

**Coordinated Dynamic Channel Allocation scheme in Mobile Ad hoc Network**Alpa Patel¹, Vinesh Kapadia², Krunal Yadav³¹Electronics & Communication Department, S.N.P.I.T & R.C., Umrakh²Electronics & Communication Department, S.N.P.I.T & R.C., Umrakh,³Electronics & Communication Department, S.N.P.I.T & R.C., Umrakh

Abstract —Dynamic channel allocation for cellular networks has also been studied extensively in the framework of cellular networks, emergence of new system concepts, such as mobile ad-hoc networks has brought this topic into the focus of research. Although MANET does not have the infrastructure, its channel assignment can be conducted in a way very similar to that in cellular system efficiently Here Research area is a distributed dynamic channel allocation algorithm that maintains the same energy efficiency and channel regulation principles of coordinated MAC protocol MH-TRACE while enabling dynamic and scalable channel assignment. This feature minimizes the overhead found in dynamic channel allocation schemes for cellular networks and makes Dynamic channel allocation scheme suitable for MANET applications.

Keywords- Channel access, Cluster head, Dynamic channel Allocation, MANET, Medium access control

I. INTRODUCTION

As the frequency spectrum is limited and mobile users are increasing so the main task of resource management is to serve to the maximum number of users through a limited number of channels. The available wireless bandwidth is divided into channels, Channel allocation deals with the assignment of channels to cells in a cellular network. Once the channels are allocated, cells then allow users to communicate via the available channels. Channels in a wireless communication system typically consist of time slots, frequency bands and/or CDMA pseudo noise sequences, but in an abstract sense, they can represent any generic transmission resource [2]. There are three major categories for allocating these channels to cells (or base-stations). They are Fixed Channel Allocation, Dynamic Channel Allocation and Hybrid Channel Allocation which is a combination of the first two methods [2]. Fixed Channel Allocation systems allocate specific channels to specific cells. This allocation is static and can't be changed. Dynamic Channel Allocation attempts to overcome the problem mentioned for FCA systems when offered traffic is non-uniform. In DCA systems, no set relationship exists between channels and cells. Instead, channels are part of a pool of resources. Whenever a channel is needed by a cell, the channel is allocated under the constraint that frequency reuse requirements can't be violated. Dynamic channel allocation for cellular networks is not directly applicable to MANETs due to the high overhead associated with the message exchanges between the channel regulators, and due to the mobility of the nodes in the network. However, these strategies may be adapted to coordinated MAC protocols used in MANETs where channel access is regulated by dynamically selected cluster heads [7]. Coordinated channel access schemes provide support for QoS, reduce energy dissipation, and increase throughput for low to-mid noise levels and for dense networks. Principles of dynamic channel allocation for cellular networks incorporated with coordinated channel access framework maintains the same energy efficiency and uses channel regulation principles that enables dynamic and scalable channel assignment [5].

The rest of the paper is organized as follows. Dynamic Channel Allocation Algorithm in section II, Dynamic Channel Allocation Algorithm for Trace in section III, Performance Evaluation parameters are mentioned in section IV and section V include conclusion of paper.

II. BACKGROUND

The purpose of channel allocation algorithms is to allocate radio channels to wireless users such that CIR is maintained at every wireless terminals. In low traffic intensity DCA scheme is used, in high traffic, especially at uniform traffic FCA is used. DCA uses channels more efficiently than FCA. DCA provides much steadier performance even in geographical variations the gain of DCA drastically increases [2].

The distributed DCA scheme involves a number of controllers scattered across the network. Centralized dynamic channel allocation schemes can produce near to optimum channel allocation [2]. In centralized dynamic channel allocation schemes, the available channels are kept in a pool and distributed to various cells by a central coordinator [2]. Being quite effective in maximizing the channel usage, these systems have a high overhead. Although this approach provides dynamic channel allocation, it is not directly applicable to MANETs due to the high overhead and mobility of the nodes in the network, these strategies can be adapted to coordinated MAC protocols used in MANETs [3],[4]. Coordinated channel access protocols make the medium access regulated, making them better suited for networks where the network load is high. Coordinated channel access scheme provides support for QoS, reduce energy dissipation, and increase throughput for

low to-mid noise levels and for dense networks [6]. IEEE 802.15.3, IEEE 802.15.4, and MH-TRACE [7] are examples of such coordinated protocols.

