The bridge to possible

Troubleshoot Catalyst 9800 Wireless Controllers

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Cisco Webex App

https://ciscolive.ciscoevents.com/ciscolivebot/#BRKEWN-3628

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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

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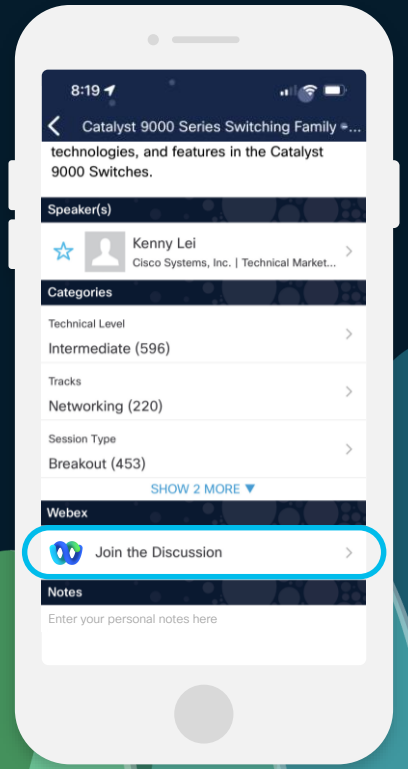


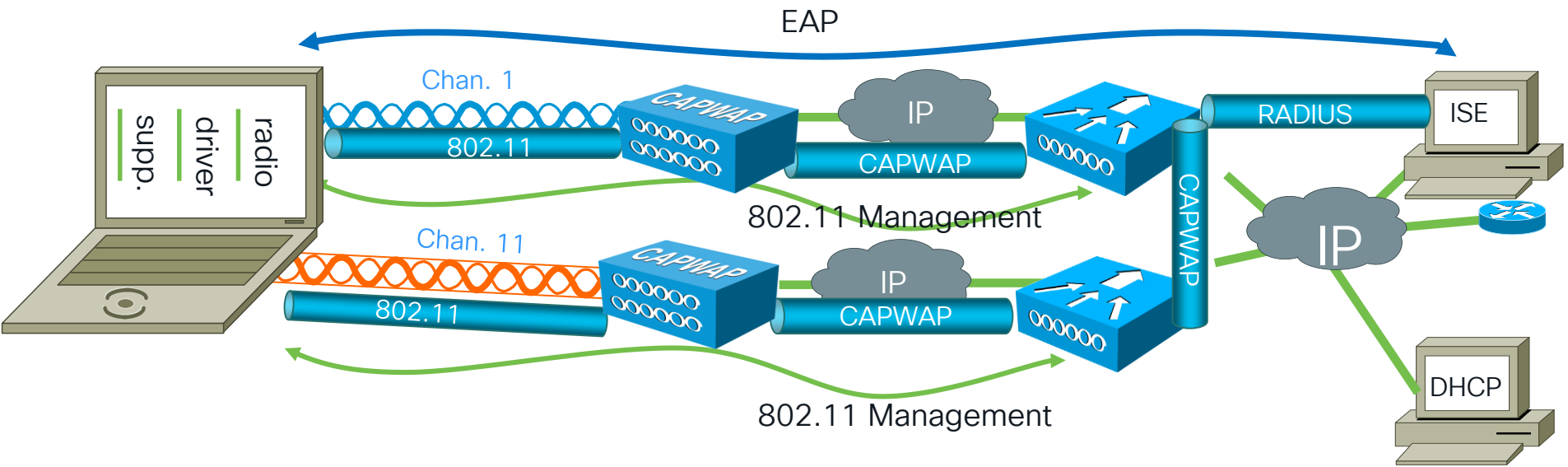
About Javier

Agenda

- Troubleshooting 101
- Architecture Basics
- Cat9800 Control Plane debugging
- Cat9800 Data Plane debugging
- Access point Control Plane debugging
- Access point Data Plane debugging
- WLC top issues
- Conclusion

Troubleshooting 101

Where do we start?

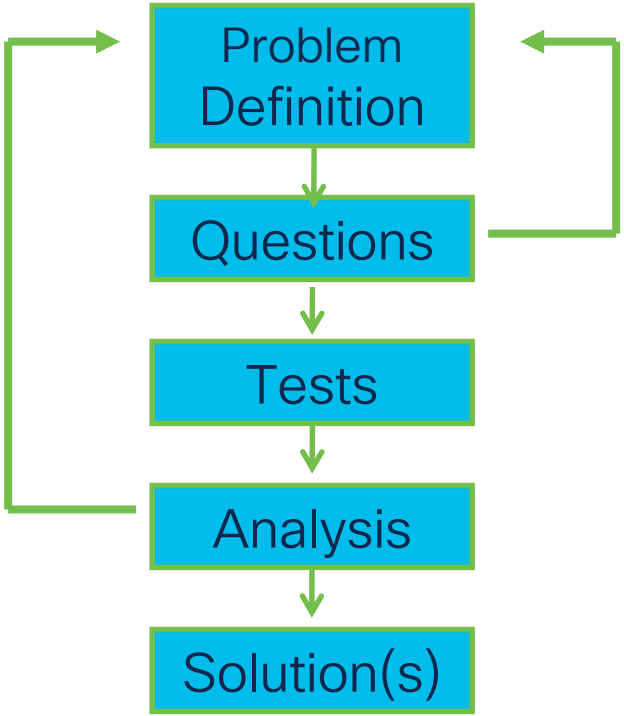


Wireless Link = Complex multi-variable equation

✓ Isolate and remove the variables

Troubleshooting Basics

- Troubleshooting 101
  - Clearly define the problem
  - Understand any possible triggers
  - Know the expected behavior
  - Reproducibility
  - Do not jump to conclusions



Troubleshooting Basics

- Logical and procedural mindset
- Step 1: Define the problem
  - Bad: “Client slow to connect”
  - Good: “Client associations are rejected with Status17 several times before they associate successfully.”
  - Reduce Scope!
  - Isolate multiple possible problems

Troubleshooting Basics

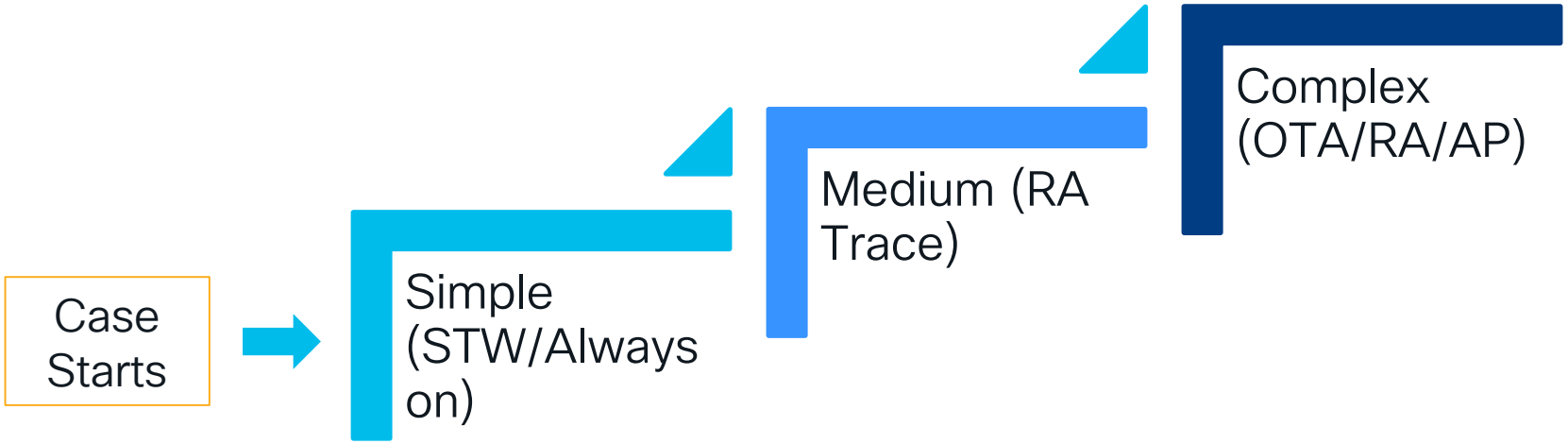
- Step 2: Understand triggers
  - Did it work before?
  - Changes
  - Finding a pattern
- Step 3: Know the expected behavior
  - Example: “One way audio between Phone A and B, because Phone A does not get an ARP Response for Phone B”

Troubleshooting Basics

- Step 4: Reproducibility
  - Reproducible = Easier

- Step 5: Fix
  - Validate Root Cause Analysis
  - Develop Fix
  - Test for solution, intersection

Complexity Control



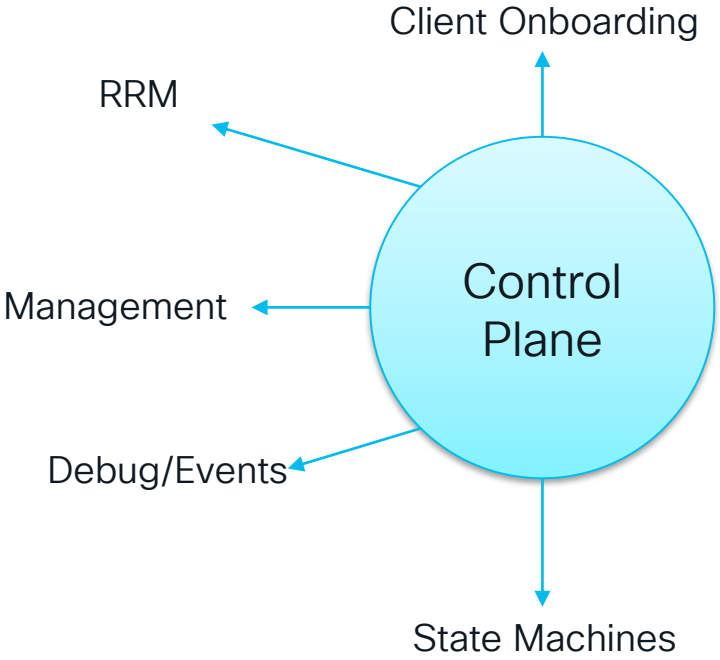
Support Case Starting Suggestions

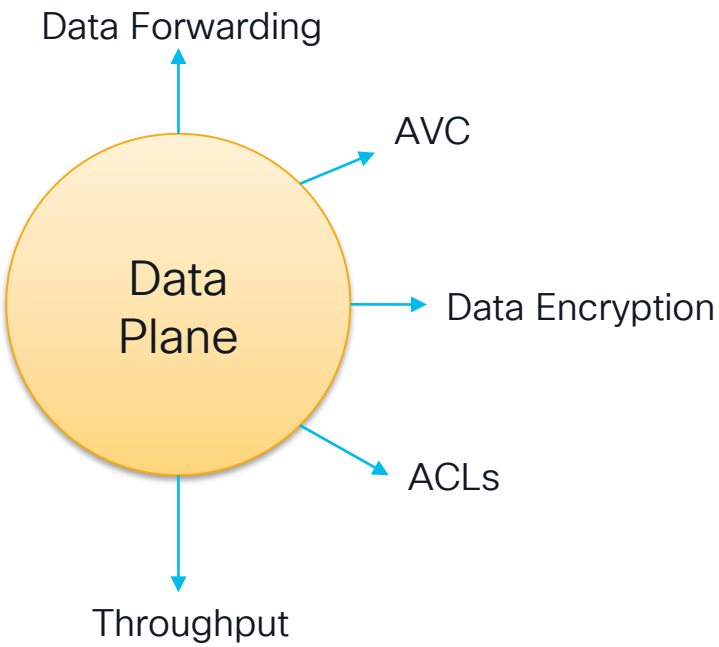
- Client issue:
  - Show tech wireless
  - RA Trace or Always on tracing
- Device Reload
  - Any support bundle/core/crash report
  - Show tech wireless
- Any feature/config question
  - Show tech wireless
- Run WCAE

Architecture Basics

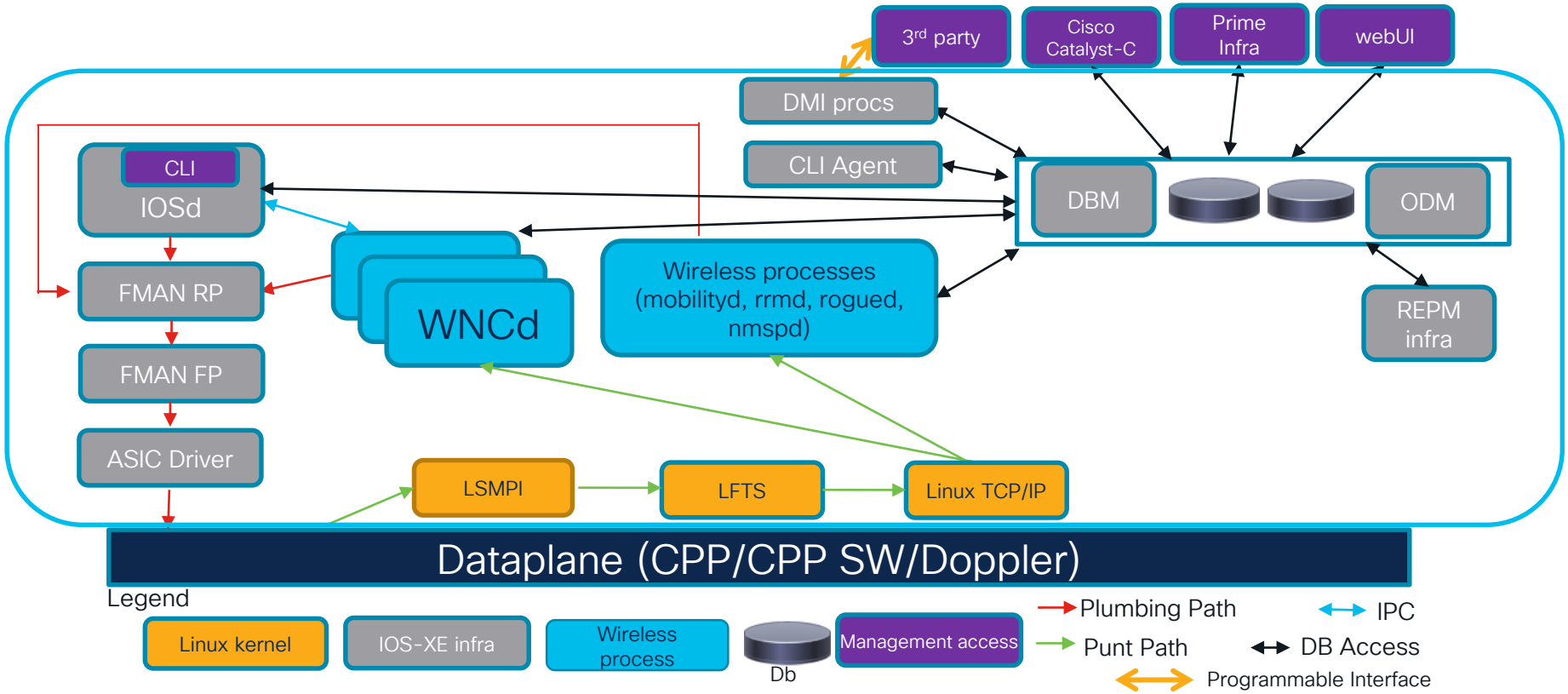
Introduction

Why do I need to care about those control plane and data plane details ?

