Maker Session: Wi-Fi Performance Testing with Odroid

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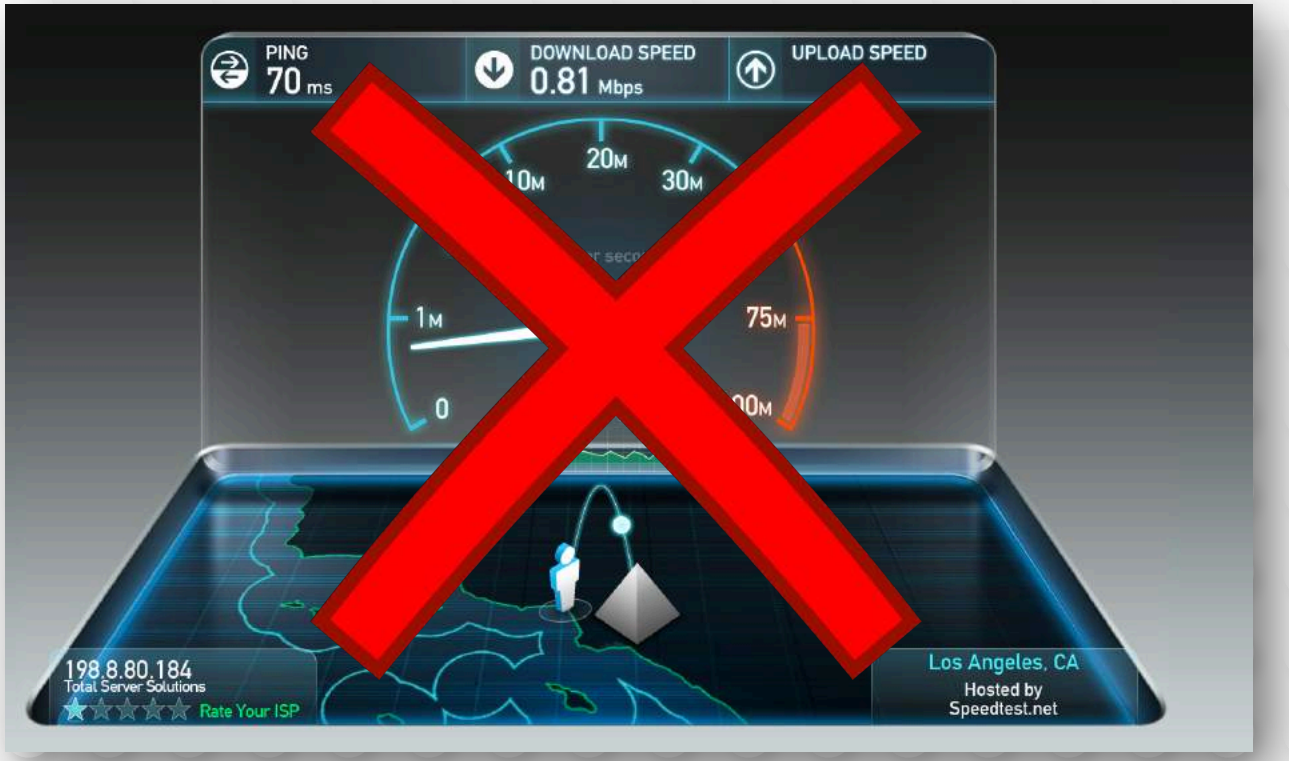
wirelessLAN PROFESSIONALS CONFERENCE

What Is The Goal?

Provide Wi-Fi professionals with better tools to measure network performance. Rather than…



Why Test Network Performance?

- Establish a baseline
- Assist in troubleshooting
- Test consistency
- Measure network throughput

Why Odroid?

Odroid-C2

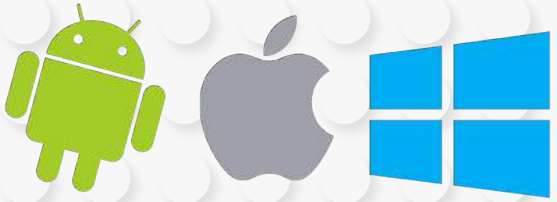
- 1.5GHz 64-bit quad-core single board computer (SBC)
- Gigabit Ethernet
- eMMC Flash Storage – *boots in about 20 seconds*
- Low power consumption - *around 1 amp*
- Very versatile
- NO 2.4GHz only Wi-Fi!

Linux Performance Testing Tools

- The following tools have been installed and configured to run automatically on boot in the WLAN_PRO Odroid image

Application	Version	Running on boot?	Port
iperf3	3.1.6	Yes	5202
iperf2	2.0.9	Yes	5001
Ruckus zap	1.83	Yes	
Ekahau eperf	3.x	Yes	5201
OpenSpeedTest.com		Yes	80

Client Applications



- We'll be using the following applications to perform the exercises

Applications	Version	macOS	Windows	Android	iOS
iperf3	3.1.6	X	X		
iperf2	2.0.9	X	X		
zap	1.83	X	X		
Ekahau Site Survey	8.6.2		X		
WiFiPerf (demo)	1.9	X		X	X
Ruckus SpeedFlex	2.0.7			X	X
H/E Network Tools (iperf2/3)	1.5.0.289			X	X
Aruba Utilities (iperf2)				X	

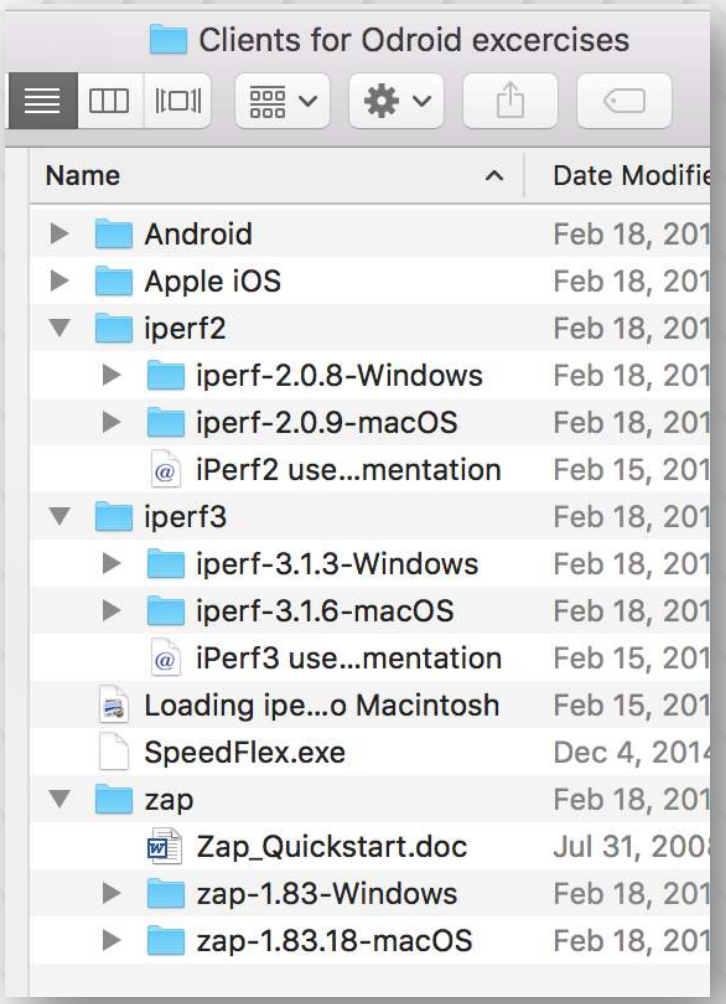
Windows/Mac Clients

Skip this step if you have successfully installed the iperf/zap clients using the emailed instructions

