



# ARISTA Cloud Builders



# **‘Mean Time to Innocence’ with CloudVision WiFi**

Arista EMEA Cloud Builders Technical Forum – Spring/Summer 2019

# Agenda

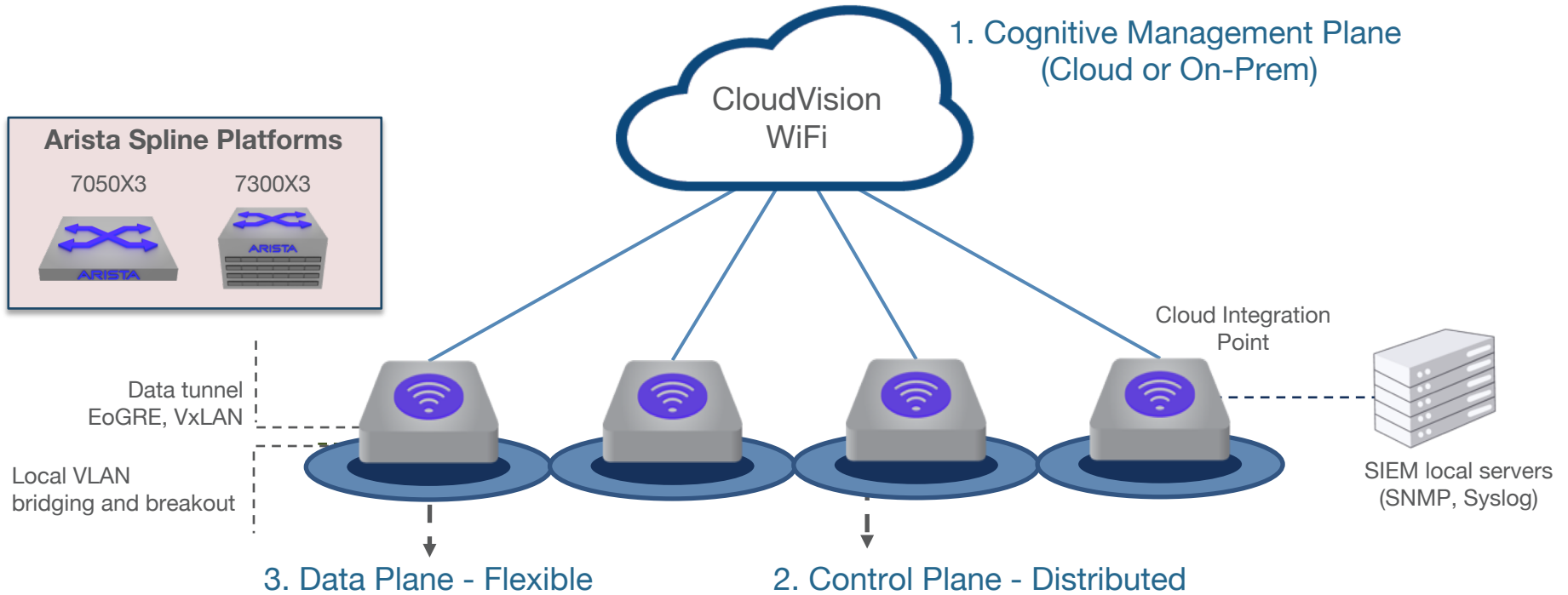
- WiFi always get blamed! ... But most times we're Innocent! 😊
- Arista WiFi Architecture
  - Data Plane - Flexible
  - Control Plane – Distributed
  - Management Plane – Cognitive WiFi
- Introducing Cognitive WiFi, featuring:
  - The Client Journey
  - Auto Packet Capture
  - Arista Packets
  - Live Client Debugging
  - Application Health Dashboard
  - The Third Radio
  - Client Simulation Test
  - Spectrum Analysis

# Wi-Fi almost always gets blamed!



But more often than not, it is not the  
direct cause of end-user issues.

