Performance Enhancement Of Wmn With Grid Topology And Multiple Gateways

Amanjot Kaur, Parminder Singh, Sukhwinder Bir

Abstract: WMN is the wireless mesh network having usability in providing internet connectivity to multiple clients. The whole network traffic will be passed through one of the gateways of the network. Routers will route the traffic either incoming or outgoing to the access point, then to the client. Access traffic can result in congestion at one of the gateway. Adopting grid topology for the WMN with varying sizes and adopting the tradeoff between the interference between the network channel and the congestion at the gateway can result in enhancing the network performance. For avoiding the interference between the network channels, increasing the number of gateways, maximum no. of gateway count can be identified. Grid topology will increase coverage. Each router will be having eight connections to the access points without having many failures.

Keywords: Grid, Congestion, Multipe channel, Access point , 8 Point access, Wireless Networks, Gateways, Routers.

1. INTRODUCTION

With the increase in the success of the WMN for providing the access of internet to the client. High bandwidth and the more network coverage to the clients is needed. WMN backbone through which whole network traffic will be passed will the routers, connected through the point to point link. Routers provides the direct links to multiple AP(access points). Routers are interfaced to the internet through the gateways[1].

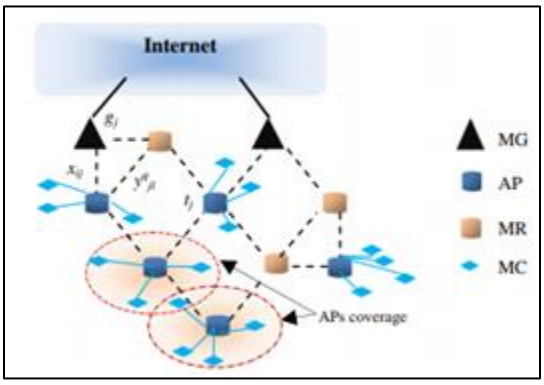

***Fig. 1** WMN Design[1]*

The figure 1 shows the full architecture of the WMN. The Internet has direct connectivity to the gateway. Gateways are having direct connectivity to either routers or the AP. Routers will route the internet traffic to the APs. Systematic arrangement of all the network backbone components will increase the performance; increase the coverage, better channel allocation, more traffic will be passed through the WMN backbone components. The quality of the data transmission will be improved[4].

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solutions. WMN has diverse applications in different fields like home based networks, enterprises network, universities networks etc. Apart from these applications users experiences wider set pr problems for example lower bandwidth, congestion at the gateways, less coverage, interference etc. All the routers are having interfacing to the multiple directions, provides the connectivity to the orthogonal channels. The number of available orthogonal channel is limited, resulted in the interferences in the channel and degradation of the performance. Design of the WMN is the primary issue for enhancing the network performance The performance is in the terms of increase of the network coverage, throughput increase, delay reduction and capacity enhancement[2]. Background: WMN is the wireless mesh network used for the purpose of sharing of internet in small or large area. Gateway has direct connection to the internet broadband line. Whole incoming and outgoing traffic will be passed through the gateway. At certain threshold level the gateway get overloaded with the traffic. The answer to the congestion will be to enhance the number of gateways. Gateways has direct connection to the routers. Routers routes the traffic to the AP and then to the clients. Keeping routers haphazard will be having higher number of connection loss. to make connection successful more number of connections will be required[1].

2. PROBLEM DEFINITION

WMN is the wireless mesh network having usability in providing internet connectivity to multiple clients. The whole network traffic will be passed through one of the gateways of the network. Routers will route the traffic either incoming or outgoing to the access point, then to the client. Access traffic can result in congestion at one of the gateway. Adopting grid topology for the WMN with varying sizes and adopting the tradeoff between the interference between the network channel and the congestion at the gateway can result in enhancing the network performance. For avoiding the interference between the network channel, increasing the number of gateways, maximum no. of gateway count can be identified. Grid topology will increase coverage. Each router will be having eight connections to the access points without having many failures.

3. GRID TOPOLOGY

Grid topology has greater benefits compared to the random topology shown in figure 2. The grid topology will be in the square shape. Routers will be positioned carefully at some location in the grid. Each router will be having eight connection point for the wireless connection. There will be better selection of the neighboring nodes amongst the eight[10][11].

