MULTI-BANDWIDTH DATA PATH DESIGN FOR MULTI STREAMING IN 5G WIRELESS MOBILE INTERNETS

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ABSTRACT: Wireless communication's users are increasing day by day as the people are most socially connected with each other. There are number of different issues which are integrated with wireless mobile Internets. Many research studies have been conducted in the areas of wireless communication to make it more efficient and delivery quality to the consumer. This paper explores future mobile systems with Multi-bandwidth data path design approach to enhance the experience of the 5G wireless mobile Internets. The proposed solution presented in this research helped in minimizing the Buzzing and lag during the processing of the video and audio streaming. The proposed solution can provide high streaming Speed by the help of the Multi-bandwidth data path design and help in overall minimizing the time delay. The presented solution has been tested on both technologies 4G and 5G.

KEYWORDS: Wireless communication, mobile, Internet, Technology, Video and Audio streaming

I. INTRODUCTION

Demand of the communication and information systems (IS) are increasing day by day as these systems have the capacity to provide the information access and connecting the tasks from any location around the globe [M+14]. In today's world of information and communication technology (ICT), the internet has become an important part of our life. So there are number of mobiles and Internet service provider throughout the globe which has been involved in adopting advance data communication systems and technologies so that the best quality of services and data connectivity can be provided to their consumers [M+12].

People use internet for different purposes such as information sharing, social media, marketing, Video Streaming, interaction including (business and social) and entertainment [LL04]. Much advancement has been made in the communication technology to address the gaps and barriers of data communication limits simulated on the data channel [Sta06]. The wireless networks, Wi-Fi, WI-MAX, 3G and 4G are considered as one of the advanced technologies in today's world especially the 3G and 4G has gained much attention within the Mobile communication companies [F+06]. Security has being a critical issue in the communication networks such as Internet [H+05]. However, it has been analysed from different surveys that the mobile internet demand is increasing day by day as on the other side the threat of the security and data privacy is also increasing [T+14]. Every organization, company, business and individual personal is concerned about the data privacy, security, protection, backup, Data connectivity and [MG98].

Many researches at academic and industrial level have been conducted for the design and implementation of a network based on wireless and mobile technologies to carry high capacity of data so that the consumer can perform number of multi-media tasks [R+13]. By the availability of the high data packet networks, the overall delay can be minimized and number of tasks specially interlinked with the video and image processes can be performed [Cho14].

In these days fifth generation cellular mobile networks has gained much attention and most of the cellular companies are planning to adopt this technology but there are certain barriers which have to be addressed before the adaptation of the fifth generation network [K+14]. The infrastructure is one of the main barriers which have to be upgraded before the deployment of the fifth generation network. Fifth Generation Mobile and Wireless Networks are still in process and it has been presented that these networks have the capacity to address number of limitations and challenges which can't be resolved by the existing Cellular Mobile Networks. 5G denotes the next major phase of mobile telecommunications standards beyond the 4G/IMT-Advanced standards [H+14]. The 5th Generation Cellular network has the capacity to carry high data packets as compared to the existing 4th Generation and other cellular network [KS13].

There are number of areas which will be improved by the integration of the 5th Generation Cellular Mobile Networks. In this research paper, we have presented the Multi-bandwidth data path design for Multi-streaming in 5G wireless mobile Internets [LL04]. The proposed solution presented in this research will also help in minimizing the Buzzing and lag during the processing of the video and audio streaming. The multi data paths will be utilized to

transfer the high streaming bits parallel and the streaming bits will be provided high priority. Video and audio streaming require high data transfer channels thus, resulting overall load on the network but still it has been analysed that there are number of consumers which are facing the buzzing during the video and audio streaming. It has been believed that the buzzing issues have been minimized by integration of the Fifth Generation Cellular Mobile Networks. The objective of this research is to present a Multi bandwidth data path for carrying Multi-streaming in 5G wireless mobile Internets.
Section II presents the related work, a brief introduction of the analysis of the different generation involved in the Cellular Mobile Networks and its communication elements directly linked with the video and audio streaming. Section III presents the detailed discussion of the proposed solution and identifies the benefits which can be simulated for Multi-streaming in 5G wireless mobile Internets. Section IV presents the verification and validation of the proposed solution and in the end of the research the conclusion and future is discussed.

