

Meraki Wireless From a Troubleshooter Perspective

cisco Live !

Rami Berkovsky
Senior Escalation Engineer, Cisco Meraki

Session ID: BRKEWN-2399

Cisco Webex App

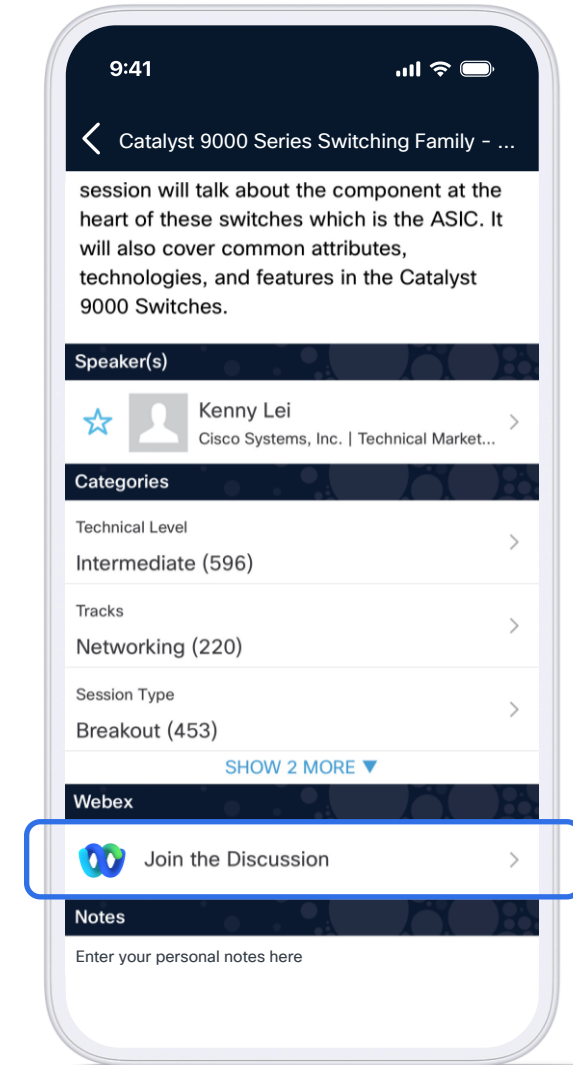
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until 14 November 2025.



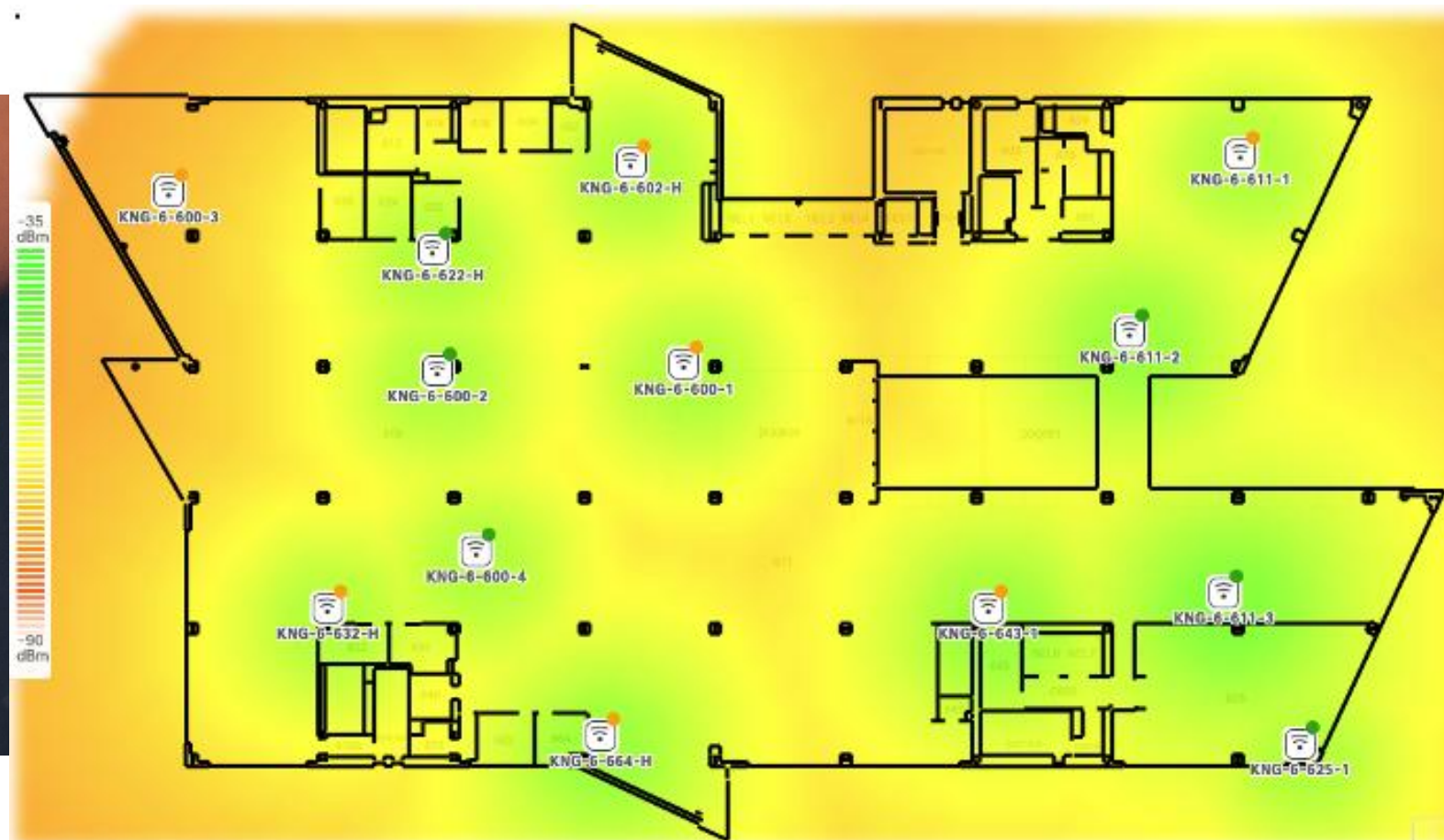
<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKEWN-2399>

Who am I?

Rami Berkovsky

Senior Escalation Engineer APJC
Wireless MR CW Meraki Cloud
9.5 years with Cisco
Based in Sydney
Coffee snob
Problem solver
Wireless enthusiast since 2010







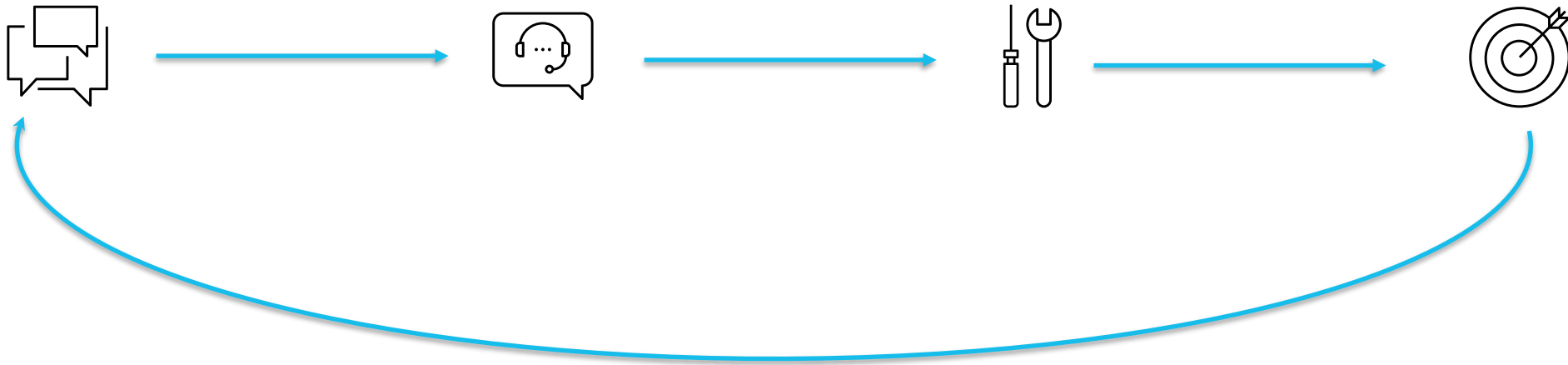
Do you have free Wi-Fi?

Of course, here's a
BSS that supports
802.11 protocols



Technical translation services

How can we help?



Most common dictionary phrases

Can't connect to the internet

Everything is so slow

It keeps disconnecting

Sometimes we get more technical – good starting point

Can't work in this **meeting room**

Something is going wrong at **2pm**

Video is buffering

Voice is choppy

Scoping to get closer to the problem

- Location
- Time
- Application
- Device Type
- SSIDs affected
- What's exactly happening?
- Recent examples (timestamp and mac address) 🙌

Problem definition

Will take us halfway to resolution

If you can narrow down and define a problem – you can fix it

13 August: SSID is not displayed



Possible solutions: ???

15 August: A Meraki AP is transmitting an SSID that ends with a special character, no issues are observed on any device.

When a different vendor's AP is added to the environment, transmitting the same exact SSID name, some device types will not try to connect to the SSID transmitted by Meraki and will prefer the other vendor's AP.

Possible solutions: Remove “spoof”, rename SSID, contain RF signal within floors

Translation time

Can't connect to the internet

Is the AP available?

Beacons

Association

Authentication

IP

Everything is so slow

Expectations Alignment

Signal

Noise

Interference

Utilisation

It keeps disconnecting

Channel Changes

DFS

Roaming

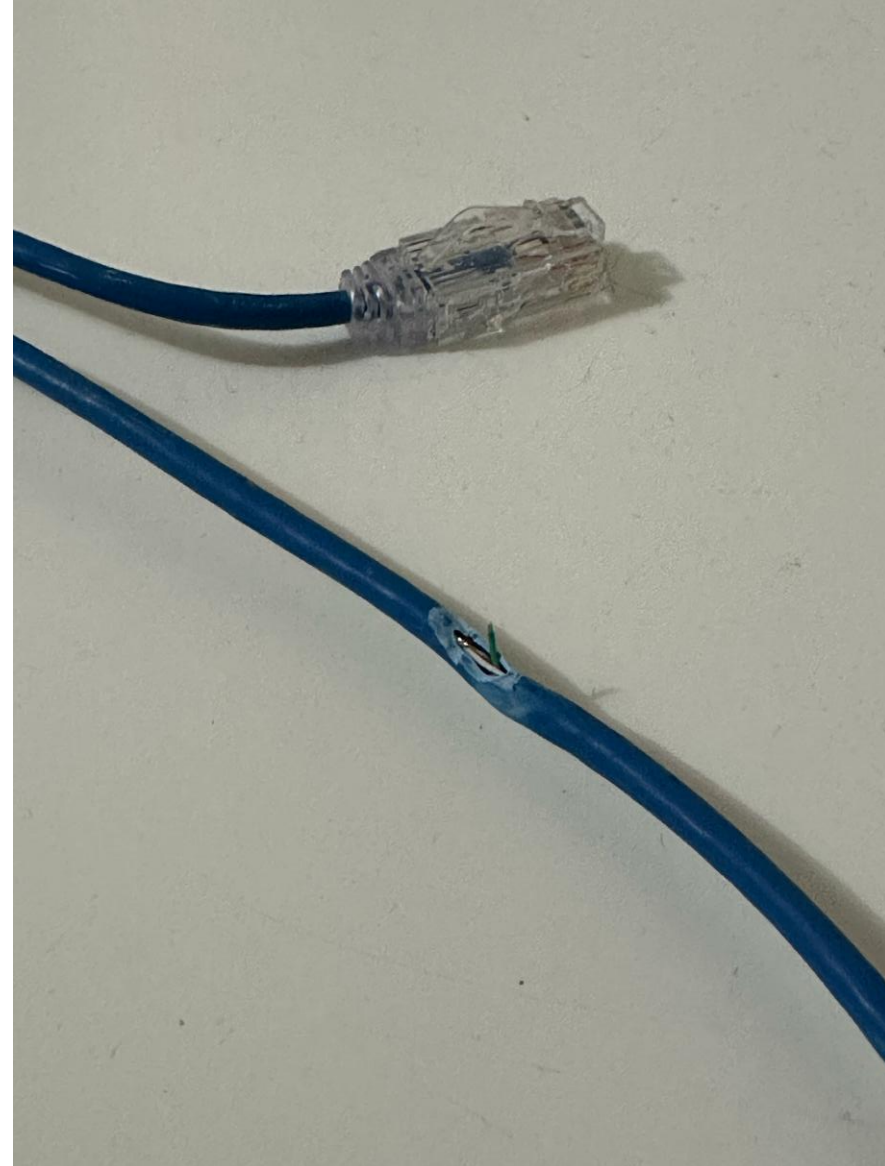
Bad actors



LUCKY

**AP works most
of the time but
unreliable**

LUCKY



A subset of APs is offline

We don't understand why

Are the right columns visible?



Connectivity (UTC-8)	Local IP	Public IP
<div></div>	10.92.128.32	50.216.
<div></div>	10.92.128.166	50.216.
<div></div>	10.92.128.31	50.216.
<div></div>	10.92.128.99	50.216.
<div></div>	10.92.128.53	50.216.
<div></div>	10.92.128.228	50.216.
<div></div>	10.92.128.95	50.216.
<div></div>	10.92.176.212	50.216.
<div></div>	10.92.176.213	50.216.
<div></div>	10.92.176.206	50.216.

The packet is always right

230	-0.065237	ee:14:31:a1:53:2c	Broadcast	802.11	2412	-80 dBm	Beacon frame, SN=1002, FN=0, Flags=....., BI=100, SSID=Wildcard (Broadcast)
231	-0.674663	TechnicolorD_c5:1a:ff	Broadcast	802.11	2412	-86 dBm	Beacon frame, SN=80, FN=0, Flags=....., BI=100, SSID="TelstraC51AFF"
239	-0.670465	NokiaSolutio_70:a4:4b	Broadcast	802.11	2412	-90 dBm	Beacon frame, SN=3580, FN=0, Flags=....., BI=100, SSID="NOKIA-A442"
243	-0.646133	TexasInstrum_16:12:fa	Broadcast	802.11	2412	-88 dBm	Beacon frame, SN=4005, FN=0, Flags=....., BI=100, SSID=Wildcard (Broadcast)
244	-0.637316	6a:49:b2:41:7e:90	Broadcast	802.11	5765	3 dBm	Beacon frame, SN=955, FN=0, Flags=....., BI=100, SSID="Berkovsky"
245	-0.637275	56:49:b2:41:7e:90	Broadcast	802.11	5765	3 dBm	Beacon frame, SN=710, FN=0, Flags=....., BI=100, SSID=Wildcard (Broadcast)
246	-0.633881	d6:35:1d:e9:14:14	Broadcast	802.11	2412	-86 dBm	Beacon frame, SN=1839, FN=0, Flags=....., BI=100, SSID="TelstraE9140C"
248	-0.618231	Netgear_9f:92:8b	Broadcast	802.11	2412	-75 dBm	Beacon frame, SN=3231, FN=0, Flags=....., BI=100, SSID="NETGEAR_EXT"
249	-0.606850	fa:8f:ca:51:86:be	Broadcast	802.11	5200	-31 dBm	Beacon frame, SN=1849, FN=0, Flags=....., BI=100, SSID=Wildcard (Broadcast)
250	-0.609712	SagemcomBroa_61:05:0f	Broadcast	802.11	2412	-90 dBm	Beacon frame, SN=4044, FN=0, Flags=....., BI=100, SSID="OPTUS_61050DM"
251	-0.577481	6a:49:82:41:7e:90	Broadcast	802.11	5200	2 dBm	Beacon frame, SN=2213, FN=0, Flags=....., BI=100, SSID="Berkovsky"
252	-0.577450	56:49:82:41:7e:90	Broadcast	802.11	5200	2 dBm	Beacon frame, SN=1306, FN=0, Flags=....., BI=100, SSID=Wildcard (Broadcast)
253	-0.605526	Arcadyan_bf:26:f8	Broadcast	802.11	2412	-87 dBm	Beacon frame, SN=1910, FN=0, Flags=....., BI=100, SSID="TelstraWi-Fi-7nj8q...
258	-0.577525	6e:49:92:41:7e:90	Broadcast	802.11	2412	-1 dBm	Beacon frame, SN=2755, FN=0, Flags=....., BI=100, SSID="Berkovsky24GHz"
259	-0.577421	56:49:92:41:7e:90	Broadcast	802.11	2412	-1 dBm	Beacon frame, SN=1050, FN=0, Flags=....., BI=100, SSID=Wildcard (Broadcast)
261	-0.589084	BillionElectr_cd:85:47	Broadcast	802.11	2412	-89 dBm	Beacon frame, SN=521, FN=0, Flags=....., BI=100, SSID="Swann-SWIFT_cd8547"

PHY type: 802.11a (OFDM) (5)

Turbo type: Non-turbo (0)

Data rate: 6.0 Mb/s

Channel: 40

Frequency: 5200MHz

Signal strength (dBm): 2 dBm

Noise level (dBm): -94 dBm

Signal/noise ratio (dB): 96 dB

TSF timestamp: 1937445189432

> [Duration: 548µs]

> IEEE 802.11 Beacon frame, Flags:

> IEEE 802.11 Wireless Management

> Fixed parameters (12 bytes)

> Tagged parameters (356 bytes)

> Tag: SSID parameter set: "Berkovsky"

Tag Number: SSID parameter set (0)

Tag length: 9

SSID: "Berkovsky"

AP capture is our best friend

Meraki

Intelligent Capture

For access points ▾

New capture

Stored captures

Scheduled captures

Proactive PCAP Enablement

Access Points

Access Points Select ▾

Interface

Wireless ▾

Output ⓘ

Save to cloud ▾

Duration (secs) ⓘ

60

Capture filters

View example filters

File name

Campus - wireless-wireless

Notes

We recommend including a description of the reason for your capture, this will help us improve the analysis capabilities of our capture tool.

