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Channel Assignment Mechanism for Wireless Local Area Networks (WLANs) - A Survey

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Abstract: *Wireless Local Area Networks (WLANs) are subjected to interference because of their working in Unlicensed Spectrum. Coverage ranges of WLANs are 30 to 300m. Channel Assignment is one of the most important problems in the WLANs. In this paper we present a Survey on the Channel Assignment techniques in IEEE 802.11.After analyzing different methods a qualitative comparison has been carried out for various methods by considering execution response, complexity and scalability. We then accomplish the Survey with many research descendants open for further scrutiny.*

Keywords**:** Channel allocation, IEEE 802.11, wireless Networks, Channel Assignment.

I. Introduction

FOR an IEEE 802.11 WLAN with a only AP, there are many research efforts in the modification of MAC protocols to find an ideal transmission probability for an effective station to reach the maximum protocol capacity, granted that the number of effective stations associated with the AP is given [1]. The sensational evolution of the wireless/mobile user populace, coupled with the bandwidth requirements of Audio/video applications, requires efficient reuse of the inadequate radio spectrum allocated to wireless/mobile technology. A total radio spectrum is to be divided into a set of disjointed channels that can be used simultaneously while minimizing interference in adjacent channel by allocating channels appropriately.

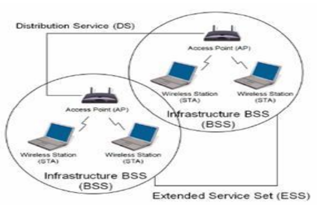

Fig.1: Infrastructure based IEEE 802.11 WLANs

Channel allocation schemes can be divided in general into Fixed Channel Allocation schemes, Dynamic Channel Allocation schemes, and Hybrid Channel Allocation schemes, combining both FCA and DCA techniques. DCA schemes can be centralized or distributed. The centralized DCA scheme involves a single controller selecting a channel for each cell. The distributed DCA scheme involves a number of controllers scattered across the network (MSCs).

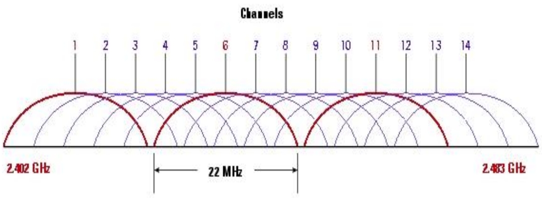

Fig 2: IEEE 802.11 Channel Allocations

II. System Under Consideration

2.1,Network topology

This survey focuses only on an IEEE 802.11 WLANs with an infrastructure network topology as shown in Fig 1, where APs and client resort to existing communication infrastructures such as legacy LAN to facilitate their communication. All communication accomplishment must be facilitated via this AP. This survey focuses only on an IEEE 802.11WLAN with an infrastructure network topology as shown in Fig. 1, where APs and clients.

2.2, IEEE 802.11 Channels

The 802.11a specification today specifies 4 channels for the UNII1 band, 4 channels for the UNII@ band, and 4 channels for the UNII3 band. These channels are spaced at 20MHz apart and are considered non-interfering, however they do have a slight overlap in frequency spectrum. It is possible to use adjacent channels in adjacent cell coverage, but it is recommended when possible to separate adjacent cell channels by at least 1 channel. Figure 2 shows the channel scheme for the 802.11 bands.

III. Channel Assignment Schemes

3.1, GDCA Algorithm

GDCA algorithm focuses on Channel Assignment (CA) problem. This mechanism for channel assignment on multi-radios, i.e., forming grid-loops via Minimum Spanning Tree (MST) and forming group channel, which provides a novel mechanism to the Multi-Radio Multi-

Channel Wireless Mesh Networks (MRMC-WMN) for assigning channels to different loops and the related maintenance and renewing.

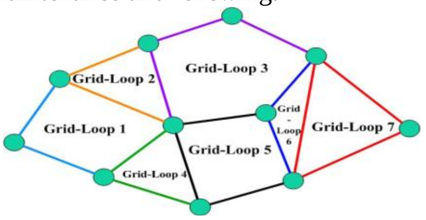

Fig3: Grid Loop Structure in MRMC

Channel Assignment in a MRMC-WMN environment recognizes efficient channel utilization and minimizes intervention but limited number of channels accessible to the network [2].

