# An Evaluation of Adhoc Routing Protocols: AODV, TORA & DSR

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***Abstract*- Numerous of methods and many simulation environments give distinct consequences. Different protocols under different environments get varying results. One protocol can be the finest in one network configuration but the worst in another. In this paper an effort has been made to compare the performance of on AODV, DSR and TORA. And comparison of these protocols on the basis of various parameters like average delay, average network load, average throughput, and average load using simulation tools like OPNET, NS-2, Qualnet etc.**

***Index Terms*- MANET, DSR, AODV, OLSR.**

## 1 INTRODUCTION

The mobile ad-hoc network, in which Mobile nodes set up connectivity via multi hop wireless communication, wires vigorous and competent process in wireless networks by incorporating routing functionality into mobile nodes. MANETs have active, sometimes rapidly-changing, multihop topologies. MANETs function like a router in order to maintain connectivity in the network since there is no centralized infrastructure to establish communication. Sometimes connections of these mobile nodes are often broken due to lack of maintained infrastructure. Hence, the need for Routing Protocols arises. These routing protocols work at a low data rate and can dynamically adapt to the changing topologies. Discussing about the historical background, it's happened in 1970's and the attention in wireless networks has been increasing ever since with full zest and zeel. In network wide broadcast is a imperative network layer function for adhoc networks supporting the route discovery and maintenance in many of adhoc unicast and multicast routing protocols. [8]. Usually, the routing protocols of MANET's may be classified into – the Table Driven proactive routing protocol and On-Demand reactive routing protocols. [9] Elaborating on table driven routing protocols, for instance OLSR and DSDV, every node persistently maintains the complete routing information of the network. A route is willingly available, when a node requires forwarding a packet. On the other hand, in on-demand routing protocols, for example DSR and AODV, mobile nodes maintain path information for destination only when they require to contact the source node or relay packets. [9] A search packet is issued and transmitted by the source node using the flooding technique to look for the destination node. Communication among nodes can be made and setup almost at a rapid pace, especially in field like an emergency and disaster operation, military battle field and even inbuilding used for security and surveillance. [11] Coming up with an efficient multicasting protocol in the wireless mobile adhoc networks it is a difficult task because a couple of factors which comprise limited bandwidth, battery power, frequent and unpredictable network topology changes. [10]

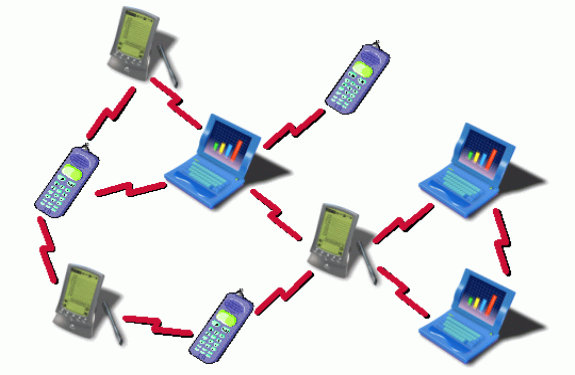

Figure: 1 MANET

Numerous Routing protocols have been proposed till now to improve the routing performance and reliability. Below are the characteristics of some of them. Routing protocols are roughly classified into three types as shown in figure 2, Table-driven, On-demand driven and Hybrid protocols.

