SPECTRAL EFFICIENCY OF BANDWIDTH ALLOCATION IN IEEE 802.16M AND AGGREGATION SCHEME IN MOBILE ADHOC NETWORK

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ABSTRACT

With today's restricted information measure, high rate services, and energy potency needs, increasing the spectral potency and minimizing the consumed power becomes essential. Investigation on the problems preventive spectral potency maximization and consumed power decrease for mobile systems is crucial for finding this modern problem. This paper aims to optimize the employment of the scarce mobile spectrum and therefore the quantity of power consumption within the multi-cell IEEE 802.16m networks.

We more propose a low-complexity, best power allocation strategy to maximize the information rate of the planned relay strategy. Simulation results recommend that our strategy obtains a considerable gain over the per-subcarrier DF relay methods, and conjointly outperforms the amplify-and-forward (AF) relay strategy in a very wide signal to- noise-ratio (SNR) region.

A close review of assorted MU-MIMO transmission and downlink techniques then follows, informative the underlying ideas and accenting the importance of MU-MIMO in cellular communication systems. This paper conjointly touches upon the subject of MU-MIMO capability moreover because the promising convexo-convex optimization approaches to MIMO system style.

Index Terms : Wimax 16m, buffer management, fuzzy, cross-layer optimization, network design, Hop by Hop Retransmission Cell Selection, Demand, Fourth Generation (4G).

II. INTRODUCTION

IEEE 802.16m is projected as associate degree improvement for the prevailing mobile WiMAX systems to satisfy the necessities of next-generation mobile broadband communication within the framework of IMT-Advanced [1]. Relay transmission as an economical approach for extending the coverage space and enhancing the output is laid out in IEEE 802.16m common place [2], [3]. Relay-cooperation transmission is often seen as a sort of cooperative communications, during which a relay station helps to forward knowledge between mobile stations and base stations.

WiMAX may be a wireless digital communications system that gives fastened and absolutely mobile web access. The present WiMAX revision provides up to forty Mb/s, with the IEEE 802.16m update and expected to supply up to one Gb/s. Cell coming up with is a vital and basic demand for WiMAX networks. Such a style issue embraces programming coverage of the bottom station for spot with reference to the present and future necessities, desired QoS and obtainable capabilities. Primarily based upon these constraints, the goal is to attenuate the network operator's total system price.

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In this paper, we tend to tackle the difficult analysis drawback of planning economical spectrum allocation mechanism for psychological feature radio networks. We more formulate an influence allocation drawback to maximize the rate of exchange, that is outlined because the maximal rate is often at the same time achieved in each direction.

The IEEE 802.16e relies on the orthogonal frequency division multiple access (OFDMA), represented as a key technology for Wimax physical layers [1,3,6,12], is employed to regulate channel information measure and to apportion subscriber station (SS)subcarriers in step with channel state. OFDMA additionally permits multiple Selective Service System to use numerous subcarriers to at the same time transmit OFDM symbols, thus known as SOFDMA (Scalable-OFDMA). In an exceedingly base station (BS), all OFDMA subcarriers area units divided into teams (known as subchannels) that area unit allotted to totally different Selective Service System with matching information measure and quality of service (QoS) necessities [14].

The rest of this paper is organized as follows. In section 1 we explain the introduction part about bandwidth allocation. We also describe the related work in section 2 and system model in section 3. In section 4 we describe the OFDMA system and System Design in section 5, Radio Technologies and network technology in section 6 and in section 7 respectively. In section 8 provide Simulation Results with Performance analysis. Finally, in section 9 we conclude our survey by summarizing lessons learned.

II. Background and related work

2.1. Cross-layer approaches

Currently, superimposed design dominates in networking style and every layer is operated severally to take care of transparency. Among these layers, the physical (PHY) layer is liable for the raw-bit transmission, whereas the media access management (MAC) layer arbitrates access to the shared wireless resources. However, the standard layer-wise design seems to be inflexible and ends up in the inefficient wireless resource utilization.

An integrated and adaptation style across totally different layers is so needed to beat this limitation. As a consequence, cross-layer improvement across PHY and therefore the waterproof layers is desired for wireless resource allocation and packet programming [10]. In cross-layer improvement, channel-aware approaches are introduced and developed to expressly take into consideration wireless channel state data (CSI). Taking advantage of the channel variation across shoppers, channel-aware approaches are shown to well improve the network performance through multiuser diversity, whose gain will increase with the quantity of shoppers.

