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An Efficient Admission Control with Adaptive Band Width Allocation Scheme for WCDMA Network

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Abstract: An adaptive B.W allocation scheme is necessary for the QoS provision in WCDMA environment. Traffic in the upcoming wireless network is expected to be extremely non stationary and next generation wireless networks including 3rd generation are expected to provide a wide range of multimedia services with different QoS constraints on mobile communication. Most important issues that the guarantee system efficiency and QoS required for different services. In a many scare resources as the radio spectrum. In this paper we propose WCDMA architecture for multilevel QoS services like voice, video and data for multiple uses and the adaptive B.W allocation scheme for multiuse's adjusted dynamically according to required network. By simulation result our proposed WCDMA architecture along with B.W allocation scheme will reduce the call blocking probability, through put, transmission time, degraded B.W, degradation ratio.

Keywords: wireless network, admission control, through put, QoS, multiclass, transmission time.

I. INTRODUCTION

The current and next generation wireless cellular networks are expected to provide multimedia services with different quality of service (QoS) requirements. A typical example is the universal mobile telecommunication system (UMTS) which is required to support a wide range of applications each with its specific QoS. There are four QoS classes defined in UMTS specifications; the conversational class, the streaming class, the interactive class, and the background class [1]. Since multimedia services have different traffic characteristics, their QoS requirements may differ in terms of bandwidth, delay, and dropping probabilities. The radio resource management unit is responsible for the fair and efficient allocation of network resources among different users. The large demand for high capacity has led to the use of micro and Pico –sized cells. As a consequence, the handoff rate significantly increases and the handoff procedure becomes a crucial issue to ensure seamless connectivity and satisfactory QoS.

Also from the user's point of view, handoff attempt failure is less desirable than blocking a new call. Due to the limited resources in wireless multimedia systems, efficient call admission control (CAC) and resource reservation (RR) schemes are needed to maintain the desired QoS. Up to now various solutions have been proposed for handoff control and channel reservation. One method is based on queuing handoff requests till a free network resource becomes available [2].However, this may cause QoS degradation for real time traffic which is delay-sensitive. Another solution is based on reserving a fixed amount of resources, permanently (guard channels, GCs) for handoff traffic [3]. However, such static approach is unable to handle the variable traffic load.

So, it obviously causes low efficiency. A mixed traffic with different bandwidth requirements has been considered [4].

There have been a considerable amount of guard channel schemes supporting voice and data in integrated mobile networks [5, 6] .Recently, Dynamic GC schemes have been discussed in the literature to improve the system utilization while providing QoS guarantees to higher priority calls [7-9]. However, these schemes have been studied for TDMA/FDMA systems and are not completely suitable for CDMA systems because CDMA systems are interference limited. Several uplink CAC's designed for CDMA have been proposed in literature. These CAC's can be classified to the following categories: power based CAC, SIR-based CAC, and throughput-based CAC. A power-based admission control with multiple power-based thresholds for multiple services has been proposed [10]. By setting higher thresholds for voice traffic, voice traffic is given a higher priority compared to data traffic. SIR-based call admission control monitors the SIR experienced by each user [11]. A throughput-based admission control having four different load limits with four classes of traffic has been also proposed [12]. In this paper, we focus on QoS-aware B.W allocation scheme and QoS parameters. Traffic type (real time and non real time), to either new or handoff requests.

Resource allocation to each traffic class can be dynamically adjusted according to the traffic capacity, mobility of users, and QoS requirements. Multiclass calls with different QoS requirements are considered. The proposed scheme achieves lower blocking and dropping probabilities while maximizing channel utilization. The rest of the paper is organized as follows. In section (2), an overview of WCDMA capacity. The model of the proposed

WCDMA scheme is presented in section (3).Bandwidth algorithm in section (4). Graphical results are presented in section (5) .Finally, concluding remarks are discussed in section (6).

