



Design Considerations for
Dual-Band Wi-Fi

Introduction



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Housekeeping

Questions?

Feel free to use the Question tool if you have a question or comment that relates to the presentation

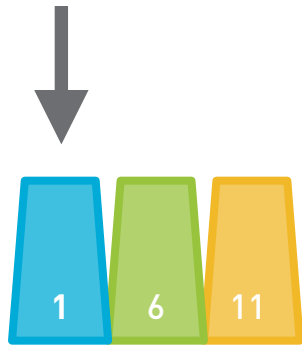
Audio or Video Problems?

If you experience audio or video problems, it's not you. It's me. Let me know with the question tool.

Dual-Band Wi-Fi

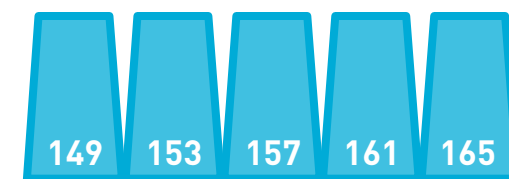
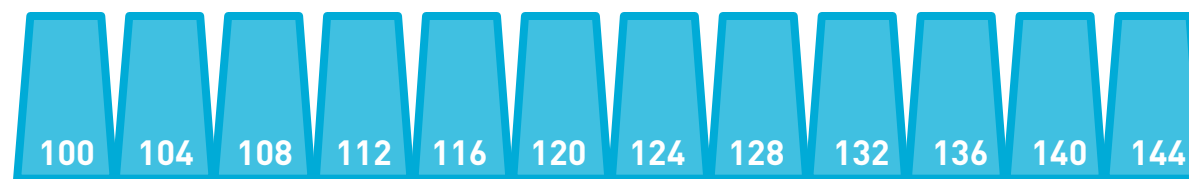
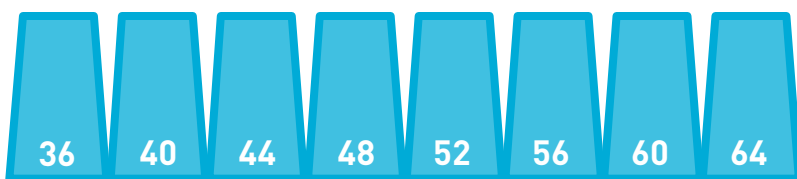
2.4 GHz (802.11b/g/n)

- Greater Range (~300 ft)
- Universal Compatibility
- Congested with Wi-Fi
- Plagued by non-Wi-Fi interference
- 3 non-overlapping channels



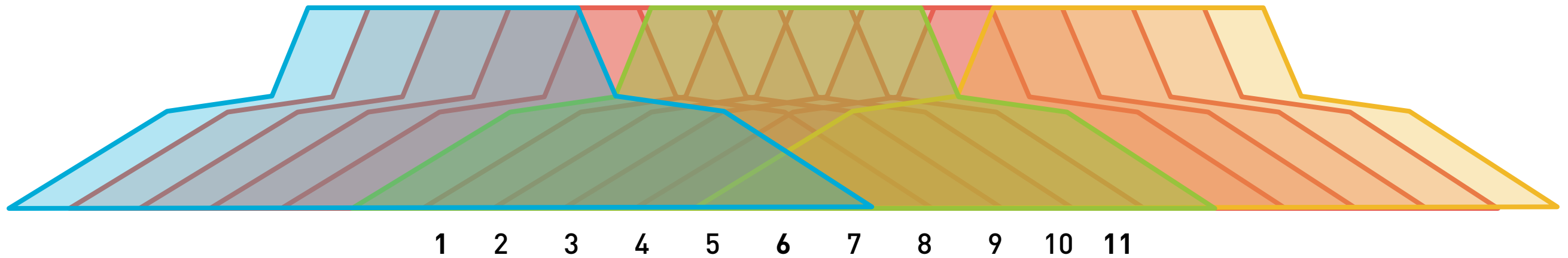
5 GHz (802.11a/n/ac)

- Lower Indoor Range (~90 ft)
- Limited Compatibility (a/n/ac)
- 24 non-overlapping channels