- Files are located on WLPC drive:

WLPC › Throughput Maker Session › Clients for Odroid excercises

- Copy the appropriate clients to your HD
  - Windows & Mac
    - Iperf2
    - Iperf3
    - zap

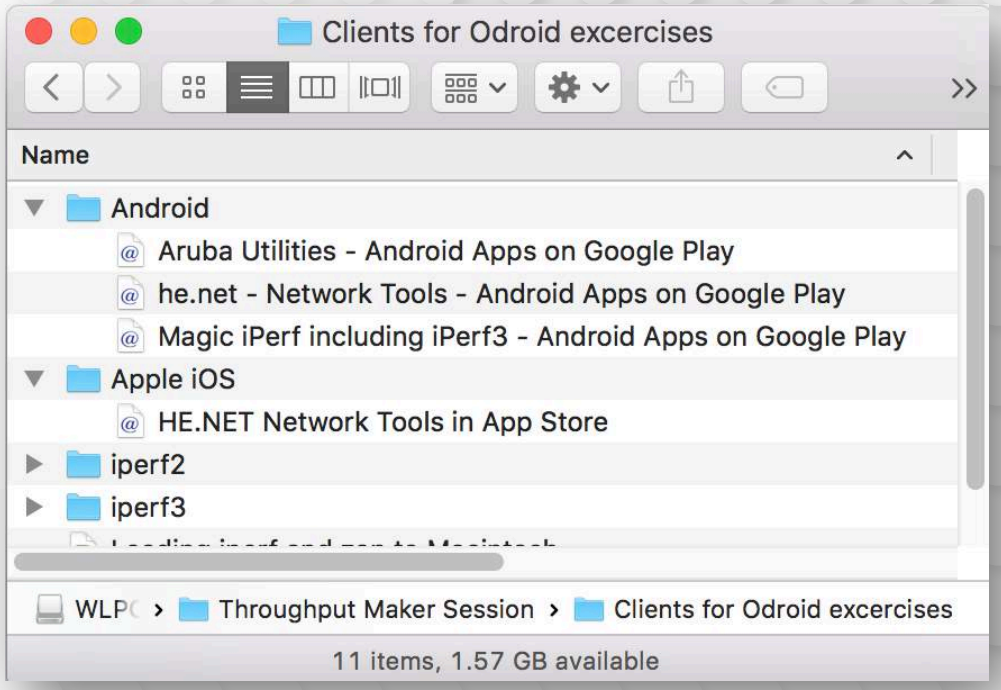


Install Mobile Clients

- Files are located on WLPC drive:

WLPC › Throughput Maker Session › Clients for Odroid excercises

- Install appropriate clients on your mobile device
  - Android - Play Store
    - Aruba Utilities
    - HE.NET Network Tools
  - Apple iOS - App Store
    - HE.NET Network Tools