II. OVERVIEW OF WCDMA SCHEME

A. Concept Of Wcdma

In a code-division multiple-access (cdma) communication system, a communication channel with a given bandwidth is accessed by all the users simultaneously. The different mobile users are distinguished at the base station receiver by the "unique spreading code" assigned to the users to modulate the transmitted signals. Hence, the cdma signal transmitted by any given user consists of that user's data which modulates the unique spreading code assigned to the users, which in turn modulates a carrier using any well-known modulation scheme. The frequency of this carrier is the same for all users. At the receiver separation is possible because each user spreads the modulated waveform over a wide bandwidth using unique spreading codes. This technique is used for channels, which suffer frequency selective fading or interference.

B. Cdma Capacity

[a] Resistant to narrow band interference
[b] Resistant to multipath fading
[c] No hard limit on number of users (soft capacity
[d] As number of users on a frequency increases the interference level increases and ber increases for all users.
[e] With proper limits all frequencies can be used in every cell.

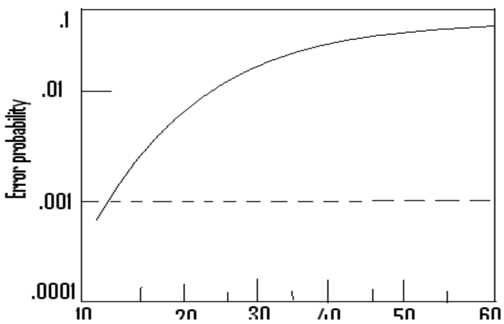

Figure.1 WCDMA capacity

[f] Cdma is interference limited system.

III. THE PROPOSED WCDMA SCHEME

A. Wideband Cdma

[a] W-cdma means "Wideband code division multiple access".
[b] It has radio channels of 5 MHz band width.
[c] It has chip rate of about 3.84 mcps.
[d] It supports both FDD and TDD.
[e] Though as the name suggests it has a wider bandwidth as compared to CDMA technique. W-cdma is not just a wide band version of CDMA.
[f] It reduces cost for video conferencing.
[g] W-CDMA may also be better suited for effective use (deployment) in the very dense cities of Europe and Asia.
[h] While not an evolutionary upgrade on the airside, it uses the same core network as the 2G GSM networks deployed worldwide, allowing dual-mode operation along with GSM/EDGE .

B. Transmitter Block Diagram

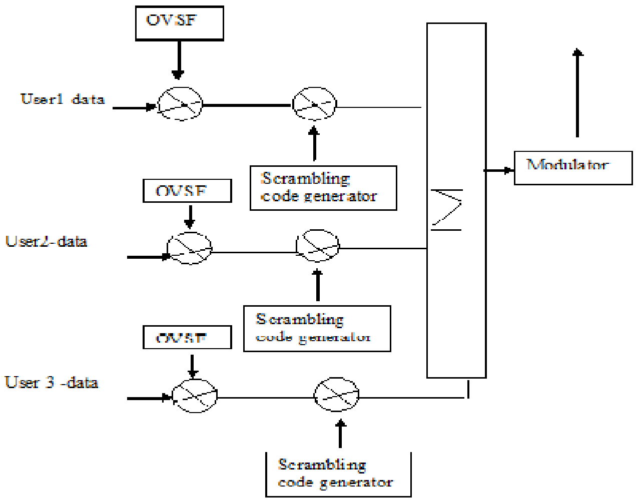

Figure3.1

C. Ovsf Generator

[a] The ovsf channelization code preserves the orthogonality between different physical channels using a tree-structured orthogonal code.
[b] The tree-structured code is generated recursively using the following equation:

$$C_{2n} = \begin{bmatrix} C_{2n,1} \\ C_{2n,2} \\ C_{2n,2n} \end{bmatrix} = \begin{bmatrix} \begin{bmatrix} C_{n,1} & C_{n,1} \\ C_{n,1} & -C_{n,1} \end{bmatrix} \\ \begin{bmatrix} C_{n,n} & C_{n,n} \\ C_{n,n} & -C_{n,n} \end{bmatrix} \end{bmatrix}$$

D. Scrambling Code

[a] Scrambling codes separate users and base station sectors from each other by allowing them to manage their own ovsf trees without coordinating amongst themselves
[b] It significantly reduces the auto-correlation between different time delayed versions of a spreading code so that the different paths can be uniquely decoded by the receiver
[c] There are 2 methods to generate the code for each user 1) Orthogonal 2) Non-orthogonal. In CDMA mostly Non-orthogonal is used to generate the code for the user.
[d] In this project we use pn sequence techniques and gold code generation techniques to generate a code for every user.