II. Literature Review

The demand of wireless technologies and Cellular Mobile networks is increasing day by day [E+14]. Many research studies have been conducted in past on the academic and information industry to address challenges within the perspective of data streaming in Cellular and mobile technologies [Z+14a]. Currently, the wireless access points and Mobile networks are available in the number of locations and regions including home, building, and offices or anywhere the person is travelling [PZ10]. The consumers (internet user) are in need of the internet connectivity in shopping malls, airport bus stations and many other areas as the world has become a globe village [T+14]. Due to the high computing power now a day, the users have the capacity to surf the internet, email, and social media everywhere. The high computation devices let the user to transfer the high video and audio information [PR99]. As the numbers of the users are increasing, there is a high risk of the security and also the load on the Cellular Mobile networks are increasing thus there is a high probability that if the load in not managed properly the overall network delay may occur. There are number of different methodologies, tools and techniques has been utilized to manage the load of overall the mobile and internet network but still it has been analysed that consumer face difficulty in video and audio streaming. The video and audio streaming challenges can be addressed by the integration of advance networks such as 4G and 5G.

In this section, we have presented the related research studies which have been conducted for the analysis of the different generation involved in the Cellular Mobile Networks and its communication elements directly linked with the video and audio streaming. The study of the existing architecture will help us to identify their limitation and how the proposed solution can be mapped on the 4G, WI-MAX and 5G Cellular Mobile networks.

A. Wi-MAX Architecture

Wi-MAX architecture is made of two layers [LL04]. The two main layers are MAC layer and PHY Layers. The MAC layer is again divided into three sub layers. The first layer is Subscriber station (SS). This layer performs all the encryption and decryption of the data received or send from the PHY layer. The DES uses the data traffic of 56 bit for the encryption and the key exchanges use the three standard encryption [SW87]. The second sub layer of the MAC is known a CS. This layer is used to map the data to service flow and connections. The last layer of the MAC layer is known as CPS [Z+14b].

Table 1. Wireless technologies comparison

Wireless Protocol	Data Rates	Airwaves
Bluetooth	1mbps	Unlicensed
WiFi-a WiFi-b WiFi-g WiFi-n	54Mbps 11Mbps 54Mbps 100mbps	Unlicensed
GPRS	115kbps	licensed
EDGE	384kbps	licensed
HSPDA	2mps	licensed
Wi-MAX	8-10Mbps	licensed
VSAT	512 kbps	licensed

Table 2. Comparison of Wi-MAX & UMTS

Parameter	WI-MAX	UMTS
Peak down-link data rate	46Mbps with 3:1 DL-to-UL ratio TDD; 32Mbps with 1:1	14.4Mbps using all 15 codes; 7.2Mbps with 10 codes
Peak up-link data rate	7Mbps in 10MHz using 3:1 DL-to-UL ratio	4Mbps using 1:1 1.4Mbps initially; 5.8Mbps later
Bandwidth	3.5MHz, 7MHz, 5MHz, 10MHz, and 8.75MHz initially	5MHz
Modulation	QPSK, 16 QAM, 64 QAM	QPSK, 16 QAM
Multiplexing	TDM/OFDMA	TDM/CDMA
Duplexing	TDD initially	FDD
Frequency	2.3GHz, 2.5GHz, and 3.5GHz initially	00/900/1, 800/1, 900/2, 100MHz

B. 4G Technology

4G technology has highly been adopted by the number of mobile services provided company. 4G technology is more advanced as compared to the 3G [HCY07]. The channel has more bandwidth and can carry more data as compared to other existing solution. In Tokyo, Japan, in the year 2005, first field trail for the 4 G was accompanied. NTT Do Co Mo was very successful in the achievement of the 1Gbps time packet transmission in downlink with the moving speed of twenty km per hour. For the utilization of the 4G services, multimode terminals should have the capability of selecting the wireless target systems. Currently, GSM system and base stations routinely broadcasts the signalling messages for the service subscription to the mobile stations [Kum11].