Dynamic channel allocation (DCA) algorithm in MANET is similar to the one that exists in cellular systems. Under non-uniform loads, it is crucial for the MAC protocol to be exible enough to let the unused bandwidth be allocated to the controllers in the heavily loaded regions. Cellular systems usually handle channel allocation through message exchanges between the cell towers. These messages would be too costly for a MANET Network system due to the highly dynamic behaviour of the network. Instead, a dynamic channel borrowing scheme that utilizes spectrum sensing has been adapted. In this Dynamic channel allocation algorithm, the channel controllers continuously monitor the power level in all the available channels in the network and assess the availability of the channels by comparing the measured power levels with a threshold. If local load increases beyond local capacity, provided that the measured power level is low enough, the channel coordinator starts using the channel with the lowest power level measurement. As the channel coordinator starts using the channel, its transmission increases the power level measurement of that channel for nearby controllers, which in turn prevents them from accessing the same channel. Similarly, as the local network load decreases, controllers do not need some channels stop the transmissions in that channel, making it available for other controllers [1]. In this algorithm, channel coordinators react to the increasing local network load by increasing their share of bandwidth.

III. DYNAMIC CHANNEL ALLOCATION ALGORITHM FOR TRACE

In coordinated MAC protocol MH-TRACE, each Cluster Head operates in one of the frames in the super frame. As the number of data slots are fixed, the CH can only provide access to a limited number of nodes. Due to the dynamic structure of MANETs, one CH may be overloaded while others may not be using their data slots. In such case, although there are unused data slots in the super frame, the overloaded CH would provide channel access only to a limited number of nodes, which is equal to the number of data slots per frame, and it would deny the channel access requests of the others. Thus, the system needs a dynamic channel allocation scheme to provide access to a larger number of nodes [1]. Dynamic channel allocation algorithm for TRACE lets CHs operate in more than one frame per super frame, if they are overloaded. Instead of choosing and operating in the least noisy frame as in MH-TRACE, in DCA-TRACE, based on the load level, CHs decide on the number of frames they require and choose that many frames from the least noisy frames.

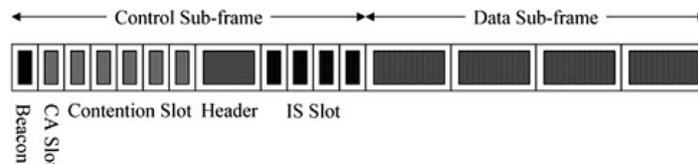


Fig.1 A snapshot of MH-TRACE Frame Format[7].

Dynamic channel allocation algorithm for TRACE is a more flexible compared to its predecessor MH-TRACE, as the clustering structure can be adjusted. By adjusting the clustering structure, DCA-TRACE is capable of adapting to: i) shrinking network dimensions, and ii) non-uniformities in load distribution.

The mobility patterns in a MANET may lead to nodes accumulating in a small region. At one extreme, when the largest distance between any two nodes in the network is below the communication radius, nodes form a single hop connected network. Due to the CH resignation mechanism in MH-TRACE, only a single CH can operate in such a scenario.

