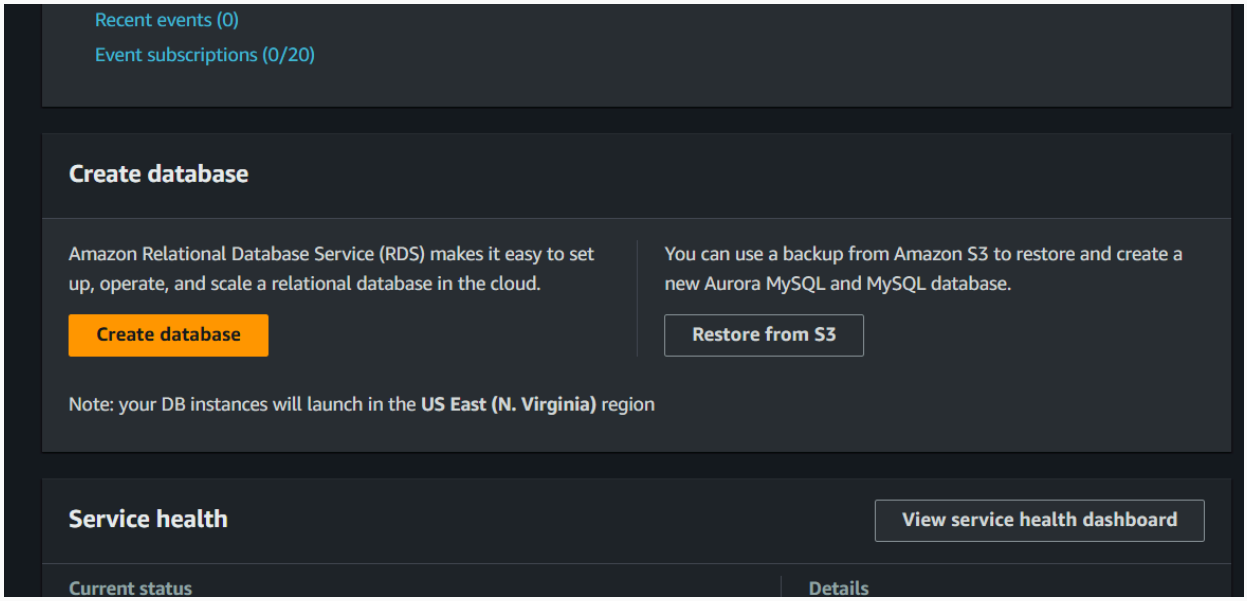
- Crear infraestructura dels servidors i la xarxa del projecte (servidors web, xarxa interna i usuaris SSH

TENGO QUE HACER LAS BASES DE DATOS (RELACIONAL) Y EL SERVIDOR RED HTTP ELA CUAL DOCUMENTARE LOS SIGUIENTES PASOS

Crear la Base de Datos en Amazon RDS

primero deberemos acceder a RSD en el buscador.



configuracion del Isard ubuntu

cambio el rango de ip en el netplan:

contra: pirineus

```
isard@ubuntu:~$ sudo cat /etc/netplan/01-network-manager-all.yaml
# Let NetworkManager manage all devices on this system
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp3s0:
      dhcp4: no
      addresses:
        - 192.168.38.0/24
      gateway4: 192.168.38.1
      nameservers:
        addresses:
          - 8.8.8.8
          - 8.8.4.4

isard@ubuntu:~$
```

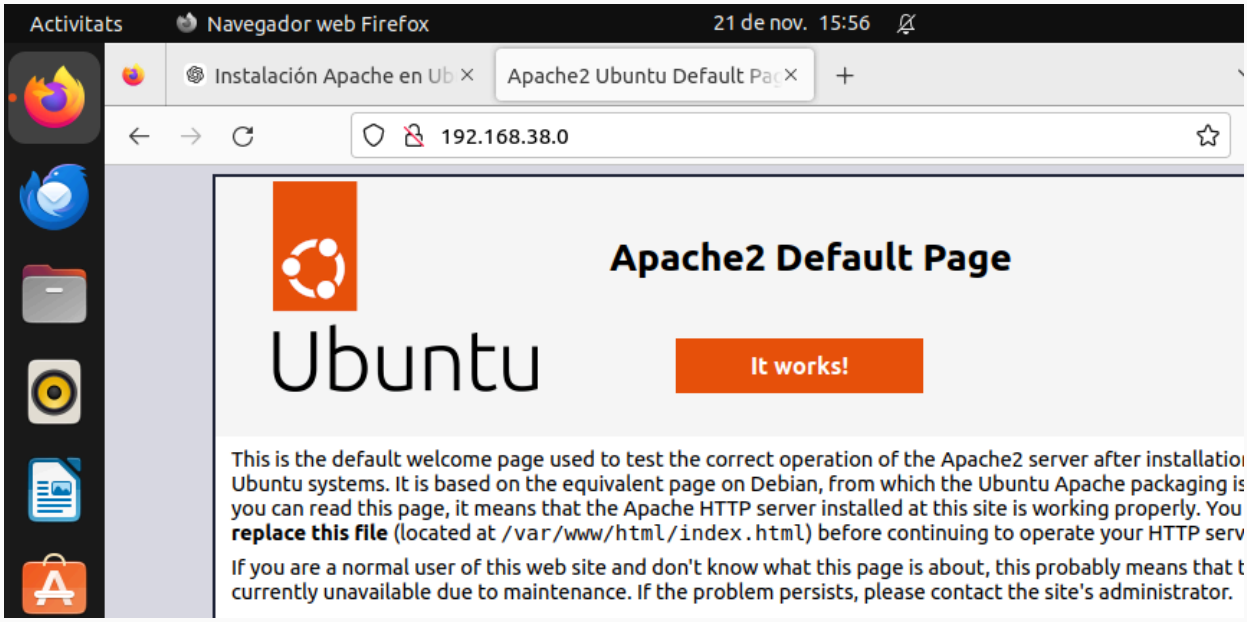
cambio el 3 interfaz que seria la ip asiganada que e tomado seria la 192.168.380/24

```
2: enp1s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gr
oup default qlen 1000
    link/ether 52:54:00:67:8e:2d brd ff:ff:ff:ff:ff:ff
    inet 192.168.122.163/22 brd 192.168.123.255 scope global dynamic noprefixrou
te enp1s0
       valid_lft 3313sec preferred_lft 3313sec
    inet6 fe80::840c:abb7:7ec5:d46d/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
3: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1366 qdisc fq_codel state UP gr
oup default qlen 1000
    link/ether 52:54:00:36:6a:d4 brd ff:ff:ff:ff:ff:ff
    inet 10.2.152.195/16 brd 10.2.255.255 scope global dynamic noprefixroute enp
2s0
       valid_lft 3312sec preferred_lft 3312sec
    inet6 fe80::4523:71b0:5a4e:dcfe/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
4: enp3s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gr
oup default qlen 1000
    link/ether 52:54:00:24:c5:9c brd ff:ff:ff:ff:ff:ff
    inet 192.168.38.0/24 brd 192.168.38.255 scope global noprefixroute enp3s0
       valid_lft forever preferred_lft forever
    inet6 fe80::5054:ff:fe24:c59c/64 scope link
       valid_lft forever preferred_lft forever
isard@ubuntu:~$
```

despues de instarlar iniciamos el servicio:

```
isard@ubuntu:~$ sudo systemctl start apache2
isard@ubuntu:~$ sudo systemctl enable apache2
Synchronizing state of apache2.service with SysV service script with /lib/system
d/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable apache2
isard@ubuntu:~$
```

arranca con la ip asignada :



guado la ifo del pache antes de seguir:

<VirtualHost *:80>

    # The ServerName directive sets the request scheme, hostname and port that

    # the server uses to identify itself. This is used when creating

```
# redirection URLs. In the context of virtual hosts, the ServerName
# specifies what hostname must appear in the request's Host: header to
# match this virtual host. For the default virtual host (this file) this
# value is not decisive as it is used as a last resort host regardless.
# However, you must set it for any further virtual host explicitly.
#ServerName www.example.com

ServerAdmin webmaster@localhost
DocumentRoot /var/www/html

# Available loglevels: trace8, ..., trace1, debug, info, notice, warn,
# error, crit, alert, emerg.
# It is also possible to configure the loglevel for particular
# modules, e.g.
#LogLevel info ssl:warn

ErrorLog ${APACHE_LOG_DIR}/error.log
CustomLog ${APACHE_LOG_DIR}/access.log combined

# For most configuration files from conf-available/, which are
# enabled or disabled at a global level, it is possible to
# include a line for only one particular virtual host. For example the
# following line enables the CGI configuration for this host only
```

```
        # after it has been globally disabled with "a2disconf".
        #Include conf-available/serve-cgi-bin.conf
</VirtualHost>

# vim: syntax=apache ts=4 sw=4 sts=4 sr noet
```

```
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module reqtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /l
ib/systemd/system/apache2.service.
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.
service → /lib/systemd/system/apache-htcacheclean.service.
S'estan processant els activadors per a ufw (0.36.1-4ubuntu0.1)…
S'estan processant els activadors per a man-db (2.10.2-1)…
S'estan processant els activadors per a libc-bin (2.35-0ubuntu3.6)…
isard@ubuntu:~$ sudo systemctl start apache2
isard@ubuntu:~$ sudo systemctl enable apache2
Synchronizing state of apache2.service with SysV service script with /lib/systemd/systemd-sysv-insta
Executing: /lib/systemd/systemd-sysv-install enable apache2
isard@ubuntu:~$ sudo mkdir -p /var/www/html/mi-sitio
isard@ubuntu:~$ sudo nano -p /var/www/html/mi-sitio
isard@ubuntu:~$
isard@ubuntu:~$ sudo cat -p /var/www/html/mi-sitio
cat: l'opció «p» no és vàlida
Proveu «cat --help» per a obtenir més informació.
isard@ubuntu:~$ sudo nano -p /var/www/html/mi-sitio
isard@ubuntu:~$ sudo nano -p /var/www/html/mi-sitio
isard@ubuntu:~$ sudo nano -p /var/www/html/CheckInTime
isard@ubuntu:~$ ls -l
total 40
drwxr-xr-x 2 isard isard 4096 de set.   9 20:58 Baixades
drwxr-xr-x 2 isard isard 4096 d'abr.   28  2023 Documents
drwxr-xr-x 2 isard isard 4096 de maig  11  2023 Escriptori
drwxrwxr-x 2 isard isard 4096 de set.   9 20:59 gpu
drwxr-xr-x 2 isard isard 4096 de maig   3  2024 Imatges
drwxr-xr-x 2 isard isard 4096 de maig  11  2023 Música
drwxr-xr-x 2 isard isard 4096 de maig  11  2023 Plantilles
drwxr-xr-x 2 isard isard 4096 de maig  11  2023 Públic
drwx------ 5 isard isard 4096 de juny   9  2023 snap
drwxr-xr-x 2 isard isard 4096 de maig  11  2023 Vídeos
isard@ubuntu:~$ sudo cat -p /var/www/html/CheckInTime
cat: l'opció «p» no és vàlida
Proveu «cat --help» per a obtenir més informació.
isard@ubuntu:~$ sudo nano -p /var/www/html/CheckInTime
isard@ubuntu:~$ sudo mkdir -p /var/www/html/CheckInTime
mkdir: no s'ha pogut crear el directori «/var/www/html/CheckInTime»: El fitxer ja existeix
isard@ubuntu:~$ sudo nano /etc/hosts
isard@ubuntu:~$ sudo nano /etc/apache2/sites-available/000-default.conf
isard@ubuntu:~$ sudo nano /etc/apache2/sites-available/000-default.conf
isard@ubuntu:~$ sudo systemctl restart apache2
isard@ubuntu:~$
```

```
isard@ubuntu:~$ sudo systemctl restart apache2
isard@ubuntu:~$ sudo nano /etc/apache2/mods-enabled/dir.conf
isard@ubuntu:~$ sudo nano /etc/apache2/mods-enabled/dir.conf
isard@ubuntu:~$ curl http://localhost/CheckInTime.html
<html>
<head>
    <title>Este es el sitio CheckInTime</title>
</head>
<body>
    <h1>¡Hola, Mundo!</h1>
</body>
</html>
isard@ubuntu:~$
```

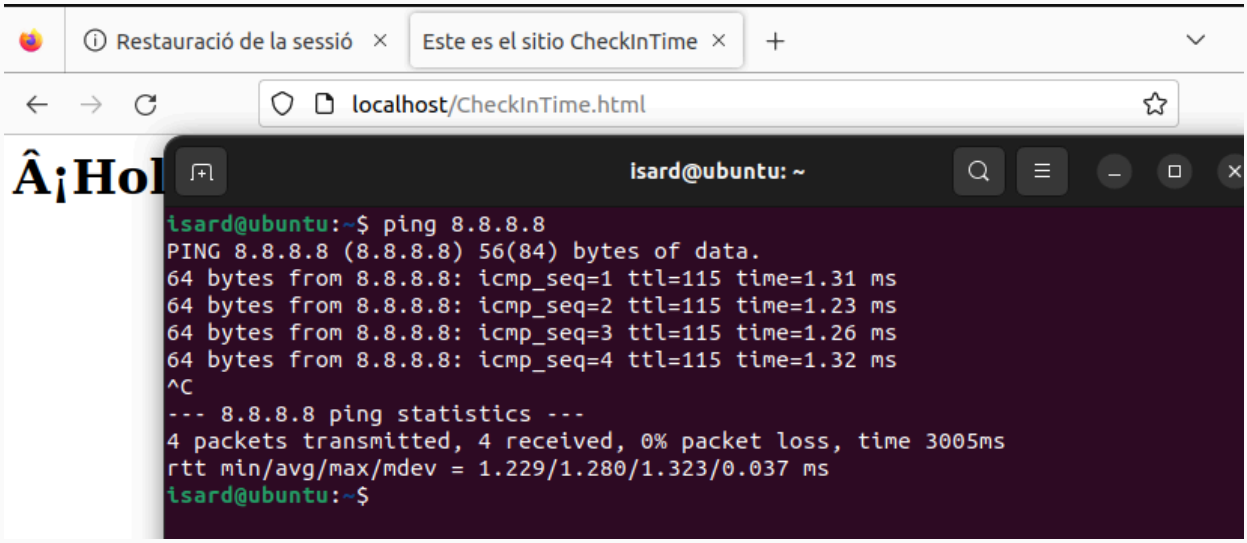
```
isard@ubuntu:~$ sudo chmod 644 /var/www/html/CheckInTime.html
isard@ubuntu:~$ sudo chown www-data:www-data /var/www/html/CheckInTime.html
isard@ubuntu:~$ sudo systemctl restart apache2
isard@ubuntu:~$ ls -ld /var/www/html/
drwxr-xr-x 3 root root 4096 de nov.  25 19:31 /var/www/html/
isard@ubuntu:~$ ls -l /var/www/html/
total 20
-rw-r--r-- 1 www-data www-data   121 de nov.  21 16:13 CheckInTime.html
-rw-r--r-- 1 root     root     10671 de nov.  21 15:53 index.html
drwxr-xr-x 2 root     root      4096 de nov.  21 16:12 mi-sitio
```