Start capture

Schedule capture



Simple and from anywhere



Highest likelihood of capturing all Data frames
(Channel Width/Spatial Streams/PHY)



Decrypted



Multiple APs



Client signal from AP view

Crisis Alert



Our CEO couldn't connect to the wireless



We might have the PCAP already

- Proactive PCAP
- Automated Packet Capture upon client connection and roaming
- Integrated in the user timeline

Feb 12
14:26:08

Failed connection to SSID **WINDOW** on access point **CW9166I** during association, and then the client roamed to access point **CW9166I**.

CHANNEL

BAND

SNR ⓘ

11

2.4 GHz

32 dB

Download packet capture

View in packet viewer

Packet capture

⤴

Native Packet Analyzer

Proactive Cloud Packet Capture

Packet capture

For access points

New capture

Stored captures

Proactive PCAP Enablement

255 captures

Time (UTC)	Name	Access Points	User	Status	File size	Packet Count	Client	Step	Reason
Aug 14, 10:57	a8:bb:56:71:11:6d_MHRY0u_dhcp_timeout	CW9166-office	Auto capture	✔ Saved to cloud	7.0 kB	28	a8:bb:56:71:11:6d	Dhcp	Timeout

Packet capture

For access points

New capture

Stored captures

Proactive PCAP Enablement

← All captures

a8:bb:56:71:11:6d_MHRY0u_dhcp_timeout

Filter Expression...

Apply

Clear

No.	Time	Source	Destination	Protocol	Length	Info
10	0.047903000	Apple_71:11:6d	de:9c:2e:ec:26:90	EAPOL	181	Key (Message 4 of 4)
11	0.049804000	Apple_71:11:6d	de:9c:2e:ec:26:90	802.11	147	Action, SN=1896, FN=0, Flags=.....
12	0.050088000	Apple_71:11:6d	de:9c:2e:ec:26:90	802.11	81	Action, SN=1898, FN=0, Flags=....., SSID="test"
13	0.051927000	de:9c:2e:ec:26:90	Apple_71:11:6d	802.11	90	Action, SN=1, FN=0, Flags=.....
14	0.251301000	Apple_71:11:6d	de:9c:2e:ec:26:90	802.11	81	Action, SN=1901, FN=0, Flags=....., Dialog Token=201
15	0.252429000	de:9c:2e:ec:26:90	Apple_71:11:6d	802.11	81	Action, SN=2, FN=0, Flags=....., Dialog Token=201
16	0.252856000	Apple_71:11:6d	de:9c:2e:ec:26:90	802.11	81	Action, SN=1902, FN=0, Flags=....., Dialog Token=202
17	0.253702000	de:9c:2e:ec:26:90	Apple_71:11:6d	802.11	81	Action, SN=3, FN=0, Flags=....., Dialog Token=202
18	0.256730000	0.0.0.0	255.255.255.255	DHCP	436	DHCP Discover - Transaction ID 0xdfad5f3
19	1.513121000	0.0.0.0	255.255.255.255	DHCP	426	DHCP Discover - Transaction ID 0xdfad5f3
20	4.556634000	0.0.0.0	255.255.255.255	DHCP	426	DHCP Discover - Transaction ID 0xdfad5f3
21	9.396065000	0.0.0.0	255.255.255.255	DHCP	426	DHCP Discover - Transaction ID 0xdfad5f3
22	18.176774000	0.0.0.0	255.255.255.255	DHCP	426	DHCP Discover - Transaction ID 0xdfad5f3
23	18.177748000	Apple_71:11:6d	Broadcast	ARP	126	Who has 169.254.182.157? (ARP Probe)
24	18.505757000	Apple_71:11:6d	Broadcast	ARP	126	Who has 169.254.182.157? (ARP Probe)
25	18.830610000	Apple_71:11:6d	Broadcast	ARP	126	Who has 169.254.182.157? (ARP Probe)
26	19.155799000	Apple_71:11:6d	Broadcast	ARP	126	ARP Announcement for 169.254.182.157
27	19.476196000	Apple_71:11:6d	Broadcast	ARP	126	ARP Announcement for 169.254.182.157
28	19.796803000	Apple_71:11:6d	Broadcast	ARP	126	ARP Announcement for 169.254.182.157

> Frame 18: 436 bytes on wire (3488 bits), 436 bytes captured (3488 bits)

> Radiotap Header v0, Length 70

> 802.11 radio information

> IEEE 802.11 QoS Data, Flags: o.....T

> Logical-Link Control

> Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255

> User Datagram Protocol, Src Port: 68, Dst Port: 67

> Dynamic Host Configuration Protocol (Discover)

0000 00 00 46 00 0b 08 90 40 a7 4a 0b 5e d7 01 00 00 .F.k.@.J.*...

0010 00 00 8c 14 40 01 08 a2 00 00 00 00 00 00 00 00 ...@.....

0020 00 00 00 00 fc c3 fe 00 04 6b 00 00 90 21 02 7fk.L.

0030 00 03 7f 00 10 00 2b 06 00 04 00 00 00 00 00 00+.....

0040 00 00 0a 6e fb 1d 88 81 30 00 de 9c 2e ec 26 90 ..n..0.&.

0050 a8 bb 56 71 11 6d ff ff ff ff ff ff 03 00 16 25 ..Vq.m....%

0060 4f b2 00 00 aa aa 03 00 00 00 00 45 00 01 48 O.....E.H

0070 5c fd 00 00 ff 11 5d a8 00 00 00 00 ff ff ff ff _...)_...

0080 00 44 00 43 01 34 aa 9a 01 01 06 00 0d fa d5 f3 .D.C.4.....

0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00Vq.m....

00a0 00 00 00 00 a8 bb 56 71 11 6d 00 00 00 00 00 00Vq.m....

00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00Vq.m....

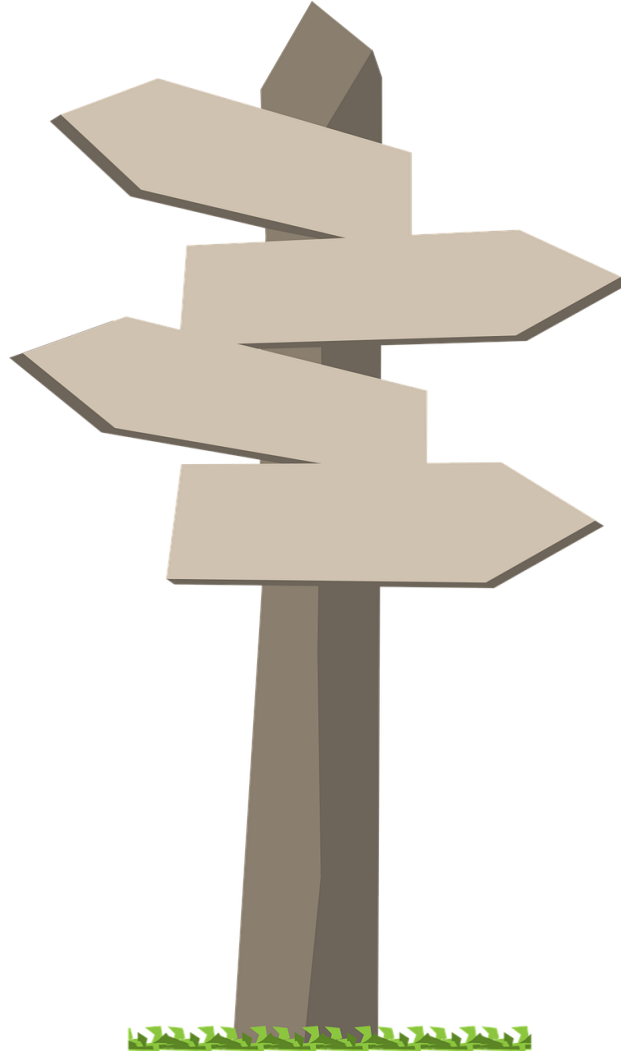


What if we don't have a PCAP?

Client details page > Timeline

Network Wide > Event log

Wireless Health > Connection
Log



Network Wide > Event log

Feb 12 14:51:42	sfo12-5-ap-38-elev	Meraki-Corp	RAYILAM-M-PX6K	802.11	802.11 disassociation	802.11_reason_code = undefined
Feb 12 14:51:42	sfo12-5-ap-38-elev	Meraki-Corp	RAYILAM-M-PX6K	802.11	802.11 disassociation	client not responding
Feb 12 14:51:35	sfo12-4-ap-041-elev	Meraki-Corp	RAYILAM-M-PX6K	802.1X	RADIUS response	radio: 2, vap: 0, group: « hide rtt 0.015 ms attr 11
Feb 12 14:51:35	sfo12-4-ap-041-elev	Meraki-Corp	RAYILAM-M-PX6K	802.11	802.11 association	channel: 133, rssi: 16, band: 6

Wireless Health > Connection Log

Connection start time ▼	Client device	Access point	SSID	Failure stage	Failure reason
Wed Feb 12, 2025, 14:55:16	RAYILAM-M-PX6K	sfo12-4-ap-041-elev	Meraki-Corp	Authentication	auth_mode='wpa3-802.1x' vlan_id='132' radius_proto='ipv6' radius_ip='fd0a:9b09:1f7::1812:0' reason='eapol_timeout' reassoc='1' roam_ap='6A:49:B2:3F:E0:B0' radio='2' vap='0' channel='133' rssi='15'

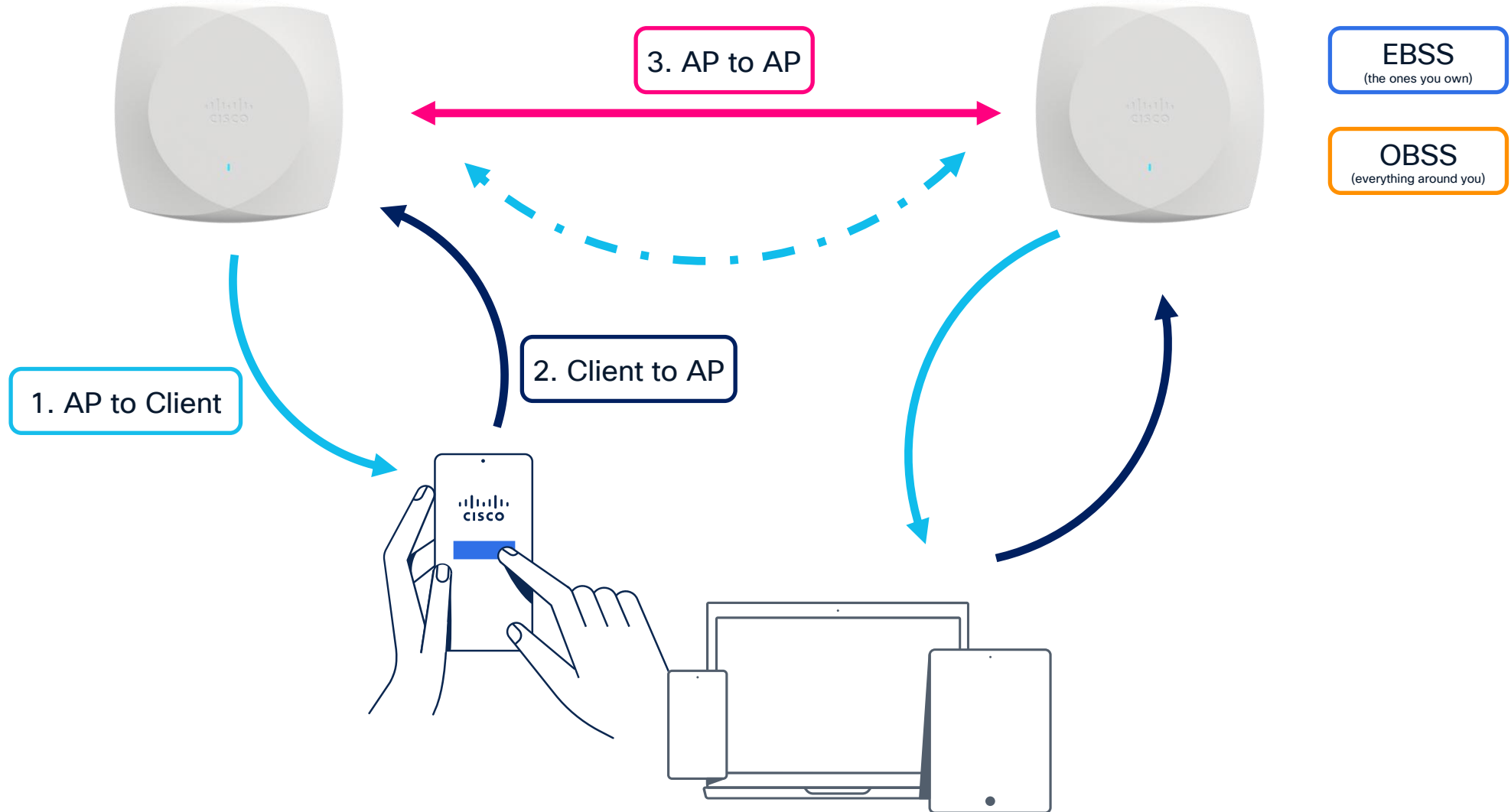
Client details page > Timeline

Feb 12 14:51:35

Roamed from access point [sfo12-5-ap-38-elev](#) then had a failed connection to SSID [Meraki-Corp](#) on access point [sfo12-4-ap-041-elev](#) during authentication because the client did not provide credentials.

CHANNEL	BAND	SNR ⓘ	VLAN ID	RADIUS SERVER	MERAKI REASON (CODE 101) ⓘ
133	6 GHz	● 15 dB	132	fd0a:9b09:1f7::1812:0	EAPoL timeout

How many points of wireless troubleshooting do we see?

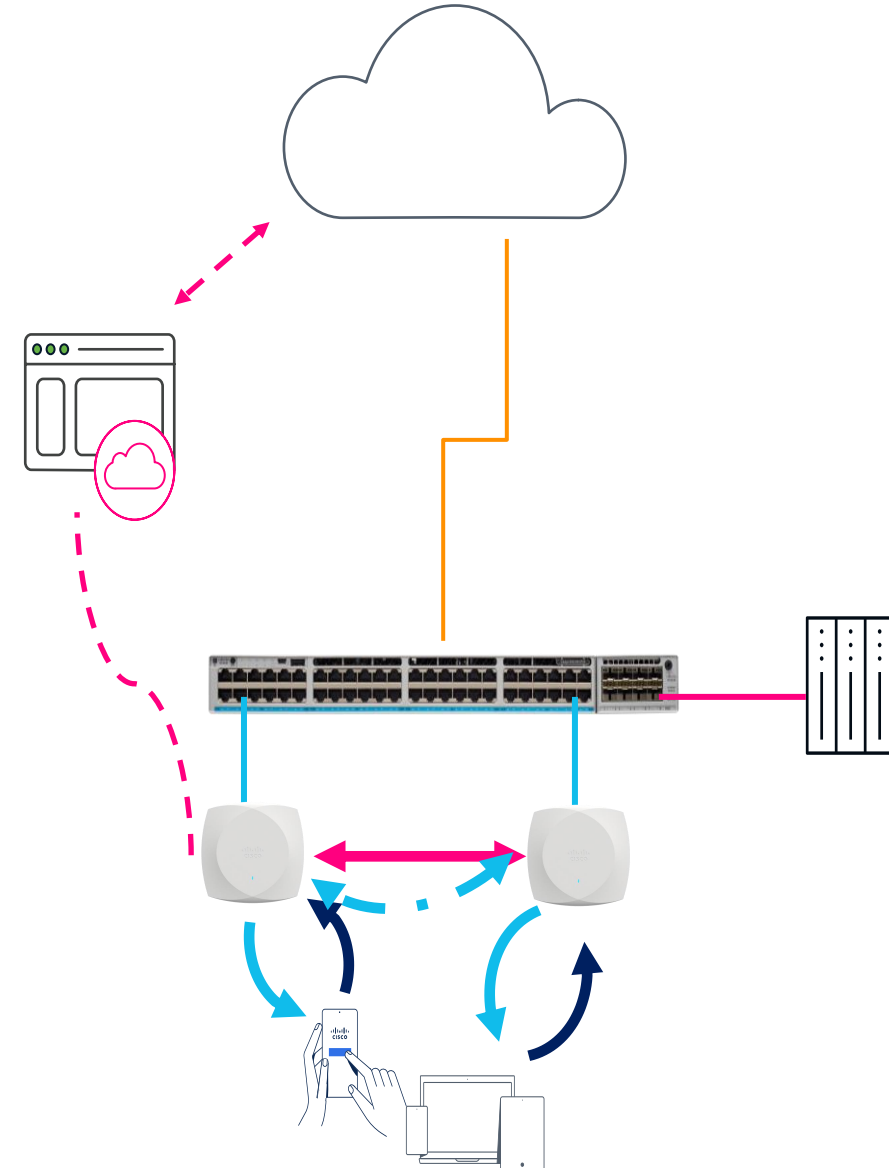


What if it's not wireless?

Single step to make most of this session irrelevant
Can save days of troubleshooting

Test with a wired client on the same VLAN

Firewalls
L3+
WAN
DNS
ARP



AP Management plane

Is the AP online and

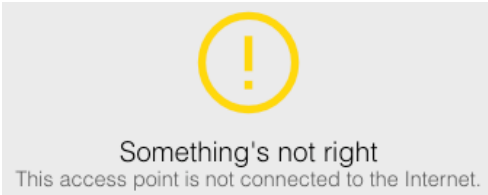
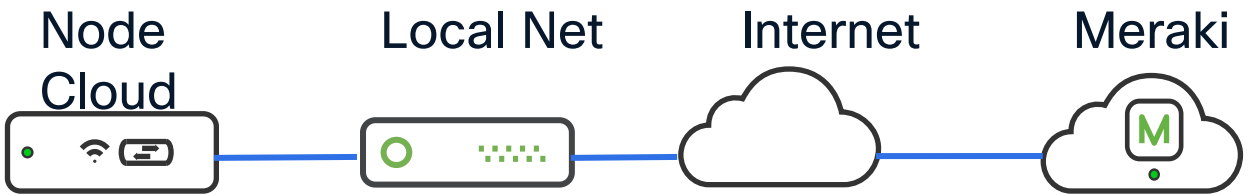
Operational

Can be monitored

Can be managed



Local Status Page Checks



Port status	<div><div></div><div></div></div>	Port Up
Power	<div><div></div><div></div></div>	802.3at
IP address	<div><div></div><div></div></div>	Using 10.10.10.10
GW communication	<div><div></div><div></div></div>	GW 10.10.10.1 reachable
DNS resolution	<div><div></div><div></div></div>	DNS resolution successful
NTP communication	<div><div></div><div></div></div>	Using NTP a.b.c.d
Public IP communication	<div><div></div><div></div></div>	Public IPs reachable
Meraki Cloud communication	<div><div></div><div></div></div>	Meraki Cloud Unreachable

Node is failing to communicate with IP 209.x.x.x UDP/TCP port 7351/443, ensure your firewall is not blocking this traffic.

