



A CONTEMPORARY SURVEY AND ANALYSIS OF DELAY AND POWER BASED ROUTING PROTOCOLS IN MANET

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ABSTRACT

Basic characteristics of a Mobile Adhoc Network (MANET) include formation of a network without any kind of infrastructure. A MANET frequently faces the challenges of dynamic topology change and inadequate resources. To communicate between source to destination during data transmission it applies the multi-hop routing method. So the amount of delay a packet experiences during transmission from source to destination is always a challenging issue in MANET. To reduce delay at different levels such as routing delay which is time required to search a path from source to destination, a processing delay that occurs when a node executes the processing for the packet for next transmission, a compression and decompression delay which is associated with audio files many innovative proposals have been developed by networking experts but still it lies as a major challenging issue. Again the proper power management of nodes in MANET plays a vital role in efficient routing. In this paper a systematic study has been carried out about different challenging issues associated with delay and power during routing in MANET and analysis has been done about important protocols of MANET dealing with delay and power.

Keywords: MANET, routing protocol, battery power, delay, throughput.

1. INTRODUCTION

There are many routing protocols which are proposed for better energy efficiency and delay management in Mobile Adhoc Networks. Classification of these protocols can be done based on their method of routing from source to destination. Depending on the congestion on traffic, node density and mobility rate such routing protocols are categorized into three types. They are proactive, reactive and Hybrid protocols. Category of Proactive protocols which are also known as Table-Driven Protocols can find out routes to all directions according to change of topology. Reactive protocols which are also known as On-Demand protocols always creates route as per demand of data transmission. A temporary route will be created when there is need of it. Hybrid protocols work as per the combined features of proactive and reactive protocols and as a result of which a better category of protocols are included in this category. The basic challenging issue in MANETs is the limited resource problem due to which it is essential to develop a reliable and robust routing method. Limited resource at the node must be utilized efficiently and it should be easily compatible to the change of network situation like size of the network and increase in number of nodes in a network. Maintaining the Quality of Service is also essential part of routing. In QoS maintenance the network has to provide a specified set of service to the user with specific end-to-end delay, with a specific jitter, bandwidth and limited packet loss. Another issue in MANETs is the real time

transmission of packets -over the network due to higher demand of time, delay and bandwidth constraints.

Many delay-aware protocols are proposed with an intension to support reduction of delay in different levels as well as to support quality of service considering specific parameters as the routing metric. The rest part of this paper is designed as follows. Section presents the motivation of preparing this article. Section 3 describes related works those have been done on this particular field. Section 4 provides a brief explanation of novel research works done by eminent researchers in this field and Section 5 provides the conclusion part of this paper.

2. MOTIVATION

Transmission delay can be defined as the total time period practiced by a packet to travel in the network from the source to destination. There are many types of delay a packet experiences during routing period. Compression and decompression delay refers to the communication of audio files. Routing delay refers to the time used in path finding from source to destination. Similarly a processing delay is the processing time taken by the node to process the packet for further transmission. A propagation delay denotes delay due to propagation of bits in wireless medium. Time required by one bit traversing from source a destination is the end-to-end delay. Other types of delays that greatly affect the overall transmission of data are Media Access Delay, Acknowledgement Delay, Re-transmission Delay and Jitter Delay. Therefore Analysis of delay at different levels



is very important to design efficient delay-aware routing protocol, this motivates us to perform a rigorous analysis of delay-based MANET routing protocol in this paper.

3. RELATED WORK

Analysis and survey of Proactive and Reactive Adhoc Routing Protocols has been done by P. Vanthana *et al* [22] in 2015 where Energy efficient relay selection strategy are analysed. In paper [2] a brief discussion has been carried out to focus on a normal packet routing in network. The Quasi-Birth and Death (QBD), a theoretical framework is used to seize the packet dispatch process in a MANET. The cumulative distribution function mean and variance of the delay at source is then found out. To model end-to-end delay in MANETs is always a challenging subject due to shortage of high quality logical framework to describe the complicated network transition model which is greatly affected by mobile nature of MANET. In [3] the authors establish applications of QBD Theory for MANET Delay analysis by smearing this concept on two-hop relay MANET which is broadcast-based. This is a better design to formulate delay (end-to-end delay) and also the throughput capacity of the nodes in such scenario. QBD-theory based model was validated through extensive simulation and results were produced.

4. STUDY AND ANALYSIS OF DELAY-BASED MANET ROUTING PROTOCOLS

For stability between energy consumption and end-to-end delay reduction in mobile adhoc network during data transmission, an intelligent protocol is designed in [1] called Power and Delay aware routing protocol (PDRP) which is based on SPR-Stable Path Routing Protocol for adhoc networks. Simulation analysis of this protocol has been done in ns2 and the experimental results show that there is high throughput and less end-to-end delay in this proposed protocol as compared to AODV routing protocol.

A fundamental measurement of amount of delay experienced by packets in mobile adhoc networks is the delay at source which is the delay time a packet's involvement at its source. But till now not much work has been done on this particular sensitive area because performance of source delay on the highly dynamic MANETs is still not very much known. This paper [2] gives a brief idea about this centered on a normal packet send method. The Quasi-Birth and Death (QBD), a theoretical framework is used to seize the packet dispatch process in a MANET. The cumulative distribution function, mean and variance of the delay at source are then found out. Then the analysis work is supported by many simulations and results show that the source delay has a great impact on the network performance and it can be controlled by packet-dispatch probability, local-queue buffer size and limit of packet-dispatch size.

