SIMULATION AND EVALUATION OF HIGH DENSITY COGNITIVE HOTSPOT NETWORK BASED ON IEEE 802.11 MINIPOP ACCESS POINT SERIES

Arinze C.O¹, Idigo V.E², Ohaneme C.O³, Agu V.N⁴, Ezechukwu A.O⁵

¹,² Department of Electronic & Computer Engineering, Nnamdi Azikwe University, Awka Nigeria
³ Department of Electrical Engineering, Nnamdi Azikiwe University, Awka Nigeria
⁴ Department of Electrical Engineering, Nnamdi Azikiwe University, Awka Nigeria
⁵ Department of Electrical Engineering, Nnamdi Azikiwe University, Awka Nigeria

ABSTRACT

This paper presents cognitive minipop Access Point (AP) architecture for high density wireless environments. This is derived from the Tranzio-Wawion radio infrastructure in our previous research. The model is based on quality of service optimization for a typical Tranzio-Wawion radio infrastructure. We used the University of Nigeria Nsukka as a testbed for preliminary studies while using MATLAB Simulink 2009b to configure parameter settings and values for the physical layer of the cognitive minipop AP communication network. The results of model physical layer provide an economical and flexible solution that encourages efficient network resource utilizations. In conclusion, using the Cognitive Minipop-AP Specifications which is operated at 2.4GHz baseband frequency, the behaviour of SNR, PER and BR considering Rayleigh channelization showed better performance for flat and no fading scenarios more excellently, though dispersive fading is evident, but its effect will only be significant in generic WLAN alone and not on Cognitive minipop-AP.

Key Words: Cognitive, Minipop, Access point, Quality of Service, Bit Error Rate, Packet Error Rate, Channelization

INTRODUCTION

Today, WLAN hotspot technology (IEEE 802.11) is observed to be having a surprising diffusion in the market of telecommunications. WLAN hotspots are creeping up day by day [1] and almost all portable devices like PDAs, laptops etc. come equipped with 802.11 network interface card and adapters. This amazing success is mainly due to the simplicity of the solution, its cost effectiveness, and, last but not least, the increasing demands for “anywhere, anytime” connectivity. A WLAN is basically constituted by one or more wireless Access Points (APs) connected to the backbone network which provide wireless connectivity to the covered area [2]. In many situations, the deployment of a single AP is not enough to provide the required connectivity. As an example, large facilities, such as an office complex, apartment buildings, hospitals, university campuses, or warehouses generally require many cooperating APs in order to provide the required services to the end users [3]. In order to access the network, a user terminal needs to receive the radio transmission of an AP at an adequate level of power. A simple way to plan radio coverage is to consider a set of possible positions of user terminals (Test Points, TPs) in the service area and a set of AP candidate sites (CSs). A subset of CSs in which to install APs has then to be selected so as to guarantee a high enough signal level at all TPs. The problem of minimizing the number of candidate AP sites that are able to cover all TPs amounts to a well-known combinatorial optimization problem has been proposed, namely the minimum cardinality set covering problem [3].

However, not all feasible solutions (subsets of AP candidate sites that are able to cover all TPs) provide the same system capacity and level of quality of service. Due to the WLAN medium access mechanism, if a user terminal is covered by more than one AP and is transmitting/receiving to/from one of them, the other APs are prevented to transmit/receive to/from other users [4]. Therefore, the overlaps between the subsets of TPs covered by different APs should be taken into account during the radio planning phase so as not to affect the QoS. This could be realized by intelligent rule base approach.

Classical methods for coverage planning based on random search heuristics can be applied to the problem as noted in [5]. In [6], the authors propose a formulation driven jointly by the maximization of the signal quality in the service area and by the minimization of the areas with a poor signal quality. The objective function comes from a combination of the above objectives. Rodriguez et al. [7] propose an integer linear programming (ILP) formulation in which the signal quality at the test points is maximized. This formulation, which does not require full coverage, is solved by using the state-of-the-art CPLEX ILP commercial solver [3]. In [8] a traffic intensity is assigned to each TP and a formulation aimed at maximizing the channel utilization of each AP is proposed. This formulation turns out to be a special case of the capacitated facility location problem. The work in [9] proposed novel mathematical programming formulations for the WLAN hotspot planning problem which take into account the coverage overlap between APs and its impact on the network capacity. In particular, given the high proliferation of mobile devices with large user density, this work seeks to propose a hotspot design which formalized the planning problem by using performance enhancement schemes as for an integrated compressed access point components for channelization studies.

