

# WiFi 6

Now With More Cowbell!



# Introductions

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# The Short Version



Nerd!!!



**6 is bigger  
than 5, so it is  
mo'bettah.**

~The End

## WiFi - History

Back in my day, WiFi networks were deployed for coverage

- Few devices
- AP's were placed in halls
  - I'm guilty of doing this
- Wifi A,B and G

Now we design for density

- Many devices
- AP's placed in the classroom
- Wifi N(4),AC(5),AX(6)



## WiFi - Rebranding

Generation of network connection	Sample user interface visual
Wi-Fi 6	 The icon for Wi-Fi 6, featuring a stylized signal tower with three curved lines representing signal strength, and a circle containing the number 6.
Wi-Fi 5	 The icon for Wi-Fi 5, featuring a stylized signal tower with three curved lines representing signal strength, and a circle containing the number 5.
Wi-Fi 4	 The icon for Wi-Fi 4, featuring a stylized signal tower with three curved lines representing signal strength, and a circle containing the number 4.

## WiFi - History Continued

Depending on WiFi technology you chose you were band limited.

- A
  - 5 Ghz
  - 8 non overlapping channels
- B & G
  - 2.4 Ghz
  - 3 non overlapping channels
- N
  - Now you could “have your way”™
  - 2.4 and 5 Ghz
- AC
  - 5 Ghz only
  - 25+ channels (22-25, 5 Ghz) (3 sad 2.4 Ghz)(Depends on AP)
  - Wider channels



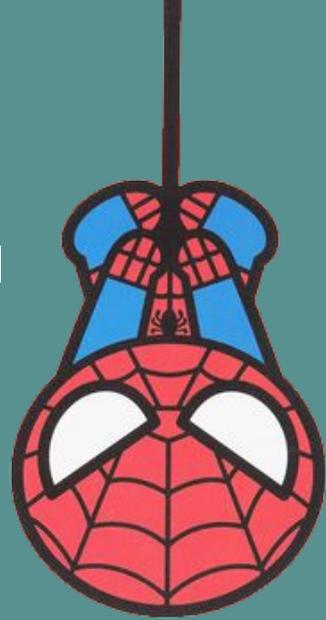
## WiFi - Why Upgrade?

Standard	Frequency	Theoretical Speed	Real-World Speed
802.11a	5Ghz	6-54 Mbps	3 - 32 Mbps
802.11b	2.4Ghz	11 Mbps	2-3 Mbps
802.11g	2.4Ghz	54 Mbps	10 -29 Mbps
802.11n	2.4Ghz	300 Mbps	150 Mbps
802.11n	5Ghz	900 Mbps	450Mbps
802.11ac	5Ghz	433 Mbps - 1.7 Gbps	210 Mbps - 1 G

## WiFi - Why Upgrade?

Each WiFi revision that has been released has advertised increased Speeds.

**“With Great Speed  
Comes Great Capacity”**



Hey, don't forget to mention that I work on 2.4 Ghz as well.

## How fast is 802.11ax?

Let's say we take the more conservative 4x estimate, and assume a massive 160MHz channel. In that case, the maximum speed of a single 802.11ax stream will be around 3.5Gbps (compared with 866Mbps for a single 802.11ac stream). Multiply that out to a 4x4 MIMO network and you get a total capacity of 14 Gbps. If you had a smartphone or laptop capable of two or three streams, you'd get some blazing connection speeds of 1GB per second or more.

In a more realistic setup with 80MHz channels, we're probably looking at a single-stream speed of around 1.6Gbps, which is still a reasonable 200MB/sec. If your mobile device supports MIMO, you could be seeing 400 or 600 MB/sec.

And in an even more realistic setup with 40MHz channels, a single 802.11ax stream would net you 800Mbps (100MB/sec), or a total network capacity of 3.2Gbps.

# WiFi - 6

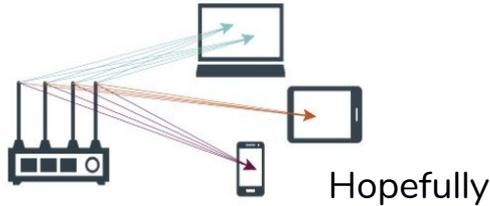
Born (ratified) September 16, 2019



Calling it WiFi AX was cooler!

