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Node Transmission Power Value Optimization in MANET

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Abstract: Mobile Ad-hoc Network (MANET) is normally recognized in zones someplace infrastructural services such as base station, routers etc. do not happen or have been damaged due to natural hardship. They have numerous pressures such as bandwidth, computational volume and battery power of each node as of their infrastructure-less nature. Power preservation is serious to appropriate actions of MANET. Countless scientists have been provided several mechanisms to diminish the power consumption variable transmission range of nodes are one such tool taken into interpretation. This paper studies the impact transmission range of routing protocols by designing a simulator in Qualnet. We note an obvious impact of variable transmission range on power consumption. All extra protocols are defined in terms of Packet Delivery Ratio (PDF), End-To-End Delay (ETED), average jitter rate, throughput etc.

Keywords: MANET; Transmission range; Average jitter rate; Packet delivery ratio; Throughput

I. INTRODUCTION

A network that does not depend upon pre-existing substructure or concentrated governance and is demonstrated by a group of active wireless network is known as A Mobile Ad hoc Network (MANET) [1,2]. Active network topology and imagination restraints in price of bandwidth and battery power are qualified in MANET's. In MANET applications due to campaign of nodes, failure of nodes, fading effects of nodes the property of nodes changes often. The neighbour discovery outline is one of the significant challenges in MANET and this part effort a node to alter its information of nearest nodes frequently. To find burst links in ad-hoc routing protocol a neighbour discovery scheme is used for route conservation [1]. Due to lack of centralization, dynamic topologies and singular port characteristics mobile ad hoc networks are wireless multi hop networks and routing has become a challenge in MANET. To overcome this challenge a lot routing protocols are discovered and is split into two distinguishable categories: Reactive (on demand) routing protocols and Proactive routing protocols. In Reactive oron-demand routing protocols whenever a node requires transmitting the data packets a path is detected. AODV (Ad-hoc On-Demand Distance Vector), DSR (Dynamic Source Routing) are reactive routing protocols. Proactive routing protocol are ensured flooded that is sent around the network and circulate periodically routing data. OLSR (Optimized Link State Routing) is the type of proactive routing protocols [3].

Various researches have been taken into account by various authors by optimization transmission range in different routing protocols in mobile ad-hoc network [4-10] which is given as:

- **a)** Neung-Um Park, et al. [2] in this paper, the impact of transmission range on hello interval in terms of throughput. Throughput Using AODV routing protocol. They confirmed that the hello interval to make the most of the network throughput depends on node speed and transmission range. Results prove that hello interval to maximize the network throughput it is expressed in language of linear function of mobility factor.
- **b)** Akram A AL Mohammed, et al. [5] shows the performance was estimate in terms of packet delivery ratio and end-to-end delay. The replication outcome prove that superior presentation can be accomplish in term of higher PDR and lower end-to-end delay by lowering the transmission range of less than 500 meters. On the opposite, while the transmission range was higher than 500 meters, PDR will start to decrease and end-to-end delay will increase. The performance dishonoured as the number of flows increased.
- **c)** Surendrapal Singh et al. [10] shows that for achieving higher values of throughput by increasing number of participating nodes. The PDR can be increased and the drop packets which increases with the increase in I the transmission range, and can be decreased by increasing the number of nodes. This is done because sufficient

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amount of energy is consumed and less residual energy left to the participating mobile nodes which transmit the data packets from source to destination node [6]. Transmission range plays an important role in mobile ad-hoc network. The impact of transmission range on different routing protocols is overviewed in above tables. Paper [1] showed that the Hello interval of AODV depends on mobility and throughput depends on transmission range. Paper [5] observed that the higher PDR was achieved below 500 meters of transmission range. They also determined that end to end delay increased above 500 m coverage area. [10] Showed that PDR can be increased with the increase in transmission range. Transmission range also impacts energy consumption [7]. From above papers it is cleared that the transmission range has impact on various parameters. Thus we are focused on transmission range impact. Hence the reactive routing protocol can be analysed for different transmission range and propagation model. Transmission range can be optimized for improvement of performance of Reactive Routing Protocol.