3.2, CACAO Algorithm

The distributed CACAO algorithm cultivates information collected by APs and clients on interference circumstances to diminish the local objective function by switching to a channel that has minimum predictable interference. At every time period, each AP individually elects the channel assignment to minimize the objective function locally. Obviously, the whole network does not need any synchronization.

Algorithm 1 CACAO Algorithm

CACAO (*api*)
1. Initialization - Initial Assignment
   api.c ← *rand*(*k*)
2. Optimization - Repeated for each AP
   2. a *Gather Statistic* ()
   2. b *ct* = *Compute Interfere* ()
   2. c *Switch To* (*ct*)

Gather Statistic () is a procedure that is used to gather statistics from clients. It returns the traffic information collected by clients. Then the AP performs computation and comparison to decide which channel it will use for the next time period by procedure Compute Interfere (). This routine computes the expected significance of interference level that the entire BSS will likely experience for the next time interval. The channel with the least obstructed traffic will be chosen. Finally the Switch To () routine allocates the AP and its associated clients the channel. The limitations of CACAO algorithm randomly selected clients to switch to other channels for a small fixed period of time. AP only measures its operating channel for efficiency.

3.3, ILP Approach

In [4], the problems of channel assignment and AP placement are solved

Instantaneously by using Integer Linear Programming (ILP).The methodology considers not only radio coverage but also load balancing between APs because the authors argue that the number of active wireless clients connected to the Aps affects network performance. That is, traffic congestion at the APs degrades the network performance such as throughput. The basic idea is therefore to distribute clients to the Aps in a WLAN such that congestion at APs is minimized. Correspondingly, the throughput is maximized. A floor plan is assumed to consist of traffic demand points, each of which is given an expected traffic demand volume. A set of AP candidate locations is also given. If a signal from the AP to the demand point is above a certain threshold, an edge is drawn between a traffic demand point and a particular AP. Similarly, an edge is drawn between two APs, whenever they are within a co-channel interference distance defined as a transmission range at which, if assigned the same channel, these two APs can interfere to some extent with one another. The objective is to minimize the maximum channel utilization at each AP, while keeping a certain level of traffic demand satisfied at each demand point. Each demand point is assigned to exactly one AP. If at least one demand point is assigned to an AP that AP will be included in the solution set. If an edge exists between two APs, each AP will be assigned a different non-overlapping channel. As mentioned earlier, the goal is to distribute clients throughout the network such that the overall network throughput tis maximized. This requires an accurate network layout containing the descriptions of demand points with estimated traffic, client distribution, and received signal levels at each demand location. In general, since such a network layout is very dynamic, new assignment of demand points to APs and Channels to APs are necessary. The new assignment however may cause a certain amount of disruption to client traffic. The authors propose another ILP that aims to minimize the amount of client traffic disruption due to the new assignment process, while maintaining the resulting channel utilization below that of the previous assignment.

3.4, Priority-Map Approach:

In [5], the channel assignment Problem is solved in tandem with the AP placement problem. A floor plan of interest is first divided into pixels. Each pixel is prioritized based on its traffic requirements, i.e., how much capacity the pixel may need and for how long. A highest-priority pixel is thus designated as one having highest demand of capacity and availability, and similarly lowest-priority pixel having lowest demand of capacity and Availability. Intermediate levels of priority are possible1.With the priority map created; the strategy is to first come up with a set of possible AP locations which can provide adequate radio coverage to every pixel of the floor plan. Adequate coverage here means a minimum level of capacity and availability required by each pixel. To achieve this, a wave propagation prediction model such as a ray tracing technique can be used to predict the coverage area generated by each candidate AP. As can be expected, more than one set of possible AP locations may result from this process. For each set of possible AP locations, the next step is to eliminate those APs which create unacceptably large coverage overlap2 between their adjacent neighbors, provided that adequate capacity and availability are still supplied to every pixel affected by this elimination. To quantify this overlap, the mean difference between the received powers of two adjacent APs is used. That is, if the difference in received power averaged over every pixel in the overlap area falls below a certain threshold, one of the APs should be eliminated. This step thus eliminates the possible interference created by the radio coverage overlap of adjacent APs. After the above elimination process, the channel assignment is now applied to each set of possible AP locations. The assignment starts in a greedy manner in which a no overlapping channel is assigned first to the AP that covers the area with highest priority.

