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A Result based comparison of DSDV, AODV and DSR routing protocols

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Abstract: *Mobile Ad Hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any centralized administration, in which individual nodes cooperate by forwarding packets to each other to allow nodes to communicate beyond direct wireless transmission range. Routing protocols of mobile ad-hoc network tend to need different approaches from existing Internet protocols because of dynamic topology, mobile host, distributed environment, less bandwidth, less battery power. Ad Hoc routing protocols can be divided into two categories: table-driven (proactive schemes) and on-demand routing (reactive scheme) based on when and how the routes are discovered. In Table-driven routing protocols each node maintains one or more tables containing routing information about nodes in the network whereas in on-demand routing the routes are created as and when required. The table driven routing protocols is Destination Sequenced Distance Vector Routing protocols (DSDV).The on-demand routing protocols are Ad Hoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR).Here we compare these protocols different parameters such as packet delivery fraction, good put(average throughput),energy consumed(in Joules) and the no of forwardline used and compare the performance of these routing protocols using NS2 environment.*

Keywords: *MANET, DSDV, AODV, DSR, NS2*

1. INTRODUCTION

A. Destination Sequenced Distance Vector Routing Algorithm:

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for adhoc mobile networks based on the Bellman-Ford algorithm. It was developed by C. Perkins and P. Bhagwat in 1994.It eliminates route looping, increases convergence speed, and reduces control message overhead. In DSDV, each node maintains a next-hop table, which it exchanges with its neighbours. There are two types of next-hop table exchanges: periodic full-table broadcast and event-driven incremental updating. The relative frequency of the full-table broadcast and the incremental updating is determined by the node mobility. In each data packet sent during a next-hop table broadcast or incremental updating, the source node appends a sequence number. This sequence number is propagated by all nodes receiving the corresponding distance-vector updates, and is stored in the next-hop table entry of these nodes. A node, after receiving a new next-hop table from its neighbour, updates its route to a destination only if the new sequence number is larger than the recorded one, or if the new sequence number is the same as the recorded one, but the new route is shorter. In order to further reduce the control message overhead, a settling time is estimated for each route. A node updates to its neighbours with a new route only if the settling time of the route has expired and the route remains optimal.

2. Source Initiated On Demand Routing

A. Ad Hoc On Demand Distance Vector Routing (Aodv):

The Ad hoc On-Demand Distance Vector (AODV) algorithm enables dynamic, self-starting, multihop routing between participating mobile nodes wishing to establish and maintain an ad hoc network. AODV allows mobile nodes to obtain routes quickly for new destinations, and does not require nodes to maintain routes to destinations that are not in active communication. AODV allows mobile nodes to respond to link breakages and changes in network topology in a timely manner. The operation of AODV is loop-free, and by avoiding the Bellman-Ford "counting to infinity" problem offers quick convergence when the adhoc network topology changes (typically, when a node moves in the network). When links break, AODV causes the affected set of nodes to be notified so that they are able to invalidate the routes using the lost link. Route Requests (RREQs), Route Replies (RREPs) and Route Errors (RERRs) are message types defined by AODV.

B. Dynamic Source Routing Protocol (Dsr):

The Dynamic Source Routing protocol (DSR) is an on demand routing protocol. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. Using DSR, the network is completely self organizing and self-configuring, requiring no existing network infrastructure or administration. The DSR protocol is composed of two main mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network:

 Route Discovery is the mechanism by which a node S wishing to send a packet to a destination node D obtains a source route to D. Route Discovery is used only when S attempts to send a packet to D and does not already know a route to D.

 Route Maintenance is the mechanism by which node S is able to detect, while using a source route to D, if the network topology has changed such that it can no longer use its route to D because a link along the route no longer works. When Route Maintenance indicates a source route is broken, S can attempt to use any other route it happens to know to D, or it can invoke Route Discovery again to find a new route for subsequent packets to D. Route Maintenance for this route is used only when S is actually sending packets to D.In DSR Route Discovery and Route Maintenance each operates entirely on demand.

3. . METHODOLOGY

In this section we have described about the tools and methodology used in our paper for analysis of adhoc routing protocol performance i.e. about simulation tool, simulation model, simulation environment performance metrics used.

A. Simulation Tool:

In this paper the simulation tool used for analysis is NS-2 which is highly preferred by research communities. NS is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks. NS2 is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. This means that most of the simulation scripts are created in Tcl(Tool Command Language). If the components have to be developed for ns2, then both tcl and C++ have to be used.

