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# USER SPECIFIC CHANNEL ASSIGNMENT ALGORITHMS IN WLAN

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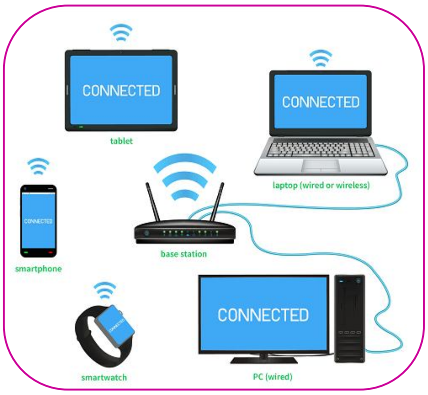
**ABSTRACT:**
*Wireless Local Area Network (WLAN) is currentlyamong the most important technologies for wireless broadband access. The IEEE 802.11 technology is attractive for its maturity and low equipment costs. The design of a wireless local area network (WLAN) has an important issue of determining the optimal placement of access points (APs) and assignment of channels to them. To provide the maximum coverage for WLAN service areas, APs should be installed such that the sum of signal measured at each traffic demand point is maximized. However, as users connected to an AP share wireless channel bandwidth with others in the same AP, AP placement should be carefully decided to maximize the throughput by considering load balancing among APs and channel interference for the user traffic demand. In this paper, a channel-assignment algorithm at the Access Points (APs) of a Wireless Local Area Network (WLAN) is proposed in order to minimize the congestion factor at the access points.*




**KEY-WORDS**: *Wireless LAN(WLAN),Access Points(AP),SIR, Power Management, Channel Assignment.*

## 1. INTRODUCTION

Communicationhas become very important nowdays for exchanging information between people from and to anywhere and at any time. There are different types of networks for communication: wired and wireless. Wireless networks are classified into four different types. The first and foremost class is cellular networks. Another class of wireless networks is wireless local area networks (WLANs). These networks are truly and entirely wireless, but require only single-hop transmission. Typical wireless LANs involves laptops with Bluetooth. The third class consists of networks that utilize satellite links. The fourth and most interesting class is ad hoc networks.Wireless telecommunication has been gaining importance over the past years. In order to work properly and to exploit their full potential, wireless networks need to be planned carefully. WLANs consists of mobile computers with network adapters (NAs) and access points (APs) which are connected to high speed wired LANs. The main goal of radio network planning is to provide widely available wireless service of high quality at a ` price. Other aspects such as security or emission reduction may also play a role. A prominent scheme for broadband wireless access is Wireless Local Area Networks (WLANs) based on IEEE 802.11 technology [5]. The authors in (Papanikos & Logothetis, 2001) proposed a load balancing technique that allows a wireless station to join an AP depending on the number of existing users and the mean Received Signal Strength Indicator (RSSI).. Themost important ones are positioning of access points (APs)and channel assignment.

It is necessary to minimize overlap between APs using same frequencies, and make sure that they don't interfere with each other.

## THE POWER MANAGEMENT ALGORITHM

The received power at each user's location is evaluated using the No Line of Sight (NLOS) Path Loss model.

PL ( d ) = P L 0 + 2 9 . 4 L o g 1 0 ( d ) + 6.1xαLog10(d)+2.4y + 1.3xy
|xa|<1.3,
|xs|<1.5,
|y|<1.5,

Where,
PL0 is the free-space path-loss in dB,
d is the distance between user and Access point in meters.
Xa, Xs and y are Gaussian random variables.

If the power received at a user from an AP exceeds the receiver's threshold, that user gets connected to that particular AP. Thus, a user can be connected with several APs. After the initial channel assignment, which is based on minimizing the interference between neighbouring APs, the network is reconfigured to minimize the congestion in the network. The channels are assigned to APs based on the final assignment of users to APs.The congestion factor at *APj, Cj*

$$Cj = \frac{\sum_{i=1}^{Nj} Ri}{BWj}$$

where *Nj* is the number of users associated with *APj* , *Ri* is the data of user *i*, and *BWj* is the maximum bandwidth for each AP (54 Mbps for IEEE 802.11g).

