ESTIMATION AND ENHANCING THE PERFORMANCE OF WLAN NETWORK'S BY LOAD BALANCING

Manjit Singh[#1], Omkara Murthy[*2]

[#] *Department of Computer Science, Lovely University*
[1] *project.2298@gmail.com*

[*] *Department of Computer Science, Lovely University*
[2] *omkar.15960@lpu.co.in*

Abstract— As the Internet becomes the critical information infrastructure for both personal and business applications, fast and reliable routing WLAN need to be designed to maintain the performance of those applications in the presence of load balancing.A huge value of wireless technology is based upon the principle of direct point-to-point, semi direct system communication. Some of the useful solutions like *Global Standard for Mobile communications* (GSM) and *Wireless Local Area Network* (WLAN) both use an approach where mobile nodes communicate directly to each other with some centralized access point device which assist them for energy and communication. A Wireless local area network (WLAN) links two or more devices using some wireless distribution method and usually providing a connection through an access point to the wider internet. This gives users the mobility to move around within a local coverage area and still be connected to the network. This research it will be assumed that ad-hoc networks include links deals up by either WLAN or Ethernet interface. This Research will be focus on the Load Balancing Scheme that can lead to better throughput and less latency and Provide the solution for quality for WLAN network in term of stability against congestion under different mobility environment.

***Keywords*— Wireless LAN, IEEE standard 802.11a, Load Balancing.**

I. INTRODUCTION

A huge value of wireless technology is based upon the principle of direct point-to-point, semi direct system communication. Some of the useful solutions like *Global Standard for Mobile communications* (GSM) and *Wireless Local Area Network* (WLAN) both use an approach where mobile nodes communicate directly to each other with some centralized access point device which assist them for energy and communication. This type of network setup has to configure manually or automatically for different operations. In multi-hop scenarios, nodes can communicate by utilizing other nodes as relays for traffic if the endpoint is out of direct communication range. A Wireless local area network (WLAN) links two or more devices using some wireless distribution method and usually providing a connection through an access point to the wider internet. This gives users the mobility to move around within a local coverage area and still be connected to the network [1]. Wireless LANs have become popular in the home due to ease of installation, and the increasing to offer wireless access to their customers. The University of Hawaii developed the world's first wireless computer communication network, ALOHA net, using low-cost ham-like radios. The system included seven computers deployed over four islands to communicate with the central computer on the Oahu Island without using phone lines. WLAN hardware was initially so expensive that it was only used as an alternative to cabled LAN in places where cabling was difficult or impossible. Early development included industry-specific solutions and proprietary protocols, but at the end of the 1990s these were replaced by standards, primarily the various versions of IEEE 802.11 (commonly misunderstood as equal to trademark Wi-Fi of Wi-Fi Alliance). An alternative ATM-like 5 GHz standardized technology, HiperLAN/2, has so far not succeeded in the market,

and with the release of the faster 54 Mbit/s 802.11a (5 GHz) and 802.11g (2.4 GHz) standards, almost certainly never will. Unfortunately, the two new specifications were incompatible because they used different frequencies. This means that 802.11a network interface cards (NICs) and access points cannot communicate with 802.11b NICs and access points. This incompatibility forced the creation of the new draft standard known as 802.11g. 802.11g supports up to 54 Mbps and is interoperable with 802.11b products on the market today.

Figure 1.1: Wireless Lan connectivity [1]

.

II.802.11 Specifications

The 802.11 specifications were developed specifically for Wireless Local Area Networks (WLANs) by the IEEE and include four subsets of Ethernet-based protocol standards: 802.11, 802.11a, 802.11b, and 802.11g.

A. ***802.11***

802.11 operated in the 2.4 GHz range and was the original specification of the 802.11 IEEE standards. This specification delivered 1 to 2 Mbps using a technology known as phase-shift keying (PSK) modulation. This specification is no longer used and has largely been replaced by other forms of the 802.11 standard. According to different standards like IEEE, IANA provide interfaces operating specifications like 802.11a, 802.11b, and 802.11g. In this research it will be assumed that ad-hoc networks include links deals up by either WLAN or Ethernet [12] interfaces.

