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MANET-Evaluation of DSDV and AROD Routing Protocol

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Abstract

Mobile ad-hoc networks (MANETS) are formed by a collection of mobile nodes that have the ability to form a communication network without the help of any fixed infrastructure. MANET is a self organized and self configurable network where the mobile nodes move arbitrarily. The mobile nodes can receive and forward packets as a router. Because of the nature of these networks, routing protocols play a prominent role in their scalability and overall performance. Due to limited radio transmission range, multiple hops may be required in order to exchange data among the communicating nodes. So, a key requirement of any efficient routing protocol is to find a route between two communicating nodes quickly and with low bandwidth overheads. Consequently, many routing algorithms have come into existence to satisfy the needs of communications in such networks. This study inspects two MANET protocols DSDV (Destination Sequenced Distance Vector) and AROD (Adaptive Routing in Dynamic Ad-hoc Networks).

Keywords: DSDV, AROD Routing.

Introduction

A mobile ad-hoc network is a collection of mobile platforms that form a dynamic infrastructure-less communication network wherever it is required. The absence of a fixed infrastructure means that the communicating nodes in the network must also handle routing. Quick and easy establishment of such networks make them feasible to use in military networks [3], wildlife tracking sensor networks [4], vehicle networks [5] [6] and in other environments where no infrastructure exists or it has been destroyed. Routing is a well studied feature of such networks because mobile nodes may move in various directions, which can cause existing links to break and the establishment of new routes. The mobility (i.e. how nodes move) of mobile nodes plays an important role on the performance of routing protocols. Routes between two communicating nodes may consist of multiple hops through other nodes in the network. Therefore, finding and maintaining routes in MANET is nontrivial.

Due to bandwidth constraints, it is readily understandable that an on demand approach (i.e. the route discovery is initiated only if there is a demand for communication) is often used in wireless ad-hoc network scenarios. Fig. shows the mobile Ad-hoc network. Here each machine is acting as router themselves.

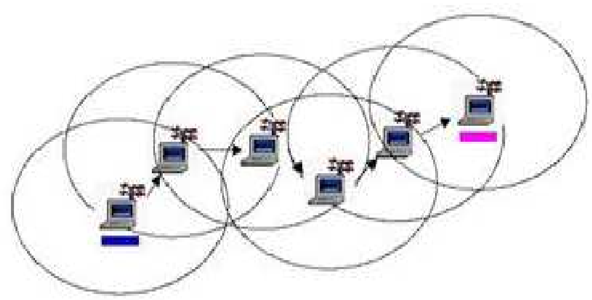

Fig.1: Mobile Ad-hoc Network

This study inspects two MANET protocols i.e Destination Sequenced Distance Vector (DSDV)[1] and Adaptive Routing in Dynamic Ad-hoc Networks (AROD)[2] and examines their performance based on variation of node density. The performance is determined on the basis of throughput with varying node density and mobility.

Routing Protocols

A routing protocols is needed whenever a packet needs to be transmitted to a destination via number of nodes and numerous routing protocols have been proposed for such kind of Ad-hoc networks. These protocols find a route for packet delivery and delivery packet to be correct destination. The IP layer is the backbone of communication. The basic operation in IP layer of MANET is to

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successfully transmit data packets from the source to the destination. Therefore, efficient routing of packets is a primary MANET challenge as it may be necessary to employ several hops i.e. multi-hop before a packet reaches the destination. Routing protocols for ad hoc networks must deal with limitations such as high power consumption, low bandwidth, high error rates and arbitrary movements of nodes. On the basis of routing information update mechanism routing protocol for ad-hoc wireless network can be classified into three categories. Fig. 3 shows basic classification of routing protocol: Basically, routing protocols can be broadly classified into three types as A) table -driven (or) proactive routing protocol, B) on-demand (or) reactive routing protocol C) hybrid routing protocol.

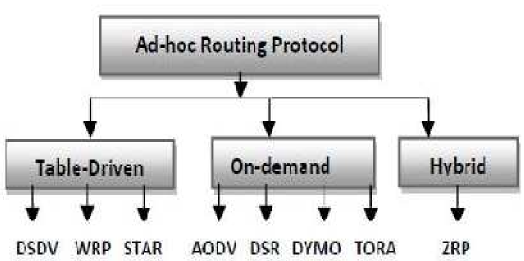

Fig.2: Classification of ad-hoc routing protocol

A) *Table-Driven (or) Proactive routing protocols*: Every node maintains the network topology information in the form of routing tables by periodically exchanging routing information. Routing information is generally flooded in the whole network whenever a node requires a path to the destination. It runs an appropriate path-finding algorithm on the topology information it maintains. Some of the existing table-driven (or) proactive protocols are DSDV[1], OLSR[7] etc.

