

# Impact of MAC Layer on The Hidden and Exposed Terminal Problem in MANET

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### ABSTRACT

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Article History Accepted : 15 Oct 2021 Published : 30 Oct 2021 Wireless networking grows rapidly because of the human desires for mobility and for freedom from tethers, i.e., from physical connections to communication networks. Recent advances in wireless technology have equipped portable computers, such as notebook computers and personal digital assistants with wireless interfaces that allow networked communication even while a user is mobile. We will focus on a particular kind of wireless network: mobile ad hoc networks. A mobile ad hoc network is a self organizing and rapidly deployable network in which neither a wired backbone nor a centralized control exists. The network nodes communicate with one another over scarce wireless channels in a multi-hop fashion. The ad hoc network is adaptable to the highly dynamic topology resulted from the mobility of network nodes and the changing propagation conditions. Generally, protocols used at medium access and physical layers of ad hoc networks are similar to those used in infrastructure based wireless networks. It is a common practise in infrastructure based wireless networks to use pre-data exchange of control information to eliminate the hidden terminal" problem.

Keywords : MAC Layer , MANET, ad hoc networks

#### I. INTRODUCTION

Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio. With radio waves distances can be short, such as a few meters for television or as far as thousands or even millions of kilometers for deep-space radio communications. It encompasses various types of fixed, mobile, and portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Other examples of applications of radio wireless technology include GPS units, garage door openers, wireless computermice, keyboards and headsets, headphones, radio receivers, satellite television, broadcast television and cordless telephones.

#### Mobile ad hoc network

A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of

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mobile devices connected without wires. Ad hoc is Latin and means "for this".

An ad hoc network is a collection of wireless mobile nodes that are capable of forming a co- operative agreement (network) between them-selves without requiring any centralized control function. Due to their non-reliance on <sup>-</sup>xed in-frastructure, ad hoc networks are gaining popularity in several networking applications includ-ing, military, rescue operations and meetings and conventions. Generally, protocols used at medium access and physical layers of ad hoc networks are similar to those used in infrastructure based wireless networks. It is a common practise in infrastructure based wireless networks to use pre-data exchange of control information to eliminate the hidden terminal" problem.

Due to the lack of a centralised control entity in ad hoc networks, sharing of wireless bandwidth among ad hoc nodes (medium access control) must be organised in a decentralised manner. There-fore distributed Medium Access Control (MAC) mechanisms such as Carrier Sense Multiple Access with Collision Avoidance and its' variants such as MACA, MACA for Wireless and 802.11 Distributed Coordination Function have gained widespread popularity in ad hoc networks. However, all these CSMA/CA based MAC protocols su®er from the well known hidden terminal" problem. In wireless networks, it is a commonly accepted practice to use a pre-data control information exchange (virtual medium sensing) to avoid the hidden terminal problem. One such virtual sensing mechanism is the 802.11 Request To Send/Clear To Send (RTS/CTS) exchange resulting in nodes getting exclusive access to the channel for a well-de<sup>-</sup>ned time period.

# Mac Layer Protocal

In the IEEE 802 reference model of computer networking, the medium access control or media access control (MAC) layer is the lower sublayer of the data link layer (layer 2) of the seven-layer OSI model. The MAC sublayer provides addressing and channel access control mechanisms that make it possible for several terminals or network nodes to communicate within a multiple HYPERLINK "https://en.wikipedia.org/wiki/Multiple\_access"access network that incorporates a shared medium, e.g. an Ethernet network. The hardware that implements the MAC is referred to as amedia access controller.

The MAC sublayer acts as an interface between the logical link control (LLC) sublayer and the network's physical layer. The MAC layer emulates a full-duplex logical communication channel in a multi-point network. This channel may provide unicast, multicast orbroadcast communication service.

### II. LITERATURE REVIEW

- Gebrehiwot K. Abraha1 [2019]An ad hoc network is a collection of wireless mobile nodes that are capable of forming a co- operative agreement (network) between themselves without requiring any centralized control function. Due to their non-reliance on <sup>-</sup>xed infrastructure, ad hoc networks are gaining popularity in several networking applications including, military, rescue operations and meetings and conventions. Generally, protocols used at medium access and physical layers of ad hoc networks are similar to those used in infrastructure based wireless networks.
- 2. Mr. S. Kushwah[2019] A critical design issue for wireless sensor networks (WSNs) is the development of medium access control (MAC) protocols that efficiently reduce power consumption. WSNssensor nodes are generally powered by batteries which provide a limited amount of energy, and it is often difficult to recharge or replace batteries. Therefore power aware and energy efficient protocols at each layer of the communications are very essential for wireless sensor networks.



