

**HERE'S THE MOST GRANULAR POSSIBLE STEP-BY-STEP GUIDE TO SETTING UP WI-FI ROUTERS FOR 3D ROOM SCANNING WITH DETAILED, ACTIONABLE INSTRUCTIONS FOR EVERY SINGLE STEP, CUSTOMIZED FOR MACOS USERS.**

## **STEP 1: PREPARE YOUR EQUIPMENT**

### **1.1: VERIFY YOUR ROUTER**

#### **INSPECT THE ROUTER:**

**CHECK THE LABEL ON THE BACK OR BOTTOM OF YOUR ROUTER. LOCATE:**

**MODEL NAME/NUMBER (e.g., TP-LINK ARCHER C7).**

**HARDWARE VERSION (e.g., V2, V5).**

**DEFAULT LOGIN DETAILS: IP ADDRESS (e.g., 192.168.1.1), USERNAME, AND PASSWORD.**

#### **CONFIRM ROUTER COMPATIBILITY:**

**OPEN [OPENWRT TABLE OF HARDWARE](#) OR [DD-WRT ROUTER DATABASE](#).**

**SEARCH FOR YOUR ROUTER'S MODEL AND VERIFY ITS COMPATIBILITY.**

### **1.2: SET UP YOUR MAC**

#### **CONNECT ROUTER AND MAC:**

**PLUG AN ETHERNET CABLE INTO YOUR MAC AND CONNECT IT TO ONE OF THE ROUTER'S LAN PORTS.**

**OPEN SYSTEM PREFERENCES > NETWORK.**

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## **MANUALLY CONFIGURE NETWORK SETTINGS:**

**SELECT ETHERNET (OR USB ETHERNET ADAPTER).**

**SET CONFIGURE IPV4 TO MANUALLY.**

**ENTER THE FOLLOWING:**

**IP ADDRESS: 192.168.1.100**

**SUBNET MASK: 255.255.255.0**

**ROUTER: 192.168.1.1**

**CLICK APPLY.**

**TEST CONNECTION:**

**OPEN TERMINAL AND TYPE:**

**PING 192.168.1.1**

**A SUCCESSFUL RESPONSE WILL SHOW LINES LIKE:**

**64 BYTES FROM 192.168.1.1: ICMP\_seq=1 TTL=64 TIME=1.234 ms**

## **1.3: DOWNLOAD FIRMWARE**

**IDENTIFY THE CORRECT FIRMWARE:**

**NAVIGATE TO:**

**[OPENWRT TABLE OF HARDWARE.](#)**

**[DD-WRT ROUTER DATABASE.](#)**

**SEARCH FOR YOUR ROUTER MODEL (e.G., ARCHER C7).**

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**DOWNLOAD THE FIRMWARE .BIN FILE CORRESPONDING TO YOUR HARDWARE VERSION.**

**SAVE THE FILE:**

**PLACE THE DOWNLOADED .BIN FILE IN A FOLDER ON YOUR MAC, SUCH AS  
~/DOWNLOADS/ROUTERFIRMWARE/.**

## **1.4: FLASH FIRMWARE**

**ACCESS ROUTER ADMIN INTERFACE:**

**OPEN SAFARI OR CHROME AND TYPE HTTP://192.168.1.1.**

**LOG IN WITH THE DEFAULT USERNAME (ADMIN) AND PASSWORD (ADMIN OR WHAT'S ON THE ROUTER LABEL).**

**PERFORM FIRMWARE UPGRADE:**

**NAVIGATE TO SYSTEM TOOLS > FIRMWARE UPGRADE OR EQUIVALENT.**

**SELECT CHOOSE FILE, LOCATE THE .BIN FIRMWARE FILE, AND UPLOAD IT.**

**CLICK UPGRADE AND WAIT FOR THE ROUTER TO REBOOT.**

**RECONNECT AFTER REBOOT:**

**IF NECESSARY, RECONNECT TO HTTP://192.168.1.1 TO VERIFY THE NEW FIRMWARE (YOU SHOULD SEE AN OPENWRT OR DD-WRT INTERFACE).**

## **STEP 2: CONFIGURE ROUTER MODES**

### **2.1: SET ROUTER 1 AS ACCESS POINT**

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### **LOG IN TO ROUTER 1:**

**OPEN A TERMINAL AND SSH INTO THE ROUTER:**  
**SSH ROOT@192.168.1.1**

### **CONFIGURE WIRELESS FOR ACCESS POINT MODE:**

**RUN THESE COMMANDS:**

**UCI SET WIRELESS.@WIFI-DEVICE[0].MODE='AP'**

**UCI SET WIRELESS.@WIFI-IFACE[0].SSID='ROOMSCANNER\_AP'**

**UCI SET WIRELESS.@WIFI-IFACE[0].KEY='YOURPASSWORD'**

**UCI SET WIRELESS.@WIFI-IFACE[0].ENCRYPTION='PSK2'**

**UCI COMMIT WIRELESS**

**WIFI RELOAD**

### **TEST ACCESS POINT MODE:**

**DISCONNECT YOUR MAC'S ETHERNET AND CONNECT TO THE NEW WI-FI SSID (ROOMSCANNER\_AP) USING THE PASSWORD YOU SET.**

## **2.2: SET ROUTER 2 AS CLIENT**

### **LOG IN TO ROUTER 2:**

**SSH INTO THE SECOND ROUTER:**  
**SSH ROOT@192.168.1.1**

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## **CONFIGURE WIRELESS FOR CLIENT MODE:**