B. Why We Chosen Ns-2?

NS-2 is chosen as the simulation tool among the others simulation tools because NS-2 supports networking research and education. Ns-2 is suitable for designing new protocols, comparing different protocols and traffic evaluations. NS-2 is developed as a collaborative environment. It is distributed freely and open source. A large amount of institutes and people in development and research use, maintain and develop NS-2. This increase the confidence in it. Versions are available for FreeBDS, Linux, Solaris, Windows, Mac OS X. NS-2 also provides substantial support for simulation of TCP, UDP, routing and multicast protocols over wired and wireless networks.

C. Simulation Model:

We run the simulation in Network Simulator (NS-2) accepts as input a scenario file that describes the exact motion of each node and the exact packets originated by each node, together with the exact time at which each change in motion or packet origination is to occur. The detailed trace file created by each run is stored to disk, and analyzed using a variety of scripts, particularly one called file *.tr that counts the number of packets successfully delivered and the length of the paths taken by the packets, as well as additional information about the internal functioning of each scripts executed. This data is further analyzed with AWK file and Microsoft Excel to produce the graphs.

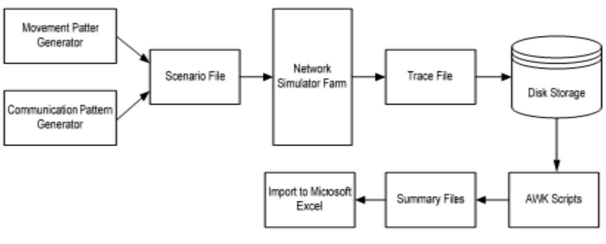

Figure 1: Overview of simulation model

D. Simulation Environment:

The performance analysis is done on Linux Operating System. Ns –allinone-2.34 was installed.

Scenario 1

Platform	Linux Operating System
NS version	Ns –allinone-2.34
Simulation time	50 s
Number of nodes	20 wireless nodes
Traffic	CBR(Constant Bit Rate)
Packet size	1000 bytes
Simulation Area size	1500 x 900 m
Node speed	20 m/s

Table 1: Simulation parameters for scenario 1

Scenario 2

Platform	Linux Operating System
NS version	Ns –allinone-2.34
Simulation time	50 s
Number of nodes	30 wireless nodes
Traffic	CBR(Constant Bit Rate)
Packet size	1000 bytes
Simulation Area size	1900 x 900 m
Node speed	50 m/s

Table 2: Simulation parameters for scenario 2

E. Performance Metrics:

The following parameters are selected for scenario 1 and scenario 2.

1) Packet Delivery fraction

The packet delivery ratio in this simulation is defined as the ratio between the number of packets sent by constant bit rate sources and the number of received packets by the CBR sink at destination.

2) Goodput

Throughput is total number of successful received packet at destination during simulation time and goodput is the average throughput in kbps.

3) **Energy Consumed**

It is the difference between the initial energy and the final energy. Here we consider initial energy as 30 Joules and the final energy is the energy which is utilised by the node after simulation. And the average energy is calculated by ratio of total energy/ number of nodes.

4) **Forward Line**

The total number of lines used by the source node to send the packets to the destination node.

4. RESULT

For Nodes =20, Simulation time=50ms					
	Parameters				
Protocols	Goodput(Avg. Throughput) in kbps	Packet Delivery fraction		Energy Consumed (in Joules)	Forward line
		Received	Sent	Total Energy	
AODV	32.79	117	1838	583.475	1619
		Ratio = 0.0637			
DSR	98.13	426	1804	4357.75	2712
		Ratio=0.2361			
DSDV	32.92	195	6125	432.1	962
		Ratio=0.0318			

Table 3: Protocols comparison on different parameters for 20 nodes

For Nodes =30, Simulation time=50ms					
Protocols	Parameters				
	Goodput(Avg Throughput) in kbps	Packet Delivery fraction		Energy Consumed (in Joules)	Forward line
		Received	Sent	Total Energy	
AODV	34.92	178	6125	652.998	2169
		Ratio = 0.0291			
DSR	68.87	312	1888	5567.04	3120
		Ratio=0.1653			
DSDV	130.44	636	2496	401.822	42
		Ratio=0.2548			

Table 4: Protocols comparison on different parameters for 30 nodes

5. Conclusion

i) For Node =20

a) DSR performs better than AODV and DSDV in case of packet delivery fraction and goodput because the number of nodes is less and no periodic update is maintained in DSR.

b) In case of energy consumption as the number of nodes used for the communication between source and destination are more compared to AODV and DSDV, so the energy consumed by nodes and forward lines in DSR is more as compared to AODV and DSDV.

ii) For Node =30

a) DSDV performs better than AODV and DSR in case of packet delivery fraction and goodput. Because the increase in speed of movement of node and as the nodes becomes more stationary will lead to more stable path from source to destination.

b) DSR consumes more energy as the number of nodes used for the communication between source and destination are more compared to AODV and DSDV, and also the number of forward lines used in DSR is more.

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