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Proportional Scrutiny of Energy Efficient Routing Protocols in MANET: Implementation

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Abstract: ***This paper focuses on Implementation of the Adhoc System Proportional Scrutiny of Energy Efficient Routing Protocols In MANET Using "NS2" Network Simulator Tool. Evaluated how the different approaches and algorithms affect the energy usage in the mobile devices. Energy is important factor in MANET so we have to use a routing protocol which results in less energy consumption and therefore increases system life time and network life time. Mobile ad hoc networks (MANET) represent distributed systems that consist of wireless mobile nodes that can freely and dynamically organize itself into temporary ad hoc network topologies. A mobile ad hoc network is a collection of nodes that is connected through a wireless medium forming rapidly changing topologies. MANETS are infrastructure less and can be set up anytime, anywhere. we have conducted survey of simulation results of various MANET routing algorithms and analyzed them. The design of efficient routing protocols is a fundamental problem in a Mobile Ad-Hoc Network (MANET). Many different protocols have been proposed in the literature, each one based on different characteristics and properties. Some of these protocols have been studied and their performance have been evaluated, in detail focusing on aspects like routing overhead, delay, throughput and packet delivery ratio. In this Project we concentrated on the energy consumption issues of the routing protocols. we have measured and compared the energy consumption behavior of three routing protocols; Ad hoc On Demand Distance Vector (AODV), the Dynamic Source Routing (DSR) and the Destination Sequenced Distance Vector Routing (DSDV) with respect to energy consumption. Evaluated how the different approaches and algorithms affect the energy usage in the mobile devices. Energy is important factor in MANET so we have to use a routing protocol which results in less energy consumption and therefore increases system life time and network life time. So our goal should be that mobile nodes uses less energy so that we could have long life time network.***

Keywords: NS2,Manet ,Adhoc Network, AODV, Routing

1. Introduction

A Mobile Ad Hoc Network (MANET) is a collection of wireless mobile nodes forming a temporary/short-lived network without any fixed infrastructure where all nodes are free to move about arbitrarily and where all the nodes configure themselves. In MANET, each node acts both as a router and as a host & even the topology of network may also change rapidly. These types of networks assume existence of no fixed infrastructure [1]. The Communication in MANET takes place by using multi-hop paths. Figure 1.1 shows simple example of MANET in which laptops communicate to each other and with mobile phones with out any acess point.

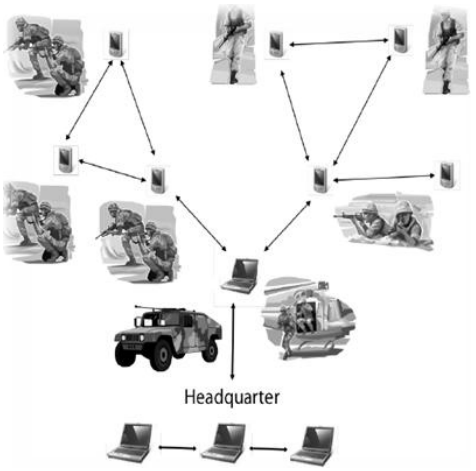

Figure 1.1: A mobile ad hoc network (MANET)

The density of nodes and the number of nodes are depends on the applications in which it is being used. The mobile hosts can move randomly and can be turned on or off without notifying other hosts. If two wireless hosts are out of their transmission ranges in the ad hoc networks, other mobile hosts placed between them can forward their messages, which effectively build connected networks among the mobile hosts in the deployed area.

2. Application of Mobile AD HOC Network

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 [2]:

Military battlefield. Military equipment now routinely contains some sort of computer equipment. Ad hoc networking would allow the military to take advantage of

commonplace network technology to maintain an information network between the soldiers, vehicles, and military information head quarters. The basic techniques of ad hoc network came from this field.

Commercial sector: Ad hoc can be used in emergency/ rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed. Information is relayed from one rescue team member to another over a small handheld. Other commercial scenarios include e.g. ship-to-ship ad hoc mobile communication, law enforcement, etc.

Local level. Ad hoc networks can autonomously link an instant and temporary multimedia network using notebook computers or palmtop computers to spread and share information among participants at a e.g. conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information. Similarly in other civilian environments like taxicab, sports stadium, boat and small aircraft, mobile ad hoc communications will have many applications.

Personal Area Network (PAN). Short-range MANET can simplify the intercommunication between various mobile devices (such as a PDA, a laptop, and a cellular phone). Tedious wired cables are replaced with wireless connections. Such an ad hoc network can also extend the access to the Internet or other networks by mechanisms e.g. Wireless LAN (WLAN), GPRS, and UMTS. The PAN is potentially a promising application field of MANET in the future pervasive computing context.