Firewall info page provides everything your device needs to become green

Source IP ▲	Destination IP	FQDN	Ports	Protocol	Direction	Description	Devices using this rule
Your network(s)	64.62.142.12/32, 158.115.128.0/19, 209.206.48.0/20, 216.157.128.0/20		7351, 9350-9381	UDP	outbound	Meraki cloud communication, VPN registry	Access points, Cameras, MX Security Appliance, Switches
Your network(s)	0.0.0.0/0	api.meraki.com	443	TCP	outbound	API Requests	
Your network(s)		cloud-meraki-asn.amp.cisco.com	443	TCP	outbound	Advanced Malware Protection (AMP) Lookups	MX Security Appliance
Your network(s)		cloud-meraki-est.amp.cisco.com	443	TCP	outbound	Advanced Malware Protection (AMP) Enrollment	MX Security Appliance
Your network(s)	158.115.128.0/19, 209.206.48.0/20, 216.157.128.0/20	syslog.log-ingester.emea.production.insight.meraki.com	443	TCP	outbound	Insight data collection	MX Security Appliance
Your network(s)	209.206.48.0/20	registry.meraki-applications.com	443	TCP	outbound	Meraki Container Registry	MX Security Appliance
Your network(s)	17.0.0.0/8		443, 2195-2196, 5223	TCP	outbound	iOS Systems Manager communication	Systems Manager
Your network(s)	0.0.0.0/0		5228-5230	TCP	outbound	Android Systems Manager communication	Systems Manager
Your network(s)	198.27.154.14/32, 13.251.22.225/32, 18.139.30.19/32, 52.64.93.238/32, 13.237.212.134/32, 13.215.192.136/32, 52.76.93.162/32, 18.153.157.174/32, 3.125.165.17/32, 3.64.43.250/32, 3.120.110.72/32, 3.70.89.174/32, 3.134.137.203/32, 3.12.119.245/32, 3.13.96.175/32, 3.20.198.200/32, 3.132.164.124/32, 3.141.76.140/32, 18.189.238.176/32, 3.12.45.197/32, 3.13.41.11/32, 35.83.73.230/32, 35.166.60.8/32, 34.208.168.67/32, 35.83.153.224/32, 35.167.61.13/32, 44.228.122.230/32, 34.211.166.40/32, 52.43.10.180/32, 35.84.224.170/32, 52.24.202.158/32, 34.218.6.117/32, 34.211.165.157/32, 35.164.43.196/32, 52.40.228.109/32, 54.212.241.230/32, 54.200.126.77/32, 54.213.72.213/32, 52.37.59.221/32, 35.160.113.242/32, 35.155.128.150/32, 54.184.179.181/32, 44.237.182.41/32, 52.89.0.105/32, 35.85.66.39/32, 158.115.128.0/19, 209.206.48.0/20, 216.157.128.0/20	443, 30001	TCP	outbound	Camera streaming proxy	Cameras	
Your network(s)	0.0.0.0/0, 2606:6940:0000:0000:0000:0000:0000/32, 2606:7bc0:0000:0000:0000:0000:0000/32, 2620:012f:c000:0000:0000:0000:0000:0000/44		80, 443	TCP	outbound	Systems Manager agent communication, Splash pages, MV cloud archive, Meraki cloud communication	Access points, Cameras, MX Security Appliance, Switches, Systems Manager
Your network(s)	158.115.128.0/19, 209.206.48.0/20, 216.157.128.0/20		80, 993, 7734, 7752, 60000-61000	TCP	outbound	Backup Meraki cloud communication, Backup configuration downloads, Measured throughput to dashboard.meraki.com, Backup firmware downloads, Mac/Windows remote desktop, Mac/Windows agent communication	Access points, Cameras, MX Security Appliance, Switches, Systems Manager
Your network(s)	8.8.8.8/32		8888	UDP	inbound	802.1X with customer-hosted RADIUS	Access points



Dashboard Connectivity Troubleshooting

If the offline node is connected to an online Meraki node.

Basic Network Check

- Power status
- Port status
- VLANs
- IP status (static / DHCP)
- DNS
- NTP
- Internet reachability
- Meraki Cloud reachability
- SSL inspection

Packet capture for switches ▼

Switch: 88:15:44:31:cd:65 ▼

Ports: 10

Output: Download .pcap file (for Wireshark) ▼

Duration (secs): 60

Filter expression:

File name: CountryTest-swit_MS-88-15-44-31-cd-65_IF-10

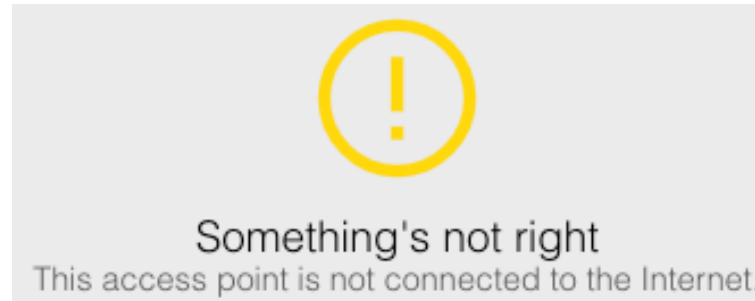
Start capture

Dashboard Connectivity Troubleshooting

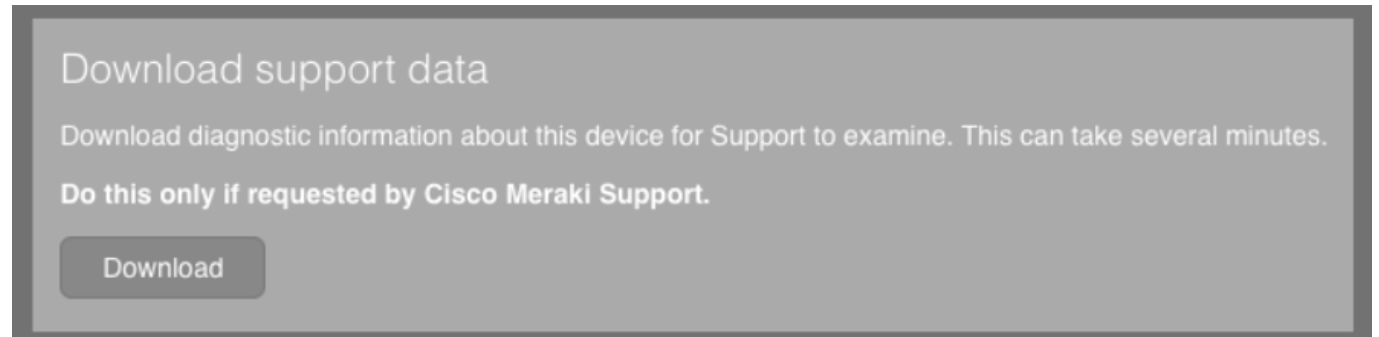
If the offline node is NOT connected to an online Meraki node and the user was able to open the LSP.

Basic Network Check

- Power status
- Port status
- VLANs
- IP status (static / DHCP)
- DNS
- NTP
- Internet reachability
- Meraki Cloud reachability
- SSL inspection



Support asks for OOB logs / support bundle



- The user send the file
- NSE (Network Support Engineer) decrypts the file
- NSE navigate through all the files and try to make sense of the logs

Connectivity troubleshooting

Can't connect to the internet

✓ Is the AP available?

✓ Beacons

Association

Authentication

IP

Everything is so slow

Expectations Alignment

Signal

Noise

Interference

Utilisation

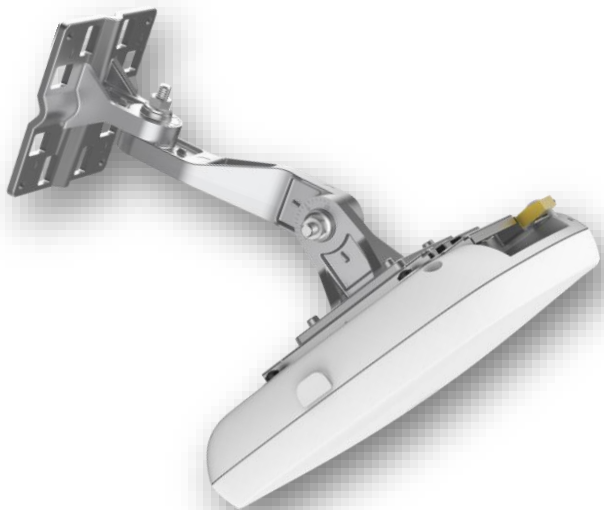
It keeps disconnecting

Channel Changes

DFS

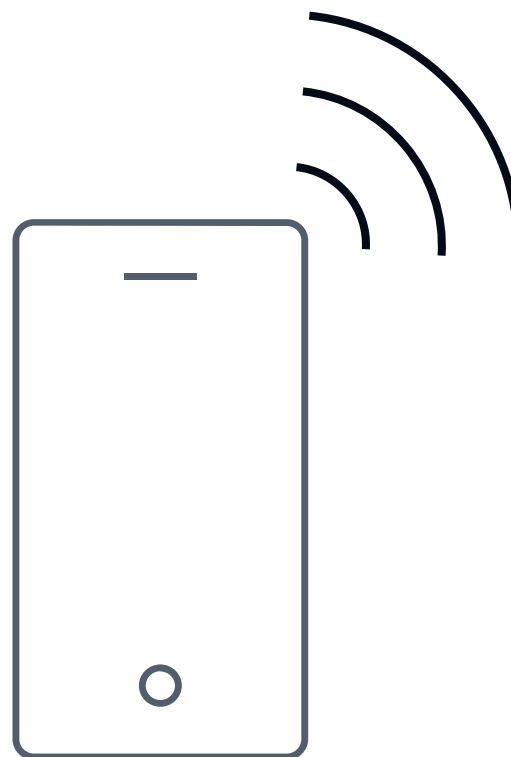
Roaming

Bad actors

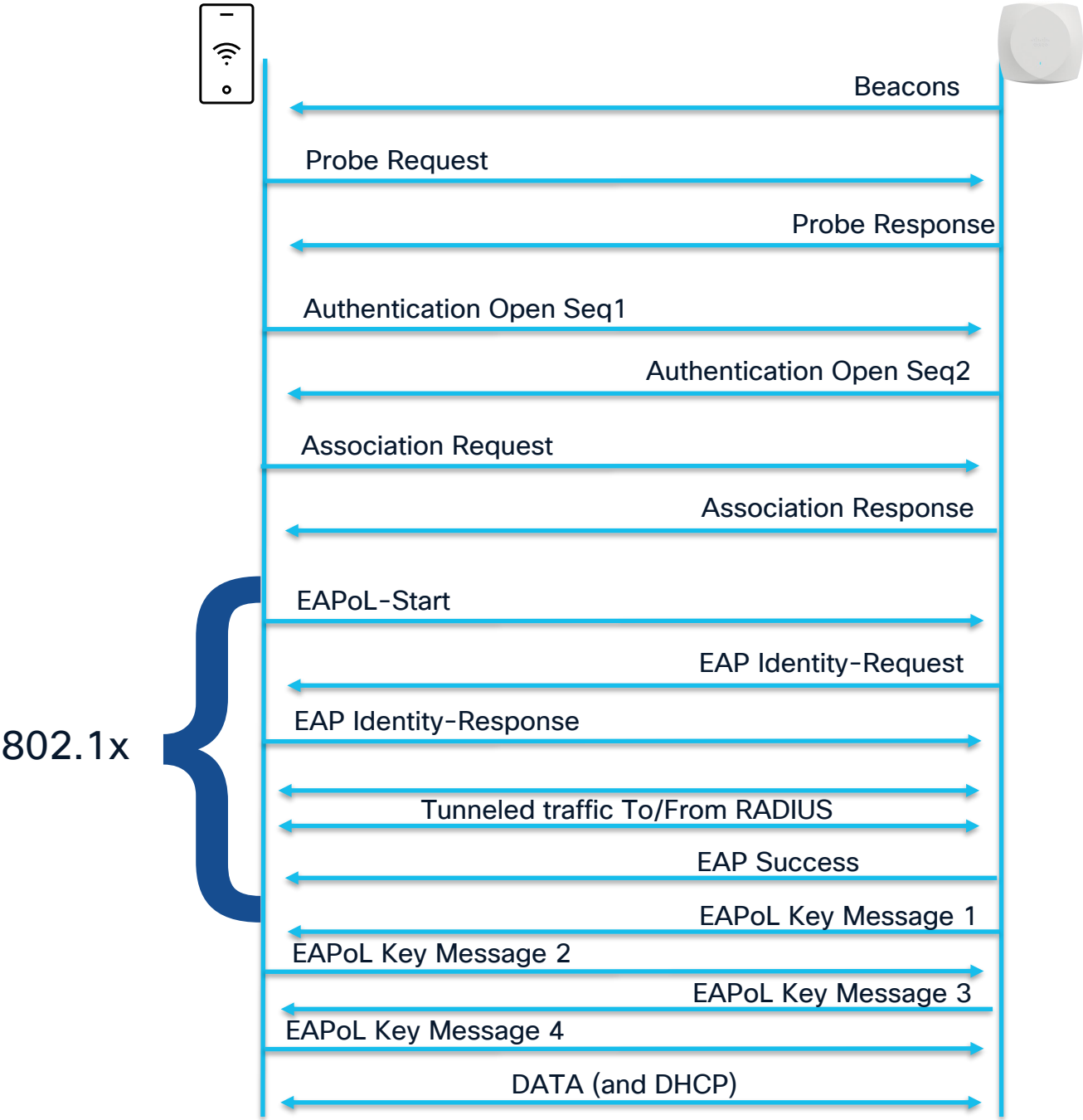


The client selects the AP

- Saved profiles
- RSSI / SNR
- Band
- Channel width
- Wi-Fi standard
- Load



Client Joining



Client Join Cheat Sheet



No Association Request from the client is usually

- No beacons / probe responses
- Client not initiating connection
- No supported basic rates

Failure after association response is usually an interoperability problem

- 802.11k/v
- 802.11w
- WPA3

EAPoL-Start and no EAP-Success

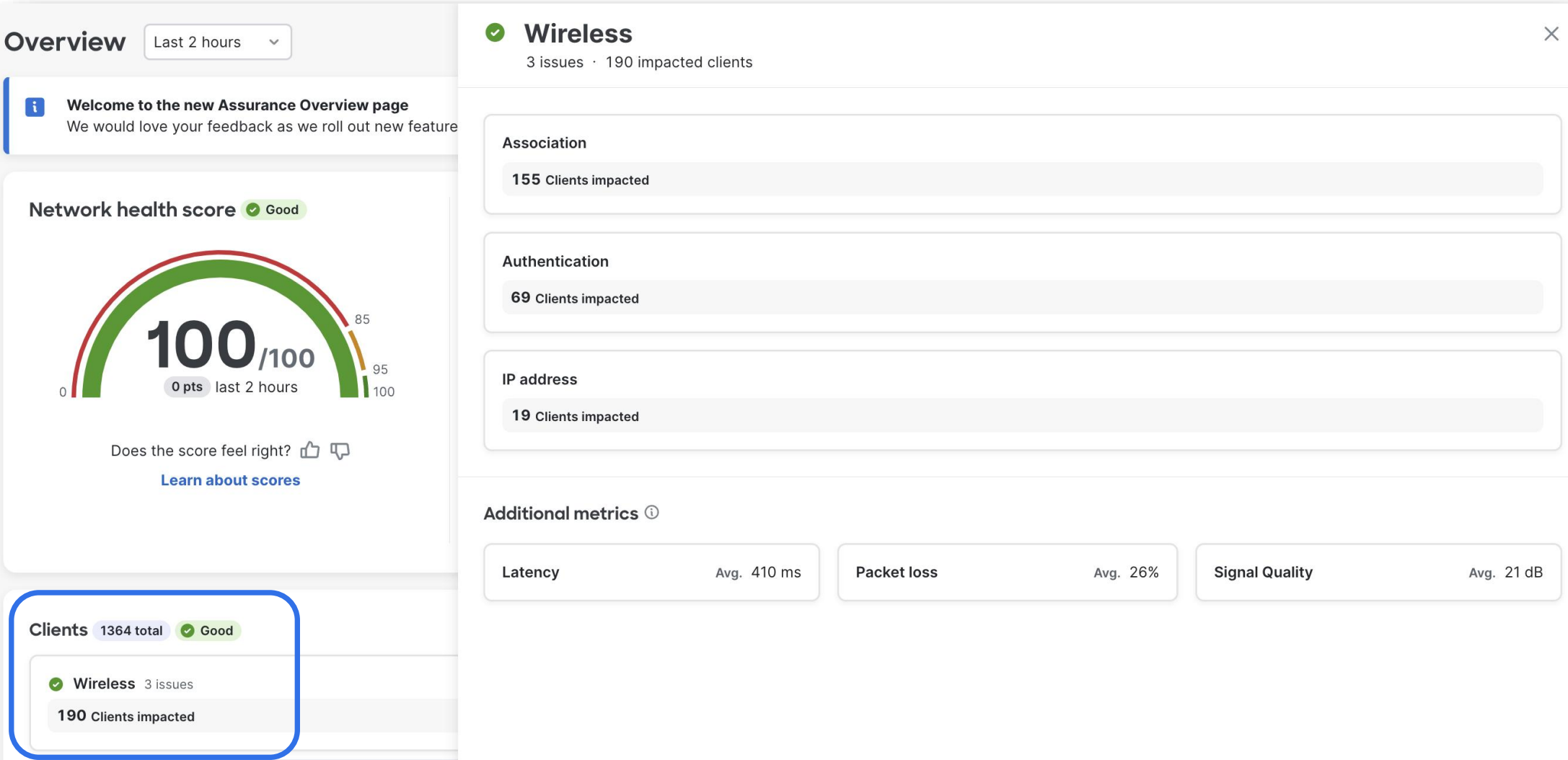
- All encrypted in the tunnel, need to check RADIUS server
- Given 2-way traffic seen

