Chapter 1

INTRODUCTION

Mobile computing has gain popularity in the last decade or so as small, economical and portable computers are available. Miniaturization has allowed devices to have embedded computers within them to automate their control. These trends seem to indicate that we are moving towards a scenario where we will have a signi icant number of mobile, wirelessly networked computers in use around us.

One way of enabling wireless networking has been to use a cellular infrastructure. The mobile user registers with a service provider who maintains some base stations over a ixed area of operation. Each of these base stations handles communications with mobile devices in its 'cell', that is, the region over which it can send or receive a radio transmission. These base stations, in turn, are connected to a ixed network, enabling communication between devices in different cells. While this constitutes a fairly reliable means of providing networking to mobile hosts, it has its drawbacks in requiring signi icant expenditure on infrastructure. Further, this kind of service is restricted to areas where the supporting infrastructure exists: where it is viable, physically and economically, to establish the required infrastructure. In the emerging scenario, it may not always be desirable to depend on such a cellular infrastructure.

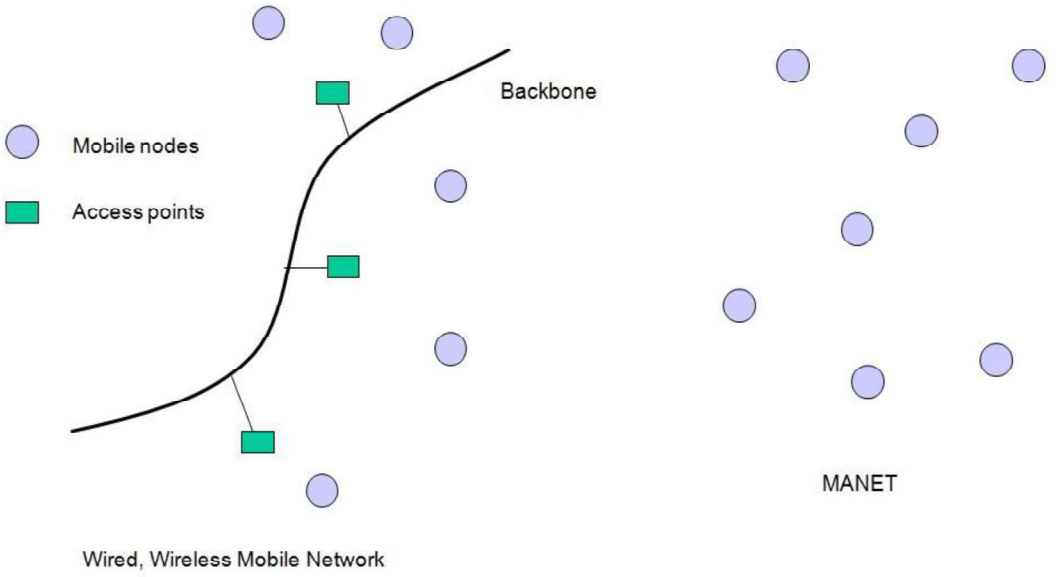

Figure 1.1: Structure of the Networks

We can have situations when there is no existing infrastructure. Typical examples include battle ield or disaster relief operations where such support either does not exist or was destroyed. Other examples include a meeting of people with mobile hosts, in which case, the people involved may not want to use a cellular system because the cost involved in setting up and using such a facility might outweigh the bene its of using the network for their particular task. An alternate approach for mobile networks without establishing a communications infrastructure is the mobile ad hoc network.

1.1 Mobile ad hoc network

An ad-hoc network is the cooperative engagement of a collection of mobile hosts without the required intervention of any centralized access point. Mobile Ad hoc Networks (MANETs) [1, 2, 3, 4, 5] are infrastructure-less wireless networks where nodes are capable of moving. They are formed arbitrarily and dynamically without much setup time or cost. Nodes of a MANETs function as routers. The communication between two hosts is done by multi-hop routing, through the nodes of the network. It is required because nodes which want to communicate may not be within direct radio range of each other. The nodes work together to discover and maintain routes between hosts in the network.

