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Improving the Quality of Service (QOS) Of Connection Admission Control Mechanism (CAC) Using Two Dimensional Queuing Model

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Abstract : *Quality of service (QOS) in real time multimedia applications has becomes a very challenging task as we move towards Wireless Technology. An effective admission control is needed to obtain better QOS, throughput and delay. To fulfill the challenge of QOS a threshold based connection admission control with two Dimensional queuing algorithms is proposed in this paper. It exploits by setting threshold on continuing connections based on available resources and bandwidth. We used the threshold to differentiate and prioritize the ongoing connections, and two dimensional queuing models for better cross layer design, traffic arrival process and multi rate transmission in the physical layer. Truncated Automatic Repeat Request (TARQ) protocol is used to reduce errors in the data link layer and to decrease link failures. Connection level and packet level performances are analyzed by modeling the connection arrival by Poisson process and packet arrival for a connection by Batch Bernoulli Arrival Process (BBAP). The proposed algorithm illustrate low computational complexity, better QOS, increased throughput and reduced delay when compared with other algorithms. The proposed algorithm also provides better performance in terms of connection blocking probability, end to end delay, packet dropping probability, queuing throughput and average packet delay.*
Keywords: *Quality of service (QOS); Wireless Technology; queuing algorithms; queuing models.*

I. Introduction

Day by day needs of wireless technology is increasing and with the advancements in the wireless technology which influences our life to use real time multimedia services. As no of applications in real time multimedia services increasing which leads to quality of service (QOS) provision and bandwidth allocations to the users is very difficult task. The present trends are towards compact communication network architecture, so this leads to more no of users can access the network. The main objective of wireless technology is to provide better QOS, efficient throughput and requisite delay which increases more no of users to use desired services when using a real time multimedia application. The most important criteria are to provide resource allocation in wireless network and bandwidth is one of them, within the bandwidth it should provide services to the users. Managing a resource allocation is very good challenging task in wireless network. Therefore better admission control scheme with efficient queue management also concentrate on available resource is the basic schemes for effective QOS. The main aim of connection admission control scheme is to provide service to the proper users and the other hand decision taking part of the network is mainly depends on guaranteed quality and optimal resource utilization which goes to better services to the users i.e. whether the connection is established to users depending on the available resources with guaranteed quality. When comparing with the wired network, channel conditions changing due to varying environment and accurate channel designing leads to creating non-deterministic queue for the wireless network is essential. The significant role of QOS routing is to find routes for incoming connections with some specific end to end QOS requirements must be satisfied. The key of QOS routing algorithm is route discovery along with link and path metrics calculations. Normally these metrics is come from physical and link layer designs. For this reason queue design with better cross layer is required which reduces link failures and to choose better paths. Along with link and path traffic rates and buffer sizes can adversely effects QOS performance in the heterogeneous wireless network with vast applications. When going to in depth on queuing management firstly the route discovery task is to provide good routes for a connection based on link and path metrics like bandwidth and data rates, delay, throughput and mainly distance from source to destination nodes. So, we need on demand queuing model with bandwidth constrained routing protocol for the wireless network. From the Signal Interference to Noise Ratio model and graph theory based model references developed a queuing model with interference taking into account and to withstand any changes in the traffic conditions with better band width utilization and network overhead or congestion control. Network congestion is the main problem for lower throughput and longer delay. Channel estimation, collision of packets, high data rates etc. leads to congestion in the wireless networks. The proposed queuing model reduces above problems. So, also we need congestion aware multi path routing protocol it should be included in the proposed model. Therefore propose model having arrival traffic modeling is to estimate band width utilization and with integrated cross layer design which to avoid network congestion. In any system scheduling is important that's why proposed model gives integrated routing with scheduling schemes also. Discussion on the proposed algorithm is Threshold Based Connection Admission control (CAC) with Two Dimensional Queue. Threshold based CAC is first to provide connections to the user from available bandwidth and for the new connection according to the time interval in which threshold is to differentiate and prioritize the ongoing no of connections. In this scheme efficient use of available resources is possible.

The data services for the connection are from Two Dimensional Queue. In this Two Dimensional Queue Truncated Automatic Repeat Request protocol is designed. Error recovery protocol is for reduction of errors and for packet collision, link failures, retransmission of packet is also there in this Queue. Adaptive coding with modulation and demodulation schemes is also proposed. In this article channel estimation with SINR and choose a best path for service is very easy. In other words say Threshold Based Connection Admission control (CAC) with Two Dimensional Queue is to provide better services to the user with guaranteed Quality of Service and mostly increase more no of users. Finally this leads to efficient use of Wireless communication and create great awareness about this technology. The objective of this research is mainly divided into two phases. The first phase is focused on the proposing of an efficient connection admission control algorithm strategy integrated with Two Dimensional queuing model and well suited for multimedia traffic sources according to today's situation. The second phase explains the key role of an integrated queuing model proposing a new multi layered with better cross layer design for a wireless network and is in heavy network load environment. This algorithm designed and tested in two phases gives first class guarantee to an adequate quality of service to the multimedia traffic connections.

II. Related Work

In this section, we provide the details of the proposed Quality of service (QOS) of connection admission control mechanisms, Queen aware connection admission control and two dimensional queues to improve the Quality of service.

