



# Why Wi-Fi Doesn't Work

**Peter Mackenzie**

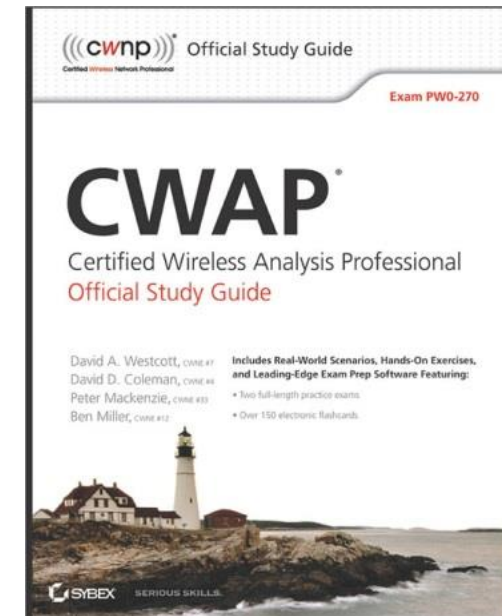
**MarQuest Limited**

**@mackenziewifi**

- Peter Mackenzie
  - Head of Technical Operations (MarQuest Limited)
  - CWNT & CWNE #33
  - SVCNX – Savvius Certified Network Expert
  - CTI – Extreme Certified Technical Instructor
  - RWCTI – Ruckus Certified Technical Instructor
  - CWNE Roundtable member
  - Served on the CWNE Board



@mackenziewifi



Co-author of the CWAP study Guide

# The Wi-Fi Doesn't Work

Signal keeps dropping out

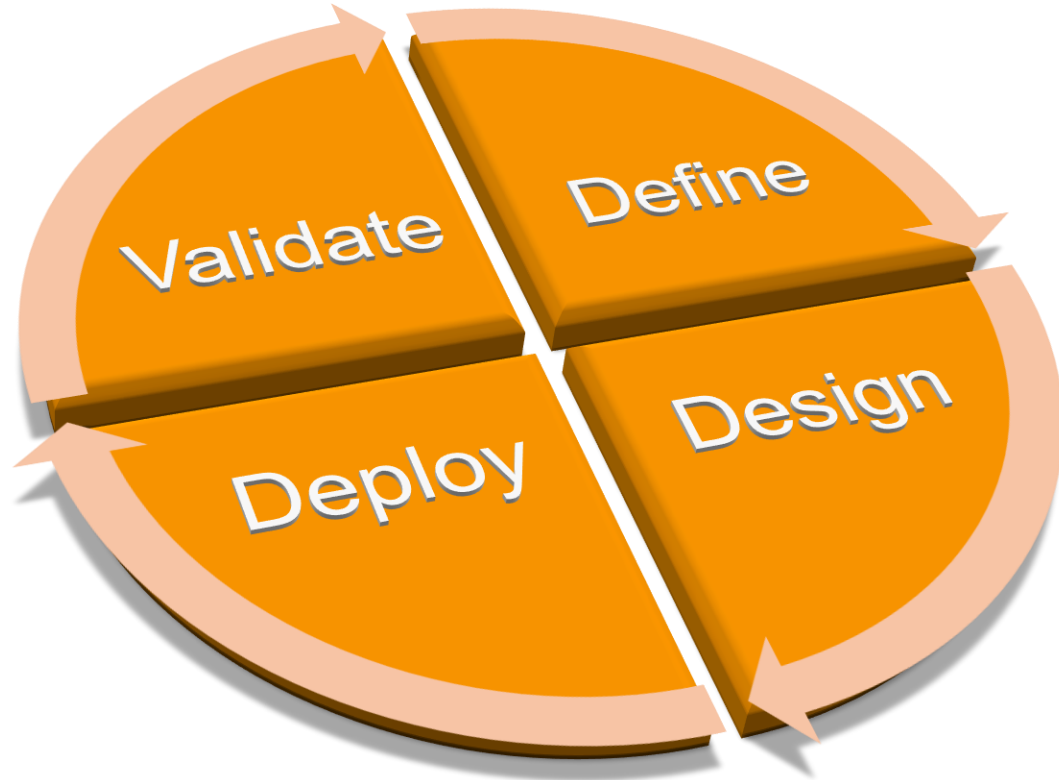
The Wi-Fi is slow

Wi-Fi is rubbish

No Wi-Fi signal in here!



# Design, Design, Design!

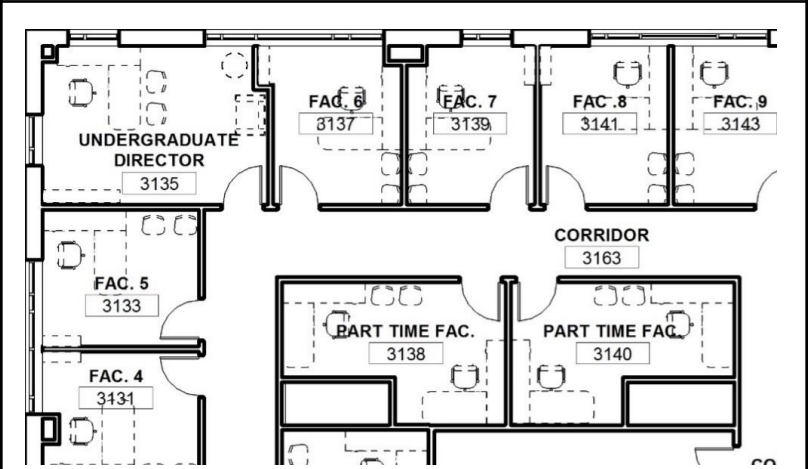


No. 1 reason the wi-fi doesn't work is bad design!

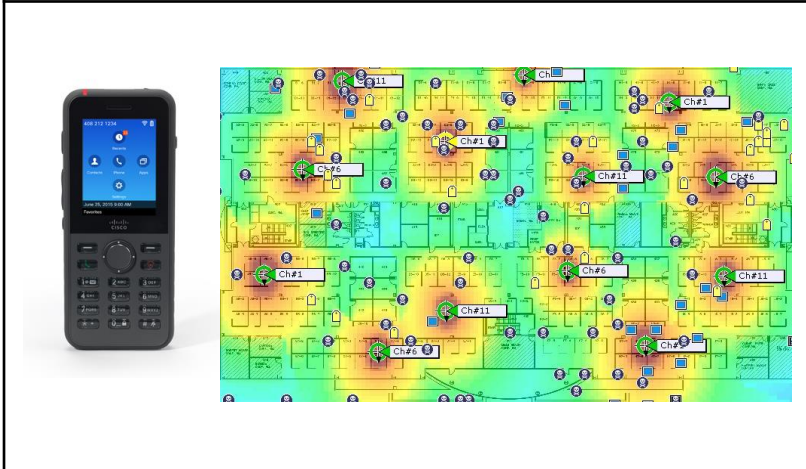
Proper wireless design is the key to a successful wireless network deployment