B. 802.11a

802.11a operates in the 5 - 6 GHz range with data rates commonly in the 6 Mbps, 12 Mbps, or 24 Mbps range. Because 802.11a uses the orthogonal frequency division multiplexing (OFDM) standard, data transfer rates can be as high as 54 Mbps. OFDM breaks up fast serial information signals into several slower sub-signals that are transferred at the same time via different frequencies, providing more resistance to radio frequency interference. The 802.11a specification is also known as Wi-Fi5, and though regionally deployed, it is not a global standard like 802.11b.

C. **802.11g**

802.11g is the most recent IEEE 802.11 draft standard and operates in the 2.4 GHz range with data rates as high as 54 Mbps over a limited distance. It is also backward compatible with 802.11b and will work with both 11 and 22 Mbps U.S. Robotics wireless networking products. 802.11g offers the best features of both 802.11a and 802.11b, but as of the publication date of this document, this standard has not yet been certified, and therefore is unavailable.

1.2 Wireless LAN Frequency Usage

The 802.11b standard defines 14 frequency channels for use with this technology. Depending on the country a user lives in and where he or she will be installing a WLAN, there are certain governmental restrictions for companies offering these products and consumers or businesses deploying these products.

In North America, the FCC (Federal Communications Commission) and IC (Industry Canada) allow manufacturers and users to use channels 1 through 11, per ETSI approval (European Telecommunications Standards Institute); most of Europe can use channels 1 through 13, while in Japan, users have all 14 channels available. There are 14 channels designated in the 2.4 GHz range spaced 5 MHz apart (with the exception of a 12 MHz spacing before Channel 14). As the protocol requires 25 MHz of channel separation, adjacent channels overlap and will interfere with each other. Consequently, using only channels 1, 6, 11, and 14 is recommended to avoid interference. Countries apply their own regulations to both the allowable channels, allowed users and maximum power levels within these frequency ranges.

1.3 WLAN Performance

Much the same way a cordless phone works better when it is close to its base, wirelessly networked

computers function best when located relatively close together and in open sight of each other. The level of performance of an 802.11 WLAN is dependent on a number of important environmental and product-specific factors. Access points will automatically negotiate the appropriate signaling rate based upon environmental conditions, such as:
a) Distance between WLAN devices (AP and NICs).
b) Transmission power levels.
c) Building and home materials.
d) Radio frequency interference.
e) Signal propagation.
f) Antenna type and location.

Depending on environmental specifics, automatic downshifting by the access point or client allows compatibility adjustment to prevailing radio frequency conditions. At any one moment, an 802.11b network can be running at 11 Mbps, 5.5 Mbps, 2 Mbps, or 1 Mbps 22 Mbps wireless networking products). And depending on where each wireless device is in a home or office, each of those devices can be transmitting at any one of these speeds.

The third-generation (3G) wide area wireless networks and 802.11 local area wireless networks possess complementary characteristics. 3G networks promise to offer always on, ubiquitous connectivity with relatively low data rates [2]. 802.11 offers much higher data rates, comparable to wired networks, but can cover only smaller areas, suitable for hot-spot applications in hotels and airports. The performance and flexibility of wireless data services would be dramatically improved if users could seamlessly roam across the two networks.

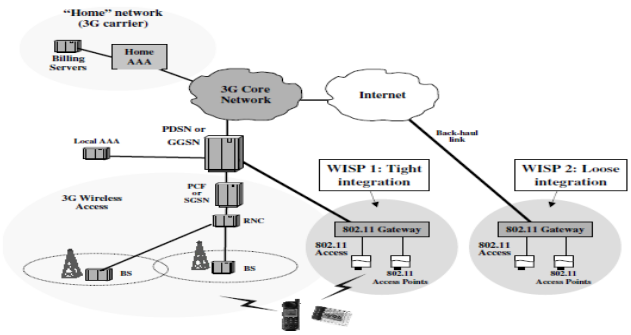

Figure 1.2: Architecture view for 802.11 services to high speed networks like 3G [2].

As network grows, necessity of maintaining the quality of service and reliability of network is tends to increase rapidly. Congestion is always on the verge of network implementation and to avoid congestion, load balancing of the traffic is act as prime solution.Load balancing became very important in case of traffic like video conferencing and variable bit rate transmission. Below is the example of integration of 802.11g network for video conference traffic.

