Configure, Verify and Troubleshoot Intel Connectivity Analytics on a 9800 Series Wireless Controller

Contents

Introduction

This document describes the configuration and operation of the Intel Connectivity Analytics feature on a 9800 series wireless controller.

Background Information

As an aspect of Cisco enterprise wireless' Device Analytics feature, Intel Wi-Fi adapters can now send diagnostic information to 9800 series controllers, such as:

- Client device information, including:
  - PC manufacturer/model
  - OS version, adapter driver version

- RF environment information, including RSSI of the associated Access Point (AP), and of neighbor APs

Prerequisites

- 9800 Series Wireless Controller
- Intel Wi-Fi adapter (AC9560, AX200, AX201, AX210, or later)
- Aironet Wave 2 / Wi-Fi 6/6E/7 APs

Requirements

- 9800 must have Cisco IOS-XE® 17.6.1 or later installed
- The Intel Wi-Fi adapter must have 22.50 or later driver installed
- The client must be configured to use either the native Windows supplicant or AnyConnect NAM
    - If using NAM, see CSCwc57807for the the minimum NAM and Windows versions necessary to work with PMF

Components Used

In this lab setup:

- 9800-L-C running 17.6.3
- Lenovo X1 Carbon Gen 9 PC running Windows 11, with Intel AX201 adapter with 22.150 driver
- AP4800, C9105, C9120, C9130

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Configure

9800 CLI

1. Enable network assurance

   ```
   9800-L#configure terminal
   Enter configuration commands, one per line. End with CNTL/Z.
   9800-L(config)#network-assurance enable
   ```

2. Enable device classifier

   ```
   9800-L(config)#device classifier
   ```

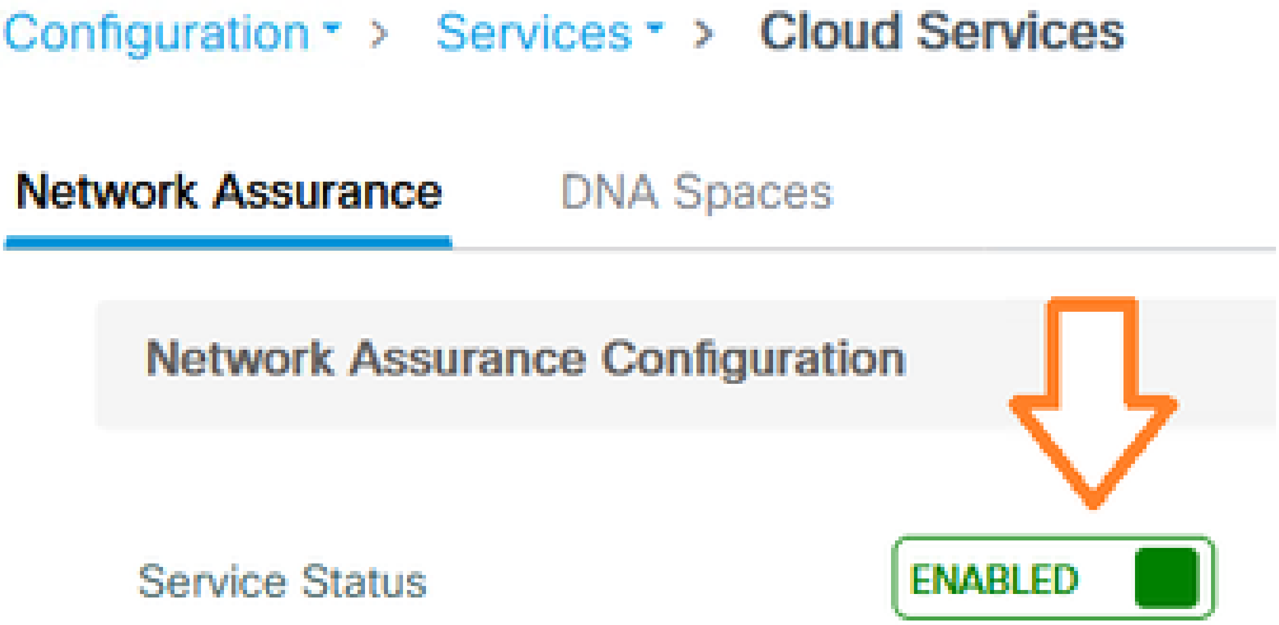
3. Enable device analytics on each WLAN. Note that "device-analytics" and "device analytics pc-analytics" are enabled by default. "device-analytics export" is optional. Also enable optional or mandatory PMF (which might impact client connectivity and/or performance.)

