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A Review on Advanced Traffic Control Techniques in Mobile Ad-Hoc Network

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Abstract

A mobile ad hoc network (MANET) is a dynamic distributed system of wireless nodes that move independently of each other. The operating transmission range of the nodes is limited and as a result, MANET routes are often multi-hop in nature. Any node in a MANET can become a source or destination, and each node can function as a router, forwarding data for its peers. MANET routing protocols are either proactive or reactive in nature. Proactive routing protocols determine and maintain routes between any pair of nodes irrespective of their requirement. The reactive on-demand routing protocols determine a route only when required. As the network topology changes dynamically, reactive on-demand routing has been preferred over proactive routing .In this Paper, we will review the routing protocol in the MANET.

Keyword: *MANET, Traffic Control, Prediction Technique.*

Introduction

A mobile ad hoc network is an autonomous collection of mobile devices (laptops, smart phones, sensors, etc.) that communicate with each other over wireless links and cooperate in a distributed manner in order to provide the necessary network functionality in the absence of a fixed infrastructure. This type of network, operating as a stand-alone network or with one or multiple points of attachment to cellular networks or the Internet, paves the way for numerous new and exciting applications. Application scenarios include, but are not limited to: emergency and rescue operations, conference or campus settings, car networks, personal networking, etc.

Mobile ad hoc network is a collection of wireless devices moving in seemingly random directions and Communicating with one another without the aid of an established infrastructure. Communication protocols for MANETs are designed to work in a peer-to-peer networking mode. To extend the normal coverage of the node, neighboring nodes act as routers. Thus, data may be sent via multiple hops from a source to its destination. There are a couple of technical challenges that must be addressed to make such networks usable in practice.

First, since the A nodes can be mobile and, thus, the topology can be changing frequently, a highly adaptive routing protocol must be employed to maintain routes between all pairs of source-destination nodes. Second, a number of computing nodes must have fair and efficient access to shared channels. The half-duplex, broadcast nature of the wireless medium makes the design of the medium access control (MAC) protocol nontrivial. Figure 1 shows the mobile ad-hoc network (MANET architecture).

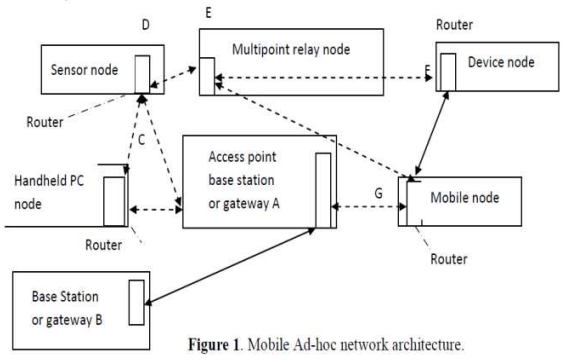

Figure 1. Mobile Ad-hoc network architecture.

Figure 1 demonstrates the ad-hoc network formed by the nodes A, C, D, E, F, and G. It shows that each mobile device or sensor functions as a node with a switch or router. An important characteristic of ad-hoc network architecture is that its organization can change due to movement of a device or sensor. In other words, the ad-hoc networks are self-organizing.

MANET is a self-configuration wireless ad-hoc network of mobile nodes. Each node has a router or a switch connected by the wireless connection. The union of connections is in an arbitrary topology. Network can function independently or connect to internet IPv4 or IPv6. The MANET organization depends upon the location of the nodes, their connectivity, their services discovery capability, and their ability to search and route messages using nearest node or nearby nodes.

Related Work

In year 1998, S. R. Das, R. Castaneda, J. Yan, and R. Sengupta performed Comparative performance evaluation of routing protocols for mobile. In this paper we studied various routing protocols some ad-hoc network routing protocols are:-

1. **Pro-active (Table driven):-** Proactive routing protocols continuously update the routing table, thus generating sustained routing overhead. Proactive protocols have a low latency and do not scale well.
2. **Reactive (On-demand):-** Reactive protocols discover routes on-demand. reactive protocols tend to have a higher latency and scale as compare to proactive protocol.
3. **Hybrid (Pro-active/Reactive):-** It periodically updates the routing table. Instead, when there is some data to send, they initiate route discovery process through flooding which is their main routing overhead. Reactive routing protocols also suffer from the initial latency incurred in the route discovery process, which potentially makes them unsuitable for safety applications and Hybrid routing protocols is a Combination of proactive and reactive.