B) *On-Demand (or) Reactive routing protocols*: Protocols that fall under this category do not maintain the network topology information. They obtain the necessary path when it is required, by using a connection establishment process. Hence these protocols do not exchange routing information periodically. Some of the existing routing protocols that belong to this category are DSR[8], AODV[9] etc.

C) *Hybrid routing protocol*: Protocols belonging to this category combine the best features of the above two categories. Nodes within a certain distance from the node concerned or within a particular geographical region are said to be within the routing zone of the given node. For routing within this zone a table-driven approach is used. For nodes that are located beyond this zone an on-demand approach is used. Some of the protocols in this category are ZRP[10], ZHLS etc.

DSDV

Destination-Sequenced Distance Vector routing protocol (DSDV) [1] is a typical routing protocol for MANETs, which is based on the Distributed Bellman-Ford algorithm. In DSDV, each route is tagged with a sequence number which is originated by the destination, indicating how old the route is. Each node manages its own sequence number by assigning it two greater than the old one (call an even sequence number) every time. When a route update with a higher sequence number is received, the old route is replaced. In case of different routes with the same sequence number, the route with better metric is used. Updates are transmitted periodically or immediately when any significant topology change is detected.

There are

when route becomes stable. In DSDV, broken link may be detected by the layer-2 protocol, or it may instead be inferred if no broadcasts have been received for a while from a former neighboring node. Figure 3 shows an example of an ad hoc network before and after the movement of the mobile nodes.

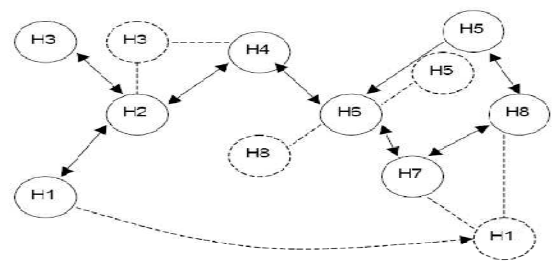

Fig.3 :Ad-hoc Network with DSDV

The data broadcast by each mobile node will contain the new sequence number, the destination's address, the number of hops to reach the destination and the sequence number of the information received regarding that destination. Each node advertises an increasing even sequence number for itself Any node that receives this infinite metric count updates its table for the matching route and waits until a greater sequence number with non-infinite metric count is received. Every mobile host also calculates the weighted average of the time taken to receive a route with the best metric. This time is called the settling time.

Fig. 4 shows the routing table of the node H6 at the moment before the movement of the nodes. The Install time field in the routing table helps to determine when to delete stale routes.

Dest	Next Hop	Metric	Seq.No.	Install
H1	H4	3	S406_H1	T001_H6
H2	H4	2	S128_H2	T001_H6
H3	H4	3	S564_H3	T001_H6
H4	H4	1	S710_H4	T002_H6
H5	H7	3	S392_H5	T001_H6
H6	H6	0	S076_H6	T001_H6
H7	H7	1	S128_H7	T002_H6
H8	H7	2	S050_H8	T002_H6

Fig.4: The Routing Table

The elements in the routing table of each mobile node change dynamically to keep consistency with dynamically changing topology of an ad hoc network. To reach this consistency, the routing information advertisement must be frequent or quick enough to ensure that each mobile node can almost always locate all the other mobile nodes in the dynamic ad hoc network. Upon the updated routing information, each node has to relay data packet to other nodes upon request in the dynamically created ad hoc network.

In DSDV [1], the DSDV tables (containing the ID, hop count and the sequence number of each destination) are propagated frequently to discover shortest paths and broken paths. Although a timely distance vector update is important for the timely discovery of transmission opportunities in network scenarios where transmission opportunities are scarce, the propagation of the DSDV tables (O(N)) might eat up a considerable portion of the bandwidth.

