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Handoff Decision for Multi-user Multi-class Traffic in MIMO-LTE-A Networks

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Abstract

LTE-A networks do not have a central controlling system or node and is made up of several networking technologies. Handover is a method to assure that users can move freely within a network without losing the network connection. Thus, handoff is important in LTE-A to maintain the quality of service. But, handoffs in LTE-A face numerous issues like rapid change in network topology, failure in calls maintenance, etc. Thus, making efficient handoff decision is important. So, in this paper we develop a vertical handoff decision model on the basis of the utility model such that the handoff occurs only to the suitable cells in order to avoid any problem in maintaining the network connectivity.

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Keywords: LTE-A Network, Handoffs, Benefit function, Utility Function, Penalty Function, and Vertical handover decision.

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1. Introduction

LTE network consists of numerous wireless technologies like 2G and 3G mobile network, Adhoc network, WLAN and radio networks and hence is considered as a hybrid network. In LTE, the interconnection between the different networks is provided by IP backbone network [1]. The basic characteristics of the 4G LTE are good usable features that can be used everywhere and at all times in connection with every possible technology, and helping the intelligent service at reasonable price. In LTE, the major attribute is the system integration in which the services of the existing technology's like WLAN, UMTS and CDMA are combined and a new wireless system is developed [2] [3]. Instead of substituting the existing technologies by a different single standard, the 4G LTE combines all the current technologies to form a well enhanced communicating network [4].

In case the mobile user moves out of the cellular range, then the communication becomes incomplete since the radio signal is out of range. Then there is a need of signal transition and this procedure is known as handoff. During handoff, there is a change in the base station that takes care of the communication between two users, but no modification in the allotted frequency band. Hence, handoff can be considered as a procedure in which there is a change in the base station from one to another or change in the cellular range boundary from one to a different one [5]. The cellular handoffs are divided in to intra cell and inter cell handoff. If the mobile terminal alters its channel when it is still inside a single network and under the influence of the same base station so as to reduce the inter channel interference, then it is considered as inter cell interference. When a handoff happens among the APs or BSs belonging to a single network, it is considered as horizontal handoff or intra system handoff i.e., it happens among the member cells of a particular system. Vertical handoff means changing from one base station to another that belongs to different networks. This handoff is used in heterogeneous environment. This handoff is also called as inter system handoff occurring at various parts of networks following different technologies [5].

In this paper, we propose to design efficient handover decision model for multi-class users of LTE networks based on the parameters latency, power, network cost, throughput and user preferences.

2. Related Works

Toni Janevski et al [6] have evaluated the performance features for the vertical handover with respect to various real time video streamed in different wireless network by considering the vertical handover from UMTS to the WiMAX network and vice versa. For vertical handover, IEEE 802.21 protocol is applied and real time video is used for the assessment of the performance metric. It is found that with the increase in the mobile user speed, the handover delay and also throughput among the UMTS and WiMAX networks keeps increasing.

Issaka Hassane Abdoulaziz [7] have proposed a technique to calculate the handover requirements in the WLAN cell in two steps. They are by determining the travel time and then the threshold for estimation. On the basis of the RSS calculated and the MT speed, the travelling time is determined. According to network attributes like tolerable handover failure probability or un-necessary handover probability, the radius of the WLAN cell and the handover latency, the time threshold is determined. By following this technique, the handover failures and redundant handovers are decreased to a larger extent of 80% and 70% when considered with respect to the traditional RSS threshold and hysteresis based mechanism.

Ardian Ulvan et al [8] have proposed the handover procedure on LTE-based femtocell has been investigated and analyzed in three different scenarios, i.e., hand-in, hand-out and inter-FAP. The hand-in and inter-FAP scenarios are quite demanding than hand-out since plenty of target FAPs were involved in the handover process. It is a challenge to make a selection of the target FAP. The mobility prediction mechanism can be used to predict the heading position of the UE and then estimate the target FAP to which the UE may be connected. The reactive handover is the potential mechanism to mitigate the unnecessary handover. The further work is needed to find the most optimize handover procedure by integrating the proposed scheme and algorithm with the handover decision criteria specified by the standard.

Chi Sun et al [9] have proposed a vertical handoff decision algorithm for 4G wireless networks. Our work considers the connection duration, QoS parameters, mobility and location information, network access cost, and the signaling load incurred on the network for the vertical handoff decision. The algorithm is based on CMDP