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Combined Algorithm For Minimize the Blocking Probability of Real Time and Non-Real Time Services in Handoff

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Abstract

This algorithm is used to minimize the blocking probability and increase the services. Handoff is very important concern in communication. It is related with the mobile phone. When a mobile user travels from one area of coverage or cell to another cell within a call's duration the call should be transferred to the new cell's base station. Otherwise, the call will be dropped because the link with the current base station becomes too weak as the mobile recedes. Indeed, this ability for transference is call handoff. Handoff is very rigorous process. Performance of handoff is very important issue.

In this paper performance of preemptive handoff is analysed by the combined algorithm for real time services and non-real time services by using MATLAB. Blocking probability is minimized in proposed algorithm.

We choose the fluid flow model [19] as the mobility model of mobile users. However, our proposed method can be easily used to other mobility models as well. The model assumes a uniform density of users throughout the area and also assumes that a user is equally likely to move in any direction with respect to the cell boundary.Blocking probabilities for both originating and handoff calls has been analyzed for real time and non real time services. The blocking probabilities have been minimized to optimum level. Starvation of non real time calls has also been minimized with the proposed design of hybrid handoff.The algorithm has been analyzed using the markov chain and SOR iteration method. Other suitable methods may find more minimum level of blocking of call. These equations have some of the drawbacks like complex nature of Poisson's distribution.

We are using MAT-LAB software for simulation of markov chain equations and passion distribution equations to calculate the blocking probability of handoff real time and Non real time calls and originating calls blocking probabilities.

MAT LAB -7.12 is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and FORTRAN.

Keywords: *Preemptive handoff, MATLAB 7.11, SOR method, Itreative method, exponential distribution generator*

INTRODUCTION

We all know ideas come in to mind when we are used to with a already established system and try to use thesystem beyond its practical limits.

Such a similar thing happened to me, this idea of designing a combined handoff algorithm for real time and non real time services came in to my mind when I was talking to one of my friend for more than 1 hr. suddenly my call get disconnected . It happened with me for 4-5 times and force d me to search for the reason behind it . I searched over internet and various IEEE papers and found some very good information about handoff and its complex algorithms.

- There has been many advances in handoff field, present handoff strategies have given preference to real time calls against non real time calls, which has caused starvation problem for non real time calls.
- There are algorithms developed to minimize the blocking probability of continuing calls.
- Most of the algorithms designed have faced the problem of starvation for non real time calls in preemptive handoff environment.

My objective is to propose a modal where all the possible alternatives can be combined to minimize the blocking probability.

Handoff basically of two types soft and hard.

Handoff Procedure:

Two basic procedures for handoff are handoff initialization and execution Handoff Detection**:**

To initiate a handoff, the quality of current communication channel is monitored in order to decide when to trigger the handoff. Handoff is a very rigorous process, so unnecessary handoffs should be avoided. If the handoff criteria are not chosen carefully, the call might be handed back and forth several times between two neighbor BS, especially when mobile user is moving around the overlapping regionbetween the two BS coverage area boundaries. If the criteria are too conservative, then the call may be lost before the handoff can take place Criteria have been proposed such as

- Word error indicator: Metric that indicates whether the current burst was demodulated properly in the MS.
- Received signal strength indication: Measure of received signal strength. The Received signal strength indicator metric has a large useful dynamic range, typically between 80 to 100 dB.
- Quality indicator: Estimate of the “eye opening” of a radio signal, which related to the signal to interference and noise ratio, including the effects of dispersion. Quality indicator has a narrow range (relating to the range of S/I ratio from 5 dB to 25 dB).

Handoff execution:

After the handoff detection phase the handoff execution phase begins. In handoff execution phase, the Message Switching

Center (MSC) controlling the new BS assigns new channel (frequency, time slot, spreading code, or combination of them) to the handoff call.

There could be a failure in the handoff execution phase if:

- No channel is available on selected BS,
- Handoff is denied by the network for reasons such as the MS has exceeded some limit on the number of handoffs that may be attempted in a given period of time,

It has taken too long for the network to set up the handoff after its initiation

All available Schemes:

FCA (Fixed Channel Allocation)
DCA (Dynamic Channel Allocation)
HCA (Hybrid Channel Allocation)
Problem in HCA and DCA
Solution with CBWL(channel borrowing without locking)
CBWL- Homogenous Network

- Vertical Channel Borrowing (VCB)
- Horizontal Channel Borrowing (HCB)
- Channel Reservation
- Pre-Emptive priority