   ```
   9800-L(config)#wlan TUCSONLAB 1 TUCSONLAB
   9800-L(config-wlan)#shutdown
   9800-L(config-wlan)#device-analytics
   9800-L(config-wlan)#device-analytics pc-analytics
   9800-L(config-wlan)#device-analytics export     # optional
   ```

```
9800-L(config-wlan)#security pmf optional       # or "mandatory"
9800-L(config-wlan)#no shutdown
```

9800 GUI

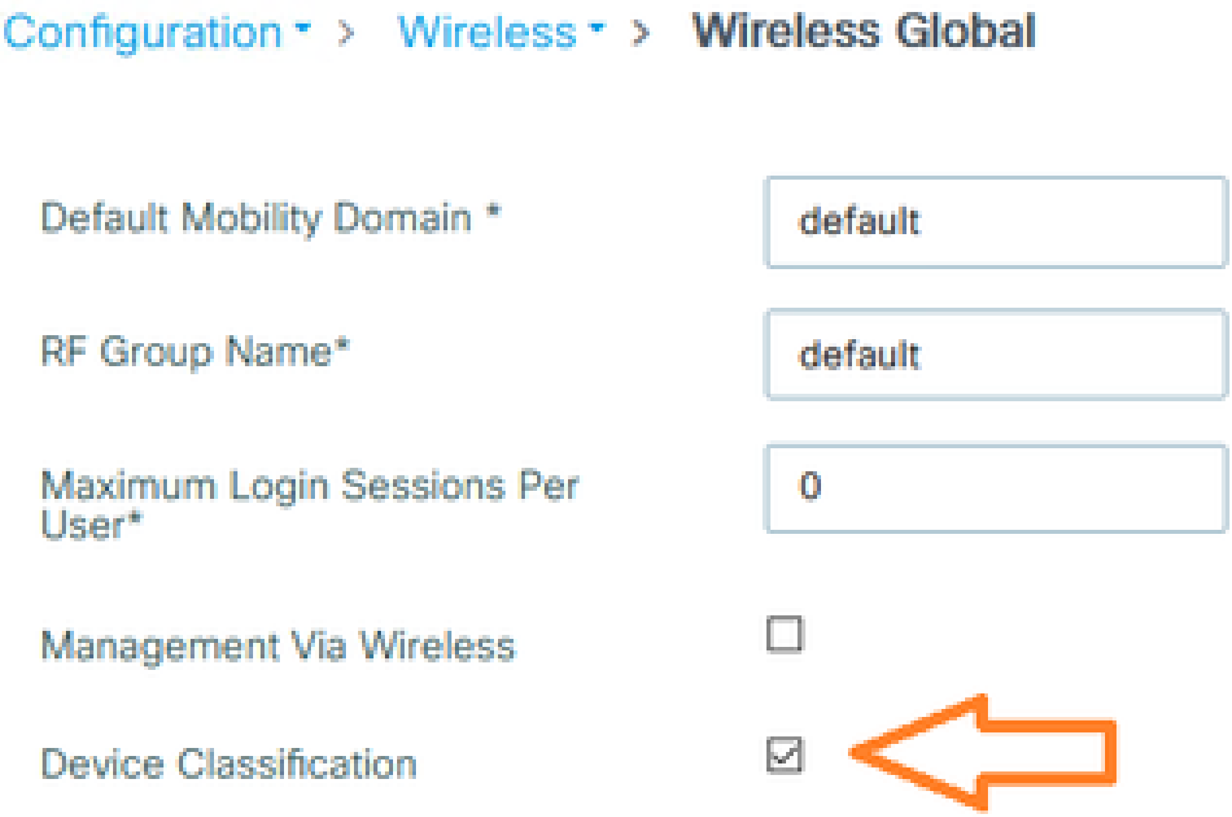
1. Enable network assurance



Configuration > Services > Cloud Services

