DYNAMIC CHANNEL ALLOCATION AND REVENUE BASED CALL ADMISSION CONTROL USING GENETIC ALGORITHM

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Abstract: *The increasing demand for advanced services in cellular networks such as data and video raises the problem of efficient bandwidth management in terms of channel availability. Dynamic channel allocation strategies is for supporting data (e.g. file transfer) and video (video viewing, video conference) with Quality of Service (QoS) by using the parameters such as call handoff probability and call blocking probability. In this paper, Dynamic Channel Allocation (DCA) is used to avoid traffic modeling for Audio/videoconferences. Call Admission Control (CAC) mechanism which makes decisions on the possible acceptance of a video call into the network is not only based on the fulfillment of user's bandwidth prediction, but also it based on the revenue that the provider will make when degrading current users in order to accommodate new ones. Genetic algorithm is an optimization tool, by this optimization tool we can find out the best match. Genetic algorithm is used for time management and for predicting accurate result. Provide high Quality of Service (QoS) to wireless Audio/ video conference users.*

Keywords: *call admission control, dynamic channel allocation, genetic algorithm, channel assignment.*

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I.INTRODUCTION

Communication is one of the integral parts of science that has always been a focus point for exchanging information among parties at locations physically apart. After its discovery, telephones have replaced the telegrams and letters. Similarly, the term `mobile' has completely revolutionized the communication by opening up innovative applications that are limited to one's imagination. Today, mobile communication has become the backbone of the society. All the mobile system technologies have improved the way of living. It's main plus point is that it has privileged a common mass of society. A cellular network or mobile network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver, known as a cell site or base station. In a cellular network, each cell uses a different set of frequencies from neighboring cells, to avoid interference and provide guaranteed bandwidth within each cell. When joined together these cells provide radio coverage over a wide geographic area. This enables a large number of portable transceivers (e.g., mobile phones, pagers, etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission. Basically the cell structure will be a hexagonal pattern, the cell geometries are shown below in fig.1.

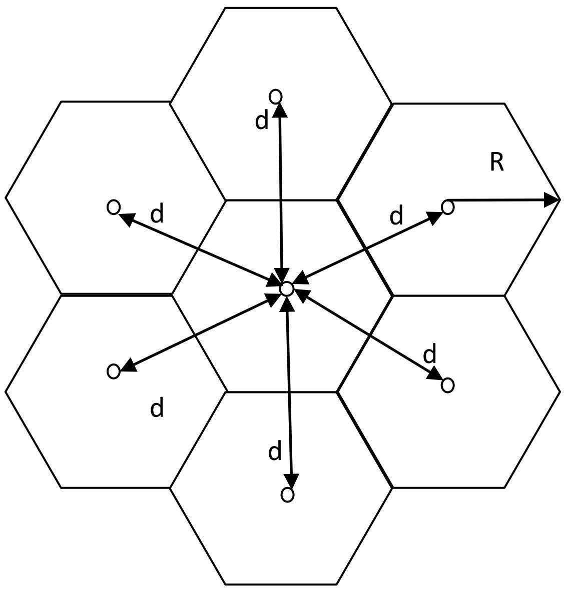

Fig: 1. Cell Geometries

CAC refers to a number of different strategies used to limit the number of call connections into the network in order to reduce network congestion. In this way, the system is able to provide the required QoS to newly incoming as well as existing users. The problem of providing efficient CAC is especially important in wireless cellular networks, where the traffic conditions in the cells can change very quickly due to user mobility.

Fixed resource channel allocation schemes use a assignment strategy as like Fixed Channel Assignment (FCA) [2], Dynamic Channel Assignment (DCA) [3], Hybrid Channel Assignment (HCA) [4]. FCA, channels are assigned to each cell permanently based on a predefined channel demand. In DCA, channels are dynamically assigned to each cell based on the channel requests. HCA, as the name implies, is a combination between FCA and DCA.