A. Connection Admission Control (CAC)

Connection admission control (CAC) is a set of movements and agreements in network statement that classifies where the connection is allowable on the basis of network ability. This considered set of network actions is introduced throughout the call setup or when calls are re-connected. It is founded on a modest algorithm secondhand to differentiate the incoming and outgoing network traffic.

B. Types of CAC Schemes

Parameter-based CAC: The user quantified flow appearances in new connection request to agree whether the network has the necessary resources to put up the new connection.

Non-statistical: It uses only the information of the Peak cell rate parameter to associate against the network available bandwidth and agree whether to accept the new connection request or not.

Statistical: It does not declare new connection requests on the foundation of their peak cell rates rather the assigned bandwidth is between the peak cell rate and the sustained cell rate. Statistical CAC algorithms are the traffic modeling of a massive range of features of the arrival processes.

Measurement-based CAC: The measurement-based CAC algorithms uses network quantity to evaluation current load of existing traffic. Measurement-based approach improves the burden on the users to exactly specify the limits or models for their traffic flow, and thus is a more applied approach for realizing statistical multiplexing gain with variable-rate traffic.

Bandwidth and buffer characterization based CAC: In the Bandwidth and Buffer Characterization-based CAC, each meeting connection is defined by (σ, ρ), where σ and ρ signify buffer space and transmission bandwidth allotted for the session at each switching node along the route. With this CAC scheme, one can continuously trade more buffer resource σ for less bandwidth ρ because the shared buffer space will not be meaningfully increased by individual σ. Such a federation has the same result of statistical multiplexing on bandwidth efficiency.

C. DYNAMIC CAC:

Virtual circuit level CAC: A conventional CAC scheme is a specific arrival process model that categorizes connection requests into a set of call classes, separately of which were pre-calculated using traffic parameters stated by the user and stored in some lookup table. This conventional CAC scheme has problems in managing the lookup table.

Virtual Path Level Dynamic CAC: Additional dynamic CAC is a virtual path (VP) level bandwidth allocation algorithm founded on application of optimal control theory to a fluid flow model of a generic VP. The fluid flow model defines the VP's mean behavior and helps as a state variable model. It animatedly cuts bandwidth based on feedback of state information, and assigns bandwidth economically though maintaining low loss and delay by permitting a tradeoff between different objectives.

Power-Spectral-Density (PSD) Neural-Net CAC: The PSD CAC scheme attentions on the Fourier transform of the auto-correlation function of the input processes. It is an examination in frequency domain. In appropriately, the design of the PSD-based neural-net connection admission controller does not deliberate system performance parameters such as the queue-length, the change rate of queue-length, and the cell loss ratio.

Priority Support-Based CAC: The CAC scheme accomplishes different performance provisions with two levels of cell loss priority inside each channel amongst the shared media channels. The priorities are allotted and required by the network locally on node by node bases at each switch along the connection path, whereas taking into account the current traffic load at each node.

Threshold Based CAC: when a new connection arrives, in its place of checking whether the available resources can put up the new connections or not it is future to check whether a percentage of the available resources would put up this connection.

Let x represent percentage and assumes the traffic request parameters required by the new connections. If then connection admissions rule as fallows

If x * available resources >=request resources

Then accept connection or not

D. MATHEMATICAL MODEL

Mathematical modeling is the art of decoding problems from an application area into controllable mathematical formulations whose theoretical and numerical analysis delivers insight, answers, and guidance useful for the originating application. A mathematical model is a clarification of a scheme by mathematical ideas and linguistic. The course of sprouting an exact model is labeled mathematical modeling. Exact models are rummage-sale not only in the usual sciences such as physical science, environmental science, soil science, weather casting and manufacturing disciplines e.g. processer science, fake intelligence, but also in the social sciences such as finances, mind, sociology and party-political science. Physicists, contrives, mathematicians, processes research forecasters and economists usage accurate models greatest lengthily. A model may help to describe a system and to study the properties of different components, and to make estimates about behavior.

E. Bernoulli Process

Stochastic process can remain categorized permitting to the nature of the time parameter and the values that X (t, s) where T is called the consideration set of the stochastic process and is typically a set of times. If T is an interval of real numbers and is continuous, the process is called a continuous-time stochastic process. Similarly, if Tis a countable set and hence is discrete, the process is called a discrete-time stochastic process. Discrete-time stochastic process is also called a random sequence, which is denoted by X[n] where n=1, 2. The values that X (t, s) accepts are called the states of the stochastic process. The set of all possible values of X (t, s) forms the state space, E, of the stochastic process. If E is continuous, the process is called a continuous-state stochastic process. Similarly, if E is discrete, the process is called a discrete-state stochastic process.

In a Bernoulli process probability of one arrival in a given slot is P, no arrivals is 1-P. It is a memory less process and is independent from slot to slot therefore Bernoulli process is an only one discrete time memory less process. It is a good model for cumulative flow of many independent models. In Batch Bernoulli arrival process n packets arrive and are binomially distributed in every slot. This is very helpful to study the discrete time systems.

