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Comparison of Performance for on-Demand Routing Protocols in case of MANET with the help of NS2

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Abstract*— *Mobile ad hoc network (MANET) is a dynamic and self organized network, which is a collection of wireless mobile nodes (hosts) communicating with each other without any predefined infrastructure or centralized administration. Because of mobility of nodes there is no fixed topology and it may result to frequent link breakage. The primary goal of any ad-hoc network routing protocol is to meet the challenges of the dynamically changing topology and establish an efficient route between any two nodes with minimum routing overhead and bandwidth consumption. So an efficient protocol is required to find route between source and destination node. A several protocols have been introduced for improving the routing mechanism to find route between any source and destination host across the network. This paper analyses and compares the performance of AODV and DSR routing protocols in terms of packet size, number of traffic sources, mobility rate, topological area, number of nodes.

Keywords— ***DSR, AODV, Routing Protocol, MANET, NS2***.

I. INTRODUCTION

MANETs are autonomous self-forming, self-maintained, and self-healing, allowing for extreme network flexibility. MANET is a network of mobile routers (In MANET All nodes can behave as routers and take part in discovery and maintenance of routes to other nodes in the network.) connected by wireless communication links – the union of which form a random topology in an arbitrary manner. The routers are free to move randomly and organize themselves at random, thus the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a stand-alone fashion, or may be connected to the larger Internet. Wireless networking is an emerging technology that allows users to access information and services electronically, regardless of their geographic position. Minimal configuration and quick deployment make ad-hoc networks suitable for emergency situations like natural or human-induced disasters, military conflicts, emergency medical situations etc.

Different kinds of metrics or characteristics may be used to analyse the performance under varying scenarios.

II. ROUTING PROTOCOLS

Routing is a core process in the network and it is used to transmit the data packets from a source node to a given destination. Several routing protocols have been developed under the authority of mobile ad hoc networking group. The operational principles of VANET and MANET match in every aspect except high speed mobility and high nature of unpredictability of their movement. This suggests the applicability of most of the MANET routing protocols in VANET.
Some of the well known ad hoc routing protocols such as AODV (Ad-Hoc On Demand Distance Vector) and DSR (Dynamic Source Routing), Position-based, Cluster-based, Broadcast-based or Geocast-based. The routing protocols basically perform three main functionality route discovery, maintenance and selection of the efficient path from the various available paths.
The ad-hoc routing protocols can be divided into two categories:

A. Table-driven Routing Protocols

In table driven routing protocols, consistent and up-to-date routing information to all nodes is maintained at each node.

B. On-Demand Routing Protocols

In On-Demand routing protocols, the routes are created as and when required. When a source wants to send to a destination, it invokes the route discovery mechanisms to find the path to the destination. The motivation behind the on-demand protocols is that the "routing overhead" (typically measured in terms of the number of routing packets are transmitted, as opposed to data packets) is typically lower than the shortest path protocols as only the actively used routes are maintained. However, as some recent performance evaluation work has shown, the routing overhead still approaches to that of the shortest path protocols, if a moderate to large number of routes needs to be actively maintained (when, for

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example, there is a moderate to large number of active peer-to-peer conversations). This is because the on-demand protocols discover routes via a flooding technique, where the source (or any node seeking the route) floods the entire network with a query packet in search of a route to the destination. After receiving the query, each non-destination node propagates it to its neighbours via a wireless broadcast. Each query carries a unique identifier, which helps prevent multiple propagation of the same query by the same node. This technique guarantees that the query reaches all nodes in the same connected component. Thus, if the destination is reachable from the source, the query will eventually reach the destination.

The sequence of hops traversed by the first query message received by the destination defines the route to be used for sending data packets. On receiving the first query, the destination replies to the source by sending a route reply message. If the wireless links are symmetric, the reply goes back to the source just by retracing the route in the opposite direction. The actual mechanics of doing this varies from protocol to protocol. For example, the DSR (Dynamic Source Routing) protocol, builds the route incrementally as a sequence of nodes visited by the query, and stores it in the header of the query packet. The reply packet carries this route and simply traverses it backwards. The AODV (Ad Hoc On-Demand Distance Vector) routing protocol, on the other hand, maintains the route in a distributed fashion using routing tables in the nodes on the route.