E. Pn Sequences

[a] Pseudo-noise sequences are binary sequences, which exhibit noise like randomness properties.

F. Lfsr (Linear Feed Back Shift Register)

[a] The contents of the registers are shifted right by one position at each clock cycle.

[b] The feedback from predefined registers are taped, XORed and shifted to the leftmost register bit.

[c] The 1st PN sequence is generated using LFSR as shown in the diagram below:

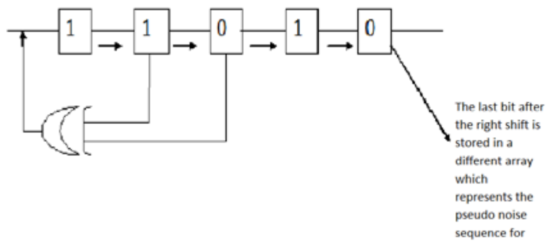

Figure.2

[d] The 2nd PN sequence is generated using LFSR as shown in the diagram below:

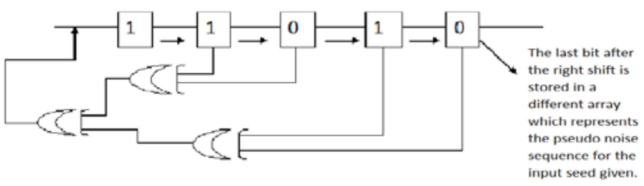

Figure.3

G. Gold Codes

[a] Gold codes have three-valued autocorrelation and cross-correlation function with values , where

$$t(m) = \begin{cases} 2^{(m+1)/2}+1 & \text{for odd m} \\ 2^{(m+2)/2}+1 & \text{for even m} \end{cases}$$

[b] The Gold code is generated by XORing both PN1 and PN2 signals. This gold code gives us the effective scrambled code of the User.

H. Summer

[a] The spreader messages are summed together for transmissions are spectrally overlapped and time-overlapped.

[b] Adaptive power control schemes are employed in CDMA technology for efficient transmission of messages.

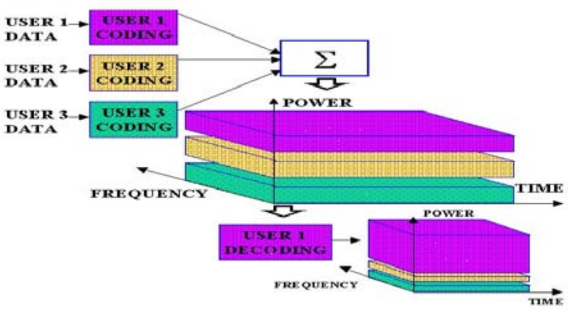

Figure.4

I. Modulator

[a] Modulator modulates the signal using BPSK signaling or DPSK signaling.

[b] The differentially coherent PSK (DPSK) signaling scheme makes use of a clever technique designed to get around the need for a coherent reference signal at the receiver.

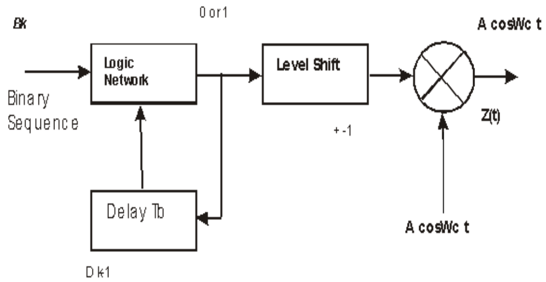

Figure.5

J. Receiver Block Diagram

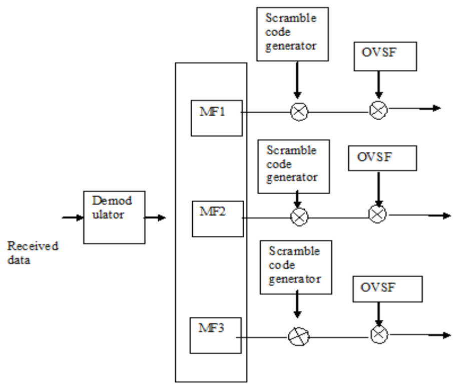

Figure.6

K. Filter

[a] The filter removes all the interference added in the channel.

