THE IMPLEMENTATION OF MOBILE IPTV FOR ONLINE LEARNING IN COVENANT UNIVERSITY

BY

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND INFORMATION ENGINEERING, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING DEGREE IN INFORMATION AND COMMUNICATION ENGINEERING

SUPERVISOR: ENGR. OMORUYI OSEMWEGIE

JULY 2020

DECLARATION

I hereby declare that I carried out the work reported in this thesis in the Department of Electrical and Information Engineering, Covenant University, under the supervision of ENGR. OMORUYI OSEMWEGIE. I also solemnly declare that to the best of my knowledge, no part of this project has been submitted here or elsewhere in a previous application for award of a degree. All sources of knowledge used have been duly acknowledged.

Signature …… Date.....

OLADIPUPO GODSON MOFIFOLUWA

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CERTIFICATION

This is to certify that the thesis titled "THE IMPLEMETATION OF MOBILE IPTV FOR ONLINE LEARNING IN COVENANT UNIVERSITY" by Oladipupo Godson Mofifoluwa, meets the requirements and regulations governing the award of Bachelor of Engineering, B.Eng. (Electrical and Electronics Engineering) degree of Covenant University and is approved for its contribution to knowledge and literary presentation.

Supervisor: Sign: ……. Date: 06/10/2020

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Head of Department: Sign: ……. Date: ……

Name: **PROF. ANTHONY U. ADOGHE**

DEDICATION

I dedicate this project firstly to the Almighty God, for his grace over my life. I also dedicate this project to my family. Their immense support cannot be over emphasized.

ACKNOWLEDGEMENT

My sincerest gratitude goes to God for his and favor over my life. I thank him for his guidance throughout the entirety of my project.

I also appreciate my supervisor Engr. Omoruyi Osemwegie for his support and guidance to me throughout the course of my final year project. He dedicated his time and resources to ensuring I understood the basics of this project, instructing me as to how to get materials relating to the project.

I also wish to appreciate my family for their prayers, support and care for me.

Final appreciation goes to all my lecturers and course mates for their encouragement throughout this period.

ABSTRACT

In recent years, the use of mobile IPTV has experienced an exponential increase. This project presents the application of mobile IPTV for online learning in Covenant University, -providing digital content in the form of text, graphics, video or audio,- presenting methods which will aid the opportunity of distant and continuous learning.

This project provides a good overview of IPTV architecture, its delivery to mobile devices and its comparisons with legacy cable television Satellite TV and Internet TV.

The application of mobile IPTV in education also presents students the opportunity to take up secondary lectures to which they were not initially registered to, for the main purpose of learning.

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LIST OF ABBREVIATIONS

IPTV	Internet Protocol Television
Mbone	Multicast Backbone
VoIP	Voice over Internet Protocol
QoS	Quality of Service
QoE	Quality of Experience
OTT	Over-the-Top Media Service
NGN	Next-Generation Network
IMS	Integrated Management System
3GPP	3rd Generation Partnership Project
DWDM	Dense Wavelength Division Multiplexing\
MSPP	Multiservice Provisioning Platform
WMSP	Windows Media Streaming Protocol
DVB-T	Digital Video Broadcasting – Terrestrial
ITU-T	International Telecommunication Union - Telecommunication

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

Internet Protocol Television is a technology which delivers multimedia video content to its subscribers/ users through the use of IP based network [1]. Internet protocol television is the future of broadcasting and will provide huge revenue for service providers. Mobile IPTV allows users /subscribers to enjoy IPTV services anywhere and on the go, through a mobile device.

IPTV has changed the way user's access information and entertainment. It has been utilized in multiple sectors such as business, entertainment, communication, healthcare, and education. IPTV has also been integrated with e-Learning systems as a tool for supporting learning in education.

The term IPTV first appeared in 1995 [2] with the founding of Precept Software by Judith Estrin and Bill Carrico. Precept developed an Internet video product named *IP/TV*. IP/TV was a Mbone compatible Windows and Unix-based application that transmitted single and multi-source audio and video traffic, ranging from low to DVD quality, using both unicast and IP multicast Real-time Transport Protocol (RTP) and Real-time control protocol (RTCP). The software was written primarily by Steve Casner, Karl Auerbach, and Cha Chee Kuan. Precept was acquired by Cisco Systems in 1998.

In 2005, the IPTV service reached about 4 million homes [3]. As of late 2009/early 2010, there were more than 25 million IPTV users in the world [4]. Mobile technologies have become more powerful and pervasive, leading to its rise and importance, hence the relevance of Mobile IPTV.

IPTV has numerous advantages; one of which is that it makes use of a computer network, hence no need to connect any cable, also it distributes live, as well as various pre-recorded media content. Also, IPTV is user-friendly and allows the user to select what he/she wants to watch. IPTV, as well as the fact that it is cost-effective, has no limitations to viewers, and viewing points.

With constant improvements in video and networking technologies, IP television (IPTV) is currently being deployed by various worldwide service providers. By delivering video content, Internet telephony (VoIP), and conventional Internet data over a converged IP infrastructure, IPTV service providers offer users/ subscribers many new exciting features that were not suitable in conventional telecoms [5]. With IPTV, TV enthusiasts can enjoy interacting with programming content as well as with other viewers watching the same content. Modified channel arrangements and on-request capacities empower watchers to get to a lot more extensive determination of substance whenever they need to.

Television distribution is one of the biggest innovation frameworks after telephone and electric power networks. Digital technologies have totally changed the phone framework making a substantially more flexible and dynamic media communications foundation and administrations. The television distribution is now experiencing a comparative computerized uprising. Internet Protocol Television

(IPTV), is one of the promising techniques which takes a step further by blending media communications and computerized TV conveyance administrations, releasing new, progressively close to home alternatives to customers, and fulfilling the guarantees of a real home broadband multimedia experience [4].

Mobile IPTV – a branch out of IPTV- grants these promises, delivering content through internet protocol-based services, allowing for the delivery of these contents across time, place, and multiple devices.

Mobile IPTV is a technology that enables users to transmit and receive multimedia traffic including television signal, video, audio, text, and graphic services through IP-based the weird and wireless networks with support for QoS/QoE, security, mobility, and interactive functions. Through Mobile IPTV, users can enjoy IPTV services anywhere and even while on the move [6].

The application of mobile IPTV for online learning is crucial to the development of distant-learning. Subscribers, especially students, have been graced with the opportunity to learn, wherever they are and on the go.

The implementation of mobile IPTV is premised on content delivery to various homes, which aim at enabling students, with future works aimed at delivering content to grown-up individuals.

Covenant University is a fast-growing institution, and I believe one of the ways to change the dynamic of education, -which has been also used by other established institutions- is the deployment of Mobile IPTV. This will, among other things, with the aid of any mobile device, provide the students with easy access to all lectures anywhere they are on campus, simply by accessing the school's network.

1.2 SIGNIFICANCE OF STUDY

Previously, television was mostly a linear, one-dimensional medium for entertainment. We were majorly passive receivers and had a limited choice of what to watch and at what time. Today, Mobile Internet Protocol TV (IPTV), as a combination of two technological revolutions, has resulted in an entertainment revolution, gracing us with the opportunity to watch what we want, and at what time we want to watch it [7].

Mobile IPTV is a convergence of digital television and the Internet. It provides digital video services by using the Internet Protocol over a network infrastructure.

Recently, Mobile IPTV's potential in education is starting to be explored and has been deployed basically and popularly in the entertainment industry more often than not, nevertheless, I believe that Mobile IPTV can be very instrumental in bettering the educational sector of our country.

The applications of mobile IPTV in the educational sector were being witnessed during the Nobel Coronavirus pandemic, as schools had to source for alternate measures for students to keep on learning.

1.3 AIM AND OBJECTIVES

This project aims to implement the use of mobile IPTV for online learning in Covenant University.

The objectives of the project are:

1. Create a scenario, making all lectures easily accessible online to all students.
2. To explore the use of mobile IPTV and its benefits in its implementation for online learning in Covenant University.
3. To explore the use of mobile IPTV in distant learning/ education.
4. To implement a strong mutual software, beneficial to everyone which will make all lecture classes accessible on mobile.
5. To configure a random video camera, to be able to convey its output to a computer system which will then send out the video.

1.4 METHODOLOGY

This project will combine the use of certain equipment's; some of which will include a video camera, a streaming software, and a mutual application which is applicable on mobile devices, - in this research work VLC media player -, as I have found out that VLC media player is accessible on mobile devices as well as laptops. The video output will be projected on the streaming software and will be redirected to VLC for the mutual benefit of everyone on the network. The stream will now be accessible via VLC on the local network by imputing the IP address of the laptop streaming the video.

1.5 PROJECT REPORT ORGANIZATION

- Chapter one (Introduction) gives a brief overview of IPTV and Mobile IPTV. It provides vital information about the aim and objectives of the project, the significance of the study, and the project report organization.

- Chapter two (Literature review) contains a brief history of the topic and explains key terms relevant to the study. This chapter also highlights and reviews past work done on this project.

- Chapter three (Methodology) This chapter describes the hardware and software specifications. The components to be used in the project are described. This chapter also provides information concerning the step by step methods used to achieve this project.

- Chapter Four (Results and Discussions) provides information about steps of implementation together with the testing phase. The results of the tests conducted are also itemized in this chapter. It is simply the result and discussion of the project study.

- Chapter five (Conclusion and Recommendation) summarizes the contributions the project has added to the body of knowledge in the area of Internet

Protocol Television. Its achievements, limitations, and recommendations are also stated in this chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Internet Protocol Television IPTV is a technology which delivers multimedia video content to its subscribers/ users through the use of IP based network [1]. Instead of the use of traditional means such as cable or satellite, IPTV delivers multimedia content via IP networks.

Prior to the deployment of Internet Protocol Television IPTV, we were merely passive receivers/ users, as we were limited to the content of what to watch, and when to watch it [7]. Also, its service (QoS & QoE) was not guaranteed and there were simultaneous channel streams.