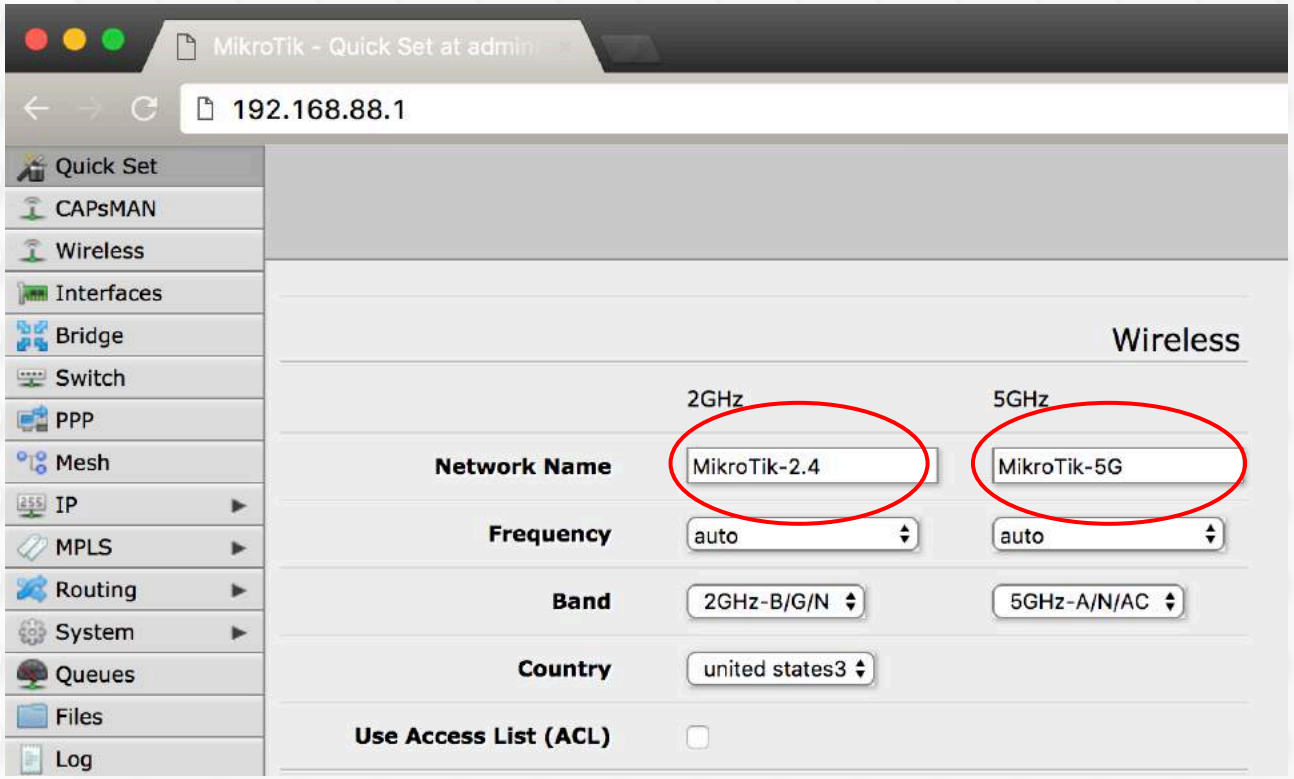


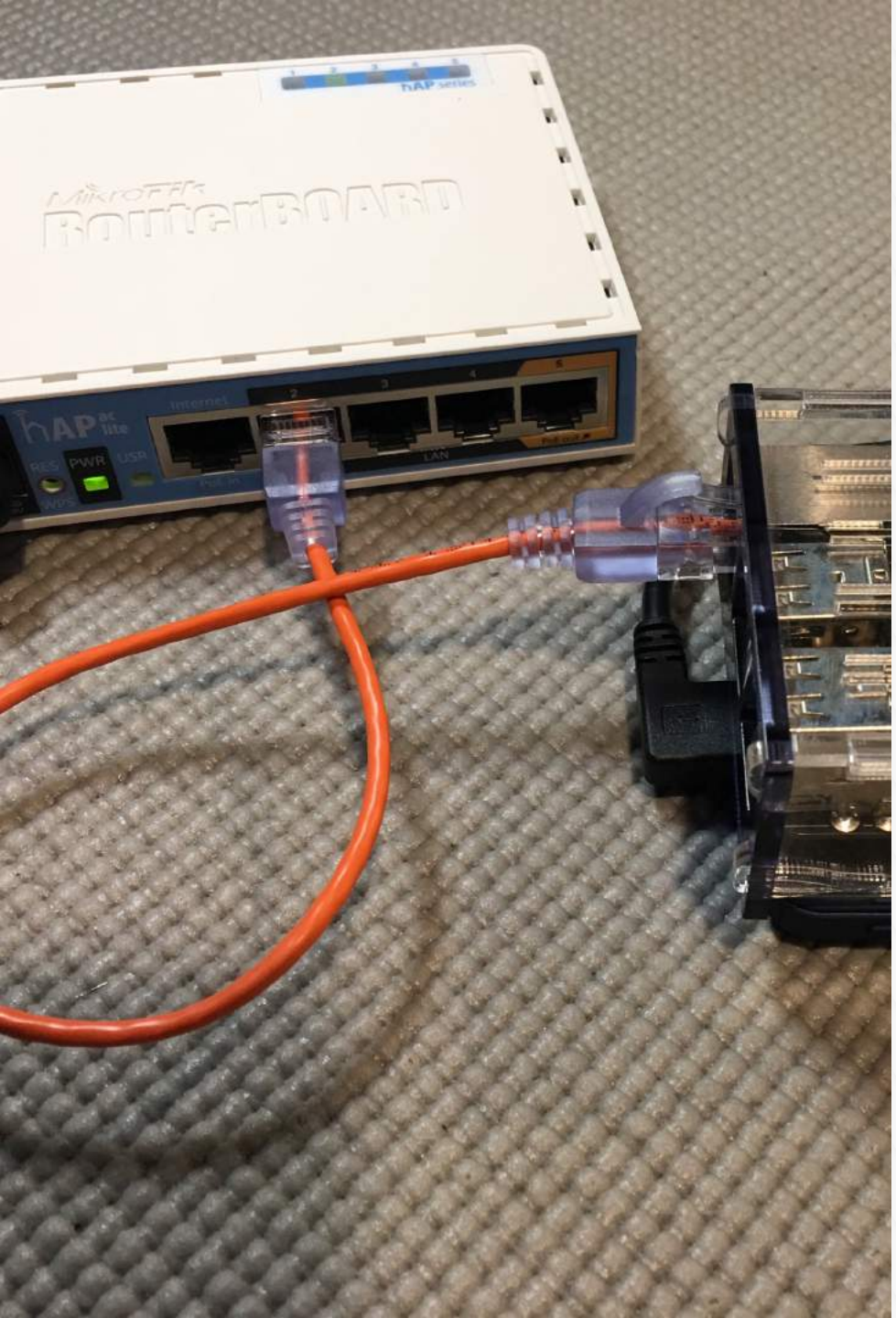
Powering On/Off

- Powering **on**
  - Once connected the KORAL Battery, the Odroid should power on automatically
  - Alternatively, the Odroid can be powered with any 5v/2a USB power source
- Powering **off**
  - Using the KORAL battery pack – press the power button twice

Configure your MikroTik SSID's

- Pick a team lead to configure the **MikroTik** at your table
- Connect to your **MikroTik** - preferably using wired Ethernet
- Open a web browser and navigate to 192.168.88.1
- Configure **separate** and unique SSID names for **2.4** and **5GHz**
- Example:
  - 2.4 GHz SSID: not-so-awesome-2.4G
  - 5 GHz SSID: super-awesome-5G





Connect Your Odroid

1. Connect your **Odroid** to the **MikroTik** using the **wired Ethernet ports 2-5**
   - Do NOT use Internet port
2. Power On the Odroid
3. The IP will display on the screen when the Odroid has finished booting

Connect Your Client Devices

- Connect your **Laptop** and/or **mobile devices** to either the 2.4 or 5GHz radios on your tables MikroTik.
- Notate the **IP address** each device obtained, we'll need these in the next steps

Login and Configure your Odroid

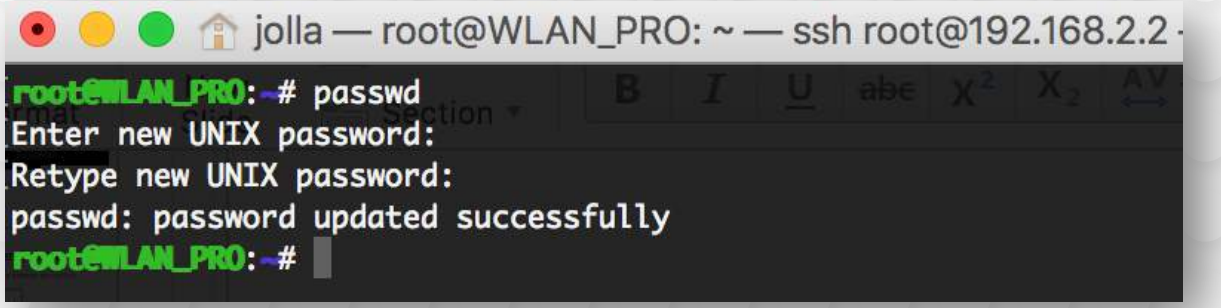
- SSH into the Odroid using an SSH client
  - Open **Terminal** (macOS) or **Putty** (Windows)

$ ssh root@A.A.A.A

Default password = wlanpro

- Change root password:

passwd



Prepare to run some tests

- Open a new terminal (macOS) or command prompt (windows)

Skip the next step if you successfully installed the iperf/zap clients using the emailed instructions

- Change directory (cd) to the location of the previously copied client files

$ cd ~/Desktop/iperf2/iperf-2.0.9-macOS/

Lets do some performance testing!

	Description	Client Application	Client OS
Task 1	Basic performance test	iperf	Windows or Mac
Task 2	Network consistency test	zap	Windows or Mac
Task 3	Graph Network Performance	WiFiPerf	Mac
Task 4	Visualize Network Performance	Ekahau Site Survey	Windows
Task 5	Mobile performance test	zap	Android or iOS
Task 6	Mobile performance test	Aruba Utilities	Android
Task 7	Mobile performance test	Hurricane Electric	Android or iOS
Task 8	Remote performance test	zap	Any
Task 9	Web browser Speedtest (HTML5)	Web Browser	Any