As observed by the authors in [10], the current use of WLANs for Internet access from wireless stations is dominated by downlink TCP traffic, but lacks robust intelligence to handle network conditions. This is the case in cyber cafes, universities, airports etc. In such high density environment, the optimal performance of hotspot WLAN setups have to take into account algorithms for congestion control, low bit error rates, enhanced throughput, localization issues between the mobile user and the APs, RSSI, as well as other hotspot WLAN metrics etc, for reliable data transport over WLANs devices like APs.

DOI: 10.24297/ijcds.v4i2.5067
RESEARCH CONTRIBUTIONS

This paper concentrates on how to improve the performance of IEEE 802.11a/b/g/n by proposing a cognitive Minipop-AP for high density WiFi-hotspot services. The model result shows the influence of Raleigh channelization fading on hotspot environment. With the simulation design, the best QoS results is obtained at no fading scenario with avg. PER of 0%, avg. SNR of 29.77dB, avg. Bit rate of 480Mb/s.

In this work, after reviewing related works on WLAN hotspot, we show the extent of effectiveness on the generic WLAN infrastructure designs in the context of selected metrics with architectural design for physical MAC Minipop-AP CHN procedure that will be compatible with the existing IEEE 802.11 series. The Cognitive Minipop-AP design in this work seeks to provide near-optimal solution for SNR, PER, BER considering the effects of fading channelization.

LITERATURE REVIEW

The work in [11] developed an opportunistic scheduling algorithm for cognitive radio networks that maximizes the throughput utility using the Lyapunov Optimization technique of secondary users. In their work, this is subject to maximum collision constraints with the primary users. The authors in [12] carried out an indepth study on cognitive network and proposed autonomous cognitive access point (CogAP) architecture, designed for cognitive controller for optimized channel decision selection. Yao Liu et al. proposed traffic prediction using Multi-Layer Feedforward Neural Network (MFNN) model for learning the effect of spatio-temporal-spectral parameters on traffic pattern and predicting future traffic loads on channels [13]. To further validate their proposal, they constructed three kinds of traffic predictors that predict traffic at different time scale; MLP, MILP and HLP. The work in [14] proposed Cognitive Medium Access (CMA), a protocol aimed at improving coexistence with a set of independently evolving WLAN bands. Two metrics were considered in their evaluation viz; (i) a cumulative interference constraint (CIC) reflecting the number of slot collisions per unit time, and (ii) a packet error rate constraint (PERC), limiting the number of WLAN packet errors due to the interferer.

However, we believe that the generic WLANs could be made intelligent and QoS mechanism could be improved to negate the generic network deficiencies. That is why there are several research works on network congestion relief in hotspot networks [15], [16]. The performance of these works is limited by the available spectrum for IEEE 802.11 WLANs. Therefore, to fundamentally relieve network congestion in WLAN hotspot network, this work intends to solve spectrum scarcity issues in its AP design architecture and to handle congestion in the hotspot network.

The introduction of Resource Reservation Protocol (RSVP) in CN is implemented as well. The key goal of this work is to show the impact of multipath fading channelization technique on QoS for WLAN hotspot AP and determine if its usage can prove service efficient in IEEE 802.11 hotspot. In this regard, the Cognitive AP Model architecture implementation in later section will consider channelization consequences to SNR, PER and BER.