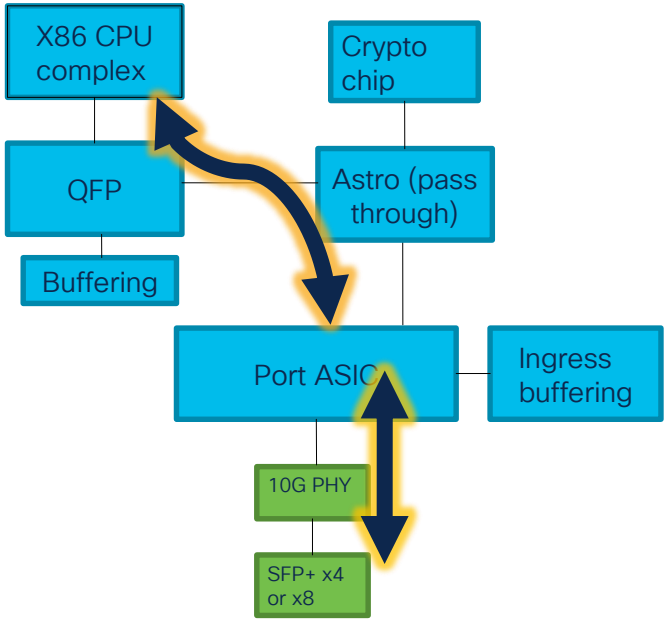




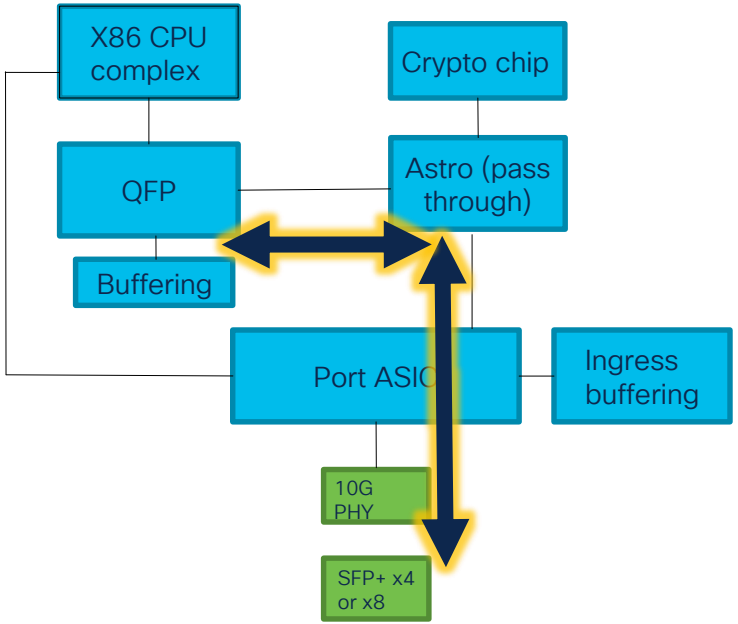
C9800 Software Process Architecture



Life of Packet – Control and Data Plane



Control Plane Packet (Punt/Inject)



Data Plane Packet

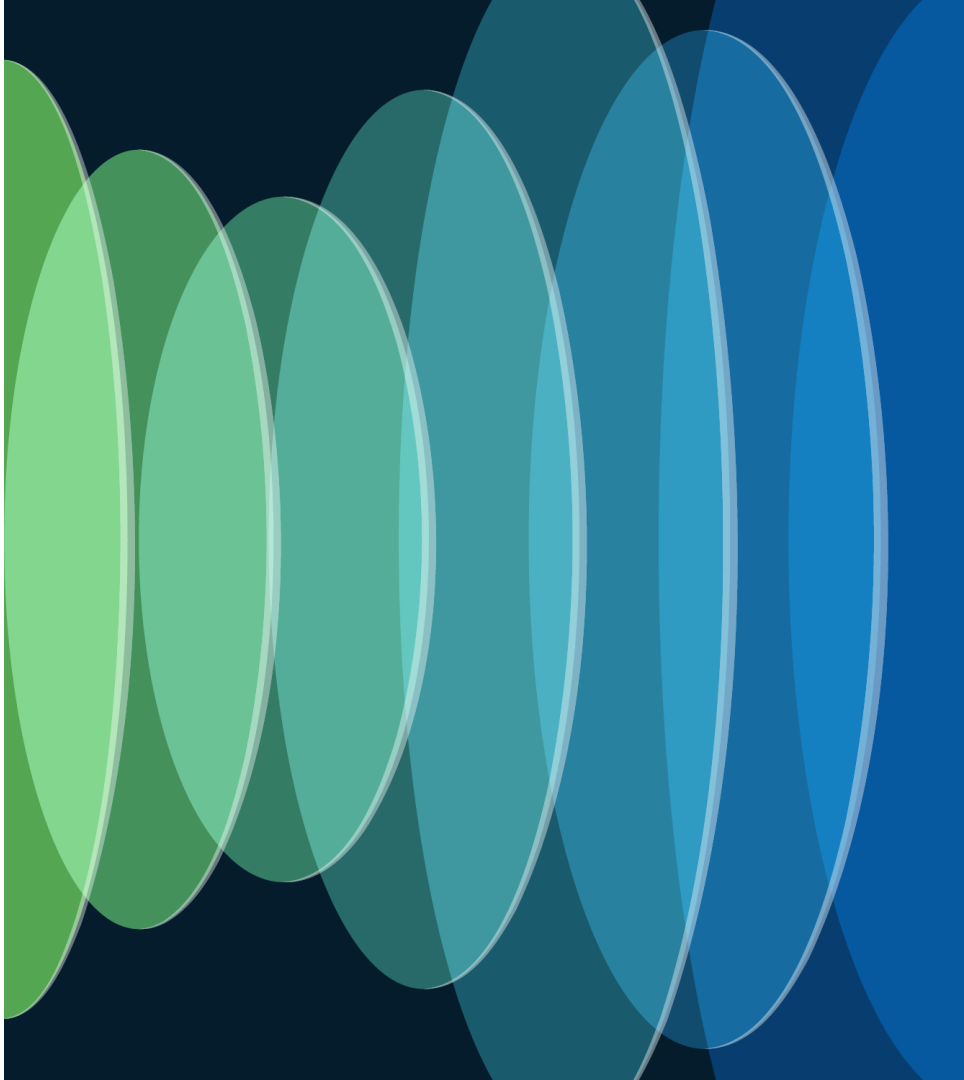
slido

What belongs to Control Plane

ⓘ Start presenting to display the poll results on this slide.

WLC Control Plane

Tracing and Debugging



IOS-XE Tracing/Debugging

IOS Logging

IOSd Syslog:

- System
- Good starting point
- Get it with: `#show logging`

AP Join:

```
May 22 2023 09:34:31.251 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface Capwap2, changed state
to up
May 22 2023 09:34:31.249 UTC: %CAPWAPAC_SMGR_TRACE_MESSAGE-5-AP_JOIN_DISJOIN: Chassis 1 R0/0: wncd:
AP Event: AP Name: ap3800i-r2-sw1-te0-1, MAC: 0042.68a0.ee78 Joined
May 22 2023 09:36:19.548 UTC: %CAPWAPAC_SMGR_TRACE_MESSAGE-3-EWLC_GEN_ERR: Chassis 1 R0/0: wncd:
Error in Session-IP: 192.168.25.101[5264] Mac: 00a3.8ec2.da00 Heartbeat timer expiry for AP. Close
CAPWAP DTLS session
```

IOSd Logging

Admin GUI connection:

```
May 29 2019 08:43:37.238 UTC: %WEBSERVER-5-LOGIN_PASSED: Chassis 1 R0/0: nginx: Login
Successful from host 192.168.0.110 by user 'admin' using crypto cipher 'ECDHE-RSA-AES128-GCM-
SHA256’
```

Wrong PSK:

```
May 29 2019 08:48:25.388 UTC: %CLIENT_EXCLUSION_SERVER-5-ADD_TO_BLACKLIST_REASON: Chassis 1
R0/0: wncmgrd: Client MAC: 001e.e5e2.35cf was added to exclusion list, reason: Wrong PSK
```

IOS-XE Tracing

- Binary, line rate tracing mechanism
- No CPU impact
- Each BinOS (non-IOSd) process has its own tracelog file (before 17.7)
- Unified tracing in 17.7+
- File starts in memory
- Rotation: At X size - > compressed and moved to disk
- Syslog-like severity levels
- Base infrastructure for other features

IOS-XE Tracing

- Binary trace (Btrace)

```
myc9800-CL#dir bootflash:tracelogs
Directory of bootflash:/tracelogs/
372820  -rw-            5270  Nov 25 2022 13:28:43 +01:00  plogd_R0-0.22150_44788.20221125122727.bin.gz
372746  -rw-            5265  Nov 25 2022 13:27:27 +01:00  plogd_R0-0.22150_44787.20221125122611.bin.gz
372495  -rw-         2263043   Aug 1 2022 23:42:49 +02:00  wncd_x_R0-0.17829_27.20220731171658.bin.gz
372508  -rw-         2290676  Jul 31 2022 19:17:48 +02:00  wncd_x_R0-0.17829_26.20220730103553.bin.gz
372767  -rw-         2284388  Jul 30 2022 12:36:12 +02:00  wncd_x_R0-0.17829_25.20220729001047.bin.gz
372545  -rw-         2276683  Jul 29 2022 02:11:42 +02:00  wncd_x_R0-0.17829_24.20220727124941.bin.gz
372493  -rw-           88311  Jul 28 2022 20:58:02 +02:00  cpp_ha_F0-0.22679_2.20220718170801.bin.gz
```

IOS-XE Tracing

Binary trace levels

- **ERROR** level represent abnormal situations. We want to raise the user attention to these
- **WARNING** represent an incident that could potentially lead to an error (or not…)
- **NOTICE** is the default logging level for binos daemons. It captures significant events if they are normal working conditions. (client connect, failover)
- **INFO** contains details about state machines and the communication flow
- **DEBUG** contains traces needed to root cause failure conditions
- **VERBOSE** voluminous traces more tuned to help developers with bugs

2-Critical
3-Error
4-Warning
5-Notice
6-Info
7-Debug
8-Verbose

Always On tracing

- Contextual Logs WITHOUT debugging
- Each process writes relevant events at Notice level
- General Problem isolation assistance
  - Is client facing authentication issues or DHCP issue or something else
- Helps establish trends
  - Isolate if reported client connectivity problem is specific to certain APs or certain client mac addresses
- Box can store 48h approx. at max HW capacity, weeks typically

Always on Tracing CLI

- Useful commands

```
# show logging process <process daemon>
```

This is last 10 minutes by default

```
# show logging process <process daemon> to-file <alwayson-process.txt>
# more bootflash:alwayson-process.txt
```

```
# copy bootflash:alwayson-process.txt tftp://<serverip>/path OR ftp://user:pass@serverip/path
```

Always on Tracing

This is Most Used

- Aggregated view across processes:

```
# show logging profile wireless filter {mac | ip} {client-mac | mobility-peer-ip}
to-file <alwayson-clientmac>.txt
```

- Focus on time window, export to file

```
# show logging profile wireless start timestamp “MM/DD/YYYY HH:MM:SS” filter mac
<mac addr> to-file <filename>
```

- Changing time displayed

```
# show logging profile wireless start last 30 minutes
```

Always on : successful client connection

RA tracing OFF

```
# show log profile wireless filter mac 0040.96b9.b5c4 to-file output.txt

[client-orch-sm] [24632]: (note): MAC: 0040.96b9.b5c4  Association received. BSSID 0038.df25.f12f, old BSSID 0000.0000.0000, WLAN
1, Slot 1 AP 0038.df25.f120, AP0038.DF24.62A8
[client-orch-state] [24632]: (note): MAC: 0040.96b9.b5c4  Client state transition: S_CO_INIT ->S_CO_ASSOCIATING
[dot11] [24632]: (note): MAC: 0040.96b9.b5c4  Association success. AID 1, Roaming = 0, WGB = 0, 11r = 0, 11w = 0
[client-orch-state] [24632]: (note): MAC: 0040.96b9.b5c4  Client state transition: S_CO_ASSOCIATING ->S_CO_L2_AUTH_IN_PROGRESS
[client-auth] [24632]: (note): MAC: 0040.96b9.b5c4  ADD MOBILE sent. Client state flags: 0x71  BSSID: MAC: 0038.df25.f12f  capwap
IFID: 0xf90400004
[client-auth] [24632]: (note): MAC: 0040.96b9.b5c4  L2 Authentication initiated. method DOT1X, Policy VLAN 1,AAA override = 0
[ewlc-infra-evq] [24632]: (note): Authentication Success. Resolved Policy bitmap:11 for client 0040.96b9.b5c4
[client-auth] [24632]: (note): MAC: 0040.96b9.b5c4  L2 Authentication Key Exchange Start. EAP type: PEAP, Resolved VLAN: 16, Audit
Session id: 22100A090000000E89D69B30
[client-keymgmt] [24632]: (note): MAC: 0040.96b9.b5c4  EAP Key management successful. AKM:DOT1X Cipher:CCMP WPA2
[client-orch-sm] [24632]: (note): MAC: 0040.96b9.b5c4  Mobility discovery triggered. Client mode: Local
[client-orch-state] [24632]: (note): MAC: 0040.96b9.b5c4  Client state transition: S_CO_L2_AUTH_IN_PROGRESS -
>S_CO_MOBILITY_DISCOVERY_IN_PROGRESS
[client-auth] [24632]: (note): MAC: 0040.96b9.b5c4  ADD MOBILE sent. Client state flags: 0x72  BSSID: MAC: 0038.df25.f12f  capwap
IFID: 0xf90400004
[client-orch-state] [24632]: (note): MAC: 0040.96b9.b5c4  Client state transition: S_CO_MOBILITY_DISCOVERY_IN_PROGRESS -
>S_CO_DPATH_PLUMB_IN_PROGRESS
[dot11] [24632]: (note): MAC: 0040.96b9.b5c4  Client datapath entry params - ssid:dot1x_j,slot_id:1 bssid ifid: 0x0, radio_ifid:
0xf90400002
[dpath_svc] [24632]: (note): MAC: 0040.96b9.b5c4  Client datapath entry created for ifid 0xfa0000001
[client-orch-state] [24632]: (note): MAC: 0040.96b9.b5c4  Client state transition: S_CO_DPATH_PLUMB_IN_PROGRESS -
>S_CO_IP_LEARN_IN_PROGRESS
[client-iplearn] [24632]: (note): MAC: 0040.96b9.b5c4  Client IP learn successful. Method: DHCP IP: 9.10.16.121
[client-orch-state] [24632]: (note): MAC: 0040.96b9.b5c4  Client state transition: S_CO_IP_LEARN_IN_PROGRESS ->S_CO_RUN
```