II. LITERARTURE REVIEW

Ghosh et al. [1] proposed hyper-heuristic methodology is used to find out the minimum frequency bandwidth given in different traffic demand distribution within the mobile network and the minimum channel reuse distance in order to avoid the effect of call interference within the same cell or adjacent cells. Yeung et al. [2] proposed six channel assignment heuristic algorithm to obtain frequency span Sajal et al. [3] proposed dynamic multi-channel assignment (DMCA) algorithm, this algorithm is based on the concept of network flows, and DMCA algorithm performs under heavy traffic conditions and handles different traffic classes gracefully. Zhang and Salari [4] proposed hybrid channel allocation scheme, we first obtain the stationary distribution of each cell when there are i calls connecting to the system and j calls holding on in the buffer. We then derive new and handoff call blocking probabilities, the average number of borrowed channels, and the average delay period of handoff calls.

Kishor et al. [5] proposed blocking and dropping probability in wireless cellular networks with handoff strategy, this algorithm is used to determine the optimal number of guard channels and the optimal number of channels used to provide a performance analysis for cellular systems. Hamid et al. [6] Discussed a multi-threshold guard channel policy and limiting behavior under the stationary traffic. Channel assignment algorithm for finding the optimal number of guard channels that minimizes the blocking probability of calls with lowest level of Quality of Service (QoS) subject to constraints on blocking probabilities of other calls. Finally the result shows that a prioritized channel assignment algorithm for multi cells cellular networks to minimize the blocking probability of calls with lowest level of QoS. Muhammad Salamah, Hashem Lababidi [7] discussed the Dynamically Adaptive Channel Reservation Scheme (DACRS) assigns handoff-reserved channels to new calls depending on the locality principle in which the base station with the help of location estimation algorithms in the mobile location center predicts the position of the mobile terminal. This scheme is designed to improve channel utilization while satisfying the QoS of the calls. Roses and Yates [8] proposed the admission policy is coded as a binary string and strings which produce good policies are found using genetic algorithms. Three policy coding methods were used i.e. Direct code, Block coding, program codes.

Robert et al. [9] designed a CAC algorithm for Code-Division Multiple Access (CDMA) networks with arbitrary call-arrival rates. The design of the CAC algorithm uses global information it incorporates the call-arrival rates and the user motilities across the network and guarantees the users' QoS as well as prespecified blocking probabilities. CAC algorithm guarantees QoS and blocking probabilities techniques and also calculates the network capacity, i.e., the maximum throughput for the entire network. Chatziperis [10] proposed to solve the bandwidth and QoS requirements for third and fourth-generation wireless networks, they built a Discrete Auto Regressive (DAR) model to capture the behavior of multiplexed H.263 videoconference from variable bit rate (VBR) coders. Kalpana Saha [11] proposed CAC protocol which provides videoconference traffic taking multiple services like voice, text and multimedia at a time for multiclass users. An adaptive scheduling scheme to allocate optimum rate for each traffic queue is proposed to minimize the scheduling delay. This protocol achieves optimum rate with reduced delay, maximum use of bandwidth and maximum QoS.

Tianshu Li [12] discussed about the interrelation between pricing and admission control in QoS-enabled networks and propose a tariff-based architecture framework that flexibly integrates pricing and admission control for multi-domain networks. Prihandoko [13] farmed a work on Adaptive Quality of Service (AdQos) to guarantee the QoS of multimedia traffic generally classified as real-time and non-real-time. The key feature bandwidth reallocation, when the system is overloaded bandwidth operation of ongoing connections is control. Fei Yu and Victor Leung [14] proposed the handoff dropping probability; statistically predict user mobility based on the mobility history of users. Their mobility prediction scheme is motivated by computational learning theory, which has shown that prediction is synonymous with data compression and their data achieves static-reservation and cell-reservation schemes. Leong and Zhuang [15] in this paper a survey on the existing literature related to the works on CAC for future wireless systems, especially in the wireless and combined wireless/wired domains were examined. As the concepts of the Virtual Connection Tree (VCT) and cell cluster have been proposed to handle user mobility, both centralized CAC policies for systems using static VCT static cell cluster and distributed CAC policies for systems using dynamic VCT dynamic cell cluster are discussed. Fang and Zhang [16] investigated the call admission control strategies for the wireless networks. They point out that when the average channel holding times for new calls and handoff calls are significantly different.

