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Comparative Analysis of Reactive Protocols in Mobile Ad Hoc Networks

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ABSTRACT
In the past few years, we have seen a rapid expansion in the field of mobile computing due to the proliferation of economical, widely available wireless devices. However, modern devices, Applications and protocols are solely focused on cellular or wireless local area networks (WLANs), not taking into account the great potential offered by mobile ad hoc networking. A mobile ad-hoc network is a self-governing collection of mobile devices (laptops, smart phones, sensors, etc.) that communicate with each other over wireless links and cooperate in a distributed manner in order to provide the necessary network functionality in the absence of a fixed infrastructure. A Mobile Ad-hoc network (MANET) is an autonomous collection of mobile routers or nodes communicating over radio links. MANET is a temporary network without infrastructure. The nodes directly communicate via wireless links within each other's radio range, while that are distant apart use other nodes as relay in a multi-hop routing function. As the nodes are mobile, the structure of the network changes dynamically and unpredictably over time. Ad-hoc networks are self-configuring and self-organizing, so to maintain communication between nodes in the network, each node behaves as a transmitter, a host and a router. It is an independent system of mobile hosts connected by wireless links.
Keywords:- MANETs, Self-configured, Throughput, Packet delivery ratio, AODV, DSR

I. INTRODUCTION

The term "ad hoc" implies that this network is a network established for a unique, often extemporaneous service customized to applications. The application may be mobile and the environment may change dynamically. Consequently, the ad hoc protocols must self-configure to adjust to environment, traffic and mission changes. A Mobile Ad-hoc network (MANET) is an autonomous collection of mobile routers or nodes communicating over radio links. MANET is a temporary network without infrastructure. The wireless routers or nodes moves randomly and organize themselves arbitrarily. The nodes directly communicate via wireless links within each other's radio range, while that are distant apart use other nodes as relay in a multi-hop routing function. As the nodes are mobile, the structure of the network changes dynamically and unpredictably over time. Ad-hoc networks are self-configuring and self-organizing, so to maintain communication between nodes in the network, each node behaves as a transmitter, a host and a router. It is an independent system of mobile hosts connected by wireless links. There is no stationary infrastructure such as base stations. If two hosts are not within radio range, every communication messages between them must pass through one or more intermediate hosts that act as routers. These hosts move around randomly, thus change the network topology with dynamism. Thus "Mobile Ad hoc Networks (MANET) are multi hop wireless networks that result from the cooperative engagement of a collection of mobile hosts without any centralized access point and infrastructure". Mobile nodes that are within the radio range communicate directly via wireless associations, while those that are far apart, rely on the other nodes to dispatch messages i.e. act as routers or hops.

II. MANET ROUTING PROTOCOLS

Routing is the act of moving information from a source to a destination in an internetwork. Routing algorithms in MANET should provide following primary expectations:

- Stable loop free connectivity
- Secure routing
- Reduced control overhead
- Have scalability and distributed routing
- Support QoS traffic prioritization
- Respond to changes in node mobility.

Proactive routing algorithm maintains routes to destination even if they are not required. Proactive routing algorithms maintain up-to-date routing information on every node in the network periodically.

Reactive routing algorithm routing tables are not updated up-to-date. Instead, a node tries to find a route only when it wants to send a packet.

Hybrid routing algorithm combines the advantages of both reactive and proactive routing algorithms. Initially proactive approach is used to have route information then reactively demand of the route is served to the needy node.

Ad hoc on-demand Distance Vector (AODV): In AODV, routing information is maintained in routing tables at nodes. Every mobile node keeps a next-hop routing table, which contains the destinations to which it currently has a route.

- It offers quick adaptation to dynamic link conditions.
- Low processing and memory overhead.
- Low network utilization, and determines unicast routes to destinations within the ad hoc network.

  Different types of route messages are used to maintain and discover the links that are: Route Request,Route Reply and Route Error.