In the paper by L. Huang, S. Kumar and C.-C. J. Kuo,"Adaptive Resource Allocation for Multimedia QoS Management in Wireless Networks", *IEEE Trans. Veh. Technol.*, vol.53, pp.547-558, 2009

In multi-service wireless networks, asymmetric bandwidth allocation has been proposed to satisfy the requirements of asymmetric traffic load introduced by some data applications. However, it is difficult to promptly adjust bandwidth allocation on uplink and downlink according to the dynamics of traffic load. Inappropriate call admission control (CAC) policies in this environment may admit superfluous real-time (RT) calls or non real-time (NRT) calls and thus lead to low bandwidth utilization.. By determining the admissible regions for the RT calls and the NRT calls, the proposed schemes prevent the calls of a specific class from overusing the bandwidth resources. Mathematical analysis and simulation experiments are employed to study and compare the performance of the proposed schemes and the existing schemes.

SOR and Iteration Method:

we use the Successive Over-Relaxation (SOR) iteration method [21] in the form of pseudo-code to solve $NT+2$ independent nonlinear equations and compute all the state probabilities $P(i, j, k, l, m)$s.

Step1: Select arbitrary initial (positive) values for λHR and λHN.

Step2: Compute all the probability P(i, j, k, l m)s using SOR method

Step3: Compute all average numbers of real-time service calls holding channels E[CR] and non real-time service waiting and holding calls E[NN]

Step4: Compute new λHR and λHN. If

$|new\ \lambda HR - old\ \lambda HR| <= \lambda$ *and* $|new\ \lambda HN - old\ \lambda HN| <= \lambda$, stop. Otherwise, go to step2.

And λ is a small positive number to check the convergence. The SOR method to compute all the probabilities P(i, j, k, l, m)s

System Modal

Mobile terminals are classified into two kinds: high-mobility and low-mobility terminals.

- Type 1 --High-mobility real-time voice service which is accessed into macro-cells
- Type 2 -- Low-mobility non-real-time data service which is accessed into micro-cells
- Type 3 -- Low-mobility real-time video service which is accessed into micro-cells

we consider a system with many homogenous cells with a fixed channel assignment scheme and a set of S channels is permanently assigned to each cell.we focus our attention on a single cell, which we call as the referenced cell in the paper. When a mobile user generates a call in the referenced cell, we donate it as an originating call.

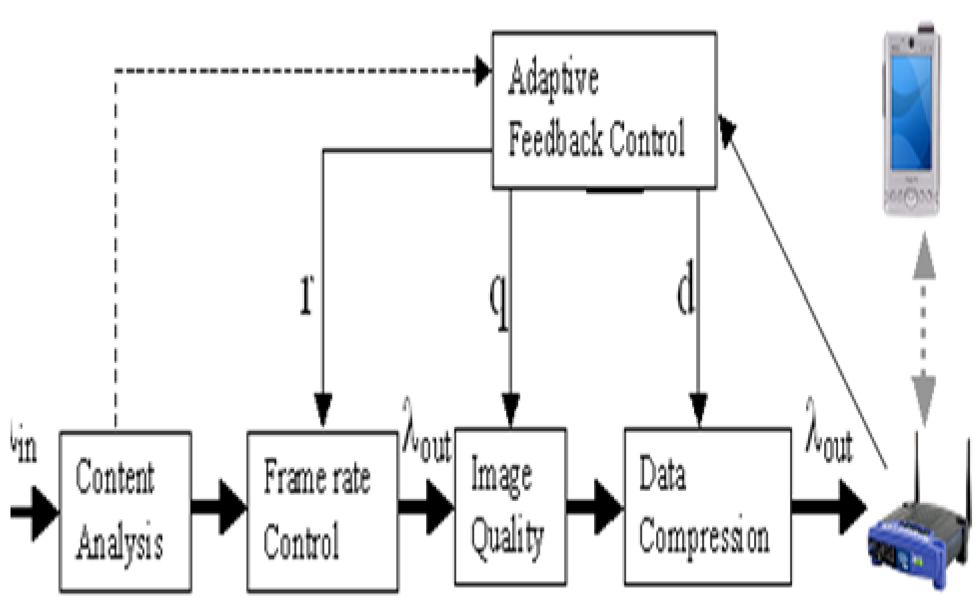

Fig 1. Video transmission

Algorithm for of Proposed Hybrid Handoff for Real Time and Non Real Time Handoff Calls

