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Congestion Control for WCDMA Radio Access Network Using Threshold Segmentation

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Abstract*—The Congestion of WCDMA network becomes a serious problem because each active user introduces interferences to the other users. In order to avoid the instability of mobile network due to the increasing of interference level and blocking probability, when a number of users appear in the system, threshold even and odd segmentation scheme are proposed. In this scheme threshold level is divided into three segments in which users are entering in the system with different levels. The goal of this work is that the maximum numbers of users are simultaneously share the system without interfere to each other .The numerical results are obtained by Matlab.

Indexed terms— **WCDMA, Load Factor, Signal to Noise Ratio.**

I. INTRODUCTION

CELLULAR wireless networks have become an important part of the communication infrastructure. It has been selected for implementation in both the North American and European 3G standards.

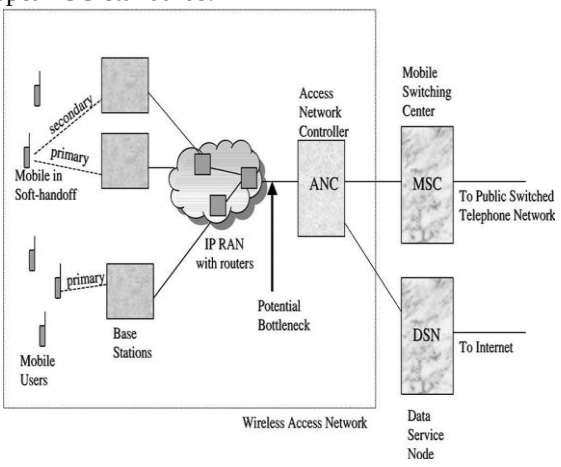

Fig.1. Wireless Access Network with IP RAN

CALL ADMISSION CONTROL: In WCDMA cellular network bandwidth is varying over time due to inter and intracell interference. To overcome the Scarcity of bandwidth in WCDMA, CAC is used [6]. It is the rule to admit requested calls maintaining the quality of service. CAC is **basically** to make a decision about whether a user should be admitted into the system according to the users' quality of service requirements and the current traffic load. Here we are interested in the maximum cell capacity and the maximum noise rise supported by a cell in the uplink direction. The estimation of these parameters is based on the load cell factor which is expressed as a function of the quality of service, the data rate R and as a function of the signal to interference ratio SNR [8, 9, 10]. Our work consists of studying an algorithm of admission control based on the threshold load factor segmentation [2]. The goal of the admission control is to increase the number of simultaneous active users, guarantying a good quality of service for connections already established and avoiding the release of unstable situations when the interference level in the cell becomes too high. In order to accept more users in the cell, a new incoming user can use the radio resources by segmented the threshold level. As the best of authors' knowledge, all literatures [1-3] still have not yet reach a solid conclusion for the problem that which CAC method is better for a specific voice or data application

II. PROPOSED METHODOLOGY

In this work we reduced various parameters which affect the overall performance of radio access network to control the congestion in the network. In these parameters include, blocking rate, passing rate, and signal to noise ratio, here we use load threshold segmentation scheme, load factor parameter is generally used in admission control procedure. We divided the target load factor in three segments, which value is fixed by the users.

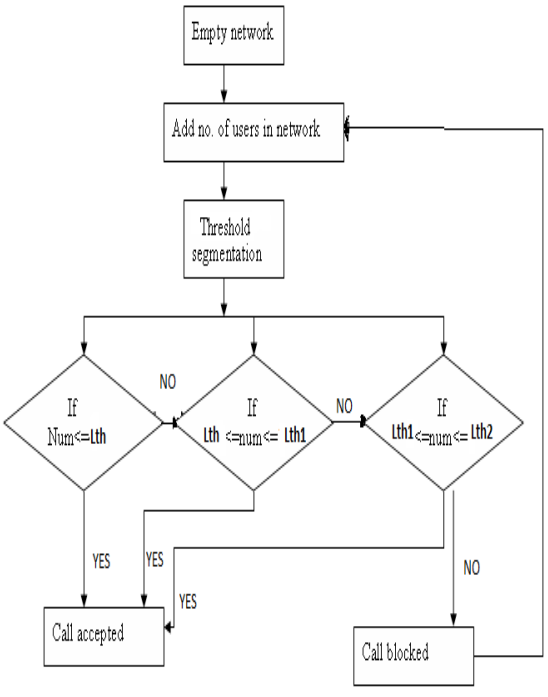

Fig.2 Flowchart for Threshold Segmentation

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In the above figure, we use three decision which in the form of threshold, here we use three threshold level, Lth, Lth1, & Lth2.

