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Equal And Unequal Distribution of Nodes based Simulation of Routing Protocols in MANET

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Abstract

One important aspect of mobile ad-hoc networks is the group mobility of nodes in topological area, since any node can enter or leave the topological area at any time. The resources are limited with mobile ad-hoc networks, so increasing number of node cannot generate more resources, but they can use and share existing resources with pre-existing nodes in the topological area. An important aspect of group mobility is mobility of nodes inside the group with reference to their leader. Inthis paper we analyze the two protocols AODV and DSDV with equal and unequal distribution of nodes in group.

Keywords

AODV, Throughput, MANET, Routing Protocol.

1. Introduction

An Ad hoc network is a collection of nodes that do not depend assurely on a preorganized infrastructure to keep the network connected. It's a self-systematized network. So the different activities of an ad hoc network are dependent on the belief and existence between the nodes. This allows the devices and the people to interconnect with no obstructions in the areas of no communication system. Nodes help each other in passing information about the topology of network and share the obligations of handling the network. The architecture of MANET consists of many layers, they are- Applications and middleware layer, Networking layer, enabling technology layer and consist of cross layer issues. In the battlefield, disaster areas and search operations [18][16], several groups are formed and each group has a leader. Member of each group moves relative to its leader and every member of group receive and send information through its group leader. Any member of any group can communicate with any other member of similar or different group, but in the supervision of their group leaders. Here each member of group is considered as a node, which also works as a router, forward data packets for other nodes. All nodes are free to move and organize themselves arbitrarily. When a receiving node is out of the direct range of the sending node, other nodes maintain network connectivity by routing packets for each other.

One important aspect of mobile ad-hoc networks [17] is the mobility of nodes in topological area, since any node can enter or leave the topological area at any time. The resources are limited with mobile ad-hoc networks, so increasing number of node can not generate more resources, but they can use and share existing resources with pre-existing nodes in the topological area. Every computation performed within the ad hoc node, and every packet (sent/received/forwarded) drains finite resource. Thus, mobility of nodes is a challenge in these networks.

Mobile ad hoc network is very useful in disaster relief and military operations, where either network and communication facility is not existed or it may be demolished. These operations are conducted in team forms. The RPGM based group can form teams with equal number of members, but in real operations the team size should be very according to necessity. Thus we require an improved version of RPGM to distribute different number of nodes as per requirement.

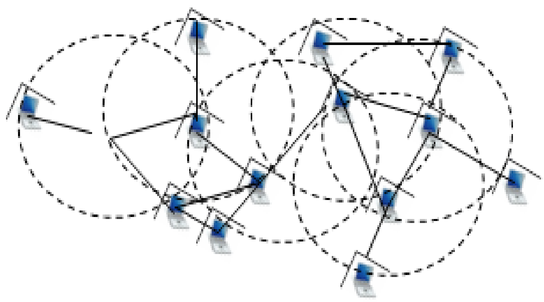

Figure 1. Mobile Ad-hoc Network

2. PRELIMINARIES

2.1. ROUTING PROTOCOLS

Routing protocols are mainly used to deliver the data cogently and for route discovery and discovers the network topology. The basic goal of routing protocols in the ad-hoc network is to put a foundation of optimal paths between source and destination with the least overhead so that packets are delivered in a timely sequence. These protocols are essential because of the mobility of the nodes. A MANET protocol should function cogently over a wide range of networking context from small ad-hoc group to

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larger mobile Multihop networks. fig 1 shows the categorization of these routing protocols.

