JOURNAL OF INFORMATION, KNOWLEDGE AND RESEARCH IN ELECTRONICS AND COMMUNICATION ENGINEERING

# ANALYSIS OF IMPACT OF CELL BREATHING ON CALL ADMISSION CONTROL IN CDMA

[1]*RAVI G. MEHTA,* [2]*RAJNIKANT P. SANDHANI*

[1, 2] **Electronics & Communication Engineering Department,**
**Government Engineering College,**
**Rajkot–360005, Gujarat, India.**

***ravigmehta@gmail.com***

***ABSTRACT :*** *Call Admission Control is very important for any CDMA network. CAC is responsible for providing good QoS to each user in the system. CDMA is interference limited system. Whenever new user enters the network, the interference level of the system increases which decreases the effective cell radius. This may affect the service quality of existing user of the system. So whether to provide service to new user or not becomes a tricky question. In this paper CAC algorithm considering cell breathing concept is discussed and the results are shown, which are useful inputs for system to eliminate such problems.*

***KEY WORDS*** *: Call Admission Control, Code Division Multiple Access, Cell Breathing.*

## I. INTRODUCTION

Number of users in mobile communication are variable. Some users may enter in the network or some users may leave the network. Those users who are leaving the network do not affect the system performance. But the users who are entering the network will play a significant role in deciding the system performance. The system may either permit the user to use its service features or it may refuse the connection. In GSM mobile system, the numbers of channels are fixed because it was using FDMA/TDMA. In CDMA the scenario is totally different. CDMA is not limited by the frequency or time slot. It's capacity is decided by the interference of the system. Each user in CDMA is using the same channel in terms of frequency. So each user will create interference to all other user's in the same cell as well as others using same frequency in other cells.

Nowadays users are using mobile communication for voice as well as data communication. In data communication also the thrust of high speed communication will never end.

It is necessary that resources in wireless environment should be used at its fullest. The Radio Resource Management is responsible for the proper utilization of the air interface. It should provide well defined QoS to the each user of the network.

Call Admission control (CAC) is used to provide minimum QoS to each user by controlling the overall resources of the system. It is responsible for accepting as well as rejecting the new call in the network. Generally preference will be given to the hand off call than new call. The reason is dropping a on going call is more irritating than blocking an call in user experience perspective.

## II. TYPES OF CAC

CAC algorithms can be classified into three ways :

1) Connection based CAC
2) Power based CAC
3) Interference based CAC

Connection based CAC calculates the average capacity of the cell based on number of connections. In this type the load of the cell is calculated by considering number of user present in the cell as well as in neighbouring cells. In this system we can also take advantage of voice activity factor and discontinuous transmission of CDMA.

In power based CAC power level of various mobiles is measured. A threshold power level is defined. So whenever a new mobile wants to enter in the system its power level is measured if it is below the threshold power level than service is granted otherwise service is rejected.

The third category is interference based CAC. In CDMA each new user entry increases the total

interference level of the system. The maximum tolerable interference level is defined. If the entry of new users crosses the limit of that interference level than the service is denied otherwise the service is provided.

Due to interference the QoS defined for the service can not be achieved. That is the reason why threshold level for interference is defined.

## III. CAC USING CELL BREATHING

In CDMA, a single 1.25 MHz channel carries one control channel and 64 voice channels. In GSM the coverage region and interference levels are well defined. But in CDMA the coverage region is dynamic, which majorly depends on the number of active users. This effect is known as cell breathing. Due to this effect the function of network engineer becomes too much difficult. The cell boundary may get stretched or compressed by this effect. So if the design is not considering it then the coverage might contain overlaps or coverage holes.

