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Performance Evaluation of AODV and DSDV Routing Protocols for Ad-hoc Networks

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Abstract - Ad-hoc networks are basically self organizing and self configuring multi-hop mobile wireless network in which the information packets are transmitted in a store and forward manner from a source to an arbitrary destination via intermediate nodes. The main objective of this paper is to performance evaluation of AODV (Ad-hoc on demand distance vector) and DSDV (Destination sequence distance vector) routing protocols on the basis of different performance metrics. In this paper, an attempt has been made to evaluate the performance of two well known routing protocols AODV, DSDV by using three performance metrics such as throughput, packet delivery ratio and Routing overheads. The Performance evaluation has been done by using simulation tool NS2 (Network Simulator) which is the main simulator.

Keywords : *AODV, DSDV, dsr, ns2.*

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Abstract - Ad-hoc networks are basically self organizing and self configuring multi-hop mobile wireless network in which the information packets are transmitted in a store and forward manner from a source to an arbitrary destination via intermediate nodes. The main objective of this paper is to performance evaluation of AODV (Ad-hoc on demand distance vector) and DSDV (Destination sequence distance vector) routing protocols on the basis of different performance metrics. In this paper, an attempt has been made to evaluate the performance of two well known routing protocols AODV, DSDV by using three performance metrics such as throughput, packet delivery ratio and Routing overheads. The Performance evaluation has been done by using simulation tool NS2 (Network Simulator) which is the main simulator.

IndexTerms : *AODV, DSDV, dsr, ns2.*

I. Introduction

Wireless networking is an emerging technology that allows user to access information and services electronically, regardless of their geographic position. Wireless network can be classified in two types- Infrastructure networks and Infrastructure Less networks or Ad-hoc Networks [6].

Infrastructure Networks:-Infrastructure network consist of fixed and wired gateways. A mobile host communicates with a bridge in the network (called base station) within its

Communicate radius. The mobile unit can move geographically while it is communicating. When it goes out of Range of one base station, it connects with new base station and start communicating through it. This is called handoff. In this approach the base station are fixed [7].

Infrastructure Less (Ad-hoc) Networks:-Ad-hoc networks are collection of wireless mobile hosts forming a temporary network without the aid of any centralized administration or stand-alone infrastructure [1]. Ad-hoc network are basically peer-to-peer self organizing and self configuring multi-hop mobile wireless network where the structure of the network changes dynamically [2]. This is mainly due to the mobility of nodes [3]. Nodes in this network utilize the same random access wireless channel, cooperating in friendly manner to engaging themselves in multi-hop Forwarding. The nodes in the network not only act as hosts but also as routers that route data to/from other nodes in the network [2].

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Routing is used to decide best suitable path for packet transmission from one place to another place. In this paper an attempt has been made to evaluate the performance of proactive and reactive routing protocols. Ad-hoc network flat routing protocols may classify as:-

Proactive routing (Table-driven) protocols:- Proactive routing or table- driven routing protocols attempt to maintain consistent, up-to date routing information from each node to every other node in the network. These protocols require each node to maintain one or more tables to store routing information, and they respond to change in network topology by propagating route update throughout the network to Maintain consistent network view.

Reactive (On-demand) routing protocols:-In reactive or on demand routing protocols, the routes are created as when required. When a source wants to send to a destination, it invokes the route discovery mechanism to find the path to the destination. This process is completed when once a source is found or all possible route permutation has been examined. Once a route has been discovered and established, it is maintained by some form of route maintenance procedure until either the destination becomes inaccessible along every path from the source or route is no longer desired.

With the increase of portable of devices as well as progress in wireless communication, Ad-hoc network gaining importance with the increasing number of widespread application. The following point shows the importance of ad hoc networks:

Instant Infrastructure: Unplanned meetings, spontaneous interpersonal communications etc., cannot rely on any infrastructure, it needs planning and administration. It would take too long to set up this kind of infrastructure; therefore ad-hoc connectivity has to setup [6].