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III. THRESHOLD SEGMENTATION PROCEDURE

1- Start with an empty network
2- Add users into the system.
3- Apply threshold segmentation after each admission in order to reach the target value of quality of service.
4. If num (number of users) < Lth, then call accepted, otherwise going to next step.
5. If num (number of users) < Lth1, then call accepted, otherwise going to next step.
6. If num (number of users) < Lth2, then call accepted, otherwise call blocked.
7- Receive a new request (new user).

1 .passing rate and blocking rate- in the above procedure, the average blocking rate of calls are reduced. Computing the call blocking rate for new users.

Call blocking rate= $\frac{\text{Number of blocked call}}{\text{Number of incoming calls}}$ (1)

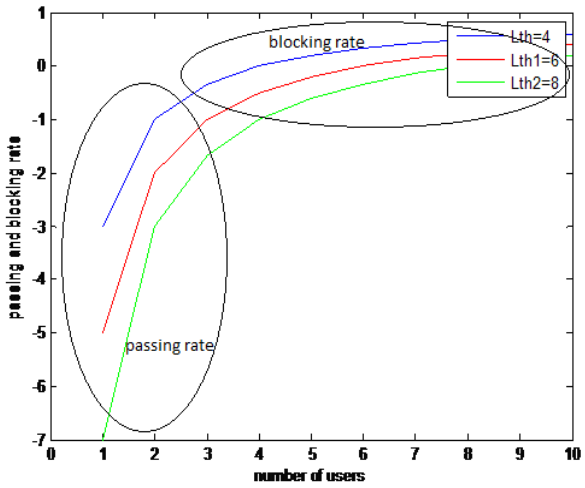

Fig.3 - Call Passing and Blocking Rate Where Threshold Load Is Even Segmented

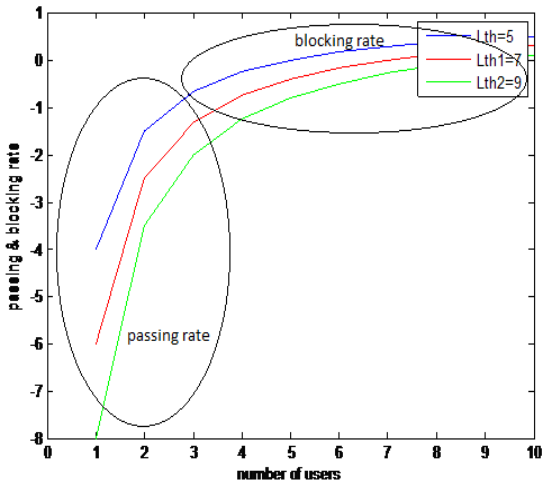

Fig.4 - Call Passing and Blocking Rate Where Threshold Load is Odd Segmented

2. Signal to noise ratio-CAC uses another Load Factor (LF) [1] as the KPI to determine whether or not the new incoming user can access the system. The LF is a parameter used to measure the network congestion. Let the required load factor of the users is L1, L2 and L3, then the signal to noise ratio is

SNR=w*L1/Ri*vi (1-L1) (2)

Where w is the spreading bandwidth, L1 is the load factor, vi is the activity factor, And Ri is the data rate.

The behavior of the radio network at loaded traffic is defined by signal to noise ratio, hare various SNR are presents with respect to number of users.

