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Efficient Data Communication and Frequency Reuse in MANET

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Abstract:

Mobile ad hoc network *(**MANET**) is a infrastructure-less and also a continuously self-configuring network of the mobile devices without having to be connected to any of the fixed physical link. The wide network loads considered for the MANETs are being increasing as the applications evolve. This focuses on the improvement in the bandwidth efficiency, efficient data communication and frequency reuse throughout the environment. MAC protocol for the wireless networks is classified as coordinated MAC protocol and uncoordinated MAC protocol. For high loaded MANETs on uniform distribution Coordinated channel access protocols has been well suited and for the non-uniform load distribution these protocols are not well suited as the uncoordinated channel access protocols lack in the on-demand dynamic channel allocation mechanisms. In order to address this problem, we present a cooperative load balancing strategy and light weight dynamic channel allocation mechanism that are applicable to cluster based MANETs. These mechanisms improve the performance in terms of efficient data communication, throughput, frequency reuse and inter-packet delay variation. It is crucial for MANET not only to adapt to the dynamic environment but also to efficiently manage the bandwidth utilization.*

Index Terms- Bandwidth efficiency, dynamic channel allocation, Mobile ad hoc networks

1 INTRODUCTION

MOBILE ad hoc networks (MANETs) have been a significant class of network, as long as communication sustain in assignment strategic scenarios such as smart missions and battlefield, emergency planning operations and in many rescue missions. MANETs are formed by the wireless hosts such as mobile, laptops etc. It does not provide any preexisting infrastructure. The path between the nodes may contain multiple hops and it may traverse multiple links in order to reach the destination. The mobility may cause changes in the routes. MANET includes many numbers of communications at the same time. As the number of user in MANET is being increased continuously the applications involved in these networks has resulted in resource intensive. This increases the efficiency of the bandwidth in MANETs. The wireless network in the MAC protocol is categorized into coordinated MAC protocol and uncoordinated MAC protocols. In uncoordinated protocols nodes will distribute the same channel and for the networks with low loads these protocols will result in bandwidth efficient due to lack of overhead. When the network load increases at the same time the bandwidth gets decreased. And because of the silent approach, these protocols are not much energy efficient. The coordinated channel access provides some of the features in it such as quality of service, increased throughput and it also reduces the energy dissipation.
The key challenges of the MAC protocol design is to maximize the spatial reuse and also support the non-uniform load distributions at the link layer multicasting is the process of sending a single data packet to multiple receivers. The multicasting services are essential for the efficiency of the resources related to the network. Due to the dynamic behavior present in the system the traffic load becomes highly non-uniform over the network whereas the uncoordinated protocols provide spatial reuse and it also adapts to the load distribution changes in the carrier sensing mechanism. The coordinated MAC protocols of MANET requires specialized spatial reuse and also channel borrowing mechanisms to address the unique features of MANETs to provide the higher bandwidth efficiency as the uncoordinated counterparts similar to the cellular system. It is important not only to choose the correct protocols and also to provide the parameter accordingly.

To attain the bandwidth efficiency the spatial reuse is strongly coupled. Owing to the lossy environment of the broadcast standard, numerous strategy be able to employ the similar channel possessions in spatially isolated location by means of negligible outcome on each other. Integrating the spatial reuse into a MAC protocol radically increases the bandwidth efficiency. And in contrast, the dynamic behavior in MANETs, the interchange load perhaps is exceedingly non-uniform around the network. Thus, it is critical that the MAC protocol be capable of resourcefully handle non-uniform traffic loads. Uncoordinated protocols inherently integrate the spatial reuse and become accustomed to the changes in sharing the load through the carrier sensing mechanism.

By focusing in to the cellular systems, c MANET MAC protocols requires a focused spatial reuse and the channel borrowing mechanisms that deals with the superior quality of MANETs in order to offer high bandwidth efficiency as their uncoordinated counter parts. There are two algorithms used to deal with the non-uniform load distributions present in the MANETs:

- a light weight distributed dynamic channel allocation (DCA) algorithm based on spectrum sensing
- a cooperative load balancing algorithm in which nodes select their channel access providers based on the availability of the resources.

