



TURN IT UP

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The bridge to possible

Catalyst Wireless

Optimize your wireless network for real time and mobile clients

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BRKEWN-2051

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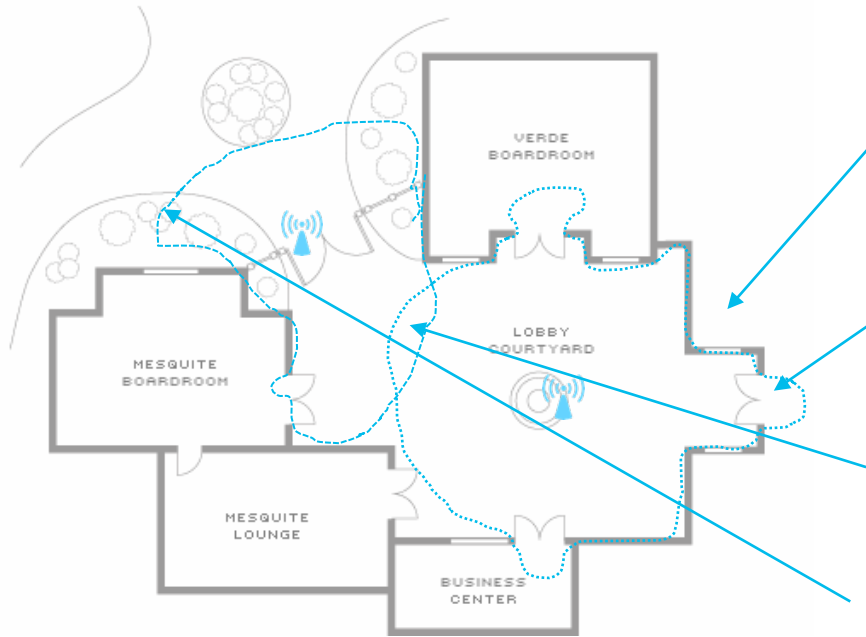




Agenda

- Introduction – the ideal Wi-Fi Coverage
- Taking Care of AP Power
- Taking Care of the Roaming Edge
- Taking Care of the Wi-Fi Domain Edge
- Maximizing Efficiency in the Cell
- Conclusion

The Ideal Wi-Fi Coverage



AP cell is not available here, where signal would be too weak for any client

Signal starts here, where STA can connect with good *goodput*

AP cell overlap is 'optimal': the STA still has good signal, but can find a better next best AP

AP cell stops where *goodput* stops

Take Care of Power

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Use the Same Power as your Clients

AP at default (max) power



This is the AP 'signal' (at phone level)

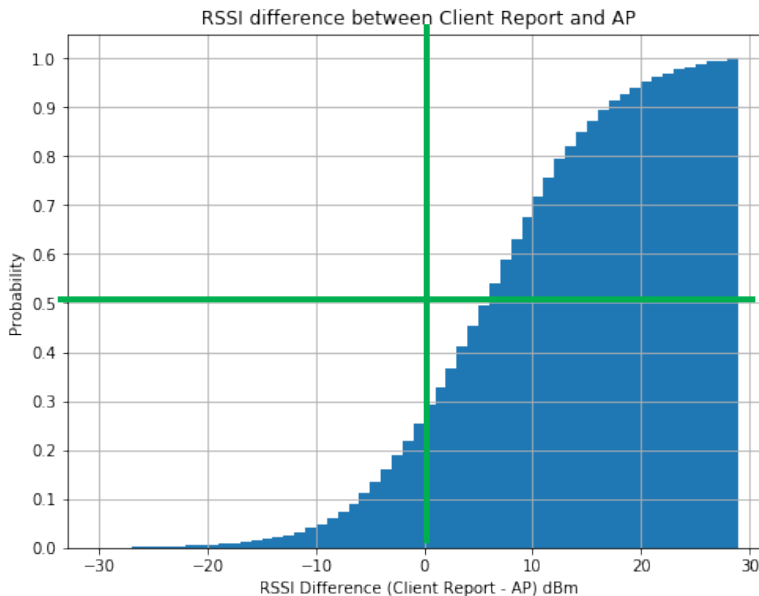
I see you at -56



This is the phone 'signal' (at AP level)

I see you at -62

AP vs client average view



Most smartphones operate at 11 to 14 dBm, so should your APs

Set the AP Power Boundaries

- You can add a 3dB margin if you are unsure
 - Some APs may be in high density environments, others may have to cover large areas
 - Stricter boundaries, before deployment, is easier than post-deployment adjustments
- This step implies that you know your clients

Configuration > Radio Configurations > RRM

5 GHz Band 2.4 GHz Band FRA

General Coverage DCA **TPC** RF Grouping Spatial Reuse

Power Assignment Method

☒ Automatic

☐ On Demand

☐ Fixed

Invoke Power Update Once

Max Power Level Assignment* 17

Min Power Level Assignment* 8

Power Threshold* -70

Power Assignment Leader

Transmit Power Update Interval

Last Run:

Power Neighbor Count:

Check Your Clients in WLC/DNAC

AireOS

Not-your-phone

MAC Address
da:30:1a:46:6f:02

Uptime
Associated since 5 Minutes 8 Seconds

SSID
Wiinet

AP Name
Office (Ch 64)

Nearest APs
Hermes(-82 dBm) Master(-81 dBm) Stairs(-64 dBm)

Device Type
iPhone13,3

OS Version
14.2.1

Last disassociated AP
b0:26:80:e4:7b:60

Last disassociation reason
User triggered disassociation

Performance
Signal Strength: -55 dBm Signal Quality: 40 dB Connection Speed: 173 Mbps Channel Width: 20 M

360 View

General

QOS Statistics

ATF Statistics

General



User Name
Jerome

MAC Address 7257.b041.f06a

Uptime(sec) 138 seconds

WLAN Name Corporate

AP Name 4800-B

Device Type iPhone12

Device OS 14.2

Client Performance Signal Strength:-62 dBm

Capabilities 802.11ac

Fabric Status Disabled

IOS-XE

General



User Name
Stephen

MAC Address d286.b8ed.f36c

Uptime(sec) 413 seconds

WLAN Name Corporate

AP Name 4800-B

Device Type Samsung Galaxy Note 20 (Phone)

Software Version (Carrier Code) TA1(AUT)

Device OS Android 10

Client Performance Signal Strength:-64 dBm Signal Quality:31 dB

Capabilities 802.11ac

Fabric Status Disabled

Reciprocal Exchanges (“Knowing Each Other”)

(Apple iOS exchange after association – same would happen with Samsung or Intel)

18.331689	Cisco_61:14:8e	62:61:8b:ba:57:f6	Association Response, SN=1462, FN=0, Flags=.....C
18.354630	62:61:8b:ba:57:f6	Cisco_61:14:8e	Null function (No data), SN=695, FN=0, Flags=.....TC
18.354636	62:61:8b:ba:57:f6	Cisco_61:14:8e	Action, SN=696, FN=0, Flags=.....C, SSID=Open
18.354903	62:61:8b:ba:57:f6	Cisco_61:14:8e	Action, SN=697, FN=0, Flags=.....C
18.355961	Cisco_61:14:8e	62:61:8b:ba:57:f6	Action, SN=5, FN=0, Flags=.....C

What is the neighborhood like?