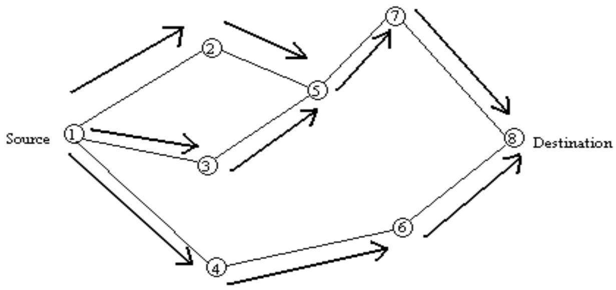
In recent years, a variety of new routing protocols targeted specifically at this environment have been developed. There are four multi-hop wireless ad hoc network routing protocols that cover a range of design choices:

Destination-Sequenced Distance-Vector (DSDV)
Temporally Ordered Routing Algorithm (TORA)
Dynamic Source Routing (DSR)
Ad Hoc On-Demand Distance Vector Routing (AODV)

While DSDV is a table-driven routing protocol and TORA, DSR, AODV fall under the On-demand routing protocols category.

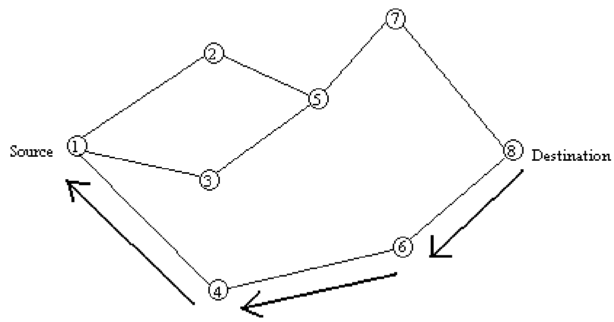
Ad-hoc On-Demand Distance Vector (AODV)

With some significant difference Ad Hoc on Demand Distance Vector (AODV) have combine functionality of DSDV and DSR routing protocol. It is reactive routing protocol that establishes route on-demand in source to destination node and does not require maintaining routes to node that are not communicating. It has the ability of unicast & multicast routing and use routing tables for maintaining route information. In this algorithm the sender node send a Route Request (RREQ) message to its neighbours for route discovery and after establishing route if any link failure occur than node send information to its upstream neighbour in form of Route Error (RRER) message. This process execute till sender node not receive the information of failure link, after receiving message sender node resend another RREQ message to find new route [4]. Advantage of this protocol is establishing on-demand route in between source and destination node with the lower delay in connection setup and does not require much memory for communication but there are several disadvantage with this protocol like if the source node sequence number is very old than the intermediate nodes can lead to route inconsistency. Heavy control overhead if there has multiple route reply packets for a single route request packet. It consumes extra bandwidth because of periodic beaconing.



(a) Propogation of Route Request (RREQ) Packet

Fig 1. RREQ in AODV



(b) Path taken by the Route Reply (RREP) Packet

Fig 2. RREP in AODV

Dynamic Source Routing (DSR)

Dynamic Source Routing (DSR) is designed specifically for multi-hop wireless ad-hoc network. Unlike other ad-hoc network protocol DSR not require any periodic routing message in network. This algorithm provides the route on-demand and the sender node knows the complete hop by hop route to the destination. The routes are store in route cache. Route discovery and maintenance are two major phases of this protocol.

At the time when node wants to send message, it check its route cache for searching the availability of unexpired route up to the destination from that node. If route is found than node start transmission of packet else start the route discovery process for searching new route in between source and destination node. Each route request packet carries the source node address, a new sequence number and the destination node id. The entire node that receiving route request packet checks the sequence number and rebroadcast that packet to it neighbours if it has not forwarded it already or that node is not the destination node after adding its address information in packet. The advantage of this protocol is that it provide on-demand routing path and does not require periodic packet that are used by a node to inform its presence to its neighbours. The control overhead is reduced by using the information efficiently from route cache by node to access the route for packet transmission that are already discovered but in this protocol path length effect the routing overhead and broken links in network does not repair locally at route maintenance process. This is the main limitation of this protocol that makes it unsuitable for large high mobility network [1].