To model end-to-end delay in MANETs is always a challenging subject due to shortage of high quality logical framework to describe the complicated network transition model which is greatly affected by mobile nature of MANET. In [3] the authors establish applications of QBD Theory for MANET Delay analysis by smearing this concept on two-hop relay MANET which is broadcast-based. This is a better design to formulate delay (end-to-end delay) and also the throughput capacity of the nodes in such scenario. QBD-theory based model was validated through extensive simulation and results were produced.

Sometimes high throughput is not needed but a particular is required delay requirement in many cases. The information delivered in the network may not require high throughput but it must reach in time. In some other cases we need high throughput but some delay is manageable. Suitable to this scenario, in this paper [4], a new multi-hop relaying algorithm is proposed to inspect the throughput, mobility delay, and delay in wireless ad hoc networks. A random mobility model is used for the experiment purpose, and solutions are given for smoothen balance between throughput and delay in mobile ad hoc networks by controlling nodes mobility pattern.

To analytically study and evaluate the capacity and delay in MANETs, two-hop relay algorithms and its variants are very much appropriate and efficient. J.Liu *et al* in [5] and [6] proposes efficient algorithms and mechanism for 2-hop relay for flexible delay control in MANETs. Closed form theoretical models have derived with careful consideration of traffic, its contention, medium contention, interferences, accurate delay and analysis of capacity which are performed on MANETs. Widespread simulations are done to show the efficiency of proposed models. Paper [5] proposes a general 2Hop Relay - algorithm for MANETs. Using Markov chain concept, a framework for performance modeling is also developed. Mathematically it proves that this algorithm can effectively handle the packet delay covering large area in MANETs which can also be used in future MANETs for supporting delay requirement-based applications.

To inspect the packet delay in MANET in more detail way, specifically, a power control mechanism is used [6] at nodal level for easy adaptation of the transmission range, and a generalized two-hop relay with less redundancy of packets for routing is adopted.

By considering the difficulty of calculating the end-to-end delay in delay-tolerant networks, an l solution is provided in [7]. While doing source routing, a comprehensive path has to be selected for a packet to start from source to reach at destination. Computation of time estimate in such type of path is difficult in dynamic networks, where the edge/link between any two intermediate node at next time slot is not predictable, it may not be available, and it depends on its previous state in the previous time slot. Calculating the traversal time from source to destination therefore depends on time spent



to wait for edges to appear plus time spent to cross them when they are available. The ETT(Expected Traversal Time) for any vigorous path considering some special scenario for different edge failure models under hybrid network setting is being proposed here. The ETT setting for initial configuration of the node can be calculated in quadratic time which is a function of path length by a formula which is founded on probability generating function. In paper [8], a new framework for meetings during the mobile state of the devices is presented. Simulation of the proposed work shows that the throughput rate is better in comparison to all other mobility models. So this conclusion can be drawn that resourceful network environments can perform better.

Delay in channel access by different relay nodes is different in multi-hop adhoc network situation. Delay in multi-hop network are analyzed properly here considering the channel access delays are autonomous and are of same magnitude at all the nodes in the network. Here, [9] multi-

hop adhoc networks are considered by taking silent relay nodes and calculating the channel access possibility, radius of transmission, network throughput and node density in the network. These factors are basically taken to calculate the end-to-end delay during packet transmission.

A power and delay based routing protocol has been presented here [10] to find a more stable path, to satisfy Qos requirement of the channel by provision of multi path selection and to take care of delay and bandwidth. This routing protocol known as PDMRP (Power and Delay aware Multi-path Routing Protocol) is evaluated using ns2. Results show that this proposed protocol performs better than Stable Path Routing Protocol based on Power Awareness (SPR) and another protocol MAODV with better throughput, lesser delay and low packet drop rate. Table-1 shows details of some important proposals offered which are based on delay and power management in routing protocols in MANET.

Table-1.Details of routing proposals based on power and delay.

Literature	Year	Key factors considered	Power estimation (Y/N)	Delay calculation (Y/N)	Advantages	Simulator
A.Ahmed, <i>et al</i> [11]	2015	Link failure	Y	Y	High throughput	NS2
D.Choudhury, <i>et al</i> [12]	2015	AODV with reduced black hole attack	Y	Y	Less delay , less congestion	NS2
Z.Huang, <i>et al</i> [13]	2014	Remaining battery energy of intermediate nodes	Y	Y	Better energy efficient mechanism	Qualnet
P.Rukmani, <i>et al</i> [14]	2013	Priority queue	N	Y	Voice traffic transmission with less delay	OPNET
R.Viegas, <i>et al</i> [15]	2013	Transmission delay	N	Y	Low network overhead	NS2
Z.Yuan, <i>et al</i> [16]	2013	Jitter	N	Y	Fairness in bandwidth allocation	NS2
S.Sridhar, <i>et al</i> [17]	2013	Energy based En-AODV	Y	Y	Increase in PDR, decrease in delay	NS2
R.Mohan, <i>et al</i> [18]	2012	Power control	Y	Y	Less n/w energy consumption	NS2
R. Jain, <i>et al</i> [19]	2011	Throughput	N	Y	Less delay, improved throughput	NS2
Z.Yuan, <i>et al</i> [20]	2010	End-to-end Queuing Delay	N	Y	Improved network delay from O(N) to O(log N)	NS2
B.Li, <i>et al</i> [21]	2010	Packet Delivery	N	Y	better performance than AODV	NS2

5. CONCLUSION

In this paper a complete survey on delay based routing issues and related Routing protocols are discussed and analysis has been done considering their routing metric. Special attention has been taken to consider those important issues related to reduction of delay at different levels. More stress has been given on approaches which have successfully implemented in highly mobile network

condition and whose simulation results showed better performance such as increased throughput, reduced end-to-end delay and satisfaction of quality of service requirements.



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