

Estudio de las tecnologías inalámbricas Metro Mesh, Wi-max y Wi-fi para implementar un ISP para el sector el Retorno de la ciudad de Ibarra

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Abstract. *This project is about the design and implementation of an ISP network in the field of Return of the City of Ibarra, prior to the study of WiFi, WiMax and MESH wireless technologies.*

In the first chapter the definition, prognosis and assessment of the current situation of the problem, the definition, justification and scope that the project will be carried out, the general and specific objectives arise. The second chapter includes a basic study of the general concepts of the introduction to wireless networks. In the third chapter deals with the analysis of the studied technologies for the project to be developed. In the cost analysis the technical specifications of the equipment that could be used in the implementation of this project are cited, then the total project costs are computed taking into account equipment costs, infrastructure costs and costs of implementation and maintenance. In chapter four the proposal for the design of wireless ISP, the structure of the network and implemented activities to complete the project is detailed.

The fifth chapter shows the conclusions and recommendations on the results obtained in developing this project..

Keywords

Wireless, implementation,ISP, Wifi, Wimax, Mesh .

1. Introduction

This project is about the design and implementation of an ISP network in the field of Return of the City of Ibarra, I study the previous WiFi, WiMax and MESH wireless technologies.

In the first chapter the definition, prognosis and assessment of the current situation of the problem, the definition, justification and scope that the project will be carried out, the general and specific objectives proposed for this paper grade also arise .

The second chapter includes a basic study of the general concepts of the introduction to wireless networks. Finally we review concepts of what an internet service provider, its basic infrastructure and value-added services

in Ecuador, the rules governing them and their requirements to operate.

In the third chapter deals with the analysis of the studied technologies for the project to be developed, then the specific requirements and then move to compare the technical characteristics are analyzed. In the cost analysis the technical specifications of the equipment that could be used in implementing this project, then the total project costs accounted cited. Besides an analysis of the demand for Internet services in the sector and technology selection it is made.

In chapter four the proposal for the design of wireless ISP, the structure of the network and implemented activities to complete the project is detailed.

The fifth chapter shows the conclusions and recommendations on the results obtained in developing this project.

2. Materials and Methods

This project is aimed at covering urban and residential area of the city of Ibarra whose scope will be limited by the streets:

- Nazacota Puento
- Av. Atahualpa
- Rio Aguarico
- Rio Lita

gathering information on the current situation of the city in our coverage area will be conducted to determine physical obstacles that may cause interference to the network and relevant information to users who will have access to this network by field observation the average number of users to be had in our coverage area is calculated.

The equipment needed to implement the main Node scope to cover our coverage area, hiring Internet service for our network will be using fiber optics to be determined Authorized Carrier Company.

With the above information will proceed to the design and implementation of the network that meets the

requirements of coverage and access to users in the specified area without cutting problems or disconnection area, a technical analysis of equipment and a cost analysis to be performed determine the best technology in terms of features and cost.

Will also analyze the services and propose appropriate access policies for users to use the network, you must also make restrictions on access to the Internet will do this with the use of a Firewall Proxy.

A study of demand internet service will be held, taking official and updated data from the website ARCOTEL to know the possibility of penetration that have the internet service provider and equipment features that are available in the market in order to make a detailed list of the most suitable equipment.

With the development of our testing we will design access policies on a test server.

The necessary conclusions and recommendations and an analysis of the lessons learned during the project will be made.

2.1 Background

Here are important facts about the city to start designing Provider Wireless Internet Service.

Location: 15 km north east of Quito, 125 km south of Tulcán...

Height: 2225 meters above the sea.

Climate: mild and dry.

Average temperature: 18 ° Celsius

Region: Sierra.

Population: 131,856 (2010) inhabitants

Geographic Coordinates:

Latitude: N 0 ° 20 ' N 0 ° 30' and Longitude: W 78 ° 15 ' W 78 ° 0'

Return sector in a residential neighborhood located south of the city of Ibarra, currently has a population of about 1500 families living in this neighborhood, totaling approximately 4500 users based on an average of 3 people per family, too They are located small businesses and educational institutions.

