MAGAZINE INCAING ISSN24489131(May-June 2021), pp 64-71

MAGAZINE INCAING
ISSN 2448 9131

Design of the internet network for the new building of the ITJMMPyH pet academic unit with base in international standards

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Summary.

The application of international norms and standards: ANSI/TIA/EIA 568-A Y 568-B, and also the 606 for the correct ***labeling of wiring and equipment, have allowed the design of an efficient structured cabling system that will provide internet to the new building of the ITJMMPyH*** Mascota academic ***unit, by installing a LAN and WLAN*** network ***with star topology and class*** C ***IP addressing, to monitor traffic in the network, and avoid collisions; the simulation*** of ***the network was*** carried ***out*** by ***means of the use of the Cisco Packet Tracer tool, the result has been satisfactory since it allowed*** to ***demonstrate that the flow of data through the different devices that make up the network is efficient and no collisions.***

Index of terms: computer ***network design, structured cabling, IP addressing, ANSI/TIA/EIA 568-A, 568-B, 606, LAN, WAN, Cisco Packet Tracer.***

Abstract.

The application of international norms and standards: ANSI/TIA/EIA 568-a, 568-b, and 606 for correct labeling of wiring and equipment, have allowed the design of an efficient structured cabling system that will provide internet to the new building of the ITJMMPyH unidad académica Mascota with a star topology and Ip address type C, to monitor network traffic, and avoid collisions; the simulation of the network was carried out by using the Cisco Packet Tracer tool, the result has been satisfactory since it allowed to demonstrate that the

flow of data through the different devices that make up the network is efficient and without collisions.

Index of terms: Computer network design, structured cabling, IP address, ANSI/TIA/EIA 568-A, 568-B, 606, network LAN, network WAN, Cisco Packet Tracer.

I. INTRODUCTION

Internet access has become a fundamental tool to shape the information and knowledge society, and can contribute to the integral development of students by supporting interactive teaching-learning methods, research on various topics through the use of knowledge networks. They assist teachers in the design of creative learning methods and collaborative teaching; likewise, it supports the administrative staff of the institution to the realization of their

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activities in a distributed way, reducing costs and maintaining permanent communication with the entire campus network.

The JoséMario Molina Pasquel y Henríquez Technological Institute (ITJMMPyH) Academic Unit (UA) Mascota has become the largest house of studies in the western highlands of Jalisco, and its growth is inevitable; currently in the institution has finished building a new building, which will house: 9 classrooms, 1 multifunctional laboratory, 1 room for measuring equipment and sanitary; that currently does not have a structured cabling network or the necessary network infrastructure to provide internet to the personnel who will work in it.

This project aims to outline the guided and unguided means to provide internet to the users of the new building by designing a reliable and efficient data network based on international norms and standards: ANSI/TIA/EIA 568-A Y 568-B, and also 606; [1] the ANSI/TIA/EIA-568-b standard is established in order to facilitate security and provide greater agility and speed to the transmission of data that are sent, mainly benefiting the student and teaching community of the institution, obtaining an excellent space to provide and receive the quality education that is demanded.

For the simulation of the network, the tool of the company Cisco Packet Tracer was used; through the Packet Tracer program, the security of the network can be validated by finding the errors in the proposed design. [2]

II. BASIC CONCEPTS ABOUT THE DEVELOPMENT OF THE PROPOSAL.

ITJMMPyH.

José Mario Molina Pasquel y Henríquez Technological Institute, Mascota academic unit. Mascot, Jalisco. Mexico.

Red LAN.

Local area networks, usually called LANs (Local Area Networks), are privately owned networks that operate within a single building, such as a home, office, or factory. LANs are widely used to connect personal computers and household appliances in order to share resources (e.g., printers) and exchange information.

When companies use LANs they are known as enterprise networks. [3]

Red WLAN.