F. Binomial Distribution

Consider at independent Bernoulli trials and it can be represent the number of successes in those n trials by the random variable X (t). Then X (t) is well-defined as a binomial random variable with parameters (n, p). The probability Mass function of a random variable X (t) with parameters (n, p) is

$$p_{x(t)}(x) = \binom{n}{t} p^t((1-p)^{n-t})$$

The binomial coefficient$\binom{n}{t}$, represents the number of ways of arranging t successes and n-t failures. Because X (t) is essentially the sum of an "n" independent Bernoulli random variables.

G. POISSON PROCESS

It is similarly used in stochastic process and modeling the times at which arrivals enter into the system. It is same as continuous time version of Bernoulli process. Arrival may appear any time, probability of arrival at any particular interval or instant is 0. Arrival process and its arrival rates are depicted in figure 1.

Arrival process is a sequence of growing events, 0<s1<s2…. where si < si+1 mean that si+1–si is a positive arrival, i.e. X is P[X ≤ 0] = 0. These random variables are called arrival periods. Note that the process starts at time 0 and that multiple arrivals cannot occur instantaneously the occurrence of bulk arrivals can be easily controlled by the simple allowance of connecting a positive integer arrival to each arrival. It will frequently specify arrival processes in a way that permits an arrival at time 0 or instantaneous arrivals as events of zero probability, but such zero probability events can typically be disregarded. In instruction to completely agree the process by the sequence s1, s2, of arrivals, it is essential to agree the joint distribution of the subsequences s1…Sn for all n>1. Although it refer to these procedures as arrival processes, they could similarly well perfect departures from a system, or any other sequence of events. While it is quite mutual, particularly in the simulation field, to refer to events or arrivals as events, it should be avoid here. The nth arrival period Sn is an arrival and [Sn ≤ t], for example, is an event. Consider nth arrival itself as an event.

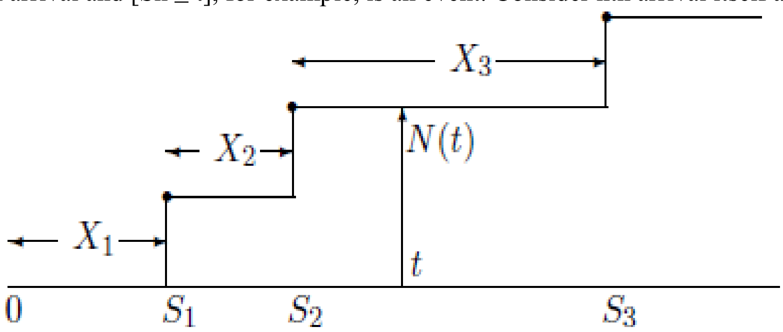

Figure 1. Arrival process and its arrival periods.

[S1, S2 …...] it's inter arrival intervals [X1, X2 . . .] and his counting process [N (t) t ≥ 0]

Poisson process is a renewal process in which inters arrival times is in sequences and it's inter arrival intervals are exponentially distributed as$f_x(x) = \lambda e^{-\lambda x}$. Where λ is arrival rate it has memory less property. The probability of no of connection can be expressed as in Poisson events n and average rate λoccur an interval T can be obtained as

$$f_{n(p)=}\frac{e^{-\lambda T}}{n!}(\lambda T)^n$$

H. QUEUE AWARE CONNECTION ADMISSION CONTROL

An analytical model based on Discrete Time Markov Chain (DTMC) is presented to analyze the system performances in both connection level and packet level. We assume that the packet arrival for a connection follows a BBAP process which is same for all connection in Queue. Connection inters arrival time and duration of connection are to be exponentially distributed with average 1/μ and 1/p. A BBAP is a stochastic process in which the Poisson process is defined by states of Markov chain. Modeling of time varying arrival rates and capture the inter frame dependency between consecutive frames. The transition matrix and Poisson arrival rate can be expressed as

$$\wedge = \begin{bmatrix} \boldsymbol{\lambda_1} & \cdots & \dots \\ \vdots & \ddots & \vdots \\ \dots & \cdots & \boldsymbol{\lambda_n} \end{bmatrix}$$

λ_nDenotes the arrival rate at state n and$\lambda_{nn'}$denotes transition rate from n to $\overline{n}$ (n, $\overline{n}$=1, 2…n) Study state probabilities of Markov chain is

$$\Pi_m = \Pi.Q_m = \Pi.1 = 1$$

The mean study state arrival rate is $\lambda = \Pi.\lambda^t$where λ^t is transpose of row vector λ=(λ1…. λn) The state of system is presented by $y_t = (n_t, \overline{y_t})$where $n_t$is state of continuous time Markov chain and $\overline{y_t}$ is no of connections in a end of every time slot T.Thus state space of the system is E= {N, C}/ n € {1…n}, C>=0}$\overline{Y_T}$. The probability of no of connection can be expressed as in Poisson events n and average rate λoccur an interval T can be obtained as

$$f_{n(p)=}\frac{e^{-\lambda T}}{n!}(\lambda T)^n$$

This function is required to get no of connections in queue. Transition matrix Q for no of connections expressed as

$$Q = \begin{bmatrix} q_{0,0} & q_{0,1} & \cdots & & \\ q_{0,1} & q_{1,1} & q_{1,2} & & \\ \ddots & \ddots & \ddots & & \\ & & q_{n-2,n-1} & q_{n-1.n-1} & q_{n-1,n} \\ & & & q_{n-1,n} & q_{,n,n} \end{bmatrix}$$

$$q_{n,n+1} \text{ is } f(p) * (1 - f(c\mu), c = 0,1 \ldots . n - 1$$
$$q_{n,n-1} \text{ is } (1 - f(p)) * f(c\mu), c = 1,2 \ldots \ldots . n \ldots \ldots \ldots \ldots \ldots \ldots (1)$$
$$q_{n,n} \text{ is } f(p)f(c\mu) + (1 - f(p))(1 - f(c\mu)$$