Always on : successful client connection

RA trace ON

```
2022/02/25 09:30:14.179966 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     19  "dc-protocol-map=9"
2022/02/25 09:30:14.179972 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     30  "dhcp-option=                "
2022/02/25 09:30:14.179977 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     57  "dhcp-option=                                        "
2022/02/25 09:30:14.179983 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     25  "dhcp-option=            "
2022/02/25 09:30:14.180003 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Framed-IP-Address   [8]      6  10.6.119.13
2022/02/25 09:30:14.180006 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Framed-IPv6-Address [168]   18  ...
2022/02/25 09:30:14.180026 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  User-Name           [1]     14  "Nico"
2022/02/25 09:30:14.180032 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     43  "audit-session-id=91208A0A001379C630372E5F"
2022/02/25 09:30:14.180037 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     13  "vlan-id=691"
2022/02/25 09:30:14.180043 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     14  "method=dot1x"
2022/02/25 09:30:14.180046 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Called-Station-Id   [30]    19  "00-1e-49-2a-8c-ff"
2022/02/25 09:30:14.180050 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Calling-Station-Id  [31]    19  "00-22-58-2b-1c-30"
2022/02/25 09:30:14.180054 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  NAS-IP-Address      [4]      6  10.138.32.145
2022/02/25 09:30:14.180057 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  NAS-Port-Id         [87]    17  "capwap_90400156"
2022/02/25 09:30:14.180061 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  NAS-Port-Type       [61]     6  802.11 wireless          [19]
2022/02/25 09:30:14.180070 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     23  "cisco-wlan-ssid=ssw"
2022/02/25 09:30:14.180076 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Cisco AVpair       [1]     29  "wlan-profile-name=300-ssw"
2022/02/25 09:30:14.180082 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:   Airespace-WLAN-ID  [1]      6  300
2022/02/25 09:30:14.180085 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Nas-Identifier      [32]    15  "sdegdc99n3001"
2022/02/25 09:30:14.180088 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Session-Id     [44]    10  "00017cdc"
2022/02/25 09:30:14.180092 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Input-Octets   [42]     6  0
2022/02/25 09:30:14.180095 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Input-Giga-Words[52]     6  0
2022/02/25 09:30:14.180098 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Output-Octets  [43]     6  0
2022/02/25 09:30:14.180101 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Output-Giga-Words[53]     6  0
2022/02/25 09:30:14.180104 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Input-Packets  [47]     6  0
2022/02/25 09:30:14.180108 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Output-Packets [48]     6  0
2022/02/25 09:30:14.180111 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Authentic      [45]     6  Remote                   [3]
2022/02/25 09:30:14.180115 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Status-Type    [40]     6  Watchdog                 [3]
2022/02/25 09:30:14.180118 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Event-Timestamp     [55]     6  1645781414
2022/02/25 09:30:14.180121 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  Acct-Delay-Time     [41]     6  0
2022/02/25 09:30:14.180175 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS: Started 2 sec timeout
2022/02/25 09:30:14.180192 {wncd_x_R0-1}{1}: [auth-mgr] [22336]: (info): [0022.582b.1c30:capwap_90400156] Device type for the session is detected as Un-Classified Device and old Un-Classified Device &Device name for the sess
2022/02/25 09:30:14.186568 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS: Received from id 1813/188 10.138.16.74:0, Accounting-response, len 20
2022/02/25 09:30:14.186576 {wncd_x_R0-1}{1}: [radius] [22336]: (info): RADIUS:  authenticator 0b af 5e 94 b8 e7 72 0a - d7 1d c8 a2 a8 d7 02 42
2022/02/25 09:30:14.193967 {wncd_x_R0-1}{1}: [sisf-packet] [22336]: (info): RX: DHCPv4 from interface capwap_90400156 on vlan 691 Src MAC: 0008.e3ff.fc04  Dst MAC: 0022.582b.1c30  src_ip: 10.4.215.21, dst_ip: 255.255.255.255
2022/02/25 09:30:16.880012 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'ping'(app-id: 0xd0001df), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:30:17.879130 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'dhcp'(app-id: 0xd00000d), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:30:19.880687 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'unknown'(app-id: 0xd000001), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided
2022/02/25 09:30:28.494692 {wncd_x_R0-1}{1}: [client-orch-sm] [22336]: (info): MAC: 0022.582b.1c30  Failed to get ewlc dot11 packet handler. Dot11 action processing error. Dropping request
2022/02/25 09:30:56.947807 {wncd_x_R0-1}{1}: [client-orch-sm] [22336]: (info): MAC: 0022.582b.1c30  Failed to get ewlc dot11 packet handler. Dot11 action processing error. Dropping request
2022/02/25 09:31:15.229113 {wncd_x_R0-1}{1}: [client-orch-sm] [22336]: (info): MAC: 0022.582b.1c30  Failed to get ewlc dot11 packet handler. Dot11 action processing error. Dropping request
2022/02/25 09:31:33.150633 {wncd_x_R0-1}{1}: [client-orch-sm] [22336]: (info): MAC: 0022.582b.1c30  Failed to get ewlc dot11 packet handler. Dot11 action processing error. Dropping request
2022/02/25 09:31:46.295867 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'ping'(app-id: 0xd0001df), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:31:46.296145 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'protocol-0xd000000'(app-id: 0xd000000), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <r
2022/02/25 09:31:46.296176 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'icmp'(app-id: 0x1000001), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:31:46.296205 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'protocol-0xd000000'(app-id: 0xd000000), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <r
2022/02/25 09:31:46.296228 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:31:46.296351 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'icmp'(app-id: 0x1000001), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.296380 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'ping'(app-id: 0xd0001df), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.296407 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:31:46.296420 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.296436 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.296472 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'dhcp'(app-id: 0xd00000d), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.296490 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'dhcp'(app-id: 0xd00000d), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:31:46.298170 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction egress (1), WLAN ID <not provided>, #
2022/02/25 09:31:46.298192 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.298224 {wstatsd_R0-0}{1}: [avc-stats] [21340]: (debug): Received stats record for app 'snmp'(app-id: 0x30000a1), client MAC: 0022.582b.1c30  , SSID 'sswa2', direction ingress (0), WLAN ID <not provided>,
2022/02/25 09:31:46.715441 {wncd_x_R0-1}{1}: [client-orch-sm] [22336]: (info): MAC: 0022.582b.1c30  Failed to get ewlc dot11 packet handler. Dot11 action processing error. Dropping request
```

Wireless Debug Analyzer

Cisco TAC Tool - Wireless Debug Analyzer

Javier Contreras

Show Advanced Debug Insights NEW!!

Select a client MAC Address and connection to see logs.

Download CSV

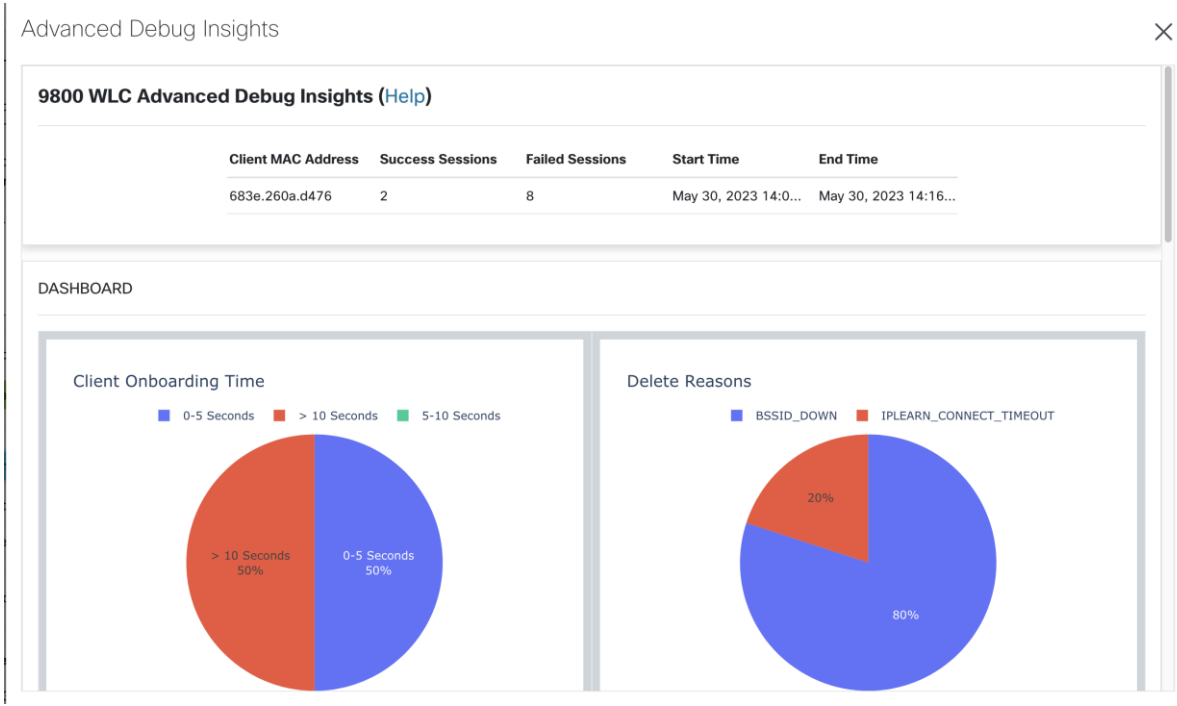
683e.260a.d476

Connection 2 of 11 1 2 3 4 5 ... 11

Show Time Show Task Show Translated Show Original Show Prior First Connection Show All

Time	Task	Translated
2023/05/30 14:08:27.671	client-orch-sm	Client roamed to a new AP/BSSID: BSSID f01[illegible]6e, WLAN test, Slot 1 AP f01[illegible], Floor6-AP4
2023/05/30 14:08:27.671	dot11	Association success for client, assigned AID is: 1. Client performed fast roam.
2023/05/30 14:08:27.671	client-orch-sm	Client started layer 2 authentication (either dot1X or PSK)
2023/05/30 14:08:27.699	client-auth	Entering 802.1X authentication process
2023/05/30 14:08:27.699	client-auth	Entering 802.1X authentication process
2023/05/30 14:08:27.700	dot1x	Controller/AP sent EAPOL Identity Request to client

Wireless Debug Analyzer



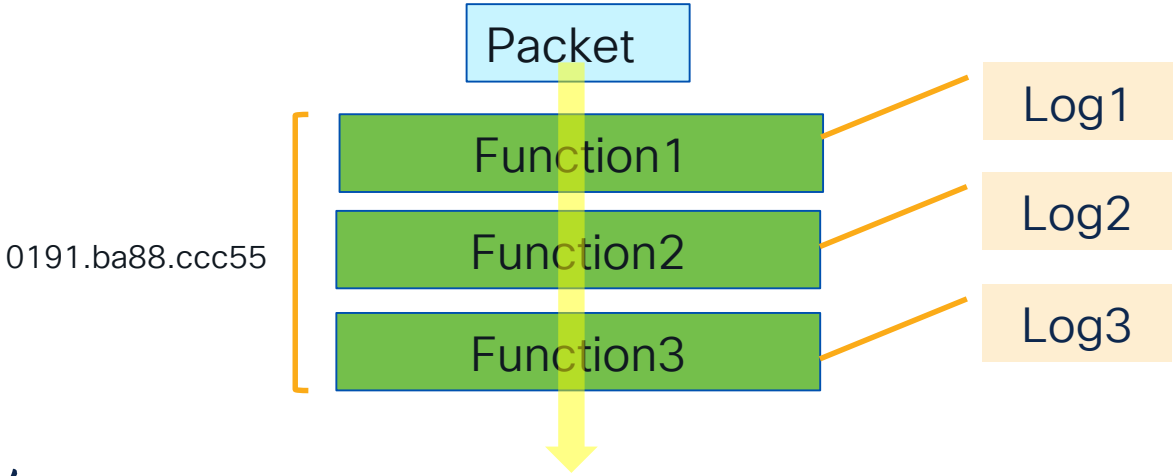
Problem example 1

Yesterday we had many users complaining about wifi in a given area

- Always on logs of selected clients.
  - Connection last state (stuck in IP LEARN?) ?
  - Were they being intentionally disconnected ?
  - RADIUS / authentication issue ?
- Cisco Catalyst Center can be key

What is Radioactive Tracing

- Track “trace of execution” for a given application context
- Application defines what is interesting
- Only context has increased verbosity



Radioactive Tracing

RA trace automatically enables all debugs when a given MAC or IP is processed

Troubleshooting > Radioactive Trace

Conditional Debug Global State: Stopped

Wireless Debug Analyzer

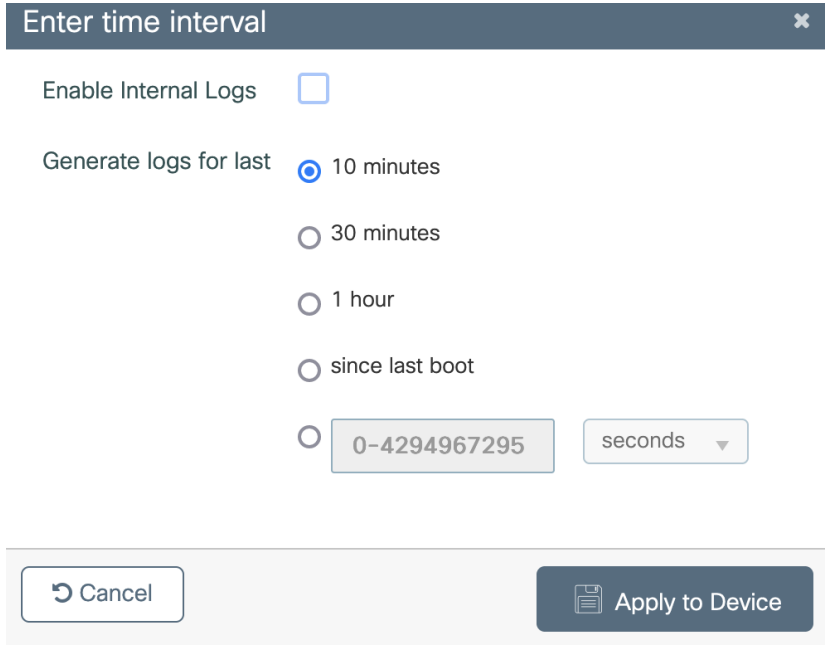
Add | Delete | Start | Stop

	MAC/IP Address	Trace file	
☐	1111.2222.3333		Generate

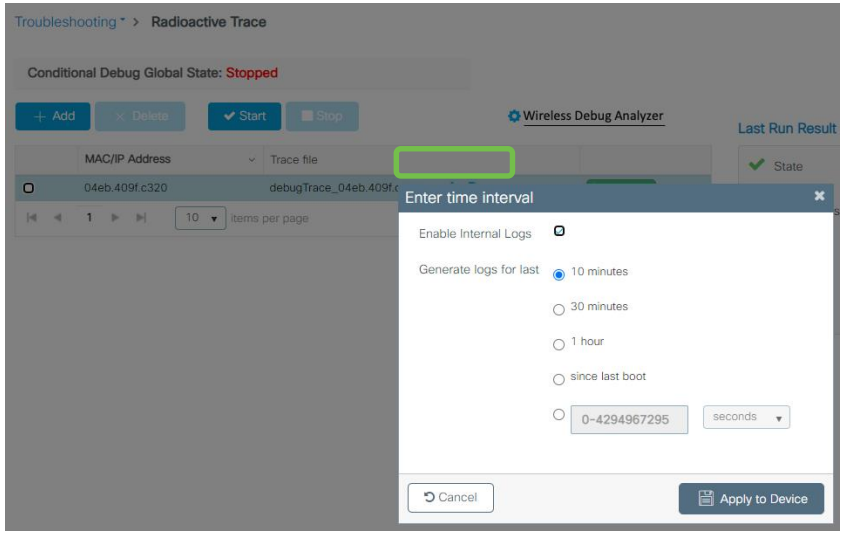
1 | 10 items per page | 1 - 1 of 1 items

Radioactive Tracing

Clicking “Generate” will decode the on-flash binary logs and collate a readable text file filtered on the mac/IP requested.