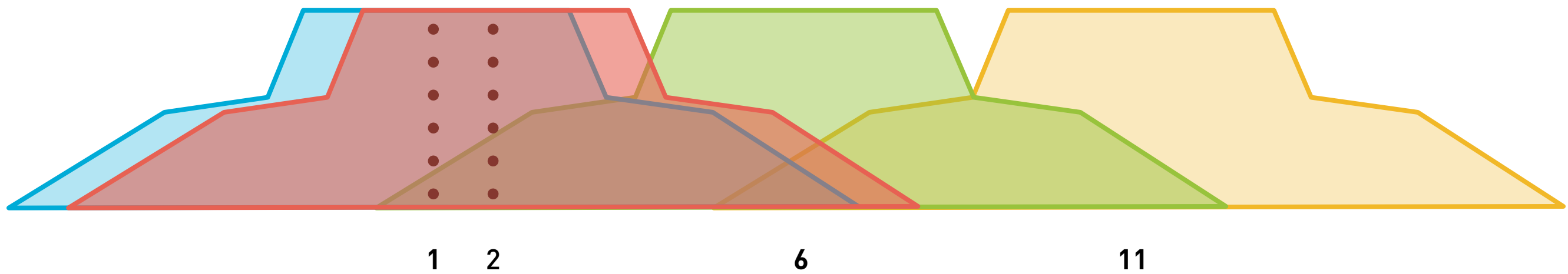


2.4 GHz Channels

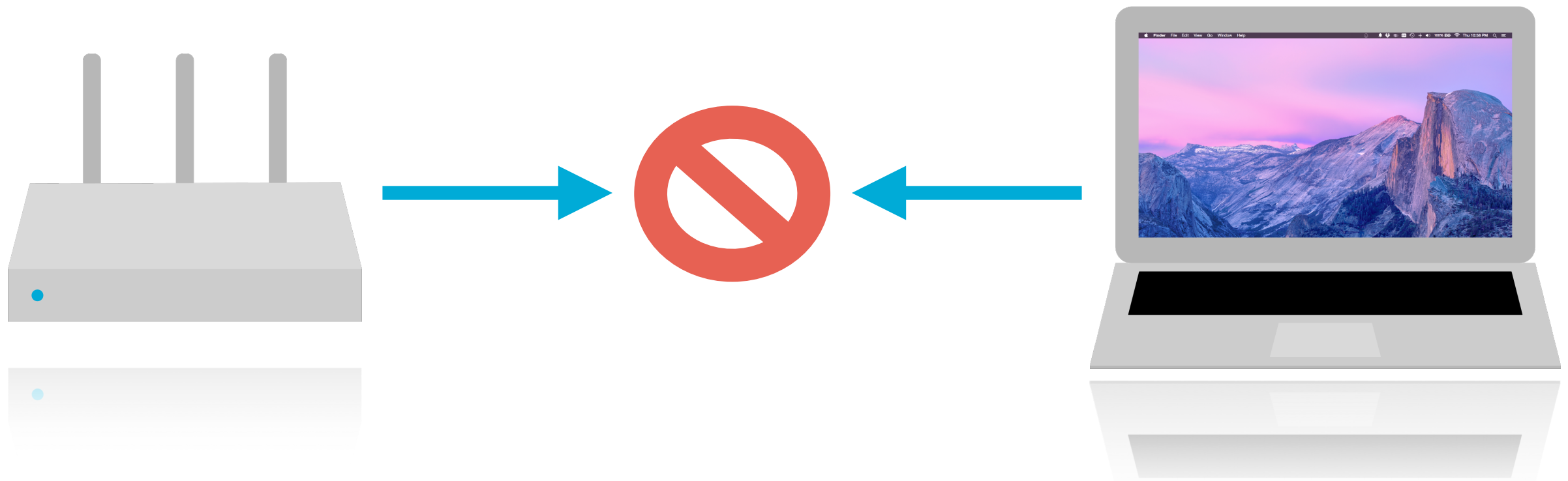
20 MHz Wide



5 MHz Between Centers



Half-Duplex



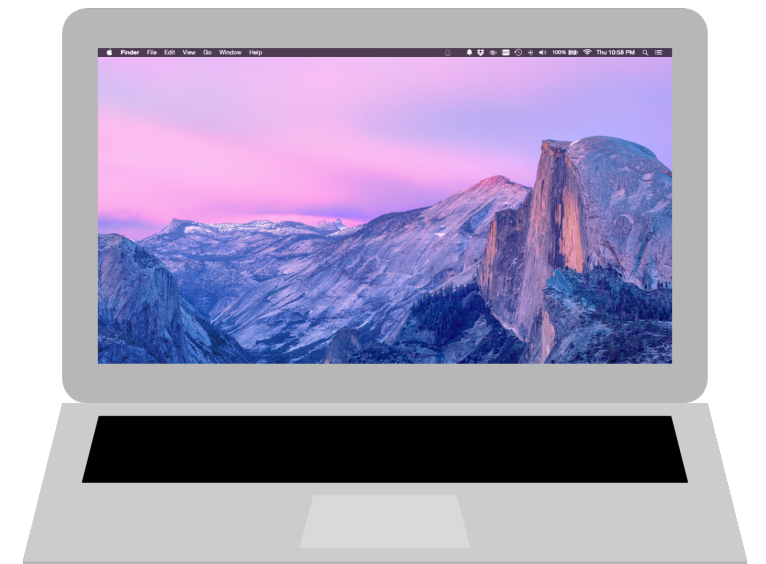
Half-Duplex



Data

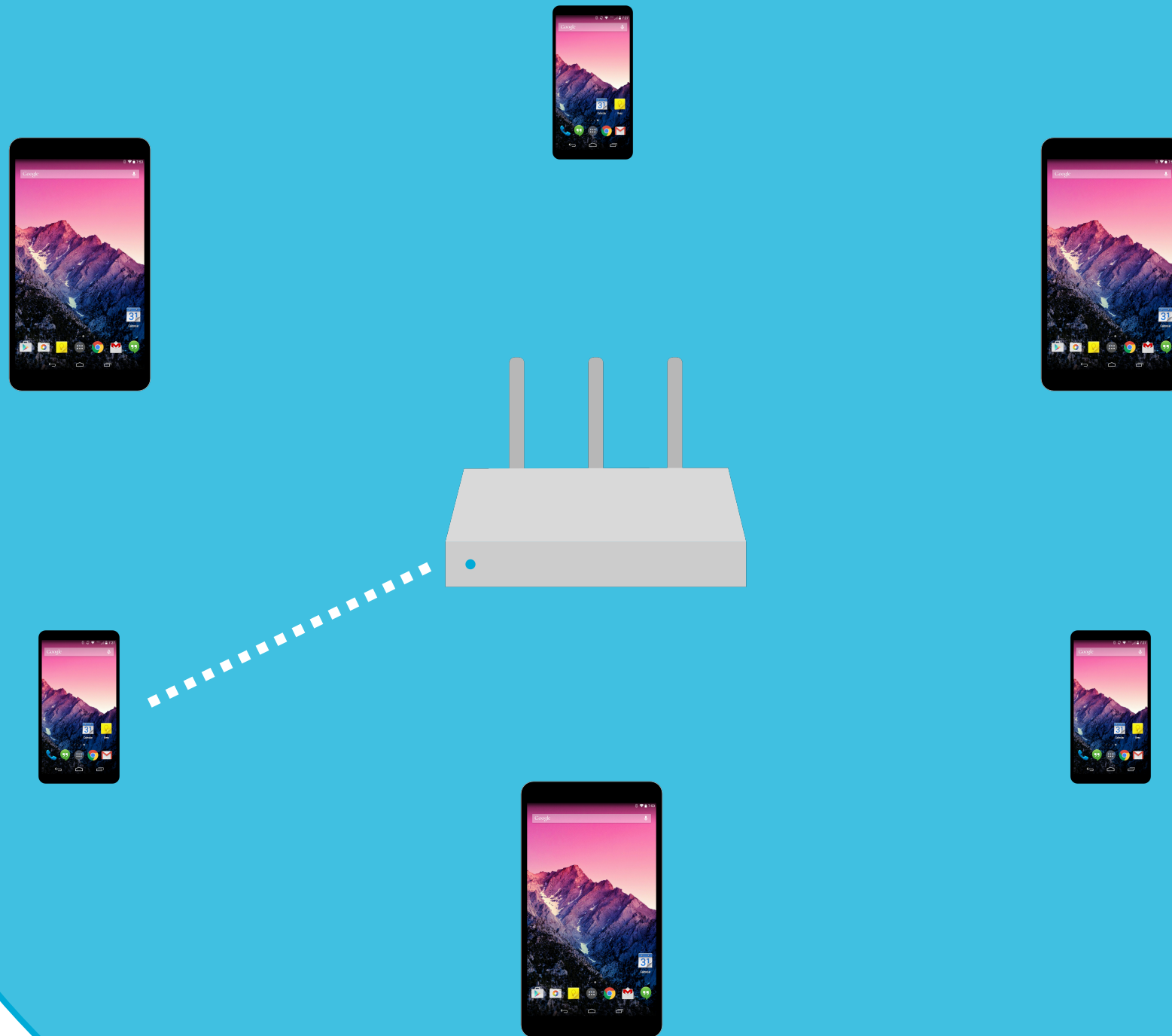


Acknowledgment



Taking Turns

The more devices on the channel, the less time left to talk



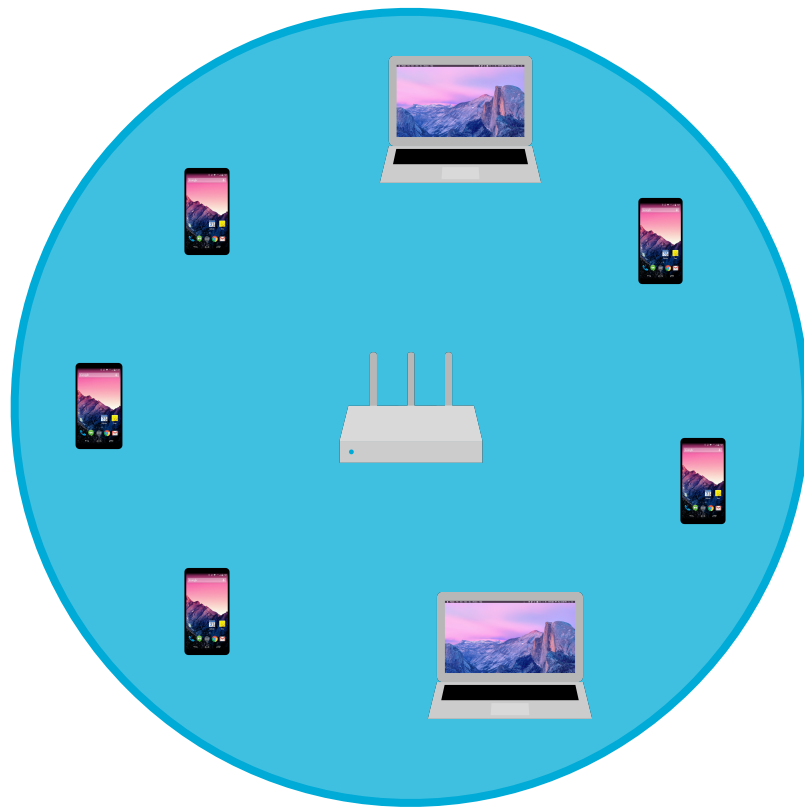
Slow Talkers

Slower conversations take more time



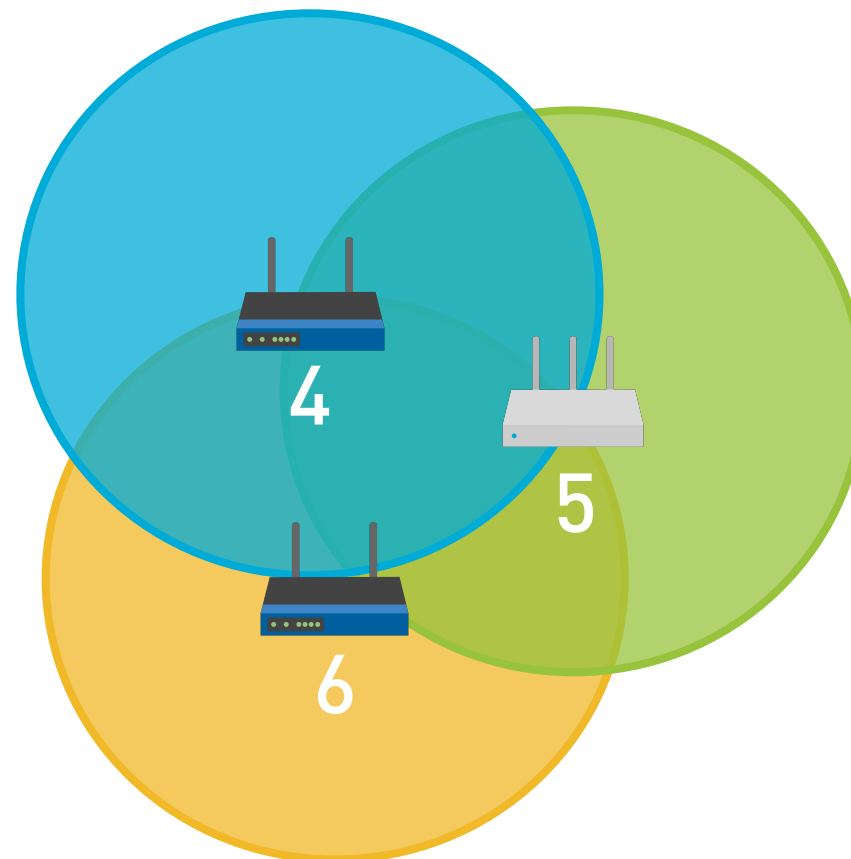
2.4 GHz Interference

Co-Channel



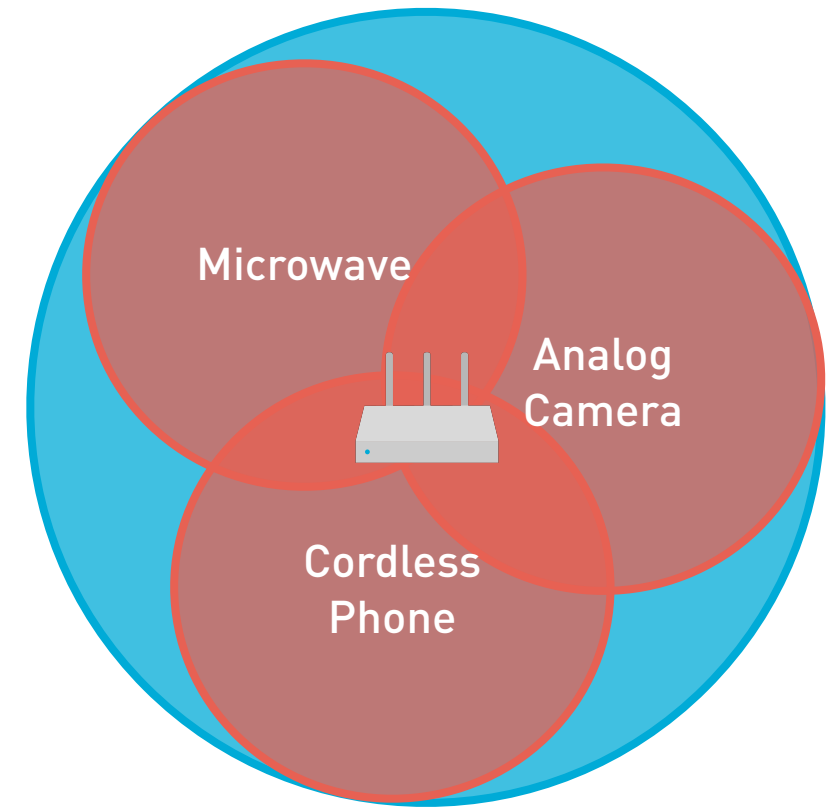
Every client and access point on the same channel competes for time to talk.

Adjacent-Channel



Every client and access point on overlapping channels talk over each other.