2.2 RELATED WORK

Wail Mardini et al [4] have planned a changed weighted spherical robin (MWRR) programming algorithmic rule for WiMAX. Their algorithmic rule prevents the problems caused by weighted spherical robin algorithmic rule WRR that causes inessential delay for class of services. Their algorithmic rule minimizes the common delay and enhances the common outturn significantly for lower categories by increasing the scale of service spherical in

WRR. Their algorithmic rule did not think about the quality state of affairs.

J. D. Mallapur et al [16] proposes a fuzzy based mostly buffer management theme that performs buffer allocation and packet dropping for wireless transmission networks within the context of future generation cellular networks. Buffers square measure allotted to requesting applications by victimization buffer allocation issue Associate in nursing packets square measure born for an application by victimization dropping issue. A buffer allocation issue for requesting application is computed adaptively supported 3 fuzzy parameters of Associate in Nursing application, namely, priority, rate of flow and packet size.

III. System model and Spectrum auction

This section introduces the notation and therefore the system model of our work, followed by the presentation of the planned spectrum auction framework and therefore the formulation of the auction game underneath the framework.

A. Spectrum auction framework

We apply auction mechanisms to tackle the spectrum allocation downside. By definition, Associate in Nursing auction may be a localized market mechanism for allocating resources and might be developed as a non-cooperative game, wherever players square measure bidders, methods square measure bids, each allocations and payments square measure functions of bids. A widely known auction is that the Vickrey-Clarke-Groves (VCG) auction [6], that is shown to possess social best outcome.

However, the VCG auction needs world data to perform centralized computations. To beat this limitation, 2 one-dimensional share auction mechanisms, specifically the SINR auction and therefore the power auction square measure planned in [10] to check the spectrum allocation downside in single-PU networks. Within the following, we tend to extend the work of [10] to the multiple-PU state of affairs by proposing the two-dimensional SINR and power auction, as shown in algorithmic rule .1

Algorithm 1 Two-dimensional spectrum auction algorithm

Price announcing: Each PU n announces a reserve bid β_n and a price $\pi_n > 0$.

Bidding: Based on β_n and π_n, each SU i submits a bid (a_i, b_i) where $a_i \in \mathcal{N}$ and $b_i \geq 0$.

Spectrum allocation: Each SU i is allocated a transmission power p_i from PU a_i as follows:

$$p_i = \frac{P_{a_i}}{g_{ia_i}} \frac{b_i}{\sum_{j \in \mathcal{M}, a_j = a_i} b_j + \beta_{a_i}}. \quad (2)$$

Payment collection: Each SU i pays PU a_i a payment $C_i = \pi_{a_i} \gamma_i g_{ia_i}$ in the SINR auction and $C_i = \pi_{a_i} p_i g_{ia_i}$ in the power auction.

Algorithmic Rule .1: Relay and Cooperative Communications

Relay and cooperative networks also are promising architectures to enhance engineering. Relay networks save energy in 2 ways: reducing path loss attributable to the shorter transmission vary and probably generating less interference attributable to the low transmission power. The results show that transmission with relays will scale back energy consumption in CDMA cellular networks; and also the higher the trail loss exponent, the lot of energy which will be saved. Power management will more scale back energy consumption.

The benefits of relay transmission area unit examined in [25], wherever the transmission delay and energy consumption of relay node area units each thought of within the exchange between total energy consumption and end-to-end communication rate in AWGN relay channels is analyzed.

B. Cross-layer improvement

As indicated in [25], cross-layer style is another outstanding approach to cut back energy consumption. The look necessities for energy potency across the link, it is shown that, as a result of every layer of the protocol stack has an Associate in Nursing inherent mutuality on alternative layers, cross-layer ways will considerably improve engineering through accommodative transmission and resource allocation schemes appreciate service, traffic, and atmosphere dynamics.

From the antecedently mentioned ways, it is additionally simple to check that cross-layer style plays a key role in reducing the holistic energy consumption, particularly for networks with MIMO and OFDMA transmission schemes.

From the margin accommodative improvement drawback that aims at minimizing the general sending power of users with individual rate constraints in realistic OFDMA systems is NP-hard. Moreover, 3 suboptimal approaches (relaxation constraint, drawback rending, and heuristics) are projected to get nearly best solutions. Obviously, the cross-layer improvement additionally ought to take into account sign overhead.

