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Throughput Maximization in Wireless LAN by Load Balancing Approach

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***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 paper presents a load balancing scheme for congestion avoidance and to improve throughput in the WLAN network. This paper focused on the Load Balancing Scheme that can lead to better throughput and Provide the solution for quality for WLAN network in term of stability against congestion under different mobility environment.**

***Index Terms*—Load Balancing, Wireless LAN, IEEE standard 802.11a, Load Balancing, OPNET**

I. Introduction

Due to huge usage of internet and growing business, bandwidth required prove to be difficult resource to fulfill with normal structure of networks. Moreover to provide a good level of quality service is also a big concern. One big solution comes in form of inter domain device management in which we can use various types of networks and structures according to requirements.

The possible way to setup quality of service in WLAN network is by implement congestion control mechanism as in this paper we have proposed load balancing scheme. Generally various standards are available but due to congestion on the network, utilization of various links available should be used.

II. Proposed Scheme for Quality Of Service

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 has focused. This research focused on eliminating the problem of load balancing in WLAN mesh networks in term of congestion. Research provided a distributed load balancing scheme to share the load on the devices. Further focused on reducing delay by providing quality on individual devices and then for whole network. Variation of standards has been proposed so to find the variation of traffic. A distributed scheme for load balancing has been used which distribute the load occurred on particular nodes to available nodes. This research provides solution for the wireless network with variation of wireless communication standards with congestion avoidance by load balancing innovate. In this work, load balancing scheme has been considered and an optimized system is developed and implemented in OPNET simulator. The load balancers are used for initialization of the experimentation (Fig 3) in which, it process the basic designs of load balancing schemes has been implemented. The changes done in the node architecture is shown below in fig 2.

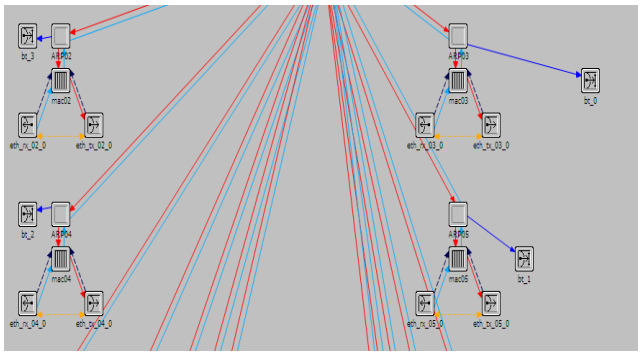

Fig 2: Flow diagram of proposed scheme.

Above is the node architecture which has been developed and implemented for the distributed load balancing scheme (fig 2). In this structure to modules have been added which are connected to MAC layer for checking the congestion and registering the free path available with less load.

III. Results and Discussions

This research focused 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 focused on the load balancing in a most distributed way possible to avoid the congestion in WLAN. For experimentation we have used OPNET simulator 14.05 with logical area of 15 km × 15 km work area with parameters like HTTP, FTP, VIDEO CONFERENCE traffic, variation of nodes and servers, particular energy level of mobile nodes. Basic parameters like FTP Traffic flow, Throughput and Upload Response Time has been used.

After basic building and implementation of WLAN networks, a scenario with congestion have been implemented. Both scenarios have been compared on the bases of parameters like throughput, Packet delivery ratio and network load.

A. Network Configuration

In this paper, WLAN network is required for complete scenario, we have used various wireless routers which are capable of handling heavy duty traffic and topology is shown in fig 3.

OPNET WLAN model proposed which support wireless-LAN backbones that consist of routers with WLAN interfaces belonging to the same BSS. These backbones can serve to WLAN EBSSs as well, where they are connected to the wireless backbone via their access points like they would be connected to a wired backbone. This scenario is built to provide an example on configuring such networks.

The network contains wireless FTP clients and wireless FTP servers. The clients and server belong to different wireless LANs, BSS 0 and BSS 1, respectively. These two LANs connected to each other with two routers. These routers, which have two WLAN interfaces (shown in figure 3), serve as the access points for BSS 0 and BSS 1and also compose the WLAN-backbone, which is the BSS 2.

