Enhancing The Quality Of Services (QOS) In Mobile Ad-Hoc Network Using The CEDAR Routing Protocol

Dissertation submitted in fulfilment of the requirements for the Degree of

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By

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ABSTRACT

Advances in wireless technology and hand-held computing devices have brought revolution in the area of mobile communication. The increasing mobility of humans across the globe generated demand for infrastructure-less and quickly deployable mobile networks. Such networks are referred to as Mobile Adhoc Networks (MANET). Usually, nodes in a MANET also act as a router while being is free to roam while communicating each others. Adhoc networks are suited for use in situations where infrastructure is unavailable or to deploy one is not cost effective. Frequent changes in network topology due to mobility and limited battery power of the mobile devices are the key challenges in the ad hoc networks. The depletion of power source may cause early unavailability of nodes and thus links in the network. The mobility of nodes will also causes frequent routes breaks and adversely affects the required performance for the applications. Availability of a route in future mainly depends on the availability of links between the nodes forming the route. Therefore, it is important to predict the future availability of a link that is currently available. I am using the CEDAR routing protocol, Core Extraction Distributed ad hoc routing(CEDAR) is an algorithm for QoS routing in ad hoc network environments. It has three key components: (a) the establishment and maintenance of a self-organizing routing infrastructure called the core for performing route computations, (b) the propagation of the link-state of stable high-bandwidth links in the core through increase/decrease waves, and (c) a QoS route computation algorithm that is executed at the core nodes using only locally available state. But preliminary performance evaluation shows that CEDAR is a robust and adaptive QoS routing algorithm that reacts effectively to the dynamics of the network while still approximating link-state performance for stable networks

DECLARATION STATEMENT

I hereby declare that the research work reported in the dissertation II entitled "**Enhancing The Quality of Services(QOS) In Mobile Ad-Hoc Network Using The CEDAR Routing Protocol"** in partial fulfilment of the requirement for the award of Degree for Master of Technology in Computer Science and Engineering at Lovely Professional University(LPU), Phagwara, Punjab is an authentic work carried out under supervision of my research supervisor Mr. Rajendra Aaseri. The content of this dissertation represents honest research effort conducted, in its entirety, by me. I am fully responsible for the contents of my dissertation work.

Signature of Candidate

Gurpreet Kaur

(11605070)

SUPERVISOR’S CERTIFICATE

This is to certify that the work reported in the M.Tech Dissertation II proposal entitled“ **Enhancing The Quality of Services(QOS) In Mobile Ad-Hoc Network Using The CEDAR Routing Protocol”**, submitted by **Gurpreet Kaur** at **Lovely Professional University, Phagwara, India** is a bonafide record of her original work carried out under my supervision. This work has not been submitted elsewhere for any other degree.

Signature of Supervisor

(**Rajendra Aaseri)**

Date:

Counter Signed by:

1) **Concerned HOD:**

HoD’s Signature: ________________

HoD Name: _____________________ Date: ____________________

2). Neutral Examiners:

External Examiner

Signature: _______________

Name: __________________

Affiliation: ______________ Date: ____________________

Internal Examiner

Signature: ______________

Name: __________________ Date: ____________________

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I am grateful to Mr. Dalwinder Singh, Head of the computer science and engineering for providing me the necessary opportunities for the doing my work.

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INTRODUCTION

A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network(i.e no pre fixed infrastructures) of mobile devices connected wirelessly without using the any centralized authority. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. They may contain one or multiple and different transceivers between nodes. This results in a highly dynamic, autonomous topology. Mobile ad hoc networks are self-configure network mean automatically establishment network of mobile nodes connected via a wireless link(used wi -fi connection).The nature and structure of such kind of network make it attractive to various types of attackers. Security is the main concern for protected communication between mobile nodes .MANET is a vulnerable (i.e weakness in security system) to various kind of security attack. In this paper telling whole security attack come under in mobile ad hoc network.

- ➢ MANETs are a kind of wireless ad hoc network (WANET) that usually has a routable networking environment on top of a Link Layer ad hoc network. MANETs consist of a peer-to-peer, self-forming, self-healing network. MANETs circa 2000-2015 typically communicate at radio frequencies (30 MHz - 5 GHz). The growth of laptops and 802.11/Wi-Fi wireless networking have made MANETs a popular research topic since the mid-1990s. Many academic papers evaluate protocols and their abilities, assuming varying degrees of mobility within a bounded space, usually with all nodes within a few hops of each other. Different protocols are then evaluated based on measures such as the packet drop rate, the overhead introduced by the routing protocol, end-to-end packet delays, network throughput, ability to scale, etc.