From this above survey shown that CAC algorithm used the above said three assignments (FCA, DCA, and HCA) and pricing control were done by multi domain networks and adaptive scheduling scheme for traffic analysis. The present work proposed a traffic model for audio/videoconference traces encoded with the latest international audio/video coding standard, in order to propose a new DCA-CAC mechanism for wireless cellular networks. In this work, the mechanism makes decisions not only based on the system's ability to accommodate newly arriving users and handoff users in terms of the estimated bandwidth but also on the profit that can be made by the provider by choosing which users will be accepted and which will be degraded based on their willingness to pay for higher quality services, as stated in their contracts. We will compare our method against the existing algorithms later in this section. Our algorithm consists of the following two channel assignment stages:

1. Regular interval assignment.
2. Genetic algorithm assignments.

III. MATERIALS AND METHODOLOGY

Dynamic channel allocation scheme, which is used as a resource-planning model, the set of available Dynamic channels in a high density cell can be divided into local channels and borrowed channels. For example, low density cells contain only local channels the dynamic channel demands arising in a high density cell can be divided into two priority classes.

Assume that the average one-way communication delay between two cells is 4millisecond, which covers both the transmission delay and the propagation delay. The mean call arrival rate in a cell λ and mean service time is 3 minutes. All the comparisons between our algorithm and the algorithm are made under uniform traffic. The message complexity of the proposed algorithm is significantly reduces due to reduction in cluster size, to acquire a channel it has to get the reply messages from at most 6 interference neighbors in spite of 30 neighbors as in algorithm it significantly reduces the call blocking rate, due to the reducing the cluster size in resource planning model. In this model, 40 nodes are used for calculating call arrival rate for dropping probability and call blocking probability. By using network simulation tool node are implemented according to system need.

A. Call Dropping and Handoff Failure

When a mobile terminal (mobile user) requests service, it may either be granted or denied service. This denial of service is known as call blocking, and its probability as call blocking probability (C_{bp}). An active terminal in a cellular network may move from one cell to another. The continuity of service to the mobile terminal in the new cell requires a successful handoff from the previous cell to the new cell. A handoff is successful if the required resources are available and allocated for the mobile terminal. The probability of a handoff failure is called handoff failure probability (H_{fp}). During the life of a call, a mobile user may cross several cell boundaries and hence may require several successful handoffs. Failure to get a successful handoff at any cell in the path forces the network to discontinue service to the user. This is known as call dropping or forced termination of the call and the probability of such an event are known as call dropping probability (C_{dp}).

In general, dropping a call in progress is considered to have a more negative impact from the user's perspective than blocking a newly requested call. According to the above definition, the call dropping probability, C_{dp}, and handoff failure probability Hfp, are different parameters. While the handoff failure probability is an important parameter for network management, the probability of call dropping (forced termination) may be more relevant to mobile users and service providers. Despite this fact, most research papers focus on the handoff failure probability because calculating H_{fp} is more convenient. If the number of handoffs throughout the duration of a call then

$C_{dp}=1-(1-H_{fp})^{H}$ ------------------ (1)

Finally, given the call blocking (C_{bp}) and dropping probabilities and (C_{dp}), the call completion probability (C_{cp}) is given by

$C_{cp}= (1-C_{bp})(1-C_{dp})$ ------------------- (2)

B. Handoff Calls and New Calls

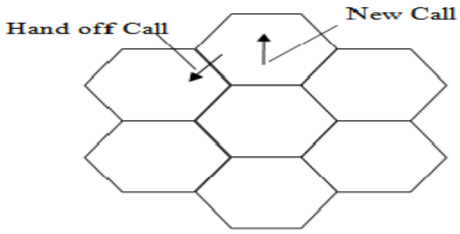

Fig: 2.New call and handoff call

Handoff and new calls are discussed in section C (Dropped Call Rates (Handoff Calls)) & E (Blocked Call Rates (New Calls)).

C. Dropped Call Rates (Handoff Calls)

The dropped call is defined as an established call which leaves the system before it is normally terminated. The Dropped Call Rate (DCR) parameter represents what percentage of all established calls is dropped during a specified time period. The DCR and voice quality are inversely proportional and high DCR may indicate coverage, handoff, or channels accessibility problems.