1. First of all network will determine whether there is requirement of handoff of not. For this analysis various network parameters and threshold conditions required for a quality voice for the current network will be compared with other available network parameters of other networks. I have done this objective through vertical handoff algorithm
2. After that analysis a vertical handoff will be assigned to mobile in current network if current network parameters are below threshold values and the other network parameters are higher. If this is not the case, then no handoff could be completed.
3. After handoff is done to a particular network from the list of available networks, it will check for whether there service required by handoff is real time or non real time handoff
4. In case of real time handoff, it will check again for whether real time handoff is of :

A. Voice calls
B. Video calls

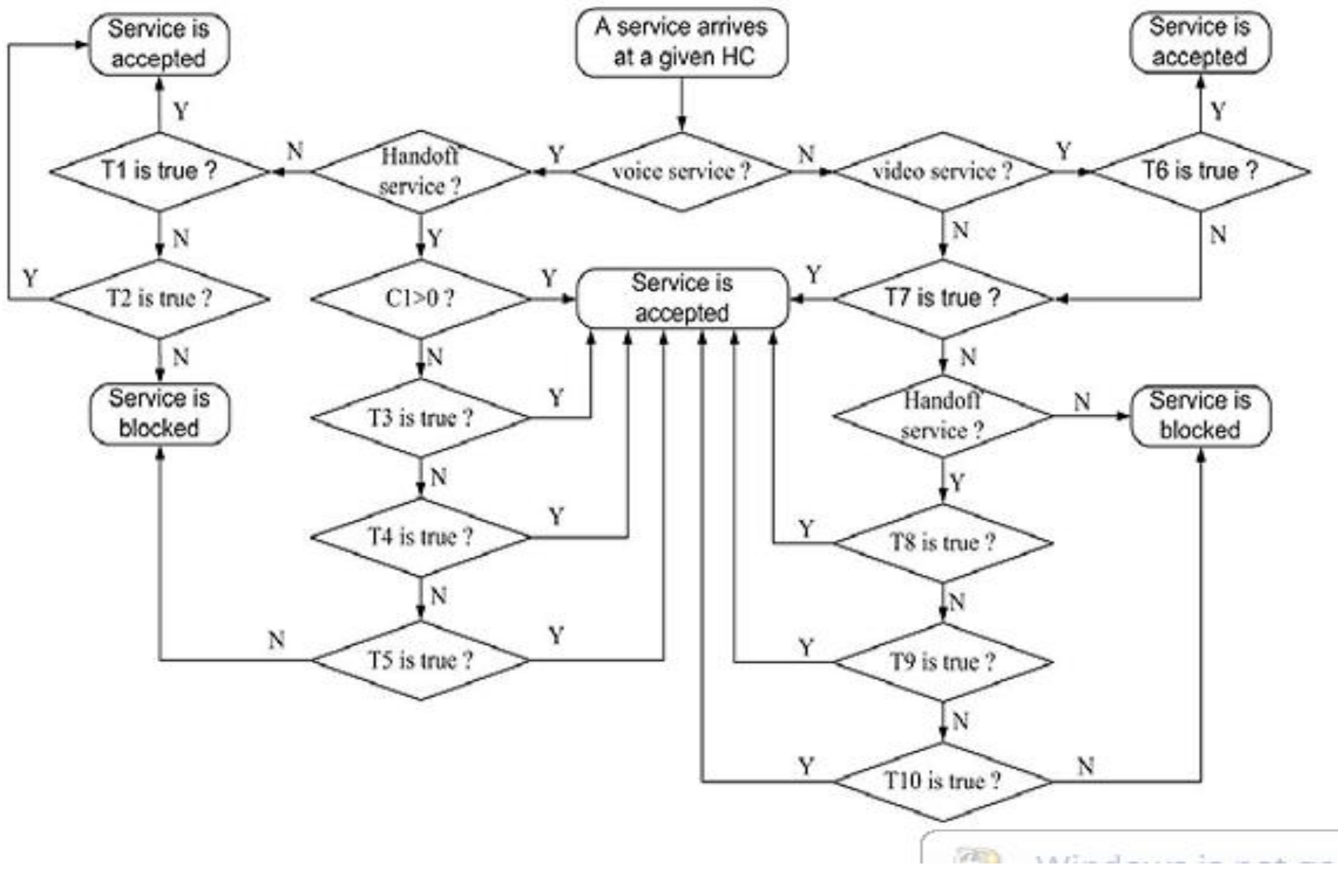

Fig2 flow chart for real time voice and video services with CBVH/RH/CR/WQ/PE

5. There are different algorithms for different services : voice services and video services

- Algorithm for the real time voice services: When an originating real-time service request arrives, it can be served only if there are channels available in RC.
- Similarly, an originating non real-time service request can be served only if there are idle channels in NC. An originating real-time service call (or an originating non real-time service call) will be blocked if it finds no channels in the RC (or NC). Figure shows the flow diagram of handling call in priority channel reservation scheme.
- When a real-time service mobile user holding a channel approaches toward the referenced cell from a neighboring cell and enters the handoff area of the referenced cell, a handoff request of real-time service is generated in the base station of the referenced cell.
- The real-time service handoff request call will be served if there are idle channels in RC on arrival. If RC is full on arrival, it will check whether there are idle channels in CC.
- If it does not found any channels in CC, it will check for number of channels available in micro cells or not. For this it will check whether C1>0 . Where C1 is the number of channels in macro cells.
