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Performance Evaluation of DSDV and AODV Routing Protocols On The Basis Of TCP Variants in WSN and MANET

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ABSTRACT
Transmission Control Protocol (TCP) provides reliability to data transferring in all end-to-end data stream services on the internet. This protocol is utilized by major internet applications. TCP was originally created to handle the problem of network congestion collapse. This paper is prepared on the performance of different TCP variants to identify the best protocol variant for network expansion. In such context, a full comprehensive simulation environment is created for evaluating the comparative performance of TCP variants like TCP NewReno, SACK, FACK, RTCP and Vegas with the routing protocol AODV and DSDV in WSN and MANET. In this paper the overall performance of WSN and MANET is analyzed by comparing on the basis of Energy, End-to-End Delay, Throughput and Packet Delivery Ratio of the network.
Keywords **–** TCP, NewReno, SACK, FACK, RTCP, Vegas WSN and MANET

I. INTRODUCTION

A Wireless Sensor Network is a network of many sensor nodes, having wireless channel to communicate with each other. Without any centralized control and predefined communication link, it can transfer signals to the exterior world. All nodes are capable to act as source or sink node at the same time. These nodes have a limited processing power because of their tiny physical size, which limits the capacity of processor and size of battery. When collectively works together, they have an ability to collect information of the physical environment. They have transceiver to communicate with the virtual world and the physical world. Routing topology to be used for the network depends on the transmission power available at its nodes. It also depends on the node's location, which may vary time to time [1].

A mobile ad-hoc network (MANET) is a type of self-possessing network of mobile nodes in which every node is connected to the whole network through the wireless link. It is also characterized by the absence of any centralized co-ordination or fixed infrastructure, which makes any node in the network act as a potential router. MANETs are also characterized by a dynamic, random and rapidly changing topology [2]. We are using such types of TCP variants with MANET and WSN. TCP was originally made for wired links. On the wired links there are very less chances of high delay and corruption of data due to external parameters. Congestion is the main cause of packet loss on wired links. So, TCP was designed by keeping in mind all the above parameters. As wireless and heterogeneous networks came into the existence, due to the requirement of reliable protocol in TCP/IP model in internet, TCP was adopted as it was on wired links. Wireless links have several problem of variable and high delay with high Bit Error Rate (BER). So initially, unmodified old TCP started to perform badly on wireless links. To deal with the problems of wireless links, a research started in the field of TCP and modifications were done according to the requirements to improve the performance. Variants named TCP NewReno, SACK, FACK, RTCP and Vegas and many more came into existence.

Therefore, active research on TCP has been done, and many improvement mechanisms have been proposed. Among them, a TCP Vegas version is one of the promising mechanisms because of its high performance. The accuracy of our analysis is validated by comparing the simulation results [3].
The simple structure WSN and MANET is shown in fig:-

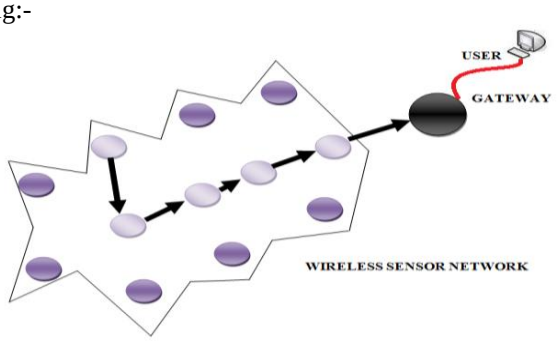

Fig.1: Wireless Sensor Network

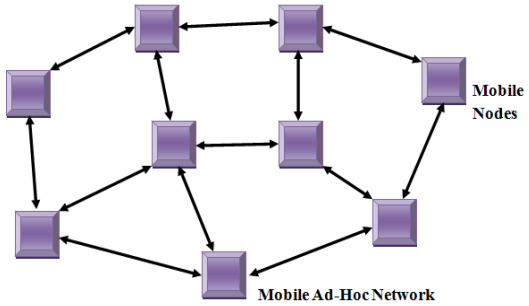

Fig.2: Mobile Ad-hoc Network

II. ROUTING PROTOCOL

A routing protocol specifies how routers communicate with each others. The routing protocols for ad hoc networks have been classified into three categories: Table-driven protocols, On-demand protocols and Hybrid routing protocols [4]. They are differing from each other on the way they obtain the routing information. The table driven protocols usually maintain the routing table of the whole network and all nodes continuously updates the routing table from dynamically changing topology of the network. Whereas the on-demand protocols only try to keep routes whenever it is required [5]. Whenever a node wants to send a data packet from source to destination, it requests for route discovery process. The route remains valid till the destination is reachable or until the route is no longer needed. A third category is also there which combines both table driven and on-demand protocol. In the routing, all the routing protocols have to follow must two basic functions first is selection of shortest path known as route between sources to destination and second is provide the delivery to right destination. From the exits routing protocol we have chosen to analyze the performance of AODV and DSDV routing protocols in MANET and WSN.

