QoS Aware Routing Protocol in Wireless Adhoc Network

JayashreeAgarkhed

Professor, Department of C.S.E, P.D.A College of Engineering,
Kalaburagi, India.

Abstract—*The Mobile Ad-hoc NETwork (MANET) is a dynamic wireless network without any centralized administration consists of the nodes with mobility which uses multi hoping for data exchange. The applications of MANET spans over diverse fields covering real time and mission critical application demanding various Quality of Service (QoS) to be satisfied by the underlying routing infrastructure. To find a least cost or most stable route, the design of routing protocol requires utmost care to be taken to meet the QoS requirements specified by the various applications with available limited resources and stringent characteristics of MANET. This paper reviews numerous QoS routing solutions considering different design issues of the MANET.*

Keywords—Routing, Ad hoc Network, QoS

I. INTRODUCTION

The Ad hoc wireless network is formed with nodes with mobility and get interconnect by multi-hop communication. Data exchange between the nodes in an ad hoc network takes place in a peer-to-peer manner as MANET does not have infrastructure. Every node is the potential candidate to act as a router to provide communication among the sender and the destination in the MANET. The details of the neighborhood nodes and identity of each node is communicated among the nodes in the network with a periodic beacon packet exchange. The MANET finds applications in various fields covering commercial, military and industrial applications with different requirements [1]. The unique characteristics of MANET are as follows.

   a) Self-creating structure
   b) Self-organizing nodes
   c) Varying Network
   d) Node with Self administration
   e) Subjected to high error rate and low bandwidth

The QoS parameter can be termed as performance level that an application can achieve. The performance is judged based on different performance metrics. These QoS parameters to be achieved is application dependent. Multimedia applications demand high data rate transmission with minimum delay. The security and reliability are the important key parameters to be considered for the applications in the field of military. Availability is the key parameter in emergency applications. In sensor networks applications achieving long network lifetime and energy conservation are important QoS parameters. The availability of real time data within the specified time is an critical issue tobe

considered while designing the routing protocols of realtime and critical applications.

The route selection is performed evaluating the QoS parameters such as data rate and delay experienced by the route.

II. RELATED WORK

Following are the types of routing methods given in ad hoc wireless networks.

1. Table driven: In this table driven, each node of the network builds and maintains routing table. Each entry in table stores the detailed information about their neighbours and hop-counts. If any node moves out of the network then routing table has to be updated. Routing table maintained at each node helps to learn the shortest route to destination.

2. On-demand: In this protocol, routing path from source to destination are established on-demand. Route discovery & Route maintenance techniques are used to find & maintain the path. Cache at each node maintains a cache to store the current route for further use. If any error occurred during communication then a route error packet is broadcasted to all nodes.

3. Hybrid technique: It combines both reactive & proactive protocols for better features. Protocol of this type is CEDRAR [6].

Author in [2] has addressed some of the QoS issues and multi hop routing paths for MANET which has got tremendous attention in recent literature. The routing protocol that supports QoS can stand-alone in a multihop mobile network for real-time applications. In [3], the authors proposed QoS protocol that satisfies end-to-end bandwidth. In [4] authors specified a distributed multi-path dynamic source routing protocol (MP-DSR) to provide end to end reliability as a QoS metric. The MP-DSR protocol forwards the data packets on multiple paths considering end-to-end reliability requirements to provide successful packet delivery with high rate than existing the Dynamic Source Routing (DSR). In [5], author proposed stable QoS preserving networks based on the availability of local state information and the knowledge of global states. For QoS routing, the local state information and two different distributed routing algorithms are used, called source initiated routing and destination-initiated routing. The probe packets are flooded nt by the both source and

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intermediate routers. It uses a techniques based on imprecise knowledge of global states, and also uses the notion of ticket-based probing for identifying a feasible route. Each probe carries at least one ticket from sender to receiver to control number of alternate paths to be searched, thus minimizing the routing overhead.

The remainder of the paper is ordered as follows. In Section II related work is reviewed. Section III gives the design issues and characteristics in ad hoc network. Section IV discusses the numerous types of QoS protocols for routing in ad hoc network. Section V highlights the conclusion.

III. DESIGN ISSUES AND QOS PARAMETERS

For the design of efficient routing protocol, various design issues and characteristics are to be considered They are as follows..

A. Design Issuses

The QoS routing protocol has to deal with several design issues.

1. Design Considerations at Link Layer

The link layer design of ad hoc wireless networks leads to many challenges. Various wireless channels are the communications medium, with low bandwidth, random amplitude and phase fluctuations due to multipath fading. They are also subjected to intersymbol interference due to delay spread, and interference from other nodes.This is due to the broadcast feature of the radio channel. The main purpose of link layer design in ad hoc wireless networks is to accomplish data rates that meets the capacity limits of the channel while carefully overcoming channel impairments using slight energy. One research area is to devise the new techniques and design strategies to provide better link layer performance even under an energy constraint.