METHODOLOGY

3.1 Overview of the Proposed Cognitive Minipop_AP Architecture

Figure 2 shows the system model of the proposed minipop_AP with the following subsystems, viz: User domain, Access/sensing control layer, Transmitter engine module, Channelization multipath module, the receiver engine module and the Sink. The detail of the above module is described below:

A. User Domain Block

This block marks the entry point to the network where users can gain connection with their client machines. Owing to virtual machine logic instantiation in the minipop-AP, upon authorization via service set identify keys, users can make connection and access resources in the network. Beside the security configurations done at the core layer such as switching speed redundancy layer, level security is implemented at the user domain through a challenge key response by the minipop extensive platform security.

B. Minipop Access Control Layer

Access/virtualization layer runs on the minipop-AP architecture having three layers of controls viz: Pilot, Training, and Adaptive modulation Control. Adaptive modulation control improves the rate of transmission. The implementation of adaptive modulation is according to the channel information that is present at the transmitter in essence. The Resource reSerVation Protocol (RSVP) is introduced in the modulation process as a signalling protocol that allows users applications to reserve or optimize for unicast and multicast data flows. RSVP is used to describe data traffic characteristics as well as enhance Quality of Service (QoS) requirements in the Minipop model.

This layer is designed to have resilience, scalability, robustness owing to its OFDM modulation scheme configurations. The OFDM is a transmission technique built for high speed bi-directional wireless data communication with high energy efficiency. Data frames from the user are convolutonally encoded into the Modulation RSVP block.

With OFDM modulation engine, channel bandwidth is divided into multiple subchannels, i.e multicarrier transmission which is a method for the efficient utilization of the band width. In this case, subcarriers are orthogonal to each other in frequency domain which reduces inter symbol interference (ISI) and frequency- selective fading. The technique is based upon the idea of multi-carrier
modulation (MCM) where transmitted data is modulated on several orthogonal carrier frequencies. The subcarriers are closely spaced together but still orthogonal, which means that they are perpendicular in a mathematical sense, and do not interfere with each other.

The OFDM with its inverse and Fast Fourier transforms (FFT and IFFT) is given by (1)

\[ X_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{2\pi jnk/N} \]  
(1)

Where \( N=0, 1, 2, \ldots, N-1 \).

C. Transmitter MiniPoP Module

The pilot, training control blocks regulates the frame reshaping and conversion by the Minipop-AP engine that assembles the data frames. The pilot block-type for channel estimation is developed under the assumption of slow fading channel, and it is performed by reshaping pilot frames into all subcarriers of OFDM symbols within a specific period. Also, it satisfies the need for carrier equalization when the channel changes. Error control and payload subsystems now delivers the frames to the multiplex antenna block for further channel transmission. Cognitive learning is carried out by the transmitter Minipop-AP before transmission. OFDM converts serial data stream into parallel blocks of size \( N \) and modulates these blocks using inverse fast Fourier transform (IFFT). Time domain samples of an OFDM symbol can be obtained from frequency domain data symbols [17] as

\[ X(i,n) = \text{IFFT}_N[X(i,k)] = \frac{1}{N} \sum_{k=0}^{N-1} X(i,k) e^{-2\pi jnk/N} \]  
(2)

where \( X(i,k) \) is the transmitted data symbol at the \( k \)th subcarrier of the \( i \)th OFDM symbol, \( N \) is the fast Fourier transform (FFT) size.

After the addition of cyclic prefix (CP) and D/A conversion, the signal is passed through the radio channel. The channel is assumed to be constant over an OFDM symbol, but time-varying across OFDM symbols.

D. Channelization Multipath (Radio Channel)

This block emulates the channel status for fading effects for SNR and Doppler effects. The Rayleigh Fading Channel in communication environment was considered in the channelization model. Actually, Multipath fading is a significant problem in communications. In a fading channel, signals experience fades (i.e., they fluctuate in their strength). When the signal power drops significantly, the channel is said to be in a fade. This could gives rise to high bit error rates (BER). Also, it is known that time-dispersive channels can cause inter-symbol interference (ISI), a form of distortion that causes symbols to overlap and become indistinguishable by the receiver. For example, in a multipath scattering environment, in this case, the receiver design is designed to see less delayed versions of a symbol transmission, which can interfere with other symbol transmissions as such; the radio channel is optimized to reduce BER.

