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A Survey On Routing Protocols Performance Simulated In Different Scenarios With Different Simulators

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ABSTRACT

Recent advances in mobile Ad-hoc networks (MANETs) have led to many new routing protocols specially designed for the MANETs where efficient routing is very important. In this paper, we have surveyed comparative performance analysis of different routing protocols such as (AODV, DSR DSDV FSR, ZRP and etc.) under the different scenarios (i.e. scenarios where number of nodes are increasing with randomized waypoint mobility and scenario where the nodes are communicating with different pause times) in term of Packet Delivery Ratio, End to End Delay, Throughput, Normalized Routing Load, Average Jitter, Consumed Energy and Remaining Energy. We have carefully studied the behavior of these routing protocols and compared their performance in different scenarios based on the results produced by leading researchers in this area and concluded that no single protocol can be designated as best for all situations, rather a routing protocol should be chosen based upon the required QoS parameters, Mobility, Scalability and size of the MANET. The Qualnet5.0 [1] and NS2 [2] simulators were used for the performance analysis of these protocols.

Key words: Mobile Ad-Hoc Network, Routing Protocol, AODV, RAODV, ERAODV DSDV, DSR, FSR, ZRP, QoS, RREQ Performance Analysis.

1. INTRODUCTION

A mobile Ad-Hoc network [3] is an infrastructure less and multi hope temporary network in which each nodes are connected to each other's via wireless link and communicating to each other's through routing protocols. In MANET the mobile nodes are connected dynamically in arbitrary manner in this infrastructure less network the topology dynamical and rapidly change throughout of the network, in this type of the network the efficient routing is a

The rest of this paper is organized as follows. In section 2 we give a brief classification of routing protocols, in section 3 we present the description of performance metrics for these routing protocols, section 4 we present the survey of current literature regarding comparison of routing protocols and finally in section 5 we conclude this paper with a table summarized of QoS of various routing protocols as studied by respected researchers.

2. ROUTING PROTOCOLS

The routing protocols are used to find a path from source to target destination. Essentially these protocols have been classified into three categories. (1) (Proactive) routing protocols [7] [8], (2) (Reactive) routing protocols [7] [8] and (3) Hybrid routing protocols (Proactive + Reactive). [9].

1.1 Proactive (Table-Driven) Routing Protocols

In proactive protocols all nodes exchange with their neighbors information about shortest routes to other nodes periodically. After analyzing these routes they compute and store the shortest path to each possible destination in a table [6]. These types of protocols are not difficult to implements in the network but due to the resource hungry nature, limited energy of the node and slow propagation of routing information it becomes infeasible to use this protocol. DSDV (Destination Sequenced Distance-Vector) [15-16], FSR (Fisheye State Routing Protocol) [17], and CGSR (Cluster Head Gateway Switch Routing Protocol) [8] [18] are table driven (Proactive) routing protocols.

1.2 (Reactive) On-Demand Routing Protocols

In contrast, reactive protocols do not continuously exchange routing information with the neighbors, instead a route is constructed only when it is needed. When a source node needs a route to a destination node it starts a node discovery process, in which route request messages are flooded across the network. The destination node responds to this request hence establishing a route. The Route is maintained until destination become unreachable, or source is no longer interested in destination. AODV (Ad-Hoc on Demand Distance Vector Routing Protocol) [10], DSR (Dynamic Source Routing Protocol) [11], TORA protocol (Temporary-Ordered Routing Algorithm) [12], CBRP (Cluster Based Routing Protocol) [13], these are all On Demand (Reactive) Routing Protocols.

1.3 Hybrid (Proactive + Reactive) Routing Protocol

Hybrid protocols are simply the combination of two protocols stated above. ZRP (Zone Routing Protocol) [19] [9] being a typical example in which the whole topology is divided into a hierarchy of zones. Proactive routing is used locally within each zone, while reactive routing is used to create routes between the zones. All nodes within a radius of r hops is considered a zone.

