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5G Network Optimizations for Streaming Multimedia Services

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Abstract: ***According to major challenges that faced the transmission of streaming media over wireless networks, it is essential to propose many mechanisms to support fair quality for all subscribers in the available coverage area. In this research, proposed algorithms could be implemented for solving delay and losses problems as the following: (I) Usage of hybrid radio resource managements (RRM) and distributed antenna systems (DASs), (II) Using smart antenna techniques in the transmission and reception of streaming packets, (III) Using proposed jamming node algorithms to solve co-channel interference without increasing number of cells and (IV) Proposed algorithms for accessing multimedia streaming services over 5G networks such as voice over internet protocol (VOIP) and Internet Protocol Television (IPTV). The proposed schemes had to improve the overall system quality of service (QoS) based on different international standard quality metrics.***

Keywords: Hybrid Radio Resource Managements (RRM), Distributed Antenna Systems (DASs), Internet Protocol Television (IPTV), Voice over Internet Protocol (VOIP) and Quality of Service (QoS).

1. Introduction

Multimedia streaming is one of the most popular services on the current Internet. However, the major problem hinders streaming media applications is the network bandwidth. To achieve scalability and deliver high-quality streams, multimedia content should be maintained close to interested clients [1]. The main objectives of our thesis are to satisfy the following issues: (I) Accuracy: by identifying main parameters for network that making accurate transmission and reception process during data flow under the effect of 4G networks; (II) Scalability: streaming Video and audio counts all streaming packets one single stream, or one million streams. It's completely scalable, and can be tailored to each site and subscribers; (III) Flexibility: these modern technologies can easily adapt to any changes in the industry and platforms under the control of 4G networks; (IV) Wide coverage area: by increasing number of network's connections based on variable distances, using different schemes for RRM and DASs, using different types of antenna especially smart antennas devices user can access these streaming technologies everywhere every time with an fair quality; (V) Optimization for QoS: streaming technologies can be optimized their QoS by studying the behavior of the network under interference and use HARQ for making an optimization for network's performance; and (VI) Enhancement for Streaming Services: by developing new high capacity MBMS radio interface technologies, radio resource management and new topological approaches in the architecture for beyond 3G systems and providing a concept for integration of a more flexible MBMS architecture into IMS (IP Multimedia Sub-System) including group management, session management, scheduling, media delivery and trans-coding [2].

The IPTV and VOIP network's core based on multimedia components where Multimedia applications contain multiple types of media such as text, graphics, animations, audio, and video. Multimedia applications through more networks are available today and can be accessed with high-speed networks. Multimedia applications examples contain the following issues: (I) Video Conferencing: IPTV service based on sharing video conferencing packets over a network. It contains the real-time streaming packets of audio (voice) and video data over the broadband service or wireless networks such as WiMAX and LTE-A (BEYOND 5G) networks and could be contained within the IPTV STB, (II) Streaming Audio: IPTV devices contains streaming packets of voice data as an existing multimedia application, which can be customized by the IPTV network operator; (III) Streaming Audio and Video: as streaming audio data, streaming audio and video packets is a supporting multimedia application accessed by IPTV devices. The IPTV network operator can package in attractive streaming AV services, and (IV) Internet Telephony: Internet telephony is a rising multimedia application that requires streaming audio through a wireless broadband network. This application supports IPTV network operators to offer a triple play service (voice, data, and video) to their subscribers [3].

2. Literature Survey

In 2009, Lee and Choi [4] added an adaptive hybrid transmission mechanism for cellular IPTV over WiMAX networks, which use a hybrid mechanism; that combines more than one channels; to make an enhancement of the overall performance with the aid of decreasing the bandwidth consumptions of the wireless system, which has constrained assets as compared to wired networks. so as to check the overall performance, Lee and Choi [4] compared their set of rules with the conventional structures. The basic challenge of the proposed algorithm is that it needs to investigate the optimization of resource allocation [4].

In 2010, Bikflavi et al. [5] combine WiMAX technology and IPTV structures; information is associated with the keys and every peer is accountable for a subset of the keys. Their evaluation confirmed that the hierarchical layout

considerably reduces the predicted variety of hops by way of the usage of the best peers on the top-level layer, however, the challenge of that work is the need to have a look at modifications of many QoS parameters over their proposed network [5].