D. General Formula of Dropped Call Rate

The general formula of dropped call rate P in a whole system can be expressed as:

$P = 1- [\sum_{n=0}^{N} a_n X^n] = \sum_{n=0}^{N} a_n . P_n$ ---------------- (3)

Where

$P_n=1- X_n$ ------------------ (4)

And

$X= (1-\delta)(1-\mu)(1-\theta\tau)(1-\beta)$ ------------------ (5)

E. Blocked Call Rates (New Calls)

Percent of calls offered that are not allowed into the system; generally % receiving busy, but may also include messages and forced disconnects. Blocking rate is an important metric to consider ensuring it and allowing customers access to center. It is generally kept very low (under 1%). Blocking rate must be considered along with Service Level to ensure that the customer has access. Blocking is sometimes used for extreme peaks to flatten them out. The network provider is generally the source for blocking reports (percent busies). If user accept calls and then give out a busy or disconnect from the AC, you report on it from the AC reports.

F. Procedure and Flow Chart for the Proposed System

In Cellular environment node is implemented according to the call arrival rate then channel allocation scheme is evaluated based on traffic. Using priority queue technique for new user and handoff user, Call Admission (CA) is considered. According to the channel availability high priority is provided to hand off user and low priority is provided to new user. These priorities are allotted by revenue basis. If the pricing value is high then call is accepted and if pricing value is low then the call is rejected. QoS of cellular environment, call dropping, long user cal, pricing analysis, bandwidth calculation. The above said parameters are considered in this work. This system used to design for avoiding the traffic modeling in the cell so that user's data loss can be maximally reduced.

Call admission control enables you to control the audio quality and video quality of calls over a Cellular -area link by limiting the number of calls that are allowed on that link at the same time it allows for traffic check if it be dynamic allocation. Audio and video quality can begin to degrade when too many active calls exist on a link and the amount of bandwidth is oversubscribed. By using Dynamic channel allocation admission control regulates audio and video quality by limiting the number of calls that can be active on a particular link at the same time for priority scheduling it checks level of audio or video quality on the link for a particular channel. In order allocate the different type of user such as audio and video which should be executes in priority checking. This check will performs priority for handoff calls and new calls for both existing users and new users. Static channel does not perform any handoff technique.

The proposed system flow chart is shown in fig. 3. This methodology is performed through NS2 (Network Simulator 2). Network simulator is based on two languages: an object oriented simulator written in C++ and an OTCL (Object Oriented Tool Command Language) used to execute user's command script. Cellular networks request to transfer the data's as per Tcl script, so that the graphical outputs are shown in NAM and XGraph. NAM refers to

(Network Animator) this is a visual aid of showing how data's flow along the network. NAM window is shown in fig.2.

