Comparative Analysis of Routing Protocols in Mobile Ad-hoc Networks

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Abstract- *Ad-hoc Wireless Networks are Infrastructure-less networks, with Multi-hop wireless links and have a shared radio channel which is more suitable for best-effort data traffic. Due to its unique characteristics, it is used in application areas such as in military and civilian domains. In this paper, we have discussed three routing protocols of ad-hoc network and compared their performance using ns2 simulator.*

Keywords*-Ad-hoc Wireless Networks, Routing Protocols-DSDV,AODV, DSR.*

I. INTRODUCTION

Ad-hoc wireless networks are the category of wireless networks that utilize multi-hop radio relaying. There is no static infrastructure such as base stations. In Ad-hoc networks every node acts as router for forwarding data packets to other node.

In these networks, nodes move arbitrarily, therefore the network may experience rapidly and unpredictably topology changes.

Additionally, because in ad-hoc networks nodes have narrow communication ranges, some nodes do not communicate directly with each other. Hence, routing paths probably contain various hops, and each node in ad-hoc networks act like as a router.

The ad- hoc routing protocols can be divided into two categories: proactive routing protocols, persistent and up-to-date routing information to all nodes is maintain at each node. Reactive routing protocols, the path are created as when required, when a source wants to connect to a destination, it appeals to the route discovery mechanisms to find the path to the destination.

The paper is described as follows. Section II gives the characteristics of an ideal routing protocol. Section III describes the various protocols used in Manet. Section IV includes the simulation environment followed by the simulation results and performance analysis in section V. Finally conclusion remarks are made in Section VI.

II. CHARACTERISTICS OF AN IDEAL ROUTING PROTOCOL

In Ad-hoc wireless networks, routing protocol should be fully appropriate, as centralized routing involves high regulation over-head. It must be flexible topology changes to frequently, caused by the mobility of nodes. Route computation and maintenance must involve a minimum number of nodes. Protocol must be loop-free and free from stale routes. Every node in the network should try to store information regarding the stable local topology only. It should be able to provide a definite level of quality of service (QOS) as demanded by the applications, and it should be also offer support for time-sensitive traffic.

III. PROTOCOLS USED IN MANET

A. Destination Sequenced Distance-Vector Routing Protocol (DSDV)

It is one of the first protocols proposed for ad-hoc wireless networks [2].It is a proactive routing protocol, which is based on Bellmen-Ford routing algorithm. In this, each node maintains a table that contains the shortest distance and the first node on the shortest path to every other node in the network. To prevent loops, it incorporates table updates with increasing sequence number tags, which counter the count-to-infinity problem, and results in faster convergence.

As it is a table-driven routing protocol, routes to all destinations are easily available at every node at all times. The tables are exchange between neighbors at legitimate intervals to keep an up-to-date view of the network topology. The tables are also delivered if a node observes a significant change in local topology.

The Broadcasting of data in DSDV protocol is mainly of two types: - 1) full dump and 2) Incremental dumps. Full dumps require multiple network protocol data unit while incremental dumps take single network protocol data unit. The proactive routing protocol is based on the periodic exchange of control message and maintaining routing table. Each node maintains complete information about the network. This information is collected from every node from the routing table. Every node knows entire topology and it can find the best node to route the information. Proactive protocols engender large volume of control message; it uses a large amount of bandwidth. The control messages may consume almost the entire bandwidth with the large amount of nodes.

B. Dynamic Source Routing Protocol (DSR)

It is an on-demand protocol designed to restrict the bandwidth consumed by control packets in ad-hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. The key distinguishing feature of the reactive protocol DSR is the use of origin routing. That is, the sender knows the exhaustive hop-by-hop route to the destination. These routes are store in a route cache; this is in contrast to AODV which uses classical routing tables, one entry per destination. DSR maintained various route cache entries for every destination. The data packets carry the source route in packet header. When a node in the ad hoc networks attempt to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically resolve such a route [1]. Route discovery works by flooding the network with route request (RREQ) packets. Every node receiving an RREQ and rebroadcasts it, unless it is the target node (destination) or it has a route to the destination in its route cache. Some a node replies to the RREQ with a route reply (RREP) packet that is routed back to the authentic source. RREQ and RREP packets are also source routed. The RREQ builds up the path pass through across the network. The RREP routes itself back to the source by traversing this path backward. The route carried back by the RREP packet is cached at the source for future use. The source node notified using a route error (RERR) packet if any link on a source route broke. The source takes off any route using this link from its cache. A new route discovery process must be initiated by the source if this route is still needed. DSR makes very contentious use of source routing and route caching.

C. Ad-hoc On-Demand Distance-Vector Routing Protocol.

AODV is a state-of-the-art routing protocol that adopts a purely reactive strategy: it sets up a route on-demand at the start of a communication session, and uses it until it breaks, after which a new route setup is initiated. AODV acquire a very different mechanism to maintain routing information. It uses conventional routing table, one entry per destination [2]. Without source routing, for routing data packets to the destination, AODV relies on routing table entries to propagate a route replay (RREP) back to the source and subsequently.

AODV uses sequence numbers maintain at each destination to determine the freshness of routing information and to prevent routing loops. These routing packets carry these sequence numbers. An important feature of AODV is maintenance of timer-based states in every node, respecting utilization of individual routing table entries. A routing table entry is expired if it not used recently. A set of predecessor nodes maintained for each routing table entry, demonstrating the set of neighboring nodes which use that entry to route data packets. These nodes are notified with route error (RERR) packets when the next hop link breaks. Every ancestor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link [1].

IV. SIMULATION ENVIRONMENT

We have used NS-2.35 for our simulation.Ns2 is the simulator used for implementing network protocols [6]. We consider 3 nodes in network which are deployed at fixed location initially and then they move in the network area during the transmission. With the same parameter we have computed the result for three routing protocols.

