

IPTV technology for the wireless Internet service provider (WISP)

Tecnología IPTV para el servicio de Internet inalámbrico proveedor (WISP)

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Abstract—This article describes the implementation of the IPTV technology through an open source system for the wireless Internet service provider (WISP) in the Cerecita site, located in the province of Guayas, Ecuador. The feasibility of implementing the IPTV technology is given through the use of the Emby Server application, in addition to the use of an operating system such as CentOS 7, which are open source and have the necessary requirements for the creation of this service. The analysis of data traffic generated on the WISP network, which will establish the advantages and disadvantages generated by the transmission of this technology, created to VOD multimedia content server that allows the video signal to be sent to users. Finally, a feasibility study was carried out to analyze the advantages and disadvantages that exist in the implementation of this IPTV technology.

Keywords—IPTV, WISP, digital television, television with satellite, VoD.

Resumen—Este artículo describe la implementación de la tecnología IPTV a través de un sistema de código abierto para el proveedor de servicios de Internet inalámbrico (WISP) en el sitio Cerecita, ubicado en la provincia de Guayas, Ecuador. La factibilidad de implementar la tecnología IPTV se da mediante el uso de la aplicación Emby Server, además del uso de un sistema operativo como CentOS 7, que son de código abierto y tienen los requisitos necesarios para la creación de este servicio. El análisis del tráfico de datos generado en la red WISP, que establecerá las ventajas y desventajas generadas por la transmisión de esta tecnología, creado para el servidor de contenido multimedia VOD que permite enviar la señal de video a los usuarios. Finalmente, se llevó a cabo un estudio de factibilidad analizar las ventajas y desventajas que existen en la implementación de esta tecnología IPTV.

Palabras Clave—IPTV, WISP, televisión digital, televisión con satélite, VoD.

INTRODUCTION

Iptv for its acronym in English Internet Protocol Television was born out of the need to extend the schema that currently have the telecommunications companies, as the IPTV service consists not only in providing subscription television, but also improves the image quality, fidelity in the sound and a guide to programming with more information.

The IPTV technology has been an evolution to the current networks and for society. There is a close relationship on the web between the PC and the TV giving rise to new technologies such as IPTV in their forms of learning, own of the digital culture. The virtual reality became a the touch reality and audiovisual's thing it is already a mode of knowledge of the reality that involves people. Resulting the need of new technological developments for education and learning in this digital age. IPTV technology was applied in the Cerecita zone of the parish Chanduy, located at 55 kilometer track to the coast way, in this site lies the Commune Lowering Chanduy, which is one of the oldest in relation to the population on the peninsula and which has approximately 1,750 inhabitants.

This commune obtain telecommunications service, by means of the most important suppliers in the market, such as:

Claro, Movistar and CNT, which provide a service using the antennas as a basic tool to achieve coverage. However, there is reflects a deficit of these since the signal does not reach the rural sectors such as the parish La Cienaga, Tugaduaja, among others. For this reason, took place the implementation of IPTV technology for the Wireless Internet service provider (WISP), for which was carried out a comparative analysis of the IPTV services and satellite TV, an analysis of the feasibility of technical requirements for the implementation of IPTV technology, also was determined the most useful tools for the implementation of a server of videos with IPTV technology and implemented IPTV service under the network infrastructure of the WISP.

After you have performed the comparative analysis was obtained as a result that the IPTV technology is a closed TV system that is based on the IP protocol, which makes it safe and with permanent control in the distribution of content, the tools that were used for the implementation of IPTV technology were the server IPTV, S.O. Centos 7, Emby Server and Emby Theater Windows (Client). In conclusion, currently the direct beneficiaries of the implementation of IPTV technology under the network infrastructure of the WISP are the inhabitants of the Cerecita zone since they receive a quality service.

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RELATED WORK

The IPTV Service has been studied worldwide by different organizations, which has motivated the interest of different internet providers to implement this technology as part of their service. This is the motivate why development the case of study for the backbone design of the IPTV services within a single internet provider network, where it describes the architecture and traffic characteristics (Cha et al., 2006) and the appropriate methodology for the policies of application of and technology to lead the establishment and globalization of the IPTV service (Chorianopoulos, 2008).