Radioactive Tracing with Internal Flag



- Logs extremely verbose
- Only need to collect TAC and BU is involved
- Always On: 14 lines
- RA Trace: 400 lines
- RA Trace + Internal: 3000 lines

Radioactive Tracing

- Debug wireless CLI is a macro
- RA tracing for a period of time
- Collates the result

```
#debug wireless mac 1111.2222.3333 ?
 ftp-server    Move log file to FTP server, temporary storage: "flash:/"
 internal      Collect all logs.(Default: only customer curated logs)
 level         Select logs above specific level (Default: debug)
 monitor-time  Max time to trace the condition (Default: 30min)
 to-file       File path in internal storage, default storage: "flash:/"
<cr>          <cr>
```

Radioactive Tracing

Basic client/AP data collection:

- Data is there, just pull it…
- Collect data with `show logging profile wireless filter {mac | ip}`

Advanced client/AP:

- Use Radioactive Tracing
- `debug wireless mac mac.of.client ftp-server ser.ver.ip.add /directory`

Basic Box logs

- Traditional show logs/syslog

Live Debugging

- Optional: Output on real time
- Similar to AireOS “debug client”
- Console is reserved

```
monitor logging profile wireless filter mac <mac>
```

Radioactive Trace – Association Failures

- Client sends disassociate

```
[client-orch-sm] [20370]: (info): MAC: <CLIENT_MAC>  Deleting the client, reason: 2,
CO_CLIENT_DELETE_REASON_DEAUTH_OR_DISASSOC_REQ, Client state S_CO_RUN
[client-orch-sm] [20370]: (note): MAC: <CLIENT_MAC>  Client delete initiated. Reason:
CO_CLIENT_DELETE_REASON_DEAUTH_OR_DISASSOC_REQ, fsm-state transition
00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|01|07|13|17|18|28|33|42|44|46|48|4d|5c|5e|7f|a4|
```

- Data Rate Mismatch in Client Association Request

```
[dot11-validate] [23406]: (ERR): MAC: <CLIENT_MAC>  Dot11 validate radio rates. Missing Supported Rate for
index = 5, encode value: 12, radio type: DOT11_RADIO_TYPE_BG
```

- AP has max clients connected

```
[ewlc-infra-evq] [17707]: (ERR): <CLIENT_MAC> CLIENT_ASSOC_FAIL Failure = IE_POST_VALIDATION_FAILURE
Validation Failure Type = 17, WLAN profile = WLAN1, Policy profile = POLICY1
[dot11] [17707]: (ERR): MAC: <CLIENT_MAC> Dot11 update co assoc fail. Sent assoc failure to CO. delete
reason: 41, CO_CLIENT_DELETE_REASON_DOT11_MAX_STA
[client-orch-sm] [17707]: (note): MAC: <CLIENT_MAC>  Client delete initiated. Reason:
CO_CLIENT_DELETE_REASON_DOT11_MAX_STA, fsm-state transition
00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|01|08|10|
```

RadioActive Trace – Failed Authentication

- Group Key Update Failed

```
[client-keymgmt] [23562]: (ERR): MAC: CLIENT_MAC  Keymgmt: Failed to eapol key m5
retransmit failure. Max retries for M5 over
[client-orch-sm] [23562]: (ERR): MAC: CLIENT_MAC  L2 Authentication of station failed.
[client-orch-sm] [23562]: (note): MAC: CLIENT_MAC  Client delete initiated. Reason:
CO_CLIENT_DELETE_REASON_GROUP_KEY_UPDATE_TIMEOUT, fsm-state transition
```

- AAA Server Down

```
[errmsg] [17837]: (note): %DOT1X-5-FAIL: Authentication failed for client CLIENT_MAC)
with reason (AAA Server Down) on Interface capwap_9000000c AuditSessionID
0B7CFB2C000002145E61348E
[ewlc-infra-evq] [17837]: (ERR): SANET_AUTHC_FAILURE - AAA Server Down username , audit
session id 0B7CFB2C000002145E61348E
[errmsg] [17837]: (note): %SESSION_MGR-5-FAIL: Authorization failed or unapplied for
client (CLIENT_MAC) on Interface capwap_9000000c AuditSessionID
0B7CFB2C000002145E61348E. Failure reason: Authc fail. Authc failure reason: AAA Server
Down.
[client-orch-sm] [17837]: (note): MAC: a86d.aa32.5271  Client delete initiated. Reason:
CO_CLIENT_DELETE_REASON_AAA_SERVER_UNAVAILABLE, fsm-state transition
00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|00|01|07|
13|1a|23|
```

Customer problem example 2

Client A is facing some problems everyday at some point

- RA trace of the client running for the whole day

Radioactive Tracing bundle

New in 17.10/ 17.9.2

Client debug bundle:

- Show tech wireless
- Show tech wireless client mac <client mac>
- RA traces
- Optional packet capture
- Show logging
- In 17.11+: AP logs are also included

Radioactive Tracing bundle

New in 17.10/ 17.9.2

```
To Enable RA traces and client details
C9800# debug wireless bundle client <client_mac1 ...client_mac5>
To disable
C9800# no debug wireless bundle client <client_mac1 ...client_mac5>
```

```
To Enable Packet capture
C9800# debug wireless bundle include epc client <mac>
To disable
C9800# no debug wireless bundle include epc client <mac>
```

Radioactive Tracing bundle

New in 17.10/ 17.9.2

```
C9800#show bootflash: | inc 2022.tar
1047    1230336 Sep 19 2022 17:20:01.0000000000 +00:00
wireless_bundle_42e4.cb89.e878 _171958_UTC_Sep_19_2022.tar
1048     316416 Sep 19 2022 17:40:51.0000000000 +00:00
wireless_bundle_42e4.cb89.e878_174050_UTC_Sep_19_2022.tar
C9800#
```

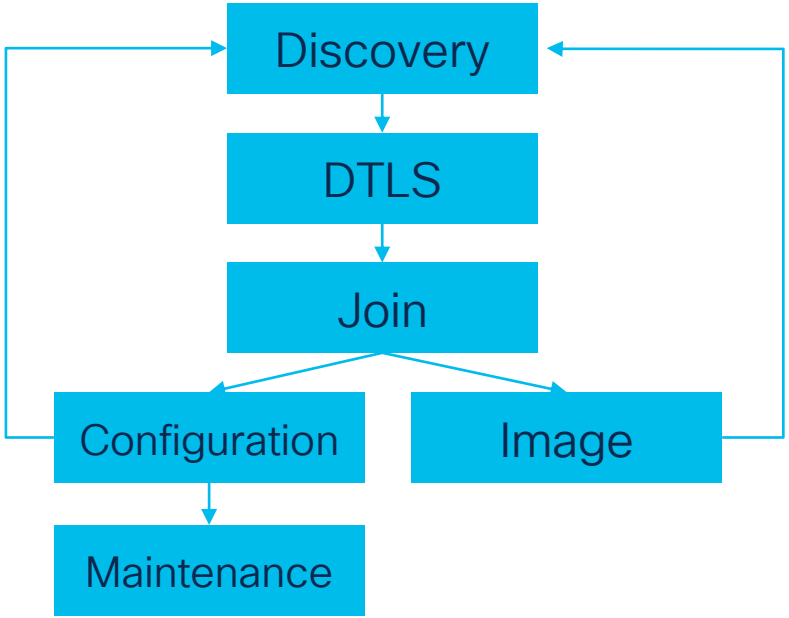
```
C9800#copy
bootflash:wireless_bundle_42e4.cb89.e878_060908_UTC_Sep_20_2022.tar
tftp://<TFTP IP>/<TFTP PATH>
C9800#
```

Customer problem example 3

My new APs are not joining the WLC

- Controller known information about AP
- RA trace of one AP MAC
- AP console (syslog) outputs
- PCAPs

AP Join Process



AP Discover/Join

- Known
- Configured
- Broadcast
  - Reaches WLCs with MGMT Interface in local subnet of AP
  - Use “ip helper-address <ip>” with “ip forward-protocol udp 5246”
- Dynamic
  - DNS: cisco-capwap-controller
  - DHCP: Option 43
- PnP
  - Only with no config

Debugging AP Join Issues

- Basics First

```
9800cl-1#sh ap uptime
Number of APs: 3


AP Name                Ethernet MAC    Radio MAC       AP Up Time       Association Up Time
-----------------------------------------------------------------------------------------------
ap9136-1               687d.b45c.14bc  687d.b45e.f7b0  175 days 1 hour  21 days 8 hours 17 min
ap9136-4               687d.b45c.1398  687d.b45e.ea00  153 days 1 hour  21 days 6 hours 52 min
9130I-r3-sw2-1_0_40    04eb.409e.1dc4  04eb.409f.5480  0  days 1 hour   0 days 0 hours 52 min
```

slido

AP joins after a disconnect. What is the first command you collect ?

ⓘ Start presenting to display the poll results on this slide.

Debugging AP Issues

```
9800cl-1#sh wireless stats ap join summary

Number of APs: 7


Base MAC        Ethernet MAC    AP Name                    IP Address       Status      Last Failure Phase    Last Disconnect Reason

-----------------------------------------------------------------------------------------------------------------------------------------

0042.68c6.4870  0042.68a0.d248  ap3800i-r3sw2-te-1-0-39-dev 192.168.41.49    Joined      NA                    NA

04eb.409f.5480  04eb.409e.1dc4  9130I-r3-sw2-1_0_40         192.168.41.43    Joined      NA                    NA

0c75.bdb5.7e80  0c75.bdb6.28c0  9130E-r3-sw2-g1012          192.168.41.48    Joined      NA                    NA

0042.68c6.4870  687d.b45c.1398  ap9136-4                    192.168.41.44    Joined      Run                   Heart beat timer expiry

687d.b45e.f240  687d.b45c.1448  ap9136-2                    192.168.41.47    Joined      Run                   Max Retransmission to AP

687d.b45e.f7b0  687d.b45c.14bc  ap9136-1                    192.168.41.46    Joined      NA                    NA

687d.b45f.1160  687d.b45c.16e0  ap9136-3                    192.168.41.45    Joined      Run                   Wtp reset config cmd sent
```

Debugging AP Issues

```
9800cl-1#show wireless stats ap mac-address 0042.68c6.4870   join detailed

Discovery phase statistics

..

Last AP message decryption failure details

  Reason for last message decryption failure              : NA

AP reported disconnect detail

  Disconnect reason from AP                               : Max retransmission reached

AP reported reboot detail

  Reboot reason from AP                                   : Reboot cmd from AP console

Last AP disconnect details

  Last Disconnect Phase                                    : NA

  Last Disconnect Reason                                   : NA

  Last Disconnect Time                                    : NA

  Current Join Status                                     : Joined
```

Debugging AP Issues

- Collect logs
  - Radio mac: general
  - Ethernet mac: discovery/dtls

```
show logging profile wireless filter mac 687d.b45c.16e0

2023/06/07 19:27:53.753618033 {wncmgrd_R0-0}{1}: [capwapac-discovery] [15193]: (note): MAC:
687d.b45f.1160  Public IP learnt is FALSE, public IP discovery is FALSE, private IP discovery is TRUE.

2023/06/07 19:27:53.753751387 {wncmgrd_R0-0}{1}: [capwapac-discovery] [15193]: (note): MAC:
687d.b45f.1160  IP:192.168.41.246[5256], Discovery Response sent

2023/06/07 19:27:53.937692128 {wncmgrd_R0-0}{1}: [capwapac-discovery] [15193]: (note): MAC:
687d.b45f.1160  Public IP learnt is FALSE, public IP discovery is FALSE, private IP discovery is TRUE.

2023/06/07 19:27:53.937843498 {wncmgrd_R0-0}{1}: [capwapac-discovery] [15193]: (note): MAC:
687d.b45f.1160  IP:192.168.41.246[5256], Discovery Response sent
```

Debugging AP Side

- Check Logs first!

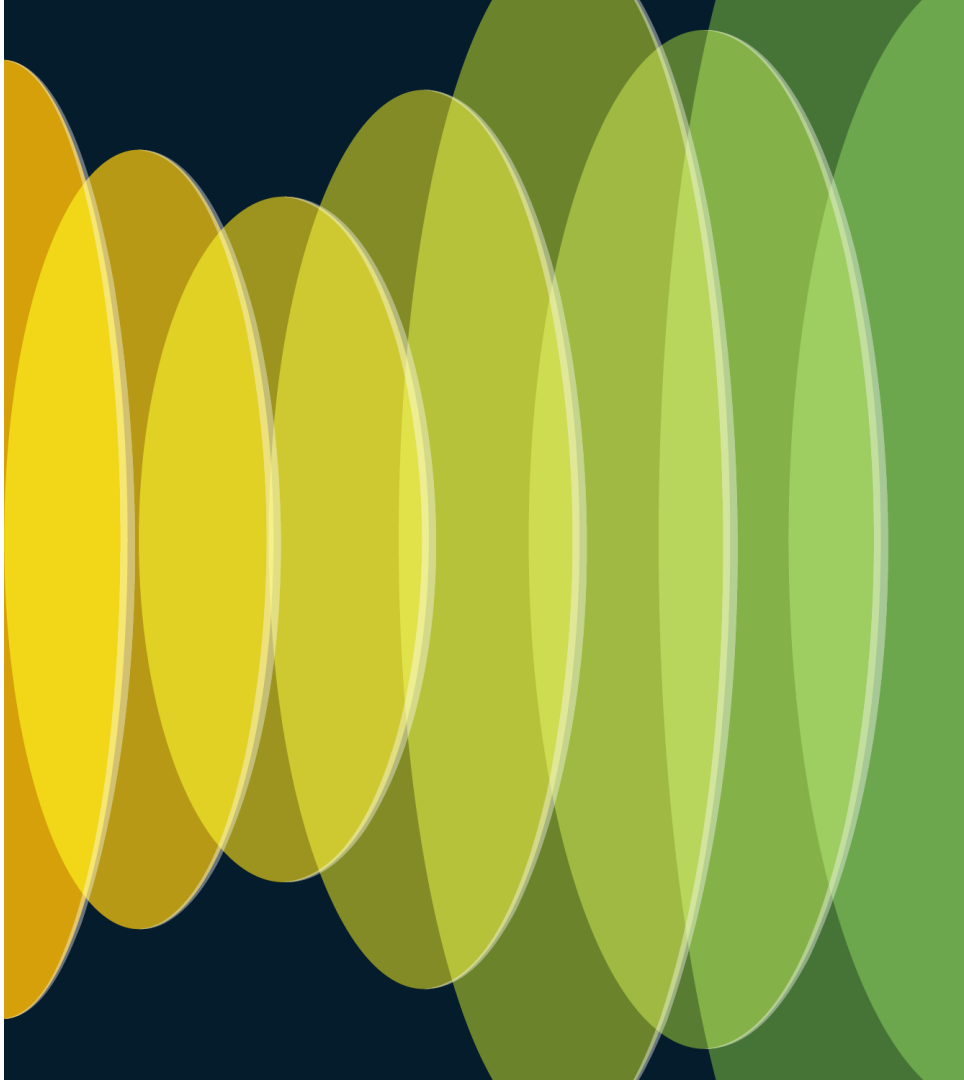
```
ap9136-3#sho log

Console logging : Level - notification, Status - enabled

Syslog logging  : Level - information, Status - active, IP - 255.255.255.255

Syncing syslogs to flash every 600 seconds.

System logging :

May 27 04:01:48 kernel: [*05/27/2023 04:01:48.5450] Re-Tx Count=1, Max Re-Tx Value=5, SendSeqNum=238,
NumofPendingMsgs=2

May 27 04:01:48 kernel: [*05/27/2023 04:01:48.5450]

May 27 11:59:54 kernel: [*05/27/2023 11:59:54.6813] Re-Tx Count=1, Max Re-Tx Value=5, SendSeqNum=243,
NumofPendingMsgs=2
```

Debugging AP Side

- CAPWAP Client debug as next step

```
ap9136-3#deb cap client error

ap9136-3#deb cap client events

[*06/07/2023 17:41:39.7436] CAPWAP State: Run

[*06/07/2023 17:41:39.7460] CAPWAP moved to RUN state stopping post join timer

[*06/07/2023 17:41:39.7472] CAPWAP IP nexthopmac F872.EAB7.3A40

[*06/07/2023 17:41:39.7668] CAPWAP data tunnel ADD to forwarding SUCCEEDED

[*06/07/2023 17:41:39.8051] AP has joined controller 9800cl-1

[*06/07/2023 17:41:39.8056] AP in local mode config starting timer

[*06/07/2023 17:41:39.8066] Change State Event Response from 192.168.40.10

[*06/07/2023 17:41:39.8070] IOT device ttyiot0 not found

[*06/07/2023 17:41:39.8286] Change State Event Response from 192.168.40.10
```

Other debugging points



Unconditional debugging

1. Enable **set platform software trace <rrm-mgrd | nginx | nmspd> chassis active R0 all debug**
2. Reproduce the issue
3. Collect **show logging process <rrm-mgrd | nginx | nmspd> to-file <FILENAME.txt>**
4. View with **more bootflash:FILENAME.txt**
5. Export with **copy bootflash:FILENAME.txt {tftp| ftp|https|scp }**
6. Disable traces with **undebug all** OR **set platform software trace <> chassis active R0 all notice**