In March 2007, Jaspal Kumar, Dr. Savina Bansal defined an Efficient Routing Technique for Mobile Adhoc Wireless Networks". They discussed GA (Genetic Algorithm) and AHP (Analytical Hierarchy Process) based route optimization technique. **GA** and **AHP** uses integrity of network services, traffic congestion , node status, power consumption & node density the network for node selection so as to optimize the route determination. As high-speed networks have flourished across the globe, their topologies have become sparser due to the increased capacity of communication media and cost considerations. A Genetic Algorithm (GA) [27] is a learning algorithm which operates by simulating evolution. Key features that distinguish a GA from other search methods include - a population of individuals where each individual represents a potential solution to the problem to be solved. Individuals are typically binary strings, but in the context of routing we will take them to be sequences of nodes. The Algorithms include randomly generating an initial population, computing and saving the fitness for each individual in the proportional to generating by probabilistically selecting individuals from population to produce offspring via genetic operators, repeating the computation for of fitness function for each individual until satisfying solution is obtained. Analytical Hierarchy Process (AHP) [19] is a method for comparing a list of objectives or alternatives. AHP is a comprehensive, logical and structured framework. It allows improving the understanding of complex decisions by decomposing the problem in a hierarchical structure.

STRENGTH:

1. Create the hierarchies to resolve the problem

2. Comparison of the alternatives and the criteria.

3. Assign the priorities to each node so that we consider best route.

4. Greater power saving.

WEAKNESSES:

Based on probabilities taking a more time to select the correct route:

In December 2004, Saman Amendra Desilva, B.S., M.S. defined Techniques to mitigate traffic overload and protocol inefficiencies in Mobile ad hoc networks". In paper he discussed Next hop prediction technique. This technique predicts the next hop that is suitable for route. Actually we transmit the data to such a node that is either out of communication range (Permanent failure) or will not respond to a transmitting node it is exposed to another transmission (Temporary failure).That causes two types of route break. One is false route break (it affect the MANET when it is above saturation) and other is real route break (affect packet delivery rate

and lower the MANET performance). For predicting next hop it use two scheme that is:

1. Pre-prediction technique

2. Post-prediction technique

Pre-prediction technique:-In this technique the sending node predicts whether the next hop node is in range or out of range even before attempting to transmit data.

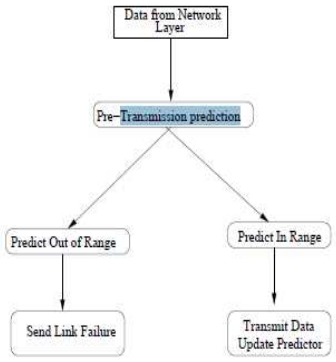

Figure 5.3: Illustration of pre-transmission prediction.

Post-prediction technique:-In this technique the sending node predicts, after a transmission attempt fails, whether the non-responsive next hop is still in range or has moved out of range of communication. Prediction data is updated after each transmission is received from a neighbor and also after a transmission failure. Both types of predictions can be implemented by modifying the MAC layer [5] and require no changes to the routing protocol. Both these techniques use Time-based prediction, Distance-based prediction, Signal-to-Noise ratio (SNR) prediction, State-based prediction, Distance predictor with

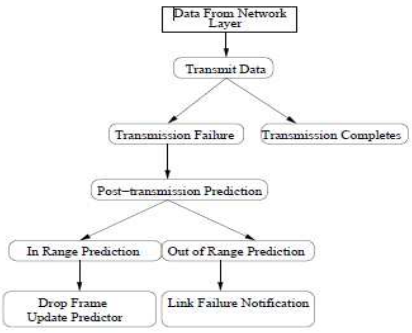

Figure 5.4: Illustration of post-transmission prediction.

