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Hybrid DSR: Evaluating AODV-Hello Messages on DSR Protocol

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Abstract: Routing in Mobile Ad hoc Network (MANET) is challenging due to the mobility of node, DSR and other reactive protocols needed to keep track of the intermittent changes of topology. Stale information in node's caches results in erroneous routing decisions. In this study an AODV-hello mechanism for link availability checking will be used which will decrease error transmission on dead rout path. A comparison and performance evaluation of standard DSR and hybrid DSR routing protocols expose outperformance of the proposed protocol. The simulation has been implemented using NS2 simulator to identify and evaluate the new protocol for MANET's.

Key words: DSR, AODV, MANET, NS2, performance, expose

INTRODUCTION

MANET is an intermittent topology which require continuous information updating which in turn drain the node's energy. MANET's routing protocols can be classified broadly into proactive and on-demand reactive protocols while the former pay cost in pre-overhead computation, the later try to minimize cost through on demand overhead computation Kaur and Singh (2015). Node energy is the most important performance factor in MANET, the wireless transmission size is the biggest conservative source of energy Xiao *et al.* (2014). Researchers try to minimize energy consumption through: finding energy-efficient, reliable and higher energy nodes paths (Mahabubul and Sattar, 2017), therefore, it is worth to make a trade of between control packet propagation and network routes maintenance Madhusudan and Kumar (2017). MANET reactive protocols use an economical method to take benefit from what all nodes overhear. AODV and DSR protocols maintained the path-route cache and link-cache structures to store path information on the fly and reduce any future repeated route request. These two structures store route path and a single link entry from respective node to a destination learned from seen forwarded packets Johnson *et al.* (2007). Management and maintenance of these caches are also challenged because of nodes mobility and high variable environment which result in stale information that directly affect the whole network's performance. Path duration or path behavior prediction is one of the effective solutions to purge route-caches and early route recovery. Cashes maintenance upon prediction techniques try to predict: relative node distance, link duration or lifetime and link availability. Signal strength can be used as powerful indication metrics for node location and mobility patterns.

The significance of this study lies in modifying DSR protocol by injection AODV-hello messagesfor link availability estimation and rout cache management as a new implicit time out technique. This will maximizes the precision of route decision as will be exploited in details through study sections.

MATERIALS AND METHODS

Qin and Kunz (2003) proposed link lifetime proactive prediction technique on DSR protocol which uses signal power strength from the packets had been received, the source node upon can perform route rebuild to avoid disconnection. Their experiment's results expose a significant reduction in data packet dropping up to 20%. Panchal and Abu-Ghazaleh research give a proposal for tackling the stalecache problem because the involved routing overhead is significant issue. The researchers investigate a complex way to validate and shorten route's cache where subsets of paths are marked to be validated but it is unclear how to make such decisions and how frequent. Han *et al.* (2006) state that paths with a large number of hops converge to an exponential distribution under some circumstances which can predict a lifetime associated with. Their study expose inadequate paths shortly consist of 1-4 hops. Usual ad hoc networks and practical MANET applications depend on minimum hop count utilization. On the other hand, their proposition ignores the correlation structure of interlink durations. A new routing protocol, called Link-Effective-Available Time (LEAT) routing was proposed by Yu *et al.* (2011). The

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method proposed a new routing link availability, link cost and product of available time. Routing was built based on new cost. This is an optimal heuristic based routing problem. Experiment results demonstrated that LEAT reduced link breakages and ensured network performance in hop counts, delay and throughput compared to current routing methods. Research of Baskaran and Palanicamy (2013) used Received Signal Strength Indicator (RSSI) to categorize network nodes in zones and accordingly, estimate link breakage. They proposed an analytical model to view how DSR with prediction approach outperform the standard DSR in high packet delivery ratio and less control packet overheads. These protocols proposed the presence of some signal strength threshold. They don't cope with if the link quality is within acceptable threshold. Then the link is incorporated in a route even if it will break soon. This can result in failed routing even if working paths exist.

