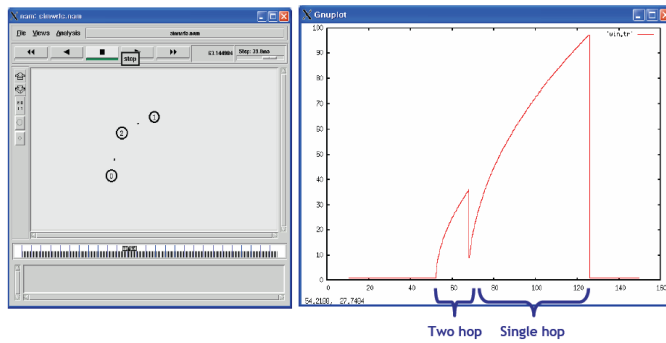
NS-2 simulation environment is shown in the following diagram:



Paper submitted by "Eitan Altman and Tania Jimenez" from "Sungkyunkwan University" on "14-10-2006" based on MAC protocol implementation was as follows:

- A single connection over a 3-nodes network
- 500m × 400m
- DSDV adhoc routing
- IEEE802.11 MAC protocol
- Simulation time : 150msec
- FTP start value set: 12ms
- Maximum Packets in if q: 50

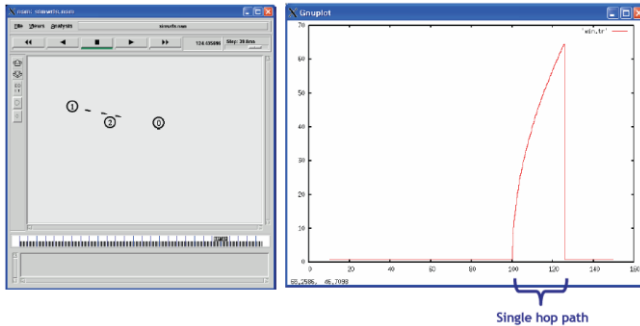
Simulation and graph are shown below:



It was further modified by them by changing following parameters:

Simulation time: 150msec
 FTP start value set: 10
 Maximum Packet in if q : 50

Simulation Graph generated by this model was given as:



4. MAC PROTOCOL TOPOLOGY DESIGN FOR BETTER PERFORMANCE

It is clear from the above experiment that by changing the FTP value from 12 to 10, we can overcome the drop of packets during transmission problem. The drop seen at 70th millisecond can also be removed.

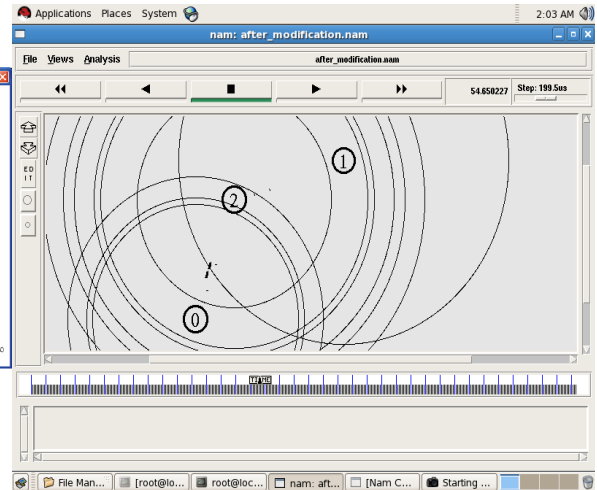
But it is also observed that the simulation time cannot be improved. In the second case the channel is used till 100th millisecond, but no data transfer takes place. After 100th millisecond the data transfer starts. It is also seen that maximum throughput is seen as 65 at 124th millisecond. And the data transfer duration is seen as 24 milliseconds.

