

DYNAMIC CHANNEL ALLOCATION IN MOBILE AD HOC NETWORK

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Abstract— *In Mobile ad-hoc networks, mobile devices range independent for the use of wireless links and dynamically varying network topology. In mobile ad-hoc network is a collection of mobile nodes that are dynamically and randomly located in such a manner that the interconnection between nodes are capable of changing on a running basis. To handle such interconnections , the channel allocating schemes for the nodes for communicating with each other in a network is an important concept. In mobile ad-hoc network the load distribution is not fixed so fixed channel allocation scheme should not work effective in such environment. So another concept dynamic channel allocation scheme should be used with multiple channel assigning to the node as per needed and using spectrum sensing for efficiently handling non-uniform traffic load distribution exists in mobile ad hoc network. Here we combine this scheme to implement in mobile ad-hoc network with a MAC layer protocol DCA-TRACE which provides importantly improvement for both uniform and non-uniform traffic loads.*

Keywords—Mobile Ad Hoc network,channel Allocation Schemes,MAC Protocols.

I. INTRODUCTION

Mobile Ad Hoc Network (MANET) is a collection of two or more devices or nodes or terminals with wireless communications and networking capability that communicate with each other without the aid of any centralized administrator also the wireless nodes that can dynamically form a network to exchange information without using any existing fixed network infrastructure [1]. In order to facilitate communication within the network, a routing protocol is used to find out routes between nodes. The primary goal of such an ad-hoc network routing protocol is correct and efficient route formation between a pair of nodes so that messages may be delivered in a timely manner. Route construction should be done with a minimum of overhead and bandwidth consumption. A network of mobile nodes using peer-to-peer communication is called an ad- hoc network. The nodes in an ad hoc network are limited by power, memory, bandwidth and computational constraints. Such networks have the ability to provide cheap communication without any fixed infrastructure. Hence, they are very useful in disaster recovery, collaborative computing, rescue operations and military surveillance. Various routing algorithms have been designed to work efficiently in bidirectional networks.

MANET is a composition of a group of mobile, wireless nodes which cooperate in forwarding packets in a multi-hop fashion without any centralized administration. MANET is self organized network in which mobile nodes can communicate with each other by smart antennas. In MANET fixed channel allocation concept is used. In FCA scheme, the area is division into a number of cells. A number of channels are assigned to each cell according to some reuse pattern depending on the desired signal quality. It is a simple technique and do not adapt to changing traffic conditions and user distribution. Where dynamic channel allocation provides more flexible channel allocation scheme. In this scheme, all channels are kept in a central pool and are assigned dynamically to radio cells as new call arrive in the system. Flexible allocation of channels should be done in MANET which provides high channel efficiency. This can be done by implementing dynamic channel allocation in MANET.

There are a lot of places where ad hoc networks are involved: military operations, emergency services, conferencing, game parties, home networking, etc. If the wireless nodes are within the range of each other, the routing is not necessary. If a node moves out of this range, and they are not able to communicate with each other directly, intermediate nodes are needed to organize the network which takes care of the data transmission. The purpose of a routing algorithm is to define a scheme for transferring a packet from one node to another. This algorithm should choose some criteria to make routing decisions, for instance number of hops, latency, transmission power, bandwidth, etc. The topology of mobile ad hoc networks is time-varying, so traditional routing techniques used in fixed networks cannot be directly applied here. There are various techniques for tracking changes in the network topology and re-discovering new routes when older ones break. Since ad hoc networks have no infrastructure these operations should be performed with collective cooperation of all nodes.

The new approach dynamic channel allocation should be used in MANET which is already working in a cellular network because it provides more flexible allocation of channels. So, the dynamic channel allocation scheme is to overcome the drawback of fixed channel allocation scheme.

To implement this dynamic channel allocation concept in MANET, DCA-TRACE protocol is used which is simply a MAC protocol. This can be implemented by using spectrum sensing technique for keeping the track of traffic in all available channels. So dynamic channel allocation scheme is used in MANET for dynamically assigning multiple channels to the nodes as needed for handling both the random and localized load distributions.