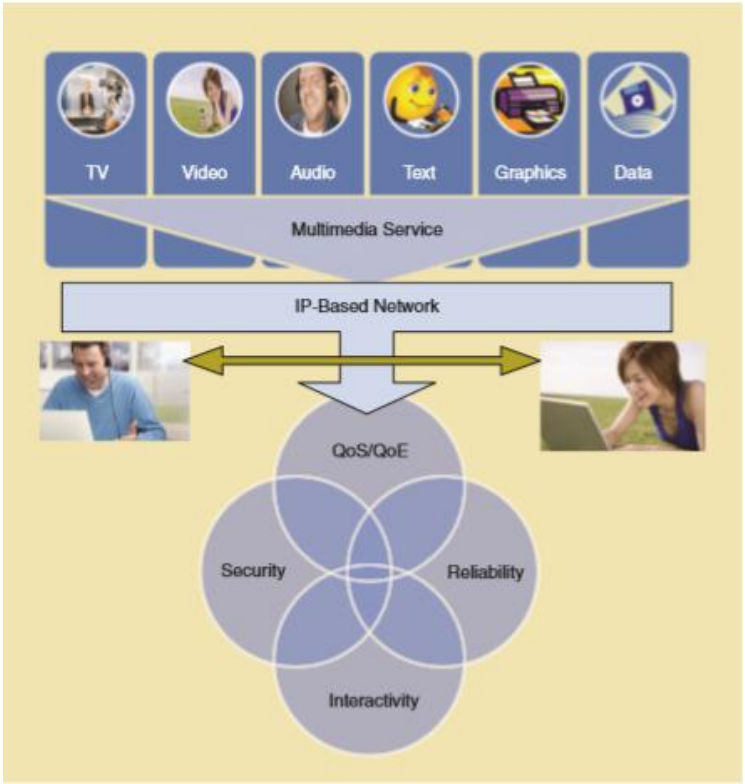

FIGURE 2-1: BASIC BLOCK DIAGRAM OF IPTV

IPTV's provision of multimedia services, which include Video, TV, Audio, Graphics Data and Text, is also tantamount to its Reliability, Security, Interactivity, and QoS & QoE (Quality of Service and Quality of Experience). QoS in this context refers to the performance of the IPTV service, usually from the network side, while Quality of Experience describes output overall from the user's side.

2.1.1 COMPARISONS BETWEEN CABLE TV, SATTELLITE TV AND IPTV

TABLE 2-1: COMPARISONS BETWEEN CABLE TV, SATTELLITE TV AND IPTV

CABLE TV	SATTELLITE TV	IPTV
Minimal interaction	No or very minimal interaction	Full interaction
Limited user centric (VoD)	Not user centric	User centric (PVR, NPVR, VoD)
Broadcast all the time, and on all networks	Broadcast all the time, and on all networks	Broadcast only channels chosen by the subscriber
Content is Limited to the subscriber	Content is Limited to the subscriber	IPTV content are unlimited

2.1.2 COMPARISONS BETWEEN INTERNET TV AND IPTV

TABLE 2-2: COMPARISONS BETWEEN INTERNET TV AND IPTV

INTERNET TV	IPTV
Potentially supranational or worldwide	Local (limited operator coverage)
Pc oriented (file sharing)	TV oriented (real time)
Depends on coding	Real SDTV/ HDTV
High level viewer involvement	Low level viewer involvement
Best effort quality (QoS not guaranteed)	Controlled QoS, "broadcast" TV quality
PC	Set-top box with a television display
Unsafe	Users are authenticated and protected
Content usually is unprotected	Media is protected
Any users (generally unknown)	Known subscribers, usually with identified IP addresses and recognizable locations

2.1.3 HISTORY OF IPTV

The word IPTV first emerged in 1995 with Judith Estrin and Bill Carrico developing the Precept Software. Precept created a web video application called *IP/TV* [2].

IP / TV was a Windows and Unix-based Mbone-compatible application that transmitted single and multi-source audio and video traffic, ranging from low to DVD quality, using both the Real-time Transport Protocol for unicast and IP multicast Real-time Transport Protocol (RTP) and Real-time control protocol

(RTCP). The script was mainly designed by Karl Auerbach, Cha Chee Kuan and Steve Casner. The Precept was acquired by Cisco Systems in 1998.

By 2008, Pakistan, Australia, Sweden, Japan, and Canada, amongst a host of other Countries had deployed Internet Protocol Television IPTV. By 2020, Internet Protocol Television IPTV had been deployed in virtually every country in the world.

2.1.4 USES OF IPTV

1. Residential: homes, hotels, accommodation centers, condos, living quarters, etc. all make use of this technology. The application of IPTV for residential uses is often deployed as triple pay services, delivered by a single cable, and often require the user to get a set-top box connected to the ISP router.

2. Corporate: dedicated TV programs, whether informational or educational programs, designed to boost media life and allow companies to build their mass media; which could be private, allowing companies to secure private data.

3. Commercial: companies that make use of IPTV for commercial purposes include telecom providers, OTT and IPTV subscription providers, owners of local networks or building-wide networks, etc.

4. Transportation: the uses of IPTV have recently been deployed in the transportation sector. Individuals traveling by buses, cars, trains, ships or planes,

seek entertainment from IPTV. IPTV delivers live TV, VoD (video on demand), route information as well as important announcements to passengers and travelers in transit.

2.1.5 COVID-19 IMPACT

The outbreak of the Nobel Coronavirus pandemic had adverse effects on various countries around the world, and in a desperate attempt to reduce the spread, with instruction from governments of the world, individuals and families were confined in their homes.

This scenario facilitated the temporary but yet significant need for individuals to subscribe to Internet Protocol Television IPTV services for entertainment.

Furthermore, the close of Schools around the world also facilitated the use of some of these services in an attempt to continue lectures whilst anticipating resumption. The same went for Churches, as they resulted to “Online Services”.

According to *Statistica,* this year, China has the highest number of pay IPTV subscribers in the world with 77.22 million, which is about 6 percent of the entire population resulting to a “paid” IPTV service or the other. Results also show that the population of free subscribers more than doubles the number of paid subscribers. This statistic shows that the need for Internet Protocol Television IPTV services has increased when comparing to the few 4000 worldwide subscribers she had when she first launched.

2.2 MOBILE IPTV is a technology that facilitates the provision of these multimedia services on mobile devices, with support of the same features of IPTV (QoS/QoE, Reliability, Security, and Interactivity) as well as mobility. Mobile IPTV allows users to enjoy all the multimedia services provided by Internet Protocol Television on the go.

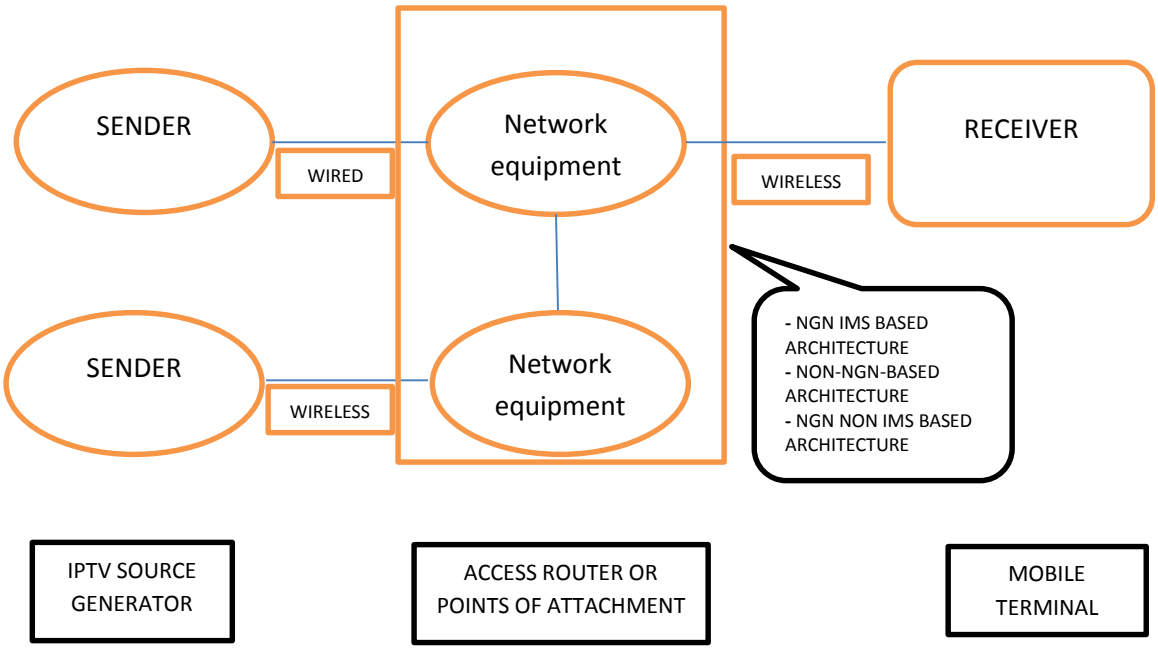

FIGURE 2-2: MOBILE IPTV ARCHITECTURE

-NON-NGN BASED IPTV: In this case, IPTV services are delivered using required protocols and network interfaces that are also used in the network for other IP based services.

-NGN IMS BASED IPTV: makes use of NGN architecture components as well as the IMS component to facilitate the delivery of IPTV services.

-NGN NON-IMS BASED IPTV: utilizes components of the NGN framework reference architecture to support the provision of IPTV services.

2.3 TECHNICAL APPROACHES

In a provisional quest to deliver multimedia content to mobile subscribers, four Mobile IPTV approaches have been developed;

IPTV plus Mobile, Mobile TV plus IP, Cellular, and Internet [6], [8].

Mobile TV plus IP

This approach makes use of the regular television broadcast to deliver IP based multimedia content (audio, text, graphics, video, and data) to its subscribers. This is the convergence of broadcasting, the internet, telecommunications, and computing. This approach also gives access to connectivity to wireless networks as well as cellular networks. Also DVB-IPI (Digital Video Broadcasting – IP Infrastructure is an IPTV standard, which allows a subscriber connected to the internet to be delivered multimedia services through Internet Protocol.

This approach however may result in loss of individuality of IP, as a result of the usage of broadcasting networks such as personalized services.

