Comparison of Proactive and Reactive MANET Protocols for Delivery Ratio and Load with Changing Mobility

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Abstract: ***In this paper issues pertaining to Destination Sequenced Distance vector (DSDV) and Ad-hoc On-demand Distance Vector (AODV) routing protocol, which are used for efficient routing under different scenarios in MANET. My objective was to implement the two routing protocols using Network Simulators and run it for different number of nodes. Then I compared the two routing protocols for different network parameters and studied the efficient protocol under a particular scenario and changing mobility on the basis of two metrics, Packet delivery ratio and Routing load.***

Keyword: Packet delivery ratio, Routing load, DSDV & AODV simulation

1. Introduction

1.1 Basic

Mobile networking is one of the most important technologies supporting pervasive computing. During the last decade, advances in both hardware and software techniques have resulted in mobile hosts and wireless networking common and miscellaneous. Generally there are two distinct approaches for enabling wireless mobile units to communicate with each other:

Infrastructured: Wireless mobile networks have traditionally been based on the cellular concept and relied on good infrastructure support, in which mobile devices communicate with access points like base stations connected to the fixed network infrastructure. Typical examples of this kind of wireless networks are GSM, UMTS, WLL, WLAN, etc.

Infrastructure less: As to infrastructure less approach, the mobile wireless network is commonly known as a mobile ad hoc network (MANET). Wireless ad hoc networks themselves are an independent, wide area of research and applications, instead of being only just a complement of the cellular system. In this report, we describes the fundamental problems of ad hoc networking by giving its related research background including the concept, features, status, and applications of MANET. Some of the key research issues for ad hoc networking technology are discussed in detail that are expected to promote the development and accelerate the commercial applications of the MANET technology.

1.2 MANET Concept

A MANET is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any existing network infrastructure. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time. The traffic types in ad hoc networks are quite different from those in an infrastructure wireless network, including:

- Peer-to-Peer: Communication between two nodes which are within one hop. Network traffic is usually consistent.
- Remote-to-Remote: Communication between two nodes beyond a single hop but which maintain a stable route between them. This may be the result of several nodes staying within communication range of each other in a single area or possibly moving as a group. The traffic is similar to standard network traffic.
- Dynamic Traffic. This occurs when nodes are dynamic and moving around. Routes must be reconstructed. This results in a poor connectivity and network activity in short bursts.

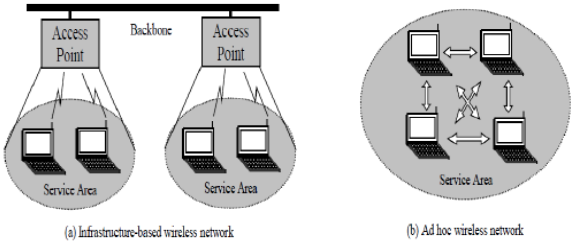


Figure 1: Wireless Network Types [4]

1.3 MANET Applications

With the increase of portable devices as well as progress in wireless communication, ad hoc networking is gaining importance with the increasing number of widespread applications. Ad hoc networking can be applied anywhere where there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use. Ad hoc networking allows the devices to maintain connections to the network as well as easily adding and removing devices to and from the network. The set of

applications for MANETs is diverse, ranging from large-scale, mobile, highly dynamic networks, to small, static networks that are constrained by power sources. Besides the legacy applications that move from traditional infrastructure environment into the ad hoc context, a great deal of new services can and will be generated for the new environment. Typical applications include.

1.4 Classification of Routing Protocols

Classification of routing protocols in MANET's can be done in many ways, but most of these are done depending on routing strategy and network structure. According to The routing strategy the routing protocols can be categorized as Table-driven and Source initiated, while depending on the network structure these are classified as flat Routing, hierarchical routing and geographic position assisted routing. Both the Table-driven and source initiated protocols come under the Flat routing.

