**RETAIL (E-COMMERCE)**

ProjectNet

Network Development with *Subnet* and IoT

Develop a network simulation scenario involving IoT and HTTP Server with *Web page*, involving the application of *Subnet technique*, work with Network Mask and IP addressing (*Internet Protocol*), in addition to interaction in a residential environment with IoT devices (*Internet of Things*) and cell phones with connection in 3G/4G communication technology, with the distributions of the respective tasks of the activity according to each Theme described in ANNEX I, using the **Software Cisco Packet Tracer** for preparing the network scenario, checking the operation of the devices applied to the scenario and performing the necessary simulations and analyses. SW *Packet Tracer* can be obtained free of charge for Windows, Linux and MacOS, according to the information and steps for obtaining it seen in class and accessed through the following *link*:

https://www.netacad.com/pt-br/courses/packet-tracer

Consider that there is a preliminary basic scenario (Figure 1), which consists of a residential plant with some IoT devices distributed and interconnected via Wi-Fi (*Wireless-Fidelity*) connection to a *Gateway* (which is also a DHCP (*Dynamic Host Configuration Protocol*) server) and to IoT and DNS (*Domain Name System*) servers. Via edge routers, there is a connection between routers that connect to a LAN (*Local Area Network*) composed of a *notebook* and a *desktop* (*hosts*). At this point there is a *wireless connection* in 3G/4G technology with a BTS (*Base Transceiver Station)* cell tower, which has a central CO server (*Central-Office Server*) for connecting mobile devices within the BTS coverage area.

Figure 1 – General network scenario in *Packet Tracer*.
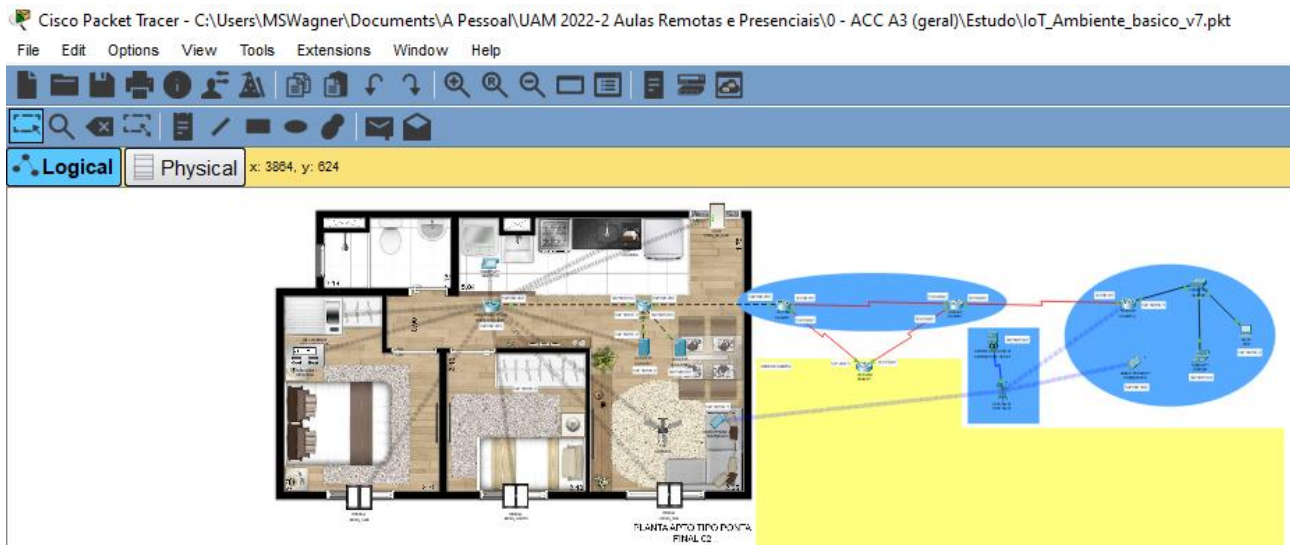
Source: Author, 2024.

