COMPARISON OF TCP AND CBR IN AOMDV ROUTING PROTOCOL OVER MANET

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Abstract

A MANET is a self-configuring network of mobile devices connected without wires. Routing protocols have a significant role in managing the transmission of data across these networks. In ,this paper we have evaluated the performance of AOMDV routing protocol which is a multipath distance vector routing protocol .This protocol has been selected due to its significant edge over other protocols in terms of delay, overhead etc. The assessment of AOMDV is done by obtaining the Packet Delivery Ratio, routing overhead and end to end delay for 10,20,30,40 and 50 node simulations using TCP as well as CBR with 10 distinct configurations for covering all possible conditions. The simulation has been done using NS-2.35.

Keywords: MANET, unipath, multipath, AOMDV, CBR, TCP, PDR, DELAY

1. Introduction

1.1 Mobile Ad hoc Networks

A MANET is a self configuring network of mobile devices connected without wires. It doesn't need much tangible infrastructure like routers, servers, cables etc. Each mobile machine functions as a node as well as a router. MANETs characteristics are distributed operation, multihop routing, autonomous terminal, dynamic topology, light weight terminals, shared physical medium and the applications range from high-performance military communication equipment for soldiers to PDA and Personal Area Networks.

1.2 Routing Protocols

A routing protocol specifies how routers communicate with each other, broadcasting information that enables them to select routes between any two nodes on a network. In ad hoc networks, nodes are not aware of the topology of their networks. Instead, they have to discover it. More importantly route construction is to be done with minimum resources i.e less overhead and bandwidth consumption. Basically the MANET routing protocols are classified into two major parts namely multipath and unipath[1].

1.2.1 Unipath Routing Protocols

The unipath routing protocols save a single route for a pair of source and destination. A route discovery is required in case of every route break which leads to high overhead and latency. The two parts of unipath routing protocols are i) Route Discovery: finding a route between a source and destination. ii) Route Maintenance: when routes are broken or new route is to be registered for the pair of source and destination in case of route failure. Some of the most popular unipath routing protocols are Ad Hoc On-demand Distance Vector (AODV), Dynamic

Source Routing (DSR), and Destination Sequenced Distance Vector (DSDV).

1.2.2 Multipath Routing Protocols

The multipath routing protocols discover multiple routes between a source and destination in order to satisfy Quality of Service (QoS) requirements. The three main parts of multipath routing protocols are *i) Route Discovery:* finding multiple routes which are node disjoint, link disjoint, or non-disjoint between a source and destination. *ii) Traffic Allocation:* Once the route discovery is done, the source will have selected a set of paths to the destination and then starts sending data to the destination along the paths. *iii) Path Maintenance:* regeneration of paths after original path discovery in order to avoid link failures that happen over time and node mobility. The advantages of the multipath routing protocols are i) Fault tolerance: As redundant Information is routed to the destination via alternative paths, it reduces the chances of the disruption in transmission in case of link failures, ii) Load Balancing: selecting multiple traffic through different paths in order to avoid congestion in links, iii) Bandwidth aggregation: Splitting the data into various streams and then each of it is routed through a unique path to the same destination and iv) Reduced delay: In the unipath routing protocols, the path discovery procedure needs to be initiated to find a new route in the interest of avoiding a route failure and this leads to route discovery delay. This delay is reduced in multipath routing protocols as multiple routes have already been discovered and registered in the initial route discovery process. Currently the most popular multipath algorithms are Temporarily-Ordered Routing Algorithm (TORA) , Split Multipath Routing (SMR) , Multipath Dynamic Source Routing (MP-DSR) , Ad hoc On-demand Distance Vector-Backup Routing (AODVBR) and Ad Hoc On-Demand Multipath Distance Vector Routing (AOMDV)[1].

2. Traffic Patterns

CBR

The CBR service category is employed for connections that transport traffic at a constant bit rate. There is an inherent dependence on time synchronization between the traffic source and destination.

The characteristics of Constant Bit Rate (CBR) traffic pattern i) unreliable: as it has no connection establishment phase, there is no guarantee that the data will reach the destination, ii) unidirectional: there is no acknowledgment or conformation from the destination regarding the transmitted data and iii) predictable: it has fixed packet size, intervals and stream duration[2].