Though, the complete procedure entered in the phase of complete complications in the presence of the 4G of the heterogeneous systems due to the presence of the wireless technologies differences as well as access protocols. The 4G infrastructure consisted of the terminal mobility to the providing of the facility of the wireless services at anywhere and anytime [R+13]. The terminal mobility allowed the clients to move across geographic wireless network boundaries. However, main two problems in the terminal mobility is the location management and the second problem is the handoff management. Location management can easily track as well as locate the mobile terminal for the possible connection. It revolves in the effective handling of the information related to the roaming terminals. Handoff management deals with the maintenance of the on-going communication when the terminal is roaming. Mobile IPv6 is a homogeneous IP-based protocol of mobility for the IPv6 wireless systems. The design consists of each of the terminal that has a home address of IPv6. When the terminal is moved out of local network, the home address converts invalidity, and obtains new IPv6 address in an address that is visited. The development as well as design of the techniques of radio access and evolution of existent system, the Third Generation Partnership Project lays down the future Long Term Evolution (LTE) foundation of advancements of standards 3GPP candidate for the 4G. The target value of the peak spectrum efficacy for the LTE systems were based on the30bps/Hz and 15 Bps/Hz in downlink as well as uplink for the transmission respectively.

C. 5G Conceptual Architecture

The 5G technology is assumed to be one of the enhanced communication standards as compared to the 4G and other existing network technology [T+14]. Currently, there is no official name provided to the 5G technology [T+14]. According to the different researches [MG98, Poi09, M+12] there will be no limitation and the people can communicate with each other through real world. The high speed of data transfer would be possible and the people will be able to send large multimedia files as high speed. The current web of standard of three WWW "World Wide Wireless Web" will be replaced with fore WWWW "World Wide Wireless Web". The new protocol stack will be implemented in the 5G Conceptual Architecture. The architecture will have different feature such as high resolution, advance billing mechanism, better quality, multi user support, advance security mechanism and many other features [T+14].

The conceptual architecture of the 5G technology has been divided into layers. These layers have been presented within similar context of the ISO model [T+14]. In 5G technology the conceptual model contain five main layers. The sequence of the layer is provided as top to bottom "Application Layer, Open transport Protocol, Upper network layer, Lower Network layer and Open Wireless architecture". It can be observed that the physical layer and Data link layer has been replaced with the Open wireless architecture layer. This layer could be one of the main approaches to introduce or integrate the real world of wireless information sharing and exchange. It has been analysed from different researches [HCY07] that Fifth Generation technology of mobile communication, is seen as consumer oriented. The customized priority of the data allocation can be set according to the user or application requirements.

The proposed solution which has been presented in this research paper for developing the Multi-bandwidth data path for Multi streaming in 5G wireless mobile Internets will be simulated on the application (Service) Layer. The solution can act as an add-on for the video and audio streaming so that the buzzing and lag can be minimized or the delay can be removed to maximum extend. In the next section the system design and proposed algorithm of the proposed solution has been presented.

Table 3. Comparison of All Generation Mobile Technology [T+14]

Technology Feature	1G	2G	3G	4G	5G
Start Deployment	1980	1990-2004	2004-2010	Currently Utilized by number of Cellular Companies	Soon
Data Bandwidth	2 Kbps	64 Kbps	2 Mbps	1 Gbps	Higher than 1 Gbps
Technology	Analogy Cellular Technology	Digital Cellular Technology	CDMA 2000	Wi-MAX LTE Wi-Fi	WWWW (Coming Soon)
Services	Mobile Telephony	Digital Voice, SMS, Higher Capacity Data Packets	Integrated high Quality audio, Video, Data	Dynamic Information Access, Wearable devices	Dynamic Information Access, Wearable devices with AI capacity
Multiplexing	FDMA	TDMA,CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit, Packets	Packets	All Packets	All Packets
Core Network	PSTN	PST	Packet N/W	Internet	Internet

III. LITERATURE REVIEW

System design for the Multi-bandwidth data path for Multi streaming in 5G wireless mobile Internets. The proposed solution will be simulated on the application (Services) to minimize the Buzzing and lag delay during the video and audio streaming. The multi-streaming mechanism has been integrated in so that the flow of the video and audio signal can be parallel executed on the data path channel. In this section, the detail discussion has been conducted on the Wireless Broadband Standards, System Architecture and Proposed Algorithm for multi transmission of the audio and video signalling in 5G wireless mobile Internets.

