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Proportional Scrutiny of Energy Efficient Routing Protocols in MANET: Review

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Abstract: ***Mobile ad hoc networks (MANET) represent distributed systems that consist of wireless mobile nodes that can freely and dynamically organize it self 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: 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.

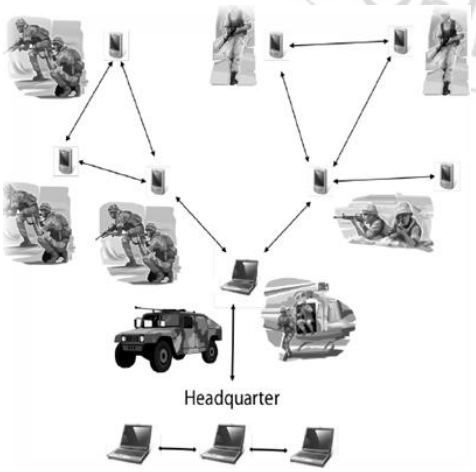

Figure 1.1: A mobile ad hoc network (MANET)

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.

2.1 MANET Challenges

The following list of challenges shows the inefficiencies and limitations that have to be overcome in a MANET environment [3].

Limited wireless transmission range. In wireless networks the radio band will be limited and hence data rates it can offer are much lesser than what a wired network can offer. This requires the routing protocols in wireless networks to use the bandwidth always in an optimal manner by keeping the overhead as low as possible. The limited transmission range also imposes a constraint on routing protocols in maintaining the topological information. Especially in MANETS due to frequent changes in topology, maintaining the topological information at all nodes involves more control overhead which, in turn, results in more bandwidth wastage.

Broadcast nature of the wireless medium. The broadcast nature of the radio channel, that is, transmissions made by a node are received by all nodes within its direct transmission range. When a node is receiving data, no other node in its neighbourhood, apart from the sender, should transmit. A node should get access to the shared medium only when its transmissions do not affect any on going session. Since multiple nodes may contend for the channel simultaneously, the possibility of packet collisions is quite high in wireless networks . Even the network is susceptible to hidden terminal problem and broadcast storms . The hidden terminal problem refers to the collision of packets at a receiving node due to the simultaneous transmission of those nodes that are not within the direct transmission range of the sender, but are within the transmission range of the receiver .

Packet losses due to transmission errors. Ad hoc wireless networks experiences a much higher packet loss due to factors such as high bit error rate (BER) in the wireless channel, increased collisions due to the presence of hidden terminals, presence of interference, location dependent contention, uni-directional links, frequent path breaks due to mobility of nodes, and the inherent fading properties of the wireless channel.

Mobility-induced route changes. The network topology in an ad hoc wireless network is highly dynamic due to the movement of nodes; hence an on-going session suffers frequent path breaks. This situation often leads to frequent route changes. Therefore mobility management itself is very vast research topic in ad hoc networks.

Mobility-induced packet losses. Communication links in an ad hoc network are unstable such that running conventional protocols for MANETS over a high loss rate will suffer from severe performance degradation. However, with high error rate, it is very much difficult to deliver a packet to its destination.

Battery constraints. This is one of the limited resources that form a major constraint for the nodes in an ad hoc network. Devices used in these networks have restrictions on the power source in order to maintain portability, size and weight of the device. By increasing the power and processing ability makes the nodes bulky and less portable. So only MANET nodes has to optimally use this resource.

Potentially frequent network partitions. The randomly moving nodes in an ad hoc network can lead to network partitions. In major cases, the intermediate nodes are the one which are highly affected by this partitioning.

Ease of snooping on wireless transmissions (security issues). The radio channel used for ad hoc networks is broadcast in nature and is shared by all the nodes in the network. Data transmitted by a node is received by all the nodes within its direct transmission range. So an attacker can easily snoop the data being transmitted in the network. Here the requirement of confidentiality can be violated if an adversary is also able to interpret the data gathered through snooping.

3. DSDV Routing Protocol

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. It was developed by C. Perkins and P.Bhagwat in 1994. The main contribution of the algorithm was to solve the routing loop problem which was found when using DV protocol. Each entry in the routing table contains a sequence number, the sequence numbers are generally even if a link is present; else, an odd number is used[12]. The number is generated by the destination, and the emitter needs to send out the next update with this number. Routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently

4. Literature Review

In this section we present literature review in details for routing protocols in MANETs:

In ref [1] Bilal et al. provides an overview of different protocols by presenting their characteristics and functionality, and then provides a classification of these different routing protocols available for the transmission in ad hoc networks. In this article we provide descriptions of several routing schemes proposed for ad hoc wireless networks. We also provide a classification of these schemes according to the routing strategy. The presented classification model of routing protocols is a meaningful attempt to clarify the vast field of ad hoc routing protocols.

In ref [4] Dinesh Singh et al Comparative Analysis of Energy Efficient Routing Protocols in MANETS (Mobile Ad-hoc Networks) have conducted survey of simulation results of various MANET routing algorithms and analyzed them. The routing algorithms considered are classified into two categories proactive and reactive. The algorithms considered are AODV, DSR, and DSDV. The performance measurements are based on the various parameters such as packet delivery fraction, average end to end delay and number of packets dropped.

In ref [5] k. arulanandam et al. In this paper, provides an overview of energy Efficiency issues in ad hoc networks . Energy models widely used in analyzing and devising ad hoc protocols were discussed. The sources of energy consumption that pertain to communications in ad hoc network were shown to exist in four main modes of operation: transmitting, receiving, idle and sleep modes. The sources of energy consumption overhead such as idle condition, collisions and protocol control messages have been discussed. The metrics used for energy-efficiency strategies have also been explored briefly. They presented a case study which sheds light on some of the energy inefficiency issues encountered in ad hoc networks.

In ref [6] Khiavi et al. in this paper evaluates performance of four commonly used mobile ad hoc routing protocols namely AODV, DSDV, DSR and TORA. Performance evaluation did in NS-2 simulator by doing many simulations. Comparison was based on Packet Delivery Ratio, Network Life Time, End-to-End Delay and Routing Overhead. By using simulation results they showed that DSDV gives better performance in wide range of simulation conditions.

In ref [8] Nivedita N. Joshi et al. in this work analysed protocols considering the performance metrics such as packet delivery ratio, end to end delay, average energy consumption, and ECSDD.

In ref [10] Shivendu Dubey et al.in this work analyse the energy consumption in traffic models (CBR, Pareto and Exponential) and measured using routing protocols namely AODV, OLSR and AOMDV. Simulation and computation of energy consumed, received and transmitted energy were done with ns-2 simulator (2.34 version) with parameter variation: number of nodes, pause time, average speed and send rate

In ref [11] according to Jaya Jacob In MANETs, the nodes are mobile and battery operated. As the nodes have limited battery resources and multi hop routes are used over a changing network environment due to node mobility, it requires energy efficient routing protocols to limit the power consumption, prolong the battery life and to improve the robustness of the system. This paper evaluates the performance of various adhoc routing protocols such as DSDV, AODV, DSR, TORA and AOMDV in terms of energy efficiency and it also proposes a new routing algorithm that modifies AOMDV and it provides better performance compared to all the above protocols. Simulation is done using NS-2(version NS-2.34).

5. Simulation Environment

5.1 Fedora- 8

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.

6. Conclusion

In this paper we present literature review in details for routing protocols in MANETs, and Successfully access different types of problems

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