# Wi-Fi CERTIFIED 6™ key features

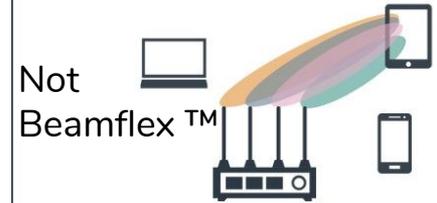
Downlink Multi-User MIMO



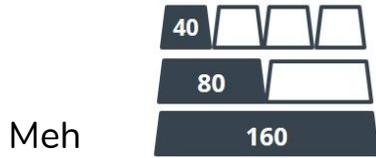
Yea Baby! OFDMA



Beamforming



160 MHz Channel Bandwidth

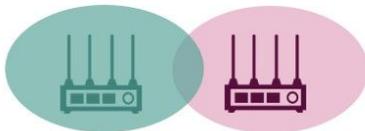


Target Wake Time



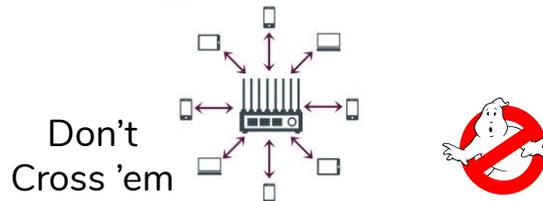
A Nifty WiFi Alarm Clock

BSS Coloring



Helps the kids play nice

8 Spatial Streams



1024-QAM

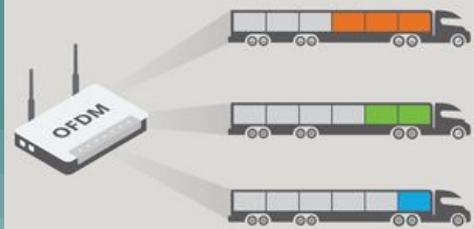
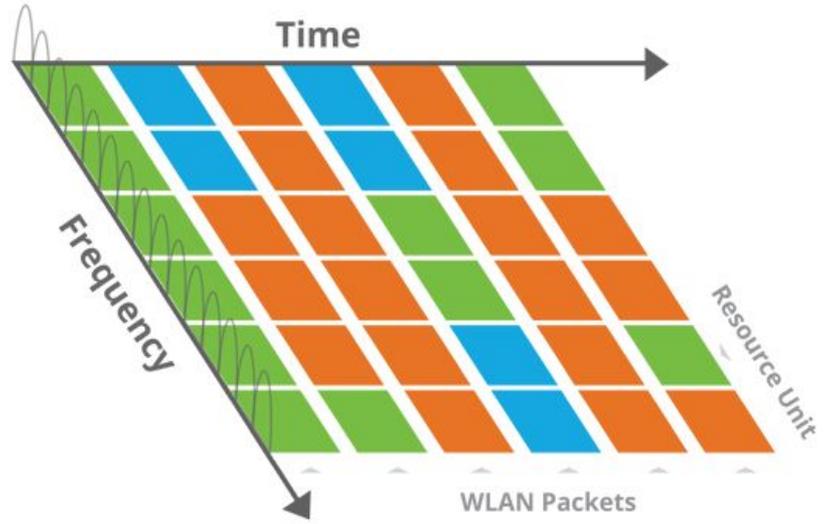
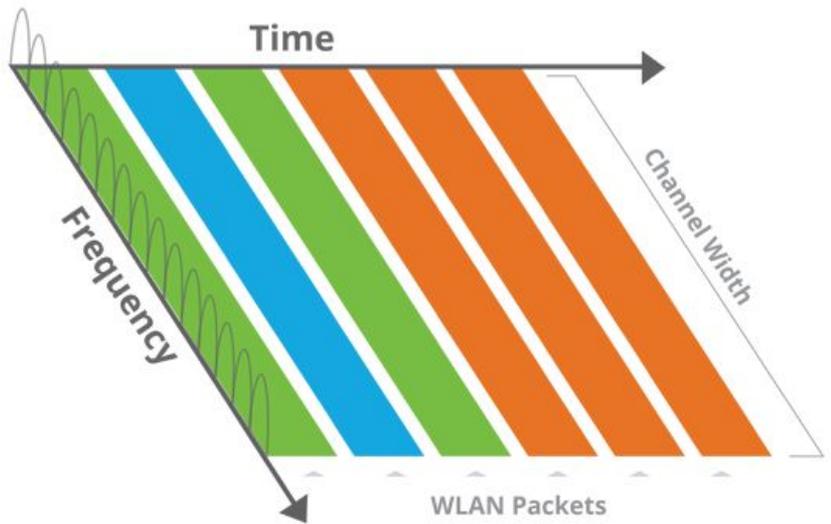


## OFDMA - Showing Devices the Love.

- Previous WiFi revisions were client-centric. An AP could only send data to one device at a time and would utilize the entire channel width to do it.
- Most network traffic is small in nature or is time sensitive (VOIP)
- With Wifi 6 an AP can send data to multiple devices at a time by breaking up a WiFi channel into smaller sub-channels.
- For example, a traditional 20 MHz channel might be partitioned into as many as 9 smaller channels.
- This allows clients to get more attention.



Infographic - graphic visual representations of information, data, or knowledge intended to present information quickly and clearly.