- *C1* the number of idle channels in a macro-cell;
- *T1* there are idle channels in *GN*;
- *T2* at least one channel in *GN* is not being used by voice services when an originating voice service arrives, this may result one data or video service be pre-empted, the pre-empted service will be pushed into *QM*;
- *T3* at least one channel in the given macro-cell is not being used by voice services when an voice handoff service arrives
- *T4* at least one of the adjacent macro-cells has idle channels and does not reach the borrowing upper limit;
- *T5* at least one of the adjacent micro-cells in the same HC has idle channels and does not reach the borrowing upper limit (including the case that at least one video user occupies *S* channels in the given micro-cell);
- *T6* the number of idle channels in the given micro-cell is larger than *S*;
- *T7* the number of idle channels in the given micro-cell is larger than zero, or the at least one video user occupies *S* channels in the given micro-cell;
- *T8* at least one of the adjacent micro-cells has idle channels and does not reach the borrowing upper limit(including the case that at least one video user occupies *S* channels in the given micro-cell);
- *T9* the up-level macro-cells has idle channels and does not reach the borrowing upper limit;
- *T10 QM* is not full and the waiting service can get a channel before it leaves the given micro-cell;

Parameter Setup

In our numerical examples, we assume that the shape of the cell is circular with radius r, and two kind of mobile users as pedestrian users. Parameters are set as follows: *r*=0.1 Km, *E[D]*=0.1r, *E[V]*=0.5meter/second, *E[TCv]*=120seconds, *E[TCd]*=60seconds, *S*=*SR*+*SC*+*SN*=10, *SR*=4, *SC* =4, *SN* =2, *MR*=5, *SE*=2, *MN*=50, and 47

ε=10-8.

The ratio of originating real-time service calls and non real-time service calls □*OR* /□*ON* is set to 1. The simulation stop criteria set to □=10-8. Both arrival events are generated by exponential function with pseudo random number generator

```
//Calculate the random number of exponential distribution
double expntl(double lamda){
        long l;
        while((l=rand())==0);
        double r = ((double)l)/RAND_MAX;
        return (-1*log(r)/lamda);
}
```