- Crear infraestructura dels servidors i la xarxa del projecte (servidors web, xarxa interna i usuaris SSH)

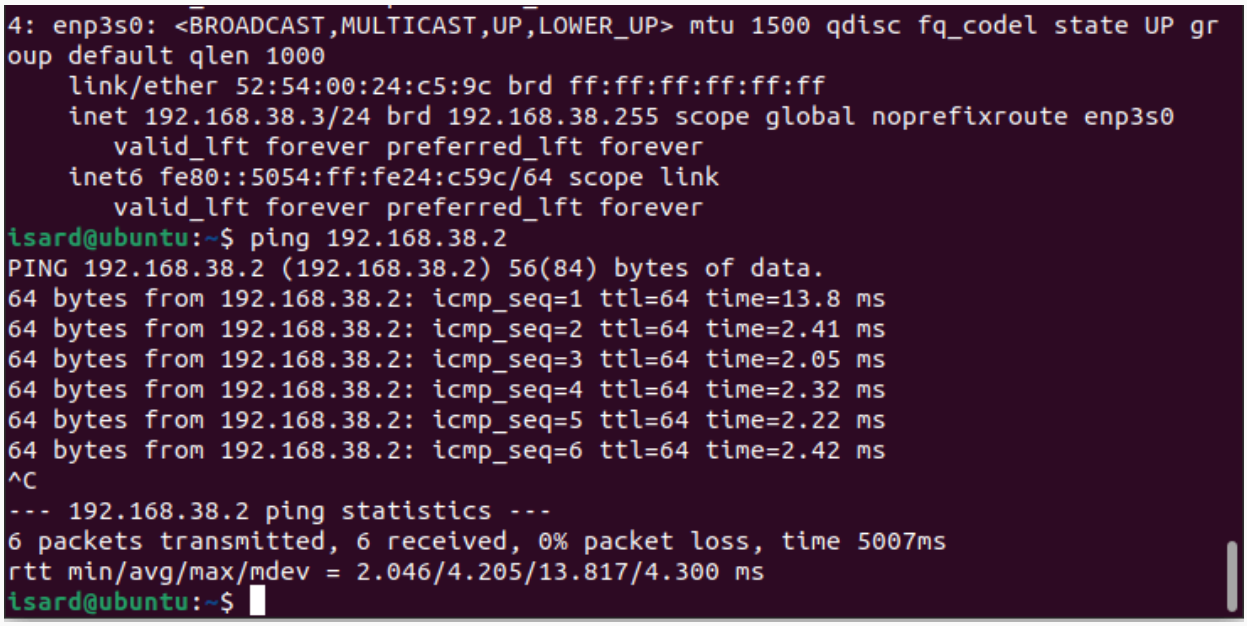
http://localhost/CheckInTime.html

http://192.168.38.x/CheckInTime.html

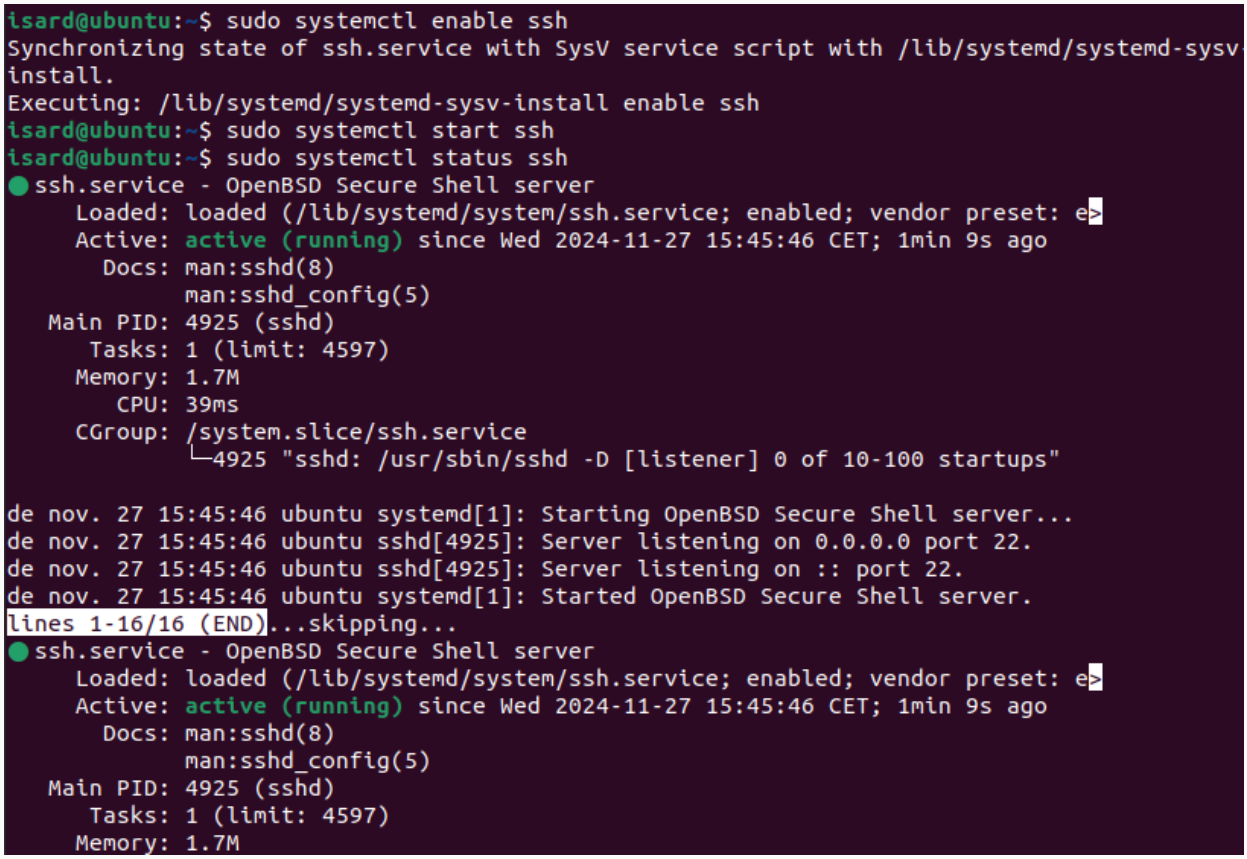
hace ping a la red:



con mi compañera hago ping y las máquinas se conectan:



creacion de admin ssh en maquina 192.168.38.3



suarios por ssh:

```
isard@ubuntu:~$ sudo adduser cliente1
S'està afegint l'usuari «cliente1»…
S'està afegint el grup nou cliente1 (1003)…
S'està afegint el nou usuari cliente1 (1003) amb grup cliente1…
S'està creant el directori personal «/home/cliente1»…
S'estan copiant els fitxers des de «/etc/skel»…
Nova contrasenya:
CONTRASENYA DOLENTA: La contrasenya és inferior als 8 caràcters
Torneu a escriure la nova contrasenya:
passwd: s'ha actualitzat la contrasenya satisfactòriament
S'està canviant la informació d'usuari per a cliente1
Introduïu el nou valor, o premeu INTRO per al predeterminat
        Nom complet []:
        Número d'espai []:
        Telèfon de la feina []:
        Telèfon de casa []:
        Altre []:
És aquesta informació correcta? [S/n]
isard@ubuntu:~$ sudo passwd cliente1
Nova contrasenya:
CONTRASENYA DOLENTA: La contrasenya és inferior als 8 caràcters
Torneu a escriure la nova contrasenya:
passwd: s'ha actualitzat la contrasenya satisfactòriament
isard@ubuntu:~$
```

CREACIÓN DE BASE DE DATOS:

```
isard@ubuntu:~$ sudo systemctl start postgresql
isard@ubuntu:~$ sudo systemctl status postgresql
● postgresql.service - PostgreSQL RDBMS
     Loaded: loaded (/lib/systemd/system/postgresql.service; enabled; vendor pr>
     Active: active (exited) since Thu 2024-11-28 19:32:13 CET; 49min ago
    Process: 1130 ExecStart=/bin/true (code=exited, status=0/SUCCESS)
   Main PID: 1130 (code=exited, status=0/SUCCESS)
        CPU: 3ms

de nov. 28 19:32:13 ubuntu systemd[1]: Starting PostgreSQL RDBMS...
de nov. 28 19:32:13 ubuntu systemd[1]: Finished PostgreSQL RDBMS.
lines 1-9/9 (END)
```

INICIAR:

sudo -i -u postgres

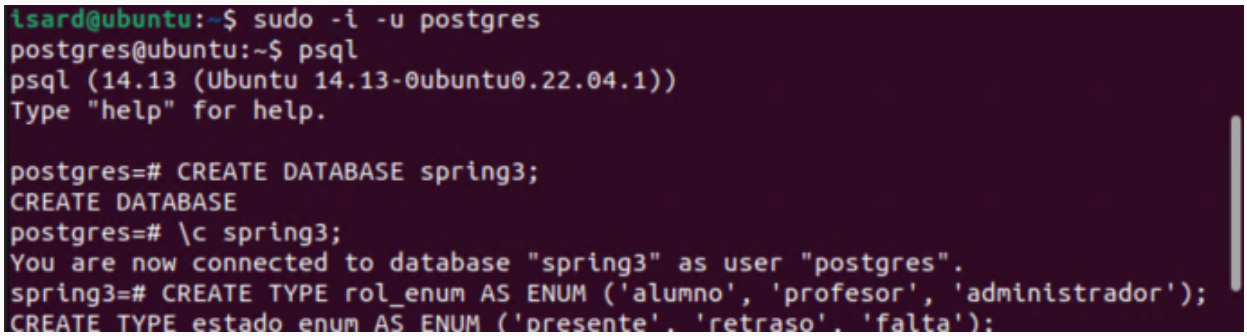
ABRIR CONSOLA;

psql

Script de las tipos: (ajustado de Mysql a postgresql)

CREATE TYPE rol_enum AS ENUM ('alumno', 'profesor', 'administrador');

CREATE TYPE estado_enum AS ENUM ('presente', 'retraso', 'falta');



Scripting de las tablas ajustado:

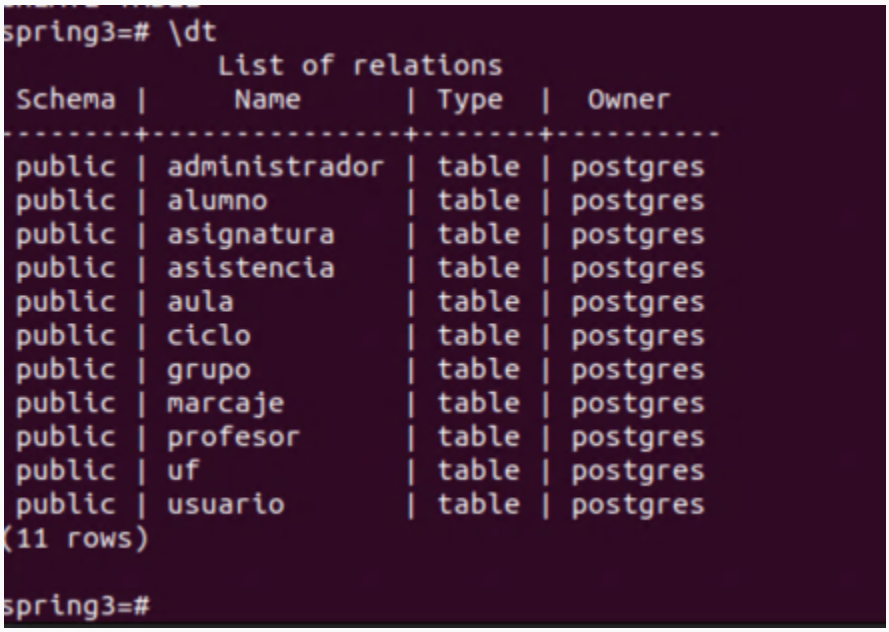
```
-- Tabla usuario
CREATE TABLE usuario (
    id_usuario SERIAL PRIMARY KEY,
    nombre VARCHAR(255) NOT NULL,
    correo VARCHAR(255) UNIQUE NOT NULL,
    contrasenya VARCHAR(255) UNIQUE NOT NULL,
    rol rol_enum NOT NULL
);

-- Tabla administrador
CREATE TABLE administrador (
    id_admin SERIAL PRIMARY KEY,
    id_usuario INT NOT NULL,
    FOREIGN KEY (id_usuario) REFERENCES usuario(id_usuario)
);
```

```sql
-- Tabla ciclo
CREATE TABLE ciclo (
    id_ciclo SERIAL PRIMARY KEY,
    nombre_ciclo VARCHAR(255) NOT NULL
);

-- Tabla grupo
CREATE TABLE grupo (
    id_grupo SERIAL PRIMARY KEY,
    id_ciclo INT NOT NULL,
    nombre_grupo VARCHAR(255) NOT NULL,
    FOREIGN KEY (id_ciclo) REFERENCES ciclo(id_ciclo)
);

-- Tabla alumno
CREATE TABLE alumno (
    id_alumno SERIAL PRIMARY KEY,
    id_usuario INT NOT NULL,
    id_ciclo INT NOT NULL,
    curso VARCHAR(255) NOT NULL,
    id_grupo INT NOT NULL,
    FOREIGN KEY (id_usuario) REFERENCES usuario(id_usuario),
    FOREIGN KEY (id_ciclo) REFERENCES ciclo(id_ciclo),
    FOREIGN KEY (id_grupo) REFERENCES grupo(id_grupo)
);

-- Tabla asignatura
CREATE TABLE asignatura (
    id_asignatura SERIAL PRIMARY KEY,
    id_ciclo INT NOT NULL,
    nombre_asignatura VARCHAR(255) NOT NULL,
    FOREIGN KEY (id_ciclo) REFERENCES ciclo(id_ciclo)
);
```

```
-- Tabla asistencia
CREATE TABLE asistencia (
    id_asistencia SERIAL PRIMARY KEY,
    id_alumno INT NOT NULL,
    id_asignatura INT NOT NULL,
    fecha_hora TIMESTAMP NOT NULL,
    estado estado_enum NOT NULL,
    FOREIGN KEY (id_alumno) REFERENCES alumno(id_alumno),
    FOREIGN KEY (id_asignatura) REFERENCES asignatura(id_asignatura)
);

-- Tabla aula
CREATE TABLE aula (
    id_aula SERIAL PRIMARY KEY,
    nombre_aula VARCHAR(255) NOT NULL
);

-- Tabla marcaje
CREATE TABLE marcaje (
    id_marcaje VARCHAR(255) PRIMARY KEY,
    id_usuario INT NOT NULL,
    fecha_hora_entrada TIMESTAMP NOT NULL,
    fecha_hora_salida TIMESTAMP NOT NULL,
    FOREIGN KEY (id_usuario) REFERENCES usuario(id_usuario)
);

-- Tabla profesor
CREATE TABLE profesor (
    id_profesor SERIAL PRIMARY KEY,
    id_usuario INT NOT NULL,
    id_ciclo INT NOT NULL,
    FOREIGN KEY (id_usuario) REFERENCES usuario(id_usuario),
    FOREIGN KEY (id_ciclo) REFERENCES ciclo(id_ciclo)
```

```
);


-- Tabla uf
CREATE TABLE uf (
  id_uf SERIAL PRIMARY KEY,
  id_asistencia INT NOT NULL,
  id_alumno INT NOT NULL,
  id_asignatura INT NOT NULL,
  FOREIGN KEY (id_asistencia) REFERENCES asistencia(id_asistencia),
  FOREIGN KEY (id_alumno) REFERENCES alumno(id_alumno),
  FOREIGN KEY (id_asignatura) REFERENCES asignatura(id_asignatura)
);
```

Listar las tablas creadas:



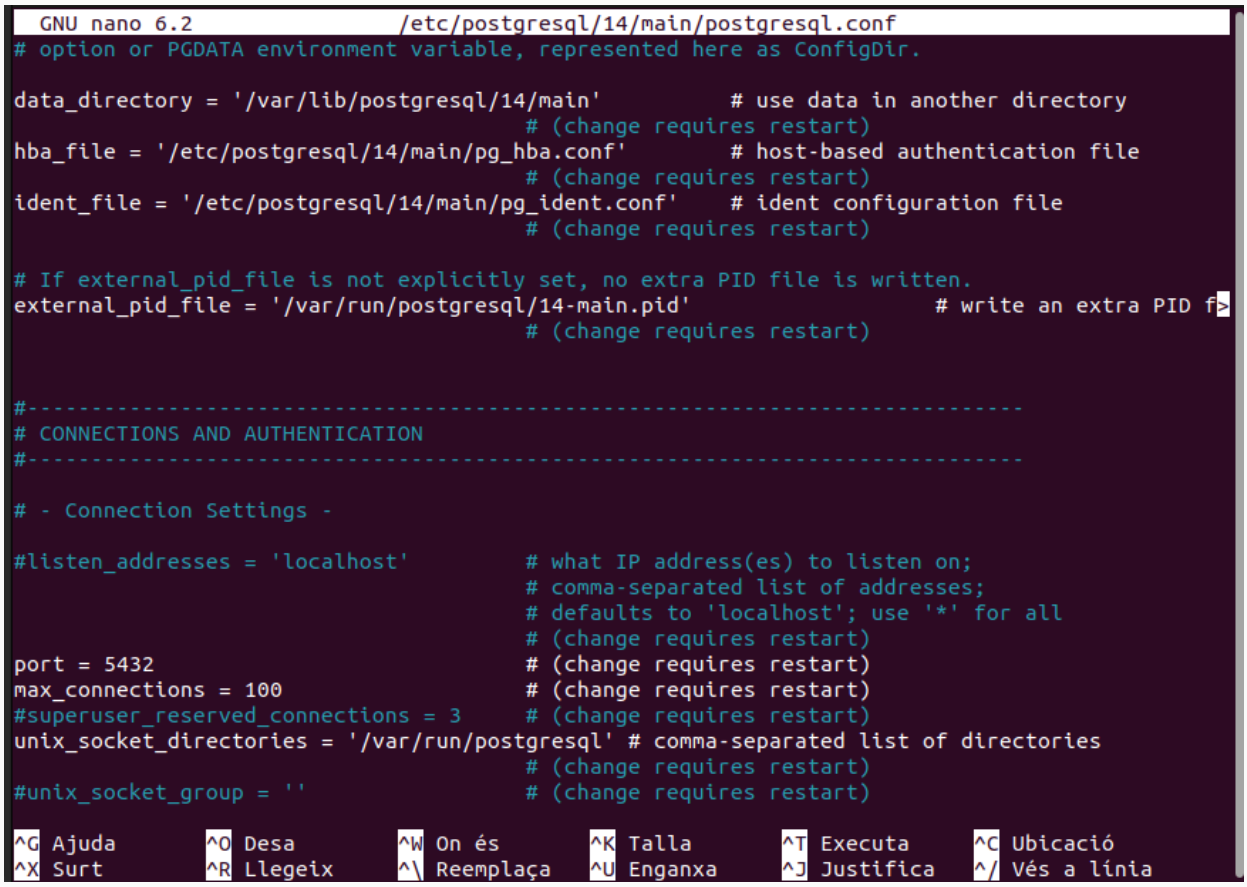
\q : SALIR Y Exit de toda la vida!