IV. Energy economical theme for OFDMA system

System description

Power-bandwidth improvement (see Fig. 4.1) and associate in nursing implicit discussion may be found and summarizes existing approaches within the context of power management for code division multiple access (CDMA) networks.

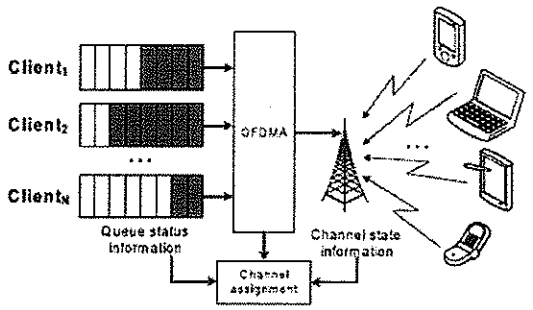

Figure 4.1. General power-bandwidth improvement theme

Applicable for OFDMA systems work energy economical improvement for OFDM and OFDMA communications square measure given. For the sake of simplicity here we tend to contemplate one cell of a wireless cellular network. They're square measure N subscriber stations (clients) and one base station (BS) in such a system. The SB arbitrates all activity within the cell and will communicate with its shoppers within the downlink (DL) sub-frames.

In what follows, we tend to target the transmission channel solely, as information transmission consumes rather more super power than reception [7,8]. Channel time is broken into (sub-) frames. (see Fig. 4.1). Specifically one shopper could transmit its information at one quantum per one frame. However, a shopper could utilize over one and up to K completely different quanta for its information transmission during a single frame.

It is assumed that attenuation factors square measure notable at the SB. they must be taken into consideration to reduce the next power consumption. Currently, we tend to conjointly assume that the packet buffer of a shopper has been often full. Whereas this assumption invokes the static steady-state cellular system operation, it all the same could bring vital conclusions concerning the performance of the energy economical schemes [38].

V. System Design

We take into account the two-way OFDM relay network shown in Fig.5.1: 2 terminal nodes T1 associate degree T2 exchange data via an intermediate relay node TR. Assume that every node incorporates a single antenna and operate in an exceedingly half-duplex mode, i.e., sending and receiving in orthogonal time slots [1], [2]. All the nodes use OFDM air interface with an equivalent N subcarriers.

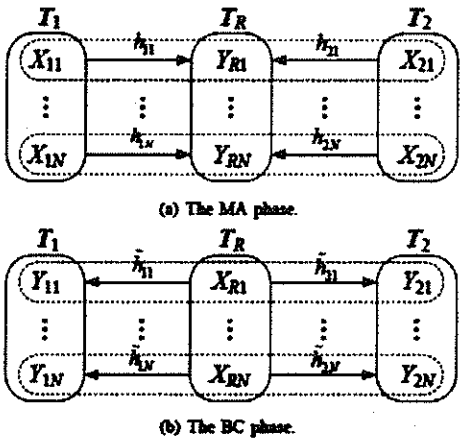

Figure5 1 :System m odelof tw o-w ayOFDM relaynetw ork

The DF relay procedure contains of a m ultiple-access (M A) section and a broadcast (BC) section w hile notdirect transm issions, as show n in Fig.5 .1 .W e tend to setX i= (X i1 , . . . X iN) and Y i= (Y i1 , . . . , Y iN) since i= one, 2 R , w herever X in and principle denote the norm alized transm itted and received signal w ithin the ordinal subcarrier at Ti. W ithin the M A section , T1 and T2 transm it X 1 and X 2 at the sam e tim e to the relay node, and therefore the relay TR perform s m ulti-user detection to com pletely decrypt X 1 and X 2 .

