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Active Resource Allocation with coordinated Base station for Multiuser Networks

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Abstract: Resource Allocation is a kind of scheduling technique of balancing the multiuser channel spectral efficiency and feedback load. This paper addresses the problem of traffic inelasticity in dynamically configured network and its impact on Average Spectral Efficiency losses. Allocating fixed bandwidth to meet dynamic user requirements will lead to communication overhead. This paper proposes the problem of traffic inelasticity by routing the dynamic user to utilize the neighbourhood base station. Dynamic bandwidth allocation for user sub channel is optimally controlled by a global router which tracks and monitor the status of various base station within its coverage area, the over flow of user requirements of a base station is balanced by routing the excess user sub bands to the ideal or available neighbour base stations assuming synchronizations between these base stations, which increases the individual base stations spectral efficiency and reduces the hardware overhead. The performance evaluation of two scheduling schemes "On Off Based Scheduling"-(OOBS) and "Switched Based Scheduling"-(SBS) has been introduced and the switch based scheduling scheme is proved as comparatively efficient.

Keywords: Multi-user scheduling, bandwidth allocation, feedback load and spectral efficiency.

I. INTRODUCTION

In order to maintain the rapid growth rate, the communication system must achieve high data rate in a limited spectrum and efficient utilization of resources available. So, the wireless communication system must achieve very high spectral efficiency which provide high data rate for the multimedia services. On the other hand the resources that are available must be used efficiently to respond to the desired requirements. Wireless communication system must operate with the limited and usually expensive spectral resources. A major challenge is to design the wireless communication system such that this limited resource can be utilized to the fullest extent. The way of improving the resource utilization is to increase the spectral efficiency via the use of active bandwidth allocation and by scheduling the users.

Only one user is scheduled at a time by single user scheduler. Parallel multiuser scheduling schedules multiuser at a time. The goal is to increase the ASE by dynamically routing the users without any complexity of implementation. The high efficiency can be obtained with the use of adaptive modulation and diversity. High spectral efficiency depends on the total number of feedback load where the increased feedback load causes the complexity in hardware.

Active resource allocation is the process of allocating bandwidth to a set of traffic. Scheduling algorithm provide mechanisms for bandwidth allocation and multiplexing. The two used scheduling schemes are OOBS and SBS [1]. The selections of users in both scheduling schemes rely on the SNR threshold which reduces the complexity of implementation and increases the user frequency.

Issues in multiuser scheduling are handled with two different schemes. The performance evaluation of OOBS and SBS [1] scheme are analytically compared to find the less complexity scheme without considerable performance degradation in the feedback load and the spectral efficiency. OOBS scheme has the advantage of scheduling the user with the greater SNR than the threshold SNR, but the average spectral efficiency is not optimized since there is an unused bandwidth loss. SBS scheme [5] demands for the number of acceptable users based on the SNR threshold and filling the empty channel with best sorted un-acceptable users SNR in the case of in-sufficient acceptable users. To perform effective scheduling, channel state information (CSI) [1] for users is required, and is obtained via their respective feedback channels. Multiuser scheduling is studied assuming the availability of the perfect CSI which would require a high bandwidth overhead. Because of the unused resources in OOBS scheme, thus the synchronization between the basestation is obtained to utilize the available bandwidth by dynamically routing the users.

This paper is organized as follows. Section II presents the literature survey whereas section III present model and mode of operation, section IV deals with proposed bandwidth allocation scheme, section V provides performance analysis, section VI illustrates these results via some selected figures. Finally section VII offers some concluding remarks.

II LITERATURE SURVEY

Slim Ben Halima et al [3] proposed three multiuser scheduling schemes where fairness is not taken into account which is based on MS-GSC combining. There is 1) Feedback efficient scheme (FBEF) 2) The bandwidth efficient scheme (BWE) 3) The bandwidth efficient power greedy scheme (BEPG), where FBEF has the key performance of low spectral efficiency and low feedback load. BWE has worst performance in terms of power savings. More specifically, in the all three scheme when a user is scheduled in a time slot it is removed from the scheduling operation in the next round until all the remaining users have been scheduled. An enhanced equal access (EEA) scheduling policy is also suggested which increases the short term fairness at the expense of certain degradation in the performance of the system mainly in terms of spectral efficiency. In Haewoon Nam et al [4] describes the scheduling scheme based on switch diversity with adaptive modulation. Here the used multiplexing technique is TDMA, where only one user is selected by the scheduled within a given guard period.