This paper is organized as follows. Section II consists of details of the Channel Allocation. Section III consists of details of the related work of Channel Allocation. Section IV consist of details of the proposed work. Section V is conclusion and Section VI is future aspect.

II. CHANNEL ALLOCATION

A. Channel Allocation Schemes:

In [radio resource management](#) for wireless and cellular network, channel allocation schemes are required to allocate [bandwidth](#) and [communication channels](#) to base stations, access points and terminal equipment [2].

B. Channel Allocation Schemes Types:

Channel allocation schemes can be divided into a number of different categories depending on the equivalence basis. For example, when channel assignment algorithms are compared based on the manner in which co-channels are separated, they can be divided into fixed channel allocation (FCA), dynamic channel allocation (DCA), and hybrid channel allocation (HCA)[3]. In FCA schemes, according to some reuse pattern, the area is partitioned into a number of cells, and a number of channels are assigned to each cell depending on the desired signal quality. FCA schemes are very simple, however, they do not accommodate to changing traffic conditions and user distribution. In order to overcome these drawback of FCA schemes, DCA schemes have been introduced. In DCA, all channels are placed in a pool and are assigned to new calls as needed. DCA schemes provide flexibility and traffic adaptability. Where in the simple FCA schemes, the same number of nominal channels is allocated to each cell. This uniform channel distribution is efficient if the traffic distribution of the system is also uniform. Because traffic can be non uniform with temporal and spatial fluctuations, a uniform allocation of channels to cells may result in high blocking in some cells which results in poor channel utilization. So FCA schemes are not able to attain high channel efficiency. To overcome this, DCA scheme is introduced in which no fixed relationship between channels and cells. All channels are kept in a central pool and are assigned dynamically to radio cells as new calls arrive in a system and after a call is completed, its channel is returned to the central pool. In DCA, a channel is suitable for use in any cell provided that signal interference constraints because in general more than one channel might be available in a central pool to be assigned to a cell that requires a channel.

Comparison of FCA and DCA

In MANET the natural of traffic is non uniform. FCA proves inefficient to handle such traffic because it does not provide flexibility in channel assignment. So DCA proves more suitable in such a situation in MANET.

Table 2.1 Comparison of FCA and DCA [3]

FCA-Fixed channel allocation	DCA-dynamic channel allocation
Low flexibility in channel assignment	Flexible channel assignment
Sensitive to time and spatial changes	Insensitive to time and spatial changes
Maximum channel reusability	Not always maximum channel reusability
Performs better under heavy traffic	Performs better under low/moderate traffic

C. MAC Protocol for MANET:

Based on the collaboration level MAC protocols can be classified into two categories: (1) coordinated and (2) non-coordinated. [1] Channel access in non-coordinated protocols is typically based on a contention mechanism between the nodes. IEEE 802.11 is an example of a non-coordinated protocol. Although it is easier to support non-uniform traffic with non-coordinated protocols. These protocols are inapplicable for highly loaded networks due to the contention mechanism. Where as in coordinated channel access protocols, the medium access

is regulated, where the network load is high then making them better suitable for networks. MH-TRACE is an example of such protocols. Coordinated channel access schemes provide support for QOS, reduce energy dissipation and increase throughput. But this protocol performs poorly under non-uniform traffic loads. For supporting non-uniform traffic loads dynamic channel allocation scheme is used. In this scheme the area can be separated into two categories which are centralized and distributed. In centralized dynamic channel allocation scheme, all available channels are kept in a central pool [3] and are distributed to various cells by central coordinator. So to overcome the defect of MH-TRACE, a new protocol called as dynamic channel allocation for TRACE which means DCA-TRACE is formed. DCA-TRACE is a new MAC protocol that maintains the same energy efficiency and channel regulation rules of MH-TRACE while enabling dynamic and scalable channel assignment. [1]

