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RESEARCH ARTICLE

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# LOAD BALANCING AND DYNAMIC CHANNEL ALLOCATION IN MOBILE ADHOC NETWORK

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**ABSTRACT**

A **mobile ad hoc network** (**MANET**) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. Every device in a MANET is free to move independently in any direction, and can change its links to other devices frequently. In general MAC protocol for wireless networks can be classified as coordinated and uncoordinated MAC protocol. In uncoordinated protocol nodes contend with each other to share the common channel. In this paper lightweight dynamic channel allocation mechanism and a cooperative load balancing strategy are introduced that are applicable to cluster based MANETs to address this problem. We present protocols that utilize these mechanisms to improve performance in terms of throughput, energy consumption and inter-packet delay variation, bandwidth efficiency in MANET. It is crucial for the Medium access control of a MANET not only adapt to the dynamic environment but also to efficiently manage bandwidth utilization.

***Key Words:*** *Load balancing, dynamic channel allocation, Mobile adhoc network.*



## I. INTRODUCTION

Manet stands for "Mobile Ad Hoc Network." A MANET is anad hoc network that can change locations and configure itself while moving. Because MANETS are mobile, they use wireless connections to connect to various networks. Each must forward traffic unrelated to its own use, and therefore be a router. The important challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks operateby themselves or may be connected to the larger Internet. It may contains multiple and different transceivers between nodes. This results in a highly dynamic, autonomous topology. The main advantage of using wireless adhoc network is the ease and speed of deployment is high and decreased speed on infrastructure. There are two topologies in adhoc network they are heterogeneous that supports different capabilities and homogeneous that have nodes with identical capabilities and responsibilities.

MANETs are a kind of Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network. MANETs consist of an end to end, self-forming, self-healing network in contrast to a mesh network that has a central controller. MANETs circa 2000-2015 typically communicate at radio frequencies (30 MHz - 5

GHz).Multi-hop relays date back to at least 500 BC.The growth of laptops and 802.11/Wi-Fi has made MANETs a popular research topic. Many papers evaluate protocols and their abilities, assuming varying degrees of mobility within a bounded space, usually with all nodes within a few hops of each other. Protocols are then evaluated based on measures such as the packet drop rate, the overhead by the routing protocol, packet delays, and nnetwork throughput.

MANETS can be used for facilitating the collection of sensor data for data mining for a variety of applications such as air pollution monitoring and different types of architectures can be used for such applications[4]. It should be noted that a key characteristic of such applications is that nearby sensor nodes monitoring an environmental feature typically register closer values. This kind of data redundancy due to the spatial correlation between sensor observations inspires the techniques for in-network data aggregation and mining. By measuring the spatial correlation between data sampled by different sensors, a wide class of specialized algorithms can be developed to develop more efficient spatial data mining algorithms as well as more efficient routing strategies[5]. Also, researchers have developed performance queueing theory.

A lot of research has been in the past but the most significant contributions have been the PGP (Pretty Good Privacy) and trust based security. No protocols have made a decent trade-off between security and performance.

**2. EXISTING WORK**

In general, MAC protocols for wireless networks can be classified as coordinated and uncoordinated MAC protocols[1] based on the collaboration level. In uncoordinated protocols such as IEEE 802.11, nodes contendwith each other to share the common channel. For low network loads, these protocols are bandwidth efficient due to the lack of overhead. A coordinated channel access protocol is suited only for loaded MANET under uniform load distributions. It is not suited for non-uniform load distributions as uncoordinated channel access protocol due to lack of on demand dynamic channel allocation. In Coordinated MAC protocols the channel access is regulated. Uncoordinated protocol nodes contend with each other to share a common channel. For low network loads, these protocols are bandwidth efficient due to lack of overhead. However as the network increases, their bandwidth efficiency decreases. Due to idle listening, these protocols are in general not energy efficient. Coordinated channel access protocol adapt only in static environment.

