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Resource Allocation Strategies for Cellular Networks

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***Abstract*—In this paper we simulate the different call admission control schemes such as non-prioritized call admission control, different reservation based call admission control ,distributed Call admission control, queue based call admission control and combination of these various call admission control schemes and analyze the effect of these schemes on call blocking and call dropping probability**

***Keywords*—Call Admission Control (CAC), channel reservation, Congestion Control, Quality of Service (QoS).**

I. INTRODUCTION

In cellular system, as the size of cell decreases the mobility of the user increases which results into higher number of hand off calls. The QoS of the call admission control inversely proportional to the call dropping probability. If the handoff dropping probability increases the QoS of the CAC algorithm decreases. So it's better to block the new call rather than dropping the ongoing call [1] [13] With the increasing trend of different services, in 3G depending on the type of service the traffic is classified into different types of traffic such as real time and non-real time traffic. Voice is real time traffic since delay in voice cannot be tolerated. The non-real time traffic can be data. Therefore the voice call should be given higher priority than the data calls. [3] [10].

In this paper we have seen the effect of different parameter on the call blocking and call dropping probability. In reservation CAC scheme we see the effect on call blocking and call dropping probability by changing the number of guard channel. The call blocking and dropping probability also changed by changing the queue size in queuing CAC scheme. We can also see the effect of static and dynamic cut off priority on the call blocking and call dropping probability.

II. SIMULATION MODEL

A. *System Model assumption:*

Table 1 System Model

Mobility	Mahattan
Traffic Model	Poisson Distribution
Number of cell	25
Number of channels	30
Cell Radius	2000
Traffic intensity	10,20,30…100
Arrival Rate	20
Classes of Traffic	1: Voice traffic 2: Data Traffic 3 video traffic

B. *Channel Assumptions:*

Each channel contains following parameters as shown in table 2.

Table 2 Channel Paramters

Direction	1=north, 2=east, 3=south, 4=west
Velocity	It decide the mobility of user (randomly generated)
Status of User	Channel busy/available
Path loss	Based on the position of user in cell
Class of User	Class 1: Voice traffic Class 2: Data Traffic Class 3: Video Streaming traffic
Previous RSS	In case of handoff, previous RSS is reserved.
Handoff Flag	Call Not handoff-0 Call handoff-1

C. *Waiting Queue module Assumptions:*

- Size of waiting Queue is varied such as 2,5,10
- There are two queue for class 1 and class 2 handoff.
- If for call duration time call is not served it will be dropped.

.As the hand off calls have the higher priority therefore queue has been used for handoff calls. As the class 1 has the higher priority therefore class 1's queue will be served first then class 2nd's handoff queue will be served. Class 3 has lower priority therefore there is no queue for this class.

D. *Working of the simulation:*

MAIN PROGRAM

1) Generate the traffic
2) Calculate the call arrival time and μ (service rate) based on traffic and the λ (arrival rate).
3) Calculate the path loss.
4) Check the arrival of call by comparing the current time and arrival time of the call.
5) If the call has been arrived then apply call admission control.
6) Update the position of the handset and path loss.
7) Check the position of handset, if it is not within cell's radius then terminate the call.
8) Check the received signal strength (RSS) of the handset and decide to whether terminate the call or take the handoff based on the RSS.
9) If the handoff takes place, find the target of the cell to which it should be handed of based on the direction and apply call admission control.
10) Check if current time equals departure time then terminate the call.

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III. NUMERICAL RESULT

The following section shows the numerical result for different CAC schemes

A. Non priority based CAC(Call admission control without queue and reservation scheme):

If hand off call and new call given the same priority then rate of hand off dropping and the rate new call blocking will be approximately same. As we know that it's better to block a new call rather than dropping the handoff call which is in progress. The handoff block has a high penalty, so if the handoff drop is more than the GOS will be less.

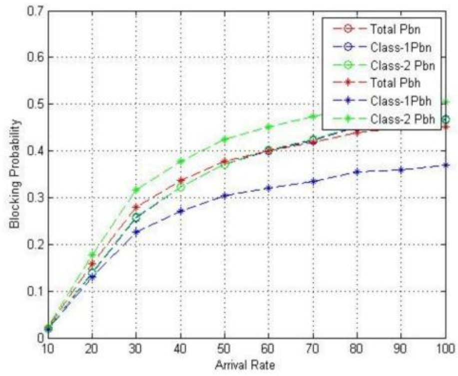

Fig. 1. Blocking and dropping probability for Non Priority Based CAC

The fig 1 shows that the call blocking and dropping probability graph for class 1 traffic. We can see that as the traffic increases the call blocking and the call dropping probability increases, that means the call blocking and dropping probability directly proportional to the traffic rate (arrival rate).