2.1 Destination Sequence Distance Vector Routing (DSDV)

DSDV is a proactive routing protocol which is based on periodic routing of control messages that use a table-driven technique by recording all routes it between all source destination pairs .This protocol is based on bellman-ford algorithm. Some enhancement of in this algorithm makes it easy to calculate the path. DSDV is a hop-by-hop distance vector routing protocol where each node maintain routing information in the form of routing table [6]. This routing table is broadcasted periodically by each sensor nodes.

This information is stored through periodic exchange of partial routing, which is stored at each node this routing information contains next hop address, cost matrix towards each destination node, sequence number which is created by the destination node. For calculate hop count DSDV use the cost matrix. The hop count is defined by the how number of nodes takes for the data packet to get the destination node. In DSDV routing each and every node forwards the updated routing table by the use periodic and trigger update mechanism to its all neighbor nodes [7]. Due to periodic update loops are created in whole network, but due to removing these loops from the network, nodes use the randomly selected sequence number, by each and every node. Each DSDV node maintains a routing table listing the "next hop" for each reachable destination and also the destination sequence number. The sequence number must be incremented each time periodically update by the node. Mostly two types of updates are made by each node which is as follows [8]:

1. Normal update
2. Expired route update.

For the normal update nodes chooses a sequence number that must be en even number. Each time of periodic update nodes increment it sequence number by 2. After increments the in the sequence number nodes transmits the message. No one can change the sequence number of other node. Whenever the route is expired, nodes use the route expired update Mechanism. This node sends the updates about route expiry. This route expiry is made by incrementing the sequence number by 1.When other nodes found the odd sequence number. Nodes will remove the corresponding entry of that route from their routing table. The key advantage of DSDV over traditional distance vector protocols is that it guarantees loop-freedom.

2.2 Ad-Hoc on Demand Distance Vector Routing (AODV)

AODV is a reactive routing protocol that is based on source initiated on demand routing. This type of routing creates routes only when it is required by the source node. This routing protocol is an expansion of DSDV and DSR routing protocols. AODV is made for minimize the no. of broadcast are removing the "count to infinity" problem [9]. This problem is type of looping process, in which each node updates to each other continuously .In the AODV when a node wants to communicate to another node. It checks the routing table for determining a shortest path. Whenever the route does not available in network it starts the route discovery process that is become an On-Deamand.in route discovery process node sends the route request (RReq).this request is type of control message which contains the types of information such as IP address of source and destination nodes ,Last known sequence for destination and the hop count[10].

The maintenance of updated routing information is made by the sequence number. Larger sequence shows the newer information of routing. In this process route request and route reply are send along with the sequence number. Whenever the node receives the route request from the source node it also updates in its routing table. It makes a reverse path to previous Node, before forwarding RREQ to its neighbors by the use of data base. So that node can forward the route reply later to previous Node through reverse track. It then increments the hop count and rebroadcast the RREQ. If in the path does not have the route to the destination node, the intermediate nodes having valid route towards the destination node .which replies with a unicast RREQ. Every node keeps track of a previous node. The HELLO messages are broadcasted periodically, if neighboring node does not receives the HELLO message within the time period. Links is considered as a failure link between itself and destination, by the node. By local repair mechanism we can repair failure link. This link failure repair mechanism is used by information to all nodes about failure link by sending RERR (Route error).the route discovery process may be reinitiated by the node.

