An End to end delay Performance of BF, DYMO and ZRP Protocols

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Abstract- Wireless mesh networks (WMNs) are in the focus of academic world and engineering research. A WMN is a multihop wireless network which consists of mesh routers and mesh clients. The end-to-end packet delay is calculated as the time interval when the packet is generated and ready for the transmission until it is delivered to the receiving application at the destination node. It includes transmission delay, propagation delay and processing delay. In general, end to end delay increases as pause time increases.

Keywords: Wireless Mesh Network, Radio propagation models, end to end delay.

I. INTRODUCTION

Wireless mesh networks (WMNs) are in the focus of academic world and engineering research. The reason is its services and Internet connectivity. Mesh routers have minimal mobility and form the back bone of the wireless mesh network which provides access to the mesh clients. We execute end to end packet delay of four propagation models in our simulations. These models are Okumara Hata propagation model, Free Space path loss model, Two Ray propagation model and Cost 231 Walfisch-Ikegami propagation model.

II. RADIO PROPAGATION MODELS

Compared to wired networks, communications in ad-hoc networks require a wireless communication channel between the transmitter and the receiver. Radio waves are exposed to reflection, diffraction or scattering leading to multipath propagation. The multiple signal paths are added up at the receiver leading to constructive or destructive interference which causes the received power level to vary. A radio signal can be successfully received when the signal to noise ratio (SNR) is above the receiver's sensitivity. Path loss plays an important role in propagation. Path loss can be expressed as the ratio of the power of the transmitted signal to the power of the same signal received by the receiver, on a given path. It is a function of the propagation distance. Estimation of path loss is very important for designing and deploying wireless communication networks.

2.1Okumara - Hata Model

This is one of the most widely used models for propagation in urban areas. This model is an empirical formulation of the graphical path-loss data provided by Okumura's model. This model is quite suitable for large-cell mobile systems, but not for personal communicationsystems that cover a circular area of approximately 1 km in radius.

2.2 Free Space Model

The free space propagation model is the simplest path loss model in which there is a direct path signal between the transmitter and the receiver, with no atmospheric attenuation or multipath components. 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 The free space model basically represents the communication range as a circle around the transmitter. If a receiver is within the circle, it receives all packets Otherwise, it loses all packets.

2.3 Two Ray Propagation Model

Another popular path loss model is the two-ray model or the two-path model. The two-path model tries to capture this phenomenon. The model assumes that the signal reaches the receiver through two paths, one a line-of-sight path, and the other the path through which the reflected (or refracted, or scattered) wave is received. The two-ray ground reflection model considers both the direct path and a ground reflection path.

2.4 Cost 231 Walfisch - Ikegami Model

This empirical model is a combination of the models from J. Walfisch and F. Ikegami. It was further developed by the COST 231 project. It is now called Empirical COST-Walfisch-Ikegami Model. The model considers only the buildings in the vertical plane between the transmitter and the receiver. The accuracy of this empirical model is quite high because in urban environments especially the propagation over the rooftops (multiple diffractions) is the most dominant part. Only wave guiding effects due to multiple reflections are not considered. As only these characteristic values are considered for the computation, the Walfisch-Ikegami model is a statistical model. But the model distinguishes between two situations, the "line of sight" (LOS) and the "none line of sight" (NLOS) situation.

III. AVERAGE END TO END DELAY

The end-to-end packet delay is calculated as the time interval when the packet is generated and ready for the transmission until it is delivered to the receiving application at the destination node or it is the average time between packet transmissions at source node until packet delivery to a destination. It includes transmission delay, propagation delay and processing delay. In general, end to end delay increases as pause time increases.

IV. RESULT AND ANALYSIS

The End-to-End Delay is defined as the average delay experienced by the data packets. It includes all possible delays caused due to route discovery, queuing, retransmission, propagation, processing and transfer times. In our simulation experiments, we run network topology single time. It runs with mobility support. The Qualnet mobility model has been used to simulate the node mobility.We execute end to end packet delay of four propagation models in our simulations. These models are Okumara Hata propagation model, Free Space path loss model, Two Ray propagation model and Cost 231 Walfisch-Ikegami propagation model.

The following figures in this section show the network end to end delay results obtained from the simulation scenarios. The obtained results are according to the mobility considerations.