Task 1 - Basic Performance Test

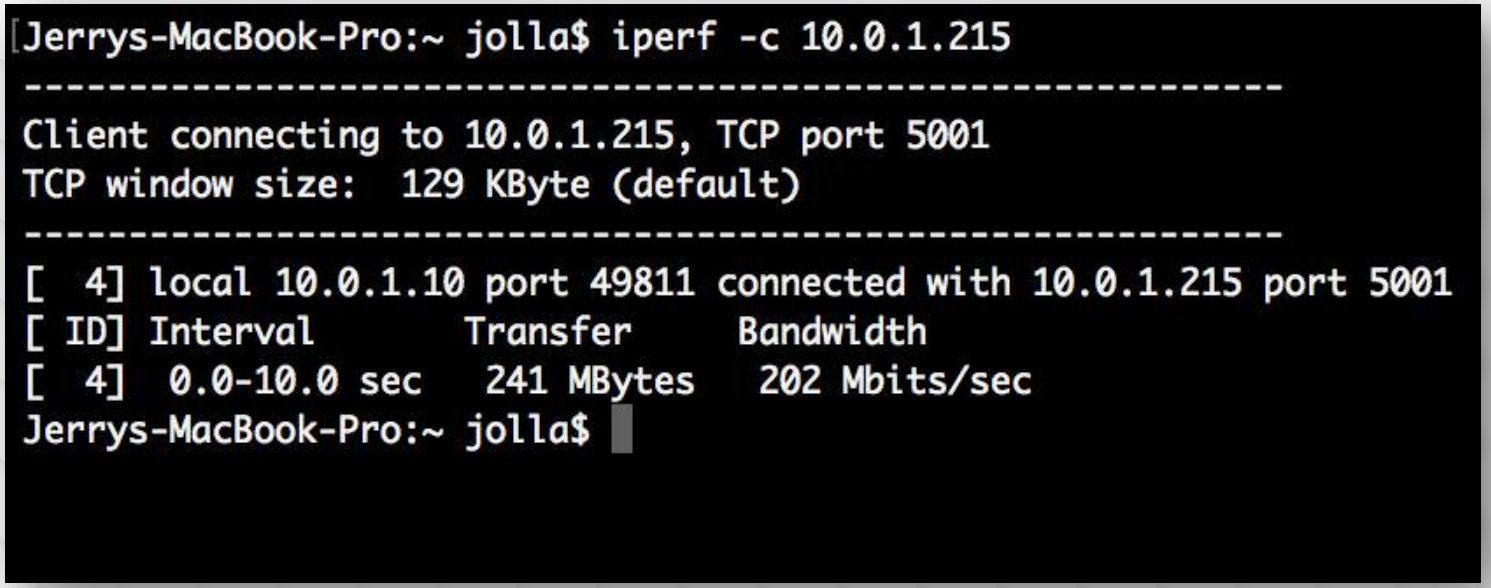
Use **iPerf2** & **iPerf3** to measure TCP & UDP network performance

1. Execute an iPerf test
   $ iperf -c A.A.A.A
2. Execute an iPerf3 test
   $ iperf3 -c A.A.A.A -p 5202

-c specifies client mode

A.A.A.A = Odroid IP

-p specifies port



Task 2 - Test Consistency

Use Ruckus **Zap** to measure the consistency of the network

1. Start **zapd**
   - Keep Zap daemon (zapd) running
2. Open a separate **terminal** (macOS) or **command prompt** (windows)
3. Run a zap test

   $ zap -sA.A.A.A -dB.B.B.B

-s specifies source IP

A.A.A.A = Odroid IP

-d specifies destination IP

B.B.B.B = Your devices IP

*do not put a space after -s or -d

```
Jerrys-MacBook-Pro:~ jolla$ zapd &
[1] 65230
Jerrys-MacBook-Pro:~ jolla$
zapd version 1.83, Copyright (C) 2004-2009
Built Jan  7 2017 at 18:27:45
Zapd service started
```

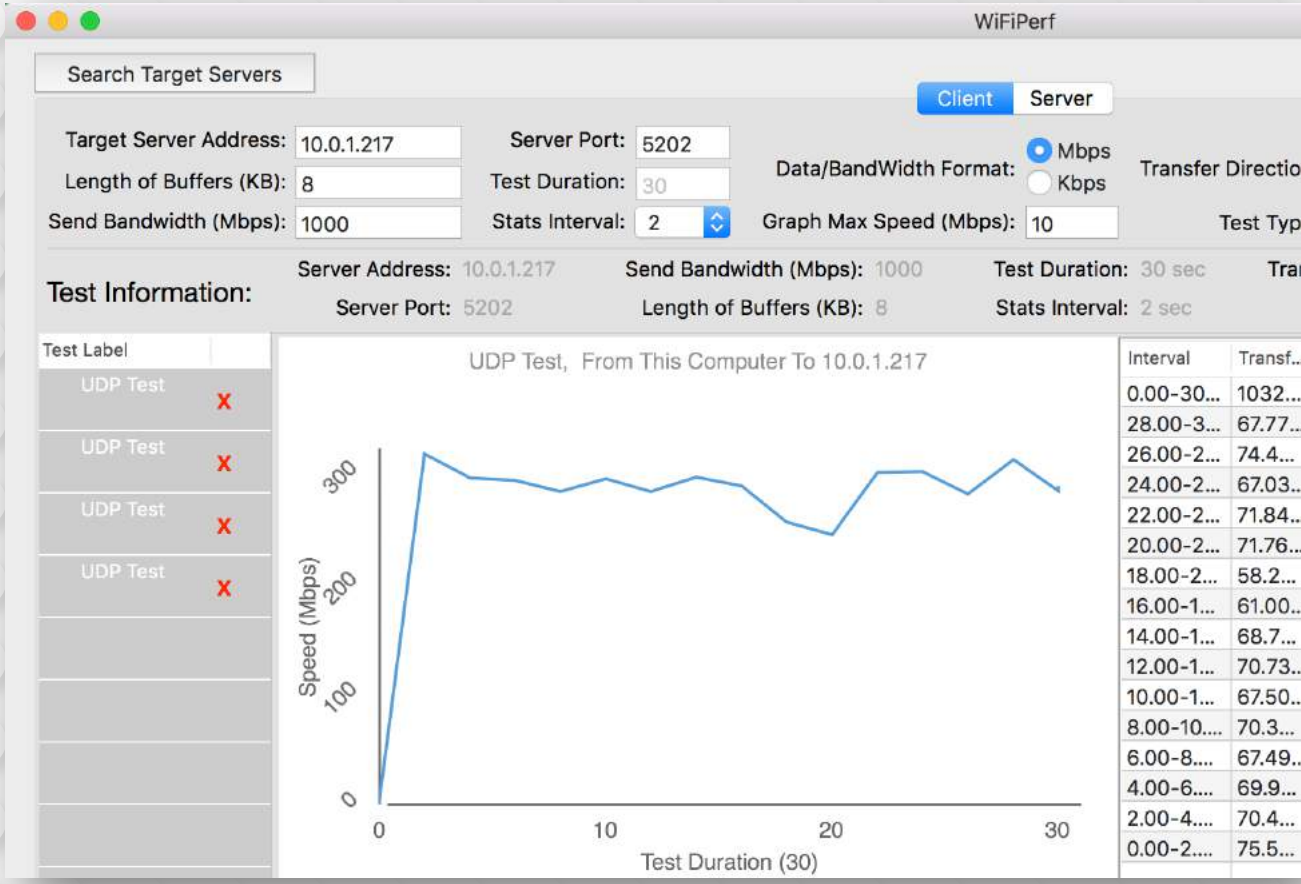
```
Jerrys-MacBook-Pro:~ jolla$ zap -s10.0.1.10 -d10.0.1.215
zap version 1.83, Copyright ( C ) 2004-2009 Ruckus Wireless, Inc. All Rights Reserved.
Built Jan  7 2017 at 18:27:44
Engaging default options -p50000 -n1000 -l1472 -q0x0

    0: 10.0.1.10->10.0.1.215    865=rx   0=dr   0=oo   0=rp   865=rx in    50.1ms   203.1mbps
    1: 10.0.1.10->10.0.1.215   1737=rx   0=dr   0=oo   0=rp   872=rx in    50.6ms   203.1mbps
    2: 10.0.1.10->10.0.1.215   2637=rx   0=dr   0=oo   0=rp   900=rx in    50.5ms   209.9mbps
    3: 10.0.1.10->10.0.1.215   3499=rx   0=dr   0=oo   0=rp   862=rx in    50.2ms   202.4mbps
    4: 10.0.1.10->10.0.1.215   4381=rx   0=dr   0=oo   0=rp   882=rx in    52.2ms   198.8mbps
```