DSR error management: DSR has a unique advantage over other reactive routing protocols by virtue of source routing. It computes the entire route path to specifies destination at the source node whereas the intermediate nodes will not participate in route decision. Routing loops cannot be formed. Like other reactive protocols, it benefits from route cache for fast replies to the route requests. Route error is the situation of facing path breakage the protocol should take care about. Link availability in DSR depends on layer 2 acknowledgement where absence of acknowledgement for specific period of time will produce error message (Fig. 1).

DSR cache maintenance: Hu and Johnson (2000) state there are two cache timeout strategies: static and dynamic timeout. Static refers to constant timeout periods for all link entries which cannot reflect the divergence of link quality features. Adaptive timeout takes different heuristics and quality metrics to predict link timeout or in other words, link duration. Many researchers proposed mechanisms for route cache maintenance in order to improve DSR protocol performance. Johnson *et al.* (2007) in 1998 proposed route cache strategy for DSR protocol it is used to store the routes the source packets mitigate further, route discovery operations. Route cache and link cash are the two cash structures in DSR protocols while the former deal with caching a complete route, the latter deal with single link entry of all learned routes. Dealing with link breakage at link level is more effective because it deals with the broken link instead of entire path participated with Chen *et al.* (2010).

AODV hello message: Charles *et al.*, estimate network connectivity in AODV protocol through broadcasting hello control messages but any other control message can also serve as link availability, indicating the presence of

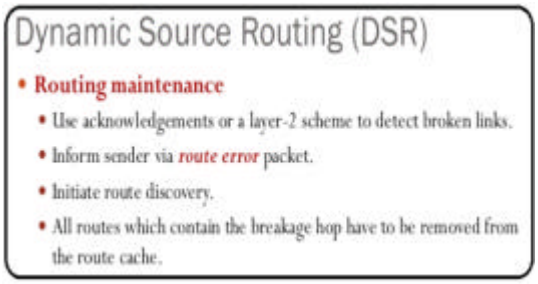

Fig. 1: DSR error management

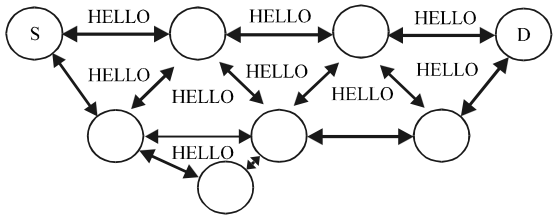

Fig. 2: A hello message in AODV

a neighbor nodes. Reception of a hello message from neighbors creates or refreshes the routing table entry to the neighbor (Fig. 2 and 3). To maintain connectivity, if a neighbor node has not sent any broadcast control message within a pre specified interval, a hello message is locally broadcast. Failure to receive any hello message from a neighbor for long time (several time intervals) indicates that neighbor is disconnected.

ALLOWED-HELLO-LOSS parameter specifies the maximum number of HELLO-INTERVAL is an important control to determine link connectivity where the link connectivity is assumed to be lost if a node had not received hello message for a period equal or >T in Eq. 1:

$$T = ALLOWED\_HELLO\_LOSS * HELLO\_INTERVAL \quad (1)$$

Perkins *et al.* (2003) stated that value for HELLO-INTERVAL parameter is one second and for ALLOWED-HELLO-LOSS parameter is two.

Hybrid DSR protocol: In this research a new link availability mechanism has been proposed to optimize DSR performance. An AODV hello message will be used periodically by all network nodes to reveal link availability and purge node's cache from stale information, it is a constant timeout mechanism. The new link's information can be used as a periodic update for route cache to keep it up to date for future route requests. Figure 3 shows the new proposed hybrid DSR error maintenance process. Table 1 exhibit the difference of hybrid-DSR hello messaging vs. AODV.

Table 1: Hello packets in DSR, AODV and hybrid DSR

Routing protocol	ALLOWED-HELLO-LOSS	HELLO-INTERVAL	Link availability
DSR	No	No	Acknowledgment
AODV	3 successive packets	1 sec.in active path only	Hello in nodes involved in active routes
Hybrid DSR	3 successive packets	3 sec in non-active paths	Ack in active route and Hello on others