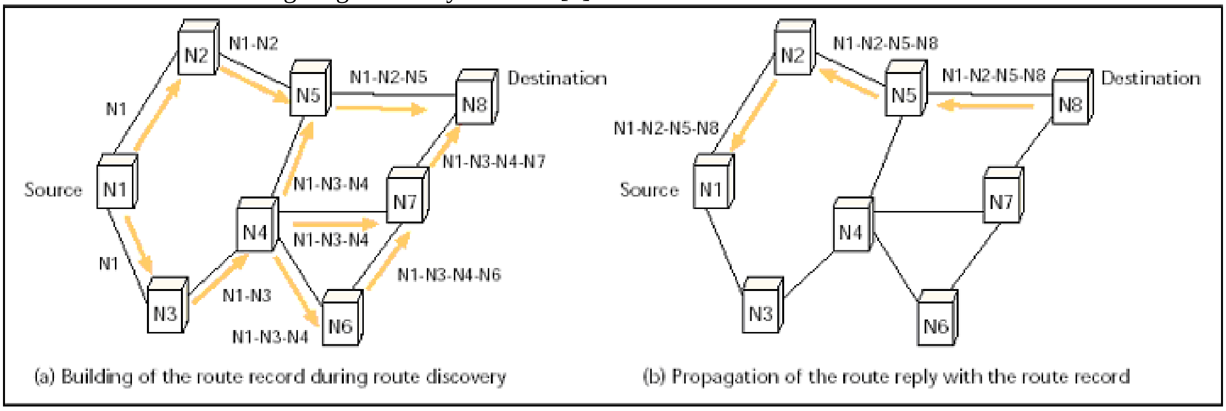


Fig 3. Route Creation in DSR

Cluster Based Protocols

It's a routing protocol which based on position and clusters. Each cluster has one cluster-head, which is responsible for intra and inter-cluster management functions. Intra-cluster nodes communicate each other using direct links, whereas inter-cluster communication is performed via cluster headers. In cluster based routing protocols the formation of clusters and the selection of the cluster-head is an important issue. In this protocol, the geographic area is divided into some foursquare grids. Only if there is a vehicle in a grid will a vehicle be elected to the cluster header, and the data packet is routed by cluster header across some grids one by one. In VANET due to high mobility dynamic cluster formation is a towering process. The various cluster based routing protocol are COIN, LORA-CBF, CBDRP.

Temporally Ordered Routing Algorithm (TORA)

The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive, efficient and scalable distributed routing algorithm based on the concept of link reversal. TORA is proposed for highly dynamic mobile, multihop wireless networks. It is a source-initiated on-demand routing protocol.

It finds multiple routes from a source node to a destination node. The main feature of TORA is that the control messages are localized to a very small set of nodes near the occurrence of a topological change. To achieve this, the nodes maintain routing information about adjacent nodes. The protocol has three basic functions: Route creation, Route maintenance, and Route erasure.

Each node has a quintuple associated with it –

Logical time of a link failure

The unique ID of the node that defined the new reference level

A reflection indicator bit

A propagation ordering parameter

The unique ID of the node

The first three elements collectively represent the reference level. A new reference level is defined each time a node loses its last downstream link due to a link failure. The last two values define a delta with respect to the reference level. Route Creation is done using QRY and UPD packets. The route creation algorithm starts with the height (propagation ordering parameter in the quintuple) of destination set to 0 and all other node's height set to NULL (i.e. undefined). The source broadcasts a QRY packet with the destination node's id in it. A node with a non-NULL height responds with a UPD packet that has its height in it. A node receiving a UPD packet sets its height to one more than that of the node that generated the UPD. A node with higher height is considered upstream and a node with lower height downstream. In this way a directed acyclic graph is constructed from source to the destination. Figure 3 illustrates a route creation process in TORA.

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As shown in figure node 5 does not propagate QRY from node 3 as it has already seen and propagated QRY message from node 2. In figure, the source (i.e. node 1) may have received a UPD each from node 2 or node 3 but since node 4 gives it lesser height, it retains that height. When a node moves the DAG route is broken, and route maintenance is needed to re-establish a DAG for the same destination. When the last downstream link of a node fails, it generates a new reference level. This results in the propagation of that reference level by neighbouring nodes. Links are reversed to reflect the change in adapting to the new reference level. This has the same effect as reversing the direction of one or more links when a node has no downstream links.