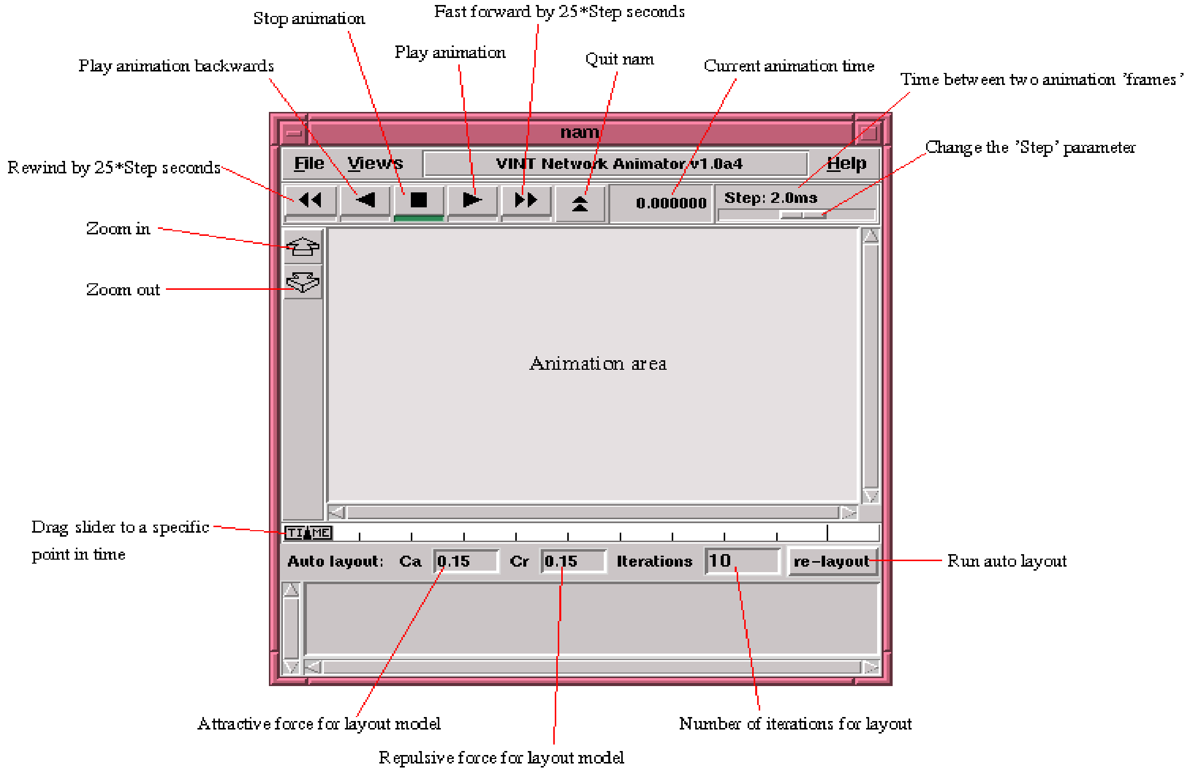

Fig: 2. NAM Window

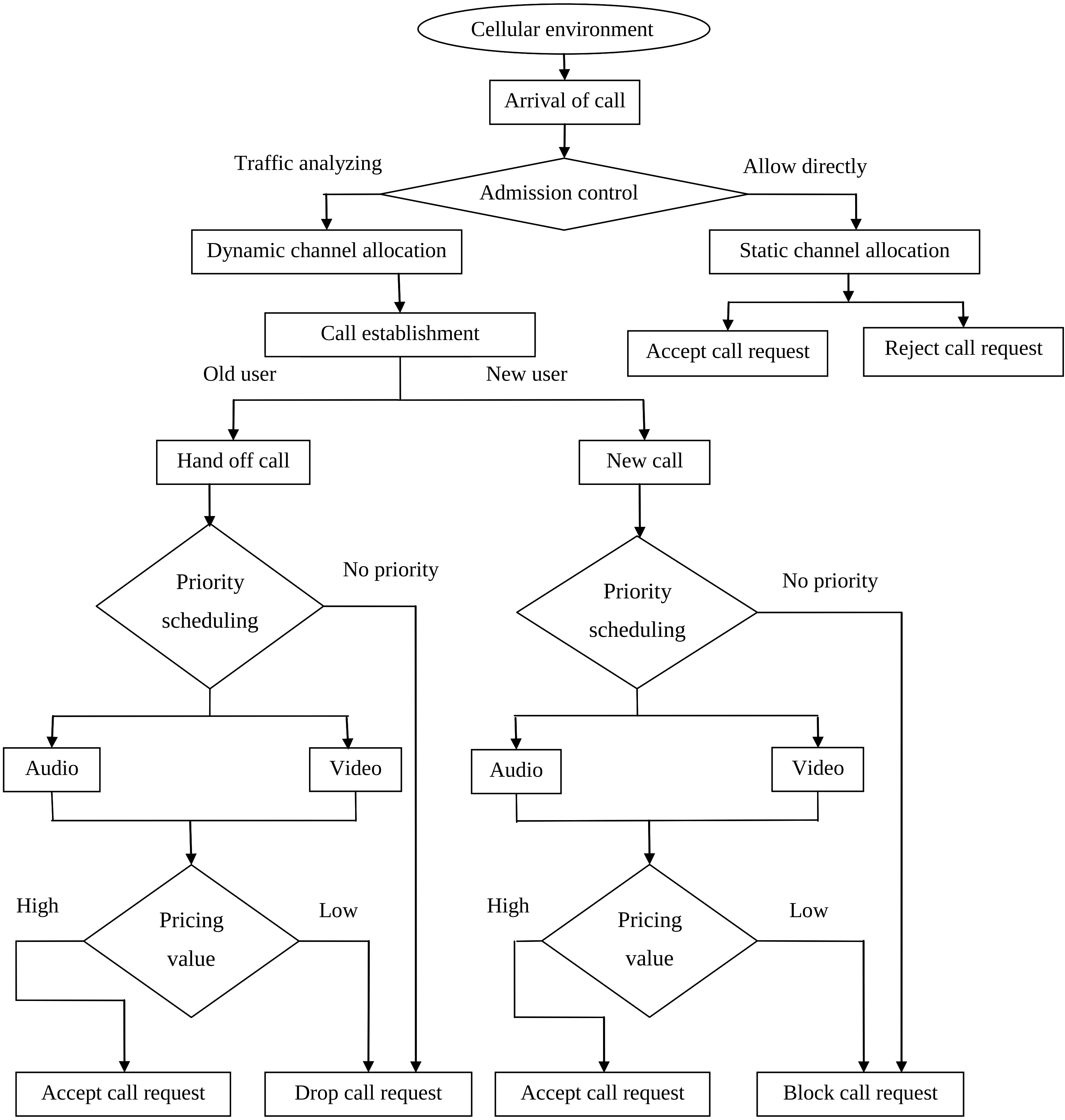

Fig: 3. Flow chart for CAC

IV. RESULTS AND DISCUSSION

The result analyses of graphs are measured and it is shown in table.1

S.No	Status	No. Calls	Audio (%)	Video (%)
1.	Call Blocking Probability-Priority	30	62	30
2.	Call Blocking Probability-No Priority	30	76	68
3.	Call Dropping Probability-Priority	30	68	30
4.	Call Dropping Probability-No Priority	30	38	34

Table: 1. Results for the methodology

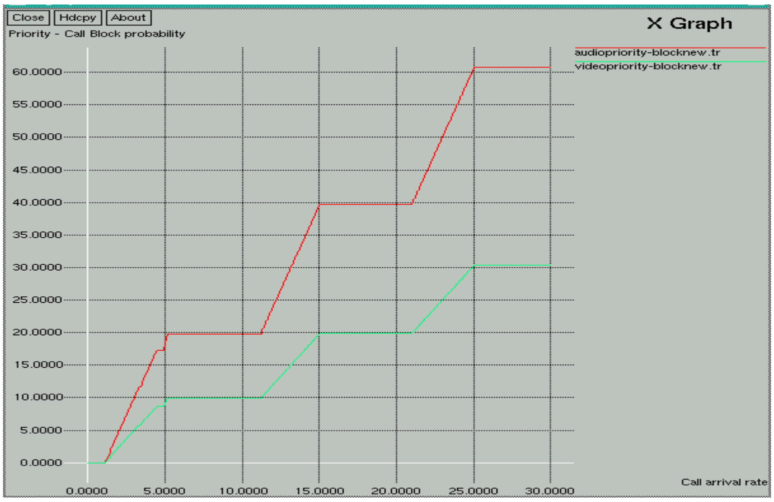

Fig: 4.New user's blocking probability with priority