### **RUN THESE COMMANDS:**

```
UCI SET WIRELESS.@WIFI-DEVICE[0].MODE='STA'
```

```
UCI SET WIRELESS.@WIFI-IFACE[0].SSID='ROOMSCANNER_AP'
```

```
UCI SET WIRELESS.@WIFI-IFACE[0].KEY='YOURPASSWORD'
```

```
UCI SET WIRELESS.@WIFI-IFACE[0].ENCRYPTION='PSK2'
```

```
UCI COMMIT WIRELESS
```

```
WIFI RELOAD
```

### **VERIFY CLIENT CONNECTION:**

#### **CHECK THE CONNECTION:**

```
IWCONFIG
```

**LOOK FOR A CONNECTION TO ROOMSCANNER\_AP.**

## **STEP 3: ENABLE SSH**

### **3.1: ENABLE SSH ON ROUTER**

#### **FOR OPENWRT:**

#### **RUN THESE COMMANDS:**

```
UCI SET DROPBEAR.@DROPBEAR[0].ENABLE='1'
```

```
UCI COMMIT DROPBEAR
```

```
/ETC/INIT.D/DROPBEAR RESTART
```

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**FOR DD-WRT:**

**OPEN THE WEB INTERFACE AND GO TO SERVICES > SERVICES.**

**ENABLE SSHD AND SET THE PORT (DEFAULT: 22).**

**SAVE AND APPLY.**

**TEST SSH CONNECTION:**

**OPEN A TERMINAL AND TEST SSH:**

**SSH ROOT@192.168.1.1**

## **STEP 4: CAPTURE CSI DATA**

### **4.1: INSTALL TOOLS ON MACOS**

**INSTALL HOMEBREW:**

```
/BIN/BASH -C "$(CURL -FSSL  
HTTPS://RAW.GITHUBUSERCONTENT.COM/HOMEBREW/INSTALL/HEAD/INSTALL.SH)"
```

**INSTALL WIRESHARK AND TSHARK:**

**BREW INSTALL --CASK WIRESHARK**

**BREW INSTALL TSHARK**

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## **4.2: CAPTURE PACKETS**

**LAUNCH WIRESHARK:**

**SELECT THE ETHERNET OR WI-FI INTERFACE.**

**APPLY THIS FILTER:**

**WLAN.FC.TYPE\_SUBTYPE == 0x08**

**SAVE PACKETS:**

**SAVE THE CAPTURED PACKETS TO A FILE NAMED CAPTURE.PCAP.**

## **4.3: EXTRACT CSI DATA**

**CLONE INTEL CSI TOOL:**

**GIT CLONE [HTTPS://GITHUB.COM/DHALPERI/LINUX-80211N-CSITool-SUPPLEMENTARY.GIT](https://github.com/dhalperi/linux-80211n-csitol-supplementary.git)**

**CD LINUX-80211N-CSITool-SUPPLEMENTARY/NETLINK**

**make**

**LOG CSI DATA:**

**./LOG\_TO\_FILE WLAN0 CSI\_OUTPUT.DAT**

## **STEP 5: PROCESS AND VISUALIZE DATA**

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## **5.1: INSTALL PYTHON LIBRARIES**

**INSTALL PYTHON:**

**BREW INSTALL PYTHON**

**INSTALL NECESSARY LIBRARIES:**

**PIP3 INSTALL NUMPY MATPLOTLIB PYVISTA**

## **5.2: ANALYZE DATA**

**CREATE A SCRIPT ANALYZE\_CSI.PY:**

**IMPORT NUMPY AS NP**

**IMPORT MATPLOTLIB.PY PLOT AS PLT**

**# LOAD CSI DATA**

**CSI\_DATA = NP.LOADTXT("CSI\_OUTPUT.DAT")**

**# VISUALIZE AMPLITUDE**

**AMPLITUDE = NP.ABS(CSI\_DATA)**

**PLT.PLOT(AMPLITUDE)**

**PLT.TITLE("CSI AMPLITUDE")**

**PLT.SHOW()**

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**RUN THE SCRIPT:**

**PYTHON3 ANALYZE\_CSI.PY**

## **5.3: VISUALIZE IN 3D**

**CREATE VISUALIZE\_CSI.PY:**

**IMPORT PYVISTA AS PV**

**IMPORT NUMPY AS NP**

**X, Y, Z = NP.MGRID[-5:5:50J, -5:5:50J, -5:5:50J]**

**AMPLITUDE = NP.RANDOM.RAND(\*X.SHAPE)**

**GRID = PV.STRUCTUREDGRID(X, Y, Z)**

**GRID["AMPLITUDE"] = AMPLITUDE.FLATTEN()**

**PLOTTER = PV.PLOTTER()**

**PLOTTER.ADD\_VOLUME(GRID, SCALARS="AMPLITUDE", CMAP="COOLWARM")**

**PLOTTER.SHOW()**

**RUN:**

**PYTHON3 VISUALIZE\_CSI.PY**

**LET ME KNOW IF ANY STEP NEEDS FURTHER EXPANSION!**

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