- Host movement frequent
- Topology change frequent
- No cellular infrastructure. Multi hop wireless links.
- Data must be routed via intermediate nodes.

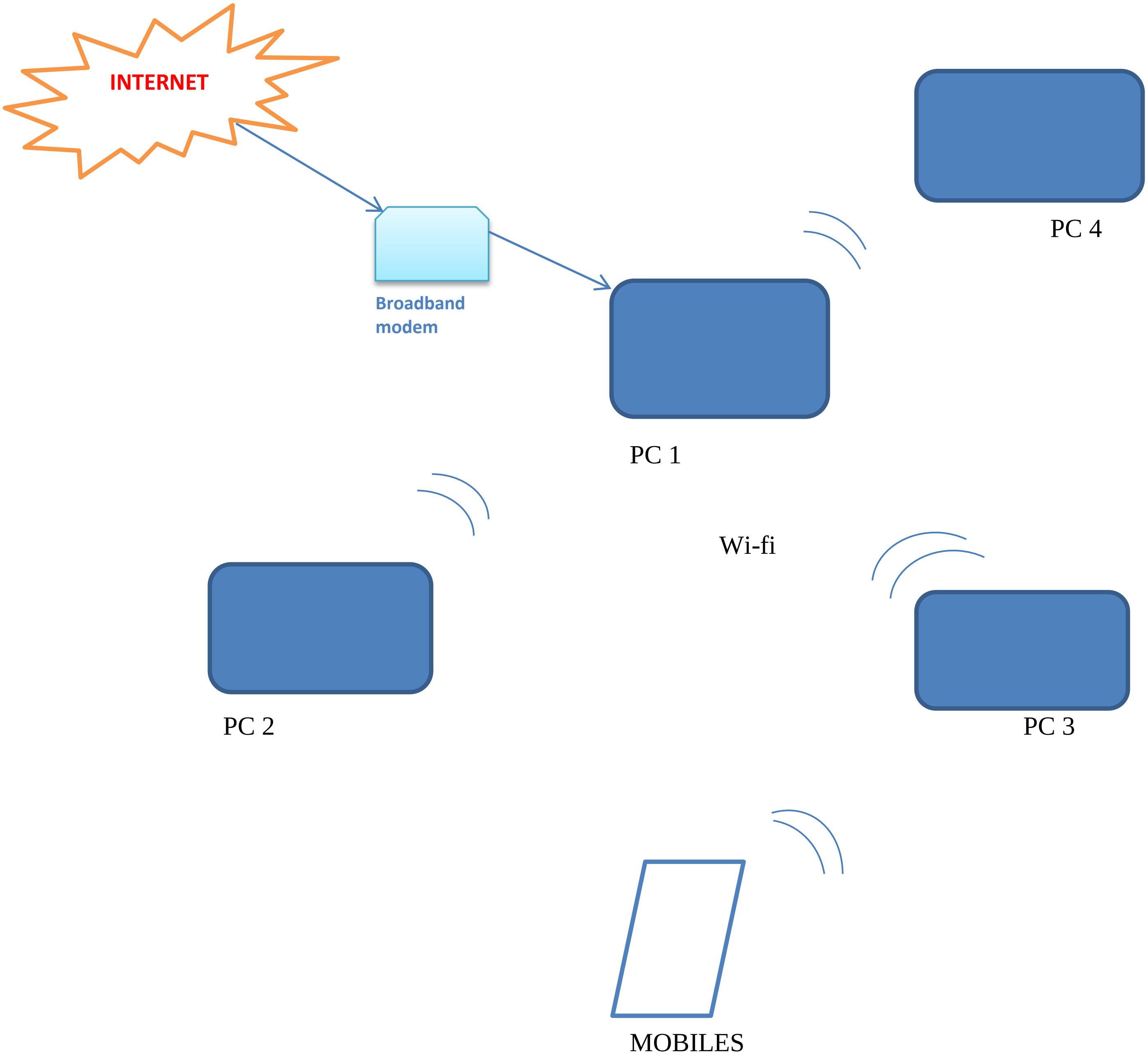

Figure: Mobile Ad -hoc network

Mobile Ad hoc Networks (MANETs) refers the one kind of mobile networks encompasses the wireless mobile nodes for communication. These nodes organize themselves dynamically in random and volatile topologies. In such a scenario, a wireless system which can deliver information from a source to destination, considering the mobility of the nodes in mind, is crucial. It is so, because a node can receive a packet of data that is sent within its frequency range. So, when the nodes are mobile, the receiving node can move out of frequency range at any time. It allows people and devices to inter network in areas with no pre-existing communication infrastructure**.**

Terminology:

Node : any device (router or host,mobiles) that implements IP.