The final solution provides the power at each AP and a matrix that shows assignment of a user connected to a single AP.

## CHANNEL ASSIGNMENT ALGORITHMS

There are 11 channels that Wi-Fi devices uses in 2.4 GHz frequency band. While setting channels on APs, channels 1,6 and 11 are usually preferred. If there are more than three APs the three channels 1,6,11 can be reused but make sure that APs on the same channels are far enough apart that their coverage doesn't overlap.Channel 1 is having range from 2.401 GHz to 2.423 GHz and has a center frequency of2.412 GHz. The overlapping channel interference factor *wjk* is defined as follows:

$$Wjk = \begin{cases} 1 - Chj - Chk \times C & if\ Wij \geq 0 \\ 0 & otherwise \end{cases}$$

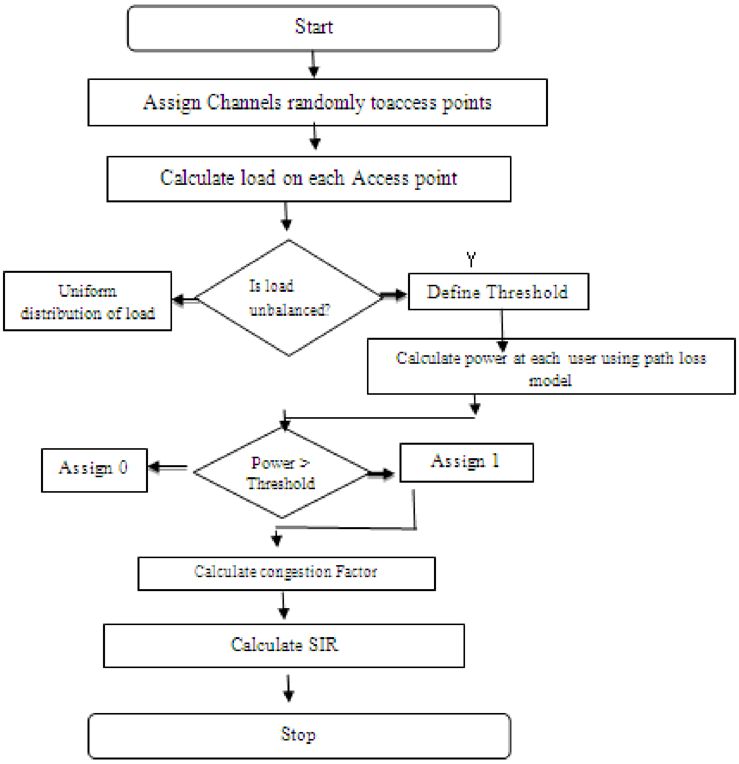
Where, Chj is the channel assigned to APj,Chk is the channel assigned to APk and C is the nonoverlapping portion of two adjacent channels. The mathematical formulation of the channel assignment algorithm, based on minimizing interference between APs, is given by the following NLIP formulation:

$$Iij = \frac{WijPj}{PL(Dij)}$$

where Wij is the overlapping channel interference factor, Pj is the transmit power of APj, Dij is the distance between APj and APk.

There are limited 11 channel resources in IEEE 802.11 b/g.If the same channel is to be assigned to two or more APs that are located at a far distance from each other, then the overlapping channel interference signal detected by each AP should be less than a given threshold value.

## Flowchart




## Numerical Results

In order to validate the algorithms there are various cases considered for simulation.

