**Setting Up Network Access Control with FreeRADIUS, CoovaChilli, and MySQL on Ubuntu 22.04**

**Prerequisites**

Before starting, ensure you have:

* **Hardware**:
  + A computer with Ubuntu 22.04 LTS installed.
  + Two network interfaces:
    - One for the internet (e.g., eth0, connected to a router/modem).
    - One for Wi-Fi clients (e.g., wlan0, a wireless card that supports Access Point mode).
  + Check if your wireless card supports AP mode by running:

iw phy | grep -A 5 -i 'Supported interface modes' | grep '\* AP'

If you see \* AP, your card is compatible.

* **Software**:
  + Internet access on the internet-facing interface.
  + A terminal to run commands (open it by pressing Ctrl + Alt + T).
* **Access**:
  + Ability to use sudo (administrator privileges).
* **Note**: This guide uses eth0 for the internet and wlan0 for Wi-Fi. Replace these with your actual interface names (find them using ip addr).

**Step-by-Step Instructions**

**Step 1: Update Your System**

To ensure your system has the latest software and security updates, run the following command in the terminal. This prevents issues during installation.

1. Open the terminal (Ctrl + Alt + T).
2. Type and run:

sudo apt update && sudo apt upgrade -y

1. Enter your user password when prompted.
2. Wait for the updates to complete (this may take a few minutes).

**Step 2: Install Required Software**

We need to install several programs to make this system work:

* **FreeRADIUS**: Manages user authentication.
* **MySQL**: Stores user data.
* **CoovaChilli**: Creates the captive portal.
* **Hostapd**: Turns your wireless card into a Wi-Fi access point.
* **Dnsmasq**: Handles IP addresses and DNS for clients.
* **Nginx and PHP**: Serves the login webpage.

Run this command to install everything:

sudo apt install -y freeradius freeradius-mysql mysql-server mysql-client hostapd dnsmasq nginx php8.1-fpm php8.1-mysql build-essential libssl-dev libjson-c-dev gengetopt devscripts debhelper haserl

* If prompted, press Y to confirm installation.
* This command installs all necessary packages. It may take some time.

**Step 3: Set Up MySQL Database**

MySQL will store user login information. We’ll create a database and a user for FreeRADIUS.

**3.1 Secure MySQL**

1. Run the MySQL secure installation script to set a root password and secure the database:

sudo mysql\_secure\_installation

1. Follow the prompts:
   * **Set root password**: Choose a password (e.g., mysqlsecret). Write it down; you’ll need it later.
   * **Remove anonymous users**: Type Y.
   * **Disallow root login remotely**: Type Y.
   * **Remove test database**: Type Y.
   * **Reload privilege tables**: Type Y.

**3.2 Create Database and User**

1. Log in to MySQL:

sudo mysql -u root -p

Enter the MySQL root password (mysqlsecret) you set above.

1. Run these commands one by one (copy and paste each, then press Enter):
2. CREATE DATABASE radius;
3. CREATE USER 'radius'@'localhost' IDENTIFIED BY 'mysqlsecret';
4. GRANT ALL PRIVILEGES ON radius.\* TO 'radius'@'localhost';
5. FLUSH PRIVILEGES;

EXIT;

* + This creates a database named radius and a user radius with password mysqlsecret.

**3.3 Set Up FreeRADIUS Tables**

1. Import the FreeRADIUS database schema to create tables for user data:

sudo mysql -u root -p radius < /etc/freeradius/3.0/mods-config/sql/main/mysql/schema.sql

1. Enter the MySQL root password (mysqlsecret) when prompted.
2. This sets up tables like radcheck for user credentials.

**Step 4: Install CoovaChilli**

CoovaChilli may not be in Ubuntu’s default repositories, so we’ll download and build it from source.

