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Analysis of Mobile ad-hoc Network(MANETs) Routing Protocol

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Abstract—*In this paper, We describes about basic structure , effects of various mobility models on the performance of two routing protocols and the issues or challenges faced by MANET.*
two routing protocols details and their performance based on Dynamic Source Routing (DSR-Reactive Protocol) and Destination-Sequenced Distance-Vector (DSDV-Proactive Protocol)
For performance we have to achieve the below Goals: must be scalable; must be fully distributed, no central coordination; must be adaptive to topology changes caused by movement of nodes; route computation and maintenance must involve a minimum number of nodes; must be localized, global exchange involves a huge overhead; must be loop-free; must electively avoid stale routes; must converge to optimal routes very fast; must optimally use the scare resources: bandwidth, battery power, memory, computing; should provide QoS guarantees to support time-sensitive trace

Keywords*: DSR, DSDV, Design issues, Routing protocols, Applications.*

1. INTRODUCTION

A Mobile Ad-Hoc Network (MANET) is a self-configuring network of mobile nodes connected by wireless links, to form an arbitrary topology. The nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly. Minimal configuration, quick deployment and absence of a central governing authority make ad hoc networks suitable for emergency situations like natural disasters, military conflicts, emergency medical situations etc [1] [2]. Many previous studies have used Random Waypoint as reference model [3] [4]. However, in future MANETs are expected to be used in various applications with diverse topography and node configuration. Widely varying mobility characteristics are expected to have a significant impact on the performance of the routing protocols like DSR and DSDV. The overall performance of any wireless protocol depends on the duration of interconnections between any two nodes transferring data as well on the duration of interconnections between nodes of a data path containing n-nodes. We will call these parameters averaged over entire network as "Average Connected Paths".

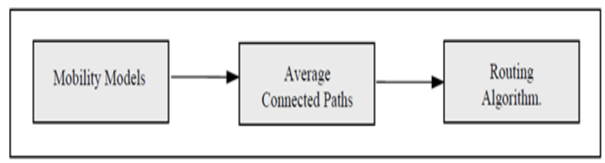

Fig. 1: Relationship between protocol performance and mobility model

The mobility of the nodes affects the number of average connected paths, which in turn affect the performance of the routing algorithm. We have also studied the impact of node density on routing performance. With very sparsely populated network the number of possible connection between any two nodes is very less and hence the performance is poor. It is expected that if the node density is increased the throughput of the network shall increase, but beyond a certain level if density is increased the performance degrades in some protocol. We have also studied the effect of number of hops on the protocol performance [5] [6] [7] [8].

2. DESCRIPTION OF ROUTING PROTOCOL

A. Destination-Sequenced Distance-Vector (DSDV)

Destination-Sequenced Distance-Vector Routing protocol is a proactive table driven algorithm based on classic Bellman-Ford routing. In proactive protocols, all nodes learn the network topology before a forward request comes in. In DSDV protocol each node maintains routing information for all known destinations. The routing information is updated periodically. Each node maintains a table, which contains information for all available destinations, the next node to reach the destination, number of hops to reach the destination and sequence number. The nodes periodically send this table to all neighbors to maintain the topology, which adds to the network overhead. Each entry in the routing table is marked with a sequence number assigned by the destination node. The sequence numbers enable the mobile nodes to distinguish stale routes from new ones, thereby avoiding the formation of routing loops [9].

Dynamic Source Routing protocol is a reactive protocol i.e. it determines the proper route only when a packet needs to be forwarded. The node floods the network with a route-request and builds the required route from the responses it receives. DSR allows the network to be completely self-configuring without the need for any existing network infrastructure or administration. 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. All aspects of protocol operate entirely on-demand allowing routing packet overhead of DSR to scale up automatically.

Route Discovery: When a source node S wishes to send a packet to the destination node D, it obtains a route to D. This is called Route Discovery. Route Discovery is used only when S attempts to send a packet to D and has no information on a route to D.

Route Maintenance: When there is a change in the network topology, the existing routes can no longer be used. In such a scenario, the source S can use an alternative route to the destination D, if it knows one, or invoke Route Discovery. This is called Route Maintenance [10] [11].

3. MOBILITY MODELS

Different mobility models can be differentiated according to their spatial and temporal dependencies.

Spatial dependency: It is a measure of how two nodes are dependent in their motion. If two nodes are moving in same direction then they have high spatial dependency.

Temporal dependency: It is a measure of how current velocity (magnitude and direction) are related to previous velocity. Nodes having same velocity have high temporal dependency.

Given below are the descriptions of four mobility models with detailed explanation for how they emulate real world scenario. Each description is accompanied by a Network Animator (NAM) Screenshot to give a visual representation of node movement in the model. NAM is a graphical simulation display tool. It has a GUI similar to that of a CD player (play, fast forward, rewind, pause and so on), and also has a display speed controller. All the simulations are performed on Network Simulator Version 2.27 which generates an output NAM file.

4. RANDOM WAYPOINT

The Random Waypoint model is the most commonly used mobility model in research community. At every instant, a node randomly chooses a destination and moves towards it with a velocity chosen randomly from a uniform distribution [0,V_max], where V_max is the maximum allowable velocity for every mobile node. After reaching the destination, the node stops for a duration defined by the 'pause time' parameter. After this duration, it again chooses a random destination and repeats the whole process until the simulation ends. Figures 2-5 illustrate examples of a topography showing the movement of nodes for Random Mobility Model.