AROD

Different existing routing protocols would work well for the different scenarios exhibited by a dynamic ad hoc network. However, it is inconvenient to require the users to switch between multiple routing protocols. Moreover, if different scenarios are exhibited by different parts of a network, the routing protocols used must be able to communicate and cooperate with each other, which is another difficult task. Thus, a routing protocol that is adaptive in an effort to maintain good performance and that also operates seamlessly in different network scenarios is desired. Adaptive Routing in Dynamic ad hoc networks (AROD)[2], which is a seamless integration of several existing schemes. Each node sends "hello" messages to allow other nodes to detect it. Once a node detects "hello" messages from another node (neighbor), it maintains a contact record to store information about the neighbor, including the received table updates from the neighbor. Once no messages are received from a neighbor for a particular period of time, or a number of consecutive message-transfer failures occur with that neighbor, the contact with the neighbor is regarded as broken.

AROD's adaptation to the correct forwarding strategy is embodied by the formulation of message priority which is maintained by four tables: the EDSDV table, the Average Inter-meeting Time (AIT) table, the Estimated Delivery Time (EDT) table, and the Collective Estimated Delivery Time (CEDT) table. Each of these tables is of size O(N) (a moderate transmission and memory requirement), where N is the network size.

In a network that has an adequate communication capacity(i.e. the total transfer opportunities in the network) and a clear gradient of decreasing estimated delivery latency or increasing delivery probability to each destination, such as a dense network with a local mobility pattern, it is suffice to use a single-copy and multi-hop delivery. However, in a sparse mobile network with random mobility and limited transfer opportunities, mobility-assisted and multi-copy delivery is used to shorten the delivery time and increase the delivery ratio. AROD adaptively trades off delivery latency/probability to bandwidth consumption. It is a seamless integration of the different routing schemes used for different network scenarios.

Performance Analysis

The following metric used for this study.

Delivery rate: Delivery rate is calculated by dividing the number of packets received by the destination through the number of packets originated by the application layer of the source (i.e. CBR source). It specifies the packet loss rate, which limits the maximum throughput of the network. The better the delivery rate, the more complete and correct is the routing protocol.

Fig 5 shows the the graph of delivery rate against number of nodes in case of DSDV.

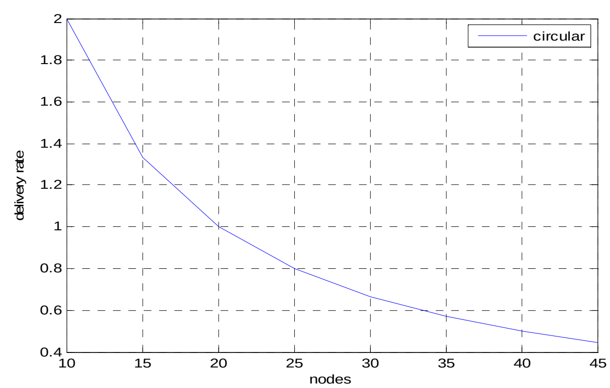

Fig.5 : Delivery Rate Vs No. Of Nodes

Here the number of nodes is increased and corresponding delivery rate is observed. We can see as the number of nodes increases the delivery rate decreases. Fig. 6 shows the graph of delivery rate v/s number of nodes in case of AROD. Here two mobility models are used. One is random mobility & another one is local mobility.

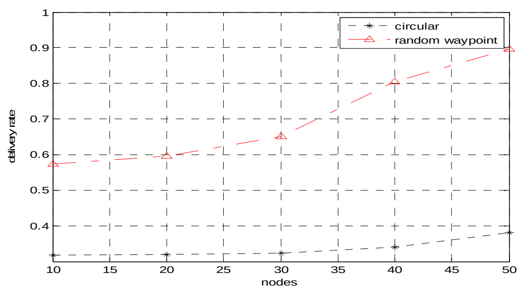

Fig.6 : Delivery Rate Vs No. Of Nodes

Conclusion & Future Work

Simulation results reveal that DSDV consumes extensive bandwidth and computation overhead presence of mobility. Due to physical limitations incurred by the medium access control of wireless networks, which physically limits he bandwidth to around 11 Mbps, it is not logical to waste up to 40% of that bandwidth for routing traffic. DSDV perfectly scales for small network with low node speeds. AROD performs better in denser networks due to the adaptation of the multi-hop delivery, which saves bandwidth compared to the multi-copy delivery. Also, AROD performs better in RWP, which shows that increased mobility improves delivery rate.

Here we compared two protocols on the basis of delivery rate v/s number of nodes. In future we will like to compare these protocols using other metrics such as end-to-end delay, throughput etc.

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