These algorithms are used for controlling the non-uniform load distribution in MANETs into a well-organized real-time coordinated MAC protocol, named MH-TRACE [7]. In MH-TRACE, the channel access is synchronized by dynamically electing the cluster heads (CHs). MH-TRACE shown to have higher throughput and also assign more energy efficient when compared to CSMA protocol. Even though MH-TRACE incorporates spatial reuse, it does not provide any channel borrowing or load balancing mechanisms and thus do not provide any finest sustain to the non-uniform loads. Hence, allocation of dynamic channel and cooperative load balancing algorithms to MH-TRACE is been utilized by creating the new protocols of DCA-TRACE, CMH-TRACE and the unique CDCA-TRACE.

The assistance of the paper are: i) a light weight dynamic channel allocation scheme for the cluster- based mobile ad hoc networks; ii) cooperative load balancing algorithm iii) we incorporate these two algorithms into the earlier TRACE framework foremost to DCA-TRACE and CMH-TRACE and iv) combination of both algorithms to provide support for non-uniform load distributions and propose CDCA-TRACE. We compare the performance of these algorithms for varying network loads.

2 BANDWIDTH EFFICIENCY TECHNIQUES DESIGNED FOR COORDINATED MAC PROTOCOL

In this section, the lightweight dynamic channel allocation mechanism is derived from channel sensing and the cooperative load balancing algorithms. We commence with a treatise of the assumptions:

- The nodes in the network present in the single transceiver are capable of with a transceiver that could function in any one of two modes: transmission or reception. Nodes cannot concurrently transmit and receive the data.
- In the Channel sensing mechanism the receiver node is capable of detecting the presence of a carrier signal that calculates its power for the messages that cannot be decoded to a legal packet.
- In Collision, the synchronized conductions obtained in the system neither of the packets can be received until any one of the transmission obtained in the receiver. Whereas the receiver captures the data if the power level of any one of the transmissions is considerably larger than that of the power level of all the other transmissions. Capturing mechanism is the major factor of the recompense gained through the channel reuse present in the system.
- The Channel coordinators of the channel resources are controlled and circulated by channel coordinators. These coordinators might be common nodes that are selected to perform the function. The channel is allocated to the nodes present in the network for the transmission process using these channel coordinators.

2.1 DEPICTION OF MH-TRACE

This segment describes the MH-TRACE protocol and targets to provide the reader a concise perceptive of the protocol. The complete protocol description is given in [4] In the MH-TRACE certain nodes assigns their role as the Cluster Heads (CH) in the system. When a node does not get a Beacon packet from any of Cluster Head for a specified amount of time, then automatically the node assumes the role of a CH in the cluster. Therefore this proposal ensures the existence of at least any one of the CH is present in the network. Each CH operated using one of the frames present in the super frame arrangement and it also provides the channel access for the nodes which all present in the communication range. In the Beacon slot, every CH makes a notification of its presence to the nodes in the neighbourhood and makes aware of the nearby nodes.

The CA slot is designed for intervention estimation for the CH operating in the same frame, and CH broadcasts a message with a given prospect and listens to the standard to determine the interference caused by the other CHs processed in the same frame. And by watching the interference levels in the medium each CHs moves the frame which is of less noise from the processing view. Contention slots are used by the nodes to process their channel access requests to the Cluster head. A node which needs to access the channel arbitrarily selects a contention slot and also sends a message in the slot to access the channel accessing process. By viewing to the medium during the contention slots, the CH becomes conscious of the nodes to facilitate request channel access and forms the transmission programme by distributing over available data slots to the nodes.

