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Performance Analysis of Congestion Control In MANET Using Different Routing Protocols

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Abstract- Mobile Ad hoc Network (MANET) is an infrastructure free network that is self-configurable and is dynamic in nature. In MANET nodes communicate with each other independently since there is no centralised controller. An extensive variety of routing protocols for MANETs have been suggested by researchers to excel the restrictions of wired routing protocols. Congestion in MANET is a restriction in the implementation of MANET as it can affect the efficiency of the network and may lead to packets loss, increased average delay during transmission or reception of data. This paper discusses various routing protocols to control congestion problem in MANET. Also various performance parameters have been evaluated here like packets transmitted, packets collided, packets that got into error, throughput and average delay by using AODV (Ad- Hoc On Demand Distance Vector), DSR (Dynamic Source Routing) and ZRP (Zone Routing Protocol) protocols by taking 5,10 and 20 nodes using the software NETSIM Simulator.

Keywords- MANET, ZRP, AODV, DSR

I. INTRODUCTION TO MANET

MANET is group of mobile hosts that is self-maintainable, self-configurable and is self- organised in nature [1]. There is no centralised controller in MANET to work upon and here mobile nodes communicate with each other independently. MANET is being used in multiple domains because it is inexpensive and has infrastructure less network [2]. MANETs have mobile nodes that can enter and exit the network in between the operations as considered by the network [3]. Mobility related with wireless nodes in MANET make it more useful for defence applications [4]. Since the Network is self organised, the probability of an attack by invader is high who wish to seek unapproved access and deface data on communication channel. The packet must extend to destination without interference like delay, packet loss, so transmission of data from source to destination is a daring task in MANET [5]. Congestion is a leading problem in MANET which leads to wastage of resources as congestion increases the transmission delay and error while transmitting the packets from source to destination end [6]. Congestion occur when demand is much more than the present available resources that is when the load in network is more than its capacity which can it handle [7]. Manet's nodes may be Personal Devices as cell phones, laptops etc [8]. MANETs are convenient in those environments where the infrastructure is not available or cannot be deployed. Congestion occurs in the network due to many reasons like when traffic rate at input side is greater than the capacity of line at the output, also due to slow processors and sometimes due to sluggish nature of links. So Congestion control is a technique or process that can either avert congestion before it happens or abolish it after it has occurred [9]. Manet provides communication facility by making communication possible in faraway places where establishing an infrastructure network is a demanding work. Also presence of restricted resources and mobility of nodes surfaces many problems like power control, security, topology control, routing, and congestion control which need a high level of research to be done [10] .

Fig 1 General Representation of MANET

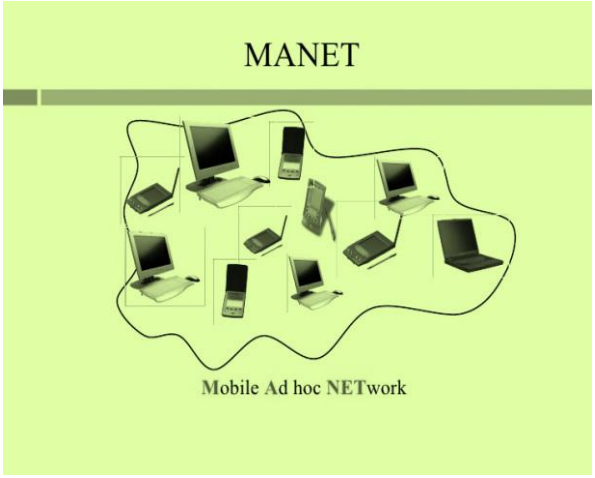

Fig 2 Architecture of MANET

II. ROUTING PROTOCOLS

To overcome these challenges many routing algorithms of Manets have been proposed. In order To classify them we have: Proactive and Reactive routing. In Proactive [11] routes between every node are made in advance even when no transmission occurs; this type of routing is not favourable for larger network, while in Reactive or On Demand routing protocols path exists only if there is transmission else not. This is much more effective than proactive routing protocol. Congestion occurs in the network due to many reasons like when traffic rate at input side is greater than the capacity of line at the output, also due to slow processors and sometimes due to sluggish nature of links. This may cause following things to happen.

