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EFFECT OF ROUTING PROTOCOLS OVER RENOVATED CONGESTION CONTROL MECHANISMS IN SINGLE-HOP WIRELESS

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ABSTRACT

Wireless network uses wireless media to send and/or receive data over air. Wireless network provides the services for data transmission that may not be effective with wires. But sometimes the situation demands to cover across the regions that are beyond the capabilities of typical cabling system. However traditional TCP is a de facto standard for reliable transmission where congestion mechanism is itself a challenge. Many renovation protocols namely TCP Newreno, TCP Vegas are cited in the literature in order to overcome the shortcomings lies in the traditional TCP. On the other hand two popular routing protocols namely DSR and AODV are widely used during the movement of the node(s).This paper experiments by simulating an environment with TCP Newreno and TCP Vegas as a transport layer protocol and DSR and AODV as a routing protocol in order to get the better compatibility in Network Layer and Transport layer protocols.

Keywords: *TCP Newreno, TCP Vegas, DSR, AODV, Congestion Control*

1. INTRODUCTION

The performance of TCP works better and considered to be satisfactory for wired networks. But there exists a lot of performance degradation in wireless networks. There are many issues like improper bandwidth allocation, bandwidth fluctuations etc. In mobile networks [3] when the node moves from one place to another rapidly then also it may lead to ineffective communication. There are situations like link failure, high error ratio, greater delay which make the wireless networks performance unreliable. Therefore traditional TCP doesn't hold well for mobile wireless networks. So various modifications for congestion control at the transport layer namely TCP Newreno and TCP Vegas are proposed for single hop wireless networks.There are basically two types of networks on infrastructure. One is infrastructure oriented another is infrastructure less. One of the major characteristics of infrastructure less network is lack of fixed infrastructure where two nodes communicate each other through intermediary node(s).The routing mechanism of IP layer plays a significant role. The popular IP Layer mechanisms are DSR and AODV.

This paper organized as follows: In Section-2 & Section-3, we have discussed the popular routing protocols and congestion mechanisms for wireless environment. In Section-4 we have presented our simulation study. Lastly, Section-5, concludes our work

2. ROUTING PROTOCOLS FOR WIRELESS ENVIRONMENT

Routing is a complex task in wireless network. The destination node may be out of range with respect to source node which is transmitting data packets. The purpose of routing is to find correct path between source and destination for forwarding the packets. If it is infrastructure based the routing may be a simple task since the route to the nodes are static or structured. But in case of infrastructure less network the routing is a difficult task. So many routing algorithms [8][11][12][13][14][15][16][17] traditionally written may not suit for the infrastructure less networks due to its dynamic topology. In this context every routing protocol in infrastructure less networks includes the mechanisms of route discovery, data forwarding and route maintenance. There are many unicast

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protocols for this environment are cited and some of the important routing protocols are as follows:

2.1 Dynamic Source Routing (DSR)

In DSR [8][9] protocol large bandwidth consumption is avoided as here each node doesn't send the entire routing table information periodically to all its neighbour nodes. Here it follows two steps. One is route discovery and the other is route maintenance. In each node it has a cache where it stores the number of nodes required from source to destination by route discovery process. So when a request is generated it follows the nodes one after the other to reach the destination. Route is maintained accordingly if route fails due to some idle nodes or node moves to a different place.

2.2 Ad Hoc On-Demand Distance Vector (AODV)

AODV[6][10] protocol resembles the DSR protocol. It also makes routing hop by hop, maintains unique sequence number as well. Whenever a route request is generated it is forwarded by intermediate nodes. When it receives acknowledgement then in a reverse way it learns the specific route to destination. The process is repeated on demand basis. But in comparison to DSR, not requires large headers having all the hop addresses from a source to destination.

