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Multipath Routing Protocol for MANET

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Abstract:- This research aims to compare the standardized TCP variants on MANETs and thereby comprehensively analyzes their performance under varying no. of TCP connections in network with different TCP variants. The routing protocol that are considered in the analysis is Dynamic Source Routing (DSR) In addition, from a transport layer's perspective, it is necessary to consider Transmission Control Protocol (TCP) as well for MANETs because of its wide application, which enjoys the advantage of reliable data transmission in the Internet. Hence, it is the most important to identify the most suitable and efficient TCP variants that can robustly perform under these specific conditions. Therefore, this also makes an attempt to evaluate the performance of the four TCP variants (New Reno, SACK, TCP and Hybrid TCP) under a variety of network conditions. The simulations results reveal that out of the four, the Hybrid TCP variant can adapt relatively well to the changing network sizes while the SACK performs most robustly in different TCP connections scenarios. On the other hand, the research asserts the fact of superiority of, reactive protocol when routing the same traffic in the network. Nonetheless, among the reactive protocols DSR performance (in the presence of a static mobility) has been found to be remarkable.

Keywords:-MANET, Routing Protocols (DSR), TCP variants (NEWRENO, SACK, TCP and Hybrid TCP), ns-2.35.

I. INTRODUCTION

The advent of ubiquitous computing and the proliferation of portable computing devices have raised the importance of mobile and wireless networking. A mobile ad hoc network is an autonomous collection of mobile nodes forming a dynamic network and communicating over wireless links. Ad hoc communication concept allows users to communicate with each other in a multi-hop fashion without any fixed infrastructure and centralized administration. Due to their capability of handling node failures and fast topology changes, such networks are needed in situations where temporary network connectivity is required, such as in battlefields, disaster areas, and large meeting places. Such networks provide mobile users with ubiquitous communication capability and information access regardless of location.

TCP has gained its place as the most popular transmission protocol due to its wide compatibility to almost all today's applications. However, TCP as it exists nowadays may not well fit in mobile ad hoc networks since it was designed for wire-line networks where the channel Bit Error Rate (BER) is very low and network congestion is the primary cause of packet loss. On the contrary of wired links, wireless radio channels are affected by many factors that may lead to different levels of BER. Wireless channel behavior cannot be predictable, but in many cases, such channels are having a high BER that cannot be neglected when studying ad hoc networks. Furthermore, node's mobility can also affect TCP sessions in ad hoc networks, which is obviously not the case of wired networks. Indeed, when nodes move, link can be broken and TCP sessions using that links can lose packets. Hence, TCP does not have the capability to recognize whether the packet loss is due to network congestion or channel errors.

Problem Identified

TCP is considered as the most popular reliable transport protocol today. It is compatible with almost all other Internet protocols and applications. However, TCP as it exists now-a-days may not well fit in wireless ad hoc networks since it was designed for wired networks where network congestion is the primary cause of data packet losses. On the contrary of wired links, wireless radio channels are affected by many factors that may lead to different levels of channel errors. Wireless channel behavior cannot be predictable, but in many cases, such channels have high channel errors that cannot be neglected when studying light-infrastructure networks such as wireless ad hoc networks. Furthermore, in addition to wireless channel behavior, there are many other factors that could affect TCP performance within this kind of networks. Link failures and network partitioning due to nodes' mobility or battery depletion may have a negative effect on the performances of TCP connections. Hence, TCP does not have the capability to recognize whether the packet loss is due to network congestion, channel errors, or link failure. It reacts to all packet losses as if it was due to congestion.

Proposed Algorithm:-

TCP-Hybrid

The main idea of TCP-Hybrid comes up from TCP sack and TCP Westwood. This algorithm behaves in the slow start phase as TCP sack exactly and in the congestion avoidance phase behaves as both with adding a new component called (Gama). However, during the Congestion phase, we automatically adjust three threshold values (Alpha, Gama, Beta)

The congestion window size (CWND) increases by one since the difference of the expected rate and the actual rate is less than Alpha (a minimal threshold) until it reaches the middle threshold Gama. The reason of that adjustment is the expected throughput is still low as well as we save the bandwidth. Since the difference is less than Gama (a middle threshold) then CWND behaves as TCP Fack with checking the bandwidth each time to know if the CWND increases or decreases with resetting both the slow start

threshold (SSThresh) and the CWND. That continues until it reaches the highest threshold Beta which is (a maximum threshold) then CWND decreases or keeps constant since the expected throughput gets high.
The scope of this section is to show the strength of our algorithm and the ability of efficient usage of Bandwidth.

