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Refining an Ad-hoc Network Performance by Executing Multiple Channel in Mac Protocol.

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Abstract-The MANET is shaped by set of wireless node without any predefined arrangement. The ad-hoc networks are based on the multi -hop communication to find the ideal route for conveyance. To make the communication, in ad-hoc network every node must collaborate among themselves to forward the packets. In ad-hoc network each node acts as a router to transmit the information to the other node. In existing network, there is a single channel is used in the MAC protocol for communication which is lead for limited throughput. The inadequate throughput can be overcome by introducing multiple channels in the MAC protocol for ad-hoc networks. One of the major challenging issues in the MANET is designing an efficient routing strategy between the multiple channel based on the channel condition. The unique characteristic of ad-hoc network is mobility .The ad-hoc networks use the MAC protocol which is defined by IEEE 802.11.The feature of the MAC protocol is used to coordinate the node in the network and allow to access the shared medium inordered to increase the network performance in multi-channel ad-hoc network. The proposed paper, deal with the multi-channel ad-hoc network to discover which channel is suitable for transmitting the packets among the multiple channel in the network. The proposed Legion Channel(LC) algorithm, allocate the channel to the host "on-demand" style, all the channels in the network act as autonomous, few control packets want to accomplish the channel assignment and the network performance can improve.

Keywords:multi-hop,throughput, medium, mobility, autonomous, Legion Channel.

I. INTRODUCTION

The Mobile Ad-hoc Network (MANET) is made by Internet Engineering Task Focus (IETF) [4]. The MANET is a wireless multi-hop distributed network. The multi-hop network increase the maximum network utilization. The MANET can easily deploy however, there is a lack of infrastructure facility. The two nodes in the network can join either directly or indirectly via intermediate nodes. The ad-hoc network is furnished with transceiver, an antenna and power level. The node in the network acts as client, server and both [1,2]. The attractiveness of the network is its size, processing ability, communication range and battery level. The multi-hop wireless communication raised in ad-hoc networks. In MANET network topology may alter regularly without any prescribed manner. In an ad - hoc network, the Medium Access Control (MAC) protocols are answerable for synchronizing the process of the nodes in the network. Generally, MAC protocol design with the single channel [11,12]. The significance of the protocol is using single channel for the wireless communication greatly reduce the network performance. So the design of MAC protocol needs to enhance the technique of ad-hoc network. The feature of the MAC protocol is used to coordinate the node in the network and allow to access the shared medium. According to IEEE 802.11 the MAC protocol [8] is used to increase the network performance by coordinating the node in the network to access the channel. The IEEE 802.11 accepted the single channel MAC protocol model [5,6]. The issue related to the single channel protocol is the network performance will greatly reduce when the number of node gets increases due to collision/contention. The one possible solution to overcome such a collision/contention is to increase the utilization of the multi-channel on the network. The advantage of using multiple channel has increased the throughput if the host allows the multiple channel. Due to the node mobility, channel assignment is a tedious task, (i.e) which channel is needed by which host. The channel selection is based on native channel condition among the multiple channel. Based on the current channel MAC forward the packet to specified adjacent node by selecting native channel condition.

II. TAXONOMY OF PROTOCOL

The proposed paper, use one control channel and 'n' data channel. The control channel uses smaller bandwidth than the data channel. The control channel is used to sense the medium by transmitting control packets. According to the MAC layer it uses Distributed Inter Frame Space (DIFS) to know the channel status. The control packets, such as RTS, CTS are the part of IEEE 802.11 standard used in multi-hop network to overcome the congestion [9]. The RTS and CTS used to reduce the collision in frame transmission. The RTS contain the information about frame control, receiver address, transmitter address, duration for data transmission and frame check sequence.After receiving RTS the receiver must wait for SIFS duration and sent the CTS. The SIFS has minimum waiting time to access the channel among multiple channel. The CTS informs that the receiver is ready to accept the data which is sent by the receiver. After the completion of control packet transmission. After the control packet successful transmission the channel define as Network Allocation Vector (NAV). The data channel used to transmit the data after SIFS duration after successful transmission of data packet the acknowledgement (ACK) packet is sent by sender after SIFS duration. Once the data channel is allocated for transmission the channel is denoted as Busy Channel List (BCL). The rest of free channel is mentioned as Idle Channel List (ICL).