# Requirements Capture

### Building Plans\Wall Attenuation



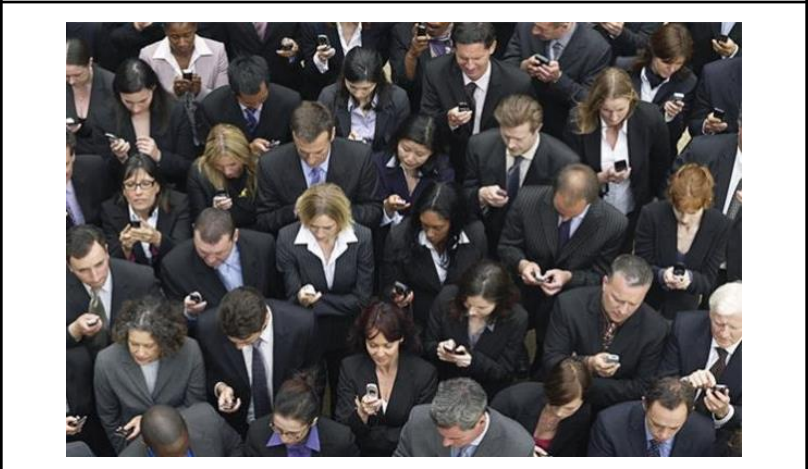
### Purpose



### Coverage Areas



### Capacity



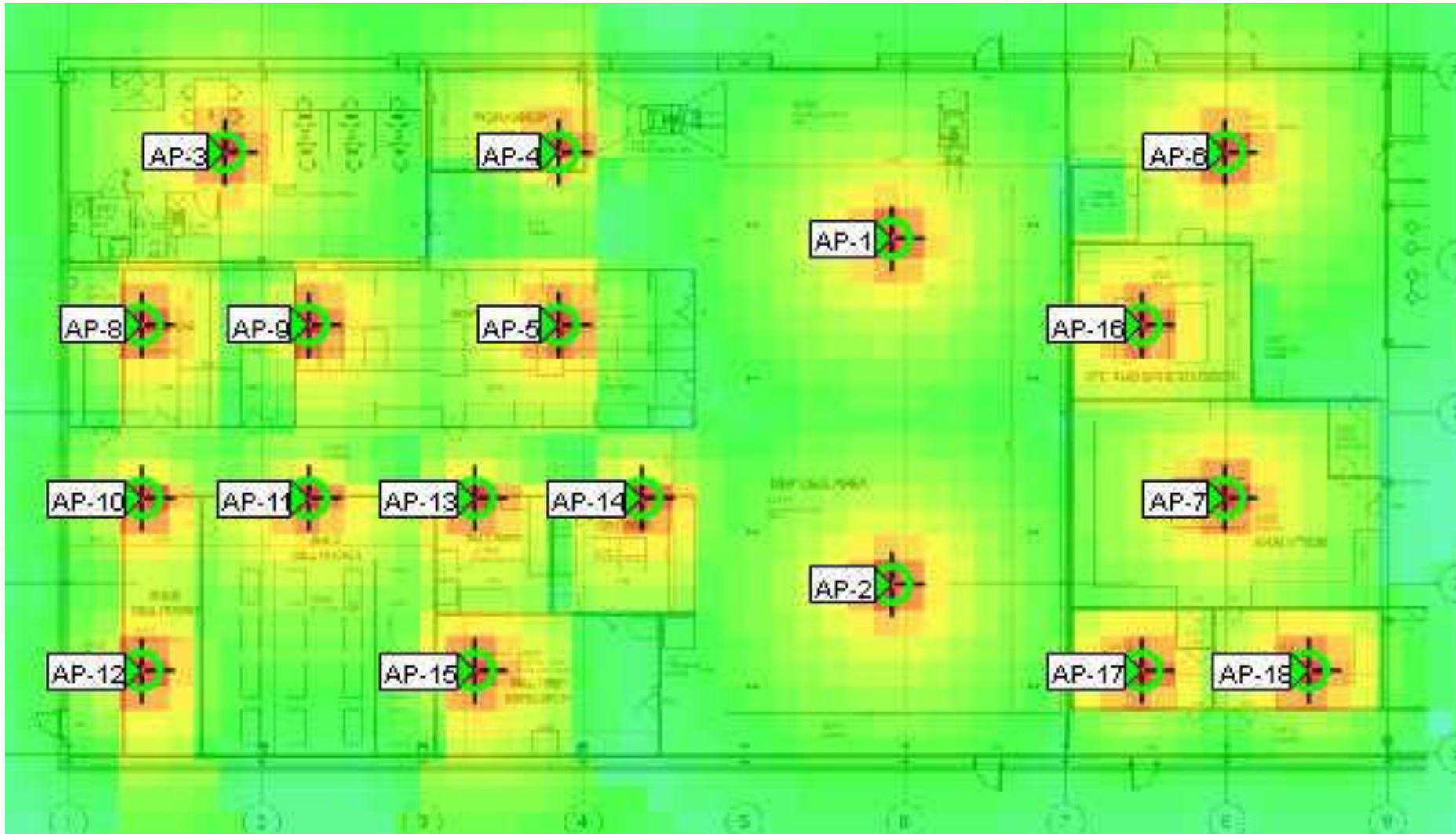
### Clients



### Applications



## Green ≠ Good



# Receiver Sensitivity

Device	2.4GHz Signal Strength	Diff.	5GHz Signal Strength	Diff.
Lenovo X220	-49dBm	-	-52dBm	-
Galaxy Note 3	-66dBm	17dB	-56dBm	4dB
iPhone 6 Plus	-58dBm	9dB	-69dBm	17db

## Lenovo X220

× trinitylane

MAC Address	Channel	PHY Type	Security	Max Data Rate	Signal
84:24:8D:A7:CA:A0	11	b, g, n	WPA2-Personal	144.4	-49
84:24:8D:A8:3E:C0	36+40	n	WPA2-Personal	300	-52

## Galaxy Note3

trinitylane (84:24:8d:a7:ca:a0)  
CH 11 2462 MHz MOTOROLA SOLUTION...  
-66 dBm  
WPA2

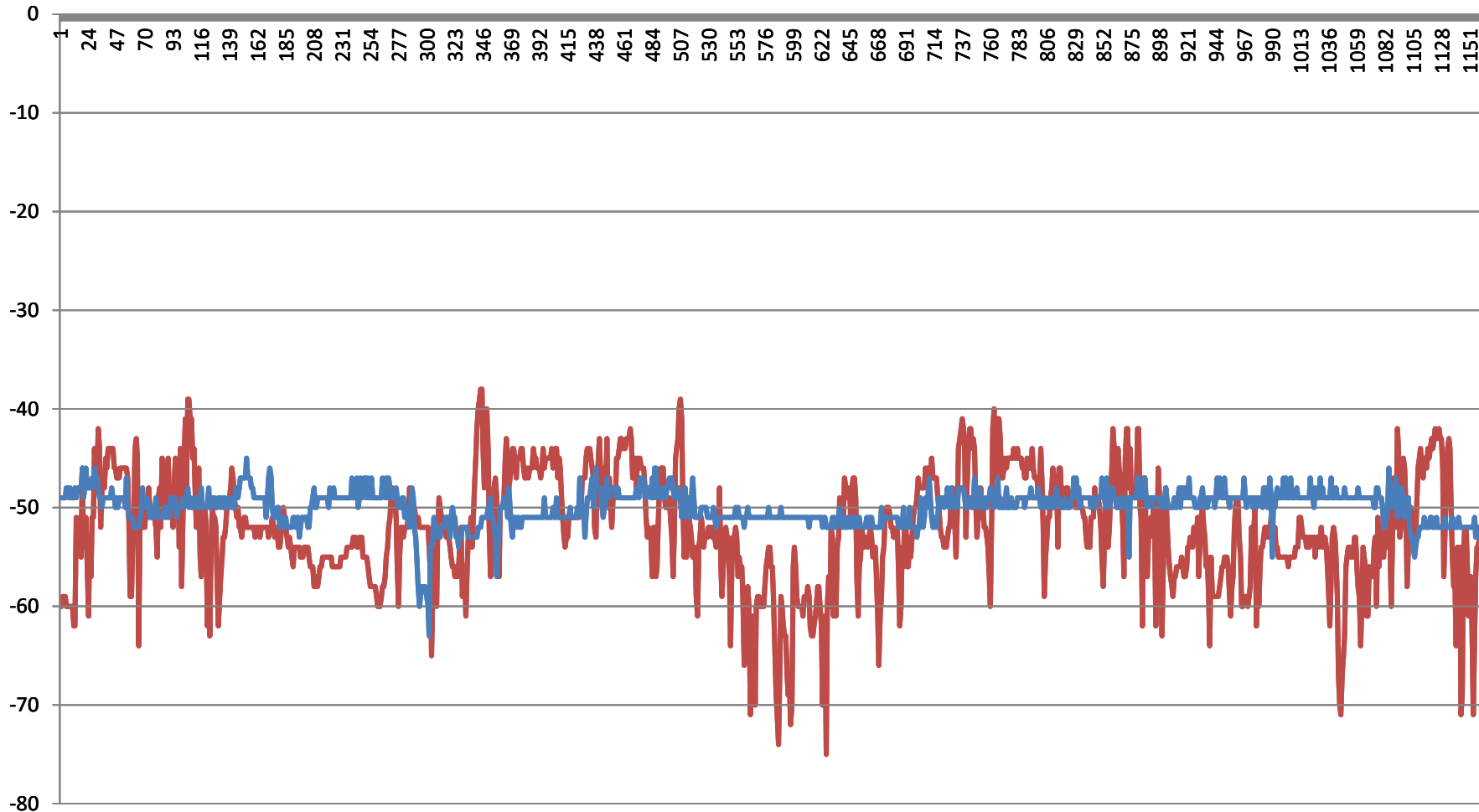
trinitylane (84:24:8d:a8:3e:c0) 5G  
CH 36 5180 MHz MOTOROLA SOLUTION...  
-56 dBm  
WPA2

## iPhone 6 plus

trinitylane  
84:24:8D:A8:3E:C0  
RSSI -58 dBm  
Channel 36  
15:43:54

trinitylane  
84:24:8D:A7:CA:A0  
RSSI -69 dBm  
Channel 11  
15:43:54

# Signal Levels



- **Static**  
Max: -45dBm  
Min: -63dBm
- **Non-Static**  
Max: -38dBm  
Min: -75dBm