### 1 .Case 1:20 users and 4 Aps

| | AP0 | AP1 | AP2 | AP3 |
|---|---|---|---|---|
| U0 | 1 | 1 | 1 | 1 |
| U1 | 1 | 0 | 1 | 1 |
| U2 | 1 | 1 | 1 | 1 |
| U3 | 1 | 1 | 1 | 0 |
| U4 | 1 | 1 | 1 | 1 |
| U5 | 1 | 1 | 1 | 1 |
| U6 | 0 | 1 | 1 | 1 |
| U7 | 1 | 1 | 1 | 1 |
| U8 | 1 | 1 | 1 | 0 |
| U9 | 1 | 1 | 1 | 1 |
| U10 | 1 | 1 | 1 | 0 |
| U11 | 1 | 1 | 1 | 1 |
| U12 | 1 | 1 | 1 | 1 |
| U13 | 0 | 1 | 1 | 1 |
| U14 | 0 | 1 | 1 | 1 |

| | | | | |
|---|---|---|---|---|
| U15 | 1 | 1 | 1 | 1 |
| U16 | 1 | 1 | 1 | 1 |
| U17 | 1 | 1 | 1 | 1 |
| U18 | 0 | 1 | 1 | 1 |
| U19 | 1 | 1 | 0 | 1 |
| No.of users connected | 16 | 19 | 19 | 17 |

**Table 1.Initial association matrix**

| | AP0 | AP1 | AP2 | AP3 |
|---|---|---|---|---|
| U0 | 0 | 1 | 0 | 0 |
| U1 | 0 | 1 | 0 | 0 |
| U2 | 1 | 0 | 0 | 0 |
| U3 | 0 | 0 | 0 | 1 |
| U4 | 0 | 1 | 0 | 0 |
| U5 | 0 | 0 | 1 | 0 |
| U6 | 1 | 0 | 0 | 0 |
| U7 | 1 | 0 | 0 | 0 |
| U8 | 0 | 0 | 0 | 1 |
| U9 | 0 | 0 | 1 | 0 |
| U10 | 0 | 0 | 0 | 1 |
| U11 | 1 | 0 | 0 | 0 |
| U12 | 0 | 1 | 0 | 0 |
| U13 | 1 | 0 | 0 | 0 |
| U14 | 1 | 0 | 0 | 0 |
| U15 | 1 | 0 | 0 | 0 |
| U16 | 1 | 0 | 0 | 0 |
| U17 | 0 | 0 | 0 | 1 |
| U18 | 1 | 0 | 0 | 0 |
| U19 | 0 | 0 | 1 | 0 |
| No.of users connected | 09 | 04 | 03 | 04 |

**Table 2.Final association matrix**

| | CF:NPM | CF:PM |
|---|---|---|
| AP0 | 0.63 | 0.35 |
| AP1 | 0.74 | 0.16 |
| AP2 | 0.74 | 0.12 |
| AP3 | 0.66 | 0.16 |

**Table 3.comparision between congestion factors**

| | Initial channel Assignment | Final channel Assignment |
|---|---|---|
| AP0 | 6 | 7 |
| AP1 | 1 | 7 |