In order to remove the above all drawbacks we have designed a new method changing some important parameters. Those are as follows:

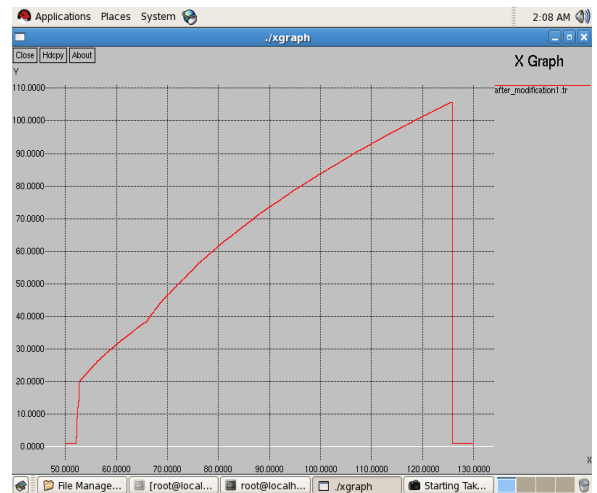
- ☐ FTP value set to be: 50
- ☐ Simulation time set to be: 130 Millisecond
- ☐ Maximum packets in ifq: 500

The simulation and graph obtained by running our new model in NS-2 are shown below:

Simulation and result animation:



Graph:



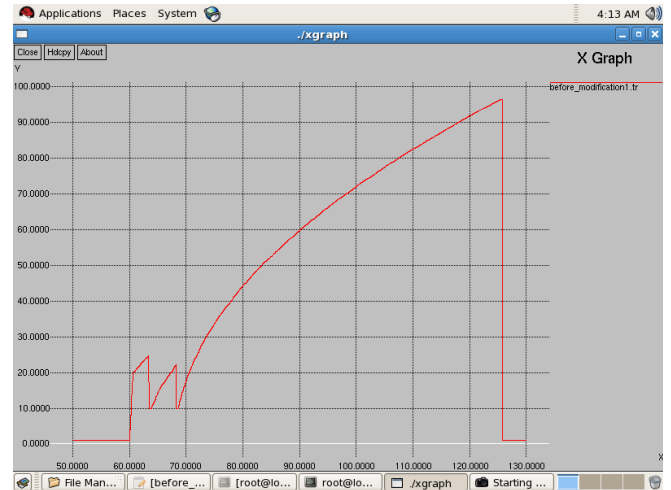
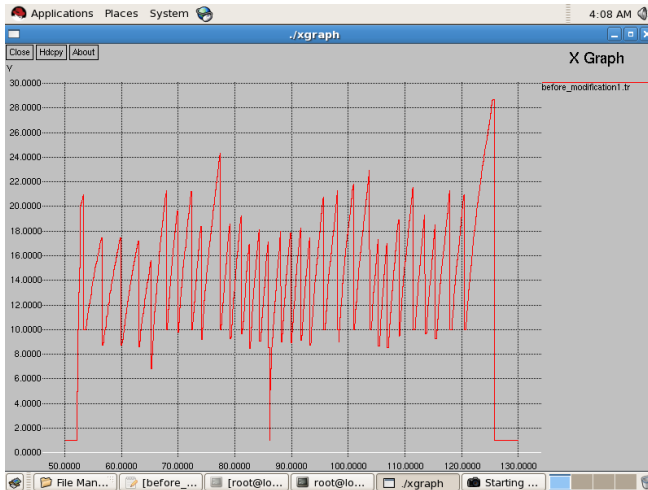
4.1. Further Experiments & Results:

4.1.1. For single hopped data transfer:

Maximum_Packets in ifq'should more than 20. Below 20 the data transfer will be very difficult. In the simulation process the following graph is observed for packet size 15 in if q.

Parameters Changed:

FTP Value set to be: 50
 Simulation Time: 130 Milliseconds
 Maximum packets in IFQ: 15.