TABLE I. SIMULATION PARAMETERS

Parameter	Value
Simulation duration	150 sec
Simulation area	500m X 500m
No. of nodes	3
Maximum segment size	512 bytes
Data rate	2mbps
Radio range	250 metre
Traffic type	CBR
Mobility	Random Way point

V. SIMULATION RESULTS AND PERFORMANCE ANALYSIS

Throughput

The throughput resulted from the considered routing protocols have been presented in Figs. 1, 2 and 3. X & Y-axis represent the time and throughput respectively. As can been seen, DSR protocol shows higher throughput than AODV and DSDV routing protocols since its routing overhead is less than the others.

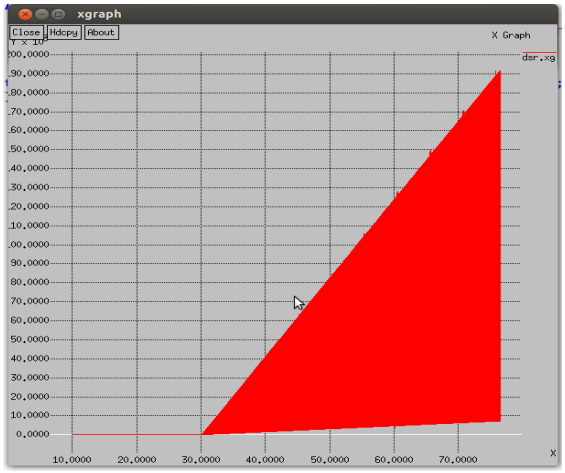

Fig.1. Throughput for DSR

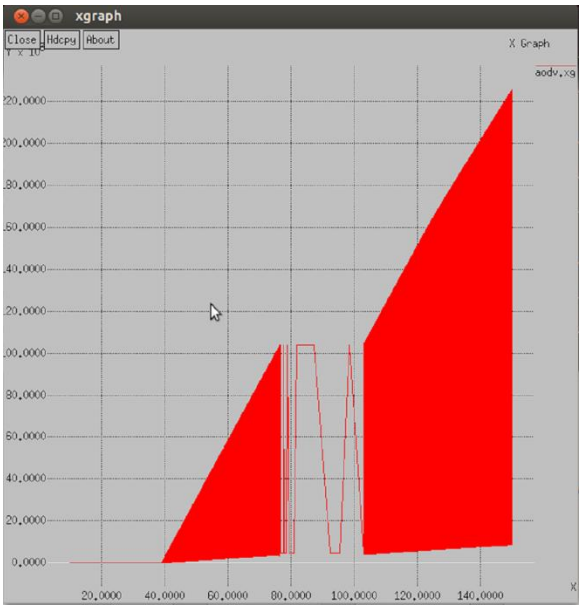

Fig.2. Throughput for AODV

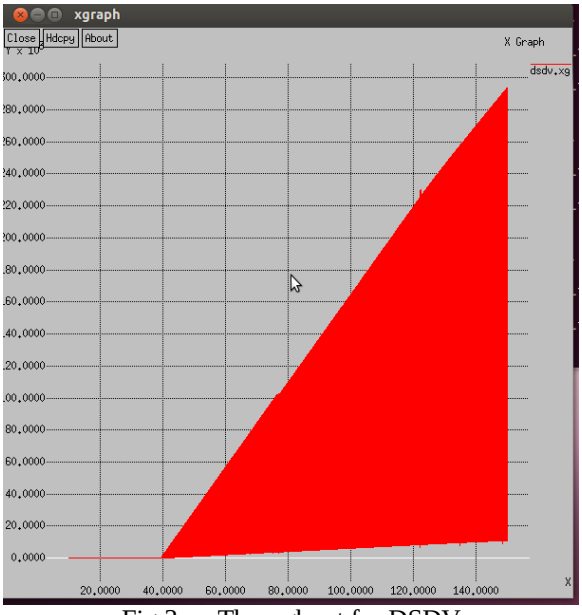

Fig.3. Throughput for DSDV

VI. EVALUATION COMPARISON OF AD-HOC NETWORKS ROUTING PROTOCOLS

It is clear from the results that DSR is the efficient routing protocol because it completes the routing process in less time and with less control overhead i.e. the number of packets generated is less than the other routing protocols. It can also found the number of packets dropped in DSR routing protocol is Zero

.Hence it concludes that DSR is more efficient than the two.

TABLE 2. COMPARISON OF ADHOC NETWORKS ROUTING PROTOCOLS

Performance Factors	AODV	DSR	DSDV
Generated Packets.	13060	11390	16911
Received Packets.	12986	7516	16797
Packet Delivery Ratio.	99.43%	65.98%	99.32%
Total no. of Dropped Packets.	51	0	49
Average end-to-end delay.	66.19ms	27.45ms	64.65ms
Start Time.	10.00sec	10.00sec	10.00sec
Stop Time.	149.99sec	76.45sec	149.99sec

VII. CONCLUSION AND FUTURE WORK

In this paper we have shown the comparison between three common routing protocols of ad-hoc wireless network in terms of Packet Average End-to-End Delay, Delivery Ratio and Throughput .After comparison we find out DSR is the most efficient Routing Protocol among the three. In Future, we will appraise two more routing protocols i.e. LEACH and TORA and will analyze its efficiency. LEACH is a hierarchical protocol which is used in Wireless Sensor Networks. LEACH - a clustering-based protocol that utilizes randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load among the sensors in the network and TORA It is a highly proficient, adaptive and scalable distributed routing protocol based on the concept of link reversal. Important feature of TORA is that control messages are localized to a very small set of nodes near the occurrence of a topological change.

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