1. Long delay: When congestion increases then it may so happen that the network chooses the different path which is no longer the shortest and safest one in terms to delay and therefore leads to a longer delay path to the destination.
2. High overhead: A large no. of communication attempts are required in order to search for a new path. And if multipath routing is used then more endeavors is needed to endure that multipath. So high overhead is required.
3. Numerous packet losses: It occurs when sending rate of transmission is much more than reception of data. Also whenever any intermediary node is congested in network it can cause to a large no. of packet losses in network.

Parameters that are discussed over here are:
Throughput: It can be defined as the ratio of total amount of data received as send by the sender to the total time taken by the last packets to reach the destination. Throughput is calculated in bits per second. It should be maximum.
Packets Errored: It tells the number of packets that went into error during transmission of data from sender to receiver over a period of time.

There are various types of routing protocols that have been presented by researchers. A few of them are as described below.

DSR

DSR is a reactive routing protocol designed for MANETs. DSR have two phases: Route Discovery and Route Maintenance. Route Discovery phase requires to find out a path and Route Maintenance phase needs to preserve the path [12], since the task of finding a path gets only executed only when node demands it ; therefore it is also called as On - Demand Routing protocol. In DSR, the source nodes convey the routing information and keep this in cache route of each node. While sending data the source node checks the route cache for a valid destination route and when it could not discover any valid route- it starts route discovery process by broadcasting route request (RREQ) packets [13]; a route from source to its destination will be established if node founds a valid route to its destination and receives this RREQ packets.

AODV

In this, route is pleaded when a node wants to transfer the data, it will check it in table if path is present to the destination node. If no path is found then it will go for route discovery method and RREQ (Route Request) messages are then broadcasted to neighbour nodes to extend to destination [14].If route error exists, node will send RREP message to source node. Any [15] change in link is notified by AODV using HELLO messages and feedback mechanism of link layer.

ZRP

Zone Routing Protocol is a mixed breed routing protocol that take use of both reactive as well as pro active protocol. In this the entire network is divided into small zones depending on the radius of the zone or we can say size of the zone. The zones here can be of variable size. Also the size of zone [16] does not depend on the geographical area take by the network. The data transmission takes place in between zones.

III. PROPOSED WORK

Here the work is done using Network Simulator NETSIM tool for the arrangement of MANET network. The various Simulation Parameter and their specifications that have been provided here are like number of nodes, velocity, channel bandwidth, simulation time and many routing protocols are given below.

Simulation Environment Parameters and Specifications

1.	Area size	500*500 m^2
2.	No. of nodes	5,10,20
3.	Mobility model	random way point
4.	Protocol	UDP
5.	Simulation time	100s
6.	Channel bandwidth	25
7.	Velocity	15m/s
8.	Routing protocols	AODV, ZRP, DSR
9.	Transmission power	100mw
10.	Application type	CBR
11.	Packet size	1480

Simulation is done in 500*500 grids consisting of 5, 10 and 20 nodes in the configuration shown in fig (c),(d),(e) for 5 nodes, 10 nodes and 20 nodes respectively. The TCP packet size is taken to be 1480 for the analysis. Here all of nodes are having Random Way Point Utility Model. Different types of protocols that are taken over here are ZRP, AODV and DSR. Also the velocity is taken to be 15 m/sec and transmission Power is 100 mW for transmission of data. The foremost aim is to study and collate the parameter metrics of various routing protocols under mentioned environment. Some measured performance metrics are packets collided, packets transmitted, Packets Errored, Throughput and average Delay.

