Abstract

The multimedia applications such as audio, video transmissions through Mobile Ad Hoc Network (MANET) require that the path through which such data transmits must be delay sensitive, have more throughput and must be energy efficient. A Mobile Ad Hoc Network represents a system of wireless mobile nodes that can freely and dynamically self-organize into arbitrary and temporary network topologies, allowing people and devices to seamlessly communicate without any pre-existing communication infrastructure. Each node in the network also acts as a router, forwarding data packets for other nodes. A central challenge in the design of Ad Hoc networks is the development of dynamic routing protocols that can efficiently find routes between two communicating nodes. Providing Quality of Service (QoS) support in Mobile Ad Hoc Networks is a particularly active research area with a number of proposals being made to support real-time applications that are based upon the interaction between the routing scheme and a QoS provisioning mechanism. There are several proposals for defining the most suitable routing protocol, but they do not perform optimally under the kind of dynamic conditions possible in Ad Hoc networks.

For the past one decade, many researchers have tried to develop the QoS routing for MANETs. They have modified the existing routing algorithms by adding QoS constraints into them. Most of the QoS aware routing algorithms developed so far take care of only single QoS metric such as delay, bandwidth, energy etc. Few of them tried to provide QoS routing using multiple metrics. However, finding a route, subject to multiple metrics is inherently difficult and in many cases it is considered to be an NP (Nondeterministic Polynomial) complete problem.
Among the existing MANET routing protocols, majority use a single route and do not utilize multiple alternative paths in a single route discovery mechanism. There exist some multipath routing protocols such as Ad Hoc On-Demand Multipath Distance Vector Routing (AOMDV). Compared to AODV the performance of AOMDV is better in terms of QoS metrics. But it fails under high mobility and high density situations. Thus, computation of the multiple disjoint paths efficiently is treated as one of the research problems. It is possible to modify the original AODV to obtain more than one node disjoint paths during single route discovery mechanism.

DSR and AODV are the two well-known on demand routing protocols. They perform better in terms of QoS metrics such as PDR (Packet Delivery Ratio), End-to-End Delay, Jitter etc. A major disadvantage of these two protocols is, the problem associated with routing of packets through flooding, resulting in congestion. The solution to avoid the unnecessary flooding of control messages such as RREQ (Route Request), is another research problem in the proposed work. Each of the packets broadcasted by the source node across the network has a timestamp associated with it. As the nodes are updated in the routing table, it is possible to calculate the average timestamp. Based on the value of average timestamp, it is possible to determine whether the RREQ needs to be broadcasted or not. This avoids the unnecessary flooding and improves the packet delivery ratio.

Upon computing multiple node disjoint paths, the QoS metrics can also be accumulated with the RREQ messages. Lifetime is one of the metrics for AODV that is stored in the routing table entry for intermediate nodes. Lifetime is an expiry time for active route or it is deletion time for an invalid route. Initially, the static life time value from AODV protocol is taken to find the route life time and based on that, the routing decisions are made. The static life time does not help when there is a frequent
change in the network topology and mobility is very high. So there is a need for the dynamic computation of the link life time. This is one of the research problems.

Another research problem is computation of energy across every node, since the efficient usage of the energy improves the network life time. During route discovery mechanism it is possible to determine which nodes have consumed more energy, so that the routing path with less consumed energy can be utilized for data transmission and only such routes are stored in routing table.

This thesis presents a Multi-constrained Multipath QoS Aware Routing Protocol (MMQARP) which computes multiple node disjoint paths, avoids unnecessary broadcasting and computes link reliable, delay aware and energy efficient paths.