3. Proposed Work

The overall goal of this work is to measure and compare the energy consumption behavior of the three analyzed routing protocols; Ad hoc On Demand Distance Vector (AODV), the Direct Source Routing (DSR) and the Destination Sequenced Distance Vector Routing (DSDV) with respect to energy consumption .

4. Methodology

Our basic methodology consisted of first selecting the most representative parameters for a MANET, then defining and simulating a basic scenario and finally, by varying the selected parameters, simulate and evaluate more scenarios.
The five selected parameters are: 1) the mobile nodes number, 2) the moving area dimensions, 3) the node's mobility pattern, 4) the number of actual traffic sources and 5) the data traffic pattern. In the simulation, nodes move according to a model called "random waypoint". Motion is characterized by two factors: (a) the maximum speed and (b) the pause time. During simulation each node starts moving from its initial position to a random target point, selected inside the simulation area. The motion speed value is uniformly distributed between 0 and the maximum speed. When a node reaches the target point, waits for the pause time and after that, by selecting another random target point, it moves again.

Fedora formerly Fedora Core, is an Red hat Package Manager-based, general purpose collection of software, including an operating system based on the Linux kernel, developed by the community-supported Fedora Project and owned by Red Hat. The Fedora Project's mission is to lead the advancement of free and open source software and content as a collaborative community. One of Fedora's main objectives is not only to contain software distributed under a free and open source license, but also to be on the leading edge of such technologies. Fedora developers prefer to make upstream changes instead of applying fixes specifically for Fedora—this ensures that their updates are available to all Linux distributions.

5. The Network Simulator (NS2)

Network simulator is a discrete event simulator targeted at networking research. Simulation can be defined as estimating how events might occur in the support of technology. NS2 provides large support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks. There are two languages used in NS2 C++ and OTcl (an object oriented extension of Tcl). The compiled C++ programming hierarchy makes the simulation efficient and execution times faster. The OTcl script which written by the users the network models with their own specific topology, protocols and all requirements need. The form of output produce by the simulator also can be set using OTcl. The OTcl script is written which creating an event scheduler objects and network component object with network setup helping modules. The simulation results produce after running the scripts can be use either for simulation analysis or as an input to graphical software called Network Animation (NAM)

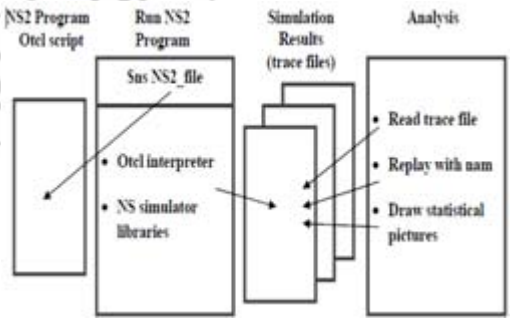

Figure 5.1: Running NS2 programs

6. Tool Command Language (Tcl)

Tool Command Language, Tcl is a powerful interpreted programming language developed by John Ouster out at the University of California, Berkeley. Tcl is a very powerful and dynamic programming language. It has a wide range of usage, including web and desktop applications, networking, administration, testing etc. Tcl is a truly cross platform, easily deployed and highly extensible. The most significant advantage of Tcl language is that it is fully compatible with

the C programming language and Tcl libraries can be

7. The Network Animator (NAM)

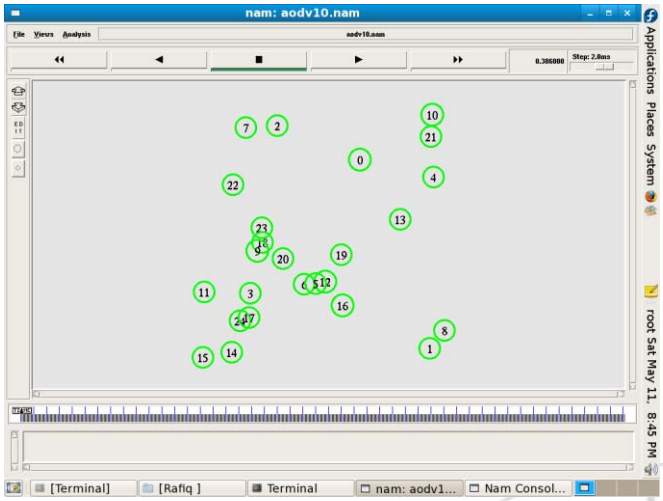

Figure 6.1: Nam Showing Topology Graph when Simulation Started (circles represent mobile nodes)