In the route erasure phase, TORA floods a broadcast clear packet (CLR) throughout the network to erase invalid routes. In TORA there is a potential for oscillations to occur, especially when multiple sets of coordinating

Nodes are concurrently detecting partitions, erasing routes, and building new routes based on each other. Because TORA uses internodes coordination, its instability problem is similar to the "count-to-infinity" problem in distance-vector routing protocols, except that such oscillations are temporary and route convergence will ultimately occur.

Applications of MANET:

Sensor Networks for environmental monitoring.
Rescue operations in remote areas.
Remote construction sites and Personal Area
Networking
Emergency Operations
Military battlefield
Civilian environments
Law enforcement activities
Commercial projects
Educational Class rooms

III. SIMULATIONS

A detailed simulation model based on NS-2 is used in the evaluation. In a recent paper the monarch research group at Carnegie-Mellon university developed support for simulating multi-hop wireless networks complete with physical, data link, and medium access control (MAC) layer models on ns-2. The distributed coordination function (DCF) of IEEE 802.11 for wireless LAN is used as the MAC layer protocol. An un-slotted carrier sense multiple access (CSMA) technique with collision avoidance (CSMA/CA) is used to transmit the data packets. The radio model uses characteristics similar to a commercial radio interface, lucent's WaveLan. WaveLan is modelled as a shared-media radio wit nominal bit rate of 2 mb/s and a nominal radio range of 250 m.

The protocols maintain a send buffer of 64 packets. It contains all data packets waiting for a route, such as packets for which route discovery has started, but no reply has arrived yet. To prevent buffering of packets indefinitely, packets are dropped if they wait in the send buffer for more than 30 s. All packets (both data and routing) sent by the routing layer are queued at the interface queue until the MAC layer can transmit them. The interface queue has a maximum size of 50 packets and is maintained as a priority queue with two priorities each served in FIFO order. Routing packets get higher priority than data packets.

Table I. Simulation Parameters

Parameter			
No. of Mobile Nodes	40	80	100
No. of Traffic sources	20	27	30
Type of traffic	TCP	TCP	TCP
Nodes Speed	(0-20) m/s	(0-20) m/s	(0-20) m/s
Packet Size	1024 bytes	1024 bytes	1024 bytes
Topology Area	1100* 1100 m*m	1100* 1100 m*m	1100* 1100 m*m

Metrics considered for performance evaluation are:
1 .Packet size Vs Average Throughput of Generating Packets.
2. Packet Size Vs Average Simulation End-to-End Delay.
3. Packet Send Time at Source Node Vs Simulation End-to-End Delay.

The table given above shows the three different sets that were considered for the experiment. The number of nodes was varied as 40,80,100 with the traffic sources 20,27 and 30 respectively. Also, some type of traffic sources were TCP. The packet size was taken to be the same 1024 bytes. Each of the mobile nodes selects a random destination at the specified time and moves towards it. The simulation ends just one second before the total simulation time, which is taken to be 400 seconds. When the packet size was further increased to 2048 bytes, there was a lot of network congestion and both of the protocols failed to deliver any results.

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IV. CONCLUSIONS

The objective of the dissertation work is to analyse and then do a simulation comparison of two on demand routing protocol for mobile ad hoc networks. The two reactive protocols that have been simulated and compared are: Dynamic source routing (DSR) protocol and Ad-Hoc On Demand Distance Vector (AODV) routing protocol. Although both of these protocols share the common feature of being Reactive in nature, yet they behave differently when subjected to identical network conditions in terms of packet size, number of traffic sources, mobility rate, topological area, number of nodes, mobility model.

REFERENCES

[1] S. M. Metev and V. P. Veiko, Laser Assisted Microtechnology, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.
[2] J. Breckling, Ed., The Analysis of Directional Time Series: Applications to Wind Speed and Direction, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
[3] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," IEEE Electron Device Lett., vol. 20, pp. 569–571, Nov. 1999.
[4] M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109.
[5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.
[6] (2002) The IEEE website. [Online]. Available: http://www.ieee.org/
[7] M. Shell.(2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEEtran/
[8] FLEXChip Signal Processor (MC68175/D), Motorola, 1996.
[9] "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.
[10] A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
[11] J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Reno congestion avoidance and control," Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
[12] Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, IEEE Std. 802.11, 1997.

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