Client Delete Reasons

- Tracking “all” client removal events, good and bad
- Around 320 delete points, both form controller and AP
- Covers:
  - Normal (session timeout/idle timeout)
  - Errors/Defects (i.e. wrong bits in M2)
  - “It depends” (i.e. Key timeout)

```
9800-cl#sh wireless stats client delete reasons

Total client delete reasons

---------------------------

Controller deletes

---------------------------

Datapath plumb                                          : 0

WPA key exchange timeout                                : 107

802.11w MAX SA queries reached                          : 0
```

Client Delete Reasons

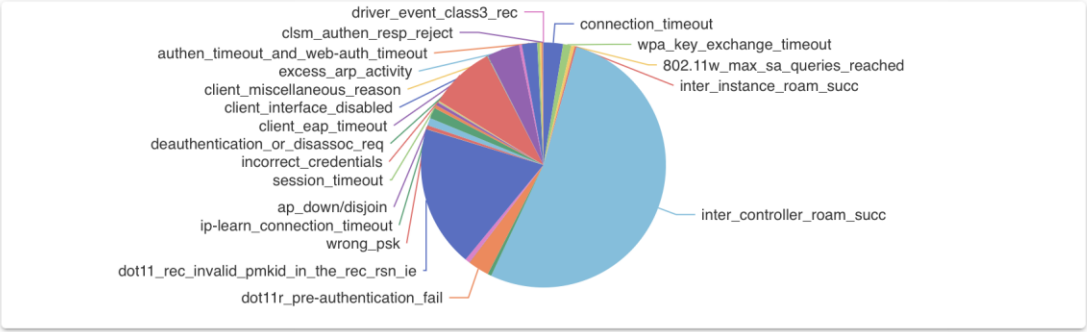
Wireless Config Analyzer Express

WCAE
GUI: 0.7, Engine:0.31

Welcome to WCAE | File: WLC7 MeetingV(10.130.240.17)--20-46-25.log | Feedback

- Summary
- Checks
- Access Points
- Controller
- Site Tags
- WLANs Summary
- AP RF View
- RF Profiles
- Channel View
- RF Stats
- RF Health
- Rogue Report
- Clients
  - Types
  - Delete Reasons
- Export
- WCAE Logs

Client Delete Reasons



Delete Reason	Count	Log Signature	Level
Connection Timeout	246	CO_CLIENT_DELETE_REASON_CONNECT_TIMEOUT	May need validation
Wpa Key Exchange Timeout	103	CO_CLIENT_DELETE_REASON_KEY_XCHNG_TIMEOUT	May happen during Normal Or
802.11w Max Sa Queries Reached	45	CO_CLIENT_DELETE_REASON_MAX_SAQUERIES	May happen during Normal Or
Inter Instance Roam Success	23	CO_CLIENT_DELETE_REASON_INTER_WNCD_ROAM_SUCCESS	May happen during Normal Or
Inter Controller Roam Success	5034	CO_CLIENT_DELETE_REASON_INTER_CTRL_ROAM_SUCCESS	May happen during Normal Or
Due To Mobility Fail(ed/ures)	47	CO_CLIENT_DELETE_REASON_MOBILITY_FAILURE	May happen during Normal Or
Dot11r Pre-authentication Fail(ed/ures)	269	CO_CLIENT_DELETE_REASON_FT_AUTH_RESPONSE	May happen during Normal Or
Sae Authentication Fail(ed/ures)	6	CO_CLIENT_DELETE_REASON_SAE_AUTH_FAILURE	May need validation

Wireless Detector

- Pull individual failures with:

```
show logging profile wireless start last X min filter mac 1111.2222.333
```

- Use Wireless Detector tool for general assessment

Wireless Detector v0.1

General Information

Total Clients:	15
Clients deleted by errors:	1
Clients deleted by warnings:	5
Clients deleted by info/normal:	3
Clients deleted by unknown reason:	5
Timestamp:	2023_Apr_18_14_58
Period collected:	1 day
Maximum Clients to display	10

Client delete events per type:

Error Delete reasons Found:

Reason code	Count
CO_CLIENT_DELETE_REASON_DOT11_DENIED_RATES	1

Warning Delete reasons Found:

Reason code	Count
CO_CLIENT_DELETE_REASON_KEY_XCHNG_TIMEOUT	1
CO_CLIENT_DELETE_REASON_MN_AP_DRIVER_EVENT_CLASS3_RECV	4

Archive Bundle

17.12
per day

- Generates a tar file
  Combines all available logs for each process
- File can be several GB
- Binary files, must be decoded by Cisco
- Post mortem Analysis

```
C9800#request platform software trace archive last <days> to-file bootflash:<archive file>
```

Summary

- Something happened yesterday:
  - Always on logging: show logging mac XXX last XX
- AP/Client debugging
  - RA trace: debug wireless mac XXX or GUI
- How AP joins/stats
- Full controller log collection

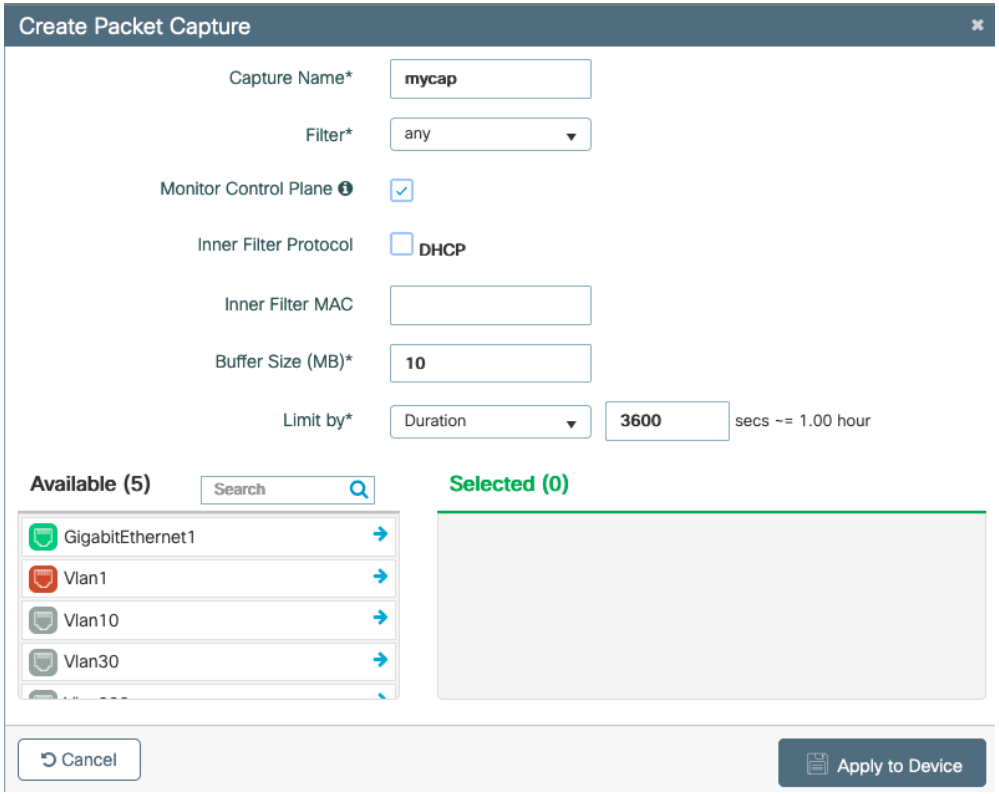
Dataplane Debugging

Embedded Packet Capture

- Get packets sent from or to and through the controller
- Export to Wireshark
- No need for switch capture
- Accessible either from GUI or CLI

Embedded Packet Capture

- Web interface to the existing EPC CLI “monitor capture …”
- One click start/stop/download
- Physical and VLAN interfaces can be selected



Embedded Packet Capture (EPC) CLI

```
monitor capture <CAPTURE_NAME> interface <> both
monitor capture <CAPTURE_NAME> control-plane both (optional)
monitor capture <CAPTURE_NAME> match any
monitor capture <CAPTURE_NAME> inner mac <CLIENT_MAC> | access-list <ACL>
monitor capture <CAPTURE_NAME> buffer size 100 circular
monitor capture <CAPTURE_NAME> limit pps 1000000
monitor capture <CAPTURE_NAME> start
monitor capture <CAPTURE_NAME> stop
monitor capture <CAPTURE_NAME> export bootflash:<CAPTURE_NAME>.pcap
```

Embedded Packet Capture

New in 17.12

- In 17.12, EPC allows to capture on a circular buffer

```
C9800#monitor capture <name> buffer file <2-5> <fsize 1-500Mb>
[circular]
```

Data Plane Statistics – Global Wireless Drops

show platform hardware chassis active qfp statistics drop all | inc Global|Wls

```
Global Drop Stats                    Packets                 Octets
PuntGlobalPolicerDrops                     0                      0
SdwanGlobalDrop                            0                      0
WlsCapwapError                       1471733              327309563
WlsCapwapFragmentationErr                  0                      0
WlsCapwapNoUidb                            0                      0
WlsCapwapReassAllocErr                     0                      0
WlsCapwapReassFragConsume          242814618            37954342616
WlsCapwapReassFragDrop                     0                      0
WlsClientError                     212513426            62965772923
WlsClientFNFV9Err                          0                      0
WlsClientFNFV9Report                       0                      0
WlsDtlsProcessingError                     0                      0
```

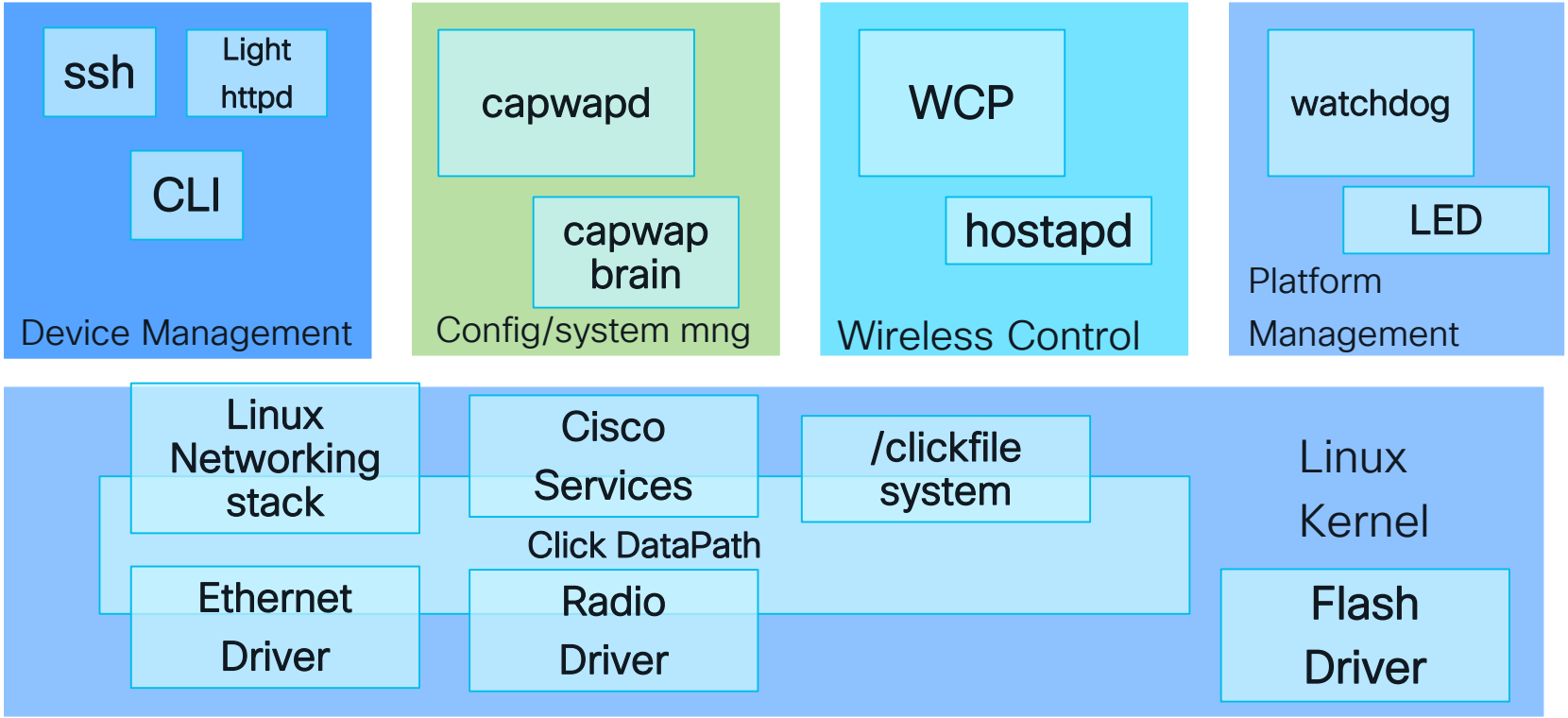
Customer problem example 4

- RA trace of the client
- PCAP on the WLC, filtered on the client MAC

Access Point Control Plane

Catalyst APs

- Simplified View



Troubleshooting on the AP side

For Wave 2 and Wifi 6/6e APs

- AP console output/ Syslogs are stored in the flash even after reboot
- **Debug client <mac>** : macro for control-plane capture. Can be exported to .pcap or export in hex
- 17.3+: you can export an AP support bundle to the WLC
- ACL and counters: **show client access-lists**
- Much more in "**Troubleshoot COS APs**"

AP Serviceability

APs have various Flash Directories to view syslog, crash and core dumps

```
ap9136-3#show flash syslogs
Directory of /storage/syslogs/
total 1848K
-rw-r--r--    1 root     root         36722 Nov 29  2022 19
-rw-r--r--    1 root     root         40916 Nov 29  2022 19.0
ap9136-3#show flash cores
Directory of /storage/cores/
total 13128K
-rw-rw-rw-    1 root     root       1974149 Jan 12 15:02 ap9136-3__27149-core-wcpd.17.9.2.52.2023-01-12.tgz
ap9136-3#show flash crash
No AP crashfile found
```

Troubleshooting Clients on the AP side

AP client trace

```
AP0CD0.F894.46E4#show ap client-trace events mac CLIENT_MAC
[*04/06/2022 10:11:54.287675] [AP] [CLIENT_MAC] <apr1v1> [U:W] DOT11_AUTHENTICATION : (.)
[*04/06/2022 10:11:54.288144] [AP] [CLIENT_MAC] <apr1v0> [D:W] DOT11_AUTHENTICATION : (.)
[*04/06/2022 10:11:54.289870] [AP] [CLIENT_MAC] <apr1v0> [U:W] DOT11_ASSOC_REQUEST : (.)
[*04/06/2022 10:11:54.317341] [AP] [CLIENT_MAC] <apr1v0> [D:W] DOT11_ASSOC_RESPONSE : (.)
[*04/06/2022 10:11:54.341370] [AP] [CLIENT_MAC] <apr1v0> [D:W] EAPOL_KEY.M1 : DescType 0x02 KeyInfo 0x008b
[*04/06/2022 10:11:54.374500] [AP] [CLIENT_MAC] <apr1v0> [U:W] EAPOL_KEY.M2 : DescType 0x02 KeyInfo 0x010b
[*04/06/2022 10:11:54.377237] [AP] [CLIENT_MAC] <apr1v0> [D:W] EAPOL_KEY.M3 : DescType 0x02 KeyInfo 0x13cb
[*04/06/2022 10:11:54.390255] [AP] [CLIENT_MAC] <apr1v0> [U:W] EAPOL_KEY.M4 : DescType 0x02 KeyInfo 0x030b
[*04/06/2022 10:11:54.396855] [AP] [CLIENT_MAC] <apr1v0> [U:W] DOT11_ACTION : (.)
[*04/06/2022 10:11:54.416650] [AP] [CLIENT_MAC] <apr1v0> [D:W] DOT11_ACTION : (.)
[*04/06/2022 10:11:54.469089] [AP] [CLIENT_MAC] <apr1v0> [U:W] DOT11_AC[illegible] : (.)
[*04/06/2022 10:11:54.469157] [AP] [CLIENT_MAC] <apr1v0> [D:W] DOT11_ACTION : (.)
[*04/06/2022 10:11:57.921877] [AP] [CLIENT_MAC] <apr1v0> [U:W] DOT11_ACTION : (.)
[*04/06/2022 10:11:57.921942] [AP] [CLIENT_MAC] <apr1v0> [D:W] DOT11_ACTION : (.)
```