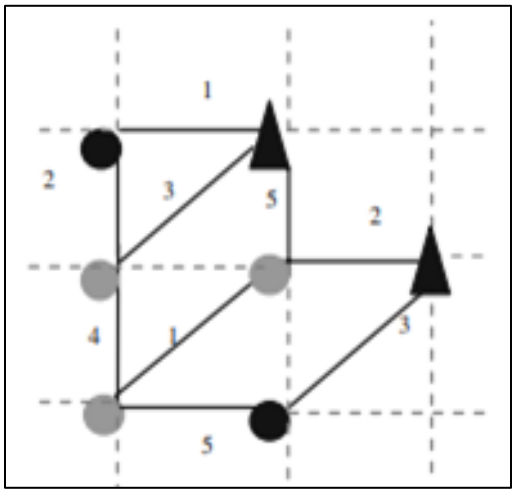


Fig. 2 *Grid Topolog*

3.1 Increase of the gateway

Gateway has direct connection to the Broadband line. increase of traffic from certain point of time will increase the level of congestion at the gateway. The distribution of the traffic at multiple gateways may be the solution. But increasing the number of gateway to certain level will increase the interferences. Trade off will be required between the congestion and interference.

$$\text{Min}\sqrt{\sum_{i\in G} F / \sum_{i\in G} Ft} \qquad \text{.....(i)}$$

Equation 1 represents the gateway count. It used the standard deviation for the traffic and the number of gateways. The standardized approach will be taken between the gateway count and the interference generated due to the traffic.

3.2 Tradeoff between the interference between the network channel and the congestion of the gateway

Optimization based process will be the solution to identify the optimal solutions. The optimization based procedure is used based on equation

$$\sum_{i\in L} dixij \sum_{i\in L}\sum_{q\in C}(fij - fji) - Fj = 0 \forall j \in L \qquad \text{.....eq. 2}$$

Equation 2 shows the evaluation for each Gateway the traffic count based on threshold level will be determined. The total allocated frequency and the channel for the respective node is calculated. Gateway count will be optimized based on the traffic in and out.

4. METHODOLOGY

Step1 sub divide the total network area into smaller grids. Each grid is of square shape.
Step2 position the routers on the grid different positions.
Step3 keeping multiple gateway at the edge of grid. Gateways has direct connection to the broadband line.
Step4 Establish eight connections from each router to the around access points. Each access point will be having direct connection to the clients for the wireless connection.
Step5 Dynamically select the channel from 8 available channel option.

4.1 Algorithms

Input: Metrics ,width,height
output: Channel selection.
Grid_wmn(matrics,width,height)
Initialize the grid with all the routers and gateways.
Initialize the router set as(r1,r2…….rn)
Initialize the Gateway set (g1,g2…gn)
for i=1 to num(gateways)
    for i=1 to rows
        for j=1 to columns
        position ri at metrics(I,j)
        select the channel from 8 channel.
        Discharge the traffic from the router to the access point and then to the clients
        end
    end
end

5. RESULTS

5.1 Performance parameters

- Throughput: It represents the number of packets received per second.
- Energy Dissipation: How much energy has been dissipated for the transmission of the data from Gateway to the Access point and then to the client device wirelessly.

5.2 List of parameters/variables

- Traffic generated.
- Number of channels.
- Traffic spots
- Number of radio interfaces.
- Number of gateways.
- Number of routers.

5.3 Interface

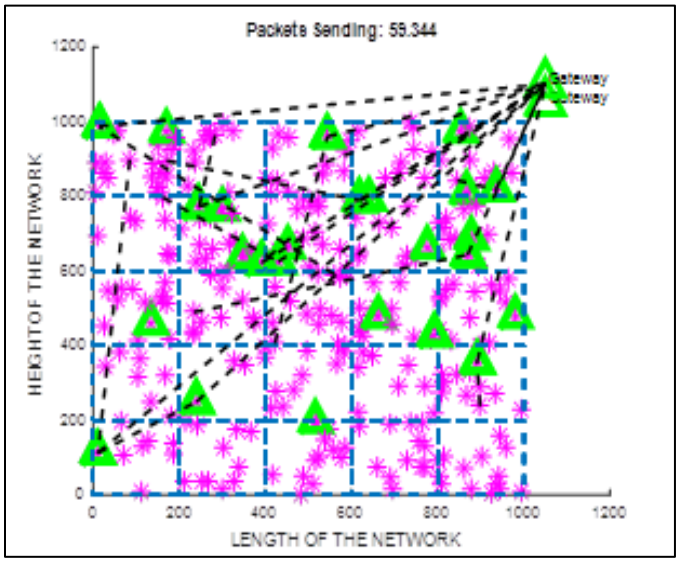


Fig. 3 *Network Interface*

Figure 3 shows the network interface. The total network area will be subdivided into square sized grids. Each grid partition is used for placing the routers. Multiple Gateways are positioned at the corner of the network. It is connected to the broadband line. Gateway will transmit the data to the router. Whole traffic, both incoming and outgoing will be routed through the gateway. Multiple gateways are kept for reducing the load on single gateway. The traffic sent to the router will be sent to the access points. The appropriate channel will be selected for the transmission of the data traffic. The grid will provide the eight direction connectivity. A total of 8 channels will be available, out of 8 channel one is to be selected.

