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Design of a network to provide wireless Internet service implementing *Top-Down Network Design* methodology

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Summary **– The purpose of this Article is show the design of a network to provide service of Internet inalámbrico in Rooms of one hotel in Acapulco of Juarez Heal up. implementing the networking methodology *Top-DownNetwork Design.***

Due to the great demand for mobile devices with *Wi-Fi connectivity (Wireless Fidelity),* the **need arises** to **design** wireless **networks that allow the efficient distribution of the Internet,** which **offers an excellent quality of service** to the **guest during their** stay in a **complex. tourist.**

Keywords **– Resort, Wireless Internet, Networks, Top-Down Network Design.**

Abstract **- The purpose of this article is to show the design of a network to provide wireless Internet service in hotel rooms in Acapulco de Juárez, Gro., Implementing the Top-Down Network Design methodology.**

Due to the great demand for mobile devices with Wi-Fi connectivity, the need arises to design wireless networks that allow the efficient distribution of Internet that offers an excellent quality of service to the guest during their stay in a resort.

Keywords **– Networks, Resort, Top-Down Network Design, Wireless network.**

I. INTRODUCTION

For the design of a wireless network it is of utmost importance the implementation of a methodology appropriate to it, since it is of great help through a series of very well structured stages, the analysis, the documentation until the implementation of a project.

The design of the wireless network is being developed for the resort: Hotel Alba Suites, in Acapulco de Juárez, Gro. Aiming to offer guests a stay with stable and efficient Wi-Fi connectivity in their rooms.

II. GENERAL OBJECTIVE

Design a network to offer wireless Internet service with quality of service to the guest inside the rooms at the Alba Suites Hotel.

III. BACKGROUND TO THE PROBLEM

The Alba Suites Hotel located in Acapulco de Juárez, Gro., is a company dedicatedto hotelservices. It currently has 244 rooms, located in 6 buildings, which do not have wireless Internet service at the service of the guest.

IV. SOLUTION PROPOSAL

For the realization of this project it is proposed to implement the technology in mesh *(Mesh)*, it is an innovative technology that basically consists of a base station and its access points that communicate with each other to form for the user or a single Wi-Fi network with the same SSID (Service *Set Identifier)* and password. [1] A *Mesh* network is able to redirect traffic through the network always in the optimal way to always have the best possible signal on the network. Wi-Fi *Mesh* networks calculate which node is best to connect to at any given time based on the status of other nodes, connected devices, distance to each of the satellites, power of the signal and many other factors, completely transparent to the user, who does not have to worry about which node it is connected to. [2]

V. CONCEPTUAL FRAMEWORK

Below are the main tools selected to carry out the implementation of theproject.

A. Mesh Technology

It is a technology that is composed of a base station and its access points, several network nodes work together to form a unified network that shares the sameWi-Fi configuration.

B. MikroTik CCR-1016

Router with features such as dynamic routing, hotspot, firewall, VPN, advanced quality of service, load balancing, real-time configuration and monitoring.

C. Ubiquiti EdgeSwitch

Switch with the ability to simultaneously process traffic on all ports at line speed without any packet loss.

D. Ubiquiti CloudKey Controller

It is a UniFi driver for UniFi device networks. Recommended for running hotspotserver, managing Access point, monitoring users, viewing maps and statistics, all from the cloud.

E. Ubiquiti EdgePoint

Weatherproof router for outdoor use with fiber optic protection.

F. UniFi AC Mesh

Wireless antenna that distributes over waves the Internet service so that users can connect their wireless devices. This model has *Mesh* technology, this means that they do not connect to the nearest point, but to the one that, although it is further away from our device,will giveus the best Wi-Fi signal and 2x2 MIMO technology (Multiple Input – Multiple Output), this means that it has greater coverage in areas of difficult access, to the Bounce the signal becomes more powerful. [3]

VI. METOLOGÍA TOP-DOWN NETWORK DESIGN

Top-Down network design is a methodology for designing networks that starts at the top layers of the OSI model before moving to the lower layers.

Top-Down network design is iterative. First it is important to get a total view of a customer's requirements. Subsequently, more details are collected regarding protocol behavior, scalability requirements, and/or technology preferences. [4]

The Top-Down network design consists of 4 phases, which are shown in Fig. 1.

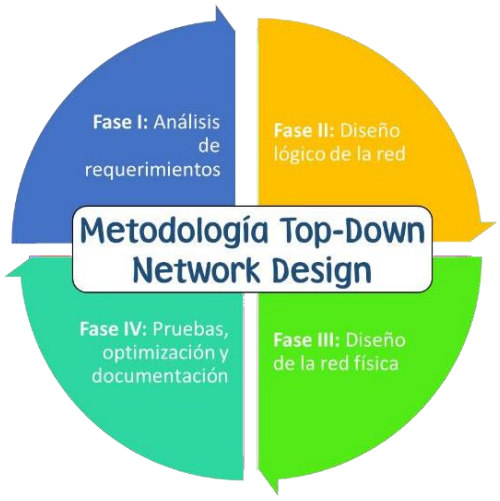

Fig. 1. Fases metodología Top-Down Network Design. Source: Author's own elaboration

A. Phase I. Requirements Analysis

It refers to requirements analysis starting with the identification of business objectives and technical requirements; it also characterizes the current state of the network, including the architecture and performance of the infrastructure principals and their devices. Finally, network traffic is analyzed, including data flow and load of active network equipment.

