Archana Patidar, M.Chiranjeevi / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 1, January -February 2013, pp.390-392

Performance Evaluation of Two Reactive Routing Protocols In MANET

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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 stand-alone infrastructure or centralized administration. Mobile ad-hoc network have the attributes such as wireless connection, continuously changing topology, distributed operation and ease of deployment. In this paper we have compared the performance of two reactive MANET routing protocol AODV and DSR by using NS-2. Both share similar On Demand behavior, but the protocol's internal mechanism leads to significant performance difference. We have analyzed the performance of protocols by varying type of traffic (UDP and TCP). A detailed simulation has been carried out in NS-2. The metrics used for performance analysis are Packet Delivery Ratio, Throughput, Average end-to-end Delay.

Keywords: MANET, TCP, UDP

1. Introduction

Mobile networks can be classified into infrastructure networks and Mobile Ad Hoc Networks (MANET) according to their dependence on fixed infrastructures [2].In an infrastructure mobile network, mobile nodes has wired access points (or base stations) within their transmission range. In contrast, Mobile Ad Hoc networks are autonomously self-organized networks without support of infrastructure. In a Mobile Ad Hoc Network, nodes move arbitrarily, therefore the network may experience rapid and unpredictable topology changes. Routing paths in MANETs potentially contain multiple hops, and every node in MANET has the responsibility to act as a router [4]. Routing in MANET has been a challenging task ever since the wireless networks came into existence. The major reason for this is the constant change in network topology because of high degree of node mobility. A number of protocols have been developed to accomplish this task. Several performance evaluation of MANET routing protocols using UDP traffic have been done by considering various parameters such as mobility, network load and pause time. Biradar, S. R. et. al. [8] have analyzed the AODV and DSR protocol using Group Mobility Model and UDP traffic sources. Biradar, S. R. et. al. [8] investigated that DSR performs better in high mobility and average delay is better in case of AODV for increased number of groups. Also Rathy, R.K. et. al. [8] investigated AODV and DSR routing protocols under Random Way Point Mobility Model with TCP and UDP traffic sources. They concluded that AODV outperforms DSR in high load and/or high mobility situations. In this paper we have investigated the performance of AODV and DSR On-Demand (reactive) routing protocol for performance comparison in the scenario. The purpose of this work is to understand there working mechanism and investigate that which routing protocol gives better performance in which situation. The rest of the paper is organized as follows. In section 3, we have given the brief introduction of AODV and DSR routing protocol. Section 4 and 5 deals with the simulation setup and results obtained on the execution of simulation. Finally, conclusion is drawn in section 5.

3. Description of Routing Protocol

3.1 Ad-Hoc on Demand Distance Vector (AODV). The Ad-hoc On-demand Distance Vector routing protocol [1, 3] enables multihop routing between the participating mobile nodes wishing to establish and maintain an ad-hoc network. AODV is a reactive protocol based upon the distance vector algorithm. The algorithm uses different types of messages to discover and maintain links. Whenever a node wants to try and find a route to another node it broadcasts a Route Request (RREQ) to all its neighbors. The RREQ propagates through the network until it reaches the destination or the node with a fresh enough route to the destination. Then the route is made available by uncasing a RREP back to the source. The algorithm uses hello messages (a special RREP) that are broadcasted periodically to the immediate neighbors. These hello messages are local advertisements for the continued presence of the node, and neighbors using routes through the broadcasting node will continue to mark the routes as valid. If hello messages stop coming from a particular node, the neighbor can assume that the node has moved away and mark that link to the node as broken and notify the affected set of nodes by sending a link failure notification (a special RREP) to that set of nodes.

3.2 Dynamic Source Routing (DSR)

DSR is a reactive routing protocol i.e. determines the proper route only when packet needs to be forwarded [4]. For restricting the bandwidth, the process to find a path is only executed when a path is required by a node (On-Demand Routing). In DSR the sender (source, initiator) determines the whole path from the source to the destination node (Source-Routing) and deposits the addresses of the intermediate nodes of the route in the packets. Compared to other reactive routing protocols like ABR or SSA, DSR is beacon-less which means that there are no hello-messages used between the nodes to notify their neighbors about their presence. DSR was developed for MANETs with a small diameter between 5 and 10 hops and the nodes should only move around at a moderate speed. DSR is based on the Link-State Algorithms which mean that each node is capable to save the best way to a destination. Also if a change appears in the network topology, then the whole network will get this information by flooding. The DSR protocol is composed of two main mechanisms that work together to allow discovery and maintenance of source routes in MANET.

