Performance analysis of Enhanced AODV and AODV for Mobile Ad-hoc Network

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Abstract-A Mobile ad hoc network (MANET) is a group of wireless mobile nodes is an autonomous system of mobile nodes connected by wireless links. Each node operates not only as an end system, but also as a router to forward packets. The nodes are free to move about and organize themselves into a network. These nodes change position frequently. 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 relatively large network topologies. The design follows the idea that each node tries to reduce routing overhead by sending routing packets whenever a communication is requested. In this paper an attempt has been made to compare the performance of AODV & possible improvement of AODV prominent on demand reactive routing protocols for MANETs. Ad hoc On Demand Distance Vector (AODV) is reactive gateway discovery algorithms where a mobile device of MANET connects by gateway only when it is needed. As per our simulation the differences in the protocol mechanics lead to significant performance differentials for this protocol. The performance differentials are analyzed using varying simulation time. These simulations are carried out using the ns-2.27 network simulator. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad hoc environment.

Keywords- AODV, CBR, Simulation, Performance, MANET, NS-2

Introduction-

Mobile Ad-hoc Networks (MANET)[2,3,4] are future wireless networks consisting entirely of mobile nodes that communicate on-the-move without base stations. Nodes in these networks will both generate user and application traffic and carry out network control and routing protocols. Rapidly changing connectivity, network partitions, higher error rates, collision interference, and bandwidth and power constraints together pose new problems in network control—particularly in the design of higher level protocols such as routing and in implementing applications with Quality of Service requirements.

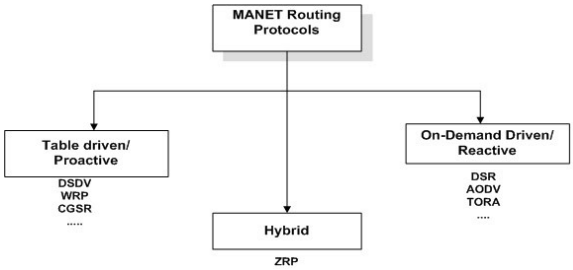
The internet engineering task force (IETE) created a mobile ad-hoc network (MANET). MANET is a collection of self configuring computer mobile node without any pre-existing infrastructure and as an autonomous system of mobile node connected by wireless link. The MANET is a routing procedure always to find a path so as to forward the packet from source to destination. The mobile nodes are connected by wireless links. The nodes are free to move independently and organized themselves into a network and nodes change position frequently. Ad-hoc[8] network requires no centralized or fixed infrastructure such as base station or access points and can be quickly and inexpensively setup is needed in wireless network. The main class of routing strategy reactive proactive and hybrid. We work on the reactive protocol; an attempt has been compare the performance analysis and simulation of prominent on demand reactive routing procedure for MANET.

Recent advancements such as Bluetooth introduced a new type of wireless systems known as mobile ad-hoc networks. Mobile ad-hoc networks or "short live" networks operate in the absence of fixed infrastructure. They offer quick and easy network deployment in situations where it is not possible otherwise. Ad-hoc is a Latin word, which means "for this or for this only." Mobile ad-hoc network is an autonomous system of mobile nodes connected by wireless links; each node operates as an end system and a router for all other nodes in the network. Nodes in mobile ad-hoc network are free to move and organize themselves in an arbitrary fashion. Each user is free to roam about while communication with others. The path between each pair of the users may have multiple links and the radio between them can be

heterogeneous. This allows an association of various links to be a part of the same network.

The popular IEEE 802.11 "WI-FI" protocol is capable of providing ad-hoc network facilities at low level, when no access point is available. However in this case, the nodes are limited to send and receive information but do not route anything across the network. Mobile ad-hoc networks can operate in a standalone fashion or could possibly be connected to a larger network such as the Internet.

Classification of Routing Protocols



Routing is the process of finding a path from a source to destination among randomly distributed routers The broadcasting is inevitable and a common operation in ad-hoc network. It consists of diffusing a message from a source node to all the nodes in the network. Broadcast can be used to diffuse information to the whole network. It is also used for route discovery protocols in ad-hoc networks. The routing protocols are classified as follows on the basis of the way the network information is obtained in these routing protocols There are many routing protocol for MANET and they are categorized into 3 groups namely: reactive, proactive and hybrid routing protocol.

