INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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TRAFFIC MANAGEMENT TECHNIQUE IN WIRELESS COMMUNICATION

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Accepted Date:

27/02/2013

Publish Date:

01/04/2013

Keywords

Call Admission Control Protocols,

Cellular Networks,

Qos For Internet Service Provision,

Degradation,

Queues In Wireless Mobile Networks

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Abstract

In the growing fast communication world, as number of user increases it raises the demand for bandwidth in the cell and whatever up-growing networks fails to overcome this requirement especially during peak hours as numerous hits increases on the network for getting access. Again, applications generate traffic at varying rates and generally require that the network be able to carry traffic at the rate at which they generate it. So that call blocking and call dropping condition arises which fail to satisfy the costumers requirement for QoS. It may happen in any type generation (2G, 3G, 4G or next generation). This paper presenting a technique which can be applicable to any generation by just changing the parameters according to the system need. We are trying do proposing the traffic management technique for Third Generation (3G). Traffic management is possible using call admission control algorithm. This paper defining the protocol that gives the priority to the handoff calls rather than allowing the new call in cell to access the bandwidth whenever insufficient bandwidth is available. To develop Traffic Management Technique (TMT) for Mobile Adhoc network (MANET) that would minimize the blocking during peak hours is simulated and tested using MATLAB

1. INTRODUCTION

Within the 3G technologies, there are several channels within one connection so users can access telephone services, the web, chat, video, etc. all on one connection ([1, 11]). It is meant for multitasking and computers and the requirements were developed around these needs. 3G was a planned standard for mobile users to be used around the world by 2002, however, in light of recent events only Japan has entered this area – others are testing it. Multi system compatibility is also needed for 3G to work. It should allow customers to roam globally (on different frequency bands) and be able to hand off to a 2nd generation system being backwards compatible. It should be possible for 2nd generation service providers to upgrade their system to 3G and connect the systems together if they must as well as be efficient.

Key features of 3G systems are a high degree of unity of design worldwide, compatibility of services, use of small pocket terminals with worldwide roaming capability, Internet and other multimedia applications, and a wide range of services and terminals ([6]).

These wireless systems will combine cellular, wireless office telephone systems, cordless telephone systems, and advanced intelligent features into one portable device.

Currently, there are three different popular system specifications for 3rd Generation:

WCDMA – Wideband code division multiple access

TD/CDMA – Time division code division multiple access

CDMA2000 – Code division multiple access

Ever since the inception of Mobile Network, the demand for the higher spectrum allocation never ended. The trend of development was to improve the service provided to the user. ([5, 3])The change in the technology is towards a common global standard. The target to reach any-time any-where type of wireless communication system, micro-cellular concept was proposed several years ago as a means of increasing the capacity.

As Airtel communication Pvt. Ltd. launches 4G in Kolkata in April 2012. Now India becoming one of the first country in the world. But you will not be able to talk or text through this as it does not offer voice and Short Message Service. It will be available in Dongles which help get Ultra fast broadband internet access. But in 3G we are experiencing all type of services. 3G includes GSM with EDGE HSPA and LTE.

2. TRAFFIC MANAGEMENT TECHIQUE

Traffic management algorithms manage the acceptance of active users by call admission. It regulates the operation of the network in such a way that ensures uninterrupted service provision, and accommodates in an optimal way new connection requests. ([9, 10, 6])Admission Control estimates whether a new user should have access to the system without impairing the bearer requirements of existing users. Thus efficient and effective Admission Control is vital for the stability and capacity of the network. Following are the categories given for admission control as---

– Interference Based Admission

– Throughput Based Admission

– QoS Class Priority Based Admission

– Adaptive QoS Based Admission

– Capacity Based Admission

In this paper presenting the traffic management techniques on the QoS priority based admission

As Admission Control plays such a fundamental role in optimising capacity, while providing QoS ([12]) and maintaining network stability, the first step in establishing a Common RRM strategy for Heterogeneous Networks to develop a Common Admission Control. There is a techniques that manages traffic as given below

In this Technique, the admission of new calls is limited into the wireless networks. The Technique works as follows:

If the number of new calls in a cell exceeds a threshold when a new call arrives, the new call will be blocked; otherwise it will be admitted.

The handoff call is rejected only when all channels in the cell are used up. The idea behind this Technique is that it is better to continue on going calls rather than to accept new customers in the future, because customers are more sensitive to call dropping than to call blocking.