IEEE 802.11 Wireless Management

▼ Fixed parameters

Category code: Radio Measurement (5)

Action code: Neighbor Report Request (4)

Meet the neighbors

IEEE 802.11 Wireless Management

▼ Fixed parameters

Category code: Radio Measurement (5)

Action code: Neighbor Report Response (5)

Dialog token: 172

▼ Tagged parameters (30 bytes)

▼ Tag: Neighbor Report

Tag Number: Neighbor Report (52)

Tag length: 13

BSSID: Cisco_d8:b7:4e (00:a2:ee:d8:b7:4e)

▶ BSSID Information: 0x00002f7

Operating Class: 125

Channel Number: 157 (iterative measurements on that Channel Number)

PHY Type: 0x07

▼ Tag: Neighbor Report

Tag Number: Neighbor Report (52)

Tag length: 13

BSSID: Cisco_d8:b7:41 (00:a2:ee:d8:b7:41)

▶ BSSID Information: 0x00002e7

Operating Class: 118

IEEE 802.11 Wireless Management

▼ Fixed parameters

Category code: Radio Measurement (5)

Action code: Radio Measurement Report (1)

Dialog token: 0

▼ Tagged parameters (31 bytes)

▼ Tag: Measurement Report

Tag Number: Measurement Report (39)

Tag length: 29

Measurement Token: 0x71

▶ Measurement Report Mode: 0x00

▼ Measurement Report Type: Beacon Report (0x05)

Operating Class: 243

Measurement Channel Number: 48 (iterative measurements on t

Measurement Start Time: 0x0a04eb099b07fc6f

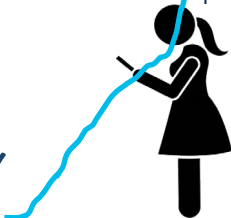
Measurement Duration: 0xb981

▶ Reported Frame Information: 0x00

Received Channel Power Indicator (RCPI): 206 (P = -7.0 dBm)

This is how I saw the world

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Activating Exchanges

For Apple or Samsung,
no action needed

For others, enable
individually 802.11k,v

Or enable MBO

- Enables 802.11k/v/w

There are no downsides
to

802.11k/v

Test PMF/802.11w
before deployment

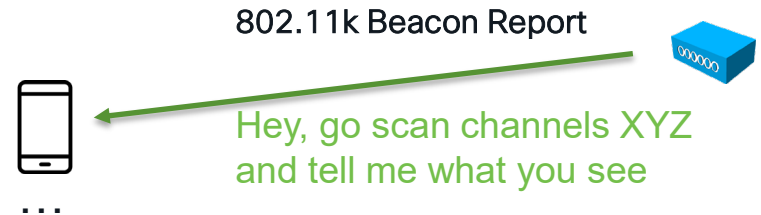
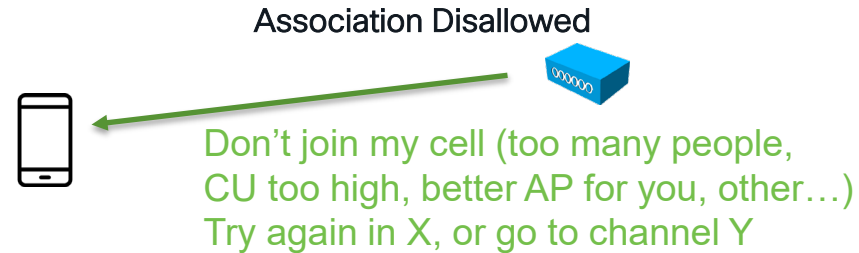
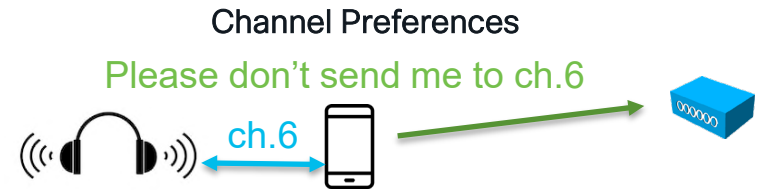
11v BSS Transition Support		Scan Defer Time	100
Assisted Roaming (11k)			
BSS Transition	<input checked="" type="checkbox"/>	Prediction Optimization	<input type="checkbox"/>
Disassociation Imminent(0 to 3000 TBTT)	200	Neighbor List	<input checked="" type="checkbox"/>
Optimized Roaming Disassociation Timer(0 to 40 TBTT)	40	Dual Band Neighbor List	<input type="checkbox"/>
BSS Max Idle Service	<input checked="" type="checkbox"/>	DTIM Period (in beacon intervals)	
BSS Max Idle Protected	<input type="checkbox"/>		
Directed Multicast Service	<input checked="" type="checkbox"/>	5 GHz Band (1-255)	1

```
C9800#conf t
Enter configuration commands, one per line. End with CNTL/Z.
C9800(config)#wlan Corporate
C9800(config-wlan)#shut
C9800(config-wlan)#security pmf optional
C9800(config-wlan)#mbo
C9800(config-wlan)#no shut
```

Wi-Fi Aware (aka MBO)


Optimized Multiband Operations (Wi-Fi Alliance)

- At association: channel preferences (STA), association disallowed (AP)
- During the session: 802.11v (BTM), including 'go to LTE' variant, 802.11k reports
- Supported by all recent Samsung Galaxy / Notes clients
- In eWLC 16.12 and AireOS 16.10



(after scan completes)

Ah, on ch 36, AP5 was there, I detected that many frames while listening for duration X, then on ch 44, ...



The diagram shows a mobile phone icon.

Clients and Report Operations

Use your Samsung Clients to create a client RF map

- C9800#wireless client mac-address a6b0.839d.d11b scan-report ?
once One-time request for a scan report (beacon measurement report) from a wireless client
periodic Periodically request a scan report (beacon measurement report) from a wireless client
C9800#wireless client mac-address a6b0.839d.d11b scan-report once mode ?
active (1) Request client to actively measure beacons with probing
passive (0) Request client to passively measure beacons without probing
table (2) Request client to report its stored beacon measurements that it has already received
- C9800#wireless client mac-address a6b0.839d.d11b scan-report once mode active bssid all ssid all operating-class ?

Active: best option,
go scan those
channels

Passive: less RF
invasive, but most
time consuming

Table: good... only
if the client
scanned within the
last 11 seconds

Clients and Report Operations

- C9800#wireless client mac-address a6b0.839d.d11b scan-report once mode active bssid all ssid all operating-class ?
- <1-255> Request beacon measurements from one specific operating class. Validated Operating Classes: 81,82,115,118,121,124.
- network Request beacon measurements for all Cisco network channels in set of six operating classes. Set of Operating Classes: {81,82,115,118,121,124}.
- <0-65535> msec
- default Default maximum measurement duration for client to measure beacons (passive = 112 msec, active = 200 msec, table = 0 msec)
- C9800#wireless client mac-address a6b0.839d.d11b scan-report once mode active bssid all ssid all operating-class 81 channel all delay none duration default
- C9800#show wireless client mac-address a6b0.839d.d11b detail
- C9800#debug wireless client mac-address a6b0.839d.d11b

Class	Channels
81	1,2,3,4,5 6,7,8,9,10 11,12,13
82	14
115	36,40, 44,48
118	52,56, 60,64
121	100,104,108, 112,116,120, 124,128,132, 136,140,144
124	149,153, 157,161

Clients and Report Operations

target channel

a6:b0:83:9d:d1:1b	Broadcast	Probe Request, SN=2076, FN=0, Flags=.....C, SSID=open
-------------------	-----------	---

Back on main AP channel

101 3.900671	a6:b0:83:9d:d1:1b	Cisco_61:14:8e	Action, SN=2138, FN=0, Flags=.....C, BI=100, SSID=open
107 4.105056	a6:b0:83:9d:d1:1b	Cisco_61:14:8e	Null function (No data), SN=2139, FN=0, Flags=...P...TC