Figure 5.1 Exponential distribution generator

Simulation Result

Both fig shows the result of analytical model and preemptive handoff scheme

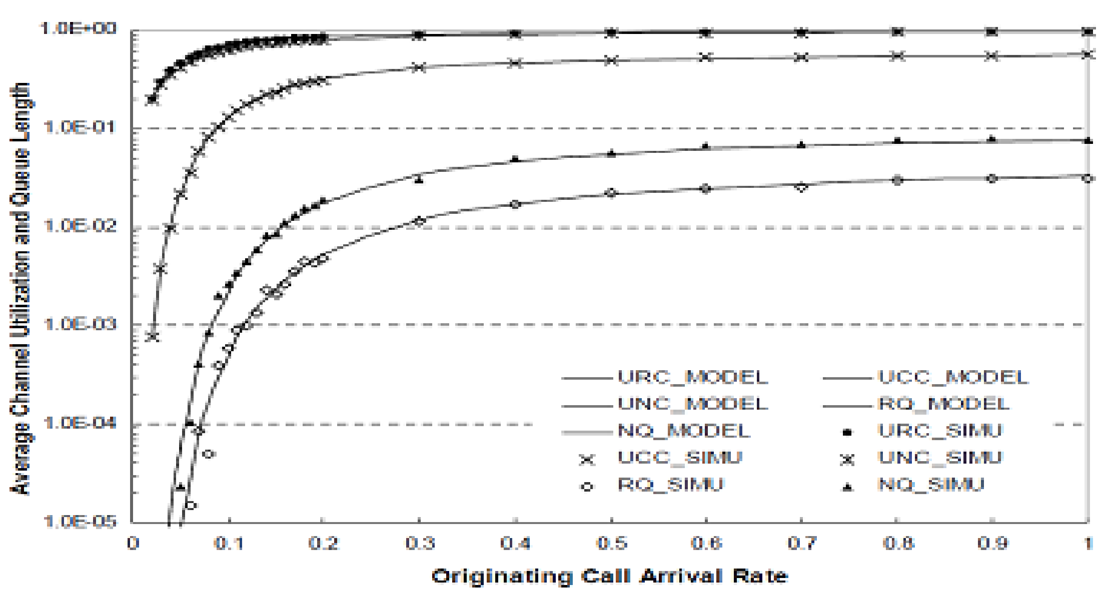

Fig.3.Comparison of average channel utilization and queue length of analytical model and simulation for preemptive handoff scheme

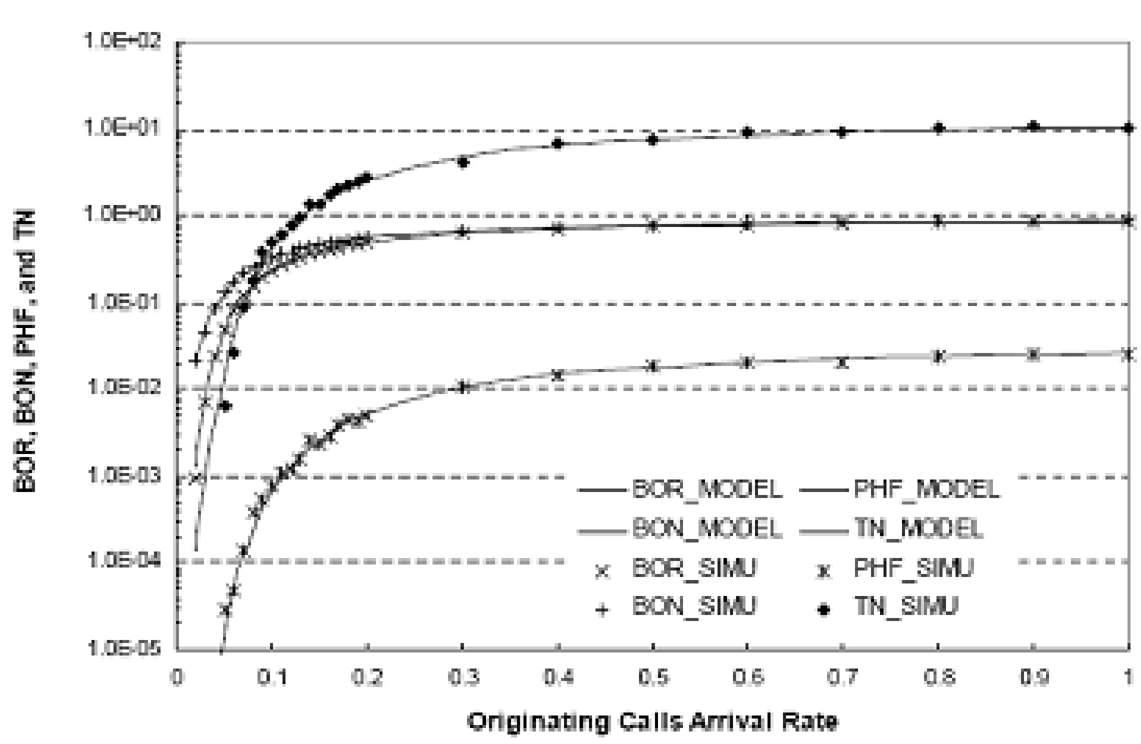

Fig.4. Comparison of BOR, BON, Phf and TN between analytical model and simulation for preemptive handoff