| | | |
|---|---|---|
| AP2 | 6 | 1 |
| AP3 | 7 | 1 |
| Avg. SIR | 3.82 | 4.1 |

**Table 3.Channel Assignment**

**Case 2:50 Users and 4 Aps**

**Table 4.Initial Association Matrix**

| | AP0 | AP1 | AP2 | AP3 |
|---|---|---|---|---|
| U0 | 0 | 1 | 1 | 1 |
| U1 | 0 | 1 | 1 | 0 |
| U2 | 1 | 1 | 1 | 0 |
| U3 | 1 | 1 | 1 | 1 |
| U4 | 1 | 1 | 0 | 1 |
| U5 | 1 | 1 | 0 | 1 |
| U6 | 0 | 1 | 1 | 0 |
| U7 | 1 | 1 | 1 | 1 |
| U8 | 1 | 1 | 1 | 1 |
| U9 | 1 | 1 | 0 | 1 |
| U10 | 1 | 0 | 1 | 1 |
| U11 | 1 | 1 | 0 | 1 |
| U12 | 1 | 1 | 0 | 1 |
| U13 | 0 | 1 | 1 | 1 |
| U14 | 0 | 1 | 1 | 1 |
| U15 | 1 | 0 | 1 | 1 |
| U16 | 1 | 0 | 1 | 1 |
| U17 | 1 | 1 | 1 | 0 |
| U18 | 1 | 1 | 1 | 1 |
| U19 | 0 | 1 | 1 | 1 |
| U20 | 1 | 0 | 1 | 1 |
| U21 | 1 | 1 | 0 | 1 |
| U22 | 0 | 1 | 1 | 0 |
| U23 | 0 | 1 | 1 | 1 |
| U24 | 1 | 1 | 1 | 0 |
| U25 | 1 | 0 | 1 | 1 |
| U26 | 0 | 1 | 1 | 1 |
| U27 | 1 | 1 | 0 | 1 |
| U28 | 0 | 0 | 1 | 1 |
| U29 | 1 | 1 | 1 | 1 |
| U30 | 0 | 1 | 1 | 1 |
| U31 | 1 | 1 | 1 | 0 |
| U32 | 1 | 1 | 0 | 0 |
| U33 | 1 | 0 | 1 | 1 |
| U34 | 1 | 0 | 1 | 1 |
| U35 | 1 | 1 | 1 | 0 |
| U36 | 1 | 1 | 1 | 0 |
| U37 | 1 | 1 | 1 | 0 |
| U38 | 0 | 1 | 1 | 1 |
| U39 | 1 | 1 | 0 | 1 |
| U40 | 1 | 1 | 1 | 0 |

| | | | | |
|---|---|---|---|---|
| U41 | 1 | 1 | 0 | 1 |
| U42 | 1 | 1 | 0 | 1 |
| U43 | 0 | 1 | 1 | 1 |
| U44 | 1 | 0 | 1 | 1 |
| U45 | 0 | 1 | 1 | 1 |
| U46 | 1 | 1 | 0 | 1 |
| U47 | 1 | 1 | 1 | 0 |
| U48 | 1 | 1 | 0 | 1 |
| U49 | 1 | 1 | 1 | 1 |
| No. of Users connected | 36 | 41 | 37 | 37 |
| | AP0 | AP1 | AP2 | AP3 |
| U0 | 1 | 0 | 0 | 0 |
| U1 | 1 | 0 | 0 | 0 |
| U2 | 0 | 0 | 0 | 1 |
| U3 | 0 | 0 | 0 | 1 |
| U4 | 0 | 0 | 1 | 0 |
| U5 | 0 | 0 | 1 | 0 |
| U6 | 1 | 0 | 0 | 0 |
| U7 | 1 | 0 | 0 | 0 |
| U8 | 0 | 1 | 0 | 0 |
| U9 | 0 | 0 | 1 | 0 |
| U10 | 0 | 1 | 0 | 0 |
| U11 | 0 | 0 | 1 | 0 |
| U12 | 0 | 0 | 1 | 0 |
| U13 | 1 | 0 | 0 | 0 |
| U14 | 1 | 0 | 0 | 0 |
| U15 | 0 | 1 | 0 | 0 |
| U16 | 0 | 1 | 0 | 0 |
| U17 | 0 | 0 | 0 | 1 |
| U18 | 0 | 0 | 1 | 0 |
| U19 | 1 | 0 | 0 | 0 |
| U20 | 0 | 1 | 0 | 0 |
| U21 | 0 | 0 | 1 | 0 |
| U22 | 1 | 0 | 0 | 0 |
| U23 | 1 | 0 | 0 | 0 |
| U24 | 0 | 0 | 0 | 1 |
| U25 | 0 | 1 | 0 | 0 |
| U26 | 1 | 0 | 0 | 0 |
| U27 | 0 | 0 | 1 | 0 |
| U28 | 1 | 0 | 0 | 0 |
| U29 | 1 | 0 | 0 | 0 |
| U30 | 1 | 0 | 0 | 0 |
| U31 | 0 | 0 | 0 | 1 |
| U32 | 0 | 0 | 1 | 0 |
| U33 | 0 | 1 | 0 | 0 |
| U34 | 0 | 1 | 0 | 0 |
| U35 | 0 | 0 | 0 | 1 |
| U36 | 0 | 0 | 0 | 1 |
| U37 | 0 | 0 | 0 | 1 |