Failure after key 2 is usually a PSK mismatch

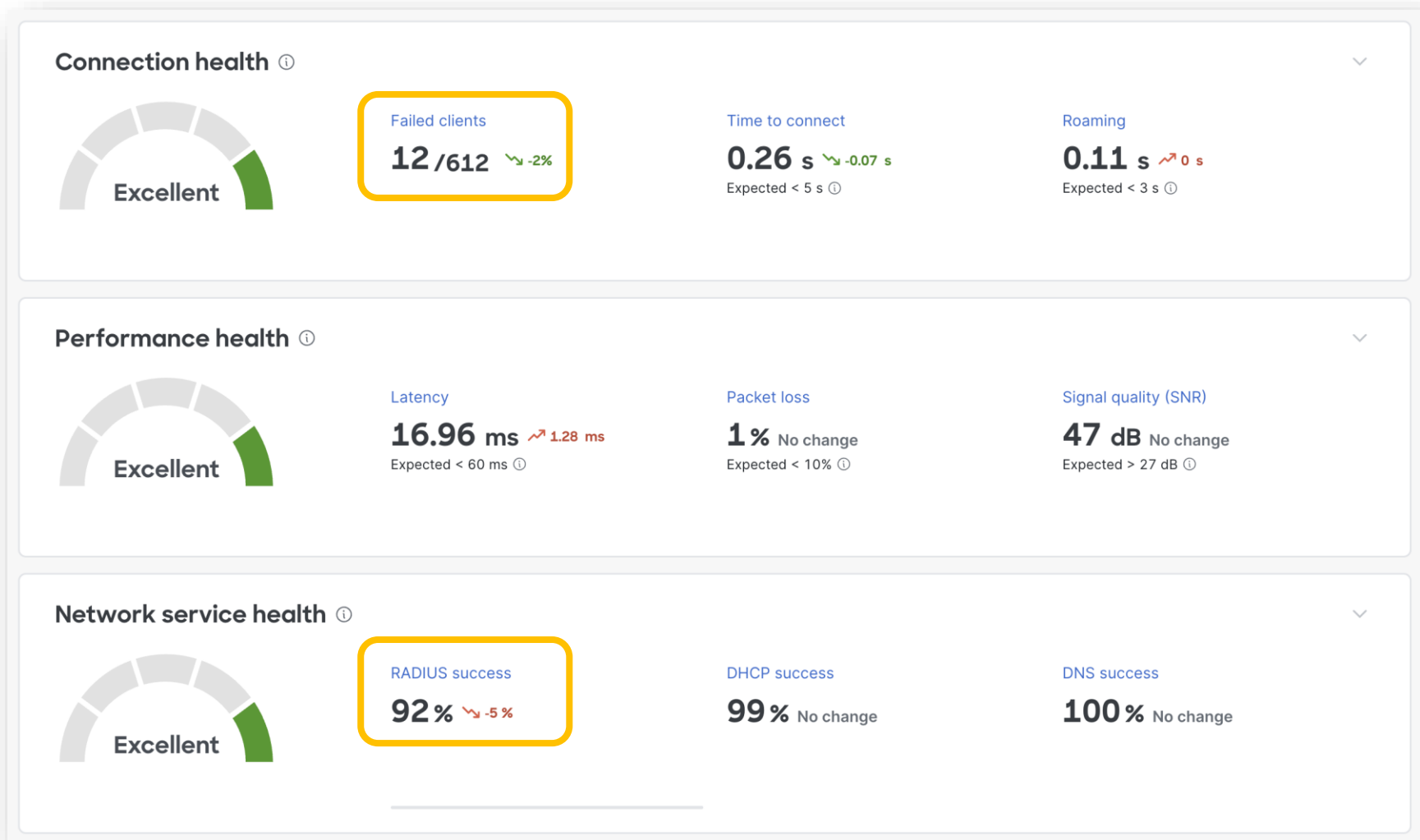
All steps passed but still no IP

- Not enough addresses in the pool
- Mandatory DHCP + static client configuration

Assurance overview shows network state



Wireless Health Overview will guide you



- Every number has a story to tell
- Click to unleash the insights

Network service health ⓘ



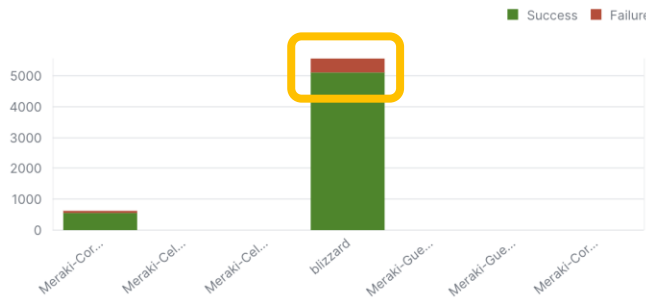
RADIUS success
92% ↘ -5%

DHCP success
99% No change

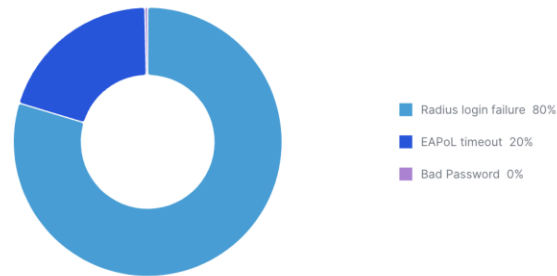
DNS success
100% No change

RADIUS Server IP All IPs

RADIUS client connection attempts by SSID



RADIUS failure reason codes



Impact

50 / 151 Access points with most failures

Access Point	Failures
sfo12-5-ap-18	59 / 81
sfo12-5-ap-21	33 / 51
sfo12-4-ap-003	31 / 273
sfo12-5-ap-15	25 / 42
sfo12-2-ap-23	24 / 46

< 1 2 3 ... 10 >

Impact

15 / 399 Clients with most failures

Client	Failures
f2:9	192 / 192
c4:f	188 / 188
f6:d	22 / 22
f2:2	21 / 21
fe:8	18 / 18

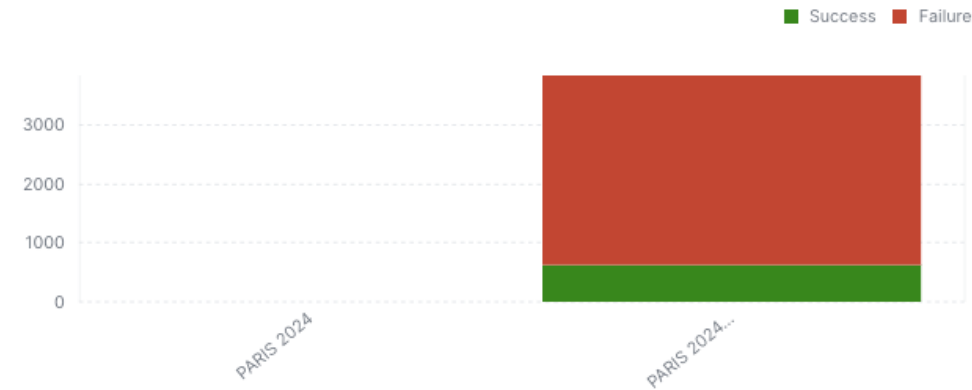
< 1 2 3 >

- Look at all Radius connections per SSID
- Filter per Radius IP to better scope
- Is it more apparent for a specific AP or specific client?
- Select sample client to investigate the timeline

You can find miss-behaving clients or bad actors

RADIUS Server IP All IPs

RADIUS client connection attempts by SSID



RADIUS failure reason codes



Impact

31 / 118 Access points with most failures

Access Point	Failures
PHQ-E04WAP-070	521 / 531
PHQ-E04WAP-067	513 / 532
PHQ-E05WAP-043	397 / 408
PHQ-W06WAP-028	240 / 240
PHQ-W06WAP-027	198 / 198

Impact

4 / 233 Clients with most failures

Client	Failures
Android	3176 / 3176
ca:44:d6:6d:05:e8	7 / 7
92:09:ae:7f:59:02	5 / 5
P24-9FCW600856N	2 / 10

Scoped to an AP? Connections tab

Last week ^

Last 2 hours

Last day

Last week ✓

Last month

All SSIDs

All bands

Connection stats

Connection problems 36 total

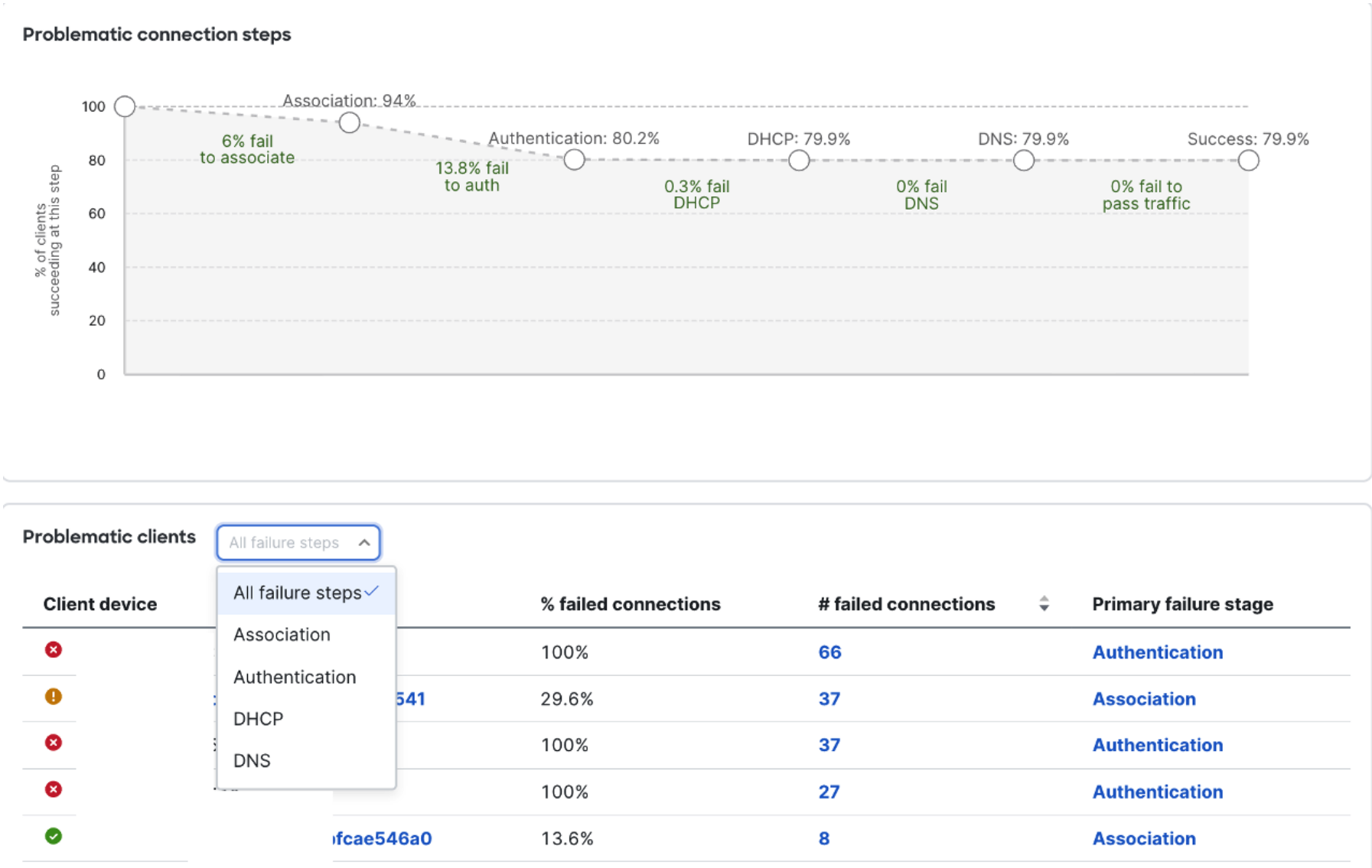
16 Alerting ⚠

Issues by SSID

All failure steps

SSID	# clients affected by connection problems	% clients devices affected by connection problems	Primary failure stage
a\	9/46	19.6%	Authentication
M	5/49	10.2%	Association
b\	2/158	1.3%	Authentication
M	0/93	0%	Association
M	0/18	0%	DHCP

Scoped to an AP? Connections tab



Connection Performance

Can't connect to the internet

 Is the AP available?

 Beacons

 Association

 Authentication

 IP

Everything is so slow

Expectations Alignment

Signal

Noise

Interference

Utilisation

It keeps disconnecting

Channel Changes

DFS

Roaming

Bad actors

						OFDM (Prior 11ax)							
MCS Index						20MHz		40MHz		80MHz		160MHz	
HT	VHT	HE	Spatial	Modulation	Coding	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI
0	0	0	1	BPSK	1/2	6.5	7.2	13.5	15	29.3	32.5	58.5	65
1	1	1	1	QPSK	1/2	13	14.4	27	30	58.5	65	117	130
2	2	2	1	QPSK	3/4	19.5	21.7	40.5	45	87.8	97.5	175.5	195
3	3	3	1	16-QAM	1/2	26	28.9	54	60	117	130	234	260
4	4	4	1	16-QAM	3/4	39	43.3	81	90	175.5	195	351	390
5	5	5	1	64-QAM	2/3	52	57.8	108	120	234	260	468	520
6	6	6	1	64-QAM	3/4	58.5	65	121.5	135	263.3	292.5	526.5	585
7	7	7	1	64-QAM	5/6	65	72.2	135	150	292.5	325	585	650
	8	8	1	256-QAM	3/4	78	86.7	162	180	351	390	702	780
	9	9	1	256-QAM	5/6	N/A	N/A	180	200	390	433.3	780	866.7
		10	1	1024-QAM	3/4								
		11	1	1024-QAM	5/6								
8	0	0	2	BPSK	1/2	13	14.4	27	30	58.5	65	117	130
9	1	1	2	QPSK	1/2	26	28.9	54	60	117	130	234	260
10	2	2	2	QPSK	3/4	39	43.3	81	90	175.5	195	351	390
11	3	3	2	16-QAM	1/2	52	57.8	108	120	234	260	468	520
12	4	4	2	16-QAM	3/4	78	86.7	162	180	351	390	702	780
13	5	5	2	64-QAM	2/3	104	115.6	216	240	468	520	936	1040
14	6	6	2	64-QAM	3/4	117	130	243	270	526.5	585	1053	1170
15	7	7	2	64-QAM	5/6	130	144.4	270	300	585	650	1170	1300
	8	8	2	256-QAM	3/4	156	173.3	324	360	702	780	1404	1560
	9	9	2	256-QAM	5/6	N/A	N/A	360	400	780	866.7	1560	1733.3
		10	2	1024-QAM	3/4								
		11	2	1024-QAM	5/6								
16	0	0	3	BPSK	1/2	19.5	21.7	40.5	45	87.8	97.5	175.5	195
17	1	1	3	QPSK	1/2	39	43.3	81	90	175.5	195	351	390
18	2	2	3	QPSK	3/4	58.5	65	121.5	135	263.3	292.5	526.5	585
19	3	3	3	16-QAM	1/2	78	86.7	162	180	351	390	702	780
20	4	4	3	16-QAM	3/4	117	130	243	270	526.5	585	1053	1170
21	5	5	3	64-QAM	2/3	156	173.3	324	360	702	780	1404	1560
22	6	6	3	64-QAM	3/4	175.5	195	364.5	405	N/A	N/A	1579.5	1755
23	7	7	3	64-QAM	5/6	195	216.7	405	450	877.5	975	1755	1950
	8	8	3	256-QAM	3/4	234	260	486	540	1053	1170	2106	2340
	9	9	3	256-QAM	5/6	260	288.9	540	600	1170	1300	N/A	N/A
		10	3	1024-QAM	3/4								
		11	3	1024-QAM	5/6								

```

Tag: VHT Capabilities
  Tag Number: VHT Capabilities (191)
  Tag length: 12
  > VHT Capabilities Info: 0x0f917876
  > VHT Supported MCS Set
    > Rx MCS Map: 0xffff
      .... ..10 = Rx 1 SS: MCS 0-9 (0x2)
      .... ..10.. = Rx 2 SS: MCS 0-9 (0x2)
      .... ..11 .... = Rx 3 SS: Not Supported (0x3)
      .... ..11.. .... = Rx 4 SS: Not Supported (0x3)
      .... ..11 .... = Rx 5 SS: Not Supported (0x3)
      .... 11.. .... = Rx 6 SS: Not Supported (0x3)
      ..11 .... = Rx 7 SS: Not Supported (0x3)
      11.. .... = Rx 8 SS: Not Supported (0x3)

```

```

> Frame 18305: 344 bytes on wire (2752 bits), 86 bytes captured (688 bits)
> Radiotap Header v0, Length 60
> 802.11 radio information
  PHY type: 802.11ac (8)
  TXOP_PS_NOT_ALLOWED: False
  Short GI: True
  Bandwidth: 40 MHz (1)
  > User 0: MCS 7
    MCS index: 7 (64-QAM 5/6)
    Spatial streams: 2
    FEC: BEC (0)
    Data rate: 300.0 Mb/s
  Channel: 40
  Frequency: 5200 MHz
  Signal strength (dBm): -44 dBm
  TSF timestamp: 110569131
> IEEE 802.11 QoS Data, Flags: .p....T

```

Wireless Overhead

MCS is important, but

- DIFS/AIFS – Interframe spacing
- Random backoff timer/CW
- Legacy preamble – BPSK
- RTS – MBR
- SIFS
- Legacy preamble
- CTS – MBR
- SIFS
- Legacy preamble
- HT/VHT preamble
- Header – MBR
- **A-MPDU – our data!**
- **CRC**
- SIFS
- Legacy preamble – BPSK
- ACK/BlockACK – MBR

Wireless Overhead

- Scenario 1
20MHz
64-QAM
VHT 802.11ac
MCS7
72.2Mbps
- Scenario 2
80MHz
256-QAM
VHT 802.11ac
MCS9
433.3Mbps
6 times faster?



