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Cross Layer Approach For Routing Protocol and Manet

Priyanka Makwana[1], Dhavalsinh Gohil[2]
[1]Student of (M.E.), [2]Assistant Professor
Computer Science and Engineering Department, S.P.B. Patel Engineering College, Mehsana, India

Absract: Mobile Adhoc NETwork (MANET) is a "on the fly" network of mobile nodes. Packets are routed through mobile nodes instead of any fixed base station. Routing protocols developed for wired networks are inadequate as they not only assume mostly permanent topology but also having high overheads. This problem leads to several routing algorithms/proposals specifically for ad hoc networks. However, some of these proposals are optimized variants of protocols designed for wired networks. This paper focused on various On Demand Routing protocols known as reactive protocols such as DSR, AODV, TORA, ABR. the cross-layer design approach is an important concept in mobile ad-hoc networks which is adopted to solve several open issues. It aims to overcome MANET performance problems by allowing protocols belonging to different layers to cooperate and share network status information while still maintaining separated layers.

Keywords: Abr, Aodv, Cross Layer, Dsr,Manet, Tora.

INTRODUCTION

Mobile Ad Hoc Network (MANET) is a collection of wireless mobile nodes dynamically forming a temporary network without the use of existing network infrastructure or centralized administration [1] [2] [3]. In Infrastructure less or Mobile Ad Hoc wireless network, the mobile nodes can move freely while communicating. In the network there are no fixed base stations and all the nodes in the network act as routers. Each node in the network participates in an Ad Hoc routing protocol that allows it to discover multi hop paths through the network to any other node. The mobile nodes in the Ad Hoc network dynamically establish routing among themselves to form their own network 'on the fly'. The nodes or routers are free to move randomly and organize themselves arbitrarily. This type of network may operate in a standalone fashion and different protocols are needed. This paper is organized as follows. Section 2 describes the need and specialty of Ad Hoc Reactive Routing protocols in brief with its vital components. Section 3 provides challenges in routing algorithms. Section 4 presents with various on-demand reactive routing protocols with their advantages and disadvantages that are used in ad hoc networks .Section 5 presents conclusion of this paper and future work and lastly the references

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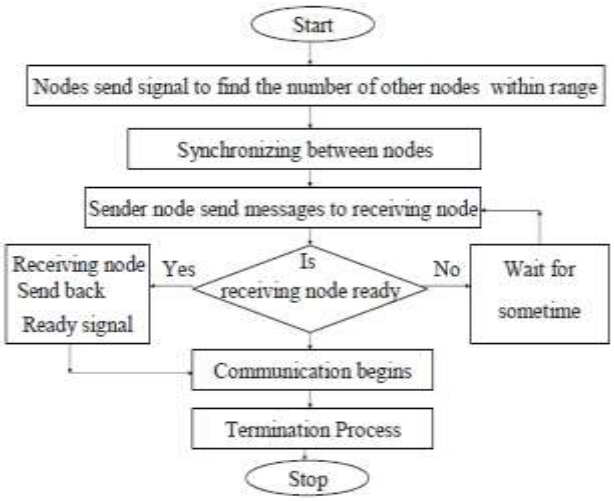

Fig 1.Typical Functioning of MANET

THE NEED OF ROUTING PROTOCOLS

A MANET routing protocol should function effectively over small, collaborative, ad hoc groups to larger mobile,multihop networks. The networking opportunities for MANETs are intriguing and the engineering tradeoffs are many and

challenging. So, a set of performance issues requires new protocols for network control. These protocols try to eliminate the conventional routing tables and consequently reduce the need for updating these tables to track changes in the network topology compared to proactive routing protocols which maintain all up-to-date information at every node [4]. Routes are created only when desired by the source node in on-demand routing protocols. In reactive approach, a source node requires to a destination, it needs to establish a route by route discovery procedure, maintain it by some form of route maintenance procedure until either the route is no longer desired or it becomes inaccessible. Finally demolish it by route deletion procedure. Routes are always available in pro-active protocols (regardless of need),the consumption of power and signaling traffic. While, being more efficient at power consumption and signalling, reactive protocols suffer longer delay while route discovery. Proactive and reactive routing protocols have been improving to be more secure, scalable and to support higher QoS [5][6][7].

ROUTING CHALLENGES IN MANET

Mobile Ad hoc Networks (MANETs) provide a vast area of research for students of universities and computer network researchers. Frequently changing topologies, battery lifetime, disconnected operations and security are some of the challenges that MANET is facing in present days. Students and researchers can only speculate about wide spread future use, with solutions to these problems. In MANET, mobile nodes are given the responsibility of routing traffic within the network. So problem arises which topology it should follow and how to reduce the communication overhead and query latency. That is why wireless networking environment is one of scarcity rather than superfluity. As bandwidth is relatively limited, and energy may be as well. The limited transmission range of wireless network coupled with the highly dynamic routing infrastructure needs extra care. Mobility also creates a lot of anxiety. Issues such as dynamic routing, synchronization, efficient channel access and quality-of-service (QoS) support, lack of central coordination, distributed nature should be considered for communication [8] [9]. Routing protocols also set some limits for the scalability of ad hoc networks. Route acquisition, service location and encryption key exchange is examples of tasks that will increase overhead in the network, which will grow rapidly with the increase of network size.