▼ Tagged parameters (687 bytes)

▼ Tag: Measurement Report

Tag Number: Measurement Report (39)

Tag length: 251

Measurement Token: 0x01

► Measurement Report Mode: 0x00

▼ Measurement Report Type: Beacon Report (0x05)

Operating Class: 124

Measurement Channel Number: 149 (iterative measurements on that Channel Number)

Measurement Start Time: 0x00000002e2ea0a5c

Measurement Duration: 0x0064

► Reported Frame Information: 0x00

Received Channel Power Indicator (RCPI): 62 (P = -79.0 dBm)

Received Signal to Noise Indicator (RSNI): 16.0 dB

BSSID Being Reported: Cisco_61:14:81 (f4:db:e6:61:14:81)

Antenna ID: 0x00

Parent Timing Synchronization Function (TSF): 0x00000000

► SubElement ID: Reported Frame Body (1)

► SubElement ID: Reported Frame Body Fragment ID (2)

▼ Tag: Measurement Report

Tag Number: Measurement Report (39)

Tag length: 89

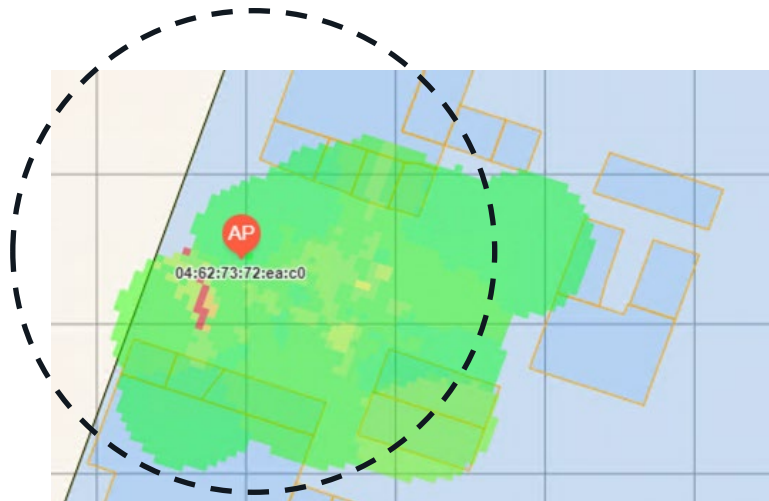
Measurement Token: 0x01

► Measurement Report Mode: 0x00

▼ Measurement Report Type: Beacon Report (0x05)

Operating Class: 124

Measurement Channel Number: 149 (iterative measurements on that Channel Number)



If you like scripting, build your own client maps

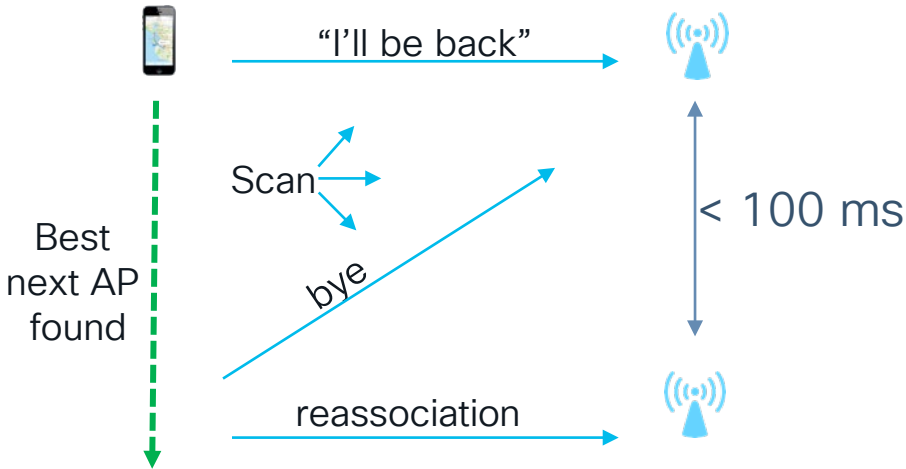
Take Care of Roaming Edge

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Roaming Scenarios

Weaker signal, need to roam...



Seamless roaming scenario

CAN
YOU
HEAR
ME



Can't talk to AP!

- No response, multiple retries, rate shifts...
- AP kicked me out

Panic scan!

AP found! Reassociation....

Failure! Bad AP / connection failed

Panic scan! ...

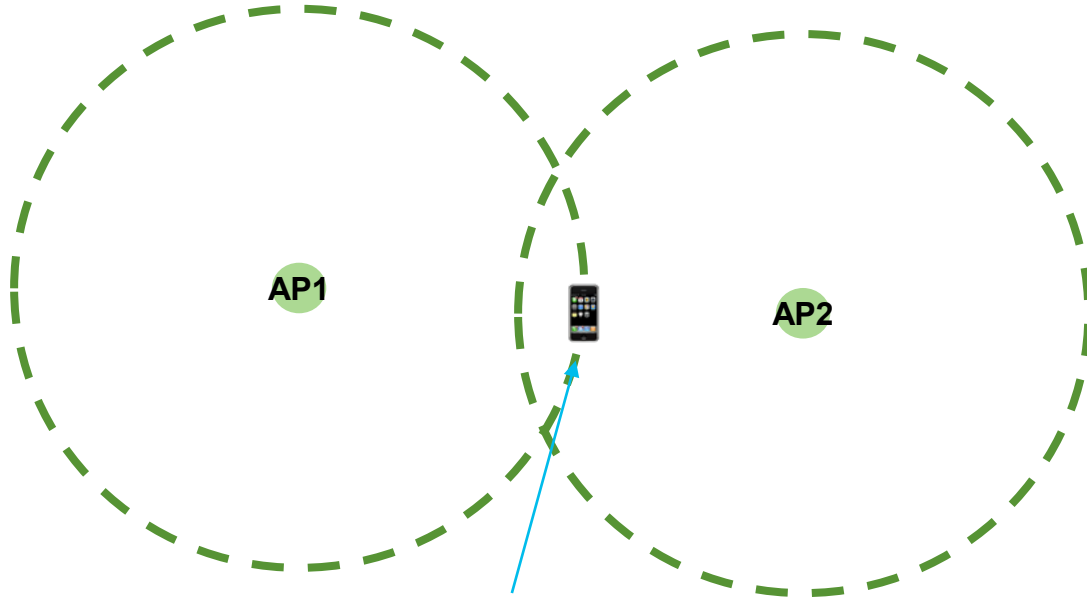


Many
seconds



"We like support calls" scenario

Optimal Cell Edge



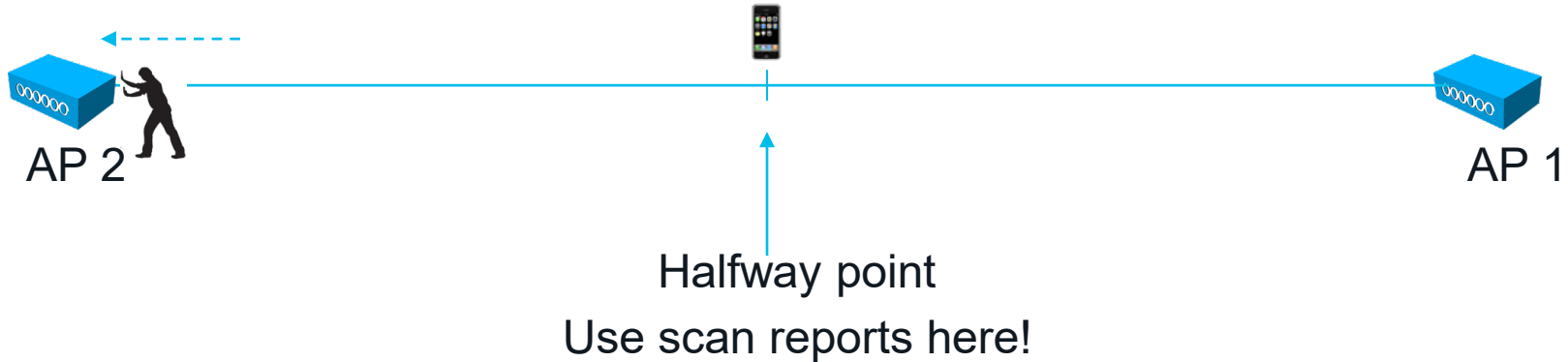
At the point where AP1 signal is -70 dBm,
AP2 signal is -62 dBm
That's a -66 dBm edge

