IEEE P802.11
Wireless LANs

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| Distributed Scheduling |
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Abstract

This document suggests text changes that enable Distributed Scheduling. Changes are relative to Draft 0.50

**Discussion**:

There are several 11ay use cases that will introduce high densities of PCP/APs with high QoS traffic (i.e. requiring SP allocations). The current specification provides two variants of clustering, but both fail when large numbers of PCP/APs and mobility are introduced. The Distributed Scheduling protocol provides a means for dense deployments of PCP/APs to share channel resources in a fair manner and improve the fidelity of SP transmissions.

**Text Changes**:

[Note: We propose to insert the following section.]

**10.42 EDMG PCP/AP Distributed Scheduling**

**10.42.1 General**

An EDMG PCP/AP may use the Distributed Scheduling protocol to improve spatial sharing and interference mitigation with other BSSs that use one or more of the same channels. An EDMG PCP/AP shall indicate that it is complying with the Distributed Scheduling protocol by setting the Distributed Scheduling enabled bit to 1 in Allocation Management field of the EDMG Extended Schedule element.

**10.42.2 Distributed Scheduling Initialization**

When an EDMG PCP/AP first enables Distributed Scheduling [DS], it shall listen during one or more DTIs for beacons from neighboring PCP/APs to determine the location (in terms of time and channel) and periodicity of their beacons as well as whether they have indicated that they are complying with the DS protocol.

**10.42.3 Distributed Scheduling Protocol**

A DS-enabled EDMG PCP/AP [DS PCP/AP] shall listen during the DTI for beacons from neighboring PCP/APs to determine their upcoming packet schedules by parsing the Extended Schedule elements [ESE] in those beacons. This may require listening on different channels since neighbor PCP/APs may choose different primary channels. The DS PCP/AP only needs to listen to beacons that carry ESEs covering time periods the DS PCP/AP has not yet scheduled.

To ensure a fair distribution of channel resources among PCP/APs in the same coverage area, the DS PCP/AP shall determine how much of each BI it can occupy on any given channel by dividing its BI length by the number of PCP/APs in the neighborhood that are using that channel. Thus, for each channel i that the DS PCP/AP is using, the DS PCP/AP shall not schedule more than 1/(Ni+1) of the BI, where Ni = number of neighbors using channel i. Both the BHI and SPs count toward the DS PCP/AP’s BI usage. CBAPs do not count toward this total since they are not guaranteed transmissions.

When creating the ESE, the DS PCP/AP shall do the following on each channel it is using. The DS PCP/AP shall randomly schedule its SPs over unoccupied time periods first, taking care not to schedule more than its fair share of the channel. If after scheduling its SPs over unoccupied time periods the DS PCP/AP has not yet used its fair share of the channel, it shall randomly schedule its remaining SPs over time periods with no neighbor SPs (CBAPs are allowed). Finally, if after scheduling its SPs over time periods with no neighbor SPs the DS PCP/AP has not yet used its fair share of the channel, it shall randomly schedule its remaining SPs over time periods with no SPs of DS compliant neighbors (i.e. the DS PCP/AP is allowed to schedule over SPs of neighbors not complying with the DS protocol).

The DS PCP/AP may schedule CBAPs anywhere in the DTI except during periods when the DS PCP/AP needs to listen for neighbor beacons. In addition, CBAPs should not traverse the start of DS neighbor SPs.

[Note: We propose to insert the underlined into section 9.4.2.252]

9.4.2.252 EDMG Extended Schedule element

The EDMG Extended Schedule element defines the channel scheduling for an EDMG BSS, including an indication of which channels an allocation is scheduled on.

The format of the EDMG Extended Schedule element is shown in Figure 36.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Number of Allocations | Allocation Management | Channel Allocation 1 | … | Channel Allocation N |
| Octets: | 1 | 1 | 1 |  1 |  1 |  6 or 18 |  |  6 or 18 |

Figure 36 - EDMG Extended Schedule element format

The Element ID, Length and Element ID Extension fields are defined in 9.4.2.1.

The Number of Allocations field indicates the number, N, of Channel Allocation fields following it.

The Allocation Management field is composed of the Distributed Scheduling Enabled subfield, which is 1 bit in length, and 7 reserve bits. If Distributed Scheduling is enabled, the Distributed Scheduling Enabled subfield is set to 1, otherwise it is 0.