PERFORMANCE EVALUATION OF PROACTIVE ROUTING PROTOCOL FOR AD-HOC NETWORKS

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Abstract

An ad-hoc network is self organized network without any fixed infrastructure and consists of wireless mobile nodes. The nodes in the network work like a transreceiver as well as a router. As the network is dynamic in nature the topology changes rapidly and unpredictavely which creates a challenge in establishing a route between the source and the destination nodes. A number of protocols are already purposed by the researchers till date. The purposed routing protocols can be classified in three different groups namely Proactive routing protocol, Reactive routing protocol, Hybrid routing protocol. In reactive routing protocol the information about the routes to all the destinations are maintained by periodic routes update process whereas the routes are calculated through route discovery process when they are required in reactive routing protocol and hybrid routing protocol combined the fundamental properties of both the protocols. In my work two proactive routing protocols, i.e. The fish-eye state routing protocol (FSR), optimized linked state Routing Protocol (OLSR), Intrazone routing protocol (IARP) and Bellman-Ford routing protocol are taken for performance evolution in different parameters in simulated environment. The better performance of these protocols than other routing protocols in networks having infrastructure inspired me to explore further and implement each of them in ad hoc networks. We investigated the performance of proactive routing protocols in terms of packet delivery ratio, average end to end delay, throughput by simulating in QualNet.

Key words: *MANET, FSR, OLSR, IARP, Wellman-Ford, Multihop, QualNet.*

1- INTRODUCTION

[1] Mobile ad hoc network are composed nodes those are self-managed without any fixed infrastructure .they contained dynamic topology by this way they can easily join or leave the network at any time. The nodes in the network work like a transreceiver as well as a router. As the network is dynamic in nature the topology changes rapidly and unpredictavely which creates a challenge in establishing a route between the source and the destination nodes. All nodes present in MANET behave as routers and take part in discovery and maintenance of routes to other nodes in the network. Efficient packet delivery to mobile nodes by the routing protocols is main challenge in MANET. Due to node mobility routing in ad hoc network is a very challenging task. Moreover bandwidth; energy and physical security are limited.

This paper discusses the performance evaluation of purposed proactive routing protocols in terms of average end to end delay, packet delivery ratio, throughput through different parameters.

The rest of paper is organised as follows. In section 2 we present types of proactive routing protocols. section 3 presents the brief description about proactive routing protocols, section 4 present the Simulation environment Parameters, section 5 present the result and discussion and section 6 present the conclusion.

2. SURVEY ON ROUTING PROTOCOLS

[2] Mobile ad hoc network does not have any fixed infrastructure. In ad hoc network node move arbitrarily so topology changes in ad hoc network is rapid and unpredictable therefore routing is very important in ad hoc network. Routing protocols can be classified in three parts. (i) Table driven (Proactive) routing protocols (ii) Reactive routing protocols (iii) Hybrid routing protocols.

Table driven protocols are also called as proactive protocols since they maintain the routing information even before it is needed. In proactive routing protocols each and every node maintained a routing table in the network and update this periodic table through periodic exchange of control massage between nodes because every node should have instant information about any topology change in the networks. In proactive routing protocol route to every destination already present so there is no initial delay to start sending data.

[3] On demand routing protocol is also called reactive routing protocol. In reactive routing protocol routes are developed when it needed so update of routing table in reactive routing protocol is not required so frequently and there is no need of maintain routes for all nodes in the networks. In reactive routing protocol for new destination every node required a route so they have to wait until new root is discovered. It is time taking process so we can say that this is main drawback of proactive routing protocols.

[4] Hybrid routing protocols inherit the advantages of proactive and reactive routing protocols. Initially hybrid routing protocol developed the routing through proactive routes and then reactive flooding satisfy the demand of additional activated nodes. Hybrid routing protocols uses the proactive routing protocol for the small domain of the networks because for the small domain proactive routing is very effective and for the nodes which are located outside the domain it uses reactive routing protocols because reactive routing protocols is more bandwidth efficient in changing networks.

3. PROACTIVE ROUTING PROTOCOLS

In proactive routing protocols each and every node maintained a routing table in the network and update this periodic table through periodic exchange of control massage between nodes because every node should have instant information about any topology change in the networks. In proactive routing protocol route to every destination already present so there is no initial delay to start sending data. In this paper 4 protocols have been taken to evaluate performance of proactive routing protocols.

(i)Fish-eye state routing protocol (FSR)

[5] The fish-eye state routing protocol (FSR) is a proactive routing protocol. It is based on link state routing and provides route information immediately when required. There is 'Scope' parameter in FSR which controlled the number of nodes with which the link state information exchanged more frequently. FSR scope can be defined as number of node that can be reachable within number of hopes. FSR is a link state routing protocol so it has a topology map at each and every node. In FSR it consumes less amount of bandwidth to update the massage in comparison to LS. For reducing the size of update massages it uses fisheye technique. Frequency of entry in routing table corresponding to neighbour nodes is higher in comparison to rest of nodes in FSR. Packet are generated and flooded over network in link state periodically or at the time of topology change but in FSR packets are exchanged periodically with neighbour nodes instead of flooding.