1. **Download CoovaChilli**:
2. cd /tmp
3. wget https://github.com/coova/coova-chilli/releases/download/1.6/coova-chilli-1.6.tar.gz
4. tar -xzf coova-chilli-1.6.tar.gz

cd coova-chilli-1.6

https://github.com/coova/coova-chilli/archive/refs/tags/1.6.tar.gz

1. **Remove Dependency** (to avoid build issues):

sed -i '/haserl/d' debian/control

1. **Build and Install**:
2. sudo dpkg-buildpackage -b -uc
3. cd ..

sudo dpkg -i coova-chilli\_1.6\_amd64.deb

* + If you get errors about missing dependencies, run:

sudo apt-get install -f

1. **Enable and Start CoovaChilli**:
2. sudo systemctl enable chilli

sudo systemctl start chilli

**Step 5: Configure Network Interfaces**

Your system needs to route traffic between the internet (WAN) and Wi-Fi clients (LAN).

1. **Find Interface Names**: Run:

ip addr

Look for your interfaces (e.g., eth0 for internet, wlan0 for Wi-Fi). Note their names.

1. **Enable IP Forwarding**: To allow your system to route traffic:

sudo sysctl -w net.ipv4.ip\_forward=1

1. Make this setting permanent:

sudo nano /etc/sysctl.conf

* + Find or add this line:

net.ipv4.ip\_forward=1

* + Save (Ctrl+O, Enter, Ctrl+X to exit).
  + Apply changes:

sudo sysctl -p

**Step 6: Configure Hostapd**

Hostapd makes your wireless card act as a Wi-Fi access point.

1. **Create Hostapd Configuration**:

sudo nano /etc/hostapd/hostapd.conf

Add (replace wlan0 with your Wi-Fi interface):

interface=wlan0

driver=nl80211

ssid=Hotspot

hw\_mode=g

channel=6

macaddr\_acl=0

auth\_algs=1

ignore\_broadcast\_ssid=0

wpa=2

wpa\_key\_mgmt=WPA-PSK

wpa\_pairwise=TKIP

rsn\_pairwise=CCMP

wpa\_passphrase=hotspotpass

* + ssid: Name of your Wi-Fi (e.g., Hotspot).
  + wpa\_passphrase: Wi-Fi password (e.g., hotspotpass).
  + Save (Ctrl+O, Enter, Ctrl+X).

1. **Link Configuration**:

sudo nano /etc/default/hostapd

* + Find or add:

DAEMON\_CONF="/etc/hostapd/hostapd.conf"

* + Save and exit.

1. **Start Hostapd**:
2. sudo systemctl enable hostapd

sudo systemctl start hostapd

**Step 7: Configure FreeRADIUS**

FreeRADIUS will authenticate users against the MySQL database.

1. **Enable MySQL Module**:

sudo ln -s /etc/freeradius/3.0/mods-available/sql /etc/freeradius/3.0/mods-enabled/sql

1. **Configure SQL Module**:

sudo nano /etc/freeradius/3.0/mods-available/sql

* + Update these lines:
  + driver = "rlm\_sql\_mysql"
  + dialect = "mysql"
  + server = "localhost"
  + port = 3306
  + login = "radius"
  + password = "mysqlsecret"

radius\_db = "radius"

* + Ensure read\_clients = yes is uncommented (remove # if present).
  + Save and exit.

1. **Configure FreeRADIUS Clients**:

sudo nano /etc/freeradius/3.0/clients.conf

* + Add:
  + client localhost {
  + ipaddr = 127.0.0.1
  + secret = radtesting123
  + require\_message\_authenticator = no
  + nas\_type = other

}

* + Save and exit.

1. **Start FreeRADIUS**:
2. sudo systemctl enable freeradius

sudo systemctl start freeradius

1. **Test FreeRADIUS**:
   * Add a test user:

echo "INSERT INTO radcheck (username, attribute, op, value) VALUES ('testuser', 'Cleartext-Password', ':=', 'testpass');" | mysql -u radius -pmysqlsecret radius

* + Test authentication:

radtest testuser testpass 127.0.0.1 0 radtesting123

* + - If you see Access-Accept, FreeRADIUS is working.