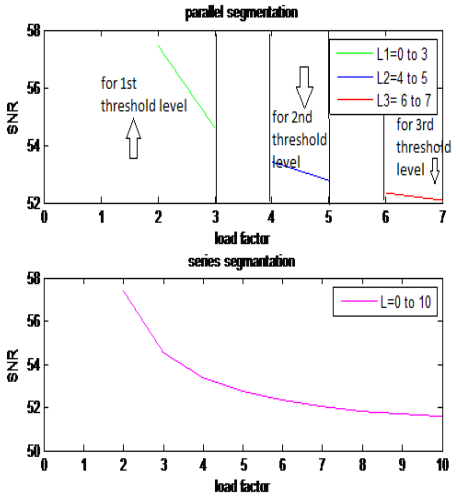

Fig.5 SNR as Function of Load Factor Where Thresholds are Even Segmented and Series Segmented at 64 Kbps

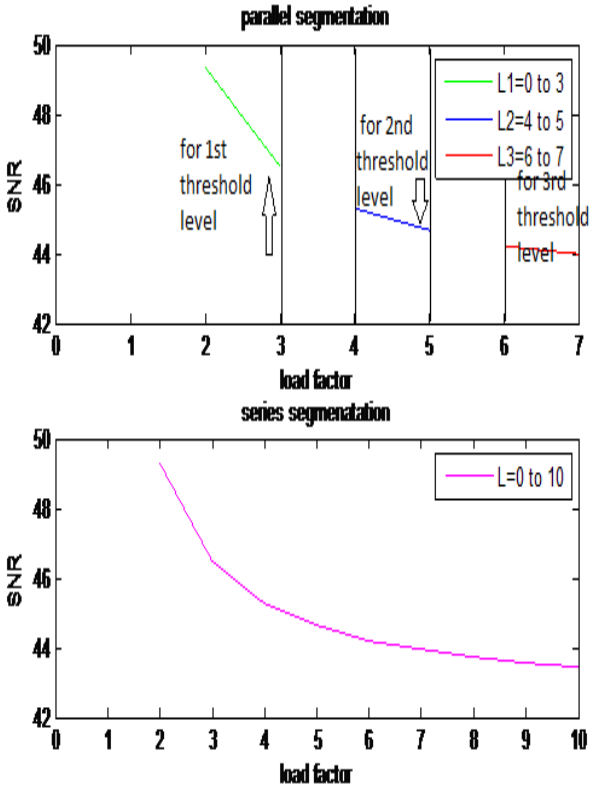

Fig.6 SNR as Function of Load Factor Where Thresholds are Even Segmented and Series Segmented at 144 Kbps

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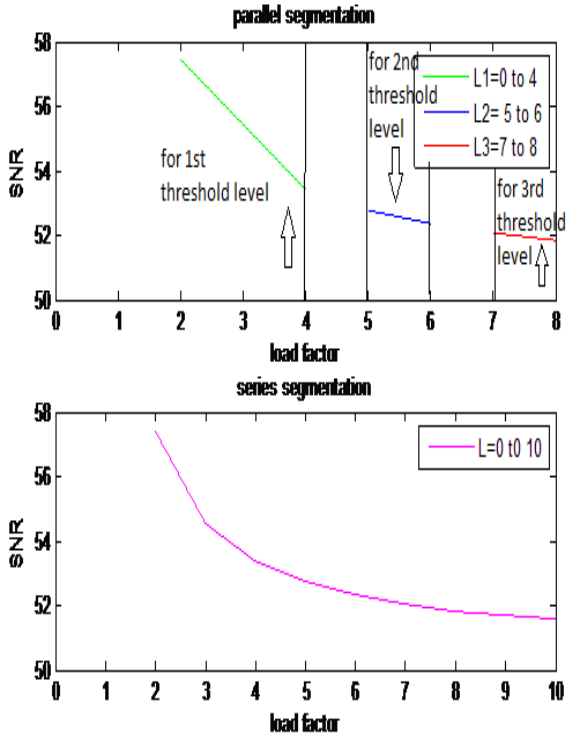

Fig.7 SNR as Function of Load Factor Where Thresholds are Odd Segmented and Series Segmented at 64 Kbps

