

# Implementation of a Local Area Network under TIA\_EIA\_568\_B and ANSI\_EIA\_TIA 607 standards in the company TUMSA

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## Abstract

Implementing a network infrastructure involves a needs assessment, architecture design, equipment selection and procurement, device configuration and connection, and testing to ensure that the network functions properly and meets performance and security requirements established.

This article presents the development that was carried out to implement a network infrastructure under regulations that guarantees an adequate design and installation of telecommunications cabling, which contributes to a reliable and efficient operation of the company's networks.

## Resumen

La implementación de una infraestructura de red implica una evaluación de necesidades, diseño de la arquitectura, selección y adquisición de equipos, configuración y conexión de dispositivos, y pruebas para garantizar que la red funcione de manera adecuada y cumpla con los requisitos de rendimiento y seguridad establecidos.

En este artículo se presenta el desarrollo que se llevó a cabo para implementar una infraestructura de red bajo normativas que garantiza un diseño y una instalación adecuada del cableado de telecomunicaciones, lo que contribuye a un funcionamiento confiable y eficiente de las redes de la empresa.

**Keywords:** network, rules, cabling, devices

**Palabras Clave:** red, reglas, cableado, componentes

## 1. INTRODUCTION

To have a Network infrastructure that maintains their services reliably and securely is essential for companies. Furthermore, in corporate environments, local area networks improve communication, generate cost savings and other benefits if the corresponding regulations are applied.

The Standards that are applied in this project are the ANSI/EIA/TIA-607 and the TIA/EIA-568-B standard, these are two important standards related to structured cabling infrastructure used in telecommunications networks in commercial and residential buildings. ANSI/EIA/TIA-607 refers to grounding system and electrostatic discharge protection in structured cabling systems, while TIA/EIA-568-B refers to Ethernet networking and cabling/network standards.

This article describes how a local area network was implemented based on TIA/EIA-568-B and ANSI/EIA/TIA-607 standards in the TUMSA company, where the voice, data and video problem are solved, since it presented interference and network problems because it does not cover the whole company. To achieve it, a reengineering of the network was carried out, the necessary material was considered calculating the total costs of the project.

## 2. WHAT IS A COMPUTER NETWORK?

A network is the interconnection of a certain number of computers by wired or wireless devices that send and receive information in data packets, share their resources and act as an organized through electrical impulses, electromagnetic waves, or other physical means (Master Magazine, 2022).

Networks are also classified according to the magnitude of the geographical area they are in:

- LAN: Local Area Network. They are the smaller networks, such as those we can install in our department.
- MAN: Metropolitan Area Network. These are medium-sized networks, optimal for a university campus, a library, or a multi-story enterprise, even for a portion of a city.
- WAN: Wide Area Network. This is where the largest and most far-reaching networks come in, like global networks or the Internet.

## 3. IMPORTANCE WITHIN COMPANIES

### 3.1 The importance of a good network infrastructure

A good network infrastructure is essential in the digital age. Network infrastructure refers to the network of hardware, software, equipment, and technologies that enable communication and data transfer between different devices and systems (Pablo Perconti, 2021).

Infrastructure is important for:

- Connectivity: A good network infrastructure allows a reliable and fast connection between different devices and systems. This is essential to ensure effective communication and real-time data transfer, which is important for many sectors.
- Security: Network infrastructure is also important to guarantee the security of an organization's data and systems. A good network infrastructure allows the implementation of effective security measures, such as firewalls, antivirus, and authentication systems, which protect the company's systems and data.
- Greater flexibility: A good network infrastructure allows organizations a quick adaptation to changes in communication needs. You can add or remove devices, increase storage and processing capacity as needed.
- Lower cost: A well-designed and managed network can reduce operating costs eventually. Implementing an appropriate network can reduce the need for physical travel and duplication of resources.

A wired network infrastructure that is organized and standardized will be able to avoid several types of technological problems for users, as well as allow the IT team to control the environment and properly support employees in their respective requests and needs.

