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Determining the Access Point for Local Wireless Network IEEE802.11 based on APSF Approach

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ABSTRACT

The performance of each station in wireless network IEEE 802. 11 highly associated with the ability of that station to identify AP. AP (Access Point) provides the most important service in a wireless local network. The common mechanism of association to AP in most wireless stations highly depends on the signal intensity of the station received from each neighboring AP. In other words, a station associated to the AP that has the strongest signal level. It is clear that such an algorithm is led to minor optimal performance due not to paying attention to load balance in different IPs. A parameter named APSF (Access Point Selection Factor) is introduced in this article which by itself is a function of signal strength, AP load, throughput and channel speed. The difference between this method and other common methods is simultaneous using of centralized and decentralized approach to choose an appropriate AP. The simulation results indicate that choosing AP using APSF has a much more better throughput compared to that of common approaches.
KEY WORDS: AP selection, APSF, wireless local, Network IEEE802.11, Dynamic AP Selection.

1. INTRODUCTION

Unlike most great scholars in network science in recent years the IEEE802. 11 wireless networks has been significantly developed and has gradually been a suitable replacement for a variety of cable networks in such a way that the experts predict that internet will be implemented as optic fiber infrastructure and wireless local networks in the near future; however, there is a largely similar condition in some countries. Easy installation and low cost of IEEE802. 11 infrastructure networks make them suitable to be used in offices, promenade centers, hotels and recreation centers. Each of these networks has their own characteristics (e.g. bandwidth, the cost of network connection, etc.).

When a wireless workstation is turned on in the space covered by many networks, or rather, in the space covered by many APs, it must be decided which of the APs it must be associated with. In such a case in which many APs are available, the workstation should choose the AP to maximize the throughput of its canal. To select the best channel, it is necessary to an appropriate effort be made by the workstation to find the network resources.

The workstation should be aware of the environment it is working within. It must estimate the location of available IP and the number of workstations related to each AP and the interference from the competing networks or other sources which may reduce the channel capacity in wireless network [12].

The question raised here is how first to identify the parameters required for making such a decision using a suitable structure and then provide a process that the workstation choose the appropriate AP with high speed and accuracy.

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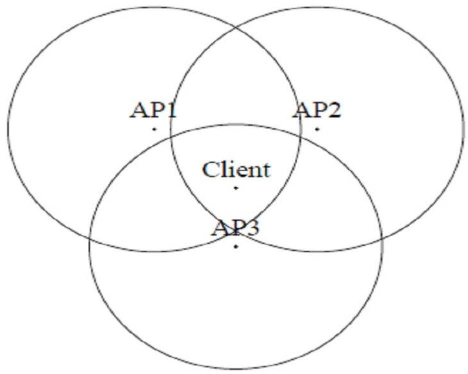
Table 1: overlapping of three areas covered by AP, IEEE802.11 which causes the workstations associated with each AP



2. A Review on Related Works

In [3], a division algorithm and conquering on APs selection are used by the authors. All the covered areas have been divided into squares with the same division by the algorithm. Then the problem is solved in each part by a comprehensive search.

In [4] the researchers used the formulating of linear programming problems to optimize the location of standing the AP. The output strength are maximized by the algorithm according to the load balance between the APs. The main feature of optimization is to minimize the maximize use of the channel in the hot spot of the service area.

In [5] the authors formulated other optimization problems by functions with different objectives. The concerned variables are APs, their height, the level of transmitter strength and sectoring the antennas to optimization problems maximize the number of requested groups coverage and fines the multiple required nodes.

In [6] the authors presented the techniques for putting the main stations in outdoor areas in order to build a wireless network in a closed area. The number of IPs required to cover n area under service are minimized by the algorithm.

In [7] a toothily algorithm has been used by the authors to locate AP. The algorithm is started with a set of potential proposed locations for AP. In deletes toothily the set of demanded nodes which have not been covered in each circulation. It is assumed in this algorithm that if an AP covers the most demanded nodes, it is more likely to be selected.

In [10] an AP selection article has been designated by making the traffic load balanced which formulated the optimization problem in such a way to minimize the heavy density and as a result, the APs within the wireless local network will have a balanced distribution that the output strength of the network will be maximized.

In [11] the kind of wireless load balancing is presented that the workstations between APs will be distributed in order to minimize the effect of workstations with low transformation rate on the workstations with high transformation rate. The potential shortcoming of this approach is that it needs a central process like an providing controller or a central switch to supervise the network resources. There must a signaling traffic established between this central unit and workstations which uses some of the resources by itself.

In [8] an AP selection mechanism has been expressed that the criteria for selection is based on the conditions of wireless channel not the intensity of received signal. However, the transformation rate for all workstations have been considered the same by the authors which are not usually occurred in a real environment.

In [2] a static approach to select AP for IEEE 802.11 wireless networks has been firstly presented and then this static approach has been optimized for reaction to a dynamic channel conditions which has been indicated as dynamic AP approach. This study shows the throughput of both approaches for IEEE 802.11b for static and dynamic states.