# Arista WiFi Architecture



# Introducing Cognitive WiFi

A set of tools to make WiFi management easier

## Client Journey

Generic client failure categorization

## Spectrum Analysis

Detect non-WiFi interference

## Client Connectivity Test

Simulate a client connection

## The Third Radio

Your ears in the network



## Auto Packet Capture

Never be late again

## Arista Packets

First integrated WiFi Analyzer

## Live Client Debugging

Troubleshoot roaming in real-time

## Application Health Dashboard

Measure multimedia App  
experience

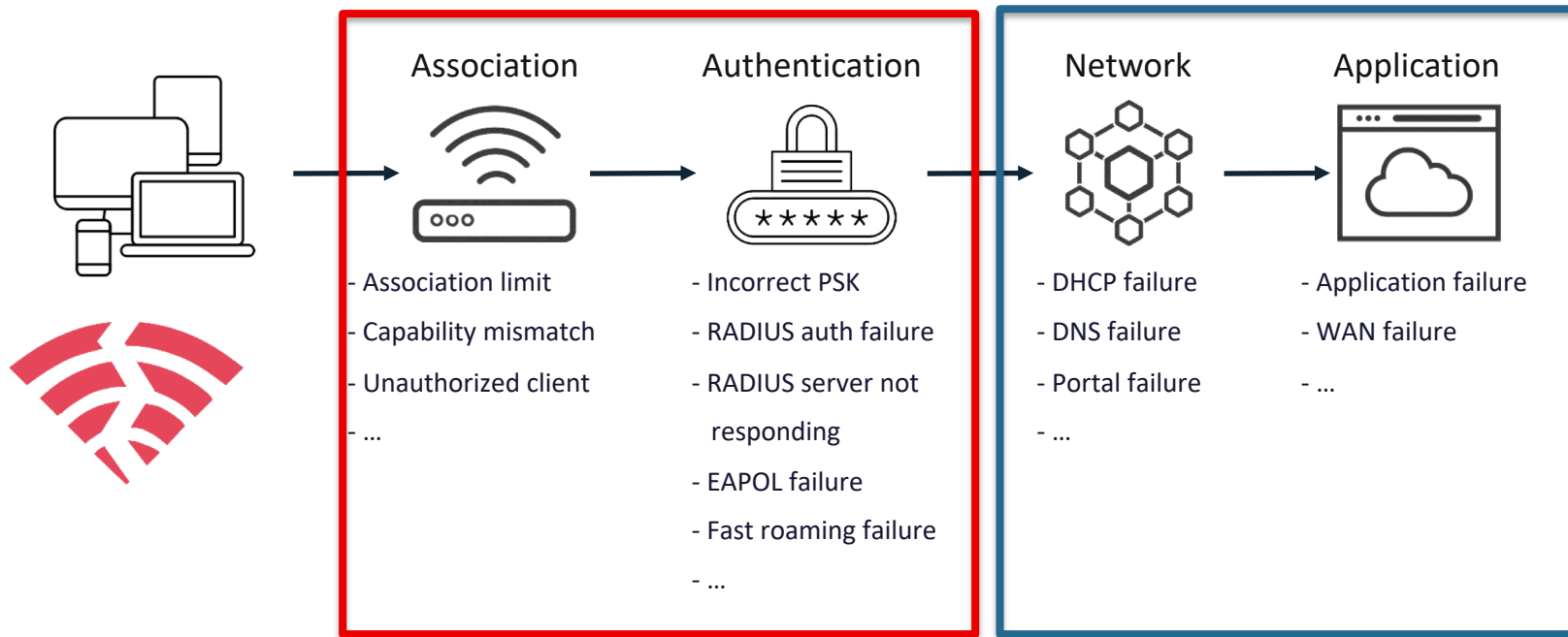


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# The Client Journey

# The Client Journey

Categorizing all possible issues into several different buckets



We can detect these,  
and try to fix them automatically

We can't fix these,  
but we can detect and report them

# Every WiFi client behaves differently

Need to understand each client's WiFi driver capabilities and behavior



# The Association Request frame

- Client vendor's documentation on WiFi capabilities is often inaccurate
- The best way to understand a specific client's capabilities is by looking at the Assoc. Request frame
- Mike Albano from Google maintains a public list of clients:

<https://clients.mikealbano.com/>

```
▶ IEEE 802.11 Association Request, Flags: .....C
▼ IEEE 802.11 wireless LAN
  ▶ Fixed parameters (4 bytes)
  ▼ Tagged parameters (170 bytes)
    ▶ Tag: SSID parameter set: GOODFELLAS
    ▶ Tag: Supported Rates 0(B), 9(C), 12(18), 24(36), 48(72), 96(144), 192(288), 384(576) [Mbit/sec]
    ▼ Tag: Power Capability Min: 10, Max: 20
      Tag Number: Power Capability (33)
      Tag length: 2
      Minimum Transmit Power: 10
      Maximum Transmit Power: 20
    ▶ Tag: Supported Channels
    ▶ Tag: RSN Information
    ▼ Tag: HT Capabilities (802.11n D1.10)
      Tag Number: HT Capabilities (802.11n D1.10) (45)
      Tag length: 26
      ▶ HT Capabilities Info: 0x01ef
      ▶ A-MPDU Parameters: 0x1b
      ▼ Rx Supported Modulation and Coding Scheme Set: MCS Set
        ▶ Rx Modulation and Coding Scheme (One bit per modulation): 2 spatial streams
          ....00 0000 0000 = Highest Supported Data Rate: 0x0000
          ....00 0000 0000 = Tx Supported MCS Set: Not defined
          ....00 0000 0000 = Tx and Rx MCS Set: Equal
          ....00 0000 0000 = Maximum Number of Tx Spatial Streams Supported: 0x00, TX MCS Set Not Defined
          ....00 0000 0000 = Unequal Modulation: Not supported
      ▶ HT Extended Capabilities: 0x0000
      ▶ Transmit Beam Forming (TxBF) Capabilities: 0x00000000
      ▶ Antenna Selection (ASEL) Capabilities: 0x00
    ▼ Tag: Extended Capabilities (8 octets)
      Tag Number: Extended Capabilities (127)
      Tag length: 8
      ▶ Extended Capabilities: 0x00 (octet 1)
      ▶ Extended Capabilities: 0x00 (octet 2)
      ▼ Extended Capabilities: 0x00 (octet 3)
        ....00 = TFS: Not supported
        ....00 = WMM Sleep Mode: Not supported
        ....00 = TIM Broadcast: Not supported
        ....00 = BSS Transition: Not supported
        ....00 = QoS Traffic Capability: Not supported
```