Let,

λ -- The arrival rate of new calls.

μ -- the arrival rate of handoff calls.

$1/\mu$ -- average channel holding time for new calls.

$1/\mu_h$ -- average channel holding time for handoff calls.

Let C be the total number of channels in cell. It is assumed that the arrival process for new calls and arrival process for handoff calls are all Poisson, and the channel holding times for new calls and handoff calls are exponentially distributed. Here, the analytical results for the new call blocking probability P_{nb} are estimated ([11,2, 3]).

In this section, developing the Markov model for a simplified version of proposed protocol. The proposed protocol is extremely complex and is not suitable for a closed form solution using Markov chain. However, presenting the Markov model of the protocol for completeness without solution We assume there is no priority in admission that is to say if there is enough bandwidth, or enough bandwidth could be freed by borrowing, the call is admitted. The degradable bandwidth is divided into equal sized segments. That is a call in state S is assigned a bandwidth. This assumption simply states that if the network is in state S > 0, no call can be admitted (even with its minimum bandwidth without borrowing). ([15, 2, 4]) These assumptions are not necessary for the establishment of the model, but rather for the tractability of the equations governing the state transition of the model.

Following Figure indicates the transition diagram for the call threshold Technique.

Let, Traffic Intensity for new calls $\rho = \lambda / \mu$ and

Traffic Intensity for Handoff calls $\rho_h = \lambda_h / \mu_h$

m -- Cutoff threshold (Determined on the basis of on-going calls)

If the total number of busy channels is less than m, the new call is accepted. The two-dimensional Markov chain is used to model the system. Let (n_1, n_2) denote the state, where n_1 denotes the number of new calls initiated in one cell and n_2 is the number of handoff calls in one cell.

The state diagram is shown in Figure below with the following transition rates:

$$q(n_1,n_2;n_1-1,n_2)=n_1\mu(0<n_1\leq m,0\leq n_1+n_2\leq C)$$
$$q(n_1,n_2;n_1+1,n_2)=\lambda(0\leq n_1<m,0\leq n_1+n_2<m)$$
$$q(n_1,n_2;n_1,n_2-1)=n_2\mu_h(0\leq n_1\leq m,0<n_1+n_2\leq C)$$
$$q(n_1,n_2;n_1,n_2+1)=\lambda_h(0\leq n_1\leq m,0\leq n_1+n_2<C)$$

It is observed that in some states, such as those when n_{1+} n_2 the flows no longer have the symmetric nature.

Let u(x) denote the step function, which is defined as follows: u(x) =1when x≥0 and when x<0

Let ū(x) = 1-u(x). Then, the following global balance equations are obtained:

$$\begin{aligned}&[\bar{u}(n_1+n_2-m)\lambda+\bar{u}(n_1+n_2-C)\lambda_h+n_1\mu+n_2\mu_h]p(n_1+n_2)\\&=u(n_2-1)\lambda_h p(n_1,n_2-1)+\bar{u}(n_1-m)\,\mu\,p(n_1+1,n_2)\\&\quad+\bar{u}(n_1+n_2-C)(n_2+1)\mu_h p(n_1,n_2+1)\\&\quad+\bar{u}(n_1+n_2-1-m)\lambda p(n_1-1,n_2),\quad 0\leq n_1\leq m, n_1+n_2\leq C\end{aligned}$$

Thus, these global balance equations are solved to find the steady-state probability distribution P (n_1, n_2) from which blocking probabilities can be obtained. However, as mentioned earlier, solving the global balance equations may be computationally intensive when the state dimension is large. It will be useful to find some approximation for the call blocking probabilities. An approximation based on the following idea is presented: the two-dimensional Markov chain model is attempted to reduce to a one-dimensional ([14, 6, 4]). Markov chain model by normalizing the average service time for each stream so that the average service time becomes identical for both streams. In this way, the one-dimensional Markov chain theory can be used to find the call blocking probabilities. This idea is based on the following observation: the blocking probability for each stream depends on the traffic intensity. The higher the traffic intensity, the higher the blocking probability

By normalizing the average service time (say, making the average service time to the unity), the arriving traffic for that stream will be scaled appropriately. This normalization process does not change the traffic intensity. Hopefully, the resulting blocking probability can be approximated ([11, 2, and 3]).