### 3.2 Importance of ups in companies

Uninterruptible Power Supply (UPS) is an essential tool for any business that relies on electronic equipment for its daily operation. Here are some of the reasons why it is important to have a UPS in a company:

- **Electronic Equipment Protection:** UPS protects electronic equipment, such as servers, switches, routers, and other devices, from blackouts, surges and voltage drops, which can damage the internal components of equipment and cause failure. This can prevent costly and lengthy downtime as well as the loss of important data.
- **Business continuity:** In case of a power outage, a UPS provides emergency power to electronic equipment for a limited period, allowing critical systems to be safely shut down and preventing the loss of important data. This minimizes downtime and ensures that the business can continue operating in a power outage.
- **Investment protection:** Replacing damaged equipment can be costly. A UPS can help protect a company's investment in electronic equipment by extending its useful life and avoiding expensive repairs and replacements.
- **Power Stabilization:** A UPS also helps stabilize the power supply, ensuring equipment receives a constant and clean energy supply. This helps to reduce the possibility of damage to equipment and improves its overall performance (Anchondo, 2021.).

### 3.3 Importance of racks in companies

A rack is a cabinet with a metal base and structure, whose main purpose is storing all the computer and telecommunications systems needed by companies or organizations where they are installed. This is where servers, switches, professional routers, NAS servers, DAS, uninterruptible power supply (UPS) and, of course, all network cabling will be stored.

To provide the different services to the local network, they offer:

- **Organization:** A rack allows technological equipment to be organized in one place, making it easier to manage and maintain.
- **Space saving:** Having a rack can reduce the space required to store equipment. Can be useful in offices or tight spaces.

- **Security:** A closed rack can provide an additional layer of security for technology equipment because it limits physical access to it.
- **Facilitates wiring:** Using a rack allows equipment wiring to be organized and hidden, making it easier to manage and maintain.
- **Increased efficiency:** The efficiency of the system can be improved if it has organized and well-managed teams, this can increase the company's productivity.
- **Increased expansion capacity:** Having a rack makes it easier to add new technological equipment and to expand the system while the company grows (Luz. Sergio, 2023).

### 3.4 Importance of aps in companies

An Access Point (AP) is a wireless network device that is used to provide wireless network access to mobile devices, such as laptops, smartphones, and tablets. It acts as a bridge between wireless devices and the existing wired network, allowing wireless devices to connect to the network and access shared resources, such as files and Internet services.

This allows employees to connect to the company network wirelessly, increasing flexibility and mobility in the workplace.

Offering higher connection speed and bandwidth can improve employee productivity. In addition, Access Points can be configured and managed centrally, allowing for easier and more effective management of the company's wireless network (Ruiz Martínez, J.C, 2021).

### 3.5 Importance of nvrs in companies

An NVR (Network Video Recorder) is a digital video recording device used to record, store, and manage video from IP cameras (network cameras). Unlike traditional DVRs (Digital Video Recorders), which are used to record video from modern cameras, NVRs are specifically designed for and optimized to work with IP cameras (NIVIAHOME, 2017).

- **Remote access:** Modern NVRs offer the ability to access recordings and real-time images remotely. This is especially useful for companies with multiple locations or for administrators who need to access surveillance information from outside the company.
- **Integration with other systems:** NVRs are often compatible with other security systems and technologies, such as alarm systems, access control, or other surveillance devices. This enables efficient integration and unified management of all aspects of enterprise security.
- **Efficient search and analysis:** NVRs often have advanced video search and analysis features, such as motion detection, facial recognition, and event search. These features make it easy to locate specific incidents and streamline the video review process.

## 4. APPLICABLE REGULATIONS

### 4.1 TIA/EIA-568-B STANDARD

It is a set of standards established by the Electronic Industries Association (EIA) and the Telecommunications Industries Association (TIA) for the design and installation of structured cabling systems for commercial buildings.

This standard is subdivided into:

- ANSI/TIA/EIA-568-B1: Generic Telecommunications Wiring in Commercial Buildings. (Requirements and recommendations in structure, configuration, interfaces, installation, performance parameters and verification).
- TIA/EIA 568-B2: Is an amendment that applies to the bending radius of 4-pair unshielded twisted-pair (UTP) patched pair.
- TIA/EIA 568-B3: Cabling components, Fiber optics (cable, connectors, connection hardware, cords, jumpers, and test equipment).

This standard is a technical standard when it is time to make connections. The two ends of the cable (UTP CATEGORY 5, 6) will carry RJ45 connectors with a certain order of colors specified by the standard (Leon. Michael, 2019).

