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GJCST Classification: C.2.1

PERFORMANCE ANALYSIS OF CALL ADMISSION CONTROL ALGORITHM FOR WIRELESS MULTIMEDIA NETWORKS

Strictly as per the compliance and regulations of:

Performance analysis of Call Admission Control algorithm for Wireless Multimedia networks

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Abstract- In todays wireless networks different wireless multimedia services have diverse bandwidth and QOS requirements, which need to be guaranteed by the wireless cellular networks. The decision to admit or reject the new user call is made by the call admission control algorithm.In this paper, a novel Call Admission Control algorithm for wireless cellular networks is proposed. The call admission control algorithm is based on power control. It determines the optimum number of admission users with optimum transmission power level so as to reduce the interference level and call blocking. By our simulation we show that our proposed call admission control algorithm reduces the blocking probability.

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I. Introduction

The upcoming wireless cellular infrastructures such as third generation (3G) and fourth generation (4G) are deemed to support new high-speed services with different Quality-of-Service (QOS) and their respective traffic profiles. The advent of the third and fourth generation of wireless multimedia services brought about a need to adapt to the existing mobile cellular networks to make them carry various classes of multimedia traffic like voice, video, image, web documents, data or a combination thereof. achieve this goal, radio resource management techniques are used. These schemes include: channel assignment, power control, call admission control, congestion control, and other traffic-and-mobility-management schemes.

Call admission control algorithm plays a central role in determining both the performance of any network, and the revenue of the network. The call admission control algorithm must decide either to accept the call or reject it, thus having an impact on both the quality of calls and the network revenues. The call admission control algorithm must deal with multiple classes of calls having different requirements, requesting different Quality of Service (QOS) and with different priorities.In our paper we are proposing novel call admission control algorithm which is based on power control . In the above algorithm priority is given for hand off request calls ,since handoffs are important then the new calls. The power of the existing users are degraded according to priorities Here non real time services are degraded first when compared with real time services which leads to reduced loss for real time services.Session III gives the detailed description of the proposed Ad-CAC algorithm along with its design approach. Session IV gives information about the simulation model and result analysis. SessionV concludes the Paper.

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II. Related Works

[1] The easiest and most simple admission control protocol is the First Come First Served (FCFS). If a request arrives and there is enough bandwidth to accommodate it, the call is admitted, otherwise rejected. FCFS produces a good utilization of the medium, but is biased against calls which require high bandwidth. Besides, it does not support prioritization because of which the hand-off calls cannot be distinguished from the new calls.

[2] In this method, the network is divided into cells. A new call is admitted only if the number of newly arriving calls is less than or equal to maximum number of calls that can be admitted in the cell .This type of threshold based algorithm does not give efficient bandwidth utilization in Multimedia Networks.

In [3-6] the well-known Guard Channel Scheme and its variations have been proposed to give higher priority to handoff connections over new connections by reserving a number of channels called guard channels for handoff call connections. All these schemes are static. Moreover, only one traffic class, i.e., voice traffic, is considered.

In [7] a Resource Reservation Estimation (RRE) methodology has been proposed. The RRE module that resides in the base station dynamically estimates the amount of bandwidth to be reserved by referencing the traffic conditions in the neighboring cells periodically or upon call request arrival depending upon the design of the system. But such a system is very complicated to design and may not assure reliability.

In [8] a Bandwidth Partitioning Scheme has been proposed. Complete Partitioning results in unfair blocking of higher bandwidth calls and leads to inefficient utilization of the bandwidth

In [9], an optimal Bandwidth Adaptation Algorithm has been obtained, but with the assumption of the continuous value of bandwidth. The practical bandwidth values of Adaptive Multimedia are more likely to be discrete than continuous.

III. Power Control and Adaptive Call Admission Control Algorithm

While describing the access system we take only one mobile cell into account in which there are M active nodes(or users) that generates messages to be transmitted to another node. In this network the base station controls all the nodes within the cell. Two kinds of links are possible in this model.