Wireless Local Area Networks (WLANs) are networks that commonly cover distances of 10 to 100 meters. This small coverage contains a lower transmission power that often allows the use of unlicensed frequency bands. Because LANs are often used for communications of relatively high data capacity, they typically have higher data rates. For example, 802.11, a WLAN technology, has a nominal scope of 100 meters and data transmission rates of up to 11Mbps.[4]

ANSI.

American National Standards Institute is an American organization formed to certify standards developed in various industries so that they are not influenced by interests of a company or group. This institute does not develop standards, but reviews and implements those developed by other organizations. For example, ANSI accredits standards developed by EIA/TIA for the design of structured cabling of a computer network. [5]

TIA-EIA Standards.

The Electronic Industries Alliance (EIA) and the Telecommunications Industry Association (TIA) are associations of Trade that develop and publish together a number of standards covering structured voice and data cabling for. [6]

ANSI/TIA/EIA 568-A.

It is the Commercial Building Standard for Telecommunications Cabling. [7] Camacho mentions that the first field of application of ANSI/TIA/EIA 568-A is the minimum requirements for telecommunications cabling within an office environment.

ANSI/TIA/EIA 568-B.

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TIA/EIA-568-B is the Wiring Standard. This standard specifies component and transmission requirements based on media. TIA/EIA 568-B.1 specifies a generic telecommunications cabling system for commercial buildings that supports a multi-product and multi-vendor environment. The ANSI\TIA\EIA-568-b standard is established in order to facilitate security and provide greater agility and speed to the transmission of data that is sent [1]

ANSI/TIA/EIA 606.

It is the Management Standard for Commercial Building Telecommunications Infrastructure. Rubio in (2012) states that the ANSI/TIA/EIA 606 standard defines how to label all the components of a wiring andstructured system.

Star topology.

The network is joined at a single point; a cabling hub or HUB that through it the blocks of information are directed towards the stations. Its advantage is that the hub monitors traffic and prevents collisions and an interrupted connection does not affect the rest of the network. The disadvantage is that messages are sent to all stations, even if they are addressed one by one. (Figure 1). [8]

Fig. 1. Star topology.

Own elaboration

IP addressing.

An IP address, is a 32-bit logical address, which is intended to identify any device connected to a communications network that uses the IP protocol. This address is represented by 4 octets in decimal format.

In addition, it is important to understand the use of the netmask. This is a combination of bits that serves to delimit the scope of a computer network. Its function is to indicate to the devices which part of the IP address is the network number, including the subnet, and which part is the one corresponding to the host.

Using the netmask, a system (computer, router, etc.) will be able to tell whether to send a packet in or out of the subnet to which it is connected. For example, if the router has the IP address 192.168.1.1 and netmask 255.255.255.0, it understands that everything that is sent to an IP address in the format 192.168.1.X, is sent to the local network, while addresses with different IP address format will be sent outward.[9] ANSI/TIA/EIA 606 defines how to label all components of a structured cabling system

Cisco Packet Tracer

Packet Tracer is the interactive network learning and simulation tool for Cisco CCNA instructors and students. This tool allows users to create network topologies, configure devices, insert packets, and simulate a network with multiple visual representations. Packet Tracer focuses onbetter supporting the networking protocols taught in the CCNA curriculum
This product is intended to be used as an educational product that provides exposure to the command-line interface of Cisco devices for practice and learning by discovery.[10]

III. METHODOLOGY.

For the development of the project, the methodology developed by James McCabe was taken as a reference and structure, which is specifically focused on the design of computer networks, which allows a better analysis of the requirements and needs of the telecommunication. [11] This methodologycomprises the following phases:

Phase 1. Analysis of the current situation.
Phase 2. Determination of requirements Phase
3. Analysis of the needs of the system Phase
4. Simulation and configuration.

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Phase 1: Analysis of the current situation.