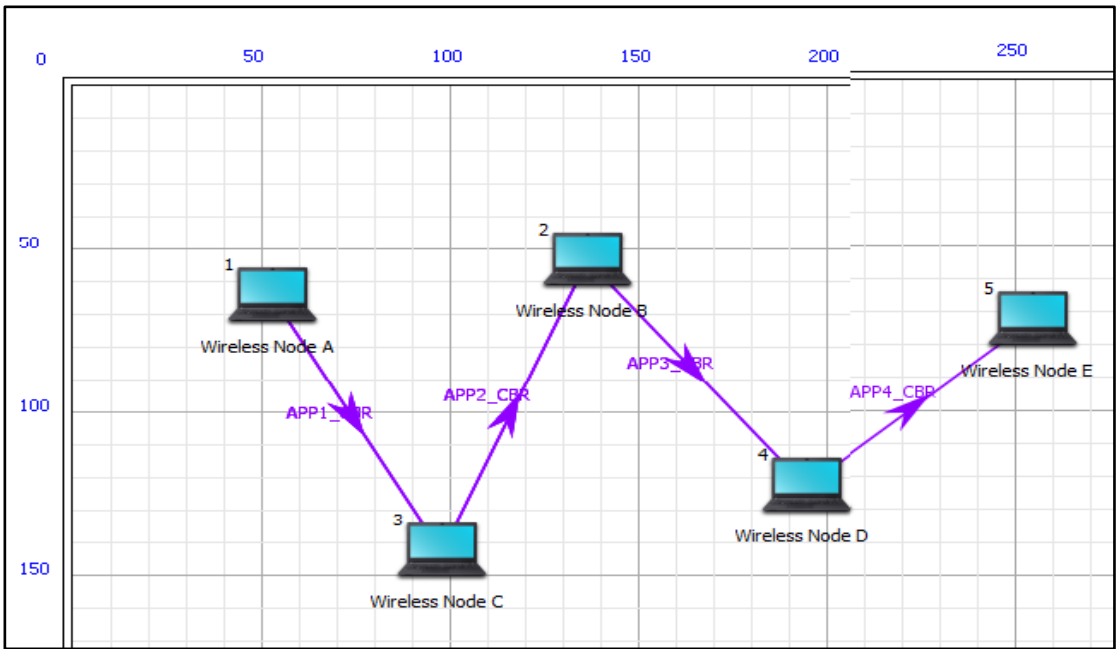

Fig 3 5 nodes configuration

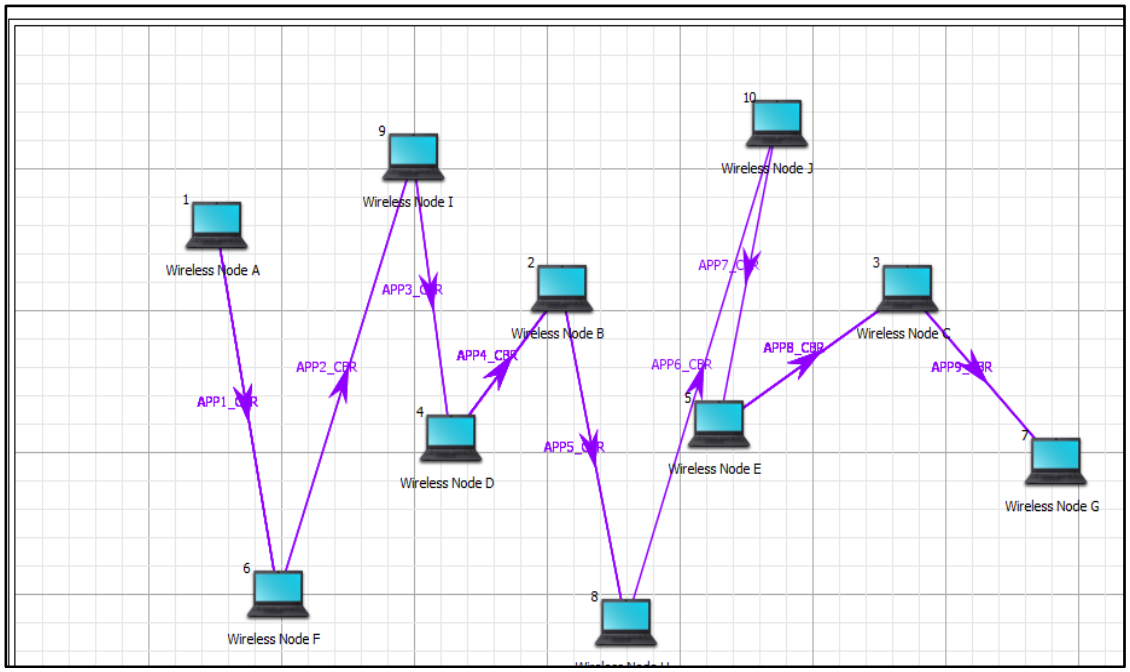

Fig 4 10 nodes configuration

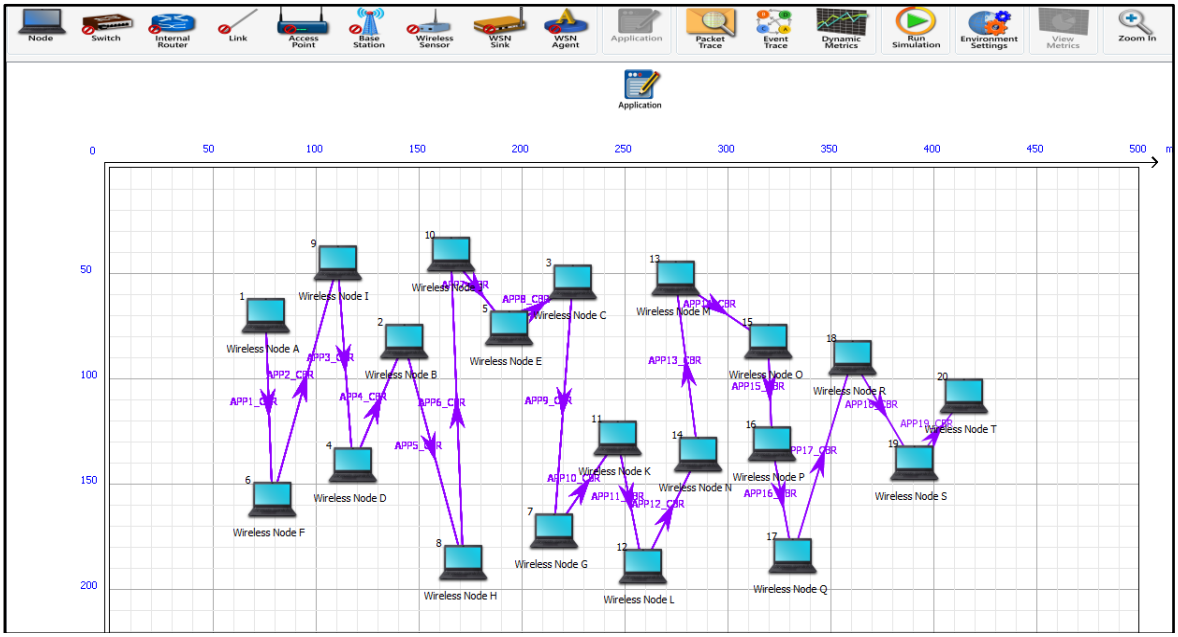

Fig 5 20 nodes configuration

IV RESULTS

Here we performed simulation on NETSIM simulator using routing protocols AODV, DSR and ZRP for 5, 10 and 20 nodes. The various parameters that are considered over here are named as Pkts transmitted pkts errored, packets that got collided, the percentage of Packets errored, Payload Transmitted, Throughput and the Average Delay at various nodes using distinct routing protocols.