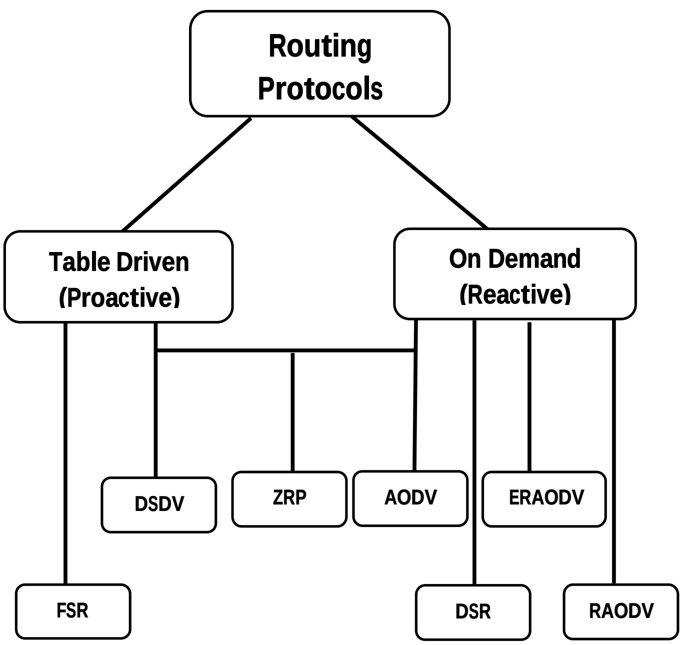

Figure 1: Classification of Routing Protocols

Destination Sequence Distance Vector (DSDV), Zone Routing Protocol (ZRP) [9] [19], Ad-Hoc on Demand Distance Vector (AODV), Dynamic Source Routing (DSR), Reverse Ad-Hoc On Demand Distance Vector (RAODV) [20], Energy Reverse Ad-Hoc On Demand Distance Vector (ERAODV) [20] routing protocols.

3. QUALITY OF SERVICE (QoS) PARAMETERS OR PERFORMANCE MATRICES OF THE ROUTING PROTOCOLS

In the past theory, researchers work on certain features of QoS in mobile ad-hoc network including QoS routing [21], QoS MAC [22] and resource reservation [23]. In this research paper we have analyzed QoS routing according to respected researchers

3.1 Packet Delivery Ratio

Packet delivery ratio is calculated by dividing the number of packets received by the destination through the number of packets originated by the application layer of the source. For the best performance packet delivery ratio of routing protocol should be as high as possible [24]. If the ratio is 1, it will be the best delivery ratio of the routing protocol.

3.2 Throughput

It equals to the ratio of number of received packets by all destination nodes to the number of packets sent by all source nodes [24] [25]. It is measured in bits per second (bps).

3.3 Average End-to-End Delay

It equals to an average delay the packets took to reach from source to destination nodes and retransmission delays at the Media Access Control (MAC) [25] [26]. It is measured in the time (ms).

3.4 Average Jitter

It shows an average delay each packet takes to reach at destinations. It should be less for a routing protocol to perform better [27].

3.5 Normalized Routing Load (NRL)

The total number of routing packet transmitted per data packet defines as Normalized Routing Load (NRL) or Normalized Routing Overhead (NRO). NRL is calculated as dividing the number of calculated total sent packet by total number of received data packets.

3.6 Consumed Energy

The energy of the routing protocols are considered and measured in Joules. Number of nodes of the network vs. the total consumed energy is considered as metric [28] [29].

3.7 Remaining Energy

Each node contains the remaining energy (Joules) after the broadcasting of data packets [28] [29].

4. LITERATURE SURVEY REGARDING ROUTING PROTOCOLS

4.1 Comparison of AODV, ZRP and FSR [30]

In this paper Ashish K. Maurya, evaluate the AODV ZRP and FSR for scalable network in this paper the researcher has simulated the three protocols and evaluated the performance metrics in term of Packet Delivery Ratio (PDR), E2End delay, throughput and average Jitter, under the two different scenarios using Qualnet5.0 Simulator.