2.2 DYNAMIC CHANNEL ALLOCATION TRACE

Because of the dynamic nature of MANETs, the traffic distribution of the load may be exceedingly non-uniform in the network. Whereas various CHs possibly may be overloaded while others may not use any of the other data slots. In ordinary MH-TRACE, this non-uniformity may cause some of the nodes to be denied in channel access even if they contend successfully in the contention slots. Cellular systems frequently handle channel allocation during message interactions between the base stations In this approach to the dynamic channel allocation, the channel regulators (CHs) are liable for measuring the interference level in the channels prior to allocating them to users, and they are required to abstain from allocating the channels.

At the end of the each frame, the interference level of the Beacon packets and CA slots are simplified with the measured values in that frame using the given expression

$$I_{k,t} = \begin{cases} M_{k,t} & \text{if } I_{k,t-1} < M_{k,t}; \\ (1-\alpha) I_{k,t-1} + \alpha M_{k,t} & \text{o.w.,} \end{cases}$$

Where, $I_{k,t}$ and $I_{k,t-1}$ specifies the interference levels of the k^{th} slot in the current and the prior super frame, respectively. $M_{k,t}$ specifies the measured interference level in that slot and where the α represents the smoothing factor, which is set to 0.2 in this simulation.

An additional method for Dynamic Channel Allocation TRACE adds on top of MH-TRACE is the dynamic allocation of the data slots. In turn to hold the temporary changes, the exponential average smoothing mechanism of [3] is also used for IS frames.

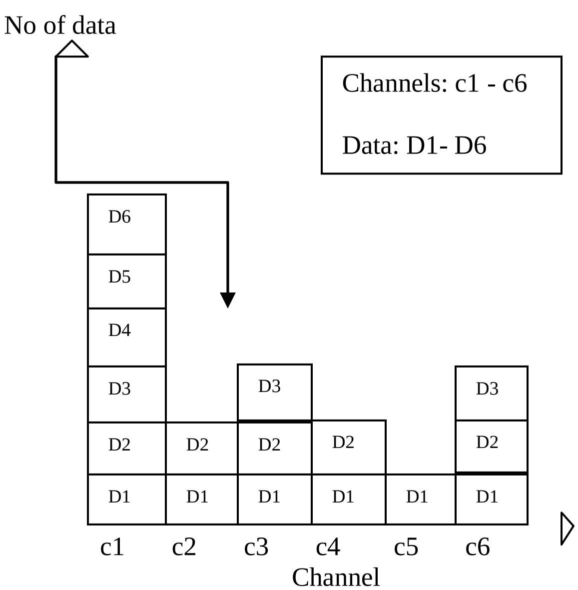


Fig. 1. An example for channel allocation, where |C| = 6, |N | = 4 and k = 4

We represent the rate of one radio on channel c by Rc(kc). As we believe that channels have the same bandwidth and same channel characteristics, and the achieved rate do not depend on the channel and therefore we can specify R(kc) for any channel $c \in C$. The fair rate distribution is achieved, for example, by using a reservation-based TDMA schedule on the given channel. A related result was reported by Bianchi in [6] for the CSMA/CA protocol.

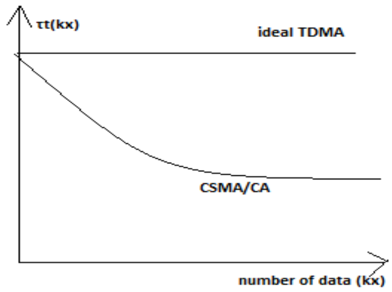


Fig. 2. The total rate Rt (kc) for different MAC protocols.

If data d chooses to operate $k_{d,c}$ radios in a specified channel, its rate on the channel can be written as $R_{d,c} = k_{d,c} \cdot R(kc)$. We assume that the data do not take advantage of at the MAC layer as opposed to the model for example given in [7]. Thus, we can write that $R_{d,c} > 0$ for all $c \in C$, where $k_{d,c} > 0$. Recall that in Figure 1, the higher the number of radios in a given channel is the lower the rate per radio in it. Hence, for example for data d2, we have $R_{d2,c1} < R_{d2,c4} < R_{d2,c3} < R_{d2,c5}$. We can obtain the rate R_d for data d by R_d = dc $R_{d,c}$.