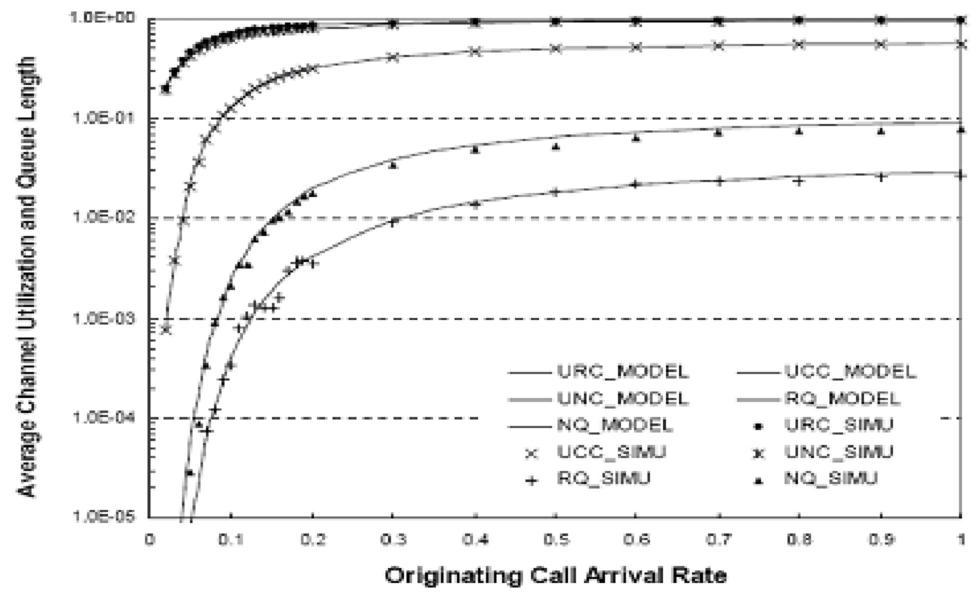

Fig.5 Comparison of average channel utilization and queue length of analytical model and simulation for preemptive handoff scheme

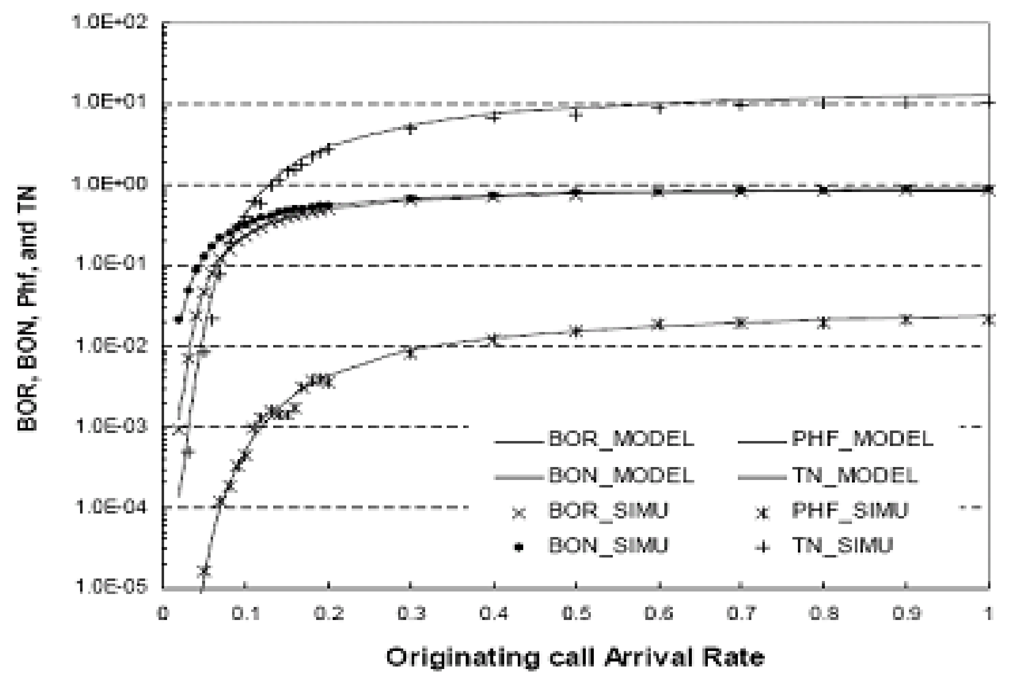

Fig.6. Comparison of BOR, BON, Phf and TN between analytical model and simulation for preemptive handoff scheme