Where each row is no of ongoing connections as length of frame T is very small compared with connection arrival and departures rate. Elements of matrix are shown above $q_{n.n+1}, q_{n,n-1}, q_{n,n}$ is represents no of connections increase by one and decreased by one and does not change.

I. BATCH BERNOULLI ARRIVAL PROCESS FOR TWO DIMENSIONAL QUEUE

Total no of packets transmitted on any link depend on channel state and assuming that the channel states of different allocated channels are independent.Probability that i packets are transmitted during one time frame in hop l is

$$p_i^l = \sum_{k \in \sum_i (k)} \prod_{h=L}^{h=Ql} Q_h^l(k) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

Transmission link in hop l of the system is allocated R_l time slots from Q_l different orthogonal physical channels in each time frame $Q_h^l(k)$ is probability that allocated channel h in hop L is in state k, $\sum_i (k)$ is combination of all possible states state on Q_l allocated channels for hop L. Probability that I packets are received correctly and j packets were transmitted over link l is

$$f^k(j, i) = c_j^i (p^{j-i})(1 - p)^j \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

Queue state M_t depends on (M_{t-1}, N_t, R_t) we can isolate R_t to analyses system behavior effectively. Take finite state Markov chain with state pair (M_{t-1}, N_t) we combine queue state and link state as a system state. Maximum no of retransmissions from TARQ protocol is $N = N_r^{MAX}$, average no of packets per transmission as

$$\overline{N}(P, N_r^{MAX}) = 1 + p + p^2 + \cdots + pN_r^{MAX} = \frac{1 - P^{N_r^{MAX}+1}}{1 - P} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4)$$

Note that $\overline{N}(P, 0) = 1, \overline{N}(P, \infty) = \frac{1}{1-P}$

$\overline{N}$ Times of transmission per packet as an entry, an equivalent SINR $\overline{P}$ will be $p^{\overline{n}}$ time unit equivalent $\overline{T_f}$ be $\overline{N}T_f$ retransmission will not occur queue or link k, transition state probability of system state

$$P_{(m,n)(v,d)}^k = \frac{p^k((M_t = v, N_{t+1} = d)}{(M_{t+1} = m, N_t = n))}$$
$$= p^k((M_{t=}v)/(M_{t+1} = m, N_t = n))\, p^k((N_{t+1} = d)/ M_{t-1} = m, N_t = n)$$
$$= p_{v/(m,n)}^k p_{d/c}^k$$

Where $p_{v/(m,n)}^k = p^k((M_{t=}v)/(N_{t-1}, N_t =))$

$$= \begin{cases} P(R_t = v - \max\{o, m - n\}, \text{if } 0 < v < Q^k \\ 1 - \sum_{0<v<Q^k} p_{\frac{v}{m,n}}, \text{if} v = Q^k \end{cases} \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

Stationary distribution of FSMC (M_{t-1}, N_t) exists let stationary distribution is

$$p^k(M = m, N = n) = \lim_{t \to \infty} p^t(M_{t-1} = m, N_t = n) \ldots \ldots \ldots \ldots \ldots \ldots (6)$$

Let $\pi_{(m,n)}^k = p^k(M = m, N = n)$

Stationary distribution $\begin{cases} \pi_{(m,n)}^k = \pi_{(m,n)}^k * p_{(m,n)}^k \\ \sum_{m \epsilon M, n \epsilon N} \pi_{m,n}^k = 1 \end{cases} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (7)$

Arrival rate to the next node with stationary distribution of current node

$A_i^{k+1} = \sum_{m \epsilon M} \sum_{n \epsilon N} \pi_{(M,N)}^k * f^k(\min\{M, N\}, i)$ Can be evaluated from equation (3)

J. PERFORMANCE EVALUATION OF CAC MECHANISM

For threshold –based CAC scheme, all of the above performance parameters can be derived from the steady state chance course of the system states π, which is obtained by solving $\pi * p = p$ and $\pi * 1 = 1$, where 1 is the column matrix of ones. The steady state probability denoted by π (n, c) for the state that here are C connections can be extracted from matrix π as follows $\pi(n, c) = [\pi]_{n,(c+1,c)}$ $n = 1 \ldots \ldots n, c = 0,1 \ldots \ldots \ldots c_{tr}$ where c_{tr} for threshold based CAC schemes.