Proactive Routing Protocols

Proactive routing protocol is also referred to as Table-driven routing protocol. In the table-driven routing approach, each node maintains a consistent view of the entire network topology in its routing table. Each
node always has valid and up-to-date information for all the other nodes in the network. So a request can be served without delay when using proactive protocols. To always maintain a consistent view of the network due to node mobility, these protocols need to periodically transmit routing information through out the network. An example of proactive protocol is Destination- Sequenced Distance-Vector (DSDV).

Reactive Routing Protocols

Reactive routing protocol is also referred to On- Demand routing protocol. In the on-demand routing approach, a route is created only when a source node desires to send data to a destination node. Once the route is created, it is maintained as long as the source node needs it or when the destination is unreachable. To serve a request in On-demand protocol, a delay is observed while the route is being discovered. Example of reactive protocol is Ad hoc On-demand Distance Vector (AODV).

Hybrid Routing Protocols

Hybrid routing protocol is a combination of both proactive and reactive algorithms. In purely proactive protocol (like DSDV), the protocol works well as long as the network topology is small and the nodes do not have a high mobility rate. But as the number of nodes increases and their mobility rate increases, it becomes difficult to keep track of all the nodes in the network .We are work on the two reactive protocols AODV and DSR [6].

Ad hoc On Demand Distance Vector (AODV)

Ad hoc On Demand Distance Vector (AODV)[1] routing algorithm is a routing protocol designed for ad hoc mobile networks. AODV is capable of both unicast and multicast routing. It is an on demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources. AODV builds routes using a route request / route reply query cycle. When a source node desires a route to a destination for which it does not already have a route, it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node and set up backwards pointers to the source node in the route tables. As long as the route remains active, it will continue to be maintained. A route is considered active as long as there are data packets periodically travelling from the source to the destination along that path. Once the source stops sending data packets, the links will time out and eventually be deleted from the intermediate node routing tables. If a link break occurs while the route is active, the node upstream of the break propagates a route error (RERR) message to the source node to inform it of the now unreachable destination(s). After receiving the RERR, if the source node still desires the route, it can reinitiate route discovery.

Enhanced AODV[5] Protocol

By varying the values of following AODV parameter and values each to ensure the high availability of alternate route and reduce rate of state route removal process:-
MY_ROUTE_TIMEOUT,
ACTIVE_ROUTE_TIMEOUT,TTL_START,
TTL_THRESHOLD, TTL_INCREMENT

The graph shows the overall performance packet delivery fraction; normalized routing load and packet loss is improved by varying the values of above parameters

when multiple sources are transmitting data to single source to make available alternative routes.

Performance Metrics

Packet Delivery Fraction: This is the fraction of number of packets received at the destination to the number of packets sent from the source multiply by 100. In other words, fraction of successfully received packets, which survive while finding their destination, is called as packet delivery fraction.

Packet loss (%): Packet loss is the failure of one or more transmitted packets to arrive at their destination.

Normalized Routing Load: Normalized routing load is the ratio of the number of control packets propagated by every node in the network and the number of data packets received by the destination nodes.

Table 1:Simulation Parameter

PARAMETERS	VALUE
Simulator	NS-2.27
Routing protocol	AODV & Enhanced AODV
Number of Nodes	50
Area	500mX500m
Packet size	512byte
Simulation time	100,200,300,400,500
Pause time	1.0
Traffic type	CBR
Mac protocol	Mac/802.11

Simulation Model

In this section, The network simulation are implemented using the NS-2[9] simulation tool The Network Simulator NS- 2 is a discrete event simulator, which means it simulates such events as sending, receiving forwarding and dropping packets. For simulation Scenario and network topology creation it uses OTCL (Object Tool Command Language). To create new objects, protocols and routing algorithm or to modify them in NS-2, C++ source code has to be changed. The simulator supports wired and wireless and satellite networks.

We consider a network of nodes placing within a 500m X 500m area. The performance of AODV is evaluated by keeping the network speed and pause time constant and varying the network size (number of mobile nodes).Table 1 shows the simulation parameters used in this evaluation.

