Abstract

$\mathbf{M}$obile Ad hoc Network (MANET) is an infrastructureless wireless network consisting of a number of self-organizing and self-managing wireless nodes, any or all of which may be mobile. These nodes act autonomously and dynamically create a wireless network amongst them without using any networking infrastructure support. Once deployed, the network nodes can freely move around, causing creation and deletion of network links depending on the radio propagation conditions, resulting in time varying network topology. The proliferation of mobile computing and communication devices (e.g., cell phones, laptops, handheld digital devices, personal digital assistants, or wearable computers) is driving a revolutionary change in modern battlefield. A practical MANET would enable the tactical forces to deploy rapidly and operate in the highly mobile in a self-configured mode.

Since the transmission radius of each node in MANET is usually much smaller than the entire network span, multi-hop routing is normally used to transfer data packet from a source node to a destination node, which means the intermediate nodes are used to route data to the destination. Suitable routing protocols need to be used to discover routes between the source and the destination as well as to determine the presence or absence of a path to the destination node. Since an ad hoc network does not have any central entity to take care of routing processes, distributed algorithms are used for these purposes. Designing a distributed protocols capable of handling the dynamic nature of these networks is an interesting, but difficult topic.

Many routing protocols have been proposed to deal with routing in MANETs. Each routing protocol is designed with a unique feature to deal with challenges of routing in MANETs. In this thesis, we have presented all the possible design patterns of ad hoc routing protocols. The present thesis analysis the performance of existing ad hoc routing protocols with respect to the tactical environment. Motivated by the quest for detailed

study, optimization of existing DSR routing protocol using cross-layer information have been presented in the thesis.

In an ad hoc network, when a source node does not have any information about a destination node, the existing geographical routing protocols use flooding techniques or location database server to know the present location of the destination. Enhancement to Ad Hoc On-Demand Distance Vector (AODV) protocol to reduce the number of control packets during location discovery, design of Ad hoc On demand Geographical Gossiping (AOGG) protocol have been presented in this thesis.

A MANET test bed creation using Android tablet PC's and performance analysis of reliable data transfer in an Ad hoc network over multiple hops have been presented in this thesis. Ad hoc-On-Android implementation of AODV routing protocol is used for application layer routing and an implementation of Reliable User Datagram Protocol (RUDP) is used to ensure reliability of data transfer.

Most of the studies have incorporated development of protocol models and verification of the same in carefully designed simulation environments. The simulation results have by and large established the validity of algorithm's theoretical formulations as developed for different situations. A practical test bed for ad hoc networks have been presented in the thesis. The ad hoc routing protocol study and the testbed validation should be useful to the researchers to understand and analyze the ad hoc routing protocol design patterns, performance evaluation of existing ad hoc routing protocols with respect to the tactical environment, to design a custom routing protocol for MANET and practically evaluate in a test bed environment.

Keywords: MANET, Mobile ad-hoc network, Ad hoc networks, Peer to peer computing, routing protocols, cross-layer design, quality of service, route discovery, route maintenance, Automatic Route Shortening, Route Optimization, geographical routing, gossiping, location discovery, Broadcasting, flooding, Reliable data transfer, tactical military network, Performance evaluation, Android application for Ad Hoc Network.