This algorithm works as given below:
If (the Dup ACKs are arrived) then
{
Let Base RTT is the minimum of all RTTs; // RTT: Round Trip Time
Expected Rate= CWND /Base RTT; //Base RTT: the minimum RTT
Actual Rate= CWND/RTT; // to estimate the flow throughput
Diff = (Expected Rate – Actual Rate) BaseRTT; // Diff: the difference between the expected and actual rate
If (Diff <) then // : Alpha (Minimum threshold)
CWND+1
else
If (Diff=) then // is a new variable to estimate the congestion possibility (Gama)
{
Let ssthresh = (BWE*Base RTT)/ seg_size; /* BWE: the Bandwidth Estimation; Seg_size: the size of the segment*/
If (CWND >sthresh) then
CWND=ssthresh
else
If (the time out is expired) then
{
Let CWND=1;
ssthresh = (BWE*BaseRTT)/seg_size;
If (ssthresh<2) then
Ssthresh=2;
}
}
else
If (Diff >β) then // β: Beta (Maximum threshold)
CWND-1;
Otherwise -> CWND;
}

II. EVALUATIONS OF RESULTS

For our work to be done successfully we have used MANET scenario with varying no of connection which are 5,10,15,20 and 25 connectionswith node density 100 and constant 30 sec under scenario using DSR as a routing protocol. We have reached to the results with the help of various performance matrices for now we have used following performance matrices.

A. Packet Delivery Ratio

This is the fraction of the data packets generated by the TCP sources to those delivered to the destination. This evaluates the ability of the protocol to discover routes.
Packet Delivery Ratio for various connections:-Figure 1 shows the PDR under various TCP variants i.e. NEW Reno, SACK, TCP and Hybrid TCP.

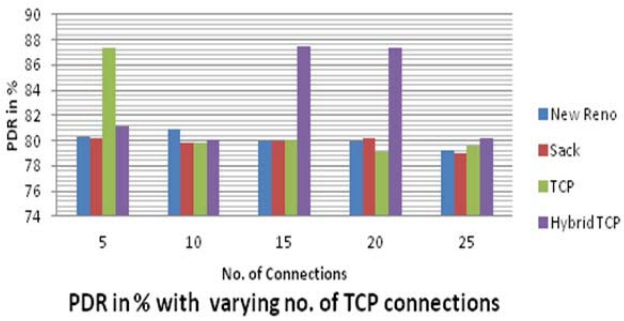

Figure 1 Packet Delivery Ratio for various transmission connections

B. End to End Delay

The end-to-end delay is the time needed to traverse from the source node to the destination node in a network. The end-to-end delay is measured in ms.The delay assesses the ability of the routing protocols in terms of use- efficiency of the network resources.
End to End Delay for various connections:-Figure 2 shows the end to end delay under various TCP variants i.e. NEW Reno, SACK, TCP and Hybrid TCP.

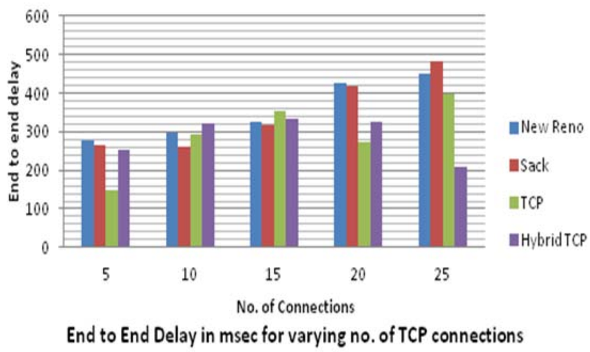

Figure 2 End to End Delay for various transmission connections

C. Throughput

The average rate at which the data packet is delivered successfully from one node to another over a communication network is known as throughput. The throughput is usually measured in bits per second (bits/sec). A throughput with a higher value is more often an absolute choice in every network.
Throughput for various connections:-Figure 3 shows the Throughput under various TCP variants i.e. NEW Reno, SACK, TCP and Hybrid TCP

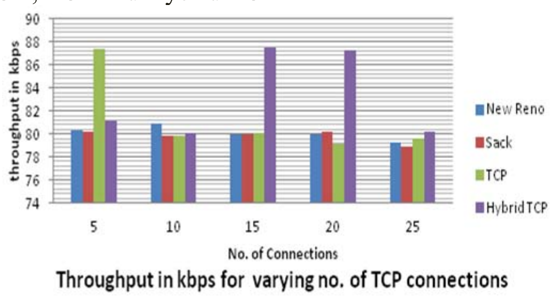

Figure 3 Throughput for various transmission connections

III. CONCLUSION

This work carried out the detailed analysis of New Reno, SACK, TCP and Hybrid TCP variants of TCP with DSR routing protocol theoretically and through simulation by NS-2 for MANET on the basis of different performance metrics viz. packet delivery ratio, end to end to end delay and average throughput. These performance metrics are analyzed for the three four variants by varying the node density for static number of nodes. Simulation of variants provides the facility to select a good environment for routing and gives the knowledge how to use variant algorithm schemes in static network. Simulation results show that, as the node density increases in the network, the performance of the variants decreases. Nodes density affects the performance of variants most as frequent path break increases with the low node density. According to simulation results as the density of nodes increases, the packet drop and overheads of routing protocol increases whereas throughput and packet delivery ratio decreases.

From our Result it is clear that the TCP variant Hybrid TCP is best as compare to the NEW Reno, SACK and TCP in terms of Packet Delivery Ratio, END to END delay, Throughput Routing Overhead. When we analyze various connections we cannot analyze clearly that which one is better because with different scenario all connections gives better performance, but when we analyze for Packet Delivery Ratio, END to END delay and Throughput DSR better for high number of node connections.

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