- iPhones start scanning at -70 dBm, jumps to next AP if 8 dB better (w/ active traffic)
- Samsung, Intel start scanning at -75 dBm, need 6 to 8 dB more to jump

The - 72 dBm Rule

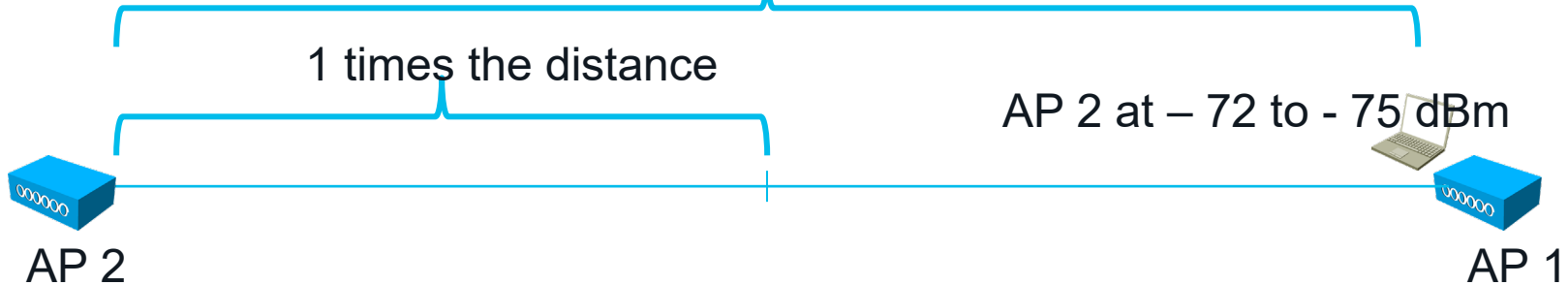
- So if you stand at the “-66 dBm border”...
 - Move away from AP 1 until you get - 66 dBm
 - Then push AP 2 in the other direction until you also hear it at - 66 dBm

AP 2 at - 66 dBm AP 1 at - 66 dBm



The - 72 dBm Rule

- Go back to AP 1
 - AP2 should be at “- 66 - 6” = -72 dBm. Add 2-3dB loss if there is a plaster wall
-> - 75 dBm
- 2 times the distance



How Much is -66 dBm in MCS?

Why “It depends” is the only answer – Minstrel algorithm

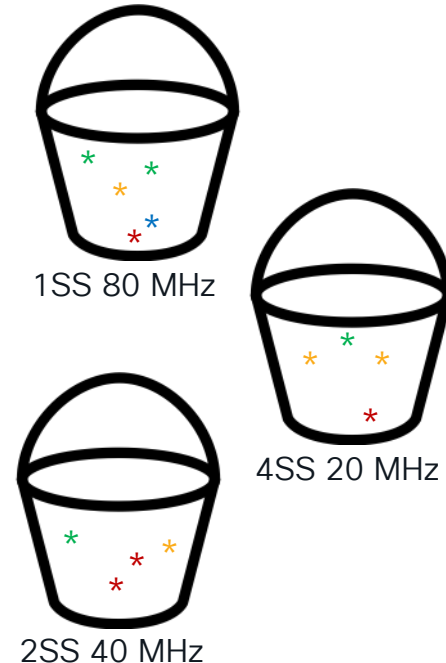
- Your clients use an adaptive algorithm to pick the best rate in real time
 - You can't tell what rate will be picked at -66 dBm
- Most algorithm derive/improve from Minstrel, let's use it as an illustration
- Start: Organize rates rates in groups
 - (MCS 0 to 9 – 1 SS 20 MHz, MCS 0 to 9 – 1 SS 40 MHz, etc.)
 - same for 2 SS, 3 SS etc.)
- Trim off groups not supported by the AP
- Optional: from each group, pick rates compatible with initial signal budget
- Compute the transmission time for each selected rate
- Transmit at the rate that provides smallest transmission time

Minstrel-VHT – Picking a Better Rate

Conditions change, and so should rates (even at same signal level)

1. At regular intervals (e.g. 100 ms), Minstrel enters a sampling period (SP)
2. During SP, pick a 'random'* rate in a group
3. Try the rate, within the max retry limit for this group (e.g. 3)
4. If the rate results in higher throughput** than previous rate, rank the rate up
5. Repeat until the end of the sampling period
6. Retain 3 rates: highest throughput, second highest throughput, highest probability (least loss/retries)

(*more on this in 2 slides, **more on this on next slide)



Minstrel-VHT – “Throughput”?

Throughput is the largest number of data payload bytes transmitted per unit of time (e.g. per second)

- Minstrel uses FLR (Frame Loss Rate, i.e. number of successful frames over total attempts over a sliding window)
- Minstrel also uses EWMA (Exponential Weighted Moving Average)
 - Statistical technique to put more weight on recent measurements
 - Choose a weight factor $0 < \lambda \leq 1$ (e.g. 0.8)
 - For the current sampling window: Window Throughput (for this rate) = $\lambda \text{ FLR}_{\text{this window}}$
 - Then: Previous window throughput = $(1 - \lambda) (\text{FLR}_{\text{previous window}})$
 - Then: “window before” throughput = $(1 - \lambda) (\text{FLR}_{\text{previous window}})^2$
 - Then $(1 - \lambda) (\text{FLR}_{\text{previous window}})^3$ etc.

Minstrel-VHT – “Throughput”?

Minstrel throughput example with EWNA/FLR

- Let's decide that $\lambda = 0.8$
- This window (t) FLR 10%
- (t-1) window FLR 40%
- (t-2) window FLR 80%

- Throughput:

$$(0.8)(0.1) + (1-0.8)(0.4) + (1-0.8)(0.8^2) \\ = 0.288 \text{ EWNA}$$

- Suppose the other way round
- This window (t) FLR 80%
- (t-1) window FLR 40%
- (t-2) window FLR 10%
- Throughput:

$$(0.8)(0.8) + (1-0.8)(0.4) + (1-0.8)(0.1^2) \\ = 0.722 \text{ EWNA}$$

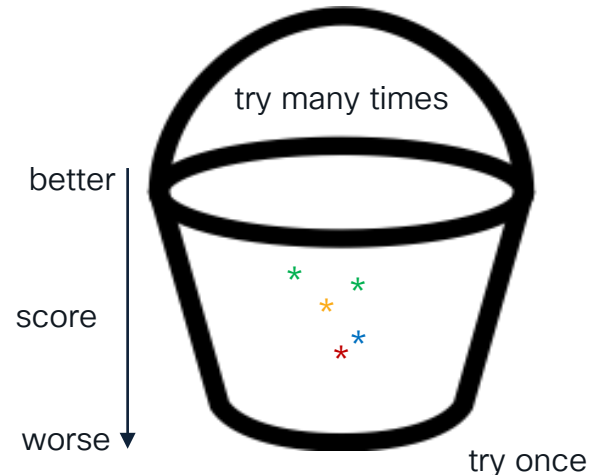


*Minstrel remembers the past, but the past becomes less important as it is farther
(good life lesson)*

Minstrel-VHT – “Throughput”?