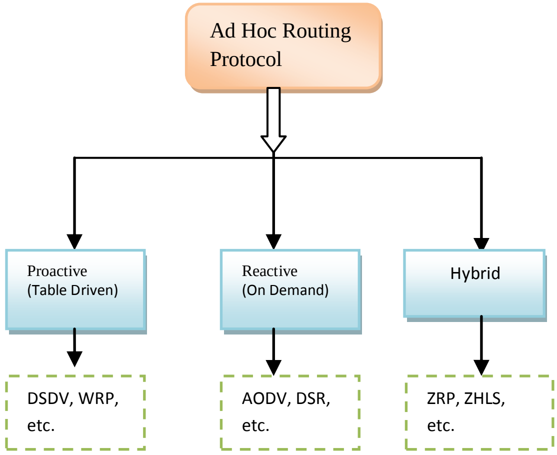

Fig 1: Hierarchy of Routing Protocols

The Routing protocols can be divided into Proactive, Reactive and Hybrid protocols, depending on the routing topology. The Proactive protocols are typically table-driven. Examples are Destination Sequence Distance Vector (DSDV). On the other hand, the Reactive protocols do not timely update the routing information. It is propagated to the nodes only when required. Example of such type includes Dynamic Source Routing (DSR) and Ad Hoc On-Demand Distance Vector (AODV). Hybrid protocols make use of both reactive and proactive approaches. Example are Zone Routing Protocol (ZRP) etc.

2.2. An overview of AODV Routing Protocols

The AODV routing protocol is an adaptation of the DSDV protocol for dynamic link conditions. Every node in this network maintains a routing table, which contains information about the route to a particular destination. Whenever a packet is to be sent by a node, it first checks with its routing table to determine whether a route to the destination is already available. If so, it uses that route to send the packets to the destination. If a route is not available or the previously entered route is inactivated, then the node initiates a route discovery process. The routing messages do not contain information about the whole route path, but only about the source and the destination. Therefore, routing messages do not have an increasing size. It uses destination sequence numbers to specify how fresh a route is.

2.2 Destination Sequenced Distance Vector Routing (DSDV)

The Destination Sequenced Distance Vector is a table driven or proactive routing protocol. Which provide independence from loops in routing tables, much dynamic and less convergence time. Each node in the MANET manage and maintain a routing table which contains list of all destination nodes present within the network along with number of hops required to reach to particular node. Each entry is marked with a sequence number provided by the destination node. The sequence numbers are used to identify stable routes thus avoiding loops formation. In DSDV [11], each node maintain a routing table, here each table must contain the destination node address, the minimum number of hops to that destination and the next hop in the direction of that destination. With the addition of sequence numbers, routes for the same destination are selected based on the following principles:

1) a newer sequence number route is always preferred;

2) the route with the better cost metric is preferred if both the route contains the same sequence number.

The routing table contains the following:

(1) IP addresses of all the available destinations

(2) IP addresses of next hop nodes

(3) Required number of hops to reach that destination.

(4) Sequence number provided by the destination node

(5) Installation time.

2.2.1Characteristics of DSDV

- Freedom from loops in routing tables
- More dynamic and less convergence time.
- Maintain a table having an entry for sequence numbers for every destination.
- A higher sequence number denotes more new update sent out by the source node.
- Avoid route loops or false routes.
- Determines the topology and route information by exchanging these routing tables.

3. Proposed Work

One important aspect of mobile ad-hoc networks is the group mobility of nodes in topological area, since any node can enter or leave the topological area at any time. The resources are limited with mobile ad-hoc networks, so increasing number of node cannot generate more resources, but they can use and share existing resources with pre-existing nodes in the topological area. An important aspect of group mobility is mobility of nodes inside the group with reference to their leader. In most of the real life examples of group mobility in MANET, such as military operation, tracking and disaster relief operations, different groups are formed. Thus, mobility of nodes is a major challenge in these networks.

