

# Raspberry Pi Wi-Fi Router & Client (Debian Trixie)

## Purpose

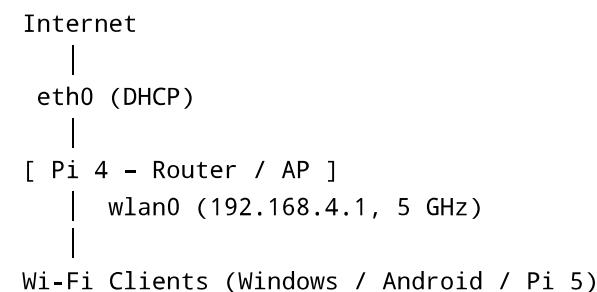
This README documents a **known-good, repeatable setup** for using:

- Raspberry Pi 4 as a **Wi-Fi Access Point + Router**
- Raspberry Pi 5 as a **Wi-Fi client**
- Debian **Trixie** on both systems

It also captures the **hard-won lessons** that prevent common Pi 5 Wi-Fi failures.

---

## 1. High-Level Architecture



## Network roles

Device	Role	Network stack
Pi 4	AP + router	systemd-networkd + hostapd + dnsmasq + nftables
Pi 5	Wi-Fi client	NetworkManager

**Golden rule:** One interface = one network manager. Never mix them.

---

## 2. Pi 4 – Router / Access Point (Summary)

- **wlan0:** Access Point (hostapd)
- **eth0:** WAN (DHCP client)
- **LAN subnet:** 192.168.4.0/24
- **Gateway:** 192.168.4.1
- **Security:** WPA2-PSK
- **Routing:** IPv4 forwarding + NAT (nftables masquerade)

The Pi 4 configuration is assumed stable and is not duplicated here.

---

## 3. Pi 5 – Wi-Fi Client (Canonical Setup)

### 3.1 Network stack selection (critical)

On the **client Pi**, use **NetworkManager only**.

Disable systemd-networkd:

```
sudo systemctl stop systemd-networkd  
sudo systemctl disable systemd-networkd
```

Ensure `/etc/network/interfaces` contains only:

```
source /etc/network/interfaces.d/*
```

---

## 4. Raspberry Pi 5 Regulatory Domain (CRITICAL)

### Why this matters

On **Pi 5**, Wi-Fi is enforced by **firmware**, not just the kernel.

If the firmware country is unset: - 5 GHz is disabled - Scanning is blocked - `nmcli` reports `wlan0 unavailable`

Kernel commands like `iw reg set` are **not sufficient**.

---

### 4.1 Required firmware configuration

Edit:

```
sudo nano /boot/firmware/config.txt
```

Add:

```
dtparam=wifi_country=DE
```

Reboot:

```
sudo reboot
```

Verify:

```
iw reg get
```

Correct output **must** show:

```
phy#0
country DE: DFS-ETSI
```

✖ If `country 99` appears → firmware configuration is missing or wrong.

---

## 5. NetworkManager Ownership (Very Common Failure)

### Symptom

```
nmcli device status
```

```
wlan0 wifi unmanaged --
```

This is a **policy decision**, not a driver error.

---

### 5.1 Root causes

Any ONE of the following makes NetworkManager ignore wlan0:

1. `systemd-networkd` config for wlan0
  2. `/etc/network/interfaces` defines wlan0
  3. NM unmanaged-devices rule
  4. Raspberry Pi “preconfigured” Wi-Fi profile
- 

### 5.2 Canonical fix

Remove Pi preset Wi-Fi profile:

```
nmcli connection delete preconfigured
```

Ensure NM is allowed to manage Wi-Fi:

```
sudo nano /etc/NetworkManager/conf.d/10-wifi-managed.conf
```

```
[keyfile]
managed=true
```

Restart NetworkManager:

```
sudo systemctl restart NetworkManager
```

Force ownership:

```
nmcli device set wlan0 managed yes
nmcli radio wifi on
```

Verify:

```
nmcli device status
```

Expected:

```
wlan0 wifi disconnected --
```

---

## 6. Connecting to the Pi 4 Access Point

Scan:

```
nmcli dev wifi list
```

Connect:

```
nmcli dev wifi connect "Pi4_AccessPoint" password "Robot2025"
```

Verify connectivity:

```
ip addr show wlan0
ping -c 3 8.8.8.8
```

## 7. Known Failure Modes (Quick Reference)

Symptom	Meaning	Fix
Scanning not allowed while unavailable	Firmware regdomain unset	dtparam=wifi_country=DE
wlan0 unmanaged	NM policy conflict	Remove networkd / preconfigured profile
AP visible on Android, not Linux	5 GHz + regdomain	Firmware country
Works on Pi 4, fails on Pi 5	Firmware enforcement	Same fix

## 8. Rules to Never Break

1. AP uses systemd-networkd, clients use NetworkManager
2. Never mix network managers on one interface
3. Always set dtparam=wifi\_country on Pi 5
4. Unmanaged means policy, not hardware
5. 5 GHz issues on Linux are almost always regulatory

## 9. Final Sanity Checklist (Client Pi)

```
iw reg get  
nmcli device status  
nmcli dev wifi list
```

Expected: - phy#0 country DE - wlan0 wifi disconnected - Pi4\_AccessPoint visible

## 10. Status

- Pi 4 router operational
- Windows / Android clients connect
- Pi 5 client connects reliably
- Configuration documented and repeatable

This README is the authoritative baseline for Pi-to-Pi Wi-Fi on Debian Trixie.