3. CONGESTION CONTROL MECHANISMS FOR WIRELESS ENVIRONMENT

In mobile computing environment the Transmission control protocol (TCP) is possibly the most popular transport layer protocol that offers connection between two nodes with reliable data delivery. When packets are transmitted by the sender to the receiver where the transmitted packets are higher than the capacity of the receiver, the buffer in the router gets filled quickly and cannot accommodate more packets. And possibly some packets may be dropped. In mobile computing environment the Transmission control protocol (TCP) is possibly the most popular transport layer protocol that offers connection between two nodes with reliable data delivery. When packets are transmitted by the sender to the receiver where the transmitted packets are higher than the capacity of the receiver, the buffer in the router gets filled quickly and cannot accommodate more packets. And possibly some packets may be dropped. In wired network TCP assumes that packet loss is due to congestion [1][2]. However it may not hold well in a wireless environment due to low bandwidth, frequent disconnections, and high bit error and so on. To reduce congestion TCP invokes congestion control mechanisms. The important congestion control mechanisms used by TCP for improving the performance in wireless network are given below:

3.1 TCP NewReno

The TCP NewReno enhances the TCP Reno where it differentiates the effective bandwidth utilization. TCP NewReno avoids unnecessary wastage of bandwidth. TCP only resends the lost packets in the window and unnecessary data packets are not transmitted. So it improves the retransmission during the fast recovery phase [5]. The fast recovery mode holds good until all the packets are not acknowledged. TCP NewReno exits this mode when all the outstanding packets get acknowledged, then congestion window is set to initial and it enters to congestion avoidance[5] operation to continue the process.

3.2 TCP Vegas

TCP Vegas[7] considers the actual time required to deliver packets from source to destination through a timer. It uses more accurate timer. However TCP Vegas may identify the loss of packets from single duplicate acknowledgements. Again TCP Vegas records the packet sent time at the instance it receives acknowledgements and compute round trip time(RTT).If it identifies the packet transmission time is more than the packet time out time then it simply starts transmitting the packets and without waiting for duplicate acknowledgements and unaffected congestion window.

4. SIMULATION STUDY

This work considers the renovations of traditional TCP namely TCP NewReno and TCP Vegas over two popular routing protocols AODV and DSR. As the TCP congestion control technique is the vital part in an effective communication, we try to investigate the effect of maximum congestion window size of TCP over the two routing protocols AODV and DSR in chain topology with number of nodes (say 3, 5, 7, 9) over a terrain area of 1000 X 1000 m^2.The experiment holds for 20 seconds .The detail of the simulation environment is shown in table 1.

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Table 1 Simulation Environment

PARAMETER	VALUE
Channel Type	Wireless channel
Routing Protocols	AODV,DSR
Number of nodes	3,5,7,9
Topology created	Chain Topology
Packet Size	512 bytes
Packet Type	FTP
Time of Simulation	20 seconds
Area of simulation	1000 * 1000 m^2
MAC Protocols	Mac/802_11

4.1 Result Outcomes

The simulation result are recorded in many scenarios of TCP Newreno and TCP Vegas over the routing protocols AODV and DSR. The observation has been undertaken with considering six number of scenarios as follows: In case of TCP Newreno the routing protocol AODV has less NRL but in case of TCP Vegas the routing protocol DSR possess less NRL depicted in figure-1 and figure-2. For simplicity, the Normalized Routing Load (NRL) increases as the number of nodes increased in both TCP NewReno and TCP Vegas protocol. The figure-3 and figure-4 indicates that AODV and DSR has less significant improvement in Packet Delivery Ratio (PDR) for small number of nodes. However in case of TCP Newreno, PDR drastically decreases as the number of nodes increases for both the routing mechanism and TCP Vegas performs better PDR at both AODV and DSR. The AODV protocol possess better result in both the TCP NewReno and TCP Vegas Protocol for throughput which is shown in figure-5 and figure-6.