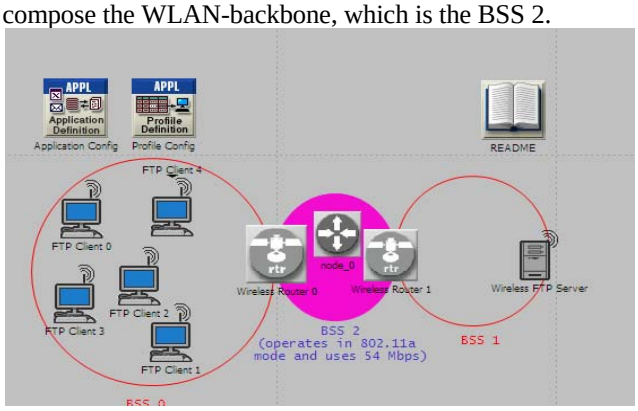

Fig 3: Network topology for WLAN

For traffic flow generation, we have used 17 applications with majority of HTTP and EMAIL services. All o f the services used as combination of services with traffic mix percentage of 50%. The configuration of the traffic is shown in fig 4 and total parameters for network configuration are shown in table 1.

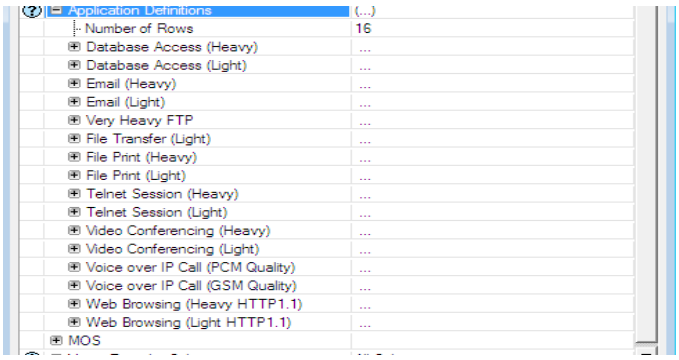

Fig 4: Application for EMAIL and HTTP traffic for WLAN

Traffic profiles have been implemented with other parameters in network. Below is the configuration table used for network parameters used in table 1.

Parameters	Value
Simulator	OPNET 14.5
Simulation Time	4600 sec
No of Routers	3
Routing Protocol	802.11
Traffic Model	CBR
Application Used	HTTP, EMAIL, FTP
Metric used	Routing updates

Table 1: Parameters used for complete configuration

To achieve this, among the two WLAN interfaces of Wireless Router 0, the first interface, IF0, was configured as an access point and its BSS ID was set to 0. The access point functionality of the other interface, IF1, was disabled and its BSS ID was set to 2. The second router was also configured similarly. Hence, IF0s on the routers became the access points, and IF1s were connected to the backbone. The backbone-LAN, BSS 2, does not have an access point and doesn't need to have one, though it is possible to configure one of the backbone interfaces as an access point. Additionally the physical layer technology used by IF1s on the routers are set to "OFDM (802.11a)" to enable 802.11a data rates and their data rates are set to 54 Mbps. In other words, BSS 2 deploys the 802.11a PHY, while BSS 0 and BSS 1 use 802.11/11b PHY.

B. Comparison of Throughput for both scenarios

Our load balancing scheme provides great results which are far more improved than the network with default parameters. Below is the difference of the performance in term of throughput of the network in fig 5.

