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Scheme to Make MANET Selfheal Stable Routing Protocol

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***Abstract*—Wireless networking is the latest trend. In all unpredictable and changing environments this networking has enormous applications. Business organizations and all users of various fields choose wireless. This is because of the reason that it allows flexibility of location. The attribute to support this is mobility, portability, and ease of installation. In mobile ad-hoc network, nodes are almost continuously moving from one place of location to another. Thus, MANET topology can change often and unpredictably. Mobility of nodes is one of the major issues of concern in mobile Ad-hoc network because it causes a link failure. In this paper a new submission has been suggested that will help mobile nodes to maintain routes to destination and that too with stable route selection. This process will make recovery phase very efficient and fast. The performance of the proposed routing protocol named as Selfheal Stable Routing protocol (SSRP) is evaluated using performance metrics like Packet Delivery Ratio, Throughput and End to End Delay. The study is based on simulation runs adopting CBR traffic pattern taking care of node failure scenarios.**

***Keywords*—MANET; AODV; security; stable; routing**

I. Introduction

The modern era has witnessed wireless networking potential applications in extremely unpredictable and dynamic environment. Communication path is unpredictable in case of wireless communication. In the development of broadband digital network, a small snag like a link failure can damage a lot in network services. This can be attributed to the fact that a single node carries a lot of traffic.

If the connection fails, it will take long time to reestablish the connection and it also increase the traffic volume. To restore the networks mechanism in a faster way, a mechanism called Self-healing algorithms have been recognized. As a working principle a self-healing system [1], [2], [8] should be able to recover from the down state to normal state and also must consider to start functioning as it was prior to the failure. It can be assumed as a key issue to optimize the networks using Self-healing process and that too expecting reasonable network failure [3]-[5], [8]. A major process involved in Self-healing network (SHN) [6], [7], [9], [15] is to design to support transmission of messages across multiple nodes. Also it is important to protect against process failures. As a healing mechanism the network will recover automatically after a failure occurs.

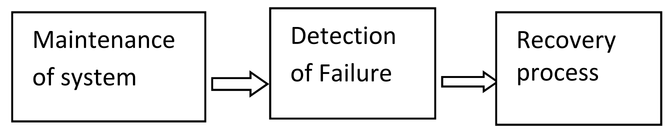

Fig. 1. Self-healing cycle.

Maintenance of system health, recovery processes which causes return from an unhealthy state to original state are major critical issues. Fig. 1 is typical example of self-healing system

This paper has highlighted the repair phase of AODV [12], [14]. Whenever a break occurs in routing, the repair phase is carried out, the proposed scheme makes some changes in existing scheme and then these changes are incorporated and executed using NS simulator. The repair phase uses new algorithm. Traffic load, node stability and energy are used as parameters to determine which route is best to carry out packet delivery. All these parameters make the protocol able to heal itself whenever there is a break. Self-heal process is carried out to make the scheme robust and more stable.

Rest of the paper has been explained as: Section II declares proposed scheme and Section III submits idea of evaluation process. Last section defines conclusion and future directions.

II. Proposed Scheme

AODV has been used as base protocol. Route selection process is unchanged as in case of original AODV. Request phase RREQ is sent and reply phase establishes a route and packets are started transferring from Source to destination.

Proposed Scheme is used to change the scenario of Repair phase of AODV. The scheme incorporates changes in repair phase of AODV. The proposed protocol helps to increase the stability of route in AODV with avoidance of route break.

In this the route stability of the node is measured by following parameters:

1) Node energy [11]
2) Node mobility
3) Traffic load.

These three parameters help to find out the stable route from source to destination.

Calculation of Route Stability in Self-heal Stable Routing Protocol (SSRP)

In order to allow more stable routes for data transmission in MANET, NEW scheme has been proposed to include a new field, called **Route Stability (ROS)** route request packet. It measures the stability of route during route request phase (RREQ) of AODV. In AODV hello packets are sent periodically to maintain the routing table, so that each node know about the connected neighbors. Each node broadcast the HELLO packet with **Node stability value (NOSV)** [13]. If node Stability value of a hello packet is larger than the threshold value then node adds the sender of the Hello packet as its neighbor.