Simulation and Results

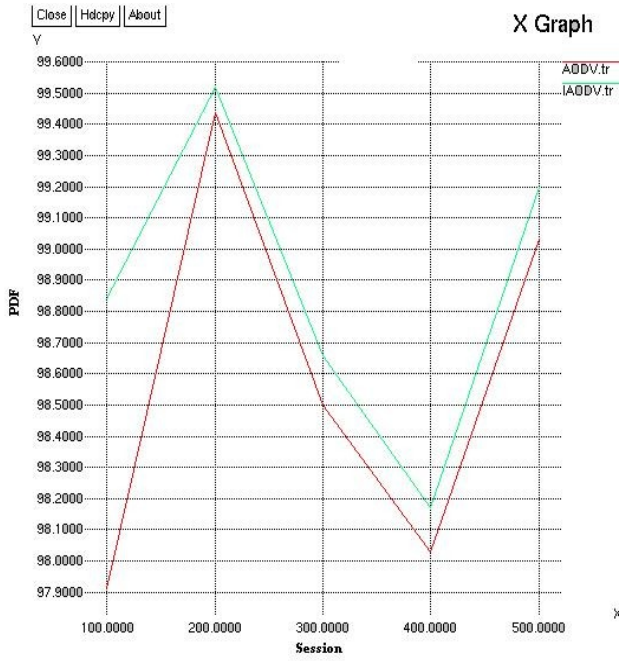


Figure 1-Packet Delivery Fraction with varying Simulation time

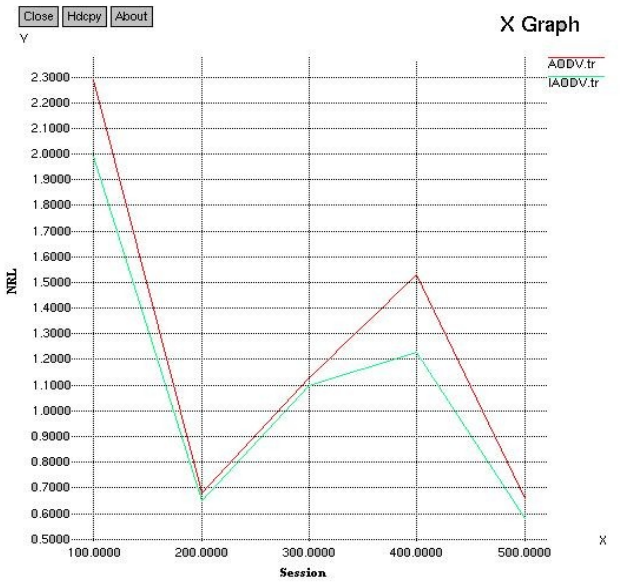


Figure 2-Normlized Routing Load with varying Simulation time

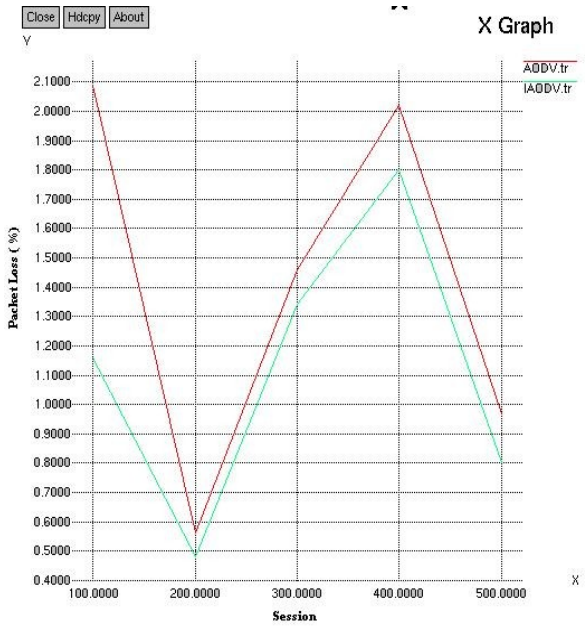


Figure 3-Packet Loss (%) with varying Simulation time

Conclusion:

This paper studied performance of AODV and Enhanced AODV based on CBR traffic source. These routing protocols were compared in terms of Packet delivery fraction, Average routing overhead and packet loss. When subjected to varying simulation time in MANET. Simulation results show that by comparing the performance Enhanced AODV results are good in compare than AODV using the simulation software NS-2.27. We successfully implemented Enhanced AODV functionalities by modifying AODV.h module. The results show that Enhanced AODV improves the performance of AODV in most metrics. Our future work will focus on studying practical design and implementation of the Enhanced AODV.

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