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Dynamic Channel Allocation in Mobile Multimedia Networks Using Error Back Propagation and Hopfield Neural Network (EBP-HOP)

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Abstract

In mobile multimedia communication systems, the limited bandwidth is an issue of serious concern. However for the better utilization of available resources in a network, channel allocation scheme plays a very important role to manage the available resources in each cell. Hence this issue should be managed to reduce the call blocking or dropping probabilities. This paper gives the new dynamic channel allocation scheme which is based on handoff calls and traffic mobility using hopfield neural network. It will improve the capacity of existing system. Hopfield method develops the new energy function that allocates channel not only for new call but also for handoff calls on the basis of traffic mobility information. Moreover, we have also examined the performance of traffic mobility with the help of error back propagation neural network model to enhance the overall Quality of Services (QoS) in terms of continuous service availability and intercell handoff calls. Our scheme decreases the call handoff dropping and blocking probability up to a better extent as compared to the other existing systems of static and dynamic channel allocation schemes.

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Keywords: Call Dropping and Blocking Probability; Dynamic Channel Allocation; Error Back Propagation Model; Hopfield Neural Networks; Mobile Multimedia Network.

1. Introduction

Recently, the demands of mobile users are varying everyday due to the portability and the availability of mobile system. But the radio spectrum is limited for this purpose as compare to mobile users. Therefore the most efficient utilization of the radio spectrum is the dynamic channel allocation schemes which improve the overall quality, capacity and performance of the wireless networks. The prime objective of the dynamic channel allocation (DCA) is to improve the capacity of mobile multimedia communication networks where the traffic load is unpredictable i.e. randomly distributed, has been proposed and explain very well in[1–4]. So far several DCA schemes have been developed and proposed to use various techniques. In recent years Hopfield neural network or HNN based dynamic channel allocation or DCA schemes have been discussed frequently[2,25,27]. HNN is fast and parallel optimizer which is very efficient neural network model for channel allocations. The optimization of the HNN can be seen in its energy function which minimizes the cost and channel allocation problem in mobile networks. This paper uses the HNN model, which plays

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a very important role for the prediction of traffic mobility as part of DCA schemes. The literature survey shows that neural network based DCA schemes are normally focused only on the channel allocation of new call and to compute the time of convergence or blocking probability of new calls. But it doesn't give more attention about the influence of traffic mobility on performance in mobile networks.

In wireless communication users want to access the network services "any place at anytime" which is controlled by mobility prediction and dynamically channel allocation during handoff management[5]. In wireless mobile network the geographical region is divided into numerous hexagonal cells, having number of channels that are used by the handoff calls and new calls. Each cell contains a base station that provides the services for the mobile users within the vicinity of the cell. Whenever a Mobile User (MU) wish to communicate with other mobile user (MU) in the network, then the message is transferred between MU and base station (BS) by radio signals within the range of BS. But when mobile users switch from the coverage area of one BS to another BS then a seamless handoff process comes into the existence which maintains the call dropping probability and QOS[6].

When handoff occurs it may be happen that, there is not enough resources available to accept the handoff calls in the new serving cell. In this situation a handoff is dropped which is more annoying than the call blocking from the user point of view as well as QoS point of view. The main characteristic of traffic mobility is to identify the next location or a cell of mobile users where the next handoff is performed. In some conditions handoff can lead to forced call termination that will effect on the overall QoS and performance of the system. Mobility prediction minimizes the call dropping probability due to the reservation of resources dynamically or in advance. So the higher priority is set on the handoff calls for the allocation of channels as compared to new call which minimizes the handoff call terminations and maintain the QoS. Therefore, a group of resources are reserved in each cell to handle the handoff calls only. However, these resources might not be used. So the reservation of resources must be done carefully which could avoid the situation of degradation of QoS for both currently served mobile users and mobile user performing handover. The benefit of this process is that it makes communication system strong in maintaining continuous calls in opposition to call dropping, while on the other hand due to the limited channel availability the rate of new call blocking probability increase. To solve this problem call admission control (CAC) with traffic mobility and dynamic channel allocation schemes are required to maintain the QoS provision and dropping & blocking probabilities of calls.

Usually there are two common schemes for channel reservation of handoff calls: a) guard channel policy and 2) fractional guard channel policy[7–9]. More practically; it is not possible to absolutely remove handoff call dropping. Therefore, one of the best ways to maintain the QoS of the communication system is to keep the probability of handoff dropping (Phd) below a threshold value. The second important issue for evaluating CAC algorithms is to keep the probability of new calls blocking (Pnb) below a certain threshold value for the maximum resource utilization[6]. This paper proposes the dynamic channel allocation policy which maintains a most favourable equilibrium between call dropping and call blocking HNN model. In addition, the performance of traffic mobility is also analyzed for the intelligent DCA techniques using error back propagation neural network (EBP-NN).

2. Related Work

Since the couple decades, there has been a lot of research done in the field of traffic mobility and channel allocation schemes[1–8,33]. Most of the traffic mobility prediction and channel allocation unique techniques are unique have been proposed. Usually schemes for traffic mobility are based on movement pattern, location history and velocity. The fluid flow and random walk model are the two most commonly methods are used for the traffic mobility in wireless network[10]. Conceptually, the shadow clustering concept is used to determine the number of resources of future based on user mobility information in microcellular wireless networks[11] A new handoff prediction scheme using data compression technique implemented by EBP-NN method to predict when and where the next handoff will occur in order to maintain the handoff dropping probability (Phd) and optimum resource utilization[28].

In[2,25] the author proposed a new dynamic channel allocation and handoff channel allocation based on traffic mobility using HNN which provides an optimum radio resource allocation for new call and handoff calls in wireless mobile networks. The hidden Markov model (HMM) modelling technique is also used in mobile network to determine the exact future position of the mobile users in the geographical area where the network is deployed[12,13]. A threshold base statistical bandwidth multiplexing using channel reservation protocol for mobile network is proposed in[14],