International Journal of Technology and Science, ISSN (Online) 2350-1111, (Print) 2350-1103 Volume 3, Issue 4, 2016 pp. 61-63

Comparative Study of Routing Protocols in MANET Using Network Simulator

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***Abstract*—. Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes that dynamically form a network temporarily without any support of central management. Moreover, Every node in MANET moves arbitrarily making the multi-hop network topology to change randomly at uncertain times. There are several familiar routing protocols like AODV, DSR, and DSDV which have been proposed for providing communication among all the nodes in the wireless network. Here we represent performance comparison AODV, DSR and DSDV based on metrics such as good put, control overhead, packet delivery ratio and average end-to-end delay by using the NS-2 simulator.**

Index Terms- MANET, AODV,DSR, DSDV.

I. Introduction

The fast growth of communication in recent years is especially observed in the field of mobile system, wireless local area network, and ubiquitous computing The rapid growth in the mobile communication is mainly due to the mobility offered to end users, providing information access to anywhere, easy deployment, and user friendliness. The set of mobile terminals that are placed in a close location communicating with each other, sharing services ,resources or computing time during a limited period of time and in a limited space forms Spontaneous ad hoc networks. Network management should be transparent to the user. These types of networks have independent centralized administration user can enter the networks and leave the networks easily.

One of the important research areas in MANET is establishing and maintaining the ad hoc network through the use of routing protocols [1]. However there are so many routing protocols present, this paper focus only considers AODV, DSR and DSDV for performance comparisons due to its familiarity among all other routing protocols.

These routing protocols are analyzed based on the important metrics such as control overhead, throughput, packet delivery ratio and average end-to-end delay and is presented with the simulation results obtained by NS-2 simulator.

Comparisons of the overall performance of the three protocols AODV,DSR and DSDV based on the throughput, control overhead , packet delivery ratio and average end-to-end delay metrics and showing concludes which protocols[2] are better among these three routing protocols.

A **network simulator** is software that predicts the behavior of a computer network. Since communication Networks have become too complex for traditional analytical methods to provide an accurate understanding of system behavior network simulator are used. In simulators, the computer network is typically modeled with devices, links, applications etc. and the performance is analyzed. Simulators typically come with support for the most popular technologies and networks in use today. In 1996-97, ns version 2 (ns-2) was initiated based on a refactoring by Steve McCann. Use of Tcl was replaced by MIT's Object Tcl (OTcl), an object-oriented dialect Tcl. The core of ns-2 is also written in C++, but the C++ simulation objects are linked to shadow objects in OTcl and variables can be linked between both language realms. Simulation scripts are written in the OTcl language, an extension of the Tcl scripting language. Presently, ns-2 consists of over 300,000 lines of source code, and there is probably a comparable amount of contributed code that is not integrated directly into the main distribution (many forks of ns-2 exist, both maintained and unmaintained).

II. Overview of Routing Protocols

In this section, a short overview of the routing operations performed by the well-known protocols DSDV, AODV and DSR[3] are discussed.

Destination-Sequenced Distance-Vector (DSDV) protocol

(DSDV) is a table driven routing scheme for ad-hoc mobile networks based on the Bellman-ford algorithm. The improvement made to the Bellman-Ford algorithm includes freedom from loops in routing table by using sequence numbers. Each node acts as a router where a routing table is maintained and periodic routing updates are transfer, even if the routes are not necessary. A sequence number is associated with each route or path to the destination to prevent routing loops. The Routing updates are exchanged even if the network is idle which uses up battery and network bandwidth. So, it is not preferable for highly dynamic networks.

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Ad hoc On-Demand Distance Vector Routing (AODV)

AODV is an On –Demand routing protocol which is confluence of DSDV and DSR. Route is calculated on demand, just as it is in DSR via route discovery process. On the other hand, AODV maintains a routing table where it maintains one entry per destination unlike the DSR that maintains multiple route cache entries for each target. AODV provides loop free routes while repairing link breakages but, DSDV doesn't require global periodic routing advertisements

Dynamic Source Routing (DSR)

Dynamic Source Routing is a Pure On-Demand routing protocol, where the route is calculated only when it is necessary. It is designed for use in multi hop ad hoc networks of mobile nodes. DSR allows the network to be self-organized and self-configured without any central administration and network setup. It uses no periodic routing messages like AODV, thus reduces bandwidth overhead and conserved battery power and also huge routing updates.

III. SIMULATION AND ANALYSIS METHOD

A packet consists of control information and user data, which is also known as the payload. Control information provides data for delivering the payload, for example, source and destination network addresses, error detection codes, and sequencing information. Typically, control information is found in packet headers and trailers. NS2 use Tcl language [4,5]for creating simulation scenario file shown in figure 1 (for example, sample.tcl). Network topology, transmission time, using protocol [6,7,8]. are defined in scenario file. If we execute this scenario file, the simulation result will be output to out.tr and out.nam file.

out.tr- all the information about communication is written in this file. We can find out the way a packet was forwarded. This file is called as trace file.

out.nam - contains the data for animation of the experiment result. This file can be executed by Nam, animation software.