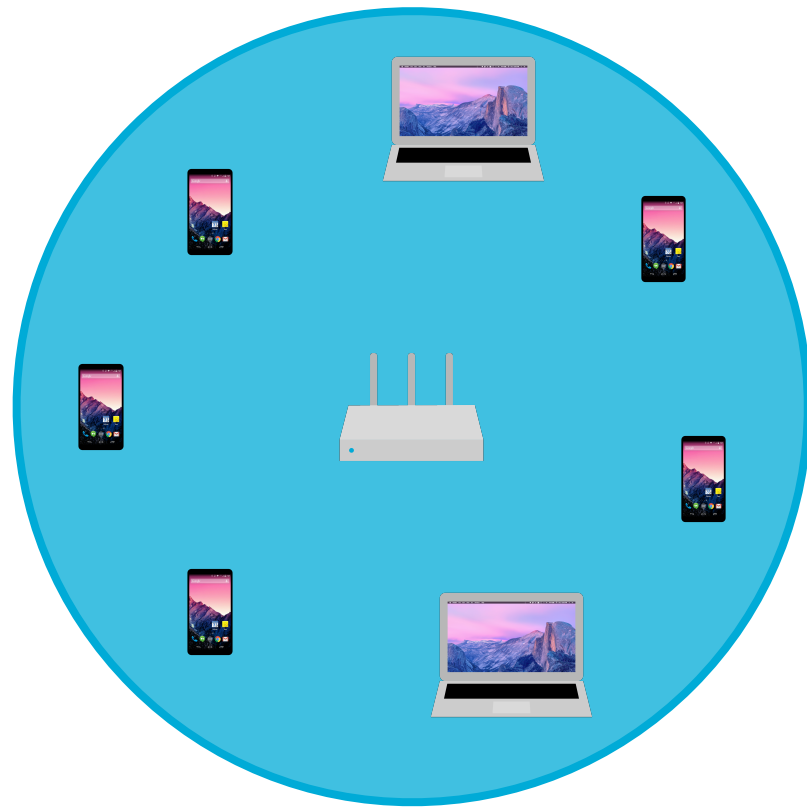
Non-Wi-Fi



Non-802.11 devices compete for medium access.

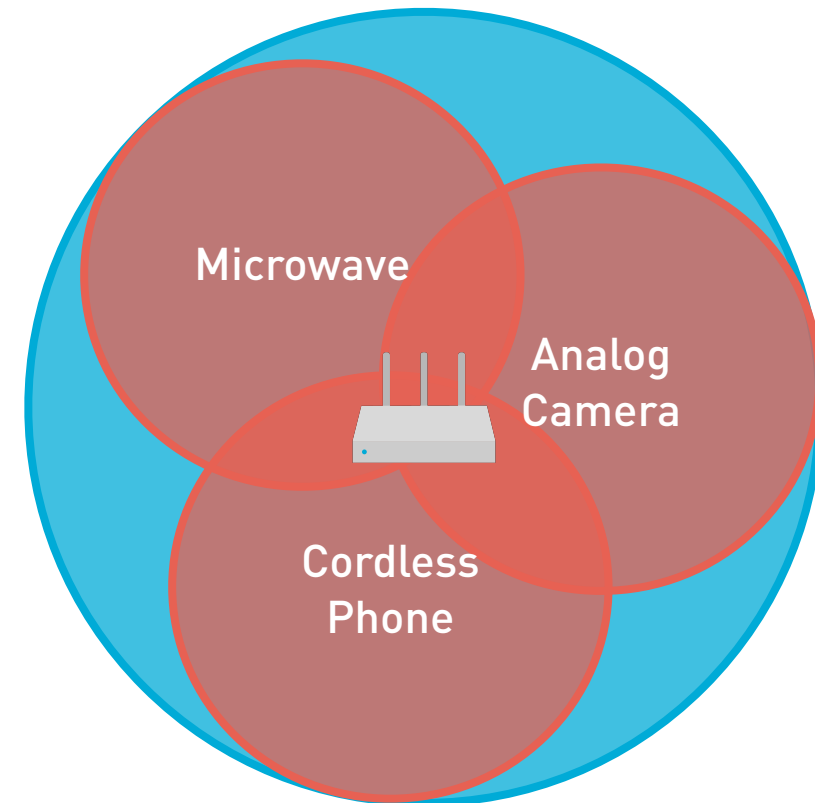
5 GHz Interference

Co-Channel



Every client and access point on the same channel competes for time to talk.

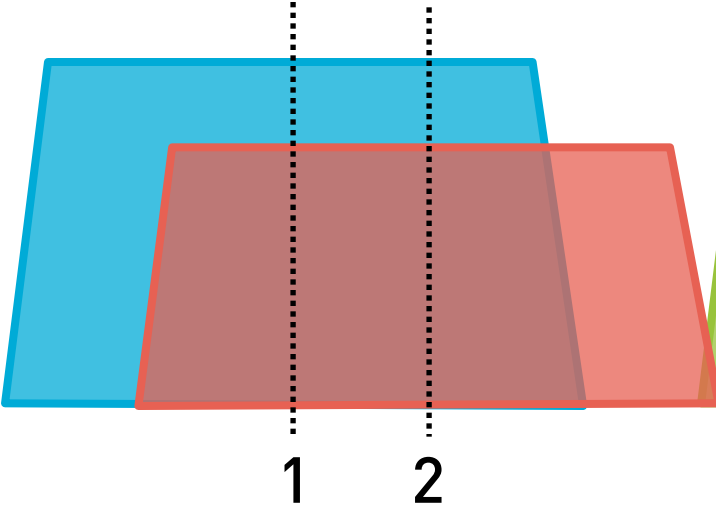
Non-Wi-Fi



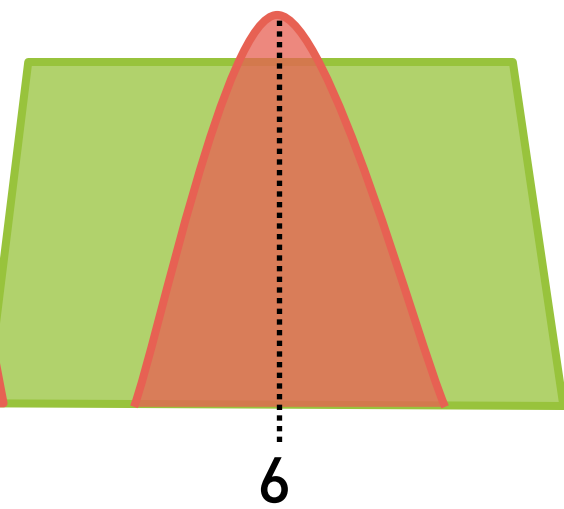
Non-802.11 devices compete for medium access.