- Minstrel then sorts rates: faster (max bytes/sec) on top, with throughput as weight
- Next sampling period will try all rates (not really ‘minstrel-spirit’ anymore), but more frequently ‘top rates’ than slow or high-loss rates

time to transmit n bytes \times EWNA = throughput score

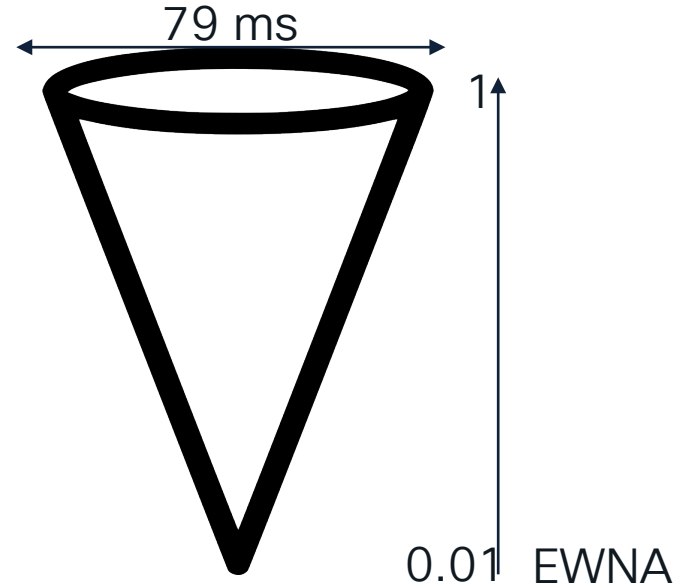


Minstrel-VHT – Retry Chain

Now we have our rates, we just need to act when transmission fails

- Minstrel defines for each rate (r) a max retry count (c)

- The count is affected by the historical FLR/EWNA for that rate
- The retry score assigns a retry time (percentage of max 79.2 ms)
- The number of retries depends then on the data rate
- (I'll retry more a rate that has been highly successful in the past)



Minstrel-VHT – Retry Chain

Now we have our rates, we just need to act when transmission fails

- The logic is as follows:(in non-sampling windows):
 1. Use best rate,
 2. If transmission fails, retry for (c_1)
 3. Switch to second best rate if fails $> c_1$
 4. Retry second best rate for c_2
 5. Switch to highest probability rate
 6. Empty buffer and $t=100\text{ms}$, , then enter sampling window

RF and MCS

Conclusion: Worry about signal, not about MCS

- Disable legacy low rates to limit the beacon spread to your cell geometry, do not touch the low MCSs
- The client does not check if the AP uses the MCS the client uses

Data Rates**

1 Mbps	Disabled
2 Mbps	Disabled
5.5 Mbps	Disabled
6 Mbps	Disabled
9 Mbps	Disabled
11 Mbps	Disabled
12 Mbps	Mandatory
18 Mbps	Supported
24 Mbps	Supported
36 Mbps	Supported
48 Mbps	Supported

9436	38.939368	172.31.255.104	54.201.225.120	TCP
9442	38.940562	172.31.255.104	54.201.225.120	TLSv1...
9443	38.940640	172.31.255.104	54.201.225.120	TLSv1...

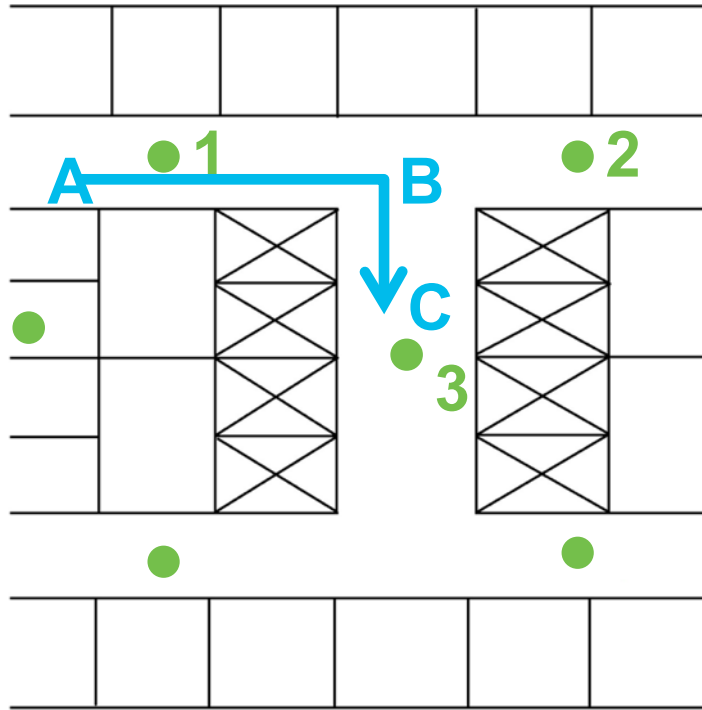
LDPC extra OFDM symbol: False
Beamformed: False
User 0: MCS 7
Group Id: 0
Partial AID: 0

Client

Data rate: 144.4 Mb/s
Channel: 36
Frequency: 5180MHz
Noise level (dBm): -99dBm
TSF timestamp: 1503338255

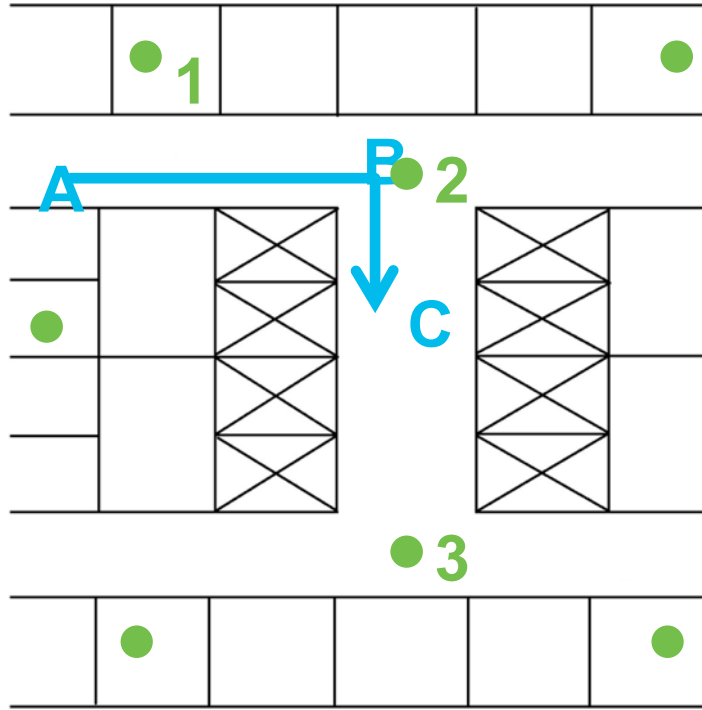
MCS/(Data Rate)	MCS/(Data Rate)	MCS/(Data Rate)	MCS/(Data Rate)
<input checked="" type="checkbox"/> 0/(7Mbps)	<input checked="" type="checkbox"/> 1/(14Mbps)	<input checked="" type="checkbox"/> 2/(21Mbps)	<input checked="" type="checkbox"/> 3/(29Mbps)
<input checked="" type="checkbox"/> 4/(43Mbps)	<input checked="" type="checkbox"/> 5/(58Mbps)	<input checked="" type="checkbox"/> 6/(65Mbps)	<input checked="" type="checkbox"/> 7/(72Mbps)
<input checked="" type="checkbox"/> 8/(14Mbps)	<input checked="" type="checkbox"/> 9/(29Mbps)	<input checked="" type="checkbox"/> 10/(43Mbps)	<input checked="" type="checkbox"/> 11/(58Mbps)
<input checked="" type="checkbox"/> 12/(87Mbps)	<input checked="" type="checkbox"/> 13/(116Mbps)	<input checked="" type="checkbox"/> 14/(130Mbps)	<input type="checkbox"/> 15/(144Mbps)