- Payload A-MPDU 1024 bytes
- Time in Microseconds

Wireless Overhead

- Scenario 1
20MHz
64-QAM
VHT 802.11ac
MCS7
72.2Mbps
- Scenario 2
80MHz
256-QAM
VHT 802.11ac
MCS9
433.3Mbps
- Scenario 3
Scenario 2 client
MBR to 24Mbps



Air time is the most precious resource

- All wireless stations – clients and APs need to compete to access the medium
 - CCA (clear channel assessment) is critical
 - Collisions will multiply the traffic congestion
 - Virtual
 - 802.11 transmission – duration field
 - NAV on each station – red light timer
 - Physical
 - Energy detection on channel
 - Non-802.11 energy?
-
- If client is unable to access the medium, the latency will increase

Resource monitor

- Beacons
- QBSS element
- $(\text{Value} / 255) * 100 = \text{channel utilization \%}$

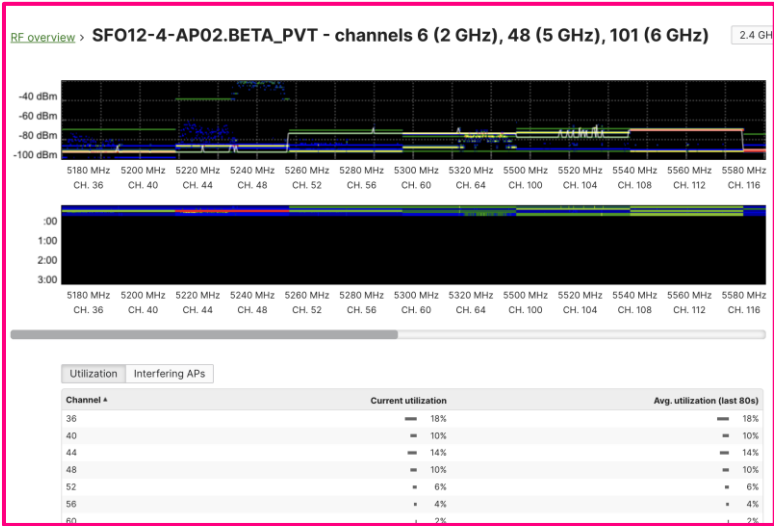
Tag: QBSS Load Element 802.11e CCA Version
Tag Number: QBSS Load Element (11)
Tag length: 5
QBSS Version: 2
Station Count: 3
Channel Utilization: 69 (27%)

Channel Utilization	Info
69	Beacon frame, SN=782, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=783, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=784, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=785, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=786, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=787, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=788, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=789, FN=0, Flags=....., BI=100, SSID="k1
69	Beacon frame, SN=790, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=791, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=793, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=795, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=797, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=799, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=801, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=802, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=803, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=804, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=805, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=806, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=808, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=809, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=810, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=811, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=812, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=813, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=814, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=815, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=816, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=817, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=818, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=820, FN=0, Flags=....., BI=100, SSID="k1
66	Beacon frame, SN=821, FN=0, Flags=....., BI=100, SSID="k1

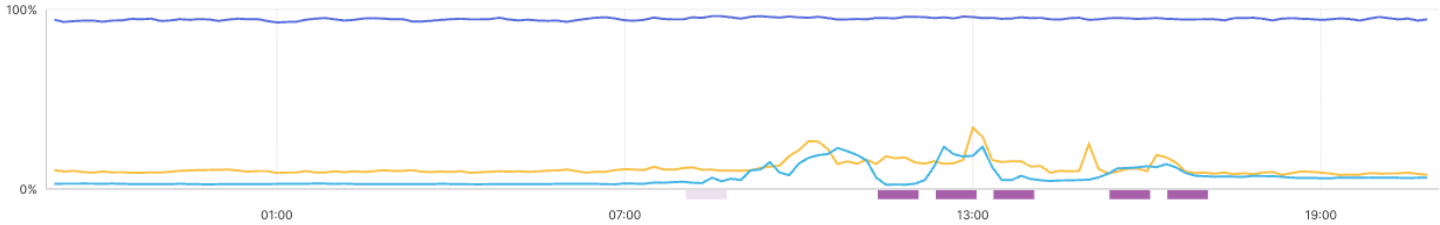
`(wlan.fc.type_subtype==0x08) && (wlan.bssid == a1:b2:c3:d4:e5:f6)`

Monitor RF Channel Utilization

Wireless> RF Spectrum



Channel utilization ⓘ 802.11 and interference ▼

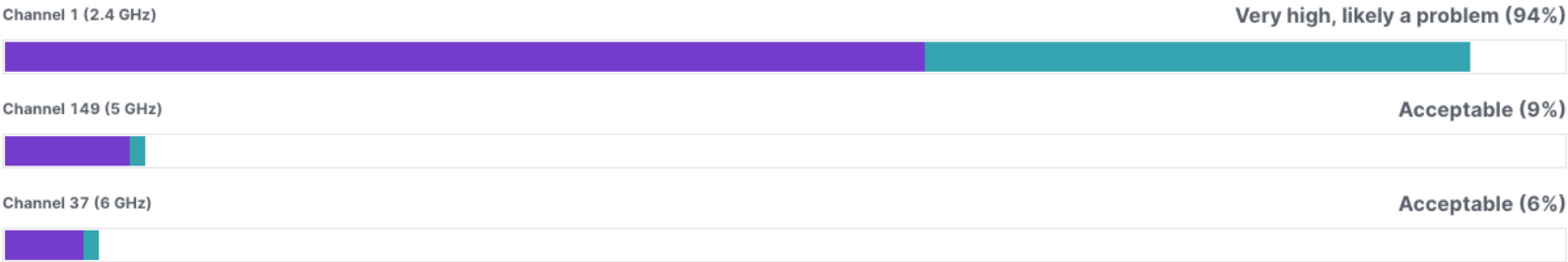


Overtime Trend

Live

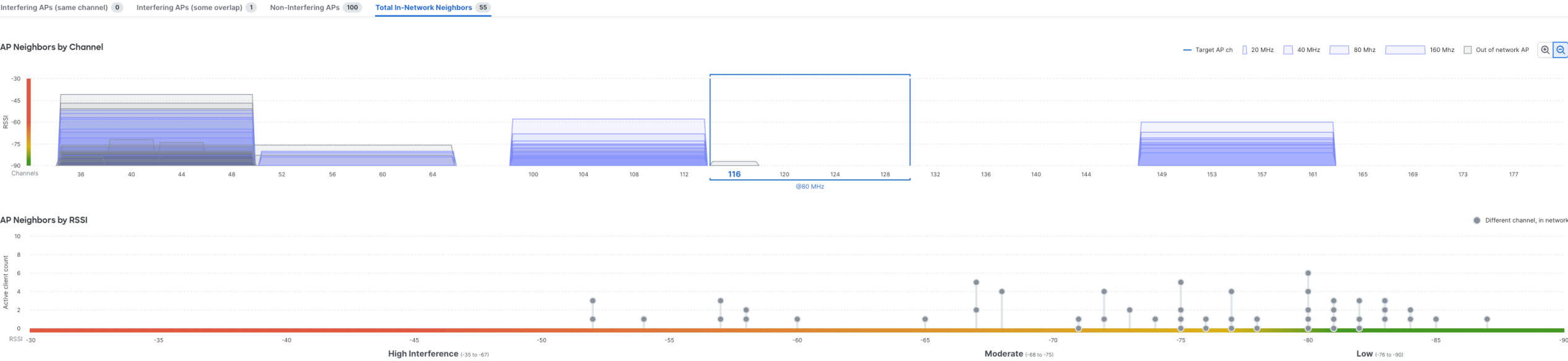
Utilization on current channels

802.11 Traffic non-802.11 Interference



You should not use 80MHz channels in 5GHz

Not enough non-overlapping channels in enterprise deployments
Especially in dual-5GHz mode

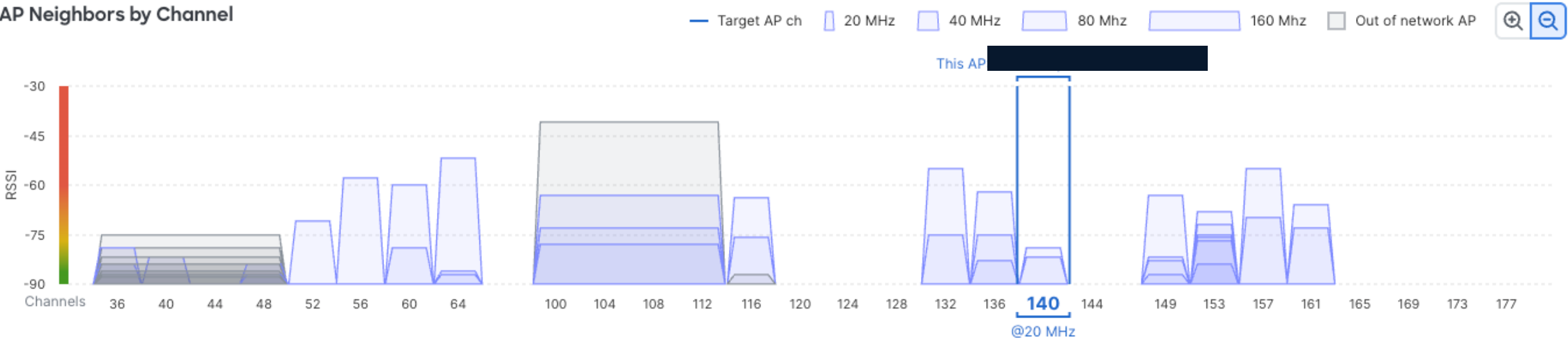


Quick change of RF profile significantly improved user experience

on 5 GHz, ch 140 @20 MHz

Interfering APs (same channel) 2 Interfering APs (some overlap) 0 Non-Interfering APs 47 **Total In-Network Neighbors 38**

AP Neighbors by Channel



OverviewConnectionsPerformanceRoaming

Statusassociated since Aug 19 20:52

Location Statusknown as of Aug 19 22:47 ⓘ

SSIDCorp

Access pointsfo12topology

SplashN/A

Signal45dB (channel 149, 5 GHz)

Usersfo12 (802.1X login)

Device type, OSIntel

Hashed IP10.219.125.178

Capable Wi-Fi standards802.11ax - 2.4, 5, and 6 GHz, 802.11r details

Toolshistory packet capture disconnect client

Radiotap Header v0, Length 70

Header revision: 0

Header pad: 0

Header length: 70

> Present flags

MAC timestamp: 7726605746

> Flags: 0x00

Channel frequency: 6215 [6 GHz 53]

> Channel flags: 0x0140, Orthogonal Frequency-Division Multiplexing (OFDM), 5 GHz spectrum

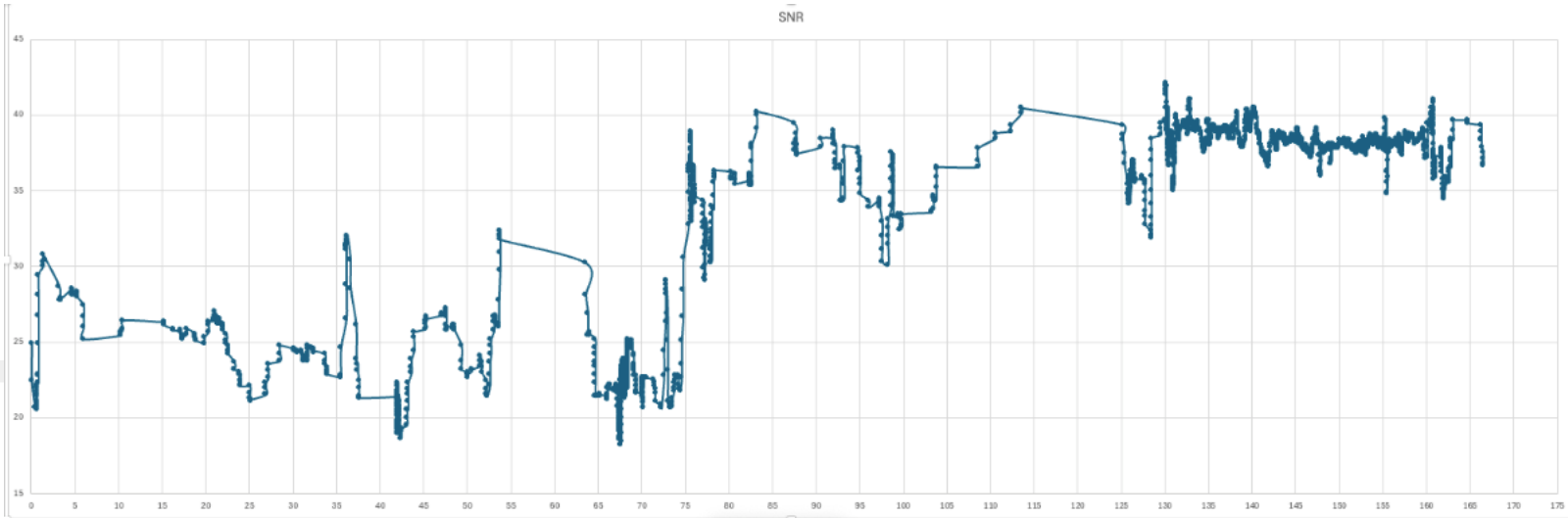
Antenna signal: -62 dBm

Antenna noise: -93 dBm

Antenna: 0

> A-MPDU status

No.	Time	Source	Destination	Protocol	Length	ID	Antenna signal	Channel freq	Id	Sequence number	BSS Id	Channel Utilization	Antenna noise
32475	73.718922	86:7	i_8a:77:e0	LLC	166		-74 dBm	6215			05		-93 dBm
32522	73.859518	86:7	:e9:05	802.11	64		-72 dBm	6215					-93 dBm
32524	73.859714	86:7	i_8a:77:e0	LLC	205		-72 dBm	6215			05		-93 dBm
32526	73.867632	86:7	:e9:05	802.11	76		-71 dBm	6215					-93 dBm
32665	74.218602	86:7	:e9:05	802.11	76		-70 dBm	6215					-93 dBm
32668	74.220502	86:7	:e9:05	802.11	64		-70 dBm	6215					-93 dBm
32671	74.220776	86:7	i_8a:77:e0	LLC	166		-70 dBm	6215			05		-93 dBm
32810	74.398398	86:7	:e9:05	802.11	64		-69 dBm	6215					-93 dBm
32813	74.398648	86:7		LLC	376		-71 dBm	6215			05		-93 dBm
32816	74.410102	86:7	:e9:05	802.11	76		-71 dBm	6215					-93 dBm
32904	74.580144	86:7	:e9:05	802.11	76		-70 dBm	6215					-93 dBm
32906	74.581793	86:7	:e9:05	802.11	64		-70 dBm	6215					-93 dBm
32908	74.582264	86:7	i_8a:77:e0	LLC	166		-71 dBm	6215			05		-93 dBm
32981	74.753624	86:7	:e9:05	802.11	64		-70 dBm	6215					-93 dBm
32983	74.753817	86:7	i_8a:77:e0	LLC	215		-71 dBm	6215			05		-93 dBm
32987	74.765806	86:7	:e9:05	802.11	76		-74 dBm	6215					-93 dBm
33291	75.394717	86:7	:e9:05	802.11	76		-72 dBm	6215					-93 dBm
33293	75.396733	86:7	:e9:05	802.11	64		-71 dBm	6215					-93 dBm
33295	75.396971	86:7	i_8a:77:e0	LLC	265		-72 dBm	6215			05		-93 dBm
33320	75.432198	86:7	802.11		174		-62 dBm	6215					-93 dBm
33342	75.442404	86:7	802.11		174		-62 dBm	6215					-93 dBm
33367	75.499750	86:7	:e9:00	802.11	91		-61 dBm	5220			00		-97 dBm
33372	75.503429	86:7	:e9:00	802.11	316		-60 dBm	5220			00		-97 dBm
33496	75.683410	86:7	:e9:00	802.11	64		-59 dBm	5220					-97 dBm
33498	75.683722	86:7	:e9:00	EAPOL	224		-59 dBm	5220			00		-97 dBm