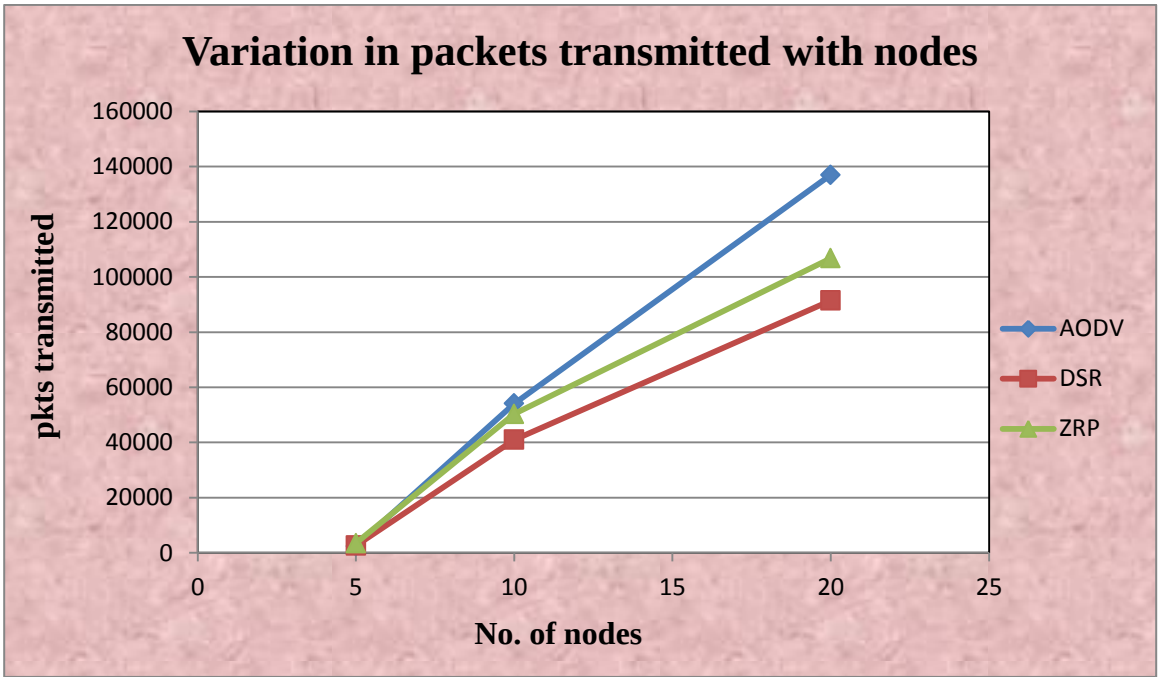

Fig 6. No. of Packets Transmitted with no. of nodes

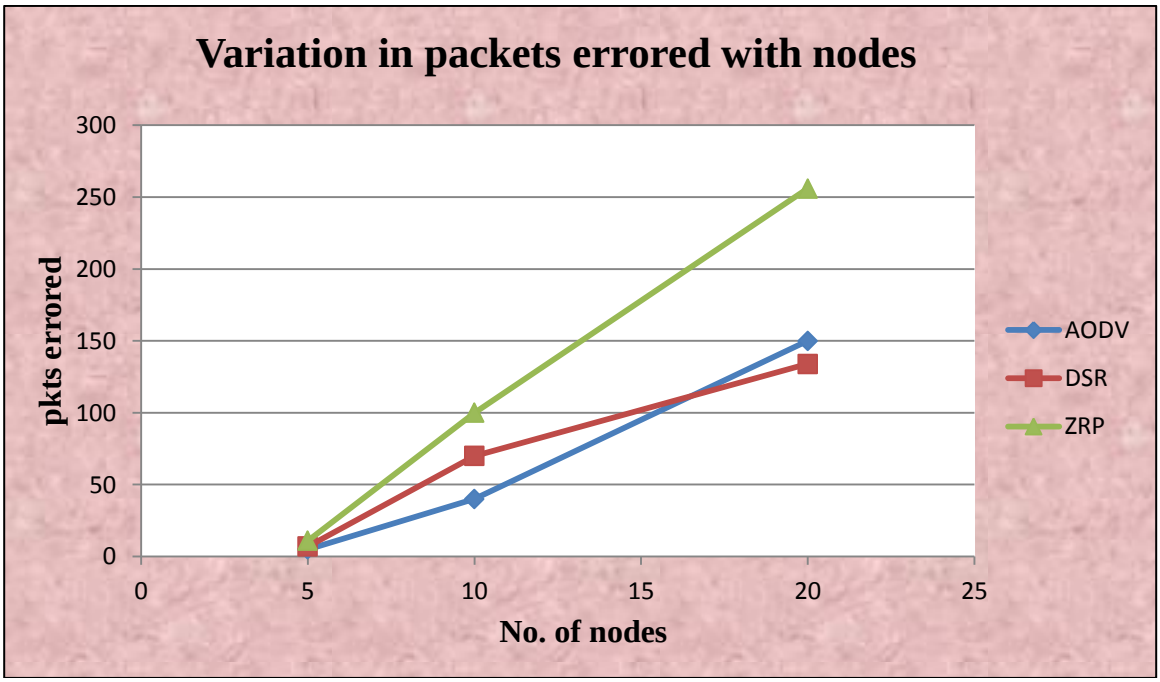

Fig 7. No. of Packets Errored with no. of nodes

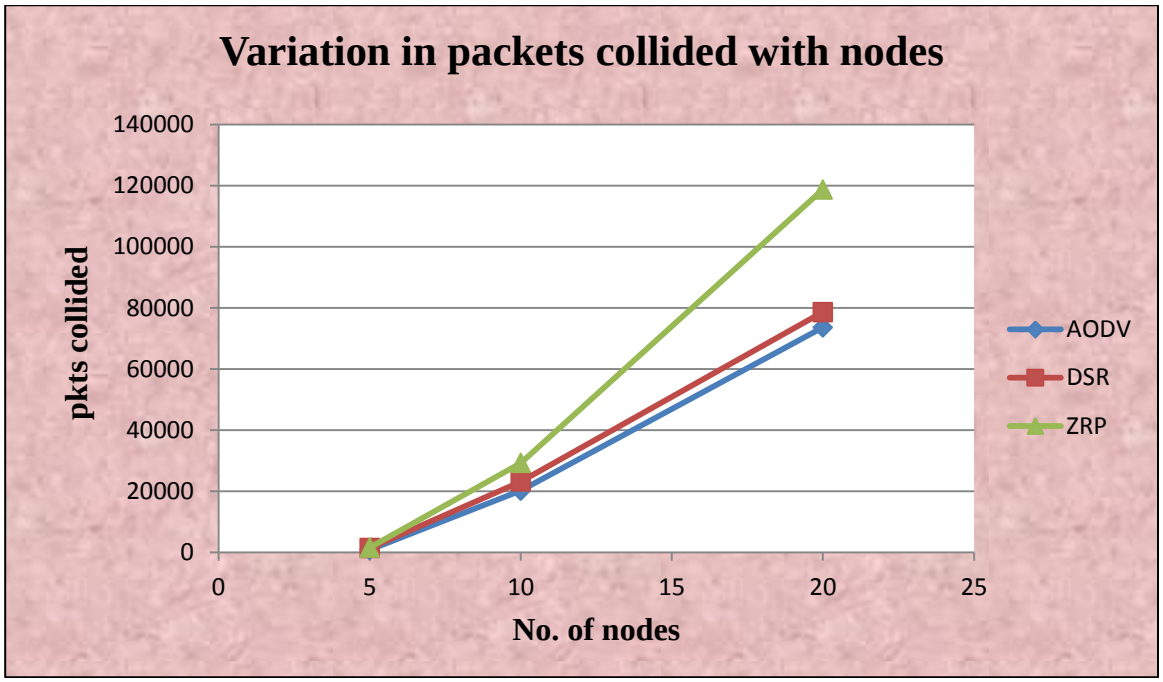

Fig 8. No. of Packets Collided with the no. of nodes

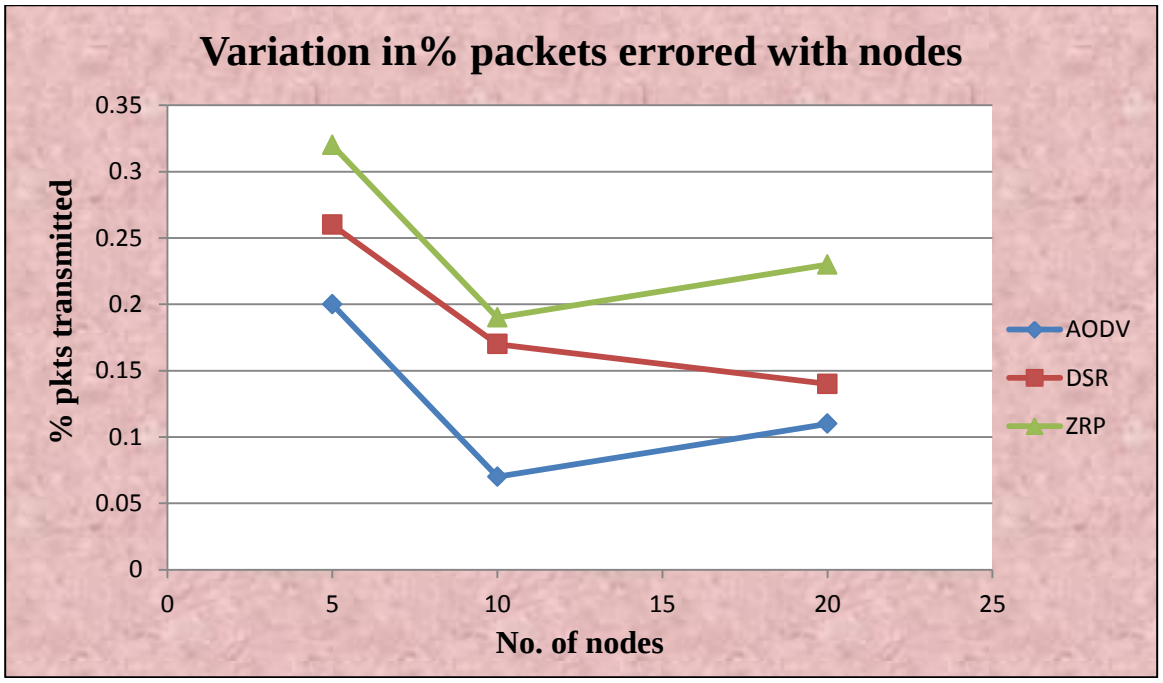

Fig 9. No. of percentage Packets Errored with the no. of nodes

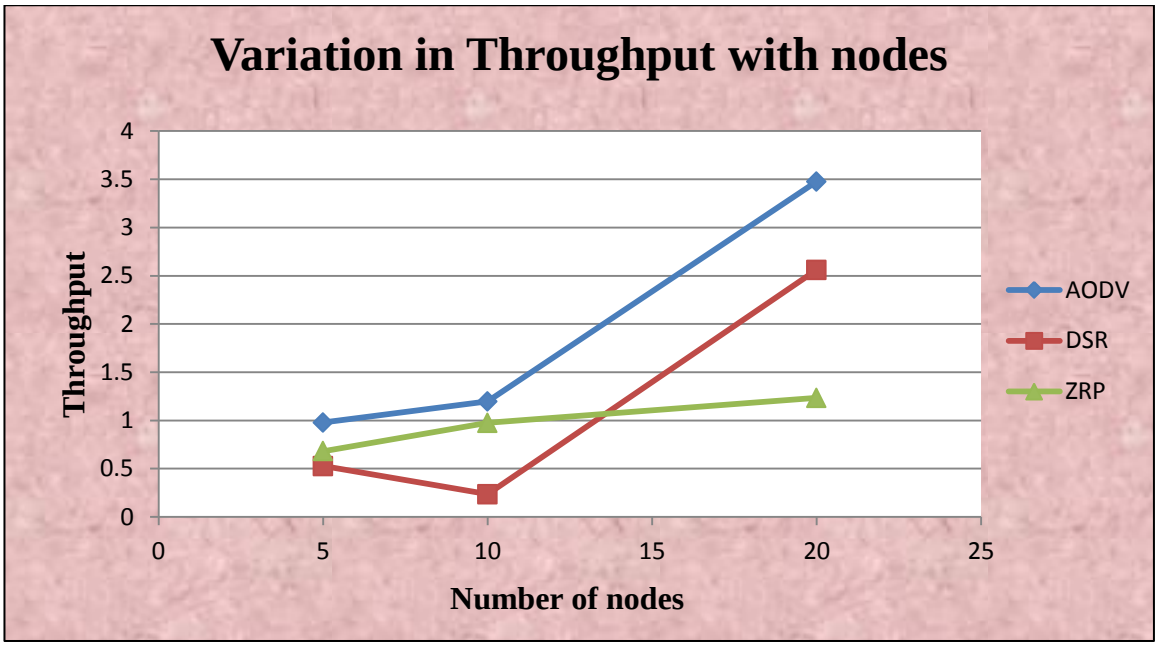

Fig 10.. Throughput of various protocols with no. of nodes.

Table 1 Comparative analysis of 5 nodes for AODV, DSR and ZRP protocols.

S. No.	Parameter/Protocol	AODV	DSR	ZRP
1	Packets transmitted	2449	2600	3492
2	Packets Errored	5	7	11
3	Packets Collided	815	1358	1559
4	% Packets Errored	0.20%	0.26%	0.32%
5	Throughput	0.978	0.527	0.68