Specifically, within the ordinal subcarrier, h1n and h2n denote the channel coefficients from T1 and T2 to TR, severally, ˜h1n and ˜h2n denote the channel coefficients from TR to T1 and T2, severally. Thus, the received signals Yin's within the ordinal subcarrier at Ti's square measure given by

$$Y_{Rn} = \sqrt{P_{1n}}h_{1n}X_{1n} + \sqrt{P_{2n}}h_{2n}X_{2n} + Z_{Rn}, \quad (1)$$
$$Y_{1n} = \sqrt{P_{Rn}}\tilde{h}_{1n}X_{Rn} + Z_{1n}, \quad (2)$$
$$Y_{2n} = \sqrt{P_{Rn}}\tilde{h}_{2n}X_{Rn} + Z_{2n}, \quad (3)$$

where Pin denotes the transmit power within the ordinal subcarrier at Ti, and Zin denotes freelance complicated additive white Gaussian noises with zero mean and unit variance, i.e., Zin ~ CN(0, 1), for i = 1, 2,R. Therefore, Pin primarily denotes the corresponding transmit SNR.

We assume that $\mu \in (0, 1)$ denotes the fastened proportion of your time slot allotted to the MA part, and everyone the terminals area a unit subject to separate power constraints PN n=1Pin $\leq$ Pimax (i = one, 2,R), wherever Pimax denotes the most obtainable power for Ti.

Infrastructure design

In the Infrastructure design, a MS will solely access a BS/ AP within the one hop manner. MSs Underneath the transmission variance of identical BS/AP shall communicate with one another through the BS/AP. Communications between completely different cells is a unit routed through backbone/core networks. The BS/ AP could also be able to execute one or multiple communication standards/protocols to satisfy completely different demands from MS.

A psychological feature radio terminal can even access completely different forms of communication systems through their baccalaureate or AP.

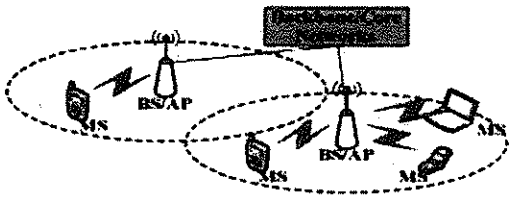

Figure 5.2 : Infrastructure design

A. Path choice

It makes a specialty of a cellular psychological feature radio network because the framework. To boot, it is accustomed ponder a replacement admission management because the thanks to boost the performance of the rule. It investigates the results of belongings users' amendment by reversal base stations and shows the following power saving efficiency. Also, it demonstrates but an easy admission management rule can improve system performance in terms of power consumption, in real time, user can select any type of application like as video occupation, voice occupation, net and e-transfer soon, supported that the trail are going to be elect.

B. Wireless Network Evolution Standards

The 3G to psychological feature transition, supported by such technologies, such developments will in any case be within the middle of the ongoing evolution of already anticipated 3G services as follows:

Send/receive e-mail
Internet browsing (information)
On-line transactions (e-business)
Location-dependent information
Company info access
Large-file transfer.

C. Network choice

Network choice during heterogeneous all-IP wireless network surroundings depends on many factors. The WNSF is triggered once any of the subsequent events occur : (a) a brand new service request is made; (b) a user changes his/her preferences; (c) the MT detects the provision of a brand new network; (d) there is severe signal degradation or complete signal loss of this link.

Coverage primarily based Cell choice (CBCS) algorithmic rule for 4G is introduced.

Example situation for real network:

A coverage space is split into cells and every cell is served by a base station. Every base station is appointed to a gaggle of channels. Once a mobile device is during a decision and transfers from this cell to a neighbor cell, then the network has to exchange the device to the neighboring base station. This method is known as hand off.

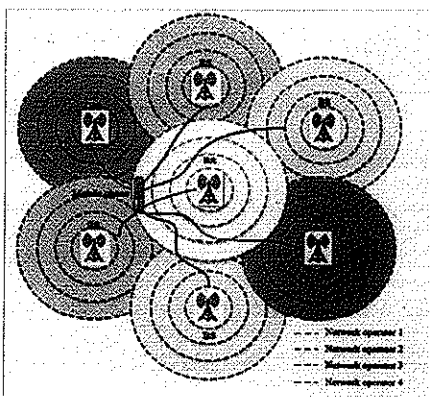

Figure 5.3. Example For state of affairs during a Real Network

The mobile node receives all the bottom stations, however at completely different power levels. The mobile user

selects the robust cell for every carrier. Fig.5.3. illustrates the instantiation state of affairs for real network base station choice.