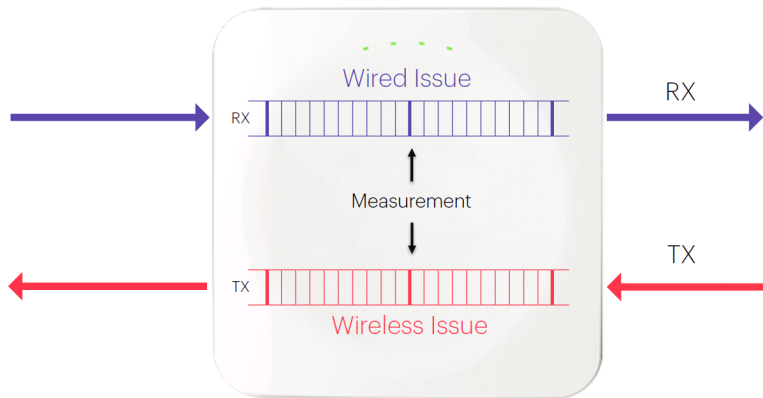


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# Auto Packet Capture

# Auto-Packet Capture

- APs buffer latest packets for each connection
- In the event of an issue, packet trace is taken and stored in CloudVision WiFi
- You are never LATE anymore when troubleshooting



The screenshot displays the CloudVision WiFi interface. At the top, under 'Clients', a client named 'Lap-382 (34:02...)' is shown with a status of 'Failed'. Below this, the 'Client Connection Logs' section shows two entries for 'Radius Authentication Failure'. The first entry is dated 'Mar 17 2017 6:32:01 PM' and the second is dated 'Mar 16 2017 6:26:40 PM'. Both entries include details such as BSSID, AP Name, SSID, and Channel. A red box highlights the 'View Packet Trace' link for the first entry.

Client Name	Status	Name	User Name	MAC Address
Lap-382 (34:02...)	Failed	Lap-382	host/Lap-382.pune.wibhu...	34:02:86:90:FB:AA

Timestamp	Event	BSSID	AP Name	SSID	Channel
Mar 17 2017 6:32:01 PM	Radius Authentication Failure Received ACCESS REJECT from Authentication server.	00:11:74:F2:20:80	C120_Phi_F2:20:9F	Spectrum	161
Mar 16 2017 6:26:40 PM	Radius Authentication Failure Received ACCESS REJECT from Authentication server.	00:11:74:F2:20:80	C120_Phi_F2:20:9F	Spectrum	161



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**Arista Packets**

# Arista Packets



A picture is worth a thousand **frames**<sup>™</sup>

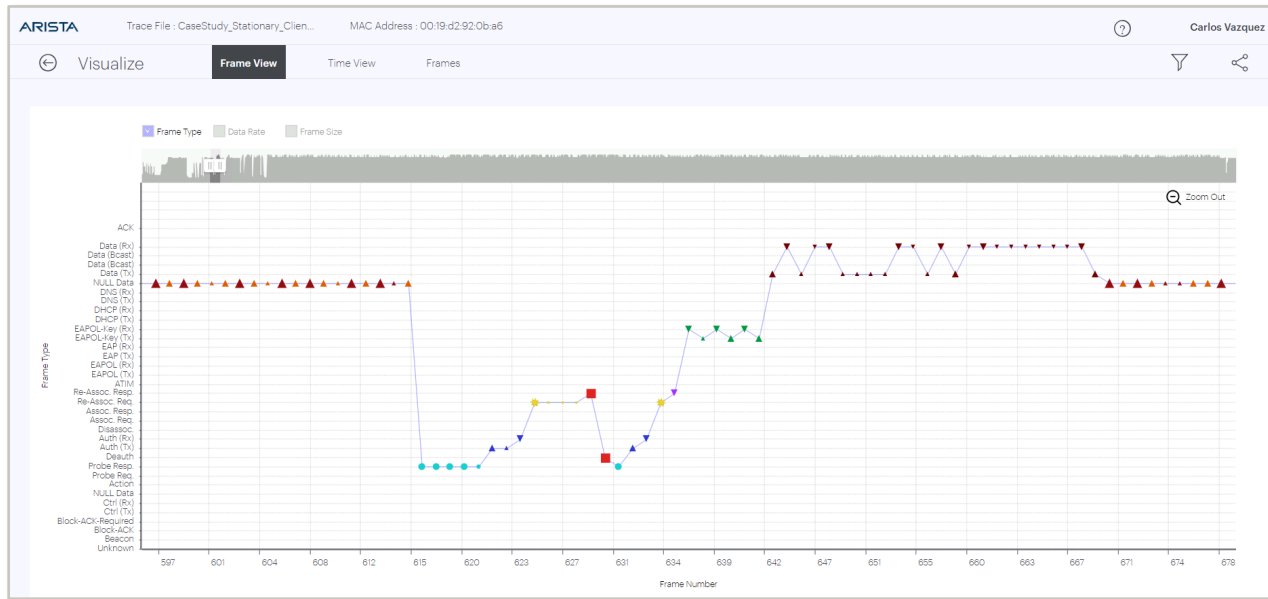
Get Visual WiFi Troubleshooting on the Cloud