II. PROPAGATION MODEL

2.1 Two Ray Propagation Model

One popular path loss model is the two-ray model or the two-path model. The free space model describe free space model assumes that there is only one single route from the transmitter to the receiver. But in truth the signal reach at the receiver through numerous paths (because of reflection, refraction and scattering) [8]. This model tries to capture this fact that the model accepts that the signal spreads the receiver through two paths, one a line of-sight path, and the other the path through which the reflected wave is received [9]. The formula is given as

$$P_r = \frac{PT * GT * GR * HT^2 * Hr^2}{D^4 * L}$$

Where, P_r =received power
P_t=transmitted power
G_t=transmitted gain
G_r=received gain
H_t=transmitted height
H_r=received height
D=Distance
L=length

$$\textbf{Pr (dbm) = 10 log (Pr/1000)}$$

2.2 Friss Free Space Model

Free space model calculates that the received power declines as negative square root of the distance it accounts mainly for the point that a radio wave which moves away from the sender has to cover a larger area. So the received power reductions with the square of the distance [11]. The free space propagation model assumes the ideal propagation condition that there is only one clear line-of-sight path between the transmitter and receiver. Friis free space equation is given by

$$P_{R=} P_t G_t G_r \frac{\lambda}{(4\pi)^2 L D^2}$$

Where, $P_r P_t$ = transmited and received power
$G_{t,} G_r$ = received and transmitted gain
D = distance
λ = wavelength
The path loss, representing the attenuation suffered by the signal as it travels through the wireless channel is given by the difference of the transmitted and received power in dB and is expressed as:

$$\textbf{P L (dB) = 10 log Pt/Pr}$$

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In this paper the transmission range value will be enhance. The different routing protocols are examined by using Average Jitter Rate, Packet Delivery Ratio, End-To-End Delay, Number of Node Breakage etc. On the basis of above parameters transmission range will be optimized [12].

III. PROPOSED WORK

The transmission range can be varied by changing transmission power. Thus in this paper, the appropriate transmission power value will be calculated for highest performance of routing protocol. For this, the reactive routing protocol like AODV, DSR and OLSR will be analyzed for different transmission range and propagation model [13].

Transmission range plays an important role in mobile ad-hoc network. The impact of transmission range on different routing protocols is overviewed in literature survey. Different Papers demonstrates that transmission range can impact on following parameters [14].

- Throughput
- Delay
- Jitter
- Packet drops
- Link Failure rate
- Overhead
- Control Traffic in network
- Energy Consumption
- Scalability etc.

Thus we are focused on transmission range value optimization for improvement of performance of the network. Hence the reactive routing protocol can be analyzed for different transmission range and propagation model. Different propagation models are used to calculate transmission power. Two available models are free space and two ray propagation. Free space is a large scale propagation model [15]. It simply suppose a transmit antenna and receive antenna to be located in an empty environment. Neither absorbing obstacles nor reflecting surfaces are considered. , the power of the earth surface is assumed to be entirely absent for propagation distances d much superior than the for propagation distances d much superior to the antenna size, the far field of the electromagnetic wave dominate all other components [16-18]. That is, we are allowed to model the radiating antenna as a point source with minor physical dimensions. In such case, the energy radiated by an Omni-directional antenna is extends over the surface of a sphere. This permits us to investigate the effect of distance on the received signal power. The received power is only dependent on the transmitted power, the antenna's gains and on the distance between the sender and the receiver so the received power decreases with the square of the distance the free space propagation model assumes the ideal propagation condition that there is only one clear line-of-sight path between the transmitters and receiver. The Two Ray Ground model is also a large scale model. It is assumed that the received energy is the sum of the direct line of sight path and the path including one reflection on the ground between the sender and the receiver. this model gives more accurate prediction at a long distance than the free space model However, the two-ray model does not give a good result for a short distance due to the oscillation caused by the constructive and destructive combination of the two rays Instead, the free space model is still used when d is small [19-21].