Following steps are included for stable route discovery:-

1) The node stability value (NOSV) is added in the Route stability value (RSTV)of RREQ packets by source node and sends it to the neighbor nodes.

2) Neighbor node compares its own node stability value with RREQ packet stability value.

3) The lowest value is selected.

If NSTV<RSTV then
RSTV<-NSTV in RREQ packet
Forward RREQ packet to the neighbors and so on.

4) New path is discovered with the lowest NSTV in route stability value.

5) If the destination node receives more than one RREQ packets then in response to the RREQ packet with largest route stability value.

Algorithm 1: Calculation of route stability value of the path

ROS-value(SN,RN)
SN- sending node
RN- receiving node
{ if (NSTV[SN]<NSTV[RN])
Update NSTV[SN] in RREQ packet; }

Based on the above algorithm, Path for stable routing is equal to the lowest node stability value.

RSTV-route stability value
RSTV(P) = min(NSTV(source node)….
NSTV(Intermediate node)…..NSTV(Destination node));
Where RSTV(p) > value A //value A is selecting value for route stability

2. Calculation of Node Stability value NSTV(n) in SSRP

Node stability value can be calculated on the basis of three different parameters [10]:

1) Level of energy of node (LOE)
2) Mobility of node (MON)
3) Traffic load (TL).

NSTV of a node is calculated periodically and transmit to the network through HELLO packets

If any node receives larger NSTV value than the predefined threshold value A from some node, it adds that node as its neighbor node.

NSTV of a node is given by

NSTV(n) = a×LOE+ b×MON+ c×TL

Where value B is the min. stability value of nodes for the route where a, b and c are weighing factor for all corresponding network parameters. All parameters with values ranging from 0 to 1, are chosen so that a+b+c = 1. These values are flexibile and have been used that can be changed as per selected network scenario.

III. Performance Evaluation -1

The performance of proposed protocol is evaluated using simulation tool NS-2.35 and is compared with AODV and DSR protocols. The performance evaluation is done on the basis of existing metrics.

Packet Delivery Ratio: It is defined as “The ratio of the number of the successful arrived packets to the number of all packets transmitted by source”. The larger value of PDR clearly indicates more data packets delivered to destination.

End–to–End delay: This is the “average time spent on data packets transmission from source to destination”. This includes all types of delay during transmission.

Throughput: The throughput is defined as the “total amount of data a receiver receives from the sender divided by the time it takes for receiver to get the last packet”. The throughput is measured in bits per seconds.

The evaluation performance of Proposed Protocol is evaluated using famous simulation tool NS-2.35 and is compared with AODV and DSR routing Protocols. The simulation network area is considered as 1000m × 1000m with 20 and 50 nodes in each simulation run. A TCL script has been written using random waypoint model and all efforts has been made to keep it bias less and same for all three protocols under testing. Proposed scheme has been shown as ‘NEW’ and AODV and DSR are named as it is in figures. Though the results were calculated using 10, 20 and 50 nodes, for this paper 20 nodes scenarios have been discussed. Table 1 shows the parameters used for simulation.

TABLE I. Simulation Parameters

ENVIRONMENT SIZE	1000 X 1000
PACKET SIZE	512 BYTES
QUEUE TYPE	DROP TAIL/FIFO
QUEUE LENGTH	50,60
TRAFFIC TYPE	CBR
PROTOCOLS	AODV,DSR, NEW

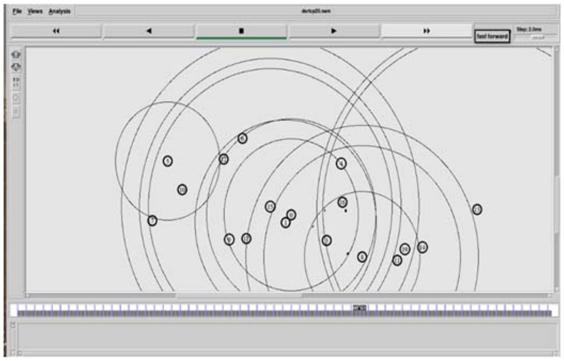

Fig. 2. Showing NAM file using pause time as function.

