An Experimental Study of DSR algorithm for Ad-Hoc Networks

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Abstract

Mobile ad hoc network is a dynamic network. In this network the mobile nodes dynamically form a temporary network without any centralized administration or the use of any existing network infrastructure. A number of routing protocols like Ad Hoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR) and Destination-Sequenced Distance-Vector (DSDV) have been proposed. On-Demand Distance Vector Routing (AODV), Dynamic Source Routing protocol (DSR) are an efficient routing protocol designed specifically for use in wireless ad hoc networks of mobile nodes.

1. Introduction:

During the last few years,we all have witnessed a continously insreasing growth in the deployment of wireless and mobile communication networks. Mobile adhoc networks consist of nodes that are able to communicate through the use of wireless mediums and form dynamic topologies.The basic characterstics of these networks is the complete lack of any kind of infrastructure, and rherefore the absence of dedicated nodes that provide network management operations like the traditional routers in the fixed networks.In order to maintain connectivity in a mobile ad-hoc network all participating nodes hve to perform routing of network traffic.The co-operation of nodes cannot be enforced by a centralized administration authority since one does not exist.Therefore, a network layer protocol designed for such self-organized networks must enforce connectivity and secuirty requirements in order to guarantee the disrupted of the higher layer protocols.

In mobile ad-hoc networks, routing is a major topic, because there is no base station thar can reach all nodes via broadcast as in cellular network.Traditional routing algorithms do not work at all well in the huighly dynamic environment of ad hoc network, so extensions of existing or completely new protocols have to be applied.In general , on demand routing performs extremely well in large networks with light traffic route may break down, requiring multiple route discoveries on the way to destination. Routing load will grow [1][2] as the traffic load increases for on demand routing protocol, In case of 100 nodes and 40 nodes with uniform traffic pattern, the result show that DSR[3] and AODV[4] (both on demand routing protocol [5]) will generate more overhead than through put.

There may be several situations where users of a network cannot rely on an infrastructure, it is too expensive or there is none at all.Examples for the use of such mobile, wireless, multiple-hop ad hoc networks, which are only called ad-hoc networks here for simplicity, are:

1. Instant Insfrastructure

Unplanned meeting, spontenous inter personal communiucations etc. Cannot rely on any infrastructure.Infrastructures need planning and administration.

2.Disaster Relief

Infrastructure typically break down in disaster areas. Hurricanes cut phonwe and power lines, flood destroy base stations, fire burns servers.Emergency team can only rely on infrastructure they can set up themslves.

3.Remote Area

Even if infrastrucutre could be planned ahead, it is sometimes too expensive to set up an infrastructure in sparsely populated area.Depending on the communication pattern, ad hoc networks satellite infrastructuresn can be a solution.

4.Effectiveness

Services provides by existing infrastructures might be too expensive for certain applications.If, for example, only connection oriented cellular network existes, but an application sends only small status information every minute, a cheaper ad-hoc packet-oriented network might be a better solution.

One of the first ad-hoc wireless networks was the packet radio network started by ARPA in 1973. It allow up to 138 nodes in the ad-hoc network and use IP packet for the data transport. This made an easy connection possible to the APRA net, the starting point of today's Internet. Twenty radio channels between 1718.4-1840 Mhz were used offering hundred to four hundred k-bits/s.The system used DSSS with 128 oe 32 chips/bit.

2. Routing in Mobile Ad-Hoc Networks:

In wireless networks with infrastructure support a base station always reaches all mobile nodes, that is always the case in ad-hoc network. A destination node might be out of range of a source node transmitting packets.

Routing is needed to find a path between source and destination and to forward the packet appropiately.

In wireless networking using an infrastructure, cells have been defined.With in a cell the base station can reach all mobile nodes without via a broadcast. In case of adhocnetwork, each node must be able to forward the data from the other nodes.