Disaster Relief: Infrastructure typically breakdown in disaster areas. Hurricanes cut phone and power lines, floods destroy Base stations, fires burn servers. No forward planning can be done, and the set-up must be externally fast and reliable. The same applies to many military activities, which are, to be honest, one of the major driving forces behind mobile ad-hoc networking research [9].

Effectiveness: Service provided by existing infrastructure might be too expensive for certain

applications. If, for example only connection oriented cellular network exist, but an application sends only small status information every other minute, cheaper ad-hoc packet-oriented network might be a better solution. Registration procedure might take too long and communication overheads might be too high with existing networks. Tailored ad- hoc networks can offer a better solution [5].

Remote Areas: Even if infrastructure could be planned ahead, it is sometimes too expensive to set up an infrastructure in sparsely populated areas. Depending on the communication pattern, so ad-hoc networks or satellite infrastructure can be a solution [9].

Other applications of wireless ad-hoc networking are Due to their quick and economically less demanding deployment, this network finds applications in several areas. Some of these include: military applications, collaborative and distributed computing, emergency operations, wireless mesh networks, wireless sensor networks, and hybrid wireless network [6].

II. Chalanges of Manet

The major issues that affect the design, deployment, performance of an ad-hoc network wireless system are as follows:

Packet losses due to transmission errors:- Mobile ad hoc network experiences a much higher packet losses due to some factors such as high bit error rate (BER) in the wireless channel, increased collision due to the hidden terminal problem, presence of interference, location dependent contention, unidirectional links, frequent path break due to node mobility and the inherent fading property of wires medium [6].

Route changes due to mobility: The network topology in an ad-hoc wireless network is highly dynamic due to mobility of nodes; hence an on-going session may suffer from frequently path breaking. This session often leads to frequent route changes therefore mobility management itself is very vast research topic in ad-hoc networking [7]. Security issues: The radio channel is used for ad-hoc wireless network is broadcast in nature and is shared by all the nodes in the network. Data transmitted by a node is received by all the nodes within its direct transmission range. So attacker can easily snoops the data being transmitted by a node in the network. Here the Requirement for confidentiality can be violated if an adversary is able to interpret the data gathered through snooping [6].

Limited wireless transmission range: In wireless network the radio band will be limited and hence data rates it can offer are much lesser than what a wired network can offer. This requires an optimal manner by keeping the overhead as low as possible [6].

Routing overhead: In wireless ad hoc networks, nodes often change their location within the network. So stales route are generated in the routing tables which lead to unnecessary routing overhead.

Battery constraints: This is one of the limited resources that form a major constraint for the node in an ad hoc network. Devices used in these networks have restriction on the power source in order to maintain portability, size, and weight of the device. [7].

Potentially frequent network partition:- The randomly moving nodes in an ad- hoc can lead to network partition. In major cases the intermediate nodes are the one which are highly affected by this partitioning [7].

Asymmetric links: Most of the wired networks rely on the symmetric links which are always fixed. But this is not a case with ad hoc networks as the nodes are mobile and constantly changing their position within network. Consider a MANET where node c sends a signal to node B but does not tell anything about the quality connection in the reverse direction [8].

III. Classification of Routing Protocols

Ad-hoc network routing protocols may be classified in many ways depending on their routing algorithm, network structure communication model, and state of information etc, but most of the protocols depending on their routing algorithm, and network structure [3][10].

Based on the network structure ad-hoc network classify as Flat routing, hierarchical routing, geographical position assisted routing. Flat routing covers two types of routing protocols based on routing algorithm.

Based on the Routing algorithms, routing protocols are classified as Proactive routing protocols and Reactive Routing protocols.

- Proactive Routing: DSDV (Destination Sequence Distance Vector Routing)
- Reactive Routing: AODV (Ad-hoc on-demand distance vector routing protocol), DSR (Dynamic source routing)

DSDV:-DSDV destination sequenced distance vector routing protocol is a table driven algorithm based on the classical Bellman – Ford routing mechanism. The improvement is made include freedom from loops in routing tables. Every mobile node in the network maintains a routing table for all possible destinations within the network and the number of hops to each destination node. Each entry is marked with a sequence number, number assigned by the destination node Routing table updates are periodically transmitted throughout the network in order to maintain table consistency.