A. Wireless Broadband Standards

The industry name of the IEEE 802.16 standards is Wireless Broadband [HMD05]. Wireless Broadband is the wireless technology which mainly functions in the radio spectrum of "10-66 in the Line of Sight (LOS) and 2-11 GHz in the Non-LOS (Wi-MAX forum)" [ZH99]. It is a point to multi point technology [MG98]. Wi-MAX and 5G is developing broadband wireless entrance technology that conveys a "carrier-class, high speed" at a comparative lower-cost than the other cellular facilities or services while giving long distances as covered than Wi-Fi and other existing wireless communication standards [PR99].

The purpose of designing Next Generation networks was to provide "cost-effective technology" [MG98] with a theoretic data rate of "70 Mbps over a wide area up to 50km in the NLOS" [N+07], control of great quality voice, records and video services. LOS is required by the Wi-MAX for higher rate of frequencies. The Wi-MAX and 5G technology's has compatibility benefit as compared to other wireless technologies which includes asynchronous transfer mode (ATM), Internet Protocol (IP) etc. Wi-MAX is categorized as a "wireless metropolitan area network" (WMAN). The 802.16 standard was designed after the failures of security that subjected down the development of "IEEE 802.11 wireless networks" [Poi09].

The IEEE 802.16 Working Group is developed for a robust mechanism incorporated Data over Cable Service Interface Specification (DOCSIS) a solution to the last mile cable problem. Since the security was considered as main priority in the development of IEEE 802.16 [PR99]. On the other hand, the Working Group was very busy in the development of several mechanisms in order to defend theft of service and unapproved or unauthorized information, alteration and disclosure [www12].

B. System Architecture

The system architecture is presented in the following figure. The System Architecture presents the location of the deployed solution. Solution has been deployed on the Application services layer.

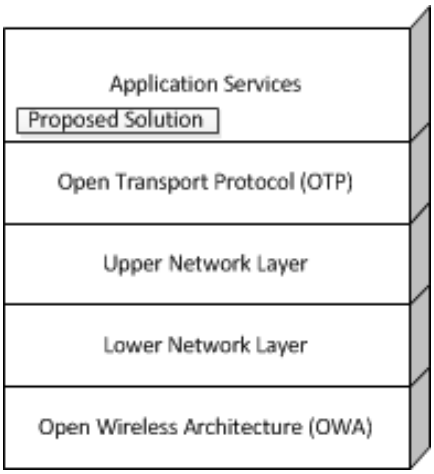

Figure 1. System Architecture

C. Proposed Algorithm

The proposed algorithm in the paper has provided a unified solution for setting the high priority of the audio and video signals and transferring the information to the designation node. The working mechanism of the proposed algorithm has been driven from the pipeline mechanism [PZB02]. The pipeline is the common mechanism which is utilized in the processing units for receiving the data simulate.

Data are access from the sources such as server. The data packets are transformed in the digital signal for the transmission. These signals are sending to the channel through open wireless architecture.

The pipeline is deployed at the application services where the signals are transmitted with simultaneously. The proposed solution in the research helps to minimize the Buzzing and lag during the processing of the video and audio streaming. The multi-data paths has been utilized to transfer the high streaming bits parallel and the streaming bits have been given high priority on the transmission channels.

IV. System Evaluation

The verification and validation (V&V) of the real time system is the critical and time consuming challenge. The performance and evaluation of any system is surrounded by number of different parameters i.e. response time, delay, data packet size and many other. The experiment has been set in the Netlogo environment. There are two main experiments which have been calculated for the verification and validation of the proposed solution.