U = upstream (from client)
D = downstream (to client)
W - Wireless driver
E - Ethernet driver
C - Click driver

AP commands from Controller

When SSH is not possible…

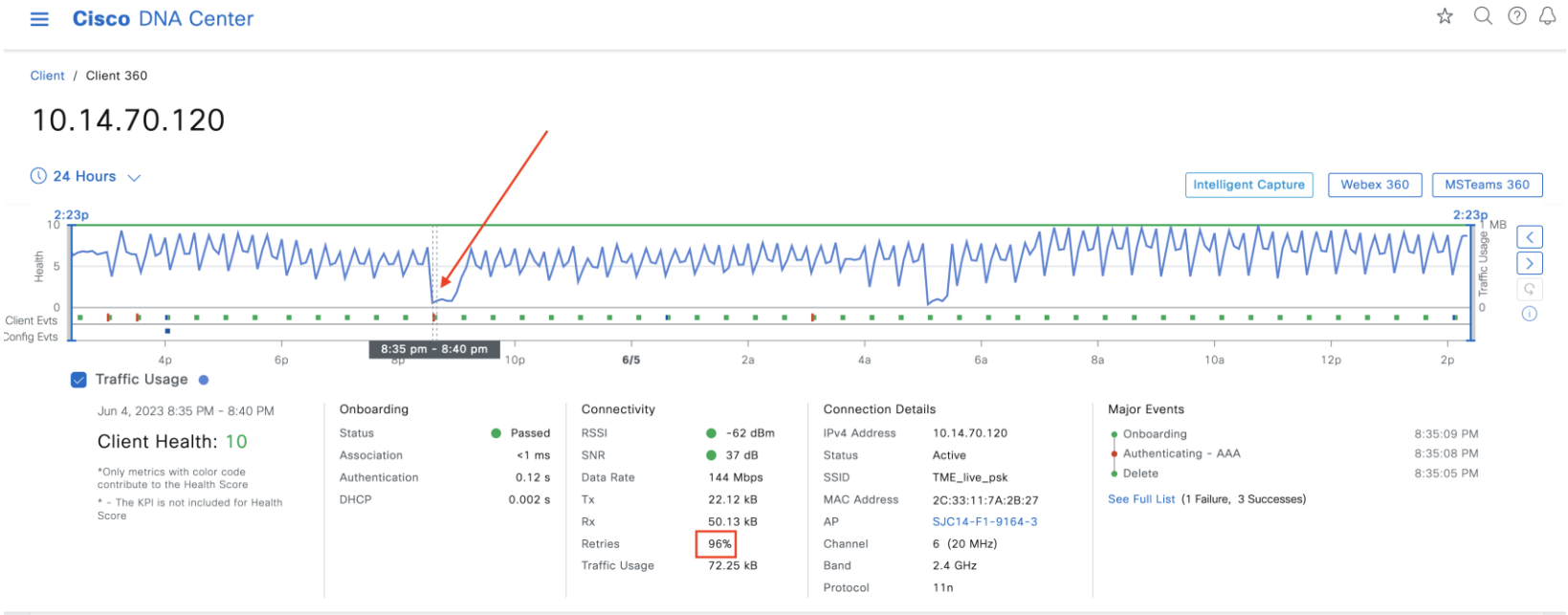
```
myc9800-CL#ap name 9120-etage remote enable
myc9800-CL#ap name 9120-etage remote command "show clock"
myc9800-CL#term mon
myc9800-CL#ap name 9120-etage remote command "show clock"
myc9800-CL#
Jan  4 18:59:25 CET: %AP_LOG-6-9120-etage : Chassis 1 *17:59:25 UTC Wed Jan  4 2023
myc9800-CL#
```

AP client debug bundle

New in 17.12

```
AP0CD0-F894-4D64#debug client-bundle start debug
22:0F:23:B1:82:EC AP0CD0-F894-4D64#show client-bundle
status Show client bundle status AP0CD0-F894-4D64#show client-
bundle status Client Bundle Status : Started
Client Bundle Starting Addresses : 22:0F:23:B1:82:EC Client
Bundle Upload Status : None
Client Bundle Upload File : None
AP0CD0-F894-4D64#debug client-bundle stop debug
22:0F:23:B1:82:EC AP0CD0-F894-4D64#debug client-bundle upload
scp admin@192.168.1.133:/bootflash 22:0F:23:B1:82:EC
```

Client 360 View

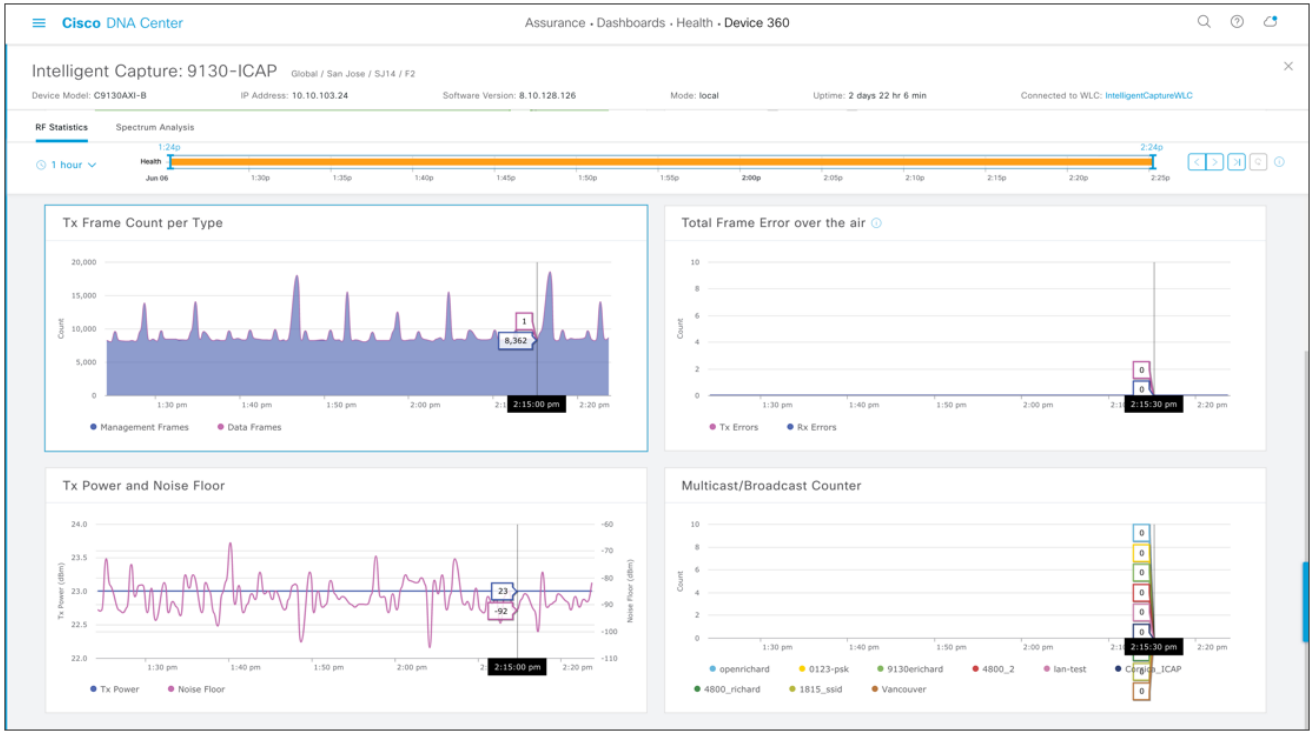


Intelligent capture

You can enable intelligent capture for a given client in the Client Health 360 dashboard

Intelligent capture

RF stats can be enabled globally or on specific APs



Customer problem example 5

Specific APs lead to bad user experience

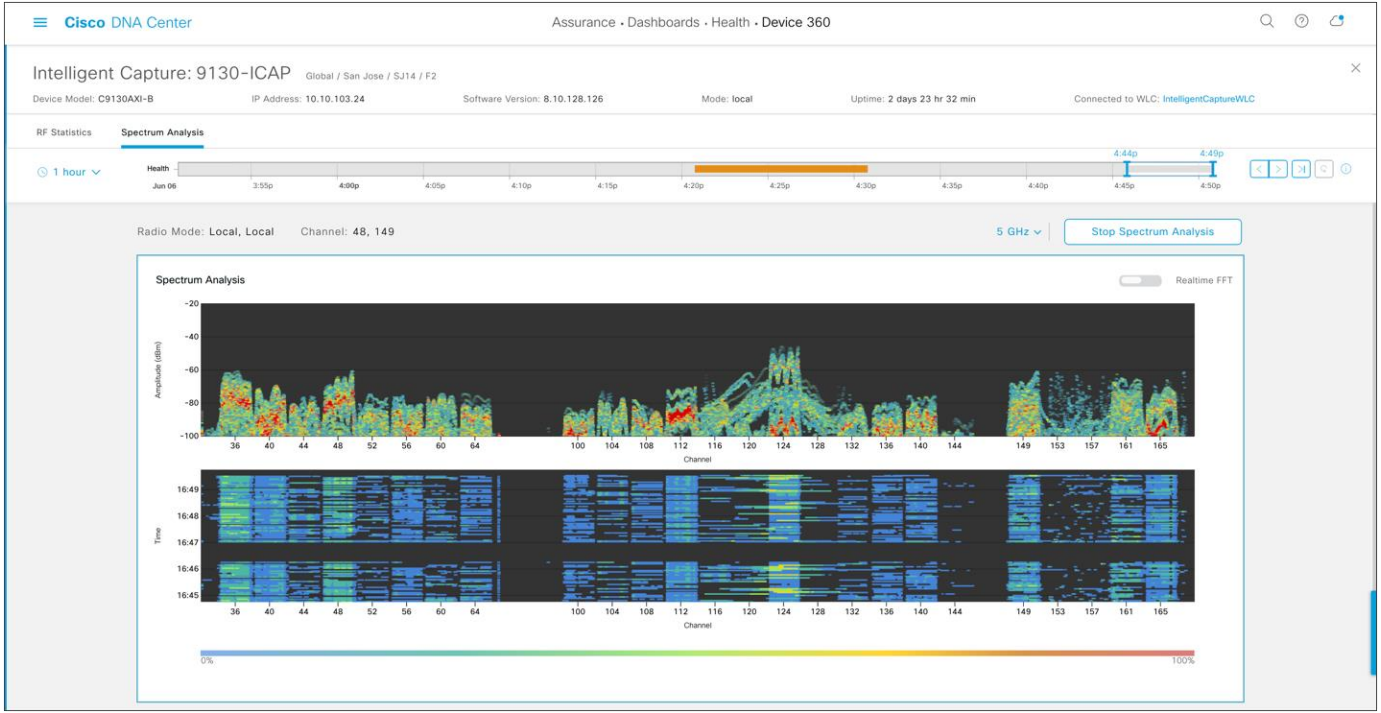
- Cisco Catalyst-C Intelligent capture (Channel utilization, drops, …)
- show commands on the APs themselves

Access Points

Dataplane Debugging

Intelligent capture

- The power of Cleanair / RF Asic / Cleanair Pro

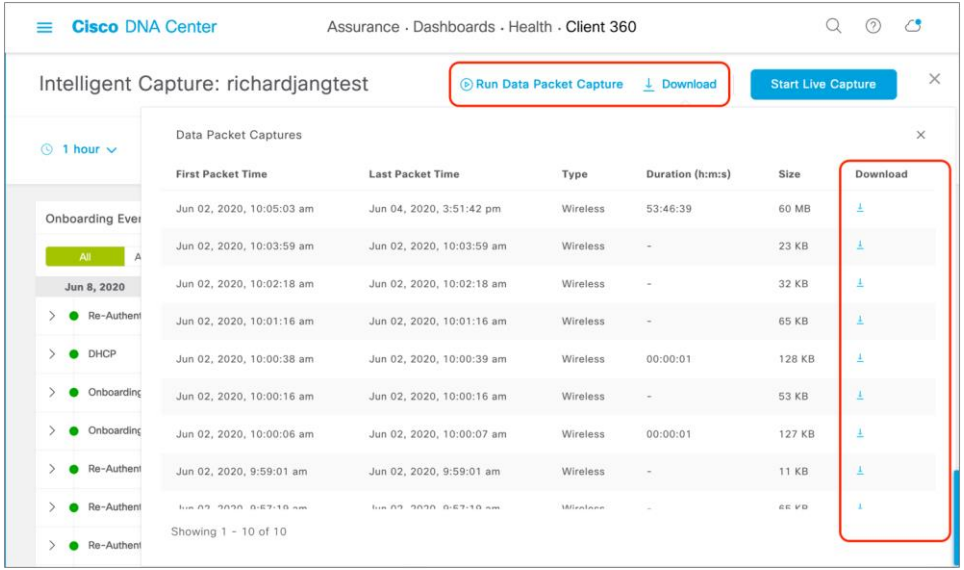


Intelligent capture

Intelligent capture page gives you an overview of events related to the client

Intelligent capture

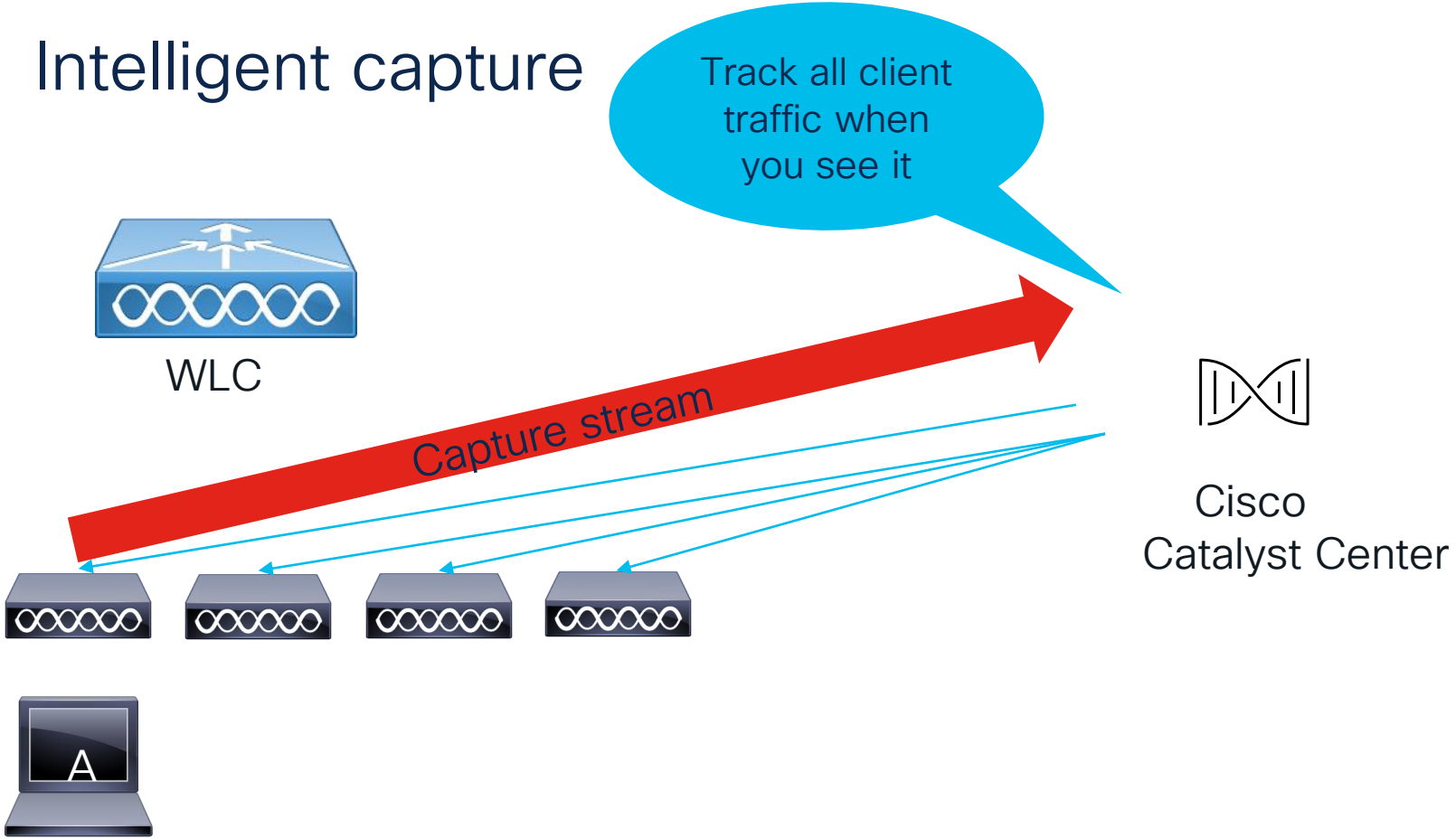
- Client intelligent capture



Data packet capture supported on 4800 , 9130, 9166

Live Capture (onboarding) on all other AP models including 9160s

Intelligent capture



Intelligent capture

Anomaly capture

Cisco DNA Center — Assurance · Dashboards · Health · Client 360

Intelligent Capture: richardjangtest — Run Data Packet Capture | Download | Live Capturing