TCP

The characteristics of Transmission Control Protocol (TCP) are i) reliable: since connection is established before transmitting data, there is a guarantee that the data will be transmitted to the destination, ii) bi-directional: each packet that is transmitted by the source will be acknowledged by the destination upon arrival of the data iii) conformity: there is flow control of data to avoid overloading the destination and congestion control mechanism exists to shape the traffic in order to conform it to the available network capacity. Today most of the Internet Protocol traffic is carried out through TCP[2].

3. AOMDV Routing Protocol

AOMDV is similar to AODV in many ways. It is based on the distance vector routing concept and uses hop-by-hop approach. Moreover, AOMDV

also finds routes on demand. The main difference between AODV and AOMDV lies in the number of routes found in each route discovery[1]. In AOMDV,

RREQ propagation from the source to the destination creates multiple reverse paths at intermediate nodes and the destination. Multiple RREPs traverse these reverse paths back in order to form many forward paths to the destination at the source as well as intermediate nodes. AOMDV also provides alternate paths to intermediate nodes as they are useful in reducing route discovery frequency.

The distinguishing feature of the AOMDV protocol lies in making sure that multiple paths discovered are loop-free and disjoint, and in finding such paths using a flood-based route discovery. AOMDV route update rules which are applied locally at each node, play a significant role in maintaining loop-freedom as well as disjointness [1]. AOMDV relies mostly on the routing information already accessible in the underlying AODV protocol, thereby limiting the overhead caused due to multiple path discovery. In particular, it does not use any special control packets. In fact, extra RRERs and RREPs for multipath discovery and maintenance and a few extra fields in routing control packets (i.e., RRER,RREQs, and RREPs) are the only additional overhead in AOMDV compared to AODV.

4. Simulation Parameters

Table 1

Parameter	**Value**
Simulator	NS-2.35
Mac Type	802.11
Simulation time	60 seconds
Channel Type	Wireless
Routing Protocol	AOMDV
Antenna Model	Omni
Simulation Area	800m X 800m
Traffic Type	tcp, cbr
Interface Queue Length	50
Interface Queue Type	Droptail/priqueue
Number of Nodes	10,20,30,40,50

5. Performance Metrics

Performance Metrics are measures that are used to evaluate MANET routing protocols and to understand their functionality at a deeper level by obtaining their performance values. We have considered the following four metrics in order to evaluate AOMDV with two traffic types CBR and TCP.

5.1 Packet delivery fraction(PDR)

The ratio of the number of data packets delivered to the destination to the number of data packets sent is known as the Packet Delivery Ratio(PDR)

Packet Delivery Ratio= (no. of packets received/number of packets sent) X 100.

5.2 Average Throughput

Average Throughput is the number of bytes received successfully at the destination

Average Throughput = (number of bytes received X 8/simulation time X 1000) kbps

5.3 Routing Overhead

Routing Overhead is the number of control packets generated by the router during simulation.

Routing Overhead = number of control packets

5.4 Average End to End Delay

End to End delay is the average time taken by a packet to arrive at the destination including all kinds of delay caused like the route discovery delay and the queued packet delay. Only the packets that have reached thee destination are counted.