Table 2: Simulation configuration

Configuration	Values
Channel	Wirelesschannel
Radio-propagation model	Tworayground
Network interface type	Mac/802_11
Interface queue type	Queue/DropTail/PriQueue
Antenna model	Omni antenna
Routing protocol	Hybrid DSR protocol
Number of mobile nodes	50
Simulation dimensions X, Y	1000, 1000
Simulation time	900 sec
Flow model	CBR
HELLO_INTERVAL	2000 msec
ALLOWED_HELLO_LOSS	3 packets
BAD_LINK_LIFETIME	6000 msec
Max Hello Interval	(1.25*HELLO_INTERVAL)
Min Hello Interval	(0.75*HELLO_INTERVAL)

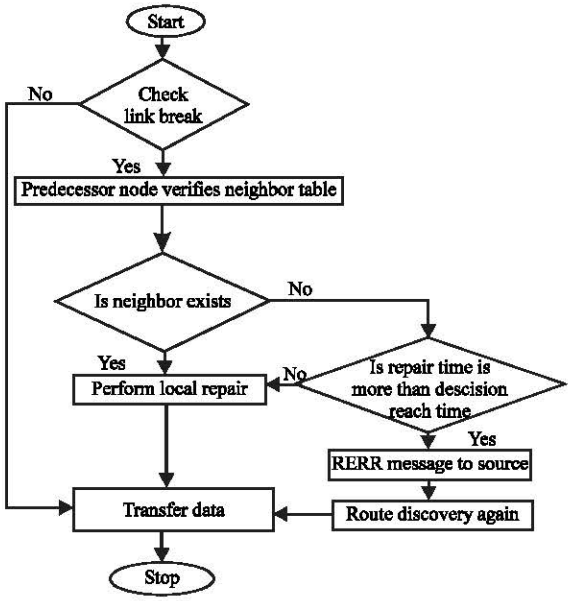

Fig. 3: AODV protocol

RESULTS AND DISCUSSION

The experiment was simulated on NS2.35 simulator with 50 mobile nodes, Table 2 give the simulation configurations. The experiment showed that hybrid-DSR worked better than standard DSR protocol. This resulted from refreshes of network information via the proposed hello mechanism. Table 3 exhibits the results of the simulation experiment.

Table 3: Simulation results

Dropped packets	Data packets	Routing packets	Salvaged packets	Routing packets/ Data packets
DSR				
0.067	0.3978	0.2689	0.1429	0.17076
Hybrid DSR				
0.0388	0.3600	0.2423	0.1946	0.11605

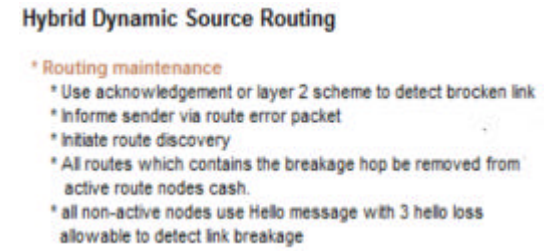

Fig. 4: Hybrid DSR protocol

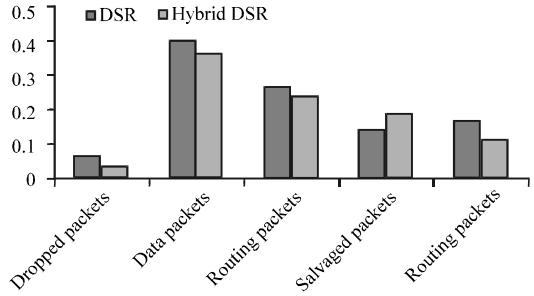

Fig. 5: DSR and hybrid DSR results

As shown in Table 3 and Fig. 4 and 5, the proposed protocol has lesser dropped and routing packets. DSR protocol has no mechanism to purge still information in routing caches, thus, replay with these information can result in expected data packet dropping, re-requesting for new paths and high route error messaging. In spite of further hello control messaging, the experiments show that the resulted routing error size outperform the hello messaging. The second column in Fig. 3 exposes higher throughput than standard DSR.

CONCLUSION

This research proposed merging the virtues of AODV link availability prediction with DSR preservation of low control communications. The results expose that the flexibility and periodicity of cache's refresh will serve the performance by avoiding fault routes replays and their consequences. The experiments results in 0.17076 and 0.11605 routing packets against data packet in DSR and hybrid DSR, respectively. High throughput of the new protocol will be directed toward the vaccination the standard protocols by the virtue of each-others.

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