QoS Multipath Path Routing in MANET

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ABSTRACT

Mobile ad hoc networks are typically characterized by high mobility and frequent link failures that result in low throughput and high end-to-end delay. The increasing use of MANETs for transferring multimedia applications such as voice, video and data, leads to the need to provide QoS support. We introduce a routing algorithm, Ad hoc on-demand multipath routing, which provides quality of service (QoS) support,(Q-AOMDV) in terms of bandwidth, hop count and end-to-end delay in mobile ad hoc networks. The results validate that Q-AOMDV provides QoS support in mobile ad hoc wireless networks with high reliability and low overhead.

1. INTRODUCTION

Mobile ad hoc networks are typically characterized by high mobility and frequent link failures that result in low throughput and high end-to-end delay. With the recent advances in wireless technologies, wireless networks are

becoming a significant part of today's access networks.There is a definite rise in popularity for portable wireless devices which are equipped for multimedia communication. Owing to the multimedia application, the problem of Quality-of-Service routing for mobile ad hoc networks is studied.QoS routing in ad hoc networks has been studied only recently . QoS routing requires not only to find a route from a source to a destination, but a route that satisfies the end to-end QoS requirement,in terms of bandwidth or delay. The role of a QoS routing strategy is to compute paths that are suitable for different type of traffic generated by various applications while maximizing the utilizations of network resources. But the problem of finding multi-constrained paths has high computational complexity, and thus there is a need to use algorithms that solve this difficulty. The major objectives of QoS routing are as follows:

a) To find a path from source to destination satisfying user's requirements.

b) To optimize network resource usage and

c) To degrade the network performance when unwanted things like congestion, path breaks appear in the network.

2. ROUTE DISCOVERY

AOMDV is an on-demand routing protocol that builds multiple routes using request/reply cycles.When the source needs a route to the destination but no route information is known, it floods the ROUTE REQUEST (RREQ) message to the entire network. Because this packet is flooded, several duplicates that traversed through different routes reach the destination. The destination node selects multiple disjoint routes and sends ROUTE REPLY (RREP) packets back to the source via the chosen routes. The purpose of computing alternate paths for a source node is that when the primary path breaks due node movement, one of the alternate paths can then be chosen as the next primary path and data transmission can continue without initiating another route discovery.In Q-AOMDV, RREQ message additionally includes HopCount, Time as well as Bandwidth so as to select the primary path in all the available paths while message is broadcasted upon receiving a route request to the destination.

Similarly RRER message also contains the metrics talked above.The mobile ad hoc network is modeled as a graph $G = (N,L)$, where N is a finite set of nodes and L is a set of bi-directional links. The protocol will only use bi-directional links, so any unidirectional links are omitted. The QoS metrics are evaluated by bandwidth(l) and delay(l). As referred to a node i, delay(i) represents the processing delay which includes the queueing delay and the packet transmission time at this node. Similarly bandwidth(l) represents the available bandwidth of the link l and bandwidth (path(m, n)) represents the bandwidth available for the entire path from node m to node n. In multi-path routing protocol, the hop count is also considered as a metric to evaluate the Qos. As discussed above ,we use the following expressions to calculate the delay, bandwidth and

hopcount:

$$delay(path(m,n) = \sum delaay + \sum delay (i)$$
$$l=p(m,n) \qquad ----------(1)$$

$$bandwidth(path(m,n)) = min\{bandwidth(i)\} \qquad ------------ (2)$$

$$hopcounter(path(m,n)) = Number\ nodes$$
$$--------(3)$$

Using the above expressions we can abtain the metric

values of each path in the network and find a

$$P = [D_{mnd}]^{\alpha}[H_{mnd}]^{\beta}[B_{mnd}]^{\gamma} /$$

$$\sum [d_{mqd}]^{\alpha}[H_{mqd}]^{\beta}[B_{mqd}]^{\gamma}$$
$$Q\epsilon nm \qquad ----------(4)$$

evalution method path preference probability P, which aims at finding a path that satisfies certain requirements such as delay ,bandwidth, hopcount..

3. ROUTE MAINTENANCE

In Q-AOMDV, when a node fails to deliver the data packet to the next hop of the route it considers the link to be disconnected and sends a ROUTE ERROR (RERR) packet to the upstream direction of the route. The RERR message contains the route to the source, and the immediate upstream and downstream nodes of the broken link. Upon receiving this RERR packet, the source removes every entry in its route table that uses the broken link (regardless of the destination). If one of the routes of the session is invalidated, the source uses the remaining valid route to deliver data packets. After a source begins sending data along multiple routes, some or all of the

routes may break due to node mobility and/or link and node failures.

4. PERFORMANCE EVALUATION

The main goal of the simulations is to evaluate the performance of both the variations of the proposed protocol. In addition, we compare the performance of our solutions with that of AOMDV.We evaluate the following key performance metrics:

1) Packet Delivery Fraction (PDF): The ratio of the data packets delivered to the destinations to

those generated by the CBR sources, i.e., Packet delivery fraction (puff%) = (Received Packets / SentPackets) *100.

2) Average end-to-end delay of data packets: This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer time.

3) Normalized Routing load (NRL): the number of routing packets transmitted

per data packet delivered at the destination. Each hop-wise transmission of a routing packet is counted as one transmission, i.e. Normalized routing

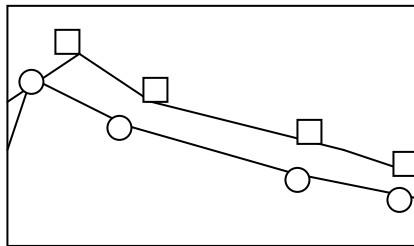load = (routing packets sent) / receives.

Figure : Packet Delivery Ratio

compares the packet delivery ratio of the two protocols in varying mobility conditions. In the simulations, all nodes moved at the same specified speed.The graph demonstrates that Q-AOMDV

(☐) performs better than the AOMDV

(○). The use of path selection causes the packet delivery ratio to drop quite drastically at higher speeds.

5. CONCLUSIONS

We presented Q-AOMDV protocol for ad hoc networks. Q-AOMDV is an on-demand protocol that using path preference probability which are calculated by delays, bandwidth, hop count to select the path to transmit the packet. Providing multiple paths is useful in ad hoc networks because when one of the route is disconnected, the source can simply use other available routes without performing the route recovery process. We attempt efficiently utilize the available network resources.

6. REFERENCES

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