Connection Blocking Probability:

This performance parameter indicates that an arriving connection will be blocked from admission control decision. From equation (1)

$$p_{block}^{tb} = \sum_{n=1}^{n} \pi(n, c) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (8)$$

Probability severs that the maximum no of ongoing connections

$$p_{block}^{tb} = \sum_{n=1}^{n}\sum_{c=1}^{c_{tr}}(1-\alpha_x)*\pi(n,c) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Blocking probability is the sum of the probabilities of rejection of all knows no of connections in the queue. α_x Is the probability of no of connections accepted from CAC module?

Average No. of Ongoing Connections:

It can be expressed as $N_e^{tb} = \sum_{n=1}^{n}\sum_{c=0}^{c_{tr}} c*\pi(n,c) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$

Average Delay: No of connections waits in queue is $D=\frac{N_x}{\Phi} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$

Queue throughput: $\phi = \lambda_b(1-p_{drop})p_{drop} = \frac{N_{drop}}{\bar{\lambda}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$

End To End Loss Rate: from equation (2)

In this model, D_t^k be the no of lost packet of node k due to queue overflow over time unit t,

$$p_{drop}^k = \lim_{t\to\infty}\sum_{t=1}^{T} D_t^k \Big/ \sum_{t=1}^{T} R_t^k = \frac{\overline{D^k}}{\overline{A^k}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Where $D_t^k = \max\left\{0,\ R_t^k - Q_t^k + \max\{0, M_{t-1}^t - N_t^k\}\right\}$

Stationary distribution of $D^k = \lim_{t\to\infty} D_T^k = \lim_{t\to\infty}\left\{0, R_t^k - Q_t^k + \max\{0, M_{t-1}^t - N_t^k\}\right\}$

$$= \max\left\{0, R^k - Q^k + \max\{0, M^t - N^t\}\right\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Then $\overline{D^k} = E(D^K) = \sum_{r\epsilon R, m\varepsilon M, n\epsilon N} D^K\, P(R^k = r, M^k = m, N^k = n)$

$$= \sum_{r\epsilon R, m\varepsilon M, n\epsilon N}\left[\max[0, r - Q^k + \max\{0, M-N\}] * p(r^k = r) * p(m^k = m, n^k = n)\right]$$

$$R^k = E(r^k) = \sum_{i\epsilon I} i * r_i^k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Loss rate of link due to transmission error$(1-p_{drop}^k)p^{\bar{R}}$, Total loss-rate of hop k

$$p_{loss}^k = p_{drop}^k + (1-p_{drop}^k)p^{\bar{R}} = 1 - (1-p_{drop}^k)\left(1-p^{\bar{R}}\right) \ldots (16)$$

End to end packet loss-rate$p_{loss} = 1 - \prod_{k=1}^{L}(1-p_{loss}^k) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$

Average End To End Delay: Consider processing delay as well as transmission delay. Average no of packets in queue and being transmitted on link k, denoteds^k with stationary distribution of queue k, $p(M^K = m, N^k = n)$

$$s^k = \sum_{M\epsilon m, N\epsilon n} m\, p(M^K = m, N^k = n) + \sum_{M\epsilon m, R\epsilon r} \min\{M,N\}\ p(M^K = m, N^k = n)$$

According to little's law average delay of hop k$p_{delay}^k = \frac{s^k}{E(A^k)(1-p_{drop}^k)} \ldots (18)$

Average end to end delayis $p_{delay} = \sum_{k=1}^{l} p_{delay}^k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (19)$

Finally from three metrics packet loss, end to end loss and average end to end delay as $\text{Metric}(i) = \beta\left(\frac{\text{delay}^R}{p_d}\right) + (1-\beta)\left(\frac{\text{Loss}^R}{p_l}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$

Where R is route, P_d andPl is the packet delay and packet loss and β is weighting factor.

III. PROPOSED METHODOLOGY

i. CAC with two Dimensional queues

The figure shows the block diagram of CAC with two Dimensional queues. When number of connections arriving to CAC as an input through Poisson process in which threshold based CAC set a bandwidth threshold and should be less than available bandwidth, connection arrival should satisfy condition, update threshold and reserve bandwidth for connections in a given interval of time. All connections should place in a queue, if any connection doesn't satisfy the condition connection rejected. It also reserve bandwidth for further ongoing connections. For ongoing no of connections data arrival process should be based on BATCH BERNOULLI ARRIVAL PROCESS (BBAP), in that data is in buffer for connections.

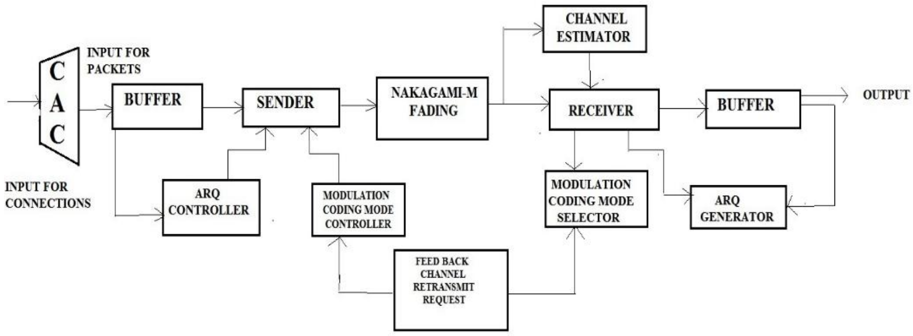

Figure 2. Block diagram of CAC with two Dimensional queues.