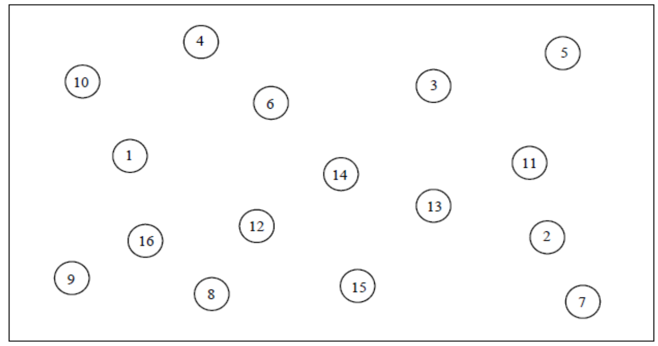

Fig. 2: Topography showing the movement of nodes for *Random mobility model*

5. RANDOM POINT GROUP MOBILITY (RPGM)

Random point group mobility can be used in military battlefield communication. Here each group has a logical centre (group leader) that determines the group's motion behavior. Initially each member of the group is uniformly distributed in the neighborhood of the group leader. Subsequently, at each instant, every node has speed and direction that is derived by randomly deviating from that of the group leader. Given below is example topography showing the movement of nodes for Random Point Group Mobility Model. The scenario contains sixteen nodes with Node 1 and Node 9 as group leaders.

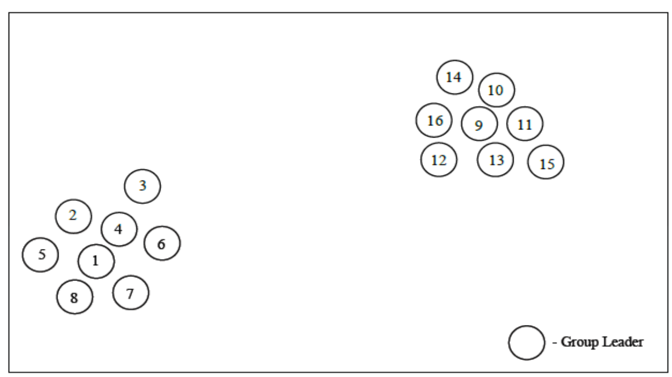

Fig. 3: Topography showing the movement of nodes *Random point group mobility*

6. FREEWAY MOBILITY MODEL

This model emulates the motion behavior of mobile nodes on a freeway. It can be used in exchanging traffic status or tracking a vehicle on a freeway. Each mobile node is restricted to its lane on the freeway. The velocity of mobile node is temporally dependent on its previous velocity.

Given below is example topography showing the movement of nodes for Freeway Mobility Model with twelve nodes.

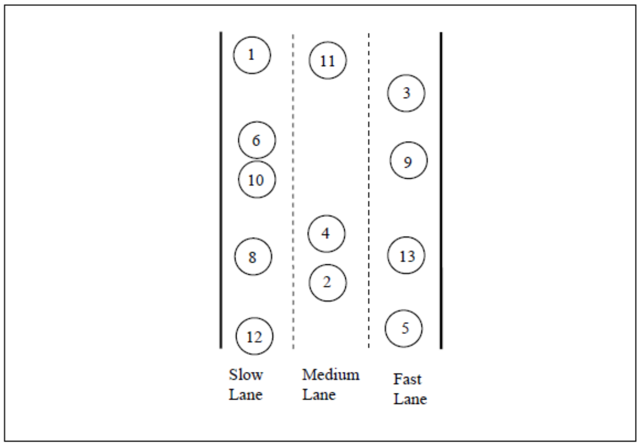

Fig. 4. Topography showing the movement of nodes for *Freeway mobility model*

7. MANHATTAN MOBILITY MODEL

We introduce the Manhattan model to emulate the movement pattern of mobile nodes on streets. It can be useful in modeling movement in an urban area .The scenario is composed of a number of horizontal and vertical streets.

Given below is example topography showing the movement of nodes for Manhattan Mobility Model with seventeen nodes. The map defines the roads along the nodes can move.

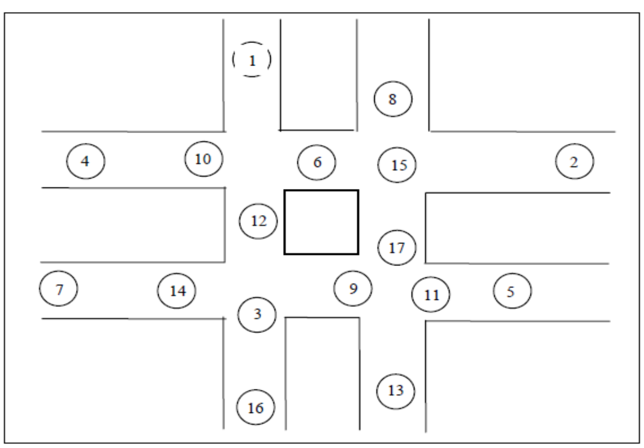

Fig. 5: Topography showing the movement of nodes for *Manhattan mobility model*

8. CONCLUSIONS AND FUTURE WORK

Empirical results illustrate that the performance of a routing protocol varies widely across different mobility models and hence the study results from one model cannot be applied to other model. Hence we have to consider the mobility of an application while selecting a routing protocol. DSR gives better performance for highly mobile networks than DSDV. DSR is faster in discovering new route to the destination when the old route is broken as it invokes route repair mechanism locally whereas in DSDV there is no route repair mechanism. In DSDV, if no route is found to the destination, the packets are dropped.

Future study should be conducted to compare protocols in low mobility environment, where routes do not break to too often. Proactive protocols may give better performance for near stable environment. Performance of other routing protocol can be evaluated over various mobility models taking in to consideration number of average connected paths to gain greater insights into the relationship between them. Designing scenarios which depict real world applications more accurately can be designed through in-depth study of the application.

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