B. Reservation based Call admission control scheme

In this scheme handoff call has been given higher priority than the new call, some channels among total channel known as guard channels, are reserved for the handoff call and remaining channel called as open access channels are accessed by new as well as handoff calls.

In this scheme the number of guard channels is static; by varying the number of channels we examined the effect of number of guard channel on the call blocking and dropping probability [3] [7] [17].

We can see in the fig 2 below if the number of guard channels (GC) is 10.

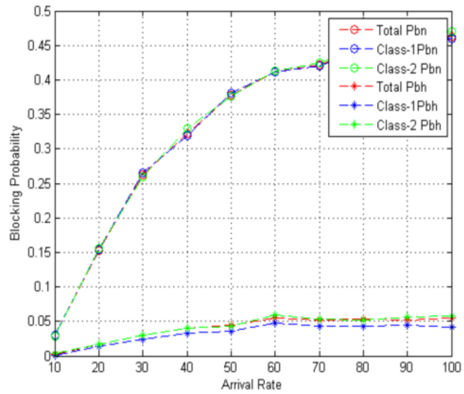

Fig. 2. call blocking and dropping reservation scheme (GC=10)

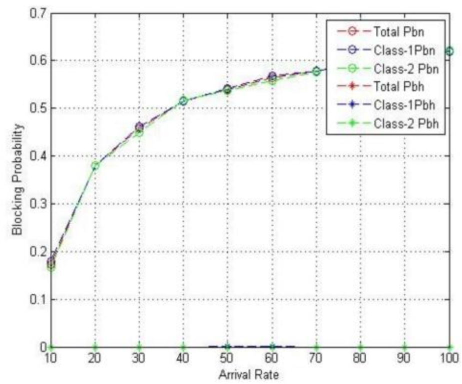

Fig. 3.: call blocking and dropping reservation scheme(GC=10)

Fig 3 depicts dropping/blocking probability when GC=20

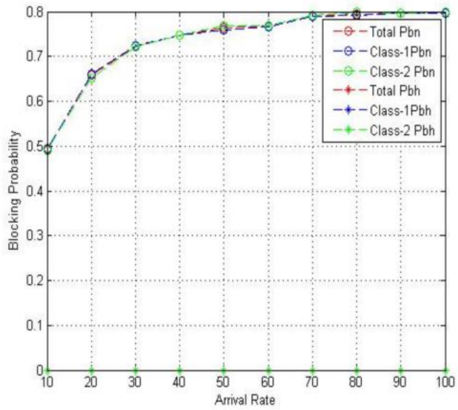

Fig. 4. Call blocking and dropping probability for reservation scheme (GC=20)

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As seen in the above Fig 2, 3, 4 we can say that as the number of guard channel increases the call blocking probability decreases.

When we compare the CAC scheme with guard channel and without guard channel we have seen that the in when GC=2 the handoff dropping probability reduced to 0.05 from the 0.37, and when GC=10 then the handoff dropping probability reduced to approximately 0.

One of the limitations of the reservation system is when the GC increases the new call dropping probability increases. When the GC=20, the new call dropping probability approximately reached to 0.8. So it is necessary to properly determine the number of guard channel.

C. Adaptive CAC scheme:

In this scheme, optimal number of guard channel is calculated, in a way that the handoff blocking probability remains below a threshold as well as at the same time minimizes the new call blocking rate [4][8].