Strategically Position Your Transition APs



- At “A” the phone is connected to AP 1
- At “B” the phone has AP 2 in the neighbor list, AP 3 has not yet been scanned due to the RF shadow caused by the elevator bank
- At “C” the phone needs to roam, but AP 2 is the only AP in the neighbor list
- The phone then needs to rescan and connect to AP 3
 - 200 B frame @ 54 Mbps is sent in 3.7 μ s
 - 200 B frame @ 24 Mbps is sent in 8.3 μ s
 - Rate shifting from 54 Mbps to 24 Mbps can waste 1100 μ s

Strategically Position Your Transition APs



- At point A the phone is connected to AP 1
- At point B the phone has AP 2 in the neighbor list as it was able to scan it while moving down the hall
- At point C the phone needs to roam and successfully selects AP 2
- The phone has sufficient time to scan for AP 3 ahead of time

Verify on your WLC

Client

360 View

General

QOS Statistics

ATF Statistics

Mobility History

Call Statistics

Recent association history:

AP Name	BSSID	AP Slot	Assoc Time	Instance	Mobility Role	Run Latency (ms)	Roam Type
4800-B	f4db.e661.148f	1	12/04/2020 17:56:37	0	Local	15	802.11i Slow
4800-B	f4db.e661.1480	0	12/04/2020 17:55:10	0	Local	14	802.11R

If this is more than 50 ms, roaming is suboptimal
If this is more than 100 ms, you need to rethink
your design (AP positions, cell overlap)

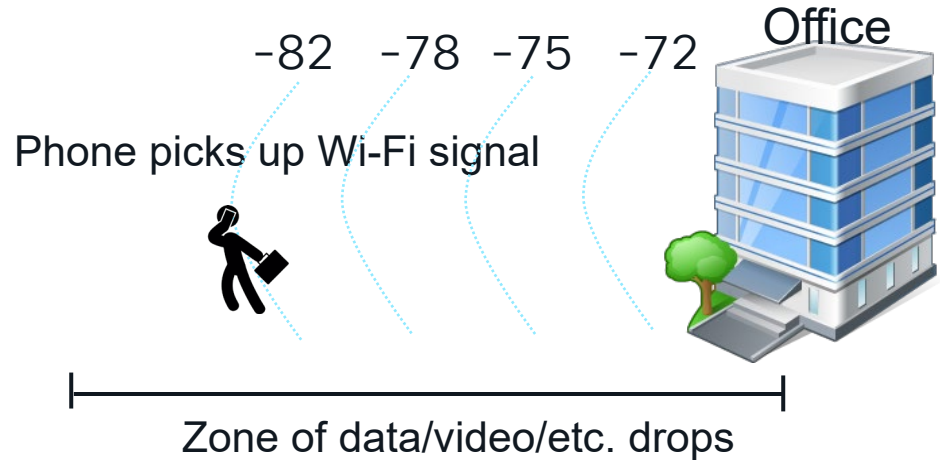
At the Edge of the Wi-Fi Domain

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Walking Away From Wi-Fi

- Phone tries to prefer Wi-Fi
 - Jumps to a better AP if available
 - Otherwise, prefers Wi-Fi as long as Wi-Fi is in range



Transition Method 1: “Optimized” Roaming

- Works in Combination with CHDM
- Use with caution

The screenshot displays the Cisco Catalyst 9800-L Wireless Controller configuration interface. The main navigation pane on the left includes links to Dashboard, Monitoring, Configuration (highlighted), Administration, Licensing, and Troubleshooting. The main content area shows the 'Configuration' > 'Wireless' > 'Advanced' path. Under the 'Optimized Roaming' tab, there are two columns for '5 GHz Band' and '2.4 GHz Band'. The 'Optimized Roaming Mode*' is enabled (checked) for the 5 GHz band and disabled (unchecked) for the 2.4 GHz band. The 'Optimized Roaming Date Rate Threshold (mbps)*' is set to 'Disable' for both bands. The 'Optimized Roaming Hysteresis*' is set to '6' for both bands. An inset window shows the 'Radio Configurations' > 'RRM' path, specifically the 'Coverage' tab for the '5 GHz Band'. It shows 'Enable Coverage Hole Detection' checked, 'Data RSSI Threshold*' at -85, and 'Voice RSSI Threshold*' at -82.

Cisco Catalyst 9800-L Wireless Controller 17.4.1

Configuration > Wireless > Advanced

Load Balancing Band Select **Optimized Roaming** High Density Preferred Calls

5 GHz Band 2.4 GHz Band

Optimized Roaming Mode* ☒ ☐

Optimized Roaming Date Rate Threshold (mbps)* Disable Disable

Optimized Roaming Hysteresis* 6 6

Configuration > Radio Configurations > RRM

5 GHz Band 2.4 GHz Band FRA

General **Coverage** DCA TPC RF Grouping Spatial Reuse

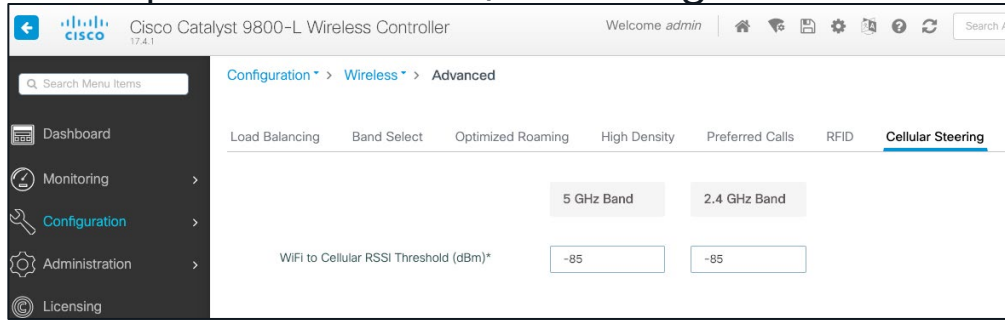
Enable Coverage Hole Detection ☒

Data RSSI Threshold* -85

Voice RSSI Threshold* -82

Transition Method 2: Wi-Fi to Cellular Steering

- Works with Samsung S8 / Android 10 and later
- Specific to Cisco/Samsung



Edit WLAN

WiFi to Cellular Steering



-85! can you hear another AP (same SSID?)