- 3. Ashikur Rahman [2018]It is well-known that the Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)-based wireless networks suffer seriously from the hidden terminal problem and the exposed terminal problem. So far, no satisfactory solutions that can resolve both problems simultaneously have been found. In this paper, we present a joint solution to the two problems. Our approach avoids the drawback of lessening one problem but aggregating the other.
- 4. Rajagopalan[2017]To analysis Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes forming temporary network without using any existing infrastructure. Since not many MANETs are currently deployed, research in this area is mostly simulation based. Random Waypoint is the commonly used mobility model in these simulations. Random Waypoint is a simple model that may be applicable to some scenarios.
- 5. Vijay Kumarl and Ashwani Kush[2017]To studied the performance analysis the transmission of information in a MANET relies on the performance of the traffic scenario (application traffic agent and data traffic) used in a network. The traffic scenario determines the reliability and capability of information transmission, which necessitates its performance analysis. The objective of this paper is to compare the performance of TCP/FTP and UDP/CBR traffic in AODV routing protocol generally implemented in a mobile ad hoc environment.
- 6. Elmustafa Sayed Ali Ahmed[2016] Most of the work on medium access of MANET has been done in the context of extending carrier sense multiple access/collision avoidance( CSMA/CA) to work with directional antenna.Several protocols have been defined in literature to tackle the directional hidden terminal problem and directional exposed terminal problem, most of them are based on the Distributed Coordination function (DCF), which are rely on RTS/CTS exchange to avoid the

interference. Nasipuri *et al* recommended one of the initial Directional MAC protocol, which utilize the Omni directional RTS and Omni directional CTS,but it is assume that the range of the directional transmission is International Journal of Future Generation Communication and same as the Omni directional transmission.

# **RESEARCH METHODOLOGY :**

Research in common parlance refers to a search for knowledge. Once can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation.

# **Objectives:**

The objective of the research work is to evaluate the problem of Hidden Terminal and Exposed Terminal for mobile Ad-hoc Networks.

- To implement static routing for MANET.
- To implement Simulation Environment for hidden and exposed terminal problems in mobile Ad-hoc network.
- To implement MAC layer protocols CSMA, MACA, 802.11 and their effect on hidden and exposed terminal problem.
- To provide the solution for hidden and exposed terminal problems.

# III. RESULTS AND ANALYSIS

Simulation is the imitation of the operation of a realworld process or system over time. The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviors/functions of the selected physical or abstract system or process. The model



represents the system itself, whereas the simulation represents the operation of the system over time.

#### RADIO RANGE



Fig.4.1:Radio Range

Configuring application file (app.conf)

•FTP <src> <dest> <items to send> <start time> FTP 0 1 10 0S FTP 0 1 0 10NS

•FTP/GENERIC <src> <dest> <items to send> <start
time> <end time>

FTP/GENERIC 0 1 10 1460 0S 600S FTP/GENERIC 0 1 0 1460 0S 0S

•TELNET <src> <dest> <session duration> <start time> TELNET 0 1 100S 0S TELNET 0 1 0S 0S

•CBR <src> <dest> <item to send> <item size> <interval> <start time> <end time>

CBR 0 1 10 1460 1S 0S 600S•CBR 0 1 0 1460 1S 0S 300S

CBR 0 1 0 1460 1S 0S 0S

'HTTP <Address> <num\_of\_server> <server\_1>
...<server\_n> <start> <thresh>

HTTP 1 3 2 5 11 10S 120S

#### **Configuring Mobility**

MOBILITY mobility\_model •NONE •RANDOM-WAYPOINT •Trace MOBILITY-WP-PAUSE Value MOBILITYRANDOM-WAYPOINT MOBILITY-WP-MIN-SPEED Minimum Speed MOBILITY-WP-MAX-SPEED Maximum Speed MOBILITY-TRACE-FILE ./mobility.in node-address simclock (x y z) 10 100S (200.0, 150.0, 0.0)

### IV. CONCLUSION

In addition, existing mobile protocols are insufficient. They are not geared towards the specialized needs of a MANET. The areas of concern within MANET data communication are raised. Future research will need to begin to address these issues. Due to the mobility and open media nature, the mobile ad hoc networks are much more prone to all kind of security risks, such as information disclosure, intrusion, or even denial of service. As a result, the security needs in the mobile ad hoc networks are much higher than those in the traditional wired networks. Because of the emergence of the concept pervasive computing, there is an increasing need for the network users to get connection with the world anytime at anywhere, which inspires the emergence of the mobile ad hoc network. However, with the convenience that the mobile ad hoc networks have brought to us, there are also increasing security threats for the mobile ad hoc network, which need to gain enough attention.

At first, we have explained the hidden and exposed terminal problem in wireless sensor networks. These problems have an impact on the performance of throughput. We have briefly explained the solution methods. After analyzing the problems, we have proposed the directional antenna based MAC protocol that used with Sensor-MAC Protocol to increase the



performance of the output of wireless sensor network. In Directional antenna based MAC protocol since the signals are focus on a narrow beam with large distance the number of multi-hop can be reduced. The directional antennas focus energy in a particular direction, so that unfair channel allocation and wastage of channels between each node can be avoided.

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