Different Tools for Different Jobs

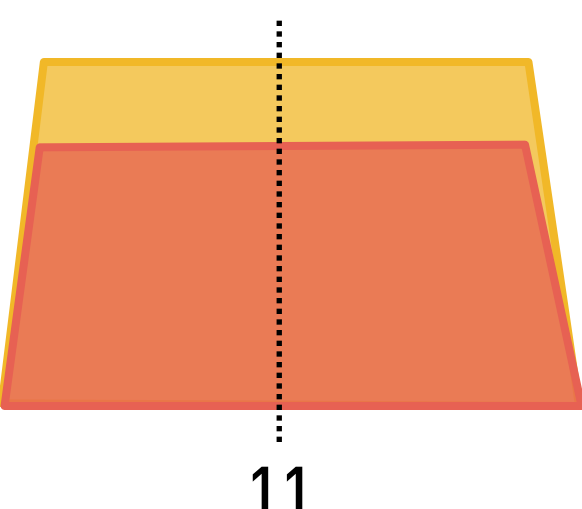
Adjacent-Channel



Non-Wi-Fi



Co-Channel



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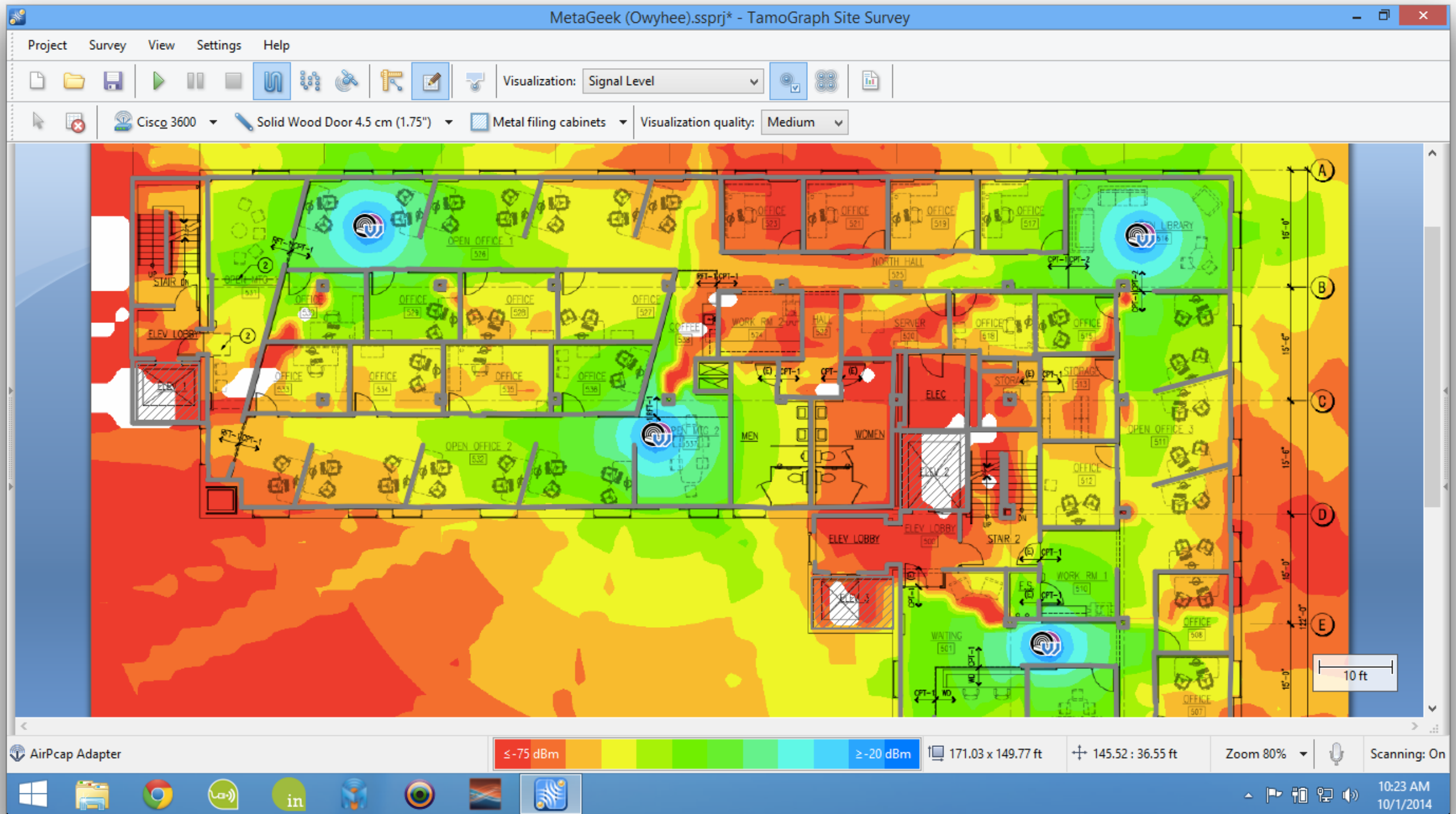
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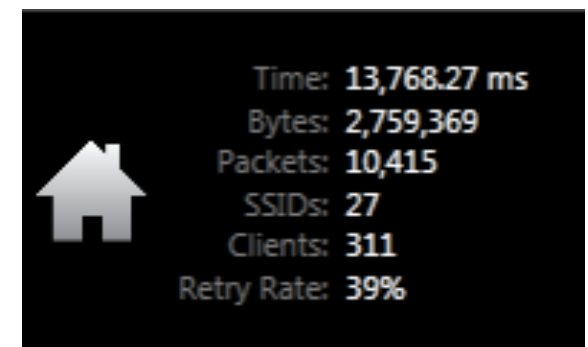
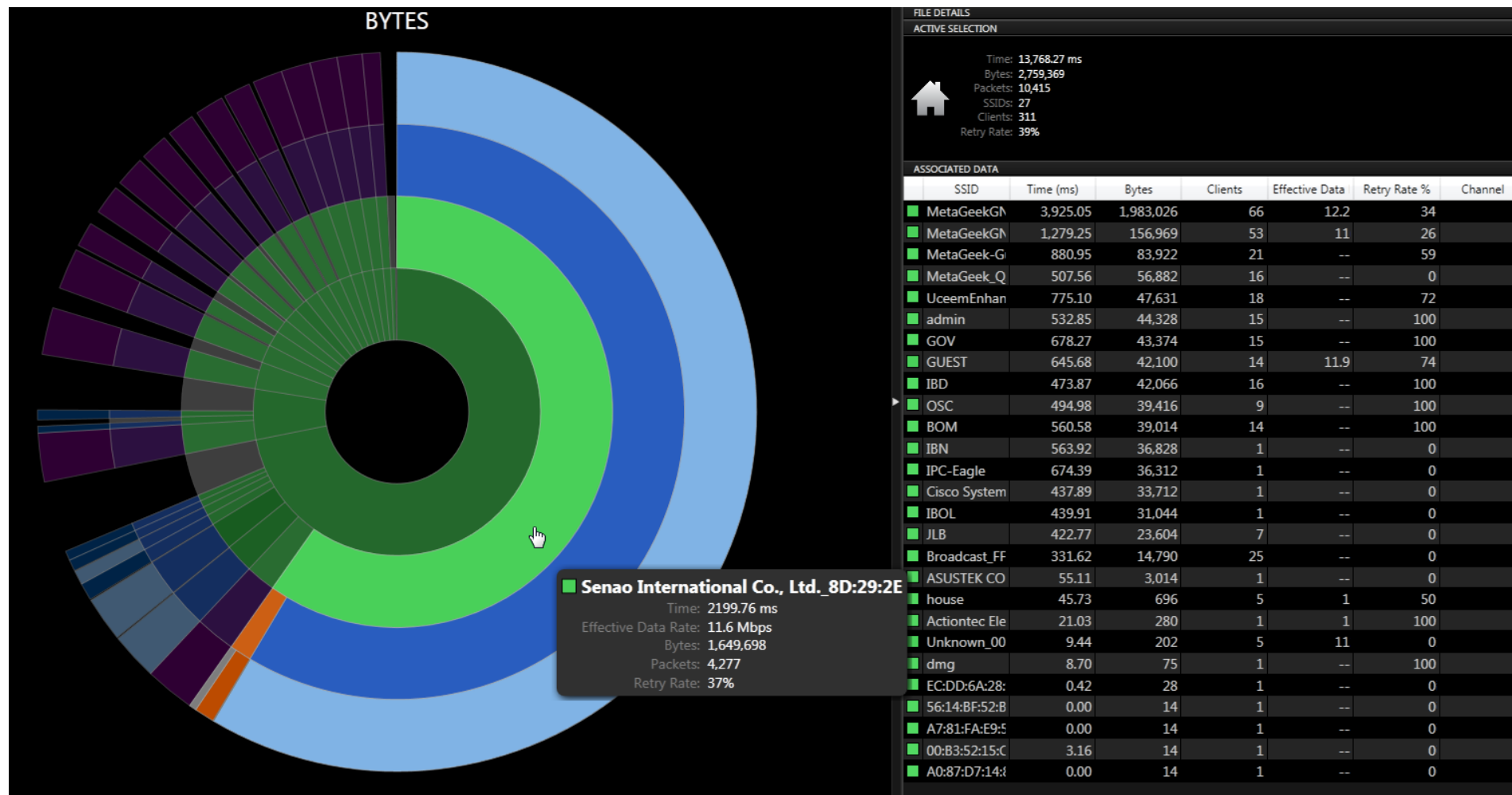
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RF Planning/Site Survey

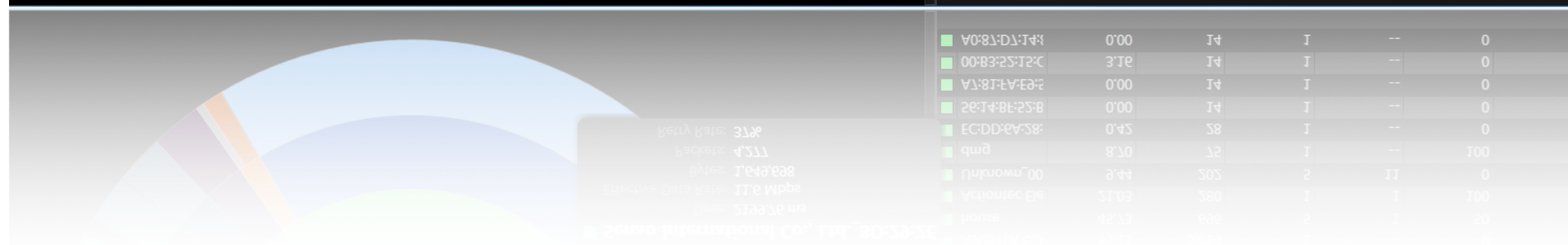


2.4 GHz Doesn't Perform as Well

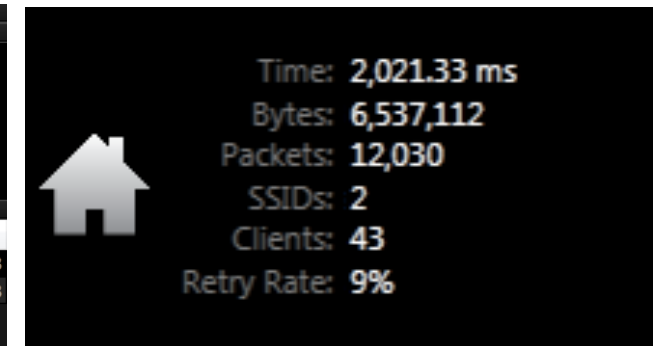
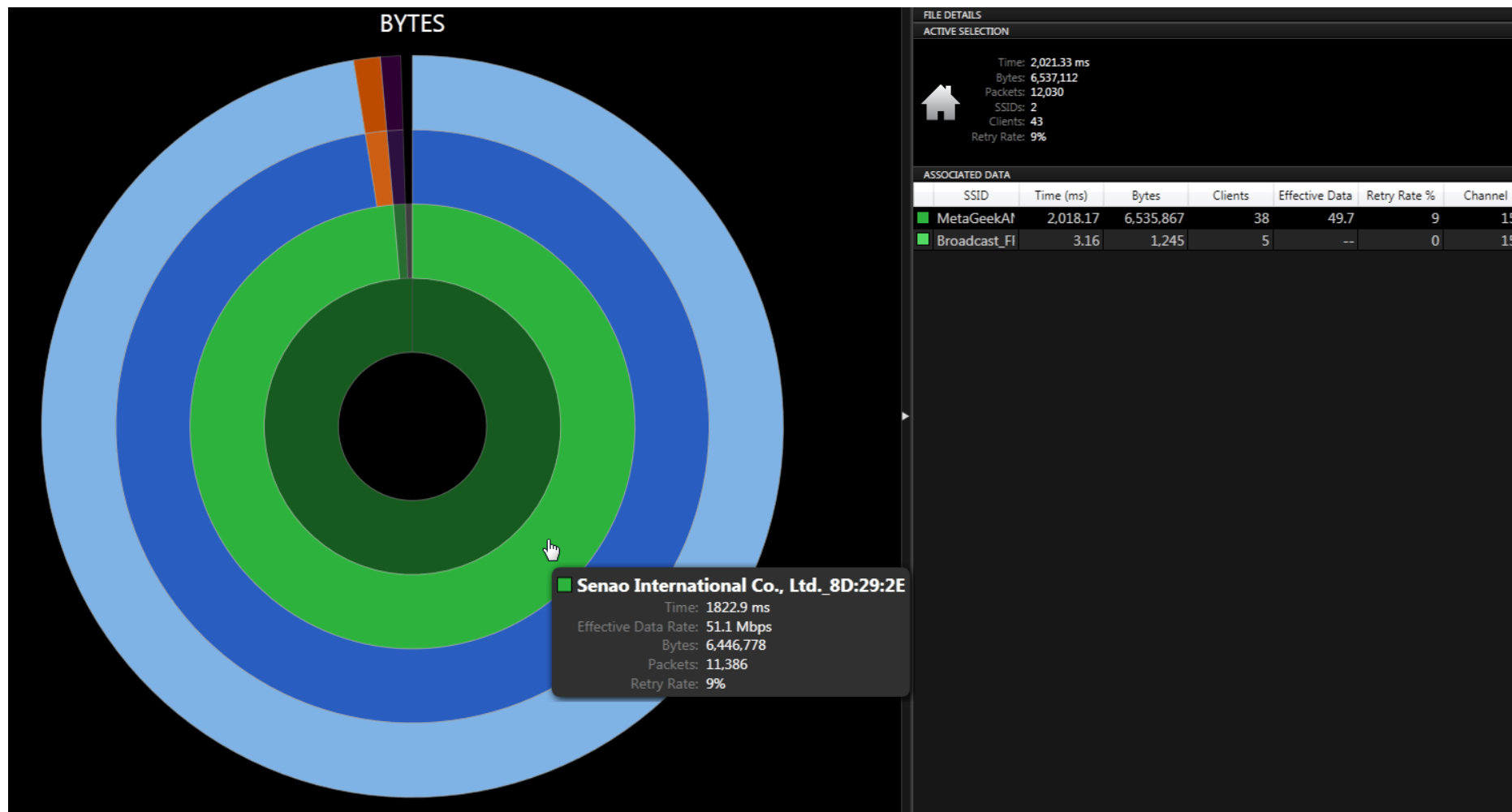