III MODEL AND MODE OF OPERATION

In this section we present the system model, channel state information of scheduling schemes and the mode of operation of two scheduling schemes.

A. System Model

We consider the Code Division Multiple Access (CDMA) [5] system for the simultaneous scheduling of many number of users instead of TDMA, where TDMA schedules only one user in a time slot. The base station has to probe all k_s users among total k users in a single time- slot. The assumptions are made such that the multiuser signals are orthogonal and there exist no inter-cell interference and no co-interference [8] among the users. We also assume that there exist the feedback path between the transmitter and the receiver. This implementation is made in a discrete time fashion with a time slot consists of a guard time period and a data transmitting period. During the guard time period the base station probes the user for scheduling the K_s users' in-order to give access to the available channel. Due to the multiuser nature the problem of interference occurs in practical wireless communication system. CDMA have been proposed to separate different users, by putting their traffic on orthogonal channels thus minimizing the mutual interference. The problem with orthogonal multiuser [8] system is the in-efficient use of total system resources, especially in wireless multipath fading environment.

The best way to communicate a message signal whose frequency spectrum does not fall within that fixed frequency range, or one that is unsuitable for the channel is to change a transmittable signal according to the information in the message signal. Modulation techniques have three properties of good bit error rate performance, power efficiency and the spectral efficiency. The digital modulation scheme of M-quadrature amplitude modulation (M-QAM) [3][4] is used for the scheduling of users and the channel used is the AWGN channel for high system ASE. For uncoded communication, a solution is to use the modulation scheme that have high spectral efficiency such as M-ary QAM, and thus provide high speed communication with limited bandwidth. The constellation size $M_n = 2^{n+1}$ (n=1,2,….N) where N=8 [3]. The SNR range is divided into N+1 fading regions that can be divided by the SNR threshold. The set of SNR threshold can be optimized subject to a specified BER constraint. The lower SNR boundary is set to the required lowest boundary SNR to achieve the target pre-determined BER ($BER_o=10^{-4}$) [4]. Based on the CSI, the transmitter maps the incoming information bits to the i^{th} constellation M_i that maximizes the spectral efficiency subject to the BER.

Assuming the M-QAM signaling, the SNR threshold for the target BER can be determined by the following equation [3]

$$\gamma_T^n = -\frac{2}{3}\ln(5BERo)(M_n) \qquad (1)$$

Where $BER_o=10^{-4}$ is the specified BER and n = 1, 2 ...N.

B. Channel State Information

In wireless communication, CSI [1] refers to known channel properties of a communication link. This information describes how a signal propagates from transmitter to receiver and represents the combined effect of scattering, fading and power decay with distance. Many communication systems require CSI either at the transmitter or the receiver or the both. Systems with coherent detection, receive beam forming, diversity combining are the examples that CSI is needed at the transmitter. On the other hand, adaptive transmission technique requires channel state transmission at the transmitter for resource allocation in order to compute the throughput or BER performance. It is to be estimates at the receiver and usually quantized and feedback to the transmitter. Therefore transmitter and receiver have different CSI. This process to obtain CSI is called channel estimation. Channel estimation is usually realized either by the using of training symbols called pilot symbols.

In multi-user system, CSI is required for each user scheduling in order to satisfy some optimality or fairness criterion. CSI acquisition at the transmitter is critically for many systems. The sources of noisy CSI include 1) Modeling errors in the channel fading statistics 2) Feedback delay 3) channel estimation error 4) Bandwidth constrained feedback 5) Feedback errors on the reverse channel and 6) Quantization error. The feedback rate is small fraction of data transmission on the forward link for slowly fading channels. Therefore, it was assumed that a powerful low rate error control code could be used to ensure error free feedback.