| | | | | |
|---|---|---|---|---|
| U38 | 1 | 0 | 0 | 0 |
| U39 | 0 | 0 | 1 | 0 |
| U40 | 0 | 0 | 0 | 1 |
| U41 | 0 | 0 | 1 | 0 |
| U42 | 0 | 0 | 1 | 0 |
| U43 | 1 | 0 | 0 | 0 |
| U44 | 0 | 1 | 0 | 0 |
| U45 | 1 | 0 | 0 | 0 |
| U46 | 0 | 0 | 1 | 0 |
| U47 | 0 | 0 | 0 | 1 |
| U48 | 0 | 0 | 1 | 0 |
| U49 | 0 | 0 | 0 | 1 |
| No.of users connected | 16 | 9 | 14 | 11 |

**Table 5.Final association matrix**

| | CF:NPM | CF:PM |
|---|---|---|
| AP0 | 1.66 | 0.74 |
| AP1 | 1.898 | 0.417 |
| AP2 | 1.713 | 0.648 |
| AP3 | 1.712 | 0.51 |

**Table 6.Comparision between congestion factors**

| | Initial channel Assignment | Final channel Assignment |
|---|---|---|
| AP0 | 7 | 10 |
| AP1 | 1 | 11 |
| AP2 | 11 | 1 |
| AP3 | 10 | 1 |
| Avg. SIR | 2.13 | 2.19 |

**Table 7.Channel Assignment**

**Case 3:50 Users and 6APs**

| | AP0 | AP1 | AP2 | AP3 | AP4 | AP5 |
|---|---|---|---|---|---|---|
| U0 | 1 | 1 | 1 | 1 | 1 | 1 |
| U1 | 1 | 1 | 1 | 0 | 1 | 1 |
| U2 | 1 | 1 | 1 | 0 | 1 | 1 |
| U3 | 1 | 0 | 1 | 1 | 1 | 1 |
| U4 | 1 | 1 | 1 | 1 | 1 | 1 |
| U5 | 1 | 1 | 1 | 0 | 1 | 1 |
| U6 | 0 | 1 | 1 | 0 | 1 | 1 |
| U7 | 0 | 1 | 1 | 1 | 1 | 1 |
| U8 | 1 | 1 | 1 | 1 | 1 | 1 |
| U9 | 1 | 1 | 0 | 0 | 1 | 1 |
| U10 | 0 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| U11 | 1 | 0 | 0 | 1 | 1 | 1 |
| U12 | 1 | 1 | 1 | 1 | 1 | 1 |
| U13 | 1 | 0 | 0 | 1 | 1 | 1 |
| U14 | 1 | 0 | 1 | 1 | 1 | 1 |
| U15 | 1 | 0 | 1 | 1 | 1 | 1 |
| U16 | 0 | 1 | 1 | 1 | 1 | 1 |
| U17 | 0 | 1 | 1 | 1 | 1 | 1 |
| U18 | 0 | 1 | 1 | 0 | 1 | 1 |
| U19 | 1 | 1 | 0 | 1 | 1 | 1 |
| U20 | 1 | 1 | 1 | 0 | 1 | 1 |
| U21 | 1 | 1 | 1 | 0 | 1 | 1 |
| U22 | 1 | 0 | 1 | 1 | 1 | 1 |
| U23 | 1 | 1 | 1 | 1 | 1 | 1 |
| U24 | 1 | 0 | 1 | 1 | 1 | 1 |
| U25 | 1 | 1 | 1 | 0 | 1 | 1 |
| U26 | 1 | 1 | 0 | 1 | 1 | 1 |
| U27 | 1 | 1 | 0 | 1 | 1 | 1 |
| U28 | 1 | 1 | 0 | 1 | 1 | 1 |
| U29 | 1 | 0 | 1 | 1 | 1 | 1 |
| U30 | 1 | 0 | 1 | 1 | 1 | 1 |
| U31 | 1 | 0 | 0 | 1 | 1 | 1 |
| U32 | 1 | 1 | 1 | 1 | 1 | 1 |
| U33 | 1 | 1 | 1 | 0 | 1 | 1 |
| U34 | 1 | 1 | 1 | 1 | 1 | 1 |
| U35 | 1 | 1 | 1 | 0 | 1 | 1 |
| U36 | 1 | 1 | 1 | 0 | 1 | 1 |
| U37 | 1 | 0 | 1 | 1 | 1 | 1 |
| U38 | 1 | 1 | 0 | 0 | 1 | 1 |
| U39 | 1 | 1 | 1 | 0 | 1 | 1 |
| U40 | 1 | 1 | 1 | 1 | 1 | 1 |
| U41 | 1 | 1 | 1 | 1 | 1 | 1 |
| U42 | 1 | 0 | 1 | 1 | 1 | 1 |
| U43 | 0 | 0 | 1 | 1 | 1 | 1 |
| U44 | 1 | 1 | 1 | 0 | 1 | 1 |
| U45 | 1 | 1 | 0 | 1 | 1 | 1 |
| U46 | 1 | 0 | 1 | 1 | 1 | 1 |
| U47 | 1 | 1 | 1 | 0 | 1 | 1 |
| U48 | 0 | 1 | 1 | 1 | 1 | 1 |
| U49 | 0 | 1 | 1 | 1 | 1 | 1 |
| No.of users connected | 41 | 36 | 39 | 34 | 50 | 50 |