**Step 8: Configure CoovaChilli**

CoovaChilli manages the captive portal and integrates with FreeRADIUS.

1. **Edit Configuration**:

sudo nano /etc/chilli.conf

* + Add or update (replace eth0 and wlan0 with your interfaces):
  + HS\_WANIF=ens33
  + HS\_LANIF=ens37
  + HS\_NETWORK=10.1.0.0
  + HS\_NETMASK=255.255.255.0
  + HS\_UAMLISTEN=10.1.0.1
  + HS\_UAMPORT=3990
  + HS\_UAMUIPORT=4990
  + HS\_NASID=nas01
  + HS\_RADIUS=localhost
  + HS\_RADIUS2=localhost
  + HS\_RADSECRET=radtesting123
  + HS\_UAMSECRET=uamtesting123
  + HS\_UAMALLOW=10.1.0.0/24
  + HS\_DNS1=10.1.0.1
  + HS\_DNS2=208.67.220.220
  + HS\_TCP\_PORTS="80 443"
  + HS\_ADMUSR=admin

HS\_ADMPWD=adminpass

* + Save and exit.

1. **Set Up Firewall**: Allow HTTP and HTTPS traffic:
2. sudo iptables -A INPUT -i tun0 -p tcp -m tcp --dport 80 -j ACCEPT

sudo iptables -A INPUT -i tun0 -p tcp -m tcp --dport 443 -j ACCEPT

1. **Save Firewall Rules**:
2. sudo apt install iptables-persistent -y

sudo iptables-save > /etc/iptables/rules.v4

* + Press Y if prompted to save rules.

**Step 9: Set Up Captive Portal with Nginx**

Create a login page for users to authenticate.

1. **Create Login Page**:
2. sudo mkdir -p /var/www/html/chilli

sudo nano /var/www/html/chilli/hotspotlogin.php

* + Add:
  + <?php
  + $uamip = $\_GET['uamip'];
  + $uamport = $\_GET['uamport'];
  + $challenge = $\_GET['challenge'];
  + $mac = $\_GET['mac'];
  + $ip = $\_GET['ip'];
  + ?>
  + <!DOCTYPE html>
  + <html>
  + <head>
  + <title>Hotspot Login</title>
  + </head>
  + <body>
  + <h2>Login to Hotspot</h2>
  + <form action="http://<?php echo $uamip; ?>:<?php echo $uamport; ?>/logon" method="post">
  + <input type="hidden" name="challenge" value="<?php echo $challenge; ?>">
  + <input type="hidden" name="uamip" value="<?php echo $uamip; ?>">
  + <input type="hidden" name="uamport" value="<?php echo $uamport; ?>">
  + <label>Username: <input type="text" name="UserName"></label><br>
  + <label>Password: <input type="password" name="Password"></label><br>
  + <input type="submit" value="Login">
  + </form>
  + </body>

</html>

* + Save and exit.

1. **Configure Nginx**:

sudo nano /etc/nginx/sites-available/chilli

* + Add:
  + server {
  + listen 80;
  + server\_name 10.1.0.1;
  + root /var/www/html/chilli;
  + index hotspotlogin.php;
  + location ~ \.php$ {
  + include snippets/fastcgi-php.conf;
  + fastcgi\_pass unix:/run/php/php8.1-fpm.sock;
  + fastcgi\_param SCRIPT\_FILENAME $document\_root$fastcgi\_script\_name;
  + include fastcgi\_params;
  + }

}

* + Save and exit.

1. **Enable Nginx Site**:
2. sudo ln -s /etc/nginx/sites-available/chilli /etc/nginx/sites-enabled/

sudo systemctl restart nginx

1. **Link Login Page in CoovaChilli**:

sudo nano /etc/chilli.conf

* + Add:

HS\_UAMHOMEPAGE=http://10.1.0.1/hotspotlogin.php

* + Save and restart CoovaChilli:

sudo systemctl restart chilli

**Step 10: Configure Dnsmasq**

Dnsmasq assigns IP addresses to Wi-Fi clients.