E. Receiver MiniPoP Module

An equalizer in the receiver minipop model attempts to mitigate ISI and improve receiver performance. At the receiver, the signal is received along with noise. After synchronization, down-sampling, and removal of the CP, the simplified baseband model of the received samples can be formulated [18] as

\[ y[n] = \sum_{l=0}^{L-1} x[n-l] h[l] + w[n] \]  
(3)

where \( L \) is the number of sample-spaced channel taps, \( w(n) \) is the Rayleigh channel component with time domain channel impulse response (CIR) for the current OFDM symbol, \( h(t) \) is given as a time-invariant linear filter. In this model, perfect time and frequency synchronization is assumed such that after taking FFT of the received signal \( y(n) \), the samples in frequency domain can be written as:

\[ Y(i,k) = X(i,k)H(i,k) + W(i,k) \]  
(4)

Where \( H \) and \( W \) are FFTs of \( h \) and \( w \) respectively. Optimization via normalization is carried out by a gain block in the receiver minipop block. The frequency synthesizer block removes all the noise components and finally demodulates the frame for the sink termination.

The procedure for the system architecture is summarized in section 3.2. Starting from the user SSID association to the QoS computation of BER, PER and SNR, the influence of fading was put into consideration for analysis purposes.
3.2. Procedure for Cognitive Minipop_AP

- NodeNi enters the cognitive hotspot network environment
- Initialize AMC, RSVP
- Access control using SSID is imposed on Ni
- If validated, then locate a close minipop_AP
- If activated, then group data for OFDM symbols
- Start pilots ()
- StartTraining()
- Else return to 6
- Call minipop_Engine to assemble OFDM frames
- Select data blocks ()
- Enable gain&assemble subcarriers
- Training_Seq = concatenated subcarriers
- Generate payload&Normalize via IFFT
- Set error control & payload
- Call multiplex OFDM frames()
- Send to transmitter OFDMA frame data
- Call cognitive channelization()
- Set cognitive fading mode in channel
- SetSNR (N)
- Setmax Doppler shift (D)
- Set channel sample period (S)
- Call cognitive minipop_AP receiver block
- Decouple payload & errors
- Call frequency equalizer () for minipop_receiver signal gain
- Disassemble OFDM frames for demodulation AP receiver
- Compute, “PER”, “SNR”, “BER”
- Load snk & visual dashboard
- End if
- End

3.2 Simulation Design of Cognitive Minipop_AP

The parameter settings and values of the University of Nigeria Nsukka (UNN) real life scenario and that of the original IEEE 802.11 standard provided three initial specifications for the physical layer during the development of our cognitive minipop_AP. Our compressed minipop_AP physical layer provides an economical and flexible solution without the need for physical wiring and redundant hotspot hardwares. In this context, the Cognitive Minipop Specifications operated at 2.4GHz baseband frequency. Our focus here is to present the effects of channel conditions in our Cognitive Minipop proposal under Rayleigh channelization states. In this regard, a generic template for running the framework in figure 1 was developed using MATLAB Simulink 2009 as a simulation tool. Conventionally, there are several toolboxes in MATLAB Simulink used in developing various design models and block diagrams. In this context, MATLAB Simulink communication toolbox was used to derive the respective block set components with their specific attributes optimized for figure 2. The interconnection of these block sets follows from the diagrammatic representation of figure 2, comprising of the source blocks, the encoder blocks, the modulator block, transmitter block, channel block, receiver block and the demodulator block and the terminal sinks. Table 1 shows the simulation parameters.

Table 1: CHN Minipop-Transceiver Parameters

<table>
<thead>
<tr>
<th>Simulation Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel</td>
<td>Rayleigh (50mW)</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>2.4GHz</td>
</tr>
<tr>
<td>Max. Data Rate</td>
<td>500Mbps</td>
</tr>
<tr>
<td>Modulation Type</td>
<td>OFDM</td>
</tr>
<tr>
<td>Number of Spatial Streams</td>
<td>11</td>
</tr>
</tbody>
</table>
3.3. Simulation Model
We would like to underline that our experiments have been carried out by using data packet traffic condition. For the Minipop in a subnet, our corresponding QoS metrics was obtained but interestingly our observation confirmed our model convergence and stability under fading conditions. Due to the nominal bandwidth used in our connections, we showed the behaviour of SNR, PER and Bit rate for our CHN model.