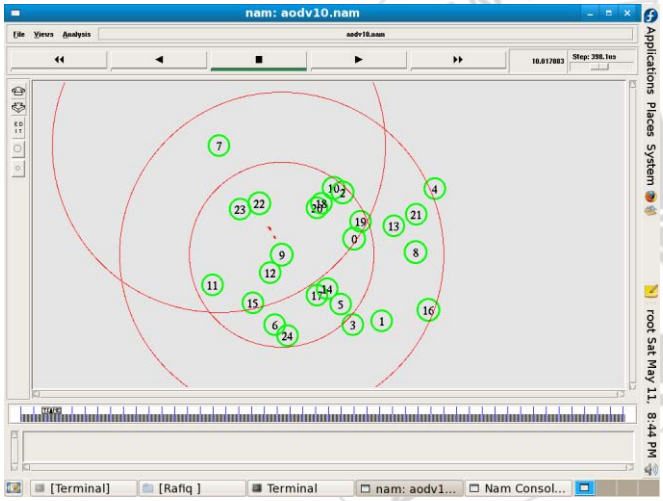

Figure 6.2: Nam Showing Topology Graph when Simulation in progress

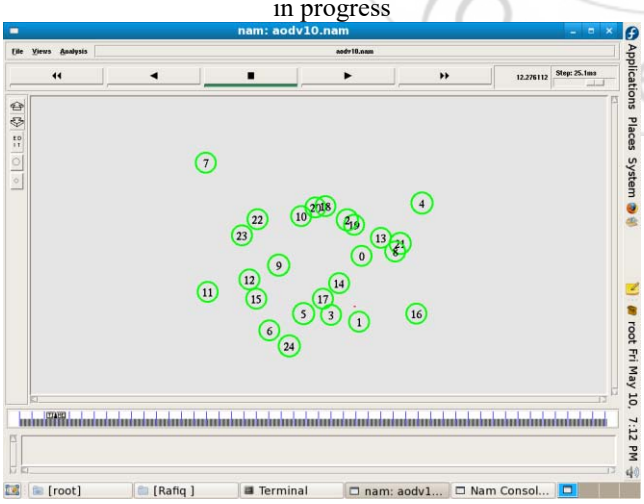

Figure 6.3: Nam showing green coloured nodes at the start

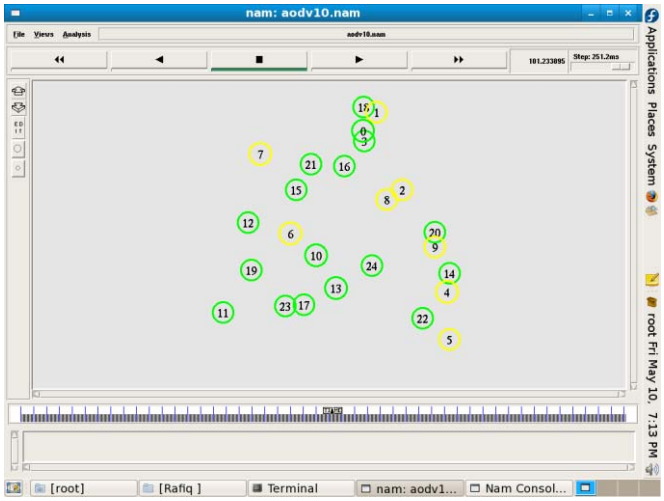

Figure 6.4: Nam showing green and yellow coloured nodes

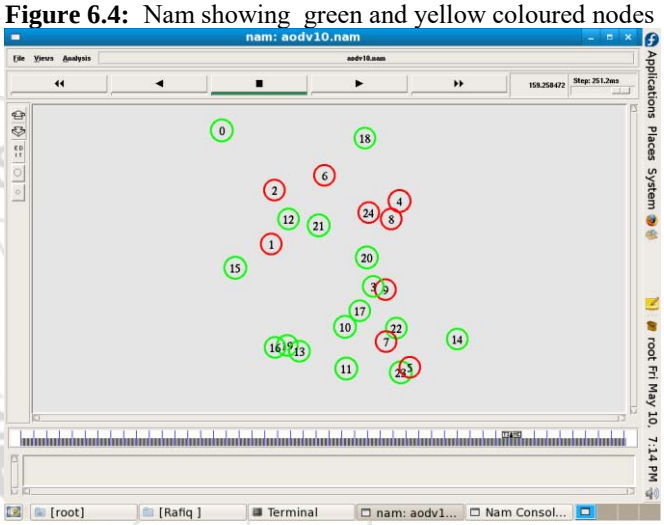

Figure 6.5: Nam showing green and red coloured nodes

8. Energy Model API

The energy model is used through the node-config API. The following parameters are generally there.

```
ns_ node-config -adhocRouting $val(rp) \
                -llType $val(ll) \
                -macType $val(mac) \
                -ifqType $val(ifq) \
                -ifqLen $val(ifqlen) \
                -antType $val(ant) \
                -propType $val(prop) \
                -phyType $val(netif) \
                -channel $chan_1_ \
                -topoInstance $topo \
                -agentTrace ON \
                -routerTrace ON \
                -macTrace OFF \
                -movementTrace OFF\
               -energyModel EnergyModel \
                -initialEnergy 200\
               -idlePower 0.73 \
               -txPower 1.40\
               -rxPower 0.9 \
               -sleepPower 0.001\
               -transitionPower 0.1\
              -transitionTime 0.005
```