Likewise, value propositions (offer) have been made for the IPTV service, focused on customer products and services, which the Venezuelan telecommunication operators can use as a basis for launching their Iptv service (De Groote, 2014). In a study for the implementation of IPTV for Cartagena organizations in Colombia on wide area network (WAN) technologies used in the city (Gergen, 2004).

There are studies on mobile solutions and adoption of IPTV (Gutiérrez et al., 2013). As well as evaluations of IPTV applications in a wimax environment of performance and improve service quality (Joo, 2009). In addition, was proposed resource allocation schemes based on the utility for multicast transmission service for multilayer IPTV in IEEE 802.16 WiMAX networks (Kuo et al., 2007). The article contribution is related to the IPTV implementation of low-cost Wimax technology with a local Internet provider in a sector rural area known as "La comuna bajada de Chanduyín Ecuador.

DEVELOPMENT

At present, the accelerated development of telecommunications, it has become evident, not only in the modernization of the telecommunications infrastructure and the emergence of new technologies, but also in the offer of new services (Lin et al., 2013).

In a telecommunications system, the sender information is temporarily converts into electrical signals (electrical voltages that vary over time) so that it can travel through the system until they reach the destination back transform it to intelligible information by the recipient. These electrical signals are called electrical signals of information; such signals can be analog or digital.

For Leon B. "television is an electronic system for the reproduction of images and sound instantly. It works on the basis of the analysis and the conversion of the light and sound in electromagnetic waves and their conversion"(Mahon et al., 2004).

Television is a means of telecommunication used for the transmission of sound with moving images on a single color (black and white), or color, and in two or three dimensions. You can refer to a television set, a television program, or the transmission medium of television. Television is a medium of communication, entertainment, education, news, and advertising. According to Grob, B., "a television system consists of equipment ubicated in the production source, the device is in the home of the viewer, and the equipment used to transmit the TV signal from the producer to the viewer"(Martelo et al.,

2015). The purpose of all this equipment, is to extend the human senses of sight and hearing beyond its natural limits of the physical distance. A television system must be designed, therefore, to embrace the essential capabilities of these senses, especially the sense of vision. The aspects of the vision that should be considered include the ability of the human eye to distinguish the brightness, colors, details, sizes, shapes and positions of objects in a scene before her.

TYPES OF TELEVISION

The analog tv, is the original television technology that uses analog signals to transmit video and audio. In a normal analogue TV broadcast, brightness, color, and sound are represented by rapid variations of any amplitude, frequency or phase of the signal. According to Vega, C. "analog signals vary in a continuous range of possible values that means that electronic noise and interference are reproduced by the receiver. So, with analog signal, a moderately weak signal becomes persistent"(Martelo et al., 2015).

According to Richeri G. "The digital terrestrial television (TDT), also called the Open Digital TV (TDA) is the transmission of moving images and sound associated (television) by means of a digital signal (binary encoding) and through a network of terrestrial repeaters"(Mazzaro, 2009).

The advantages of digital terrestrial television are similar to other means of digital transmission in relation to analogue platforms such as cable and satellite TV: the ability to compress the signal, a more efficient use of the radio spectrum to transmit for more than one television signal, the capability of streaming audio and video of better quality and lower transmission costs, are some of the features of this television.

Free Television, or open signal, is transmitted via satellite, but there are some stations that transmit the signal in the VHF and UHF bands. On TV open signal, a small antenna receives signals from the satellites. However, these channels, which are apparently free, are actually paid. Some are paid directly by the pay for the use of the license rights or through voluntary donations. Channels also use sponsors to share the license rights in decrease of the amount to be paid by the viewer.

Pay Television, refers to the subscription television services, usually provided by the analog tv and cable television and digital satellite, and increasingly through digital terrestrial television and internet connection. According to Alcázar M. and Corner E. "The subscription television began in the transition from multiple channels and the transition in the post-network age. Some parts of the world, especially in France and the United States, have also offered terrestrial analogue signals available for subscription"(McWhirter and Hoffman-Goetz, 2012).