1. *Uplink: this demonstrates data transmission from mobile station MS to BS.*
2. *Downlink: this describes the data transmission from BS to MS.*

In a topological aspect, the base station is positioned for good propagation condition. The location of the portables is uncertain and varying. The wireless propagation conditions have a strong impact on a choice of a suitable multiple access protocol.

a) *Adaptive Power Control algorithm*

The transmit power can be represented as: $P(t+1)=P(t)+\lambda.sign(SIRtarget-SIRest)[dB]$ (1)

Where P(t) represent the transmit power at time t, λ is the power control step size, SIRtarget, and SIRest are the target and estimated SIR respectively. The term sign is the sign function: sign(x) = 1, when x ≥ 0, and sign(x) = -1, when x < 0.

It can be noted that sign (SIRtarget-SIRest) =-1 is equivalent to a TPC power up command which can be represented by bit 0. From Equation 1, it can be observed that the transmit power will be increased or decreased by λ on every time slot. The transmitted power will always change even when there is no change in the channel.

The transmit power is updated according to the following equation:

$P_u(t+1)=P_u(t)+AF_u(t).PDF_u(t)\lambda.TPC_u(t)$ (2)

Where AFu (t) is the Adaptive Factor of u^{th} user at time t, and TPCu (t) is the TPC command of u^{th} user at time t, corresponding to sign (SIRtarget-SIRest) in Equation 1, and PDF_u (t) is the Power Determining Factor. If the received message is High Contention Message, then it will increase the parameter and subsequently increases the power and if the message is Low Contention then the parameter will be decreased and correspondingly the power also.

b) *Adaptive call admission control algorithm*

Let P_t be the total power of the existing users in the network.

Let P_a be the total available power.

Let P_r be the power of the requested new user to get admission in the network.

1. Wait for call request arrival.
2. If a new call request arrives.
3. If it is a hand off call.
4. If $P_{t+} P_{r<} P_a$
5. Admit the request call.

else

6. If $P_{t+} P_{r>} P_a$
7. Degrade the existing users who are using Non real time services.
8. After degrading NRT services If $P_{t+} P_{r<} P_a$
9. Admit the request call.

else

10. If still $P_{t+} P_{r>} P_a$
11. Degrade the existing users who are using real time services.
12. After degrading RT services If $P_{t+} P_{r<} P_a$
13. Admit the request call.

else

14. If still $P_{t+} P_{r>} P_a$
15. Reject the requested call.
16. Else if it is new call repeat steps 4 to 15.

In the above algorithm priority is given for hand off request calls ,since handoffs are important then the new calls. The power of the existing users are degraded according to priorities . Here non real time services are degraded first when compared with real time services which leads to reduced loss for real time services. The existing users are degraded to a minimum power level till they maintain acceptable quality of service in the network.

Upgradation

If M are the out going calls in the network .The out going calls are the calls that are moved from current cell to the other neighboring cells. If N are the completed calls in the network. The total power used by the out going calls and completed calls in the network is $P_m + P_{n.}$

$P_{m=}$ power used by M out going calls in the network.

$P_{n.=}$ power used by N competed calls in the network.

The power levels are updated in the network .The power left by the M out going calls and N competed calls can be used by the existing users in the network.

IV. Simulation Results

a) *Simulation Setup*

In this section, We simulate the proposed adaptive call admission control (ACAC) algorithm for WCDMA cellular networks. The simulation tool used is NS2 which is a general- purpose simulation tool that provides discrete event simulation of user defined networks. In the simulation, mobile nodes move in a 600 meter x 600 meter region for 50 seco- -nds simulation time. Initial locations and movements of the nodes are obtained using the random way point (RWP) model of NS2. All nodes have the same tra - -nsmission range of 250 meters.

The simulation parameters are given in table I.