VI. Radio Technologies

New wave

Due to the potential of managing frequency property problems for broadband access, the Orthogonal Frequency Division Multiplexing (OFDM) primarily based wave continues to be thought of terribly promising within the future. However, it is expected to be skimpy to deal with all the challenges of numerous applications and numerous situations in 5G are shown in Fig 6.1. To accommodate the new services like large Machine Communication (MMC) with slim band, filter primarily based various waveforms, like Filter-Bank Multi-Carrier (FBMC), are the sensible candidates for the new air interface due to the great performance of spectrum localization and loose necessities of synchronization. Among the new waveforms, filtered OFDM and UFMC (Universal filtered multi-carrier) is a unit attracting a lot of attention since the benefits of OFDM, e.g., simple compatibility with MIMO, area unit maintained and out-of-band (OOB) emission is reduced by applying digital filters.

Aiming to satisfy the varied necessities within the future with completely different waveforms, software package outlined configurable waveforms are a unit expected to be a decent selection of the 5G air interface style. Dynamic OFDM or filtered OFDM configuration with completely different subject is supported for various use cases. To boot, new functionalities are introduced simply by upgrading the software package with low value.

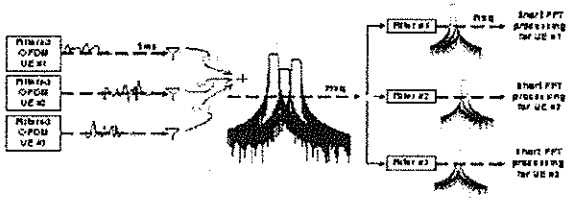

Figure 6.1. Example of asynchronous transmission supported F-OFDM

VII. Network Technologies

UDN

The main plan behind UDN is to extend the density of deployed stations by introducing verdant low power tiny cells, therefore on improving system capability and network coverage. Obviously, UDN leads to a lot of overlapping space among cells. Therefore, interference and quality management become essential problems. Besides, it will be essential to cut back the CAPEX/OPEX, see Fig. 7.1. Therefore advanced receiver and interference handling approaches, new architectures and protocols shall be devised to handle the higher than issues.

Further, accelerated recognition mechanisms will be achieved by introduction of special synchronization signals; 2) quality management: as quality frequency are going to be very high in UDN, new affiliation and quality handling schemes, particularly aided quality ways shall be applied to ensure user's seamless quality experience; concurrent multiple affiliation, like a UE connecting with over 2 APs, will be accustomed improve the quality expertise of the user and improve rate within the cell edge; 3) CAPEX/OPEX reduction: easy access node readying are going to be essential for UDN, which needs low value nodes, straightforward backhauling (wired or wireless) and automatic configurations.

Meanwhile, versatile and automatic network procedures shall be designed for economical operation, considering the variety and quality of UDN infrastructures, as well as each C-RAN and DRAN. Besides, UDN conjointly brings the bachelor are degree and UE nearer. It will build the communication link tend to be risen, particularly just in case of high frequency communication with huge antennas deployed.

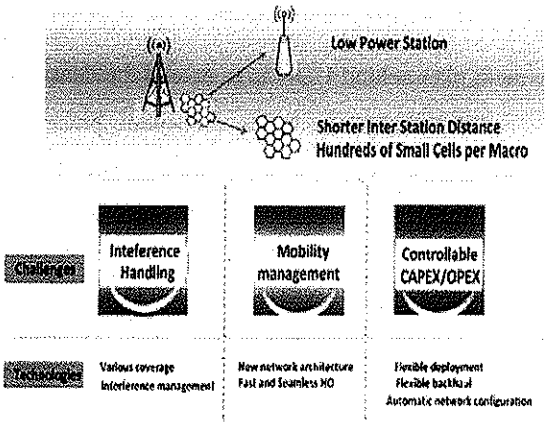

Figure 7.1 .Challenges and technologies for UDN

D2D

D2D direct communication is a vital technology space for 5G that opens new business opportunities for operator managed networks to support new use cases, services, and situations. The attainable use cases embody, for instance, to relay info within the Multi-hop Wireless Edge Network, to be used as a front haul in mesh networks for UDN, to support safety applications, low latency and high responsibility in transport Networks, and to support MTC and IoT.

The motivation of D2D is that additional and additional applications need location discovery and communication with neighboring devices, and also the handiness of the D2D practicality would scale back the value of communication and facilitate effective sharing of resources. Service suppliers will more profit of D2D practicality to require some load off of the network during a native space like a bowl and what is more, D2D communication may be of crucial use in natural disasters.