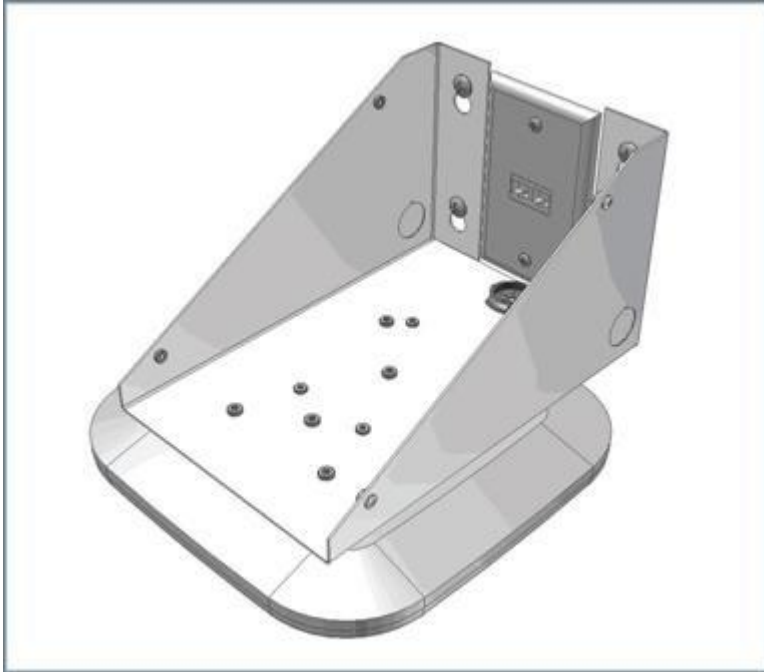
# Proper access point placement



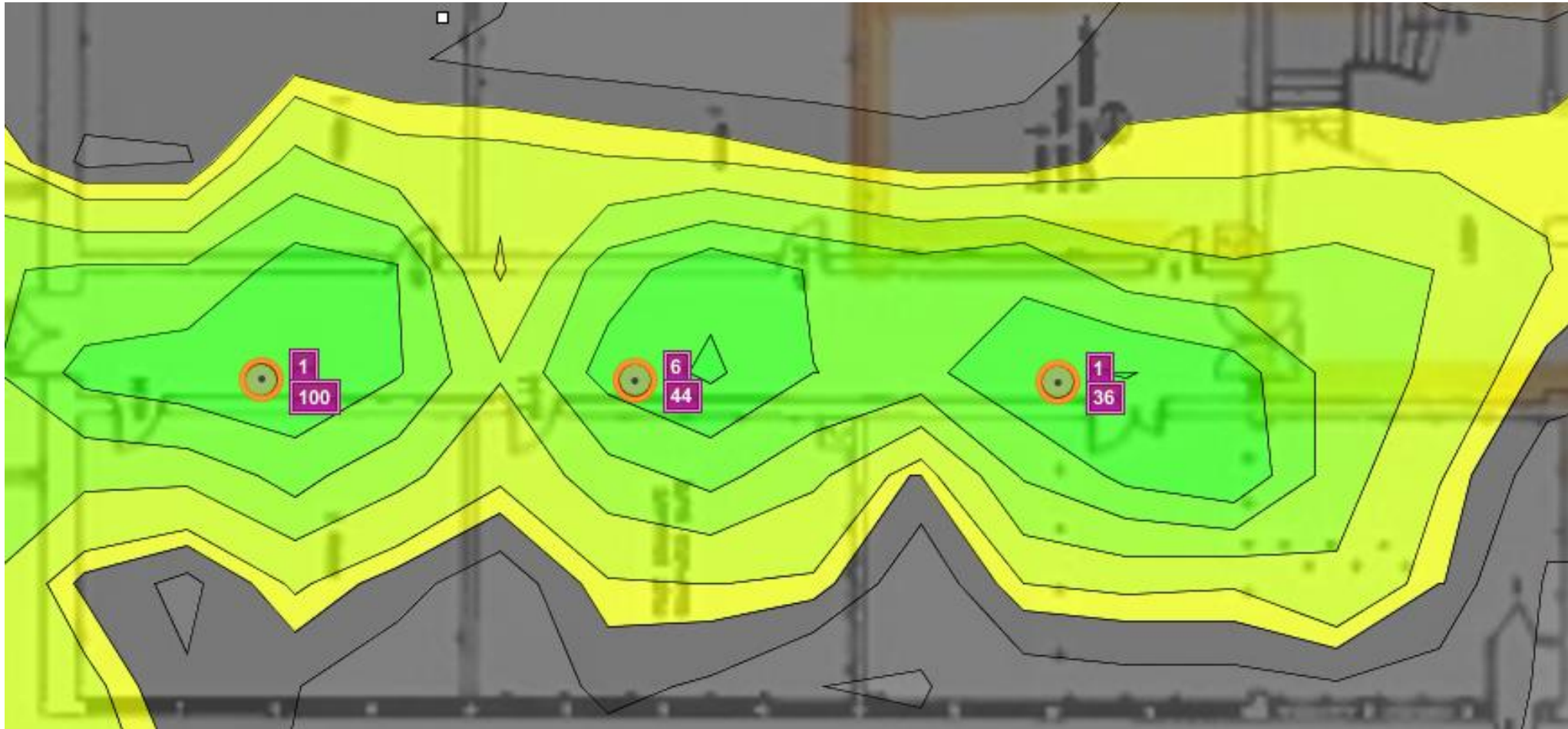
# Wall Mounted AP



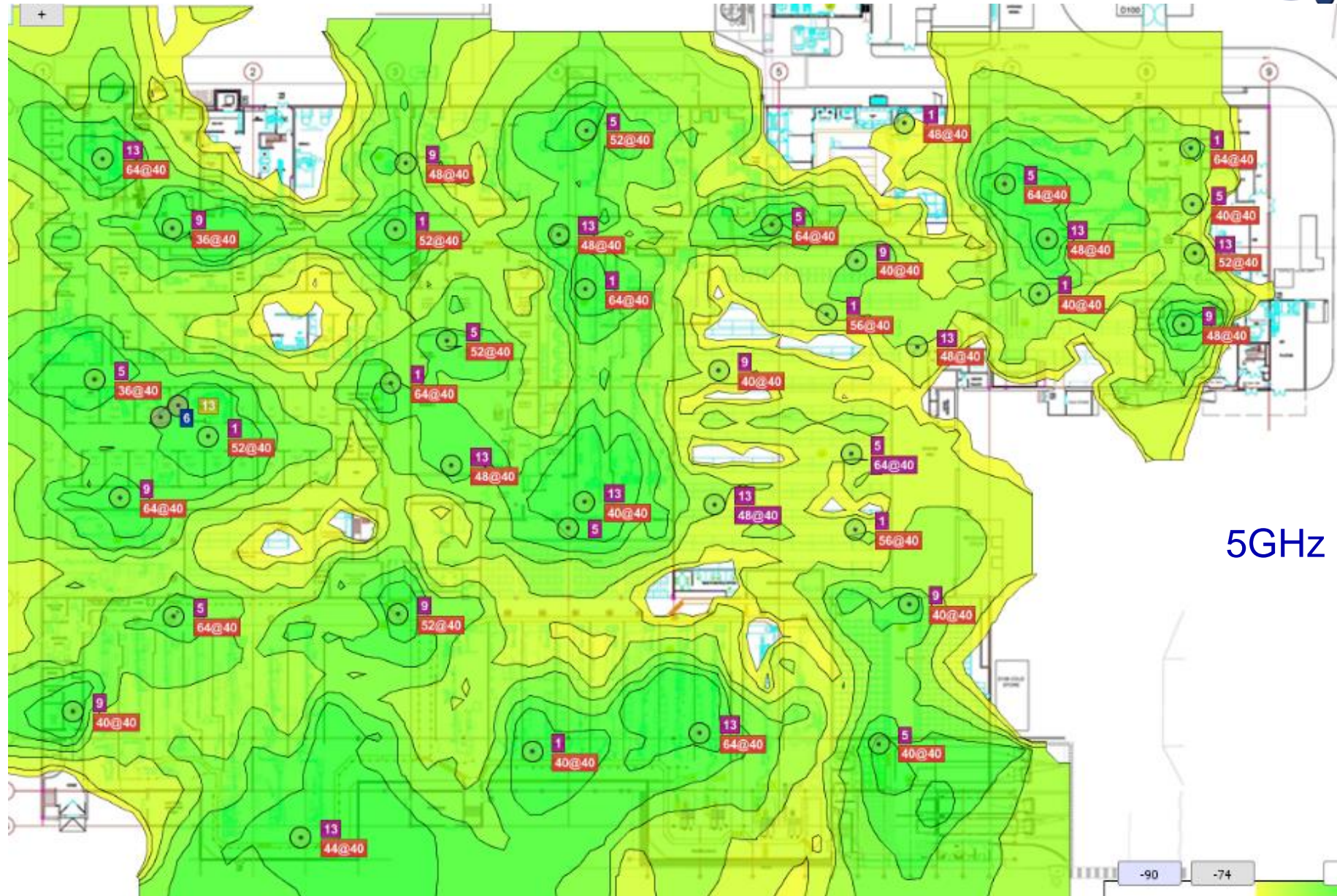
# Wall Mount Options



# APs in Corridors



# RRM (Radio Resource Management)



5GHz Coverage