4.1 Reference Point Group Mobility Model (RPGM)

RPGM [10] is used in military operation for battlefield communication, where the commander and soldiers together form a logical group. Here, every group has a logical center (commander or leader) that define the group's movement behavior. Each normal member of the group (soldier) is uniformly placed in surrounding of group leader (commander). Subsequently, at any time, each node assigned a direction and speed that is derived by dynamically deviating from its group leader. The movement in group mobility is defined by following equations:

$| V_{member} (t) | = | V_{leader} (t) | + random () * SDR * max\_speed$ ……..(1)

$| \Theta_{member} (t) | = | \Theta_{leader} (t) | + random () * ADR * max\_angle$ ……..(2)

Where ADR (Angle Deviation Ratio) <= 1and 0 <= SDR (Standard Deviation Ratio)

Generally, Reference Point Group Mobility (RPGM) model can be used with equal number of nodes assigned in all group. The Reference Point Group Mobility (RPGM) model is modified to assign equal as well as unequal number of nodes to each group.

The Algorithm for *i*RPGM Model is as follows:

```
Assume:
        in_name, mobilenode as Two Dimension Dynamic
Array
        x as One Dimension Array
        CurrentTime,SimulationTime, GROUP_No'S as
        Integer
         NODE_No'S, A as Integer
        SPEED_DEV, ANGLE_DEV as Real
Let:
        Simulation_Time = 110 //second
        A = 0 // Initialize by zero
Begin:
        GROUP_No'S = Input ("Enter Number of
Groups")

        FOR J = 1 To GROUP_No'S
                x [J] = Input("Ente Number of node in
Group")
        NEXT J
        SPEED_DEV = Input ("Enter Speed of Deviation")
        ANGLE_DEV = Input ("Enter Angle of Deviation
in degree")
        ANGLE_DEV = ANGLE_DEV / 2.314 * 180
        FOR J = 1 To GROUP_No'S
        in_name [J] = Input ("Enter Reference Point trace
file for Group")
        NEXT J
        FOR J = 1 To GROUP_No'S
                FOR K = 1 To X[J]
                        mobilenode
[J][K].initialize_node( ) and save in output trace file
                 NEXT K
                A = A + X[J]
                NODE_NUMBERS = A
        NEXT J
        FOR CurrentTime = 0 To SimulationTime
                FOR J = 1 To GROUP_No'S
                        NODE_No'S = x [J]
                        FOR K = 1 To NODE_No'S
                        mobilenode [J][K].update_node(
) and write in output trace file
                        NEXT K
                NEXT J
        NEXT CurrentTime.
 End.
```

4. Simulation Environment

The experimental setup is done with the use of NS 2.34 under Red Hat Linux Server Enterprise Edition 5. The tcl script is created for creating energy evaluation model and the traffic types are generated with the help of cbrgen.tcl [24] script. The selected parameters can be changed using setdest [25] command. Each simulation result generates a trace file, which is used as input for a awk script created to obtained statistical results. Further graphs have been plotted with the use of MS-Excel and analyzed the results.
The metrics used to evaluate the performance are given below.

Average Throughput: The total number of the data packets generated by each source, counted by k bit/s.
Packet Delivery Ratio: The ratio of number of data packets generated by the "application layer" with CBR source and the number of data packets received by the CBR sink at the destination [9].
Number of Drop Packets: The number of the data packets generated by the sources failure to reach at the destination.

5. Experimental Setup and Analysis

The experimental setup is done with the use of NS 2.34 under Red Hat Linux Server Enterprise Edition 5. The tcl script is created for creating energy evaluation model and the traffic types are generated with the help of cbrgen.tcl [24] scriptThe major parameters of our experiment are listed in Table1.

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Table-1. Simulation Parameters

Parameter	Value
No. of nodes	60
No. of Groups	2, 4, 5
Simulation Time	110s
Speed Deviation	5 (in m/s)
Angle of Deviation	5 (in degree)
Traffic Type	CBR
Mobility Model	*Modified* RPGM
Network Interface	WirelessPhy
Packet Size	512 byte
Area	700 X 700

6. Result & Discussion

It is observed from the fig. that, the impact of the Blackhole attack to the Networks throughput. The throughput of the network decreases as the nodes increases. And another analysis is that the throughput also decreases when the process is run on UDP connection and that in Tcp connection.