2. Design considerations at network layer

a) Estimation of Resource: During route establishment abailable bandwidth to a node or link and delay are estimated. Available bandwidth to a link or node dynamically varies. Bandwith is also subjected traffic of its neighboring nodes.

b) Route discovery: It based on choice of routing. Reactive routing reduce overhead at the expense of more delay. Proactive routing leads to increase overhead with less delay. To support QoS aware routing it is desirable to achieve routing with less overhead and latency.

c) Resource reservation: The biggest challenging issue in Ad hoc network is allocation of limited resources among hosts in Ad hoc networks. The resource reservation scheme must be used for setting and maintaining QoS-aware routing.

d) Route maintenance: In MANETs, mobility of nodes causes frequent topology change, making it difficult to meet the QoS constraints. Biggest design issue is incorporating fast route maintenance scheme which discover a route break up.

e) Route selection: Route failures adds up to the end-to-end delay. While designing of QoS-aware routing

protocol, a route with largest available bandwidth, route reliability and route length should be considered.

f) Route failure notification: Routing protocol must provide information about bandwidth available or routing delay estimation through feedback to the application.

B. QoS Parameters

Following are the few of the commonly used QoS metrics in the QoS routing Protocols in MANET.

- Packet Drop: It is the number of data packets which were dropped during their journey to reach the sink.
- Mean Delay: It is defined as the average time between the moment a data packet is sent by a data source and the moment the sink receives the data packet.
- Packet Delivery Ratio: The Packet Delivery Ratio (PDR) is related to the number of packets received successfully at the sink with the total number of packets transmitted.
- Mean Throughput: This is the mean number of packets received by the sink per second.
- Routing Overhead: It is defined as the number of routing packets transmitted for the number of data packets delivered.

C. General QoS algorithm

To satisfy the requirements specified by the applications in MANET, the following algorithm gives the general outline for QoS routing.

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Algorithm: QoS Based Routing algorithm

Step1: Start

Step2: Neighbor node discovery procedure

Step 3: Resource estimation

Step 4: Route discovery using either proactive or reactive

   routing technique

Step 5: Data transmission phase

   Step 5.1: Transmit data to next hop neighbor

   Step 5.2: If route break identified

      Step 5.2.1: Go to step 3

      Step 5.2.2: Go to step 5

Step 6: Performance evaluation

Step 7: End

IV. QOS BASED ROUTING PROTOCOLS

Various QoS based routing protocol in Ad hoc network are discussed as follows.

A. Core-Extraction Distributed Ad Hoc Routing

It uses a greedy algorithm to create an approximate minimum dominating set. All hosts in the network are either member of the core or one-hop neighbors of core hosts. Local topology information in maintained by only core host and it identify topology change, bandwidth

available and perform important task of route discovery and route maintenance [7].

B. Ticket-based QoS Routing

Routing protocol of this type uses tickets to find delay-constrained or bandwidth constrained routes. Tickets are scattered during route discovery a means to find routes with available bandwidth and or to provide delay and limit the flooding for route request packets. It use imprecision model that uses a weight function to estimate the current delay or bandwidth within some precision tolerance based on old and a new delay or bandwidth difference. It performs route discovery by multiple path searches by limited flooding in order to find a qualified route. For this it use yellow or green tickets. Yellow tickets are used for discovery a feasible route with certain delay/bandwidth constraints. The green tickets are used for identifying low-cost routes. Resource reservation done by the destination sending a confirmation message back to the source along the reserved route after the primary route is selected. Route maintenance required when a route is broken. The host on discovering, a route break searches for a local repair by broadcasting its next-hop node's next-hop node to its neighbors and finding a neighbor that has sufficient resources to reach the destination with a new alternative path [6].

C. Trigger-based Distributed-QoS Routing

TDR is a distributed QoS aware, location based routing protocol. It use a local neighborhood database, an activity-based database and performs call admission during route discovery, soft reservations, and prediction of route break to support QoS. It performs bandwidth estimation at lower layers. It uses selective forwarding for route discovery. Route discovery in TDR uses selective forwarding. [8].

D. QoS-aware Routing Based on Bandwidth Estimation

BEQR is a reactive routing protocol based on ad-hoc on demand distance vector (AODV), includes adaptive feedback and admission control by estimation of bandwidth availabe at each host during route discovery [9].

E. ACO based TORA

The objective of QoS aware routing is to provide a feasible path between source and destination node that satisfy two or more QoS parameters. This support multipath by combining ACO framework which is based on behavior of ants and. Temporally Ordered Routing Algorithm (TORA) that increase network lifetime and reduce packet loss. This algorithm is useful for real time applications due to less delay. Multipath routing support, increases the network stability is a one of the important parameter for multimedia application to achieve an uninterrupted data transmission.

F. QoS aware Hierarchical Multi-hop Routing Protocols in MANETs

QoS aware Hierarchical Multi-hop routing schemes for MANET finds best path from a source to a desired destination by calculating the QoS information. This information is collected from group heads or from member of group. The cluster creation algorithm used to form clusters and improves performance even if number of nodes increase. The packets are routed based on information available with gateways. This algorithm manages the handover dynamically.

V. CONCLUSION

For communication among mobile nodes, various issues and characteristic to be considered in the design of QoS aware routing protocol. The main issue that has to considered is satisfying QoS requirements of diverse applications. Various QoS aware routing protocols are reviewd in this paper considering efficient utilization of underlying recourses with less delay and reliable transmission.

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[10] ANEFFICIENTANT BASEDQOSAWARE INTELLIGENTTEMPORALLYORDEREDROUTING ALGORITHM FORMANETS

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