6	Average Delay	1.5	1.3	0.98

Above table implies that considering 5 nodes in MANET packets errored are 5,7 and 11, % packets Errored are given by the ratio of packets errored to the packets transmitted multiplied by hundred, throughput is 0.978, 0.527, 0.68 for AODV, DSR and ZRP routing protocol.

Table 2 Comparative analysis of 10 nodes for AODV, DSR and ZRP protocols.

S. No.	Parameter/Protocol	AODV	DSR	ZRP
1	Packets transmitted	54105	40985	50345
2	Packets Errored	40	70	100
3	Packets Collided	20181	23186	29257
4	% Packets Errored	0.07%	0.17%	0.19%
5	Throughput	1.197	0.234	0.975
6	Average Delay	21.07	18.01	12.43

Above table implies that considering 10 nodes in MANET packets errored are 40, 70, 100 , % packets errored are given by the ratio of packets errored to the packets transmitted multiplied by hundred, throughput is 1.197, 0.234, 0.975 for AODV, DSR and ZRP routing protocol.

Table 3 Comparative analysis of 20 nodes for AODV, DSR and ZRP protocols.

S. No.	Parameter/Protocol	AODV	DSR	ZRP
1	Packets transmitted	137066	91463	106783
2	Packets Errored	150	134	256
3	Packets Collided	73589	78595	118686

4	% Packets Errored	0.11%	0.14%	0.23%
5	Throughput	3.477	2.566	1.234
6	Average Delay	21.88	15.84	14.43

This table shows that considering 20 nodes in MANET packets errored increases as no. of nodes has increased and are 150, 134, 256 , % packets errored are given by the ratio of packets errored to the packets transmitted multiplied by hundred are 0.11%, 0.14%, 0.23%, and throughput is 3.477, 2,566, 1.234 for AODV, DSR and ZRP routing protocol.

IV. CONCLUSION

In this proposed work, Packets transmitted, Packets Collided, Percentage of Packets errored , Throughput and Average delay are studied and calculated. We have simulated a network framework to control problem of congestion in MANET with 5, 10 and 20 nodes using AODV, DSR, and ZRP Routing Protocols. Simulation Results shows that AODV protocol outstands in comparison to other protocols having throughput 0.978, 1.197, 3.477 and % packets Errored 0.02%, 0.07%, 0.11% for 5, 10 and 20 nodes in network. However as the number of nodes increases, congestion also increases leading to a large no. of packets Errored and packets collisions in AODV also.

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