In this the transmission range value will be enhanced for routing protocols Table 1. The different routing protocols are examined by using Average Jitter Rate, Packet Delivery Ratio, End-To-End Delay, Number of Node Breakage etc. On the basis of above parameters transmission range will be optimize [22-24].

In this section transmission range is calculated using Friss formula. The transmission range from 2 dbm to 16dbm will be used for result analysis. Following are the parameters fixed for calculation of transmission range Table 2.

$$Pr = 7.94 \times 10^{-7}$$

$$Gr, Gt = 1$$

$$\lambda = 0.125$$

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Transmission power (dbm)	Transmission range in meters using Friss formula for nearest distance (d^4)	Transmission range in meters using Friss Free space model for farthest distance (d^2)	Transmission range in meters using Two Ray Propagation model for farthest distance (d^4)
2	21.08	444.6	0.06684
4	23.65	559.72	0.07499
6	26.54	704.7	0.08414
8	29.78	887.16	0.09441
10	33.42	1116.9	0.10593
12	37.49	1406.08	0.11886
14	42.07	1770.1	0.13336
16	47.20	2228.5	0.14963

Table 1: Transmission range.

IV. SIMULATION PARAMETERS

Parameters	Values
Map size	1500 m × 1500 m
Simulation Time	900 seconds
Node density	50
Data Sinks	17 pairs
Node Movement	Random Wave point Mobility
Speed	10 mps
Pause time	10s
Transmission Range	2, 4, 6, 8 up to 16 dbm
Received power	7.94×10^{-7}
MAC Protocol	802.11 b
Propagation Model	Free space and Friis Model
Message Size	512 kbytes
Transmission Rate	2 Mbps
Antenna Type	Omni Directional
Traffic mode	Constant Bit Rate (CBR)
Simulator	Qualnet 5.02

Table 2: Parameters stimulation.

V. RESULTS AND ANALYSIS

AODV, DSR and OLSR are compared for Friss Propagation Model as shown from Figures 1-3.

5.1 For Two Ray Propagation Model

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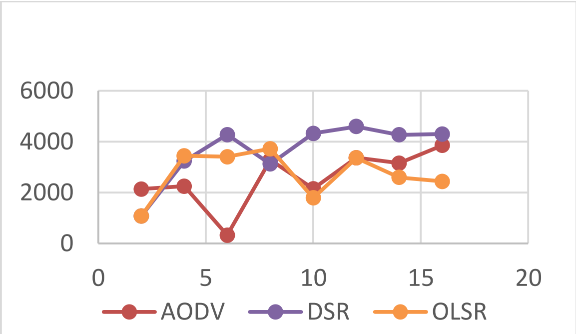

Figure 1: Throughput for two ray model.

As the transmission range increases the throughput value of DSR protocol increases as compared to AODV and OLSR as shown in Figure 1.

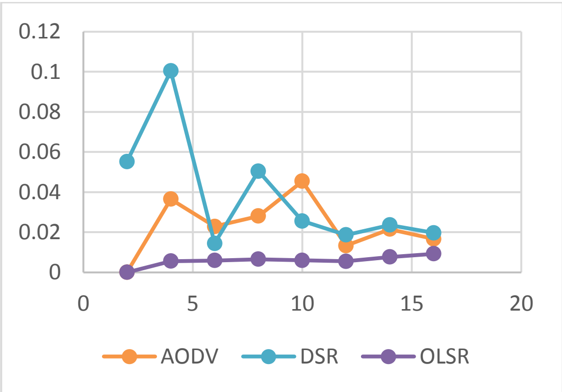

Figure 2: Average jitter rate for two ray model.

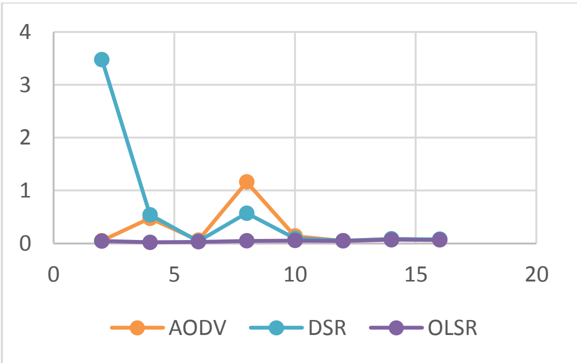

Figure 3: Average end to end delay for two ray models.