Area Size	600 X 600
Number of Cells	2
Users Per Cell	20
Slot Duration	2 msec
Radio Range	250m
Frame Length	2 to 8 slots
CDMA codes	2 to 5
Simulation Time	50 sec
Routing Protocol	AODV
Traffic Source	CBR, VBR
Video Trace	JurassikH263-256k
Packet Size	512 bytes
MSDU	2132
Transmission Rate	1Mb,2Mb,…5Mb
No. of Users	2,4,6,8 and 10
SINR Threshold	5
Tx power,Rx power	0.66w,0.395w
Speed of mobile	25m/s

Table I. Simulation Parameters

b) *Performance Metric*

The performance is mainly evaluated according to the following metrics:

Throughput: It is the throughput received successfully, measured in Mb/s.

Average End-to-End Delay: The end-to-end-delay is averaged over all surviving data packets from the sources to the destinations.

Call Blocking Probability*:* It means the likelihood that a new arriving call is blocked. Actually, it depends on the CAC scheme.

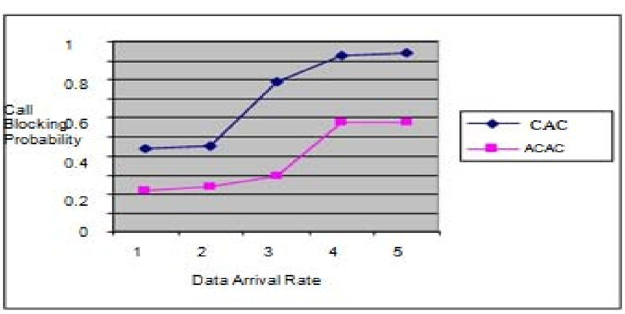

Figure1: Arrival Rate Vs Call Blocking probability

As shown in the figure 1 the call blocking probability of adaptive call admission control is less compared with non adaptive call admission control algorithm (CAC).H ere in ADCAC the users are degraded and the resource is given to the requesting users . CAC algorithm is not dynamic hence most of the resouce is wasted.

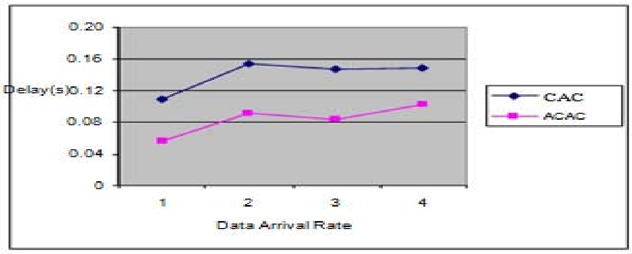

Figure2: Arrival Rate Vs delay

As shown in the figure 2 the delay of adaptive call admission control is less compared with non adaptive call admission control algorithm (CAC).Here in ADCAC more users are admitted in the network hence data can be transmitted sucessfully. where as in CAC algorithm of the resouce is not used efficiently the data is not transmitted sucessfully.

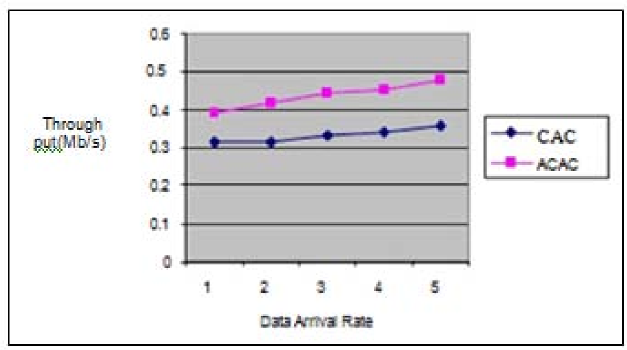

Figure3: Arrival Rate vsThroughput

As shown in the figure 3 the Throughput off adaptive call admission control is more compared with non adaptive call admission control algorithm (CAC).here in ADCAC the users as the resource is used efficiently the requesting users are admitted in the network with out delay . where as in CAC algorithm of the resouce is not used efficiently the users have to wait for getting admission in the network.

V. Conclusion

In this paper, a novel Call Admission Control algorithm for wireless cellular networks is proposed. The call admission control algorithm is based on power control. The existing users are degraded to a minimum power level till they maintain acceptable quality of service in the network and resource is utilised by the new requesting users. our proposed call admission control algorithm reduces the blocking probability increases the throughput.

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