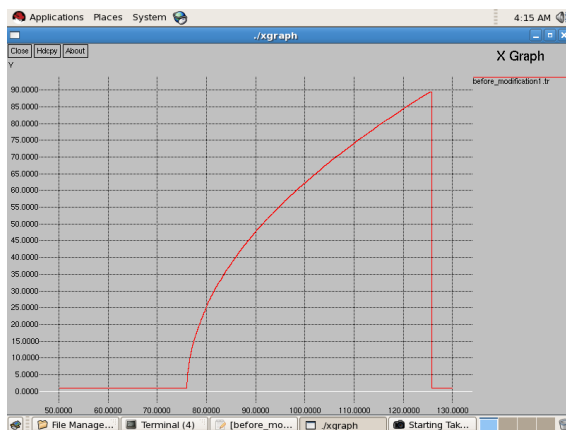
4.1.2. For long duration data transfer it is seen FTP start should be $-32 \leq \text{FTP start value} \leq 52$. Below 32 the data transfer rate decreases. Following is the graph obtained from simulation process for FTP start value=31.

Parameters Changed:

FTP Start Value set to be: 31

Simulation time: 150 milliseconds

Maximum Packets in IFQ: 20



Above 52 the data transfer rate again decreases. Following is the graph obtained from simulation process for FTP start value=60.

Parameters Changed:

FTP Start value set to be: 60

Simulation time: 130 milliseconds

Maximum Packets in IFQ: 20

Thus it is found that the ideal value of the data transfer duration is 76 milli-seconds. It will be possible only when the FTP start value is in between 32 & 52.

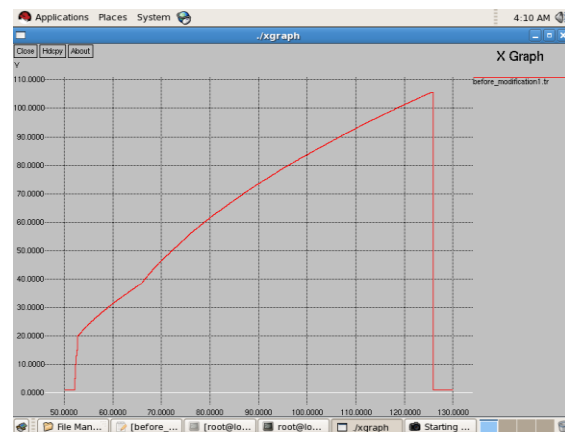
4.1.3. The simulation duration can be reduced from the original value 150 milli-second to 130 milli-seconds as the data transfer duration is maximum 76 milli-seconds and it is in between 52 to 126th milli-seconds. Following is the ideal response of the simulation process till 130th milli-second.

Parameters Changed:

FTP value set to be: 52

Simulation Time: 130

Maximum Packets in IFQ: 20



5. APPLICATIONS

5.1. Broadband Wireless Network:

- A similar kind of WiMAX broadband wireless service provision can be established.
- Huge cost benefits due to fast deployment and low-cost hardware.
- Users are provided the service quality (bandwidth or delay) based on their requirements.

5.2. Rural Internet Connectivity:

- Can bring Internet technology to rural villages by providing the following services.
- Internet connectivity at very low costs.
- Teleconference service using VoIP application.
- TeleEducation/ Telemedicine services can be provided with Video over IP (Video conferencing)

6. CONCLUSION

Now a day it is necessary for a communication system to be a cheap one. As in various rural areas, mostly in 3rd world countries the communication is a major problem. MAC 802.11 is the most efficient protocol for establishing a telecommunication process in those areas. The above shown ideas can help in designing the low cost MAC protocol network as well as in performance improvement.

7. REFERENCES

- [1] Marc Greis' Tutorial for the UCB-LBNL-VINT Network Simulator.
- [2] J.Broach, D.A. Maltaz, D.B. Johnson, Y-C. Hu, and J. Jetchava —A Performance Comparison of Multi-hop wireless ad-hoc network routing protocols||, Proc. Of ACM MOBICOM'98 Conf., October 1998.
- [3] R. Castaneda and S.R. Das, —Query Localization Techniques for on demand protocols in ad networks||, Proc. Of ACM MOBICOM'98 Conf.