Following are the fundamental differences between wired networks and ad-hoc wireless networks related to routing:

1. Asymmetric Links

2. Redundant Links

3.Interference

4.Dynamic Topology

the following observations concerning routing can be made for ad-hocnetworks for moving nodes:

1. Traditional routing algorithm[6] known for wired network will not work efficiently or fail completely. These algortihm have not designed with a highly, asymmetric links, or interface in mind.

2. Routing in wireless as hoc network cannot rely on layer knowledge alone. Information fron lower layer concerning connectivity or interface can help routing algorithm to find a good path.

3. Centralized approaches will not really work, because it takes toolong to collect current

status and dsseminate it again. With in this time the topology has already changed.

4.Many nodes need routing capabilities while there might be some without, at least one router has to be with in range of each node. Algorithm have to consider the limited battery power of these nodes.

Most od the existing routing protocols follows two diiferent dsign approached to confront the inherent characterstics of ad-hoc networks, namely table-driven and the source-initiated on demand approaches.

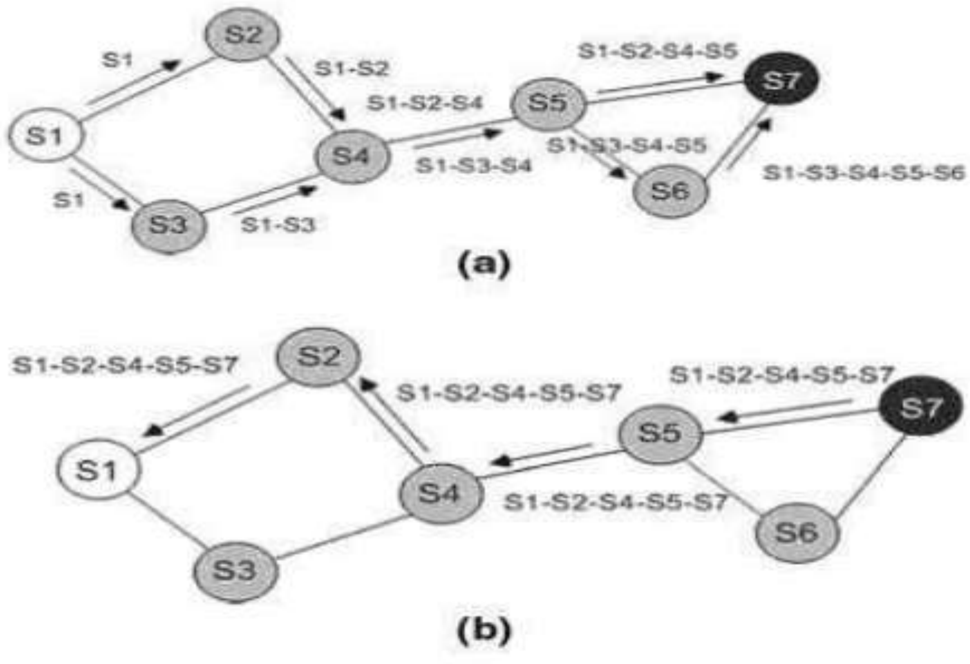
3. Dynamic Source Routing Protocol (DSR) protocol:

Determining source route requires accumulating the address of each device between the source and destination during route discovery[7][8]. The accumulated path information is cached by nodes processing the route discovery packets The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPV6 To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply[9] would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).

To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Request message header (this requires that all links are symmetric). In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error[10] packets are generated at a node. The erroneous hop will be removed from the node's route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most viable route.

In the following example, the route discovery procedure is shown where S1 is the source node and S7 is the destination node.



(a) Route Discovery (b) Using route record to send the route reply

In this example, the destination S7, gets the request through two paths. It chooses one path based on the route records in the incoming packet and sends a reply using the reverse path to the source node. At each hop, the best route with minimum hop is stored. In this example, it is shown the route record status ate each hop to reach the destination from the source node. Here, the chosen route is S1-S2-S4-S5-S7.

4. Advantages and Disadvantages:

a) DSR uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead.

b) The disadvantage of DSR is that the route maintenance mechanism does not locally repair a broken down link. The connection setup delay is higher than in table- driven protocols. Even though the protocol performs well in static and low-mobility environments, the performance degrades rapidly with increasing mobility. Also, considerable routing overhead is involved due to the source- routing mechanism employed in DSR. This routing overhead is directly proportional to the path length.