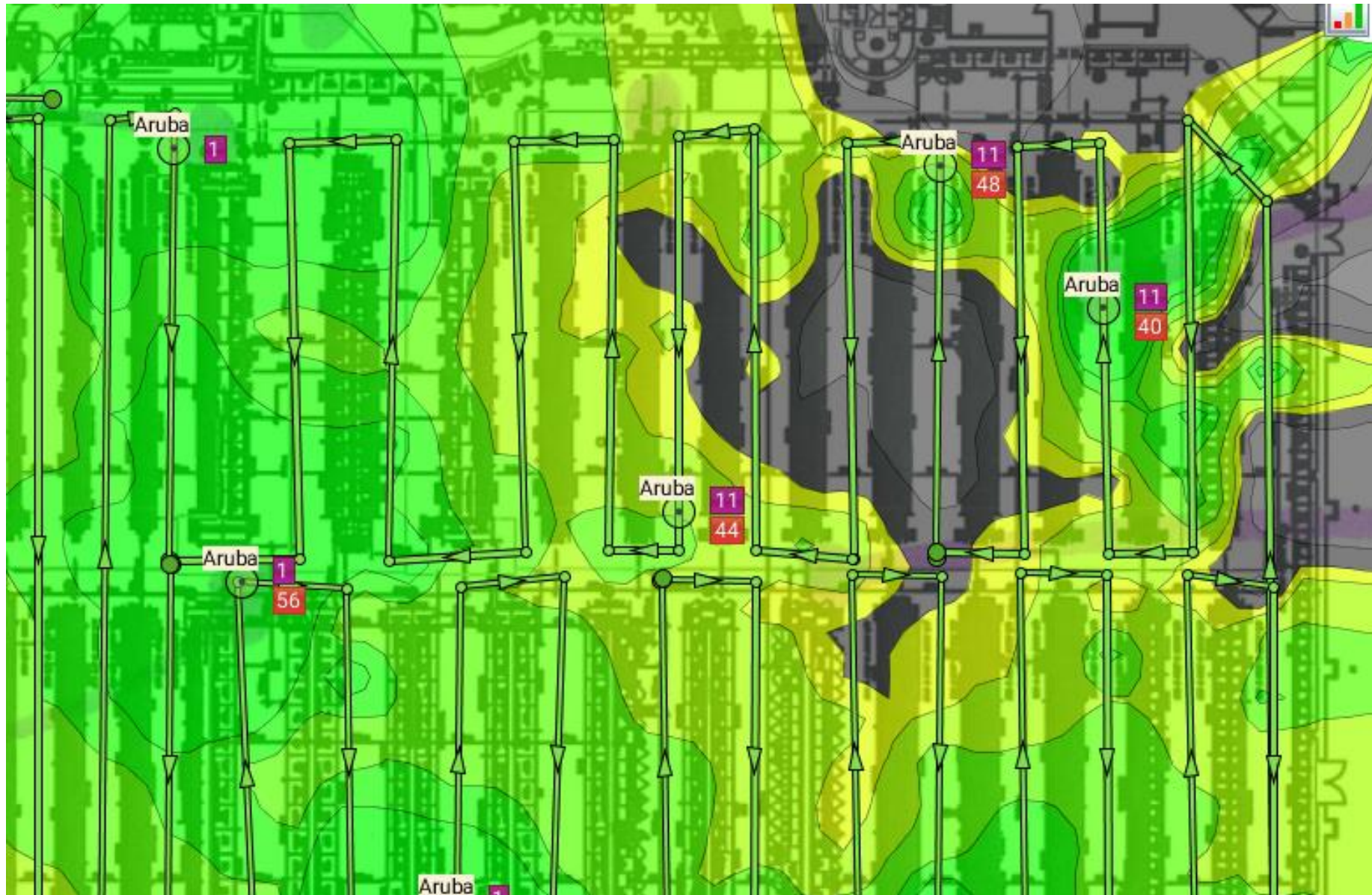
-90 -74

# RRM (Radio Resource Management)

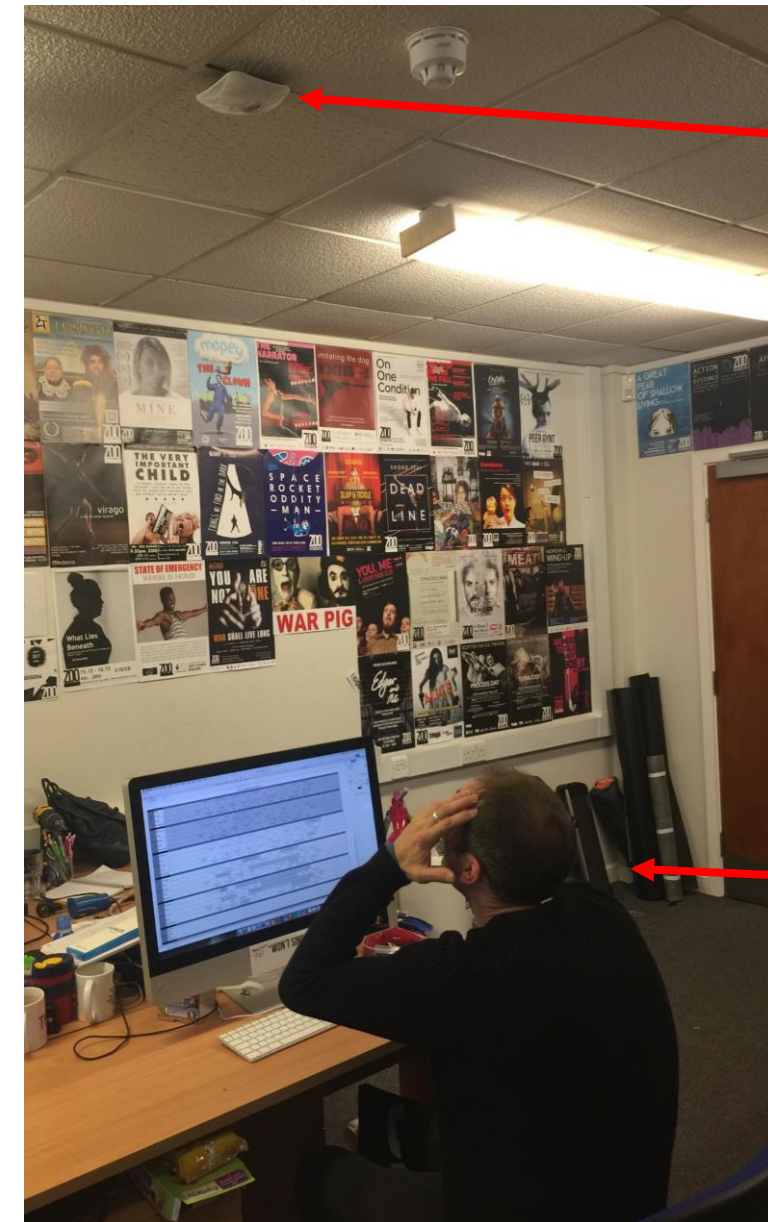


2.4GHz Coverage

# RRM – Using default values



# Defining the problem



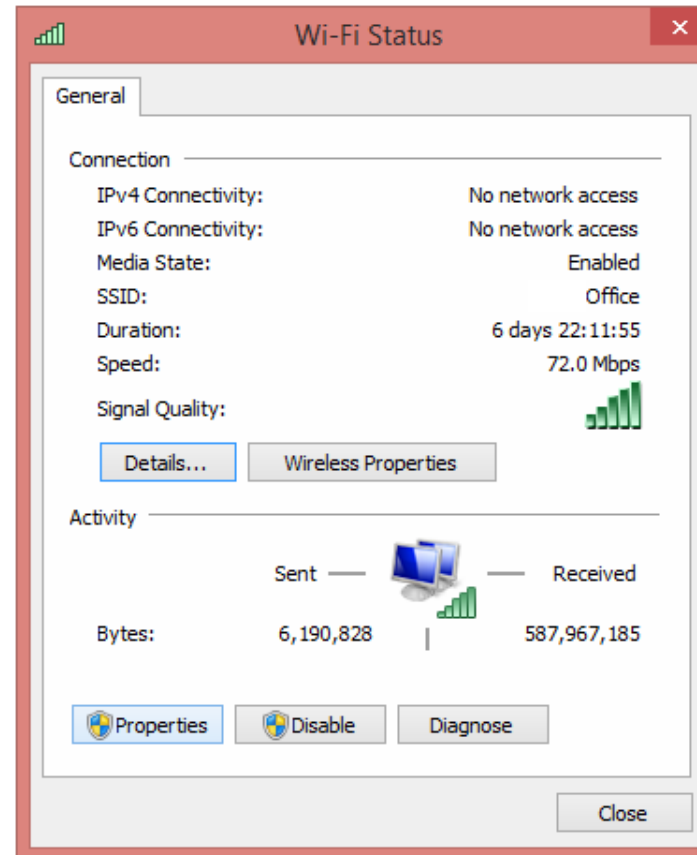
AP

“The Wi-Fi is rubbish here!”

