PERFORMANCE COMPARISION OF TWO ON DEMAND ROUTING PROTOCOL AODV AND DSR in MANET

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Abstract— A mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes forming a temporary network without using any existing infrastructure i.e. nodes are connected through a wireless medium forming rapidly changing topologies and nodes are free to move about and organize themselves in to a network. These nodes change positions frequently. The main classes of routing protocols are Proactive, Reactive and Hybrid. A Reactive (On Demand) routing strategy is a popular routing category for wireless Ad hoc routing. It is a relatively new routing philosophy that provides a scalable solution to relative large network topologies. Routing protocols are analyzed against several performance matrices: Average throughput, Normalized routing load (NRL), Packet delivery fraction (PDF), Average end to end delay by varying Pause time, Number of nodes. The simulation result shows that throughput of AODV protocol is better than DSR protocol as the nodes are increasing/adding to network. Packet drop rate and end to end delay of AODV protocol is less than DSR protocol as the nodes are increasing. Efficiency achieved by the AODV protocol in mobile Ad hoc networks. The simulation is done in network simulator (NS) 2.

In this paper the performance differentials are analyzed using varying simulation time, Pause time and Number of nodes. These simulations are carried out using the ns-2 network simulator. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad hoc environment.

Key words: Performance, Routing Protocol, AODV, DSR, Mobile Ad-hoc Networks Introduction

I. INTRODUCTION

A Mobile ad hoc network is a group of wireless mobile computers (or nodes) in which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed. A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time, because the nodes are mobile. The network is decentralized, where all network activity, including discovering the topology and delivering messages must be executed by the nodes themselves. Hence routing functionality will have to be incorporated into the mobile nodes. MANET is a kind of wireless ad-hoc network and it is a self-configuring network of mobile routers (and associated hosts) connected by wireless links the union of which forms an arbitrary topology. The routers, the participating nodes act as router, are free to move randomly and manage themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet.

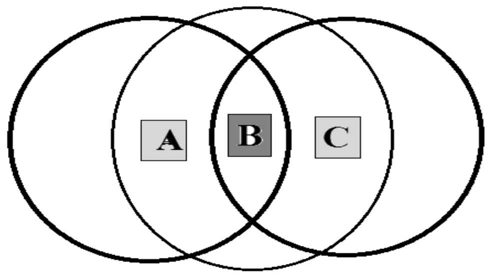

Fig. 1: Example of a simple Ad hoc network with three participating nodes

The mobile nodes can directly communicate to those nodes that are in radio range of each other, whereas others nodes need the help of intermediate nodes to route their packets. These networks are fully distributed, and can work at any place without the aid of any infrastructure. This property makes these networks highly robust. In Figure 1.1 nodes A and C must discover the route through B in order to communicate. The circles indicate the nominal range of each node’s radio transceiver. Nodes A and C are not in direct transmission range of each other, since A„s circle does not cover C.

II. ROUTING PROTOCOLS OF AD HOC NETWORKS

There are several routing protocols have been developed for AdHoc Mobile networks [1]. Such protocols must deal with typical limitations of these networks which include high power consumption, low bandwidth and high error rates.

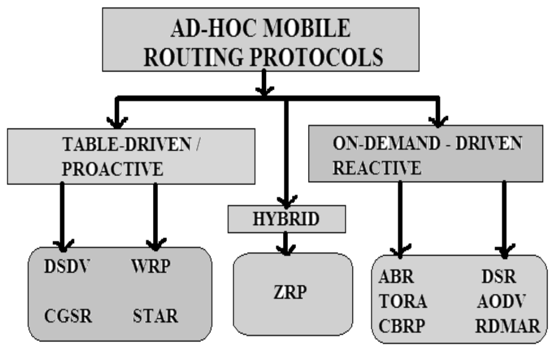

Fig. 2: Ad Hoc mobile routing protocols

A. Table-Driven Routing Protocols

In table driven routing protocols, consistent and up to date routing information to all nodes is maintained at each node.

B. On-Demand Routing Protocols

In On-Demand routing protocols, the routes are created as and when required. When a source wants to send to a destination, it invokes the route discovery mechanisms to find the path to the destination.

III. AD HOC ON-DEMAND DISTANCE VECTOR ROUTING (AODV)

AODV [2] discovers routes on an as needed basis via a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information.

It uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers. An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighbouring nodes which use that entry to route data packets. These nodes are notified with RERR packets when the next-hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, RERR packets in AODV are intended to inform all sources using a link when a failure occurs. 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 as the leaves.

IV. DYNAMIC SOURCE ROUTING (DSR)

The key feature of DSR [4] is the use of source routing. That is, the sender knows the complete hop -by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts 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 determine such a route. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed 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. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. The source removes 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 aggressive use of source routing and route caching.

V. PERFORMANCE METRICS

A. Packet delivery fraction

The ratio of the data packets delivered to the destinations to those generated by the CBR sources. Packets delivered and packets lost are taking in to consideration.

B. Throughput

There are two representations of throughput; one is the amount of data transferred over the period of time expressed in kilobits per second (Kbps). The other is the packet delivery percentage obtained from a ratio of the number of data packets sent and the number of data packets received.