The most popular methods of distribution of pay television are cable and satellite television. In addition to these popular methods, there is also the IPTV (the transmission of signals is carried out via the IP protocol, transmitted in xDSL or fiber optic networks), the MMDS service (the signal transmission is through microwave) and special service of pay-TV (TVA), these last two are already practically in disuse.

Satellite television is television programming issued through a point of Earth by means of satellite communications and

received by an external antenna, usually a parabolic model generally referred to as a mini satellite dish, together with a satellite receiver in the form an external set-top box or a satellite tuner module built into a TV set. The decoders are available along with a card or USB to be connected to a personal computer. In many areas of the world satellite television providers offer a wide range of channels and services, often in areas that are not served by the providers of cable or terrestrial. According to Giordano E. "The transmission is done by the DTH (Direct to Home) that transmits both analog and digital signals. This function has a satellite receiver analog or digital"(Muñoz et al., 2009).

Cable TV or CATV is a distribution of audiovisual content system of television, FM radio and other services to consumers through coaxial cables fixed in place of the old traditional system of transmission by means of radio antennas (TV station) what Spreaded to several countries, mainly through the pay-TV services.

WISP

Voinea points out that ".^a WISP is an Internet service provider (O'Driscoll, 2008) with a network based on wireless networks"(Ramos Garduza, 2011). networks Wifi wireless of mesh, or an equipment designed to operate in open frequency 900 MHz, 2.4 GHz, 4.9, 5, 24 and 60 GHz or licensed frequencies in the UHF band (this include the frequency band of MMDS), LMDS and other bands from 6 GHz to 80GHz.

WISP often offer additional services such as content based on location, virtual private network and voice over IP. WISP have a large market share in rural environments where the cable and digital subscriber lines are not available; in addition, with the available technology, can meet or exceed the wire-speed legacy and telephony systems.

WIMAX

According Enriquez , Ortiz, Taha, "WiMAX is a family of wireless communication standards initially designed to provide data rates of 30 to 40 megabits per second (Mbps), with the update of 2011 that provides up to 1 Gbit/s for fixed stations"(Seguí et al., 2008).

This pattern is similar to the standard Wifi and even (IEEE 802.11), which is already widespread, but adds knowledge and latest features designed to improve the yield of communication, which allows higher speeds of 1 Gbit/s, some in direct competition between it and other designed for other specific applications. The propose of the WiMAX standard is to establish the final part of the infrastructure of broadband (last mile), providing connectivity for the home, the use of business and access points (Seguí et al., 2008).

IPTV TECHNOLOGY

Some authors indicate that IPTV (Internet Protocol Television) or PPVT (TV over IP) is a new method of transmission of television signals, as well as VoIP (Voice over IP), IPTV uses the Protocol IP (Ramos Garduza, 2011) Internet Protocol as a means of transport content. The fact that IP (Mazzaro, 2009) stands for Internet Protocol does not mean that the content of

television is distributed via streaming on the Internet. IPTV is not, therefore, a television broadcast on the web.

The content of IPTV is sent only in streaming, but with the guarantee of quality in the delivery. The receiver is a decode device connected to the TV (similar to the cable TV unit or DTH), or even a gaming console like the Xbox 360 and PlayStation 3. It enables the delivery of audio and video with high quality, and are based on a broadband connection (which is generally sold in conjunction with the service as an integral part) of at least 4 Mbps. The band destined to IPTV, does not interfere with the Internet bandwidth. For example, the purchase of a speed of 6 Mbps Internet in a package of IPTV, the telephone company provides at least 10 Mbps for the client, where 4Mbps are exclusive of IPTV. The concept of IPTV (Internet IP Television), it is no more than the connectivity of the Internet television using, however, a dedicated infrastructure, parallel to the Internet,"just to ensure the quality and speed of service. The IPTV service is not illegal, as it uses the Internet (broadband), where the viewer pays a fee to the operator, in order to use the service.