IPTV plus Mobile

This approach tends towards the fact that Internet Protocol Television is the future of entertainment, and the introduction of Mobile IPTV brought about the prospect of the delivery of all multimedia services “on the go”. This approach shows us that IPTV goes way beyond archaic methods like fixed terminals such as set-top boxes. It also aided by the use of wireless networks and its mobility services are based on IMS (IP Multimedia Services) which is a set of specifications from 3GPP for delivering IP multimedia to mobile users.

Cellular

This approach makes use of IP based broadcasting networks which are also applicable to mobile terminals. This method of delivery is presented by the Open Mobile Alliance, which is a mobile specification resource organization that provides network interoperability. Another feature of this approach is that it is bearer Agnostic, meaning it will function irrespective of its distribution network.

Internet

This method is open for individuals who want to be content providers, service providers, or consumers, and there are presently countless video services out there. A huge disadvantage of this approach is that it's QoS (Quality of Service) is not guaranteed as it focuses on delivering just the deliverable multimedia content,- especially audio and video- without having to worry about any special features. Reports say that this approach (Internet) will be a real dominant force in future times, so long as mobile devices keep on connecting to the internet.

2.4 MOBILE IPTV PROTOCOLS

IPTV makes use of multicasting, with the use of certain protocols for content delivery. -IP multicast is used for the transference of live TV content and is based on the concept of a group consisting of single source methods, transmitting data to different other locations simultaneously [7] - Protocols which include:

Internet Group Management Protocol (IGMP)

Internet Group Management Protocol (IGMP) is a protocol used for live television broadcasts.

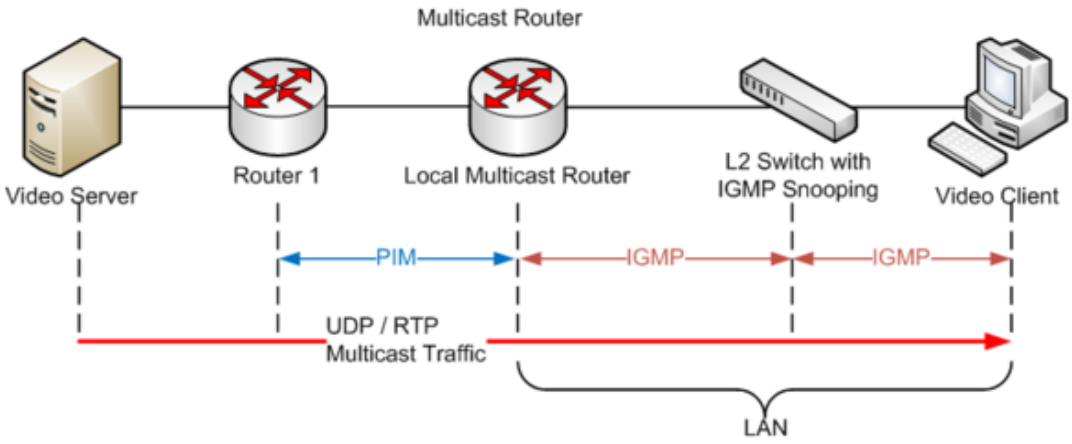

FIGURE 2-3: IGMP ARCHITECTURE

IGMP is located in layer 3 of the OSI model network protocol stack, alongside ICMP and ARP. This protocol operates between a host and a local multicast router and is used to establish multicast group memberships by sending an IGMP group message [7].

Real-Time Streaming Protocol (RTSP)

This protocol is concerned with the delivery of data/ multimedia services in real-time. Sources of data may be live feeds or stored feeds. RTSP does not stream data itself, what it does is communicate with the server streaming the media. It is a protocol that is suitable for the operation of streaming network servers. This protocol is similar to HTTP (Hyper Transfer Text Protocol).

This protocol defines a set of methods a client can send to the server. Methods which include: SETUP-, which is a request describing how to transport the bitstream-, PLAY- used to play the streaming media-, PAUSE – used to pause media content-, RECORD –used to record the streaming media- and a host of others [7]. This protocol is situated in the Session Layer of the OSI network model.

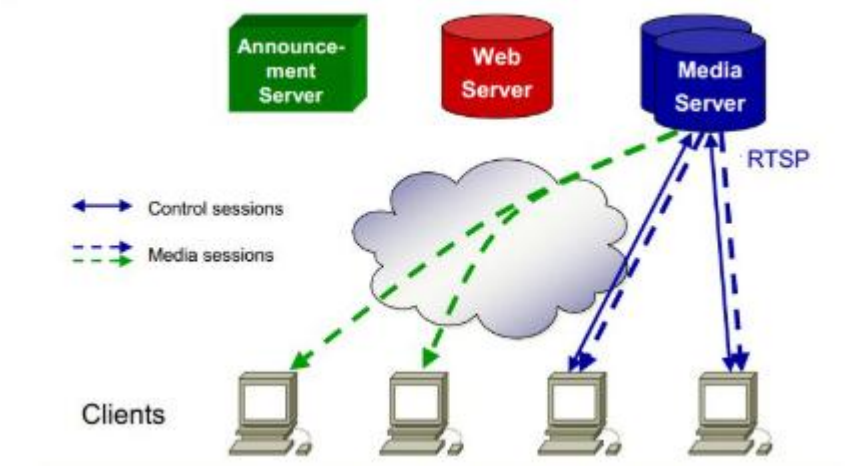

FIGURE 2- 4: RTSP ARCHITECTURE

Real-Time Messaging Protocol (RTMP)

RTMP is a transmission control based protocol used for streaming multimedia services over the internet. It was usually used by both a server and a flash player. This protocol delivers its content by splitting streams into fragments; 64 bytes for audio, 128 bytes for video, etc.

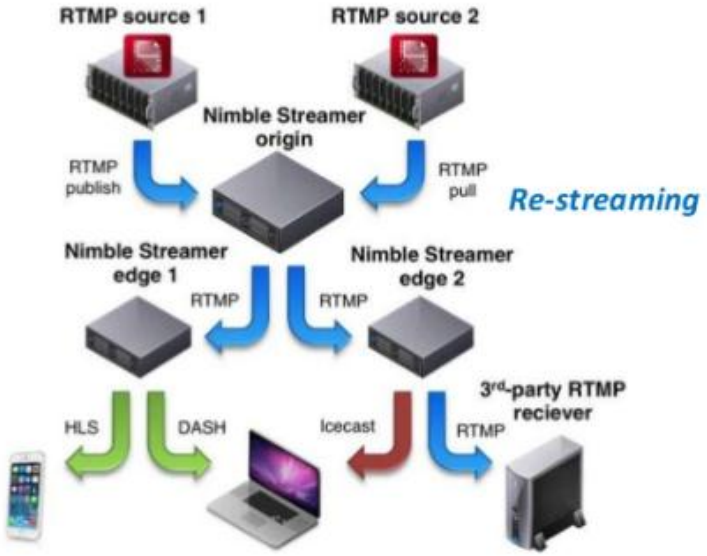

FIGURE 2- 5: RTMP ARCHITECTURE

Hypertext Transfer Protocol (HTTP)

Hyper Text Transfer Protocol is a protocol for hypermedia information systems. HTTP is mainly used for the World Wide Web, as it is used to establish connections with Html pages and servers.

There are certain METHODS that can be used by HTTP (Web-based) for live streaming. Methods which include: true streaming, progressive download, Dynamic adaptive streaming over HTTP (MPEG-DASH), HTTP live streaming (HLS), Microsoft Smooth Streaming (MSS), HTTP Dynamic Streaming (HDS), Icecast, SHOUTcast.

2.5 MOBILE IPTV STANDARDS

IPTV is a crucial service, and part of those to become part of the New Generation Network (NGN).

According to the ITU-T International Telecommunication Union-Telecommunication Standardization Sector [9], [4], the standardization of mobile IPTV environments will:

- End approaches where subscribers are limited to the choice of content to watch.
- Make it possible for temporary residents or expatriate subscribers to watch content from their home country/ state of origin.
- Provide content at lower costs.
- Provide a wider market for subscribers.
- Provide an increase in Quality of Service (QoS) and Quality of Experience (QoE).
- Provide consorted security.

ITU-T started its focus group on IPTV between the years 2006-2007, in response to the markets demand on standards.

IPTV services as discussed in the ITU-T are E-commerce, E-publishing, **E-learning**, Video on Demand (VOD), Audio Services, Linear Broadcast TV and so much more.

ITU-T H.760 Series (multimedia application framework) is a standard suite for a multimedia application that aids terminals support interactivity anywhere in the world.

ITU-T H.761 (Ginga-NCL for IPTV) is used as a language for other frameworks such as HTML and H.762 (LIME). It has very good integration with video streaming.

ITU-T H.762 – LIME (Lightweight Interactive Multimedia Framework) is based on basic JavaScript and HTML. (Basic web design)

ITU-T H.750: Metadata for IPTV; covers the location, conveyance, and delivery of metadata, rights, security, and privileges related metadata for IPTV.

Other standard groups in mobile IPTV-related standardization include DVB-CBMS, OMABCAST, and WiMAX-Multicast Broadcast Service.

2.6 IMPLICATION OF THE USE OF MOBILE IPTV IN EDUCATION

The use of mobile handheld devices is inevitable in education, be it a mobile phone or a tablet computer, and has become a superb learning tool for both indoor and outdoor learning experiences [10]. Because of its supreme importance/ advantage, some schools result in providing these devices for their students.

According to research carried out by campustechnology, 94% of students prefer to use their mobile devices in the classroom, as it improves the retainment of information.

An example of the use of this technology is its use in Suan Dusit University [11] located in Bangkok, Thailand, which aims to provide and support distance and life-long learning, whilst providing the same information to its students and surrounding community as well as aiding the increment of knowledge for students hoping/ trying to learn a different course outside their major.

Research shows that via this technology, students/ learners could learn/ relearn at their comfort. Reports also show that in the coming years, mobile devices will replace notebooks and all alike, as one mobile device are more compatible than numerous notebooks, and will help increase effective learning whilst aiding the transfer of education materials from student to student [12].