Router : a node that forwards IP packets not explicitly addressed to itself.

Host: any node that is not a router, i.e. it does not forward packets addressed to others(pc).

Link:

A communications facility at a layer below IP, over which nodes exchange IP packets directly without decrementing IP TTL (Hop Limit) Wi fi connection .

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Characteristics of MANET:

Mobile ad hoc network is a collection of autonomous and mobile elements such as laptop, smart phone tablet PC etc. The mobile nodes can dynamically self-organize in arbitrary temporary network topology. There is no preset infrastructure thus it does not have the clear boundary. Some main characteristics of MANET are discussed below:

Infrastructure less:

MANET is an infrastructure les system which has no central server, or specialize hardware and fixed routers. All communication between nodes are provided only by wireless connectivity.

Wireless Links:

Wireless links make Mobile Ad Hoc Network unreliable and susceptible to various kinds of attacks Because of limited power supply of wireless nodes and mobility of nodes, the wireless links between those nodes in the mobile ad hoc network are not consistent for communication participants.

Node Movement:

Mobile nodes are autonomous units in network which continuously change their position and topology independently. Due to continuous motion of nodes the topology changes frequently which mean tracking down of particular node become difficult. The nodes can easily come out of or into the radio range of various other nodes. The routing information of nodes change continuously as their movement becomes random.

Power limitation:

The mobile hosts are small and light weight. They are supplied by limited power resources such as small batteries. This limitation causes vulnerability namely when attackers may target some node batteries t disconnect them, that may lead to network partition Some attacks may try to engage the mobile nodes un necessarily, so that they keep on using their battery for early drainage.

Dynamic topologies

Nodes are free to move arbitrarily, thus the network topology may change randomly and rapidly a unpredictable times, and may consist of bot bidirectional and unidirectional links.

Self-Configuring:

Various mobile devices mainly in an ad-hoc manner, e.g. for creating a home network. They can remain an autonomous network, interconnecting various devices, at home, for example, but PANs will become more meaningful when connected to a larger network.

- In MANET, each node act as both host and router. That is it is autonomous in behavior.
- Multi-hop radio relaying- When a source node and destination node for a message is out of the radio range, the MANETs are capable of multi-hop routing.
- Distributed nature of operation for security, routing and host configuration. A centralized firewall is absent here.
- The nodes can join or leave the network anytime, making the network topology dynamic in nature.
- Mobile nodes are characterized with less memory, power and light weight features.
- The reliability, efficiency, stability and capacity of wireless links are often inferior when compared with wired links. This shows the fluctuating link bandwidth of wireless links.
- Mobile and spontaneous behavior which demands minimum human intervention to configure the network.
- All nodes have identical features with similar responsibilities and capabilities and hence it forms a completely symmetric environment.
- High user density and large level of user mobility.

ADVANTAGES:

There are various Advantages of the MANET are following:

1. They provides access to information and services regardless of geographic positions.
2. Independences from central network administrations.
3. Self configuring network ,nodes are also act as routers.
4. Less expensive as compared to wired network.
5. Scalables – accommodates the additions of more nodes.
6. Improved flexibility.
7. Robust due to decentralize administration.
8. The network can be setup at any p;ace & time.

APPLICATIONs:

Ad hoc networking can be applied anywhere where there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use. Ad hoc networking allows us the device to maintain connections to the network as well as easily adding and removing devices to and from the network. MANET can be applied to a large variety of use cases where conventional networking cannot be applied. MANET is used in following areas:

Military battlefield:

The modern digital battlefield demands robust and reliable communication in many forms. In the battlefield it is needed by soldiers for relaying information related to situational awareness.

Sensor Networks:

Another application of MANETs is sensor networks.This technology is a network composed of a very large number of small sensors. These can be used to detect any number properties of an area. Examples include temperature, pressure, toxins, pollutions, etc. Applications are the measurement of ground humidity for agriculture, forecast of earthquakes. The capabilities of each sensors are very limited, and each must rely on others in order to forward data to a central computer.