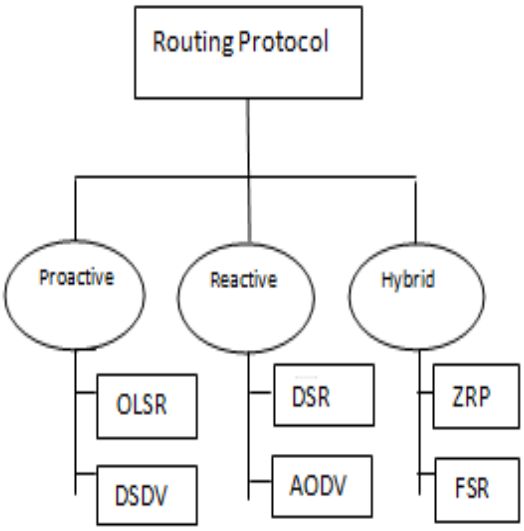


Figure 2 Classification of Routing Protocol

1.1 Temporary Ordered Routing Algorithm (TORA): is an adaptive and scalable distributed routing algorithm proposed for multi-hop wireless networks and highly dynamic mobile that is based on link reversal concept. TORA finds the routes from source node to the destination node through different routes. In order to achieve this, the nodes in the network maintain the routing information of the adjacent nodes. The functions of this protocol are basically route erasing, route creation and route maintenance. TORA maintains multiple routes to the destination. With this, once a route change or route error occurs it does not have any effect but only react when the entire routes to the destination are lost. This form of routing protocol detects the partition and erases all the invalid routes in term of network partitioning.

1.2 Adhoc On-Demand Distance vector Routing Protocol (AODV): is on demand routing protocol, whenever a route from source to destination is required then only it develops a route. [3], created with the combination of Dynamic source routing (DSR) and Destination Sequenced Distance-Vector (DSDV); AODV use properties of route request (RREQ) and also route maintenance procedure from DSR and some features like sequence number, periodic updates, hop by hop count from DSDV routing protocol.[5] Following information is contained in the packet header for route request:

- Source node IP address
- Broadcast ID
- Current sequence number for the destination

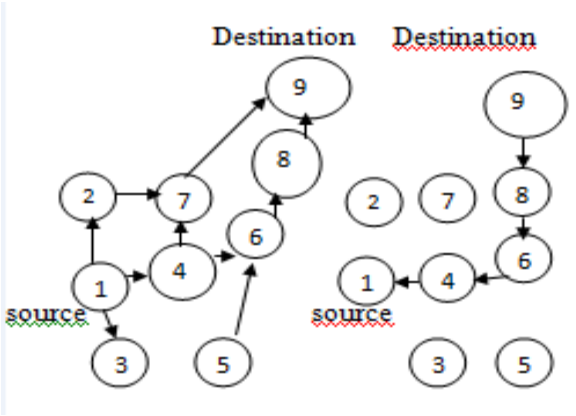


Figure 3: Route Discovery

During a route discovery process as shown in Figure 3, the source node broadcasts a route query packet to its neighbors. If any of the neighbors has a route to the destination, it replies to the query with a route reply packet; otherwise, the neighbors rebroadcast the route query packet. Finally, some query packets reach to the destination.

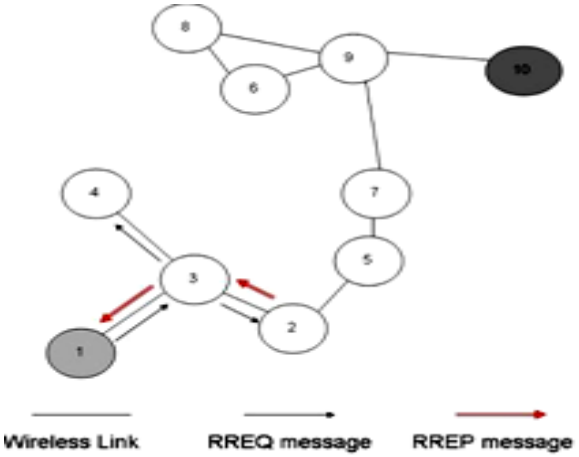


Figure 4. AODV Route Maintenance Process

The route maintenance process in AODV is very simple (as shown in Figure 4). Once the link in the communication path between node 1 (source node) and node 10 (Destination node) breaks the upstream node that is affected by the break, in this situation node 4 generates and broadcasts a RERR message. The RERR message eventually ends up in source node 1. After receiving the RERR message, node 1 will generate a new RREQ message.