2.3 FREQUENCY REUSE IN THE CHANNELS

In the cellular radio system, a land area to be given with radio service which is divided into regular shaped cells, which can be any of the regular shapes although hexagonal cells are predictable. We mean that the cluster is a form of arrangement of cells over which the complete frequency band is divided. And this arrangement of cells is repeated again and again. The frequency reuse factor is defined as over the number of cells present in the cluster of the system. **Frequency reuse**. The key feature of the cellular network is the capability to **re-use** the **frequency** to enhance both coverage and capacity of the system process. As explained, the adjacent cells have to use dissimilar **frequencies**, still there will not be any problem with two cells suitably remote away from each other and operating with the similar **frequencies**. Frequency reuse provides the access to use the smaller spectrum covering a larger area with a greater traffic load. Some of the efficient resource management like power monitoring, efficient adaption modulation, coding scheme contribute the reusing mechanism.

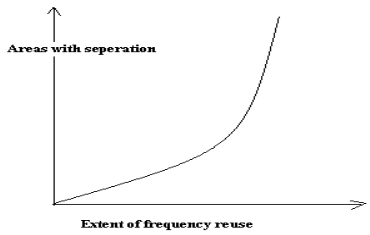


Fig 3: Dependence of Frequency

3 SYSTEM MODEL AND PERFORMANCE EVALUATION

3.2 SYSTEM MODEL

For evaluation purposes, we conduct the ns-2 simulations for all the protocols. We have discussed various routing layer considerations of TRACE systems in the previous work [4]. In this paper, we focus on the performance of the MAC layer. Hence, we use simple network and transport layer protocols which provides the local broadcasting. A connection-less transport layer is assumed in which the transport layer directly connects the upper layers and lower layers [8].

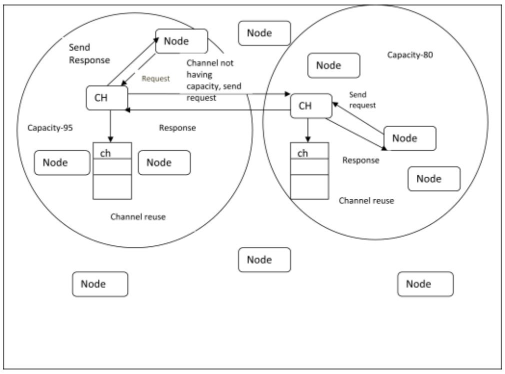


Fig. 5. System architecture representation which provides the technique for frequency reuse in the cluster.

All the nodes present in the channel receives the packets as long as the power levels authorize the successful decoding. Ad hoc DCF mode of broadcasting traffic for link layer is used in IEEE 802.11. Similarly no ACK scheme is used in the TRACE protocols, and there are no packet retransmissions in the channel. For IEEE 802.15.4, beacon packet enabled mode of operation is been used with guaranteed time slot (GTS) mechanism. Then the ACK mechanism is disabled for the data packets are active for the control messages. In our simulations, nodes are said to be flawlessly synchronized. TRACE does not implement a node synchronization algorithm in it. It is probable to obtain high synchronization precision in nano-seconds by using the GPS system [5]. In order to segregate the problems, for the multi-hop scenarios this simulation is been done. The dimensions in the network are certain to have each coordinator separated below the communication radius range from all the neighbouring coordinators. Hence, normalized rate statistics are obtainable for the IEEE 802:15:4 protocol.

3.2 PERFORMANCE EVALUATION

From the above simulation, it can be observed that the performance of our dynamic channel allocation algorithm and cooperative load balancing mechanism is better than the other algorithm used to provide frequency reuse approach. The dynamic allocation of channels and resources by this simulation gives better output. The increase of the summit queries helps to provide the desires of other nodes present in the network[7]. Due to the association of the nodes in the network, the diameter of the network may minimize over the course of the network operation [6]. The bandwidth efficiency of the MH-TRACE reduces the operation, as MH-TRACE cannot change the number of frames dynamically present in each super frame, and where each CH can only use a single frame at the time. Whereas due to the dynamic environment, the network load might not be uniformly be distributed among all the clusters.