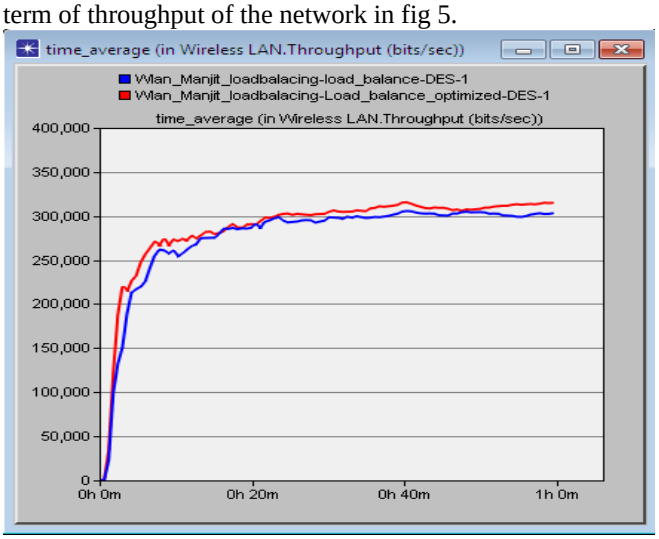

Fig 5: Throughput comparison for both scenarios

Proposed load balancing scheme has shown improvement than other scenario with default parameters. Throughput for proposed network is around 320000 bits/sec and throughput in case of normal scenario is 30000 bits/sec.

C. Comparison of Upload Response Time for both scenarios

Our Proposed load balancing scheme provides great results which are far more improved than the network with default parameters. Below is the difference of the performance in term of upload response time of the network in fig 6.

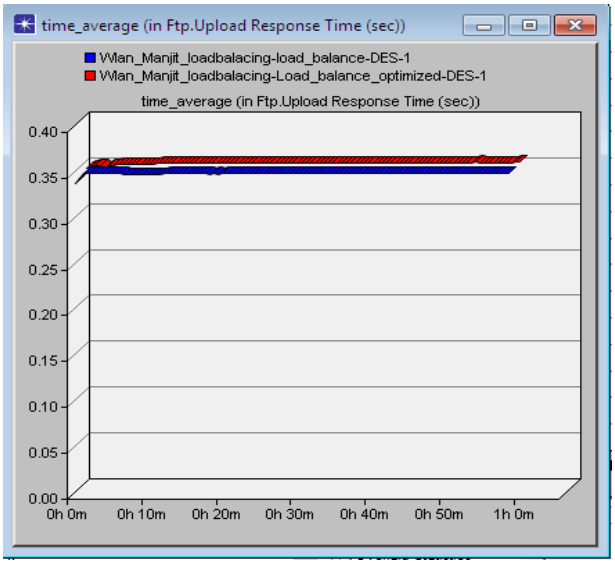

Fig 6: Comparison of upload response time for both networks

Proposed load balancing scheme has shown slighter more upload response time as compared to normal network. Upload response time for proposed network is around 0.34 sec and upload response time in case of normal scenario is 0.33 sec.

The proposed balancing scheme provides good vision of controlling the traffic and maintaining the quality of service in WLAN network.

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IV. Conclusion and Future Scope

In this work, the Distributed load balancing scheme (shown in fig 3) has been implemented and main focused part is to provide maximization the throughput to the WLAN networks and to fulfill the experimentation, this research use the load balancing scheme with variance(shown in fig 2) for easy and effective load balancing in WLAN network.

Various experimentations have been done for the estimation of the WLAN networks which provides us the idea about the load balancing option for traffic flow. This Research proved to be a good solution for saving resources while finding the links with less load and availability of bandwidth based on the already flowing traffic on the link. In this research, we have considered the node architecture of the load balancers for providing the updates about load and bandwidth of various links which is required to have smooth flow of traffic.

In experimentation, we show the performance increase in term of throughput and traffic flow in case of proposed optimized load balancing scheme. Different standards for WLAN have been used for the experimentation.

In future, this research can be enhanced by implementing the hybrid schemes of load balancing such as load balancing by time stamps and security can also introduce to load balancer devices because proposed scheme have only focused on improvement of performance in term of fast communication but have not considered the security prospective of the network. Attacks like denial of service can be implement by becoming the part of load balancing schema and launching of attack can be successful by implementing hidden observation actions of attack.

It is an important task to be implement along which testing of proposed structure with integration of wired and ad-hoc network in future

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