The ITJMMPyH UA Mascota consists of two buildings; a main one, which currently houses 100% of the students, teaching staff and administrative area, classrooms, multipurpose laboratory, computer room, etc., andn this is thesite, which is the point where all computer and telecommunications devices converge connected to the current network. The second is a building of recent construction where 9 classrooms and a multifunctional laboratory are distributed, which currently do not have the necessary network infrastructure to provide internet to that building. With the development of this project it is intended to communicate the new building with the old one by connecting two WI-FI repeater antennas. (See Fig.2)

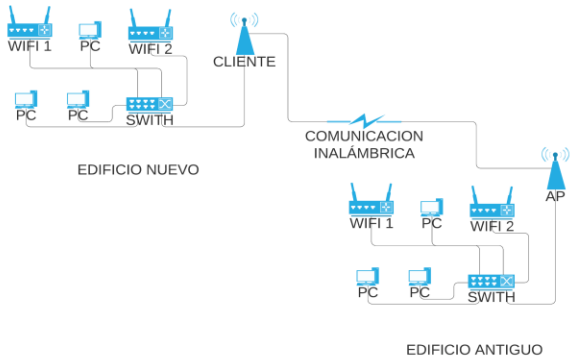

Fig. 2. Diagram of connection between buildings.

Own elaboration

Currently the new building is fully constructed and has the necessary furniture for its functional use, but completely lacks an adequate infrastructure for the internet network; there are no pipes or appropriate arrivals to introduce the structured cabling necessary for the installation of the LAN network, which will be used for the teaching of classes and the development of practices.

Phase 2: Determination of requirements

In the new building, network connections are required in each of the 9 classrooms and the multifunctional laboratory, as well as adapting a space that will be used as a site; thus installing in each of the classrooms two network points, one on the teacher's table and another as support for auxiliary equipment, in the multifunctional laboratory they will install more network nodes as it will have a more extensive use than classrooms. (See Fig.3)

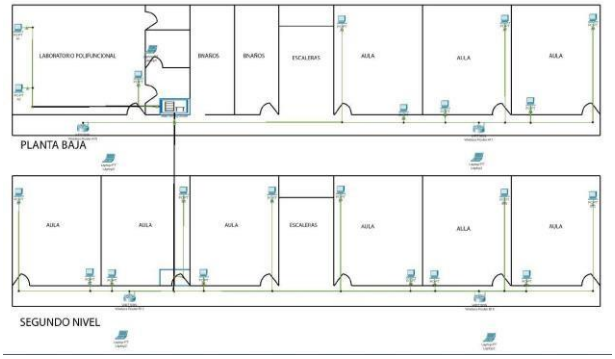

Fig. 3. Mapping of network nodes of the new building.

Own elaboration

There will be two types of users within the network; students who will use the WLAN network to consult information on the Internet and perform collaborative work on it, and teachers who will use the Ethernet network connections to view information online, upload or download files to the cloud, and interact with students.

There will be no need to have a centralized server since no applications will be used on the network, since each user will use the network only as a vehicle for internet connection and to pass information from equipment to computer, even if this is not the primary service on the network.

As described above, to cover the system needs are required of the following Implements of red: (See Fig. 4)

Quantity	Description
2	Ubiquiti NanoStation airMAX crazy M2 CPE antennas, up to 150Mbps, frequency 2 GHz (2412-2462 MHz) with integrated 8 dBi antenna
2	Cisco SG100-24 24-Port Gigabit Switch
1	Router Cisco Rv345 Gigabit Ethernet With Firewall
1	Wall Mount Cabinet Fixed Body Rack 19 9u

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1	Coil Cable 305 Mts Utp Cat6 Copper Panduit

Fig 4. Required network implements.