5. Difference Between DSR and AODV

Dynamic Source Routing (DSR) and AdHoc On Demand Distance Vector Routing (AODV) are both routing protocols for wireless mesh/ad hoc networks. Both the protocols employ different mechanisms that result in varied performance levels. DSR and AODV can be compared and evaluated based on the packet delivery ratio, normalized MAC[11] load, normalized routing load, and average end-to-end delay by altering the number of sources, speed, and pause time.

Both DSR and AODV are demand-driven protocols which form a route on demand when a transmitting computer desires a route. The main difference between DSR and AODV is the source routing feature. The DSR is based on source routing in which all the routing information such as is maintained at the mobile nodes. The DSR computes the routes and also updates them. The source routing is a technique in which the packet sender identifies the entire sequence of the node into which the packet has to pass through. The packet sender lists the route in the packet's header so that the next node to which the packet has to be transmitted can be identified by the address on the way to the destination host. The AODV[11] uses a combination of a DSR and DSDV mechanism. It uses the route discovery and route maintenance from a DSR and hop-by-hop routing, periodic advertisements, sequence numbers from DSDV. The AODV easily overcomes the counting to infinity and Bellman Ford problems, and it also provides quick convergence whenever the ad hoc network topology is altered.

When DSR and AODV are analyzed using a packet delivery ratio parameter by varying the paused time in the intervals of 0, 10, 20, 40, 100 the results obtained for both on demand routing protocols look similar.

The normalized routing[12] load is analyzed for both protocols by varying paused times. The values for the DSR protocol were less as compared to the AODV which show fairly stable results even after increasing the number of sources. If normalized routing load is stable, the protocol is considered to be scalable. The routing overhead for AODV is mainly from the route requests. DSR finds the route in the cache as a result of aggressive caching. This helps to avoid a frequent route discovery process in DSR thereby decreasing the routing overhead for DSR when compared to AODV.

6. Experimental study of DSR protocol

for simulation pupose for DSR protocol,node mobility is not considered in the following scenerio and topology of 800 m X 400 m for 100 seconds.The physical radio characterstics such as antenna gain, transmit power etc., Lucent Wave LAN DSS radio has been chosen. It has been simulated up to 30 nodes:

Routing Information of DSR for simulation

No of nodes	Average Delay	Through put	No of send bytes
10	.009227061674	0.9969418960244	343940
15	0.00911513885	0.99231950855854	542360
20	0.009625761021	0.99235474400611	343956
25	0..9625760121	0.9892944360856269	342870
30	0.009927681071	0.96928777527	344056

6.1 Average End-to – End Delay

As the experimental results express that, average reduces from some instant when node increases from 10 to 15,but it increases symmetrically when number of nodes increases.

6.2 Throughput

DSR protocol deliver a greater pergentage of the originated data packets when there is a little number of nodes.It becomes nearly 100% when there are about 10 nodes.It reduces sharpely when number of nodes increases.

6.3 Sent Bytes

DSR protocol uses on demand packets, it exhibit the desirabe property that the incremental cost of additional sources decreases as the sources are added.

7.Conclusion

In this work, performance of mobile ad hoc network routing protocol DSR and AODV has been studied and Performance carried out in terms of packet delivery ratio, packet miss ratio, Throughput, end to end delay, routing overhead and energy consumption. From the analysis, it is observed that packet delivery ratio, throughput decreases as node density and node speed increases. Also it is observed that end to end delay and routing overhead increases as node density and node speed increases for both protocols. Packet delivery ratio for AODV is better than DSR in high mobility condition. AODV shows more end to end delay at low and high speed in comparison to DSR. Also it is analyzed that AODV shows more routing overhead at low and high speed in comparison to DSR. Energy consumption in DSR is almost constant as the no. of nodes increases but in case of AODV it increases as no. of nodes increases.

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