III. TCP VARIANTS

TCP is an alternative transport layer protocol which is supported by TCP/IP. TCP is also knows as connection oriented protocol means a virtual connection is established before transmission of data stream where the connection is treated as a stream of bytes. It is also provides much reliability, full-duplex connection. Every transmission of data is acknowledged by the receiver [11]. If the sender does not receive acknowledgement within a specified amount of time, the sender retransmits the data. There are different type of TCP's versions that we are using with DSDV and AODV routing protocol in WSN and MANET for compare and analysis of its performance.These are following in brief:

3.1 NewReno:- NewReno is a slight modification over TCP-RENO. It is able to detect multiple packet losses and thus is much more efficient that RENO in the event of multiple packet losses. New-Reno enters into fast-retransmit when it receives multiple duplicate packets, however it doesn't exit fast-recovery until all the data which was outstanding at the time it entered fast recovery is acknowledged.

3.2 SACK:- TCP's cumulative Ack mechanism is known as selective Ack mechanism. SACK is allowing a receiver. This is used to specify accurately which data has been received. It is also used which data is still missing. The main advantage of SACK arises in condition of occasional loss.

3.4 FACK*:* - FACK algorithm uses information provided by SACK to add more precise control to the injection of data into the network during recovery – this is achieved by explicitly measuring the total number of bytes of data outstanding in the network.

3.5 RTCP*:*-Real time control protocol is also the variant of TCP that is relative protocol of Real-time Transport Protocol (RTP).RTP supports the data transfer to multiple dimensions. That does not provide Timely delivery and other quality-of-service guarantees but RTCP monitor quality-of-service and convey the information in on- going session.

3.6 VEGAS*:* - Vegas indicate about the congestion through packet delay. TCP Vegas adjust the window size according to the congestion in the network. It detects congestion before the packet losses.

IV. SIMULATION PARAMETERS AND RESULTS

In order to analyze and compare the performance of AODV and DSDV routing protocol simulation experiments are performed. The purpose of the simulations is to compare the efficiency of these routing protocols with TCP Variants based on different simulation parameters. These are following

- Energy Consumption
- End-to-End delay
- Throughput
- Packet Delivery Ratio

4.1 Energy Consumption (EC): Energy consumption is defined as Energy required by each node during transmitting and receiving the data packets. It can be calculated in Joule.

EC = Initial energy – remaining Energy at each node

4.2. End-to-End Delay: It refers to the time taken for a packet to be transmitted across to network from source to destination.

4.3. THROUGHPUT: It is the average rate of successful message or data delivery over a communication channel.

4.4. Packet Delivery Ratio: It is ratio of number of packets successfully delivered to the destinations to the total packet generated by sources.

We have created a wireless scenario of 100 nodes randomly scattered in an area 2000x2000. The Table.1- indicates the simulation parameters.

Table.1 Simulation Parameters

Simulation Tool	NS-2
No. Of Nodes	100
MAC Protocol	802.11 & 802.15.4
Mobility Model	Random Way Point
Antenna Model	Omni Directional
Routing Protocol	AODV,DSDV
Simulation Area	2000 x 2000
Simulation Time	30sec.
Data traffic	TCP