**Table 8.Initial Association Matrix**

| | AP 0 | AP 1 | AP2 | AP3 | AP 4 | AP 5 |
|---|---|---|---|---|---|---|
| U0 | 0 | 0 | 1 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| U1 | 0 | 0 | 0 | 1 | 0 | 0 |
| U2 | 0 | 0 | 0 | 1 | 0 | 0 |
| U3 | 0 | 1 | 0 | 0 | 0 | 0 |
| U4 | 1 | 0 | 0 | 0 | 0 | 0 |
| U5 | 0 | 0 | 0 | 1 | 0 | 0 |
| U6 | 1 | 0 | 0 | 0 | 0 | 0 |
| U7 | 1 | 0 | 0 | 0 | 0 | 0 |
| U8 | 1 | 0 | 0 | 0 | 0 | 0 |
| U9 | 0 | 0 | 1 | 0 | 0 | 0 |
| U10 | 1 | 0 | 0 | 0 | 0 | 0 |
| U11 | 0 | 1 | 0 | 0 | 0 | 0 |
| U12 | 0 | 0 | 0 | 1 | 0 | 0 |
| U13 | 0 | 1 | 0 | 0 | 0 | 0 |
| U14 | 0 | 1 | 0 | 0 | 0 | 0 |
| U15 | 0 | 1 | 0 | 0 | 0 | 0 |
| U16 | 1 | 0 | 0 | 0 | 0 | 0 |
| U17 | 1 | 0 | 0 | 0 | 0 | 0 |
| U18 | 1 | 0 | 0 | 0 | 0 | 0 |
| U19 | 0 | 0 | 1 | 0 | 0 | 0 |
| U20 | 0 | 0 | 0 | 1 | 0 | 0 |
| U21 | 0 | 0 | 0 | 1 | 0 | 0 |
| U22 | 0 | 1 | 0 | 0 | 0 | 0 |
| U23 | 0 | 0 | 0 | 1 | 0 | 0 |
| U24 | 0 | 1 | 0 | 0 | 0 | 0 |
| U25 | 0 | 0 | 0 | 1 | 0 | 0 |
| U26 | 0 | 0 | 1 | 0 | 0 | 0 |
| U27 | 0 | 0 | 1 | 0 | 0 | 0 |
| U28 | 0 | 0 | 1 | 0 | 0 | 0 |
| U29 | 0 | 1 | 0 | 0 | 0 | 0 |
| U30 | 0 | 1 | 0 | 0 | 0 | 0 |
| U31 | 0 | 1 | 0 | 0 | 0 | 0 |
| U32 | 1 | 0 | 0 | 0 | 0 | 0 |
| U33 | 0 | 0 | 0 | 1 | 0 | 0 |
| U34 | 0 | 0 | 0 | 1 | 0 | 0 |
| U35 | 0 | 0 | 0 | 1 | 0 | 0 |
| U36 | 0 | 0 | 0 | 1 | 0 | 0 |
| U37 | 0 | 1 | 0 | 0 | 0 | 0 |
| U38 | 0 | 0 | 1 | 0 | 0 | 0 |
| U39 | 0 | 0 | 0 | 1 | 0 | 0 |
| U40 | 0 | 1 | 0 | 0 | 0 | 0 |
| U41 | 0 | 0 | 1 | 0 | 0 | 0 |
| U42 | 0 | 1 | 0 | 0 | 0 | 0 |
| U43 | 1 | 0 | 0 | 0 | 0 | 0 |
| U44 | 0 | 0 | 0 | 1 | 0 | 0 |
| U45 | 0 | 0 | 1 | 0 | 0 | 0 |
| U46 | 0 | 1 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| U47 | 0 | 0 | 0 | 1 | 0 | 0 |
| U48 | 1 | 0 | 0 | 0 | 0 | 0 |
| U49 | 1 | 0 | 0 | 0 | 0 | 0 |
| Conn .Users | 12 | 14 | 9 | 15 | 0 | 0 |