Service Status ENABLED

2. Enable device classification



Configuration > Wireless > Wireless Global

Default Mobility Domain * default

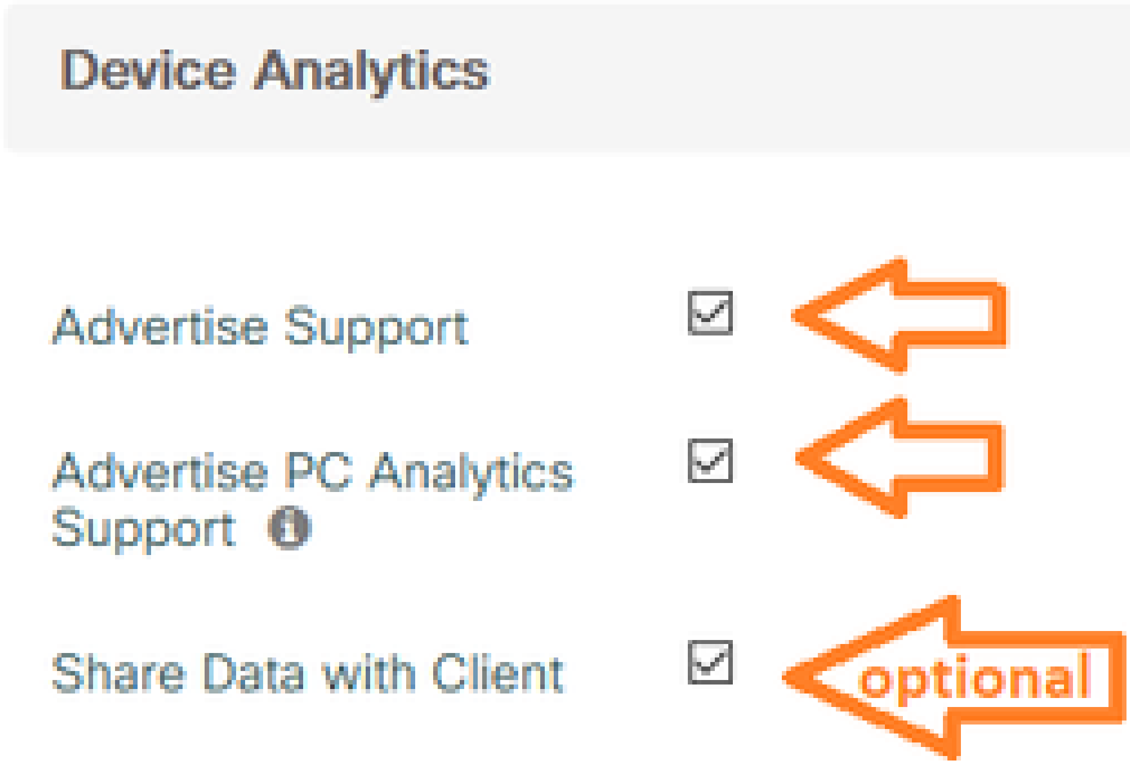
RF Group Name* default

Maximum Login Sessions Per User* 0

Management Via Wireless □

Device Classification ☑

3. For each WLAN, under Advanced > Device Analytics, enable Device Analytics support, PC Analytics support and (optionally) Share Data with Client