1 hour — PCAP — Jun 08 — 11:06a – 12:06p

Onboarding Events — LIVE

All | Anomaly | Export PCAP

Jun 8, 2020	Time	Duration
KeyExchange	12:02:55 pm	3,061 ms
KeyExchange	12:02:52 pm	3,257 ms
KeyExchange	12:02:49 pm	3,242 ms
KeyExchange	12:02:45 pm	3,260 ms
KeyExchange	12:02:42 pm	3,243 ms
Client Deauthentica...	12:02:45 pm	
KeyExchange	12:02:45 pm	
Authentication Done	12:02:42 pm	
Authentication Start	12:02:42 pm	
Association Done	12:02:42 pm	
Association Start	12:02:42 pm	
Re-Authentication	12:02:09 pm	98 ms
Re-Authentication	11:56:43 am	65 ms

KeyExchange
Jun 8, 2020, 12:02:45.546 pm

Client richardjangtest failed to connect due to 4-way handshake timeout

Auto Packet Analyzer — Show: IPv4 and IPv6 — Download Packets

802.11 Open Auth, Association, 802.1x/EAP, DHCP, Data, 802.11k/11v, Associated AP

Interpacket Gap (µs): 100,000,000 / 100,000 / 100 / 0.1

RSSI (dBm): 50 / 0 / -50 / -100

Packets

PACKET — From Client — From AP — Interpacket Gap — RSSI (dBm)

ASSOCIATED AP — 9130-ICAP

Last Session — Selected Session

WLC top issues

WLC High CPU

Control Plane:

- Client onboarding and authentication
- RRM
- Web authentication interception
- Rogue detection
- mDNS
- AP CAPWAP state
- 802.11k/v

Data Plane:

- AP and client data traffic
- ACLs
- AVC
- QoS

WLC High CPU

- “High CPU” can happen on any single CPU core if a single process is causing it.
- CPU utilization within IOSd :

```
#show process cpu sorted
CPU utilization for five seconds: 0%/0%; one minute: 0%; five minutes: 0%
 PID Runtime(ms)     Invoked      uSecs   5Sec   1Min   5Min TTY Process
 698      288459     7731847         37  0.07%  0.01%  0.00%   0 NTP
 309      437356     7723454         56  0.07%  0.00%  0.00%   0 nbar-graph-sende
 236     1150250   240761597          4  0.07%  0.02%  0.00%   0 IP ARP Retry Age
 682      854081    38604249         22  0.07%  0.01%  0.00%   0 ONEP Network Ele
 495      123974     7981160         15  0.07%  0.00%  0.00%   0 Crypto IKEv2
```

WLC High CPU

- The real command

```
9800-l#sh processes cpu platform sorted

CPU utilization for five seconds: 17%, one minute: 16%, five minutes: 17%
Core 0: CPU utilization for five seconds: 12%, one minute: 11%, five minutes: 17%
Core 1: CPU utilization for five seconds: 14%, one minute: 13%, five minutes: 16%
Core 2: CPU utilization for five seconds: 16%, one minute: 10%, five minutes: 28%
Core 3: CPU utilization for five seconds: 10%, one minute: 11%, five minutes: 23%
Core 4: CPU utilization for five seconds: 15%, one minute: 14%, five minutes: 17%
Core 5: CPU utilization for five seconds: 13%, one minute: 27%, five minutes: 21%
Core 6: CPU utilization for five seconds:  5%, one minute: 74%, five minutes: 39%
..
   Pid    PPid    5Sec    1Min    5Min  Status        Size  Name
-------------------------------------------------------------------------------
  4046    3974     89%     60%     57%  S          2435268  linux_iosd-imag
 27483   27476     36%     36%     36%  S         10557400  pubd
 19435   19422     36%     94%     95%  S           130092  smand
 20672   20656      5%      6%      6%  S           564508  odm_0
 17955   17947      5%      4%      4%  S           895584  wncd_1
```

WLC High CPU

- Exception for 9800-CL and 9800-L: dedicated CPU cores DP

```
#show process cpu platform sorted
CPU utilization for five seconds:  8%, one minute:  5%, five minutes:  5%
Core 0: CPU utilization for five seconds:  1%, one minute:  1%, five minutes:  1%
Core 1: CPU utilization for five seconds:  2%, one minute:  2%, five minutes:  2%
Core 2: CPU utilization for five seconds:  1%, one minute:  1%, five minutes:  2%
Core 3: CPU utilization for five seconds:  6%, one minute: 17%, five minutes: 17%
   Pid    PPid    5Sec    1Min    5Min  Status        Size  Name
-------------------------------------------------------------------------------
 22225   21691     29%     29%     29%  S           248940  ucode_pkt_PPE0
 29758    8871      1%      1%      1%  S          1140752  linux_iosd-imag
 21672   21163      1%      1%      1%  S           255992  fman_fp_image
 29725   29544      0%      0%      0%  S             9672  pttcd
 29653   29388      0%      0%      0%  S           206924  pubd
```

WLC High CPU

- Checking DP load

```
#show platform  hardware chassis active qfp datapath utilization summ
  CPP 0:                    5 secs        1 min        5 min       60 min
Input:     Total (pps)           7            5            5            5
                 (bps)        4224        12584        11216        10872
Output:    Total (pps)           5            4            3            3
                 (bps)       20712        11056        10976        10856
Processing: Load (pct)           0            0            0            0
```

WLC High CPU

CPU Utilization | Wireless Interface | Management Summary | Redundancy

IOS Daemon CPU Usage(Top 5 Process)

IOSD CPU Dump

Process	5Sec	1Min	5Min
HTTP CORE	0.00%	1.82%	0.83%
SEP_webui_wsma_h	0.00%	0.45%	0.18%
Check heaps	0.00%	0.03%	0.05%
SASRcvWQWrk2	0.00%	0.08%	0.04%
Crimson config p	0.07%	0.03%	0.02%

Datapath Utilization

Datapath Utilization Dump

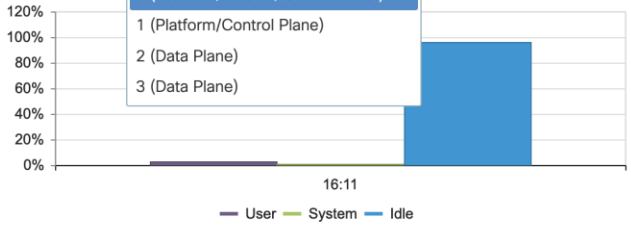
Data Plane	Core 2	Core 3
PP (%)	0.43	0.00
RX (%)	0.00	0.03
TM (%)	0.00	1.40
IDLE (%)	99.57	98.57

CPU trend
(CPU (%) vs Device Time)

Slot: Active CPU: 0 (Platform/Control/Service Plane)

Control Plane Data

- 0 (Platform/Control/Service Plane)
- 1 (Platform/Control Plane)
- 2 (Data Plane)
- 3 (Data Plane)



WLC High CPU

What to do in case a specific process like WNCD is on high CPU ?

Check the balancing of APs across WNCD processes

```
#show wireless loadbalance tag affinity wncd 0
Tag                          Tag type                  No of AP's Joined
-------------------------------------------------------
Site1                   SITE TAG                          200
Site2                   SITE TAG                          200
```

WLC High CPU

Leverage WCAE for WNCD analysis

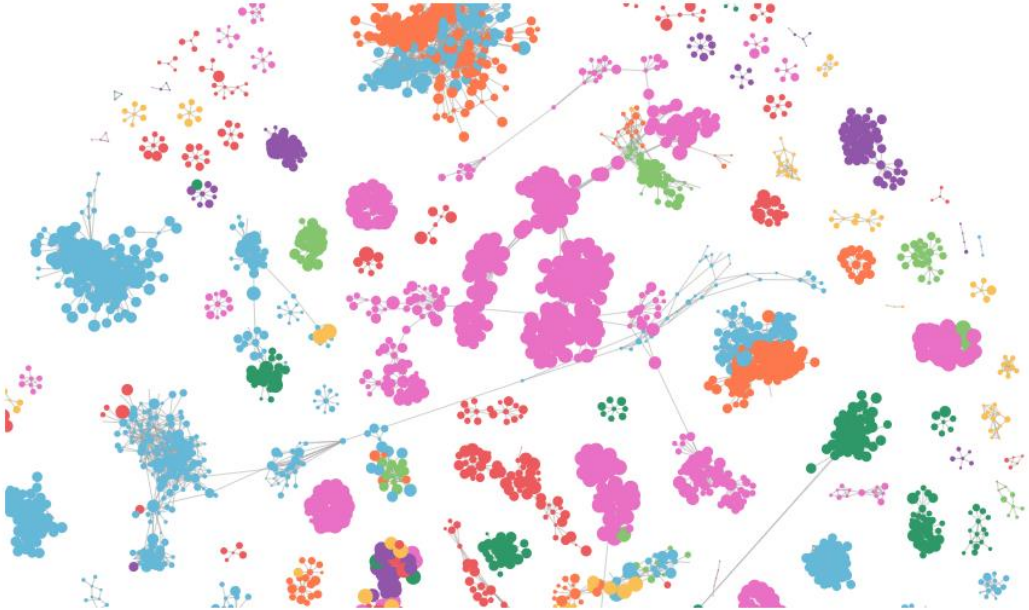
Back to Content Tab

WNCD ID	Tags Count	Tags Assigned	AP Count	Client Count	CPU load	Percentage Aps	Percentage Clients
0	2	(Click on + sign to expand)	141	1250	22	9.00	7.28
1	1	(Click on + sign to expand)	227	2497	43	14.50	14.54
2	1	(Click on + sign to expand)	227	2035	34	14.50	11.85
3	1	(Click on + sign to expand)	226	3025	51	14.43	17.62
4	1	(Click on + sign to expand)	226	2092	43	14.43	12.18
5	1	(Click on + sign to expand)	226	2639	47	14.43	15.37
6	2	(Click on + sign to expand)	154	2275	34	9.83	13.25
7	2	(Click on + sign to expand)	139	1356	22	8.88	7.90
		Totals:	1566	17169			

WLC High CPU

RF View - Band: 5 GHz

AP Classified per : WNCD. NDP RSSI: -85



Radio Count: 3498
Link Count: 14740

WNCD	AP Count	Client Count
wncd0	278	1262
wncd1	700	1843
wncd2	119	1800
wncd3	194	2210
wncd4	682	11152
wncd5	241	461
wncd6	270	1132
wncd7	481	1576

☐ Show Legend | View Type: WNCD | Link RSSI Filter: -85

Control Plane Drops

sh platform software punt-policer {drops}

Punt Cause	Description	Config Rate(pps) Normal	Config Rate(pps) High	Conform Packets Normal	Conform Packets High	Dropped Packets Normal	Dropped Packets High	Config Burst(pkts) Normal	Config Burst(pkts) High
2	IPv4 Options	874	655	0	0	0	0	874	655
3	Layer2 control and legacy	8738	2185	947389	0	0	0	8738	2185
4	PPP Control	437	1000	0	0	0	0	437	1000
5	CLNS IS-IS Control	8738	2185	0	0	0	0	8738	2185
6	HDLC keepalives	437	1000	0	0	0	0	437	1000
7	ARP request or response	437	1000	0	1702688	0	0	437	1000
8	Reverse ARP request or repso	437	1000	0	0	0	0	437	1000
9	Frame-relay LMI Control	437	1000	0	0	0	0	437	1000

Data Plane Statistics – Traffic sent to CPU

show platform hardware chassis active qfp feature wireless capwap datapath statistics drop all

```
Drop Cause                                    Packets                Octets
==============================================================================
Wls Capwap unsupported link type Error              0                     0
Wls Capwap invalid tunnel Error                     0                     0
Wls Capwap input config missing Error               0                     0
Wls Capwap invalid TPID Error                       0                     0
Wls Capwap ingress parsing Error                    0                     0
Wls Capwap invalid FC subtype Error                 0                     0
Wls Capwap SNAP Invalid HLEN Error                  0                     0
Wls Capwap Invalid SNAP Error                 1461925             323436123
Wls Capwap ipv4 tunnel not found Error          10943               4017497
```

Data Plane Statistics – Traffic sent to CPU

show platform hardware chassis active qfp feature wireless wlclient datapath statistics drop all

```
9800-cl#show platform hardware chassis active qfp feature wireless wlclient datapath statistics drop all

Drop Cause                                                                  Packets               Octets
============================================================ ===================== =====================
Wls Client V6 Max Address drop                                                    0                    0
Wls Client IPGlean Counter Index Error                                            0                    0
Wls Client IPGlean Counter Unchanged Error                                        0                    0
Wls Client IPGlean alloc no memory Error                                          0                    0
Wls Client IPGlean bucket max limit drop                                          0                    0
Wls Client iplearn l2 punt data packet skip                                       0                    0
Wls Client iplearn v4 punt data packet skip                                       5                 1373
Wls Client iplearn v6 punt data packet skip                                       5                  950
Wls Client input subblock missing error                                           0                    0
Wls vlan bridging mcast/bcast DMAC i/p SB miss error                              0                    0
Wls vlan bridging src SVI i/p SB miss error                                       0                    0
```

WLC High CPU

Other possible causes for high WNCD CPU usage :

- Very high probing activity
- ARP storms (controlled now with auto-exclusion)
- Huge amount of cleanair interferers
- Heavy mDNS usage

HA hot issues

WLC HA related concerns

```
Katar2#show redundancy switchover history
Index  Previous  Current  Switchover              Switchover
       active    active   reason                  time
-----  --------  -------  ----------              ----------
   8       2        1     active unit removed     14:06:05 CEST Wed Mar 29 2023
   9       1        2     active unit removed     14:25:29 CEST Wed Mar 29 2023
   10      2        1     Active RMI port down    11:00:22 CEST Thu Mar 30 2023
   11      1        2     active unit removed     11:08:53 CEST Thu Mar 30 2023
   12      2        1     active unit removed     11:18:47 CEST Thu Mar 30 2023
   13      1        2     active unit removed     11:34:32 CEST Thu Mar 30 2023
   14      2        1     active unit removed     11:51:34 CEST Thu Mar 30 2023
   15      1        2     user forced             12:01:51 CEST Thu Mar 30 2023
   16      2        1     active unit removed     12:08:46 CEST Thu Mar 30 2023
   17      1        2     user forced             09:40:40 CEST Tue May 9 2023
```

WLC HA related concerns

Unexpected failovers:

- Check WLC reload reason, system reports and crash files
- For 9800-CL: VMWare features
- Aggressive failover timers

ISSU HA Failures

First step is to check the ISSU compatibility matrix

```
#show redundancy config-sync failures historic mcl
 Mismatched Command List
------------------------
-snmp-server enable traps hsrp
```

```
#show install log
```

WLC HA useful troubleshooting commands

```
Show tech wireless redundancy
Show chassis detail
show platform software stack-mgr chassis active R0 sdp-counters
show platform software stack-mgr chassis standby R0 sdp-counters
show platform software stack-mgr chassis standby R0 peer-timeout
show logging process stack_mgr start last 30 minutes to-file
bootflash:stack_mgr_logs.txt
show logging process rif_mgr start last 30 minutes to-file
bootflash:rif_mgr_logs.txt
```

WLC HA useful testing commands

- Useful to troubleshoot RP
- Capture all traffic in port

```
test wireless redundancy packetdump start
test wireless redundancy packetdump stop
Katar2#dir
Directory of bootflash:/

25      -rw-          237568  May 10 2023 11:51:30 +02:00  haIntCaptureLo.pcap
1087409  drwx           90112  May 10 2023 11:50:59 +02:00  tracelogs

test wireless redundancy rpingp
```

AAA top issues

Intermittent RADIUS server not responding

Is it because the 9800 is not even sending RADIUS requests ?