**Table 9.Final Association Matrix**

| | CF:NPM | CF:PM |
|---|---|---|
| AP0 | 1.9 | 0.56 |
| AP1 | 1.67 | 0.65 |
| AP2 | 1.85 | 0.42 |
| AP3 | 1.57 | 0.69 |
| AP4 | 2.31 | 0 |
| AP5 | 2.31 | 0 |

**Table 10.Comparision between congestion factors**

| | Initial channel Assignment | Final channel Assignment |
|---|---|---|
| AP0 | 9 | 4 |
| AP1 | 2 | 11 |
| AP2 | 4 | 11 |
| AP3 | 11 | 2 |
| AP4 | 8 | 2 |
| AP5 | 4 | 11 |
| Avg. SIR | 2.6 | 2.8 |

**Table 11.Channel Assignment**

**Case 4:80 Users and 4APs**

**The number of connected users in Initial Association Matrix are:**

| | AP0 | AP1 | AP2 | AP3 |
|---|---|---|---|---|
| No.of users connected | 62 | 61 | 64 | 60 |

**Table 12**

**The number of connected users in Final Association Matrix are:**

| | AP0 | AP1 | AP2 | AP3 |
|---|---|---|---|---|
| No.of users connected | 20 | 18 | 22 | 20 |

**Table 13**

| | CF:NPM | CF:PM |
|---|---|---|
| AP0 | 2.8703 | 0.925 |
| AP1 | 2.824 | 0.833 |
| AP2 | 2.962 | 1.018 |
| AP3 | 2.777 | 0.925 |

**Table 14. Comparison of congestion Factors**

| | Initial channel Assignment | Final channel Assignment |
|---|---|---|
| AP0 | 11 | 6 |
| AP1 | 8 | 11 |
| AP2 | 8 | 11 |
| AP3 | 6 | 11 |
| Avg.SIR | 2.1 | 2.42 |

**Table15.Channel Assignment**

**Case 5:80 Users and 8APs**

| | CF:NPM | CF :PM |
|---|---|---|
| AP0 | 2.8703 | 0.833 |
| AP1 | 2.8703 | 0.74 |
| AP2 | 2.9166 | 0.74 |
| AP3 | 2.5925 | 0.925 |
| AP4 | 3.703 | 0 |
| AP5 | 3.657 | 0.046 |
| AP6 | 0.416 | 0.416 |
| AP7 | 0 | 0 |