[b] The system uses band pass filter for filtering out the interference from the received message bits.

L. Demodulator

[a] The reference carrier is created from the input signal is at the same frequency as that of the original carrier, but without any phase changes, in the sense the reference carrier has a constant phase.

[b] The recovered carrier is mixed with the input modulated signal to retrieve the unmodulated signal.

M. Matched Filters

[a] Cdma base stations must be able to discriminate these different code sequences in order to distinguish one transmission from another.

[b] These filters are used as signal processors in communications receivers to calculate the correlation between the transmitted signal and the received signal.

[c] The matched filter indicates when this code sequence is detected in the input data stream. The output of a matched filter will be a score value.

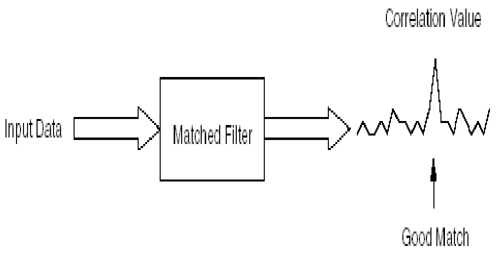

Figure.7

N. De-Spreader

[a] Once the message of each user is differentiated using the match filter bank the retrieved message bits are passed down to despreader blocks.

[b] Where these message bits are again multiplied by the spreading code developed by the gold code generator in the receiver system. The dispreading of the message takes place exactly.

IV. BANDWIDTH ALGORITHM

A. Concept

Band width adaptation algorithm in such a way that the allocated bandwidth to the on going calls will not differ from each other by more than one step. The band width of an ongoing call is also allowed to be degraded below band width requirement b_{req} to minimize new call blocking and handoff call dropping probabilities.

B. B.W Adaptive Algorithm

If ((incoming is a new call) and (number of ongoing calls <K)

{ If (available bandwidth > or = b_{max})

Then assign b_{max} to incoming call Else

{ $b_{allocated} = 0$

for (t=1,t<N, t++)

While ($b_{allocated} < b_{min}$ and $n_t > 0$

{

randomly degrade one of n_t connections by amount of $b_{degrade}$

$$b_{degrade} = \min (b_{min}, b_t - b_{min})$$

$$b_{allocated} = b_{allocated} + b_{degrade}$$

}

}

}

Else reject incoming call

C. QoS *Measures*

In case of QoS measures we are considering degradation ratio, through put, degradation band width are the QoS measures and can be calculated from total band width occupies in the channel.

V. RESULT

It shows the performance plot for degradation in band width allocated with respect to increase in number of users for fixed bandwidth allocation technique (fbat), adaptive bandwidth allocation technique (abat). The plot shows that with increase in number of users the degradation eventually increases number for abat where as the fbat method the degradation is not applicable

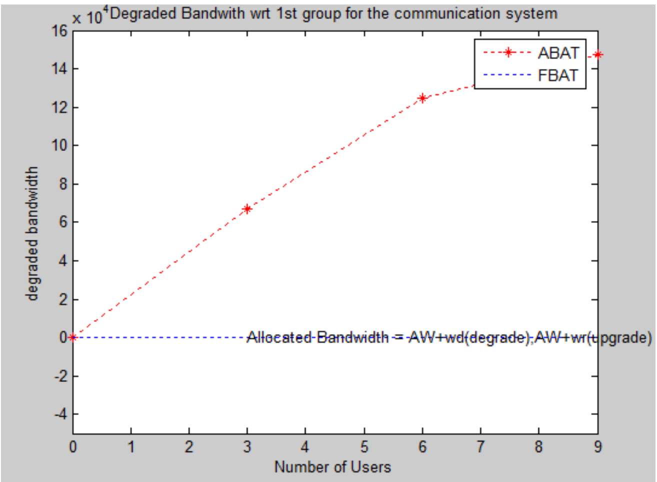

Figure.8 1B.W degradation plot for the system

It shows the degradation for the proposed two methods abat, fbat with respect to group of users in the plot it is observed that the degradation for abat system varies where as in fbat system it is constant.