The following approximate model is used:

The new call arrival stream is Poisson with arrival rate ρ and with service rate (corresponding channel holding time for new calls) 1 (the unity). The handoff call arrival stream is also Poisson with arrival rate ρ_h and service rate 1. ([12, 8, 13]) Let P_j^a denote the probability that there are j busy channels in steady state (j=0, 1, 2 …C) for the approximate model. Then, the following stationary distribution for the approximate model is obtained:

$$P_j^a = \begin{cases} \frac{(\rho+\rho_h)^j}{j!} P_o & j \le m \\ \frac{(\rho+\rho_h)^m \rho_h^{j-m}}{j!} P_0 & m+1 \le j \le C \end{cases}$$

Where

$$P_0^a = \left[\sum_{j=0}^{m} \frac{(\rho+\rho_h)^j}{j!} + \sum_{j=m+1}^{C} \frac{(\rho+\rho_h)^m \rho_h^{j-m}}{j!} \right]^{-1}$$

From this stationary distribution, the blocking probabilities are obtained for new calls and handoff calls as follows:

$$p_{nb}^a = \frac{\sum_{.j=m}^{c} \frac{(\rho+\rho_h)^m \rho_h^{j-m}}{j!}}{\sum_{j=0}^{m} \frac{(\rho+\rho_h)^j}{j!} + \sum_{j=m+1}^{C} \frac{(\rho+\rho_h)^m \rho_h^{j-m}}{j!}}$$

$$p_{hb}^a = \frac{\frac{(\rho+\rho_h)^m \rho_h^{C-m}}{C!}}{\sum_{j=0}^{m} \frac{(\rho+\rho_h)^j}{j!} + \sum_{j=m+1}^{C} \frac{(\rho+\rho_h)^m \rho_h^{j-m}}{j!}}$$

These equations are used to approximate the call blocking probabilities for the cut-off priority Technique. By using above equations the call blocking probabilities is approximated for cut-off priority Technique.

1. Simulation Model

The simulation model and assumptions, which is used to analyze this Technique is that instead of putting limitation on the number of new calls, it is based on the number of total on on-going calls in the cell to make a decision, whether a new arriving call is accepted or not. Following assumptions are made for simulation

Initially call request is generated in the cell, once a new call is admitted into the network, lifetime of this call is selected according to its distribution and instead of checking number of new calls, and numbers of ongoing calls are checked. If numbers of ongoing calls are less than threshold m, new call will be accepted otherwise new call will be blocked. Once the call accepted, its parameter is updated. Next for handoff purposes the signal strength is checked with handoff higher threshold. If received signal strength (RSS) is less than handoff threshold at the same time if channels are available in targeted cell handoff request is accepted otherwise it is blocked. Thus new call blocking probability and handoff blocking probability is estimated.

2. Assumed Simulation Parameters

For simulation purpose maximum distance between two hop reference nodes is considered as 20 m.

The system is tested for 30 and 60 number of channels per reference node.

For Low traffic Low mobility, traffic is varied between 1 to 5 Erlangs per reference node and mobility is assumed 0 to 1 m/s.

At high traffic low mobility scenarios, traffic is varied between 6 to 10 Erlangs per reference node and 0 to 1 m/s mobility is considered.

For Low traffic High mobility, traffic is varied between 1 to 5 Erlangs and mobility is assumed to be 1 to 5 m/s.

At high traffic high mobility, traffic is varied between 6 to10 Erlangs and mobility is assumed 1 to 5 m/s

Each cell has C=30 channels.

Cell radius = 2000 m.

Arrival of new calls initiating in each cell forms a Poisson process with rate λ.

Threshold for new call K=15

Cutoff threshold m =25

Each call requires only one channel for service.

Arrival rate of new call and handoff call $\lambda = \lambda_h = 30$.

$\mu_h = 1/400$, and μ is varying from 1/600 to 1/200.

Traffic = 5 to 60.

3. Algorithm for Traffic Management

The traffic management techniques gives the priority to the handoff call to access the bandwidth instead of new call request whenever there will be the insufficient bandwidth in the cell.

Following are the steps that describe how call blocking probability and dropping probability is minimized.

