Wireless Network Basics

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Enabling Research & Education Collaboration

Outline

1. Introduction
2. Wi-Fi Basics
3. Channel Management
4. Tools
5. What equipment to buy

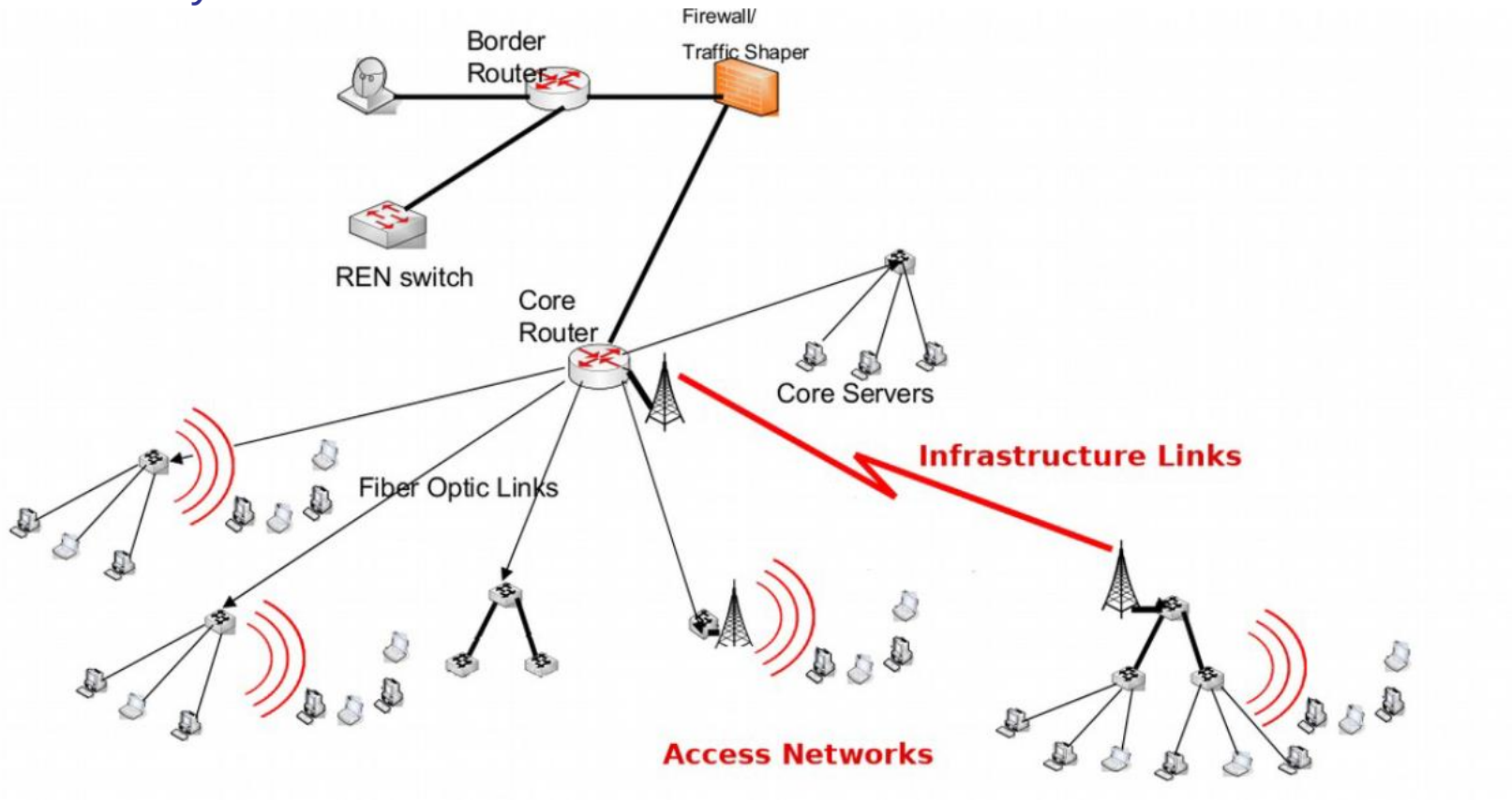
   Utilisation

Objective

To ensure that we can deploy and troubleshoot wireless networks.

Introduction – What can we use wireless for?