End to End delay and average Jitter rate decreases on increasing transmission range in OLSR.

5.2 For Free Space Model

AODV, DSR and OLSR are compared for Free Space Formula as shown from Figures 4-7.

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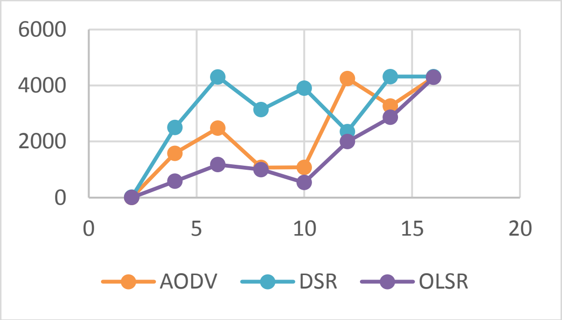

Figure 4: Throughput for free space.

As the transmission range increases the throughput value of DSR Protocol increases as compared to AODV OLSR as shown in Figure 4.

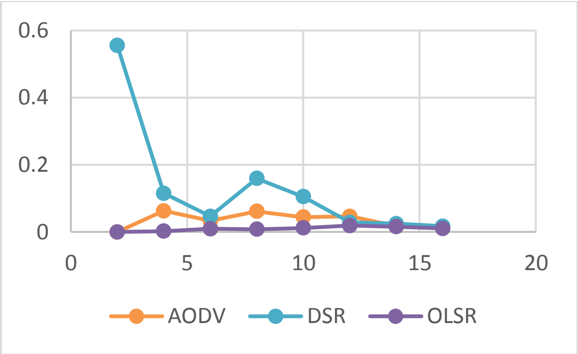

Figure 5: Average jitter rate for free space.

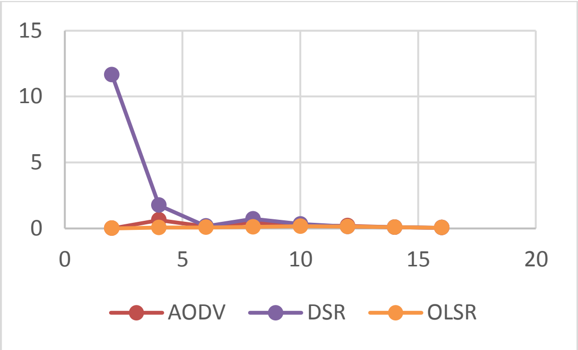

Figure 6: Average end to end delay for free space.

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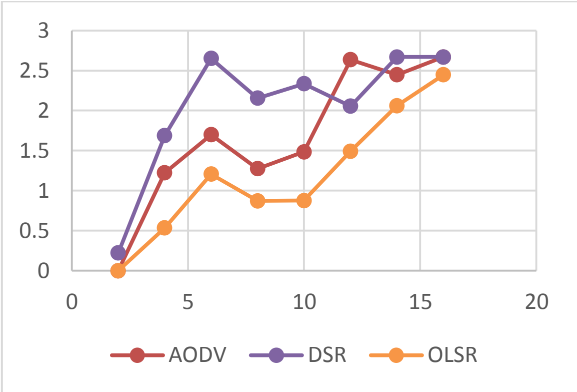

Figure 7: Packet delivery ratio in percentage for free space.

VI. CONCLUSION

In this Thesis we calculated the distance for different values of Transmission Power for Free space model and Two Ray Propagation model and the impact of transmission power on routing protocol performance. In this presentation AODV, DSR and OLSR are analyzed for free space propagation model. Throughput, Average jitter rate, End to end delay, drop packets are investigated to check the performance of routing protocol AODV, DSR and OLSR. The graphs demonstrate that DSR performs well if throughput is considered otherwise OLSR outperforms in terms of delay and average jitter. Further the routing protocols will be analyzed for two ray propagation model. Transmission power will be optimized for distance and range.

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