Sign up for FREE!

<https://packets.arista.com/>

# Arista Packets

- First built-in WiFi graphical analyzer in the industry
- Each 802.11 frame is represented by a symbol, makes it easier to visualize issues
- Share button allows collaboration between Support and Engineering teams

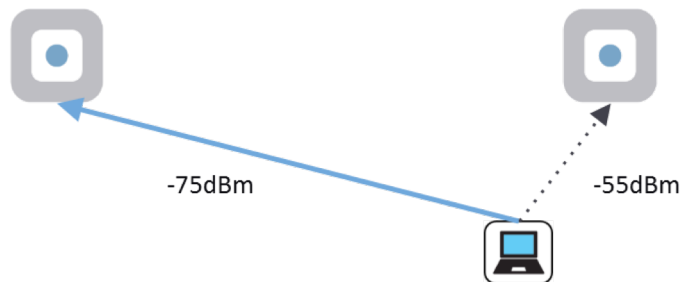




‘Mean Time to Innocence’ with CloudVision WiFi

# Live Client Debugging

# Every WiFi Client Roams differently – Examples



- Starts new scan when RSSI < -75
- Starts new scan when CU > 70%
- Supports 802.11r



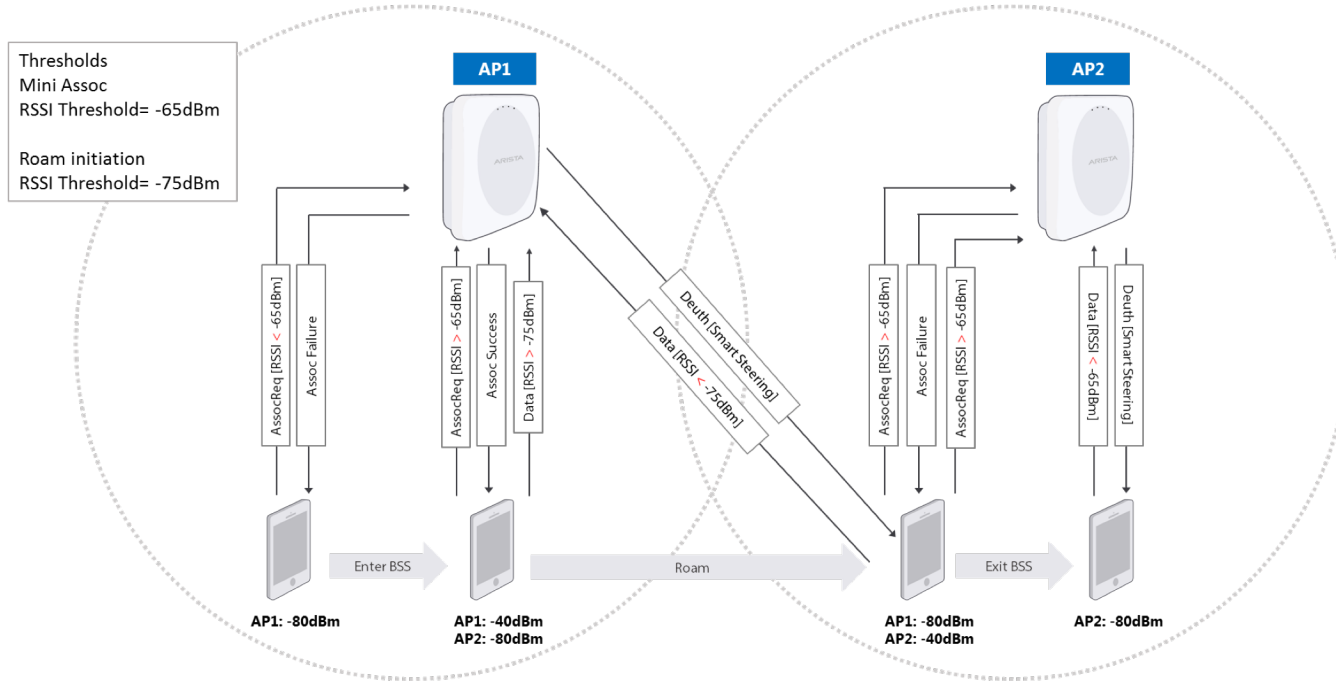
- Starts new scan when RSSI < -70
- Only roams if new RSSI is 12dBm better
- No 802.11r support