- Communication based on radio waves.
- Can be used for Access Networks or Infrastructure Links.
- Wireless signal usually measured as RSSI in dBm. -30 dBm > -40 dBm



What is Wi-Fi?

- Wi-Fi is basically when we use wireless for access networks.
- IEEE 802.11 set of wireless standards.
- Wi-Fi can run in the ISM band, typically deployed in ISM (Industry, Scientific, Medical) band which is not licensed.
- Two main Access Wi-Fi bands – 2.4 GHz and 5 GHz

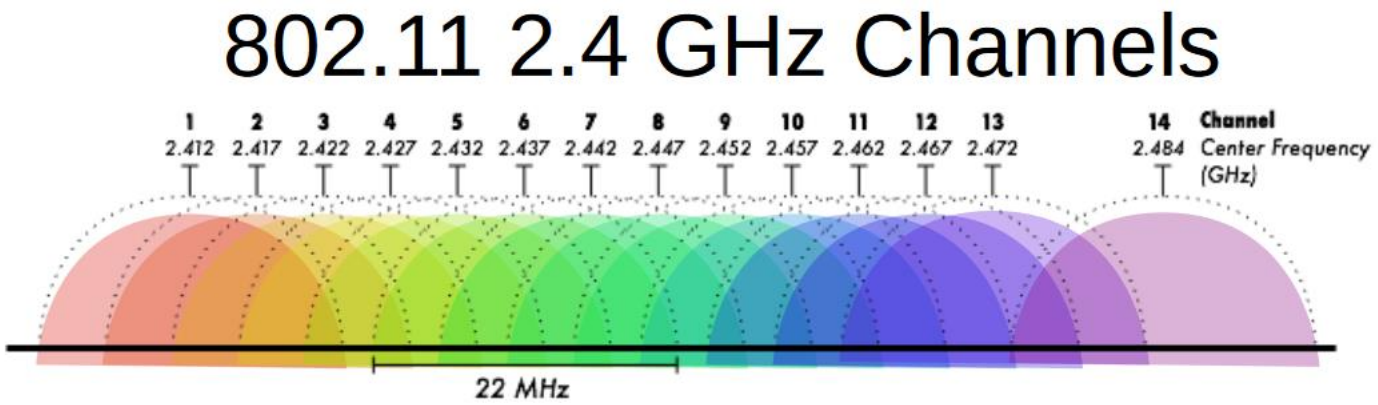
Standard	Data rate [Mbps]	Frequency [GHz]
802.11b	11	2.4
802.11a	54	5
802.11g	54	2.4
802.11n	150/300/600	2.4 / 5
802.11ac	1300	5
802.11ax	11000 (?)	2.4 / 5

New Wi-Fi standard names

802.11W	Year	New name / brand
802.11b	1999/2012	(Wi-Fi 1 unofficial)
802.11g	2003	(Wi-Fi 3 unofficial)
802.11a	1999/2012	(Wi-Fi 2 unofficial)
802.11n	2009	**Wi-Fi 4**
802.11ac	2013	**Wi-Fi 5**
802.11ax	(2020)	**Wi-Fi 6**
802.11ax with 6 GHz	(2020)	**Wi-Fi 6E**

Channel Management

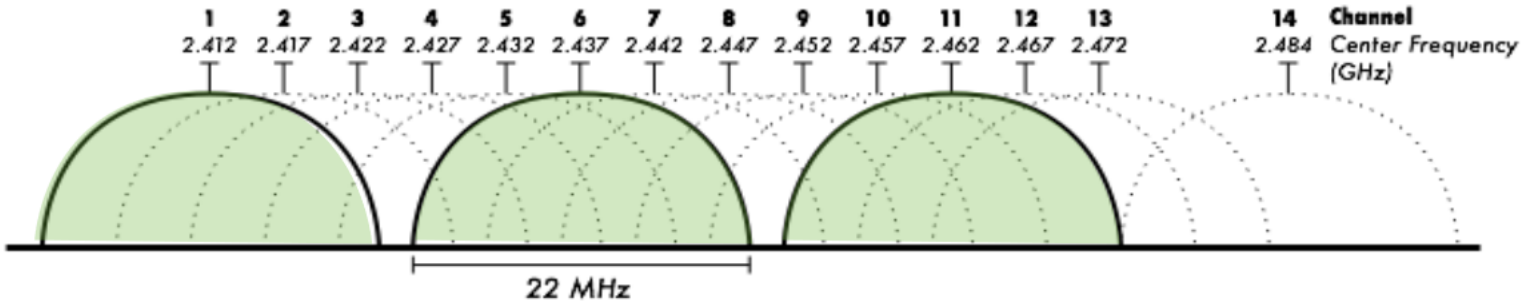
- Each band is divided into channels.
  - 2.4 GHz band has14 overlapping channels of 22 MHz
  - 3 of these 14 channels do not overlap with each other; Channels 1,6, and 11
  - 5 GHz band has 25 non-overlapping channels of 20 MHz but can be aggregated to 40 MHz and 80 MHz.