-  User 0 (Web Page)
-  User 1 (Streaming Video)
-  User 2 (Social Media)



-  User (0,1,2)

## BSS Coloring - Basic Service Set Coloring - Increasing Efficiency

- With WiFi you need to be careful to make sure you limit channels from overlapping.
- AP's were not very good coordinating channel resources
- With WiFi 6 AP's can identify signals from overlapping networks and make decisions on medium contention and interference management based on this information. Helps devices ignore other devices transmissions.
- Helpful when the density of AP's are high.



## Other Improvements - A lot of little improvements can make a big difference

- Downlink MU-MIMO
  - Wasn't used much in WiFi 5 (AC) hopefully higher adoption in WiFi 6
- Beamforming
  - Needed for MU-MIMO
  - Not to be confused with Ruckus BeamFlex™
- 160 Mhz wide channels
  - With the current number of channels this isn't very useful
- 8 Spatial Streams
  - Potential for high data rates
  - Probably won't see devices take advantage of this
- Target Wake Times
  - Devices coordinate with the AP when it will connect next.
  - Great for low power devices
- 1024 QAM
  - Up to a 25% increase in throughput, but will require a strong clear signal.

## Deployment Considerations

- Most WiFi 6 AP's are going to need more power.
  - PoH or 802.3bt allows for 60 and 90 Watts of power
- Switch upgrade
  - WiFi 6 has the potential to saturate your traditional 1 Gbps network connection
  - Many WiFi 6 AP's come with a 2.5 GbE port or faster



Ruckus R750 AP  
1 and 2.5 Gbps ports



Ruckus 7150-48ZP Switch  
16x100/1000 Mbps/2.5 Gbps PoH ports

## Devices - Classic chicken / Egg story

- Devices that support WiFi 6 are out, and new ones are being released at an increasing rate
- Notable phones with support
  - iPhone SE, 11, 11 Pro, and 11 Pro Max Ultra Large
  - Samsung Galaxy S10, S10E, Note 10, S20 Line and Fold
- Computers
  - Dell XPS 13 (2020)
  - HP Spectre x360
  - Lenovo Yoga c940
  - LG Gram 17
  - Not Apple laptops yet
- My guess is most budget Chromebooks will have it for the 2021 buying season.



## Access Points

- All the major players in the WiFi market have released some sort of WiFi 6 Access point.
  - Most will release a flagship model with more economical versions to follow
  - Many include additional radios such as Bluetooth for IoT devices
- 

WiFi - Whaatt??? We Get More WiFi Goodness???



# WiFi - 6e?

Expected Certification Early 2021



I thought you said no more letters?!?

## WiFi 6e - Everything you love about 6, but with an “e”.

- FCC allocated 1.2 Ghz of new Wi-Fi spectrum in the 6 GHz band
  - 2.4 GHz band has 60 MHz allocated
  - 5 GHz band has 500 Mhz allocated