- Starts new scan when RSSI < -70
- Only roams if new RSSI is 8dBm better
- No 802.11r support

# Smart Steering

Solves sticky client issues in real time



# Live Client Debugging

A great tool to troubleshoot roaming issues in real-time

Wi-Fi Clients Access Points

5 Clients

<input type="checkbox"/>	Status	Name
<input type="checkbox"/>		Chromecast
<input type="checkbox"/>		carlos
<input type="checkbox"/>		Galaxy-S9
<input type="checkbox"/>		am335x-0.0
<input checked="" type="checkbox"/>		Galaxy-S6

- Rename
- Capture Packet Trace
- Packet Trace History
- Start Live Client Debugging
- Disconnect

ARISTA Live Client Debugging - carlos

Download log file to view historical log entries from start time till now.

```
1 SSID : GOODFELLAS
2 BSSID : 00:11:74:86:6E:D0
3 AP NAME : Salon_86:6E:FF
4 Chan : 36
5 Time : 2019.04.05 09:45:26 (America/Los_Angeles)
6 Tdiff(msec) Timestamp Event
7 0 2019.04.05 09:45:26 AP received authentication request from client at [-50]db
8 0 2019.04.05 09:45:26 Client successfully authenticated
9 6 2019.04.05 09:45:26 Signals a new WPA or WPA2 exchange
10 6 2019.04.05 09:45:26 Setting PMK from PSK as this is a WPA or WPA2 PSK authentication
11 6 2019.04.05 09:45:26 AP received (re)association request from client
12 7 2019.04.05 09:45:26 Client successfully (re)associated
13 7 2019.04.05 09:45:26 First phase of WPA/WPA2 4-Way Handshake Completed
14 14 2019.04.05 09:45:26 Second phase of WPA/WPA2 4-Way Handshake Completed
15 14 2019.04.05 09:45:26 Third phase of WPA/WPA2 4-Way Handshake Completed
16 15 2019.04.05 09:45:26 Fourth phase of WPA/WPA2 4-Way Handshake Completed
17 18 2019.04.05 09:45:26 Node Authorized
18 18 2019.04.05 09:45:26 The client got VLAN []
19 38 2019.04.05 09:45:26 Client sent DHCP REQUEST
20 174 2019.04.05 09:45:26 Client has received IP [fe80::1073:dce7:1ebb:93a2]
21 179 2019.04.05 09:45:26 DHCP ACK sent to Client from [172.16.14.1]
22 179 2019.04.05 09:45:26 Client has received IP [172.16.14.131]
23 SSID : GOODFELLAS
24 BSSID : 88:B1:E1:00:03:D0
25 AP NAME : Estudio_00:03:EF
26 Chan : 36
27 Time : 2019.04.05 09:45:28 (America/Los_Angeles)
28 Tdiff(msec) Timestamp Event
29 0 2019.04.05 09:45:28 Node Left
30 91155 2019.04.05 09:46:59 Node Left
31 SSID : GOODFELLAS
32 BSSID : 00:11:74:F2:43:A0
33 AP NAME : Sotano_F2:43:BF
34 Chan : 48
35 Time : 2019.04.05 09:47:06 (America/Los_Angeles)
36 Tdiff(msec) Timestamp Event
37 0 2019.04.05 09:47:06 AP received authentication request from client at [-51]db
38 2 2019.04.05 09:47:06 Client successfully authenticated
39 2 2019.04.05 09:47:06 AP received (re)association request from client
40 15 2019.04.05 09:47:06 Signals a new WPA or WPA2 exchange
41 15 2019.04.05 09:47:06 Setting PMK from PSK as this is a WPA or WPA2 PSK authentication
42 15 2019.04.05 09:47:06 Client successfully (re)associated
```