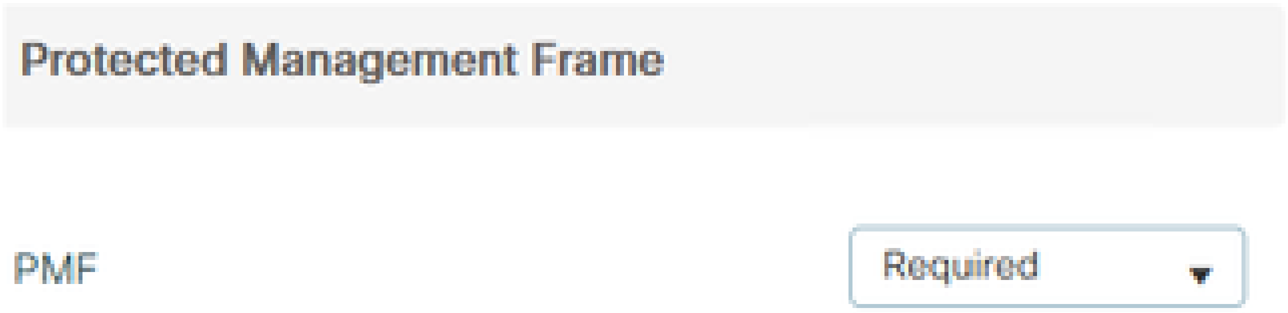
Device Analytics

Advertise Support ☑

Advertise PC Analytics Support ☑

Share Data with Client ☑

4. For each WLAN, set PMF to Optional or Required (note: this may impact client connectivity and/or performance)



Protected Management Frame

PMF: Required

Verify

Associate the Intel client to the wireless network.

9800 CLI

- View the STA INFO report for the client MAC address

```
9800-L#show device classifier mac-address 36da.2624.f622 detail
Client Mac: 36da.2624.f622
Device Type: LENOVO 20XXS3JC01
Confidence Level: 40
Day Zero Classification: LENOVO
Device Name: Unknown Device
Software Version: 22.150.00.03
Device OS: Windows 10
Device Vendor: Intel
Power Type: AC Powered
Hardware Model: AX201 160MHz
```