Own elaboration

Phase 3: Analysis of system needs

According to the site where the solution will be made and taking into account the size of the facilities and the level of security required, a network design with a class C IP address is proposed, since the requirements of the nodes andtheWIFI zones are not very wide so a class C network will be sufficient, the addresses will be configured as follows: (Fig. 5, Fig. 6 and Fig. 7)

VLAN1	
IP	192.168.1.0/24
SUBNET OF MASK	255.255.255.0
BROADCAST	192.168.1.255
RANK OF IP'S VALID	192.168.1.0 - 192.168.1.254

Fig 5. IP structure

Own elaboration

GROUND FLOOR			
KNOT	LOCATION	PUERTO SWITCH A	IP CONFIGURATION
A1	POLYFUNCTIONAL LABORATORY	1	DHCP
A2	POLYFUNCTIONAL LABORATORY	2	DHCP
A3	POLYFUNCTIONAL LABORATORY	3	DHCP
A4	CLASSROOM 1	4	DHCP
A5	CLASSROOM 1	5	DHCP
A6	CLASSROOM 2	6	DHCP
A7	CLASSROOM 2	7	DHCP
A8	CLASSROOM 3	8	DHCP
A9	CLASSROOM 3	9	DHCP
A10	AISLE	10	DHCP

Fig 6. Requirements and Structure of the ground floor networkOwn elaboration

SECOND LEVEL			
KNOT	LOCATION	PORT SWITCH B	IP CONFIGURATION
B1	CLASSROOM 4	1	DHCP
B2	CLASSROOM 4	2	DHCP
B3	CLASSROOM 5	3	DHCP
B4	CLASSROOM 5	4	DHCP
B5	CLASSROOM 6	5	DHCP

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B7	CLASSROOM 7	7	DHCP
B8	CLASSROOM 7	8	DHCP
B9	CLASSROOM 8	9	DHCP
B10	CLASSROOM 8	10	DHCP
B11	CLASSROOM 9	11	DHCP
B12	CLASSROOM 9	11	DHCP
B13	AISLE	11	DHCP
B14	AISLE	11	DHCP

Fig. 7. Requirements and Structure of the second level network

Own elaboration

IV. RESULTS.

Phase 4: Simulation and configuration

For the design of this network the star network topology was used, by its design and by the requirements of the network establishes an optimal operation. (See fig. 7)

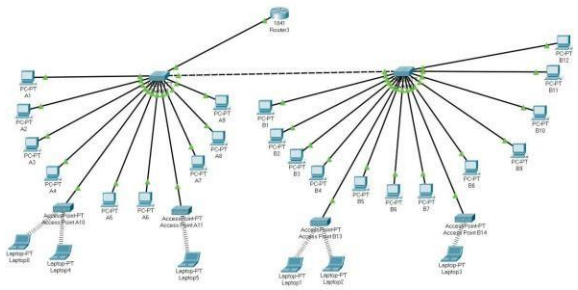

Fig 7. Network topology of the new building Own elaboration

For the configuration and simulation of the network, the tool Packet Tracer, this tool offers a display of the network very close to the reality.

In the configuration of the simulated network, the necessary equipment was used to cover the system requirements, using as follows: 1 Router with ip address 192.168.1.1, 2 Switch with DHCP addressing for the connection and distribution of nodes, 9 PC's and 2 Access Point in ground floor, both with DHCP addressing, 12 PC's and 2 Access Point in second level, both with DHCP addressing; all the above connected via UTP cable using THE ANSI/TIA/EIA 568-A and 568-B standards, as well as the 606 standard for the correct identification of each network node.

Below are the results obtained through screenshots, performing connectivity simulations (PING) between devices.