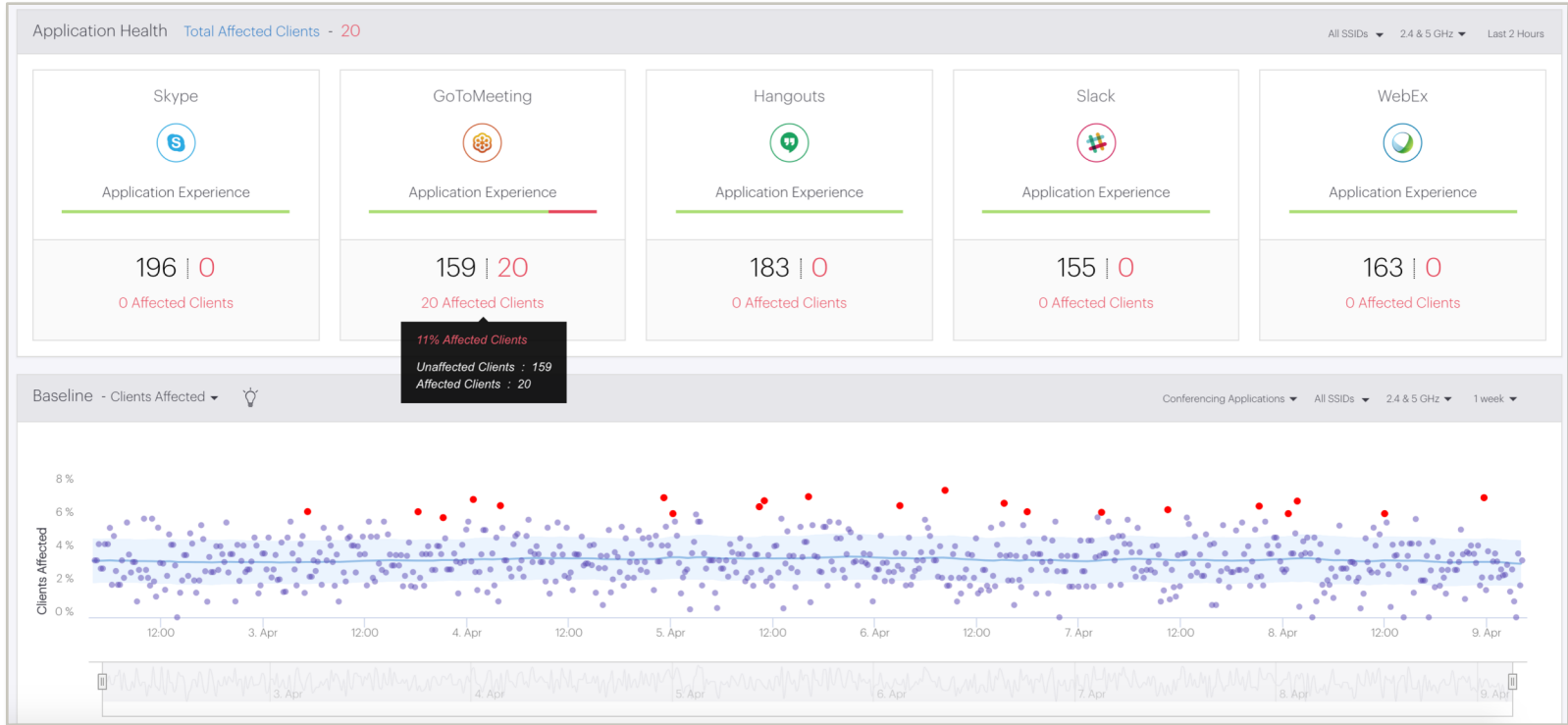


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# Application Health Dashboard

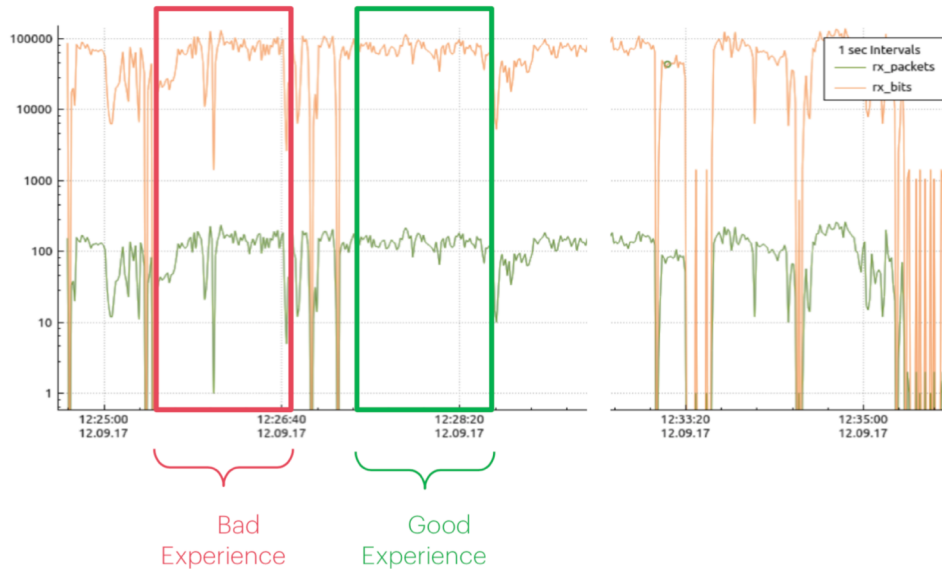
# Application Health Dashboard

Shows affected clients on a per-application basis, in real-time and historically



# Application Experience

- Most WiFi users complaints come from Multimedia Applications
- Cognitive WiFi also measures “Application Experience” using Machine Learning algorithms
- Multimedia traffic is examined in chunks of 30s and classified using ML trained models