First sender node having information about no of connections, at what time should provide service to the customer send data to the destination or customers with less delay. In this whole process sender node checks traffic information and QOS requirements this information together with addresses of the source and destination nodes, with request ID are recorded into route request packet. ARQ controller checks whether packets reach to the destination or not if not ARQ generator send retransmission request to the ARQ controller, this send the packets. Sender nodes select the feasible link according to the sufficient bandwidth and calculate average delay and loss-rate of every feasible link send packets through channel and at the destination side through proper adaptive modulation and coding selection provide service to the customer. In process of sending information to the destination nodes RRQ (ROUTE REQUEST) packet receive with same request ID more than once, and then select the best performance link as a feasible link. Calculate arrival rate to the next node, and record it to the RRQ packet header with the average loss rate and delay. If RRQ packet reached or any route failed, then feasible route has been found, send ROUTE REPLY PACKET to the sender node otherwise takes nodes as a source node from broad cast group the connection is suffocated. Assume there are finite no of physical orthogonal channel separated in a frequency domain or spreading codes, transmission time on each channel is divided into fixed sized time slots, which are occupied by only one link or shared by different links in a non-time sharing system or time sharing systems. There is a limited no of Transmission Modes (TM) in Adaptive Modulations and Coding Schemes (AMC), each corresponds to one particular interval of SINR at the receiver. A frame by frame TM selection process for each link is performance at the transmitting node based on the feedback channel bases from the receiver, to maximize data transmission efficiency and at the same time to keep average Packet Error Ratio (PER) is in consider level. The Packet Error Ratio (PER) for transmission mode can be depend on NAKAGAMI parameter M and average SINR (Signal Interference to Noise Ratio). Finally depend on the channel state of link transmission of packets is possible in that particular link. Due to link failures or any transmission errors A Truncated Automatic Repeat Request Protocol (TARQ) is employed at each hop where error recovery and retransmission of packets is take place at the receiver.

ii. THRESHOLD BASED CONNECTION ADMISSION CONTROL

When a new connection arrives, instead of checking whether the available resources can accommodate the new connections or not it is proposed to check whether a percentage of the available resources would accommodate this connection. Let x represent percentage and assumes the traffic request parameters required by the new connections. The connection admissions rule is given below.

If x * available resources >= request resources
Then accept connection.
Else do not.

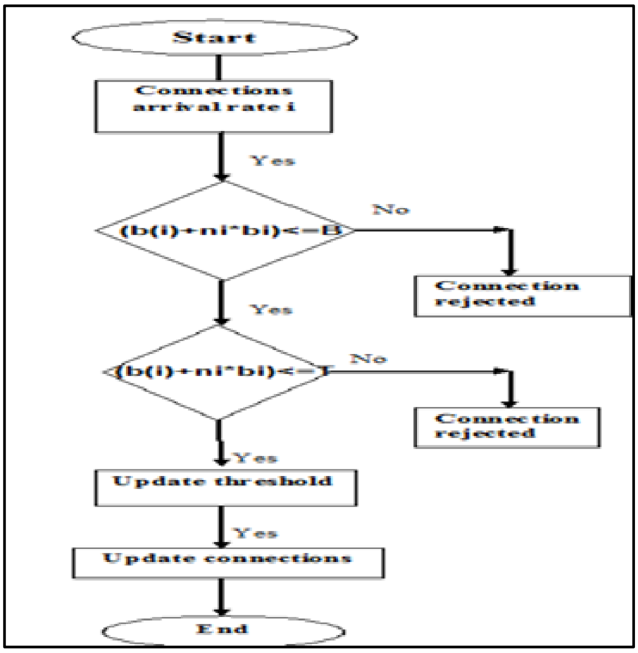

Figure 3. Flow chart of threshold based CAC.

Flow chart of threshold based CAC is given in figure 3. In this case, a Threshold T is used to limit the no of ongoing connections. When a new connection arrives, the CAC module checks connections with in the available bandwidth and threshold then update threshold and reserve bandwidth for the connections otherwise not as shown in figure. Putting threshold T to the resource of availability in the sense some mount of resource always available for later usage. Simulation found that putting threshold, some amount of traffic is effected instead of other types of traffic. Putting a threshold to the network results better throughput, less delay or loss performances can be reached. To apply threshold based CAC to the network implies that the effective bandwidth constraint also achieved. It is more convenient when compared with other CAC schemes because percentage of bandwidth for a new connection to the effective bandwidth of already arrived connections are varied i.e. which is capacity of the link minus all effective bandwidth of existing connections. In this method three types of components can be achieved i.e. Connection bandwidth allocation (CBA), Bandwidth Unit

IV. Simulation Results.

Performance Analysis:

The average number of ongoing connections, connection blocking probability and connection dropping probability with connection arrival rates are shown in figures 4-6. As the connection arrival rate increases the ongoing connections also increases but, blocking probability decreases and connections dropping probability increases when compared to other CAC algorithms.

