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Performance analysis of AODV and DSR Routing Protocols using NS2 Simulator

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Abstract: *Path routing and protocol collections are the crucial tactics to design any wireless network. In Mobile Adhoc Network (MANET) the nominated protocol should have best in terms of data delivery and data reliability. Hence the performance analysis of the protocols is the main step before selecting a specific protocol. In this paper, the performance analysis is approved out on Adhoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR) protocols using NS2 simulator. The delay, throughput, control overhead and packet delivery ratio are the four collective measures used for the comparison of the performance of overhead protocols.*

Keywords: *Mobile Adhoc Network; Routing protocols; NS2 (Simulator); Throughput; Delay; Packet Delivery Ratio; Control Overhead. Network simulator*

I. Introduction

The Ad hoc networks consist of hosts interrelated by routers without a fixed infrastructure and can be prepared dynamically. Significant work has been ended in the improvement of routing protocols in various types of ad hoc networks like MANETs, WMNs, WSNs, and VANETS etc. [1]. In current years, the attentiveness in ad hoc networks has grown due to the accessibility of wireless communication devices that work in the ISM bands. Though designing an ad hoc network in particular we are afraid with the capabilities and limitations that the physical layer imposes on the network performance. Later in wireless networks the radio communication links are unreliable so it is necessary to come up with an integrated design covering of physical, MAC and network layers. The main vision of MANET is to support strong and effective operation in wireless networks by incorporating routing functionalities at each mobile node.

For such designing features of ad hoc networks Routing-based methodology, Information-theoretic approach, Dynamic control approach or Game-theoretic approach has been applied [2]. In MANET to support mobile computing a mobile host must be able to communicate with other mobile hosts which may not lie inside its radio transmission range. Hence routing protocols will want to perform four important functions as determination of network topology, maintaining network connectivity, transmission scheduling and channel assignment, and packet routing. Routing protocols in MANETs were recognized based on the design objectives of minimal control overhead, minimal processing overhead, multi hop routing capability, dynamic topology conservation and loop prevention [3]. Sorting on routing protocols in MANETs can be done on routing tactic wise or network structure wise. According to routing strategy the routing protocols can be classified as table-driven or proactive and source-initiated or reactive or on-demand routing. Each of these categories of protocols performs differently on different wireless circumstances. Hence the performance analysis of these protocols is a must task to know its performance and work in that environment. Several factors will affect the inclusive performance of any protocol operating in an ad hoc network. For example, node mobility may cause link failures, which undesirably impact on routing and quality of service (QoS) support. Network size, control overhead, and traffic intensity will have a significant impact on network scalability along with inherent features of ad hoc networks may result in unpredictable variations in the overall network performance. The principal objective of this paper is to estimate and measure the effects of many factors that may stimulus network performance. While there has been performance analysis of ad hoc networks [4-6] still some of the significant factor estimation is also missing. Again none of these papers have equated with OLSR as a routing protocol and also they have not measured geographical network size into account.

We emphasized on the performance metrics of end-to-end delay, throughput, control overhead, and packet delivery ratio. The above metrics are validated for variable network load, variable mobility and variable network size. The remainder of this paper is organized as follows. Section 2 gives a brief idea on the different routing protocols used for performance analysis. Section 3 describes the simulation methodology and performance metrics.

II. Simulation Methodology And Performance Metrics

2.1 Simulation Methodology:

To analyze the overall performance of routing protocols simulation is done by using Network simulator. We have considered two routing protocols AODV (AdHoc on Demand Distance Vector) and DSR (Dynamic Source Routing). There are various routing protocols available for network analysis such as DSDV (Destination Sequenced Distance Vector), DSR and AODV etc. A route or path is predefined in DSDV from source to destination. The path is randomly updated and data packets do not follow same path or route for whole time it changes its route with update which allows more bandwidth. The communication takes place only when needed in AODV hence it is called On Demand routing protocol. AODV is the mixer of On Demand and Distance Vector. On Demand means communication takes place when desirable otherwise not needed and Distance Vector means link protocol. AODV and DSR are both reactive protocols. DSR is also On Demand protocol which allows the network to be completely self-configuring and self-organizing. All nodes dynamically discover a route or path from source to destinations.