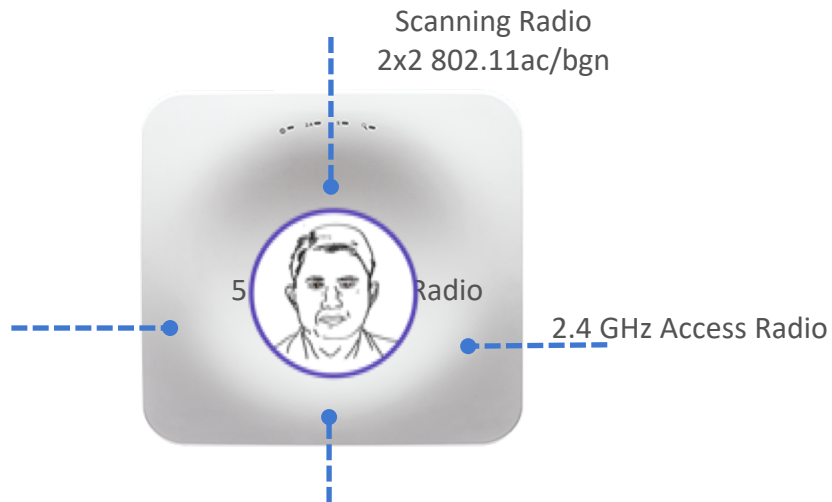


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# The Third Radio

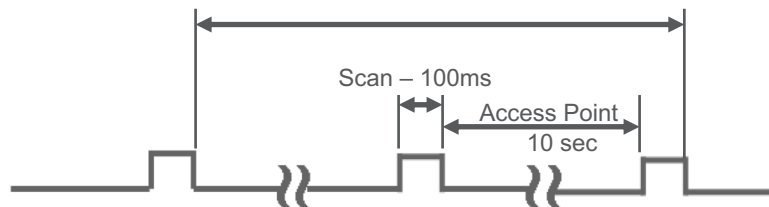
# The Third radio – Your network's ears

- Most tricky client issues require sending a field engineer onsite to take a packet capture
- The integrated 3rd radio in Arista APs can:
  - Take packet captures anytime, without affecting active clients
  - Simulate a client, to uncover issues before they happen



Imagine embedding a field engineer inside the AP

# Dedicated Scanning vs Background Scanning



Dedicated scanning is becoming a major requirement to support modern high-bandwidth applications

- Background scanning disrupts these applications when running
- Background scanning is often disabled automatically or entirely
- RRM and RF optimization suffers without constant off-channel data

2.4GHz	5GHz
Number of Channels	
14	36
Time to complete one full scan using background scanning	
2 minutes, 21.6 seconds	6 minutes, 3.6 seconds
Time to complete one full scan using dedicated scanning	
1.4 seconds	3.6 seconds

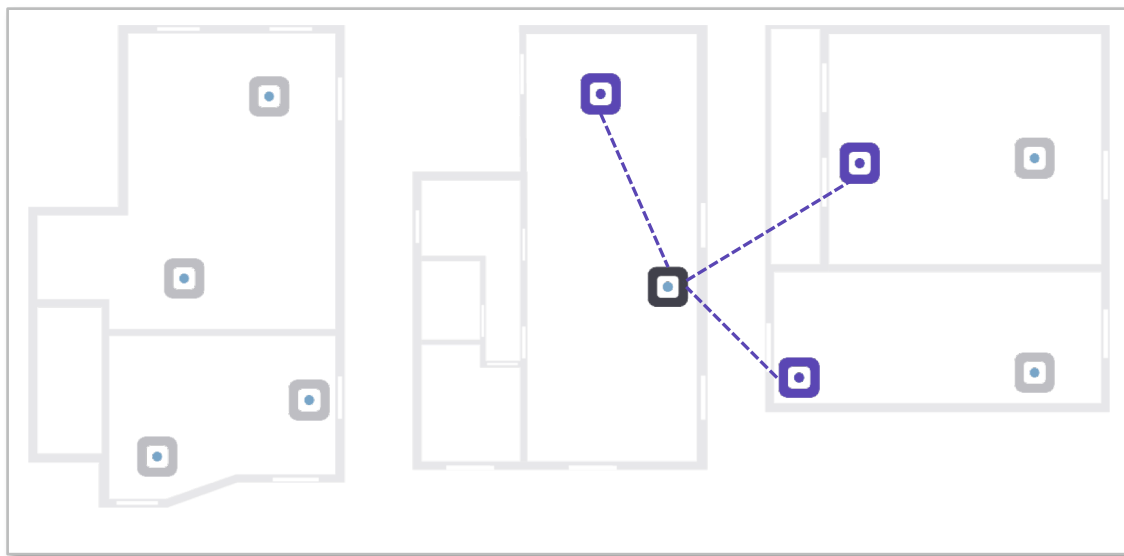


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# Client Simulation Test

# Client Simulation Test

- The 3rd radio can be turned in client mode and connect to neighboring APs
- Several test profiles can be defined to simulate real client traffic
- Tests can be scheduled at convenient time to uncover issues before they affect users