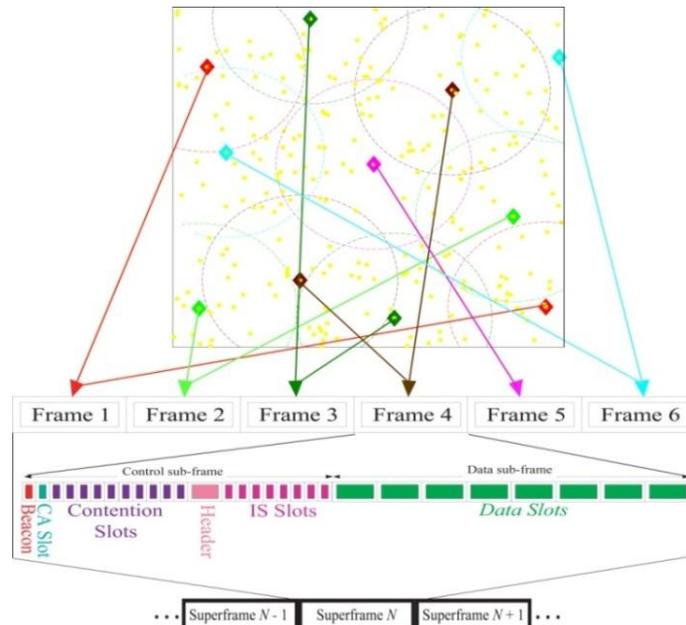


Fig.2 A Snapshot of MH-TRACE clustering and medium access. Diamonds represent selected cluster heads and dots represent the nodes in the network. CH-frame matching, together with the contents of each frame, is depicted [7].

Since each CH only accesses one of the frames in each super frame, the access time of the all the remaining frames will not be used and is thus wasted [7]. On the other hand, DCA -TRACE adapts to this situation by letting the single CH access all the frames and all the data slots.

In DCA-TRACE, CHs mark a frame as unavailable if there is another cluster that uses the frame and resides closer than a certain threshold, Tr , measured through the high interference value of that frame. Even under high local demand, CHs refrain from accessing these frames that have high interference measurements, in order to protect the stability of the clustering structure and the existing data transmissions. At the end of each super frame, CHs determine the number of frames that they need to access, m , based on the reservations in the previous frame. Depending on the interference level of each frame, they choose the least noisy m frames that have an interference value also below a common threshold, Th . If the number of available frames is less than m , the CHs operate only in the available frames. Another mechanism that DCA-TRACE adds on top of MH-TRACE is the dynamic assignment of data slots. In MH-TRACE, data slots are assigned in a sequential order. On the other hand, DCA-TRACE CHs keep track of the interference levels of each IS slot of each frame in the super frame. In order to accommodate temporary changes, the exponential moving average smoothing mechanism is used for IS frames. Knowing the interference values of all IS slots, the CH assigns the available data slots to the nodes that request channel access beginning with the slot that has the lowest interference value. In the case of a channel borrower, this mechanism allows the CHs that operate in a frame to assign slots that are not used by other CHs as much as possible. The implemented dynamic channel allocation algorithm also allows utilizing the slots as many as possible in the frame of the superframe eventually optimum use of spectrum.

IV. PROPOSED METHODOLOGY

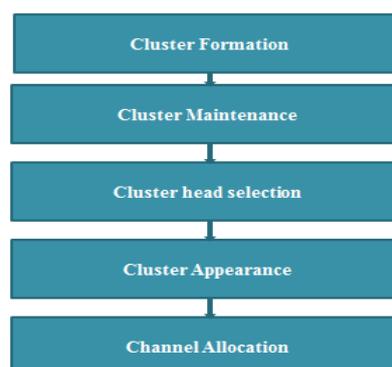


Fig.3 Flow of Dynamic channel Allocation Algorithm

Flow of Dynamic channel allocation algorithm is shown in fig.3. The steps of cluster Formation, cluster maintenance, cluster head selection and cluster appearance [7] used by DCA algorithm for MANET is same as the coordinated MAC protocol MH-TRACE. Use of different no. of frames per superframe has impact on throughput, delay and packet delivery ratio. Implemented work shows the effect and gives the idea about choosing the frames per superframe that helps in utilizing the spectrum and improves the performance of the protocol.

