# MULTI OBJECTIVE MULTI AGENT BASED ACCESSPOINT SELECTION MECHANISM USING FUZZY LOGIC

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**Abstract:**

The last few years have seen a tremendous increase in the deployment of 802.11 Wireless Local Area Networks (WLANs). The proliferation of wireless users and the promise of converged voice, data and video technology is expected to open new numerous opportunities for 802.11 based WLANs in the networking market.When the WLAN design was first developed in 1990, the model assumes that a WLAN deployment comprises one stand alone Access Point (AP).In fact, such a system provides satisfactory user experience as long as there is few users with relatively light traffic load and one AP. Due to rapid increase of wireless users and the requirement for continuous coverage, multi-AP WLANs now a days span buildings or floors. Some neighboring APs have to be configured on the same channel due to the limited number of channels the 802.11 standard supports.In WLANs often a station can potentially associate with more than one AP. Therefore, a relevant question is which AP to select best from a list of candidate ones. In IEEE 802.11, the user simply associates to the access point with the strongest received signal strength.Hence a multiobjective approach(ie.multiple parameters are considered)and fuzzy based decision making is proposed.Here each node are treated as agent which trying to access best AP.Fuzzy based decision making ensures effective utilization of expert knowledge.

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# I. Introduction:

Wireless Local Area Networks (WLAN)[8]are rapidly becom- ing a normal part of the communications access infrastruc- ture.Due to their low cost,simplicity of installation and high data rates, demand for wireless LAN products has grown dramatically over the last few years,and it shows no sign of slowing.Indeed,it is strengthened by the growth of laptops and personal mobility products.With the spread of wireless LAN as a way to access to the Internet,the number of stations (STAs) connected with the wireless LAN are also increasing.However, with the increase in STAs in the wireless LAN, achievable throughput per STA decreases because they share the commu- nication resource provided by access points (APs).Therefore, multiple APs are required to serve many STAs and to improve the transmission capacity in the wireless LAN. In fact, IEEE

802.11 wireless LAN can extend the communication range by using the multiple APs. In wireless LAN constructed with multiple APs,the following significant issue can arise:how to select an appropriate AP among available APs.In the existing architecture, the received signal strength[1] is usually em- ployed to select an AP.However,such AP selection strategy causes the concentration of STAs to specific APs: many STAs may associate with only a few APs because their signal strengths measured by the STAs are strong, while only a few STAs may associate with the remaining APs. This results in an imbalanced traffic load among APs in the wireless LAN.

# II. Overview of WLAN:

Mobile computing has become extremely popular in todays society.Todays Internet has significant limitations, when it corresponds to the mobility.For an example, if user must be connected to the Internet through a physical cable, their move- ment is dramatically restricted.On the other hand, wireless connectivity poses no such restriction and allows a great deal more free movement on the part of the network users. In other words, wireless technology enables users to connect to the In- ternet regardless of location.As a result, wireless technologies are rapidly becoming a normal part of the communications access infrastructure. Wireless LAN is one of the widespread wireless access infrastructure in wireless technologies because Wireless

LANs offer a quick and effective extension of a wired network or standard LAN.By simply installing access points to the wired network, personal computers and laptops equipped with wireless LAN cards can connect with the wired network[2].

## III. Handoff Process:

A handoff in 802.11 is the process that allows a wireless client (STA) to change of access point (AP)[4].The handoff detection and decision process is vendor specific and is not specified by 802.11 standards.

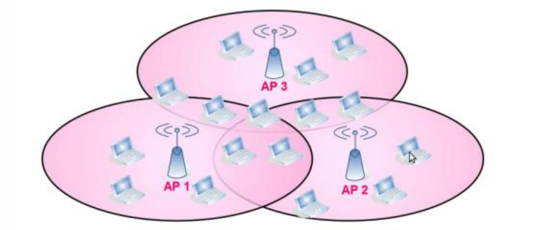


Fig. 1. Handoff

*A. Types of WLAN networks*

The basic service unit of 802.11 network is the Basic Service Set (BSS),which is simply a group of STAs that com-municate with each other.Communications take place within a some what fuzzy area,called the basic service area, defined by the propagation characteristics of the wireless medium. When a STA is in the basic service area, it can communicate with the other members of the BSS.The BSS consists of two types of modes: the ad hoc mode and the infrastructure mode.

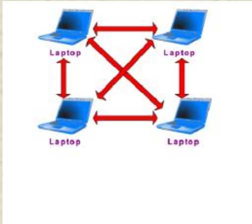


Fig. 2. Adhoc network

*1) Adhoc WLAN:* Figure shows the ad hoc mode network. As Shown in Figure2,STAs in an ad hoc network communicate directly with each other and thus must be within the same communication range. The smallest possible 802.11 network is an ad hoc network with two STAs. Typically, ad hoc networks are composed by a collection of small number of STAs set up for a specific purpose and without the aid of any centralized administration or standard support services. One common use is to create a short-lived network (e.g., for a single meeting in a conference room.)


Fig. 3. Adhoc network

*2) Infrastructure WLAN:* As shown in figure 3,Infrastructure networks[7] are distinguished by the use of an access point from the ad hoc networks.Access points are used for all communications in infrastructure networks, including communication between STAs and APs in the same service area.If one STA in an infrastructure BSS need to communicate with another STA in the same BSS,the communication must take two hops. First, the originating STA transfers the frame to the AP.Second, the access point transfers the frame to the corresponded STA.In an infrastructure network, first of all the STA must have an association, which is the process for joining in 802.11 network, with an AP to obtain network service.STAs always initiate the association process,and APs may choose to accept or deny access based on the contentions of an association request.