1) Time Delay (Proposed Solution vs. Existing Solution),
2) Streaming Speed (Proposed Solution Vs. Existing Solution).

A. Time Delay

The experiment has been conducted to identify and analysis that how much the time delay has been improved by the integration of the proposed solution as compared to the existing solution. It has been analysed from the simulation results that proposed solution based on the Multi-bandwidth data path design has less delay as compared to the solution for audio and video streaming executed on the existing technologies. In the simulation environment we have utilized the 4G and 5G technology. It has been observed from the results that 20% to 30% of the time delay has been minimized by the integration of the proposed solution.

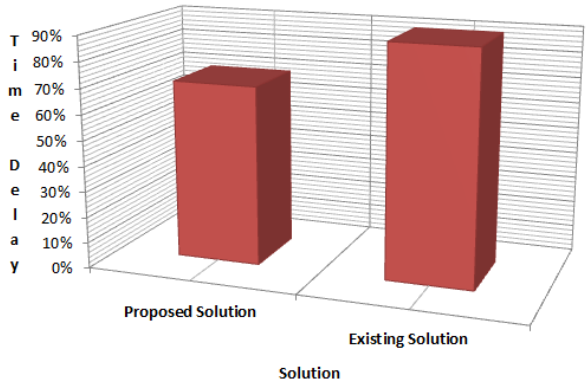

Figure 2. Time Delay

B. Streaming Speed

The main goal of the proposed solution is to improve the streaming speed thus this help in minimizing the Buzzing and lag during the processing of the video and audio streaming. It has been analysed from the results that the by the integration of the Multi-bandwidth data path approach the overall Streaming Speed thus resulting into the overall improvement in the audio and video signals.

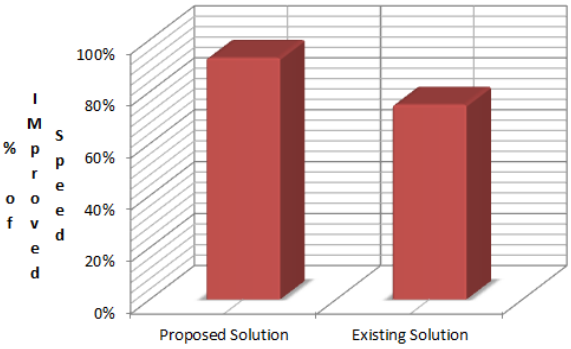

Figure 3. Streaming Speed

C. Finding

It has been evaluated from the simulation results that the proposed solution is effective and has help in addressing the issues of the Buzzing and lag during the processing of the video and audio streaming. The proposed solution can provide high streaming Speed by the help of the Multi-bandwidth data path design and help in overall minimizing the time delay.

The presented solution has been tested on both technologies 4G and 5G. It has also been analysed that the proposed solution has better results on 5G technology as compared to the 4G technology. The Multi-bandwidth data path design is a new concept and it can help in addressing number of signal issues with the perspective of different consumer requirement in-context of Mobile or internet data.

We proposed Multi-bandwidth data path scheme for 5G real wireless world. Data requests will be

controlled by PCF (Packets Control Function) in the CDMA2000 network and data reply will be controlled by PDIF (Packet Data Interworking Function) in WLAN. Data traffic is routed through PDSN from CDMA2000 network to WLAN network. The Multi-bandwidth data path scheme has been defined to do bandwidth reselection for rerouting so that all network resources can be used efficiently.

V. CONCLUSION

The demand of the communication technology within the context of the mobile and internet are increasing day by day. Cellular and internet services provided are looking forward for the adaptation of the new technologies and standard which can help them to enhance the data communication processes. In the research, we have presented a design approach based on the Multi-bandwidth data path design. The proposed approach presented in this research identify that Multi streaming can be improved by the development of multi-bandwidth data path design on the application layer of next generation technology. In has been concluded from the simulation results the proposed solution provide better audio and video streaming results on 5G technology.

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