The provision of multimedia services (video, audio, text) via mobile devices is also tantamount to its mobility, aiding the access of information anywhere around the world at any given time, however, to every advantage there is a disadvantage, which gives rise to the fact that students will easily get distracted, disrupting the learning process in classrooms.

2.7 TECHNICAL CHALLENGES

There are certain obstacles which Mobile IPTV must scale through to aid a smooth launch and also contribute to a quality used by its subscribers. The majority of these

challenges [13] occur in the wireless link, which is between the source and the destination (mobile device).

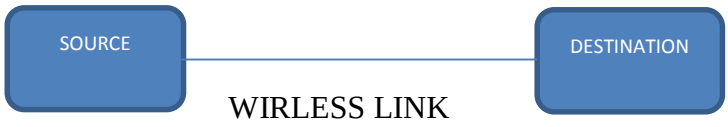

FIGURE 2- 6: BASIC REPRESENTATION OF A SOURCE TO ITS DESTINATION

SERVICE COVERAGE

The reason behind the creation of mobile IPTV is the provision of Internet Protocol Television services anywhere and anytime on the go. However, there is a bit of a limitation in providing services “anywhere”, as it is almost impractical to deploy a network covering all locations around the world with no blind-spots. This issue results in the use of vertical handover within wireless networks –WLAN, WIMAX, and 4G-. Vertical Handover refers to the changing of a network node to different connectivity types, to access a supporting infrastructure, usually for mobility. It is also the automatic fall over of one technology -for example, WLAN to CELLULAR- to maintain seamless communication, however, sustaining the challenges of selecting the best network, as well as soft handover persists, as it is near impossible providing sustaining mobile IPTV operates effortlessly when passing through different networks without any break/ degradation [6].

BANDWIDTH

Prior to the introduction of 4G, effective bandwidth was insufficient for the wireless link, and as a result a restriction to high definition video services. Even with the introduction of 4G, bandwidth might be limited for mobile IPTV services which require more; services that make use of ultra-definition video [1], [6]. A wired link will always possess more bandwidth than a wireless link.

In this case, it is important to always pay attention to bandwidth when providing IPTV services on mobile devices.

DYNAMIC ENVIRONMENT

Wireless Link propagation properties such as refraction, diffraction, fading, reflection, scattering, etc. usually varies when you compare with the wired link, which is stationary. As the network node changes (to maintain seamless communication), available bandwidth, media access control and physical layers (MAC/PHY) also changes. Therefore it is important to deploy mobility-aware technologies, sensitive to environmental factors.

WIRELESS LINK

It is important to note that the wireless link is vulnerable to physical factors. Factors which include fading, shadowing which causes packet degradation -as the mobile device moves around-. Also, factors such as temporal reflection and physical obstruction limit signals and lead to signal and quality degradation. As well, it is important to note the wireless link's varying conditions when deploying mobile

IPTV services. The challenges experienced in the wireless link are also tantamount to the reality of frequent non-line-of-sight transmissions as well as error-prone radio channels [14].

TERMINAL CAPABILITIES

The introduction of mobile IPTV introduced the factor of mobility, enabling IPTV services to be viewed on the go anytime and anywhere, coupled with the pre-existing IPTV features of QoS/QoE, Reliability, Security, and Interactivity. However, this technology raises certain concerns, one of which is that mobile terminals have limited capabilities in comparison to IPTV terminals. These capability limitations mean that mobile IPTV solutions are restricted in regards to some of the services they offer to mobile devices. For example, when proving a service/ video stream, it is important to note the mobile device screen size.

QoS AND QOE

It is important that services based on IPTV service key for high quality cell phone support key quality of service (QoS) factors. Factors which include: jitter and delay, bandwidth, packet-error ratio, packet loss. The handling of these factors is tantamount to its use by subscribers. It is important that mobile IPTV delivery systems deal with such factors through careful system architecture and careful network traffic management, optimized buffering, and also error-correction [6], [8], [14].

It is also important for mobile IPTV services to facilitate good QoE by offering a service that is resource-aware. For example; increase or decrease the transmission rate according to the subscribers requirements.

BUSINESS ISSUES

A major concern in regards to the business aspect of mobile IPTV is the possibility that people most times tend not to subscribe to services on very tiny screens. It is therefore now very important to combine certain factors that will attract users/ subscribers to mobile IPTV.

One factor/ obstacle that needs to be overcome to make subscribers attracted to mobile IPTV services is a quality interface. The small screen size of mobile devices is always a hindrance to very fancy user Interfaces.

The provision of live TV in mobile devices is certainly one of the attractive points for mobile IPTV subscribers; hence, the provision of more very good content should be provided the subscriber's and should also fit the condition of mobile environments which may include screen size. Random and short content is also key in attracting subscribers.

SCALABLE VIDEO CODING

This technology (scalable video coding) enables the system to consider the available bandwidth as well as the network's terminal types. It is difficult to perform scalable video encoding in real-time because of its complexity even though it enables the scalable representation of the high coding performance video output.

It is however necessary to provide further study as to how to monitor the SVC rate according to the availability of network services.

MIDDLEWARE CONCERN

Middleware is vital to the management of mobile IPTV services. Through its deployment, the service provider could well control the remote use of IPTV services. This also serves as a realistic option for the integration of IPTV channels into specific networks. There are various solutions in regards to the implementation of middleware on set-top boxes; however, it is too big to be run on a mobile device. Web applications are however an applicable solution for this issue.

2.8 REVIEW OF RELATED WORKS

This segment includes reviews of other related works on mobile IPTV and its implementation.

Ismail Djama and Toufik Ahmed proposed in [15] that the interconnection between the 802.11WLAN networks and the broadcasting networks be seamless. This makes use of an Adaptation Gateway (AG) to perform media adaptations at every access network. Adaptation Gateways features a specific channel and video bit-rate sensitivity to tackle connection degradations (packet loss, signal strength ...).

In this paper, various experiments are performed to evaluate performance, and these experiments depict that the existing cross-layer Adaptation Gateway (AG) interlayer reduces –to some extent- packet losses, as well as enhance the quality of the television service.

The Adaptation Gateway (AG) capitalizes on the capabilities of the rate variability to preserve QoS for mobile subscribers. The various experiments conducted in this paper depict the importance of cooperation across layers to achieve continuous QoS assurances.

In this paper, [16] the writers discussed some major layer 1 alternative transport networks including Ethernet-on-fiber, SONET, DWDM, as well as its passive WDM/DWDM (PWDM) variation.

This article analyzes and describes various IPTV transport architecture alternatives and takes into consideration the economic cost and performance metrics for these transport schemes, bearing in mind certain factors such as the number of users/ subscribers, operational constraints, network topology, and bandwidth demand.

Dense wavelength division multiplexing (DWDM) when integrated with Ethernet aggregation is realized to pertain –to some extent- to IPTV transport networks.

This paper also discusses the ROADM and MSPP architectures and its supremacy over the PWDM network whilst bearing in mind factors such as technicality and cost when the video on demand is low. Also, the ROADM architecture depicts flexibility in applications considered to have high IPTV demand.

This paper highlights four alternative solutions [the GBE (Gigabit Ethernet)-over-fiber solution, the GBE-over-PWDM solution, the SONET transport solution, the DWDM transport solution] it also offers an in-depth economic study focused on their nodal architectures. This paper also discusses the economic analysis of IPTV when driven by GBE demand, as well as the number of subscribers/ users.

The writers in [17] Discussed the benefits, Progress considerations and problems with the introduction of IPTV over WiMAX (Worldwide Microwave Network Interoperability), a high-speed networking system wireless internet access over wide areas, providing multiple physical layers (PHY) and Media Access Control (MAC) options.

This paper gives an overview of various IPTV services, classified by their services and type of content. The writers also described the generic IPTV architecture, describing components such as the Set-Top Box. The paper also discusses the two major transport networks: core networks and access networks.

Ali C. Begen in his paper Error Control for IPTV over xDSL Networks [5] discusses the necessity of error control for IPTV networks, accessing -in particular- DSL environments (DSL – a data-link tech responsible for high-speed data running over telephone cable plants-). This paper assesses subscriber lines which are strongly subject to external noise and signal attenuation. External noises which include crosstalk (a phenomenon between neighboring wires due to capacitive and inductive coupling), background noise, and impulse noise.

The mitigation techniques for crosstalk and impulse noise are also expressed in this paper.

The illustration of the development of mobile IPTV for online education was expressed in this paper [11]. This paper was a study of the development of Suan Dusit Internet Broadcasting (SDIB); a mobile IPTV prototype for online learning developed in Thailand.

This paper aimed at providing online education for children, students studying at the Suan Dusit Rajabhat University, variety (which includes teachers, staff, or anyone interested), Radio (subscribers with slow internet access) with respective channels put in place for each (4 channels). The requirement detail for its IPTV architecture is Its provision of IPTV services across various access networks be it cable, optical, xDSL or wireless, and its delivery of services to various devices.

The streaming server Used for visual and audio transmissions through the internet is Flash Media Server (FMS) which passes the RTMP (Real Time Messaging Protocol). The encoder used in the compression of video and audio files is FMLE (Adobe Media Live encoder) used with Flash Media Server (FMS) for encoding into multiple bandwidths.

Windows Media Player is the software used in displaying content to various subscribers and the protocols used are RTMP (Real Time Messaging Protocol) and HTTP Live Streaming (HLS) to support mobile streaming.

FIGURE 2- 7: SUAN DUSIT INTERNET BROADCASTING ONGOING COOKING CLASS

Pannee Suanpng in her paper also gave a survey on Student demographics, student's behavior using mobile devices in learning, mobile IPTV system evaluation, and more, in regards to the implementation of Mobile IPTV for online learning.

This paper [18] describes the application of IPTV in the educational field, explaining that IPTV plays the main role in distant education. The writers itemized the components of IPTV architecture, [components of which include: Acquisition servers (A-servers), Distributed servers (D-Server), VoD (video on demand) creators and severs, IP routers, Residential gateways, STB (Set-top box)] and explained its importance towards its implementation.

This paper compares and differentiates Internet TV and IPTV concerning geographical limitations, service access, image quality, content, and charges to the user. It also discusses its Aid for interactive TV – a two-way IPTV system capable of providing immersive TV services to service providers-, time-shifting, and its access on multiple devices.