Average End to end delay = ∑ (arrive time – send time) / ∑ Number of connections

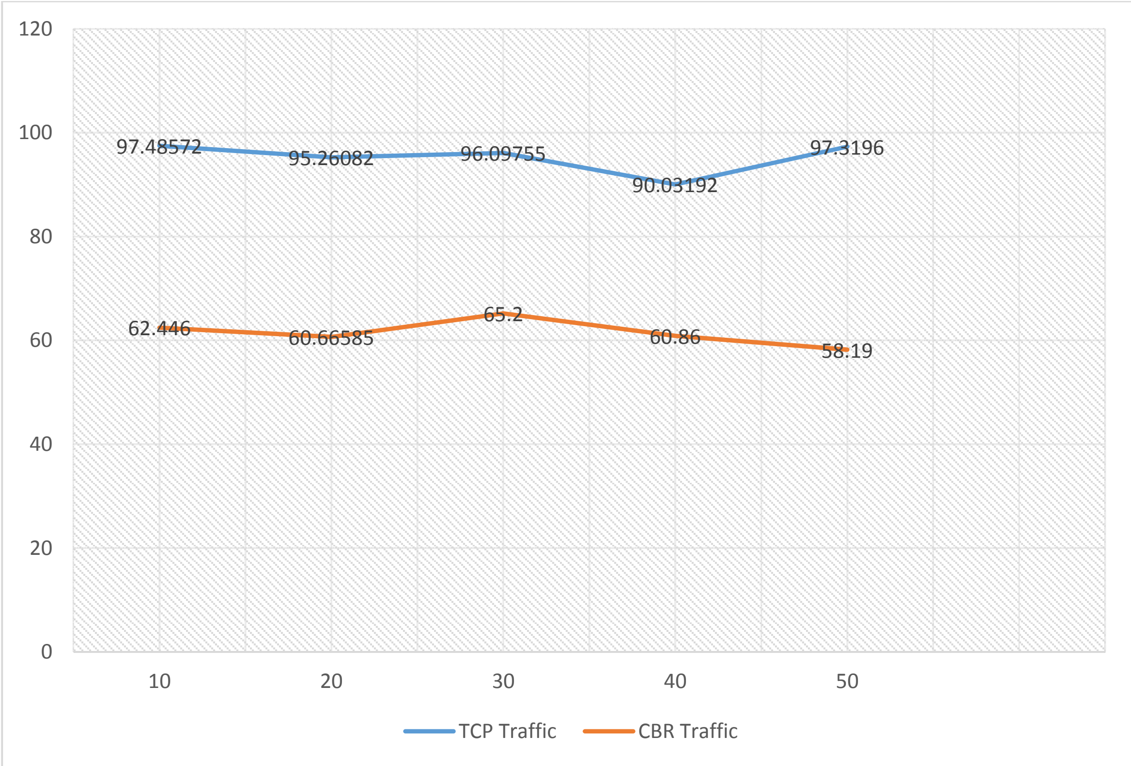
6. Results and Discussion

6.1 Packet Delivery Ratio

Table 2

PACKET DELIVERY RATIO		
Number of nodes	**TCP**	**CBR**
10	97.486	62.446
20	95.261	60.666
30	96.098	65.200
40	90.032	60.860
50	97.320	58.190

Table 2 shows the average readings of all five node configurations and we can clearly see that using TCP traffic a better Packet Delivery Ratio can be achieved.

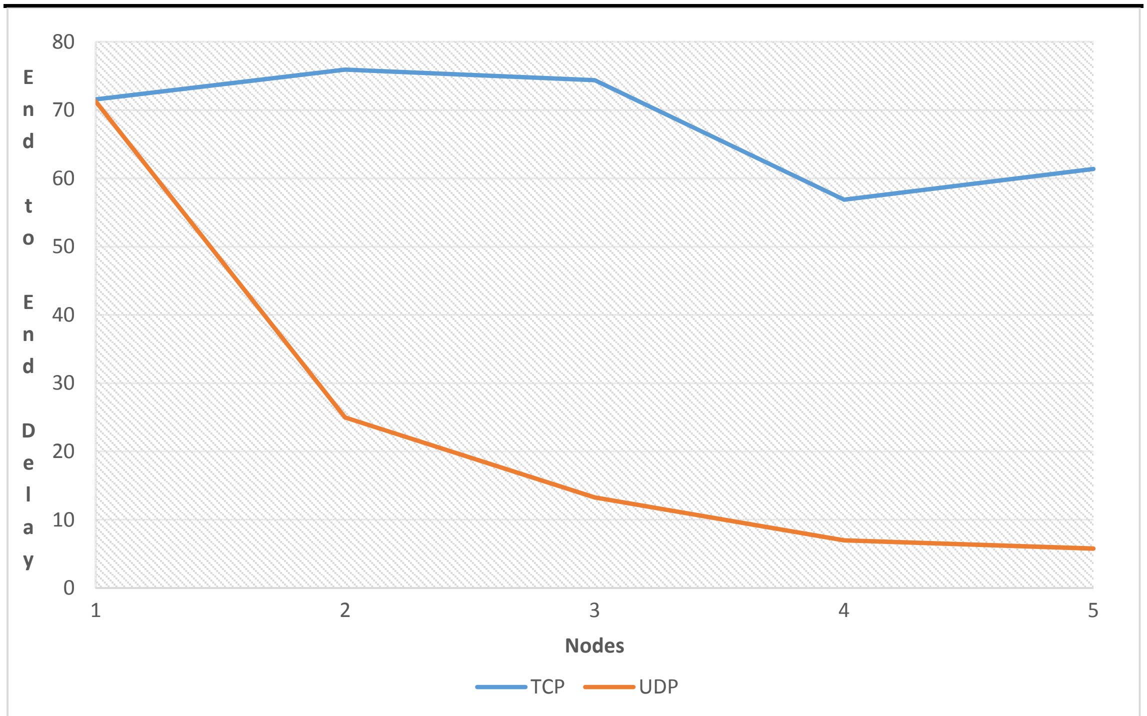


6.4 Average End to End Delay

Table 3

Average End to End Delay		
Number of nodes	**TCP**	**CBR**
10	71.561	71.284
20	75.930	24.972
30	74.385	13.266
40	56.880	6.981
50	61.373	5.771

Table 3 highlights the advantage of cbr traffic as lower delay is achieved and this helps in faster data transmission which is a necessary aspect for certain networks.