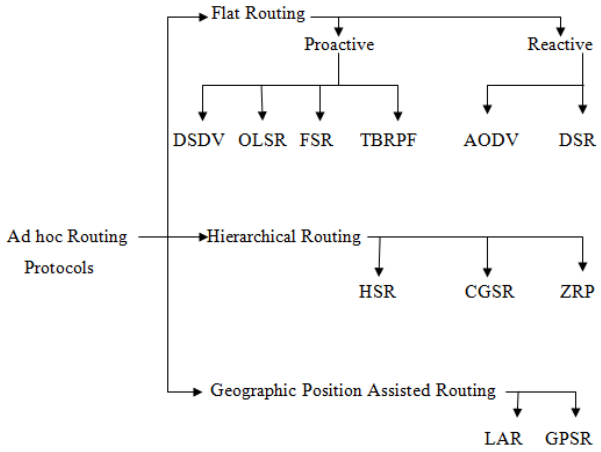


Figure 2: Classification of Routing Protocols in Mobile Ad hoc Networks

2. Simulation

To be able to implement the Destination Sequenced Distance Vector and Dynamic Source Routing protocols certain simulation scenario must be run. This chapter describes the details of the simulation which has been done and the results of the simulations done for the protocols. The simulations were conducted under FEDORA 9 platform.

2.1 CBR file

Manually giving traffic connections for a large number of nodes would be cumbersome. So random traffic connections of TCP and CBR can be setup between mobile nodes using a traffic scenario generator script. The generator script is available under "/indep-utils/cmu-scen-gen" directory, and the file name is cbrgen.tcl. Using this script we can generate random traffic connections between any numbers of nodes. We need to define the following to generate random traffic connections: [1] [2]

1. The type of traffic connection (CBR or TCP)
2. The number of nodes for which simulation is being done
3. A random seed value
4. Maximum number of connections
5. Rate, whose inverse is used to compute the interval time between CBR packets

2.2 Scenario file

As cbr file is used to store the traffic connections, similarly scenario file is used to store the initial position of the nodes and movement of nodes at different times and their speed, etc. Since it will be difficult to manually give initial position, movement of the nodes and their speed for each movement at different times we use a random file generator here also. The node movement generator is available under /indep-utils/cmu-scen-gen/setdest/ directory. It is available under the name "setdest", which is an exe file. This file is run with certain arguments to create the scenario file. The arguments are:

(1) Number of nodes
(2) Pause time
(3) Maximum speed
(4) Simulation time
(5) X-axis dimension
(6) Y-axis dimension

The cbr and scenario files are loaded in the tcl program instead of creating traffic and movement of the nodes manually and the program is executed. [1][2]

2.3 NAM file and TRACE file

After simulating the program using cbr and scenario files we can get the output in form of two files. One is called as the network animator file (NAM) and the other is called the trace file. These two files are created in the due course of running the program. Basically the two files stores the same things but in different format. NAM file stores the output in such a way that it can be used by the animator to show an animated result, and the trace file stores the output so that it can be analyzed. [2]

3. Simulation of DSDV and AODV

My aim here was to implement DSDV and AODV routing protocol for 10 nodes sending cbr packets with random speed. First the cbr files and scenario files are generated and then using dsdv protocol simulation is done which gives the nam file and trace file. Then another nam and Trace files are created AODV protocol. [2] The following figures are the execution of the nam files instances created. For each execution of the same program different nam files are created and we can view the output on the network simulator.

3.3 Movement Model

The mobile nodes move according to the \random waypoint model. Each mobile node begins the simulation by remaining stationary for pause time seconds. It then

selects a random destination in the defined topology area and moves to that destination at a random speed. The random speed is distributed uniformly between zero (zero not included) and some maximum speed. Upon reaching the destination, the mobile node pauses again for pause time seconds, selects another destination, and proceeds there as previously described. This movement pattern is repeated for the duration of the simulation. [1] The movement patterns are generated by CPU's movement generator (setdest). The chosen values for pause time and maximum speed.