Task 3 - Network Performance Graph

Use **WiFiPerf** to measure and graph TCP & UDP network performance on **macOS**

1. Start WiFiPerf (macOS)
2. Configure WiFiPerf settings
   - Target Server Address: A.A.A.A
   - Server Port: 5202
3. Run Test

A.A.A.A = Odroid IP



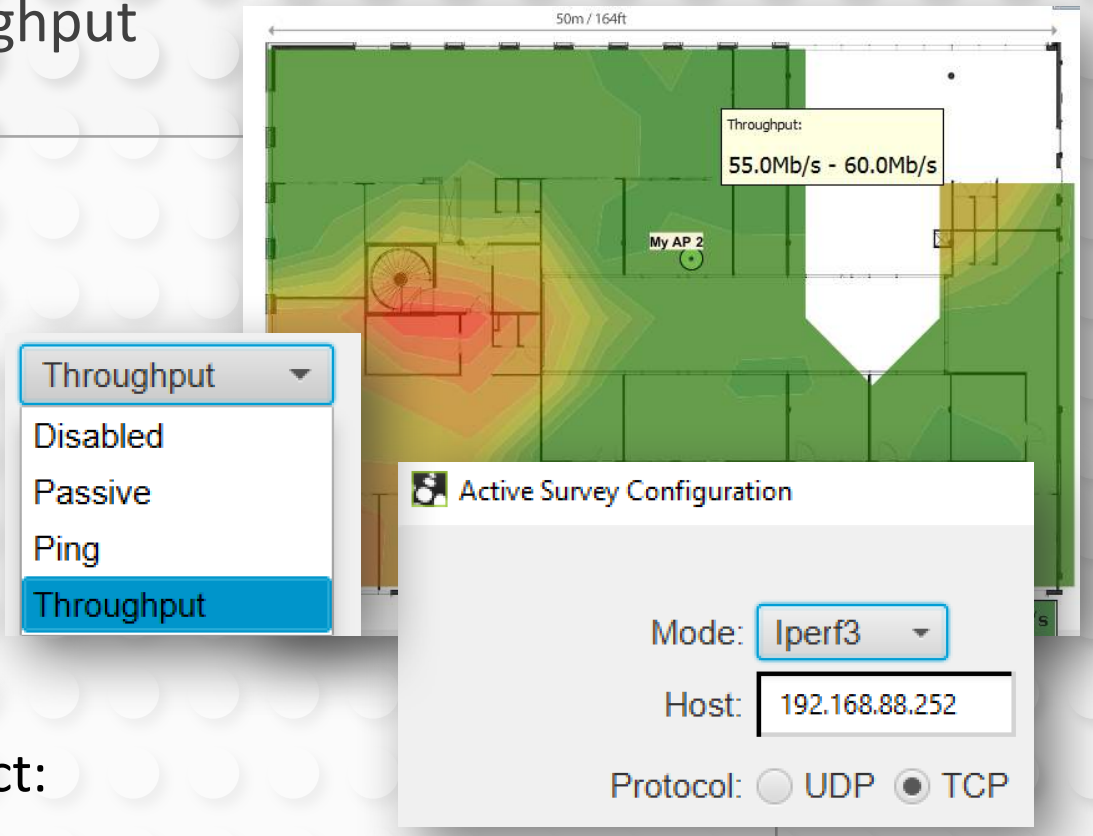
Task 4 - Visualize Network Performance

Ekahau Site Survey can be used to create heatmaps - visualizing network measurements of Jitter, Packet Loss, and Throughput

1. Connect your internal Wi-Fi adapter to the SSID you want to test
1. Start Ekahau Site Survey (Windows version)
2. Configure internal adapter for Throughput
    - Mode: iPerf3
    - Host: A.A.A.A
3. Perform a Stop-and-Go Survey

or

1. Open and analyze the sample throughput project: Throughput-Project-Example.esx

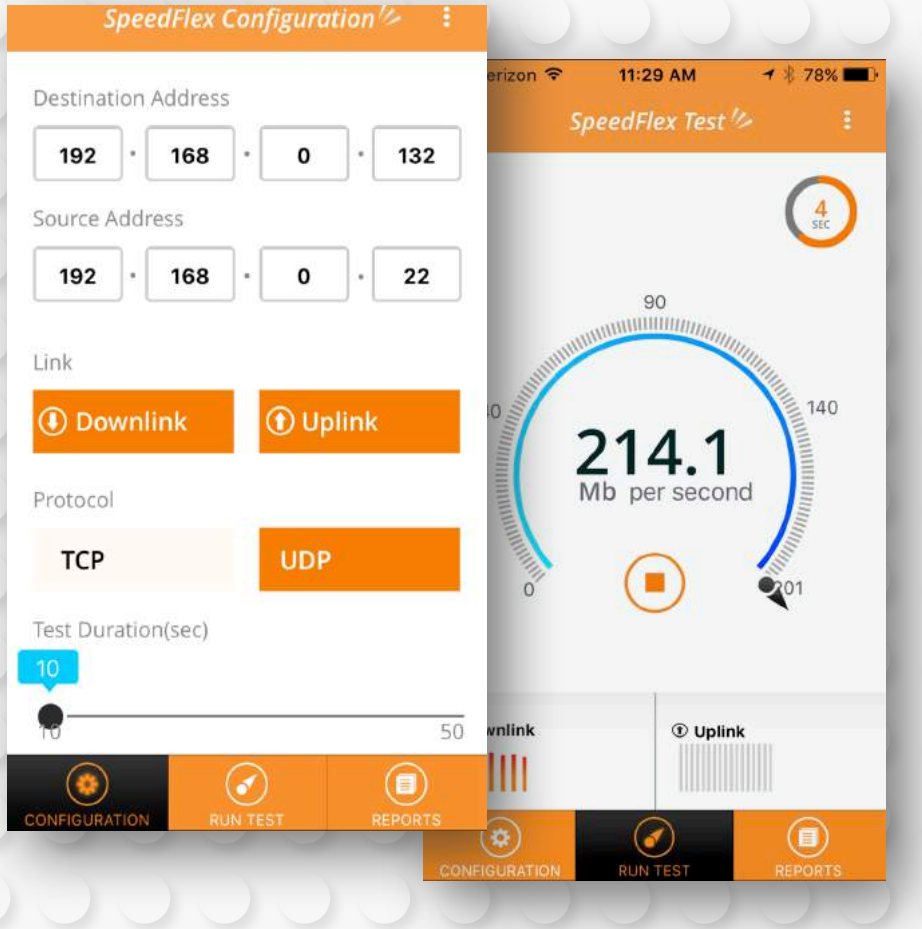


Task 5 - Mobile Performance Test #1

Use **Ruckus SpeedFlex** to measure the network performance from an **Android** or **iOS** mobile device