(ii) Optimised link state routing protocol (OLSR)

[6] OLSR protocols are optimised form of classical link state algorithm use the concept of multi point relay (MPR). In MPR there are some selected nodes only which have responsibility to forward broadcast massages during the flooding process. By this way it reduces the massage overhead in comparison to classical flooding. In OLSR the nodes which are selected as MPR only can generate link state information. OLSR works very effectively for larger and denser networks and where traffic is random.

(iii) Intrazone routing protocol (IARP)

[7] Intrazone routing protocol (IARP) is a proactive routing protocol. Generally IARP is used to improve the performance of globally existing reactive routing protocols. IARP is a proactive part of ZRP hybrid routing protocols. In IARP each node monitors the changes accurse in R-hop neighbourhood and avoids the global route discovery to local destination. IARP's routing provides enhanced, route maintenance after routes have been discovered.

(iv) Bellman-Ford routing protocol

[8] Bellman-Ford routing protocol is a proactive routing protocols which is based on Bellman_ford algorithm this is a distance vector algorithm. This protocols and algorithms currently use in the IPv4 Internet. If that protocol is used in those system of networks which have several hundreds of networks and if there is any loop formed then Bellman-ford take much time to resolve that loop so this protocol is not suitable for larger networks.

4. SIMULATION ENVIRONMENT AND PARAMETERS

All four protocols are simulated in QualNet simulator. QualNet provides a comprehensive environment for designing protocols, creating and animating network scenarios, and analyzing their performance. In this paper, we have taken two different test scenarios.

Test Scenario 1

In the first scenario I have taken maximum speed- 20m/s, minimum speed- 0m/s, simulation time- 50s, packet size- 4packets/second, dimension space 1000x1000m, mobility model- random waypoint, pause time- 10s, 20s, 40, 100s and traffic type- CBR for varying network where no. of nodes (50) kept a constant.

Test Scenario 2

In the second scenario Parameters I have taken maximum speed- 20m/s, minimum speed- 0m/s, simulation time- 50s, packet size- 4packets/second, dimension space 1000x1000m, mobility model- random waypoint, number of nodes- 25, 50, 75, 100 and traffic type- CBR for varying network where pause time (20s) kept a constant.

5. RESULTS AND DISCUSSION

The simulation results have been carried out by mainly considering the following three different scenarios:

1. The packet delivery ratio

2. The average end-to end delay

3. Throughput

5.1 The packet delivery ratio

With the first scenario where dependency is on pause time, the packet delivery ratio of the routing protocol is compared.

Value	10 Sec	20 Sec	40 Sec	100 Sec
Bellman_Ford	0.8163265	0.7653061	0.7704082	0.7704082
IARP	0.6683673	0.5943878	0.6020408	0.6020408
OLSR_INRIA	0.7755102	0.7270408	0.7372449	0.7372449
Fish_Eye	0.8061224	0.755102	0.7653061	0.7627551

Table 1: Packet delivery ratio with the varying pause time at 50 nodes.

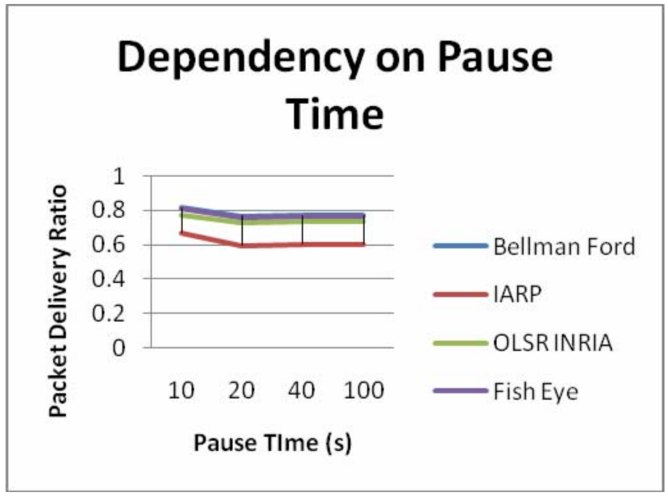

Figure 1: Line chart of packet delivery ratio with varying pause time

With the second scenario where dependency is no. of node, the packet delivery ratio of the routing protocol is compared.