5.4 Throughput

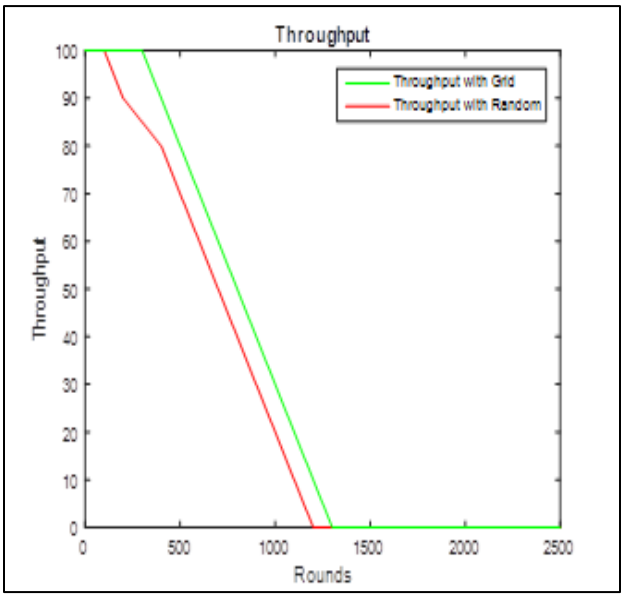
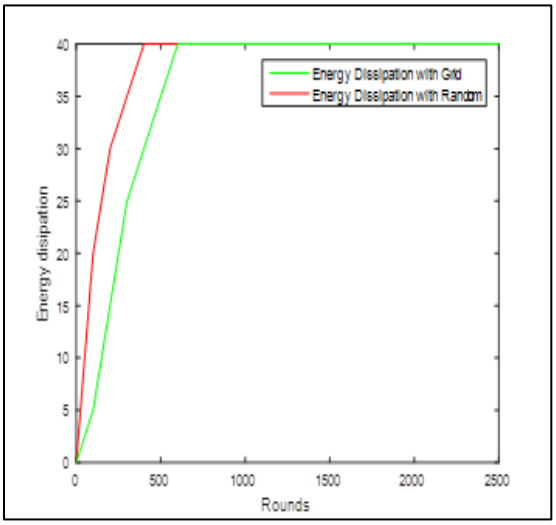


Fig. 4 *Throughput*

Figure 4 shows the throughout for the network under two scenarios. One is the grid topology and other is the random topology. For the grid topology the network throughput is better. There are two basic benefits which makes the network with high performance. One is the having multiple gateways. Second point is grid topology provides right point connectivity from router to the access point. Creating multiple channel will provides the option for selecting one channel. The rate of the failure for the channel selection will be low. So the throughput has improved because of low failure rate for the channel selection.

5.5 Energy dissipation



Fig, 5 *Energy dissipation*

Figure 5 shows the energy dissipation for the grid topology and the random topology. The grid topology has lower energy dissipation. Congestion or level of delay will be reduced at the Gateway level. Multiple gateway provides the option for selecting one free gateway. This will reduces the delay of packet to be transmitted to the router. Router with multiple point connectivity will provides the option to select the best channel from available 8 channels.

Providing multiple gateways and grid topology it will provides the better ability for the WMN to have better performance network. Least traffic will be transmitted on the congested Gateways. The total traffic from the gateway will be based on its availability. Grid topology will provides the option for having positioning the routers at the better position for better coverage and better abilities.

6. CONCLUSION

WMN is the wireless mesh network provides the ability to share the single broadband line to the multiple clients lying all around. All the clients access the network connection wirelessly for both incoming and outgoing traffic. Distributing the access points randomly will be having more failure in selection of the channel and also routing the traffic from router to the access point. In the proposed system Grid type of topology is builded. All the Router nodes are positioned at the grid positions for better connectivity. Each router will be having eight point connectivity. Best channel from the eight available channel will be selected. The

selection option will be much better for higher success rate for the delivery of both incoming and outgoing traffic. The proposed Grid topology with multiple Gateways provides the better performance. The performance is measured on the basis of different parameters like throughput and Energy dissipation. Both parameters has shown the improvement.

7. FUTURE WORK

WMN is current being used in various public and private places for the internet sharing. the internet sharing will be more effective if some optimization criteria is used for the selection router and the access point.

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