OVERVIEW OF VARIOUS ON-DEMAND ROUTING PROTOCOLS

In On-Demand routing protocols, the routes are created as and when it is needed. Once a route has been established in the network, it is maintained until either the destination becomes inaccessible or until the route is no longer used.
Existing on-demand re-active routing protocols are:

A. DSR (Dynamic Source Routing),
B. AODV (ad hoc On-Demand Distance Vector Routing)
C. TORA (Temporally-Ordered Routing Algorithm)
D. ABR (Associativity Based Routing)
E. LAR (Location Aided Routing)
F. LMR (Light-Weight Mobile Routing)
G. SSA (Signal Stability Based Adaptive Routing Algorithm)
H. CBRP (Cluster Based Routing)
I. RDMAR (Relative Distance Micro-Discovery Ad-Hoc Routing)
J. MSR (Multi-Path Source Routing)
K. AOMDV (Ad-Hoc On-Demand Multi-Path Distance Vector Routing)
L. ARA (Ant-Colony Based Routing Algorithm)

DYNAMIC SOURCE ROUTING

The Dynamic Source Routing (DSR) [7] [8] is one of the classic example of an on-demand routing protocol that is based on the idea of source routing. DSR protocol is designed (1996) for use in multihop ad hoc networks for mobile nodes. DSR [10] [11] [12] protocol allows the network to be completely selforganizing and self-configuring and does not need any existing network infrastructure. It uses no periodic routing messages, thereby reduces network bandwidth overhead, conserves power and avoids large routing updates. Route Discovery and Route Maintenance are two main features of DSR, which work together to allow nodes to discover routes and maintain source routes to arbitrary destinations in the network. DSR needs support from the MAC layer to identify link failure.

AD-HOC ON-DEMAND DISTANCE VECTOR ROUTING

AODV is a modification of the DSDV algorithm [10] [11].Originally AODV (1999) is a combination of both DSR [13] [12] [14] and DSDV approach. It inherits the basic on-demand mechanism of route discovery and route maintenance from DSR and the use of hop-by hop routing sequence. AODV shares DSR's on-demand characteristics in that it also discovers routes on an "as needed" basis via a similar route discovery process. The recent specification of AODV includes an

optimization technique to control the RREQ flood in the route discovery process. It uses an expanding ring search initially to discover routes to an unknown destination. Increasingly larger neighbourhoods are searched to find the destination in the expanding ring search. The search is controlled by the Time-To-Live (TTL) field in the IP header of the RREQ packets. If the route to a previously known destination is required, the prior hop-wise distance is used to optimize the search. This enables computing the TTL value used in the RREQ packets dynamically, by taking into consideration the temporal locality of routes.

TEMPORALLY-ORDERED ROUTING ALGORITHM

Temporally-Ordered Routing Algorithm (TORA, 1999) is a distributed protocol designed to be highly adaptive so it can operate in a dynamic multihop network. TORA [7] [10] is designed to minimize reaction to topological changes. The basic underlying algorithm is in a family referred to as to as link reversal algorithm. A key concept in its design is that control messages are typically localized to a very small set of nodes. TORA uses an arbitrary height parameter to determine the direction of link between any two nodes for a given destination [11] [15]. As a consequence of this for a given destination multiple routes are often present, but none of them are necessarily the shortest route. When a node wants to initiate a route, it starts to broadcasts a Query to its neighbors.

CROSS-LAYER DESIGN IN WIRELESS NETWORKS

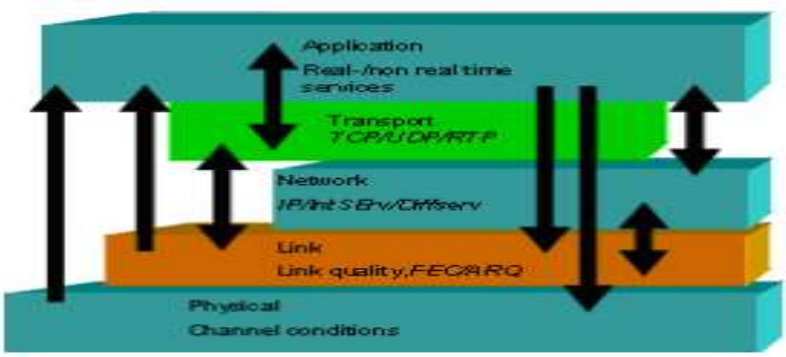

Fig.2. Cross-Layer for wireless protocol stack

CROSS LAYER DESIGN

Data communication is virtually divided into layers. Each layer plays a significant role in packet transmission.The higher layers provides services to the lower layers. For instance Network layer determines the path through which MAC forwards the packets. A cross layer solution is one where lower layer collects certain information (like MAC estimating the power of the packets) and forwards it to upper layers which take their decision based on this information. We will discuss the role of layers and their participation in the current context[16].

