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Comparative Performance Analysis of Routing Protocols for Mobile Ad-Hoc Networks

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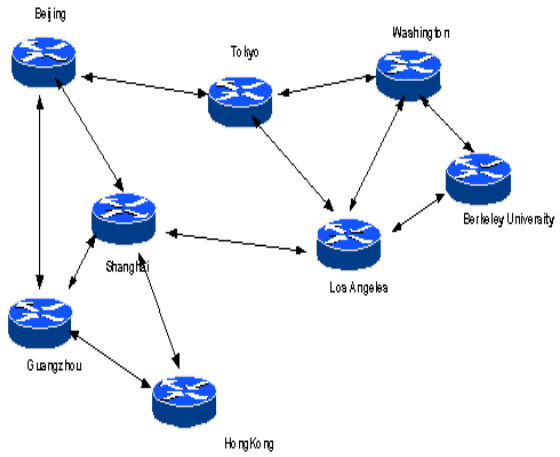
Abstract : Mobile Adhoc networks are dynamically changing and configuring networks. As the adhoc itself suggests that they are temporary networks where nodes are moving from one network to another network. Routing becomes a challenging task in this type of networks. Thus different protocols like DSR , AODV and DSDV are designed to provide efficient routing of packets in Mobile Adhoc networks. This paper focuses on performance comparison of these algorithms under different environments and different conditions.

Keywords : **MANET , Ad-Hoc networks , AODV , DSDV , DSR.**

1.Introduction

An ad hoc network is a set of wireless mobile nodes forming a transient network with a dynamic topology. Some possible uses of ad hoc networks include students using laptop computers to participate in an interactive lecture, business associates sharing information during a meeting, soldiers relaying information for situational awareness on the battlefield and emergency disaster relief personnel coordinating efforts after a hurricane or earthquake. Mobile Ad-hoc Network (MANET) is a collection of wireless mobile nodes which dynamically forms a temporary network without the use of any existing network infrastructure or centralized administration. Wireless Ad Hoc networks , also known as Mobile Ad Hoc multi-hop wireless networks is a collection of wireless mobile hosts making a transient network without the aid of any established infrastructure or centralized administration **[2]** . Mobile Ad Hoc Networks (MANETs) are characterized by a dynamic, multi-hop, fast changing topology. MANETs have several salient features : *1) Dynamic topologies 2) Bandwidth-constrained, links 3) Energy constrained operation 4) limited physical security*. A MANET uses multi-hop routing instead of a static network infrastructure to provide network connectivity. Routing protocols in MANETS has received huge interest in the past years due to the fact that existing internet routing protocols were designed to support fixed infrastructure and their properties were unfit

for mobile ad hoc networks. Routing is a core problem in networks for sending data from one node to another. The routing protocols for fixed networks cannot be directly used for wireless networks. Several routing protocols have been proposed for mobile Ad Hoc networks. The protocols are classified into reactive and proactive protocols.



Proactive/Table –Driven protocols: This type of protocols attempt to find and maintain consistent, up-to-date routes between all source-destination pairs regardless of the use or need of such routes and we need periodic control messages to maintain routes up to date for each nodes. They find routes in advance for all source and destination pairs and periodically update topology information to manage them [1]. DSDV is a proactive protocol.

Reactive/On Demand protocols: Routes are created only when a source node request them. Data forwarding is accomplished according to two main techniques: I) Source routing, II) Hop-by-hop routing [1]. They find the path only when there is data to be transmitted and as a result, generate low control traffic and routing overhead. AODV and DSR are reactive protocols.

2.Protocols

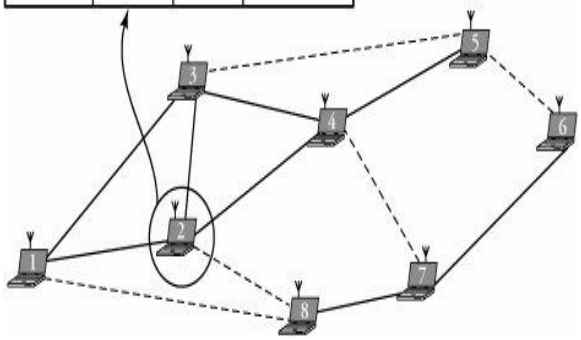
In this section , we will look at proactive protocols like DSDV and reactive protocols like DSR and AODV.

2.1. Destination Sequenced Distance Vector (DSDV)

It is a proactive protocol. As the name suggests it works in advance. DSDV is a table driven routing protocol based on the classical Bellman-Ford routing algorithm. In this routing protocol, each mobile node in the system maintains a routing table. The routing table has all of the destinations nodes and the number of hops to each destination. Each entry in the routing table has a sequence number assigned by the destination node. The route labeled with the highest sequence number is always used. By periodically updated messages, routing tables maintain consistent state. The data broadcast by each mobile node will have the new sequence number, the destination's address, the number of hops to reach the destination and the sequence number of the information obtained regarding that destination. When Node A determines that any destination node is unreachable, it advertises the next odd sequence number for the route that has failed with an infinite metric count. Any node that receives this infinite metric count updates its table for the matching route and waits till a greater sequence number with non-infinite metric count is received. Every mobile host also calculates the weighted average of the time taken to receive a route with the best metric. This time is called the settling time. DSDV solves the huge problem related to Distance Vector routing of wired networks i.e., Count-to-infinity, by using destination sequence numbers. The DSDV protocol advertises its own routing table to each of its current neighbors.