B. Phase II. Logical Network Design

This phase shows network diagrams according to the information taken in the previous phase, the project plan is updated with the most relevant data for the implementation and includes security planning, network management of design and access requirements.

C. Phase III. Physical Network Design

During the physical design phase, technologies and products (brands and equipment references) that agree with the logical design registration are proposed.

D. Phase IV. Testing, Optimization and Documentation of Network Design

Finally,a pilot test plan or prototype is implemented, if a fault is found, the network design is optimized and the work is documented with the final design. In all phases of the design, feedback, suggestions, improvements or needs of new applications with the user are recommended for network monitoring. [4]

VII. DESIGN DEVELOPMENT IMPLEMENTING THE METHODOLOGY *TOP-DOWN NETWORK DESIGN*

Next, according to the *Top-Down Network Design* methodology, a brief description of the steps to follow implemented to the project is made:

A. Analysis of requirements

The tourist complex has the following characteristics in its infrastructure, mention is made of these characteristics, after a review:

- It has wireless Internet service for guest service in pool, bar and bar areas.
- The speed range they handle for each mobile device that connects to the wireless network is 2 to 5 megs.
- For network management it has: 1 MikroTik Router, 8 Ubiquiti EdgeSwitchmanageable switches, 2 Telmex 100 Mbps Internet modem with fiber connection, 1 Ubiquiti Cloud Key Controller and fiber optics for switch connection.
- It has the following networked computer, which is connected by Cat UTP cable. 6:40

computers, 4 printers, 39 IP cameras, 6 AP's (Access Point) UniFi.

Analysis of business goals

The main goal of the business is to offer stable and efficient wireless Internet service in rooms of the hotel complex on an acceptable budget.

Analysis of technical goals

- Scalability: The implementation may be scalable as the resort intends to build more buildings.
- Performance: the network will be managed so that each guest device has a certain Internet connection speed. This to avoid saturation of the Internet.
- Security: VLAN's (Virtual Local Area Network) will be implemented for the guest network, to restrict access to equipment with confidential information of the tourist complex.
- Ease of use: guests will be able to access the Wi-Fi network exclusively for themselves with just a password.
- Adaptability: it will avoid incorporating design elements that make it difficult to implement new technologies in the future. A flexible design will be able to adapt to changes in traffic pattern and quality of service (QoS) requirements.

B. Logical design development

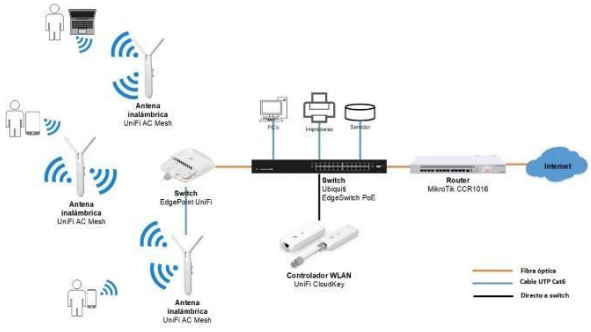

Fig. 2. Example of solution implementation. Source: Own elaboration of the author.

In Fig. 2, the deployment schema is displayed with the computers to be used.

To guarantee the quality of service, the network that will be provided to the guests by means of wireless antennas, will have a different IP address to the administrative teams, assigned by *VLAN's*,this to avoid the congestionamiento of network, and for the security of the internal network of the tourist complex.

Also each device will be given a speed range to prevent a single user who is watching *streaming* videos or any activity that needs a lot of bandwidth, from monopolizing the entire Internet for a single device.

The Internet that will be granted only for the use of guests will be 2 modems of 100 Mbps each, with enterprise Internet and fiber optic connection.

C. Physical design development

Selection of technologies and devices for the *network*

The equipment that makes up the current system of the tourist complex has characteristics that help to meet the general objective, so these will be used.

The systems area of the tourist complex is made up of the following components:

1. MikroTik CCR1016 Router. Receive the connection from the ISP (Internet Service Provider) to distribute it to the different network devices.
2. Ubiquiti EdgeSwitch. It is a manageable switch and is responsible for distributing the Internet connection of the network.
3. Ubiquiti CloudKeyController. This is the computer on which configurations related to Internet distribution are made on Access Point computers.

Internet connection areas. They correspond to the set of switches and Access Points to provide Internet access at the service of the user.

1. Ubiquiti EdgePoint. It is a switch for weathering that will be located in the buildings for the connection of the AP's.
2. UniFi AC Mesh. It is the wireless antenna responsible for providing wireless Internet service in the rooms of the resort by waves.

MAGAZINE INCAING ISSN24489131(September-October 2021), pp. 39-45

The connection of ISP, Router and Switches is multimode fiber optic that guarantees the reliability and speed between them. In the case of some Access Point the connection is through UTP Cat.6 cable.