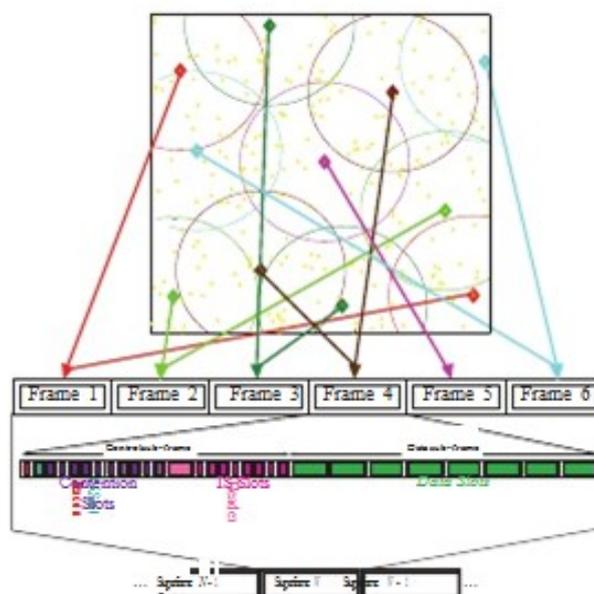


Figure 2.1 MH-TRACE Clustering and medium access [1]

MH-TRACE and DCA-TRACE both is MAC protocols related to different channel allocation schemes in a network. Below table shows the comparison of MH-TRACE and DCA-TRACE. Table 2.2 Comparison of MH-TRACE and DCA-TRACE[1]

MH-TRACE	DCA-TRACE
Less flexible	More flexible
Collision increases	Collision reduces
Level of interference decreases	Level of interference increases
Data slots are assigned in sequential order	Dynamic assignment of data slots

III. RELATED WORK

In first paper defines Due to dynamic behavior of MANET, the traffic load may be highly non uniform over the network area. So it is essential that the MAC protocol be able to handle spatially non uniform traffic loads efficiently. MH-TRACE (Multihop Time Reservation Using Adaptive Control for Energy Efficiency) is a coordinated MAC protocol where the channel access is regulated by dynamically chose cluster head. MH-TRACE does not allow any channel borrowing mechanism and therefore it does not execute as well as possible under non uniform load distribution. A new protocol DCA-TRACE (Dynamic Channel Allocation

for TRACE) is forming for MANET, it is a new MAC protocol that is able of saving energy, decreasing jitter and increases the transmission for random and localized load distributions. DCA-TRACE provides more advance for both uniform and non uniform traffic loads. [1]

In second paper define A given radio spectrum can be separated into a set of disjoint radio channels which can be used at the same time while maintaining an acceptable received radio signal. There are mainly two different channel allocation schemes: Fixed channel allocation (FCA) and Dynamic channel allocation (DCA). FCA is very simple scheme in which area is partitioned into a number of cells and a number of channels are assigned to each cell according to some reuse pattern. But FCA do not adjust to changing traffic conditions and user distribution. In order to defeat these problems DCA scheme is introduced. In DCA scheme, all channels are placed in a pool and are assigned to new calls as needed. So DCA provides flexibility and traffic adaptability. The main idea of DCA scheme is to judge the cost of using each candidate channel and select the one with the minimal cost provided that certain interference constraints are fulfilled. [3]

In third paper Soft clustering of the nodes merged with time division multiple access (TDMA) channel access within a cluster has been shown to provide an energy efficient result for MANET. Such channel access schemes use a parameter that is vital in determining network performance as a number of frames per super frame which determine the amount of spatial reuse possible. When a similar number of frames per super frames is used, each frame is consists of a large number of slots enabling a frame to support more nodes but also limiting the choice of frames for cluster head to select getting higher co-channel interference and collisions. The optimal value of the number of frames is the one that minimizes the merged effect of both collisions and dropped packets. [4]