## IV. Agent

An intelligent agent(IA) is an autonomous entity which ob- serves and acts upon an environment(i.e. it is an agent) and directs its activity towards achieving goals(i.e.it is ra- tional).Intelligent agents may also learn or use knowledge to achieve their goals. They may be very simple or very complex: a reflex machine such as a thermostat is an intelligent agent as is a human being, as is a community of human beings working together towards a goal.Stations which selects different AP is an example for utlity based agent[10].

## V. Fuzzy based implementation

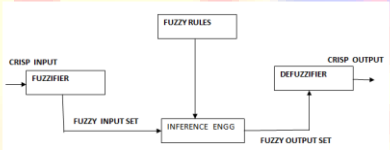


Fig. 4. Fuzzy Implementation

Fuzzy logic[2] is a form of many-valued logic; it deals with reasoning that is approximate rather than fixed and exact. In contrast with traditional logic theory, where binary sets have two-valued logic: true or false, fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false. Furthermore, when linguistic variables are used, these degrees may be managed by specific functions. The SNR(Signal to Noise Ratio) values are identified for the

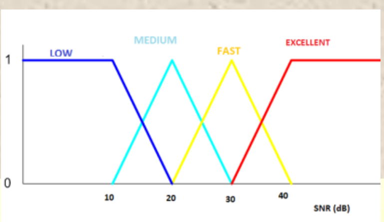


Fig. 5. Fuzzy Example

AP selection. If the SNR value is greater than 40 dB then the signal strength is Excellent If the SNR value is between 25 to 40 dB then the signal strength is Fast. If the SNR value is between 15 to 25 dB then the signal strength is Medium If the SNR value is between 10 to 15 dB then the signal strength is Slow If the SNR values is between 5 to 10 dB then No signal

*3) Fuzzification:* Using membership functions to graphi-

cally describe a situation as shown figure 6 is input member- ship function for SNR.

*4) Rule evaluation(Application of fuzzy rules):* The rules example are

if SNR is low and Load is low then weak reject if SNR is medium and load is low then select

if SNR is high and load is low then select

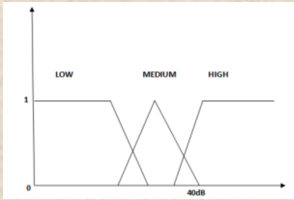


Fig. 6. Input Membership function for SNR

if SNR is low and load is medium then weak reject if SNR is medium and load is medium then select

if SNR is high and load is medium then select if SNR is low load is high then then reject

if SNR is medium and load high weak reject if SNR is high and load is high weak reject

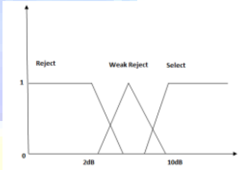


Fig. 7. Output Membership function for AP Selection

*5) Defuzzification:* Defuzzification is obtaining the crisp or actual results,ie,after the inference step, the overall result is a fuzzy value. This result should be defuzzified to obtain a final crisp output. This is the purpose of the defuzzifier component of a FLS. Defuzzification is performed according to the membership function of the output variable. For instance, assume that we have the result in figure 7 at the end of the inference. In this figure 8, the shaded areas all belong to the fuzzy result. The purpose is to obtain a crisp value, represented with a dot in the figure, from this fuzzy result.

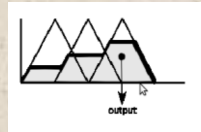


Fig. 8. Deffuzzification Example

## VI. Experimentation:

NS2[9]is a object oriented network simulator for WLAN configurations. The simulation for 3 node with an Access Point is shown is figure 9

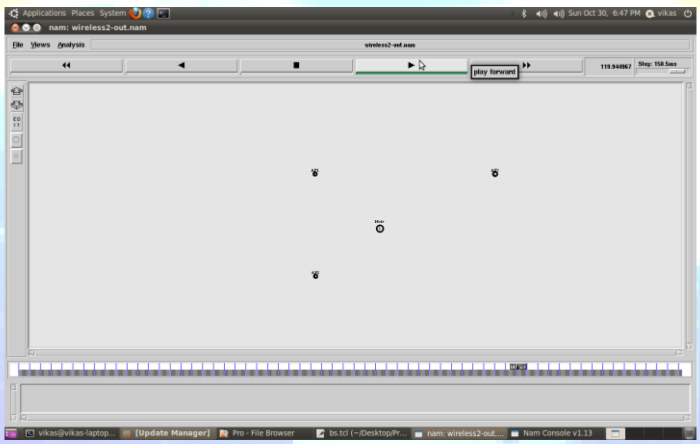


Fig. 9. AP Simulation

## VII. Conclusion and Future Work

The AP selection is important in application where WLAN is shared by large number of mobile nodes.Selection technique used in 802.11 which consider SNR done can be improved used multi object and multi agent approch.Fuzzy based de- cision making improves the system as expert knowlege is incorprated in control.Hence the system improves to the next level of intelligence.Use of type2 fuzzy[10] in decision making which can hadlle second order uncertainity.Type-2 fuzzy sets and systems generalize (type-1) fuzzy sets and systems so that more uncertainty can be handled.From the very beginning of fuzzy sets, criticism was made about the fact that the membership function of a type-1 fuzzy set has no uncertainty associated with it,something that seems to contradict the word fuzzy,since that word has the connotation of lots of uncertainty.So, what does one do when there is uncertainty about the value of the membership function using type-2 fuzzy set.

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