Given the scenario presented, Figure 2 illustrates the residential IoT part, consisting of 2 routers (*Home Gateway* and *Router*), 2 servers (IoT *Server* and DNS *Server*), 1 *tablet*, 1 air conditioner with its thermostat, 3 windows, 1 fan and 1 cell phone (*Smartphone*).

Figure 2 – Part referring to the IoT residential network scenario.
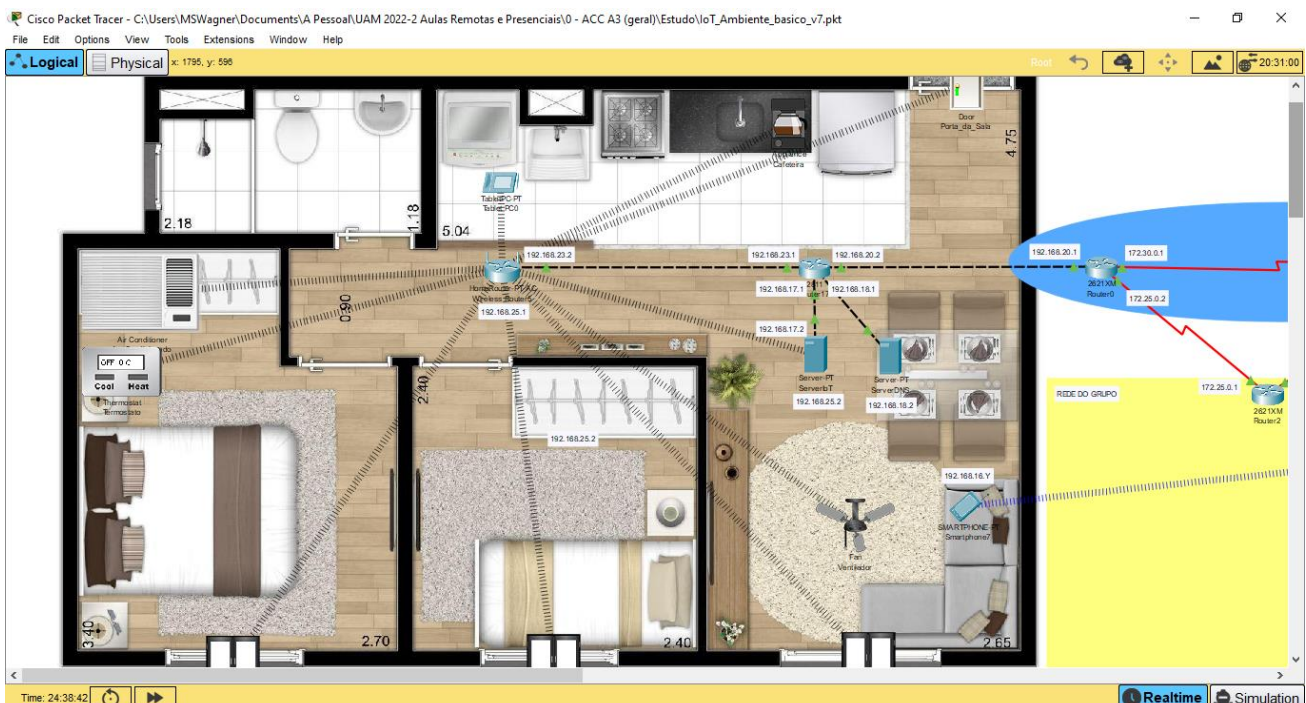
Source: Author, 2024.

In Figure 3 you can see the part of the MAN (*Metropolitan Area Network*), which comprises 3 routers interconnected by serial communication (*Serial* DTE) highlighted in red,

which, in turn, connects to a LAN (*Local Area Network*) consisting of 1 *desktop*, 1 *notebook* and 1 *router* (router with serial connection to the MAN and via 3G/4G signal with the cellular network). The cellular network connects the *Smartphones* present in the residence and in the LAN area, in addition to the LAN *router.* In the cellular network, the CO *Server* works as a DHCP Server for devices connected to the 3G/4G cellular data network.