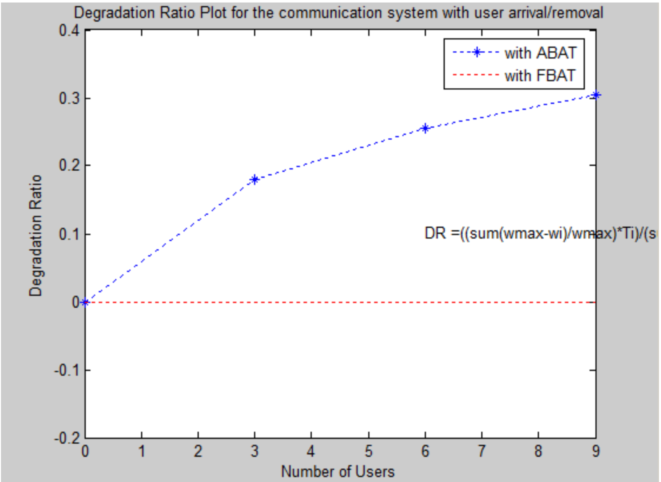

Figure.9 degradation ratio for implemented system

It shows the propagation delay for fbat & abat system the propagation delay is considerably less for 12 users over constant bandwidth. There is a decrement of about 40% in propagation delay compared to fbat system.

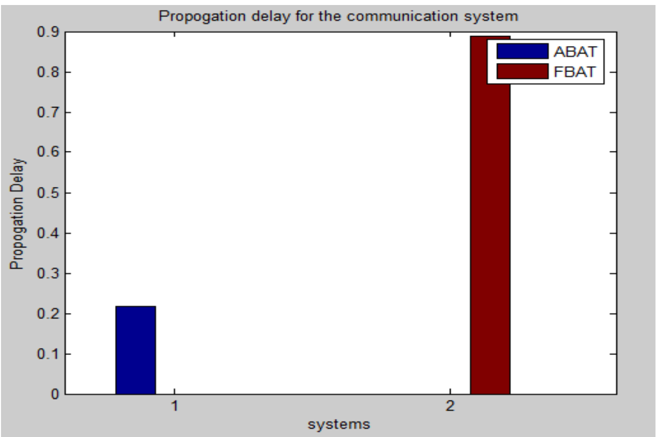

Figure.10 Propagation delay for abat & fbat

Figure shows the through put analysis for two systems namely abat &fbat methods. In case of abat method it could be observed that the through put remains decreased with increment in number of users where as it could be completely eliminated in case of fbat system.

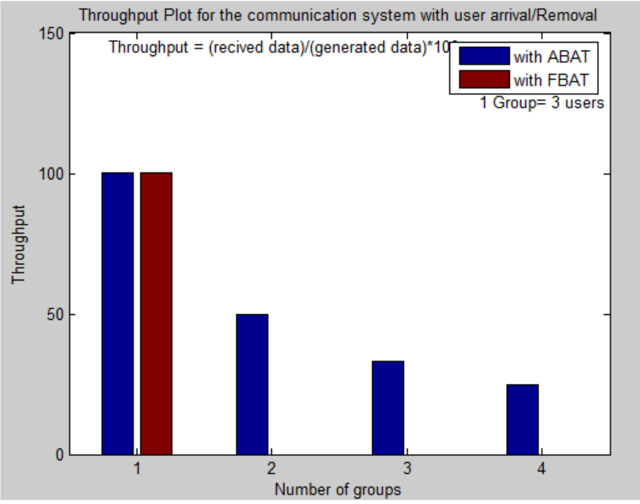

Figure.11 Through put plot for two systems

VI. CONCLUSIONS

In this paper, a new analytical model for a WCDMA wireless network which uses adaptive bandwidth allocation to provide users multilevel QoS. Four performance metrics—throughput, transmission time delay, degraded bandwidth, degradation ratio are observed .We extend the WCDMA scheme to overcome the resource constraint by degrading the QoS provided to each user and system is implemented on following WCDMA architecture with cellular communication . The performance is evaluated by adding or removing different group of users to evaluate the algorithm efficiency. The matrix used to evaluate the QoS parameters. As a result, this scheme is able to guarantee a high QoS with high bandwidth capacity for different applications.

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