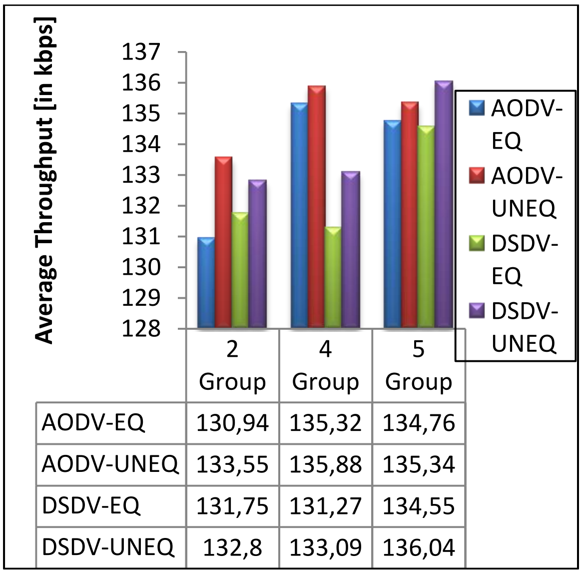

Figure 6.1: Average Throughput in AODV and DSDV with 2,4 and 5 Group with equal and unequal distribution of groups

Figure 6.1 shows that Average throughput performance of AODV protocol and DSDV protocol with CBR traffic for equal and unequal distribution of nodes inside groups. Average Throughput with CBR shows that AODV routing protocol works better in equal distribution of nodes whereas DSDV works better in unequal nodes distribution as the no of group increases.

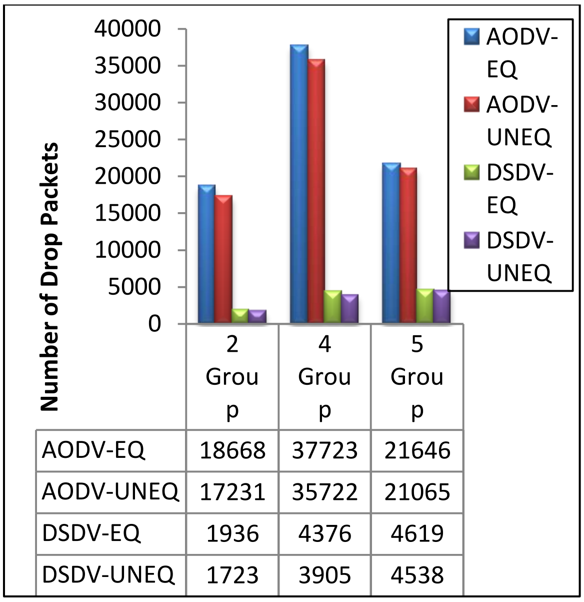

Figure 6.2: Number of drop packets in AODV and DSDV with 2, 4 and 5 Group with equal and unequal distribution of nodes

Figure 6.2 shows the performance of No of drop packet parameter in AODV and DSDV protocols in 2, 4 and 5 Group with equal and unequal distribution of nodes in the groups. The number of drop packet is more in AODV as compared to DSDV in both equal and unequal distribution of nodes in all groups.

7. Conclusion and Future Work

The simulation results indicate that in terms of parameter Average Throughput AODV routing protocol works better in equal distribution of nodes whereas DSDV works better in unequal nodes distribution as the no of group increases.

The number of drop packet is more in AODV as compared to DSDV in both equal and unequal distribution of nodes in all groups.

These results state that AODV routing protocol perform well with equal distribution and DSDV perform better with unequal distribution in terms of average throughput, whereas AODV routing protocol perform well with unequal distribution and DSDV perform better with equal distribution in terms of PDR. In future, further attempts will be made to evaluate and measure performance of various MANET routing protocols with more number of uneven distributed groups with different number of nodes inside the groups under various scenarios and other routing protocol as well.

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