Because it marked the RADIUS as dead ?

```
%RADIUS-4-RADIUS_DEAD: RADIUS server <ip-address>:1812,1813 is not responding.
```

- RA trace + EPC

Intermittent RADIUS server not responding

- RA trace after server is dead: not useful
- Best: RA trace for client triggering dead state
- Not easy. May need WNCD logs to debug and collect over a period of time.

Intermittent RADIUS server not responding

```
#Show aaa servers
RADIUS: id 18, priority 1, host 1.1.1.1, auth-port 1812, acct-port 1813, hostname r1
State: current UP, duration 304s, previous duration 0s Dead: total time 0s, count 0
Platform State from SMD: current UP, duration 304s, previous duration 0s SMD
 Platform Dead: total time 0s, count 0
Platform State from WNCD (1) : current UP
Platform State from WNCD (2) : current UP
Platform State from WNCD (3) : current UP
Platform State from WNCD (4) : current UP
Platform State from WNCD (5) : current UP
Platform State from WNCD (6) : current UP
Platform State from WNCD (7) : current UP
Platform State from WNCD (8) : current UP, duration 2559s, previous duration 0s Platform Dead: total time 0s,
count 0
```

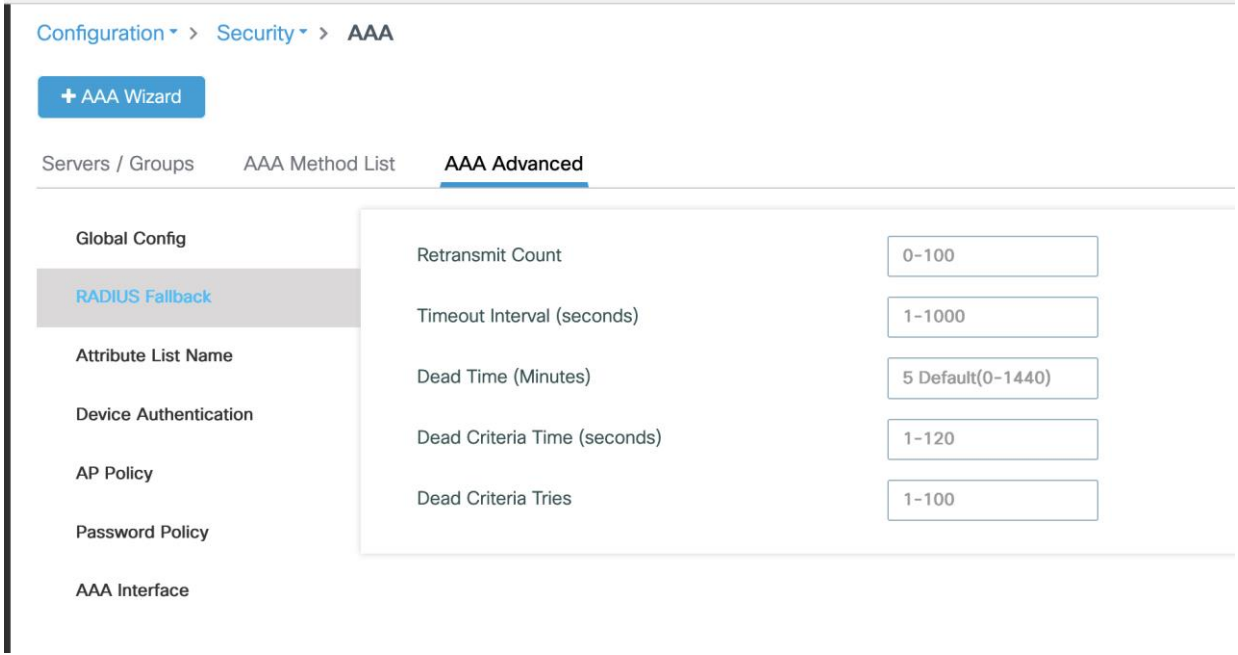
Typical causes

- RADIUS servers may ignore RADIUS requests

Authentication Summary	
Logged At:	October 18,2012 12:00:14.499 PM
RADIUS Status:	RADIUS Request dropped:
NAS Failure:	
Username:	
MAC/IP Address:	00:21:97:6C:68:E1
Network Device:	SWTHO6002279:192.168.10.66:FastEthernet0/36
Allowed Protocol:	
Identity Store:	
Authorization Profiles:	
SGA Security Group:	
Authentication Protocol :	

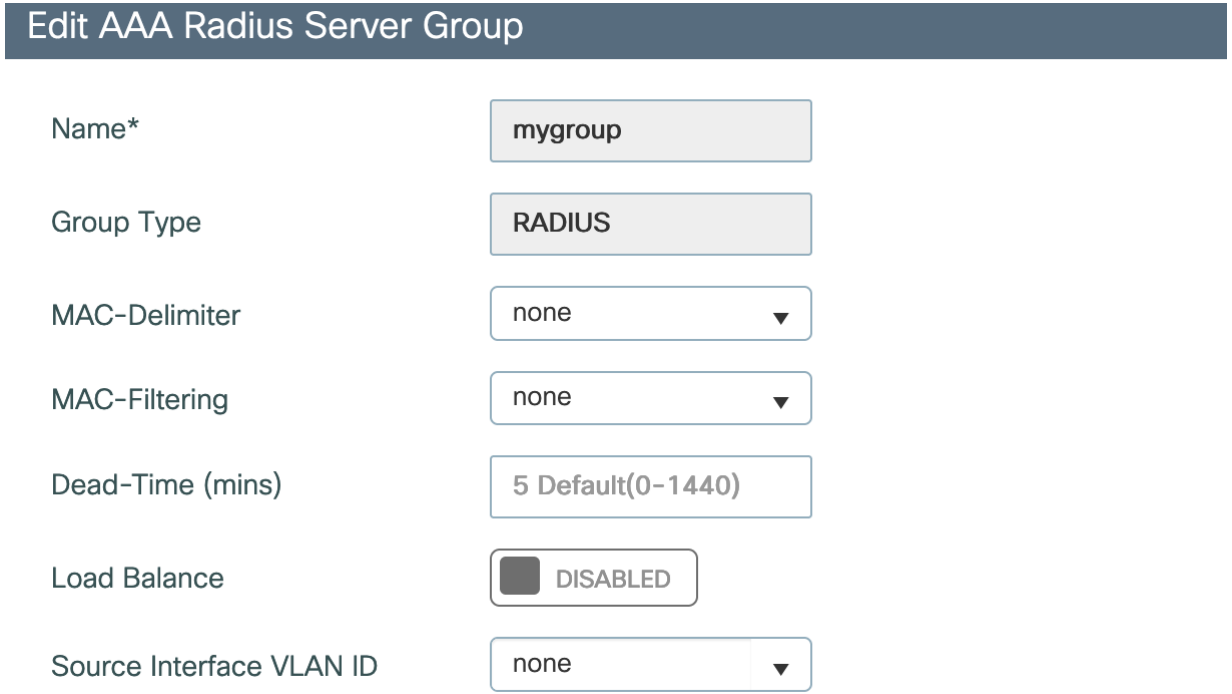
Typical causes

- Dead time not set means dead RADIUS is immediately marked back alive



Typical causes

- Dead timer can be set within AAA server groups



Throughput Issues

What is slow ?

Slow can be : few kbps, few Mbps or “just 100Mbps instead of 800”

Important: Delimited problem description

- Is everything equally slow ? Speedtest ? Local file transfer ? FTP ?
- Are all laptops affected equally ?
- Is it just browsing that’s giving a slow “feel” ?

What is slow ?

- General “wifi is slow” versus one app (Citrix)
- Per application behavior. FTP vs iPerf, TCP vs UDP
- Fragmentation impact (adjust MSS) or latency
- Isolate client types
- Isolate locations, Aps
- Get RF data
- Is client roaming?

What is slow ?

Very slow: Over the Air capture

- Frame retries vs Total
- Gaps: no AP or client TX
- Reconnections ?
- MCS data rates used
- Beacon loss

What is slow ?

“Could be better”:

- Open/WPA2-AES or better
- WMM
- Frame aggregation. Block ACKing 64 vs acking 3-4 frames
- MCS Data rate
- Spatial streams

Flash space issues

Can my WLC face free space problems ?

- Low frequency on appliances
- Tracelogs have limit in size and file count
- Automatic rotation
- IOS images, crash files, system reports can use rest of space
- C9800-CL are typically limited on flash space
- Common: Old CL on 8 GB disk (16 mandatory now)

Public Service Announcements!

Legacy Crypto Deprecation

- 17.15 kills DES, MD5, RSA<1024
- SNMPv3 may stop working if using them
- Any public key (SSH/Certs) using 1024 will get deleted
- IOS-XE has been warning since 17.9.2
- 17.12.4/17.9.6: `crypto engine compliance shield disable`

17.12 AP console now in 115.200

- Default speed is now 115.200
- Only for clear config
- Upgrades or manufacturing new will stay at 9600
- Alignment with Meraki persona
- Faster boot

AP Image Corruption

- CAPWAP download over WAN (fragmentation)
- Image may get corrupted, AP ends on boot loop

```
Verify signature failed for /bootpart/part2/ramfs_data_cisco.squashfs (File system corruption detected)

SQUASHFS error: xz decompression failed, data probably corrupt

|

Fatal error: failed to start the image. Please fall back to alternate partition... (Recovery Logic)
```

AP Recovery..

- What is Alternate-Boot enhancement?
- 17.3.8, 17.6.6, 17.9.4 & above..

Without Alt-boot

- No recovery
- Indefinite attempts to boot
- Console Recovery

With Alt-boot

- AP remote recovery
- Attempt to boot 5 times
- Boot backup image

CVE-2023-20198 Web UI Vulnerability

- Install Fixed Image
  - Now....!
- It does not impact Guest feature
- Possible Workarounds:
  - Disable HTTPs/HTTP
  - Disable all http session modules (no UI)
  - Use ACL

IOS-Aps… Gone, not Gone, here we go

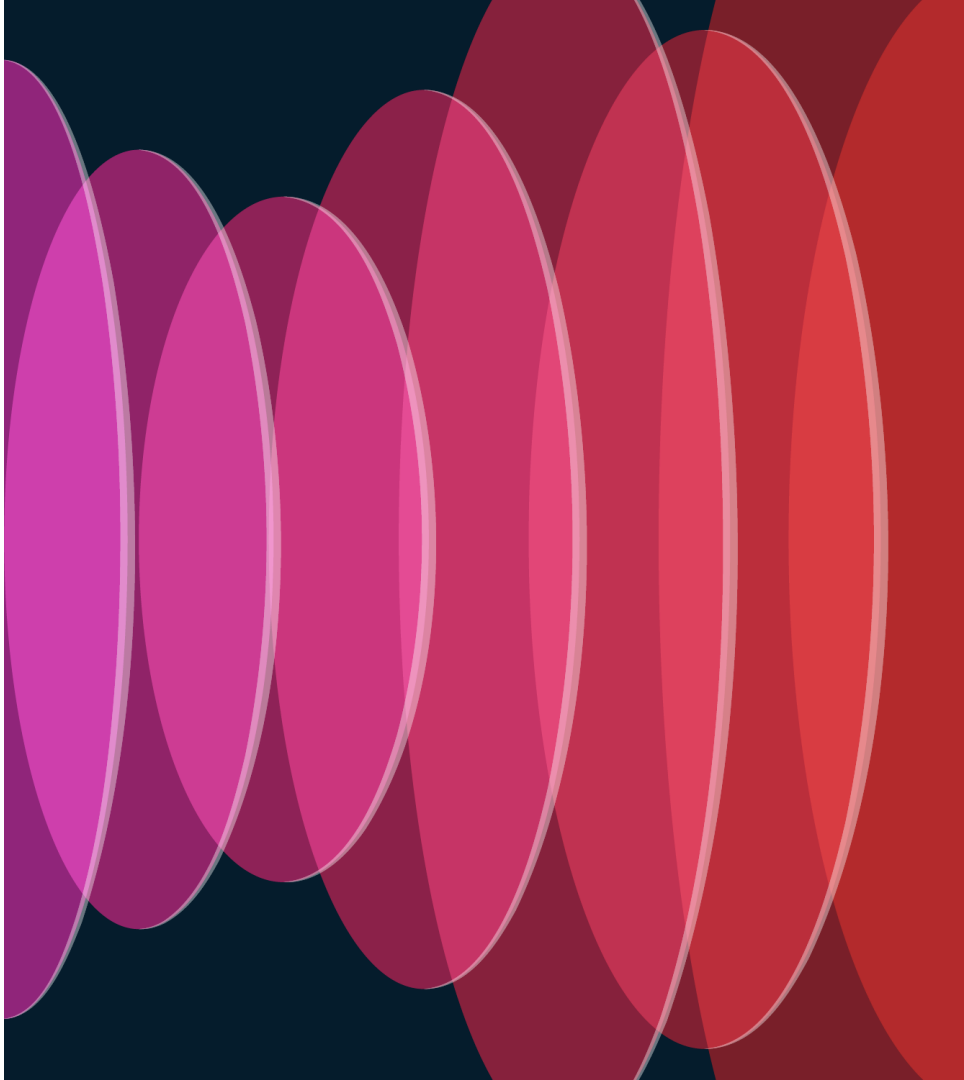
- 17.9.6, 17.12.4+: AP will be allowed to join
  - No support whatsoever
  - No further testing
- 17.13, 17.14
  - Not tested
- 17.15
  - Join rejected

Upgrading to IOS-XE 17.9 and higher

- Aps running Old code (8.10MR5 or lower)
- RMA stock
- Distributor stock

- Get interim through 8.10MR latest, or 17.3.5

Tools and References



Wireless Troubleshooting Tools

https://developer.cisco.com/docs/wireless-troubleshooting-tools/

- WCAE
- WiFi-Hawk
- WLAN Poller
- Wireless Debug Analyzer
- Guestshell scripts
- Cisco Support Assistant Extensions

Monitor 9800 KPIs

What commands to collect to monitor 9800 operations ?

https://blogs.cisco.com/networking/wireless-catalyst-9800-wlc-kpis-part-1

https://www.cisco.com/c/en/us/support/docs/wireless/catalyst-9800-series-wireless-controllers/217738-monitor-catalyst-9800-kpis-key-performa.html

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Thank you