New user's call blocking rate vs. call arrival rate with priority setting, in this blocking probability of audio call users is much greater than video call users. By revenue bases it achieves low blocking rate for video call users it is shown in fig 4.

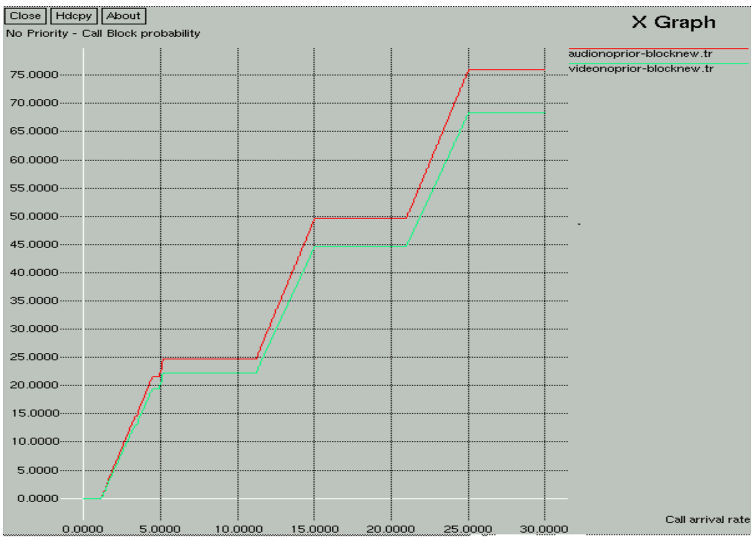

Fig: 5.New user's blocking probability without priority

New user's call blocking rate vs. call arrival rate without priority setting, in this blocking probability of audio call users is greater than video call users. But there is not much difference as like priority graph this is shown in fig 5.