C. End to End Delay

The time taken by the packet to reach the destination is called end to end delay so it is the time taken to travel between two ends i.e. source and destination.

VI. SIMULATION RESULT AND ANALYSIS

A. Simulation Environment

The simulation experiment is carried out in LINUX (UBUNTU-12.04.3). The detailed simulation model is based on network simulator-2 (ver-2.35), is used in the evaluation. The NS instructions can be used to define the topology structure of the network and the motion mode of the nodes, to configure the service source and the receiver, to create the statistical data track file and so on.

B. Traffic Model

Continuous bit rate (CBR) traffic sources are used. The source-destination pairs are spread randomly over the network.

C. Mobility Model

The mobility model used is Random waypoint mobility model because it models the random movement of the mobile nodes.

We have taken two On-demand (Reactive) routing protocols, namely Ad hoc On-Demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR). The mobility model used is Random waypoint mobility model because it models the random movement of the mobile nodes. Pause time was varied as 0s, 10s, 20s, and 30s

Parameter	**Value**
Number of nodes	40
Simulation Time	200 sec
Pause Time	1ms
Environment Size	1000x1000
Pause time	0,10,20,30 sec
Traffic Size	CBR (Constant Bit Rate)

Packet Size	512 bytes
Packet Rate	5 packets/s
Maximum Speed	20 m/s
Seed	0.0001
Simulator	ns-2.35
Mobility Model	Random Waypoint
Antenna Type	Omnidirectional

Table. 1: Simulation Scenario

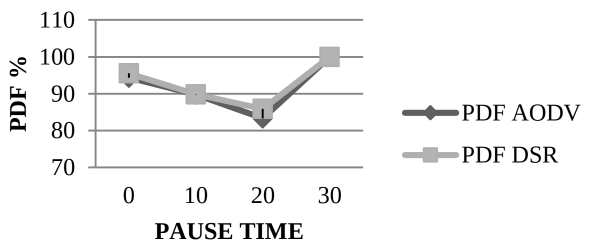

Fig. 3: A PDF Comparisons of AODV and DSR Varying Pause time.

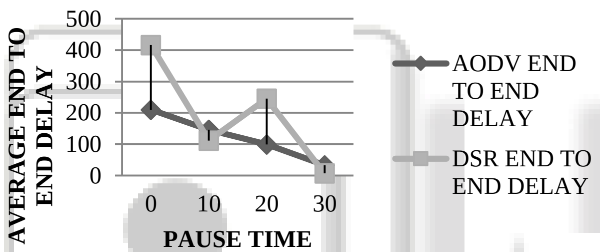

Fig. 4: AVERAGE END TO END DELAY OF Comparisons of AODV and DSR Varying Pause time

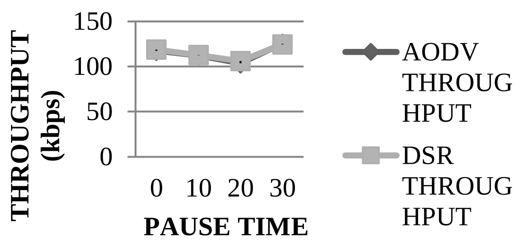

Fig. 5: THROUGHPUT OF Comparisons of AODV and DSR Varying Pause time

1) Fig.3 and fig.4 shows that the results of the simulations yield some interesting conclusions: AODV suffers in terms of packet delivery fraction (PDF) but scales very well in terms of end-to-end delay.
2) DSR on the other hand scales well in terms of packet delivery fraction (PDF) but suffers an important increase of end-to-end delay.
3) AODV good packet receiving in comparisons to DSR. AODV managed to handle the increased load, even though more packets are dropped & more routing packet generate
4) DSR having larger path low mobility is in ability to outperform AODV with respect to tcp throughput AdHoc network varies in inversely path length.
5) However DSR performance is better than AODV when connection density is the net-Work is High.as the connection density increases.

VII. CONCLUSIONS

This work compared the performance of AODV and DSR routing protocols for ad hoc networks using ns-2 simulations.

AODV and DSR use the reactive On-demand routing strategy. Both AODV and DSR perform better under high mobility simulations. High mobility results in frequent link failures and the overhead involved in updating all the nodes with the new routing information less in AODV and DSR, where the routes are created as and when required.

DSR and AODV both use on-demand route discovery, but with different routing mechanics. In particular, DSR uses source routing and route caches, and does not depend on any periodic or timer-based activities. DSR exploits caching aggressively and maintains multiple routes per destination. AODV, on the other hand, uses routing tables, one route per destination, and destination sequence numbers, a mechanism to prevent loops and to determine freshness of routes. The general observation from the simulation is that for application-oriented metrics such as packet delivery fraction and delay AODV, out performs DSR in more “stressful” situations (i.e., smaller number of nodes and lower load and/or mobility), with widening performance gaps with increasing stress (e.g., more higher mobility).

DSR, however, consistently generates less routing load than AODV. The poor performances of DSR are mainly attributed to aggressive use of caching, and lack of any mechanism to expire stale routes or determine the freshness of routes when multiple choices are available.

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