Start

Step1: Defining and initializing the call system parameters

Step2: Generating the New Call Request

Step3: If (New Call < Threshold (K))

Accept the New Call Request

Else

Block the New Call Request

Step 4: Update the Parameters of call

Step5: Check the location and Receive Signal Strength (RSS)

Step6: If (RSS < Handoff Threshold (m))

Accept the New Call Request and Handoff this Request to the Targeted cell

Else

Block the Handoff Call Request

Step7: If (Channel Status < 1)

Accept the Handoff Call Request

Else

Drop the Handoff Request

Stop

4. Simulation Result

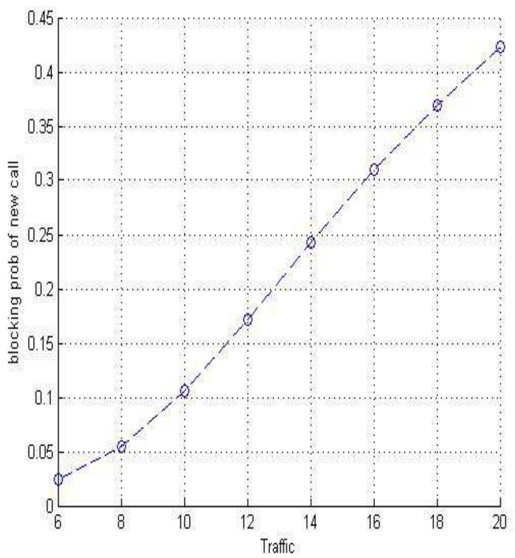

Figure 1: New call blocking Probability verses Traffic

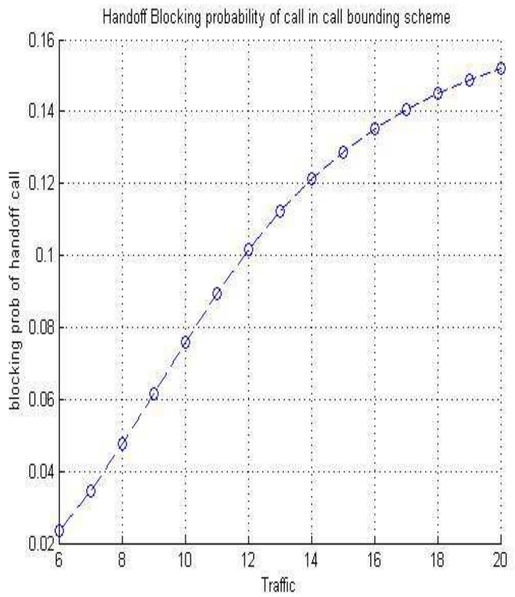

Figure 2: Handoff call dropping Probability verses Traffic

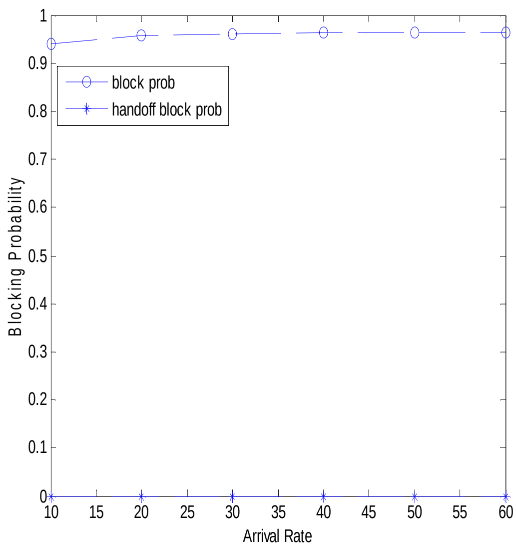

Figure 3: Showing the comparison between new call blocking probability and handoff call dropping during Traffic load

The figure 3 is combination of two programs of figure 1 and figure 2 which shows that handoff call dropping is minimum as compare to the new call blocking probability.

3. CONCLUSION

Initially call request is generated in the cell, the new call request will be granted for admission if the total number of ongoing calls is less than the threshold. Once the new call is accepted in the system, distance and velocity of call is updated. Locations and signal strength of call is monitored for every second.

If signal strength of new call is less than handoff threshold and guard channels are available in the target cell, handoff call is transferred from source cell to target cell, otherwise handoff call is blocked.

4. ACKNOWLEDGMENTS

I thanks to my guide who directed me till the completion of this work and for her valuable suggestion and unconditional help. I thank to all teaching and non teaching staff of Electronics and Telecommunication Department for the constant encouragement. I specially thanks to my Head of Department and my loving friends.

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