Due to cell breathing each entry of new user will decrease the cell radius. The equation given below gives us the maximum distance range achievable by considering various features.

$$d_{\max} = \frac{\lambda}{4\pi}\sqrt{\frac{P_{s\max}.L_{pce}(S-(n-1).\varepsilon V/F}{N_t}}\sqrt{g_b.g_m} \quad \text{.....(1)}$$

$d_{max}$ = Maximum distance covered
$\lambda$ = Wavelength of the signal
$P_{smax}$ = Maximum power transmitted by the mobile station.
$L_{pce}$ = Pathloss
S = Service factor
F = Intercell interference factor
n = No. of user present in the cell
$\varepsilon$ = Non orthogonality factor
V = Voice Activity Factor
$N_t$ = Therma Noise
$g_b$ = Base station antenna gain
$g_m$ = Mobile station antenna gain

This equation gives us the maximum range of the cell. So as the new user enters in the network the new cell radius is found. On basis of new radius of the cell and the largest distant user algorithm is defined which will decide that the user will be permitted or not. The algorithm is shown in next section.

## IV. CAC ALGORITHM

The algorithm takes three inputs :

1) New radius of the cell
2) Outermost user of the cell
3) Distance of user requesting service

The algorithm is shown below :

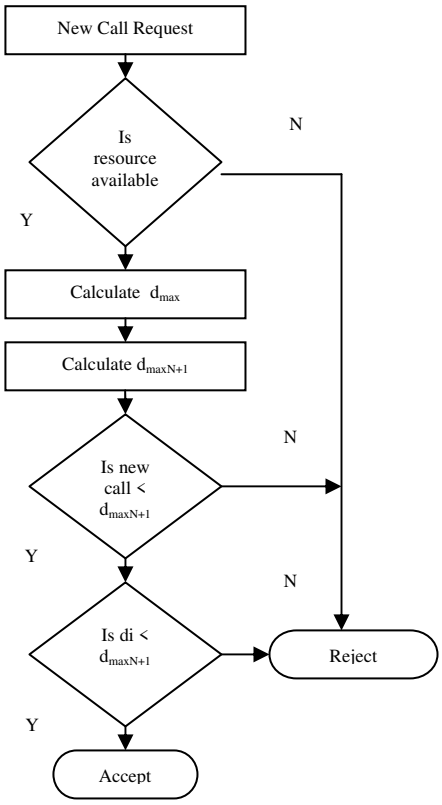


Figure - 1 Flow chart of CAC using cell breathing

The algorithm first checks that whether resources are available or not.

The distance of user requesting service is compared with the new radius of the cell if it is less then the user can be given the service.

After that the new cell radius is compared with the distance of the farthest user of the cell. If the new radius is bigger one then the service is granted otherwise the service is denied.

The comparison is done to ensure that the entry of new user does not create problem to the existing user and the new user is also within in the new range of the cell.

## V. RESULTS

*CASE-I*

In first case, new mobile is 2.5 km away from the base station. The old boundary is 10.1419 km. After addition of new user the new boundary becomes 10.0420 km. The old user is having distance 10.12 km. So if new user is permitted then old user will get disturbed. Due to this reason the service is not provided to the new user.