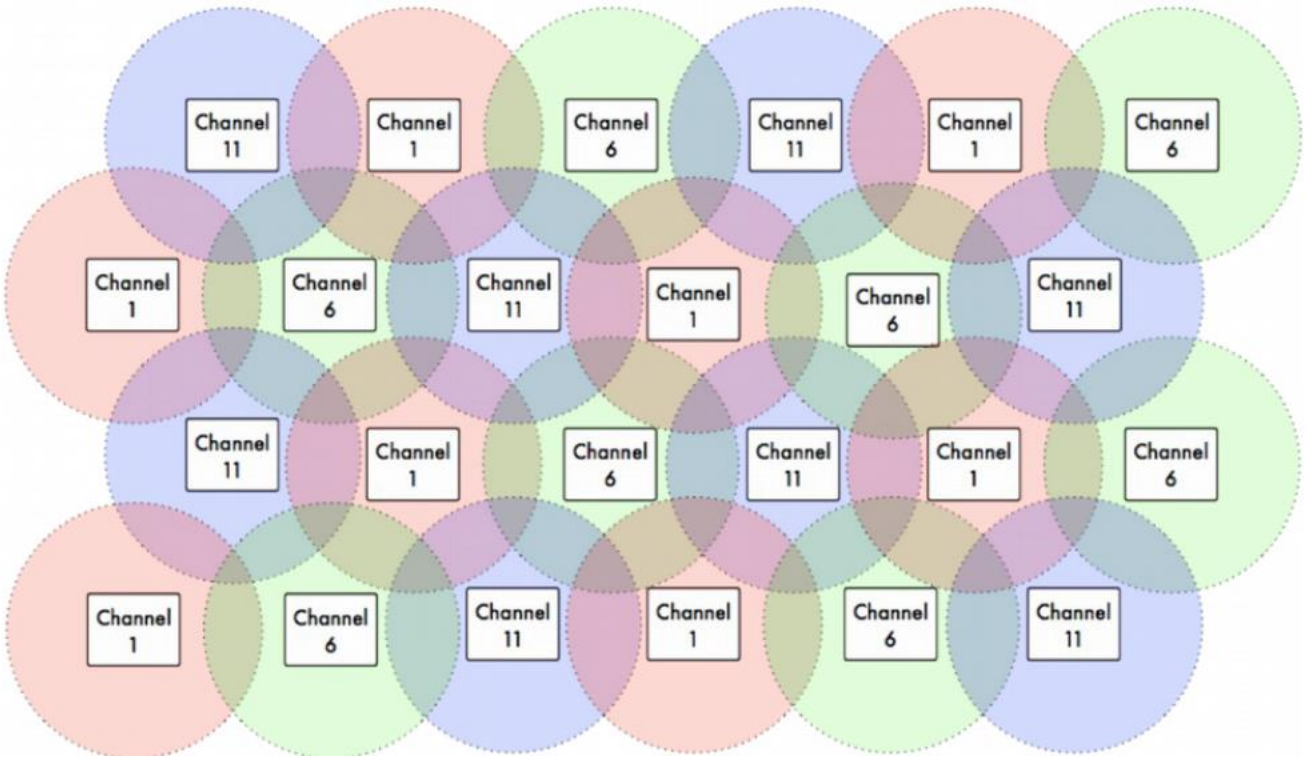
- Downside of 2.4 GHz is the overlapping channels!

Channel Management

- Too bad 2.4 GHz can not be avoided.
- Work around, use the 3 non-overlapping channels for A.Ps in proximity.
- Bad design case scenario: 1 A.P in Channel 1 and Nearby A.P in Channel 2 results in Adjacent Channel Interference.
- Good design scenario; for 3 A.Ps close to each other channels 1,6,and 11 should be used for each.