Disaster Area Network:

Ad hoc can be used in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed. Information is relayed from one rescue team member to another over a small handheld.

Personal Area Network:

Personal Area Networks (PANs) are formed between is why some energy conserving algorithms have been implemented (COMPOW,PARO and MBCR are some examples).

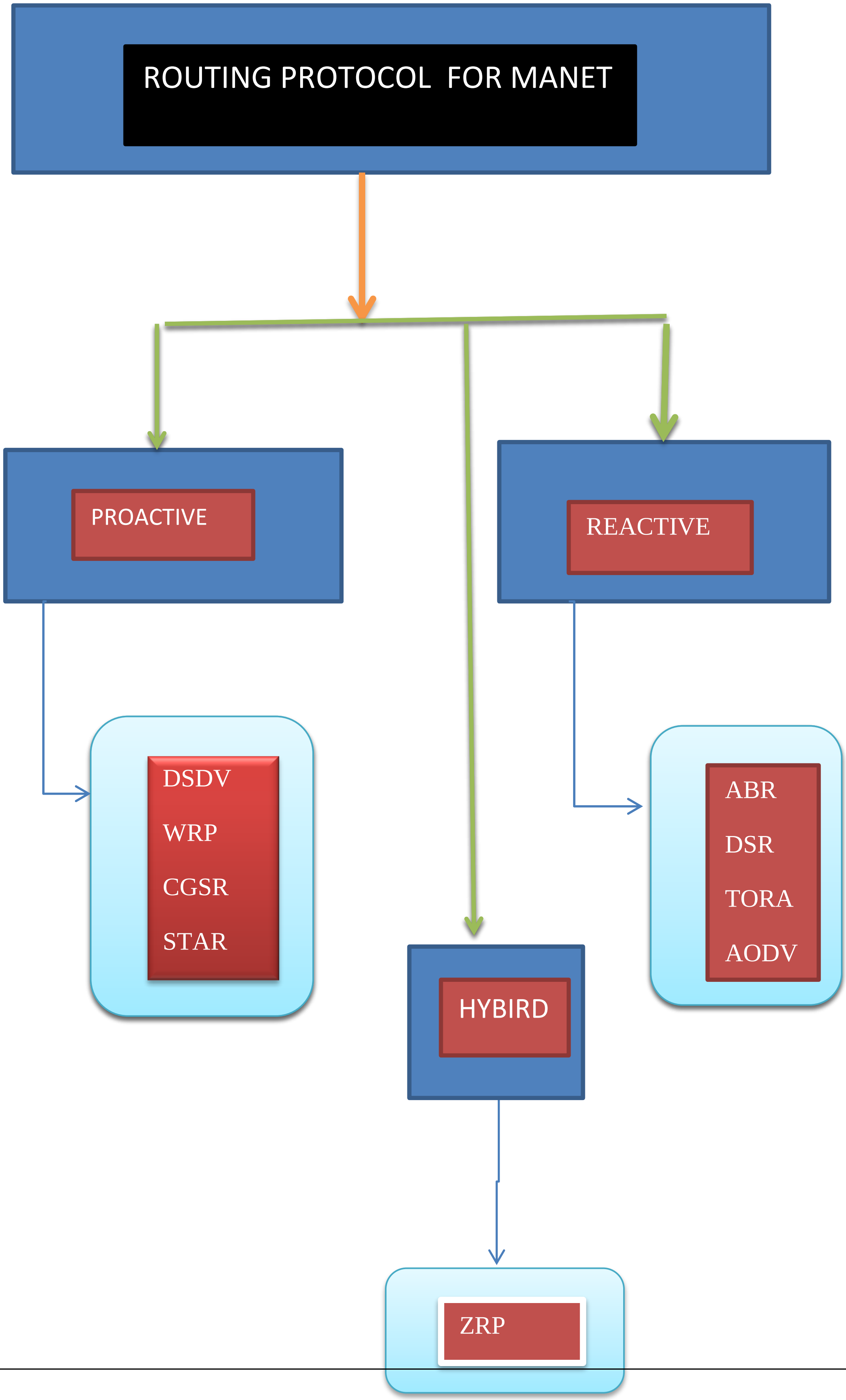
CHAPTER-2

REVIEEW OF THE LITERATURE

Aarti and Dr.S .S . Tyagi et al, the paper is Study of mobile adhoc networks(MANETs): characteristics, challenges, application and security attacks ,In this paper I am study mobile adhoc network is an infrastructure -less network .Its collection of the mobile nodes that communication with each other without the use of any centralized authority. Due to its fundamental characteristics such as the distributed operation, multi hop routing ,wireless medium, dynamic topology etc. But MANETs is a vulnerable to various kinds of the security attacks like black hole attack ,wormhole rushing attack etc.Its also focused on the challenges: limited the bandwidth, hidden terminal problem,routing overhead ,battery constraints,packet losses due to transmission error etc.MANETs are use military Battlefield,personal area network and Bluetooth etc.In this paper tells us MANETs vulnerability.The vulnerability is the weakness in the security system.A particular system may be vulnerable to unauthorized data manipulation because the system does not verify a user`s identity before allowing data access.Some of the vulnerability are as follows: lack of centralized management, no predefined boundary,adversary inside the network etc.The various aspects of the security goals like availability, confidentiality, integrity,authenticationetc.

Satyam Shrivastava and sonali jain, the paper is A brief introduction of the different types of security attack found in mobile ad hoc network.The security issue is the main problem of MANETs,because many nodes perform many kind of misbehavior.In this paper describes the types of the routing.Firstly we define the routing Is a process of moving the packect from source to destination.this is done by router device.It is selection a path for traffic in a network to travel the packet to target user. The problem in routing is due to the rapidly changes in the topology of the node and the devices.Ther are basically two types of routing are following:

FIGURE: ROUTING PROTOCOL FOR MANET



Proactive MANET routing: The proactive routing approach, also known as table driven routing, consists of maintaining consistent and updated route information between all possible Source-Destination (S-D) pairs in the routing tables. Thus, routes between S-D pairs are always available reducing the latency in route establishment. Since a large amount of routing information is periodically disseminated and stored, the downside to such an approach is the high overhead of control packets and power consumption even when no data is being transmitted. Optimized Link State Routing (OLSR) is a very popular proactive protocol, and in fact it is used for most of the implementations currently considered by IETF.