III. PROCESS OF ALGORITHM

In multiple channel ad-hoc network one channel is defined as control channel and the 'n' channels are defined as data channel. The list of channel is available for transmission in the network. The channel list is divided into two categories. First, Busy Channel List (BCL), it contains the list of channels which is occupied by some other nodes. Second, is an Idle Channel List (ICL) contains the information about list of free channels which may use by the newly entered node. The proposed legion-channel algorithm follows the three steps, 1) the channel must be allotted to the host only "on-demand" fashion. 2) Each channel in the network acts as self-regulating manner. 3) Due to the nature of mobility only few control packets need to achieve channel assignment.

IV. PROPOSED ALGORITHM

Primary Message Exchange:

1) ***Request to send (RTS):*** The sender sends the control message through an idle channel to know whether the receiver is ready for transmission.
2) ***Clear to send (CTS):*** Once the receiver ready for transmission it must reply with CTS message after SIFS duration.
3) ***Distributed Inter Frame Space (DIFS)***: The DIFS sense the channel from the ICL and transmit frame after the static amount of time. DIFS duration can be calculated by the following method.
   DIFS = SIFS + (2 * Slot time).
4)***Shortest Inter Frame Space (SIFS)***: The SIFS is a predefined amount of small interval time taken between short packets. IEEE 802.11 family describes the SIFS [1] for all interframe space. Example The acknowledgement will sent after the SIFS has expired. By default the SIFS duration in 802.11g is 10 µs.
5) ***Data:*** The data channel used for transmission of data after receiving CTS.
6) ***Acknowledgment (Ack):*** After successful transmission the acknowledgement packets are sent after SIFS duration.

V.EVOLUTION OF ALGORITHM

The proposed algorithm maintains two channel list 1) Busy Chanel List (BCL) 2) Idle channel List (ICL). The BCL when the adjacent node of A say B, uses the channel, then add the entry to BCL[i] BCL of A [i] is the index of BCL. It has three fields.

-BCL[i].node ->has the destination node id. Eg: Destination of B's Id.

-BCL[i].ch->Data channel is used by the destination node.

-BCL[i].time->Time of data channel released by the destination node.

The BCL is used to maintain the list of busy channels which is used by each individual node.

ICL: It denotes the number of free channels in the list.

The fig: 1 explains the frame structure of the proposed method. The sender senses the channel status before transmitting if it is in idle state, it transmits its packet after a short period of time, such a duration is mentioned in DIFS (Distributed Inter-Frame Space). The RTS is sent by sender to verify whether the receiver is ready to receive the packet. The SIFS is set with minor interval time taken between short packets. The CTS are sending by receiver to inform the sender that the receiver is prepared to accept the packet. The DATA module describes that the data is sent by the sender. Acknowledgement (ACK) after successful transmission the acts is sent by the receiver.

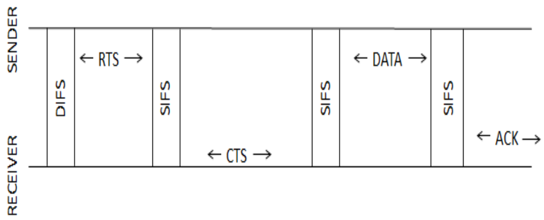


Fig:1 Basic Data Exchange.

The algorithmic work as follows newly entered node finds the free channel from the BCL contain a list of channels which is used by a node in the network.

The BCL, it checks the condition, whether the selected channel is in the BCL.If the target channel is not in the BCL then following values must be assigned

-BCL [i]- node contains the destination node id.