The standard also defines cable types, distances, connectors, cable terminations, their performances, cable installation requirements, and testing methods for installed cables. The intent of these standards is to provide best practices for the design and installation of cabling systems that support a wide variety of existing and future services. The developers expect that the tier will offer a commercial life cycle of cabling systems for more than ten years (Reinaldo. Peter, 2021).

### 4.2 ANSI/EIA/TIA-607 STANDARD

ANSI/EIA/TIA-607 is a standard developed by the Telecommunications Industries Association of America (TIA) and the Electronic Industries Association (EIA) of the United States, which establishes requirements for the protection of structured cabling systems against electrostatic discharge and other types of electromagnetic interference.

ANSI/EIA/TIA-607 specifies the requirements for the installation of a grounding system and surge protection. Must be implemented in structured cabling networks to protect equipment and guarantee the safety of people working in the facilities.

This standard establishes the procedures for the connection and linking of grounding system equipment, as well as the selection of materials and the location of grounding system points.

It is important in the implementation of structured cabling networks. It ensures that the cabling system is protected against interference and electrical shock that may affect the performance of the network and the safety of people and equipment connected to it (Esteban Cortez W.J, 2012).

## 5. PROBLEM STATEMENT

Certain problems were the starting points to realize this project. These problems that were raised will be mentioned and described below.

- The wiring of the IP cameras was exposed and near the power wiring that causes interference providing that it does not have a clear signal from the cameras or that it is not seen completely, on the other hand, more cameras were needed.
- Phone lines suffer from interference, this means that some phones do not receive calls or that they are not heard well, and you need to create a recorder to receive calls.
- The bandwidth is not enough to cover the company, also some network sockets are needed.

## 6. JUSTIFICATION

Network devices are the basis of all companies. Having them in function will add more bandwidth within the company and have less waiting time on computers, besides better security inside and outside. This will offer support to the security area and those in charge of the communications department, maintain a certain order in the devices and facilitate their manipulation when maintaining them. By protocol; if you want to maintain a device on the rack side, the labeling order must be displayed. Apart if a port is damaged; the patch panel port would be damaged and not the device port. The development of this project aims to implement a rack that stores technological devices (switch, router, a UPS, and NVR) for some of these are no longer dispersed within the company but have a specific place, also provide better security with IP cameras.

The advantage of applying the TIA/EIA-568-B standard is that it offers better connectivity, fast and reliability, between different devices that are within the company. It can be used for small or large networks, which means that it also provides scalability. This characteristic allows the company adaptation for the changing needs of the network. Furthermore, it provides wide compatibility with the variety of network devices and technologies that ensures that other network components can work together effectively. Finally, it gives solution to the order and identification of cable for future maintenance.

ANSI/EIA/TIA provides protection against electrostatic discharge in telecommunications infrastructure. Reduces the risk of damage to electronic equipment. Besides, this standard helps to reduce electromagnetic interference Wich ensures a clear and reliable communication. Therefore, reduce the costs of repairing and replacing damaged equipment, which reduces maintenance costs too.

## 7. OBJECTIVE

Implement and rebuild structured voice and data cabling, IP CCTV system, installation and configuration of NVR, switch, analog switch, UPS, AP, and Router for the improvement of network, security, and communication inside and outside the company based on the TIA/EIA-568-B and ANSI / TIA / EIA- 607 for the company TUMSA.

## 8. RACK DEPLOYMENT

### 8.1 rack implementation

In the following project a rack that complies with the standards is implemented. There is where a Router, switch, UPS, NVR, and analog switch were installed to have an order in the devices, and these are not scattered throughout the company. In the same way, an Access Point was installed to expand the bandwidth.

The rack was assembled in the indicated place where the rack grounding was located and screwed to the floor so that it could not be moved. Accessories were added to it (organizers, patch panel, trays) and the sections where each device will be located are indicated with adhesive labels, for have an order. The end-to-end cables and their accesses of the devices that are scattered within the company were marked, to disconnect later and have an idea of wiring order that will be routed to the room where the rack is located.



Figure 1. a) Rack with its organizers, b) Physical ground installation, c) Wires marked before disconnecting

## 8.2 wiring distribution

The wiring was distributed over the Styrofoam ceiling tile, through concrete walls and the cable was combed to pass it through the metal envelope and then pass it on the wiring distribution rings until it reached the devices that will be in the rack.