According to the views expressed by O'Driscoll (O'Driscoll, 2008) IPTV services can be classified into three main groups:

- Live Tv, with or without interactivity related to the current TV program; Deferred TV: catch up television (plays a television program that aired for hours or days), on the TV (repetitions of the current TV program from your start);
- Video on Demand (VOD): browse through a catalog of videos, not related to the programming of television.

IPTV is distinguished from Internet TV for their normalization process under way and the preferential deployment scenarios in the telecommunication networks by subscribers with high-speed access at the premises of the end-users through the decoders and other equipment of the customers of the establishment.

INFRASTRUCTURE

The IPTV (Ramos Garduza, 2011) service infrastructure consists of the elements described below: Bedside System or head-end, the video headend is one of the centerpieces of the infrastructure of an IPTV service. Its role is to capture the content from different sources are: land, off-line, a la carte, etc., to process and encode in accordance with the standards of the default compression (MPEG-2, MPEG4, WM9, etc.) encapsulated over IP and, finally, available for distribution over the network.

The head-end Systems can be divided into two parts: the reception and processing of signals. Systems for the reception can be divided according to the environment and, in general, include an element of signal and an element of reception:

Reception by Satellite: this includes the satellite antenna mount dedicated to capture the satellite signals nearby, converters "Low Noise Block"(LNB) and splitters whose received signal distribution extends to the receptor called Integrated receiver decoders"(IRD).

Reception by land (.air") covers a range of VHF / UHF antennas, and splitters for distribution to the receptors, which

are the demodulators of VHF / UHF. Reception of air channels outside is linked to the local and regional content and can occur in both SHE, as in the VHO.

Reception by dedicated connection uses the fiber optic with the possible use of specific receptors for this purpose. The processing of the signal starts after the received signals, when they are processed and encoded for transmission through the issuance or stored (VOD). The signals are amplified and distributed to the encoders (encoders), which are the main elements of this block. In turn, these are responsible for the encoding and compression of the content received, in accordance with the compression standards set by the operator. Usually, the default encoding is defined by the Moving Picture Experts Group (MPEG) of the International Organization for Standardization (ISO). It is important to note that the most widely used standards are MPEG-2, MPEG-4 and, more recently, the MPEG-4 AVC (Advanced Video Coding) MPEG-4 or H.264 (standard version by the UIT-T), since they offer better compression than the others.

MIDDLEWARE SERVER

It can be considered as the operating system of solution. In other words, the middleware server is the component responsible for the intelligence service, in addition to stand in the supply of the service end-to-end, and therefore responsible for the interconnection of the different parts of the system: media server, set-top box, head-end, DRM of the network. In this same line of reasoning, it can be said that the middleware is the facilitator of the IPTV solution.

FUNCTIONS OF MIDDLEWARE

Among the functions supported by the middleware, we highlight two:

Functions to the subscriber: the role of "electronic program guide" (EPG), presentation and interactive services (VOD, PVR, etc.); the presentation and interactivity of the integrated services (video, telephony, Caller ID, etc.); programming information; parental control and the subscriber account information.

Functions for the operator: represented by activities such as the application programming interface (API), software development kit (SDK), service management, customer management, transaction management, content management and distribution strategy, remote control of devices user set-top box, the interface with the billing, provisioning interface / activation, the integration with security systems and reporting.

The safety of the content is a key requirement to allow the provision of IPTV. Traditional systems of conditional access, or conditional access systems (CAS), are designed primarily for broadcast services / pay-per-view. Such legacy systems have focused mainly on the content in transit and not stored content. These legacy systems encrypt it the contents of the header and then decrypt it at home the subscriber, using the smart card-based authentication generally located on the set top box.

Security in the context of IPTV also covers the protection of video content stored across the infrastructure, in the operator's

servers or the units of the subscriber. The need for more comprehensive solutions leads to a new category of solutions called digital rights management (DRM). The DRM has as purpose, manage the digital contents. It is used on the basis of the specific conditions defined by the user's usage rights and seeks to ensure the access control (authentication and authorization), using the accounting (management of rights of use), control of replication (copying), the authenticity of the source, the confidentiality, integrity and availability of protected content.