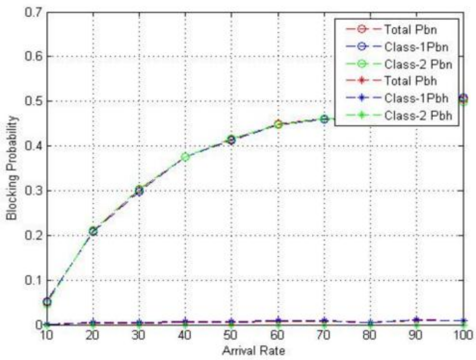

Fig. 5. Call blocking and dropping probability for reservation scheme (GC=20)

In the adaptive call admission control scheme, we can see that even though initially we had consider GC=20, the algorithm modified the number of guard channels thus as shown in the above fig, the handoff blocking probability is under the threshold as well as the call dropping probability has been minimized

D. Queue based CAC Scheme:

In queue based CAC scheme, we consider the 3 types of traffic such as class 1, class 2 and class 3.

As the class 1 traffic is voice traffic, the voice hand off has been given highest priority therefore the class1 handoff calls are queued when there is no channel available, therefore the handoff blocking probability reduces[2].[6]

By varying the length of queue (k) we have examined that as the queue length increases the handoff blocking probability deceases. As shown in fig 6, 7, 8

1) When k=2

In the above fig we can examine that the call dropping probability of queue based scheme for the class 1 traffic is less as compared to call dropping probability of without queue based scheme for class 1 traffic. Fig 7 represent call blocking and dropping probability when k=2.

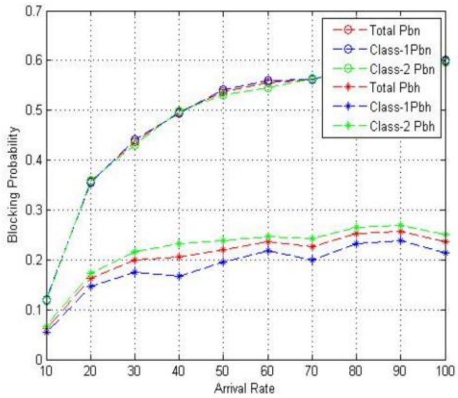

Fig. 6. . Call blocking and dropping probability for queuing scheme (k=2)

2) When k=5

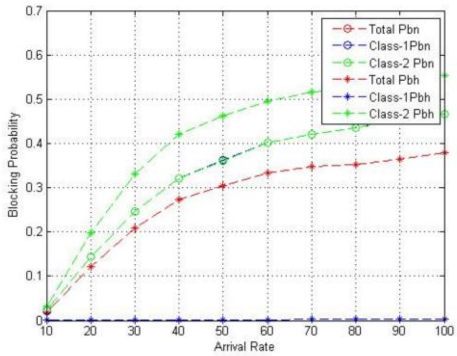

Fig. 7. Call blocking and dropping probability for queuing scheme (k=2)

3) When K=10

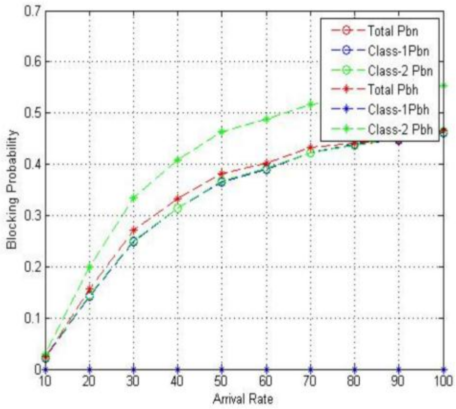

Fig. 8. Call blocking and dropping probability for queuing scheme (k=2

E. Distributed Call admission control scheme:

In this scheme, for each cell the number of ongoing calls in neighboring cells is tracked, which helps to determine the impact of a neighboring cells calls on the particular cell's call admission[2] [9].

Based on the collected information from the neighboring cells the threshold is calculated and the new call will be accepted if the number on ongoing calls is less than the dynamically calculated threshold [5] [11].

As shown in fig 9, the call dropping probability reduced to approx. 0.1

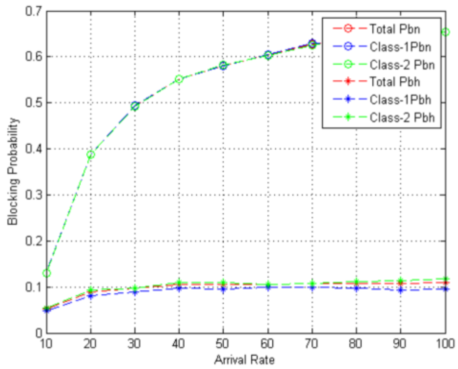

Fig. 9. Call blocking and dropping probability for queuing scheme

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