In [9] the potential bandwidth has been presented as a criterion for APs selection and has been defined as the bandwidth which the workstation expects to obtain having associated with AP and then the potential AP bandwidths have been measured using an active assessment method without needing to being associated to the last APs stations and the optimal selection are made.

In [5] a simple mathematical model has been presented for modeling the effect of transformation models of multiple data.

3. The approach to determine the APSF access point

An approach has been presented in this research to not be taken into consideration AP as much as possible and not influence its designation and implementation and mostly acts as a decentralized approach and just adds a field to Beacon and Probe frame structures which will be explained more. It has been attempted in this approach that each stations firstly be identified the appropriate AP using the current parameters and then associated with it.

The method is to firstly calculate a parameter named APSF for each AP, and then the selection process will be made based on the calculated amount for APSF. Using this method causes the distribution of a demands between APs. This method can be expressed as a linear programming method and maximize the number of system's sessions. This method can balance the system load. However, it may be that this method creates problems on multimedia software which needs high signal ability.

To calculate APSF, the following parameters have been taken into consideration:

- Signal Strength which displays with SS
- Channel Speed
- Throughput which displays with TP
- AP Load which displays with L

Channel Speed and Signal Strength are clear from the start, however, studying the TCP/IP packages will be required to calculate the throughput. However, this issue is somewhat different regarding AP Load which there may be different methods for estimating or calculating each AP Load. But this time, a field containing AP Load is added to Beacon and Probe frame. However, it may be assumed that there is no need to involve the Throughput and the AP with less load will have higher Throughput. However, there may be a powerful AP that have a response ability in a higher time though having a high load. Therefore, Throughput has also been considered in the parameters.

4.1: Periodical Operation Algorithm on each AP in Interval T1

1. Periodically update its AP _ Load
2. End.

4.2: AP Initial Selection Algorithm

This Algorithm has been adopted from [13] which some changes have been applied within:

1. Scan for all near APs
2. For each AP
3. Log the Signal_ strength
4. If Associating with AP Successful then
5. Log the channel _ speed
6. Log the AP _Load
7. Estimate throughput by transmitting data
8. Calculate and log APSF
9. End.

It can assess the process of suitable AP to be associated with by studying the APSF station. Now the question raised here is that this assessment should be done for all stations which are associated to or this assessment is specified to the stations which have not been associated with.

The stations which has not been associated to a specific AP will be associated to a AP that has the highest APSF having assessed and calculated APSF; however, regarding the stations which have been associated with a specific AP, the APFS is initially calculated and then the station decides, considering the costs of cutting and reinstalling to AP , that whether to be associated to the same station or associated to an AP with higher APSF.

4.3: Dynamic AP Selection Algorithm

This algorithm has been adopted from [13] and some changes have been made within:

1. scan for all nearby APs
2. for each discovered AP
3. log the signal strength
4. if associating with the AP is successful then
5. log the channel speed
6. Log the AP Load
7. estimate throughput by transmitting data
8. calculate and log APSF
9. if current AP is NULL then
10. reset ss threshold
11. go to 14
12. else if the AP with the largest APSF is current AP
13. decrease ss threshold
14. if association with the AP of the largest APSF fails then
15. go to 1
16. while (true)
17. if signal strength < ss threshold then
18. go to 1.

4.4: Calculating APSF

Having Signal Strength and, Load and AP Throughput, to calculate APSF we have:

APSF=SS*TP*1/L (1).

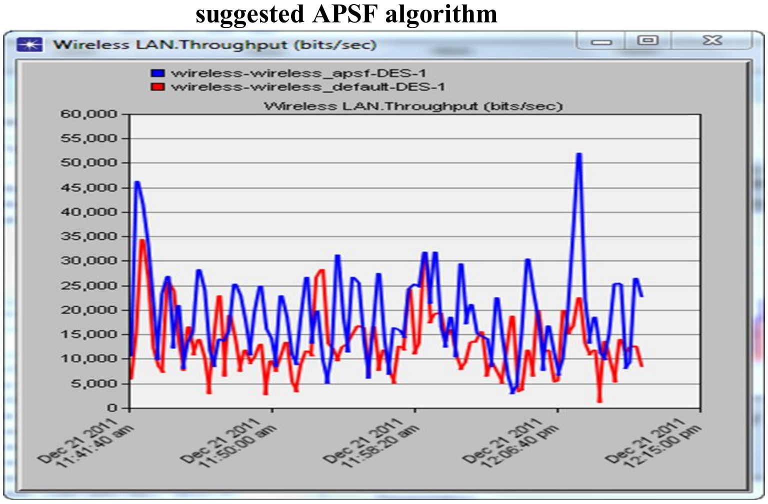
When the workstation is turned on, all the stations around are scanned. During the scanning process, SS can be visible for each discovered AP. When the station is associated to AP, the Channel-Speed will be available. The TP Throughput is the size of all data transferred divided into the Tt transmission time under an ideal condition. The data transmitted are RTC and CTS, the delivered files and ACKs. Therefore, TP can be calculated as below [1]:

TP=(RTS+CTS+data_Size+ACKs)/Tt (2)

Given the fact that signal interferences cause Packet Loss during transmission process, hence RTt can be calculated as below [1].

$$RTt=\sum_{i=1}^{\infty} P^{i} \cdot (1-P) \cdot i \cdot T_t=\frac{T_t}{1-P} \quad (3)$$

Table 2: the comparison between the network throughput and conventional algorithm and the suggested APSF algorithm



Given the fact that error rate of packet delivery of P is not static, its estimation just with mathematical formulas is difficult. Instead TP can be estimated by measuring the time spent for data transfer. Given these interpretations, APSF can be measured having calculated the throughput.

4. Computer Simulation

To study the results achieved from applying the presented multi-parameters algorithm (APSF) to determine the access point on the experimental environmental wireless network parameters with 10, AP and 50, the wireless workstations has been implemented using the simulation software OPENT 14.5. The transmitted signal strength has been considered 0.005 watts and the work mode on IEEE 802.11b standard and the rates of data transmission is 11 Mbps. Two different scenarios have been considered for the simulated network. One scenario is the one in which AP selection is based on the current standard approach and based on the received signal strength intensity and the other one is the scenario in which AP is selected based on APSF approach, that is the suggested approach here. After simulating these two scenarios during 30 minutes, it has been observed that according to figure 2, the total network throughput suggested here (APSF) is somewhat better than the conventional method.

5. Conclusion

An approach has been presented which can solve to a great extent the problem of AP selection in IEEE 802.11 wireless local networks . To obtain this objective, first the parameters affective in selecting AP are obtained which includes: Signal Strength, Channel Speed, Throughput and AP Load which is displayed as L.

Then a parameter named APSF is defined using the founded parameters and then the signal strength is used as a main parameter to starting the association processes and the APSF is also used as a determining parameter to define whether the current AP is a suitable one or not; if not, it is used as a criteria to select a suitable AP. The simulation results indicate that the approach suggested here increases the mean output of wireless local network to a significant amount. However, the point that should be taken into consideration that the approach suggested by the authors has not yet complete if being appropriated in a real implementation and determining the suitable weight for each parameters and or determining the SS-threshold, for instance can be considered in the future studies.

REFERENCES

1. S. Venkatesan, C. Manoharan, Access Point Selection in WLAN using Optimal Association Control Algorithm, European Journal of Scientific ResearchISSN 1450-216X Vol.60 No.2 (2011), pp. 237-246© EuroJournals Publishing, Inc. 2011.
2. Murad Abusubaih, James Gross, Sven Wiethoelter, Adam Wolisz, On Access Point Selection in IEEE 802.11Wireless Local Area Networks, Telecommunication Networks Group Technische Universit¨at Berlin, 2006.
3. Ashish Raniwala, Tzicker Chiueh, Deployment Issues in Enterprise Wireless LANs, Department of Computer Science, Stony Brook University,2005.
4. Y. Lee, K. Kim, and Y. Choi, “Optimization of AP placement and channel assignment in wireless LANs,” LCN 2002. 27th Annual IEEE Conference on Local Computer Networks, pp. 831–836, November 2002.
5. R. Mathar and T. Niessen, “Optimum positioning of base stations for cellular radio networks,” Wireless Networks, pp. 421–428, 2000.
6. R. C. Rodrigues, G. R. Mateus, and A. A. F. Loureiro, “On the design and capacity planning of a wireless local area network,” NOMS 2000. Network Operations and Management Symposium, pp. 335–348, April 2000.
7. G. Fanglu and C. Tzi-cker. Scalable and Robut WLAN Connectivity Using Access Point Array. Proc. of the 2005, International Conference on Dependable Systems and Networks (DNS’05) Vehicular Technology Conference 2004-Fall (VTC2004-Fall), 2005.
8. Y. Fukuda and Y. Oie. Decentralized Access Point Architecture for Wireless LANs: Deployability and Robustness. Proc. IEEE vehicular Technology Conference 2004-Fall (VTC2004-Fall), 2004

9. S. Vasudevan, K. Papagiannaki, C.Diot, J.Kurose and D.Towsley, Facilitating Access Point Selection in IEEE 802.11 Wireless Networks,2005.
10. Akl, Robert, Sangtae, Park, Optimal AccessPoint selection and traffic allocation in IEEE 802.11 Networks, 2005.
11. Haykin,"Cognitive Radio: Brain-Empowered Wireless Communications", IEEE Jour. Select Areas in Communications, Vol.23, No.2, pp.201, Feb.2005.
12. John T. MacDonald, Udayan Das, Dennis A. Roberson, Client Channel Selection for Optimal Capacity in IEEE 802.11 Wireless Networks, 2008.
13. Ping Hsieh, Fu-Min Chang, and Shang-Juh Kao Adaptive Access Points Selection for 802.11 Wireless Networks, 2007?.