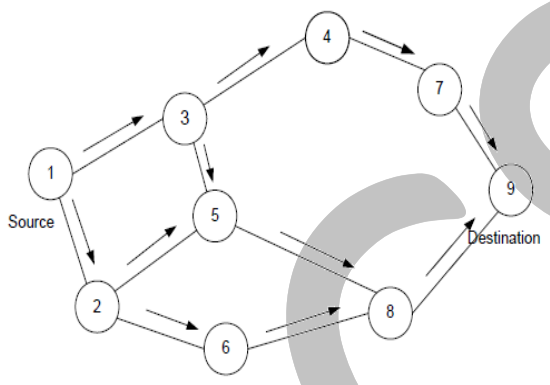

Figure1:The Flooding of Route Request Packet

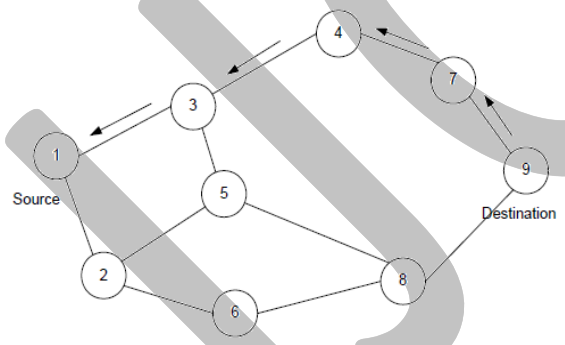

Figure2:The forwarding of Route Reply packet

Advantages AODV creates routes only on demand, which greatly reduces the periodic control message overhead associated with proactive routing protocols.

Disadvantages Route setup latency is exist when a new route is needed. AODV queues data packets while discovering new routes and the queued packets are sent out only when new routes are found. It causes throughput loss in high mobility scenarios, because the packets get dropped quickly due to unstable route selection.

Dynamic source routing algorithm (DSR): DSR is an On Demand routing protocol. . It uses the concept of source routing in which creates routes only when source requires. The DSR protocol works into two main mechanisms called Route Discovery and Route Maintenance.

Route Discovery is the mechanism in which a source node tending to send a packet to a destination obtains a source route to destination. It is initiated only when a source node wants to send packet to a destination and doesn't already know the route to it. And, then it maintains that route in the cache of the nodes.

Route Maintenance is the mechanism in which source node is able to detect the link failures to the destination. It then repairs the route or finds an alternate route. It is used only when source is sending packets to a destination. Route maintenance includes monitoring the routes against failure through route error messages and route cache.

One of the main benefit of DSR protocol is that there is no need to keep routing table so as to route a given data packet as the entire route is contained in the packet header .The limitations of DSR protocol is that this is not scalable to large networks and even requires significantly more processing resources than most other protocols.

III. RESULTS

The following table 1 shows the different observation parameters and requirements of AODV and DSR protocols.Figure3 and figure4 shows the Graphs between Window Size and No. Of Packets transferred when no.of nodes =50.

Table 1: Simulation Parameters

Parameter	Value
Simulation Time	150 Sec
No. of Nodes	15,50,70,100
No. of Receivers	15,50,70,100
Traffic Type	CBR
Pause Time	0.01 Sec
Maximum X-coordinate value	500M
Maximum Y- coordinate value	400 M
Packet Size	512 byte(minimum)
MAC Protocol	802.11
Mobility Model	Random Waypoint
Routing Protocols	AODV,DSR

Observation Parameters	WindowSize,Mean hop Count,Packet delivery ratio, No. of packets transferred,throughput