Simulation results

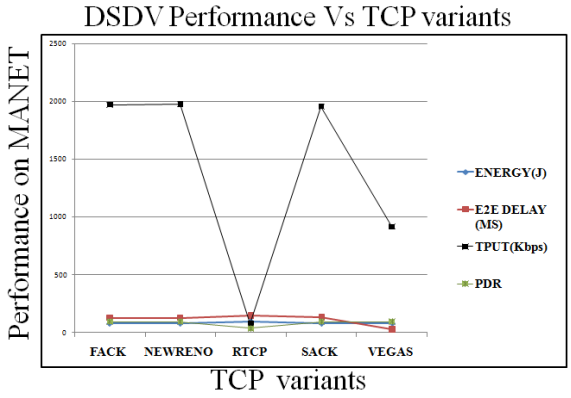

Fig:-3

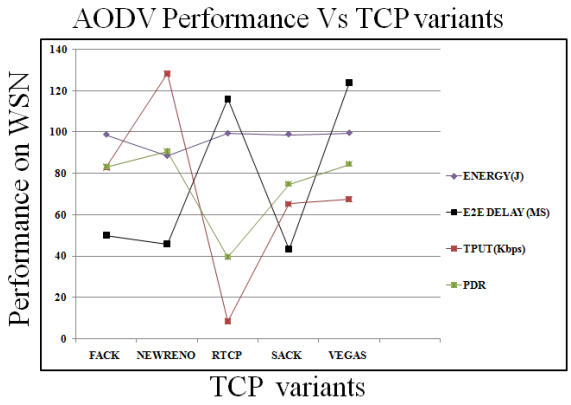

Fig:-4

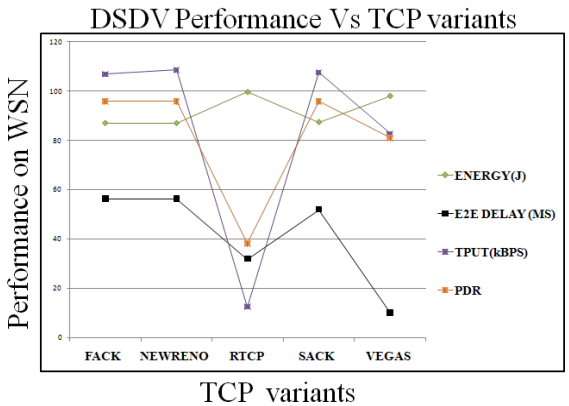

Fig:-5

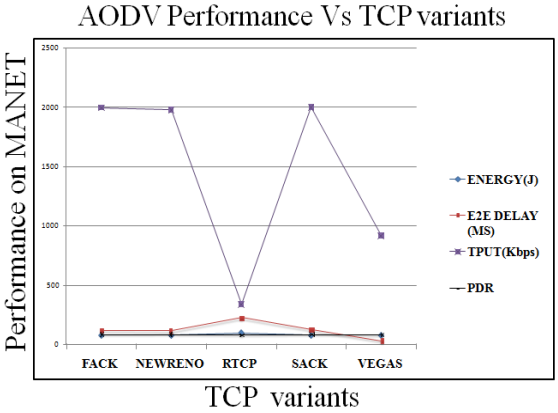

Fig:-6

Showing the performance of AODV and DSDV routing protocols in tabular form:

Table-2 Energy

VARIENTS	AODV-MANET	AODV-WSN	DSDV-MANET	DSDV-WSN
FACK	LOW	HIGH	LOW	HIGH
NewReno	LOW	HIGH	LOW	HIGH
RTCP	LOW	HIGH	LOW	HIGH
SACK	LOW	HIGH	LOW	HIGH
VEGAS	LOW	HIGH	LOW	HIGH

Table-3 Throughput

VARIENTS	AODV-MANET	AODV-WSN	DSDV-MANET	DSDV-WSN
FACK	HIGH	MEDIUM	HIGH	HIGH
NewReno	HIGH	HIGH	HIGH	HIGH
RTCP	LOW	LOW	LOW	LOW
SACK	HIGH	MEDIUM	HIGH	HIGH
VEGAS	LOW	MEDIUM	MEDIUM	HIGH

Table-4 Packet delivery Ratio

VARIENTSS	AODV-MANET	AODV-WSN	DSDV-MANET	DSDV-WSN
FACK	LOW	HIGH	LOW	HIGH
NewReno	LOW	HIGH	LOW	HIGH
RTCP	LOW	LOW	LOW	MEDIUM
SACK	LOW	MEDIUM	LOW	HIGH
VEGAS	LOW	HIGH	LOW	HIGH

Table-5 E2E Delay

VARIENTS	AODV-MANET	AODV-WSN	DSDV-MANET	DSDV-WSN
FACK	LOW	HIGH	LOW	MEDIUM
NewReno	LOW	MEDIUM	LOW	MEDIUM
RTCP	LOW	HIGH	LOW	LOW
SACK	LOW	MEDIUM	LOW	MEDIUM
VEGAS	LOW	HIGH	LOW	LOW

V. CONCLUSION

From the above simulation results we observe that in case of MANET, AODV and DSDV have lower performance in terms of (i) Energy (ii) E2E delay (iii) Packet delivery Ratio which is shown in table 1, 2, and 4. But in case of WSN, AODV and DSDV is much higher performance than simple MANET in case of (i) Energy (ii) Throughput and (iii) E2E Delay and (iv) Packet Delivery Ratio which is shown in all table 1-4. Only in case of throughput, the performance of AODV and DSDV is high. From the table.1 we observed that the energy consumption is increased. The energy consumption in routing is proportional to routing packet overhead like RREQ and RREP packets. If we reduced these packets overhead by reducing the number of control packets, we can reduce the energy consumption and increase the efficiency of the network. Our future enhancement is to develop an algorithm that reduce these routing packets and reduce the energy consumption.

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