D. Design testing, optimization and documentation

In Fig. 3, an example of the distribution of UniFi AC Mesh AP's is shown in a building with 12 rooms along and 4 at the top of the resort.

The AP's onthe first floor of the building are connected by UTP Cat. 6 cable, while the antennas on the 3rd floor are connected through Meshtechnology. The wireless antennas will be located in the middle of 4 rooms in the balcony area, this is so that the signal strength can arrive with the same power to the required rooms.

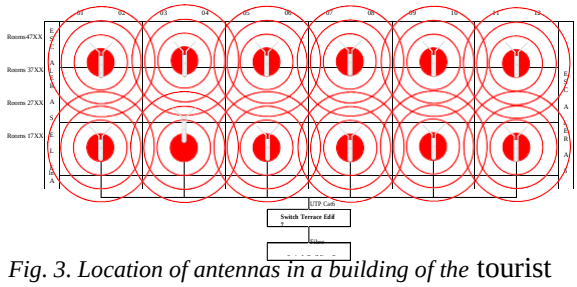

Fig. 3. Location of antennas in a building of the tourist *complex. Source: Own elaboration of the author.*

Then, to carry out the tests in the rooms, a heat map will be used to check the functionality of the proposed equipment. A UniFi AC Mesh antenna is located in

point proposal in the Fig. 3, y herself Enter a the room a measure the dBm (decibels-milivatio), one measure Logarithmic of power in relation a one milivatio, Used for measure the intensity of the signal that reaches the mobile from an wireless networkbrica the cellular. This figure is always negative, therefore, the signal it more powerful how much more herself about to zero.

Color	dBm
	More than -48 dBm (smaller numbers) = Excellent
	Between -49 and -55 = Very good
	Between -56 and -65 = Good/Average
	Between -66 and -74 = Low coverage
	Between -75 and -89 = Very low coverage (problems setting calls)
	From -90 dBm = No coverage

Table 1. Approximate equivalence table to find out the level of coverage based on the dBm in air received. Source: Author's own elaboration

For the measurement of signal strength, an HP laptop is used with the Installed program *Xirrus Wi-Fi Designer* [5], this program collects measurements in real time with active surveys, allows to load aflat of thefacilities where the wireless antennas are placed, in the plane the location of the antennas to be measured is added and with a computer it moves throughout the map so that the program captures the decibels of the intensity of the antenna.

It is very important to take into account various factors that can produce noise or interfere with the wireless signal that is being emitted from the AP's, it can be a door of the room or simply the signal of another wireless network. [1]

VIII. RESULTSTWO

In Fig. 4, the location of the wireless antenna in the upper left and the points made with the computer throughout the room and the measurement that marks the decibels are displayed. Through the colors, you can notice that the measurements are within the excellent range and very good wireless signal.

Fig. 4. Wi-Fi intensity test in room 1701. Source: Own elaboration of the author.

In Fig. 5, the test is shown in another room of the building, this room is adjacent to the room shown in Fig. 4.

The wireless antenna is located exactly in the middle of these 2 rooms, and as you can see, the intensity of the signaldoes not varymuch, some decibels change, even so, you still have excellent / very good signal in both rooms.

Tests in both rooms were conducted with closed doors and windows, except for the balcony area.

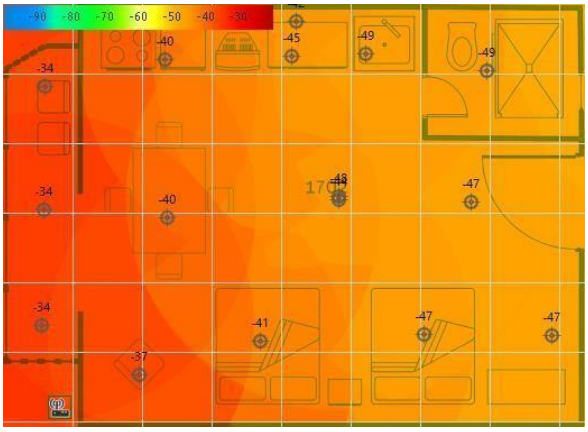

Fig. 5. Wi-Fi intensity test in room 1702. Source: Own elaboration of the author.

IX. CONCLUSION

By seeing the results of the tests in the building, it can be concludedthat it wasfeasible to carry out the methodological design and the main objective will be met, which is the distribution of a wireless network efficiently with service. from the Internet to the guest service in the resort, and that the proposed tools were a good option for implementation.

Technology advances on large scales, and it is of utmost importance to carry out projects with adaptability for the future, the benefits with the implementation of the proposal are that it has a flexible design to adapt to these new technologies and that it may be scalable as the resort intends to grow.

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PORTRAYALS

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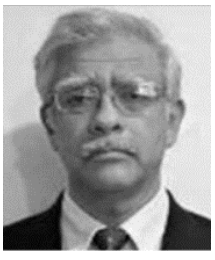

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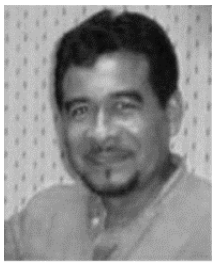

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