In 2012, Easwara and Parvathi [6] defined overall performance evaluation of multicast video streaming over WiMAX. numerous goal performance metrics which includes throughput packet loss, packet jitter, packet delay, and minimal peak were used to quantify the system overall performance, however, their study needs to reveal the impact of WiMAX generation on packet delay variations and packet transmission/reception.

In 2013, Hamodi and Thool [7] introduced the overall performance evaluation of IPTV over WiMAX networks thinking about video streaming for real-time video coded the use of distinct codes. The simulation outcomes indicated that scalable video coding (SVC) is suitable for video streaming over WiMAX. the restrictions of this take a look at (I) transmit power; (II) coverage area; (III) mobility; (IV) constant antenna configuration, and (V) fixed channel bandwidth.

In 2014, Sheikh et al. [8] provided an efficient approach for WiMAX soft handover in VoIP and IPTV. Sheikh et al. furnished additional parameters to the network topology; which progressed the performance of handover with the aid of enhancing the QoS, e.g. throughput became progressed via minimizing the value of β-aspect to make a soft handover via load balance approach.

In 2014, Li and Yu [9] provided a unique algorithm to investigate main parameters of IPTV structures over wireless networks: (I) blocking rate and (II) bandwidth utilization. Unicast, broadcast, and multicast are the most critical transport schemes for presenting cellular IPTV services. Experimental consequences confirmed the validity of the evaluation, and multicast scheme accomplished the high-quality performance rates by recognizing to the opposite schemes [14].

In 2014, Kaur and Baghla [10] defined a theoretical view to expose the impact of WiMAX on IPTV, which give an advanced QoS at excessive information rates for IP networks. They provided a survey of IPTV services over WiMAX networks.

In 2015, Mapoka, Trust T., et al. [11] discussed an distributed handover optimized authentication scheme based on independent session key per access network (HOISKA) that developed for the decentralized multi-service group key management scheme over wireless mobile multicast. It enables a handover user involved in multiple multicast service subscriptions to securely reuse the long-term credential initially issued by the trusted authentication server for deriving unique session keys per access network as it performs handover authentication across various access networks that simplifies handover by reducing handover exchange signaling constituting to handover delays.

In 2018, S. Zhou, et al. [12] explained the investigation of the performance of First-In, First- Out (FIFO) queues over wireless networks by characterize the stability region of a general scenario where an arbitrary number of FIFO queues, which are served by a wireless medium, are shared by an arbitrary number of flows. In general, the stability region of this system is non-convex. Thus, it develops a convex inner-bound on the stability region, which is provably tight in certain cases. The Simulation results show that the discussed algorithms significantly improve the throughput of wireless networks with FIFO queues, as compared to the well-known queue-based flow control.

3. Objectives of Research

This research aimed to propose new techniques by executing more algorithms for accessing multimedia streaming services over 5G networks through the radiated power from mobile base stations controlled with indoor and outdoor antennas to formulate DASs for increasing network capacity and improving bandwidth efficiency regardless the signal levels of received power signals, also more methodologies will be programmed and implemented for maximization signal power to noise power ratios and minimization of packet losses and End-to-End delay.

4. Importance of Research

The importance of proposed schemes that supporting fair QoS for all subscribers anytime anywhere as the following: (I) improving the quality of transmitted and received signals for verifying more performance of streaming multimedia over 5G wireless networks, (II) Solving capacity problems and minimizing co-channel interference reduction factor instead of increasing network cells and (III) minimizing time delay and packets delay variation for data packets over 5G wireless to realize higher bandwidth efficiency.

5. Research Methodologies

(I) Using hybrid RRM and DASs for maximizing signal power levels to support fair capacity for all network's subscribers and solving bandwidth limitations problems, (II) Using indoor and outdoor antenna controllers to control on the radiated power signals outputted from microwave antennas with high antenna gains as smart antenna techniques to support more improvements for data packets over 5G wireless signals, (III) Optimization of 5G coverage network to realize performance metrics for wireless signals by: (i) lower End-to End delay; (ii) Lower values of packet delay variations, (iii) higher levels of signal to noise ratio; (iv) lower levels of Bit Error Rates, (v) maximization for network throughput, and (vi) maximization for network mean opinion score that reflects the quality of received signal through mobile base stations and (IV) Using Multimedia Broadcast Multimedia Services (MBMS) and Hybrid Automatic Repeat Request (HARQ) for optimizing overall system quality while accessing video conferencing application.

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Author Profile

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