2.9 CONCLUSION

In recent years, there has been a slight migration from cable TV, through Satellite TV to IPTV [4], providing subscribers the opportunity to “pay as you watch” or make use of services.

Initially premised on delivery of content/ services to homes, the uses of Internet Protocol Television can be witnessed in transportation, and most especially in the educational sector.

Recent technology has also developed the delivery of these contents to be made accessible anywhere and on the go, giving rise to mobile Internet Protocol Television.

This chapter gives a detailed overview of mobile IPTV and also entails a review of similar papers and proposed schemes towards the delivery of IPTV and its deployment in education. It discusses variations in technologies and techniques used in deploying mobile IPTV.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter gives an explanatory overview of the basic implementation model of mobile IPTV for online learning in Covenant University, which will be administered on the school network; CSIS-MH etc. It also gives a detailed explanation of all the devices used for the actualization of this project, as well as the specifications necessary.

3.2 SYSTEM SPECIFICATION AND DEVELOPMENT TOOLS

There are certain factors to consider, which include certain hardware and software components that will be required for the actualization of this project. A Video Camera: As the idea is to portray class content for a classroom, a video camera with high quality is required. As the quality will later diminish during transmission, a webcam is not advisable. The video camera is connected to a capture card with the aid of an auxiliary cord.

A Video Capture card: this is very crucial towards content delivery. A capture card converts the digital camera input into an analog form that the computer can read and understand [19]. The digital video will then be compressed with the aid of an encoder, which makes use of modern streaming compressors/ de-compressors. These "codecs" help reduce the video data to the minimal value, by eliminating irrelevant or repeated data. Capture cards include Pinnacle System, Dazzle, or AverMedia.

FIGURE 3- 1: CAPTURE CARD

VLC Media Player: this software will be used to play the video of any class on campus, connected to the network. VLC is a video software which is made available on all device; especially windows and IOS devices. VLC Media player can serve as both a streaming server as well as multimedia software and can be used for playing videos in various formats.

Each video stream from the respective class will have a unique id, the id being the IP address of the laptop delivering the content. VLC allows you to access that content by inputting the IP address as well as the port number (usually “8080”) of the laptop delivering the content. This stream will thence be made available to you provided you are connected to the network.

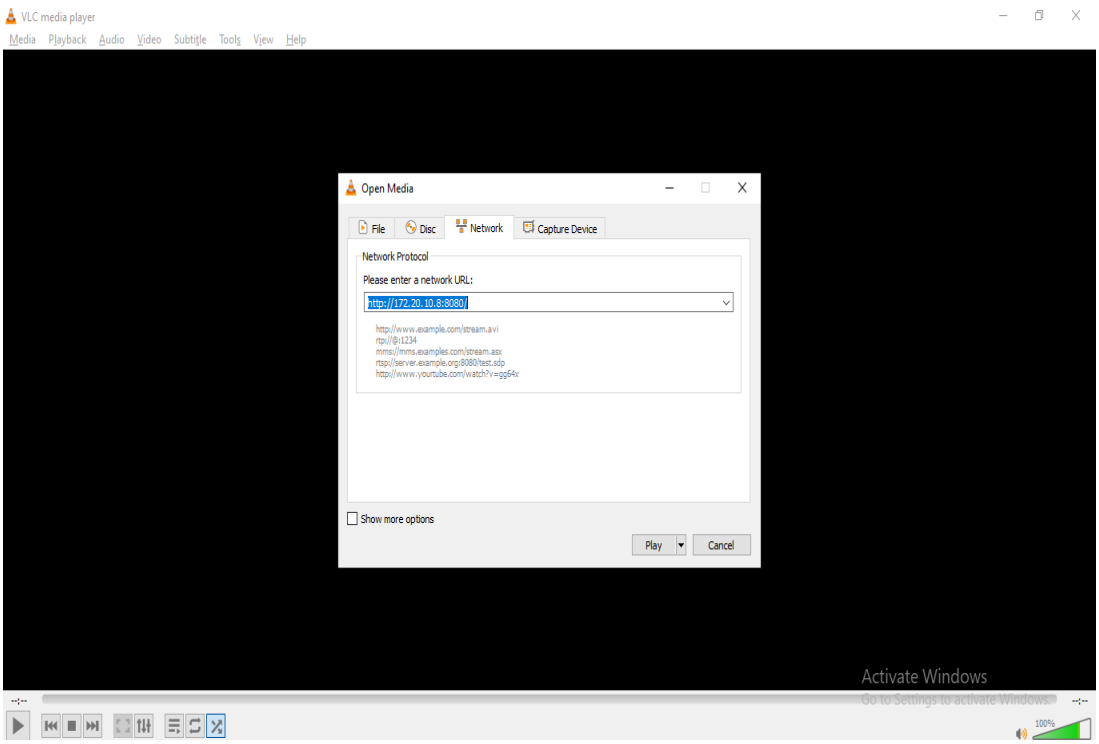

FIGURE 3-2: CONNECTING VLC TO THE NETWORK

Software Vision Mixer: A software vision mixer aids a user to change/ switch between various sources. It also permits you to combine multiple video inputs into one, aiding a smooth video delivery.

In circumstances where the teacher/ lecturer wishes to display the note/ content where he/she is teaching from, this software helps to combine both into one video with various virtual presets already in place. Some certain software vision mixers allow you to record the video in which you are portraying, allowing the user to relay it back if he/ she so pleases.

The Software vision Mixer I will be using for this project is vMix, which is available on just the windows system.

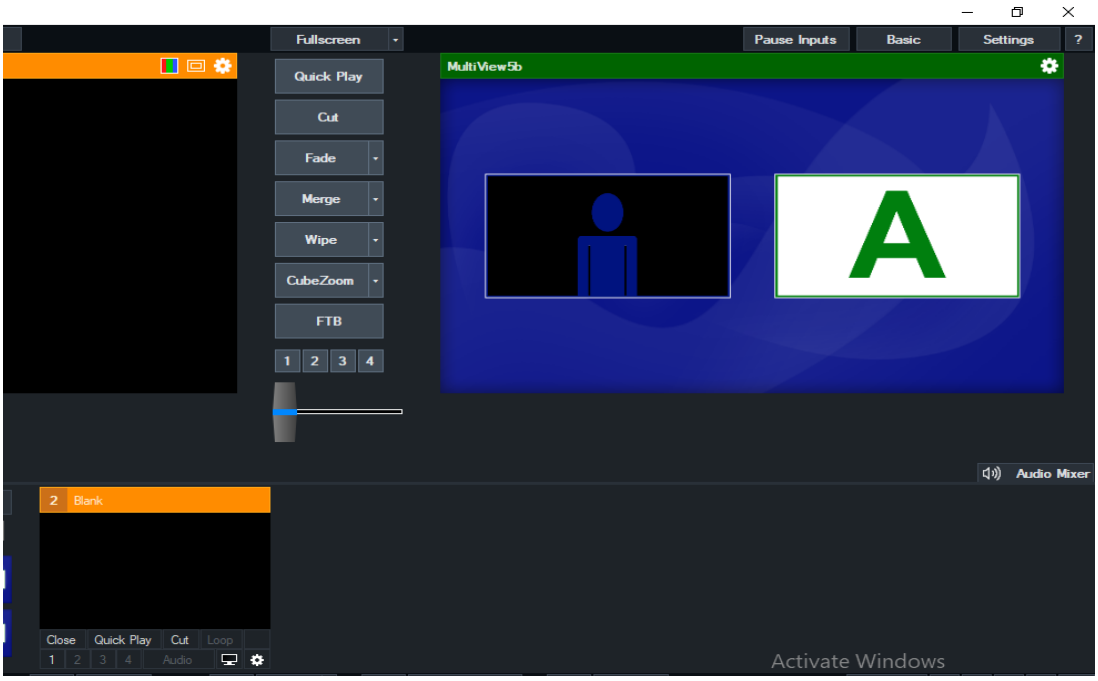

FIGURE 3- 3: vMix Software

In addition to the use of multiple inputs on this platform –as stated above-, another advantage is the ability to edit such videos/ change the virtual set before delivering such content to the public.

Streaming server: VLC Media Player can be used as a streaming server, and could be used both to stream and receive network streams on the network.

The QoE (Quality of experience) during content delivery, as well as its delivery over mobile devices, is what makes VLC media player a viable and preferred option for mobile IPTV.

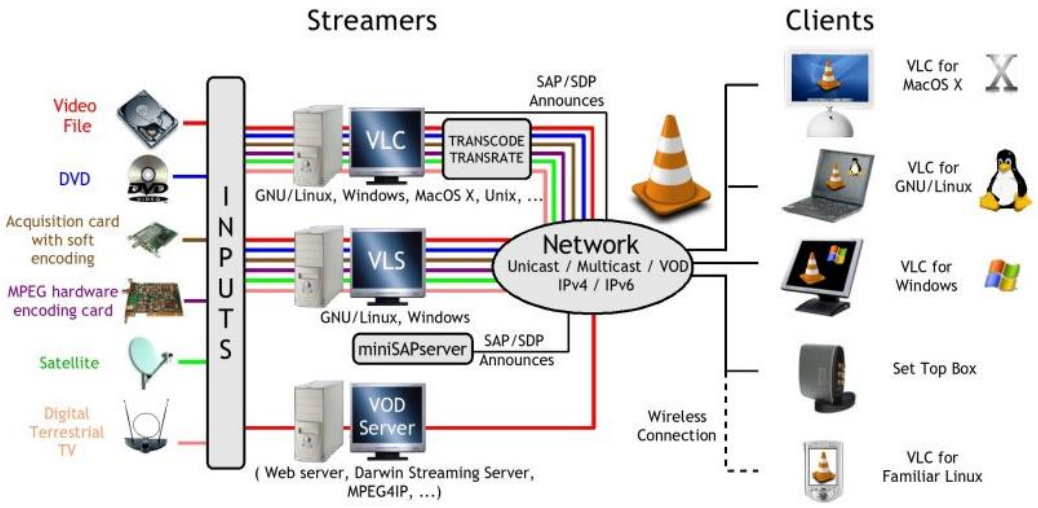

FIGURE 3- 4: CONNECTING STREAMERS TO VLC CLIENTS

3.3 PROPOSED SOLUTION APPROACH

The purpose of this project is to make all lectures accessible online, and most importantly, in real-time, giving lecture access to all students on campus. This method of classroom delivery reduces congestion and overcrowding in certain classrooms and as well encourages students to take secondary courses aside from those initially registered by them, for the main purpose of learning.