1. Start SpeedFlex
2. Configure SpeedFlex settings
   - Destination Address: A.A.A.A
3. Run Test

A.A.A.A = Odroid IP



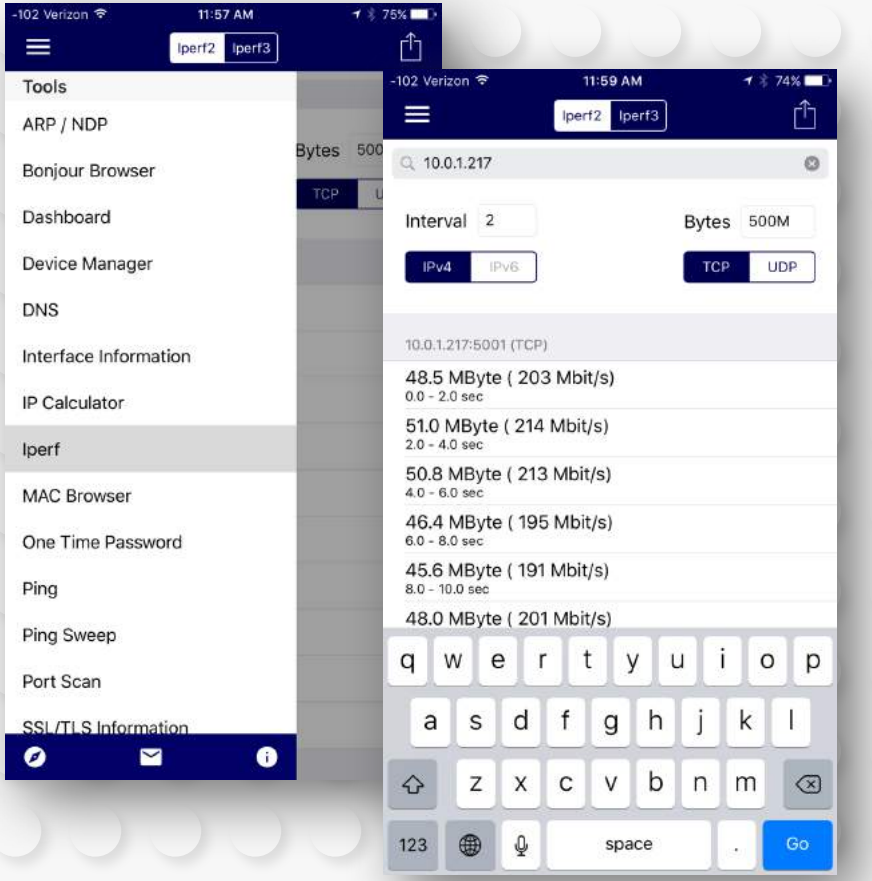
Task 6 - Mobile Performance Test #2

Use **H/E Network Tools** to perform an iperf2/3 measurement from **Android** or **iOS**

1. Start H/E Network Tools
2. Select iperf from the list of tools
3. Configure iPerf settings
    - Select: iperf2
    - iperf2 Server: A.A.A.A
    - Interval: 2
    - Bytes: 500M
4. Select field at top and click Go

*To use iperf3, select iperf3 and specify port **5202**

Example: A.A.A.A -p 5202



Task 7 - Mobile Performance Test #3

Use **Aruba Utilities** to run an iPerf test from an **Android** device

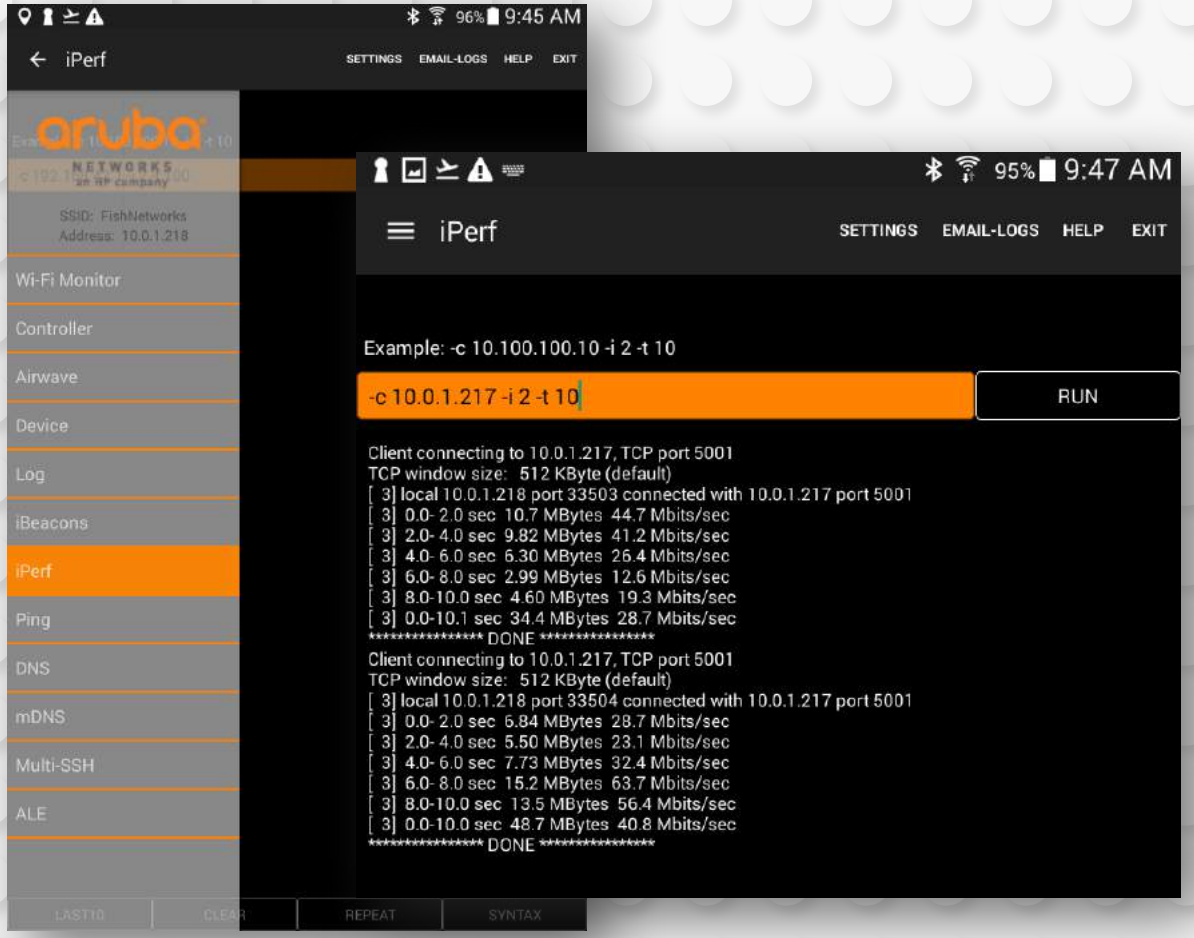
1. Start Aruba Utilities (Android)
2. Select iPerf from the list
3. Configure iPerf settings

