ABSTRACT

A Mobile Ad Hoc Network (MANET) is, in general, an autonomous system of mobile hosts, usually connected by wireless links, without any supporting fixed infrastructure. Due to the mobility of the hosts, the network topology changes frequently and unpredictably. Routing in ad hoc network is a challenging task. The major reason for this is the constant change in network topology because of high degree of node mobility. Multipath routing allows the establishment of multiple paths between a source and destination node. The need of multipath routing is to increase the reliability of data transmission or to provide load balancing. Load balancing is important in mobile ad hoc networks because of the limited bandwidth between the nodes and also the nodes have only limited energy resources (battery power).

The quality of service is subjected to several parameters like variable capacities of the nodes, link availability and reliability of unidirectional or bidirectional nature. Several manifold routing protocols have been proposed to achieve the quality of service and extensive research is going in this field, with the goal of dynamically and efficiently creating and maintaining routes between communicating nodes with quality of service and energy awareness. Existing MANET routing protocols found the reliability of
the link using the mechanisms namely average changes of signal strength between two nodes, location aware mechanism using global positioning system and based on the probability that the active link between nodes will be continuously available, since probability based prediction method estimates the link availability in a better way. It has been used by several routing protocols to determine the reliable route.

In the present study, the methodology used for reliability estimation based on prediction, is essentially a mathematical derivation of the conditional probability. The conditional reliability for a given prediction period $t_p$ on the continuous available time for an active link between two nodes at time $t_0$, one uses probability / reliability theory of exponential and weibull nodes and Poisson stochastic process characteristics in a big way. The standard assumptions for the exponential nodes are, the epoch lengths are identically independent and exponentially distributed random variables having constant hazard rate. Whereas, the weibull nodes have identical, independent, weibull distributions and the hazard rate is function of a time.

The first phase of the thesis proposes to design a Reliable and Energy aware QoS Routing (REQR) protocol for MANET. It finds the multiple paths between the source and the destination using the QoS metrics namely route availability and energy consumption. In this work, reliability is calculated based on prediction, so that the uncorrelated memoryless exponential nodes
have only one epoch during prediction period from the initial time and the routing protocol takes into account energy awareness and Quality of service. Simulation results show that REQR achieves better packet delivery ratio, less energy consumption and reduced delay.

Memoryless exponential nodes have the property that each subsequent event is completely independent from the previous events. So, it always has the constant failure rate. Due to memoryless property of the exponential nodes used in REQR, the estimation of link reliability may vary significantly. In case of high mobility, it may degrade the network performance. It is observed that typical protocol REQR is geared towards better link reliability estimation. The second phase of the thesis proposes an Adhoc On Demand Multipath Reliable and Energy aware QoS Routing (AMQR) protocol for MANET. This protocol uses weibull nodes to find the multiple paths between the source and the destination. In this work, link reliability is estimated based on prediction, so that the uncorrelated weibull nodes have any number of epochs during prediction period from the initial time. The routing protocol considered energy awareness also to achieve Quality of service when the hazard rate is a function of time that is closer to reality. Simulation results show that AMQR protocol attains better packet delivery ratio, reduced energy consumption and reduced delay.
Recently, the importance given for the design of congestion aware routing protocol for MANET is due to heavy traffic in the network. Also, the congestion problems are prevalent in transport, MAC and network layers. The third part of the thesis proposes a Cross layer Based Congestion Control Technique for Reliable and Energy aware Routing in MANET (CBCCT). It uses the rate based congestion control in transport layer protocol to regulate the speed of sending rate. In the MAC layer, if the signal interference occurs the link is assumed to be congested. The routing table is updated with the congested route entries and will be forbidden to forward the packet temporarily to relieve congestion. If source receives congestion status information from both MAC and transport layers for the same route then congestion free route will be established for transmission without performing rate control. So CBCCT provides congestion aware routing by attaining less packet drop with reduced delay.