3. Results

3.1 Analysis technical characteristics

A summary of key features of the technologies that will be the subject of this review. To measure with a numerical Likert scale rating of 1 to 5 is made of the different technical characteristics we consider in the following table:

Likert Scale Rating

CHARACTERISTICS	WI – FI	WIMAX	MESH
	802.11	802.16d	802.11 s
Transmission speed	3	5	3
Frequency band	5	3	5
Radio link	5	5	1
Channel band width	5	5	5
Performance	3	5	3
Encryption	5	5	5
Modulation	5	4	4
Access Protocol	5	4	4
QoS	3	5	5
TOTAL	39	41	34

3.2 Cost analysis

For an efficient network should provide as much quality services at the lowest cost, that is why the network design must consider the economic cost in terms of both equipment on the user side as service provider, likewise should consider the cost of installation and network deployment.

Here we can see the equipment costs with wireless technology:

Equipment costs. WIFI technology

EQUIPMENT	QTY	P. UNIT	SUBTOTAL
Equipo Servidor	1	1000,00	1000,00
Equipo Monitoreo	1	800,00	800,00
Switch CRS125-24G-1S-RM	1	306,00	306,00
Access Point QRT 5	1	166,00	166,00
Antena OmniTIK UPA-5HnD	1	99,00	99,00
Antena SXT Lite5	30	59,00	1770,00
TOTAL			4141,00

In the following table we will see the cost of equipment Wimax:

Equipment costs. WIMAX technology

Equipment	QTY	P. UNIT	SUBTOTAL
Servidor de Gestión NETSPAN	1	6200,00	6200,00
Equipo Monitoreo	1	800,00	800,00
Estación de radio Base (BSR)	1	3100,00	3100,00

Antena Omnidireccional	1	117,00	117,00
Equipo Local Cliente (CPE)	30	110,00	3300,00
TOTAL		13517,00	

Then we have the cost of equipment that could be used in the implementation to be done with the Mesh technology, these are values taken from the website of manufacturers to Ecuador, to get as close as possible to prices, take into account these values are subject to changes constates:

Equipment costs. MESH technology

EQUIPMENT	QTY	P. UNIT	SUBTOTAL
Server		1000,00	1000,00
Monitoring Equipment		800,00	800,00
Enrutador Linksys WRT54GL		150,70	150,70
Antena Omnidireccional 15 dBi HG2415U-PRO		99,00	99,00
Equipo Cliente Nano Station locoM5	0	97,50	2925,00
TOTAL		4974,70	

3.3 Demand Analysis

The growth of a company is given by its position in the market, for which the number of customers and their loyalty to the company becomes a very important factor in the economic analysis. To determine the demand is expected to meet with this project took into account the telecommunication sector statistics published quarterly on the website of the ARCOTEL, and the results of the Population Census 2010 issued by the INEC.

According to the VII national population census conducted in 2010, of 499 14'483 inhabitants in Ecuador, the total population of the canton Ibarra reaches 181,175 inhabitants, of whom 93,389 were women and 87,786 men. It has an area of 1162.22 km², with a density of 131.87 inhabitants / km² in the canton, 2,604 inhabitants / km² in urban areas and 39.91 inhabitants / km² in rural areas.

The number of users accessing the Internet services in the Province of Imbabura are:

Users with Internet access in Imbabura

PERIOD	SEP-2012	DIC-2013	DIC-2014
USERS	106491	149840	189258
% POPULATION	25,85	34.64	43,12

The above table shows that there is an approximate annual growth of 9% of the population with access to Internet services in the Province of Imbabura on average. Now we will conduct an analysis of growth estimated by the INEC in place that the implementation of the Network intends population. The following table shows the size of the population in the province of Imbabura and the city of Ibarra in 2010.