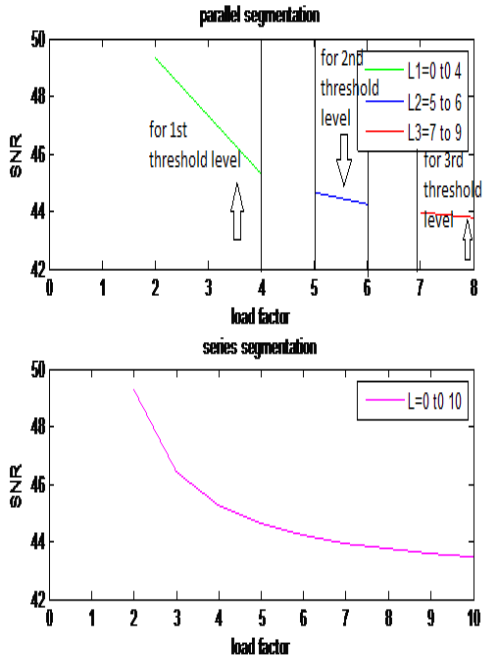

Fig.8 SNR as Function of Load Factor Where Thresholds are Odd Segmented and Series Segmented at 144 Kbps

IV.RESULTS AND DISCUSSION

1. According to the figure 3 & 4 , we can clearly see that blocking rate reduced when threshold segmentation scheme are used where the load are even segmented and odd segmented.
2. According to figure 5, 6, 7, and 8, we can clearly see that the signal to noise ratio as the function of load factor are increases because the load factor are reduced when the overall threshold level are divided into three segments. and if threshold level is not divided than signal to noise ratio decrease and users are interfere to each other.

V. COMPUTER SIMULATION

In this section, we compare the congestion control performance for different data rates. All the simulation parameters are based on the 3GPP [13]. Table I gives the parameters for even segmentation Narrowband (64 kbps) and Wideband (l44Kbps) and Table. II gives the parameter for odd segmentation, Narrowband (64 kbps) and the Wideband (l44Kbps) voice services for the 3G system and table III gives the parameter for series segmentation on narrowband and wideband voice services for 3G systems.

Table-I Parameters for Even Segmentation

EVEN SEGMENTATION				
Narrowband				
parameter	notation	Load factor(L1)	Load factor(L2)	Load factor(L3)
Chip rate	w	5 mcps	5 mcps	5 mcps
Activity factor	vi	0.5	0.5	0.5
Data rate	Ri	64 kbps	64 kbps	64 kbps
Signal to noise ratio	SNR	Upto 54.56db	Upto 52.74db	Upto 52.05db
Wideband				
parameter	notation	Load factor(L1)	Load factor(L2)	Load factor(L3)
Chip rate	w	5 mcps	5 mcps	5 mcps
Activity factor	vi	0.5	0.5	0.5
Data rate	Ri	144 kbps	144 kbps	144 kbps
Signal to noise ratio	SNR	Upto 46.45db	Upto 44.63db	Upto 43.94db

Table-II Parameters for Odd Segmentation

Odd Segmentation				
Narrowband				
Parameter	Notation	Load Factor(L1)	Load Factor(L2)	Load Factor(L3)
Chip Rate	W	5 Mcps	5 Mcps	5 Mcps
Activity Factor	Vi	0.5	0.5	0.5
Data Rate	Ri	64 Kbps	64 Kbps	64 Kbps

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Signal To Noise Ratio	Snr	Upto 53.39db	Upto 52.33db	Upto 51.84db
Wideband				
parameter	notation	Load factor(L1)	Load Factor(L2)	Load factor(L3)
Chip rate	w	5 mcps	5 mcps	5 mcps
Activity factor	vi	0.5	0.5	0.5
Data rate	Ri	144 kbps	144kbs	144 kbps
Signal to noise ratio	SNR	Upto 45.28db	Upto 44.22db	Upto 43.94db

Table III Series Segmentation

SERIES SEGMENTATION		
Parameters	***Data rate***	***Signal to noise ratio***
Chip rate(5 mcps)	64 kbps	Upto 51.56db
Activity factor(0.5)	144 kbps	Upto43.45db

VI. CONCLUSION

In this paper, the congestion control performance for the even threshold segmentation and odd threshold segmentation schemes are compared in the WCDMA environment. Results show that both segments have almost the same GoS performance for different service types for the current 3G system. We conclude that the if threshold segmentation scheme are used then overall blocking rate are reduced and different users are not interfere to each other because the users are divided into the segments here signal to noise ratio are increases with respect to load factor so the overall performance of the system were improve.

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