Client-Level Analysis

- Air Time: 2199ms
- Data Rate: 11 Mbps
- Bytes: 1,649,698
- Packets: 4,277
- Retry: 37%



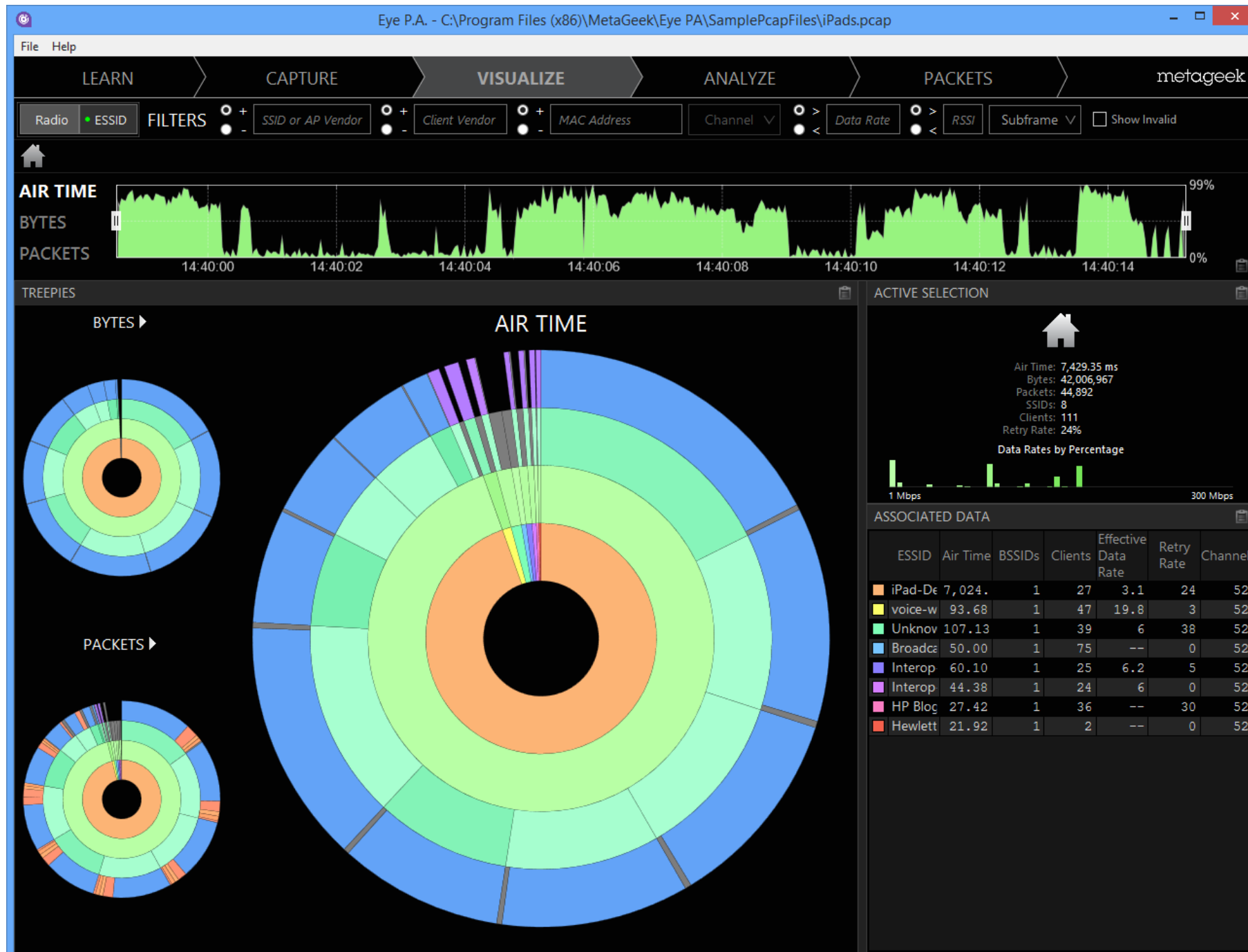
5 GHz Performs Much Better



Client-Level Analysis

- Air Time: 1822.9
- Data Rate: 51 Mbps
- Bytes 6,446,778
- Packets: 11,386
- Retry: 9%

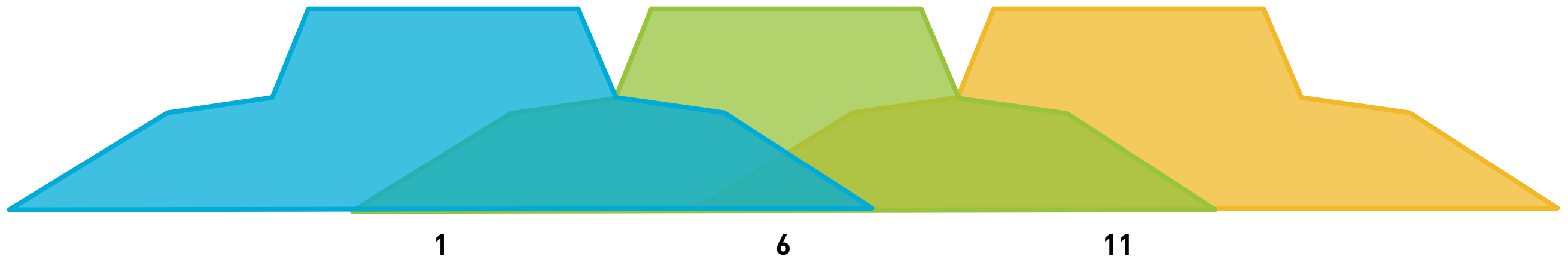
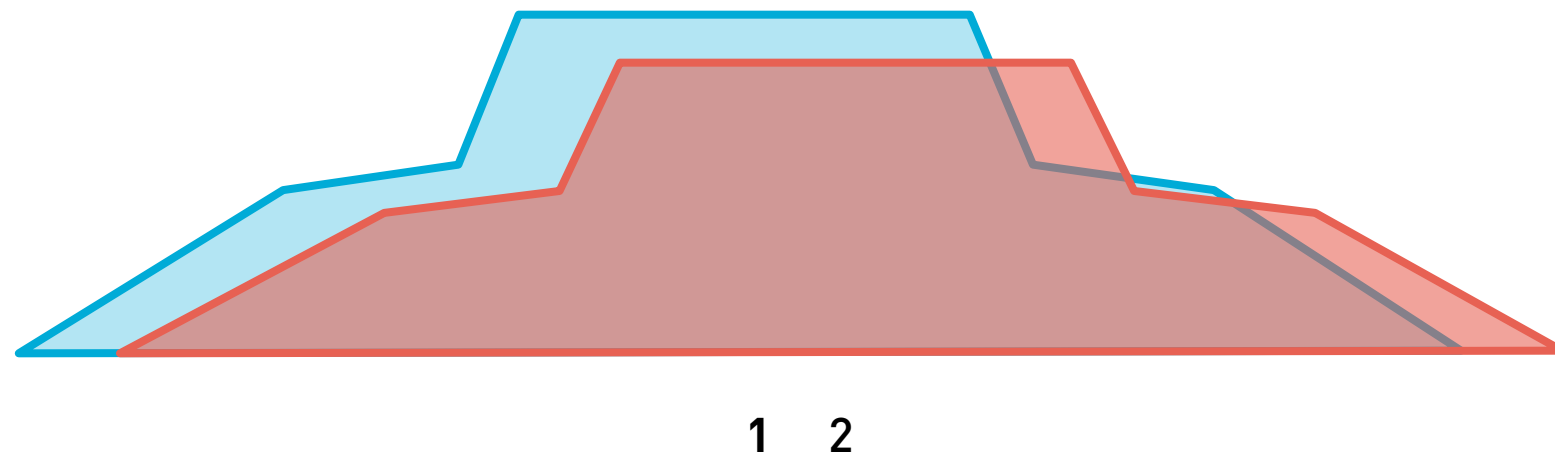
Live Throughput Comparison



Dual-Band Network Goals

1. Eliminate adjacent-channel interference
2. Minimize co-channel interference
3. Provide 2.4 GHz compatibility
4. Provide a fast, 5 GHz network