**Figure 2.** The wiring distributed by the envelopes until reaching to the distribution.

In the area outside of facilities, that is the part of company parking, the wiring went through steel tubes, because the cable would be exposed and could be damaged by rodents or weathering, that would prevent the wiring from being damaged and have more lifetime.



**Figure 3.** Steel boxes to be added to the pipeline for wiring

The old cable that did not work was also removed and the new cables for Ip cameras were punched just as their steel boxes were added so that the wiring is not damaged.



**Figure 4.** Wiring already distributed by the steel pipe



Cabling was run to the boardroom and to the human resources department to install the Ethernet Jack ports to further expand the network.

### 8.3 device connection

The devices were ordered through the OSI model, the equipment was also connected to the patch panel, as well as the installation of the physical earth and the new cameras were connected.



Figure 5. Order of devices in the rack

### 8.4 device configuration

Switched lines as well as incoming and outgoing calls were configured.

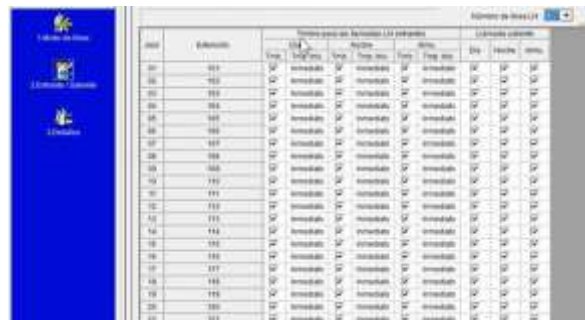


Figure 6. Incoming and outgoing call settings

The NVR was configured so that the guards could manipulate the cameras in an easy and efficient way. Besides, the boss could see the cameras from his laptop.



Figure 7. Configuring the NVR for laptop viewing

NVR was configured so that the guards could manipulate the cameras in an easy and efficient way, also so that the boss could see the cameras from his laptop.

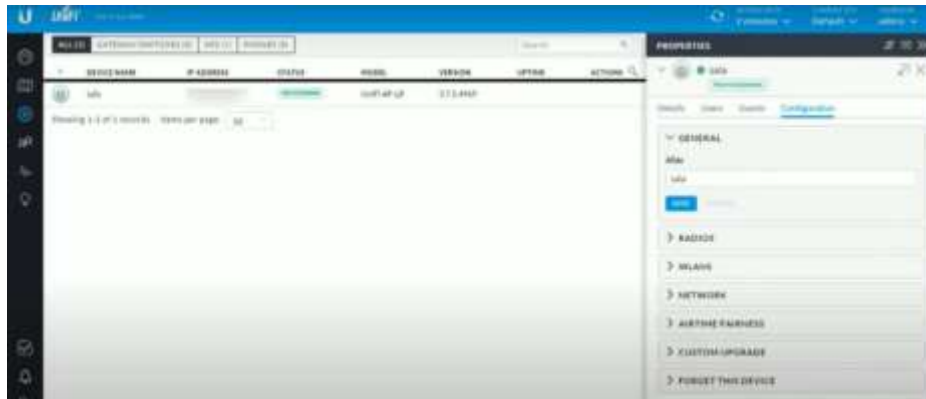


Figure 8. AP configuration and update

## 9. CONCLUSIONS

The project that was carried out in the TUMSA company allows growth according to current and future needs to implement various devices or they can also be updated. With the regulations applied, it provided several benefits to the company, such as the EIA/TIA 568B standard, which offered an improvement in the network, such as in the meeting room, since the bandwidth did not cover that area, as well as an order of wiring and devices inside the rack to facilitate future maintenance, with the ANSI/TIA/EIA 607 standard offers security to the cabling system, providing protection against interference and electrical discharges that may affect the performance of the network, the safety of people and equipment connected to it.

However, with these two standards that were applied in the project, it was guaranteed that the structured cabling infrastructure complies with the safety, performance, and reliability standards for an efficient business environment and capable of satisfying its needs.

All this was carried out, thanks to the great communication of the SICCOMS network and telecommunications team and the head of planning of the TUMSA company, who guided us to reach the final product that will be very useful to the staff, since without it they would not have found certain details that affect the installation that were finally solved.

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