It is worth noting that are DRM systems that provide the necessary security infrastructure to prevent piracy of content independent video if stored or transmitted. The operation of the DRM is based on the contents of the encryption at end headend and decryption is based in the upper box established at the use of digital certificates. In this perspective, the content is encrypted wherever you are and is only decrypted on your screen. The DRM also has many points of contact throughout the system and therefore requires the integration of end-to-end with the various components of the solution to ensure the protection of the content.

VIDEO SERVERS OR MULTIMEDIA

The video servers are responsible for storing and making available content that is offered in the demand for subscribers. So that store the contents of VOD and dissemination of content also selected to enable the PVR functionality for the end user. This type of PVR is known as Network PVR (nPVR) where the content is not stored on the user's premises, but if in the operator's systems. The servers have, therefore, a high storage capacity and high availability, which supports a large number of simultaneous video streams.

SET TOP BOX

Is the component of the service layer that performs the interface between the IPTV system with the user and the content display devices (tvs, plasma screens, etc.). Stay to the middleware components, DRM decoder navigation, which has a storage capacity of local content and therefore the realization of the function of a PVR.

BENEFITS OF IPTV

For telecommunications companies:

In practice, the telecommunications companies can enter the business of pay-TV, offering a complete package (4 Touch: telephony, broadband, mobile and TV (Rennie, 2006).

In conventional networks of all channels are sent to the consumer, being present at the input of the receiver. IPTV channels are available on request. In situations more favorable understanding will be present two channels, which allows the display of a recording and one, which is not only limited to the available bandwidth of the user. The IPTV works only during 1 month on the TV after this will only work open channels.

For the spectators

In addition to benefiting the telecommunications companies, this technology allows for greater user interaction with the TV, as it has the choice of the contents in his hands, and can mean a significant reduction in the value of the package closed in a single account.

IPTV operates differently to the traditional systems of television (cable, satellite and terrestrial), since only the programs and content "on-demand" (VOD) selected are distributed to the consumer. The IPTV always has two-way communication, that offers a true interactivity between the user and the system. With IPTV is possible, for example, to answer a telephone call and watch on TV, in a Picture-in-Picture, the image of the person with whom you are speaking. You can also buy immediately a product being announced, or is displayed in a novel Rennie (2006).

To obtain a higher level of service high quality IPTV Broadcasting is required and a broadband of at least 4 megabytes completely unique to the service, that is to say, it is necessary to separate the normal bandwidth IPTV Internet bandwidth.

DIFFERENCES BETWEEN IPTV AND INTERNET TV

According to, Pineda, end Mauri Muñoz et al. (2009), "the main difference is the way in which delivers the content. While television over the internet travels through a network of public open global Internet, IPTV uses a private network, managed."

In other words, IPTV is a technology that allows the television services to be delivered over a data network of property for broadband packages by using the Internet protocol suite. Although the Internet television is a television broadcast service distributed computing on the internet. IPTV is the multicast of the content within the managed network while Internet TV is transmitted over the network (Internet). As its name suggests, the internet television uses the public Internet to deliver video content to end users. IPTV uses secure dedicated private networks to deliver video content to consumers. These private networks are managed, are sized and operated by the service provider. The delivery of IPTV is a higher quality, more reliable, and more consistent viewing experience with a video. In the best effort, the Internet may be subject to delays due to lower bandwidth, high traffic or the poor quality of the connection. A digital "set top box" is generally used to access and decode the video content delivered through a system of IPTV while a PC is almost always used to access the Internet TV services (Rennie, 2006).

Given that the Internet is more open than a network of property, the personal computer dedicated may also require certification of digital rights management in order to ensure compliance with the laws of copyright. In the case of the IPTV service, copyright laws are handled during the contract negotiations between the operator and the media company that provides the material.

