

Performance Evaluation and Analysis of MAC Protocol in Mobile Ad Hoc Wireless Network using NS-2

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Abstract: A Mobile Ad Hoc Network (MANETs) is a collection of wireless hosts that can be rapidly deployed as a multi hop packet radio network without the aid of any established infrastructure or centralized administration[1] . medium Access Control (MAC) protocols are responsible for coordinating the access from active nodes. Carrier Sense Multiple Access (CSMA) refers to a family of protocols used by stations contending for access to a shared medium like an Ethernet cable or a radio channel. MACA (Multiple Accesses with Collision Avoidance) Protocol is a Contention based Sender initiated Protocol which uses Three way handshaking means that Request to send packet, clear to send packet ,Data packet exchange. by the help of binary exponential back off Algorithm avoid congestion problem and this algorithm help to determine correct sending rate. in which if any packet transmitted by a node is drop, the node uses the back-off (BEB) algorithm to random amount of time . A comparative study was done on Ns-2 2.35 Version simulator over CSMA & MACA . DSR routing protocol will use to evaluate the CSMA& MACA performance.

Keywords: AWN , QOS , MAC , MACA , CSMA, DSR , Throughput , packet delivery ratio , Average jitter , Routing overhead wireless network.

1. INTRODUCTION

Mobile Ad Hoc Networks are wireless networks which do not require any infrastructure support for transferring data packet between two nodes [1], [2], [3], [4], [12]. It is a self-configuring infrastructure less devices connected by wireless and equipped with networking capability. in these network node movement are random . all nodes are capable to move and can be connected dynamically in arbitrary manners. These devices can communicate with other nodes that immediately within their radio range or that is outside their radio range .

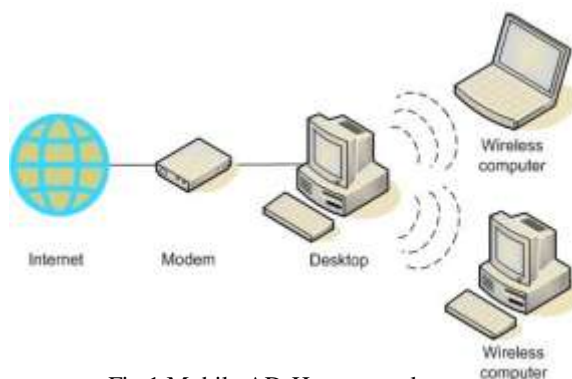


Fig.1 Mobile AD-Hoc network

Ad hoc wireless networks (AWNs) are zero configurations, self organizing, and highly dynamic networks formed by a set of mobile hosts connected through wireless links [1], [2], [3], [4], [5], [6], [12]. Ad hoc routing protocols can be categorized into three main part: Proactive, reactive and hybrid protocols. Reactive protocols are also called Demand Driven protocols and Proactive protocols are known as Table Driven protocols. Hybrid routing protocols are mixture of both reactive and proactive characteristics. As a router, the mobile host represents an intermediate node which forwards traffic on behalf of other nodes. If the receiving node is not within the transmission range of the transmitting node, the transmitting node takes help of the intermediate nodes to communicate with the receiving node.

Quality of service (QoS) is the performance level of a service offered by the network to the user. The aim of QoS provisioning is to achieve a more deterministic behavior of network, so the information which is carried by the network can be better delivered and network resources can be better utilized [4], [7], [8]. A network or a service provider can offer different kinds of services to the users. Here, a service can be categorized by a set of measurable Pre specified service requirements such as minimum bandwidth, maximum delay, maximum delay variance (jitter), and maximum packet loss rate. After accepting a service request from the user, the network has to ensure that service requirements of the user's

flow are met, as per the agreement, throughout the duration of the flow. A MAC protocol in a multi-access medium is essentially a distributed scheduling algorithm that allocates the channel to requesting nodes [2], [4], [12], [13]. Two commonly used access principles in wireless networks are fixed assignment channel access and random access method. In the former method, a pair of nodes is statically allocated a certain time slot (frequency band) as is the case for most of voice-oriented wireless networks. On the other side, in random access MAC protocols method, the sender dynamically competes for a time slot with other nodes. This is a more flexible and efficient method of managing the channel in a fully distributed way, but suffers from collisions and interference.

2. Fundamental MAC Protocols For MANET:

Various MAC schemes developed for Ad hoc Networks can be classified into two categories protocols . in contention free (eg. TDMA , CDMA , FDMA) certain assignments are based to avoid contentions [5] . contention based schemes are aware of the risk collisions of transmitted data. contention free MAC schemes are more applicable to static networks and/or networks with centralized control . in this survey we shall focused on contention based MAC schemes. we can view this category as a collection of random access and dynamic reservation and collision resolution protocol.