AODV-PF

AODV-PF is an update over on-demand routing protocol. When a node, S, needs a route to a destination, D, it floods a route request (RREQ) through the network attempting to find the destination. owever, rebroadcasts of this RREQ message are limited to nodes within a predefined forwarding region.Each node that receives a RREQ checks to determine whether it is inside the forwarding region.A sample forwarding region can be either a circular or a Box like virtual area drawn around the destination node[17].

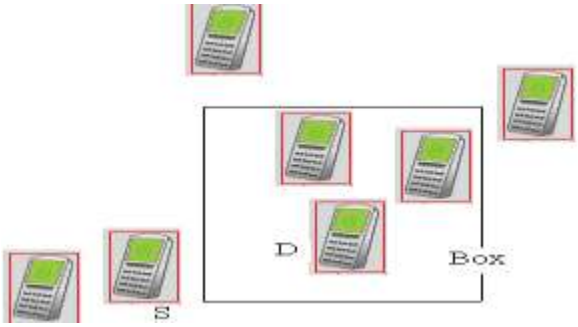

Figure 3: Sample PF Box forwarding region. A route between source node S and destination node D is found by flooding theforwarding region

In PF Box, a neighbor of S determines if it is within theforwarding zone by using the location of S and the expected zone for D. The technique include a two stage route discovery method. In the first stage, the route request packet is forwarded according to either PF Box. If a route reply packet is not received within the route request timeout period, then a second route request packet is flooded through the entire MANET. If a route reply packet is (again) not received within the route request timeout period, then D is considered unreachable.

RELATED WORK

A. Metrics for Reliable Routing

Wireless mesh networks (WMNs) have emerged as a flexible and low-cost network infrastructure, where heterogeneous mesh routers managed by different users collaborate to extend network coverage. This paper proposed a novel routing metric, Expected Forwarded Counter (EFW), and two further variants, to cope with the problem of selfish behavior (i.e., packet dropping) of mesh routers in a WMN.

Issues

1.Cross-layer metric for reliable routing is proposed for WMN not for MANET, so proposed metric can be used to enhance the QoS performance of MANET.

2.Forwarding probability estimation technique is proposed for WMN which is not effective for MANET, so other estimation technique is required to be proposed.

3.Simulation was performed on ORBIT testbed, so NS2 can be used for simulation.

B. Delay-Guaranteed Scheduling

The algorithm guarantees finite buffer sizes and aims to solve a joint congestion control, routing, and scheduling problem in a multihop wireless network while satisfying per-flow average end-to-end delay constraints and minimum data rate requirements.

Issues

1. Simulation was performed on MATLAB, so NS2 can be used for the same simulation.
2. Scheduling policy is defined to schedule routing packets instead of identifying specific path. So instead of scheduling policy, specific path can be identified to route the packets.
3. An algorithm which is proposed is trying to solve joint congestion control, routing and scheduling problem. So it can be enhanced by only considering routing problem.

C. Reducing Delay inMultihop Wireless Networks

authors have addressed how to minimize end-to-end delay jointly through optimizing routing and link layer scheduling. Authors have presented two cross-layer schemes, a loosely coupled cross-layer scheme and a tightly coupled cross-layer scheme. In the loosely coupled cross-layer scheme, routing is computed first and then the information of routing is used for link layer scheduling

Issues

1. Simulation performed in this paper is performed directly by programming where NS2 is not used. So NS2 implementation can be done in future work.
2. Resource reservation & admission control is not proposed in this paper, which can be addressed in future work

CONCLUSION

Being one of the most popular fields of study during the last few years, almost every aspect of ad hoc networks has been explored in some level of detail. Yet, no ultimate resolution to any of the problems is found or, at least, agreed on. In this survey paper, an effort has been made to concentrate on the comparative study and performance analysis of various on demand/reactive routing protocols. Also it is clear that the above mentioned protocols.This survey paper present an overview of these reactive routing protocols for the students or researchers to have an idea about these protocols so that they can be able to enhance the features of these protocols. There is still much work to be done to optimize these routing protocols for different scenarios and applications separately for a general solution.At the present time, the cross-layer design (CLD) approach is an important concept in mobile ad-hoc networks (MANETs) which is adopted to solve several open issues and challenges. It aims to overcome MANET performance problems by allowing protocols belonging to different layers to cooperate and share network status information while still maintaining separated layers.

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