3.4 Communication Model

In the scenario used in this study, five mobile nodes communicate with one of two fixed nodes (hosts) located on the Internet through a gateway. As the goal of the simulations was to compare the different approaches for gateway discovery, the traffic source was chosen to be a constant bit rate (CBR) source. Each source mobile node generates packets every 0.2 seconds in this study. In other words, each source generates 5 packets per second. Since each packet contain 512 bytes of data, the amount of generated data is 5*512*8 bit/s = 20 kbit/s, for each source. The traffic connection pattern is generated by CMUs traffic generator (cbr-gen.tcl). The main parameters in cbrgen.tcl are \connections" (number of sources) and \rate" (packet rate);

Table 1: Simulation Setup

Parameter	*Value*
Transmission range	250 m
Simulation time	110 s
Topology size	800m x 500m
Number of mobile nodes	14
number of sources	4
Number of gateways	2
Traffic type	constant bit rate
Packet rate	5 packets/s
Packet size	512 bytes
Maximum speed	10 m/s

4. Performance Metrics

The second goal of this project is to compare the performance of the two protocols under different scenario. Comparing the different methods is done by simulating them and examining their behavior. In comparing the two protocols, the evaluation could be done in the following three metrics:

(1) The packet delivery ratio defined as the number of received data packets divided by the number of generated data packets

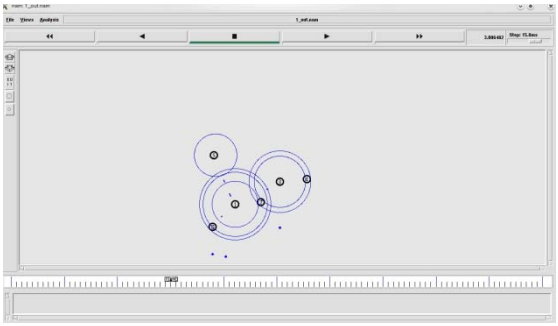


Figure 3: AODV simulation

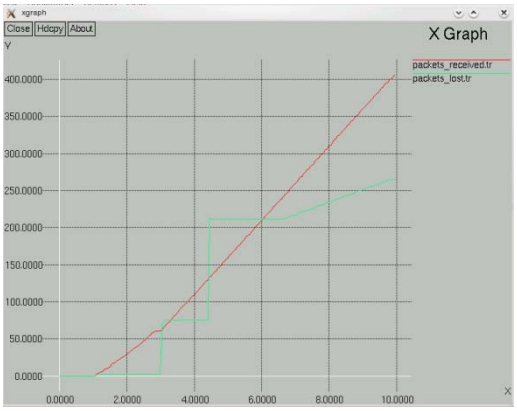
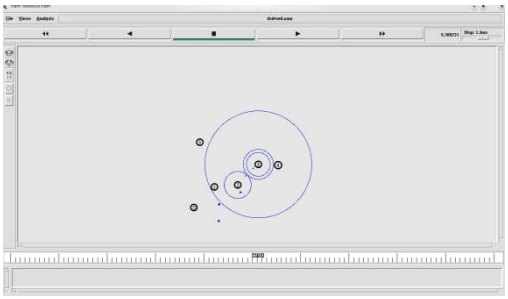


Figure 4: AODV delivery ratio and load



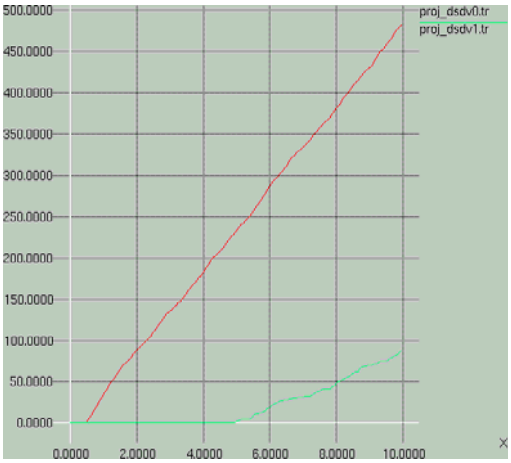


Figure 5: DSDV simulation and delivery ratio and load

(2) The end to end delay is defined as the time a data packet is received by the destination minus the time the data packet is generated by the source.

5. Conclusion

The study reveals that, DSDV routing protocol consumes more bandwidth, because of the frequent broadcasting of

routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which results in less overhead and more bandwidth. From the above, chapters, it can be assumed that DSDV routing protocols works better for smaller networks but not for larger networks. So, my conclusion is that, AODV routing protocol is best suited for general mobile ad-hoc networks as it consumes less bandwidth and lower overhead when compared with DSDV routing protocol.

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