Fes conecio amb trucar al admin del server com ssh mol 192.168.38.3 la xarxa del server

configuraciones adicionales permisos de postgres modificar usuarios:

sudo nano /etc/postgresql/14/main/postgresql.conf

listen_addresses=”*”

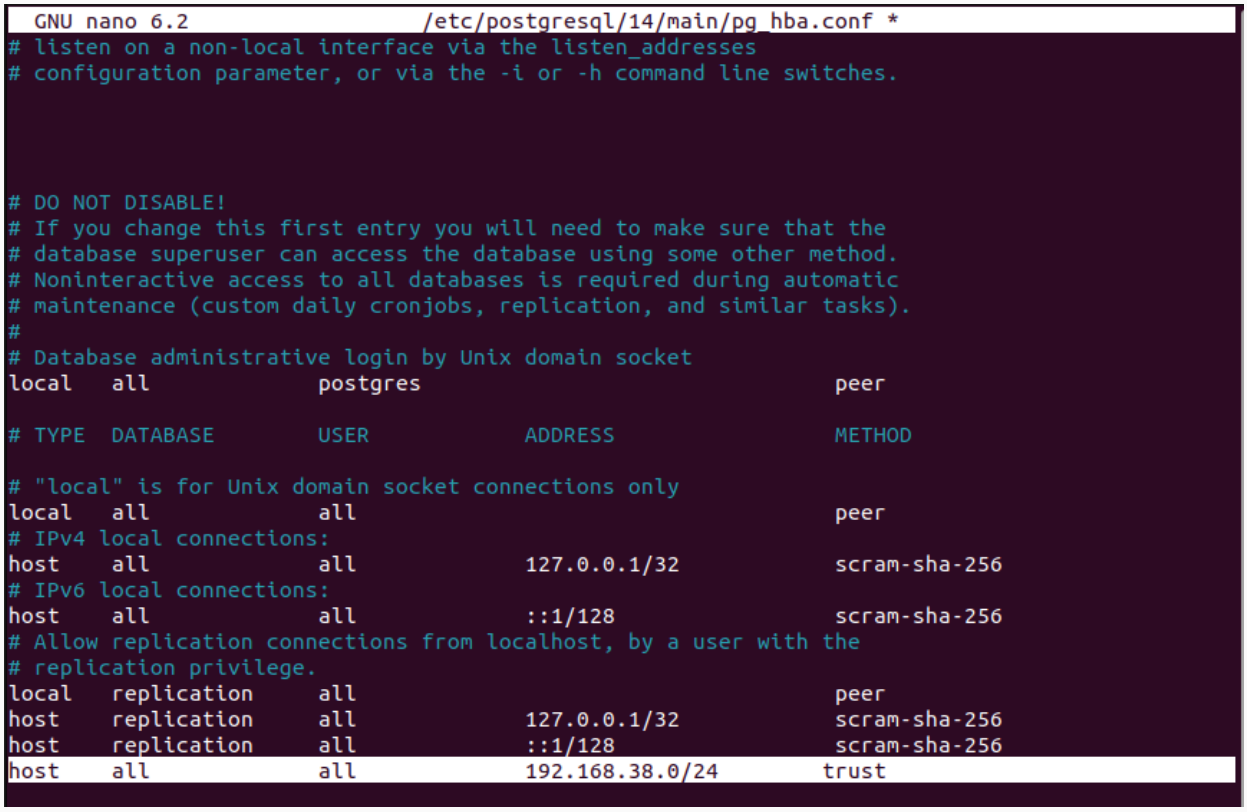


```
  GNU nano 6.2                /etc/postgresql/14/main/postgresql.conf *
# option or PGDATA environment variable, represented here as ConfigDir.

data_directory = '/var/lib/postgresql/14/main'          # use data in another directory
                                        # (change requires restart)
hba_file = '/etc/postgresql/14/main/pg_hba.conf'        # host-based authentication file
                                        # (change requires restart)
ident_file = '/etc/postgresql/14/main/pg_ident.conf'    # ident configuration file
                                        # (change requires restart)

# If external_pid_file is not explicitly set, no extra PID file is written.
external_pid_file = '/var/run/postgresql/14-main.pid'                   # write an extra PID
                                        # (change requires restart)


#------------------------------------------------------------------------------
# CONNECTIONS AND AUTHENTICATION
#------------------------------------------------------------------------------

# - Connection Settings -

listen_addresses = '*'          # what IP address(es) to listen on;
                                        # comma-separated list of addresses;
                                        # defaults to 'localhost'; use '*' for all
                                        # (change requires restart)
port = 5432                             # (change requires restart)
max_connections = 100                   # (change requires restart)
#superuser_reserved_connections = 3     # (change requires restart)
unix_socket_directories = '/var/run/postgresql' # comma-separated list of directories
                                        # (change requires restart)
```

modificamos el rango de ip que se puede conectar:

sudo nano /etc/postgresql/14/main/pg_hba.conf

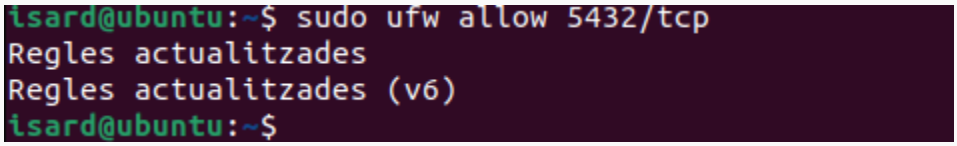
agrego la siguiente linea:



```
  GNU nano 6.2                  /etc/postgresql/14/main/pg_hba.conf *
# listen on a non-local interface via the listen_addresses
# configuration parameter, or via the -i or -h command line switches.




# DO NOT DISABLE!
# If you change this first entry you will need to make sure that the
# database superuser can access the database using some other method.
# Noninteractive access to all databases is required during automatic
# maintenance (custom daily cronjobs, replication, and similar tasks).
#
# Database administrative login by Unix domain socket
local   all             postgres                                peer

# TYPE  DATABASE        USER            ADDRESS                 METHOD

# "local" is for Unix domain socket connections only
local   all             all                                     peer
# IPv4 local connections:
host    all             all             127.0.0.1/32            scram-sha-256
# IPv6 local connections:
host    all             all             ::1/128                 scram-sha-256
# Allow replication connections from localhost, by a user with the
# replication privilege.
local   replication     all                                     peer
host    replication     all             127.0.0.1/32            scram-sha-256
host    replication     all             ::1/128                 scram-sha-256
host    all             all             192.168.38.0/24         trust
```

quito firewall:

sudo ufw allow 5432/tcp



```
isard@ubuntu:~$ sudo ufw allow 5432/tcp
Regles actualitzades
Regles actualitzades (v6)
isard@ubuntu:~$
```

conectarse al usuario postgres sin contraseña (prueba): psql -h 192.168.38.3 -U postgres -d spring3