In this paper lightweight dynamic channel allocation mechanism and a cooperative load balancing strategy[8] that are applicable to cluster based MANETs to address this problem. The protocols utilize these mechanisms to improve performance in terms of throughput, energy consumption and inter-packet delay variation (IPDV),bandwidth efficiency[10] in MANET. It is crucial for the Medium access control of a MANET not only adapt to the dynamic environment but also to efficiently manage bandwidth utilization. MAC protocol design is the maximization of spatial reuse and providing support for non-uniform load distributions.

**3. PROPOSED WORK**

Similar to cellular systems, coordinated MANET MAC protocols need specialized spatial reuse and channel borrowing mechanisms that address the unique characteristics of MANETs in order to provide as high bandwidth efficiency as their uncoordinated counterparts. Due to node mobility and the dynamic nature of the sources in a MANET, the network load is often not uniformly distributed. In this paper two algorithms has been proposed to cope with the non-uniform load distributions in MANETs a light weight distributed dynamic channel allocation algorithm based on spectrum sensing, and a cooperative load balancing algorithm in which nodes select their channel access providers based on the availability of the resources.

We apply these two algorithms for managing non-uniform load distribution in MANETs into an energy efficient real-time coordinated MAC protocol, named MH-TRACE [4,5]. In MH-TRACE, the channel access is regulated by dynamically selected cluster heads (CHs). MH-TRACE has been shown to have higher throughput and to be more energy efficient compared to CSMA type protocols. Although MH-TRACE incorporates spatial reuse, it does not provide any channel borrowing or load balancing mechanisms and thus does not provide optimal support to non-uniform loads.

Hence, we apply the dynamic channel allocation and cooperative load balancing algorithms to MH-TRACE, creating the new protocols of DCA-TRACE, CMH-TRACE and the combined CDCA-TRACE. The contributions of this paper are:

1) To propose a light weight dynamic channel allocation scheme for cluster-based mobile ad hoc networks
2) To propose a cooperative load balancing algorithm
3) To incorporate these two algorithms into our earlier TRACE framework leading to DCA-TRACE and CMH-TRACE
4) To combine both algorithms to provide support for non- uniform load distributions and propose CDCA-TRACE.

To provide dynamic channel allocation and cooperative load balancing we use the MH-TRACE (Multi-Hop Time Reservation Using Adaptive Control for Energy Efficiency) protocol. MH-TRACE protocol contains four types of slots CA-slots, contention slots, IS slots, data slots. Each slot can be used to identify the channel efficiency, energy level. Why we need dynamic channel allocation means, the channel controller continuously monitor the power level in all available channels in network and assess the availability of the channels by comparing the measured power level. If it is below then, it will access the other channel in the network.

We create Nodes and channel Election process of cluster head, in which channel having high capacity it elected as a cluster head. Using beacon packets we can identify the channel coordinator, after the time expire if you cannot get bacon packet then cluster head automatically created. To allocate a channel depends on power level. Channel reuse is based on channel capacity cluster head maintain stack depends on size. Data can be split in to packet and then send data to destination nodes.

## 4. METHODOLOGY DESCRIPTION

### 4.1 Region Intimation and Elective Cluster Head:

In the region each node sends ‘hello’ message to other nodes which allows detecting it. Once a node detects ‘hello’ message from another node (neighbor), it maintains a contact record to store information about the neighbor. Nodes do not know their respective region. So we need to intimate the region to the nodes. The channel resources are managed and distributed by cluster head(CH). It can be ordinary nodes that are selected to perform the duty, or that can be specialized nodes. The channel needed to the nodes in the network for their transmission is provided by these cluster head. We have to select cluster based on memory, battery and mobility which is having high value and assign them as cluster head.

### 4.2 Dynamic channel allocation:

In MH-TRACE [6] certain nodes assumes the roles of channel coordinator, here called cluster head. All cluster head send out periodic beacon packets to announce their presence to the nodes in their neighborhood .when a node does not receive a beacon packet from any cluster head for a predefined amount of time, it assumes the role of a channel coordinator. In MH-trace this is divided in to super frame, is repeated in time and further divided into frames. Each cluster head operates one of the frames in super frame. In this frame cluster head maintains the capacity level of all channels.

