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Performance Evaluation of Average Energy Consumption in DSR Protocol

Ruhy Khanam[1], Chaitali Sinha[2]
[1]M.Tech Scholar
[2]Reader
ruhy28@gmail.com[1], chaitali.choudhary@gmail.com[2]

Abstract

MANET stands for mobile ad-hoc network. MANET is a type of network that can change locations and can configure itself. Because in MANETS nodes are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. MANET is highly dynamic networks with physical infrastructure undefined. So this network is infrastructure less, decentralized and self-organizing networks. In MANET the nodes are not static so the main question arises due to mobility is how to maintain a routing table, what the speed of mobility and how the nodes will communicate with each other. The main objective of this paper is to understand the behavior of DSR over MANET on the basis of various parameters like throughput, energy consumption, routing overhead and end to end delay.

***Keywords**:* DSR (Dynamic Source Routing Protocol); MANET (Mobile ad-hoc network); end to end delay; throughput; routing overhead

1. Introduction

Manet is wireless networks which entirely consist of mobile nodes that communicate with each other without base stations. This network does not depend on infrastructural support. The purpose of this network is to set-up the short lived network for the mobile nodes that's why it forms the dynamic network. In MANET environment the nodes are movable, along with time they change their position so because of that reason the nodes are called mobile nodes and the network are called infrastructure less.

MANET consists of mobile hosts also known as mobile nodes equipped with wireless communication devices. The transmission of a mobile host is received by all hosts within its transmission range due to the broadcast nature of wireless communication and omni-directional antenna. If any host is out of there transmission range in the ad-hoc network, other host within the network can forward the message so that the messages reaches to their destination. Due to the mobility of wireless hosts, each host needs to be equipped with the capability of an autonomous system, or a routing function without any statically established infrastructure or centralized administration. The mobile hosts can move arbitrarily and can be turned on or off without notifying other hosts. When they move out of their range the host turned off and another host can be used for communication. Due to mobility and autonomy a dynamic topology was introduced in the networks not only because end-hosts are transient but also due intermediate hosts on a communication path are transient.

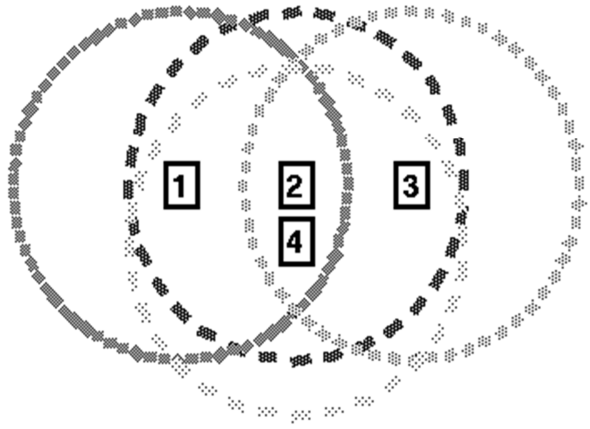
Here the mobile hosts are also known as routers as each node is responsible for routing the packets to the destination. The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a stand-alone fashion, or may be connected to the larger Internet. The main features of MANET are:

Data Routing Capabilities - Packet can be routed from source to destination by various intermediate or neighbor host. In MANET each host act like a router to forward the packet to correct destination

Flexible network architecture and flexible network architecture - Here host are mobile host that means there is no fixed position for them so the network topology changes unpredictably and hence this network is also known as dynamic network. The communication between the links may be in unidirectional or bidirectional.

Energy consumption - The network architecture and routing path affects the efficiency of communication energy at individual nodes. Being battery powered, these wireless nodes have limited operational time. Disproportionate energy consumption among them can lead to failure of the network. Recently, the optimization of the energy utilization of wireless nodes has received significant attention. Different energy optimization techniques including clustering, node mobility and topology control have been proposed.

Resource Constraints - In this network limited bandwidth available between two intermediate nodes and also nodes may have limited energy and thus computation need to be energy efficient.



2. ROUTING PROTOCOL IN MANET

An **ad-hoc network** is a standard that controls how nodes decide which way to route message between computing devices in a network. Here nodes are not familiar with the network topology, they have to discover it: typically, a new node announces its presence and listens for announcements broadcast by its neighbors. Each node learns about others nearby and how to reach them, and may announce that it too can reach them.