No

No one hears you here either, go to LTE



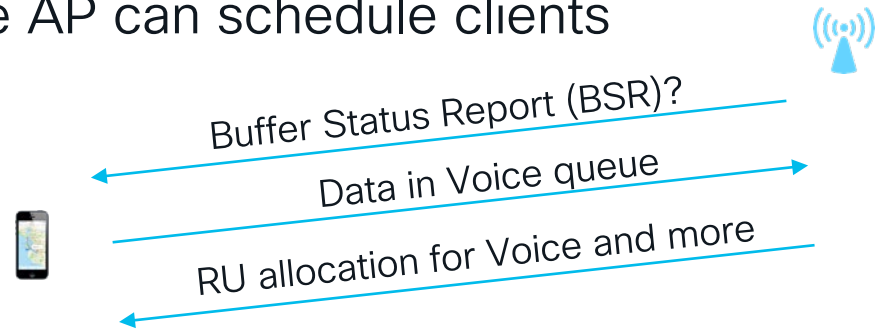
While in the Cell



802.11ax APs



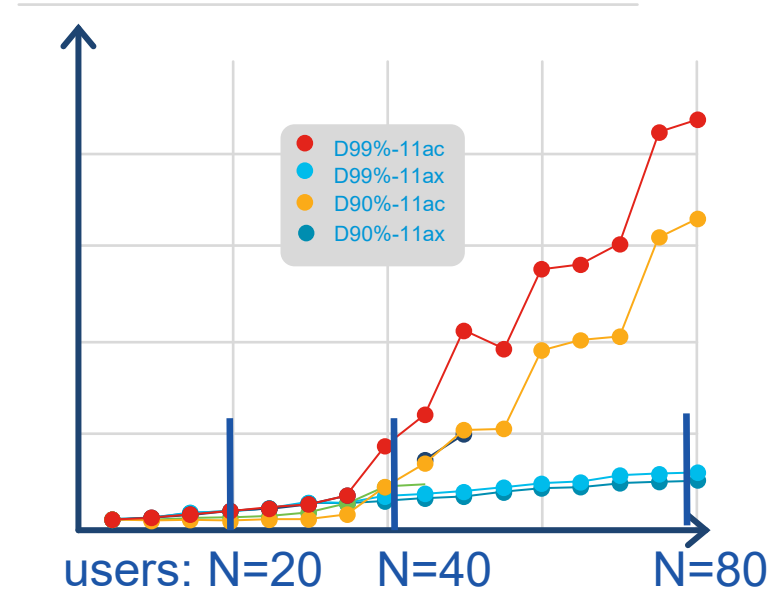
- It is hard to saturate a 5.83 Gbps, 8x8 uplink/downlink MU-MIMO with eight spatial streams
- But in case you thought you would...
- With OFDMA, UL-MU-MIMO, the AP can schedule clients



- Of course, if you overload your AP, as usual, some clients may suffer

FastLane Plus

- You may remember FastLane
 - With Apple iOS and MacOS (since 2015)
 - Activates a list of prioritized apps
- For 802.11ax, we developed FastLane plus
 - the (11ax iOS 14 and up) client tells us in advance what traffic is going to come up
 - Uses an Advanced Service Request (ASR) frame
 - This is where you love the AI A13/A14 chips
 - We pre-book resources, and allocate them as traffic flows



ASR Config CLI/GUI

To enable FastLane Plus, use the Advanced Service Request Function

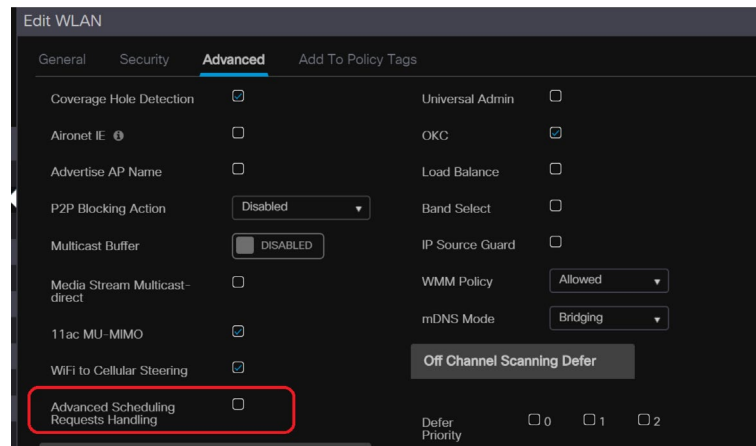
AireOS (8.10 MR4)

Command	Description
config wlan asr {enable disable } <WLAN ID>	Enable or Disable ASR for a given WLAN
show wlan <wlan _id>	Display if ASR is enabled/disabled for a given WLAN

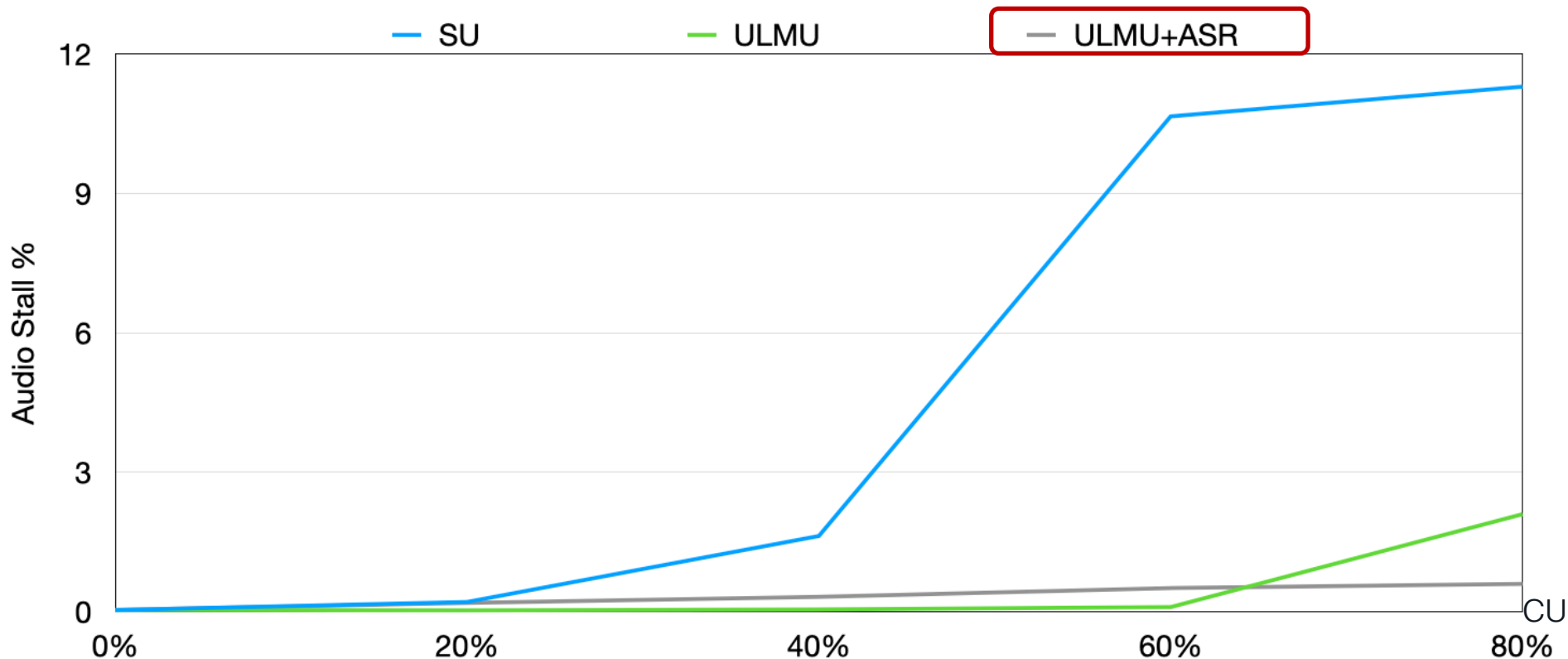
IOS-XE (17.4.1)