Large amount of network traffic, route updates can employ in two types of packets they are first is the "Full Dump" and second is the "Incremental routing". A full dump sends the full routing table to the neighbors and could cover many packets whereas, in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. When the network is relatively stable, incremental updates are sent to avoid extra Traffic and full dump are relatively infrequent. In a fast changing network, incremental packets can grow big, so full dumps will be more frequent [13].

AODV: The AODV is a Reactive on demand ad-hoc distance vector routing algorithm. AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on demand basis as opposed to maintaining a complete list of routes, as in the DSDV algorithm. When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the destination. In AODV each router maintains route table entries with the destination IP address, destination sequence number, hop count, next hop ID and lifetime [11].

RREQs route requests and RREPs route replies are the two message types defined by the AODV. When a route to a new destination is needed, the node uses a broadcast RREQ to find a route to destination. A route can be determined when the request reaches either the destination itself or an intermediate node with a fresh route to the destination. The route is made available by unicasting a RREP back to the source of RREQ. Each node maintains its own broadcast id, sequence number. The broadcast ID is incremented for every RREQ packet. Since each node receiving the request keeps track of a route back to the source of the request, the RREP reply can be unicast back from the destination to the source, or from any intermediate node that is able to satisfy the request back to the source [10].

IV. Simulation Based Analysis

This section described the simulation tool, network setup, Simulation parameters and simulation results. The performances of proactive and reactive routing protocols are evaluated on the basis of three performance metrics: Throughput, Packet delivery ratio, Routing overhead.

a) Simulation Tool

In this paper simulation of proactive and reactive routing protocols is done by using network simulator (NS2) software due to its simplicity and availability. NS is a discrete event Simulator targeted at networking research. NS provides substantial support for simulation of TCP, routing, and multicast routing protocols over a wired and wireless network. NS2 is written in C++ and OTCL. C++ for data per event packets and OTCL are used for periodic and triggered event. NS2 include a network animator called network animator which provides visual view of simulation. NS2 preprocessing provides traffic and topology generation and post processing provide simple trace analysis. AWK programming is used for trace file analysis.

b) Network Setup and Simulation Parameters

The following network setup and simulation parameters are used in this paper to analyze the performance of proactive and reactive routing protocols.

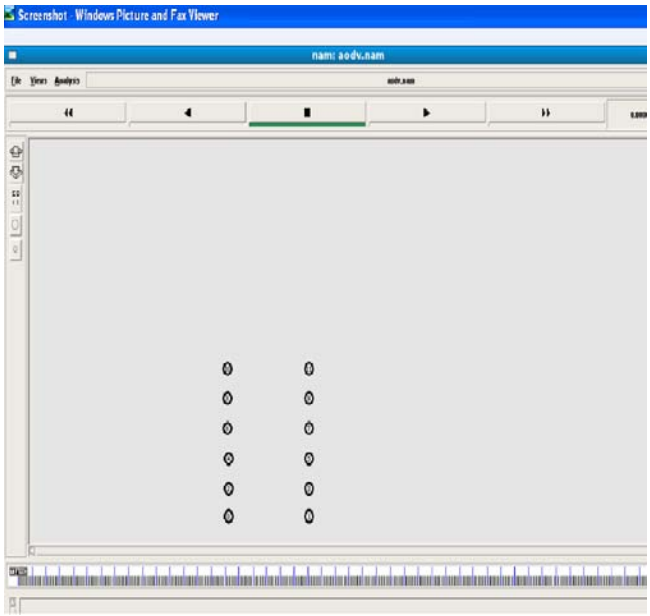

Fig. 1 : Network Setup

This topology is consists by 12 nodes, where 6 nodes are senders and remaining are receivers. All the senders start traffic at different time. So the transmitting node share the channel bandwidth with other previous transmitting nodes. This topology is generated by the network animator, by considering the following simulation parameters table.