1.3 Dynamic Source routing (DSR) DSR is an efficient and simple routing protocol that is used in ad-hoc networks as a result of its route maintenance and discovery. Dynamic source routing protocol is an On-demand routing protocol, mobile node store the source routes into the caches. [4] Dynamic source

routing protocol is a loop-free and uses no periodic routing messages, therefore conserve battery power, and reduce network bandwidth. [7] Working of DSR is classified into two parts: a) Route Discovery b) Route Maintenance

Route Discovery: Once node S desires to send a packet to node D, but didn't recognize a route to D, node S initiates a route discovery protocol. [3] The source node S floods Route Request (RREQ) and every node append own identifier when forwarding RREQ. Route Maintenance: Route maintenance is a process by which a packet sender S detects if the topology of the network has been changed, so that it can no longer uses its route to the destination D.[9] This may due to failure in link or host listed in source node move out of transmission range. [9]

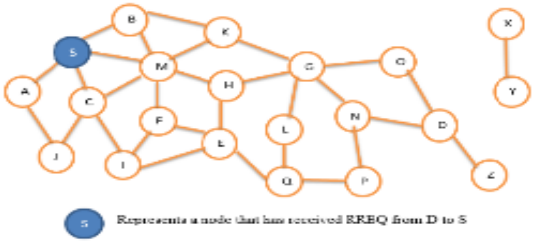

Fig.5: Route discovery in DSR

When a node in the ad-hoc network sends packet to a destination and does not know the route, it dynamically determines the route using route discovery process. Figure 5 shows a route recovery in DSR.

1.4 Characteristics of an Ideal Routing Protocol for Ad Hoc Network A routing protocol should have following characteristics:

- It must be fully distributed.  Adaptive to frequent change in topology.
- Transmission should be reliable to reduce message loss.
- The convergence must be quick, once the network of the topology becomes stable.
- Optimal use of bandwidth, computing power, memory and battery power.
- It must provide a certain level of quality of service (QoS).

## 2. PREVIOUS WORK

Ample amount of research work has been done in the past regarding the evaluation of MANETs, developing the routing protocols which are application specific, then comparison has been done to filter out the best available routing protocols, numerous algorithms have been developed, are being developed and are still worked upon. but still numerous grey areas are available that form the basics of research. This review work on Mobile adhoc network elaborates the scope of Mobile adhoc networks in various fields. Yiannis S. et.al had measured the performance of OLSR versus AODV and DSDV, under profound background traffic in terms of packet loss, routing overhead, throughput. The author simulates the scenario under different duration times. A heavily loaded wireless environment is simulated with wide range of number of nodes and extracts specific results. Simulation duration indeed affect the performance both qualitatively and quantitatively. *J Broch et al.* performed experimental performance comparison of both proactive and reactive routing protocols. In NS-2 simulation, a network compactness of 50 nodes with unstable pause times and different movement patterns were chosen. Zafar M. et.al had analyzed thecomprehensive experimental performance of DSR, AODV, and DSDV routing protocol for different metrics values with predefined constraints. Many scenarios had been designed with fixed number of nodes but changeable mobility. Dilpreet K. et.al had explained the characteristics of AODV, OLSR, TORA, DSDV, DSR routing protocols based on performance metrics under low mobility and low traffic network as well as high mobility and high traffic network in mobile ad-hoc networks. Puneet M. et.al had analyzed the performance of AODV, OLSR, GRP and DSR Routing protocols under different parameter like delay, load, media access delay, network load with database load in MANET. *Arunkumar B R et al.* Authors perform simulations by using NS-2 simulator. Their studies have shown that reactive protocols perform better than table driven (proactive) protocols. Lakhan dev S. et.al had analyzed the effect of mobility on performance of three MANET on-demand routing protocols i.e. DYMO, DSR, and AODV. Author applied EXata/Cyber 1.2 from scalable networks for simulation of these protocols. *S. P. Setty et.al.* Examined the performance of present wireless routing protocol AODV in a diversity of nodes placement models like Grid, Random and Uniform exploration QualNet 5.0. Hossein A. et.al had