RF Physics



RF Absorption



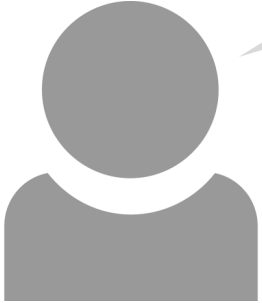
RF Absorption



RF Reflection



Case Study

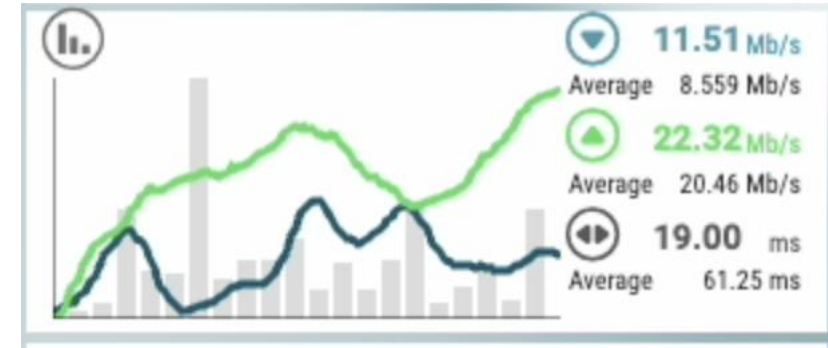


All users report **slow** connections

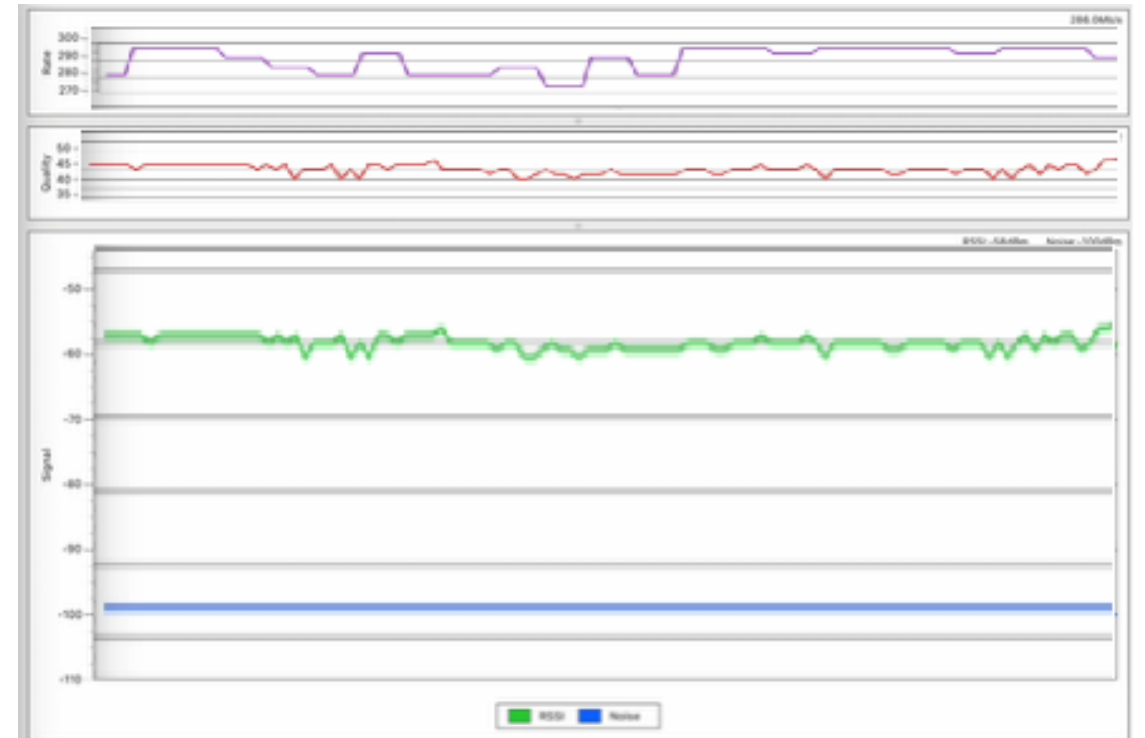
Let's run some tests



Production hours test



```
64 bytes from 10.128.128.126: icmp_seq=4 ttl=64 time=6.880 ms
64 bytes from 10.128.128.126: icmp_seq=5 ttl=64 time=16.334 ms
64 bytes from 10.128.128.126: icmp_seq=6 ttl=64 time=72.450 ms
64 bytes from 10.128.128.126: icmp_seq=7 ttl=64 time=115.067 ms
64 bytes from 10.128.128.126: icmp_seq=8 ttl=64 time=154.845 ms
64 bytes from 10.128.128.126: icmp_seq=9 ttl=64 time=207.980 ms
64 bytes from 10.128.128.126: icmp_seq=10 ttl=64 time=426.354 ms
64 bytes from 10.128.128.126: icmp_seq=11 ttl=64 time=481.417 ms
Request timeout for icmp_seq 12
Request timeout for icmp_seq 13
64 bytes from 10.128.128.126: icmp_seq=12 ttl=64 time=2666.054 ms
64 bytes from 10.128.128.126: icmp_seq=13 ttl=64 time=1709.506 ms
64 bytes from 10.128.128.126: icmp_seq=14 ttl=64 time=1247.714 ms
64 bytes from 10.128.128.126: icmp_seq=15 ttl=64 time=1027.990 ms
64 bytes from 10.128.128.126: icmp_seq=16 ttl=64 time=524.532 ms
64 bytes from 10.128.128.126: icmp_seq=17 ttl=64 time=1099.053 ms
```



User and engineers should see issues differently



What users see?

Speed test is slow



What do we see?

RSSI and Noise are consistent

Data rate is fluctuating

Latency on the wireless

10.128.128.126 tests only the wireless medium

8.8.8.8 would have tested wireless / LAN / WAN

Speed test is slow

User and engineers should see issues differently



What do we see?

RSSI and Noise are consistent

Data rate is fluctuating
Latency on the wireless
10.128.128.126 tests only the wireless medium

8.8.8.8 would have tested wireless / LAN / WAN
Speed test is slow

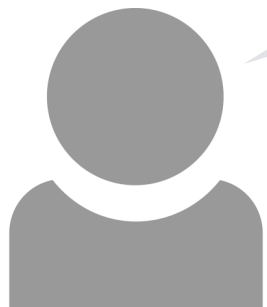


What do we learn?

RF is most likely OK

Shared medium must be busy
Too many users? CCI?
This is where we should focus

Anything beyond WLAN will be slow, it's just another symptom



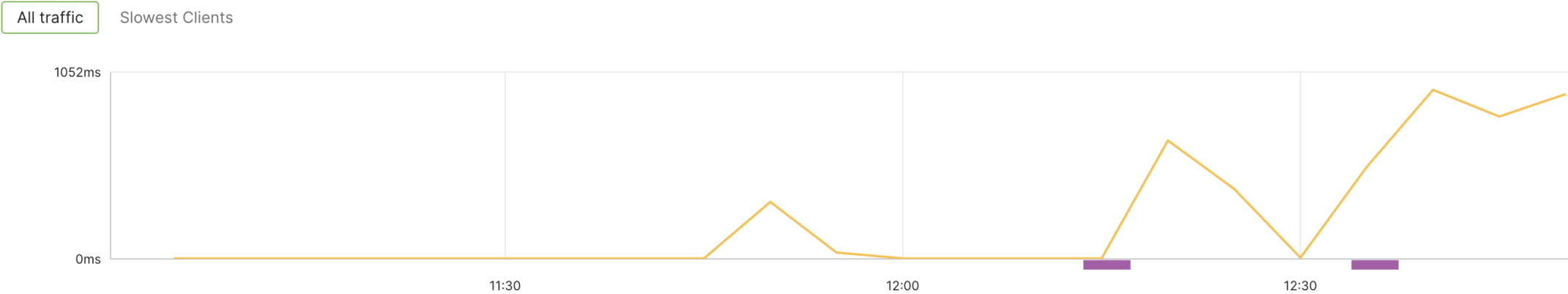
All the time

Specific time and days?



Node details page > Performance tab

Average wireless latency ⓘ



Average wireless latency ⓘ

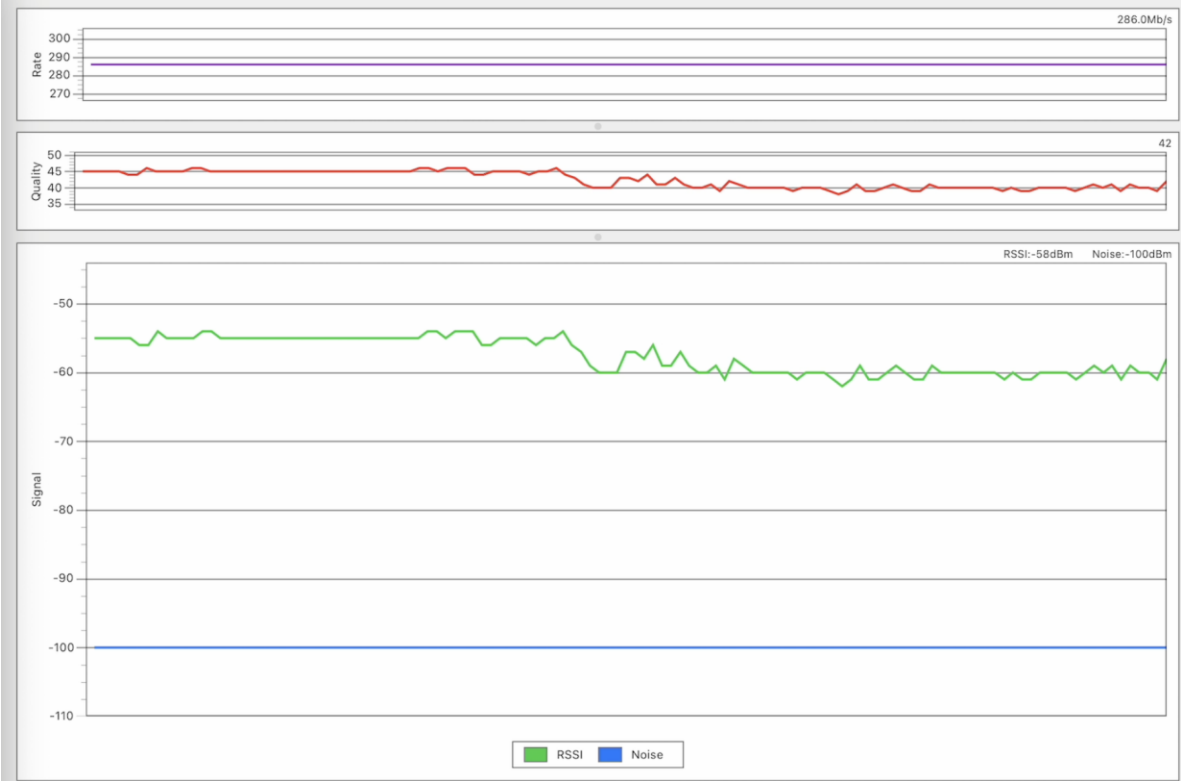
All traffic Slowest Clients

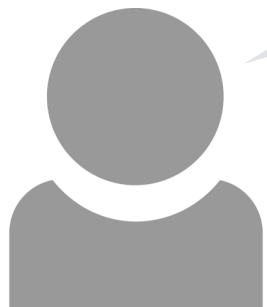
Client	Average latency for all traffic
	● 1,182ms
	● 1,096ms
	● 848ms

After hours test



```
64 bytes from 10.128.128.126: icmp_seq=785 ttl=64 time=28.138 ms
64 bytes from 10.128.128.126: icmp_seq=786 ttl=64 time=15.514 ms
64 bytes from 10.128.128.126: icmp_seq=787 ttl=64 time=39.802 ms
64 bytes from 10.128.128.126: icmp_seq=788 ttl=64 time=45.120 ms
64 bytes from 10.128.128.126: icmp_seq=789 ttl=64 time=145.198 ms
64 bytes from 10.128.128.126: icmp_seq=790 ttl=64 time=120.569 ms
64 bytes from 10.128.128.126: icmp_seq=791 ttl=64 time=157.116 ms
64 bytes from 10.128.128.126: icmp_seq=792 ttl=64 time=12.714 ms
64 bytes from 10.128.128.126: icmp_seq=793 ttl=64 time=12.757 ms
64 bytes from 10.128.128.126: icmp_seq=794 ttl=64 time=60.863 ms
64 bytes from 10.128.128.126: icmp_seq=795 ttl=64 time=6.624 ms
64 bytes from 10.128.128.126: icmp_seq=796 ttl=64 time=3.415 ms
64 bytes from 10.128.128.126: icmp_seq=797 ttl=64 time=5.919 ms
64 bytes from 10.128.128.126: icmp_seq=798 ttl=64 time=7.738 ms
64 bytes from 10.128.128.126: icmp_seq=799 ttl=64 time=3.334 ms
64 bytes from 10.128.128.126: icmp_seq=800 ttl=64 time=29.787 ms
64 bytes from 10.128.128.126: icmp_seq=801 ttl=64 time=79.852 ms
64 bytes from 10.128.128.126: icmp_seq=802 ttl=64 time=123.038 ms
```



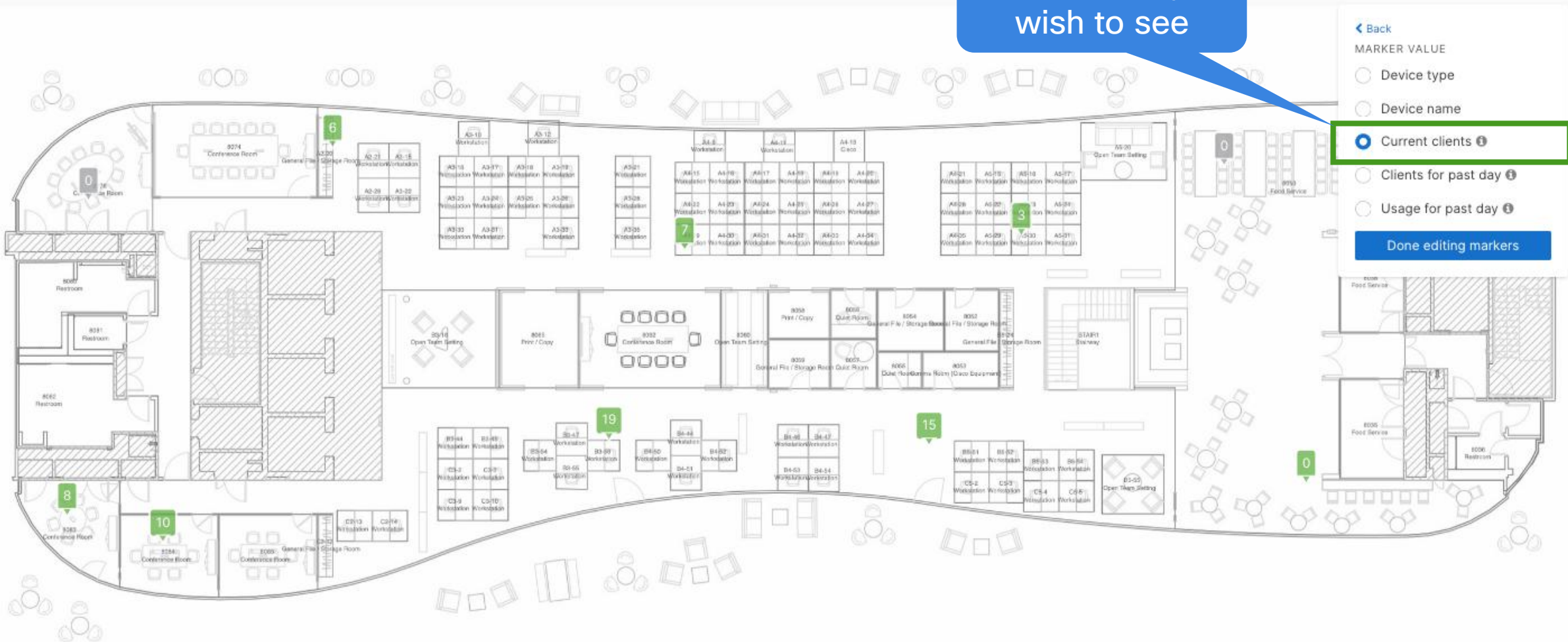


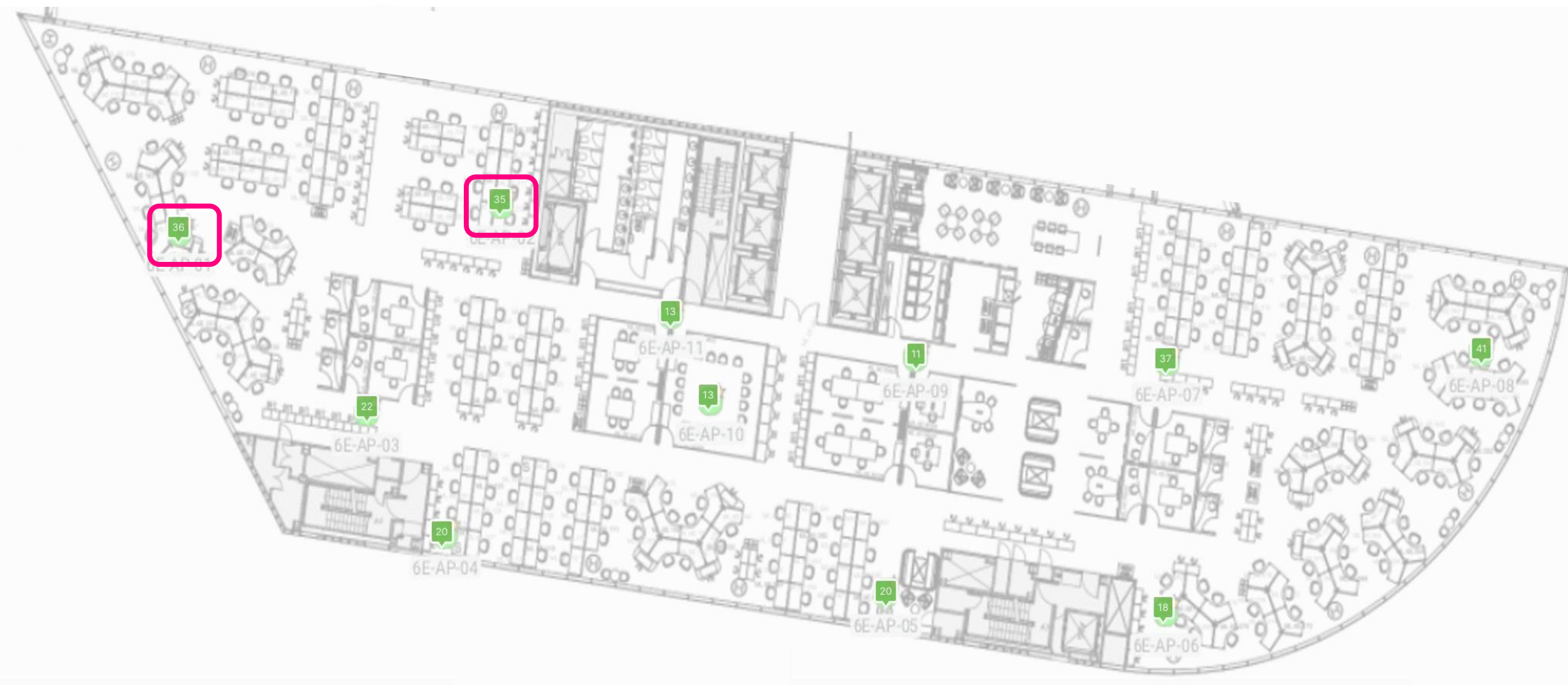
Yes

Is it location specific?