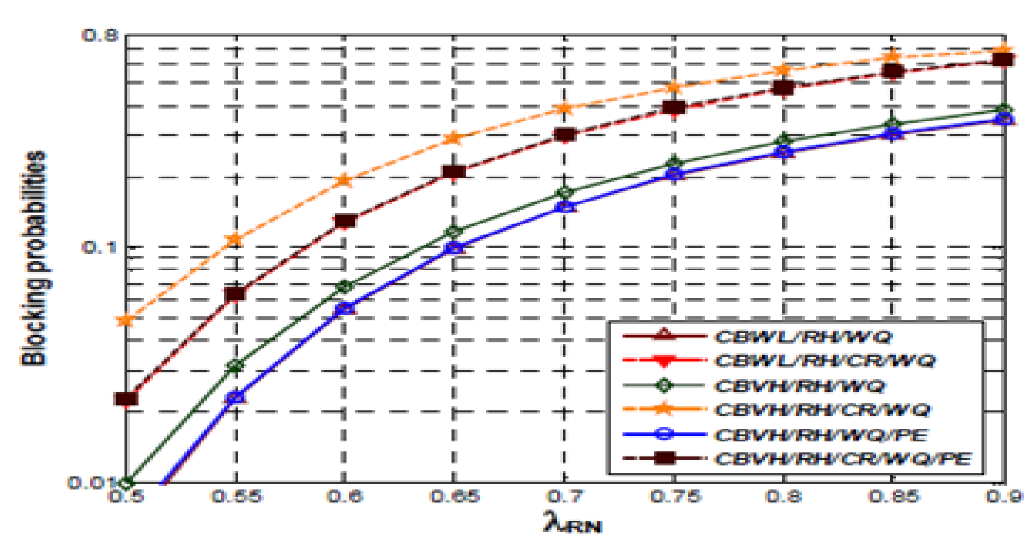

Fig.7 Blocking probability of originating voice services

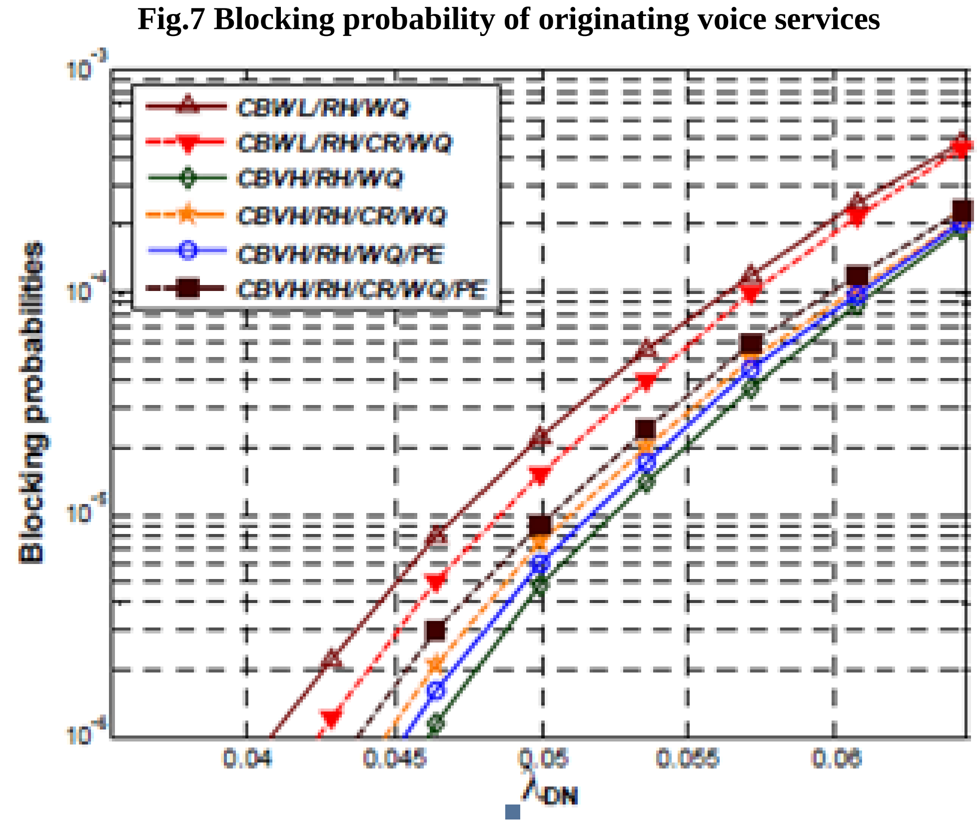

Fig.8. The blocking probability of handoff data services.