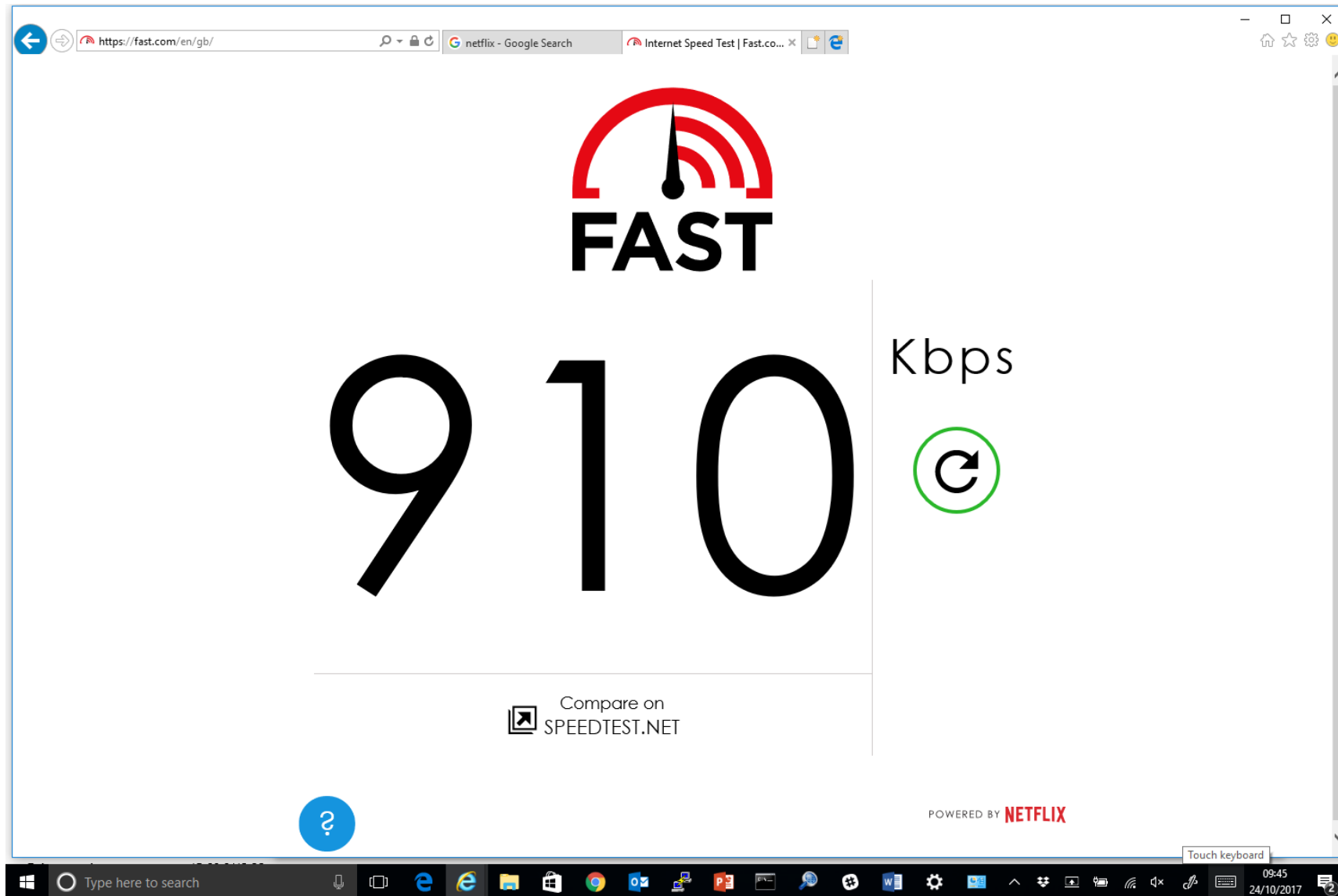
User



# Limited Connection



# How big is your pipe?

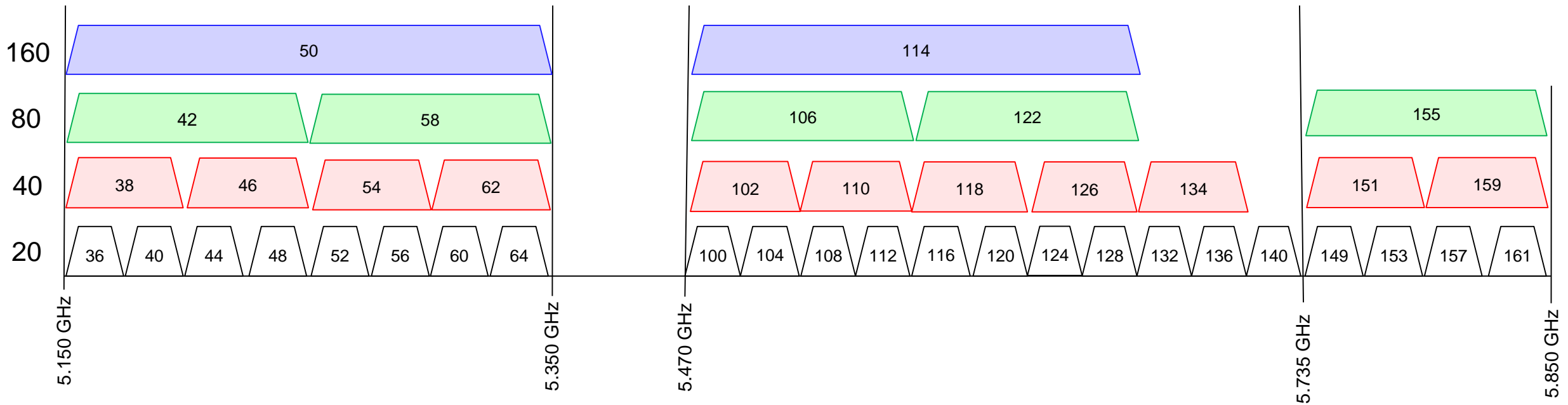


The screenshot shows a web browser window with the URL <https://fast.com/en/gb/>. The page features the FAST logo, which consists of a red speedometer icon above the word "FAST" in bold black letters. Below the logo, the test result "910" is displayed in large black font, followed by "Kbps" in a smaller black font. To the right of the result is a green circular refresh icon. At the bottom of the page, there is a link to "Compare on SPEEDTEST.NET" and the text "POWERED BY NETFLIX". The browser's taskbar at the bottom shows various application icons and the system clock indicating 09:45 on 24/10/2017.

# Channel Sizes

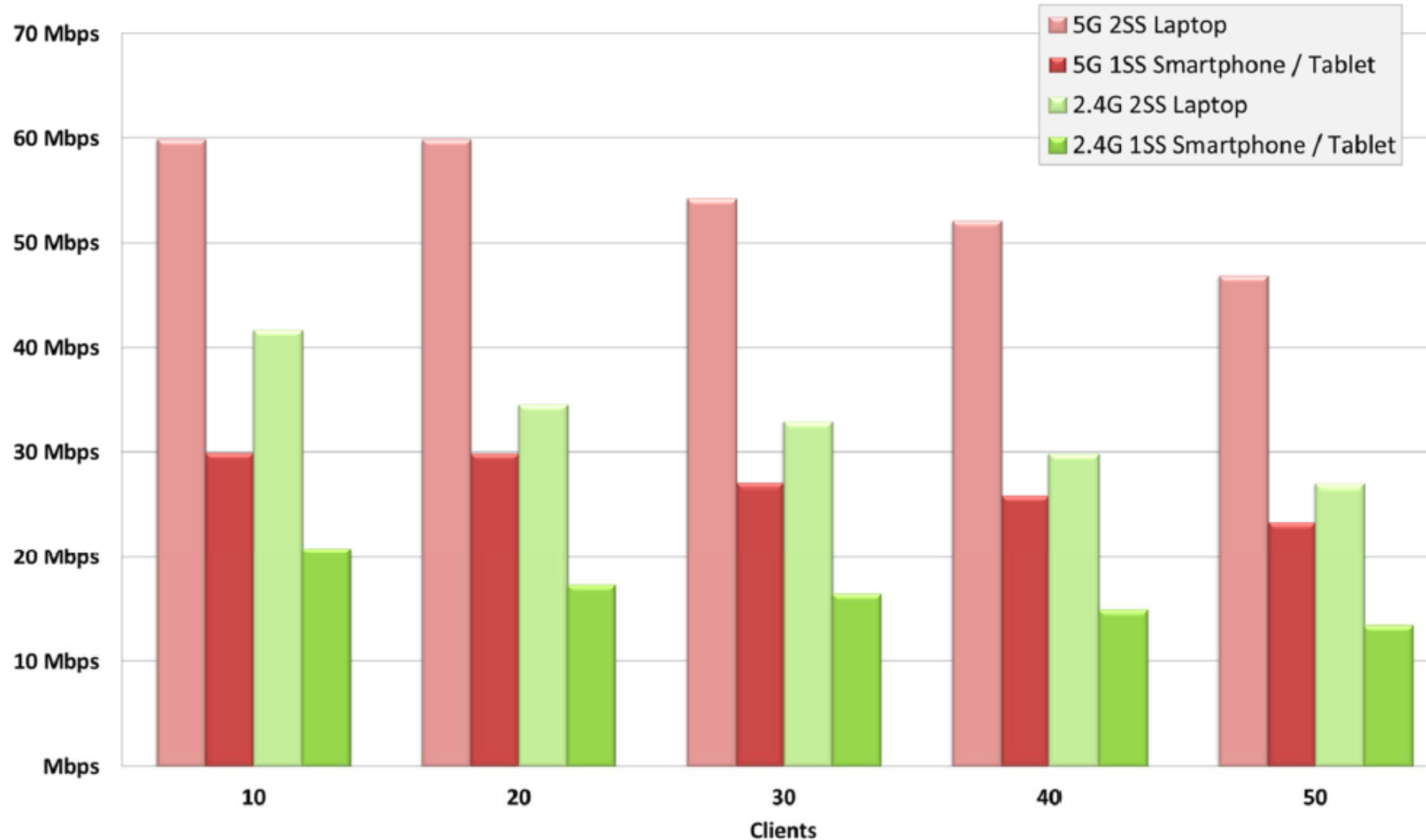
## Channel Widths:

- 802.11a channels are 20 MHz wide
- 802.11n channels are 20/40 MHz wide
- 802.11ac channels are 20/40/80/160 MHz wide



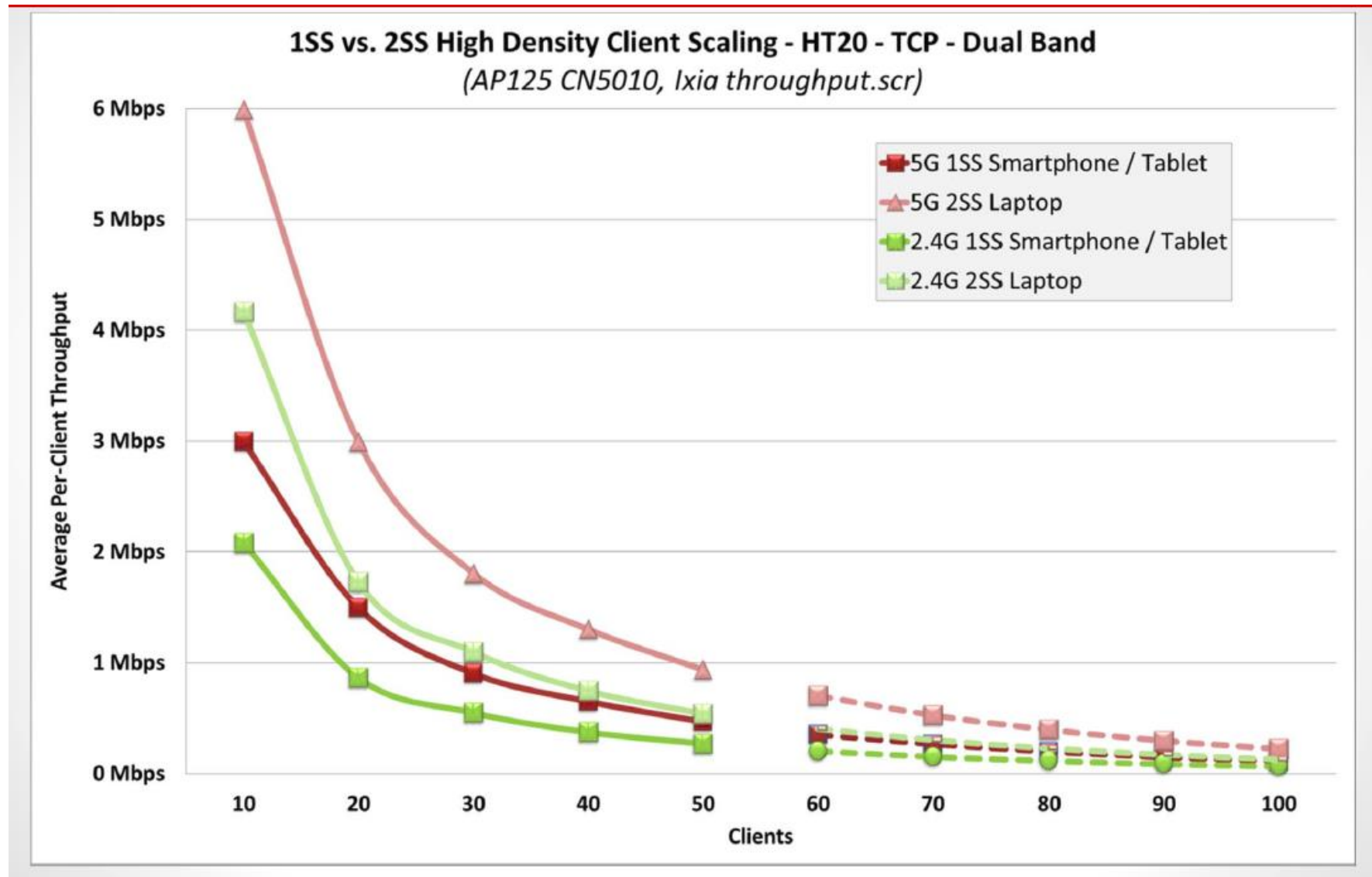
# 20MHz Channel Capacity

1SS vs. 2SS High Density Client Scaling - HT20 - TCP - Dual Band



Sourced from Aruba's High Density Wireless Networks for Auditoriums VRD by Chuck Lukaszewski

# Per-Client Throughput



Sourced from Aruba's High Density Wireless Networks for Auditoriums VRD by Chuck Lukaszewski

# Mixed Client environments

## 2 Spatial Streams Devices



## Single Spatial Streams Devices



## 3 Spatial Streams Devices



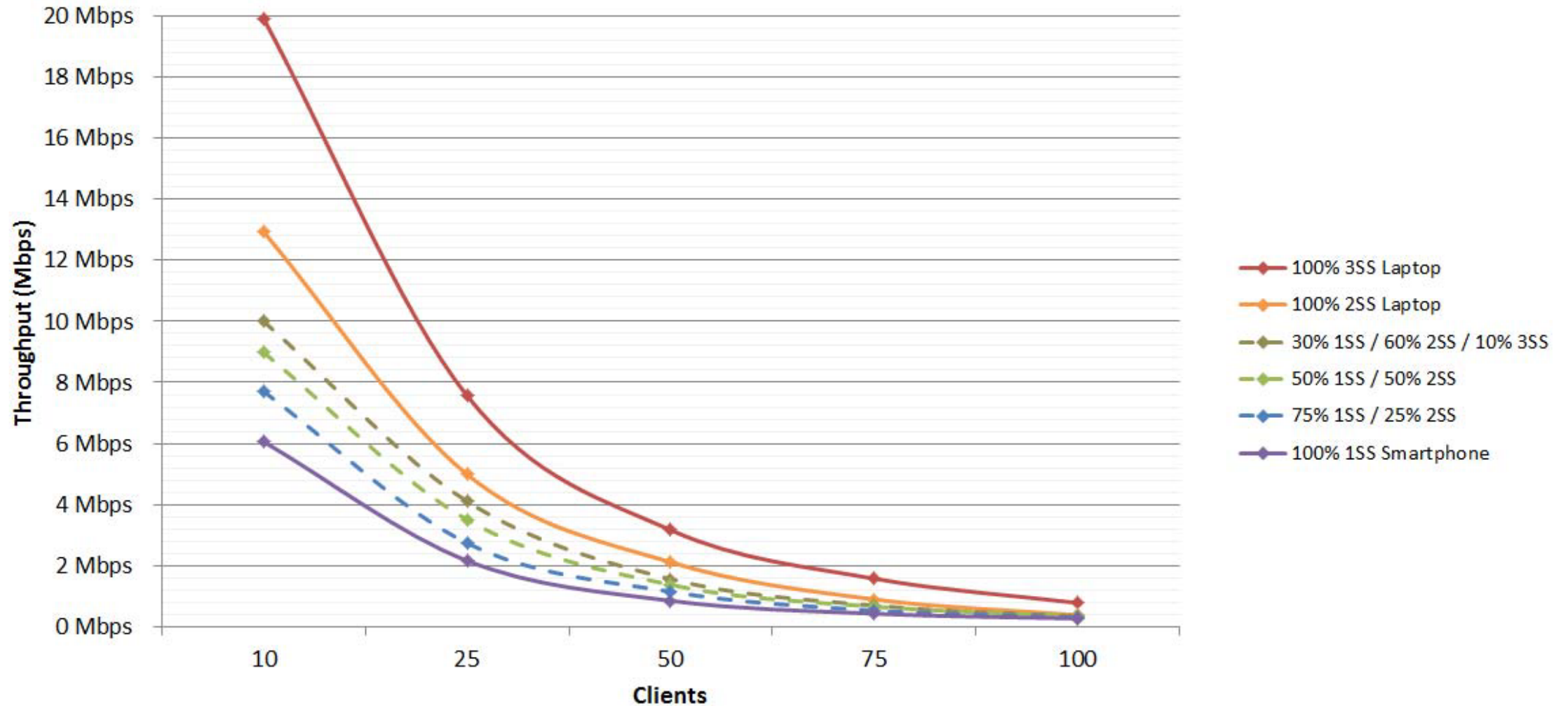
## Legacy Devices (a/b/g)