Figure 3 – Part of the network scenario that includes MAN, LAN and 3G/4G.
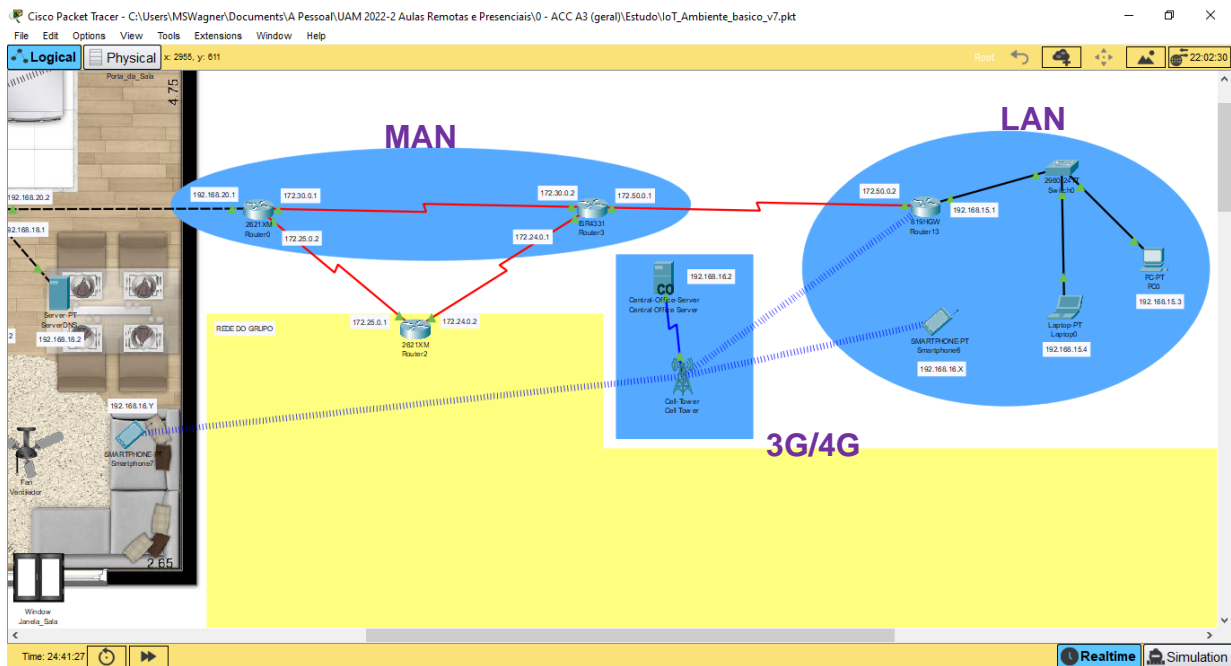
Source: Author, 2024.