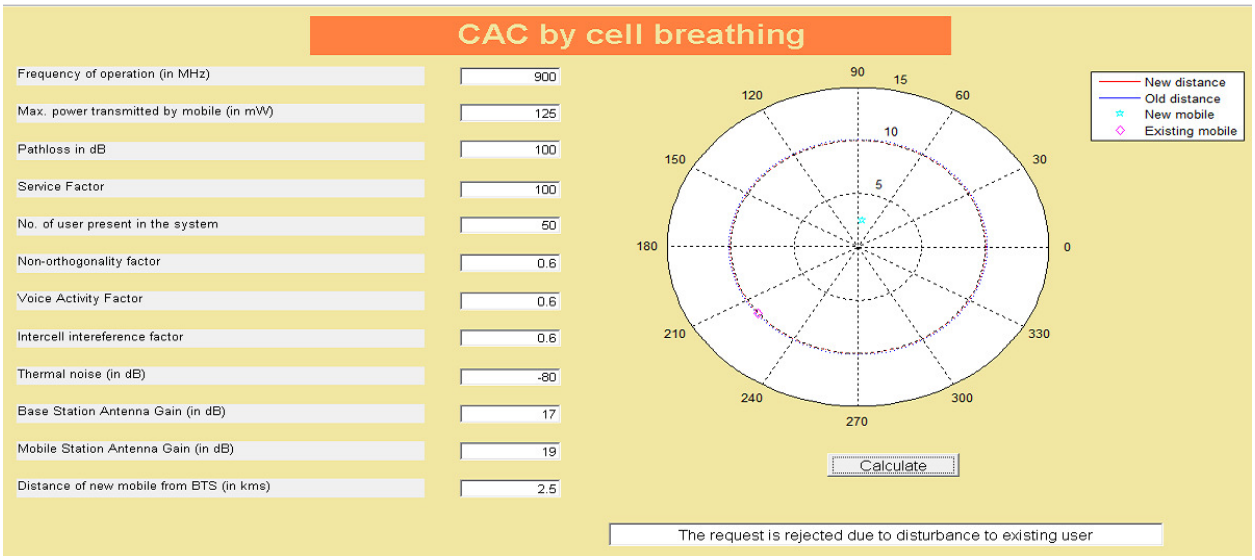


Figure – 2 :- Practical Application of CAC algorithm using Cell Breathing Concept (case - I)

*CASE - 2*

In second case, the mobile station requesting the service is 2.4 km away from the base station. Due to other system parameters the old boundary of the system is 2.8055 km. If this user will enter in the system then new boundary is 2.7599 km away from base station. Existing user is at 2.7108 km away. So the requesting user will be permitted the service.

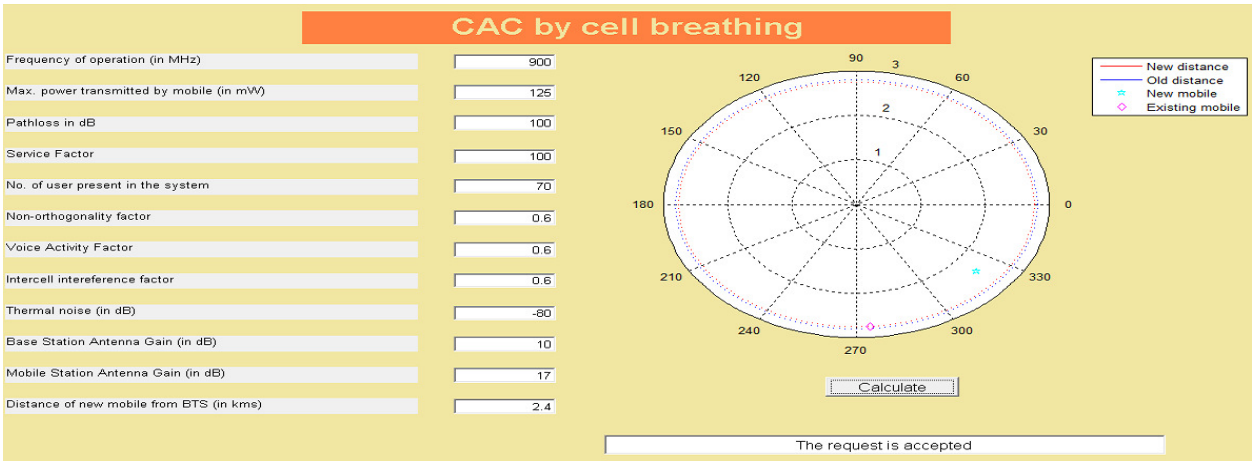


Figure – 3 :- Practical Application of CAC algorithm using Cell Breathing Concept (case - II)

*CASE – 3*

In third case, the new mobilee is 3.5 km away from the base station. Due to other system parameters the old system boundary is 3.2265 km. If new user is permitted in the network then due to cell breathing the new boundary will become 3.1869 km. The old user is situated at 3.16 km. Now here the user requesting service is away from the new boundary so the service is denied.