In this 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 the load on the channel controller increases beyond capacity, provided that the measured power level is low enough, the channel coordinator starts using an additional channel with the lowest power level measurement.

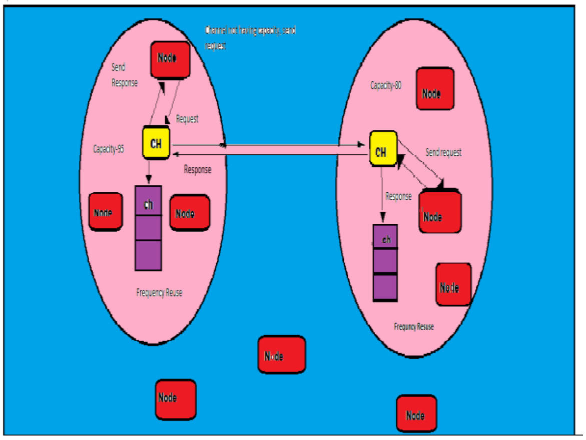
### 4.3 Data transmission and Load Balancing

In Dynamic channel allocation algorithm the channel controller monitors the power level in all the available channels in the network. If the load on the channel controller increases beyond capacity and measured power level is low, then the channel coordinator send request to other region of channel coordinator, if other region channel coordinator having capacity, then using CSMA protocol it will send acknowledgement. If cluster head receive the acknowledgement it will send that to nodes. Then we can send data from one node to other node within region and also outside the region by splitting a data into packet and send to other region destination nodes

The load on the channel coordinators originate from the demands of the ordinary nodes. Many nodes in a network have access to more than one channel coordinator. The underlying idea of the cooperative load balancing algorithm is that the active nodes can continuously monitor the load of the channel coordinators and switch from heavily loaded coordinators to the one with available resources. These nodes can detect the depletion of the channels at the coordinator and shift their load to the other coordinators with more available resources. The resources vacated by the nodes that switch can be used for other nodes that do not have access to any other Channel coordinators. Thus time consumed for waiting can be minimized.

**5. ARCHITECTURE DIAGRAM:**

Following diagram specifies how the network performs. Here two regions are shown and how they communicate within each region and between regions is been shown. The capacity of region-1 is allocated as 95 and capacity of region-2 is allocated as 80. Accordingly channel frequency are allocated to channel coordinator and it is been maintained in a stack.




This is the architecture diagram of proposed system. There are two regions each of which has certain number of nodes.

CH represents channel coordinator or header

Ch- represents frequency allocated to CH that is channels

Here node in region-1 send a request to its channel coordinator, if it has available frequency it will allocate it or else channel header of region-1 send a request to channel head of region-2 for channel. If it has the data is send to it from where it reaches the destination.

**6. FUTURE ENHANCEM NT**

Frequency reuse is tightly linked to the bandwidth efficiency. In dynamic behavior of MANETs the traffic load may be highly non uniform over the network area. MAC layer allows channel coordinators to utilize channel reuse and adapt to any changes in the traffic distribution. Frequency reuse is based on channel capacity. Cluster head maintain stack depends on size. In stack mechanism, maintains frequency and this frequency can be reuse

**CONCLUSION**

The Light weight dynamic channel allocation algorithm and a cooperative load balancing algorithm is been proposed in this paper. The dynamic channel allocation works through carrier sensing and does not increase the overhead. It has been shown to be very effective in increasing the service levels as well as the throughput in the system with minimal effect on energy consumption and packet delay variation. The cooperative load balancing algorithm has less impact on the performance compared to the dynamic channel allocation algorithm. The combined system has been shown to perform at least as well as the systems with each algorithm alone and performs better for many scenarios. Both of the algorithms as well as the combined system also have a fast response time, which is on the order of the superframe duration of 25ms, allowing the system to adjust under changing system load.

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