Various approaches could be taken towards content delivery. One of which is a pre-recorded lecture of the class relayed live to everyone on the network, the other involves delivering the content in real-time.

3.3.1 TRANSCODING METHODS

The compressor/ decompressor standard which will be used to aid the compression of our live video stream is the h.264+mp3 codec. This is the most commonly used

codec and is supported by every device. The audio codec to be used is MPEG Audio with a bit rate of 50kb/s and a sample rate of 8000 Hz.

The IPTV protocol used to stream the video is HTTP, and the port is 8080. The destination box is not to be left empty. If so, VLC will have to check all the network interfaces which are on the port 8080.

An IP address port and path are to be specified, using the syntax **IP ADDRESS: PORT NUMBER/PATH.** For example, 192.30.40.1:8080/documents.

The generated stream output string will then have the code;

:sout=#transcode{vcodec=h264,scale=Auto,acodec=mpga,ab=50,channels=2,samplerate=8000,scodec=none}:duplicate{dst=http{mux=ffmpeg{mux=flv},dst=:8080/},dst=display} :no-sout-all :sout-keep

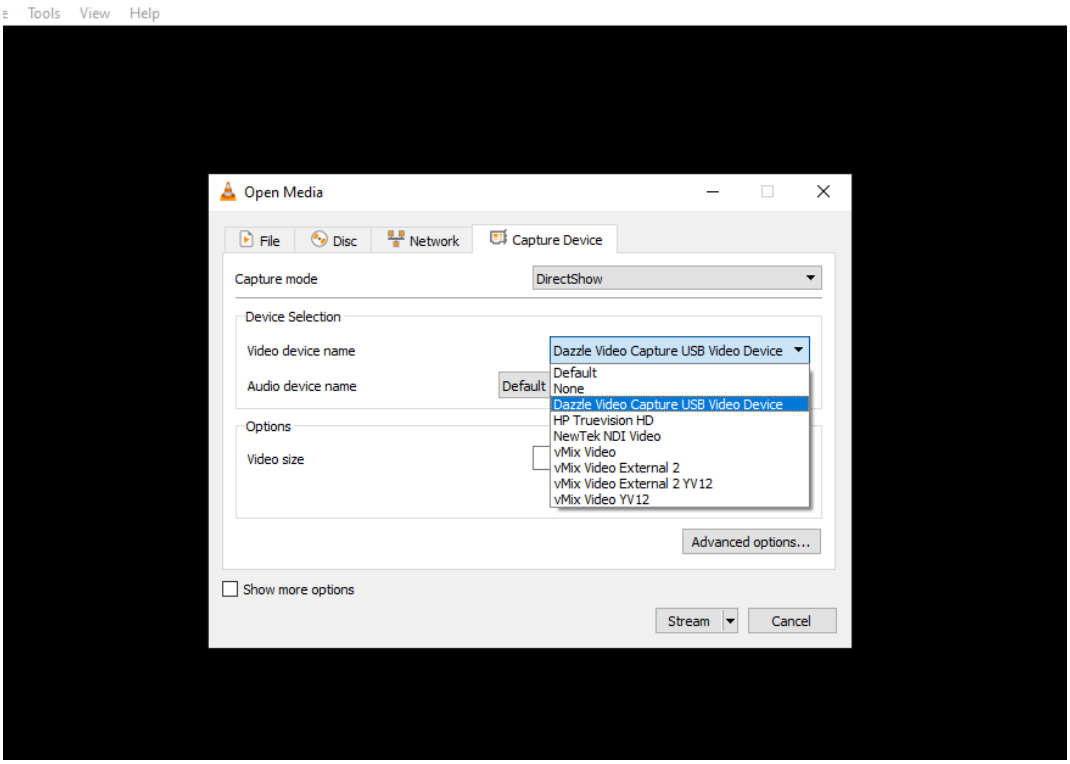

FIGURE 3- 5: CAPTURE CARD SHOWING ON VLC

3.3.2 ENCAPSULATION METHODS

The UDP methods make use of MPEG TS encapsulation. HTTP output method can be used alongside certain encapsulation formats which include: - MPEG1, MPEG TS, OGG, ASF, MPEG PS or RAW encapsulation.

3.3.3 OUTPUT METHODS

-Play locally: - this feature allows you to view the streamed content locally on your device screen.

-File: - This option saves the stream to a file. This option allows you to save the streamed content as it is read by VLC without any processing.

-HTTP (HyperText Transfer Protocol): -this is the most efficient output protocol. It involves you specifying the IP address and the port number on which to watch the content.

-MS-WMSP/ MMSH (Windows Media HTTP Protocol): - this output method allows you to deliver IPTV content by specifying the IP address and the port number on which to listen to. This output method only works for the ASF encapsulation method.

-UDP (User datagram protocol): - this output method streams in unicast format by giving an address in the range 0.0.0.0 – 223.255.255.255. this output method also

makes it possible to stream to IPV6 addresses. This output method only works with the TS encapsulation method.

-RTP (Real-Time Protocol): - works like UDP, and makes use of both multicast and unicast addresses.

This method of live delivery will require multiple camera's and laptops at various locations; i.e classrooms all over campus, and with the aid of a software vision mixer and VLC Media player, coupled with the knowledge of the various IP addresses of the streaming laptop, Students will be able to view/ remotely attend whichever class they so wish to, wherever they are.

Creating an M3U file for IPTV ensures that all pre-recorded classes are well organized in the form of a playlist format for the users to see. With this method, users have easy access to whichever class they wish to attend.

3.4 CHAPTER SUMMARY

This chapter describes and envisages the effectiveness as well as the importance and the steps taken towards a good QoE in content delivery. The parameters and specifications required, as well as the code word used to deliver content in the form of IPTV which will be accessed on the network, are described in this chapter.

CHAPTER FOUR

MODEL IMPLEMENTATION AND TESTING

4.1 INTRODUCTION

The emphasis of this chapter is on the actual development of chapter 3- the methodology-. This chapter also discusses the testing and results of the project, in a view to actualizing the effectiveness of this method in regards to the implementation of online learning in Covenant University. This chapter also discusses the implementation of each device, as well as certain observations made.

4.2 MODEL SOFTWARE

As explained earlier, the model software's I'll be using for this project are vMix and VLC media player. The latter being it is easily accessible and a popular application that is used basically by most students in the University. VMix because of its ability to manipulate various inputs in real-time, offering users the chance to display various things if they so please; such as lecture notes, etc.

Choosing the frame rate for providing the external output is very crucial for the quality of the delivery process. On vMix's User Guide, the use of this function identified the reality that the external output allowed you send your video content externally to HDMI, Analog, or SDI through compatible hardware's, hardware's such as Bluefish, AJA, and Blackmagic Design, as well as other applications running on the same PC such as Skype. However, via certain protocols on the VLC media player, it was possible to extract the video for a successful disperse on the network.

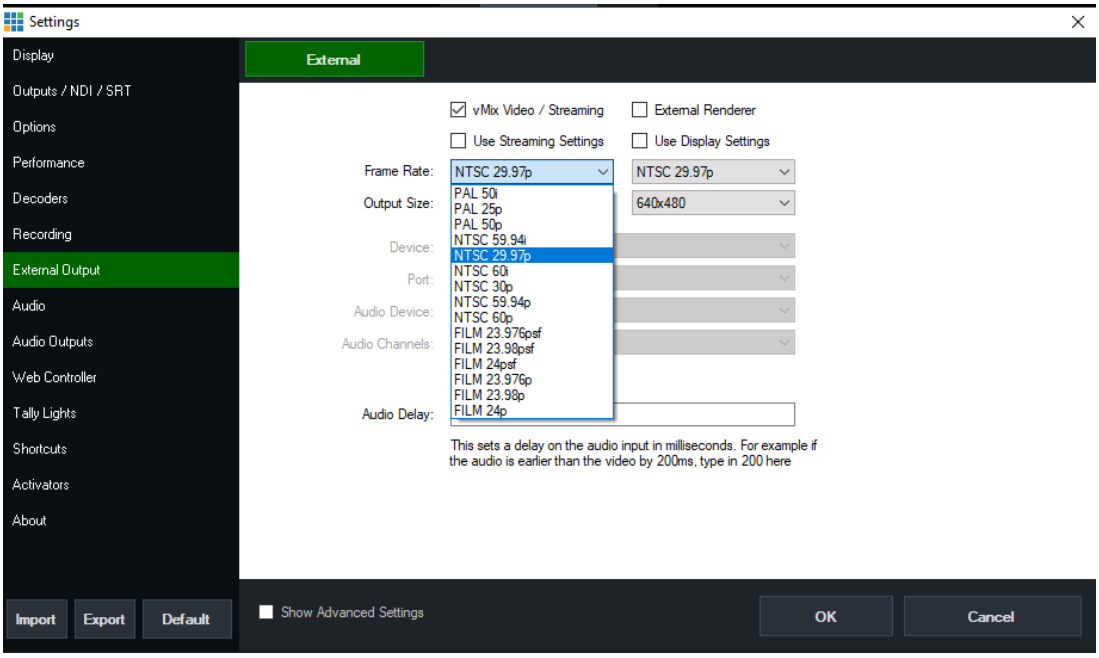

FIGURE 4- 1: vMix FRAMERATES

The frame rate I used for the external output is NTSC 29.97p. The allowed frame rates are PAL 50i, PAL 25p, PAL 50p, NTSC 59.94i, NTSC 29.97p, NTSC 60i, NTSC30p, NTSC 59.94p, NTSC 60p, FILM 23.976psf, FILM 23.98psf FILM 24psf, FILM 23.976p, FILM 23.98p, FILM 24p.