STRENGTH:

1. Efficiently predict the next hop using various prediction criteria.

WEAKNESSES:

1. Not single prediction technique work to decrease the problem of real route break and false route break.

2. Lesser power saving.

In the year 1999, E.M. Belding-Royer, C.-K., Toh performed a work on "**Routing protocols for ad-hoc mobile wireless networks**". This paper presents a set of tables that summarize the difference among these various protocols in terms of the complexity, route update patterns and capabilities. Routing protocols for Ad-hoc networking can be classified into four categories viz.

(i) Based on routing information which are updated by anyone of the routing mechanism (Proactive or table-driven, reactive or on-demand and hybrid protocols)

(ii) Based on that instantaneous time information (Both Past and Future time information) for routing

(iii) Based on routing topology (Flat Topology, Hierarchical Topology)

(iv) Based on the use of particular resources (Power Aware Routing and Geographical Information Assisted Routing) for assistance.

Each node in these routing protocols in Mobile Ad hoc networks operates on constrained battery power. The power will start decreases with time even though the node is idle. Power management is an important concept which concentrates how to reduce the energy consumed in the wireless interface of battery-operated mobile devices. So Energy Conservation is taken as a prime factor since all wireless devices usually rely on portable power sources such as batteries to provide the necessary power.

In October 2004,H. Pucha , S.M. Das, Y.C. Hu, performed work on" **The performance impact of traffic patterns on routing protocols in mobile ad hoc networks**". In this paper author shows impact on protocol performance in MANET routing and included several new results on transient connections, traffic concentration, network size and traffic volume. **Network size** of an ad hoc network refers to the total number of nodes in the ad hoc network. As the network size N increases, the average hop length of

routes increases as the probability that a data packet will experience an error while being routed along the path. Although this probability increases irrespective

of the routing protocol used, protocols that use source routing such as DSR have an additional penalty from carrying longer routes in the packet header.

Mobility in an ad hoc network can be characterized by the speed of nodes in the systems as well as the duration of the pause time during which nodes do not move .The average speed of nodes in the system determines the rate at which links break and consequently the overhead consumed by the route maintenance in on-demand protocols. The increased routing overhead in turn can affect the packet delivery ratio of routing protocols from increased multi-access interference .**Communication** included with the random waypoint mobility in the ns-2 network simulator has been widely used in previous protocol comparison studies. Communication consists of the following parameters:

1. Number of CBR sources (S): - The number of CBR (constant bit rate) sources is varied to stress the Congestion level in the network.
2. Traffic volume (V): The aggregate packet rate from all CBR sources is varied to stress the throughput of the routing protocol

In the year 2008, Thomas Kunz, presented the work on" **Energy-Efficient MANET Routing: Ideal vs. Realistic Performance". In this paper** authors presented some results on integrating energy-efficiency aspects into a standard MANET routing protocol, OLSR. In particular, they are exploring the impact of nodes having only inaccurate/imprecise knowledge of the energy levels of other nodes. They use two different energy efficient variants of the OLSR protocol and simulate a wide range of scenarios.

In the year2007, Rajib Mall and Prasant Kumar Patnaik presented work on,"**A Novel Power Aware Routing Technique for Mobile Ad Hoc Networks", In** this paper authors proposed a novel power and battery aware routing protocol, which not only incorporates the effect of power consumption in routing a packet and recent traffic density each node but also exploits the charge recovery effect phenomenon observed in batteries. Route selection is based on a cost metric, which captures the residual battery capacity and drain rate of mobile nodes in the network.

In the year 2010, P.K.Suri, M.K.Soni, Parul Tomar presented work on, **"QoS enabled power aware routing protocol (QEPAR),** Authors proposed a bandwidth-efficient power aware routing protocol "QEPAR". The routing protocol is presented to minimize the bandwidth consumption as well as delay. QEPAR will help in increasing the throughput by decreasing the packet loss due to non availability of node having enough battery power to retransmit the data packet to next node. The proposed protocol is also helpful in finding out an optimal path without any loop.

Objectives

The proposed research work is about to achieve the following research objectives

- Study and analyze existing traffic control techniques in MANET.
- Define a MANET network along with specific bandwidth based parameters.
- Design an Improved technique that is inspired from prediction technique.

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