Figure 4 – Part of the scenario for creating a network with *Subnet* as per ANNEX I.
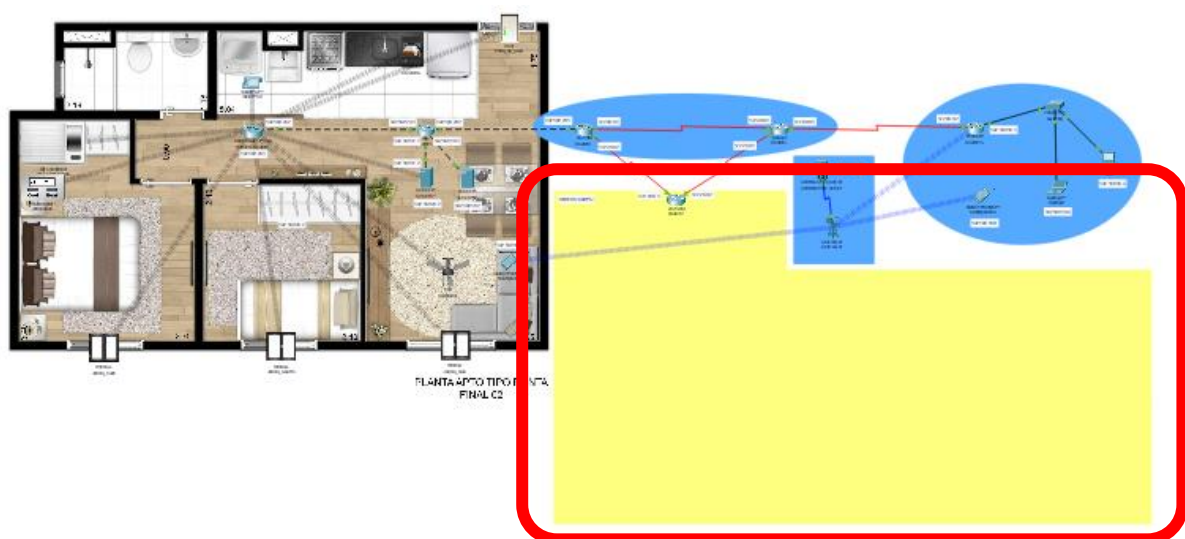
Source: Author, 2024.

Based on Figure 4, more specifically in the part highlighted in red, there is a yellowish area, which corresponds to the region in which each work will insert the respective network with *Subnets*, according to the Themes of ANNEX I. In this yellowish space, each group must insert the necessary network elements (described and specified in ANNEX I) for the connection to the MAN via the *Fast Ethernet* interface of the router (*router* 2), making the necessary configurations so that it is possible to perform a *ping* between the elements of the network created by you with the LAN made available.

In the IoT home section of Figure 2, you must insert at least 2 IoT devices different from those presented in the basic scenario, in accordance with ANNEX I, configure them and connect them to the other existing IoT devices, defining at least 2 configuration rules for each device added to the basic network. To configure the rules, use the *tablet* provided in the IoT scenario, accessing the *Desktop tab* and then *Web Browser*. On the Internet browser screen, type the URL *tranquilotech.com.br* to access the IoT Server. After that, the *login screen* will appear, where you must enter the user (*Username*: **admin**) and password (*Password*: **admin**). At this point, the *Control and Management Home page* of the IoT devices connected to the *Home Gateway* will be loaded (in the case of new devices, these must be configured and connected to the *Home Gateway*). By accessing the *Conditions link*, you will be able to add, change and delete the operating rules of the elements present in the residential IoT network. After making changes, it is recommended that you *log out* of the IoT Server.

In the yellow part, you must add 2 *Smartphones* and connect them to the 3G/4G network, demonstrating connectivity with the other *Smartphones* already existing in the basic scenario. To do this, a *ping* can be made between the devices on the 3G/4G network.

In view of the above, is requested:

a) **Provide** a **brief explanation** of the idea for the **residential IoT part** with regard to the IoT devices added to the basic scenario (overview).

b) **Provide** a **brief explanation** of the *Subnet* **scenario** created, including the *Subnet* calculations and respective explanations of IPv4 address distributions to the *hosts*.

c) **Provide** a **print of the Subnet scenario created** in the yellow part with the network devices and *Smartphones* connected to the 3G/4G network and **another print of the residential IoT part** with the network elements inserted in the environment, with the

respective **general explanations** about the scenarios implemented with a focus on 3G/4G and IoT.

d) **Provide** **prints of the screens during the simulation** and **respective explanations** about: the scenarios implemented in IoT with the rule configurations (*Conditions*), the *pings* and *traceroutes* (***tracert command***) performed for connectivity tests between the *Subnet* and LAN devices made available in the basic scenario.

e) **Do** the sending of the ***Packet Tracer* simulation file** with the scenario added and developed in the yellowish part and IoT part (***.pkt***).