Select what you wish to see





Common problem example



40 clients per AP
should be fine on an
Enterprise grade AP

Yes, but there is one more thing



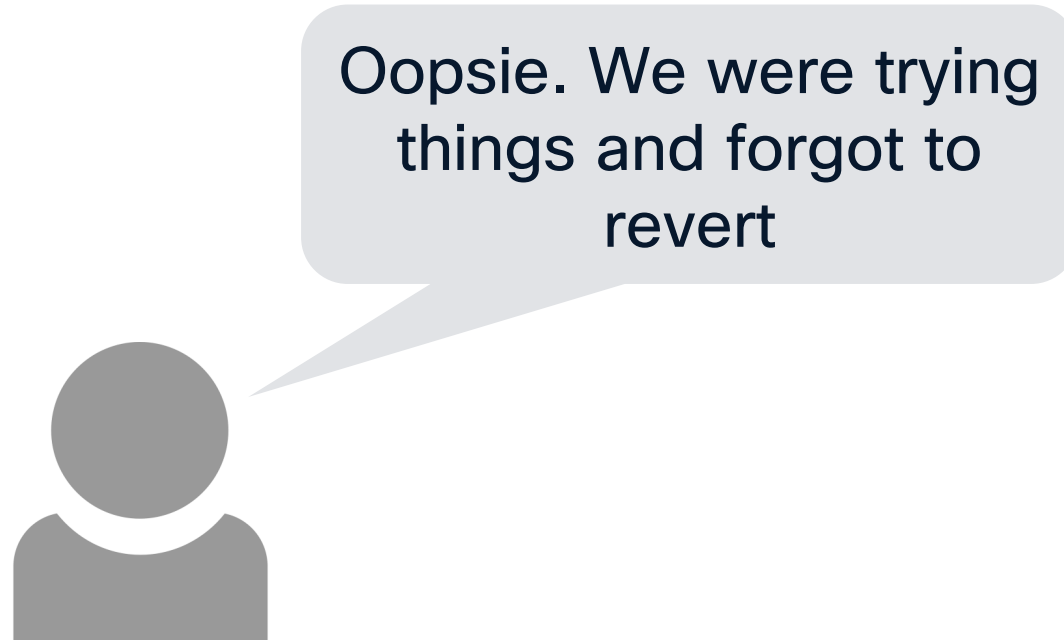
Same channel on strongest neighbors will cause performance issues



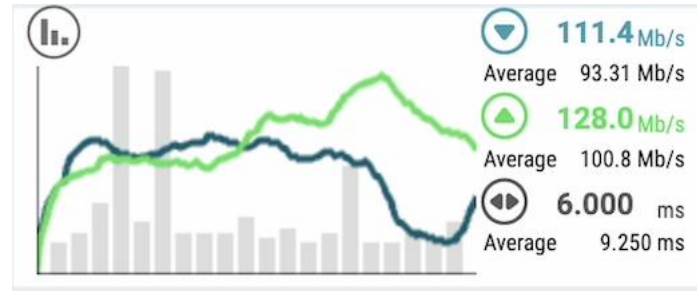
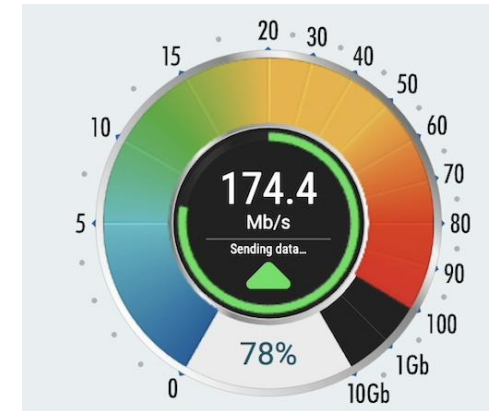
Wireless -> Radio Settings



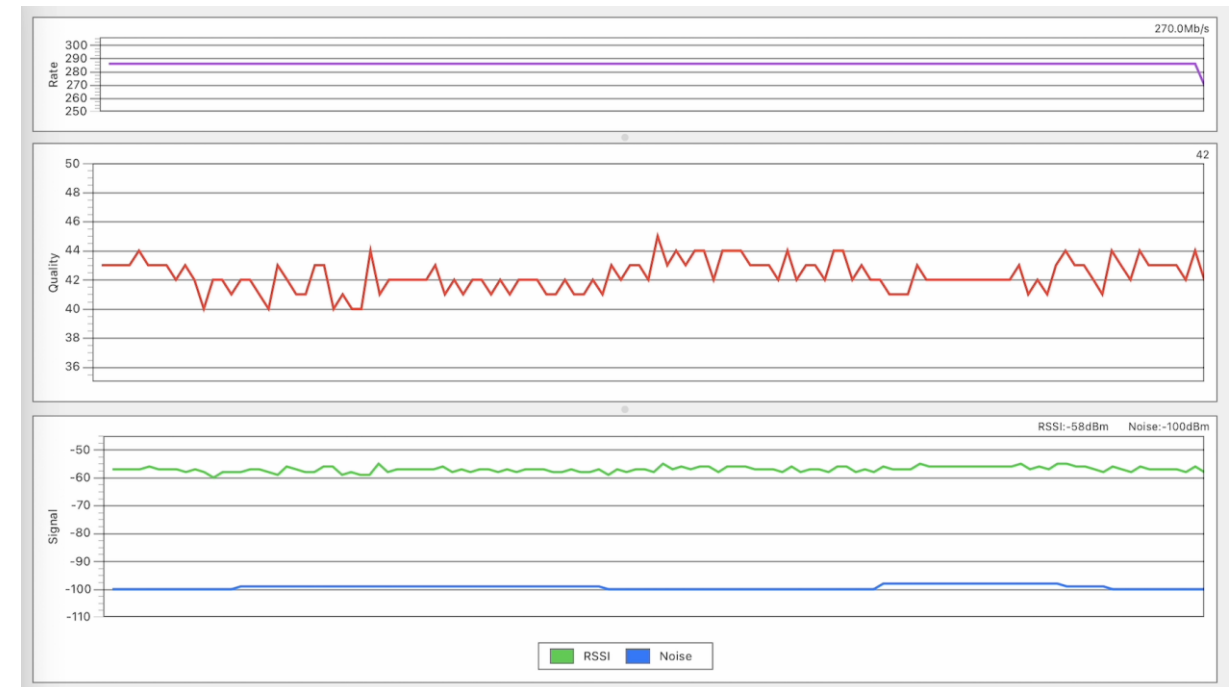
Common problem example



Fixed results



```
64 bytes from 10.128.128.126: icmp_seq=0 ttl=64 time=18.089 ms
64 bytes from 10.128.128.126: icmp_seq=1 ttl=64 time=8.465 ms
64 bytes from 10.128.128.126: icmp_seq=2 ttl=64 time=6.025 ms
64 bytes from 10.128.128.126: icmp_seq=3 ttl=64 time=7.619 ms
64 bytes from 10.128.128.126: icmp_seq=4 ttl=64 time=14.078 ms
64 bytes from 10.128.128.126: icmp_seq=5 ttl=64 time=5.412 ms
64 bytes from 10.128.128.126: icmp_seq=6 ttl=64 time=7.065 ms
64 bytes from 10.128.128.126: icmp_seq=7 ttl=64 time=5.868 ms
64 bytes from 10.128.128.126: icmp_seq=8 ttl=64 time=11.829 ms
64 bytes from 10.128.128.126: icmp_seq=9 ttl=64 time=26.262 ms
64 bytes from 10.128.128.126: icmp_seq=10 ttl=64 time=4.545 ms
64 bytes from 10.128.128.126: icmp_seq=11 ttl=64 time=13.754 ms
64 bytes from 10.128.128.126: icmp_seq=12 ttl=64 time=5.430 ms
64 bytes from 10.128.128.126: icmp_seq=13 ttl=64 time=43.528 ms
64 bytes from 10.128.128.126: icmp_seq=14 ttl=64 time=90.874 ms
64 bytes from 10.128.128.126: icmp_seq=15 ttl=64 time=7.893 ms
64 bytes from 10.128.128.126: icmp_seq=16 ttl=64 time=5.308 ms
64 bytes from 10.128.128.126: icmp_seq=17 ttl=64 time=5.765 ms
64 bytes from 10.128.128.126: icmp_seq=18 ttl=64 time=11.202 ms
64 bytes from 10.128.128.126: icmp_seq=19 ttl=64 time=18.448 ms
```



Unexpected Disconnections

Can't connect to the internet

✓ Is the AP available?

✓ Beacons

✓ Association

✓ Authentication

✓ IP

Everything is so slow

✓ Expectations Alignment

✓ Signal

✓ Noise

✓ Interference

✓ Utilisation

It keeps disconnecting

Channel Changes

DFS

Roaming

Bad actors

Easiest way to explain a disconnect

RRM channel change to improve experience

Time (GMT) ▾	Access point	SSID	Client	Category	Event type	Details
Feb 12 23:06:12	UK_EPREDWAP05-014			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 23:06:12	UK_EPREDWAP03-012			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 23:06:12	UK_EPREDWAP03-012			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 23:06:12	UK_EPREDWAP02-012			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 23:06:12	UK_EPREDWAP01-014			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 23:06:12	UK_EPBLUEWAP07-004			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP05-014			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP08-014			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP03-012			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP04-016			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPBLUEWAP03-013			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP03-013			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPBLUEWAP07-004			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP05-010			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 22:06:06	UK_EPREDWAP09-010			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP05-014			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP01-019			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP04-011			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP04-016			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP02-008			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP05-017			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPBLUEWAP03-012			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 21:06:12	UK_EPREDWAP05-010			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 20:06:09	UK_EPBLUEWAP07-005			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 20:06:09	UK_EPREDWAP05-010			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 20:06:09	UK_EPREDWAP03-017			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 20:06:09	UK_EPREDWAP05-009			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 07:02:29	UK_EPREDWAP05-008			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 06:01:44	UK_EPREDWAP01-019			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »
Feb 12 05:01:40	UK_EPREDWAP02-002			AI-Enhanced RRM	AI-Driven Channel Change	Auto Channel Update more »

DFS channel change because **we had to**

Time (JST) ▾	Access point	SSID	Client	Category	Event type	Details
Feb 13 08:45:13	JTANDMERWTN1611			DFS	DFS event detected	band: 5, channel: 120, radio: 1
Feb 13 08:31:33	JTANDMERWTN1509			DFS	DFS event detected	band: 5, channel: 136, radio: 1
Feb 13 08:26:16	JTANDMERWTN1504			DFS	DFS event detected	band: 5, channel: 116, radio: 1
Feb 13 08:21:14	JTANDMERWTN1505			DFS	DFS event detected	band: 5, channel: 132, radio: 1
Feb 12 15:10:31	JTANDMERWTN1608			DFS	DFS event detected	band: 5, channel: 120, radio: 1
Feb 12 15:01:48	JTANDMERWTN1604			DFS	DFS event detected	band: 5, channel: 128, radio: 1
Feb 12 14:56:17	JTANDMERWTN1603			DFS	DFS event detected	band: 5, channel: 52, radio: 1
Feb 12 13:53:56	JTANDMERWTN1511			DFS	DFS event detected	band: 5, channel: 112, radio: 1
Feb 12 13:08:29	JTANDMERWTN1614			DFS	DFS event detected	band: 5, channel: 128, radio: 1
Feb 12 11:51:55	JTANDMERWTN1503			DFS	DFS event detected	band: 5, channel: 56, radio: 1
Feb 12 11:30:06	JTANDMERWTN1621			DFS	DFS event detected	band: 5, channel: 108, radio: 1
Feb 12 11:00:19	JTANDMERWTN1601			DFS	DFS event detected	band: 5, channel: 104, radio: 1
Feb 12 09:58:40	JTANDMERWTN1503			DFS	DFS event detected	band: 5, channel: 52, radio: 1
Feb 12 09:58:19	JTANDMERWTN1612			DFS	DFS event detected	band: 5, channel: 104, radio: 1
Feb 12 09:58:17	JTANDMERWTN1610			DFS	DFS event detected	band: 5, channel: 124, radio: 1
Feb 12 09:56:53	JTANDMERWTN1613			DFS	DFS event detected	band: 5, channel: 100, radio: 1
Feb 12 09:56:05	JTANDMERWTN1611			DFS	DFS event detected	band: 5, channel: 64, radio: 1
Feb 12 09:37:22	JTANDMERWTN1510			DFS	DFS event detected	band: 5, channel: 116, radio: 1
Feb 12 09:31:46	JTANDMERWTN1508			DFS	DFS event detected	band: 5, channel: 136, radio: 1
Feb 12 09:17:22	JTANDMERWTN1502			DFS	DFS event detected	band: 5, channel: 120, radio: 1
Feb 12 09:10:56	JTANDMERWTN1605			DFS	DFS event detected	band: 5, channel: 112, radio: 1
Feb 12 08:49:31	JTANDMERWTN1523			DFS	DFS event detected	band: 5, channel: 60, radio: 1
Feb 12 08:20:53	JTANDMERWTN1504			DFS	DFS event detected	band: 5, channel: 100, radio: 1
Feb 12 08:20:51	JTANDMERWTN1501			DFS	DFS event detected	band: 5, channel: 56, radio: 1
Feb 12 08:08:33	JTANDMERWTN1512			DFS	DFS event detected	band: 5, channel: 140, radio: 1
Feb 10 18:31:16	JTANDMERWTN1506			DFS	DFS event detected	band: 5, channel: 140, radio: 1
Feb 10 16:44:27	JTANDMERWTN1601			DFS	DFS event detected	band: 5, channel: 64, radio: 1
Feb 10 14:57:26	JTANDMERWTN1610			DFS	DFS event detected	band: 5, channel: 116, radio: 1
Feb 10 12:45:31	JTANDMERWTN1612			DFS	DFS event detected	band: 5, channel: 52, radio: 1
Feb 10 11:56:19	JTANDMERWTN1621			DFS	DFS event detected	band: 5, channel: 140, radio: 1

CSA will sometimes help

- Used by Auto RF, AI RRM or DFS
- Some clients will follow
- Some clients may ignore

Tag: Channel Switch Announcement Mode: 0, Number: 36 , Count: 15
Tag Number: Channel Switch Announcement (37)
Tag length: 3
Channel Switch Mode: 0
New Channel Number: 36
Channel Switch Count: 15

Time	Type	Frame Type	Channel Switch Count	Channel
0.000000	Management frame	Beacon	15	44
0.000098	Management frame	Neighbor Repor...	15	44
0.102367	Management frame	Beacon	14	44
0.204766	Management frame	Beacon	13	44
0.307295	Management frame	Beacon	12	44
0.409614	Management frame	Beacon	11	44
0.512000	Management frame	Beacon	10	44
0.614368	Management frame	Beacon	9	44
0.716867	Management frame	Beacon	8	44
0.819228	Management frame	Beacon	7	44
0.921632	Management frame	Beacon	6	44
1.023986	Management frame	Beacon	5	44
1.126471	Management frame	Beacon	4	44
1.228856	Management frame	Beacon	3	44
1.331246	Management frame	Beacon	2	44
1.433604	Management frame	Beacon	1	44
1.461755	Management frame	Beacon	36	

How can we optimise the RF?

2020

Extract DFS channel changes
Review and understand which channels are most affected
Remove the channels from the allowed list
Remove all DFS channels from config?
Analyse before & after

Check channel changes
Inspect non 802.11 and neighbour 802.11 interferers
Remove these channels from our channel map
Analyse before & after

2025

AI channel planning

 0 APs were affected by disruptive RF events in this network.
[Download historical report](#)



Enable

AI channel planning improves channel assignment by leveraging artificial intelligence to optimize channel planning capabilities.

What is Meraki's Auto RF?

Auto RF is Cisco Meraki's radio resource management (RRM) solution that optimizes wireless configurations using 15 mins of RF data (Snapshot-based) to improve RF performance.

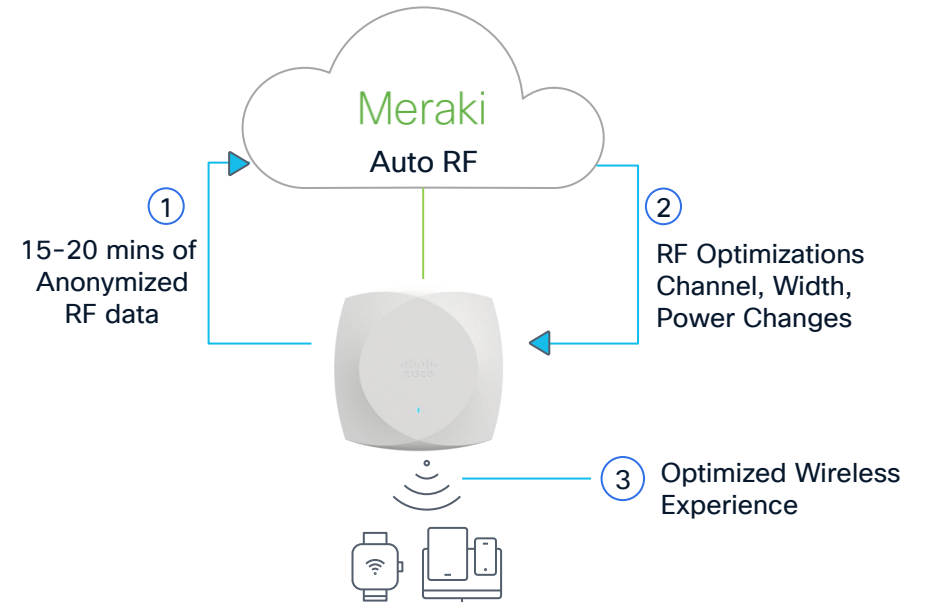
Supported RRM Services

Dynamic Channel Assignment (DCA)

Dynamic Band Selection (DBS)

Transmit Power Control (TPC)

Topology



Capabilities AI-Enhanced RRM brings to Meraki

Wireless Client Disruption

RRM Services Ready at Any Scale

Supports RRM services, DCA, DBS, TPC, FRA, and AP zone-level configurations for deployments of all sizes and use cases.