# Driving in rush hour



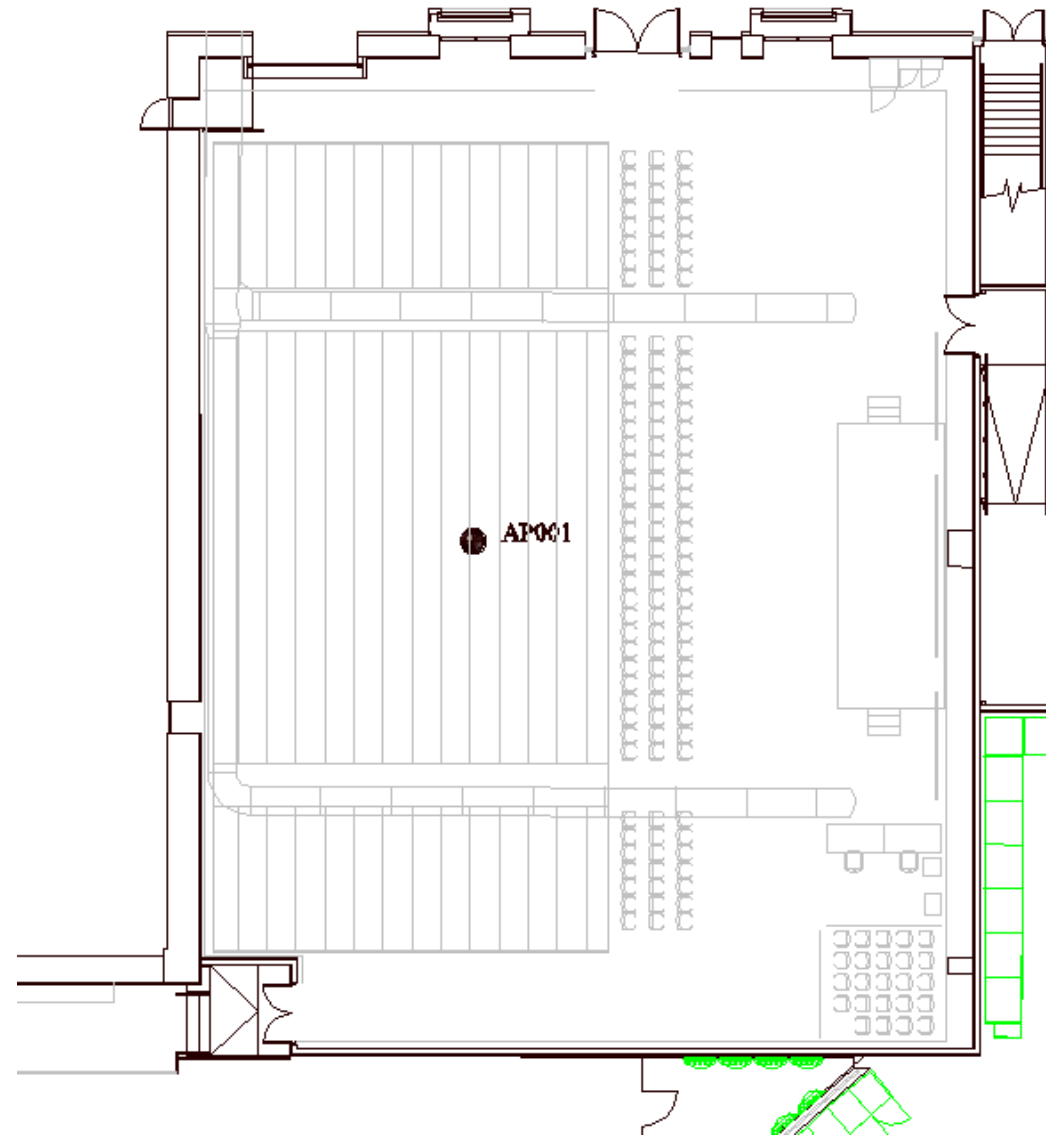
# Per-Client Throughput



Sourced from Aruba's High Density Wireless Networks for Auditoriums VRD by Chuck Lukaszewski

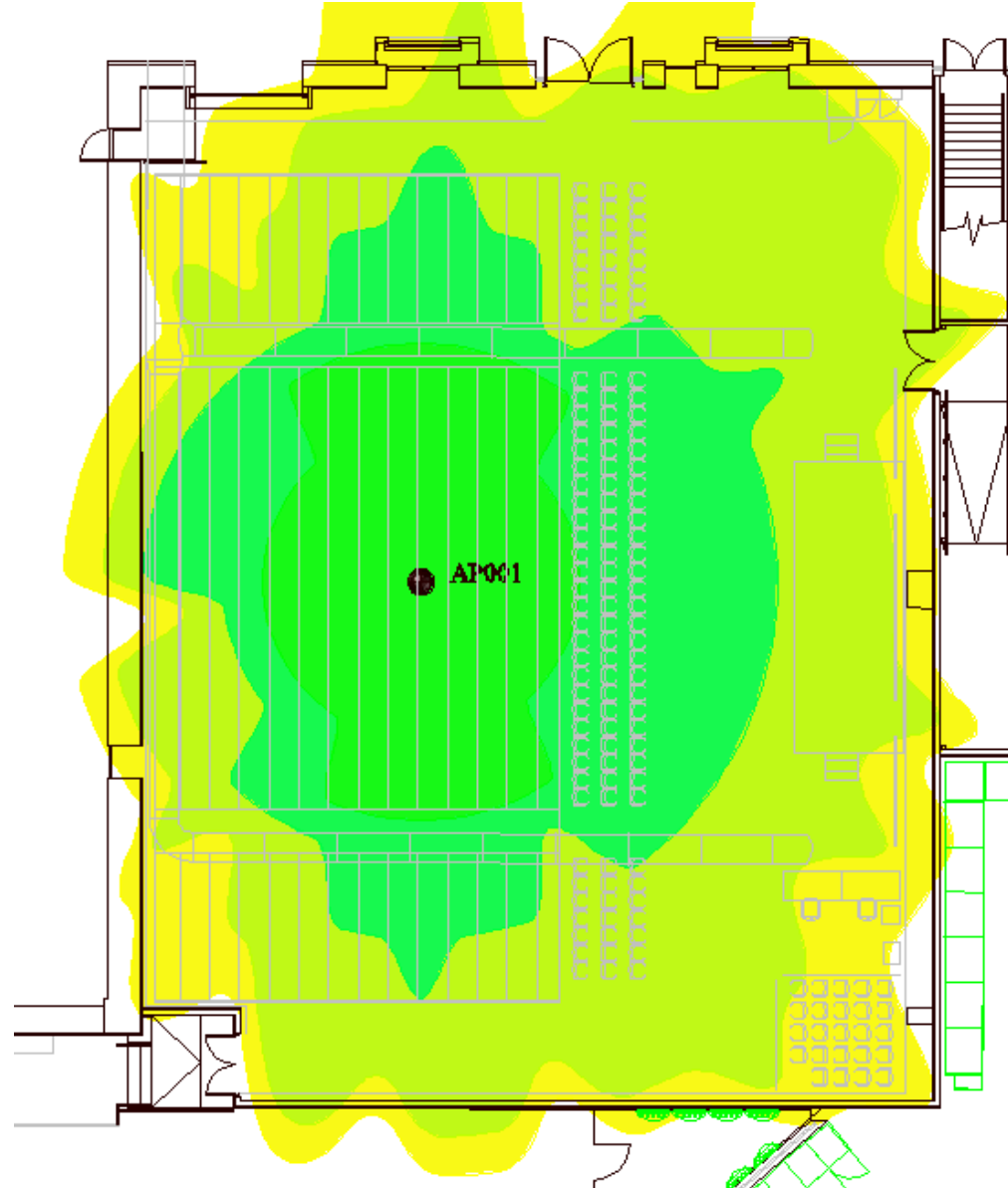


# Designing for Capacity



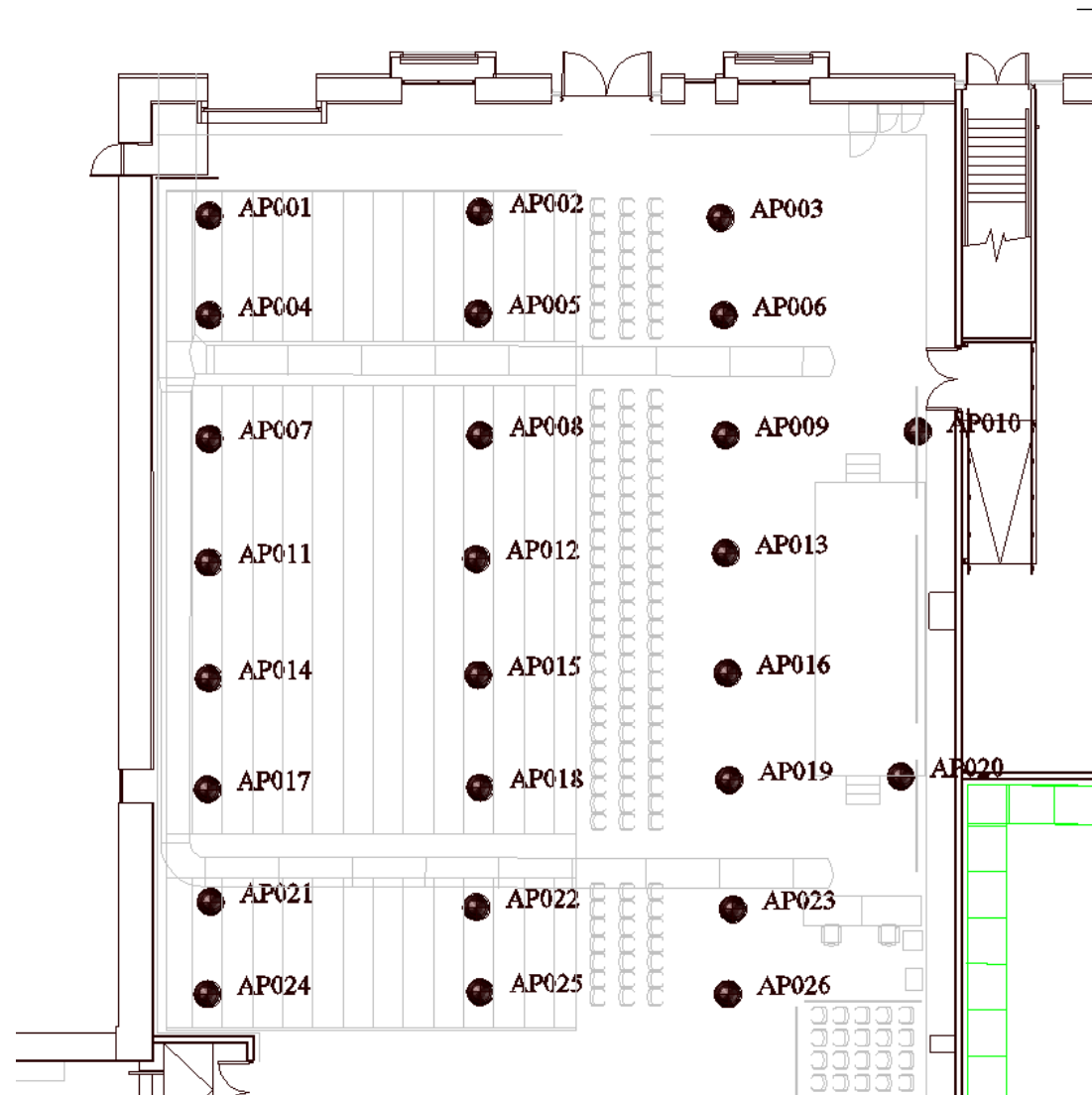
- 800 Seats
- Average 1.5 Devices per person (1200 Devices)