   -c A.A.A.A -i 2 -t 10

   -c connect to an iPerf server at specified IP

   -i sets the reporting interval time in seconds

   -t time in seconds to run test for
4. Run



Task 8 - Remote test between 2 devices

Use **Zap** to remotely measure the network performance between two devices

1. Start Zapd or Ruckus SpeedFlex on any two devices

   Example: iPhone running SpeedFlex and Odroid running zapd

2. Run a remote zap test from Windows or Mac

   $ zap -sA.A.A.A -dB.B.B.B

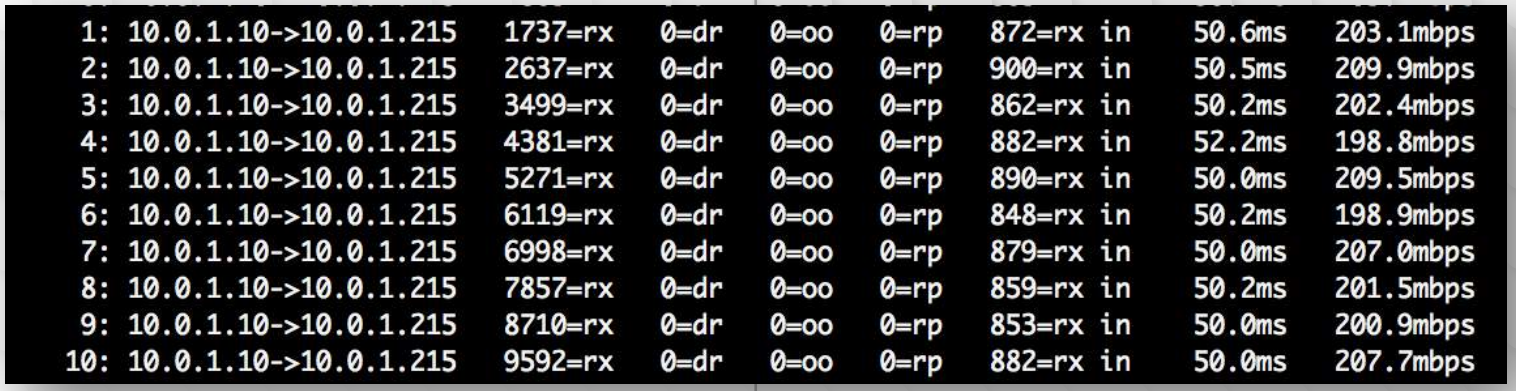
-s specifies source IP

A.A.A.A = IP of Device 1

-d specifies destination IP

B.B.B.B = IP of Device 2

*do not put a space after -s or -d

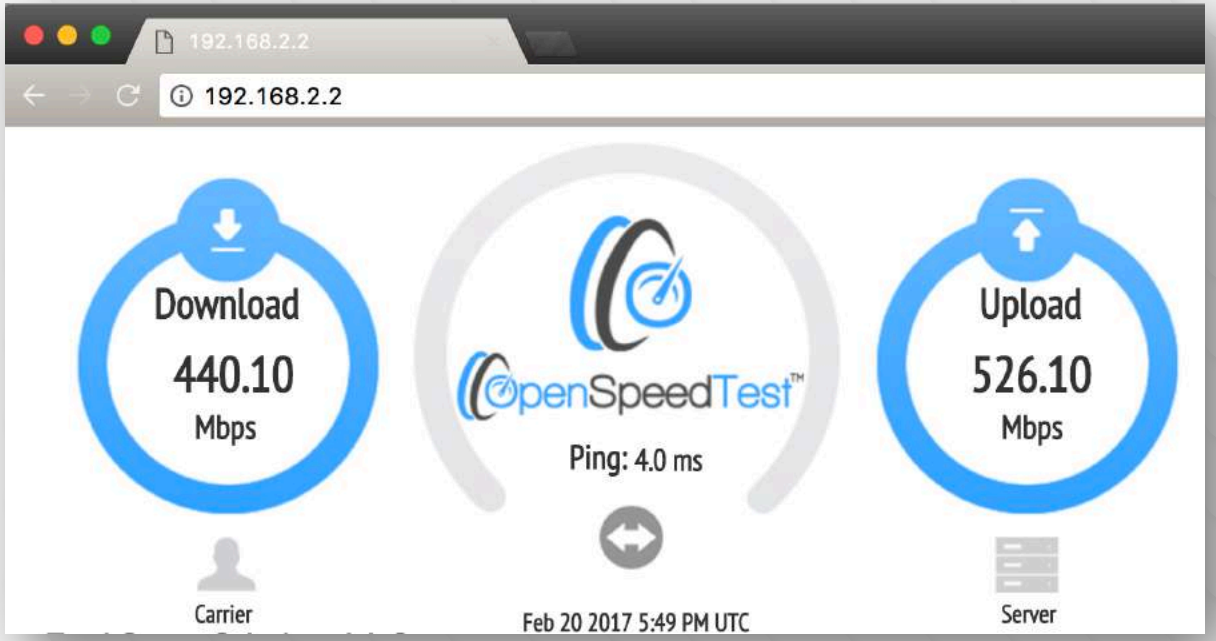


Task 9 - Web browser Speedtest (HTML5)

Use **OpenSpeedTest** to test the throughput of the network

1. Open a **web browser**
2. Navigate to the **IP address** of Odroid
3. Click "Start Testing Speed"

**Test is performed locally, however an internet connection is required for OpenSpeedTest to work*



What else can this Odroid box do?

Description	Client Application	Client
Turn your Odroid into a Wireless AP	SSH client	Windows or Mac
Analyze Live Wi-Fi Traffic with HORST	SSH client	Windows or Mac
Turn your Odroid into a remote WiFi sensor	WiFi Explorer Pro (beta)	Mac

Physical Buttons

- **Button 1** = Toggle LCD Screen On/Off
- **Button 2** = Toggle WiFi Explorer Pro Sensor
- **Button 3** = Toggle Wireless AP / Hotspot
- **Button 4** = Launch LXDE Desktop

Button scripts located in:

/boot/lcd_buttons/

Special thanks to Adrian Granados (**@adriangrandos**)

Turn your Odroid into a Wireless AP

1. Insert the USB Wi-Fi Adapter
2. Configure your AP
   - Locate and edit the AP config file:

     /boot/ap.txt

     ```
     # nano /boot/ap.txt
     ```

   - Modify at least the following settings:
     - ssid=WLAN_PRO
     - wpa_passphrase=changeme
     - channel=36
3. Press button 3 to Start/Stop the AP

H.O.R.S.T

Highly Optimized Radio Scanning Tool

lightweight IEEE802.11 wireless LAN analyzer with a text interface

http://br1.einfach.org/tech/horst/

By: Bruno Randolf

https://twitter.com/spiralsun69

horst

Note: "horst" has moved to GitHub: https://github.com/br101/horst! This information here is just kept for reference!