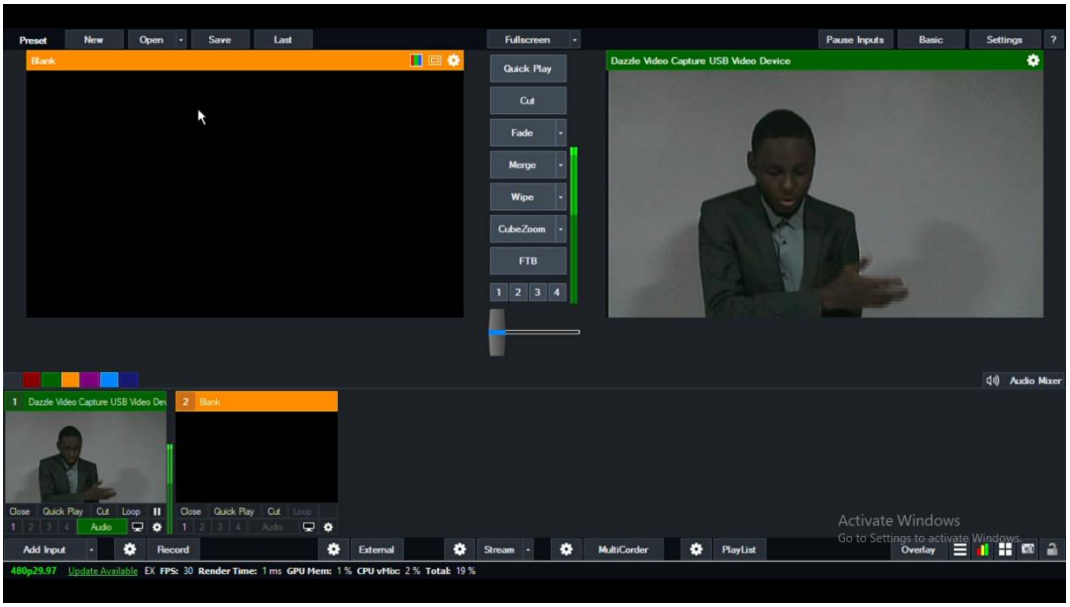

FIGURE 4- 2: vMix CONTENT AFTER SUCCESFUL INTEGRATION

After the successful integration of the video camera with the capture card, the result is shown above.

4.3 H.264/ MPEG-4 AVC CODEC

H.264, regarded also as MPEG-4, is an advanced coding standard, [20] created by the Joint Video Team (JVT), established by experts from the ITU-T Video Coding Expert Group (VCEG) and (MPEG) The Moving Picture Experts Group of ISO/IEC in 2003. The standardization of the first version of this codec was completed in the same year-2003-. This coding standard defines high-quality video compression. This project aimed to create a standard willing to offer good image quality ay bit rates significantly smaller than prior requirements (MPEG-2, H.263) without raising the interface design complexity.

H.264 makes use of various profiles for video encoding. There are many encoding techniques and algorithms used by H.264 for video compression. The fundamental barter is improved efficiency with a complicated bitstream and is more difficult to decipher.

MPEG-4 AVC was created mainly for low-quality internet applications and video conferencing, hence the use of 8bits/ sample, as well as an orthogonal sampling of 4:2:0.