Table 1 : Simulation Parameters

Channel	Channel/Wireless Channel
Propagation	Propagation/Two ray ground
Network interface	Phy/WirelessPhy
NS version	NS-allinone-2.31
MAC	Mac/802_11
CBR Packet Size	512 bytes
Interface Queue	Queue/Droptail/PriQueue
Link layer	LL
Antenna	Antenna/Omni Antenna
Interface Queue Lenth	50
No. of nodes	12 (6-senders, 6-eceivers)
Simulation area size	700*600
Simulation duration	60 second
Routing protocols	AODV, DSDV
Performance Metrics	Throughput, Packet Delivery Ratio, Routing Overhead

c) Performance Metrics

The following metrics are used in this paper for the performance analysis of AODV, DSDV Routing protocols. These are:

i. Throughout: It is the amount of data transferred over the period of time expressed in bits per second.
ii. Packet delivery ratio: It is the ratio of the number of data packets received by the destination node to the number of data packets sent by the source mobile node.
iii. Routing Overhead: The number of control packets generated by each routing protocol.
iv. Average end to end delay:

d) Simulation Results

The simulation results are shown in the following section in the form of graphs and charts. In this paper an attempt has been made to evaluate the performance of two well known routing protocol DSDV, AODV according to his simulation results. The simulation results are genrated through the Excel graphs according to above mentioned criteria shown in table.

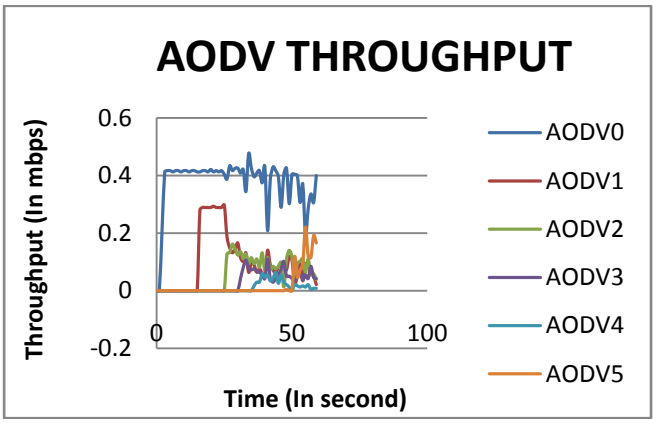

Fig. 2 : AODV Throughput (Node= 12)

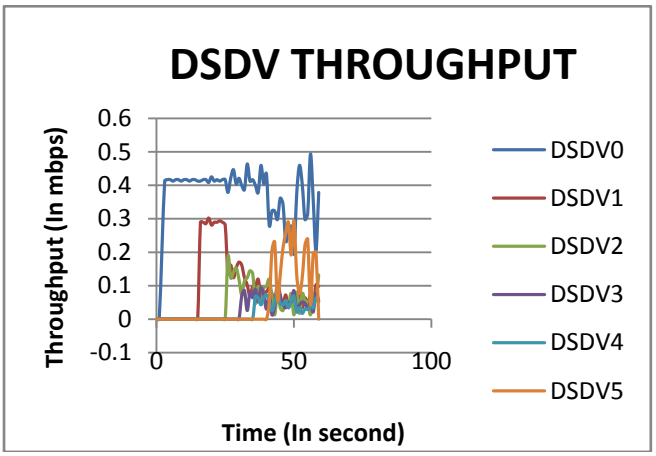

Fig. 3 : DSDV Throughput (Node =12)

According to above all 'Throughput graphs' and 'network topology' the 6 nodes are sender and remaining are receivers. First node start traffic at 1.5 second and utilize the full channel bandwidth. So the throughput of first node is gretter than others nodes.

After Second node start the traffic at 15 second and this node shares the channel banwidth with first node. So the throughput of second node is lower than first node because of late starting of traffic and throughput of first node is also decresed because of sharing bandwidth.