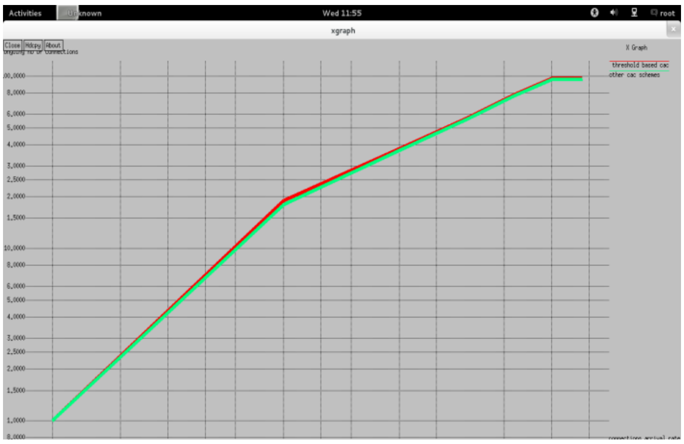

Figure 4. Average no of ongoing connections vs connection arrival rate.

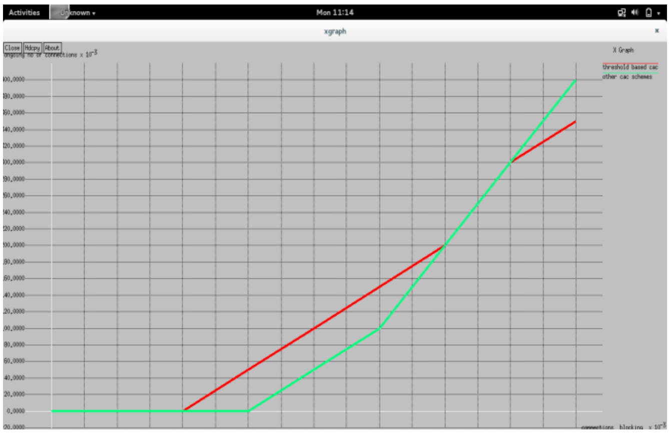

Figure 5. Connection blocking probability vs connection arrival rate.

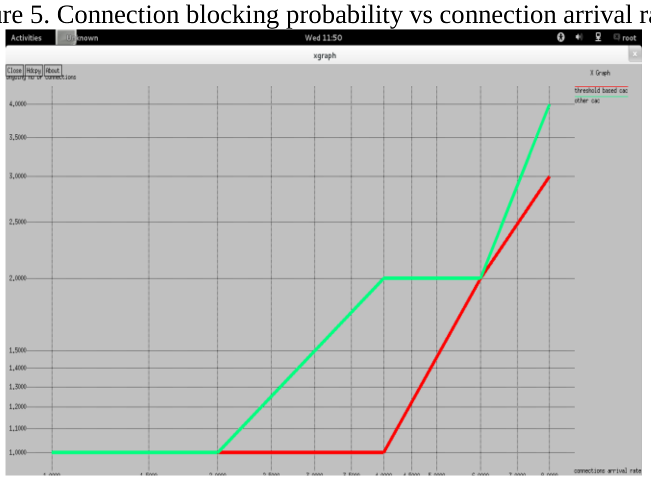

Figure 6. Connections dropping probability vs connection arrival rate.

Simulation topology is in use for 20 nodes which are arbitrarily located in area is 900×900 and distance between nodes is less than 300m. Every node taking static transmission power, antenna gain where SINR (i, j) = $p * \sigma(i,j) * d(i,j)^{-3}$ where p is transmission power and antenna gain, $\sigma(i,j)$ is interferences and $d(i,j)^{-3}$ is distance between nodes. P= 0.85×10^{7} , $\sigma(16,\ 20) = 0.77, \sigma(4{,}9) = 0.66$ and $\eta = 100$ where η is network load as shown in figure 7-9 and figures 10 shows data sent between the nodes.

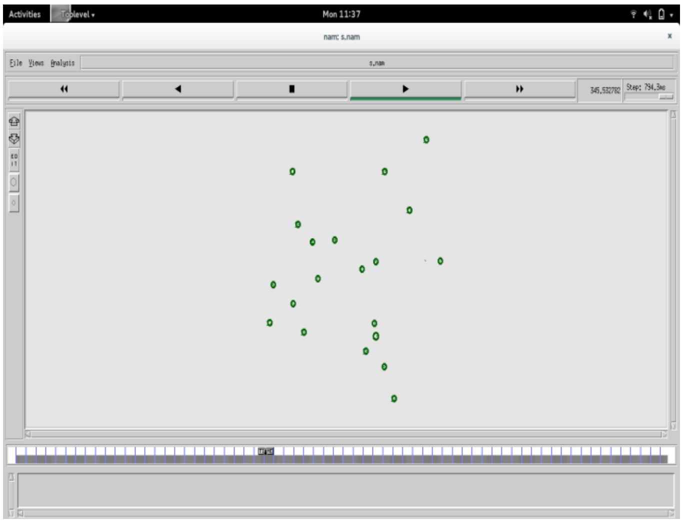

Figure 7. Network Animator with 20 nodes.