To carry out network performance several simulators are available in market which provides output according to network. Generally for home automations AdHoc network is considered, called Mobile Ad hoc Networks (MANETs). The word is combination of three words i.e. Mobile means portable or changeable, AdHoc means for specific purpose, Network means Flexibility data application for communication of network. Several routing protocols have been presented regarding communications using MANETs. Selecting a routing protocol according to data transmission is very important issue to evaluate network performance of wireless Mobile AdHoc Networks (MANETs).

In this paper, the detail analysis and simulation of network is presented using Network Simulator (NS-2.35) with different routing protocols and traffic models.

2.2 NS2 (Network Simulator):

The network simulator is basically used to analyze the performance of routing protocols of wired and wireless networks. Here NS2 is used to carry out the performance of AODV and DSR routing protocols under different traffic models. The NS2 is simply a tool used to prove useful in studying the nature of communication networks. The main components of NS2 are NS, OTcl file, Nam file, Trace file and Awk etc. Firstly we installed the NS2 kit based on "allinone" suit by running the install script then verify essential functionality of components in NS2. Various models are available in Network Simulator but we used according to our applications.

2.2.1 Node Model:

Node model is used for processing capabilities, memory capacity, energy source etc. Firstly we developed a new model then define it after defining validates the model and use it.

2.2.2 Node Deployment Model:

Node deployment model is used for placement of nodes and its position a uniform model. The position of node is defined according to network area space and movement of nodes at different speed.

2.2.3 Packet Loss Model:

Packet Loss model is used for packet drop or packet loss in network model.

2.2.4 Traffic Model:

Traffic is for traffic that nodes send source to destination. The traffic model used in this paper is CBR (Constant Bit Rate) and UDP (User Datagram protocol) Model.

2.3 Simulation Methods and Parameters:

The aim of our analysis is to measure and analyze the effect of different traffic conditions with various factors and parameters on the performance of mobile AdHoc networks (MANETs). The effect of different traffic models with different packet size and number of nodes is very different on performance of routing protocol in Mobile AdHoc Networks.

2.4 Performance Metrics:

The second aim of this paper is to present comparison performance between two protocols AODV and DSR under different traffic conditions. In comparing the two protocols, the simulation is done in the following metrics:

1) Packet Delivery ratio (PDR): The total number of received data packets divided by total number of packet generated.
2) End to End Delay: Data packet received time by destination minus data packet generated time by source OR Time taken by data packet to reach the destination.
3) Throughput: The rate of successfully transmitted data packet per second during simulation of network.
4) Packet Loss: PL is given by the following formula
Packet loss= (no. of packets generated at source-no. of packets received at destination)/no. of packets generated at source

2.5 Simulation parameters for AODV and DSR routing protocols:

This analysis includes the simulation of 10, 20, 30, 40, 50 nodes. Total simulation time is 10 ms. i.e. time between the starting of simulation and ending of the simulation. Traffic type is CBR and TCP. Data rate is 11 Mbps. Bandwidth is also 11Mbps.Maximum packets in queue is 50.

The simulation parameters are defined in below table:

Channel type	Wireless Channel
Propagation model	Propagation/Two Ray Ground
Network interface type	Phy/WirelessPhy
MAC protocol type	Mac/802_11
Queue type	Queue/Drop Tail/PriQueue
Link layer type	LL
Antenna type	Antenna/Omni Antenna
Max packet in queue	50
Routing Protocol	AODV and DSR
Agent trace	ON
Router trace	ON
Mac trace	ON
Movement trace	ON
Simulation time	10 ms
Transmission range	500meters

III. Results And Analysis Of Network Simulator

Packet delivery ratio:

Figure 1 shows the simulation results of packets delivery ratio. We can see that under low traffic load as 10 nodes to 30 nodes. DSR perform same as AODV, but when the number of nodes becomes more, PDR of AODV decreases which means under more traffic packet delivery ratio of DSR is better than AODV.

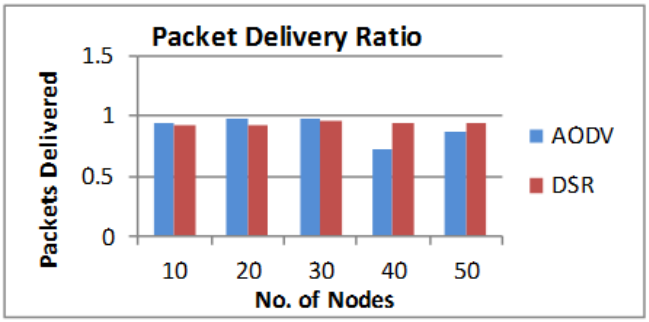

Fig 1: Packet delivery ratio

Throughput Transferred:

Figure 2 shows throughput, rate of data transmission with different traffic load. Initially rate of data transmission of AODV is greater than DSR it is up to 45 Kb/s. As traffic increase throughput of AODV decreases up to 20Kb/s. Throughput transferred of DSR is better than AODV at more number of nodes.