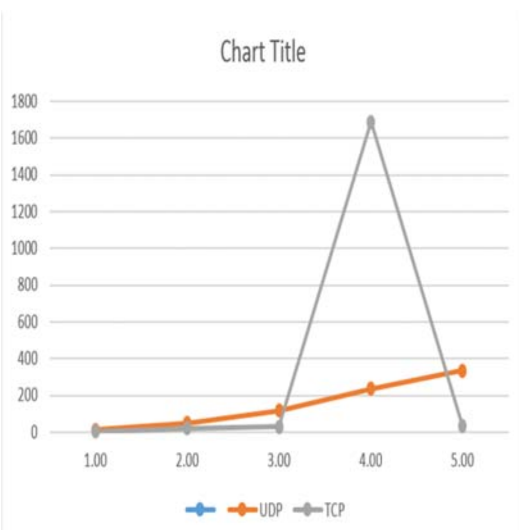


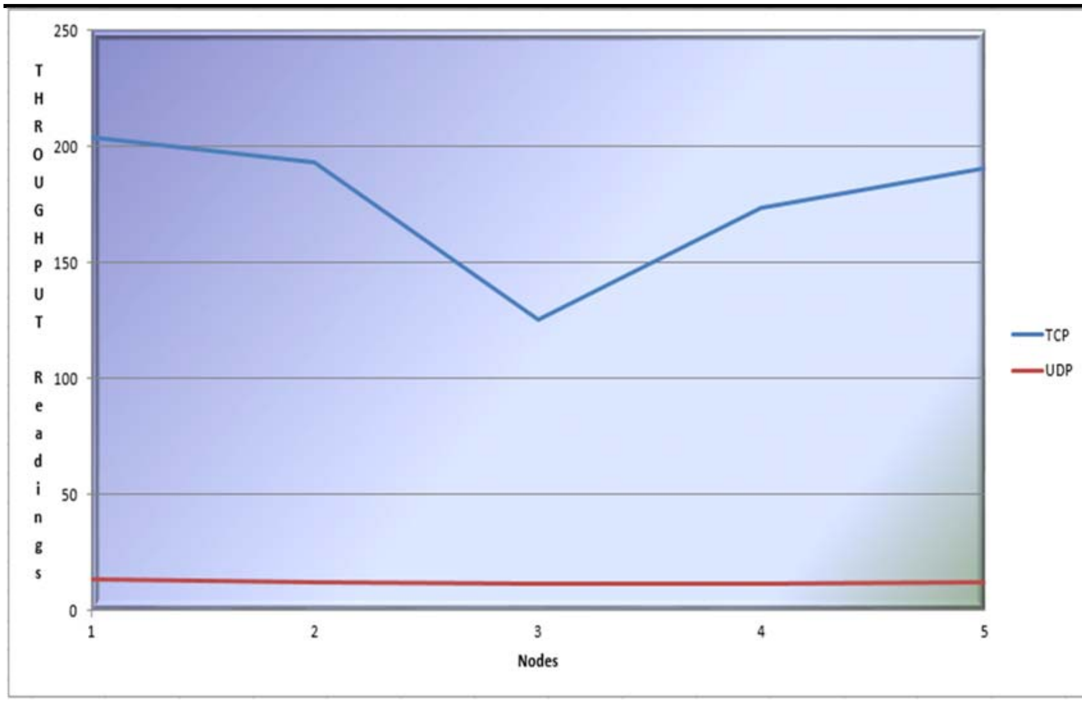
6.5 Routing Overhead

Average Overhead		
Number of nodes	**TCP**	**CBR**
10	3.512	11.835
20	21.524	49.689
30	28.795	116.199
40	1687.386	234.390
50	31.4772	333.490

6.6 Throughput

Average Throughput		
Number of nodes	**TCP**	**CBR**
10	204.192	13.81
20	193.056	12.536
30	125.318	11.389
40	173.545	11.68
50	191.011	12.332





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