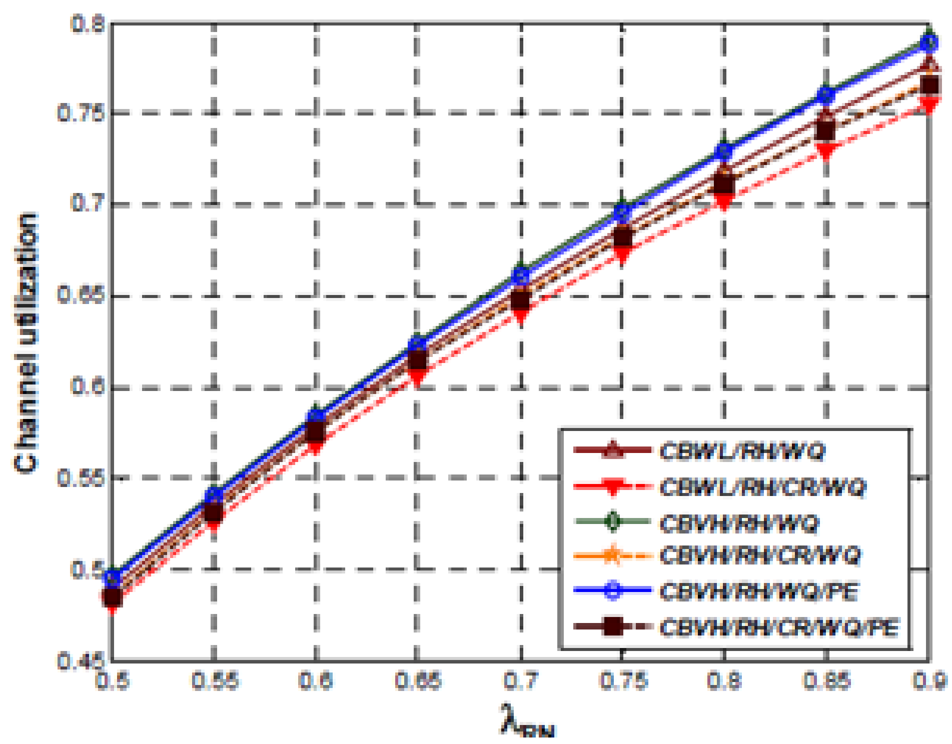

Fig 9. Channel utilization

RESULT ANALYSIS AND CONCLUSION

The design of handoff scheme is an important consideration for QoS in the integrated wireless mobile network system with real-time and non real-time services. The hybrid reservation handoff schemes (without and with preemptive procedure) have been proposed in this dissertation. An analytical model for the system performance has been presented. Our extensive simulation results are also matches with the analytical evaluations. Blocking probability of originating calls, forced termination probability of real-time service calls, and average transmission delay of non real-time service has been evaluated. It is observed that forced termination probability of real-time service handoff request calls and average transmission delay of non real-time service users could be decreased by our preemptive priority reservation handoff scheme. There is no transmission failure of non real-time service handoff requests except for a negligible small increase in blocking probability as a non real-time service handoff request can be transferred from the queue of one base stationto another

Some future developments of the work done so far are as follows.

- Mobility pattern of mobile user is a key character to model the system. How about the system performance if we choose a mobility pattern other than the Fluid Flood Model?
- Based on our analytical model, the performance of system can be evaluated if the number of channels and other system parameters are given. However, during the system design phase, following question should be answered. Given a set parameters of desired QoS, how to compute the minimum number of channel necessary and how to choose the best reservation number?
- In next generation wireless network, the type of traffic may be divided into multi classes instead of just two classes (real-time service and non real-time service). Every class of service has different requirement of QoS and maybe has different charge police.

Therefore, extending our work to support the wireless mobile network integrated multi-class traffic is one of the future work area.

In this dissertation, a propose channel borrowing based channel allocation scheme for wireless overlay networks is being studied. An elaborate analysis of our scheme is also presented. The system parameters used in this paper are fixed. They can also be adjusted according to current or future environment variables, which can be accomplished from several ways, e.g. predictive algorithm and integer programming. From the simulation results, we can conclude that our schemes outperform CBWL schemes in the same conditions. In the proposed scheme, only handoff requests may borrow channels from horizontal cells or heterogeneous cells.

Furthermore, voice services can pre-empt channels borrowed by other services in macro-cells. This will not terminate ongoing non-real-time handoff services in some conditions. For example, most data sessions use TCP/IP protocol, which will resume the slow-start after a long pause caused by handoff requests.

Blocking probabilities for both originating and handoff calls has been analyzed for real time and non real time services. The blocking probabilities have been minimized to optimum level. Starvation of non real time calls has also been minimized with the proposed design of hybrid handoff.

However there may be advances in algorithm of hybrid handoff. The algorithm has been analyzed using the markov chain and SOR iteration method. Other suitable methods may find more minimum level of blocking of call. These equations have some of the drawbacks like complex nature of Poisson's distribution. Other distributions functions may be used like Gaussian distribution function for minimum random probabilities. The method used for random number generation may be opted from some different available random number generation tools. However Poisson distribution has been found very much suitable for handoff equations. All the algorithms that are less complex than our method will definitely increase the blocking probability rate. However there are always scope of improvements in any method, so possibilities are there that some other methods of minimization may be achieved in future.

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