Trend, Reward, Client-Based RRM

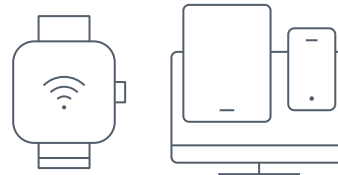
Uses AI to optimize based on historical trends, RF performance, and client-side telemetry.

After Hours RF Tuning

Defers optimizations after peak hours to minimize disruptions but uses peak hour data for relevance to clients' activity times.



AI-Enhanced RRM



Trust & Visibility

Config Simplification

RF Visibility Widgets

Provides org-to-AP level visibility of RF health, RRM changes, co-channel interference, etc.

RF Insights and Recommendation

AI reviews customer config against intended outcomes and provides insight recommendations to ensure goals are met.

Predictive RF Simulator

Uses historical data to predict outcomes of RRM config changes, giving admins peace of mind before applying them.

Understand why changes are made

AI-Driven Channel Change

Auto Channel Update x hide	
New_Channel	53/20
Old_Channel	53/80
Band	6
Radio	2
Event_Reason	-Channel bandwidth quality is improved 23 percent -Channel width is decreased to reduce co-channel interference

AI-Driven Tx Power Change

Tx power reduced to decrease network interference x hide	
Old_Power	7
New_Power	4
Radio	1
Event_Reason	-Tx Power is changed to 4 dBm from 7 dBm -Old Tx Power 7 dBm is higher than optimal Tx Power 4 dBm -Channel Max Power is 24 dBm and TPC threshold is -70

Too many changes during prime time

Busy hour



Enable

Busy hour option minimizes changes during the most active hours of the day ⓘ

Schedule (UTC+10)



The estimated busy hour for this network is 8:00 to 18:00



Auto

The optimal busy hour is determined by analyzing client count and network usage data from the last 6 weeks.



Manual

APs will still move for: DFS, jammed channel, excessive CCI, AP addition

Unexpected Disconnections

Can't connect to the internet

✓ Is the AP available?

✓ Beacons

✓ Association

✓ Authentication

✓ IP

Everything is so slow

✓ Expectations Alignment

✓ Signal

✓ Noise

✓ Interference

✓ Utilisation

It keeps disconnecting

✓ Channel Changes

✓ DFS

Roaming

Bad actors

“Roaming is a client decision”

- But is our cell coverage overlap adequate?
- Did we do the best we can to help? 802.11r
- It's so hard to monitor and troubleshoot

Roaming tab for each client

Roaming event log

#	 Origin AP to New AP			Roam time (ms)	RSSI (dBm)	SNR (dB)	Band (GHz)	Start time
1	 syd	11 → syd	07	1,060	-63 → -43	32 → 52	5 → 5	Aug 22, 6:55 AM
2	 syd	07 → syc	-06	1,050	-56 → -40	39 → 55	5 → 5	Aug 22, 6:58 AM
3	 syd	06 → syc	-10	1,060	-81 → -53	14 → 42	5 → 5	Aug 22, 7:03 AM
4	 syd	10 → syd	-12	1,030	-56 → -53	39 → 42	5 → 5	Aug 22, 8:26 AM
5	 syd	12 → syd	11	50	-55 → -53	40 → 42	5 → 5	Aug 22, 8:33 AM
6	 syd	11 → syd	07	30	-64 → -42	31 → 53	5 → 5	Aug 22, 8:44 AM
7	 syd	07 → syc	-04	1,030	-67 → -51	28 → 44	5 → 5	Aug 22, 8:44 AM
8	 syd	04 → syc	-04	2,890	-51 → -69	44 → 26	5 → 2.4	Aug 22, 8:45 AM

Apr 5 16:30:10	<ul style="list-style-type: none">Client 12321789012345678901 roamed from AP 12-GBLON-GB027-046-PB-01 then had a successful connection to SSID WiFiVw for 6 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 42 dB</td><td>● 3060 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 42 dB	● 3060 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 42 dB	● 3060 ms						
Apr 5 16:24:45	<ul style="list-style-type: none">Client 01234567890123456789012345678901 roamed from AP 12-GBLON-GB027-046-PB-01 then had a successful connection to SSID WiFiVw for 2 hours.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 50 dB</td><td>● 3200 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 50 dB	● 3200 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 50 dB	● 3200 ms						
Apr 5 16:21:46	<ul style="list-style-type: none">Client 12345678901234567890123456789012 had a successful connection to SSID WiFiVw for 2 hours.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 52 dB</td><td>● 2840 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 52 dB	● 2840 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 52 dB	● 2840 ms						
Apr 5 16:21:45	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 18 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 42 dB</td><td>● 3510 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 42 dB	● 3510 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 42 dB	● 3510 ms						
Apr 5 16:18:25	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 3 hours.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 51 dB</td><td>● 3660 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 51 dB	● 3660 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 51 dB	● 3660 ms						
Apr 5 16:16:53	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 4 hours.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 51 dB</td><td>● 2540 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 51 dB	● 2540 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 51 dB	● 2540 ms						
Apr 5 16:16:42	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 3 hours.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 52 dB</td><td>● 2670 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 52 dB	● 2670 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 52 dB	● 2670 ms						
Apr 5 16:16:11	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 2 hours.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>64</td><td>5 GHz</td><td>● 50 dB</td><td>● 3840 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	64	5 GHz	● 50 dB	● 3840 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
64	5 GHz	● 50 dB	● 3840 ms						

Apr 7 18:21:15	<ul style="list-style-type: none">Client 123214567890123456789012345678901 roamed from AP 12-GBLON-GB027-036-PB-01 then had a successful connection to SSID WiFiVw for a few seconds.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 47 dB</td><td>● 110 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 47 dB	● 110 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 47 dB	● 110 ms						
Apr 7 18:20:11	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 roamed from AP 12-GBLON-GB027-036-PB-01 then had a successful connection to SSID WiFiVw for 15 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 54 dB</td><td>● 50 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 54 dB	● 50 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 54 dB	● 50 ms						
Apr 7 18:19:45	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 6 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 53 dB</td><td>● 360 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 53 dB	● 360 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 53 dB	● 360 ms						
Apr 7 18:19:39	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 roamed from AP 12-GBLON-GB027-036-PB-01 then had a successful connection to SSID WiFiVw for 1 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 55 dB</td><td>● 560 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 55 dB	● 560 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 55 dB	● 560 ms						
Apr 7 18:19:12	<ul style="list-style-type: none">Client 123214567890123456789012345678901 roamed from AP 12-GBLON-GB027-046-PB-01 then had a successful connection to SSID WiFiVw for 6 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 53 dB</td><td>● 560 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 53 dB	● 560 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 53 dB	● 560 ms						
Apr 7 18:19:07	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for a few seconds.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 53 dB</td><td>● 10 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 53 dB	● 10 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 53 dB	● 10 ms						
Apr 7 18:19:06	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 roamed from AP 12-GBLON-GB027-046-PB-01 then had a successful connection to SSID WiFiVw for 0 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 51 dB</td><td>● 540 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 51 dB	● 540 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 51 dB	● 540 ms						
Apr 7 18:19:00	<ul style="list-style-type: none">Client 123456789012345678901234567890123456789012345678901 had a successful connection to SSID WiFiVw for 9 minutes.								
	<table><tr><td>CHANNEL</td><td>BAND</td><td>SNR ⓘ</td><td>TIME TO CONNECT</td></tr><tr><td>40</td><td>5 GHz</td><td>● 49 dB</td><td>● 640 ms</td></tr></table>	CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT	40	5 GHz	● 49 dB	● 640 ms
CHANNEL	BAND	SNR ⓘ	TIME TO CONNECT						
40	5 GHz	● 49 dB	● 640 ms						

Unexpected Disconnections

Can't connect to the internet

- ✓ Is the AP available?
- ✓ Beacons
- ✓ Association
- ✓ Authentication
- ✓ IP

Everything is so slow

- ✓ Expectations Alignment
- ✓ Signal
- ✓ Noise
- ✓ Interference
- ✓ Utilisation

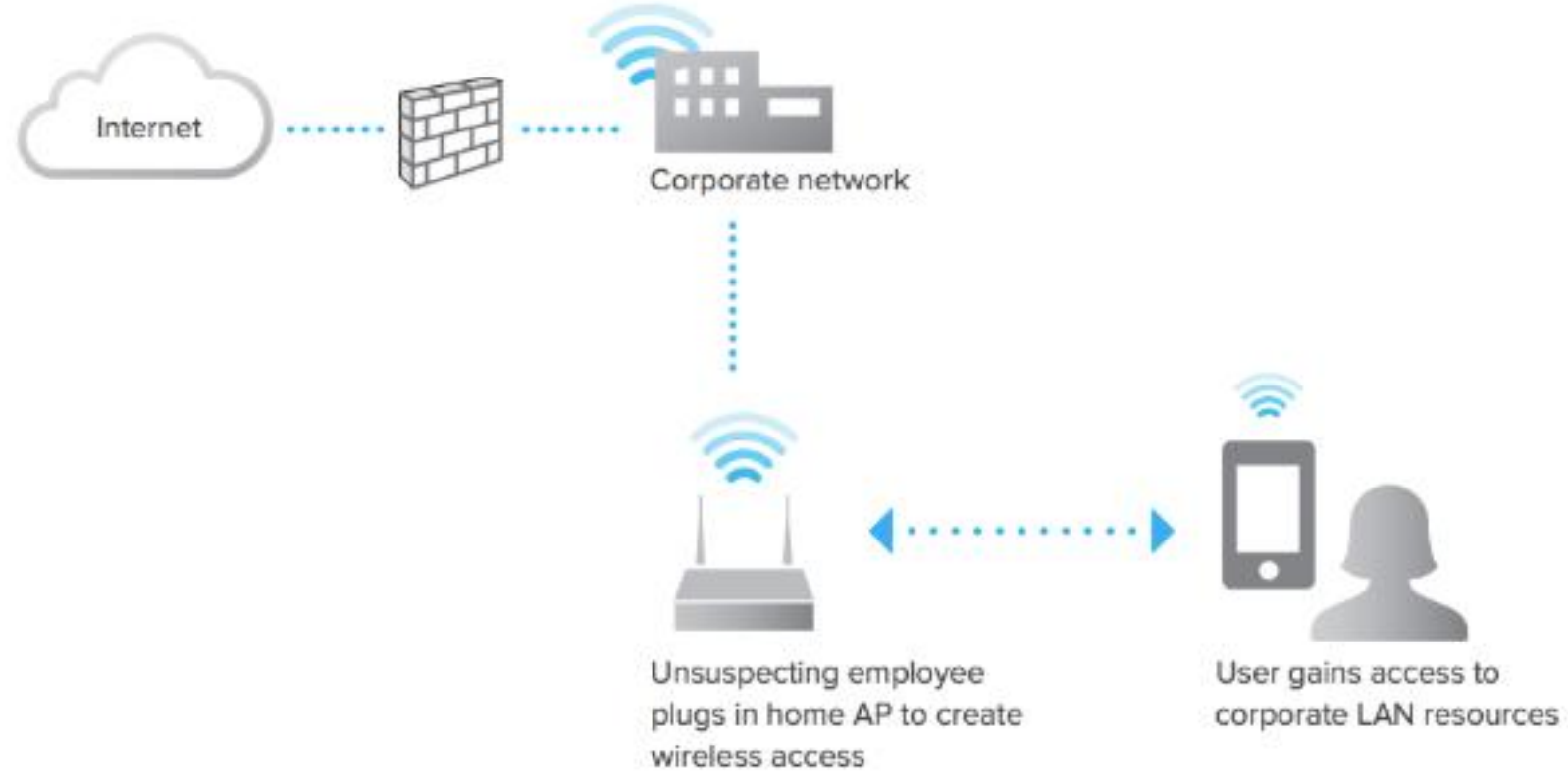
It keeps disconnecting

- ✓ Channel Changes
- ✓ DFS
- ✓ Roaming
- ✓ Bad actors

Spoofing



Rogue on LAN



Containment

1.701920	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-65	dBm	Deauthentication, SN=0, FN=0, Flags=.....
3.221788	e2:55:a8:77:7a:0b	de:58:7b:02:5d:b1	802.11	74	-97	dBm	Deauthentication, SN=44, FN=0, Flags=.....
3.221798	e2:55:a8:77:7a:0b	de:58:7b:02:5d:b1	802.11	74	-97	dBm	Deauthentication, SN=44, FN=0, Flags=....R...
3.221803	e2:55:a8:77:7a:0b	de:58:7b:02:5d:b1	802.11	74	-97	dBm	Deauthentication, SN=44, FN=0, Flags=....R...
3.221807	e2:55:a8:77:7a:0b	de:58:7b:02:5d:b1	802.11	74	-97	dBm	Deauthentication, SN=44, FN=0, Flags=....R...
3.498440	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-67	dBm	Deauthentication, SN=0, FN=0, Flags=.....
4.170422	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-66	dBm	Deauthentication, SN=0, FN=0, Flags=.....
5.300679	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-69	dBm	Deauthentication, SN=0, FN=0, Flags=.....
5.368501	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=.....
7.012708	e2:55:a8:77:7a:0b	1e:07:80:fe:e1:30	802.11	74	-97	dBm	Deauthentication, SN=3, FN=0, Flags=.....
7.012721	e2:55:a8:77:7a:0b	1e:07:80:fe:e1:30	802.11	74	-97	dBm	Deauthentication, SN=3, FN=0, Flags=....R...
7.012726	e2:55:a8:77:7a:0b	1e:07:80:fe:e1:30	802.11	74	-97	dBm	Deauthentication, SN=3, FN=0, Flags=....R...
7.012730	e2:55:a8:77:7a:0b	1e:07:80:fe:e1:30	802.11	74	-97	dBm	Deauthentication, SN=3, FN=0, Flags=....R...
7.089091	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=.....
7.101579	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=.....
7.771360	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-69	dBm	Deauthentication, SN=0, FN=0, Flags=.....
8.671522	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=.....
9.804385	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=.....
9.822778	e2:55:a8:77:7a:0b	6a:a7:e0:81:8d:15	802.11	74	-97	dBm	Deauthentication, SN=7, FN=0, Flags=.....
9.822784	e2:55:a8:77:7a:0b	6a:a7:e0:81:8d:15	802.11	74	-97	dBm	Deauthentication, SN=7, FN=0, Flags=....R...
9.822789	e2:55:a8:77:7a:0b	6a:a7:e0:81:8d:15	802.11	74	-97	dBm	Deauthentication, SN=7, FN=0, Flags=....R...
9.822794	e2:55:a8:77:7a:0b	6a:a7:e0:81:8d:15	802.11	74	-97	dBm	Deauthentication, SN=7, FN=0, Flags=....R...
10.393955	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-67	dBm	Deauthentication, SN=0, FN=0, Flags=.....
12.275042	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-71	dBm	Deauthentication, SN=0, FN=0, Flags=.....
12.795102	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=.....
12.800234	e2:55:a8:77:7a:0b	4a:ec:be:6c:f9:27	802.11	74	-67	dBm	Deauthentication, SN=0, FN=0, Flags=.....
12.801306	e2:55:a8:77:7a:0b	4a:ec:be:6c:f9:27	802.11	74	-68	dBm	Deauthentication, SN=0, FN=0, Flags=....R...
13.401357	e2:55:a8:77:7a:0b	Broadcast	802.11	74	-70	dBm	Deauthentication, SN=0, FN=0, Flags=.....

Users keep disconnecting frequently
Patterns don't make any logical sense
Can be to individual MAC addresses or a broadcast
Enable 802.11w to alleviate
Find the source physically, use the signal strength

Look holistically before diving in

Most discovered AP issues in MR networks



APs for the last day ▾

OFFLINE	ALERTING	ONLINE	REPEATERS
0	0	21	1

Search... 22 access points Download As ▾

#	Status	Name	MAC address	Connectivity	Ethernet 1 ▲	Ethernet 1 LLDP	Firmware version	Alerts
1	○						MR 26.8.3	
2	●				100 Mbit, full duplex	Port 31	MR 26.8.3	
3	●				100 Mbit, full duplex	Port 37	MR 26.8.3	
4	●				100 Mbit, full duplex	Port 32	MR 26.8.3	
5	●				1000 Mbit, full duplex	Port 29	MR 26.8.3	
6	●				1000 Mbit, full duplex	Port 38	MR 26.8.3	
7	●				1000 Mbit, full duplex	Port 29	MR 26.8.3	
8	●				1000 Mbit, full duplex	Port 5	MR 29.5.1	
9	●				1000 Mbit, full duplex	Port 20	MR 29.5.1	
10	●				1000 Mbit, full duplex	Port 3	MR 29.5.1	
11	●				1000 Mbit, full duplex	Port 15	MR 29.5.1	
12	●				1000 Mbit, full duplex	Port 34	MR 29.5.1	
13	●				1000 Mbit, full duplex	Port 15	MR 26.8.3	
14	●				1000 Mbit, full duplex	Port 33	MR 29.5.1	
15	●				1000 Mbit, full duplex	Port 41	MR 29.5.1	
16	●				1000 Mbit, full duplex	Port 1	MR 29.5.1	
17	●				1000 Mbit, full duplex	Port 2	MR 29.5.1	
18	●				1000 Mbit, full duplex	Port 43	MR 29.5.1	
19	●				1000 Mbit, full duplex	Port 40	MR 29.5.1	
20	●				1000 Mbit, full duplex	Port 28	MR 29.5.1	
21	●				1000 Mbit, full duplex	Port g7	MR 26.8.3	
22	○				1000 Mbit, full duplex		MR 29.5.1	unreachable

100 results per page < 1 >

No Newly
offline device

AP become Repeater

Dormant AP
Offline for > 7 Days

Connected as full duplex
but 100 Mbps speed
→ Check Switch Port Config

Multiple
SW versions are being used

Unreachable

Sometimes the most complex problems have the simplest solutions

LUCKY





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