However, there exist several challenges concerning D2D, as well as economical interference management theme, signature style, as shown in Fig. 7.2, with the aptitude of economical interference management via central controller, may well promise far better performance than D2D while not network management.

Therefore, sanctionative network controlled D2D practicality within the 5G style ought to be thought of from the start to make sure economical, superior mechanisms that area unit well integrated and harmonized with alternative aspects of 5G.

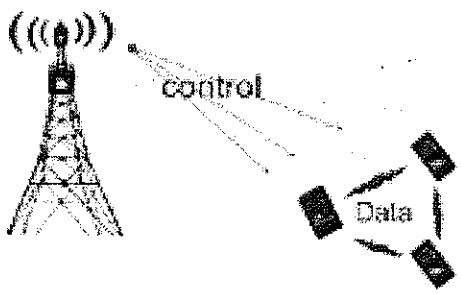

Figure 7.2. Network controlled D2D communications

VIII. Simulation Results with Performance analysis

Simulation Model and Parameters

Network machine (NS2) [20] is employed appraise the performance of the projected Fuzzy primarily based

Dynamic Buffer Management (FBDBM) theme. The projected theme is enforced over IEEE 802.16 Macintosh protocol. Within the simulation, purchasers (SS) and also the base station (BS) are deployed in a very one thousand meter x one thousand meter region for fifty seconds simulation time. All nodes have identical transmission vary of five hundred meters. Within the simulation, variable cosmic background radiation traffics are used. There are eight downlink traffic flows from Bachelor of Science to SS. The simulation settings and parameters are summarized in Table one.

Table I

Area Size	1000 x 1000
Mac	802.16
Clients	10
Radio Range	500m
Simulation Time	50 sec
Routing Protocol	DSDV
Traffic source	CBR
Physical Layer	OFDM
Channel Error Rate	0.01
Packet Size	1500 bytes
Frame Duration	0.005
Transmission Rate	250 Kb, 500 Kb,750 Kb, 1000 Kb
No.of flows	2,4,6,8

The system parameters are unit given in Table I. Having the simulation eventualities and every one the system parameters, the best relay choice, power allocation and subcarrier assignments area unit evaluated victimization algorithmic program. The step size for ë and ì is ready to zero.01 divided by Relay choice is performed per metal, since metal is that the smallest resource unit for the LTE network. The simulation situation (user locations, choice of the GBR users and also the assignment of the applications to the users) is continual one hundred times to urge a good result. The multipath channel elements area unit continual over a thousand times.

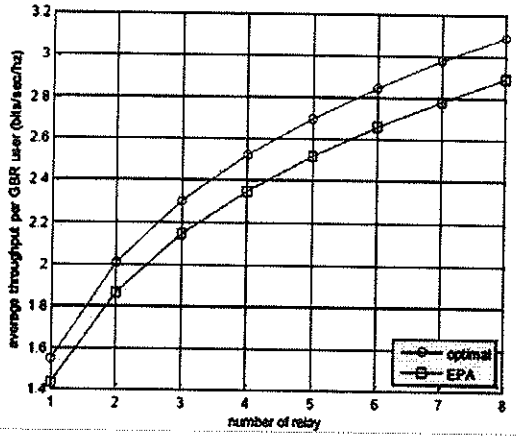

Figure. 8.1 Average throughputs for GBR user as a perform of number of relays

Fig. 8.1 shows the typical turnout per user in bits/sec/Hz for the best theme, and ancient best schemes as a perform of the amount of relays. The Environmental Protection Agency theme provides slightly lower turnout compared to the best theme, as a result of the best theme continuously allocates subcarriers by considering the channel condition and minimum rate demand. So, some users have terribly high rate for most of the subcarriers area unit allotted to those users, whereas others have terribly low rate as a result of only a few or no subcarriers area units allotted to them.

The best theme considers each minimum rate demand further as channel condition, and distributes the subcarriers to the users supported their minimum rate demand. So, once we average over the overall variety of channel realizations, the typical turnout is higher for the best theme, however it violates fairness that is additionally evident in Fig.8.1. However, the performance gap for the

best theme reduces with a rise within the variety of relays. It is noted that every one, best themes offer lower turnout compared to the normal best scheme.