Scenarion-1 [30]. Design a network with the randomized waypoint mobility model with different pause time, simulation parameters are shown in Table 1.

Table1: Simulation parameter for Scenario 1

No. of mobile nodes	50
Area of space	1500m X 1500m
Minimum Speed	10 m/s
Maximum Speed	20 m/s
Time of Simulation	300 sec
Packet Size	512 bytes
Source	4 packets/sec
Node Position Strategy	Random
Pause time	20, 40, 60, 80 and 100 seconds
No. of simulations	15

Scenarion-2 [30]. Design the network with randomized waypoint mobility model with the increasing the number of mobile nodes as shown in Table 2.

Table 2: Simulation parameter for Scenario 2

No. of mobile nodes	20, 40, 60, 80, 100
Area of space	1500m X 1500m
Minimum Speed	10 m/s
Maximum Speed	20 m/s
Time of Simulation	300 sec
Packet Size	512 bytes
Source	4 packets/sec
Node Position Strategy	Random
Pause time	30 seconds
No. of simulations	15

Packet Delivery Ratio: The packets delivery ratio of the AODV remains best in contrast of the FSR and ZRP routing protocols. AODV sent more than 60% of CBR packets in scenario 1 and delivers more than 80% data packets in scenario 2.

Throughput: The simulation result shows that the throughput is remain best of AODV and delivered higher data packets in comparison to FSR and ZRP in both scenario-1 and scenario-2.

Average Jitter: The AODV more opportunities for jitter because of source node initiating route discovery mechanism by a route request packet to its neighbors, but ZRP has jittering least half then FSR and AODV routing protocols in both scenarios.

Average End-to-End Delay: According to this simulation result the average e2end delay of FSR routing protocol remain lowest with the maximum delay 0.49 sec. In scenario 2 the average end to end delay first increase then decrease for AODV and FSR with the increase in pause time but in case of ZRP from pause time 60s to 100s it remains constant. The best performance has been showed also by ZRP in scenario 2 having a lower end to end delay to a maximum delay of 0007. The average end-to-end delay is always less than 0.065s of the three protocols, AODV but in case of very high at the beginning and decreases significantly with increasing dead time of 20 and 40.

4.2 Comparison of AODV and DSR [31]

The Author [31] has focused On Demand routing protocols such as Ad-Hoc on Demand Distance Vector (AODV) and Dynamic Source Routing (DSR) protocols. Both routing protocols has been simulated for compare the performance to each other in term of Packets Delivery Fraction, Average E2End Delay and Normalized Routing Load using NS2 Simulator [31]. The scenario parameters are defined in Table-3.

Packet Delivery Ratio: DSR has higher delivery rate than AODV with 10 and 20 sources. The packet delivery rate approaching remain higher up to 100% for both AODV and DSR with 30 and 40 sources. In low pass time the performance of AODV was similarly with DSR. This phenomenon can be explained that AODV maintain only on route for the destination at source if route is fail AODV broadcast for the new route to reach the destination that means AODV does not maintain the multiple paths in their routing table in comparison of DSR save the multiple route at source in their routing table for the destination if the one route is fail the another route will be replace. So DSR outperforms AODV.

Table 3: The Parameters of the Scenario [31]

Mobile Nodes	50
Environment Area Size	500m*500m
Maximum speed	20m/s
Type of Traffic	CBR
Size of Packet	512 bytes
Transferred Rate	4 packets/s
Seed	4
No of Traffic sources	10, 20, 30, 40
Total Simulate Time	200s
Transmission Range	250m
Queue Size	50
Pause time	0/20/40/60/90/130/170 /200
Radio propagation model	Two Ray Ground

Average End-to-End Delay: With the 10 sources nodes the delay of the AODV is remain longer then DSR but increasing the no of sources nodes the delay of AODV remain shorter than DSR. Because of the DSR use the stale route to transferred the packets but AODV chose the fresh path to transfer the data packets from source to destination according to their routing table which remain up to date with RREQ message technique.