During the simulation, the data were captured via the signal scopes aggregated via the AP Signal aggregation dashboard which captures the inputs signal and writes the signal data to the MATLAB workspace in an array structure. Consequently, after developing the setup in figure 2, we performed our experiments over this tested by varying three fading constraints on the channel at 0.08secs and at 1sec. The fading constraints are dispersive fading, flat fading and no fading. These were found to impose performance degradation in traditional hotspot networks.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>20M</td>
</tr>
<tr>
<td>AMC</td>
<td>Enabled</td>
</tr>
<tr>
<td>RSVP</td>
<td>Enabled</td>
</tr>
<tr>
<td>FFT Size</td>
<td>64</td>
</tr>
<tr>
<td>IFFT</td>
<td>64</td>
</tr>
<tr>
<td>Number of Sub carriers (Data Pilots)</td>
<td>155</td>
</tr>
<tr>
<td>Channel Encoding</td>
<td>Convolution Code 5/6</td>
</tr>
</tbody>
</table>

### SIMULATION ANALYSIS
At the end of each run, the following details as summarized in the tables below were collected at:

\[ T = 0.08 \text{ sec and } T = 1 \text{ sec} \]
Table 2. Case 1: Higher Bit Rate at No Fading

<table>
<thead>
<tr>
<th>At Tsec= 0.08Sec</th>
<th></th>
<th>No fading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersive fading</td>
<td>PER = 4%</td>
<td>PER = 0%</td>
</tr>
<tr>
<td>PER = 4%</td>
<td>SNR = 15.98dB</td>
<td>SNR = 27.93dB</td>
</tr>
<tr>
<td>Bit Rate = 180Mb/s</td>
<td>Bit Rate = 360Mb/s</td>
<td>Bit Rate = 480Mb/s</td>
</tr>
</tbody>
</table>

Table 3. Case 2: Higher Bit Rate at Flat and No fading Conditions

<table>
<thead>
<tr>
<th>At Tsec= 1Sec</th>
<th></th>
<th>No fading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersive fading</td>
<td>PER = 6%</td>
<td>PER = 0%</td>
</tr>
<tr>
<td>PER = 6%</td>
<td>SNR = 22.52dB</td>
<td>SNR = 27.79dB</td>
</tr>
<tr>
<td>Bit Rate = 240Mb/s</td>
<td>Bit Rate = 480Mb/s</td>
<td>Bit Rate = 480Mb/s</td>
</tr>
</tbody>
</table>

Figure 3 shows the data transmission at the simulation runoff the cognitive visual board.

Since quality of service (QoS) is a very key factor in hotspot designs, therefore, it becomes essential to model cognitive wireless channels, which try to describe the wireless environment as close as possible. The collection of Minipops forming a cognitive hotspot network is developed to work on point to point radio communication. The propagation phenomenon called multipath propagation, in which the transmitted signals reach the receiving end through two or more paths was assumed in this context. These physical limits on the communication of the network affect the performance of the network in generic hotspot networks. The need arises to use channel models that characterise such physical limits. These channel models provide an estimate of the physical-layer performance of cognitive wireless transmission.
In this case, we considered a popular channel models called Rayleigh channel. It has better advantage compared with Addition White Gaussian Noise (AWGN). The AWGN is a basic channel model in nature that does not take into account fading, frequency selectivity, nonlinearity or dispersion, but just simulates the background noise of a channel. The signal being transmitted gets disturbed by it. However, using the Rayleigh distribution describes the statistically time varying nature of the transmitted data packet better under channel fading influence. Rayleigh fading channel is a useful model of real-world phenomena in wireless communications. These phenomena include multipath scattering effects, time dispersion, and Doppler shifts that arise from relative motion between the transmitter and receiver. Since we are conscious of the tropospheric and ionospheric propagation, the Rayleigh fading is deemed a useful model.