THE IPTV IN THE HOME

The IPTV system has been designed to be applied in the networks of service providers, such as cable companies, since they have the infrastructure that is required to be able to

communicate between the central so that you can get to all users. When it describes the infrastructure, we mean the backbone or spine) fiber optic cables and other equipment that allow the transmission at high speed.

DIGITAL HOME NETWORKS (DHN)

The use of the digital home network can be to share an Internet connection, network games, share files, and share printers. With the latest technological advances in the digital video and television over IP, consumers want to include the distribution of video on the home network. Some examples of this application is IPTV, video sharing from one device to another, to have library of DVD's, and video conferencing.

According to Sierra, as the use of home networks (Domestic Home Network, DHN) grows, the attention is directed to the physical layer of the network, methods of connecting these devices to the network, and that technology dhN to use. The most basic form of a home network is a CAT5 Ethernet cable between two computers, assuming that are fairly close. But normally a computer is quite distant from the other.

With the advance of technology and the growth of the market, we hope that the networking facilities can be more personalized for each user and have the ability to tailor the network DHN within the physical environment of the home.

The only common element across the network is the IP protocol, which is the basis for the television over IP (IPTV). In addition, it is expected that the majority of home networks are hybrid; this means that they can handle multiple transmission media and different technologies.

METHODOLOGY

For the implementation of the IPTV Technology with a Wireless Internet Service Provider (WISP) in the Cerecita precinct, Guayas province, aimed at the Lower Commune of Chanduy, software and hardware were used with the characteristics required for the implementation of IPTV technology, as well as the application of Quality of Service (QoS) to ensure good video streaming. Within the software part will be used the IPTV application "Emby Server" and as CentOS 7 operating system. In the wireless internet service in the study area, the main node and Mikrotik communication equipment were installed and configured, under links point to point and multipoint point, from the backbone to the CPE or end customers. The tower of 24 meters in height with an elevation of 70 meters, were located two sectoral antennas of 120 that allow to connect a maximum of 300 subscribers with a distance of up to 7 kilometers and with optimal quality in the signal, these antennas are connected to a router that segments the bandwidth for each user connected to the network, navigating at a speed previously configured, from 1 Mega to 5 Mega symmetric.

Figure 1 details the different types of hardware that were used for the implementation of a wireless internet provider with Wimax technology.

The design of the implementation of IPTV Technology is shown in Figure 2, you can see providers of Internet services with WIMAX technology. For the IPTV service, each customer's link was applied the quality of service (QoS). The IPTV

Quantity	Type/Model	Description	Features
1	Routerboard RB1100AHx2 brand mikrotik	Server-router Gigabit Ethernet- bandwidth manager	That helps the management and monitoring of the network
2	120 antennas' brand Ubiquiti	Stations of the signal	You work in frequency 5.8 Ghz
2	Base Box RB912	Outdoor Enclosure	Radio and propagates the signal to large distance
1	Antenna SEXTANT G SHPNd	Recipients of last mile link	To receive the package of megas controlled
10	Equipment CPE or customers	Receiving signal	That receive the signal of the radio stations signal
1	Tower of 24 meters galvanized	The main tower	Placement of antennas

Figure 1. WISP Hardware Features.
Source: Prepared by the authors.

server is located in Internet provider datacenter, this model shows the importance of the relationship that each elements keep and the application of IPTV as corporate channels, video on demand (VoD).

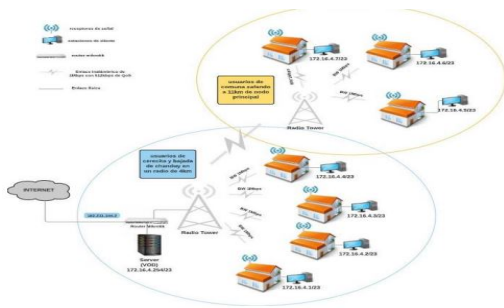


Figure 2. IPTV Technology implementation design.
Source: Prepared by the authors.

RESULTS

Geographical scope.

IPTV technology in the Cerecita Campus, users subscribed to this service, Figure 3 shows the distances between the provider and a customer, the subscriber distances range from 1km to 11km.