Nodes	25	50	75	100
Bellman Ford	0.8979592	0.8010204	0.869898	0.625
IARp	0.5586735	0.5994898	0.6071429	0.5943878
OLSR INRIA	0.7831633	0.8137755	0.7602041	0.6352041
Fish EYE	0.8188776	0.8061224	0.744898	0.127551

Table2: Packet delivery ratio with the varying nodes with 20s pause time

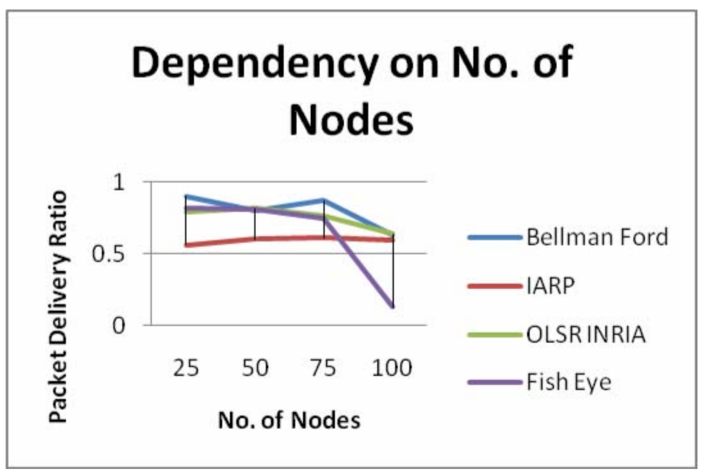

Figure 2: Line chart of packet delivery ratio at varying nodes

If compare those results then it shows that packet delivery ratio at varying pause time for all four protocols come in following order (i) Bellman-Ford (ii) FSR (ii) OLSR (iv) IARP. And if we compare packet delivery ratio of these four protocols at varying nodes then at node 25 Bellman-Ford's packet delivery ratio is more than other protocols but at 100 nodes OLSR's packet delivery ratio is more than other protocols. So we can say that performance of Bellman-Ford protocol in terms of packet delivery ratio at varying nodes is better than other protocols for small network region but for the large network region performance of OLSR in terms of packet delivery ratio at varying nodes is better than other protocols.

5.2 The average end-to end delay

With the first scenario where dependency is on pause time, the average end-to end delay of the routing protocol is compared.

Value	10 sec	20 sec	40 sec	100 sec
Bellman_Ford	0.0124023	0.0122418	0.0125517	0.0125517
IARP	0.0069791	0.006529	0.0080303	0.0080351
OLSR_INRIA	0.0089752	0.0091388	0.0095143	0.0095142
Fish_Eye	0.071868	0.064061	0.0679574	0.0662429

Table 3: The average end-to end delay with the varying pause time with 50 nodes

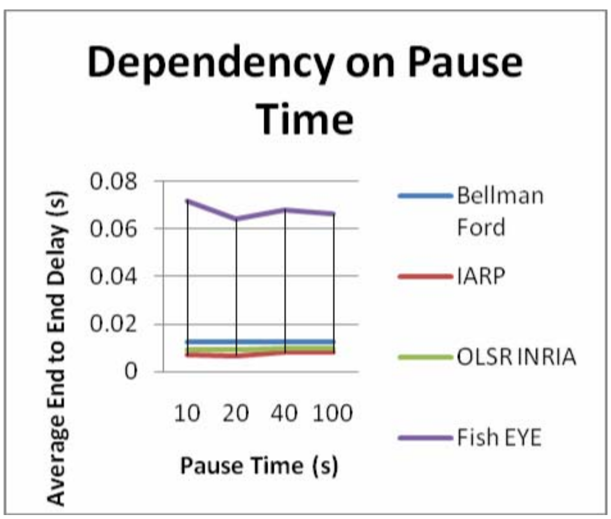

Figure 3: Line chart of the average end-to end delay with varying pause time.

With the second scenario where dependency is no. of node, the average end-to end delay of the routing protocol is compared.

Nodes	25	50	75	100
Bellman Ford	0.0129915	0.0166353	0.019694	0.027239
IARp	0.00661	0.0069463	0.0068898	0.0074905
OLSR INRIA	0.0099789	0.0096766	0.0116932	0.0183684
Fish EYE	0.0112432	0.0690683	0.368785	0.795938

Table 4: The average end-to end delay with the varying nodes with 20s pause time.

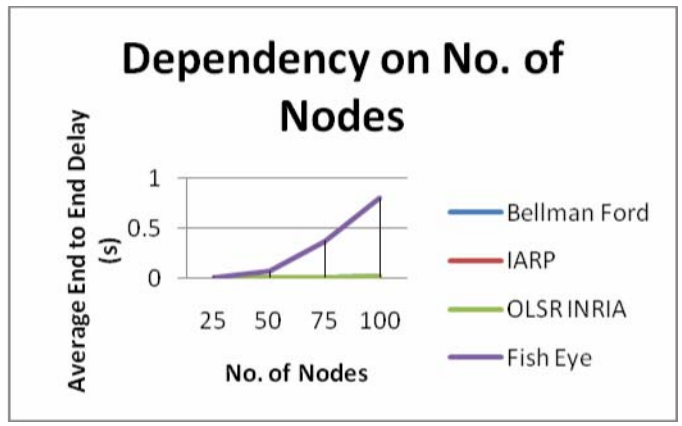

Figure 4: Line chart of the average end-to end delay with varying node.