Performance of the routing protocol depends on the setting and requirement of the mobile ad-hoc network. Some routing protocol efficient in some scenario and might not be efficient for another scenario.

The goal of mobile ad hoc networking is to extend mobility into the realm of autonomous, mobile, wireless domains, where a set of nodes, which may be combined routers and hosts, themselves form the network routing infrastructure

in an ad hoc fashion. Hence, the need to study special routing algorithms to support this dynamic topology environment. Routing protocols for mobile ad-hoc networks have to face the challenge of frequently changing topology, low transmission power and asymmetric links.

Due to diversity of applications areas, researchers have proposed a wide range of routing protocols for ad hoc networks. The basic goals of these protocols are the same: maximize throughput while minimizing packet loss, control overhead and energy usage. However, the relative priorities of these criteria differ among application areas. In addition, in some applications, ad hoc networking is really the only feasible solution, while in other applications; ad hoc networking competes with other technologies. Thus, the performance expectations of the ad hoc networks differ from application to application and the architecture of the ad hoc network, thus each application area and ad hoc network type must be evaluated against a different set of metrics.

In mobile ad hoc networks routing protocol can be classified into various categories based on different criteria. The classification is not mutually exclusive and some protocols fall in more than one class. The deviation from the traditional routing metrics and path-finding processes that are employed in wired networks makes it worth further exploration in this direction. The routing protocols for ad hoc wireless networks can be broadly classified into four categories based on

- Routing information update mechanism
- Use of temporal information for routing
- Routing topology
- Utilization of specific resources

The routing mechanism in mobile ad-hoc network is divided in to:-

1. Table Driven (Pro-active) routing.
2. Reactive (on-demand) routing.
3. Hybrid (both pro-active and reactive) routing.

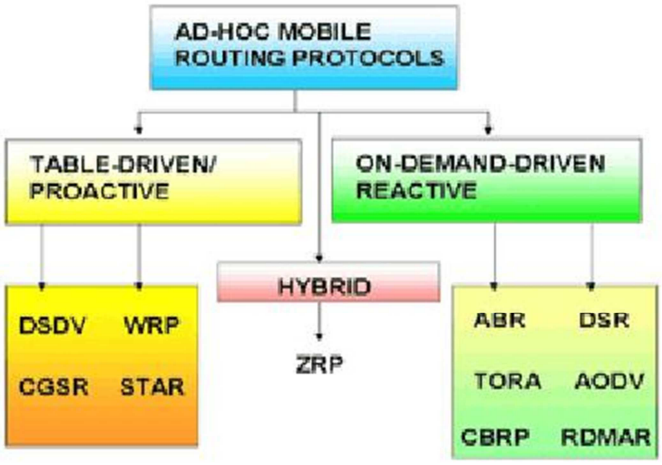


Table Driven/Proactive Routing protocol are the traditional routing protocol, extensions of the wired network routing protocols. Whenever there are data packet has to send, the route has already been defined. The protocol of this section maintains the global topology information in the form of tables at every node. These tables are updated frequently in order to maintain consistent and accurate network state information and they respond to changes in network topology by propagating updates throughout the network in order to maintain a consistent network view. The areas in which they differ are the number of necessary routing-related tables and the methods by which changes in network structure are broadcast. The destination sequenced distance-vector routing protocol (DSDV), wireless routing protocol (WRP), source-tree adaptive routing protocol (STAR), and cluster-head gateway switch routing protocol (CGSR) are some examples for the protocols that belong to this category.

On demand-driven/reactive routing protocol- Routing protocol is based on some sort of query-reply dialog. This type of routing protocol creates routes only when desired by the source node. When a node requires a route to a destination, it initiates a route discovery process within the network. This process is completed once a route is found or all possible route permutations have been examined. Once a route has been established, it is maintained by a route maintenance procedure until either the destination becomes inaccessible along every path from the source or until the route is no longer desired. Associability based routing (ABR), Dynamic Source Routing Protocol (DSR), Temporally-ordered Routing Algorithm (TORA) are some examples of this category.