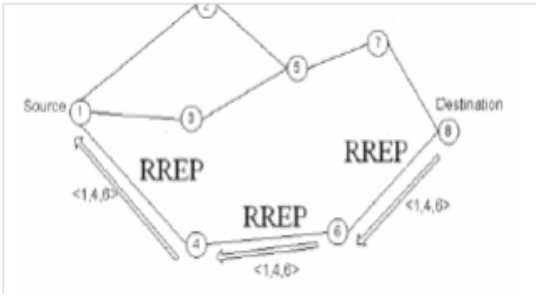
Routing Table for Node 2

Destination	Next Hop	Metric	Dest. Seq. No.
1	1	1	123
2	0	0	516
3	3	1	212
4	4	1	168
5	4	2	372
8	1	INF	432



2.2. Dynamic Source Routing (DSR)

DSR is a source initiated , reactive/on-demand protocol. This kind of routing generates routes only when desired. Since source routing is employed, the source node learns from what it hears. DSR doesn't force any use of regular messages from the mobile hosts for maintenance of routes. When a packet is to be sent to a destination whose route doesn't exist, a route discovery process is initiated. It is based on 2 main processes: (a) the route discovery process which is based on flooding and is used to dynamically find new routes, maintain them in nodes cache, (b) the route maintenance process, periodically finds and updates networks topology changes. Discovered routes will be cashed in the relative nodes. Once the route has been established, node maintains a route table that contains the source routes it has learnt about. When a better path is available appropriate changes are made to the route entry. If a node doesn't have a route to any particular destination, it sends a Route Request (RREQ) message, which is flooded in the network. Each RREQ packet is uniquely known by the initiator's address and the request id. Route is replied by the destination node in the form of RREQ using the Route Reply (RREP) message. Thus the route may be considered unidirectional or bidirectional. Also, DSR enables multiple paths to be learnt for a any destination. DSR does not require any regular update messages, thus avoiding wastage of bandwidth. DSR uses source routing which computes the routes when necessary explicitly lists this route in the packet's header, identifying each forwarding "hop" by the address of the next node to which to transmit the packet on its route to the destination host.



DSR (modified) Route Reply

2.3. AD-hoc On-Demand vector (AODV)

AODV is on demand/reactive protocol. Ad-hoc On-demand distance vector (AODV) is a variant of traditional distance vector routing algorithm. Like DSDV, AODV provides loop less routes in case of link breakage but unlike DSDV, it doesn't require global regular routing advertisement. In AODV, each host maintains a typical routing table. It uses the on-demand mechanism of discovery and route maintenance from DSR and the hop-by-hop routing and sequence number from DSDV. For each destination, AODV creates a routing table like DSDV, while DSR uses node cache to maintain routing information **[3]**.

3.Analysis

In a standard wireless mesh network, stationary mesh nodes provide routing and relay capabilities. Since MWMN implements mobility in the WMN, under mobile conditions although the nodes prefer AODV best for routing, due to the fact that timely availability of routes is mandatory, DSDV shows greater throughput. From this analysis we can come to a conclusion that DSDV performs better in providing throughput support for the MWMNs [4].

3.2. In wireless sensor networks

Comparing the different performance matrices such as packet delivery ratio (PDR), loss packet ratio (LPR), and average end to end delay (Average End to End) with varying pause time and number of node under TCP & CBR connection via network simulator NS2.35 for wireless sensor network [5] . In CBR, Data are sent at a fixed bit rate. In the network, constant bit rate are supplied. TCP is an oriented, reliable and conforming transport protocol .Packet Delivery Ratio = (Total Received) * 100/ (Total Sent Packets) . Average End to End Delay= (time packet received – time packet sent)/total no. of packet received . Loss Packet Ratio= (nSentPackets-nReceivedPackets) / nSentPackets) * 100 . The performance of AODV, AOMDV, DSR and DSDV can be changed according to different scenario. According to observation the performance of DSR is better than AODV, AOMDV and DSDV in TCP connection type. Also in CBR connection type, performance of AODV is better than AOMDV, DSDV and DSR.

3.3 Based on NCTUns simulation

The results indicate that the performance of the two on demand protocols namely DSR and AODV is superior to the DSDV. It is also observed that DSR outperforms AODV in less stressful situations, i.e smaller number of nodes. AODV outperforms DSR in more stressful situations [6]. The poor delay and packet delivery ratio of DSR is mainly due to caching and lack of mechanisms to expire stale routes.

3.1. In Mobile Wireless Mesh Networks

3.4 Using OPNET 11.0 network modelling environment from OPNET technology

In all results, OLSR shows the best performance in terms of data delivery ratio and end-to-end delay [7] .

3.5 Based on NS2 simulation

We analyze that performance of DSDV protocol is not good as throughput is very low and routing load is very high as compared to AODV and DSR protocols. AODV performed good in some situations than DSR protocol but overall DSR is performing better than AODV protocol like if we compare average end to end delay. There is no effect on the performance of DSDV protocol if packet size. AODV and DSR protocols perform better at less packet size. Performance of all three protocols decrease as mobility of nodes increase [8] .

4.Conclusion

According to the requirements, different protocols behave differently in each situation. Thus , the performance of protocols depends on the requirements , network parameters .ie. throughput , delay , overhead etc.

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