CODE FINALA CONECCION:

```
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include <MQTTClient.h>
#include <ArduinoJson.h>
#include <SPI.h>
#include <MFRC522.h>

// Pines para el lector RFID
#define SS_PIN 5
#define RST_PIN 0

MFRC522 rfid(SS_PIN, RST_PIN); // Instancia del lector RFID

// Configuración Wi-Fi
const char WIFI_SSID[] = "Messi";         // Nombre de tu red Wi-Fi
const char WIFI_PASSWORD[] = "messidios";       // Contraseña de tu red Wi-Fi

// Configuración de AWS IoT
const char AWS_IOT_ENDPOINT[] = "a24nifur910c6a-ats.iot.us-east-1.amazonaws.com"; // Reemplaza con tu endpoint de AWS IoT
const char THINGNAME[] = "ESP32_RFID";
const char AWS_IOT_PUBLISH_TOPIC[] = "ESP32/RFID";
```

```
// Certificados

const char CA_CERT[] PROGMEM = R"EOF(

-----BEGIN CERTIFICATE-----

MIIDQTCCAimgAwIBAgITBmyfz5m/jAo54vB4ikPmljZbyjANBgkqhkiG9w0BAQsF

ADA5MQswCQYDVQQGEwJVUzEPMA0GA1UEChMGQW1hem9uMRkwFwYDVQQDExBBbWF6

b24gUm9vdCBDQSAxMB4XDTE1MDUyNjAwMDAwMFoXDTM4MDExNzAwMDAwMFowOTEL

MAkGA1UEBhMCVVMxDzANBgNVBAoTBkFtYXpvbjEZMBcGA1UEAxMQQW1hem9uIFJv

b3QgQ0EgMTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBALJ4gHHKeNXj

ca9HgFB0fW7Y14h29Jlo91ghYPl0hAEvrAIthtOgQ3pOsqTQNroBvo3bSMgHFzZM

9O6II8c+6zf1tRn4SWiw3te5djgdYZ6k/oI2peVKVuRF4fn9tBb6dNqcmzU5L/qw

IFAGbHrQgLKm+a/sRxmPUDgH3KKHOVj4utWp+UhnMJbulHheb4mjUcAwhmahRWa6

VOujw5H5SNz/0egwLX0tdHA114gk957EWW67c4cX8jJGKLhD+rcdqsq08p8kDi1L

93FcXmn/6pUCyziKrlA4b9v7LWIbxcceVOF34GfID5yHI9Y/QCB/IIDEgEw+OyQm

jgSubJrIqg0CAwEAAaNCMEAwDwYDVR0TAQH/BAUwAwEB/zAOBgNVHQ8BAf8EBAMC

AYYwHQYDVR0OBBYEFIQYzIU07LwMlJQuCFmcx7IQTgoIMA0GCSqGSIb3DQEBCwUA

A4IBAQCY8jdaQZChGsV2USggNiMOruYou6r4lK5IpDB/G/wkjUu0yKGX9rbxenDI

U5PMCCjjmCXPI6T53iHTfIUJrU6adTrCC2qJeHZERxhlbI1Bjjt/msv0tadQ1wUs

N+gDS63pYaACbvXy8MWy7Vu33PqUXHeeE6V/Uq2V8viTO96LXFvKWlJbYK8U90vv

o/ufQJVtMVT8QtPHRh8jrdkPSHCa2XV4cdFyQzR1bldZwgJcJmApzyMZFo6IQ6XU

5MsI+yMRQ+hDKXJioaldXgjUkK642M4UwtBV8ob2xJNDd2ZhwLnoQdeXeGADbkpy

rqXRfboQnoZsG4q5WTP468SQvvG5

-----END CERTIFICATE-----
```

```
)EOF";



const char DEVICE_CERT[] PROGMEM = R"KEY(
-----BEGIN CERTIFICATE-----
MIIDWTCCAkGgAwIBAgIUMboMuS4KdsjrgSBH6QeyL69uteQwDQYJKoZIhvcNAQEL
BQAwTTFLMEkGA1UECwxCQW1hem9uIFdlYiBTZXJ2aWNlcyBPPUFtYXpvbi5jb20g
SW5jLiBMPVNlYXR0bGUgU1Q9V2FzaGluZ3RvbiBDPVVTMB4XDTI0MTExNTE3NDQx
OVoXDTQ5MTIzMTIzNTk1OVowHjEcMBoGA1UEAwwTQVdTIElvVCBDZXJ0aWZpY2F0
ZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBALF5HsDBfNXqG5bhpxPz
KCu4Ua6xUS4HWAPl5pDZkNzldhxTOIHMmqEnYZTeHI/1WPWNpUadDcGRdumeoBtU
8WSWW23WXPh0Unp7ovQv5mBmwqu37czaCPrDtBhZRcmL0VHKAPBUi63+ADAAWnFW
FXvt+h2Ef1qWL182TZ5P52H2+8WU+FxMszNlcFavUYgKE9PoNW1CJ4QfSsRYrnLl
+2hqOl51uSGX3B70Be8werK42b3uiIsOX2G4IAKKJVZbzUhNfn+IFBd6ahLshZhT
7ADXPhlgg9+G1usnR2/hZPNDsYwJHoNbB8Tr/sECd+rCy2yADmMeV3n+dzIS6tcB
3CcCAwEAAaNgMF4wHwYDVR0jBBgwFoAU/bLhk30CndKYjLrMdrqpu9HiKzswHQYD
VR0OBBYEFEdqcy5zMEJDf8ZTeJZp0p8QwhmdMAwGA1UdEwEB/wQCMAAwDgYDVR0P
AQH/BAQDAgeAMA0GCSqGSIb3DQEBCwUAA4IBAQCk4GTiALFik3zJNOST/2BP2PKU
Wr/HWZMEUu6Ei3kaLFmyU54+oxcDpg/ApEsuWFn+glu57PFhqxzN0acDV+Vy30xv
Y0Uge1SsMClzVUmfbtEnOpwid776nXjAO5ZAGBfEDIocY/jXisQ9cahoNU0zqV8Q
3OpvUoSqYj6a7Vp1TWuslfxiJU7QzzrYIEXcNVu5Ooa7XzB2lZ3ef4ejmglaRwWq
SOQbl7ILY8B3mJSAnedVhKDmb6rWlO239SrG/UihI52HyVm1a7B/gTtApf7HFX/m
OvGLd6SXYPH46JDUjom/GhO+C4EC1QZGC2xJFBmpd7CEVVzoPm9jSqUjK+5N
```

```
-----END CERTIFICATE-----

)KEY";

const char PRIVATE_KEY[] PROGMEM = R"KEY(

-----BEGIN RSA PRIVATE KEY-----

MIIEpAIBAAKCAQEAsXkewMF81eobluGnE/MoK7hRrrFRLgdYA+XmkNmQ3OV2HFM4

gcyaoSdhlN4cj/VY9Y2lRp0NwZF26Z6gG1TxZJZbbdZc+HRSenui9C/mYGbCq7ft

zNoI+sO0GFlFyYvRUcoA8FSLrf4AMABacVYVe+36HYR/WpYvXzZNnk/nYfb7xZT4

XEyzM2VwVq9RiAoT0+g1bUInhB9KxFiucuX7aGo6XnW5IZfcHvQF7zB6srjZve6I

iw5fYbggAoolVlvNSE1+f4gUF3pqEuyFmFPsANc+GWCD34bW6ydHb+Fk80OxjAke

g1sHxOv+wQJ36sLLbIAOYx5Xef53MhLq1wHcJwIDAQABAoIBAANtpYxvsGupdBL8

FPAruFDv5JQNVNYgyjB5FnUh3syFmjx91w+a1jnauuXXTJHzWV6U9+ZfTk648qUc

rVcZ0vfwd5+tjmo2RQmcrc8txbODCKush+l3JMlDUo1N3C1CiC6eSlpaJ8CasYI7

34Nk+FFGjZhYYOVtFUkvkVxHit63kHOmKZ8VymwXXRrYUUjJMZcTIsAjMrW0n/zQ

5K2z8YTKHSLJAciVgLYSUvNecITJ4M20T0IEFiH36UReAjcD4f8p9c5w1W+kMgBO

eyxienzSpgIgL2E6YmIXMSm6kmNQOBOXLK0FwI78DSYDmOe2A0WcQ7lSgP0SU+WJ