C. Mode of operation

1) OOBS Scheme: The OOBS scheme is based on absolute threshold generalized selection combining (AT-GSC) [2] scheme. The scheduler selects in each time slot all the users whose SNR is greater than the SNR threshold. During the guard time period the BS sends the pilot signal to all the K users. The entire users estimate its individual SNR and compare it with the preselected SNR threshold. Only those users which are greater than the SNR threshold sends its channel state information to the BS as a feedback. Here the feedback rate is reduced significantly since the user need to send only an information indicating the SNR region instead of sending the whole channel state information. Thus the OOBS scheme has an average of fewer feedbacks when compared to GSC [2] based scheduling algorithm without a spectral efficiency loss. In SBS scheme the un-acceptable users are also scheduled in order to fill the empty channel, whereas in OOBS, the bandwidth is left idle which results in inefficient utilization of the resources. This helps us to propose a scheme called dynamic resource allocation (DRA) or Active resource allocation(ARA) having the synchronization between the base station which helps in filling up of channel with the excess acceptable users which supports in proper utilization of the resources.

IV PROPOSED BANDWIDTH ALLOCATION SCHEME

In this paper, we propose a scheme to be considered at the network side, to efficiently allocate and maintain bandwidth in such a way that all available resources are efficiently used.

A. ARA Description

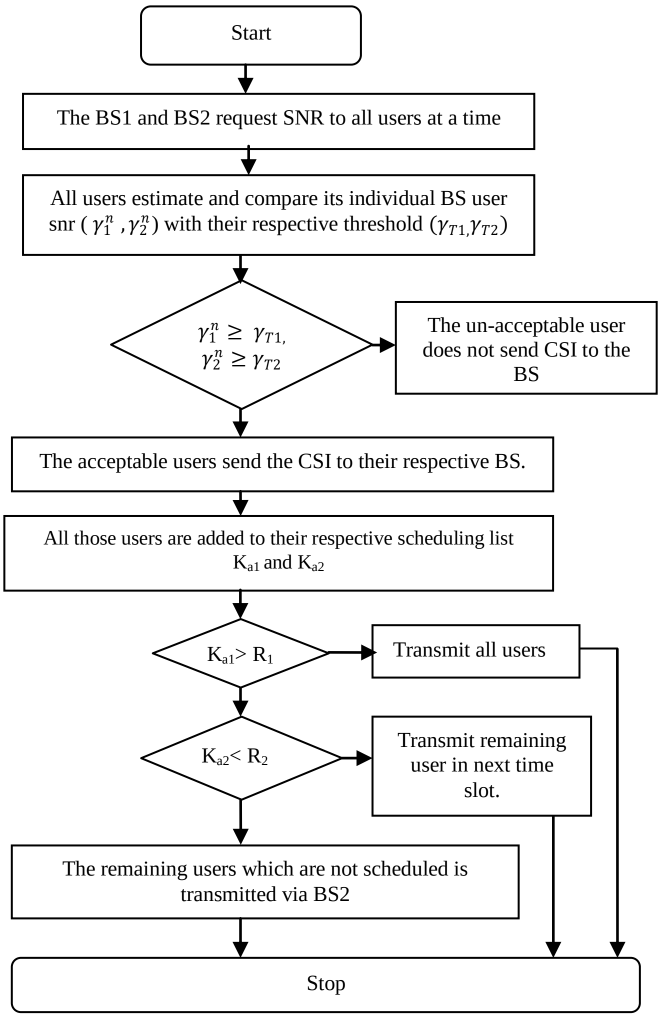

Fig:1 Mode of operation of ARA-OOBS scheme

In our proposed system we consider two base stations BS1 and BS2 and there exist synchronization between the both basestation. Each basestation has the knowledge of other showing the synchronization. Let K_1 be total available users in BS1, K_2 be total available users in BS2, R_1 and R_2 be the resource available in each BS, K_{a1} and K_{a2} be the acceptable users of BS's. The threshold of each basestation is given by γ_{T1} and γ_{T2}. Where γ_1^n and γ_2^n refers to the particular BS individual user SNR. Active Resource Allocation exists for various cases that are discussed below. Case 1: BS1 has more number of acceptable users than the available resource and BS2 has less number of acceptable users. Case 2: BS1 has less number of acceptable users than the available resource and BS2 has more number of acceptable users than the available resource. Case 3: Both BS has more number of acceptable users than the available resource. Case 4: Both BS has less number of acceptable users than the available resource.