After evaluating these results we find out that average end to end delay of IARP protocols is less than rest of protocols (OLSR, FSR, Wellman-Ford) at both scenario when nodes are varying and pause time is fixed or when pause time are varying and nodes are fixed. So we can say that in case of average end to end delay, performance of IARP is better than other protocols.

5.3 Throughput

With the first scenario where dependency is on pause time, Throughput of the routing protocol is compared.

Value	10 sec	20 sec	40 sec	100 sec
Bellman_Ford	13383	12547	12630.5	12630.5
IARP	15303.5	13706.5	13896	13896
OLSR_INRIA	14043.5	13163	13348	13348
Fish_Eye	14174.5	13277.5	13457	13412

Table 5: Throughput with the varying pause time at 50 nodes.

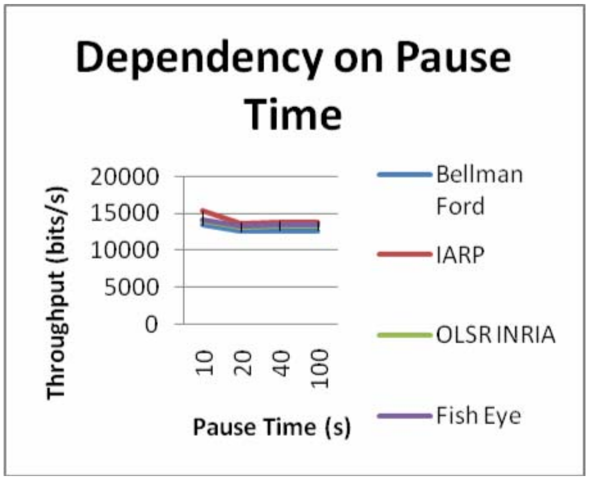

Figure 5: Line chart of Throughput with varying pause time.

With the second scenario where dependency is no. of node, Throughput of the routing protocol is compared.

Nodes	25	50	75	100
Bellman Ford	14867.5	13129.5	14265.5	10290.5
IARp	13924	13773.5	13946	13705.5
OLSR INRIA	14255	14727	13829	11569
Fish EYE	14333	13717.5	12723.5	2298.5

Table 6: throughput with varying nodes at 20s pause time.

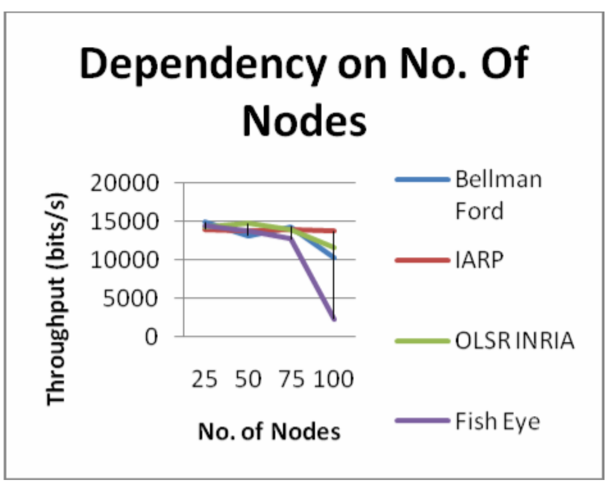

Figure 6: Line chart of Throughput with varying nodes.

After evaluating these results where pause time is varying and nodes are fixed then we can find out that when pause time is increases then throughput of all nodes going to decrease and performance of IARP protocol in terms of throughput is better than rest of protocols at any pause time and when evaluate these protocols for varying nodes at fixed pause times then we find out that throughput of Wellman-Ford protocol at 25 nodes is better than rest of protocols But at 100 nodes performance of IARP protocols in terms of throughput is better than other protocols.

6. CONCLUSION:

After evaluating all these results in terms of packet delivery ratio, average end to end delay and throughput at varying nodes or varying pause time we find out that overall performance of OLSR in terms packet delivery ratio is better than IARP, FSR and Wellman-Ford and IARP protocols shows the better performance in terms of average end to end delay and throughput in comparison to Wellman-Ford, FSR and OLSR. So we can say that overall performance of IARP protocols is best among these protocols in terms of packet delivery ratio, average end to end delay and throughput at varying nodes or varying pause time. FSR protocol is worst among these protocols.

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