-BCL[i].ch-> allocate the data channel which is used by the destination node.

ι-BCL[i]. time->Time of data channel released by the destination node.

It sends the RTS to the receiver through the selected channel. Then the receiver waits for SIFS duration, then send the CTS to the sender.

Algorithm:Legion Channel

1.If(target!==BCL[i])
2.BCL[i].host=target id
3.BCL[i].ch=target channel
4.BCL[i].time=T_{pre}-(T_{DIFS}+T_{RTS}+T_{SIFS}+T_{CTS}+L_d+ack)
5.wait(DIFS)
6.send (RTS)
7.wait(SIFS)
8.receive(CTS)
9.else
10.ICL[i]=available channel
11.orgin=ICL[i]
12.send(RTS,L_d)
13.If(target=ICL[i])
14.ICL[i] ->ICL[i]
15.If(!receive(CTS))
16.orgin_wait=T_{SIFS}+T_{CTS}+2_ι
17.receive(CTS)
18.else
19.resend(RTS,L_d)

Meanings of the variables used in the algorithm

Variable	Meaning
T_{SIFS}	Distance of Short Inter-Frame Spacing.
T_{DIFS}	Distance of Distributed Inter-Frame Spacing.
T_{RTS}	Duration of RTS
T_{CTS}	Duration of CTS.
T_{pre}	Present time of host.
L_d	Data packet length.
ack	Acknowledgement.

VI. EXPERIMENTAL RESULT

The ad-hoc network performance can be improved by using multiple channel in the network. The performance is evaluated based on the following criteria. Hundred nodes are formed randomly in a physical area size of 100 X 100.

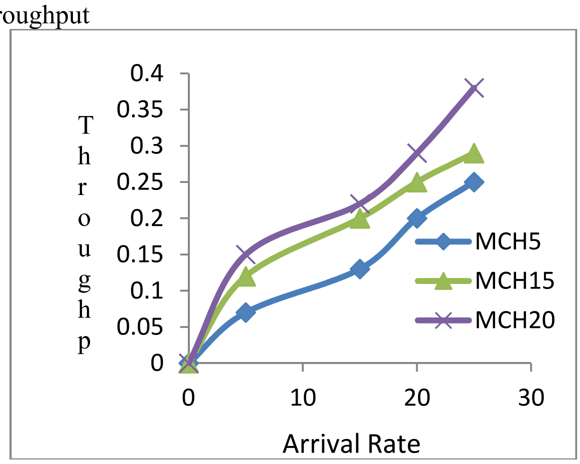
Parameter	**Value**
Nodes	100
Area	100 x 100
Length of DIFS	60 µs
Length of SIFS	20 µs
Slot duration	20 µs

The performance is based on the following equation,

$$Throughput = \frac{length\_of\_packet * delivered\_packet}{time}$$

$$Utilization = \frac{length\_of\_packet * delivered\_packet}{Time * no\_channel}$$

Where length_of_packet is the total number of bits in the data packet, delivered_packet refers the number of packets received by the target. Time represents the total amount of time used for stimulation. no_channel determines the total channel used for transmission, including both control and data channel. This simulation is based on distributed, multi-hop ad-hoc network. Thus the network utilization can be improved by using multiple channel in the ad-hoc network.The following chart, based on arrival rate vs throughput



Arrival Rate vs Throughput.

VII. CONCLUSION

The proposed paper deal with the multiple channel along with MAC protocol in ad-hoc network. The network performance can be enhanced by introducing a legion channel algorithm in ad-hoc networks. The 802.11 MAC acts as a backbone for high performance packet forwarding in multi-hop wireless networks. . The legion algorithm is designed for multiple channels in an ad - hoc network by using a control packet RTS/CTS and DATA/ACK phases. Thus the network, performance can be achieved by introducing a legion channel algorithm for ad-hoc networking.

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