Fig. 2 shows a snapshot of scenario being run using a TCL script and results are shown using Network Animator tool, NAM, which is part of Network Simulator. Trace file is created after executing the simulation and results are calculated using this trace file. The PDR, Delay and Throughput are calculated using program and the data values have been shown in figures below.

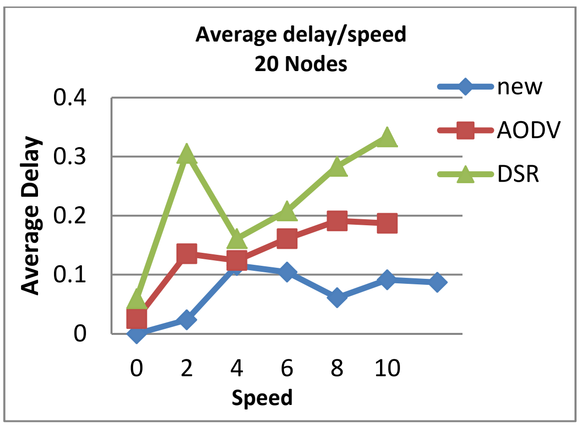

Fig. 3. Delay using speed as function.

In spite of all the calculations still 'NEW' scheme is able to carry out delay within limits. This is due to the route stability mode. The 'NEW' scheme carries out calculation part before the route repair phase and is able to carry out repair operation faster. The gain is significant and helps in carrying out operation of data transfer at a faster rate (see Fig. 3).

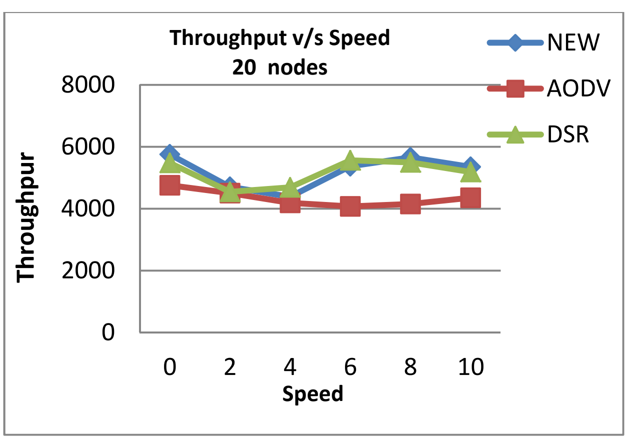

Fig. 4. Throughput using speed as function.

Fig. 4 is a representation of Throughput with speed as a function. Speed of 10 m/s is almost like a car moving in a street. Though the figures are almost touching the scales of each other, still it can be said that 'NEW' is almost reaching the maximum value at all the speeds making the target almost same as that of AODV and DSR. Value is higher in almost all cases against AODV.

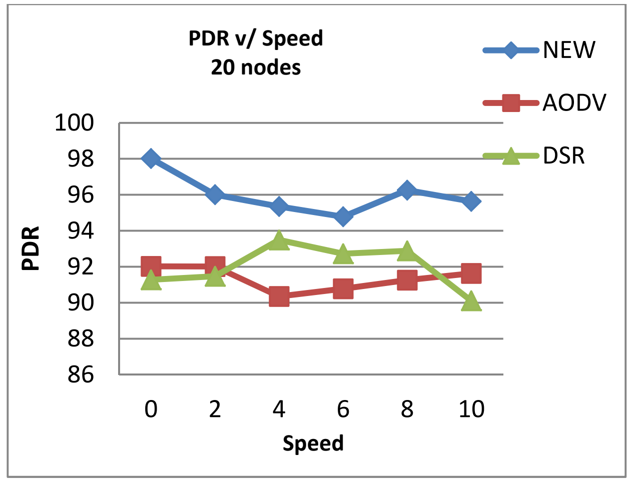

Fig. 5. PDR using speed as function.

Packet delivery ratio, which is main metrics used has shown improvements in all cases as is evident in Fig. 5. It can easily be seen that even at higher speed of 10m/s there is gain in PDR. This parameter clearly makes the algorithm a successful attempt in achieving the stable routing.

The same scenario was used for pause time as a function in place of speed (Fig. 6). Pause time from 0 to 1000 has been used with simulation time increased to 1500 seconds. Pause time of 0 shows maximum movement of nodes throughout the simulation time and 1000 delayed one. The experiment was conducted for 10, 20 and 50 nodes. Here results for 20 nodes have been shown for discussion.