**Table 16.Comparision of Congestion Factors**

| | Initial Channel Assignment | Final Channel Assignment |
|---|---|---|
| AP0 | 9 | 4 |
| AP1 | 7 | 9 |
| AP2 | 7 | 9 |
| AP3 | 5 | 10 |
| AP4 | 5 | 10 |
| AP5 | 3 | 10 |
| AP6 | 10 | 3 |
| AP7 | 4 | 10 |
| Avg.SIR | 0.59 | 1.2 |

**Table 17.Channel Assignment**

**Case 6:100 Users and 4 APs**

| | CF:NPM | CF :PM |
|---|---|---|
| AP0 | 3.4722 | 1.25 |
| AP1 | 3.425 | 1.203 |
| AP2 | 3.564 | 1.11 |
| AP3 | 3.518 | 1.064 |

**Table 18.Comparison of Congestion Factors**

| | Initial Channel Assignment | Final Channel Assignment |
|---|---|---|

| | | |
|---|---|---|
| AP0 | 2 | 5 |
| AP1 | 10 | 2 |
| AP2 | 3 | 10 |
| AP3 | 5 | 10 |
| Avg.SIR | 2.6 | 2.8 |

**Table 19.Channel Assignment**

**Case 7.100 users and 10 AP**

| | CF:NPM | CF :PM |
|---|---|---|
| AP0 | 4.13 | 0.925 |
| AP1 | 3.564 | 1.388 |
| AP2 | 3.425 | 1.157 |
| AP3 | 3.611 | 1.157 |
| AP4 | 4.629 | 0 |
| AP5 | 4.629 | 0 |
| AP6 | 4.583 | 0 |
| AP7 | 4.583 | 0 |
| AP8 | 0 | 0 |
| AP9 | 0 | 0 |

**Table 20.Comparison of Congestion Factors**

| | Initial Channel Assignment | Final Channel Assignment |
|---|---|---|
| AP0 | 1 | 2 |
| AP1 | 10 | 1 |
| AP2 | 9 | 1 |
| AP3 | 5 | 10 |
| AP4 | 6 | 1 |
| AP5 | 7 | 1 |
| AP6 | 7 | 1 |
| AP7 | 7 | 1 |
| AP8 | 1 | 10 |
| AP9 | 2 | 10 |
| Avg.SIR | 1.32 | 1.94 |

**Table 21.Channel Assignment**

**Case 8:100 users and 10APs**

| | CF:NPM | CF :PM |
|---|---|---|
| AP0 | 1.89 | 0.46 |
| AP1 | 1.66 | 0.601 |
| AP2 | 1.851 | 0.324 |
| AP3 | 1.574 | 0.55 |
| AP4 | 2.314 | 0 |
| AP5 | 2.314 | 0 |
| AP6 | 1.66 | 0 |
| AP7 | 1.89 | 0.046 |
| AP8 | 1.712 | 0.138 |
| AP9 | 1.712 | 0 |
| AP10 | 1.66 | 0.138 |
| AP11 | 1.89 | 0.046 |

**Table 22.Comparision of congestion factors**

| | Initial Channel Assignment | Final Channel Assignment |
|---|---|---|
| AP0 | 1 | 1 |
| AP1 | 11 | 1 |
| AP2 | 1 | 6 |
| AP3 | 6 | 1 |
| AP4 | 11 | 6 |
| AP5 | 6 | 1 |
| AP6 | 1 | 11 |
| AP7 | 6 | 1 |
| AP8 | 11 | 5 |
| AP9 | 1 | 1 |
| AP10 | 9 | 8 |
| AP11 | 4 | 1 |
| Avg.SIR | 0.4 | 1.6 |

**Table 19.Channel Assignment**

From the above various cases it is clear that the SIR at user is maximized and the congestion factor is improved.Thus the channel is assigned to AP based on power management which maximizes the SIR at user level.

## CONCLUSION

The entire network is balanced. The minimum interference and power management algorithm shows a great improvement in the load distribution and average SIR. When a new node is introduced then that node is allocated to that access point which have less utilized power and bandwidth. As the number of nodes are increased the congestion factor is increased and vice versa. The increased SIR at the users shows the performance of the algorithm.

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