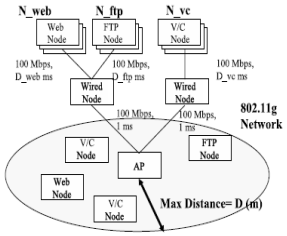

Figure 1.3: 802.11g services with video conference applications [3].
In Our research, load balancing will be done in such a distributed way so to increase the throughput of the implemented network and to reduce the delay of the network.

2 .Proposed Work

2.1 *Problem Defination*

WLAN is providing the solution for communication as it is providing the services for video, voice, burst data, regular services for communication etc. To support such a diversified range of services, better quality in routing, security and load balancing are required. Load balancing the traffic is the main function to which this research will focus. This research will tends to eliminate the problem of load balancing in WLAN mesh networks in term of congestion. Research will provide a distributed load balancing scheme to share the load on the devices. Further will focus on reducing delay by providing quality on individual devices and then for whole network.

2.1.2 *Objectives*

To provide a distributed load balancing scheme, this can lead to better throughput and less latency and to Provide solution for

quality for WLAN network in term of stability against congestion under different mobility environment.

2.1.3 *Methodology*

This research will focus on providing solution for said problem by enhancing quality of service between nodes so that network will have better throughput and less delay. This research will be focused on the load balancing in a most distributed way possible to avoid the congestion in WLAN. Research will start with building a WLAN network in OPNET 14.0 simulator with parameters like HTTP, FTP, VIDEO CONFERENCE traffic, variation of nodes and servers, particular energy level of mobile nodes. Basic parameters like Packet delivery, Throughput, Delay, Retransmission Attempt, Network Load for WLAN will be used.After basic building and implementation of WLAN networks, a scenario with congestion will be implemented. Both scenarios will be compared on the bases of parameters like throughput, Packet delivery ratio, end to end delay and network load. To avoid the Congestion, proposed distributed load balancing will be done by implementing the WLAN in similar line to content delivery networks.Proposed load balancing will balance the load according to the variance of load defined by server and control the flow of the traffic and distribution of the traffic accordingly. Content delivery network scenario will be used for providing quality of service for WLAN by sharing resources from servers and by balancing the load in between them. Scenario will show the improvement after implementation of proposed scheme by providing the improved results which further will be compared with previous scenario (congestion scenario) and results can be compared as similar done in paper [4] for further validation. Finally this research will show the improvement done by proposed scheme in graphs with respect to parameters like throughput, delay, retransmission attempt, and network load.

3. Results

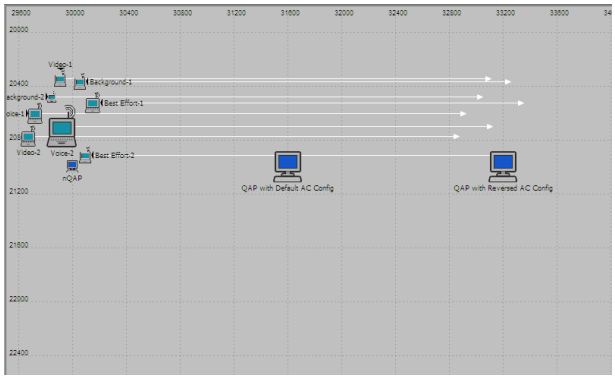

Fig 3: Basic Topology for experimentation

Delay of the wireless network is given below:

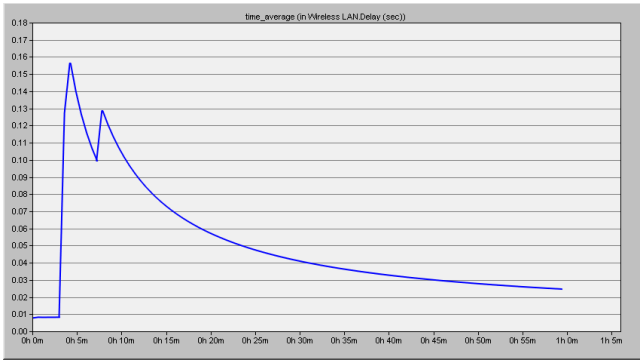

Fig 4: delay in wireless network

Throughput for the wireless LAN is given below:

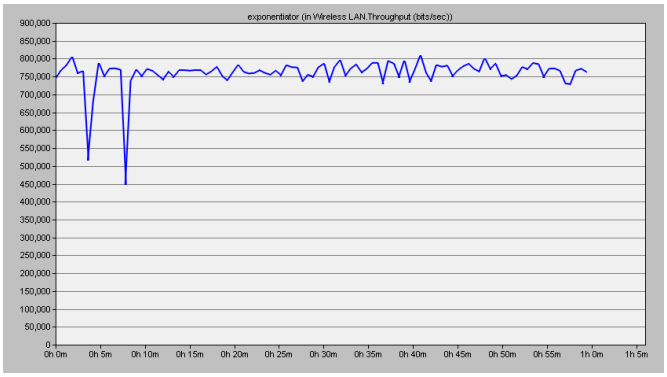

Fig 5: Throughput of wireless network

References

[1] T Muhammad Akber Farooqui, "Protocol Design Issues in WLAN", *Proceedings of the World Congress on Engineering, Vol I, WCE 2009, pp 1 - 3, London, July 2009.*

[2] M. Buddhikot, G. Chandranmenon, S. Han, Y. W. Lee, S. Miller, L. Salgarelli, "Integration of 802.11 and Third-Generation Wireless Data Networks", *IEEE INFOCOM, pp 45-56, 2003.*

[3] Masato Shimakawa, David P. Hole, Fouad A. Tobagi," Video-conferencing and Data Traffic over an IEEE 802.11g WLAN using DCF and EDCA", IEEE, vol- 7, pp 125-129, *2005.*

[4] Rajan Vohra, Ravinder Singh Sawhney, Gurpreet Singh Saini," OPNET based Wireless LAN Performance Improvisation", International Journal of Computer Applications, Vol. 48, No. 1, pp 123-127, June, 2012.

[5] Bhaskar Sardar, Debashis Saha," A SURVEY OF TCP ENHANCEMENTS FOR LAST-HOP WIRELESS NETWORKS", IEEE Communication, *3RD QUARTER, Vol-8, No- 3, pp 156-158, June, 2006.*

[6] Shaik Madhar Saheb A. K. Bhattacharjee, A. Vallavaraj and R. Kar, "A Cross-Layer based Multipath routing protocol for IEEE 802.11E wlan", IEEE, pp-5-8, GCC conference and exhibition, February, dubai 2011.

[7] Yan Zhan, Nirwan Ansari, Hiroshi Tsunoda," Wireless Telemedicine Services Over Integrated IEEE 802.11/WLAN and IEEE 802.16/WIMAX Networks", *Wireless Technologies for E-Healthcare, IEEE Wireless Communications, Volume-5, issue- 10, pp 1137-1145, • February 2010.*

[8] Ming Li, Liang Zhao, Xi Li, Xiaona Li, Yasir Zaki, Andreas Timm-Giel, Carmelita Görg," Investigation of Network Virtualization and Load Balancing Techniques in LTE Networks", *IEEE, 2012.*

[9] Ravindra L. Pardhi, Vishwas T. Gaikwad," Voice and Video over Wireless LAN", International Journal on Computer Science and Engineering (IJCSE), NCICT 2010 Special Issue, 2010.

[10] G. Prakash, P. Thangaraj," Non-Saturation Throughput Analysis of IEEE 802.11 Distributed Coordination Function", European Journal of Scientific Research, Vol-51, No-2, pp.157-167, 2011.

[11] V. Berlin Hency, D. Sridharan," Enhancement of Qos of WLAN by Improving Handoff Speed using an Efficient COA Assignment", European Journal of Scientific Research, Vol-54 No- 2, pp.207-214, 2011.

[12] OPNET Modeler 14.5 Documentation.

[13] http://www.webopedia.com/TERM/S/static_routing.html, date last viewed: 2012-10-11.

[14] Routing protocols and concepts, CCNA exploration companion guide. ''*Introduction to dynamic routing protocols in Wlan*''. Chapter three pages 148 to 177.

[15] Mamta, Lovnish Bansal," HTTP and FTP Statistics for Wireless and Wireline Network with & without IEEE 802.11b DCF based on OPNET ", International Journal of Advanced Engineering Research and Studies, Vol- 1, Issue- 2, pp 202-207, 2012.

[16] Sung-Hee Lee, Young-Bae Ko, Youg-Geun Hong, and Hyoung-Jun Kim, ''A New MIMC Routing Protocol Compatible with IEEE 802.11s based WLAN Mesh Networks'', pp-126-131, ICOIN, International conference, IEEE, 2011.