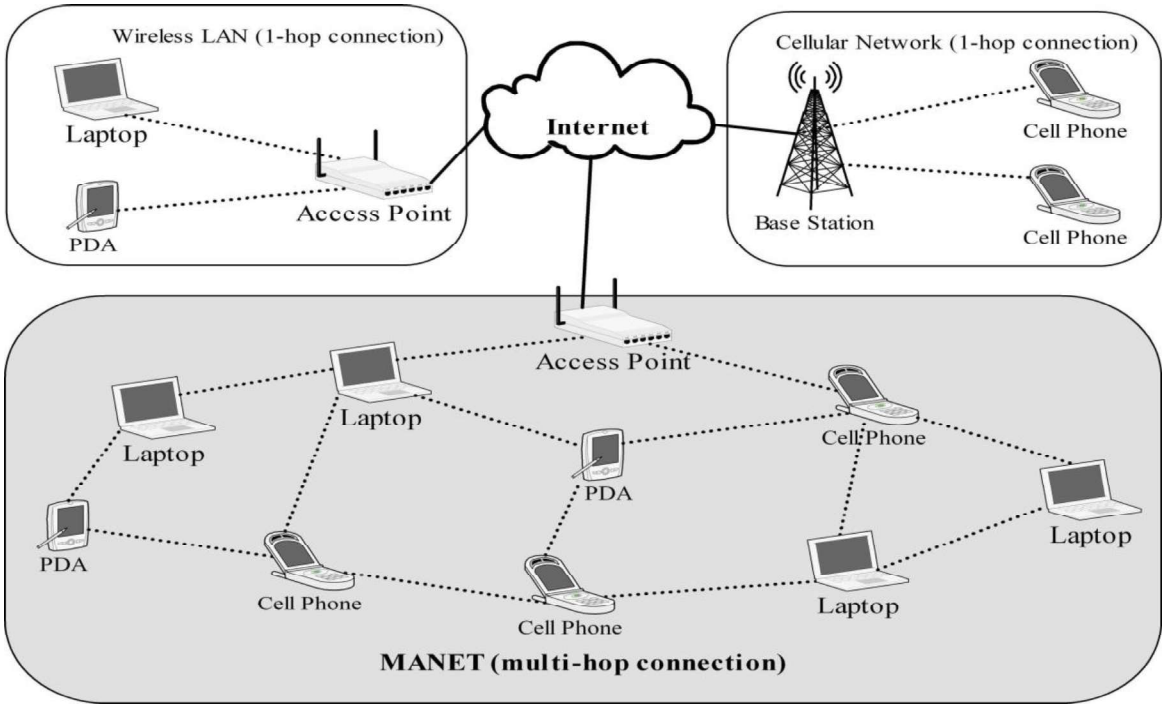

Figure 1.2: Mobile ad hoc network

Some characteristics of MANETs are:

- Dynamic topology

  Because of the mobility, the links between nodes can break and reform rapidly. As a result, the topology of the network changes very frequently in comparison with wired networks, where topology change is generally due to occasional link failure or link re-establishment.

- Constrained power

  Often, the nodes in a MANET are battery operated devices and need to conserve energy to remain operational for as long as possible.

- Limited physical security

  This is the important concern but due to the open nature mobile Ad hoc network is prone to get affected by intruder activity like compromising the nodes.

- Bandwidth-constrained variable-capacity links

Routing

Routing in a network, deals with the task of inding a path through the network between a given pair of nodes. A source wanting to send a packet to a particular destination sends the packet to a neighboring node with a route to the destination. This node in turn sends the packet to the next-hop on the route, and so on, till the destination is reached.

Routing in wired networks

Several routing protocols exist for wired networks. Almost all can be classi ied as using either the distance vector or the link-state algorithms. In distance vector routing, each router periodically sends its view of its distance from every other node in the network to its neighbors. Based on this information, each router calculates its next-hop neighbors along the shortest path to every node. In link-state routing, each router periodically sends its view of the status of its adjacent network links to all the routers in the network. Each router can then take forwarding decisions based on a complete picture of the network obtained by combining the latest updates from all the routers.

Routing in MANETs [6]

The algorithms described above were designed for use in static wired networks where topology changes are infrequent and all links are bi-directional. They are also computation intensive, making them dif icult to use with constrained resources. Due to these problems, new routing algorithms are required that take into account the characteristics of MANETs. The issue of routing in MANETs deals with inding paths between nodes that are part of a rapidly changing topology with possibly uni-directional links, while using minimum resources.

In wireless network like Mobile ad-hoc network, nodes are free to move any where inside the con ine region with dynamic topology. These properties of MANET make them dif icult to evaluate analytically. Therefore, to analyse and understand these features, studies are based on simulation of the network by designing and creating diverse scenarios with varying the node speed, pause time, mobility model etc. The simulation is the replication of the operation of a real-world process or system over time.

Simulators like NS2, Qualnet Opnet and GloMoSim etc. are used for the purpose. T. R. Andel et.al [7] questioned the validity of simulation and showed that it leads to misleading results. Nevertheless, move for real implementation is always an expensive matter. Therefore, we have chosen the simulation path. Selection of simulator is an important concern because simulators have their own limitations. Cavin et.al [8] said that the learning curve for NS-2 is sheer and debugging is complex due to the dual C++/OTcl code behavior of the simulator. An important limitation of NS2 is its large Memory usage; scalability lacking and simulations of a few hundred to a few thousand of nodes are undertaken.

The mobile nodes are free to move within the con ine region. These nodes are controlled by rules of mobility models, they move within the range of Min and Max speed. Speed is always considered to be an important parameter because as nodes speeds is lower link breakage is not often, but at higher nodes speeds links may break often because the nodes joins and leaves the network at faster speed. One another factor is area also at the time of simulation because if area is less then there is very less

probility for not delivering packets but if area is large then the delivery of the packets within the pre-de ined time is more depend on the orientation of node moments.