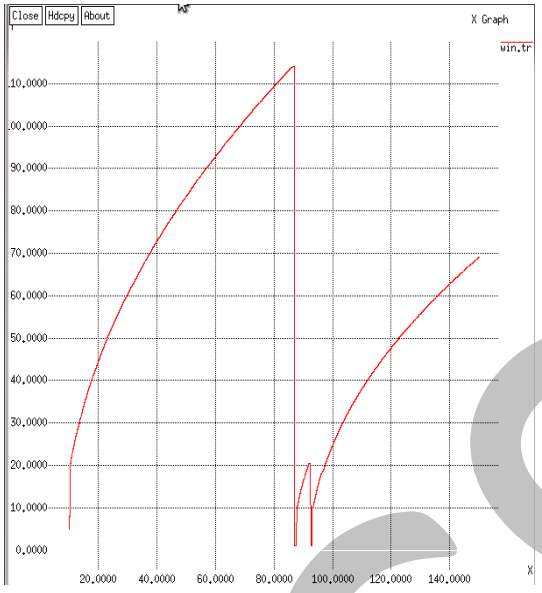

Figure 3: Graph showing Window size v/s No. of packets when nn=50 in AODV

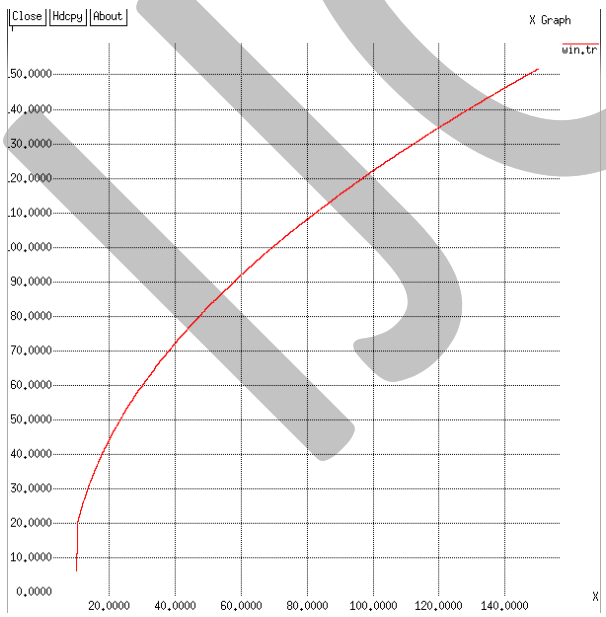

Figure 4: Graph showing Window size v/s No. of packets when nn=50 in DSR

Performance Metrics:

The simulations were performed using Network Simulator (NS-2), which is popularly used for ad hoc networking community. Random waypoint mobility scenario creates random mobility scene every time it is executed (using setdest command in ns2).

The routing protocols were compared based on the following performance metrics:

Packet Delivery Ratio (PDR): Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources. This performance metric gives us an idea of how well the protocol is performing in terms of packet delivery at different speeds and different pause time. The greater value of packet delivery ratio means the better performance of the protocol.

Throughput: This metric represents the total number of bits forwarded to higher layers per second. It is the average at which data packet is delivered successfully from one node to another over a communication network. It is usually measured in bits per second.

Throughput = (no of delivered packets * packet size) / total duration of simulation.

Mean Hop Count: It may be defined as the mean of number of the hops travelled by a packet.