# Client Simulation Test

- Different profiles can be set, including different Applications, VoIP and Throughput
- Use WiFi to uncover non-WiFi issues before users even notice

Client Connectivity Test Results

HQ1 - O-90-HQ1 - G & A-Feb 14-16:53  
Start Time: Feb 14, 2018 4:53:24 PM Stop Time: Feb 14, 2018 4:57:55 PM

▼ Association ●  
Association Status : Successful

▼ Authentication ●  
Authentication Status : Successful  
Security Method : PSK

▼ DHCP ●  
DHCP Status : Successful  
IP Address : 192.168.183.10  
**Latency : 567 ms**  
DNS Server Option : 8.8.8.8  
DHCP Gateway : 192.168.183.254

▼ DNS  
DNS Status : Successful  
IP Address : 172.22.22.40  
**Latency : 9 ms**  
Status : Successful  
IP Address : 172.22.22.10  
Latency : 6 ms  
Status : Successful

▼ WAN Latency  
WAN Reachability : Successful  
WAN URL : www.google.com  
**Latency : 14 ms**  
Status : Successful

▼ Application Test ●

Productivity Social **Communication** Custom

Skype for Business Successful Latency : 6 ms

**GotoMeeting** Successful Latency : 24 ms

Slack Successful Latency : 5 ms

Yammer Successful Latency : 6 ms



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# Spectrum Analysis

# Spectrum Analysis

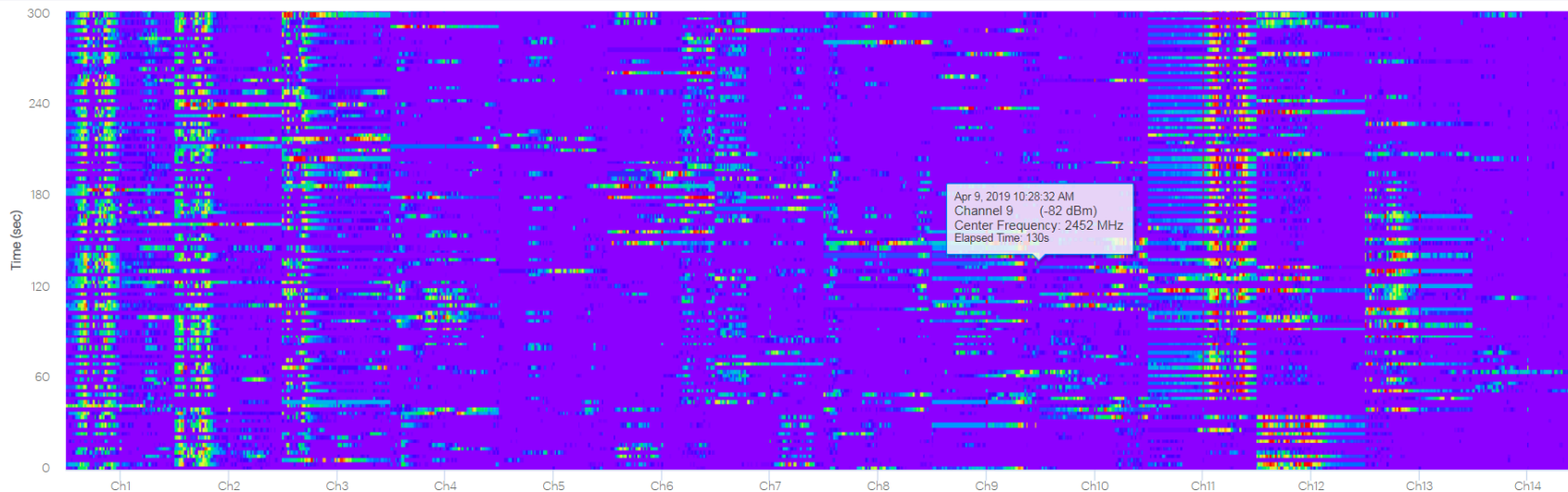
Spectrum Analysis - RHQ-001 ⓘ

Start

Start Time - Apr 9, 2019 10:26:22 AM

End Time - Apr 9, 2019 10:31:26 AM

5 Minutes ▾ 2.4 GHz ▾



# Summary

- WiFi always gets blamed! ... But most times it's Innocent! 😊
- WiFi issues can get complex:
  - Most times require packet captures onsite
  - This is expensive and often implies service loss
- Cognitive WiFi offers:
  - SW tools to find out if WiFi is Innocent or not
  - Very easy way of taking Packet Captures remotely using 3rd Radio
- Cognitive WiFi allows to manage large WiFi networks with very few IT people



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**Demo**



# Thank You