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.

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1. High-Level Architecture

```
Internet
   │
 eth0 (DHCP)
   │
[ Pi 4 – Router / AP ]
   │  wlan0 (192.168.4.1, 5 GHz)
   │
Wi-Fi Clients (Windows / Android / Pi 5)
```

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.

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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.

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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/*
```

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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.

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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  --
```

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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
```

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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

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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**

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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

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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.