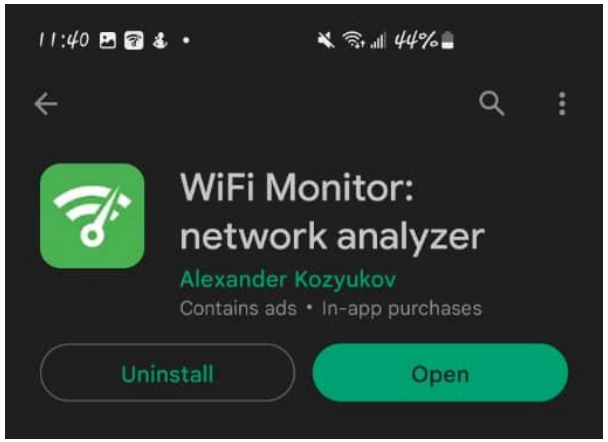
More than 3 APs in the same space?



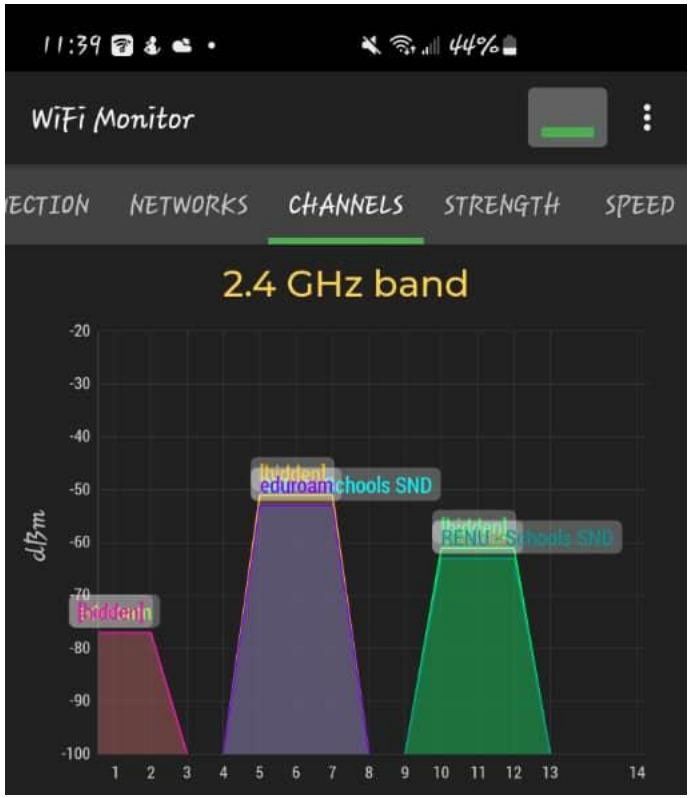
Tools

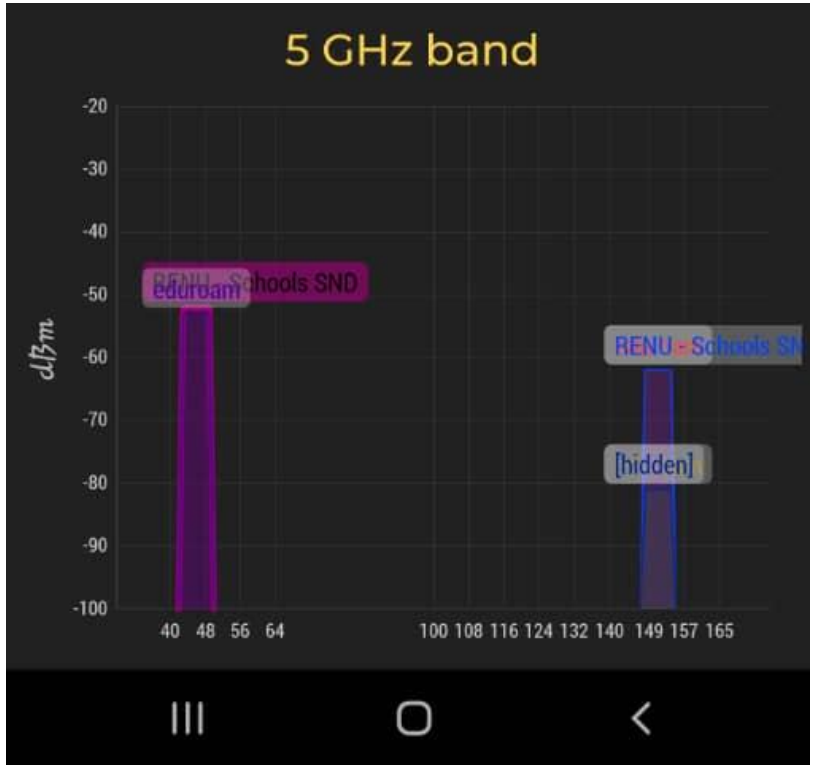
- Design tools allow you to plan for your wireless network using a simulation environment. Examples;
  - Unifi Design Center for Unifi.
  - Huawei WLAN Planner.
- Spectrum analyzing apps can also help in channel management decisions.