Eliminate Adjacent-Channel Interference

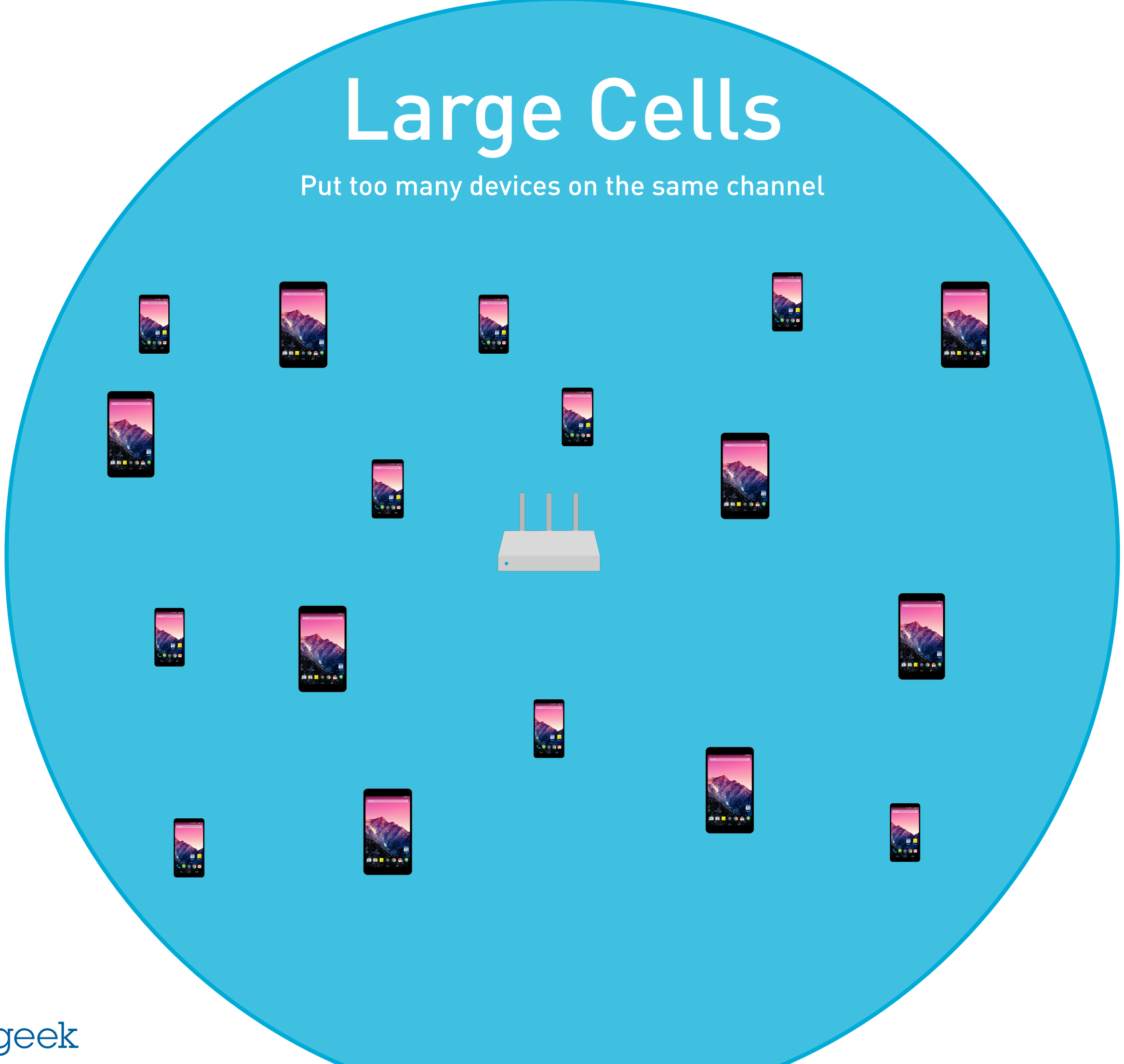


Minimize Co-Channel Interference

1. Small cells
2. Dual-band AP's
3. Good channel plan
4. Make sure everyone has good coverage

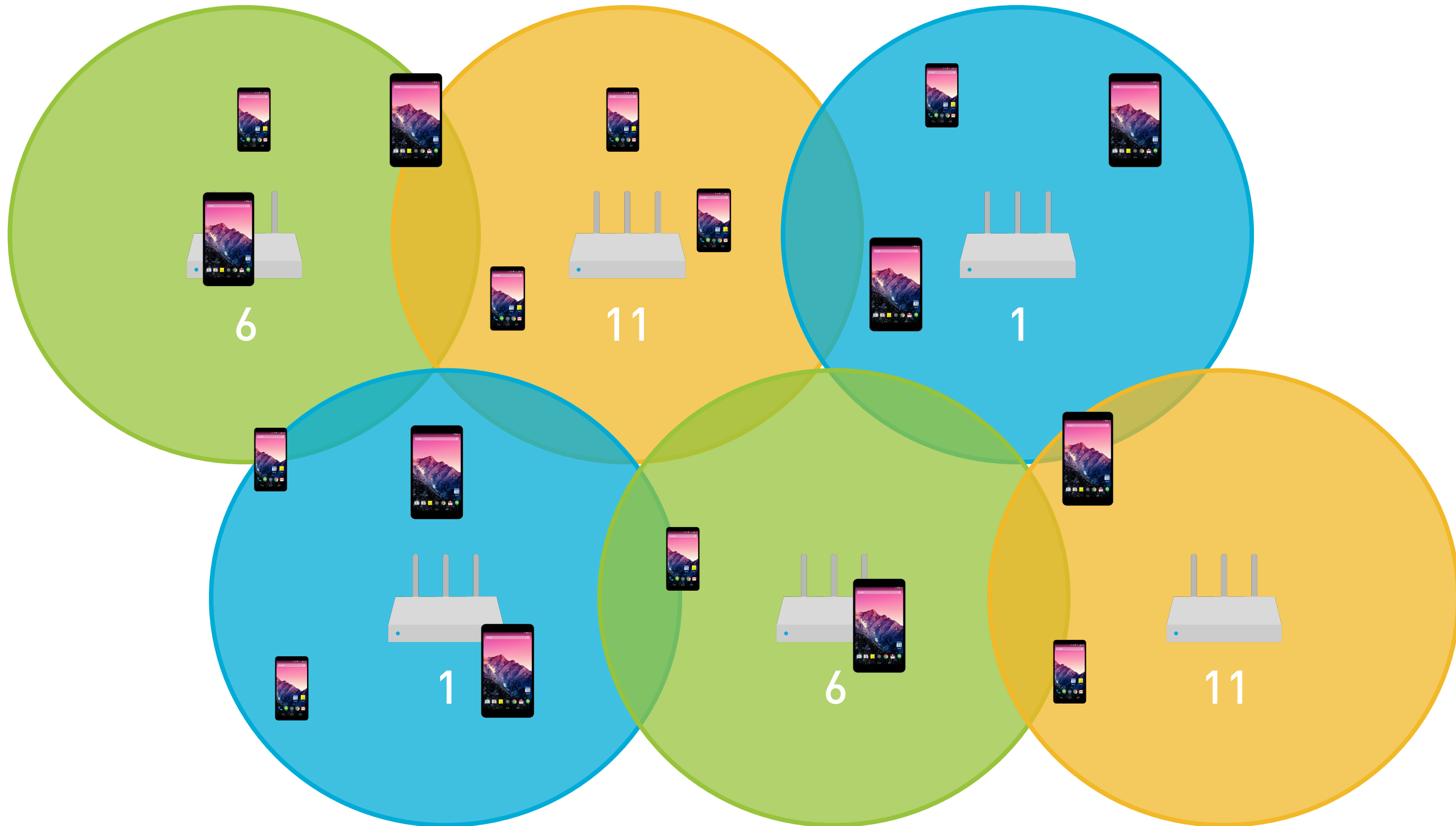
Large Cells

Put too many devices on the same channel



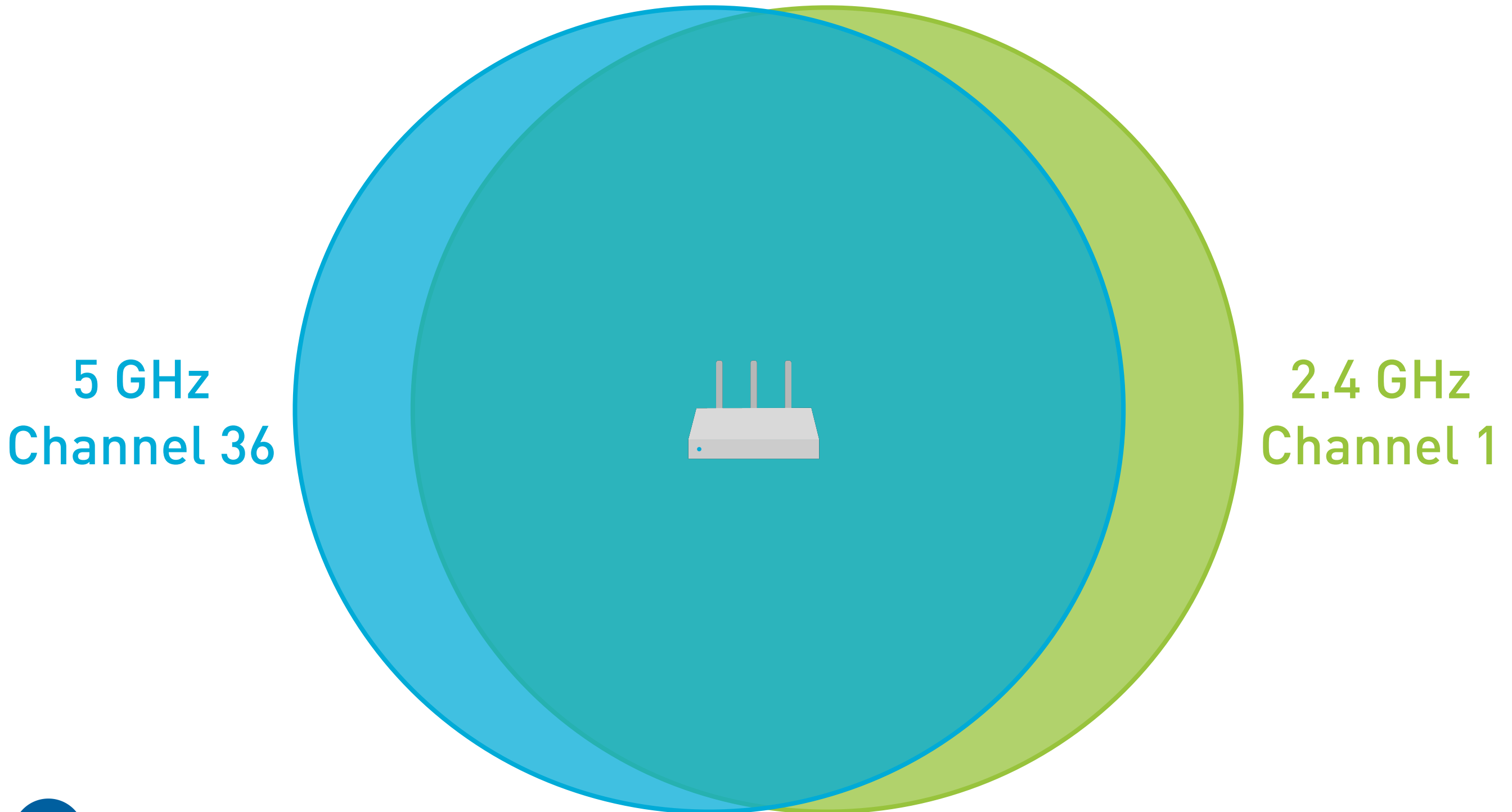
Small Cells

Divide devices up onto different channels



Dual-Band AP's

Bonus channel!