"horst" is a small, lightweight IEEE802.11 wireless LAN analyzer with a text interface. Its basic function is similar to tcpdump, Wireshark or Kismet, but it's much smaller and shows different, aggregated information which is not easily available from other tools. It is mainly targeted at debugging wireless LANs with a focus on ad-hoc (IBSS) mode in larger mesh networks. It can be useful to get a quick overview of what's going on on all wireless LAN channels and to identify problems.

- Shows signal (RSSI) values per station
- Calculates channel utilization ("usage") by adding up the amount of time the packets actually occupy the medium
- "Spectrum Analyzer" shows signal levels and usage per channel
- Graphical packet history, with signal, packet type and physical rate
- Shows all stations per ESSID and the live TSF per node as it is counting
- Detects IBSS "splits" (same ESSID but different BSSID – this is a common driver problem)
- Statistics of packets/bytes per physical rate and per packet type
- Has some support for mesh protocols (OLSR and batman)
- Can filter specific packet types, source addresses or BSSIDs
- Client/server support for monitoring on remote nodes

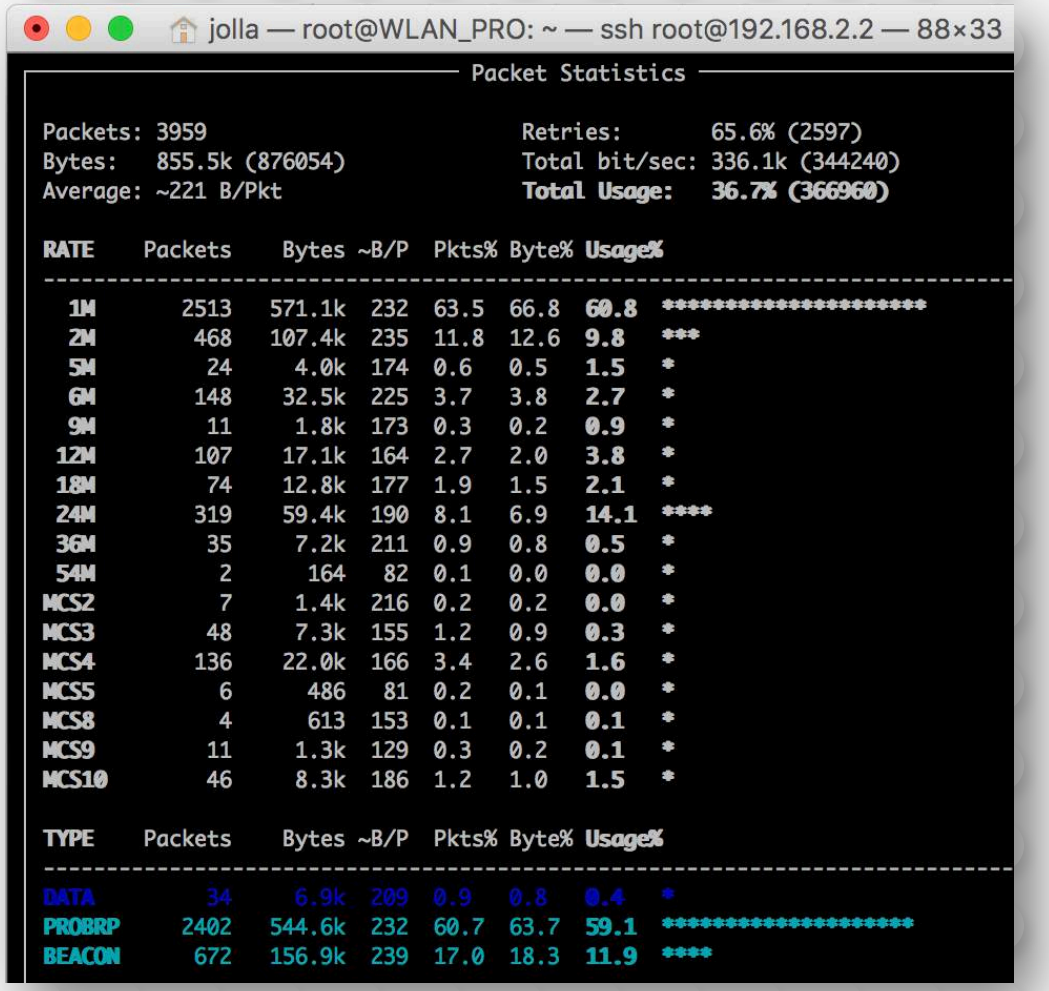
More info: https://github.com/br101/horst

HORST - Getting started

1. Power Cycle Odroid
2. Insert USB Odroid WiFi Module
3. SSH into Odroid

4. Launch Horst

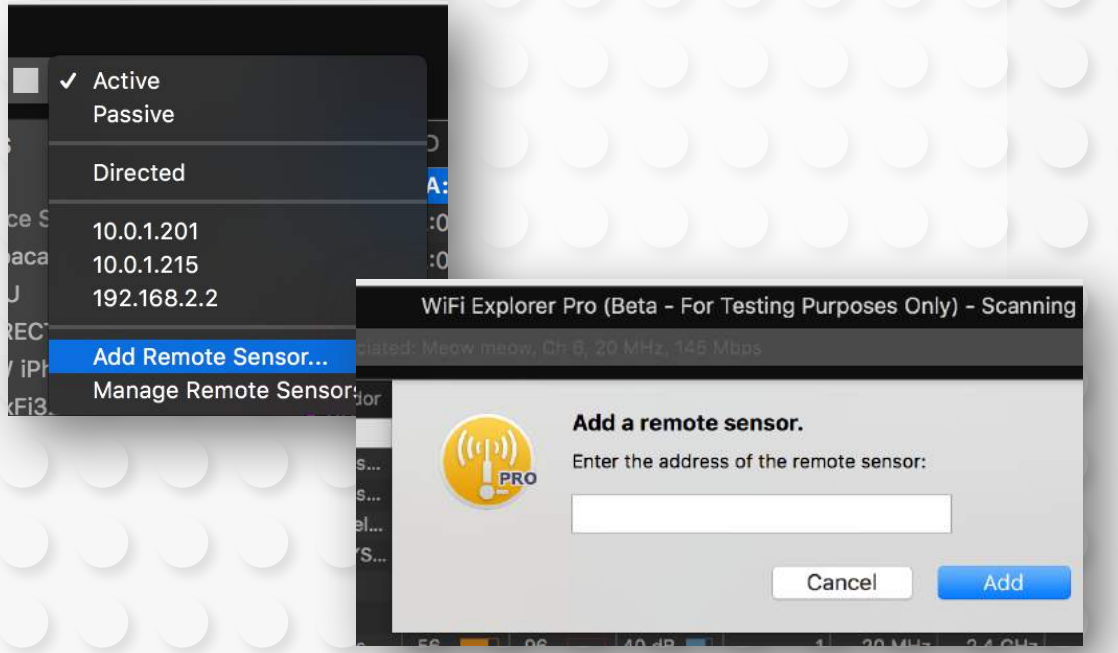
horst



WiFi Explorer Pro Remote Sensor

- Odroid:
  - Press button #2 to enable and disable the wifiexplorer-sensor service
  - SSH command line # service wifiexplorer-sensor start/stop

- macOS Client:
  - Start WiFi Explorer Pro (beta)
  - Add Odroid as a Remote Sensor



Thank you!