evaluated the performance of four widely used ad hoc network routing protocols using different packet size patterns (uniform distribution and 1024 bytes) and also, different MAC layer (802.11b, 802.11g) for ordinary and large-scale MANETS using simulation environment (OPNET 14.0). *N Vetrivelan & Dr. A V Reddy* analyzed the performance differentials using varying network density and simulation times. They performed two simulation experiments for 10 & 25 nodes with simulation time up to 100 sec. Geetha J. et.al had discussed various routing protocol of each category under mobile adhoc networks. The author explained several routing schemes projected for ad-hoc mobile networks and also provided a classification of these schemes according the routing strategy. *Khan et al.* studied and compared the performance of routing protocols by using NCTUns network simulator. In their paper, performance of routing protocols was evaluated by varying number of nodes in multiples of 5 in the ad hoc network. The simulations were carried out for 70 seconds of the simulation time. The packet size was fixed to 1400 bytes. Chien-Chung S. et.al had projected to map probability-based directional and omni directional broadcast to bond and site percolation, respectively, and described a collection of directional antenna-based broadcast schemes for mobile ad hoc networks. Latha K. et.al had explained the performance analysis of a policy-b based mobile adhoc network management system, which is developed under the CERDEC DRAMA (Dynamic Re- Addressing and management system) program. Authors presented their use of modeling and simulation (M&S) techniques to develop detailed models of the DRAMA architecture and analyze the performance under range of operational parameters. *Jorg D.O.* studied the behavior of different routing protocols for the changes of network topology which resulting from link breaks, node movement, etc. In his paper, performance of routing protocols was evaluated by different number of nodes. But he didn't explore the performance of protocols under high mobility, huge number of traffic sources and huge number of nodes in the network which may tend to congestion situations. Se-Young L. et.al had projected ANMAS (Adhoc network multicasting with Ant system), a new multicasting algorithm for mobile adhoc network (MANET). This algorithm used the indirect communication technique of the ants via "pheromone" to successfully obtain dynamic topology change information, safer multicasting path are generated and adapts the well known CBT (Core based tree) multicasting algorithm into the ANMAS framework with suitable modifications to make "tolerable" multicasting group in MANET. Andrea D. et.al had investigated the incompetence of the overlay multicasting solution in mobile ad-hoc networks with admiration to the network layer multicasting by comparing the distribution tree cost of different solutions. The authors calculated the ratio between the cost of distribution tree in case of network layer and of multicasting overlay. *S. Gowrishanker et al* examined the analysis of OLSR and AODV by using NS-2, the simulation period for each scenario was 900 seconds and the simulated mobility network area was 800 m x 500 m. In each simulation scenario, the nodes were initially located at the center of the simulation region. The nodes start moving after the first 10 seconds of simulated time. In it, the application used to generate is CBR traffic and IP is used as Network layer protocol. Dilpreet Kaur & Naresh Kumar highlighted the significant issues and challenges in ad hoc networks. This analyzed paper elaborate the characteristics of ad hoc routing protocols Ad-hoc On Demand Distance Vector Routing (AODV), Optimized link State Routing (OLSR), Temporally Ordered Routing Algorithm (TORA), Dynamic Source Routing (DSR), Destination-Sequenced Distance-Vector Routing (DSDV) based on the performance metrics like packet deliveryfraction, Average delay, Normalized Routing load, Throughput and Jitter under low mobility and low traffic network with under high mobility and high traffic network.

## 3. CONCLUSION

An elaborate review was done on the research done by various eminent researchers on the mobile adhoc networks. Various areas like performance analysis based on routing protocols, routing algorithms, multicasting etc. Were focused upon in the papers published by researchers. An effort has been done in this review paper to filter the grey areas that could be worked upon in the future. Some areas of importance that can be focused upon include optimal use of bandwidth, computing power, memory and battery power along with improving a certain level of quality

of service (QoS). It also provides effects of various routing protocols like DSR, AODV, OLSR & their hybrid protocols. Further research paper will be focused on evaluating the performance of routing protocols viz. AODV, TORA and DSR.

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