Population size and Imbabura Ibarra

	POPULATION	PERCENTAGE
IMBABURA	398244	100%
IBARRA	181175	45,5%

From this information to conclude that the objective of market positioning arises as a starting point to 5% of the number of new users who accessed the Internet in the third quarter of 2014 (887 users) in the city of Ibarra.

In practice not necessarily those 887 users will subscribe to the service, since according to the statistics there are about 2600 inhabitants in the area for want of cover which 70% is in the age of Internet use, equivalent to 1820 potential users , take into account users who already have Internet service contract.

To ensure the positioning and permanence of a company in the market an important factor to consider is the analysis of demand, which is why we review statistical data on Internet penetration in Ecuador according to the Agency for Regulation and Control Telecommunications SENATEL before.

3.4 Technology selection

After analyzing each of the technologies and equipment necessary costs have a consolidated summary of this analysis. We have added one more column to assign a value of the Likert scale where 5 will be the lowest cost and in January the highest cost, to get a view of the costs of each of the technologies and equipment.

Consolidated cost of equipment

EQUIPMENT	WIFI	LIKERT	WIMAX	LIKERT	MESH	LIKERT
Server	1000,00	5	6200,00	2	1000,00	5
Monitoring Equipment	800,00	3	800,00	3	800,00	3
Switch	306,00	4	3100,00	1	150,00	5
Access Point	166,00	4	-	5	250,00	3

Antenna	99,00	5	117,00	3	99,00	5
Customer Equipment	59,00	5	110,00	3	97,50	4
TOTAL	2430,00	25	10327,00	17	2396,50	20

After receiving the technical, cost and demand analysis we have the following conclusions:

- According to the technical characteristics compared in Table 10 and analyzing the requirements of the ISP network, we can conclude that the technologies best suited to the needs of the project is WIFI and MESH, as it has similar characteristics but for the area you want cover can implement a single node can fully cover the polygon, using long range WIFI equipment, we can also use unlicensed frequency bands 2.4 GHz and 5.8 GHz for what we need permission from the ARCOTEL.

- According to the analysis of equipment costs made possible we can select two technologies that have lower costs and equipment WIFI MESH.

- The technologies that best meet the requirements set are WiMax and MESH, this does not mean that WiFi technology is not efficient in projects of this kind, we find it cost-efficient performance.

- According to the Likert scale we can choose the WiFi technology because it is what gives us the best score in the cost comparison.

- The final selection will be by WiFi technology, and that the network has the characteristics of MESH should have more than one node, the concept of mesh mesh networks, and in this case we want to cover the area can do from a single node with the long-range WiFi technology.

3.5 Access network structure WISP

The access system will have a structure consisting of a central base from which point-multipoint links are established to client computers.

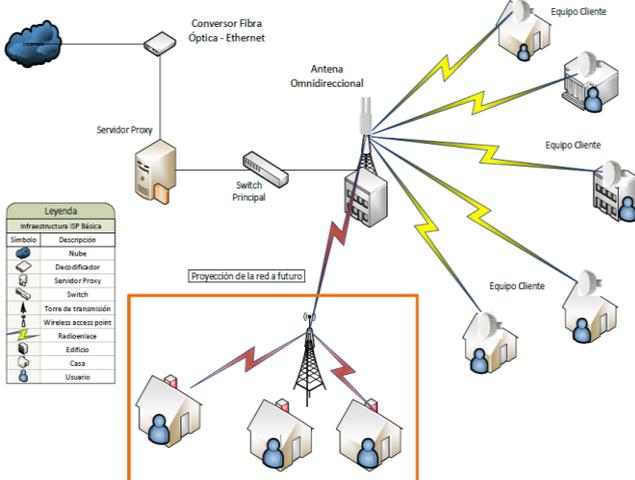
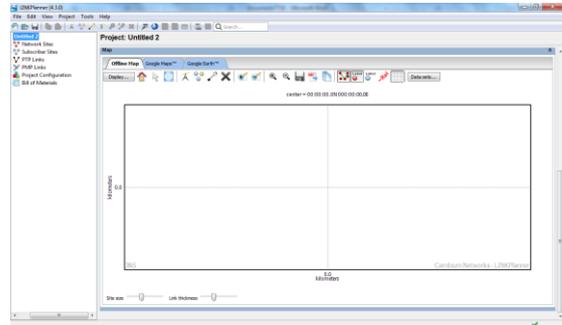