- Ping from PC A7 with ip 192.168.17 to PC A1 with ip 192.168.1.22

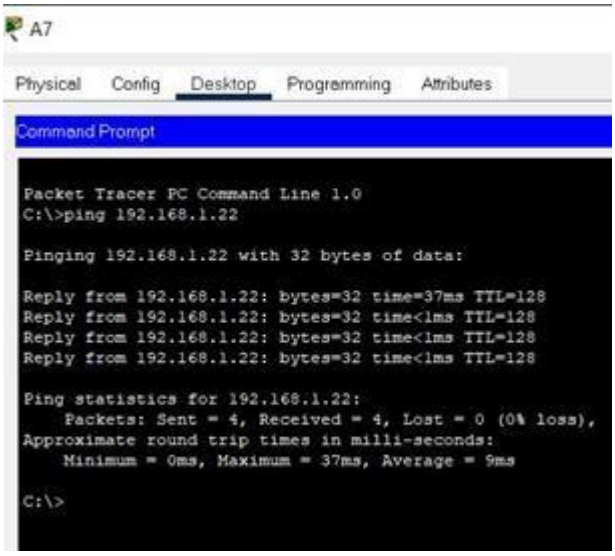

Fig 8. PING 1

Own elaboration

- Ping from PC B8 with ip 192.168.9 to PC B10 with ip 192.168.1.20

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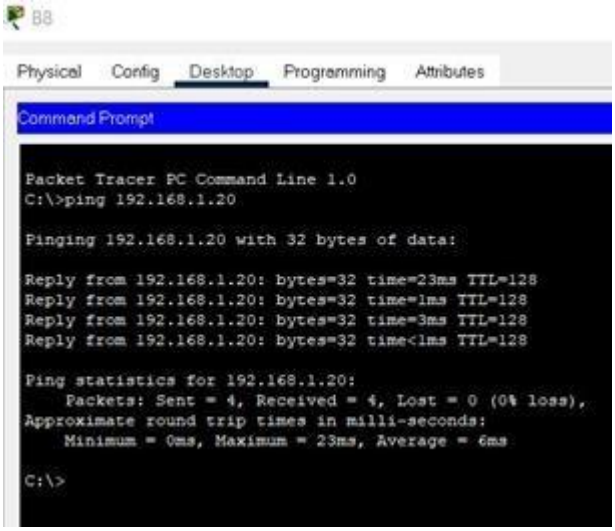

Fig 9. PING 2

Own elaboration

- Ping from Laptop4 with ip 192.168.25 to Laptop1 with ip 192.168.1.28

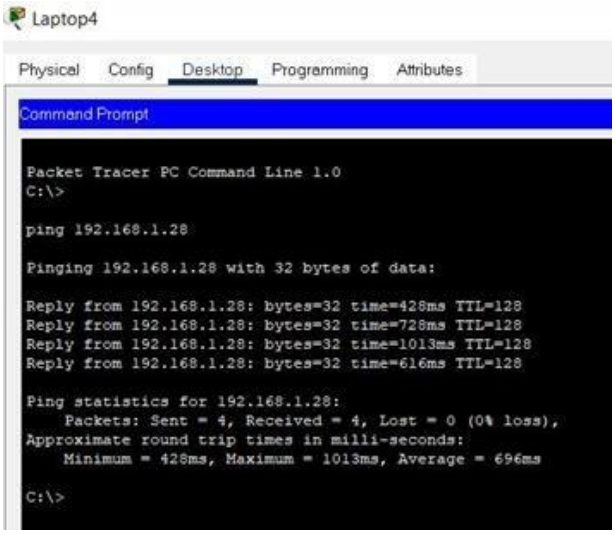

Fig 10. PING 3

Own elaboration

Simulations were performed graphically sending packets between computers, this is done by Packet Tracer.

Fig 11. GRAPHIC PING

Own elaboration

V. CONCLUSION.

With the design of the internet network for the new building of the ITJMMPyH Mascota Academic Unit based on the ANSI/TIA/EIA 568-A, 568-B and 606 standards, guided by the packet tracer simulator, it is concluded that it is feasible since throughout the simulation project all the results are positive, giving scope to the needs These are present and taking into account the future growth of the building, facilitating the preventive and corrective maintenance of the network.

The design of the proposed network is planned according to the needs of the institution. Based on the standards and methodology cited in this research, the development of projects of the same turn using the regulations and methodologymentioned in the research is widely recommended.

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