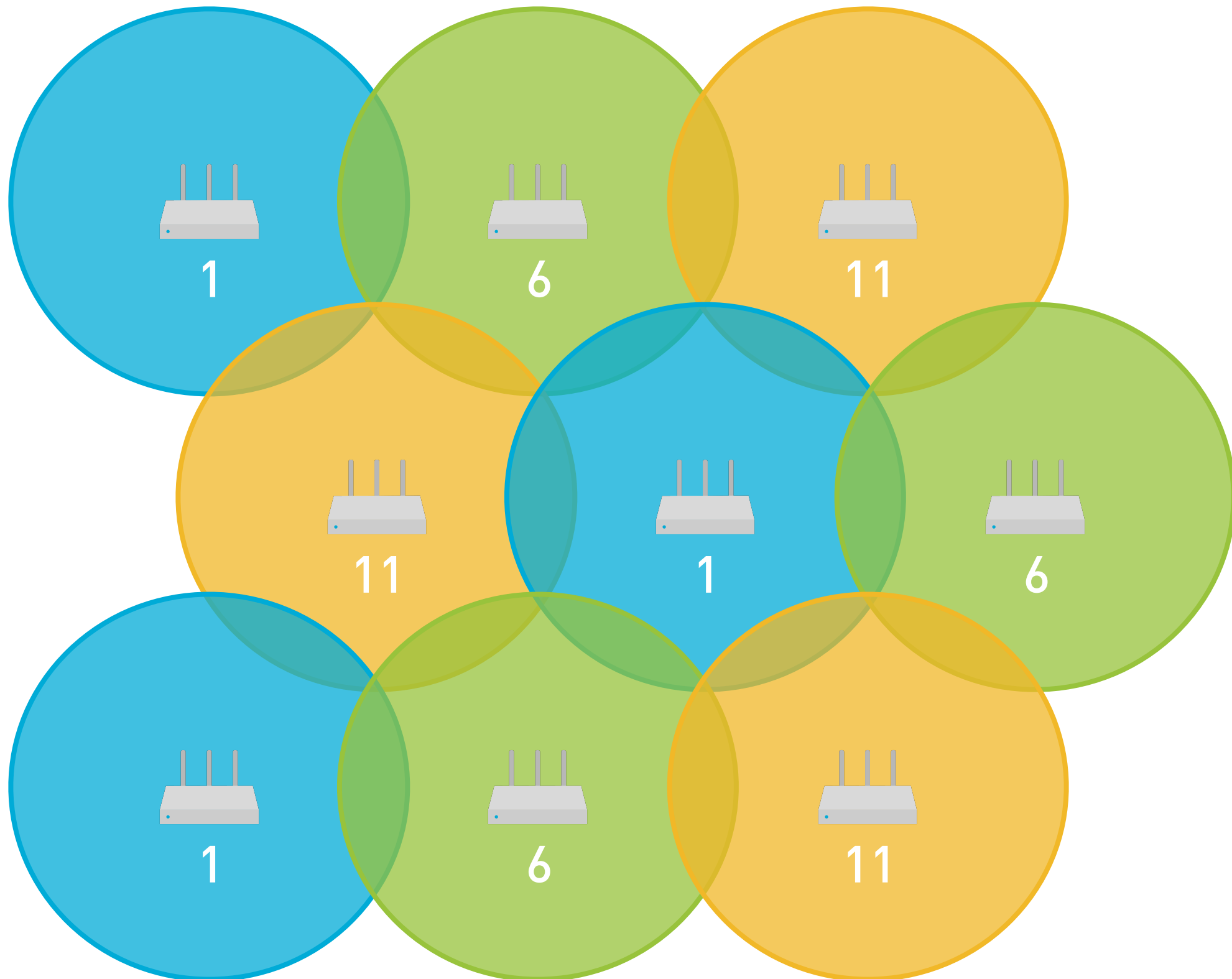
5 GHz

Channel 36

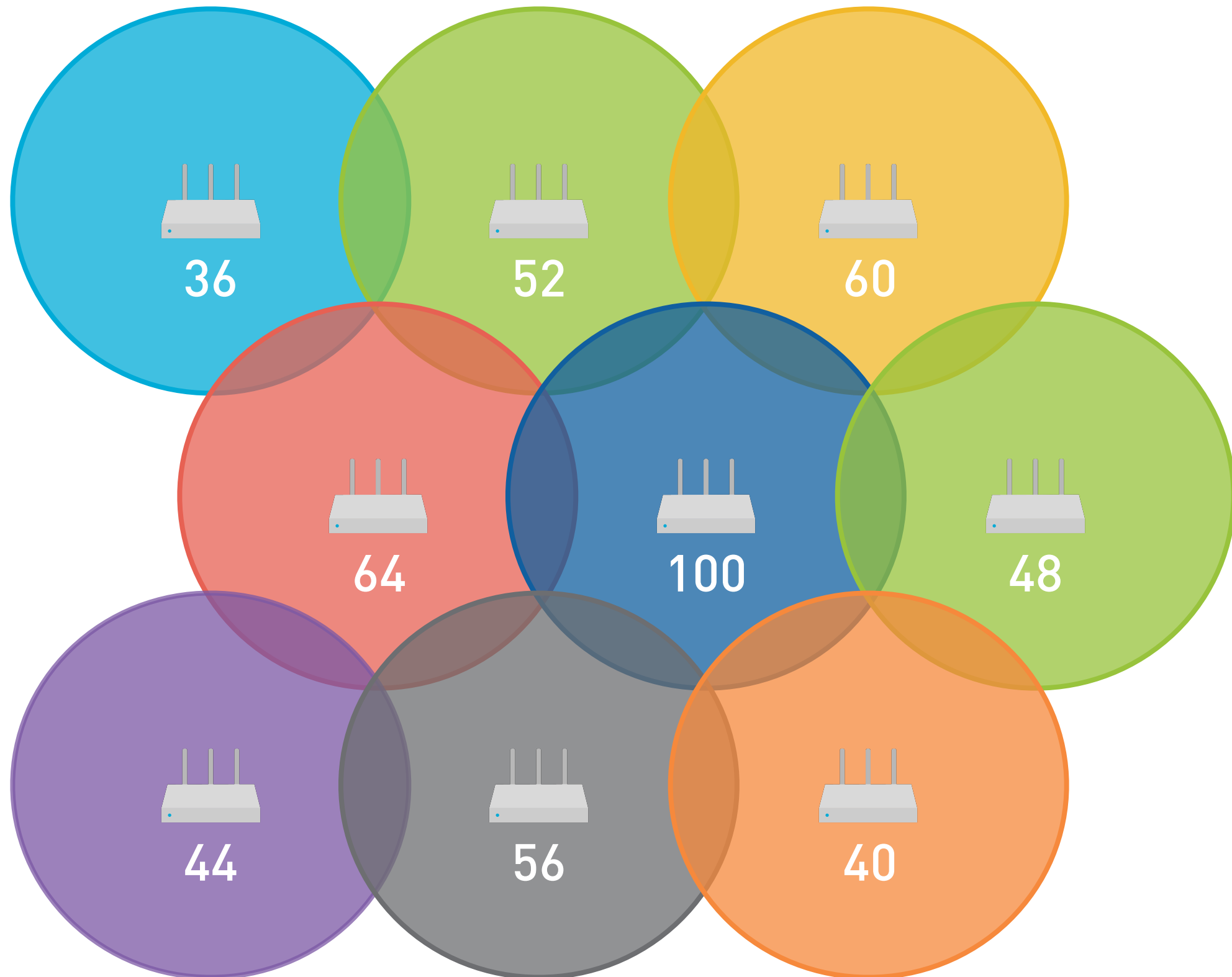
2.4 GHz

Channel 1

2.4 GHz Channel Reuse



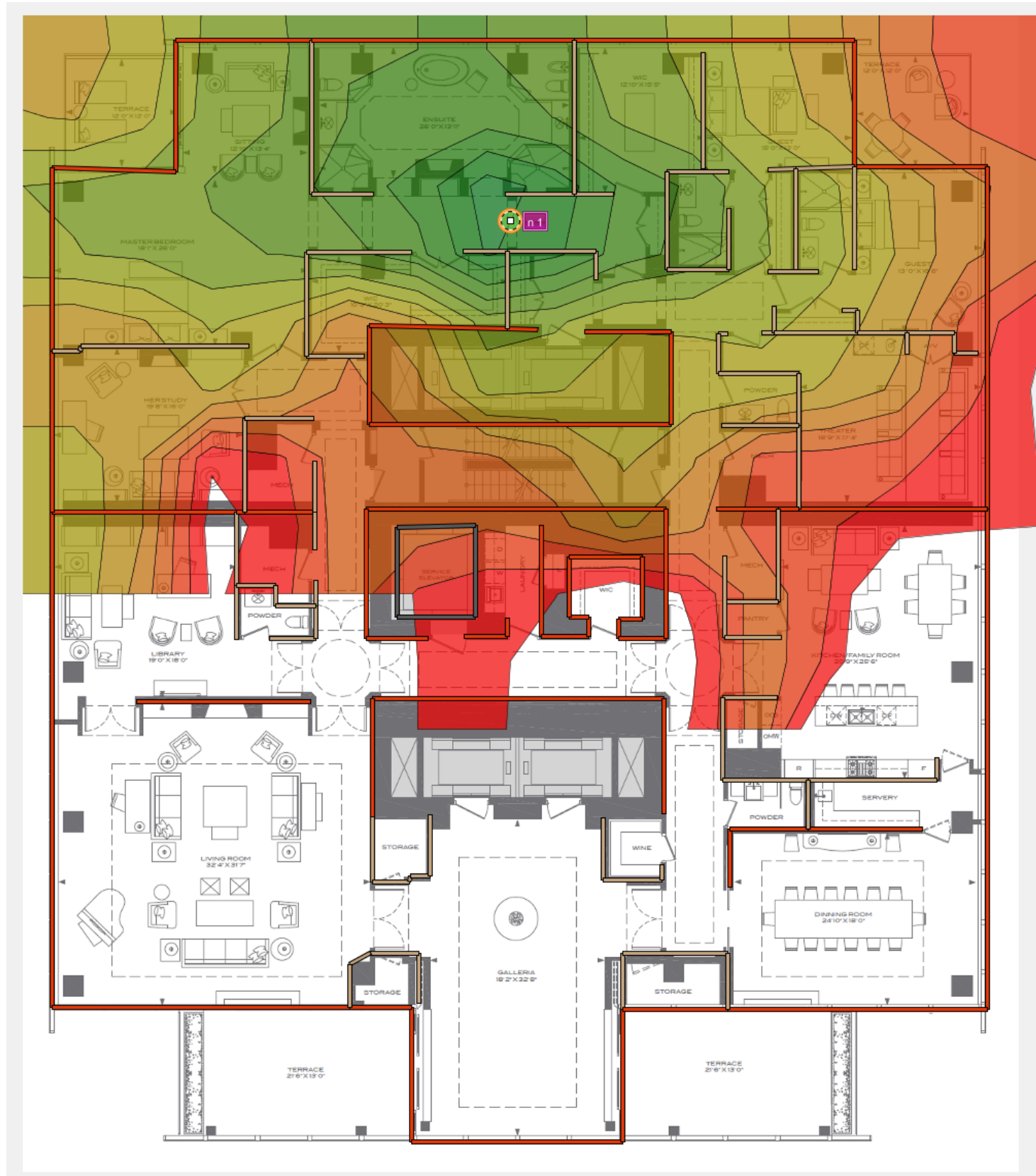
5 GHz Channel Reuse



2.4 GHz Range

2.4 GHz Simulated Range

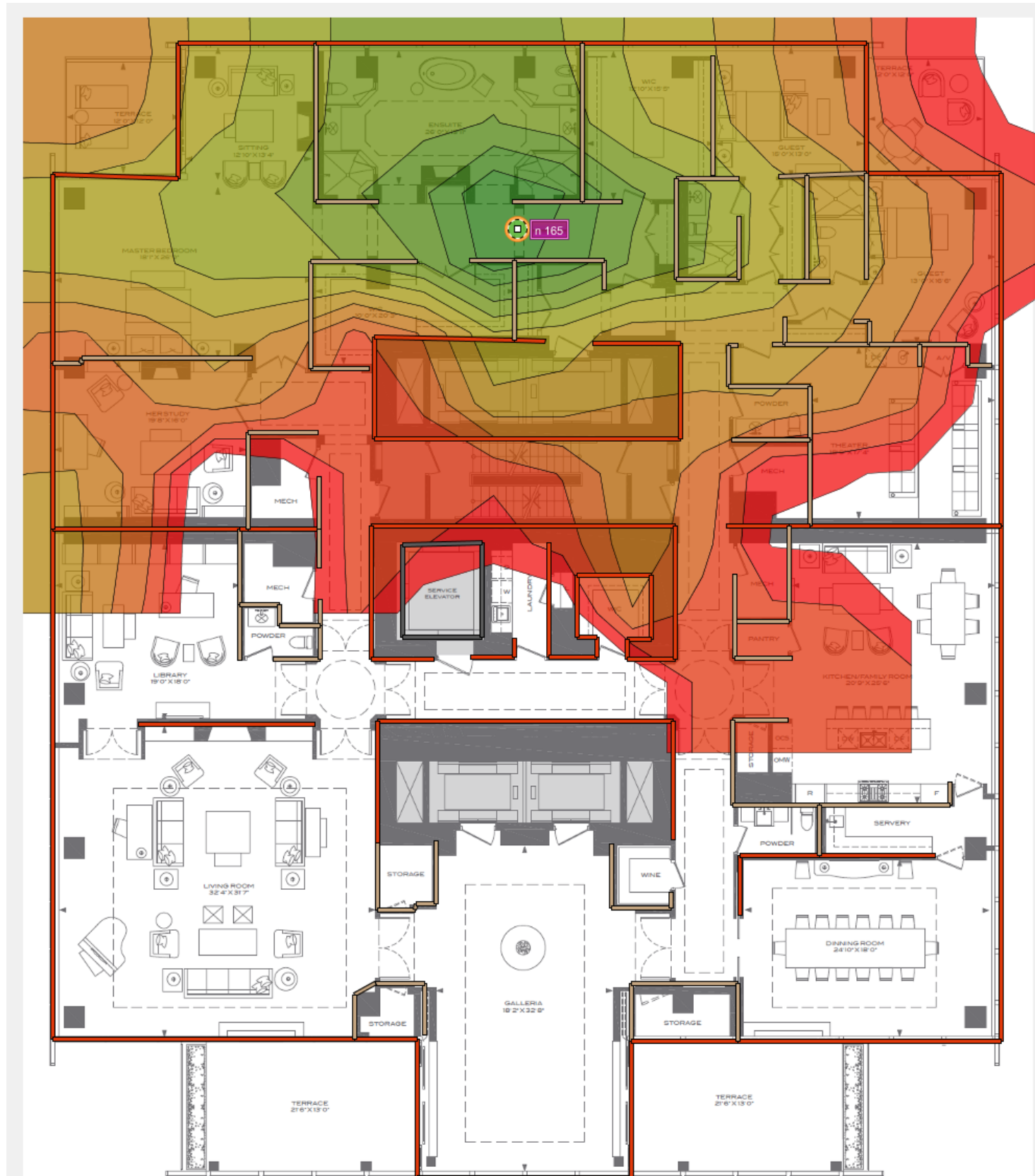
- 150 Mbps (dark green)
- 1-11 Mbps (red)
- Greater indoor range
- Typically a good thing, right?



5 GHz Range

5 GHz Simulated Range

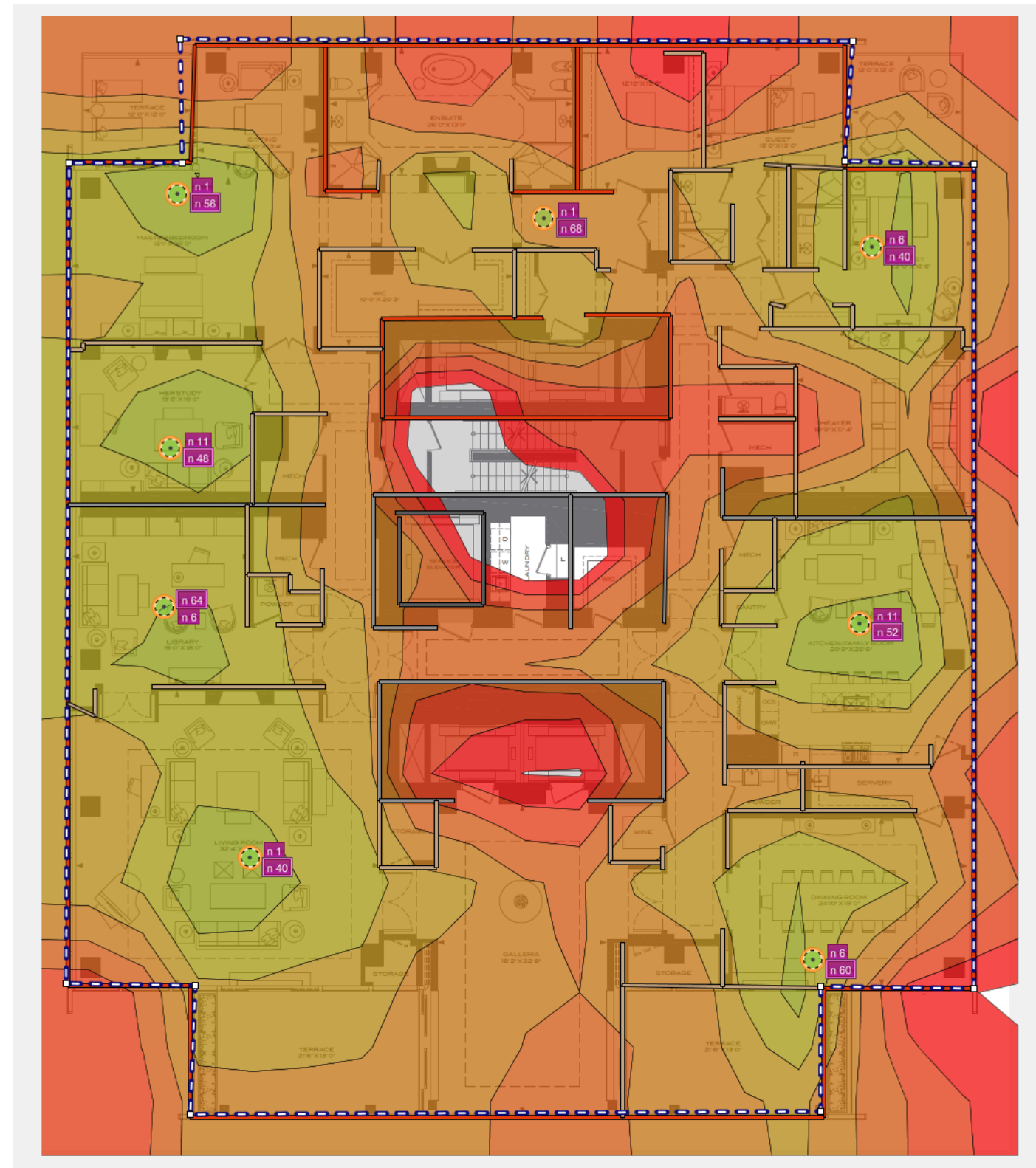
- 150 Mbps (dark green)
- 6-12 Mbps (red)
- Lower indoor range
- Typically a bad thing, right?



Dual-Band Network

Dual Band Access Points

- Eliminate adjacent-channel interference
- Minimize co-channel interference
- Double potential wireless bandwidth
- Provide 802.11b/g/n compatibility
- 802.11a/n/ac clients enjoy better performance
- Lower retry rates
- Lower impact from interference



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- 2x2 MIMO

Questions?



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Twitter: [@FuelCellWiFi](https://twitter.com/FuelCellWiFi)



Thanks for Attending!