- Reactive MANET routing: A reactive routing approach, also known as on-demand routing, establishes and maintains routes between S-D pairs when requested by the data source node. Although such an approach generates routing overhead only ondemand, it nevertheless requires added latency for route discovery before routes are established. The Dynamic Source Routing Protocol (DSR) is a well-known reactive protocol that utilises route discovery and route maintenance on-demand to route data from a source to a destination. The Ad hoc On-Demand Distance Vector (AODV) routing protocol [4] is another well-known reactive protocol. AODV uses an on-demand route discovery and maintenance algorithm for route establishment in unicast routing and it is based on a modified Bellman-Ford algorithm. AODV attempts to improve DSR by maintaining routing tables at the nodes, thus data packets do not have to contain routes. Another reactive MANET routing protocol is the AOMDV (Ad-hoc On-Demand Multipath Distance Vector).The main property which distinguishes AOMDV from AODV is that it enables loop-free and mutually link-disjoint multiple paths to a destination of a communication path providing fault tolerance. AOMDV chooses an optimal path until this breaks. Alternative routes are cached and they will be called only when a link failure occurs.

In this papers study the ATTACKS IN MANETs like active attack and passive attack.Passive attack: Passive attacks are the attack that does not alter the data transmitted within the network.But it includes the unauthorized “listening” to the network traffic data from it. Passive attacker does not disrupt the operation of the routing protocol.

Active attack:The active attacks are the attack generate unauthorized access to network helps the attacker to make the change such as modification of packets,denial of service(DoS) etc.The active attack can be internal and external attack.

Jyoti Thalor et al , Detection and prevention technique in mobile adhoc network network (2014).The objective of this paper was about defense mechanism which has been installed in the network to prevent from intruders.The defense mechanism has been installed for network attacks like black hole attack, wormhole attack .sybil, rushing, grey hole etc.In which using the various techniques to avoid the attacks and detect its .

Abhishek vaish et al , the paper is Research Issues and challenges of wireless network(2014).The author explained about the arrival of wireless technology has reduced the human efforts for accessing data at various location by replacing wired infrastructure with wireless infrastructure.since wireless device need to be small and bandwidth constrained,some of the key challenges in wireless networks are signal fading(noise),mobility,data rate enhancements, minimizing size and cost security and quality of services.