### Wi-Fi 6E brings Wi-Fi® into 6 GHz

#### Features



6 GHz

More, contiguous spectrum



80  
160 MHz

Wider channels



Less interference

#### Benefits



Gigabit speeds

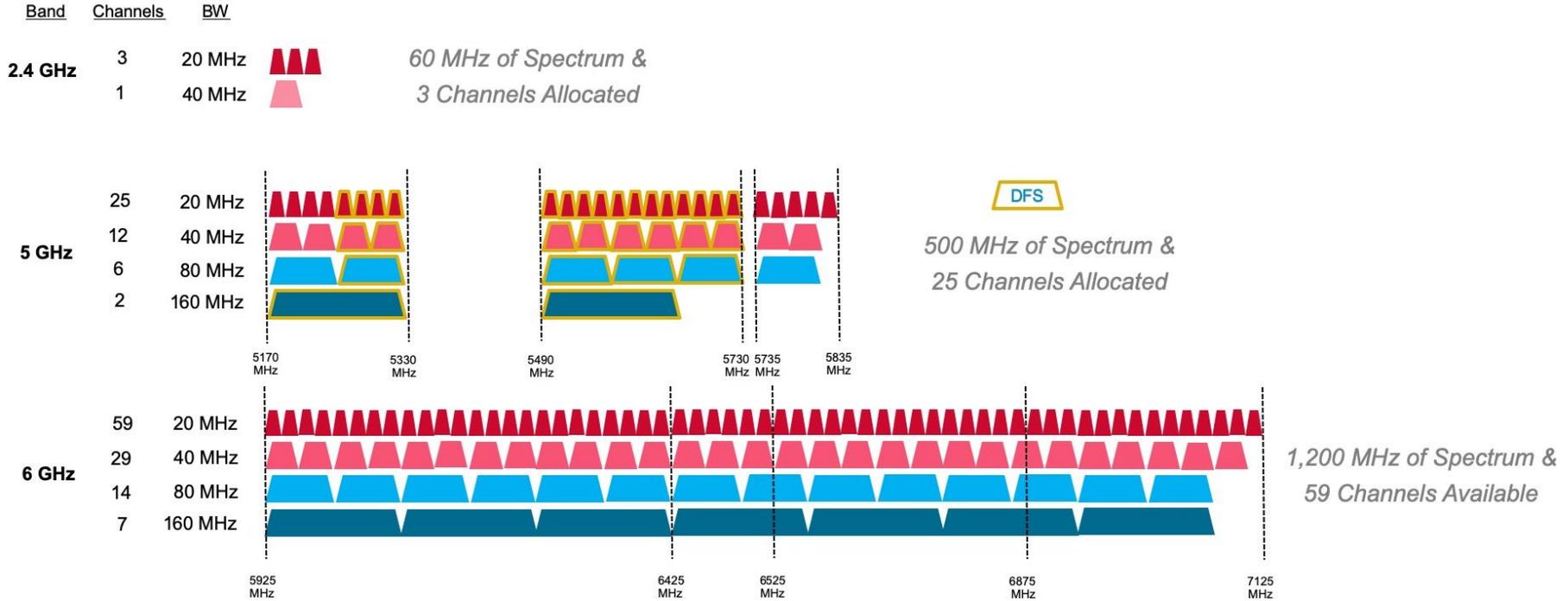


Extremely low latency



High capacity

# WiFi 6e - Everything you love about 6, but with an "e".

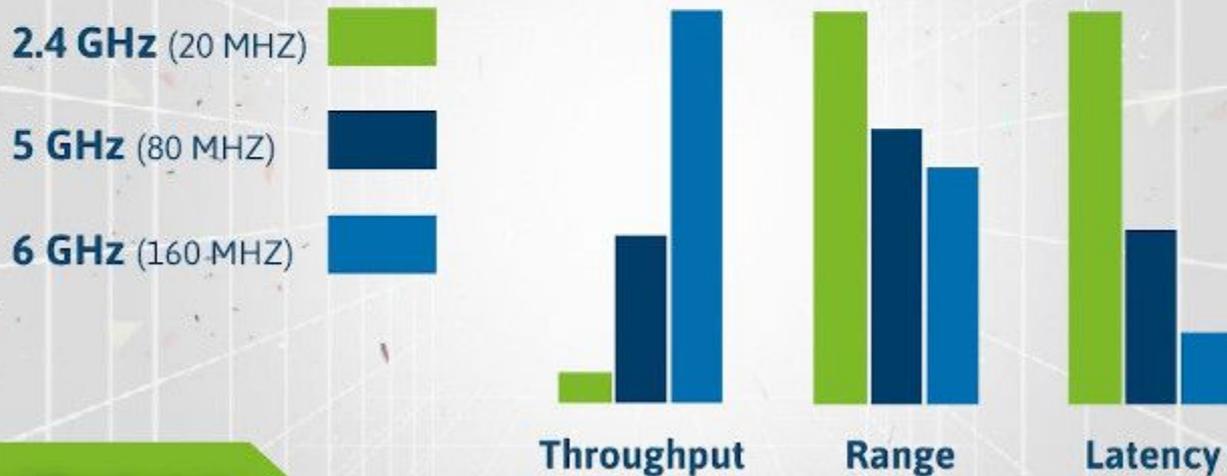


# WiFi 6e - Everything you love about 6, but with an "e".



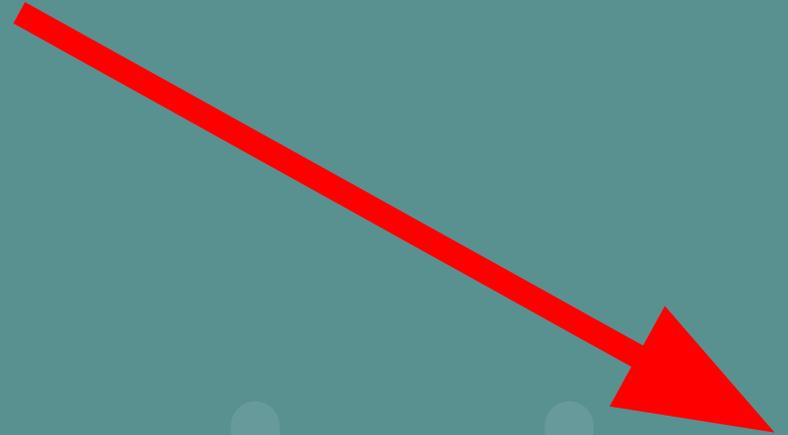
## Wi-Fi 6E trials

### 6 GHz boosts Wi-Fi performance



Courtesy of Broadcom Inc

# Questions in Chat, or if allowed Unmute



Press ALT-F4 to issue a complaint!