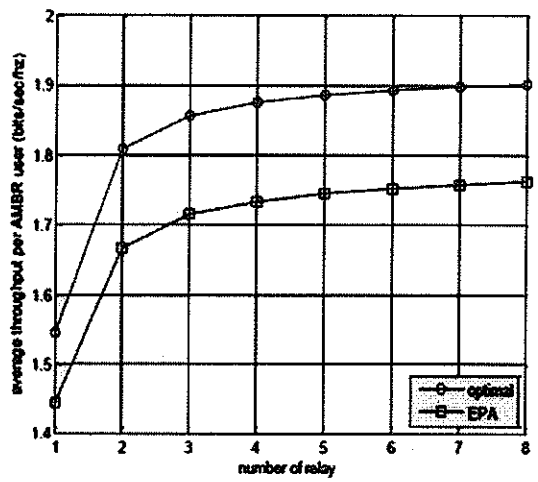

Figure 8.2. Average turnout for AMBR user as a perform of variety of relays, ∂=0.5.

The Environmental Protection Agency theme with power, refinement performs well, though they need lower procedure quality compared to the best one. The Environmental Protection Agency theme has higher rates compared to the best theme. This is often attributable to the ability refinement and subcarrier adjustment employed in the Environmental Protection Agency theme.

The typical turnout for the GBR users for all schemes as a perform of the amount of relays is shown in Fig.8.2.The traditional theme provides rock bottom turnout since it takes into account each users' minimum rate needs and channel condition the best theme has the very best turnout altogether cases. However, all best schemes exhibit performance near one another with the increase in variety of relays will increase.

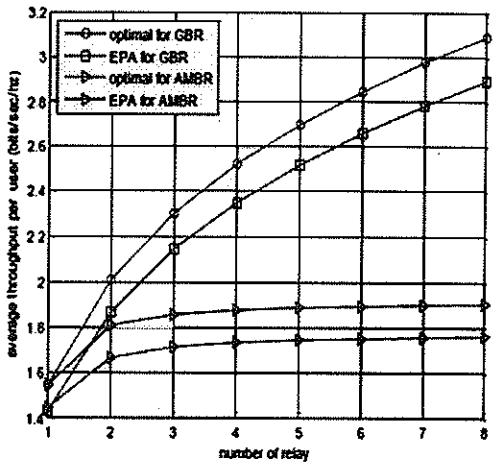

Figure 8.3. Average turnout for GBR and AMBR user as a perform of variety of relays, ∂=0.5 comparison

The reason is that every one, best schemes initially assign subcarriers and power to the GBR user, and once all GBR users area unit happy, the remaining subcarriers and power area unit then allotted for the AMBR users. So, the reverse characteristic has been discovered just in case of AMBR users for all themes except the best scheme, as shown in Fig.8.2. Since the AMBR users do not have any minimum rate needs, the normal best theme provides the very best turnout. Fig 8.3 provides the comparison of turnout for GBR and AMBR user with relay distance of ∂=0.5.

IX. Conclusion

With the worldwide commercialization of 4G LTE, the interest of the wireless community is shifted to R&D on 5G. There is already an exact level common agreement among wireless stakeholders on 5G needs, and application eventualities. To satisfy the user demands, key performance indicators are a unit known, further as potency needs. Even supposing it's still so much manner of drawing a transparent image, the long run network may be visualized as being Super quick, Soft and inexperienced.

To attain the visionary options, the normal principles in coming up with a wireless network ought to be deeply revisited in terms of many innovative R&D themes.

In this paper, a coverage primarily based cell choice algorithmic program for WiMAX is introduced. The projected algorithmic program is well appropriate to decide on the most effective coverage base station. The main criteria for cell choice like demand, profit and capability is additionally given to pick the bottom station. The performance of the projected CBCS algorithmic program is compared with the prevailing approaches. We have projected a unique DF relay strategy for two-way OFDM relay networks and derived its possible rate region. The key plan is creating use of the cross-subcarrier channel writing to totally exploit frequency selective attenuation.

We then extended the projected auction framework to the tough situation with free spectrum bands by developing associate degree algorithmic program supported no-regret learning to succeed in a metallic element of the auction game. Previous analysis shows that optimized energy-efficient style (including network readying, transmission theme and resource management) may considerably cut back the energy consumption of the complete network. All the same, current analysis result area unit still quite preliminary and plenty of challenges stay.

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