# Designing for Capacity



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- Average 1.5 Devices per person (1200 Devices)

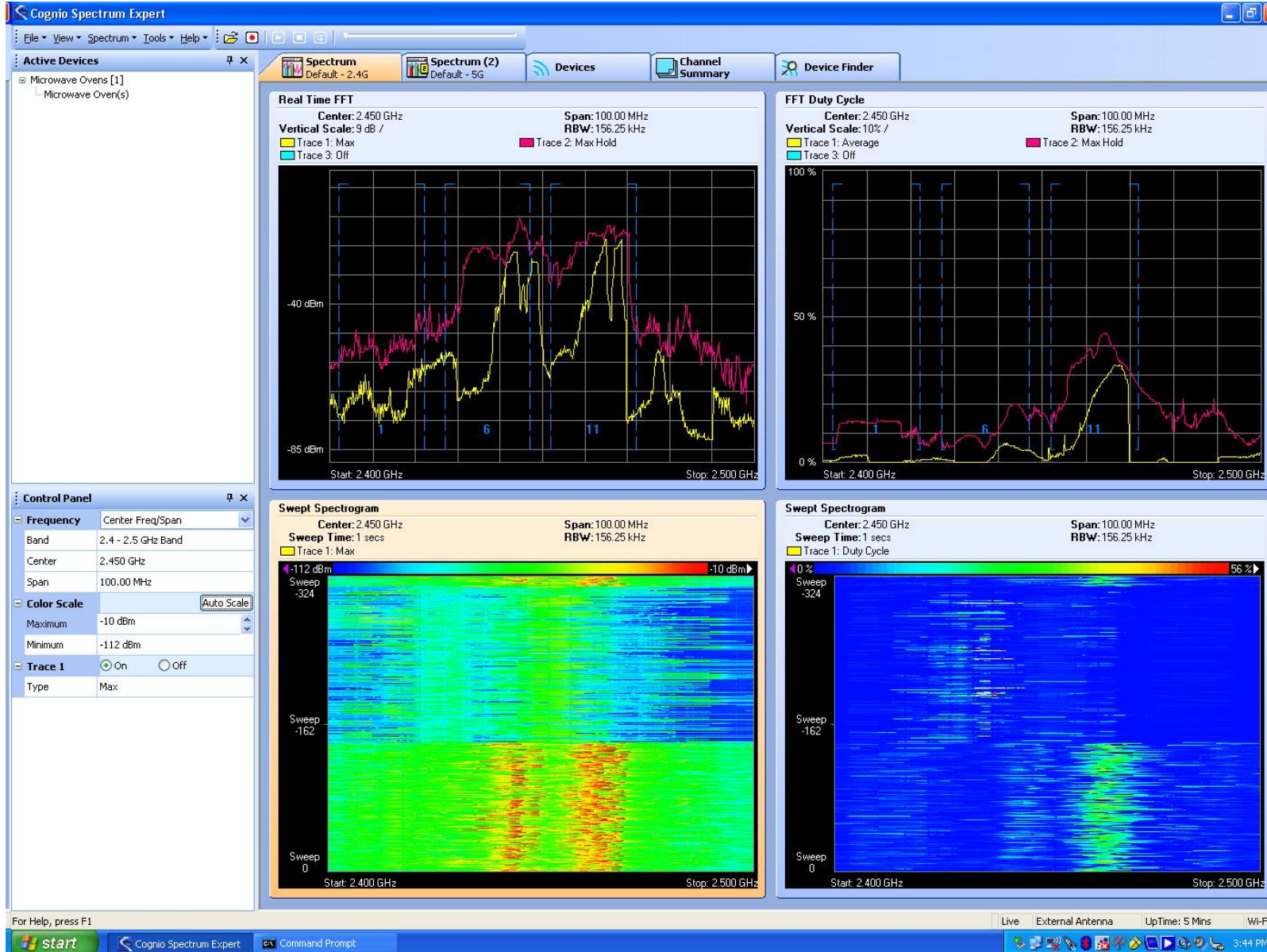
# More APs $\neq$ More Capacity



- 800 Seats
- Average 1.5 Devices per person (1200 Devices)

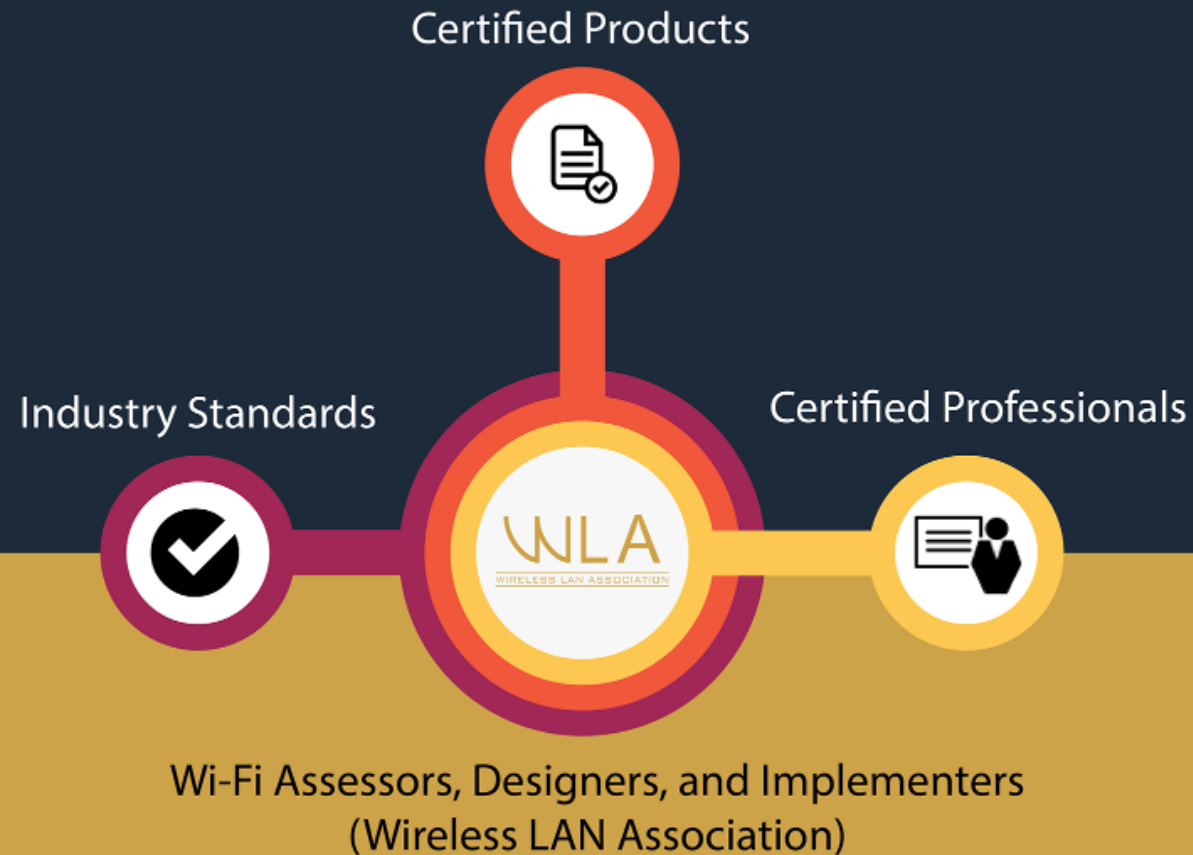
Customer Solution  
**26 Access Points?**

# Spectrum Analysis



- Great Wi-Fi starts with a great design
- Detailed customer requirements capture
- Specifying realistic requirements
- Proper AP placement
- Spectrum analysis
- Validation

# Wireless LAN Association



Join today at [www.wlanassociation.org](http://www.wlanassociation.org)

Thank You!

Any Questions?