The ARA is applicable only for first two cases. In this paper we consider the first case of dynamically routing the users form first basestation to the other basestation. This in turn eliminates the in-efficient utilization of available resources.

B. Operation of Proposed Scheme

The Fig 1 describes the flowchart of ARA-OOBS scheme. With this scheme during the guard time period the BS sends the pilot signal to all K_1 and K_2 users. The entire users estimate its individual SNR and compare it with their corresponding preselected SNR threshold. Only those users which are greater than the SNR threshold sends its channel state information to the BS as a feedback. Those users which do not have an acceptable SNR is not scheduled. These users are then added to the scheduling list K_{a1} and K_{a2} . If the first BS acceptable users are greater than the resource available in it it checks for the ideal resource in the second BS. It there exist an ideal resource in BS2 it routes the users of first BS through other else transmits the remaining user in next time slot. By the process of dynamically routing the users we can increase the system performance by increasing the average spectral efficiency and by reducing the system overhead. By this algorithm we can eliminate the presence of ideal bandwidth or resources.

V PERFORMANCE ANALYSIS

In this section, we analyze the performance of OOBS schemes in terms of average number of feedback load (AFL) ASE and average bit error rate (BER) with and without bandwidth allocation. Based on the Rayleigh fading assumption, the received SNR γ_i will share a common probability density function (PDF), given by

$$p_\gamma\ (\gamma) = \frac{1}{\bar{\gamma}} \exp\ \left(-\frac{\gamma}{\bar{\gamma}}\right) \qquad (2)$$

Where $\bar{\gamma}$ is the common average SNR for all users. The corresponding cumulative distribution function (CDF) is given by

$$P_\gamma\ (\gamma) = 1 - \exp\ \left(-\frac{\gamma}{\bar{\gamma}}\right) \qquad (3)$$

Before we see the performance measures, the definition of several common parameters for the OOBS with and without bandwidth allocation and the SBS schemes are defined. K denotes total number of users, K_s denotes the total number of scheduled users, K_a denotes the total number of acceptable users and γ_T denotes the preselected SNR threshold.

A. OOBS Scheme with Resource allocation

1) AFL: : Feedback load is defined as the number of average feedbacks required for the scheduler to perform a user selection process. If a feedback is allowed to have enough number of bits from CSI, the AFL in general will be lower than the case of 1 bit feedback. In this section we calculate the AFL required by the OOBS scheme during the guard period. Recall that the scheduler asks for the feedbacks from the users that are above an SNR threshold value γ_T . In this case the number of feedback is same as the number of acceptable users that are above the threshold. Thus the numbers of users follow binomial distribution. The equation for AFL in given by

$$AFL = K\ \exp(-{}^{\gamma_T}/_{\bar{\gamma}}) \qquad (4)$$

2) ASE: Spectral efficiency is defined as the information rate that can be transmitted over a given bandwidth in a specific communication system. It is a measure of how effectively the spectrum is utilized .To obtain the ASE of the scheduled users for each time slot, we need to multiply the average number of scheduled users. Since the number of scheduled users of the OOBS scheme is $K[1-P_\gamma(\gamma_T)]$. Finally the ASE of the scheduled users for each time slot in fist basestation becomes

$$ASE = K\left[\sum_{n=q}^{N-1} R_n \left\{\exp\left(-{}^{\gamma_{T_n}}/_{\bar{\gamma}}\right) - \exp\left(-{}^{\gamma_{T_{n+1}}}/_{\bar{\gamma}}\right)\right\}\right]$$

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$$+ KR_n \exp(-{}^{\gamma_{T_N}}/_{\bar{\gamma}}) \quad (5)$$

3) BER: The average BER for overall codes and SNR of the scheduled user is given as the average number of bits in error divided by the average number of bits transmitted.