1. **Edit Configuration**:

sudo nano /etc/dnsmasq.conf

* + Add:
  + interface=wlan0

dhcp-range=10.1.0.2,10.1.0.254,255.255.255.0,12h

* + Save and exit.

1. **Start Dnsmasq**:
2. sudo systemctl enable dnsmasq

sudo systemctl start dnsmasq

**Step 11: Add Users**

Add a user to the MySQL database for testing.

echo "INSERT INTO radcheck (username, attribute, op, value) VALUES ('user1', 'Cleartext-Password', ':=', 'pass1');" | mysql -u radius -pmysqlsecret radius

* This creates a user user1 with password pass1. Repeat for more users, changing the username and password.

**Step 12: Test the System**

1. **Connect to Wi-Fi**:
   * On a phone or laptop, connect to the Wi-Fi network Hotspot with password hotspotpass.
2. **Open a Browser**:
   * Try visiting any website (e.g., google.com).
   * You should be redirected to http://10.1.0.1/hotspotlogin.php.
3. **Log In**:
   * Enter user1 and pass1.
   * If successful, you should get internet access.
4. **Check Logs**:
   * FreeRADIUS logs:

sudo tail -f /var/log/freeradius/radius.log

Look for Access-Accept.

* + CoovaChilli clients:

sudo chilli\_query list

**Step 13: Optional - Limit User Access Time**

To limit users to 30 minutes per day:

1. **Enable SQL Counter**:

sudo nano /etc/freeradius/3.0/mods-available/sqlcounter

* + Add:
  + sqlcounter dailycounter {
  + counter\_name = Daily-Session-Time
  + check\_name = Max-Daily-Session
  + reply\_name = Session-Timeout
  + sqlmod\_inst = sql
  + key = username
  + reset = daily
  + query = "SELECT SUM(acctsessiontime) FROM radacct WHERE username = '%{%k}' AND UNIX\_TIMESTAMP(acctstarttime) + acctsessiontime > '%b'"

}

* + Save and exit.
  + Enable it:

sudo ln -s /etc/freeradius/3.0/mods-available/sqlcounter /etc/freeradius/3.0/mods-enabled/

1. **Set Time Limit**:

echo "INSERT INTO radcheck (username, attribute, op, value) VALUES ('user1', 'Max-Daily-Session', ':=', '1800');" | mysql -u radius -pmysqlsecret radius

* + This limits user1 to 1800 seconds (30 minutes) daily.

1. **Restart FreeRADIUS**:

sudo systemctl restart freeradius

**Step 14: Troubleshooting**

If something doesn’t work:

* **Check Service Status**:

sudo systemctl status freeradius chilli hostapd nginx dnsmasq

* + Ensure all services are active (running).
* **View Logs**:
  + FreeRADIUS: sudo tail -f /var/log/freeradius/radius.log
  + CoovaChilli: sudo tail -f /var/log/chilli.log
  + Nginx: sudo tail -f /var/log/nginx/error.log
* **Common Issues**:
  + **No Redirect to Login Page**: Check HS\_UAMHOMEPAGE in /etc/chilli.conf and ensure Nginx is running.
  + **Authentication Fails**: Ensure HS\_RADSECRET in /etc/chilli.conf matches secret in /etc/freeradius/3.0/clients.conf.
  + **No IP Address**: Verify dnsmasq is running and configured for wlan0.

**Final Notes**

* **Security**: Use strong passwords for MySQL, FreeRADIUS, and CoovaChilli in a real environment.
* **Advanced Management**: Consider installing **daloRADIUS** for a web interface to manage users:

sudo apt install daloradius

Configure it to connect to the radius database.

* **Testing**: Connect a device, log in, and ensure internet access works. Check logs for confirmation.