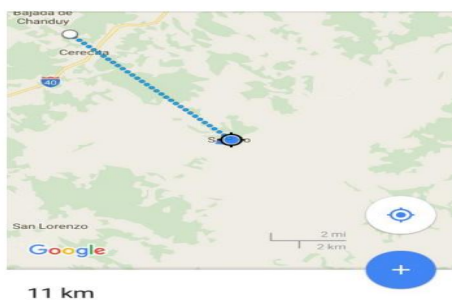


Figure 3. Example of distance from client to WISP.
Source: Prepared by the authors.

The connectivity distances from the client to the WISP provider is shown in Figure 4, the connection have no communication problem.

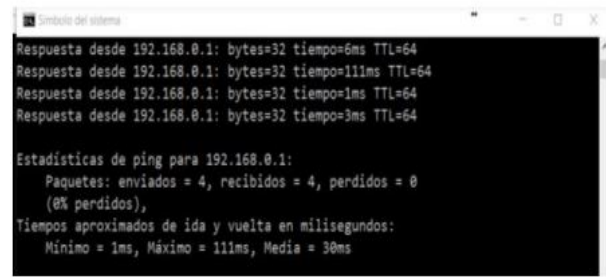


Figure 4. Connectivity test.
Source: Prepared by the authors.

Quality of service. The configuration of QoS for the video streaming was done to guarantee a good service. Figure 5 shows what was reserved for the data transmission bandwidth of the server, where was designated a minimum configuration of 512k

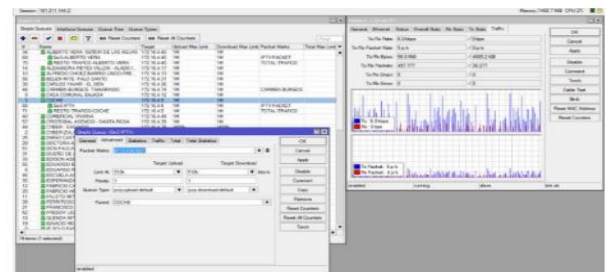


Figure 5. Bandwidth configuration.
Source: Prepared by the authors.

In order for customers to have a transmission without delay, bandwidth was assigned through Tree Queues, and Bandwidth 1 Mb and 2 Mb bandwidth plans were suggested for customers. The QoS configuration for the use of this IPTV service with Wimax technology is shown in Figure 6.

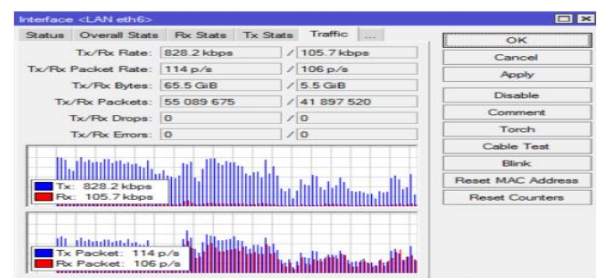


Figure 6. QoS Configuration.
Source: Prepared by the authors.

CONCLUSIONS

This paper presents the implementation of the IPTV technology over a Wimax network of an internet provider in Çomuna Bajada de Chanduyin the Cerecita's zone of Ecuador.

Our focus was the direct benefits to the inhabitants in being able to offer contents of videos of quality as well as the service offered. Also presented were the tools used for the implementation of the IPTV technology are the IPTV server, CentOS 7, Emby Server and the Emby Theater Windows (client). In addition, the technical requirements for the implementation of the IPTV technology and the tests carried out for the project are shown. It could be noted that the IPTV system obtained good results in terms of its operation and quality of videos in the clients that obtained that benefit.

Despite all the advantages and possibilities of the proposed IPTV system, it has several limitations that could be improved in future work. First, the proposed IPTV system is designed for limited geographic areas, as well as the number of users to use this service.

Therefore it is proposed to carry out research on new IPTV implementations with Wimax for more than 1000 users. Secondly, the work shown was done on a small WISP company, which would be interesting to test performance and quality in other types of infrastructures.

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