$$\overline{BER} = \sum_{n=1}^{N} R_n \overline{BER_n} \Bigg/ \sum_{n=1}^{N} R_n P_n \quad (6)$$

VI NUMERICAL RESULTS

In this section, we make a comparison between the proposed scheme and the conventional scheme. The Fig.2 presents the AFL of OOBS and SBS scheme. Based on the mode of operation of SBS scheme the AFL decreases from K and converges to K_s and for OOBS scheme AFL increases to full K feedbacks. The Fig.3 represents the ASE for OOBS scheme such that spectral efficiency increases as $\bar{\gamma}$ increases with the constant threshold. The ASE for low γ_T is converging

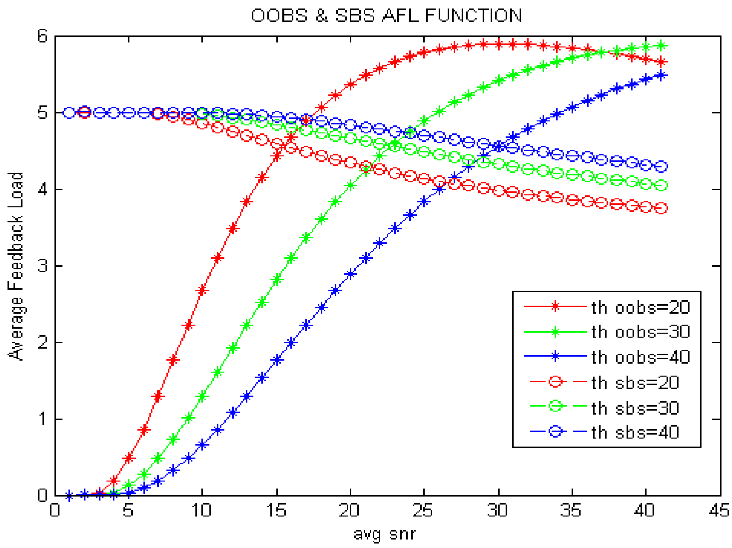

Fig (2) AFL of OOBS and SBS as a function of average SNR

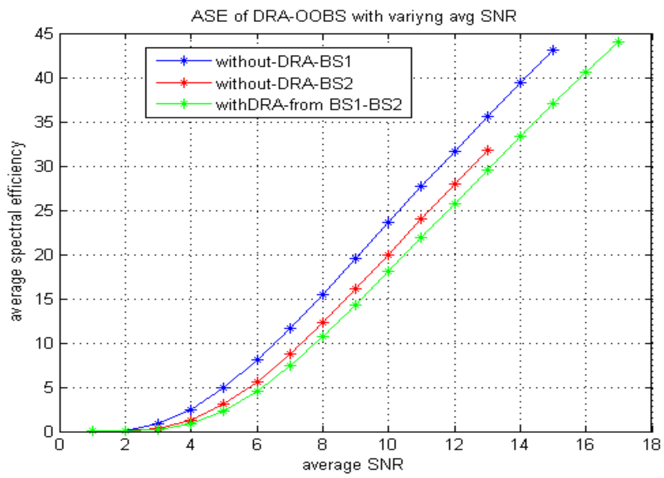

Fig (3) ASE of ARA-OOBS as a function of average SNR

faster than that for high γ_T because for the OOBS scheme, the AFL for low γ_T is converging faster than that of high γ_T. The Fig.4 shows the BER performance of OOBS scheduling for different modulation schemes. For specific scheduled user id the BER is calculated with different modulations showing the higher order modulation is the best for transmission.