As is evident from Fig. 7, Throughput is more in case of 'NEW' scheme. Major comparison is cited in terms of AODV as the modifications are done on AODV and it is clear that there is gain all the way from pause time of 100 to 1000.

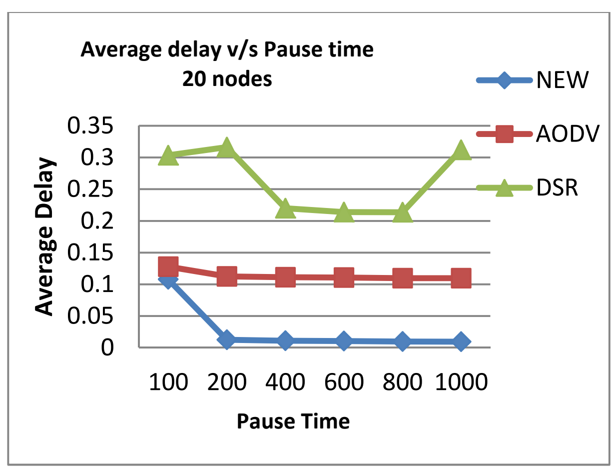

Fig. 6. Delay using Pause Time as function.

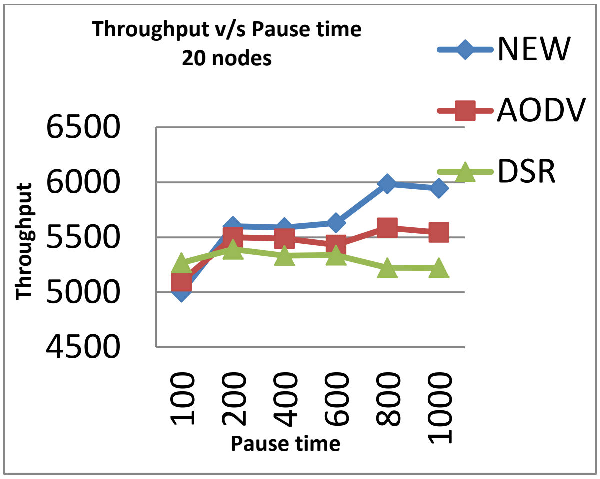

Fig. 7. Throughput using pause time as function.

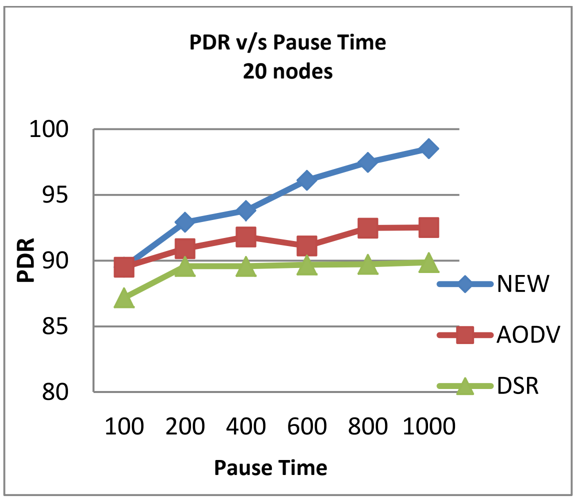

Fig. 8. PDR using pause time as function.

Packet delivery ratio is major parameter for any protocol success evaluation. This parameter has been shown in Fig. 8. It is evident that in all cases PDR is more than other two protocols. It has a gain of 3% to 7% which is significant. The process is true for all cases of pause time, whether the movement starts at pause time of 100 or at 1000.

IV. Conclusion

A new scheme has been proposed and an algorithm showing repair of AODV has been submitted. The algorithm requires changes in Repair phase of AODV and it has been incorporated on AODV. The comparison has been done using existing schemes ADOV, DSR and the 'NEW'. The simulations have been carried out using NS simulator and results clearly indicate that 'NEW' scheme is more stable and gives much better packet delivery in all cases. The efforts are on to add more features of algorithm in the AODV. These features are energy parameter and fading effects that the protocol causes in many cases.

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