International Journal of Research Studies in Computer Science and Engineering (IJRSCSE)
Volume 1, Issue 1, May 2014, PP 36-41
www.arcjournals.org

Comparative Appraise and Future Perspectives of Reactive and Proactive Routing Protocols in Manets

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Abstract: *The field of mobile Ad-hoc network has gained an important part of the interest of the researchers and become very popular in last few years. This paper highlights the functioning of various type of protocols used for wireless Ad-hoc networking. The most widely used ad hoc routing protocols are Ad-hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance Vector (DSDV), Dynamic Source Routing (DSR), OLSR (optimized link state Routing) and temporally Ordered Routing Algorithm (TORA), Cluster head Gateway Switch Routing Protocol (CSGR). This paper endeavors to endow with a wide-ranging synopsis of this vibrant field. Foremost this paper explains the imperative task that mobile ad hoc networks participate in the growth of future wireless technologies. Then, it reviews the most modern research activities in these areas, including a summary of MANET's uniqueness, capabilities, relevance, and devise restraints. The paper concludes by presenting a set of challenges and problems requiring further research in the future.*

Keywords: *DSDV, DSR, AODV, OLSR, TORA,CSGR, MANET's*

1. INTRODUCTION

An ad hoc network is a collection of wireless mobile hosts forming a temporary network. An ad-hoc network is a self-configuring network of wireless links connecting mobile nodes. They form an arbitrary topology, where the nodes are free to move randomly and arrange themselves as required. The transmission of a mobile host is received by all hosts within its transmission range due to the broadcast nature of wireless communication and Omni-directional antennae. If two wireless hosts are out of their transmission ranges in the ad hoc networks, other mobile hosts located between them can forward their message. Due to the mobility of wireless hosts, each host needs to be equipped with the capability of an autonomous system, or a routing function without any statically established infrastructure or centralized administration. Nodes rely on each other to established communication, thus each node acts as a router.

Ad Hoc networks were developed by the Defence Forces, to comply with the military framework. These networks were then proved useful in commercial and industrial fields.

Depends on how the protocols handle the packet to deliver from source to destination, most of the protocol classifications are made as:-

1.1 Proactive Routing

These types of protocols are called *table driven protocol*. In the routing, the route is predefined. Packets are transferred to that predefined route. In this scheme, packet forwarding is faster but routing overhead is greater because one has to define all of the routes before transferring the packets. Proactive protocols have lower latency because all routes are maintained at all the times. Examples of proactive protocols are DSDV (Destination Sequenced Distance Vector), OLSR (Optimized Link State Routing).

1.2 Reactive Routing

These types of protocols are called *On Demand Routing Protocol*. In this type of routing, the routes are not predefined. A node calls for route discovery to find out a new route when needed. This route discovery mechanism is based on *flooding* algorithm which employs on the technique that the source node broadcasts the packets to its neighbors and intermediate nodes forward the packets to its neighbors. This is a repetitive technique until reaches to destination. *Reactive* techniques have smaller routing *overheads* but higher *latency*. Examples of Reactive protocols are DSR, AODV, and TORA.

2. ADHOC ROUTING PROTOCOLS: AN OVERVIEW

2.1 Dynamic Source Routing Protocol (DSR)

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. The protocol is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network. The use of source routing allows packet routing to be trivially loop-free, avoids the need for up-to-date routing information in the intermediate nodes through which packets are forwarded. All aspects of the protocol operate entirely on-demand.

2.2 Ad-hoc on-demand Distance Vector protocol (AODV)

The Ad-hoc On-demand Distance Vector routing protocol enables multihop routing between the participating mobile nodes wishing to establish and maintain an ad-hoc network. AODV is a reactive protocol based upon the distance vector algorithm. The algorithm uses different messages to discover and maintain links. Whenever a node wants to try and find a route to another node it broadcasts a Route Request (RREQ) to all its neighbors. The RREQ propagates through the network until it reaches the destination or the node with a fresh enough route to the destination. Then the route is made available by a RREP back to the source. The algorithm uses hello messages that are broadcasted periodically to the immediate neighbors. These hello messages are local advertisements for the continued presence of the node, and neighbors using routes through the broadcasting node will continue to mark the routes as valid. If hello messages stop coming from a particular node, the neighbor can assume that the node has moved away and mark that link to the node as broken and notify the affected set of nodes by sending a link failure notification (a special RREP) to that set of nodes.

2.3 Temporally Ordered Routing Algorithm (TORA)

TORA protocol belongs to the class of reactive protocols. The protocol is highly adaptive, efficient and it is used to establish the "temporal order" of topological change events which is used to structure the reaction to topological changes. The protocol is designed to minimize reaction to topological changes. The protocol is distributed in that nodes need only maintain information about adjacent nodes. The protocol is "source initiated" and quickly creates a set of routes to a given destination only when desired. The protocol accomplishes three functions through the use of three distinct control packets such as query (QRY), update (UPD) and clear (CLR). QRY packets are used for both creating and maintaining routes, and CLR packets are used for erasing routes.