The basic scenario file (***ProjectNet_IoT_basic_env.pkt***), has the distribution of scenarios and network elements for the chosen Theme to be added and script for obtaining and installing Cisco *Packet Tracer* are available. Remember that this is a semester-long work and that it involves important concepts of Retail (e-commerce) discipline related to the technology used in the consumer environment and provision of *Web pages*.
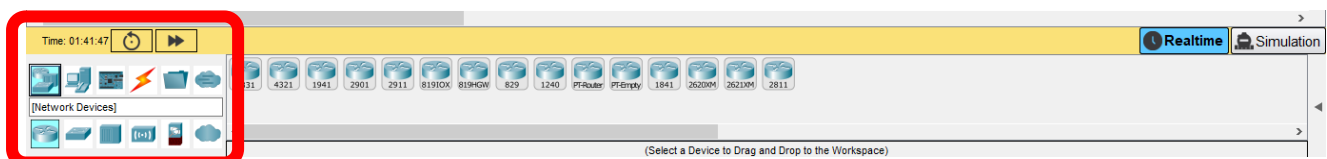
Figure 5 – Cisco *Packet Tracer* at *Networking Academy*.
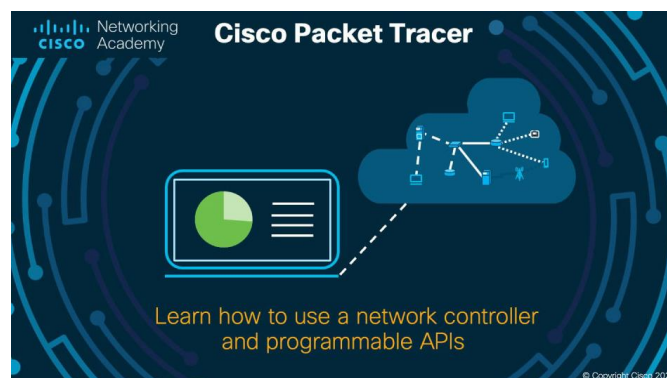
Source: Author, 2024.

Below are the parts of the simulator that have devices that can be used in IoT environments and, therefore, in the home.

Figure 6 – Basic network devices – wired and wireless (*routers*, *switches* and *hubs*).

Source: Author, 2024.

Figure 7 – End devices in a network.

Source: Author, 2024.

Figure 8 – Common devices in residential environments in an IoT network.

Source: Author, 2024.

Figure 9 – Common devices in *Smart City environments* of an IoT network.

Source: Author, 2024.

Figure 10 – Common devices in industrial environments (Industry 4.0) in an IoT network.

Source: Author, 2024.

Figure 11 – Common devices in *Smart Grid environments* of an IoT network.

Source: Author, 2024.

Figure 12 – Common devices in IoT environments.
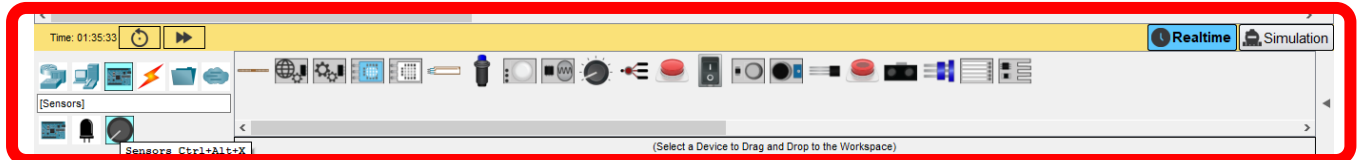

Source: Author, 2024.

Figure 13 – Common devices in IoT environments – actuators.

Source: Author, 2024.

Figure 14 – Common devices in IoT environments – sensors.

Source: Author, 2024.