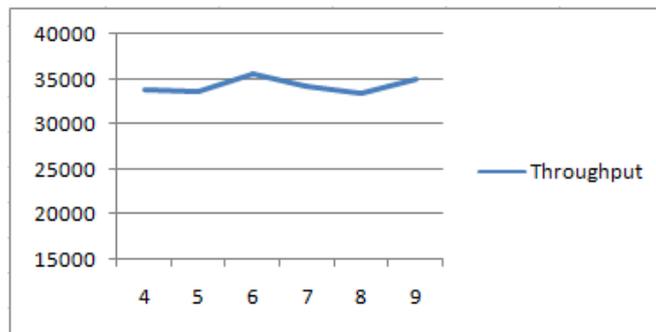
V. SIMULATION RESULTS

Ns-2 simulation is used in simulation study. In this simulation created a MANET using 50 nodes and Delay, throughput and Packet Delivery Ratio versus no. of frames per superframe has been measured.

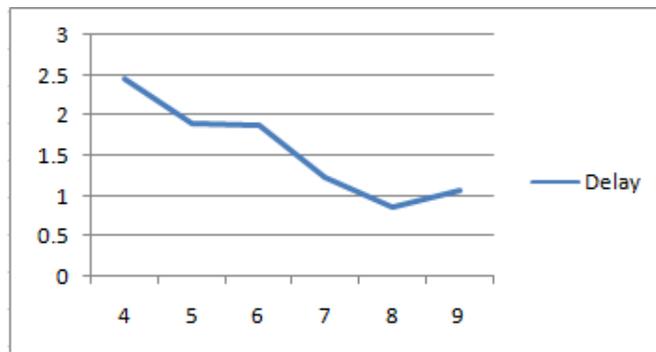
TABLE 1 SIMULATION PARAMETERS

Parameters	Values
Network Dimension	500m x 500m
Network Interface	Wirelessphy
No. of Nodes	50
Propagation Model	Two ray ground
MAC	MAC/802_11
Interface Queue Type	Queye / DropTail / Priqueue
Routing	DCA
Antenna Model	Omni Directional
Link Layer	LL
Superframe length	100
Max. user per channel	100
Initial energy	100 J
Simulation time	250 s
Traffic type	CBR
CBR packet size	512 bytes

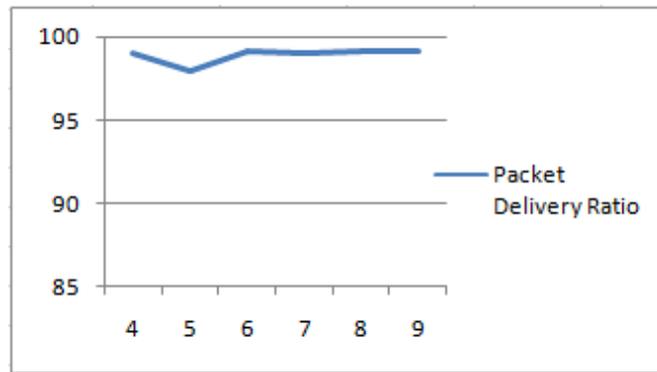
TABLE 1 shows the parameters used for simulation study. Various simulation results for throughput, delay, packet delivery ratio are shown in the graph given below.



(a)



(b)



(c)

Fig.4 (a)Throughput versus number of frames per superframe (b) Delay per number of frames per superframe.(c)Packet Delivery ratio per number of frames per superframe.

Since all the clusterheads choose the least interference frame for transmission, the distance between the co-frame clusterheads is an increasing function of number of frames. Therefore, the number of collisions decreases, Hence we get more no.of packet delivered as shown in fig.4(c). For Dynamic channel allocation algorithm we get throughput as shown in fig.4 (a), which is almost constant as we go for least interference frame for transmission. Due to less collision and dropped packet the delay gets decreasing as shown by fig.4(b).

VI. CONCLUSION

This paper summarizes the concept of MANET, channel allocation concept in MANET, explanation of Dynamic channel allocation concept, implementation of Dynamic channel allocation algorithm for Trace in Ns-2. DCA algorithm for TRACE solves inefficient spectrum utilization under non-uniform load distribution problem of coordinated MAC protocols. The algorithm is built on MH-TRACE and includes the same energy saving and collision minimization mechanisms that exist in MH-TRACE, A coordinated channel access scheme, DCA algorithm for TRACE is capable of decreasing jitter compared to an uncoordinated protocol.

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