Diagram of the general structure of the ISP network

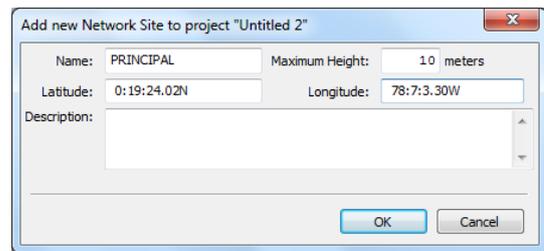
3.6 Simulation links

For the simulation of wireless network links the LINKPlanner software will be used, as it ensures a correct calculation of the factors of interest in the links will be implemented.



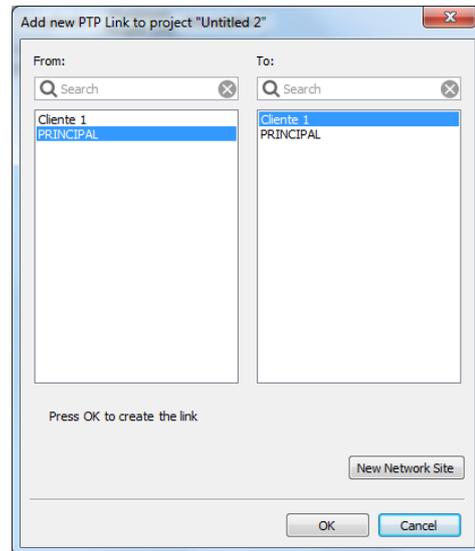
Interface de LinkPlanner

We proceed to enter the coordinates and height of the points we want to link.



Join coordinate main node

Then we create a new link.



New Link

In the picture presented to us we can see if the link will interference, the link distance, you can also land surveying, Fresnel zone.



Report link Main Node - Customer

The LINKPlanner software gives us the opportunity to review the details of the link, this leads us to a report in PDF format, you can see the annex to this document.

4. Conclusions

Based on the study, design and development data in the different chapters of this project can conclude the following:

- WiMAX is a technology designed for outdoor environments with multiple coverage areas km², so that there is a relatively large area that is potentially exposed to unauthorized access.
- WiMAX technology was not designed as local area network (LAN) but is oriented more towards MAN / WAN networks. It is a technology intended for operator servicing multiple users simultaneously, and therefore has to ensure that some users are unable to access the information to others.
- The wireless communication technology WiMAX broadband deployment allows access links reaching so it would be ideal to expand the network coverage in the future.
- The implementation of an Internet Service Provider wiring average take longer to deploy its various services, primarily for the installation time of physical infrastructure. This directly affects the recovery time of the initial investment. On the other hand most wireless communication systems can be installed and implemented in considerably less time.
- The MESH technology has great advantages over WIFI and WIMAX, but in this case the cost of deploying more than one node to the desired area imply a very high cost.
- The area to be covered is an urban area that favors the bonds do not have natural interference either trees or mountains, but there is interference from other devices that use radio spectrum in the same frequency.

- With a view to future expansion of the ISP network; the design proposed in this implementation has been structured to be easily understood. Thus leading to the possibility of future expansion by adding new relay nodes at strategic locations in the city thus expanding the coverage area.

- To start trading as Internet service provider approval of the Agency for Regulation and Control of Telecommunications, since it must meet all the requirements and standards for the use of frequencies is required.

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