5. PERFORMANCE EVALUATION

The factors influencing fading are multipath propagation, speed of the mobile (Doppler shift), speed of the surrounding objects and the transmission bandwidth of the signal. The multipath delay spread leads to time dispersion and frequency selective fading. Three fading modes which we investigated in our implementations are No fading, Flat fading and dispersive fading.

Figure 4: Response of SNR, BER and Bit rate under dispersive Fading

Figure 4 represents the plots of SNR, BR and PER under dispersive fading. The signal to noise ratio plot on the figure shows a slow and hilly distributed fluctuation of amplitude delay of the transmitted signal over a period of time. At a time of 0.08 sec, the SNR recorded a value of 15.98dB which is very low depicting that the transmitted signal strength is very weak with respect to the noise levels. This will eventually allow a lower data rates and more/refer transmission-all of which offer lower bit rate to the users. At a time of 1 sec, it recorded an improved SNR of 22.52dB which also shows a little improvement on bit rate, although still very inauspicious. The BR shows a more flat distributed relationship with a 180Mb/s at 0.08 sec and 240Mb/s at 1 sec indicating that the system’s throughput under this fading scheme is very small while the BER on the other hand shows a sharp spikes of plot with a recorded value of PER of 4% at 0.08sec and 6% at 1sec which shows that the total number of transferred bits error during the period gradually increased. It can be seen from the analysis so far under this fading scheme that the minipop can still show data transceiver integrity.

Figure 5 is a representation of our cognitive minipop-AP simulation plot under no fading channelization scheme. The performance of this system where evaluated under the following parameters; SNR, BR and BER. From the plots, one can denote that SNR was kept approximately constant throughout the period of the simulation. At 0.08sec of this fading scheme, the signal to noise ratio is seen to be 29.75dB while at 1sec, it is seen to fluctuate to 29.79dB. The BR plot on the other side is seen to be fairly constant, remaining at 480Mb/s throughout the simulation period, indicating that the system was highly stable under this scheme. The BER shows no plot indicating that there was no bit error in the signal transmission which implies that the PER recorded a zero percent value throughout the period of the transmission.

Also, the plots on figure 6 show that three parameters were analysed fading scheme and they are SNR, BR and BER. The signal to noise ratio shows a rough distribution with some points and progressively increase with time towards the end of the plot. However, at 0.08sec, it recorded a value of 27.93dB while at 1sec, it recorded a value of 27.79dB but continuously increase towards 30dB which depicts that the transmitted signal strength is strong with respect to the noise levels. The BER show no plot indicating no bit error in the signal transmission while the Packet Error Rate (PER) is used to test the performance of an access terminal’s receiver. It is the ratio, in percent, of the number of Forward Test Application Protocol (FTAP) test packets not successfully received by the access terminal (AT) to the number of FTAP sent to the AT by the test set. For high SNR, in a wireless system, it is possible to assume that errorless period length follows a geometric distribution with parameter $\lambda(\xi)$ which is related to the mean length $L$ through:
\[ \lambda(t) = 1/\omega = BER \]  \hspace{1cm} (5)

From the receiver perspective, the probability that a packet contain an error event (or a part of an error event) is simply given by the probability that the errorless period begin at the first bit of a newly received packet lasts for less than the packet length \( N \).

Hence PER is given by:

\[ \text{PER} = \sum_{i=1}^{N} \lambda(t)(1 - \lambda(t))^i = I - (1 - \lambda(t))^N \]  \hspace{1cm} (6)

Combining 1 and 2, we have

\[ \text{PER} = 1 - (1 - \text{BER})^N \]  \hspace{1cm} (7)

Where \( N \) = Packet Length.

From the plot and proof, one can deduce that the PER of the system under flat fading is zero percent at 0.08sec and at 1sec. The BR plot of the system under this scheme was seen to be progressively constant with a recorded value of 360Mb/s and an improved value of 480Mb/s at 1sec.