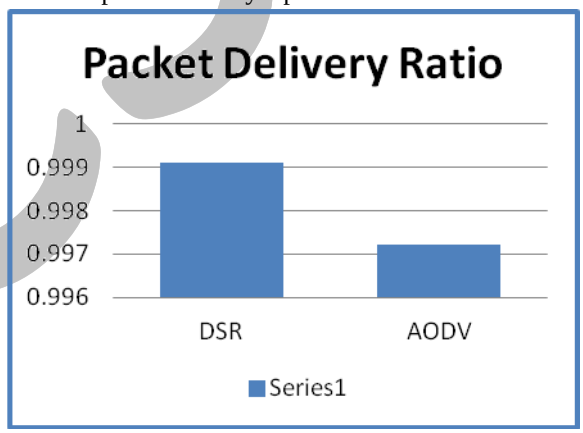

Figure 5: Bar Chart Showing Packet Delivery Ratio between AODV and DSR

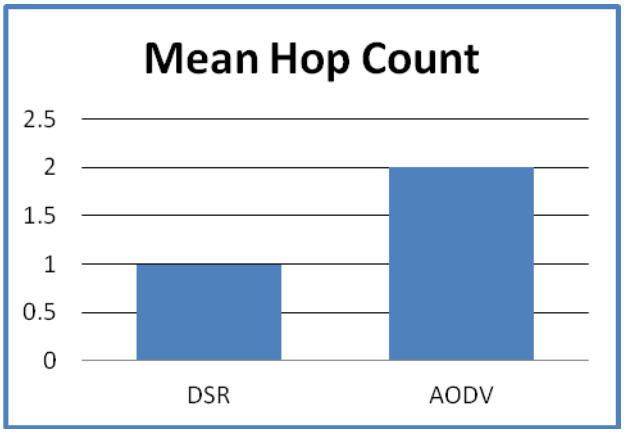

Figure 6: Bar Chart showing Mean Hop Count between AODV and DSR

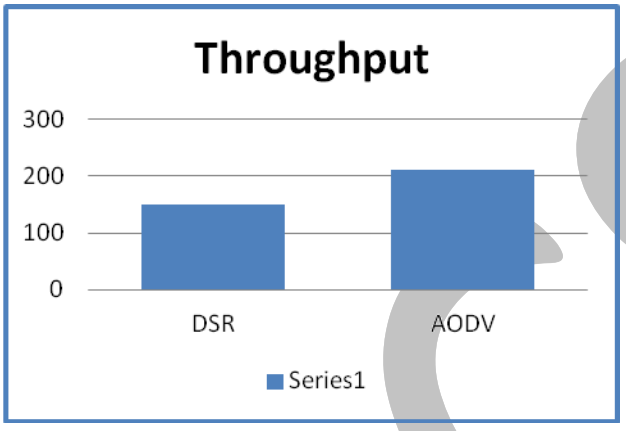

Figure 7: Bar Chart Showing Throughput between AODV and DSR

Figure5 to Figure7 shows that AODV protocol outperforms DSR in terms of throughput and Mean hop count whereas DSR outperforms AODV in terms of Packet Delivery Ratio. Hence this shows that AODV is more adaptive as it is continuously adjusts according to Network Size and maintains Window Size according to incoming traffic. For small configuration DSR may be suited for deployment .However, AODV is suited for large deployment.

IV. CONCLUSIONS

Performance in Mobile Ad-Hoc Network is major concern for the functionality of the networks. The Availability of network services, their confidentiality and data integrity can be achieved by assuring that all performance issues have been resolved. Mobile Ad Hoc Networks often suffer from bottle necks because of the Features Mobile Ad Hoc Networks supports with open medium, shifting topology, No central control monitoring or management, peer dependent algorithms and no defense mechanisms. Various measurement studies have demonstrated that network traffic can exhibit a noticeable impact on window queuing performance. However, many routing protocols developed for Mobile Ad Hoc Networks over the past few years have been primarily designed and analyzed under the assumptions of either CBR or Poisson traffic models, which are inherently unable to capture traffic self-similarity. In this work we have summarized the routing protocols including reactive, pro-active and also hybrid. We also worked on implementing performance analysis scenarios for the same. It was crucial to re-examine the performance properties of Mobile Ad Hoc Networks in the context of more realistic traffic models before practical implementation show their potential performance limitations. This work evaluates the performance of well-known and widely investigated Mobile Ad Hoc Networks routing protocols, AODV and DSR, in the presence of the inter node traffic. However, we also considers various performance metrices in which AODV protocol outperforms DSR in terms of throughput and Mean hop count whereas DSR outperforms AODV in terms of Packet Delivery Ratio.

V. FUTURE WORK

Mobile Ad-Hoc Networks are a collection of mobile nodes forming a ad hoc network without infrastructure or using any centralized access point. Data transmission between nodes, typically multiple hops is limited transmission range. The node mobility of the different nodes makes the situation even more complex. Various MANET routing protocols especially for these conditions have been developed over the years to tackle these problems. The main scope of this review work was to review routing protocols. In future of this research work, we will try to evaluate other protocols especially reactive protocols that have been recommended for operations in MANETs such as those for performing multicast and broadcast communication.

This work is about simulation and performance evaluation of AODV and DSR protocols in mobile Ad hoc networks. We simulated a Mobile ad hoc network with all nodes in the network receiving FTP traffic. The performance of these routing protocols is evaluated with respect to protocol window size and energy. As, not many studies have been done on the performance evaluation of routing protocols for measuring energy of nodes with respect to window protocol size for different MANET Protocols. It was crucial to re-examine the performance properties of Mobile Ad Hoc Networks in the context of more realistic traffic models before practical implementation show their potential performance limitations. This work evaluates the performance of well-known and widely investigated Mobile Ad Hoc Networks routing protocols, AODV and DSR, in the presence of the inter node traffic. More work can be done to find out other performance parameters like End to End delay, Routing load, etc which

will the case study worth producing specific decisions for selection of a particular protocol. In addition to it, we plans to investigate the performance of these protocols for congestion control mechanism by increasing the number of nodes for VBR traffic.

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