Normalized Routing Load: DSR always outperforms AODV even in stressful environment. This can be used on a cache strategy of DSR. By the route cache of DSR probably a route cache, and thus accesses route discovery response less frequently than AODV.

4.3 Comparison of AODV, DSDV, RAODV and ERAODV.

In [32] paper the researcher has focused, that which routing protocols will be the best to increase the lifetime of the network or in term of the energy efficient routing protocols among the Ad-Hoc On Demand Distance Vector (AODV) Protocol and Destination Sequence Distance Vector Routing (DSDV) protocol, Reverse Ad-Hoc On Demand Routing Protocols (RAODV) and Energy Reverse Ad-Hoc On Demand Routing Protocols (ERAODV). The discrete event simulator NS2.34 has been used for the simulation.

Table 4: The Parameters of the Scenario [32]

Type of Channel	Wireless
Channel Radio Propagation Model	Two-Ray Ground
Antenna	Omni
Queue Type	Drop
Queue Size	50
NIC Type	Phy/Wireless Phy
MAC	802_11
Area	800x800
Tx Power	4.00W
Rx Power	3.00W
Idle Power	1.0W
Transition Power	0.01W
Transition Time	0.003s
Sleep Power	0.004W
Total Time of Simulation	110 ms
Initial Energy of Each node	200.0 (Joules)
Routing Protocols	AODV,DSDV, RAODV,ERAODV
Traffic	FTP
Size of Packets	1060
Number of Mobile Nodes	5,15,25,35,45,55,65,75, 85,95,
Mobility Speed	10 m/s

Packets Delivery Ratio: Packet delivery ratio remain best of ERAODV with increasing the density of nodes as compared to AODV and DSDV.

Energy Consumption: Energy consumption of ERAODV is less than DSDV and AODV because it consume less energy on the time of transmission of packets.

Normalized Routing Load: Normalized routing load remain high of DSDV as usual, because DSDV generate more amount of traffic as compare to AODV and ERAODV.

Throughput: Interprets that throughput of ERAODV and AODV is higher than DSDV because of the maximum packets are successfully delivered to the destination. ERAODV use for the maximized save the network and the performance of basic services AODV routing protocol. According to this paper the AODV protocol will be best for adopting any routing strategies in order to increase network lifetime [32].

5. CONCLUSION

In this paper we have surveyed some of the leading literature regarding MANET routing protocols and their Quality of Service (QoS) parameters. We have deeply analyzed the studies conducted by various researchers and compared their results in term of efficiency and performance. Results produced by these researchers were based upon different scenarios.

From these results we find that AODV and ERAODV routing protocols were remain far-better in performance then other protocols. The behavior of DSDV was found independent of the scenario. This was due to the table driven methodology used by DSDV. We may not designate a single routing protocol to fit all situations, rather the protocols should be chosen based upon the required QoS parameters, mobility, scalability and size of the MANET.

Table 5: A summary of QoS parameters in surveyed scenarios

Scenarios		**Routing Protocols**	**Packets Delivery Ratio**	**Normalized Routing Load**	**Energy Consumption**	**Throughput**	**Jitter**	**Average E2End Delay**
Scenario 1	Pause Time 20s,40s,60s, 80s,100s	AODV	High	----	----	High	Medium	Low
		FSR	Low	----	----	Low	Medium	Low
		ZRP	Low	----	----	Low	Low	Medium
Scenario 2	Density of Nodes 20,40,60,80, 100	AODV	High	----	----	High	Medium	Medium
		FSR	Low	----	----	Low	Medium	Medium
		ZRP	Low	----	----	Low	Low	Low
Scenario 3	Pause Time 20s,40s,60s, 90s,130s,170s,200s	AODV	Low	High	----	Low	----	Low
		DSR	High	Low	----	High	----	High
Scenario 4	Pause Time 5s,15s,25s,35s,45s,55s,65s,75s,85s,95s	AODV	Low	Low	High	High	----	----
		DSDV	Low	High	High	Low	----	----
		ERAODV	High	Low	Low	High	----	----

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