Similerly third node start traffic at the 25 second then the three nodes share the channel bandwidth. so the throughput of first two nodes are gretter, and third node's throughput is lower because of late starting of traffic and sharing of bandwidth.

Similerly fourth node, fifth node, and sixth node start traffic at 30 second, 35 second, and 40 second. if we increase the no. of senders and receivers and increse the traffic between sender and receivers, the throughput is decreses of all the senders and receivers.

On the basis of above graph, it is observed that the throughput of AODV is better than DSDV.

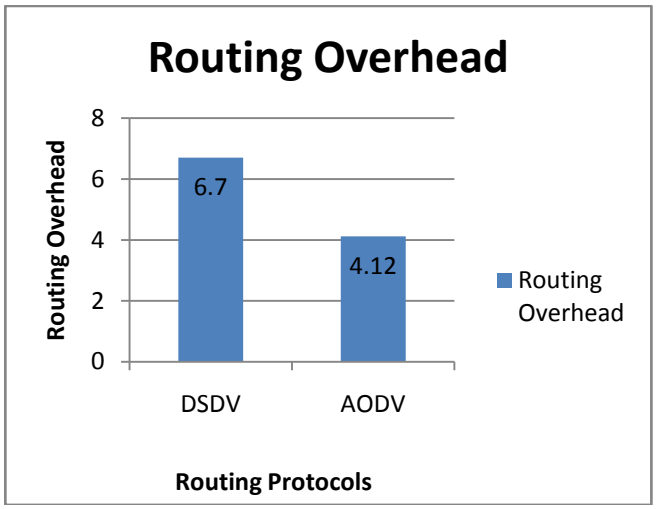

Fig. 4 : Routing overhead of (DSDV, AODV)

According to above Routing overhead chart, The Routing overhead of DSDV Routing protocol is maximum, and the AODV routing protocol is minimum.

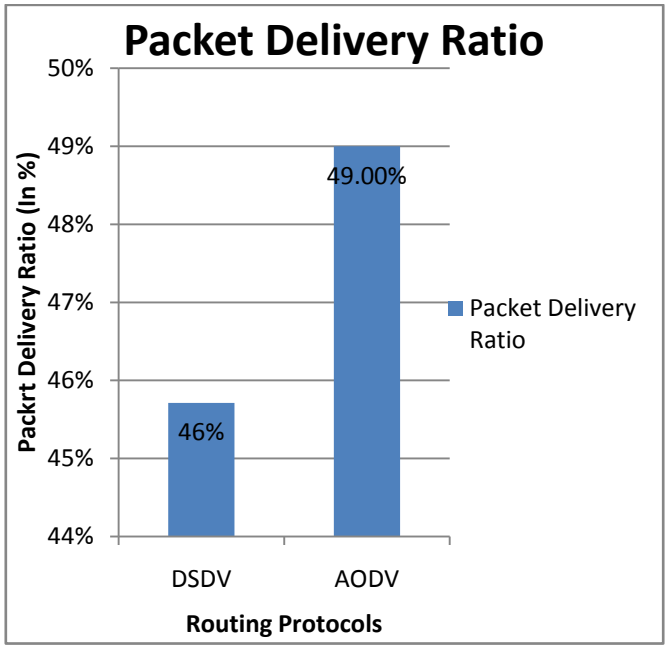

Fig. 5 : Packet Delivery Ratio For (DSDV, AODV)

According to above packet delivery ratio graph, the packet delivery ratio of DSDV is minimum, and AODV is maximum.

V. Conclusions

In this paper, the performance evaluation of AODV and DSDV routing protocols is done in the above mentioned criteria. The simulation results of all Excel graphs provide the information that if the number of nodes increases in the transmission then the throughput decreases. First graph shows that AODV throughput is better than DSDV because of his consistent performance. Second graph shows that AODV has minimum routing overhead and DSDV has maximum routing overhead. Third graph shows that AODV provides highest packet delivery ratio and DSDV provides lowest packet delivery ratio. In the analyzed scenario, it is found that the overall performance of AODV is better than 'DSDV'.

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