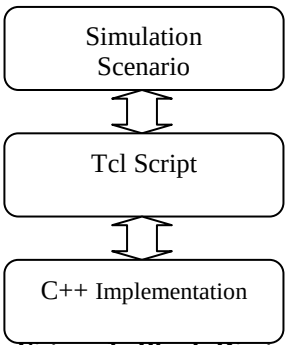

Figure 1: Block Diagram

- **Simulation Scenario**

NS2 use Tcl language for creating simulation scenario file (for example, sample.tcl). Network topology, transmission time, using protocol etc. are defined in scenario file. If we execute this scenario file, the simulation result will be output to out.tr and out.nam file.

- **Tcl Script :** Tcl script for ns is used to simulates a simple topology. First of all, you need to create a simulator object. This is done with the command set ns [new Simulator].

- **C++ Implementation**

C++ defines internal mechanism of each block. It does things like packet forwarding, scheduling events, collecting statistic, and so on.

The Routing protocols were compared based on 4 parameter metrics given below.

Packet delivery Ratio:

Packet Delivery Ratio (PDR) is the ratio between the number of packets transmitted by a traffic source and the number of packets received by a traffic destination. It measures the loss rate as seen by transport protocols and as specific to both the correctness and efficiency of ad hoc routing protocols. A great packet delivery ratio is desired in any network

Average End-to-End delay:

The packet End-to-End delay is the average time that a packet takes to travel the network. This is the time from the generation of the packet in the sender up to its reception at the destination's application layer and it is measured in seconds. Therefore includes all the delays in the network such as transmission times, buffer queues and delays induced by routing activities and MAC control exchanges.

Throughput

Throughput defined as the ratio of the total amount of data that reaches a receiver from a sender to the time it takes for the receiver to get the last packet.

Control overhead:-

Refers to the time it takes to transmit data on a packet-switched wireless network. Each packet requires extra bytes of format information that is stored in the packet header and combined with the assembly and disassembly of packets, decreases the overall transmission speed of the raw data.

By varying No. of nodes:

By changing number of nodes then measure the parameter values such as control overhead, normalized routing overhead, delay, packet delivery ratio, throughput and jitter by keeping the speed of the node is constant.

IV. SIMULATION RESULT

Here we present output of the simulation we created nodes and NAM is tcl/tk based animation tool that provides animation or Nodes, Links, Queues, Packets and Agents. The figure 1 shows the NAM output of the simulation where nodes are and randomly placed with random topology. Here we setting the default parameter by considering seven nodes and thirty nodes for MAC 802.11 and analyzing AODV, DSR, DSDV protocol and the parameters are mentioned in the bellow table 1

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Area (Flat Grid Topology)	300 X 500 m
Pause time	10s
Max Speed	20ms
UDP Traffic	3Conn

Table.1.Simulation parameter

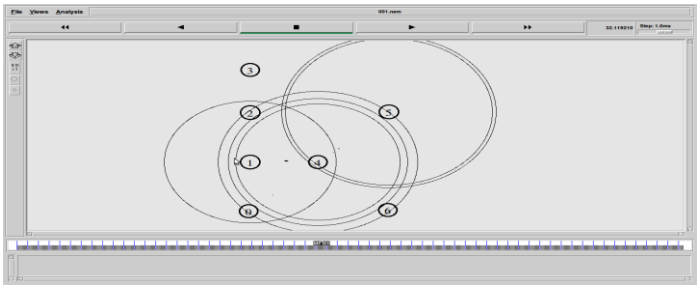

Fig 1: Nam Output

Protocol	Number of nodes	Through put	Packet Delivery Fraction	Delay
AODV	10	2538	98.77	0.4365
	30	2398	98.56	0.03299
	50	2469	99.47	0.00929
DSR	10	50869	98.05	0.2956
	20	23425	99.46	0.1012
	30	2379	99.47	0.0090
DSDV	10	661	99.46%	0.0122
	30	15377	60.72	0.01044
	50	21741	88.43	0.0074

Table 1: Comparison table for 10, 30, and 50 nodes

As it can be seen from the above simulation, end to end delay is higher in AODV followed by DSR and DSDV having the lowest and most stable End to End Delay in mobility. By increasing number of nodes in small area then reduce the end to end delay in AODV and increasing speed of the node then increase the delay in AODV. In DSR and DSDV slightly lower delay compared to AODV

Conclusion

DSDV performance is the best considering its ability to maintain connection by periodic exchange of data's. As far as Throughput is concerned, but AODV and DSR perform better than the DSDV even when the network has a large number of nodes. Overall, our simulation work shows that AODV performs better in a network with a larger number of nodes whereas DSR performs better when the number of nodes is slight. Average End-to-End Delay is the least for DSDV and does not change if the no of nodes are increased. Thus, we find that AODV is a viable choice for MANETs. In this paper, we have done complete analysis of the four MANET's routing protocols.

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