Figure 7.1: Node –config API

9. The Trace File

After running the script, a trace file named '.tr' is generated

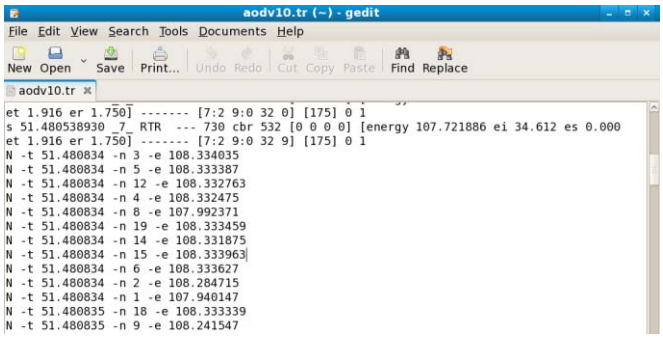

Figure 8.1: Contents of trace file

10. Average Remaining Energy versus Number of Nodes

Figures 4.1 and Figure 4.2 shows that Average Remaining energy and % Average Remaining Energy of DSDV is higher than DSR and AODV when we are increasing number of nodes from 10 to

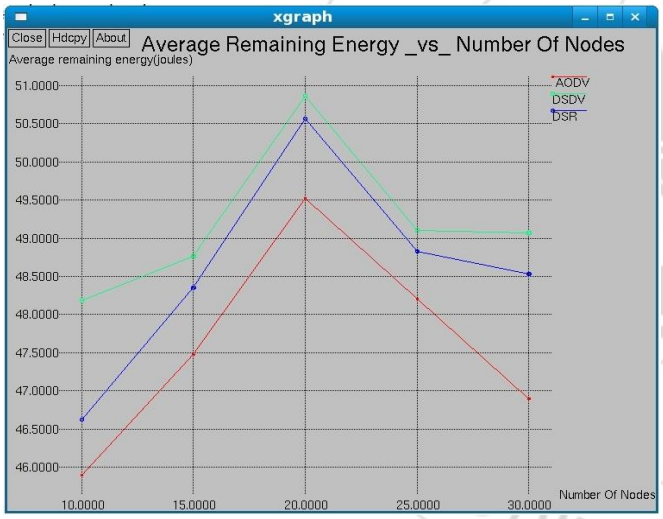

Figure 9.1: Average Remaining Energy versus Number of nodes

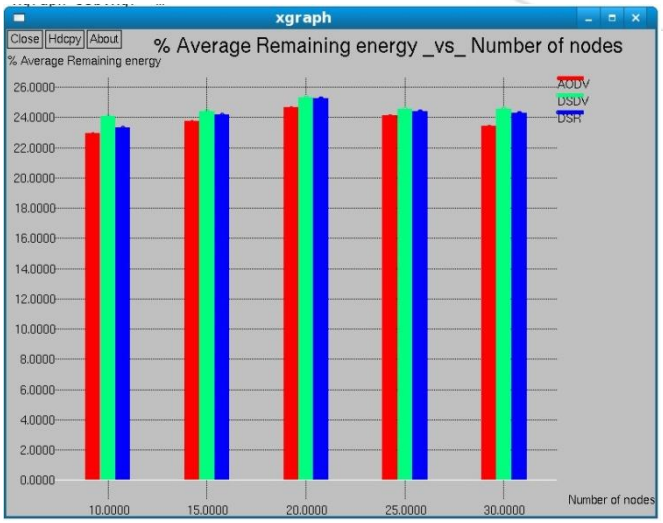

Figure 9.2: % Average Remaining Energy versus Number of nodes

11. Conclusion and Future Scope

Routing in MANET's is an interesting research area that has been growing in recent years. The main difficulty in MANET is faced because of the continuous change in the environment. With this changing environment a routing protocol is used to decide the best suitable route for sending data to the sink from a source node. One of the major concerns is to send this data on a route which consumes less power, because the power is a limited resource in mobile ad hoc networks. So to make our communication energy efficient, we have to choose a routing protocol which considers energy as an important parameter.

In this work, the performance of three routing protocols has been analysed against various parameters such as, average remaining energy, average consumed energy, network life time ,system life time and ECSDD. It would be interesting to note the behaviour of these routing protocols for larger number of nodes say 100,150 and 200 nodes in the network .Also it would be interesting to note the behaviour of these routing protocols for FTP traffic. Also it would be interesting to compare these routing protocols with other routing protocols say AOMDV, TORA and OLSR for above considered performance metrics and also interesting to note the behaviour of these protocols on a real life test.

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