In this paper A Multihop dynamic channel assignment scheme separates the cell into microcell and microcell to accept and complete the call. The radio resources are assigned to each call based on the interference information in surrounding cells. There are two different channel searching algorithms are usable which are sequential channel searching and packing based channel searching. . Multihop DCA (MDCA) scheme improves the system capacity and call blocking probability. This scheme works on the information provided by the Interference Information Table. MDCA can efficiently cover the hot-spot traffic. [7]

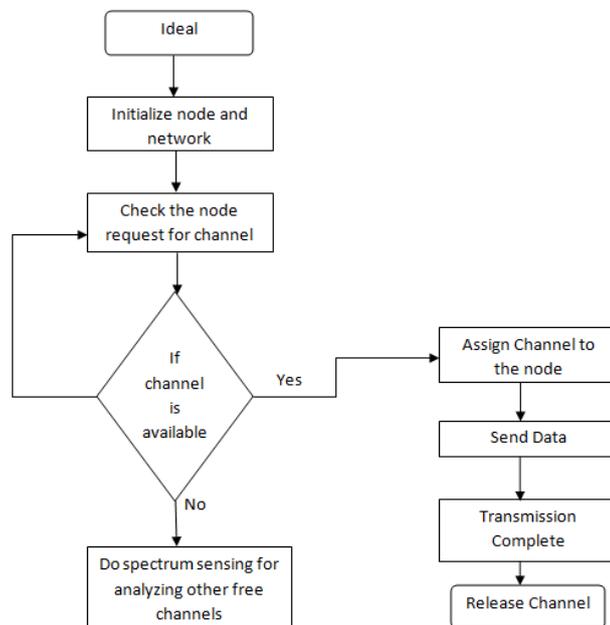
In this paper MH-TARCE is a MAC protocol that merges the features of full centralized and full distributed networks for energy efficient for real time packet broadcasting in a Multihop radio network. MH-TRACE clusters are just for organizing the channel access and minimizing the interference. Time is organized into cyclic a super frame which consists of various time frames to suffer reservation based periodic channel access for real time traffic. Each cluster head selects the frame with least interference based on its own measures for the operation of its cluster. An significant beneficial of MH-TRACE is that it allows QOS to streaming media such as voice traffic and it attains traffic adaptive energy efficiency in a Multihop network without using any worldwide information except synchronization. [8]

The Local Packing (LP) algorithm, a base station distributed dynamic channel allocation (DDCA) adapting to local traffic required, is presented in this paper. Also defined some other DCA algorithms, even when the network has a big number of channels, it maintains a well-disposed performance over FCA under uniform traffic in the part of interest. More importantly, the LP algorithm has a tremendous capability of alleviating congestion at traffic

hot spots. This algorithm can be enforced, distributed at the base stations with a simple Augmented Channel Occupancy table, or centrally at the mobile switching center. [9]

IV. PROPOSED WORK

A. Flowchart of proposal work



In the proposed work in detail first step starts with identifying, second step is the analyzing and then third step is the initializing whole network and all nodes. Once all nodes in a network is initialized then check the available nodes whether they are requesting for channels or not. If any node request for a channel then first check whether the channel is available for that node or not. If the channel is available then immediately allocate that channel to the respective node. Once a channel is allocated to the node, then a node can further do its communication using that channel and after finishing its transmission that node releases that channel so that any other node in a network can use that channel for communication. The available channel is searched in a network by using a technique which is called as spectrum sensing. Spectrum sensing is used for searching all available channels in a network. If a channel found available using this technique then it can be further use by any node for communication in a network. So this flowchart shows the whole concept of channel allocation to the nodes in a network.

V. CONCLUSION

Dynamic channel allocation scheme can be implemented in MANET by using a MAC protocol DCA-TRACE with spectrum sensing. This approach can work well under non-uniform load distribution because it provides flexible channel allocation in a network. This scheme uses carrier sensing of existing packets and does not increase any communication overhead in a network. It provides much better performance with respect to throughput, energy consumption and transmission rate. Thus dynamic channel allocation scheme with multiple channel assignment to any nodes of a network as per needed provides much better performance in a MANET.

VI. FUTURE WORK

We will implement this proposed work in ns2 simulator.

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