2.4 Destination Sequenced Distance Vector (DSDV)

This protocol is based on the Bellman-Ford classical routing Mechanism. Here each mobile node maintains a routing table that includes all accessible destinations, the number of hops necessary for reaching that destination and the sequence of the digits appropriate to that destination. Routing table entries are tagged with sequence of digits which are originated by the destination nodes. This sequence of digits is used to distinguish new routes from old routes and also to determine the creation of a ring. Route updates are transmitted either periodically or immediately after a significant topology change is being detected. DSDV protocol generates a supplementary traffic that adds to the real data traffic.

2.5 Cluster head Gateway Switch Routing Protocol (CSGR)

This protocol is based on the DSDV routing algorithm. Mobile nodes are collected inside packets and a cluster head is selected. A gateway node is a node in a communication interval between two or more cluster heads. CGSR protocol uses a distributed algorithm which is stable since the cluster heads will change only under two conditions:- when two cluster heads come within the range of each other or when a node gets disconnected from any other cluster .In this state, the origin sends the packet to its cluster head; the cluster head sends this packet to the gateway node to which it and the node which is located in the route of destination are connected. The Gateway sends the packet to another cluster head and this action continues until the cluster head receives the destination node of packet. Finally, the destination cluster head sends the packet to the destination node.

2.6 Optimized Link State Routing Protocol (OLSR)

Optimized Link State Routing is an optimization of the classical link state algorithm tailored to the requirements of a mobile wireless LAN. The key concept used in the protocol is that of multipoint relays (MPRs). The MPRs substantially reduces the message overhead as compared to a classical flooding mechanism, where every node retransmits each message when it receives the first copy of the message. In OLSR, link state information is generated only by nodes elected as MPRs. Thus, a second optimization is achieved by minimizing the number of control messages flooded in the network. As a third optimization, an MPR node may chose to report only links between itself and its MPR selectors. Hence OLSR provides optimal routes (in terms of number of hops).

3. OVERVIEW OF LITERATURE SURVRY

The impact of the AODV protocol, its implementation on end-to-end bandwidth and power consumption in real scenarios have been theoretically and empirically analyzed by C. Gomez et.al[1]. Results suggest that, in the tested scenarios, a different parameter configuration than that proposed by default may lead to significant improvement in reactivity to topology changes, while having a small impact on power consumption and end-to-end bandwidth.

Performance Analysis of three Routing protocols in wireless Mobile Ad Hoc Network has been carried out by M .Lakshmi et.al [2]. Simulation carried out by NS-2 simulator. Author writes that DSDV is more suitable for networks where changes in the topology are limited. DSR is suitable for network in which the nodes move at moderate speed. AODV in the simulation has the best all round performance.

In [3] the author gives An Quantitative Study on Different Routing Protocols in Multi service Environments by OPNET simulator. The simulation results show that OLSR protocol has better performance in terms of throughput and delay, particularly for large networks. For smaller networks the performance of AODV and OLSR are the same.

Comparative analysis on DSDV, AODV and DSR with respect to the four mobility models has been done by Valentina Timcenko et.al [4]. Simulations have been carried out by the Network Simulator (NS2). AODV performs best with the group model. DSR performs best with the RW model.

In [5] the author analyzed the performance of network by considering different parameter constraints with respect to mobility speed, Traffic and Network size. The simulation results shows that DSDV produces better results than TORA and can be used as the routing protocol under low mobility conditions. In random walk model AODV protocol perform better under low and high mobility conditions.

Optimized-AODV improves the performance of AODV under conditions of high load and moderate to high mobility [6].Simulation results show that the overhead of AODV is slightly less than *Optimized-AODV*. DSDV gives comparatively lower throughput as the large number of routing bits is required. Increase in overhead reduces the throughput.

The performance of AODV and OLSR is compared by S. Gowrishankar et.al [7]. The simulation is done by using NS-2. Simulation results show that AODV performed well, regardless of mobility rate. But AODV fails when the node density increases. OLSR shows consistent

performance. The average end to end delay of packet delivery is higher in OLSR as compared to AODV. AODV demonstrates significantly lower routing load than OLSR.

In [8] the author compares the performance of AODV, TORA and DSR by varying the size of the networks by OPNET simulator. Simulation results show that AODV and DSR have better performance than TORA for maximum as well as minimum number of nodes.

Performance comparison of AODV, TORA and DSR is given by N Vetrivelan et.al [9].The simulations are carried out on NS-2 simulator. The performance analyzed by using varying network size and simulation times. The simulation results show that AODV performs well in terms of Average Delay, Packet Delivery Fraction. TORA has lower routing load than DSDV and AODV.