Route Discovery: When a source node S wishes to send a packet to the destination node D, it obtains a route to D. This is called Route Discovery. Route Discovery is used only when S attempts to send a packet to D and has no information of a route to D.

Route Maintenance: When there is a change in the network topology, the existing routes can no longer be used. In such a scenario, the source S can use an alternative route to the destination D, if it knows one, or invoke Route Discovery. This is called Route Maintenance**.**

4 Performance Metrics

A number of quantitative metrics that can be used for evaluating the performance of MANET routing protocols. We have used the following metrics for evaluating the performance of two on-demand reactive routing protocols (AODV & DSR).

4.1 Packet delivery ratio

Packet delivery ratio is the fraction of packets sent by the application that are received by the receivers and is calculated by dividing the number of packets received by the destination through the number of packets originated by the application layer of the source. For better performance of a routing protocol, it should be better [9].

4.2 Throughput

The throughput is defined as the total amount of data a receiver receives from the sender divided by the time it takes for the receiver to get the last packet. The throughput is measured in bits per second (bit/s or bps) [9].

4.3 Average End-to-End Delay (second)

This includes all possible delay caused by buffering during route discovery latency, queuing at the interface queue, retransmission delay at the MAC, propagation and transfer time. It is defined as the time taken for a data packet to be transmitted across an MANET from source to destination.

D = (Tr –Ts)

Where Tr is receive Time and Ts is sent Time [9].

5. Simulation Setup

We have used Network Simulator (NS)-2 in our evaluation. The NS-2 is a discrete event driven simulator [5,6] developed at UC Berkeley. We have used Red Hat Linux environment with version NS-2.34 of network simulator. NS-2 is suitable for designing new protocols, comparing different protocols and traffic evaluations. It is an object oriented simulation written in C++, with an OTcl interpreter as a frontend. NS uses two languages because simulator got to deal with two things: i) detailed simulation of protocols which require a system programming language which can efficiently manipulate bytes, packet headers and implement algorithms, ii)research involving slightly varying parameters or quickly exploring a number of scenarios. The movement of nodes in the Group Mobility model is generated by a software called Mobility Generator which is based on a frame work called Important (Impact of Mobility Patterns on Routing in Ad-hoc Network, from University of Southern California)[7].In the scenario we have considered four group with twelve node and one group leader in each.

Table 1: Simulation Parameters

Parameter	Value
Simulator	NS-2.34
Protocols	AODV,DSR
Traffic Source	UDP,TCP
Radio Model	Two Ray Ground Propagation Model
Mobility Model	Random Way Point
Application Agent	CBR,FTP
Number of Nodes	5,10,15
Max. Simulation Time	450 Sec
MAC	802.11
Antenna	Omni Directional Antenna
Simulation Time(sec)	2,4,6,8,10,12,14

Table 2: UDP Traffic Pattern Comparisons:

Performance Metrics	Protocols					
	AODV			DSR		
No of Nodes	5N	10N	15N	5N	10N	15N
PDR	73.74	90.46	89.08	84.18	94.66	96.18
THROUGHPUT	20.85	19.28	22.14	34.42	28	27.8
END TO END DELAY	0.0028	1.692	2.74	0	0.815	0.72

Table 3: TCP Traffic Pattern Comparison:

Performance Metrics	Protocols					
	AODV			DSR		
No of Nodes	5N	10N	15N	5N	10N	15N
PDR	75.96	89.97	88.84	82.83	97.38	94.59
THROUGHPUT	32.71	12.57	24.14	20.57	11.71	18.71
END TO END DELAY	0.0028	0	0.257	0.257	0.017	1.2

5. Conclusions

I have compared two On-demand routing protocols, namely, Ad hoc On-Demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR).The simulation of these protocols has been carried out using NS-2 simulator. The significant observation is, simulation results agree with expected results based on theoretical analysis. In this project, two routing protocol are used and their performance have been analyzed using random waypoint model with respect to three performance metrics such as packet delivery ratio, throughput and average end to end delay with different traffic sources. In UDP traffic pattern DSR perform well in PDR and average end to end delay but AODV is better in throughput of dropped packets. All over performance of DSR is better in UDP traffic pattern. In TCP traffic pattern DSR perform well in PDR and throughput of dropped packets but AODV performance is better in average end to end delay. DSR perform well in both the traffic pattern. AODV and DSR perform well in TCP traffic pattern. All over performance of TCP traffic pattern is better.

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