This paper study the various attack in mobile Ad network,Attacks against a MANET might be launched by malicious nodes that are not part of the network (outsiders). MANET nodes protect their communication through the use of cryptographic techniques which enable secure verification of a node identity by other nodes preventing malicious outsiders from penetrating the MANET resources. Apart from the external attackers, attacks could be launched by nodes that are authorised to be part of the MANET (insiders) or they are compromised nodes (hacked devices). MANET routing protocols are inclined to be attacked by malicious nodes. Most of the times, such protocols do not encompass any security mechanisms thereby being vulnerable to node misbehaviour. In the following we summarise the most popular attacks against

Qos aware bandwidth constrained precedence based routing protocol for ad hoc network(2016), this paper study related quality of services.The developing qos constraints routing protocol for MANET is still a challenging task. As the routing protocol has to decides which routes is ables to fulfil the requirement of the desired QOS.This paper is based on designed of such kind of techniques that will estimates the available bandwidth throughout the path by assigning precedence.

CHAPTER-3

SCOPE OF THE STUDY

This study focuses about the enhancing the quality of services in MANET using the core extraction distributed ad hoc routing protocol .It will also focus on the compromised nodes in the network which become a threat for the entire network and make the tasks easier for the intruders or hackers to get into the network and distort the entire network.

To provide the defence mechanism protect from any harmful activity in the network. And keep the intruders away from the wireless and mobile ad hoc network.

- Provides the efficient transmission of data
- Secure data accessibility
- Reliable data delivery
- .It providing sufficient resource to meet the requirement.
- The common QOS requirement for real traffic are max delay ,jitter, bandwidth.

CHAPTER 4

OBJECTIVE OF THE STUDY

MANET nodes protect their communication through the use of cryptographic techniques which enable secure verification of a node identity by other nodes preventing malicious outsiders from penetrating the MANET resources. Apart from the external attackers, attacks could be launched by nodes that are authorized to be part of the MANET (insiders) or they are compromised nodes (hacked devices). MANET routing protocols are inclined to be attacked by malicious nodes. Most of the times, such protocols do not encompass any security mechanisms thereby being vulnerable to node misbehavior.

The main aim of the QOS routing is to find out the feasible path through the network.My main objectives is

- Implementing the CEDAR routing protocol
- Calculate the results
- Comparison the result with existing one routing protocol

CHAPTER-5

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY:

Core extraction distributed Ad hoc Routing (CEDAR) in MANET

To simulates the CEDAR in Mobiles ad hoc network using 10 –100 nodes in the network based on parameter likes bandwidth, delay ,packet loss ratio ,throughput, packet delivery ratio etc.

CEDAR is a partitioning routing protocol emphasing QOS support. And also it is an algorithm for QOS routing in ad hoc network environments. Each partitions includes a core nodes.

CEDAR has three key components:

1 .Core extraction means the election of some nodes and then responsibles for topology establishment & maintenance of self configuring routing infrastructures called core.The core node selected by distributed algorithm.

- The election of core nodes is based on the appronimation of mathematical principle called minimum dominating set of network.
- This is the minimum subset of nodes such that all the nodes are at most one hop away from a dominating node.

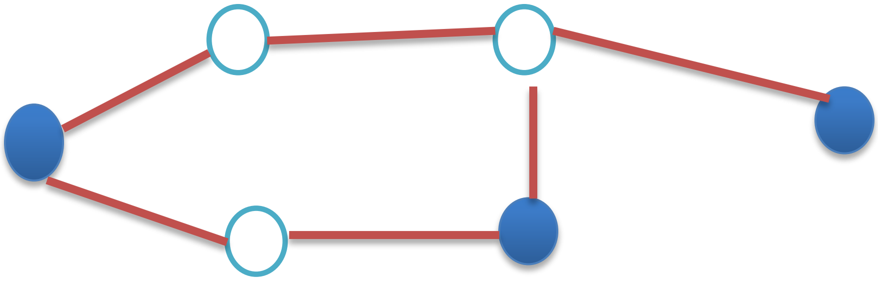


Figure: Minimum Dominating set

- Oriented to small and middle size networks
- Core extraction/election: A set of nodes is distributivedly and dynamically selected to form the core, which maintains local topology and performs route calculations

- The core consist of the dominators and tunnels which are unicast path to connects each core node with nearby core nodes.
- The fill circle is a core node and also called minimum domination set.