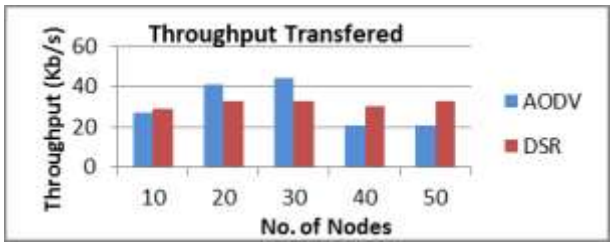

Fig 2: Throughput Transferred

Throughput Generated:

Figure 3 show throughput generated, rate of generation of data with number of nodes. Throughput generated for low traffic is more in AODV up to 60 Kb/s. As traffic increases throughput of DSR is also increases up to 40 Kb/s. Throughput of DSR is better than AODV.

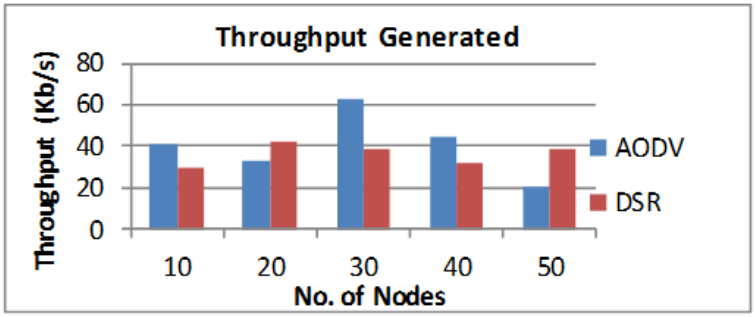

Fig 3: Throughput Generated

End to End delay:

Figure 4 shows End to End delay of DSR is less than AODV. End to end delay of AODV is between 1.3-2.5 sec.. And end to end delay of DSR is between 1-0.95 sec.

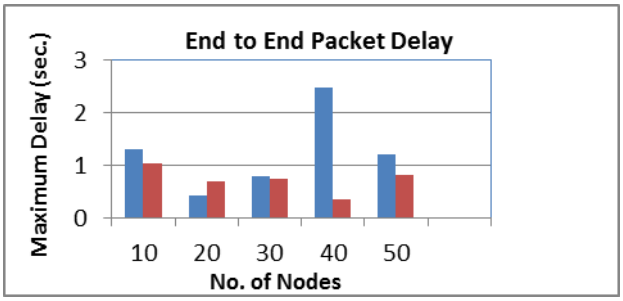

Fig 4: End to End delay

Packet Jitter:

Figure 5 shows data packet jitter of DSR is less than AODV. Packet jitter of AODV is between 0.4-1.6 sec.. And packet jitter of DSR is between 0.2-0.4 sec..

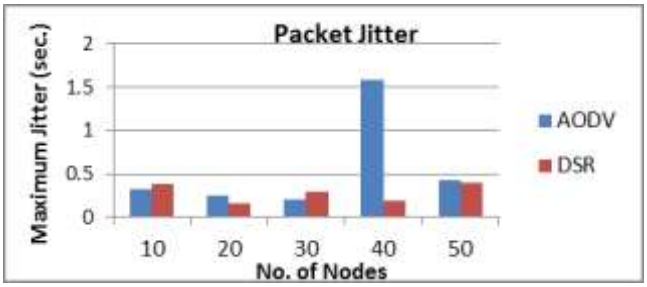

Fig 5: Packet Jitter

Packet Generated:

Figure 6 shows data packet generated of DSR is more than AODV. The total number of packets generated increases with increase in number of nodes in DSR but generation of packets decreases as number of nodes increases in AODV. In DSR up to 200 packets are generated but in AODV up to 150 packets. Hence more data packets are generated in DSR than AODV.