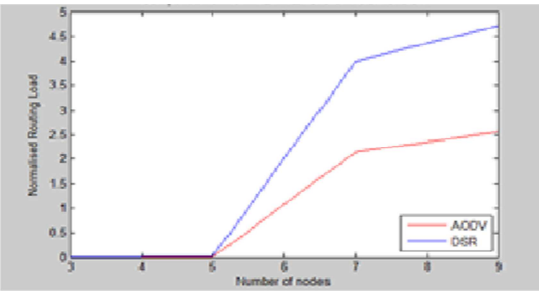


Figure1:: TCP Newreno over AODV AND DSR

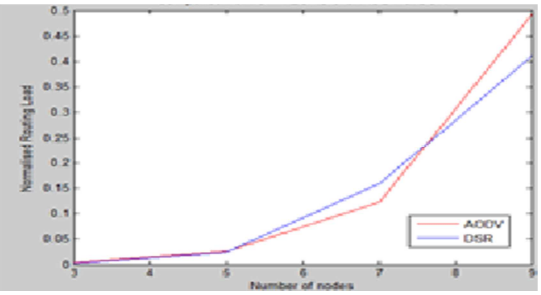
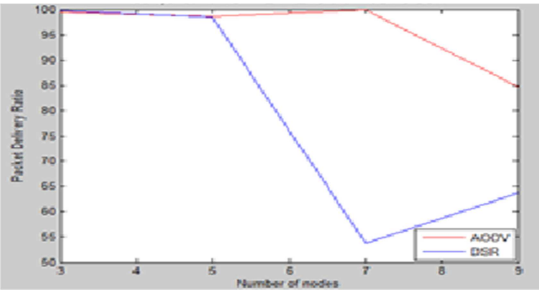


Figure2: TCP Vegas over AODV AND DSR



Figur3:: TCP Newreno over AODV AND DSR

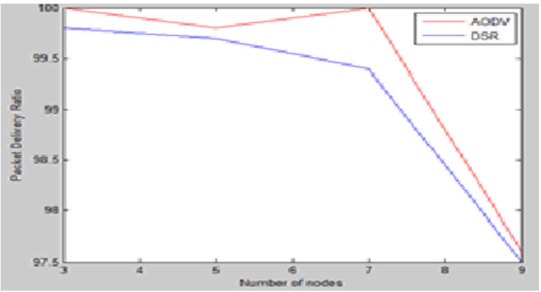


Figure4: TCP Vegas over AODV AND DSR

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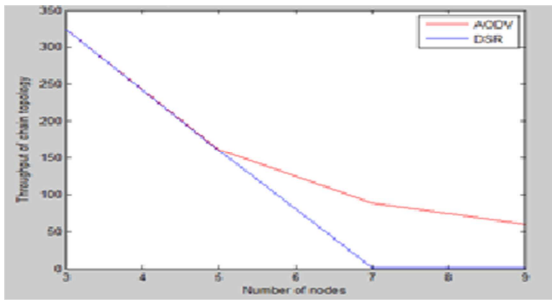

Figure5: TCP Newreno over AODV AND DSR

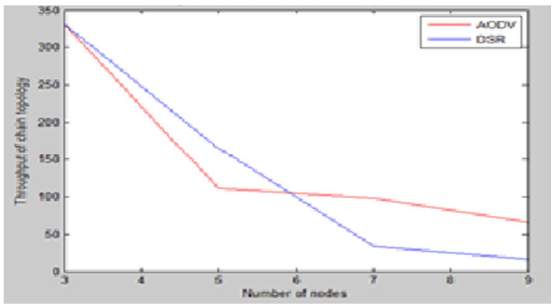

Figure6: TCP Vegas over AODV AND DSR

5. CONCLUSION

TCP is a transport layer protocol that is well known for its reliability. TCP provides guaranteed delivery from end-to-end. However there may be congestion due to different date transfer issues, but the congestion over the network is avoided by making the data transfer rate slower by reducing the window size. As the requirement demands to have a network where wired infrastructure is tough to implement, TCP renovated protocols are used to enhance the performance. We summarize our observation as follows:

We observed that in case of TCP Newreno, the Packet Delivery Ratio (PDR) doesn't possess better result when we have more number of nodes taken in to consideration for both the routing mechanisms. Comparatively TCP Vegas performs better PDR for both routing mechanisms. The AODV protocol possess better result in both the TCP Newreno and TCP Vegas Protocol for throughput.

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