H5HxPdECgYEA3diiUahHrNqOxULrG1MnyKEf9r6mOHsU52Wkqjh/zTS+8+hU1eB1

awg2l996rnm33nGfWI3D4JQduawNFraF1/IEn2iYjhVQmTDqtKrG93lJ85/9JWf8

iAGUaiHncFuIpl/anjVtoEMCOjRHPzjA3e28ySkkpFi5Q+tZD3L7RmUCgYEAzMup

MZKSRKbvgCqH7S/vKMSh3CZULfFQaluxsTNl7vas6HQT1MckmzwkWeb8mDVIpaUO

sIe8gz2emT0oArBlunvnnRZm2m/WLC5Yd8ea7wJEU56OVn9FoogxjKNdA/vnp1GK

QF2dAkCte1X7vkuAt8h2KQAYxwhVlfuzkSpu+ZsCgYBvq2WBjyCNLPLi7t1jwsbq

4dgyHyOSmLocBHkPyiLiy6M3KYLSqgrQ1rCMYEzj2JcqXK1mKO4pdMVFugpYnYXf

/o4/I6pvEuGgSxRJ3xEKbz4/aRBHLQHcAFeR2QEj+J9fiC6GpsRJAJH1dG1MsKe8
```

```
zrfR1mkAZTzUqHoLIcjEVQKBgQCuIMBUSQaa3sGm3QLD1kzoAgCJugE7KwIv3JUC
UOxruUudPg0ajtR+NS3HTxIYrL1/Mg+CY3cSs9LlAk3Bs5BbdjyhoUmEkzCsUh+g
gJQogmnsG1V1EDP6FQjkRoaw+3+lETyWq8HzB2E6DArHa1Ufbo+hHtbybBCxPNka
JdVD3wKBgQDa76rYaFXNDSCeCZATJN/3bdAS6ZekuKZd5+52rvfAvplrigztYyJc
MPwC04MrHjz62Rhqz6Ifv1JQnJ1ZXHkM8xfAHLMLbJuxgtj4DO6g8oGtaG99HaJ7
30N8E7RZ3wlV0+XL9NJecvnAEgZiLAIH3s0qiiY+/sm0YN0gzN24bA==
-----END RSA PRIVATE KEY-----




)KEY";




// Variables globales
WiFiClientSecure wifiClient;
MQTTClient mqttClient(256);

// Función para conectarse a Wi-Fi
void connectWiFi() {
  Serial.print("Conectando a Wi-Fi...");
```

```
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("\nWi-Fi conectado!");
  Serial.print("Dirección IP: ");
  Serial.println(WiFi.localIP());
}

// Función para conectarse a AWS IoT
void connectAWS() {
  Serial.println("Configurando certificados...");
  wifiClient.setCACert(CA_CERT);
  wifiClient.setCertificate(DEVICE_CERT);
  wifiClient.setPrivateKey(PRIVATE_KEY);

  mqttClient.begin(AWS_IOT_ENDPOINT, 8883, wifiClient);

  Serial.print("Conectando a AWS IoT...");
  while (!mqttClient.connect(THINGNAME)) {
    Serial.print(".");
    delay(1000);
```

```
  }

  if (mqttClient.connected()) {
    Serial.println("\nConectado a AWS IoT!");
  } else {
    Serial.println("Error al conectar a AWS IoT.");
  }
}

// Publicar datos a AWS IoT
void publishToAWS(String nuidHex, String nuidDec) {
  StaticJsonDocument<200> jsonDoc;
  jsonDoc["NUID_Hex"] = nuidHex;
  jsonDoc["NUID_Dec"] = nuidDec;

  char payload[256];
  serializeJson(jsonDoc, payload);

  mqttClient.publish(AWS_IOT_PUBLISH_TOPIC, payload);
  Serial.println("Mensaje publicado a AWS IoT:");
  Serial.println(payload);
}
```

```
// Función para convertir el NUID a formato Hexadecimal
String convertToHex(byte *buffer, byte bufferSize) {
  String hexString = "";
  for (byte i = 0; i < bufferSize; i++) {
    if (buffer[i] < 0x10) hexString += "0";
    hexString += String(buffer[i], HEX);
  }
  hexString.toUpperCase(); // Convierte la cadena a mayúsculas
  return hexString;        // Luego la devuelve
}

// Función para convertir el NUID a formato Decimal
String convertToDec(byte *buffer, byte bufferSize) {
  String decString = "";
  for (byte i = 0; i < bufferSize; i++) {
    if (i > 0) decString += "-";
    decString += String(buffer[i], DEC);
  }
  return decString;
}

void setup() {
  Serial.begin(115200);
```

```
  // Conexión a Wi-Fi y AWS IoT
  connectWiFi();
  connectAWS();

  // Inicializar lector RFID
  SPI.begin();
  rfid.PCD_Init();
  Serial.println(F("Lector RFID inicializado."));
}

void loop() {
  mqttClient.loop(); // Mantener conexión MQTT

  // Reconectar si la conexión se pierde
  if (!mqttClient.connected()) {
    Serial.println("Reconectando a AWS IoT...");
    connectAWS();
  }

  // Verificar si hay una nueva tarjeta RFID
  if (!rfid.PICC_IsNewCardPresent() || !rfid.PICC_ReadCardSerial()) {
    return; // Si no hay tarjeta, salir del loop
```

```
  }

  // Convertir NUID a Hexadecimal y Decimal
  String nuidHex = convertToHex(rfid.uid.uidByte, rfid.uid.size);
  String nuidDec = convertToDec(rfid.uid.uidByte, rfid.uid.size);

  Serial.println("Tarjeta detectada:");
  Serial.println("NUID (Hex): " + nuidHex);
  Serial.println("NUID (Dec): " + nuidDec);

  // Publicar NUID en AWS IoT
  publishToAWS(nuidHex, nuidDec);

  // Detener la tarjeta y deshabilitar la encriptación
  rfid.PICC_HaltA();
  rfid.PCD_StopCrypto1();

  delay(1000); // Esperar 1 segundo antes de la próxima lectura
}
```