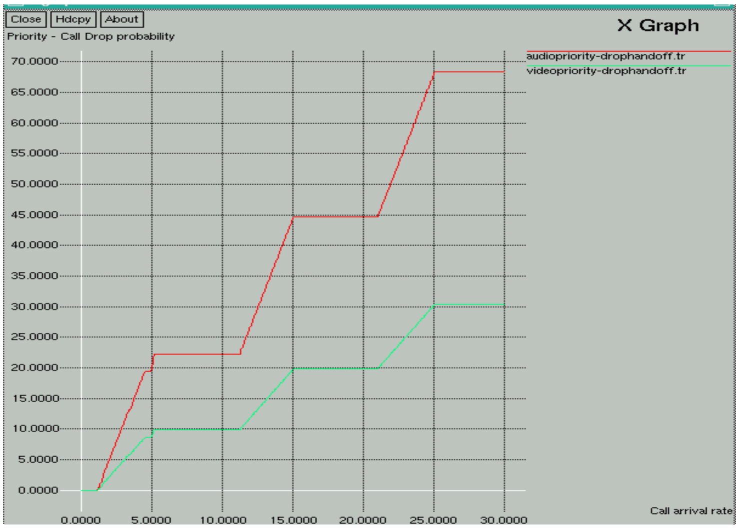

Fig: 6.Handoff user's dropping probability with priority

Handoff user's call dropping rate vs. call arrival rate with priority setting, in this dropping probability of audio call users is much greater than video call users. By revenue bases it achieves low dropping rate for video call users. When compared to Blocking probability Dropping is high this scenario is shown in fig 6.

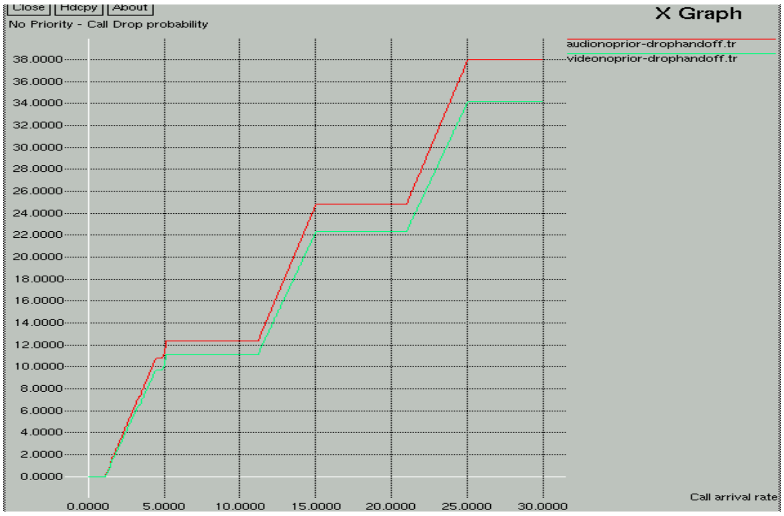

Fig: 7.Handoff user's dropping probability without priority

This graph (fig.7) which shows that new user's call dropping rate vs. call arrival rate without priority setting, in this dropping probability of audio call users is greater than video call users. But there is not much difference as like priority graph.

V. CONCLUSION

In this work the proposed, highly efficient DCA-CAC mechanism for channel allocation to avoid traffic in audio/video conference for next generation cellular networks. The mechanism, which is evaluated over a cellular network with cluster, lies in the utilization of precomputed traffic scenarios for decision-making on the acceptance or rejection of a new call. It also combines sequential heuristic methods into a genetic algorithm that consists of two stages. The two-stage algorithm seeks the optimum solution by using the regular interval assignment stage and the genetic algorithm assignment stage. The precomputation is based on the traffic parameters declared by the video source at call setup; these parameters are used for the "identification" of the source as a user adopting a specific mode from the pool of modes which have provided the basis for the precomputation of our traffic scenarios. Then, this precomputation is used in combination with an algorithm which maximizes the provider revenue, in order to make decisions on the acceptance or rejection of a new audio/videoconference call. This mechanism is shown to provide high QoS to wireless audio/videoconference users and to outperform a DCA-CAC mechanism based on equivalent bandwidth estimation.

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