Figure 5: Response of SNR, BER and Bit rate under No fading

Figure 6: Response of SNR, BER and Bit rate under Flat fading
6. DISCUSSION

Our investigations with our compressed minipops-AP show that generic WLAN-AP for high density networks lacks robustness and flexibility in the context of QoS metrics transmission for high density network environment. Hence, in future work, the model of cognitive hotspot model reengineered for quality of service provisioning in a high density environment will address Congestion management using VLAN and Resource Reservation Protocol, Network scalability, and Adaptive Modulation Control for packet drop (hysteresis loss), and Co-interference Model for composite Minipop-APs. The result from figure 5 to figure 7 show that the effect of the various Raleigh fading on hotspot environment. More particularly, with the simulation parameters, the best result is obtained at no fading scenario with avg. PER of 0%, avg. SNR of 29.77dB, avg. BR of 480Mb/s i.e. throughout for the frequency bands in the minipop-APs OFDM transceiver.

Following our deductions earlier and previous works, for downtime avoidance and excellent QoS from users perspective (which will form our major drive for future work), we will show an intelligent (efficient) interconnection of this cognitive Minipop-APs for limitless subnets in high density hotspot environment that is capable of providing higher network capacity for efficient packet delivery and congestion free network. In improving the throughput, latency, RSS, etc, in our future work, taking cognizance of the initialization processes of the generic WLAN infrastructures, such as the Minipop switch interconnection in the CHN architecture, we, shall introduce the following in our reengineering viz:

- An Analytical model that will handle traffic control issues in between the switching system and the mobile user end device
- An Adaptive Modulation Control Scheme for Hysteresis and low SNR which is meant to suppress or normalize fading effect while being fault-tolerant at the same time.
- Subnet location isolation for every user in the cognitive hotspot architecture.
- An MLS reengineering for Virtual LAN (VLAN) and Resource Reservation Protocol (RSVP) for broadcast traffic optimization.

Consequently, we have succeeded to show the extent of the efficiency of our proposed cognitive minipop-AP, our future work will concentrate on the deployment of this AP in a high density hotspot environment in order to achieve a network capable of supporting high performance workloads (HPW) such as heavy web applications, data and video services. The performance of this network will be measured by QoS parameters such as throughput, latency and service availability from the end user application perspective, such that will support multiple flow from various subnets could be localized within such subnet, but still share link capacity of the MLS fairly.

7. CONCLUSION

We formulated and developed a minipops-AP which is a compressed and enhanced form of the Tranizio-Wavion minipop infrastructure we have at UNN. In developing its physical layer and the simulation model, we used the UNN real life scenario and that of the original IEEE 802.11 standard. Our compressed minipops-AP physical layer provides an economical and flexible solution without the need for physical wiring and redundant hardwares. We presented the architecture and its various block sets using Matlab Simulink as a simulation tool in figure 3. Also, we succeeded to present our model under Raleigh channelization effects after developing the simulation model as shown in figure 3, we performed our experiment by varying the three fading constraint on the channel at 0.08sec and 1sec respectively. Due to the nominal bandwidth in our connections, we showed the behaviour of SNR, BER and BR for our model. From the results obtained, the best results was obtained at no fading while the least was obtained under dispersive fading based on the three fading scheme studied in this work. Our previous work opined the need to ensure QoS to the end user and also showed the limitations of generic WLAN (G-WLAN) in high density hotspot environment while our future work will be on CHN that will be a decentralized location independent system based on well structured integrations which makes for easy-of deployment-and-use, efficiency in QoS as well as offering a well defined secured system that connects mobile guests to secured wireless switching centre. Thus, the interconnection and the deployment of these compressed minipop-APs will be shown in the future work. In conclusion, using the Cognitive Minipop-AP Specifications which is operated at 2.4GHz baseband frequency, the behaviour of SNR, PER and BR considering Rayleigh channelization showed better performance for flat and no fading scenarios more excellently, though dispersive fading is evident, but its effect will only be significant in generic WLAN alone and not on Cognitive minipop-AP.

References

[1]. http://www.eweek.com/article2/0,3959,485099,00.asp


This work is licensed under a Creative Commons Attribution 4.0 International License.

DOI : 10.24297/ijcds.v4i2.5067