3. Contention based random access MAC protocol:

In random access based schemes , such as Aloha Aloha means "Hello". Aloha is a multiple access protocol at the data link layer and proposes how multiple terminals access the medium without interference or collision. The protocol allows every node to send a frame if it ready to send. But when two node send simultaneously then collision occurs therefore the node will wait for a random interval of time and then send the frame again. The process uses again and again till the node has sent all the frames successfully. The maximum success rate or throughput that can be achieved with Aloha protocol is only 18%. ALOHA is a random access protocol which share broadcast channel access among a number of users with relatively low throughput demand. There are two main ALOHA versions un slotted and slotted: un slotted aloha has no coordination between system stations, and slotted aloha, uses a master clock to provide synchronized channel time slots to improve throughput.



Figure 2: ALOHA Protocol

4. Carrier sense multiple access (CSMA): Carrier Sense Multiple Access (CSMA) refers to a family of protocols used by stations contending for access to a shared medium like an Ethernet cable or a radio channel. There are multiple "flavors" of CSMA; each has a different way of dealing with the collisions that can occur when more than one station attempts to transmit on the shared medium at the same time.

In CSMA (carrier sense multiple access) protocol when a node wants to send data over the network ,first it sense the common channel whether it's idle or busy. If it's idle, the node sends its data with sensing the medium continually. Otherwise, the node delays its transmission to avoid a collision with existing packets. While in the wireless networks, the signal strength is inversely proportional to the square distance from the transmitter node are out of transmitter's range can't sense the transmitted signal .

Collision detection (CSMA/CD) [6] was then added in order to detect collision during transmissions, stopping them , allowing another attempt later. CSMA based scheme further reduce the possibility of packet collision.

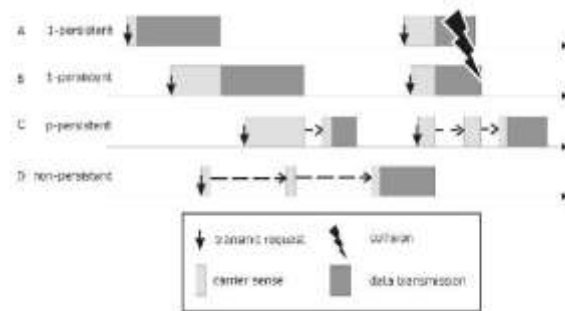


Figure 3: CSMA Protocol

5. Contention based dynamic reservation/collision Resolution:

In order to solve the hidden and exposed terminal problem in CSMA , researchers have come up with many protocols which are contention based but involve some form of dynamic reservation /collision resolution. in particular we shall discuss several important contention based schemes in the signal channel, receiver initiated, power aware, multiple channel and QOS aware categories.

6. Single channel MAC protocol:

The earliest protocols that were designed to implement as a MAC layer protocols were the single channels schemes. Using one channel to share all the information (control signals and the DATA), these schemes faced a lot of problems that decreased the efficiency of the entire network.

7. Multiple access collision avoidance(MACA):

Multiple Access with Collision Avoidance (MACA) is a slotted media access control protocol used in wireless LAN

data transmission to avoid collisions caused by the hidden station problem and to simplify exposed station problem [2], [12], [14], [15], [16]. This MACA protocol is not fully solve the hidden node and exposed terminal problem and nothing is done regarding receiver blocked problem.

Contention Based Protocol

Nodes are not guaranteed periodic access to the channel.

They cannot support real time traffic.

Three way handshaking,

RTS—CTS—Data packet exchange.

Binary Exponential back off Algorithm Sender initiated Protocol.

The basic idea of MACA is a wireless network node makes an announcement before it sends the data frame to inform other nodes to dont send frame at that time. When a node wants to transmit, it sends a Request-To-Send (RTS)signal with the length of the frame to send. If the receiving node allows the transmission, it replies Clear-To-Send (CTS) signal to the transmitter with the length of the data frame that is about to receive. Meanwhile, a node that hears RTS signal it should remain silent to avoid conflict with CTS signal; a node that hears CTS signal should keep silent until the data transmission is complete When a node wants to transmit a data packet, it first transmits a RTS (Request to Send) frame. The receiver node, if receiving node allow transmission , it send CTS (Clear to Send) packet.

Once the sender receives the CTS packet to the receiver without any error, it starts transmitting the data packet.

If a packet which is transmitted by a node is lost, the node uses the binary exponential back-off (BEB) algorithm to back off a random interval of time before retrying.

8. CONCLUSION

A Mobile ad hoc network (MANET) is a self organizing, self managing infrastructure less wireless communication network in which all nodes can be considered as hosts or routers. In these networks, the Medium Access Control (MAC) protocols are responsible for coordinating the access from nodes. In order to avoid transmission collisions in MANETs, a reliable and energy efficient MAC protocol is needed . media access control protocol are design to overcome some Ad-hoc wireless network issues and issues are: (node mobility; Limited bandwidth availability ,an error- prone broadcast channel; synchronization; bandwidth efficiency; Hidden and exposed terminal problem ,QoS support) . In this article, we present a comprehensive survey of major MAC schemes, which integrating various issues and challenges.

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