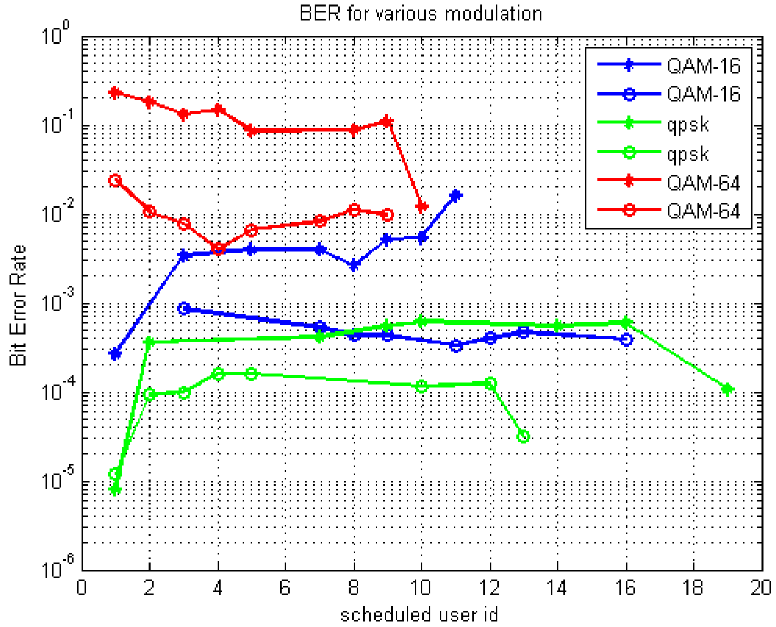

Fig (4) BER of OOBS for various modulations

VII CONCLUSION

In this paper, we proposed the active resource allocation scheme in OOBS scheduling to overcome the problem of traffic in-elasticity and the presence of ideal bandwidth. We compared the statistical characteristic the ASE, AFL and BER with the conventional scheme. The results obtained using the above mentioned method for user admission and traffic shaping with active bandwidth management; suggest that for users, dynamically adapting the channel give good spectral efficiency with minimal system overhead. These numerical results show that the proposed bandwidth allocation scheme is an efficient one.

REFERENCES

[1]. Sung Sik Nam, Mohamed-Slim Alouini, Hong-Chuan Yang and Khalid A. Qaraqe, “Threshold-Based Parallel Multiuser Scheduling,” IEEE Trans.on Wireless Commun. vol. 8, no. 4, Apr. 2009.
[2]. M. K. Simon and M.-S. Alouini, “Performance analysis of generalized selection combining with threshold test per branch (T-GSC),” IEEE Trans. Veh. Technol., vol. 51, no. 5, pp. 1018–1029, 2002.
[3]. Slim Ben Halima, Mohamed-Slim Alouini, and Khalid A. Qaraqe,”Joint MS-GSC Combining and Down-Link Multiuser Diversity Scheduling” IEEE Trans.on Wireless Commun, vol.8, No.7.July 2009.
[4]. Haewoon Nam, Young-Chai Ko and Mohamed-Slim Alouini,”Performance Analysis of Switch Based Multiuser Scheduling with Adaptive Modulation,”IEEE conf. June 2007.
[5]. G. B. Holter, M.-S. Alouini, G. E. Øien, and H.-C. Yang, “Multiuser switched diversity transmission,” in Proc. IEEE Vehicular Technology Conf. (VTC’04-Fall), Los Angeles, CA, 2004, pp. 2038–2043.
[6]. Haewoon Nam and Mohamed-Slim Alouini,’’ Multiuser Switched Diversity Scheduling Systems with Per-User Threshold,’’ IEEE Trans. on Commun. vol. 58, no. 5, May 2010.
[7]. H.-C. Yang and M.-S. Alouini, “Performance analysis of multibranch switched diversity systems," IEEE Trans. Commun., vol. 51, no. 5, pp. 782-794, May 2003.
[8]. Haewoon Nam, Joint Diversity Combining Technique and adaptive modulation in wireless Communication, 2006
[9]. Hong-Chuan Yang and Mohamed-Slim Alouini, Order Statistics in Wireless Communication, United States of America by Cambridge university press, New York publications 2011.
[10]. Y.Xu, H. Liu and Q.Zeng, “Resource Management and QoS Control in multiple traffic wireless system and Mobile internet system,”14th International conference on computer communications and Networks, vol. 17, no. 19, pp.125-130, Oct. 2005
[11]. Kirti Keshav and Pallapa Venkaatara m,” A Dynamic Bandwidth Allocation Scheme for Interactive Multimedia Applications over Cellular Network,” Tenth International Conference on Network, ISDN 2011.