Task: Download WiFi Monitor app on your phone!



Output


11:39
44%
WiFi Monitor
NETWORKS
CHANNELS
STRENGTH
SPEED
2.4 GHz band
dBm
-20
-30
-40
-50
-60
-70
-80
-90
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14
eduroam
RENU - Schools SND


5 GHz band
dBm
-20
-30
-40
-50
-60
-70
-80
-90
-100
40 48 56 64
100 108 116 124 132 140 149 157 165
[hidden]

What equipment should you buy?

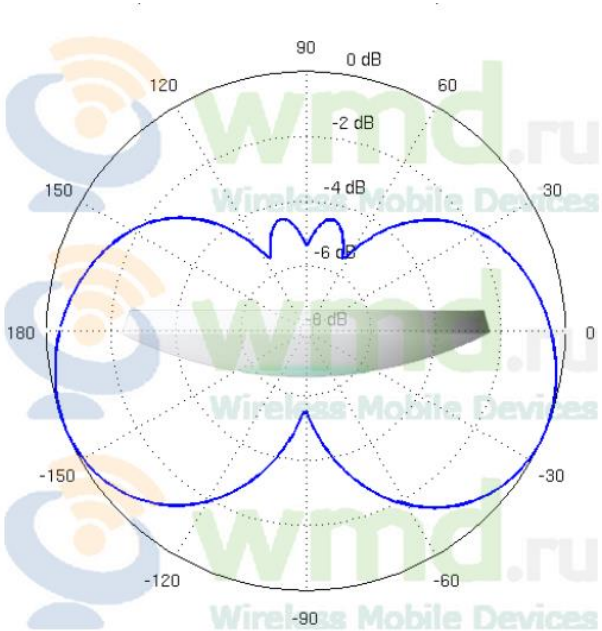
- For A.Ps to be deployed outside. Deploy Outdoor A.Ps.
- Managed (With controller management) VS Unmaged
  - Managed is more costly.
  - Unmanaged AP means more manual work.
- Merits of managed APs.
  - Automatic channel optimization.
  - More control over AP performance (power) and user experience.
  - Easy scalability and more functionality.
  - Examples of vendors who make managed APs; CISCO, UBIQUITI, and ARUBA.
  - Examples of Unmanged; TP-Link, and D-Link

Powering APs

- Power of Ethernet (PoE) Switches
- Power over Ethernet adapter.
  - Matching your device power rating.

Where to place the AP?

- Target the users.
- How?
  - Know the radiation pattern of your access point.
  - Survey your target coverage and choose the best position.

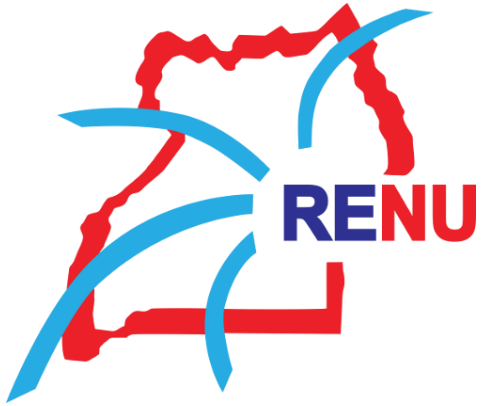


Deploying an AP?

- Physical Installation - Deploy APs
- Layer 2: SSID (network name)
  - Human readable.
  - Roaming consideration – Same SSID.
- Layer 3: IP Planning
- Authentication
  - Pre-shared keys
  - Enterprise Authentication.

Point-to-Point link

- Line of Sight.
- Spectrum analysis.
- AP power can cover distance and losses. (Link Budget)



Thank You