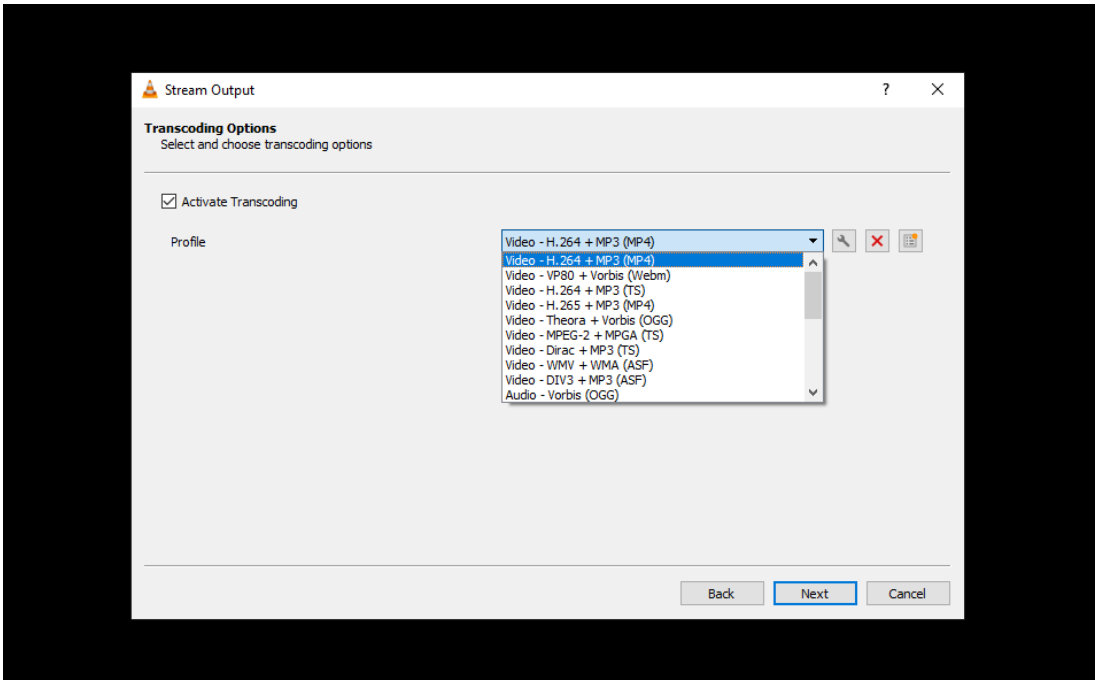

FIGURE 4- 3 VLC MEDIA PLAYER CODING STANDARDS

The generated output code without elementary streams is shown below

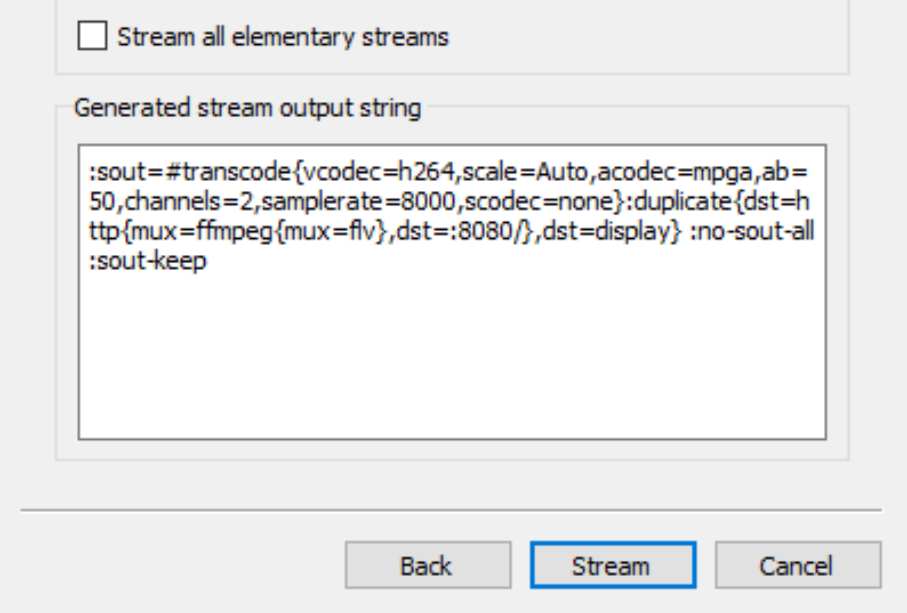

FIGURE 4- 4: GENERATED OUTPUT CODE WITHOUT ELEMENTARY STREAMS

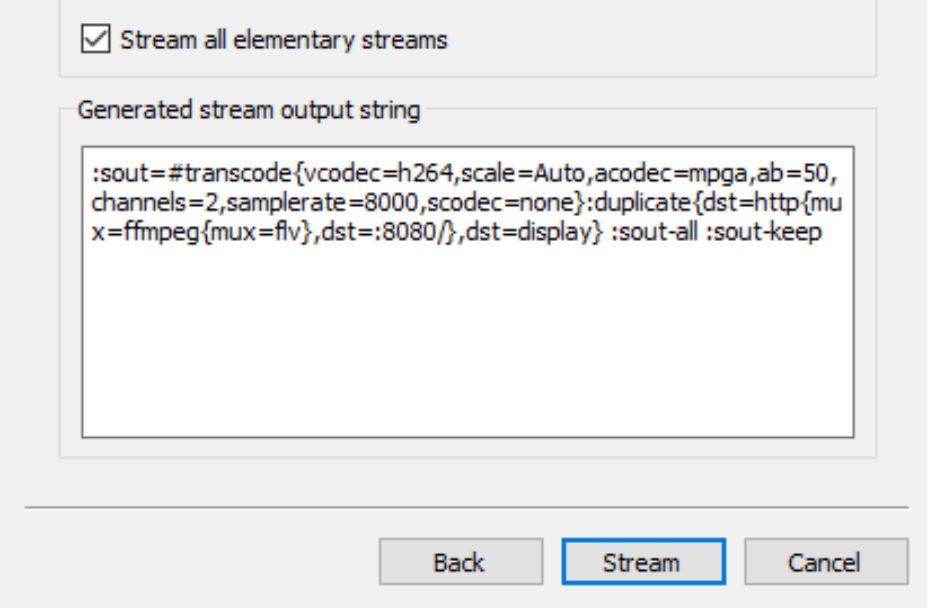

FIGURE 4- 5: GENERATED OUTPUT CODE WITH ELEMENTARY STREAMS

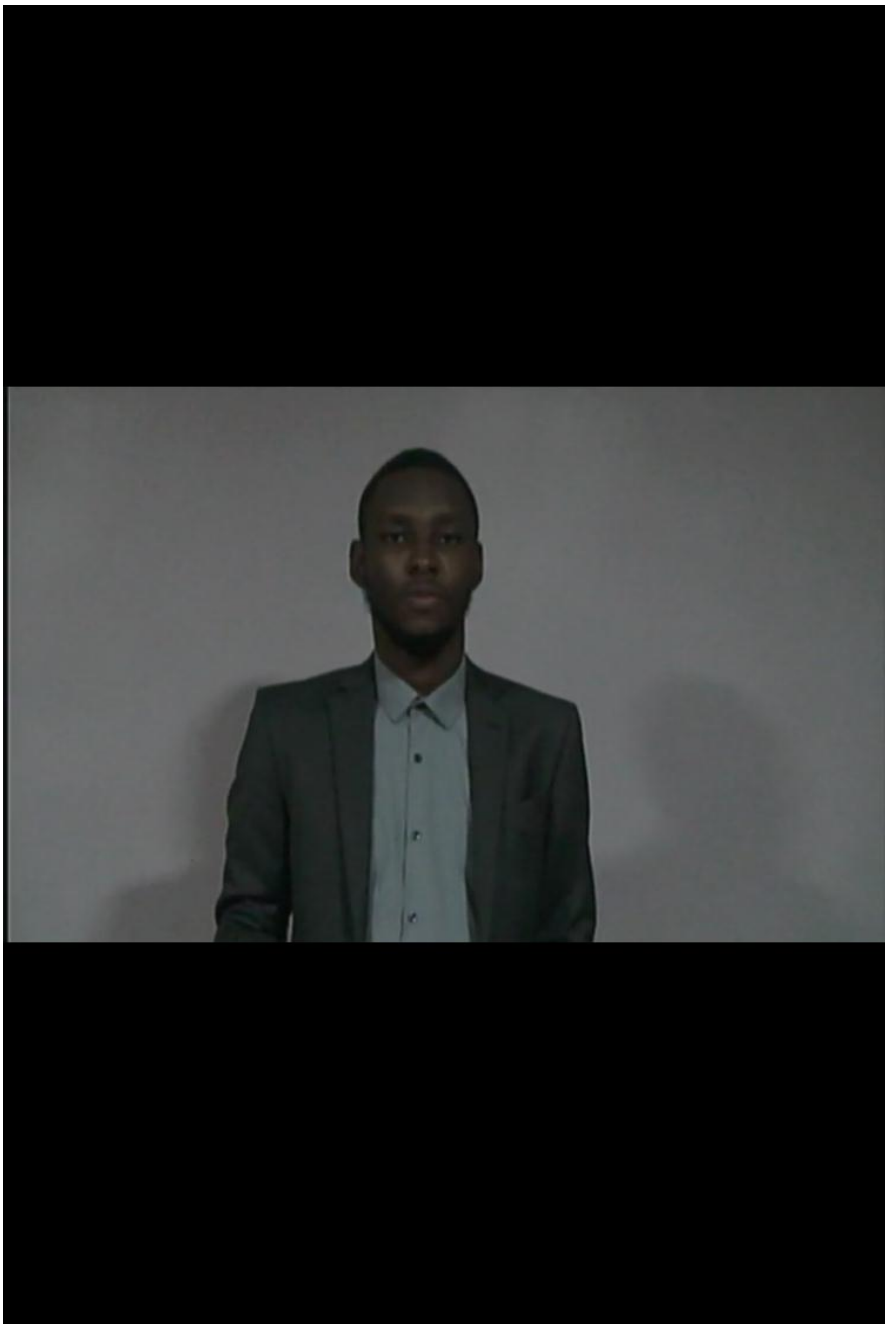

FIGURE 4- 6: THE END PRODUCT STREAM

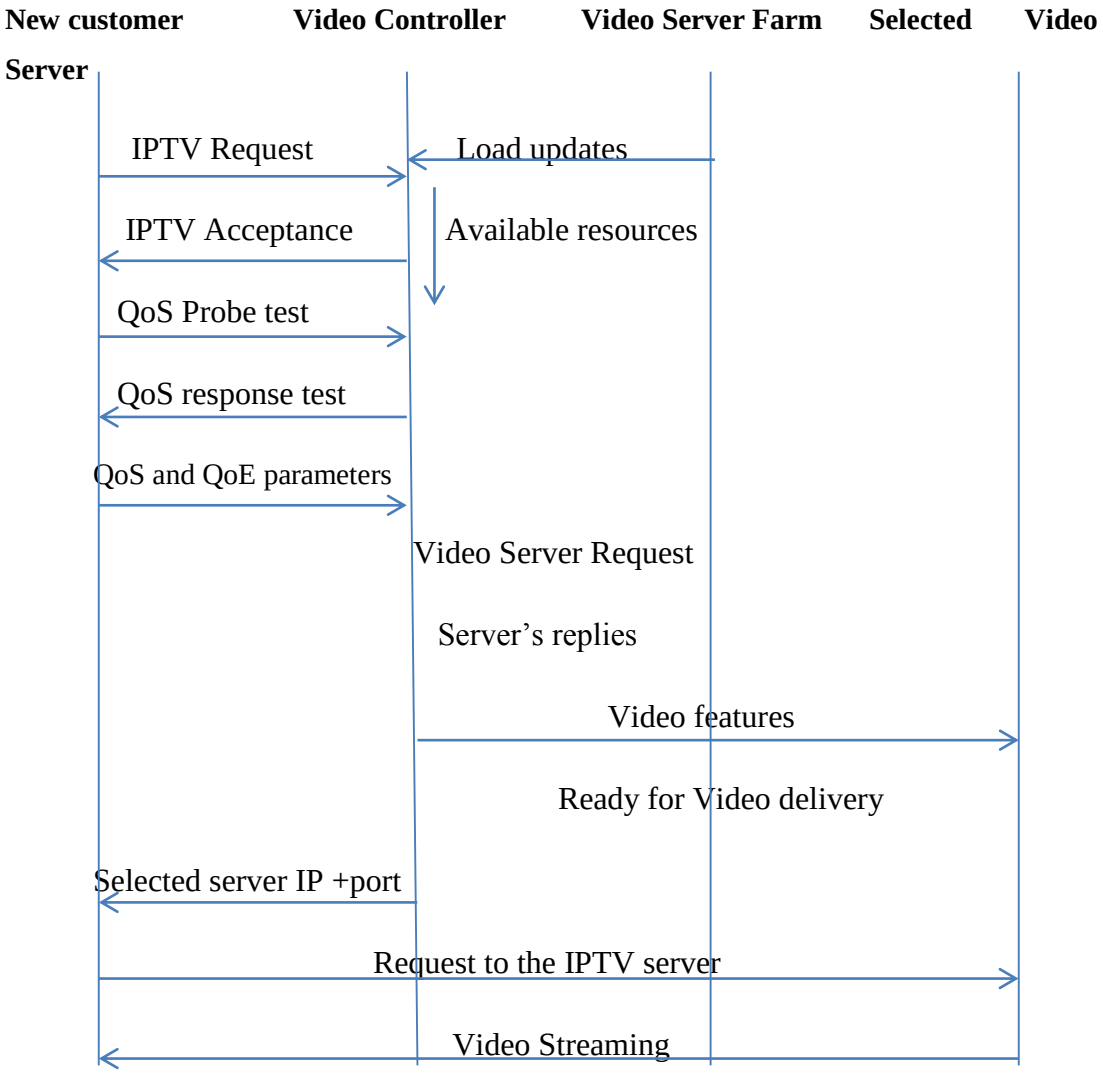

FIGURE 4- 7: NETWORK PROTOCOL

CHAPTER FIVE

CONCLUSION

5.1 PROJECT SUMMARY

This project proposes the implementation of mobile IPTV for online learning in Covenant University. This project base was explained through its implementation for education, IPTV, and mobile IPTV architecture, its model deployment, and the delivery of live content in real-time. The objective of this project is to explore the use of mobile IPTV in distant learning/ education.

A basic model was used for the implementation of this project. This report details all the processes in regards to the implementation of this project, and is as detailed as shown below:

- Chapter one introduces an introduction to the project. The aim of this project, as well as the objectives was also itemized in this chapter.
- Chapter two introduces the topic-proper and combines the history of IPTV and the preceding technologies, to have a grasp of the knowledge of the topic in focus. Inherent in chapter two is also a review of previous works relating to the implementation of mobile IPTV.
- Chapter three provides a wider understanding of the proposed model and entails the basic model, as well as the parameters used.
- Chapter four provides a visual simulation of the proposed topic, describing the analysis and also the testing's done.
- Chapter five concludes the report and provides recommendations for future works.

5.2 CHALLENGES FACED

While working on this project, I faced certain challenges; some of which were:-

- I never knew anything regarding internet protocol Television and its applications; hence I had to gather information and knowledge about it.

- As mobile IPTV is a topic not that sought-after, there was a limit to the content I could source for, hence I had to source for means to get information regarding mobile IPTV.

- I had to learn the implementation of mobile IPTV with the use of various software's, of which I was never familiar with.

- I had to figure out the right protocol which would be viable for mobile IPTV.

5.3 ACHIEVEMENTS

- I was able to explore the use of mobile IPTV and its application for online and distant learning.

- I was able to implement a mutual software – in my case VLC media player- making classes accessible online.

- I was able to configure a random video camera to be able to convey its output to a computer system which will then send out the video.

- I was able to conjure a basic model, consisting of a video camera and a capture card, which can be implemented on a larger scale as such for an institution like Covenant University.

5.4 RECOMMENDATION

There are certain changes/ additions that could be made for the improvement of mobile IPTV's implementation for online learning. One of which is improving the quality of user experience as well as Quality of Service (QoS). Also, measures could be taken to provide certain features which will give access to multiple views at the same time. The provision of factors that will provide good service coverage wherever you are in the world will help in ensuring content delivery to more people irrespective of the remote places they may be. The addition of machine learning (ML) will also help in adding intelligence to the IPTV network.

Also, certain security solutions will have to be implemented to ensure and mitigate threats to content security.

5.5 CONCLUSION

IPTV and Mobile IPTV are very crucial for content delivery, and it serves as the future of telecommunications, the entertainment industry, as well as the education sector, placing consumers in the driver's seat in regards the control of what he or she wants to watch.

Mobile IPTV provides a huge advantage to distant learning and helps ensure that knowledge is continuously passed across, irrespective of the age group and wherever the users are all over the world.

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