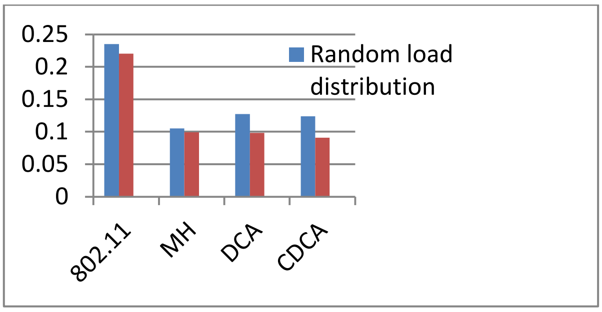
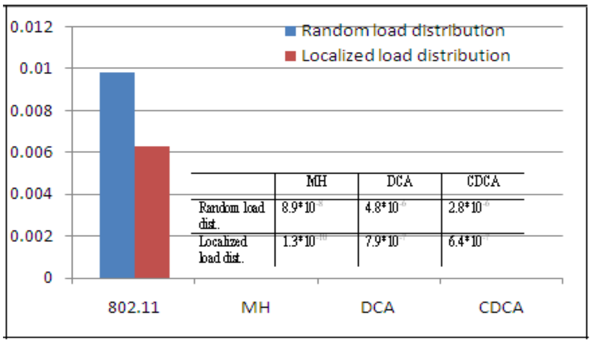


Fig.6. Average energy consumption of nodes per second



	MH	DCA	CDCA
Random load dist.	$8.9*10^{-8}$	$4.8*10^{-6}$	$2.8*10^{-6}$
Localized load dist.	$1.3*10^{-10}$	$7.9*10^{-7}$	$6.4*10^{-7}$

Fig.7. Average inter packet delay variation of the protocol

4 CONCLUSION

In this paper, we have focused on the bandwidth utilization and it leave full revision of the system for delay receptive communications. Channel handover has been implemented which is used to provide uninterrupted channel access for source nodes that travels away from one channel coordinator to another coordinator by transferring their load. The cooperative load balancing algorithm is been improved to offer such channel handover facility. In the improved system, moving of the active node is required to change its channel coordinator not only based on the load but also on the channel coordinators is based on the RSSI measurements of the Beacon packets from each and every channel coordinator.

REFERENCES

[1] G. Bianchi. Performance analysis of the IEEE 802.11 distributed coordination function. IEEE Journal on Selected Areas in Communication, 18(3), Mar. 2000
[2] M. Cagalj, S. Ganeriwal, I. Aad, and J.-P. Hubaux. On selfish behaviour in CSMA/CA networks. In Proceedings of the IEEE Conference on Computer Communications (INFOCOM '05), Miami, USA, Mar. 13-17 2005.
[3] A. Adya, P. Bahl, J. Padhye, A. Wolman, and L. Zhou. A multi-radio unification protocol for IEEE 802.11 wireless networks. In Proceedings of Broadnets'04, pages 344–354, Lausanne, Switzerland, 2004
[4] B. Karaoglu, and W. Heinzelman, "Multicasting vs. broadcasting: What are the trade-offs?" in Proc. IEEE Global Telecommun. Conf., Dec. 2010, pp. 1–5
[5] P. Vyskocil and J. Sebesta, "Relative timing characteristics of GPS timing modules for time synchronization application," in Proc. Int. Workshop Satellite Space Commun., 2009, pp. 230–234.
[6] M. Felegyhazi, M. Cagalj, S. Bidokhti, and J.-P. Hubaux, "Non-cooperative multi-radio channel allocation in wireless networks," in Proc. IEEE 26th Conf. Comput. Commun., May. 2007, pp. 1442–1450.
[7] B. Tavli, and W. B. Heinzelman, "MH-TRACE: Multi hop time reservation using adaptive control for energy efficiency," IEEE J. Sel. Areas Commun., vol. 22, no. 5, pp. 942–953, Jun. 2004.