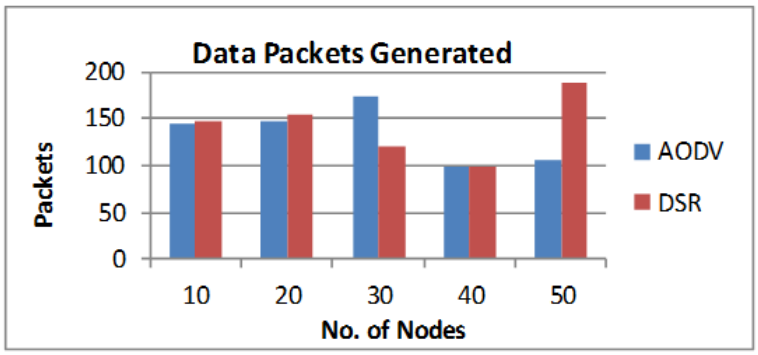

Fig 6: Packet Generated

Packet Dropped:

The figure 7 shows the comparison of AODV and DSR routing protocol in terms of packet drop. Packet drop is depends on the number of packets dropped down during transmission of data packets. DSR receives almost all packets from source as compare to AODV. Hence, packet drop in AODV is greater than DSR. For AODV, packet drop is 8-30. Packet drop of DSR is 3- 10.

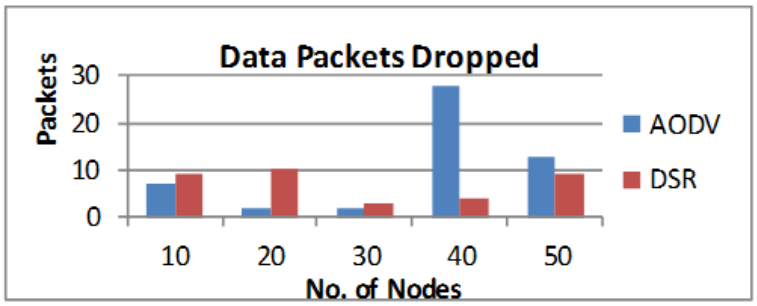

Fig 7: Packet Dropped

Packet Transferred:

Figure 8 shows data packet transferred of DSR is more than AODV. The total number of packets transferred increases with increase in number of nodes in DSR but transmission of packets decreases as number of nodes increases in AODV. In DSR up to 180 packets and in AODV up to 160 packets are transmitted. Hence more data packets are transferred in DSR than AODV.

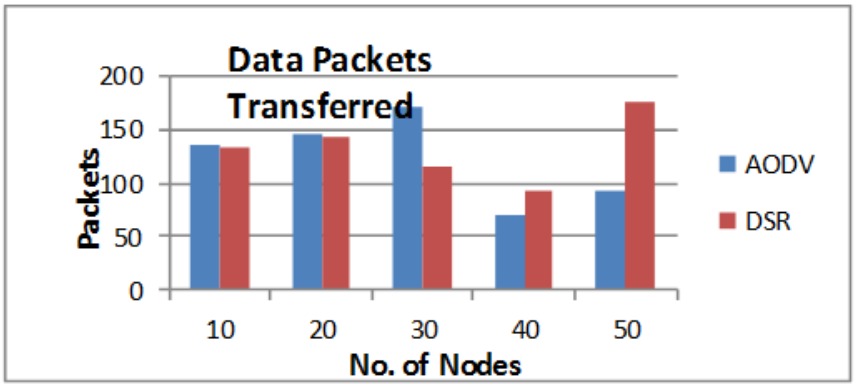

Fig 8: Packet Transferred

IV. Simulation Conclusion

We used a detailed simulation model to demonstrate the network performance analysis of the two routing protocols. The general observation from the simulation is that for application oriented metrics such as end to end delay and packet delivery ratio. The DSR performs is less stressful situations than AODV. The poor delay and throughput performances of AODV are mainly attributed. Aggressive caching, however, seems to help AODV at low traffic loads and also keeps its routing load down. We also observe that packet generated, packet transferred, packet loss, packet dropped all parameters are weak in AODV compare with DSR. The DSR performance is very good with high transferred rate, more packets generated and packet loss is very less. The successful test on the comparison of AODV andDSR shows that our network performance will increases by this simulation of NS-2 and it is beneficial for internet of things to choose best routing protocols.The proposed system is designed and implemented under NS2 platform in Linux atmosphere. The performance of DSR routing protocol is superior with different measuring parameters. DSR protocol is the enhanced solution for every traffic circumstance. In upcoming, we enlarge the quality of service of DSR protocol by purposed a boost version of DSR protocol named Multipath DSR. Multipath DSR formulate the existing protocol more consistent, reliable and efficient.

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