Hybrid routing protocol- Reactive and proactive feature of a particular routing protocol is not enough for some routing mechanism. But the mixture of both the protocols can give the better solution. The hybrid protocol includes some of the feature of the proactive protocols and some of the feature of reactive protocols. This type of protocols is the choice of proactive and of reactive routing depends on the hierarchy level where a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels. The choice for one or the other method requires proper attribution for respective levels. Here, each node maintains the network topology information up to *m* hops. Zone Routing Protocol (ZRP) is the protocol that falls in this category.

3. OVERVIEW OF ROUTING PROTOCOL

The transmission of packets from a source to a destination address is called Routing. A routing protocol determines the path by which the packets are forwarded, shares information with immediate neighbor devices and other devices in the network, and adjusts to changing network conditions.

Dynamic Source Routing protocol is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. Important features of DSR are:

Source Routing- Here the sender knows the complete hop-by-hop route to the destination. These routes information are stored in a route cache. Data packets sent by the source node carry the complete route information in the packet header. Intermediate nodes forward the packet based on the route information stored in its header. In most cases, the only modification that an intermediate node may make to the header of a packet is to the hop count field.

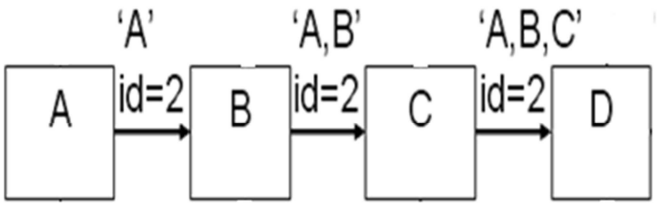
On Demand- DSR attempts to reduce routing overhead by only maintaining routes between nodes taking part in data communication. The source discovers routes on-demand by initiating a route discovery process only when it needs to send a data packet to a given destination. As a result, a significant amount of routing overhead is eliminated.

Dynamic source routing protocol (DSR) 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 major difference between this and the other on-demand routing protocols is that it is *beacon -less* and hence does not require periodic *hello* packet *(beacon)* transmissions, which are used by a node to inform its neighbors of its presence. The basic approach of this protocol (and all other on-demand routing protocols) during the route construction phase is to establish a route by flooding *RouteRequest* packets in the network. The destination node, on receiving a *RouteRequest* packet, responds by sending a *RouteReply* packet back to the source, which carries the route traversed by the *RouteRequest* packet received.

Mobile nodes are required to maintain route caches that contain the source routes of which the mobile is aware.

Entries in the route cache are continually updated as new routes are learned. The DSR protocol is composed of two main mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network:

Route Discovery -



Suppose node A wants to send data to the destination D. If node A has route information till destination D in his Route cache, this route is immediately used. If not, the Route Discovery protocol is started:

- Node A (initiator) sends a RouteRequest packet to all its neighbor in the network.
- If node B has recently seen another RouteRequest from the same target or if the address of node B is already listed in the Route Record, Then node B discards the request.
- If node B is the target of the Route Discovery, it returns a RouteReply to the initiator. The RouteReply contains a list of the "best" path from the initiator to the target. When the initiator receives this RouteReply, it caches this route in its Route Cache for use in sending subsequent packets to this destination.
- Otherwise node B isn't the target and it forwards the RouteRequest to his neighbors (except to the initiator).

Route Maintenance - Route Maintenance is the mechanism by which node A is able to detect, while using a source route to D, if the network topology has changed such that it can no longer use its route to D because a link along the route no longer works. When Route Maintenance indicates a source route is broken, A can attempt to use any other route it happens to know to D, or can invoke Route Discovery again to find a new route. Route Maintenance is used only when A is actually sending packets to D.

4. PERFORMANCE PARAMETERS

Network Size- measured in terms of nodes. How many nodes we are creating to evaluate the protocol.

Topological rate of change- The speed by which the topology of the network changes.

Link Capacity- effective link speed measured in bits/second, after accounting for losses due to multiple access, framing, etc.

Traffic patterns- How effective is a protocol in adapting to non-uniform traffic patterns?

5. Conclusion

DSR consumes much energy then proactive protocols because they generate the routes whenever needed. So route discovery phase and route maintenance phase consume energy to perform the operation like RREQ, RREP. DSR also uses caches to hold more than one route information to a particular destination. This also leads the power consumption.

In this study, it is also noted that many routing protocol had been evaluated on the basis of end to end delay, throughput, routing overhead etc. But evaluation for energy consumption and average energy consumption for any protocol is not considerably good.

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