The performance of network under different routing protocol AODV, TORA,GRP and DSR for delay, network load and throughput is done by Mrs.Razan Al-Ani [10]. Simulation is carried out by OPNET Simulator .Results shows that OLSR outperforms the AODV, DSR, TORA and GRP in both delay and throughput.

In [11] the author compares the performance of MANET by considering the different mobility models by simulation. The results show that DSR performs best in making it efficient in the utilization of limited resources, which includes bandwidth and power in comparison to DSDV.

Performance of AOMDV and AODV routing protocols were analyzed in the presence of selfish behaviors by using simulator NS-2 by Abdur Rashid Sangi et.al [12].Simulation result show that AOMDV work better than AODV routing protocol in presence of selfish behaviors.

The performance of on-demand routing protocols such as AODV, DSR and TORA for mobile nodes for four mobility models are analyzed by Prajakta M. Dhamanskar et.al by NS-2 Simulator [13].The result shows that Average end-to-end delay in AODV increases as the number of nodes increases .Also they concluded that performance of RPGM mobility model is the best and performance of Manhattan Grid is the worst as compared to other mobility models for all the three protocols.

The effect of mobility on the performance of MANET by considering the packet delivery fraction parameter is analyzed by Manoranjan Das et.al [14]. In simulation they have considered AODV as the routing protocol for the performance comparison at different pause time and traffic density. For the performance analysis they have used Global Mobile Simulator .It is observed from the detailed analysis that the packet delivery fraction for the MANET with higher load is less than lower load and the routing load for network with higher load is higher than the network with lower load.

A detailed analysis of performance affected due to change in mobility by using GLOMOSIM simulator is done by Banoj Kumar Panda et.al [15]. From the analysis it is observed that the Packet delivery fraction is more in AODV routing protocol than DSR routing protocol at high mobility condition. The end to end delay is more in AODV routing protocol than DSR routing protocol at high mobility condition.

In [16] the author evaluates the efficiency of the seven MANET routing protocols DSR, AODV, DSDV, TORA, FSR, CBRP and CGSR. They concluded that all protocols delivered a high percentage of the produced packets when the movement of nodes was low and this value reaches maximum when the movement of nodes reaches zero. DSR and AODV protocols have shown better performance than other protocols.

A detailed analysis of performance affected due to change in mobility in different terrain area by using GLOMOSIM simulator has been carried out by Banoj Kumar Panda et.al[17]. From the analysis it is observed that in high mobility condition AODV performance is better than DSR . In large terrain area node density is low due to which link break is very high and the Packet delivery fraction of both the protocols still decreases in compare to low and medium terrain area.

The behavior of OLSR and DSR under the effect of selfish nodes, Regular Black Hole, and New Black Hole attacks has been analyzed by Mahmood Salehi et.al [18]. Analysis of network parameters has been evaluated using NS-2 simulation tool. Simulation results represented that

under all the attacks, the amount of packet drop ratio and End-to- End delay for DSR is almost higher than OLSR.

The author detect and isolate multiple Black hole and Gray hole nodes during route discovery process and propose a modified version to improve the Performance of MANET [19]. MR-AODV isolates Black hole and Gray hole nodes during route Discovery phase as R-AODV and sets up a secure route for data transmission. It attempts to further reduce normalized routing overhead by decreasing number of forwarded reply packets sent by adversaries.

The effect of different entity mobility models on the performance of MANET routing protocols are analyzed by Liu Tie-Yuan et.al [20].The results show that the RWP model has the highest delivery ratio, lowest end-to-end delay, and shortest average hop count, the RD model just reversed.

Author carries out the performance analysis of AODV protocol over networks of different size using the OPNET simulator [21]. It has been observed that the performance of AODV remains stable, for low node density as well as in the high node density. As the number of nodes in AODV network increased, the throughput is also increased.

4. OBJECTIVES OF THE RESEARCH WORK

The objectives involve the following.

1) To investigate the performance of Ad-hoc On–demand Distance Vector (AODV) and test out its impact on Multipath routing in Mobile Ad-hoc Network (MANET).

2) To investigate the performance of Dynamic Source Routing (DSR) and analyze its impact on Multipath routing in Mobile Ad-hoc Network (MANET).

3) To combine Ad-hoc On–demand Distance Vector (AODV) and Dynamic Source Routing (DSR) and examine its performance in comparison to stand alone protocols.

4) Evaluation of The Energy Consumption, Node Density, End To End Delay, Throughput, Packet Delivery Ratio, Normalised Routing Load, Bit Error Rate, Node Mobility.

The main objective of this research work is to study the performance of various type of wireless routing protocol under different network conditions to enhance the performance of routing protocol for adhoc mobile networks by using the best suited simulator.

ACKNOWLEDGEMENTS

The author thanks to the Guru Kashi University, Talwandi Sabo, India for giving him the opportunity to carry out research in the modern research area. The author also thanks to his supervisors for giving him valuable guidelines to carry out the work ahead.

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