2. The second components of the CEDAR is l**ink state propagation** it provides link state propagation from all network nodes to all core nodes only stables link states are propagated.

- Propagates the link states of stables ,high bandwidth link in the core through increase /decrease waves.
- The slow moving increase waves(signal) and fast moving then decrease waves which is denotes by corresponding changes in the availables bandwidth on link.

3. **Routes computation**: The route computations first establishes a core path form the dominators of the sources to that the destination.

- The core path provides the directionality of routes from source to destination based on the satisfying the requested bandwidth using only local information (i.e partial knowledge of the ad hoc network topology).
- The routes selection and computation is on demand.All the computation is done by core nodes.

There is some condition of the routes computation are following:

a) Discovery the location of destinations & establishment of the core path to destinations.
b) Establishment of a short stables admissibles QOS routes from source to destination using core path as directional guidelines.

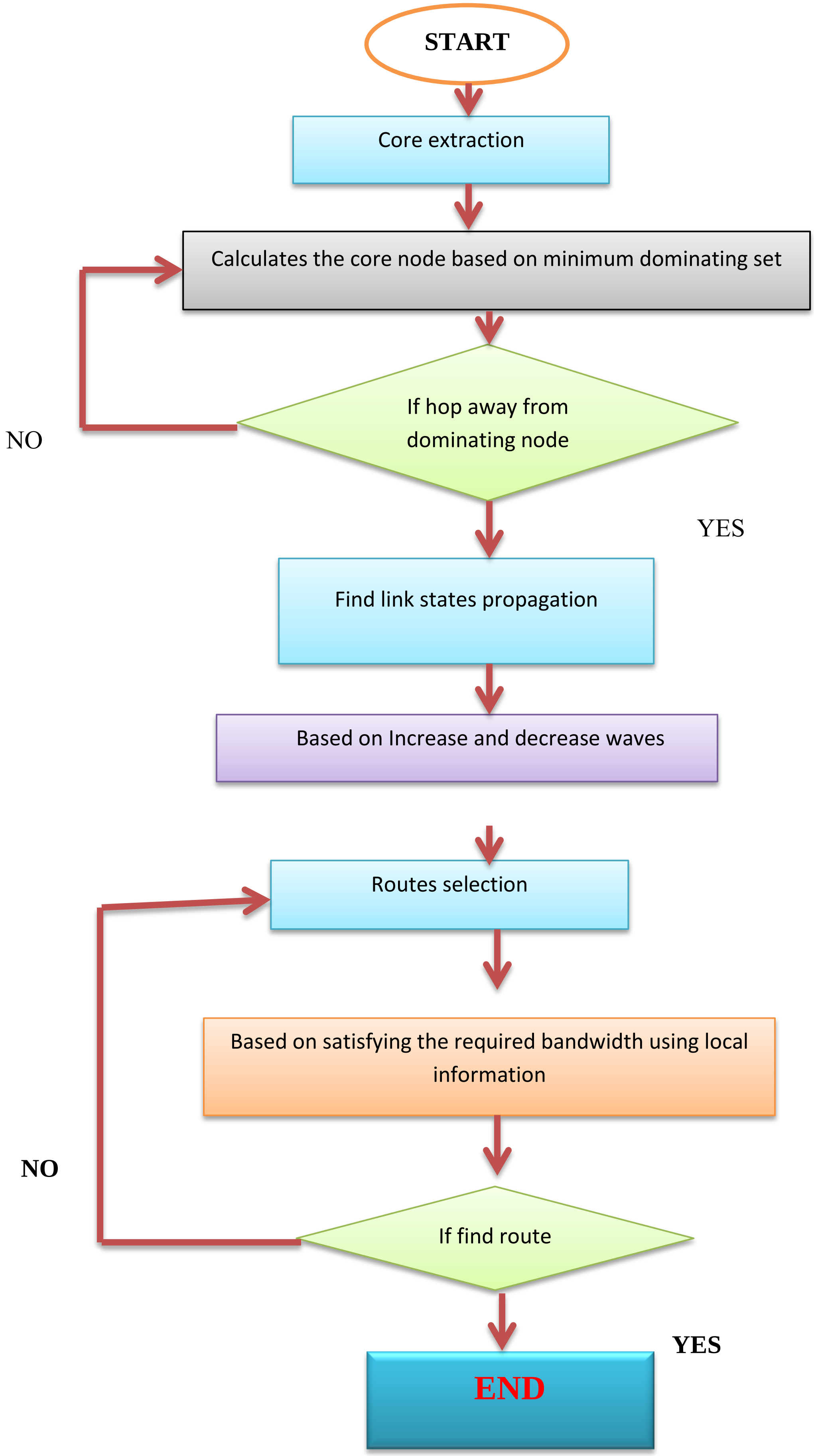
c) Dynamic re –establishment of routes for ongoing connections is upon link failures due to the topology change in the network.