TABLE 1
SUMMARY OF CHANNEL ASSIGNMENT TECHNIQUES IN IEEE 802.11

Techniques	Nature		Deploy		Channel		References
	static	Adaptive	Uncoordinated	Centrally Managed	Overlap	Non Overlap	
GDCA Algorithm	*			*		*	[2]
CACAO Algorithm	*			*		*	[3]
ILP Approach	*			*		*	[4]
Priority-Map Approach	*			*		*	[5]

The challenge would be how to capture the network dynamics as much as possible while maintaining the complexity of implementation of channel assignment algorithm at a practical level. Furthermore, when WLANs are deployed in an uncoordinated fashion by different network administrators, the scalability of the implementation of channel assignment algorithms becomes even more important issue. In such scenarios, a channel assignment scheme of choice should be cooperative and Scalable enough to orchestrate channel switching across the entire network without creating significant interference to the neighbors. Being aware of the neighboring networks located in different administrative domains, the scheme should also be able to interact and exchange necessary information with its neighbors in order to allocate appropriate channels to the APs.

The research direction tends to shift toward adaptive channel assignment in uncoordinated environments, in which network dynamics is incorporated

IV. Conclusion And Open Research Issues

Channel assignment is one mechanism to improve the performance of WLANs. In this survey we have discussed several existing channel assignment schemes applicable to either centrally managed or uncoordinated environments. Several possible future research directions and open issues with regard to channel assignment in WLANs are outlined below:

into the problem formulation. The following system parameters need to be considered: client locations, building layouts and AP locations, time fluctuation of traffic demand of wireless clients at various locations, and application Quos requirements.

Continually monitoring the network dynamics, say on a daily basis, at a particular location may lead to a discovery of traffic pattern. Channel assignment can then be performed at a particular location during a particular period of time based on the prediction as well as the application requirements. The schemes discussed in this survey assume either Uplink or downlink traffic. To be more realistic, traffic in both directions should be considered. This is reasonable as peer-to-peer communications become more popular.

References

[1] F. Cali, M. Conti, and E. Gregorian, “Dynamic tuning of the IEEE 802.11 Protocol to achieve a theoretical Throughput limit,” IEEE/ACM Trans. Networking, vol. 8, no. 6, pp.785-799, Dec. 2000.

[2] Yan Xia, Yingzhi Zeng, Zhenghu Gong, “A Distributed Channel Assignment Mechanism for Multi-radio Multi-Channel Wireless Mesh Networks” JOURNAOF NETWORKS, VOL. 6, NO. 2, FEBRUARY 2011. Xiaonan Yue, Chi-Fai Wong, S. -H.Gary Chan. “A Distributed Channel Assignment Algorithm for Uncoordinated WLANs” IEEE CCNC 2010 proceedings.

[3] Y. Lee, K. Kim, and Y. Choi, “Optimization of AP Placement and Channel Assignment in Wireless LANs,” in Proc. 27th Annual IEEE Conf. Local Computer Networks, pp. 831–836, Nov. 2002.

[4] P. Wertz, M. Sauter, F. Landstorfer, G.Wolfle, and R. Hoppe, “Automatic Optimization Algorithms for the Planning of Wireless Local AreaNetworks,” in Proc. IEEE Vehicular Technology Conference, vol. 4, pp. 3010–3014, Sep. 2004.

[5] A. Mishra and V. Shrivastava, D. Agrawal, S. Banerjee, and S. Ganguly, “DistributedChannel Management in Uncoordinated Wireless Environments, “in Proc.International Conference on Mobile Computing and Networking, pp. 170–181, 2006.

[6] I.KatzelaandM.Naghshineh,“ChannelssignmentSchemesfor CellularMobileTelecommunicationSystems:AComprehensive Survey,”IEEE Personal Commun., June 1996, pp. 10-31

[7] S. Pack, J. Choi, T. Kwon, and Y. Choi,“Fast-Handoff SupportinIEEE802.11WirelessNetworks,” IEEE Commun. Surveys Tutorials, vol.9,no.1,pp.2-12, 2007

[8] P.Mahonen,J.Riihijarvi,and M. Petrova,“Automatic Channel Allocationfor Small Wireless Local Area Networks using Graph Colouring Algorithm Approach,” in Proc. IEEE Int. Symposium on Personal, Indoor and Mobile Radio Communications, pp. 536–539, Sept. 2004

[9] M. Gast, 802.11 Wireless Networks: TheDefinitive Guide O’Reilly, Farnham, 2nd ed., 2005.