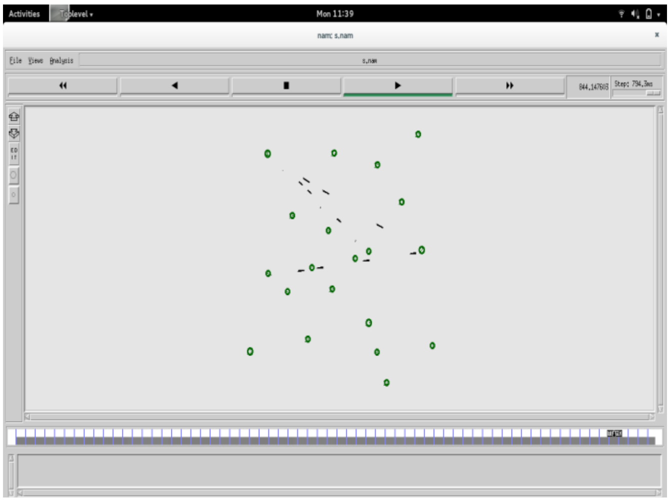

Figure 8. Data sent between the nodes.

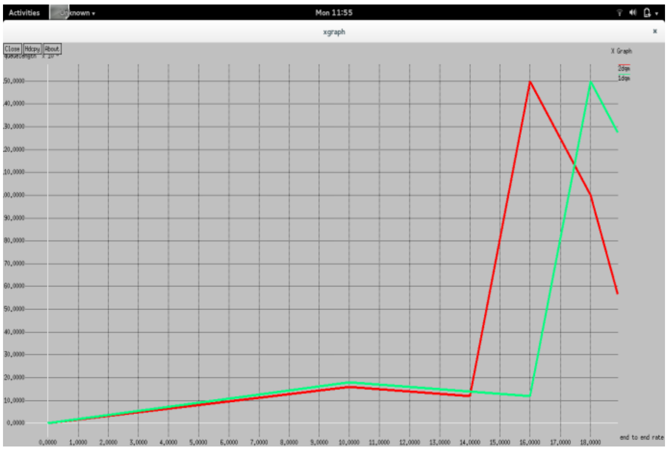

Figure 9. End to End loss rate vs packets in queue.

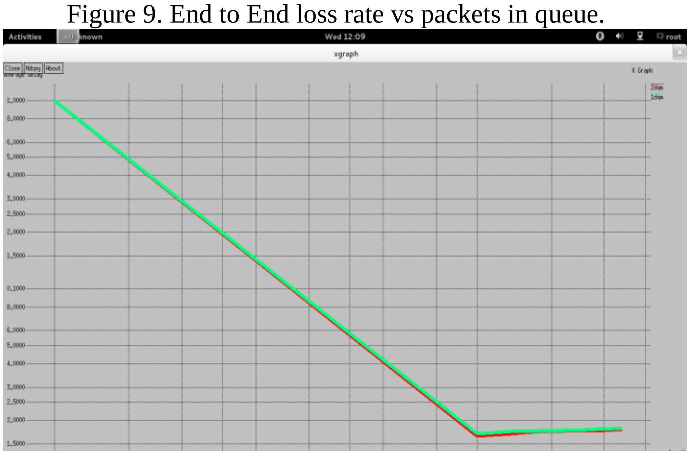

Figure 10. Average delay vs number of packets in queue.

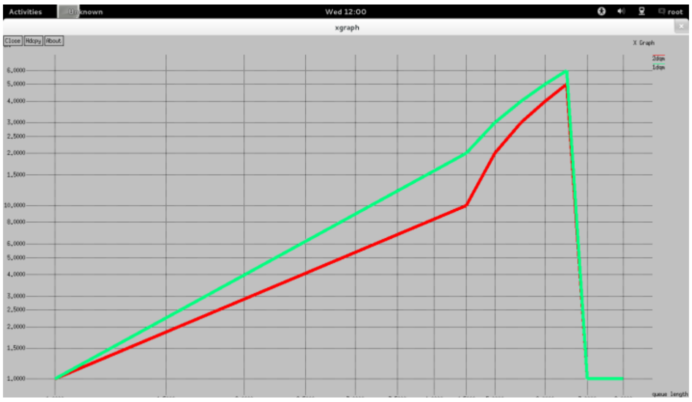

Figure 11. Queue lengths vs SNR.

V. Conclusion

Problems of Queuing performance and transmission have been addressed. For threshold based CAC scheme with two dimensional queuing, thresholds are dynamically adjusted to varying traffic from time to time according to QOS requirements. For QOS support and service differentiation, the control threshold prioritizes the connections while making admission decisions. The packet loss is reduced by the retransmissions based on TARQ protocol. The connection-level and packet-level performances of both the CAC mechanisms have been deliberated based on the queuing model. The connection arrival is modeled by a Poisson process and the packet arrival for a connection by a BBAP process. The analysis determines various performance metrics such as average number of ongoing connections, blocking probability, throughput, average packet delay, packet loss, and packet drop. The proposed algorithm illustrates low computational complexity, better QOS, increased throughput and reduced delay when compared with other algorithms. The proposed algorithm also achieved better performance in terms of connection blocking probability, end to end delay, packet dropping probability, queuing throughput and average packet delay.

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