- QoS Route Computation:

  - A core path is established first from dominator (neighboring core node) of source to dominator of destination
  - Using up-to-date local topology, dominator of source finds a path satisfying the requested QoS from source to furthest possible core node
  - This furthest core node then becomes the source of next iteration.
  - The above process repeats until destination is reached or the computation fails to find a feasible path

- Subset of nodes in the network is identified as the core
- Each node in the network must be adjacent to at least one node in the core
- Each node picks one core node as its dominator (or leader)
- Core is determined by periodic message exchanges between each node and its neighbors
- Attempt made to keep the number of nodes in the core small
- Each core node determines paths to nearby core nodes by means of a localized broadcast
- Each core node guaranteed to have a core node at <=3 hops

FLOW CHART: CEDAR ALGORITHM


START
Core extraction
Calculates the core node based on minimum dominating set
NO
If hop away from dominating node
YES
Find link states propagation
Based on Increase and decrease waves
Routes selection
Based on satisfying the required bandwidth using local information
NO
If find route
YES
END

Advantages

- Route discovery/maintenance duties limited to a small number of core nodes
- Link state propagation a function of link stability/quality

Disadvantages

- Core nodes have to handle additional traffic, associated with route discovery and maintenance

TOOLS:

The NS-2 network simulation tool is using to perform CEDAR algorithm in mobile Ad hoc network.

NS2 stands for Network Simulator Version 2. It is an open-source event-driven simulator designed specifically for research in computer communication networks.

Features of NS2

1. It is a discrete event simulator for networking research.

2. It provides substantial support to simulate bunch of protocols like TCP, FTP, UDP, HTTP.

3. It simulates wired and wireless network.

4. It is primarily Unix based.

5. Uses TCL as its scripting language.

6. Otcl: Object oriented support

7. Tclcl: C++ and otcl linkage

8. Discrete event schedule

CHAPTER-6
PRESENT WORK

Problem definition

In the present work, we investigate and find out feasible route in mobile adhoc networks in providing service quality. The present work focuses to provide solutions that result in reduced delay and increased throughput the nodes by interactions of other node in the network. Further, it aims to use link prediction with routing protocol to avoid link breaks at network and use the core extraction distributed ah hoc routing protocol. Using the core extraction distributed ad hoc routing algorithm. . It has three key components: (a) the establishment and maintenance of a self-organizing routing infrastructure called the core for performing route computations, (b) the propagation of the link-state of stable high-bandwidth links in the core through increase/decrease waves, and (c) a QoS route computation algorithm that is executed at the core nodes using only locally available state. But preliminary performance evaluation shows that CEDAR is a robust and adaptive QoS routing algorithm that reacts effectively to the dynamics of the network while still approximating link-state performance for stable networks

CHAPTER-7

SUMMARY and CONCLUSION

Advances in wireless technology and hand-held computing devices have brought revolution in the area of mobile communication. The increasing mobility of humans across the globe generated demand for infrastructure-less and quickly deployable mobile networks. Such networks are referred to as Mobile Adhoc Networks (MANET). Usually, nodes in a MANET also act as a router while being is free to roam while communicating each others. Adhoc networks are suited for use in situations where infrastructure is unavailable or to deploy one is not cost effective. Frequent changes in network topology due to mobility and limited battery power of the mobile devices are the key challenges in the adhoc networks. The depletion of power source may cause early unavailability of nodes and thus links in the network. The mobility of nodes will also causes frequent routes breaks and adversely affects the required performance for the applications. Availability of a route in future mainly depends on the availability of links between the nodes forming the route. Therefore, it is important to predict the future availability of a link that is currently available. I am using the CEDAR routing protocol, Core Extraction Distributed ad hoc routing(CEDAR) is an algorithm for QoS routing in ad hoc network environments.To enhancing the qos in the networks and find out the throughput ,jitter,delay etc.

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