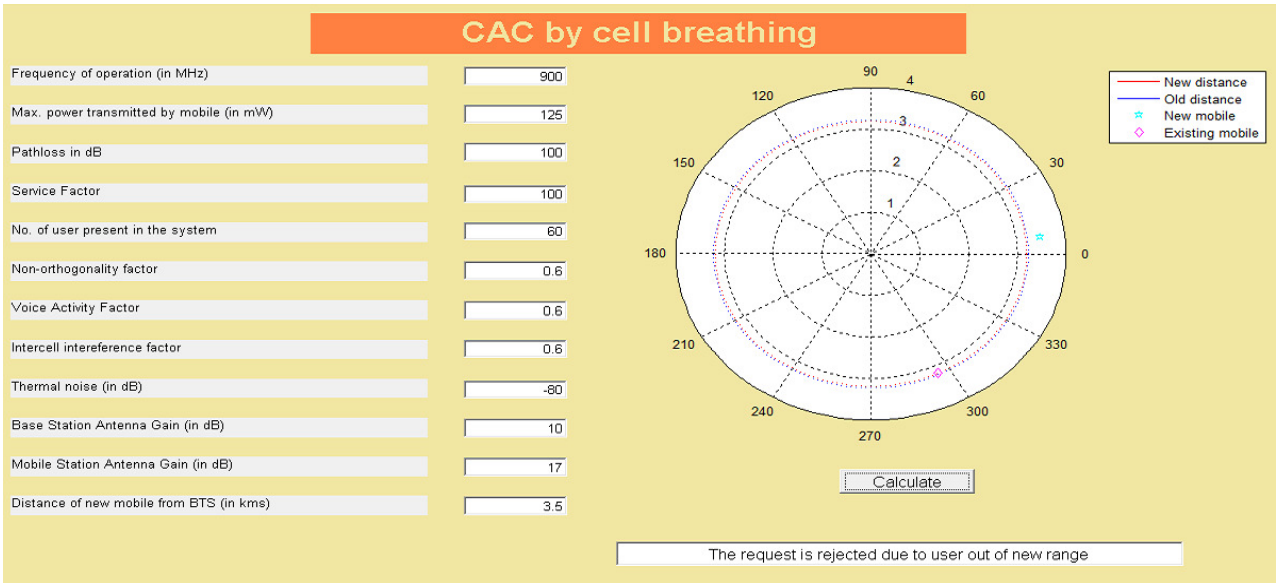


Figure – 4 :- Practical Application of CAC algorithm using Cell Breathing Concept (case - III)

## VI. CONCLUSION

Cell breathing plays very important role in Call admission control. It considers the impact of new user on the system. The current users are ensured minimum set of QoS before new user is permitted to access the network. The role of cell breathing in multicell can be further studied to get realistic results.

## VII. REFERENCES

[1] Jon M. Peha and Arak Sutivong, "Admission Control Algorithms for Cellular Systems", *Wireless Networks,* 117-125, 2001.

[2] Mohamed H. Ahmed and Halim Yanikomeroglu, "SINR Threshold Lower Bound for SINR-based Call Admission Control in CDMA Networks with Imperfect Power Control ", *IEEE Communications*, Letters Vol. 9, No. 4, April 2005.

[3] Ramachandran Ramjee, Don Towsley and Ramesh Nagarjan, "On optimal call admission control in cellular networks", *Wireless Networks 3,* 1997.

[4] Jyoti L. Mishra and Keshav P. Dahal, "Call Admission Control using Cell Breathing Concept for Wideband CDMA", *Wireless Networks 5, 2000.*

[5] Young-Long Chen1, Jyu-Wei Wang, "Performance of Call Admission Control with Power Control in Multimedia Cellular Systems", *International Journal of Applied Science and Engineering, 2007.*

[6] N. Tamilarasan, S. Lenin, P. Dananjayan, "Call Admission Control for CDMA systems with adaptive modulation", *International Conference on Control, Automation, Communication and Energy Conservation, 2009.*

**[7]** Luo, Xing Guo, et al. "Probabilistic Access Based Call Admission Control in Multi-Traffic CDMA System." *Advanced Materials Research,* vol. 468–471, Feb. 2012.