Command	Description
(config-wlan) scheduler asr (config-wlan) no scheduler asr	Enable or Disable ASR for a given WLAN
show wlan <wlan _id>	Display if ASR is enabled/disabled for a given WLAN

GUI in next IOS-XE release

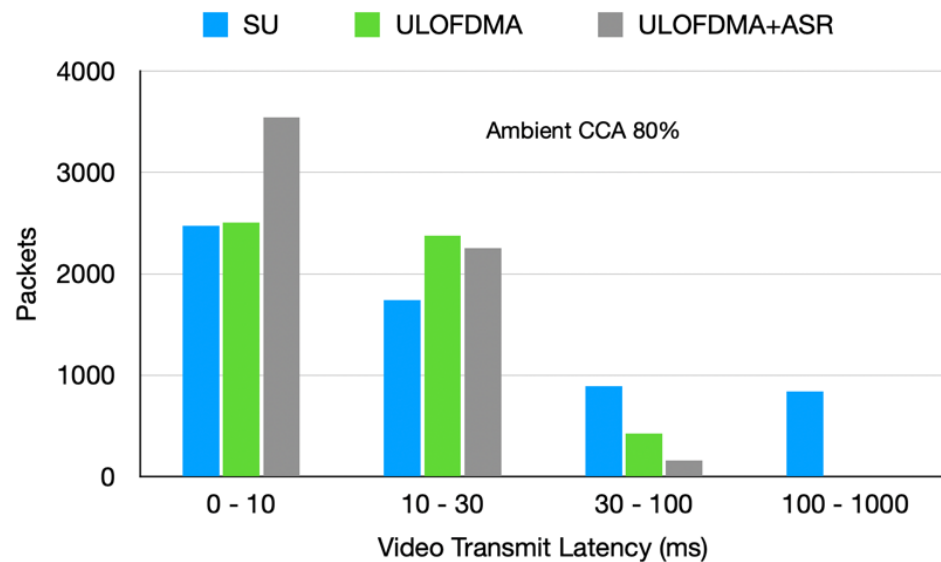
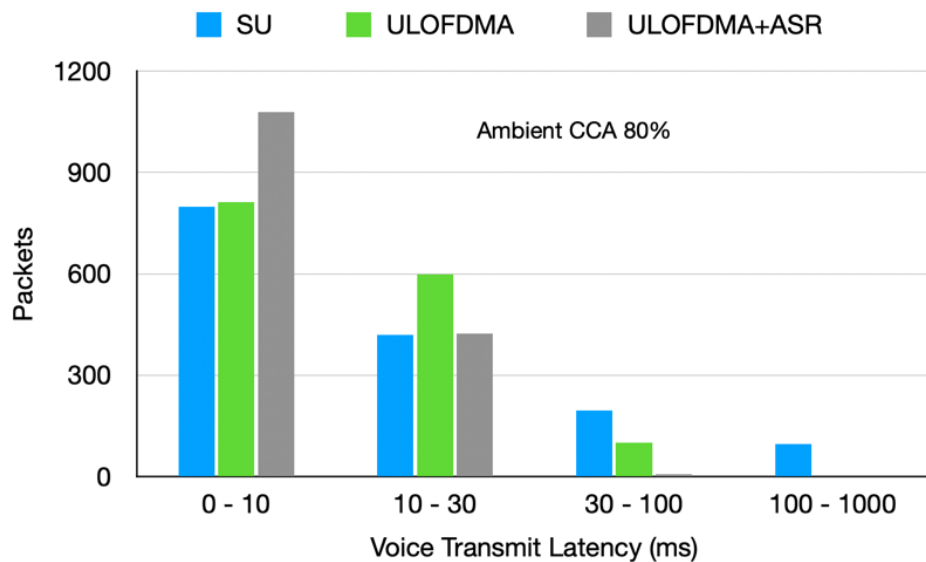


ASR Effect on Audio Stalls



No more robotic voices, no more “can you hear me?”

ASR Effect on Latency

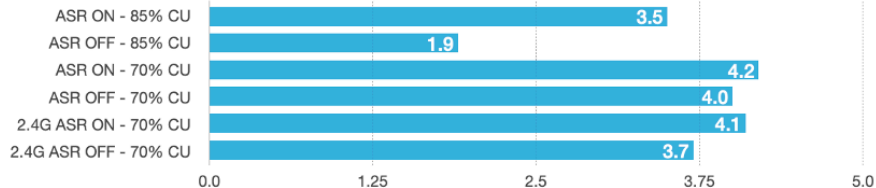


ASR Effect on MoS

20 MHz MOS

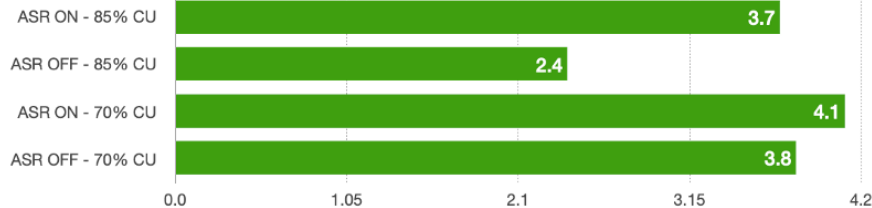
ASR ON/OFF	MOS
ASR ON - 85% CU	3.5
ASR OFF - 85% CU	1.9
ASR ON - 70% CU	4.2
ASR OFF - 70% CU	4.0
2.4G ASR ON - 70% CU	4.1
2.4G ASR OFF - 70% CU	3.7

20 MHz - MOS Comparison



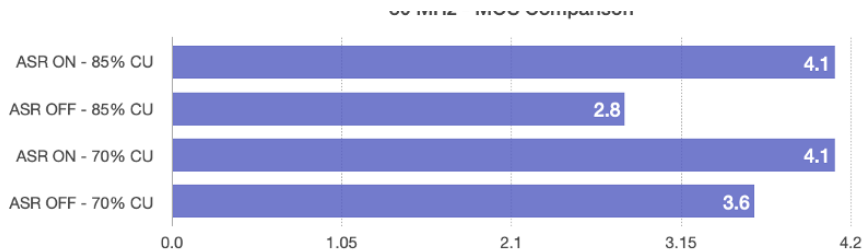
40 MHz MOS

ASR ON/OFF	MOS
ASR ON - 85% CU	3.7
ASR OFF - 85% CU	2.4
ASR ON - 70% CU	4.1
ASR OFF - 70% CU	3.8



80 MHz MOS

ASR ON/OFF	MOS
ASR ON - 85% CU	4.1
ASR OFF - 85% CU	2.8
ASR ON - 70% CU	4.1
ASR OFF - 70% CU	3.6



Skype audio, 16 calls

FastLane Plus Conclusions

- If you have iOS 14 devices in your 802.11ax enable ASR:
 - Consistent MOS score improvement for Voice and Video across bandwidths and at 70% & 85% congestion level.
 - Delay factor (ms) improvement for Video calls across bandwidths and at 70% & 85% congestion level.
 - Better UL latency numbers (negligible packets in higher latency bucket 40-100 ms or >100ms with ASR)

Conclusion



Recommendations Summary

- Position your APs to avoid signal bleeding on entrances
- Set AP power to client power (11/14 dBm?)
- Disable low legacy rates to match the cell size
- Ensure 8 dB overlap between cells
- We give you tools to know exactly how your client behaves and sees the network: use them as much as your network allows
 - client specs report,
 - leaving reason codes,
 - scan reports (802.11v, 802.11k, MBO),
 - ASR



The bridge to possible

Thank you

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TURN IT UP

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