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Access Point Association in IEEE 802.11 WLAN

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Keywords- WLAN, IEEE 802.11, selection, association, access points

Subject- Here is an extended abstract of the work we would like to present at ICTTA'04 (April 04)

I. Introduction- In IEEE 802.11 [1] Wireless Local Area Networks (WLAN), each wireless station (STA) is associated to one and only one AP (Access Point). The selection of the AP for every wireless stations is an important procedure. A proper choice increases the total capacity of 802.11 WLAN and then leads to efficient use of the available frequency bandwidth. A bad cell selection can cause wireless networks blockings that could be avoided ([3]) as we show it in this paper.

II. Access Point association in WLAN- The two modes of operation defined in the 802.11 standard are described: the Infrastructure and the Ad-Hoc modes, where there is no access points. In this paper, we consider only the infrastructure mode. The procedures that a STA should perform in order to associate with an AP such as scanning, authentication ([5]) and association itself are reminded.

Two scanning procedures are defined: active and passive scanning. A STA, after scanning and making a list of all available APs in the network, will choose an AP to associate with. Which criterion must the STA use to select this AP? This criterion is not specifically stated in 802.11 standard. Different possible method of selection are applied in manufacturers' devices. In most presently-proposed 802.11 products, the STA chooses to associate with the AP that has the best performances in the term of Signal to Noise Ratio (SNR) at the STA geographical position.

We highlight the inconvenients of the currently-used methods of selection of the access points by the wireless stations and try to find and to propose solutions that can rectify this situation.

III. Model and results- We simulate a simple WLAN model for different criterias of AP selection: received power level, received signal-to-intereference ratio and AP-STA distance. Channels are assigned to APs according to 802.11 standard. We remind in the paper APs channel assignment rules.

To calculate the Signal to Noise Ratio (SNR) between each station and each access point, we consider that Noise = sum of the transmitted power of each AP using the same channel * link gain between this AP and the wireless station.

In the paper, simulation results are commented. For example, Figure 2 shows the AP cells (called Basic Service Area or BSA) for a non-uniform distribution of wireless stations, where the best SNR criterion is used. We see that this type of AP selection leads to a cell that has a high concentration of stations. In fact, cells shapes are indendent of the concentration of wireless stations. A WLAN cell with a high number of stations might have quickly bad performances: low data rate and high delays. In the

paper we propose some solutions such as transmitted power decrease for the AP that has a high data load.

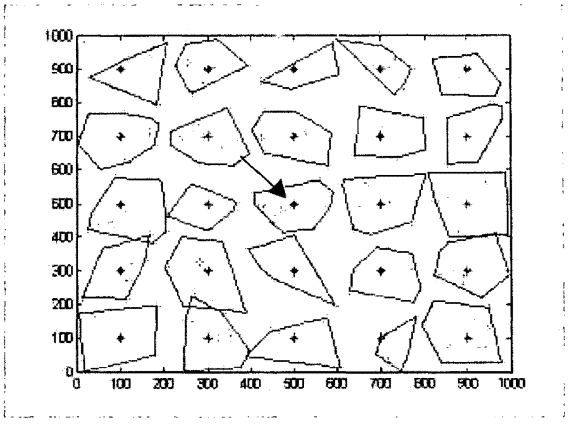


Fig. 2- For a non-uniform distribution of wireless stations, shape of WLAN cells for an AP selection based on the best received SNR. The central cell has a high number of stations. This leads to bad performances.

IV. Conclusion

In this paper, we highlight the fact that if the load distribution isn't considered for AP selection in a WLAN, this may lead to inefficient use of the bandwidth.

Some solutions that can rectify this situation are proposed and discussed at the end of the article: power variations and proposing and implementing load distribution algorithms in the 802.11 standard are enhancements that can lead to a greater capacity and better performances. Research papers proposing solutions are mentioned (e.g., [7])

References (used in this abstract)

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