Mobility model is the set of rules in which the nodes move from a point to another point in a network. Mobility model de ines the location of node at a point of time. They also have major impact on the routing protocols performance. The commonly used models are Random waypoint mobility model, Reference point group mobility model here mobility for each node is assigned with a reference point which follows the group movement Based on this reference point and each mobile node can be placed randomly in the neighborhood, in Manhattan Grid model nodes movement by horizontal and vertical de ined by maps, in Gauss Markov model velocity of a node is assumed to be correlated over time and is modeled as a Gauss-Markov stochastic process etc.

The routing protocols in MANET are basically classi ied into two group namely single path and multi path protocols. The single path protocol group is further classi ied into four groups namely proactive (route is established well ahead of the transmission), reactive (routes are established on demand), hybrid (combination of reactive and proactive) and geographic (routes are established on the basis of geographic location of the nodes). There are a number of protocols developed under each of these groups.

1.2 Objective of the Thesis

The objective of the thesis is to assess Manets based simulation of the network by creating different scenarios with effectively changing the node speed, node density, mobility model and mobility framework, etc. and evaluated with respect to the metrices like end to end delay, throughput, normalized routing load, average no of broken links, packet delivery ratio. The Study of MANET scenarios and applied parameters are important to select appropriate routing protocols from the right group of protocols for any application. Now a day's MANETs has a wide application area. It varies from disaster management system (men induced and natural disaster) to civilian (example-vehicular ad hoc network) systems. This study considers the disaster management aspect. In this case, there is an immediate need of communication setup. The communication needs to be ef icient, in order to save life.

1.3 Plan of the Thesis

The remainder of the thesis is organized as follows. In chapter 2, a straight study of the background and base of the thesis work. A brief introduction is provided for all the related topics including computer network, Ad-hoc network, security concern, application oriented designed scenario and routing protocols etc.

In chapter 3, simulations done through widely used simulation platform like Qualnet & NS2 is described. We observed the effect of simulators under different scenarios. The same set of condition was employed on both simulator and check the performance on Computation-runtime, Memory usage and Area impact. The useful observation is that NS2 started to lag under heavy load. In the next work we have compare routing protocols performance and their views for MANET. The performance of routing protocols namely AODV (reactive) and OLSR (proactive) was compared for Average end to end delay & throughput.

Studies on routing protocols, mobility models, with variation in one or more parameters are reported [15-27]. Emergency operations such as search and rescue can also earn great bene its from MANETs. In situations where the infrastructure-based communication facilities are destroyed due to wars, terrorism or due to natural disasters such as hurricanes or earthquakes, immediate deployment of mobile ad hoc networks would be a good solution for coordinating rescue activities. A signi icant amount of study on disaster management system has been reported in literature [28-34]. In chapter 4, we propose a post disaster mitigation management system using MANET consisting of three stages namely Disaster core location (incident-location), irst aid treatment area and hospital area with two interfaces, one between irst and second layer and other between irst and third layer. The links are provided by relief ambulance. The co-ordination task is managed by a four way movement [35]. Mobility of nodes between the stages has been modeled with reference point group mobility model (RPGM) based on attraction level. Performance of ad hoc network is analyzed for reactive (AODV), proactive (OLSR) and hybrid (ZRP) protocols. Our simulation studies conducted on Qualnet indicates that both the mobility model and routing protocols affect the communication between the stages. In addition, applications in this area requires a secure communication as eavesdropping or other security threats can

compromise the network and threaten the safety of data involved in these operations. Secure multicast may also be required. Hence, major security issue must be considering for such application and to provide secure communication.

A study of Security issue & reliable communication in MANET was done [9, 10, 11, 12, 13]. In chapter 5, we propose and simulate a secure Digitally Signed Secure Acknowledgement Method (DSSAM) with the use of digital signature.Three parameters are considered viz, irst secure acknowledgement, second node authentication and third packet authentication as improvement on watchdog and twoack techniques with to overcome three weakness of watchdog namely Receiver collision, Limited Transmission power and False identity problem. We have observed the performance of DSSAM and compared with two standard methods namely Watchdog and Twoack and reactive routing protocol DSR. The rate of detection of malicious behavior is more for the proposed system. However, associated overheads are high. A tradeoff between performance and overhead has been considered.

At the time of Post disaster mitigation demands optimize and short way covering all necessary check positions with obstacle avoidance. It also demands exchange of real time information among responders for saving lives. In chapter 6, we propose and simulate SROA: Shortest route with obstacle avoidance method for MANET. It is access best possible short route with obstacle avoidance [14] and applicable in every real time of mitigation scenario of people and vehicular moment. we irst observed the effect of variation in pause time on AODV, OLSR and ZRP. We observed that as movement increases, the alogorithms require more time to ind the path for destination, so the average end to end delay is high. ZRP gives the best performance followed by OLSR and AODV. The end-to-end delay also decrease with pause time. In the second part, we calculated the average value for broken links and connected ties with each node for particular node speed. We have taken nodes speed from 1 to 10 m/s. For each node speed we have taken all transmission ranges and made the average ceiling value of broken links and connected links by taking SROA and RWP mobility method one by one. We observed that SROA performs better than RWP. This is because of the obstacle avoidance by SROA.