Fig 4.1
DELAY VALUES FOR OKUMARA HATA MODEL

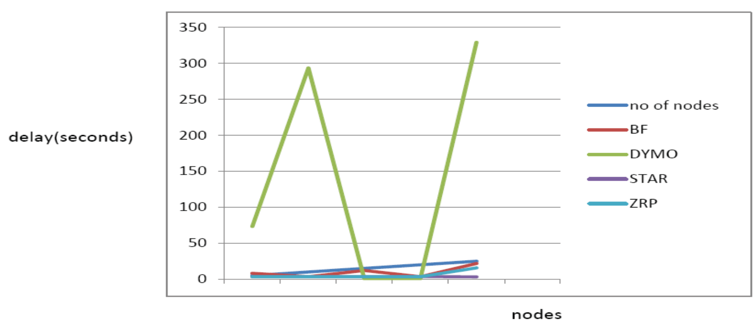


Fig 4.2
DELAY VALUES FOR FREE SPACE MODEL

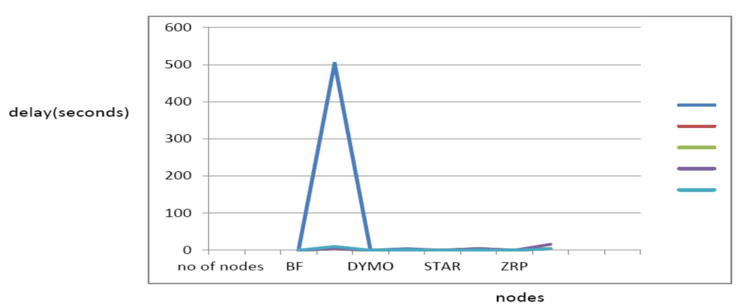


Fig 4.3
DELAY VALUES FOR TWO RAY MODEL

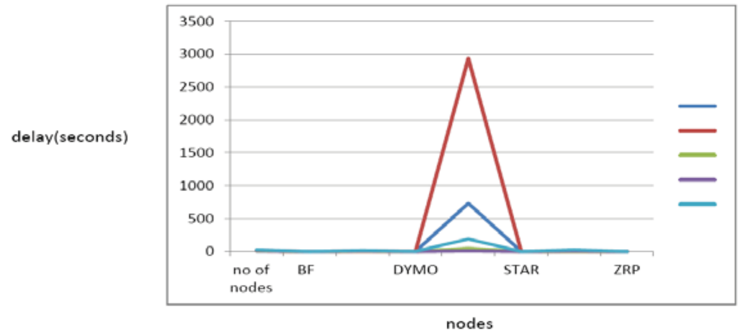
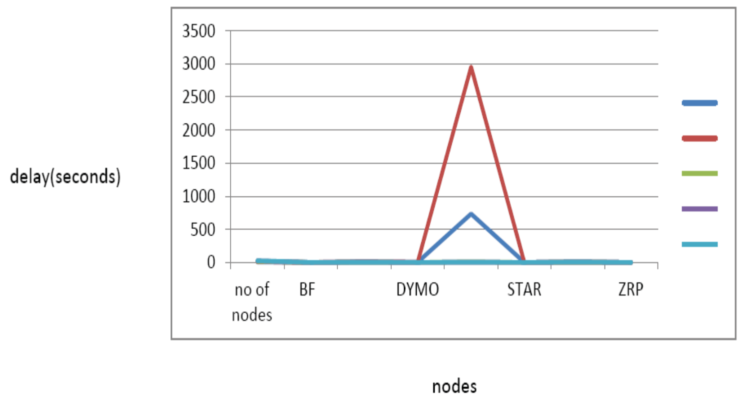


Fig 4.4
DELAY VALUES FOR COST 231 W-1 MODEL



V. CONCLUSIONS

On analysing the delay behaviour of these propagation models, it is concluded that DYMO protocol helps in obtaining high throughputs but much delay in the transmission of data packets does not make this proactive protocol reliable for urban wireless mesh networking for long distances. The Bellman Ford protocol is best suited for lower node densities and STAR/ZRP protocols are appreciable more on intermediate or higher node densities.

Considering the propagation model is, we can conclude that reactive and/or hybrid routing can be best suited for Okumara-Hata model. In case of Free Space model, proactive and/or reactive routing may perform well. For Two Ray propagation model, proactive, reactive and/or hybrid routing can achieve good results and so in the case of Cost 231 W - I model.

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