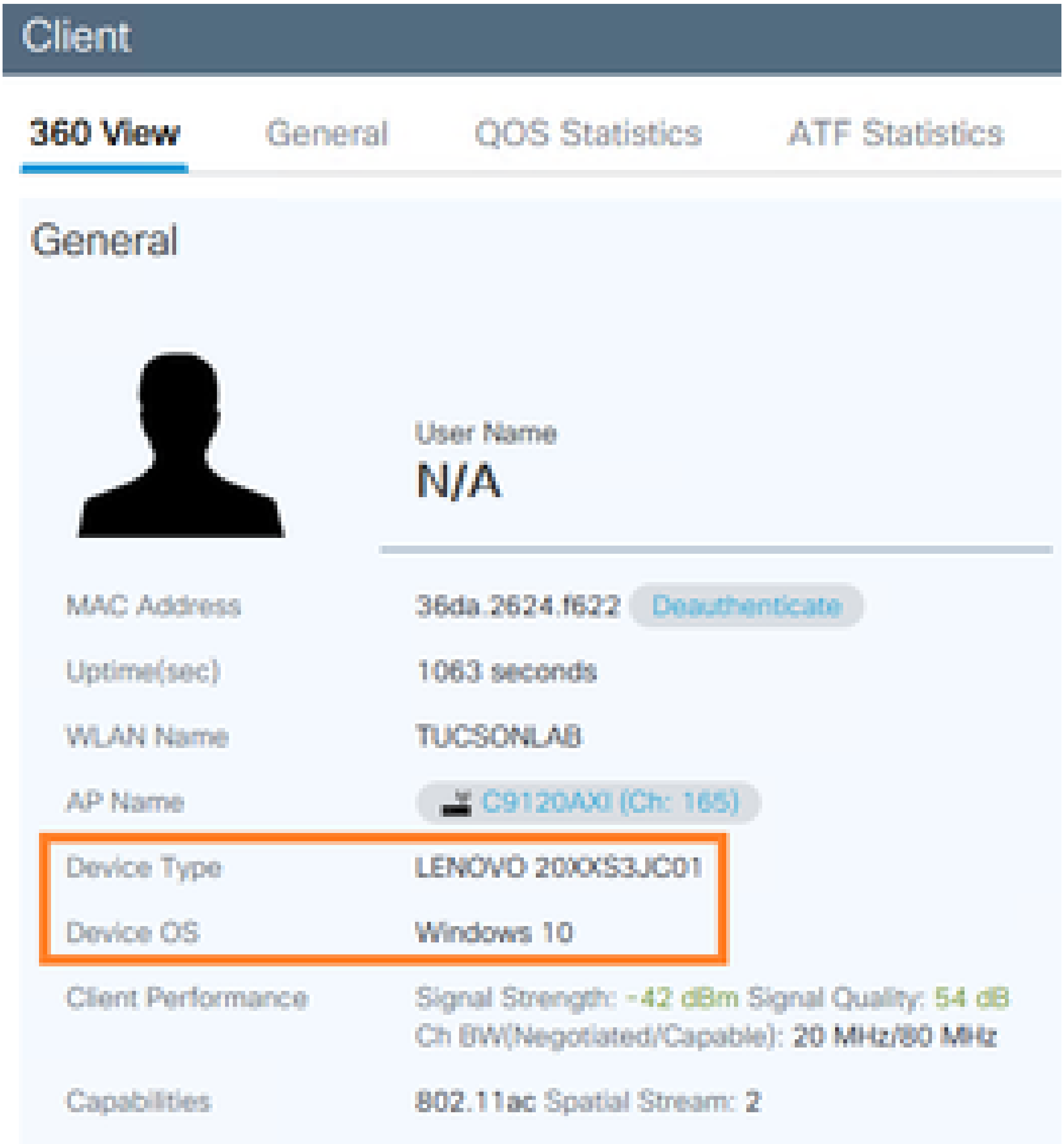
- View the PC Analytics info from the client

```
9800-L#show wireless client mac-address 36da.2624.f622 stats pc-analytics
-------------------------
Neighbor APs Info:
-------------------------
Reported time:: 08/02/2022 22:40:39
-------------------------
Roaming Reasons:
-------------------------
Selected AP RSSI:: -55
Candidate BSSIDs:
-----------------
Neighbor AP                      RSSI(dB)
683b.78aa.230e                   -62
04eb.409f.0d6e                   -55
3c41.0e3b.0d6e                   -64
-------------------------
Failed AP Report:
-------------------------
Last Reported Time:: 08/02/2022 22:40:39
APs with Invalid IEs: None
APs not sending response:
-------------------------
BSSID                            Frame Type
084f.f983.4a4e                   Authentication Response
04eb.409f.0d6e                   Other Frame types
-------------------------
PC Analytics report stats
-------------------------
----------------------------------------------------------------------
    Report Type            Processed Reports          Dropped Reports
----------------------------------------------------------------------

    STA Info                      1                             0
    Neigh AP                      1                             0
    Low RSSI                      0                             0
    Beacon Miss                   0                             0
    Failed AP                     1                             0
    Unknown APs                   0                             0
```

9800 GUI

- View the STA INFO report, in Monitoring > Wireless > Clients > client MAC:
    - Under the 360 View tab:

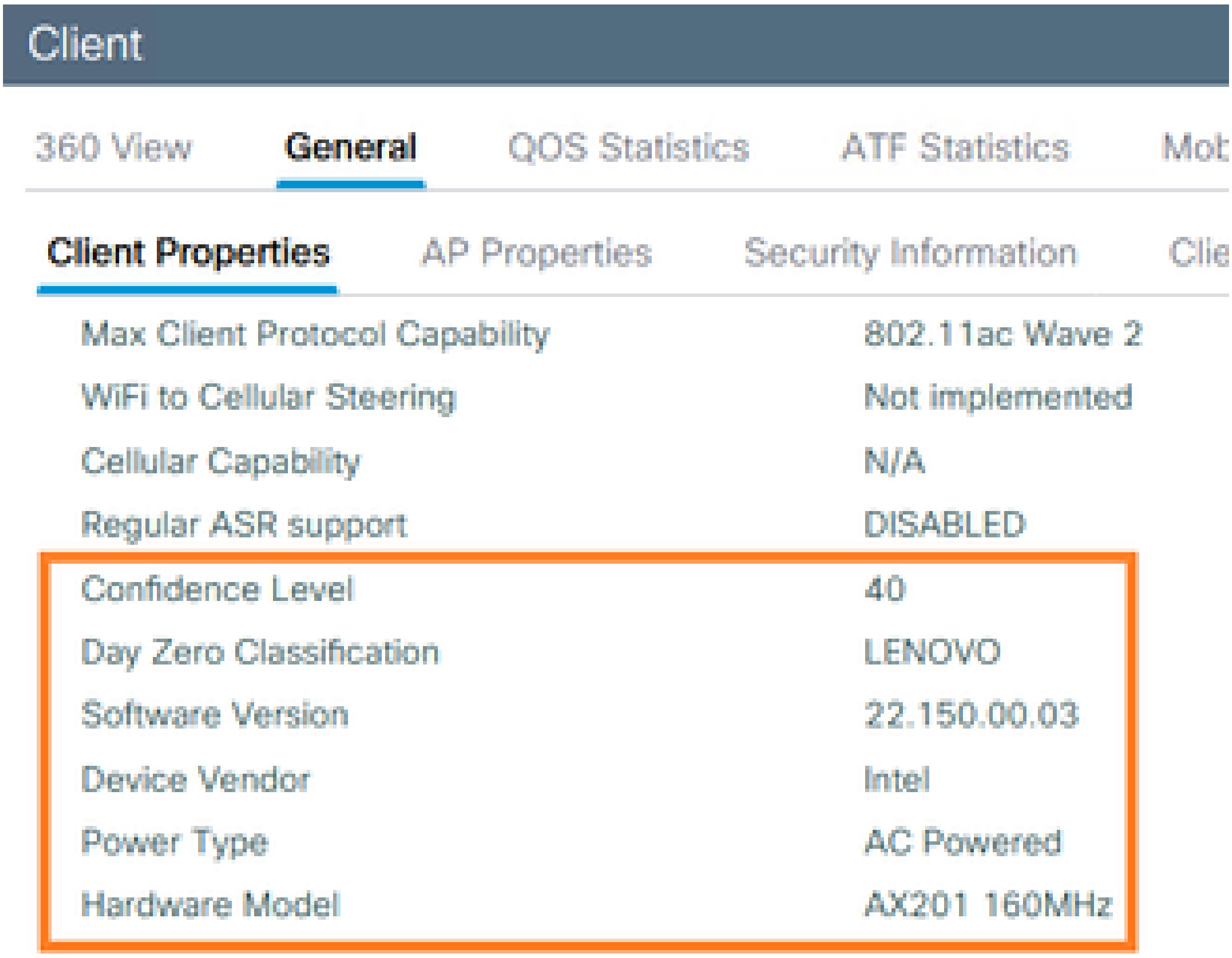


General

User Name
N/A

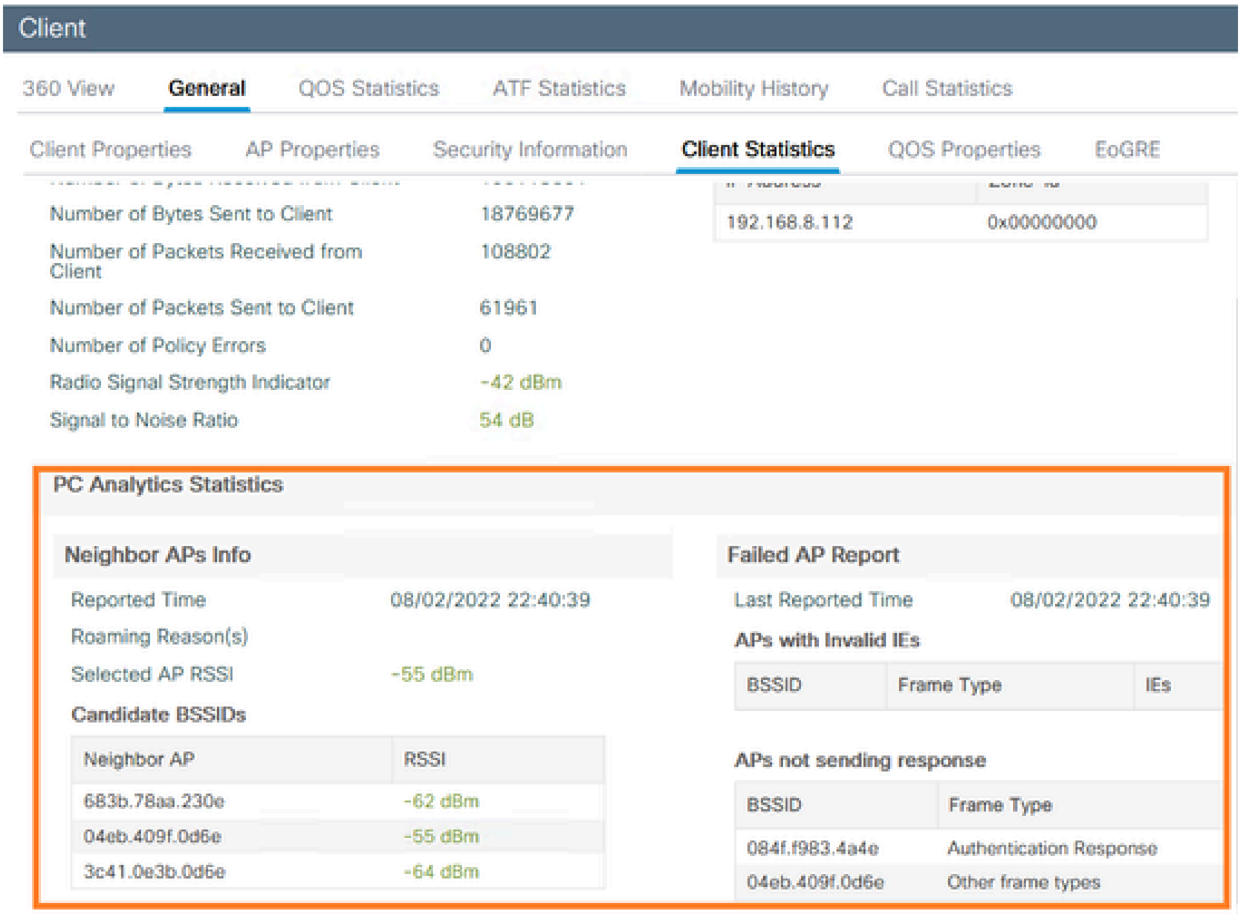
MAC Address	36da.2624.f622
Uptime(sec)	1063 seconds
WLAN Name	TUCSONLAB
AP Name	C9120AXI (Ch: 165)
Device Type	LENOVO 20XXS3JC01
Device OS	Windows 10
Client Performance	Signal Strength: -42 dBm Signal Quality: 54 dB Ch BW(Negotiated/Capable): 20 MHz/80 MHz
Capabilities	802.11ac Spatial Stream: 2

- Under the General > Client Properties tab:



Max Client Protocol Capability	802.11ac Wave 2
WiFi to Cellular Steering	Not implemented
Cellular Capability	N/A
Regular ASR support	DISABLED
Confidence Level	40
Day Zero Classification	LENOVO
Software Version	22.150.00.03
Device Vendor	Intel
Power Type	AC Powered
Hardware Model	AX201 160MHz

- Under the General > Client Statistics tab:



Number of Bytes Sent to Client	18769677
Number of Packets Received from Client	108802
Number of Packets Sent to Client	61961
Number of Policy Errors	0
Radio Signal Strength Indicator	-42 dBm
Signal to Noise Ratio	54 dB

192.168.8.112	0x00000000

PC Analytics Statistics

Neighbor APs Info

Reported Time	08/02/2022 22:40:39
Roaming Reason(s)	
Selected AP RSSI	-55 dBm

Candidate BSSIDs

Neighbor AP	RSSI
683b.78aa.230e	-62 dBm
04eb.409f.0d6e	-55 dBm
3c41.0e3b.0d6e	-64 dBm

Failed AP Report

Last Reported Time	08/02/2022 22:40:39

APs with Invalid IEs

BSSID	Frame Type	IEs

APs not sending response

BSSID	Frame Type
084f.f983.4a4e	Authentication Response
04eb.409f.0d6e	Other frame types

Troubleshoot

You can collect the following:

- Client RA traces from the 9800
- EPC from the 9800, filtered on client MAC
- Client debugs from the AP
- Over the Air (OTA) packet capture

The following examples show a working case (use the Windows supplicant) and a non-working case (using AnyConnect NAM)

RA Traces

Enable the RA traces on the 9800

```
debug wireless mac 38:87:D5:09:33:EB internal monitor-time 2085978494
```

(have the client under test associate to the AP)

Turn off RA traces and copy to TFTP server

```
no debug wireless mac 38:87:D5:09:33:EB internal monitor-time 2085978494
```

(locate the latest ra_trace file)

```
dir bootflash: | include ra_trace
```

```
copy
bootflash:ra_trace_MAC_38:87:d5:09:33:eb_211303_UTC_Fri_Aug_05_2022.log
tftp://192.168.10.2/ra_trace.log
```

What to look for in the RA Traces

If PC Analytics is working with the Intel client, then the RA Traces will show the feature parsing the data from the received action frame:

```
2022/08/05 21:12:14.083830 {wncd_x_R0-0}{1}: [client-orch-sm] [24548]: (debug
2022/08/05 21:12:14.083831 {wncd_x_R0-0}{1}: [dot11-validate] [24548]: (debug
2022/08/05 21:12:14.083836 {wncd_x_R0-0}{1}: [dot11-validate] [24548]: (debug
```

Then you should see data as reported by the client, for example the driver version:

```
2022/08/05 21:12:14.083917 {wncd_x_R0-0}{1}: [dot11-validate] [24548]: (debug
```

Embedded Packet Capture

Start EPC on the 9800

```
monitor capture MYCAP clear
monitor capture MYCAP interface Ten0/1/0 both
monitor capture MYCAP buffer size 100
monitor capture MYCAP match any
monitor capture MYCAP inner mac 38:87:D5:09:33:EB
monitor capture MYCAP start
```

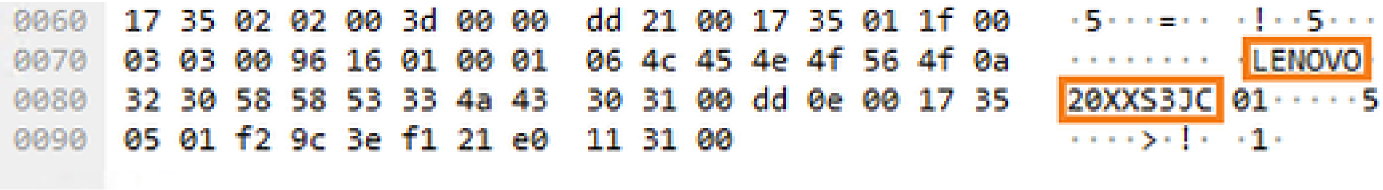
(have the client under test associate to the AP)

Stop EPC and export to TFTP server

```
monitor capture MYCAP stop
monitor capture MYCAP export tftp://192.168.10.2/MYCAP.pcap
no monitor capture MYCAP
```

What to look for in the EPC

In Wireshark, look for an action frame (wlan.fc.type_subtype == 0x000d) whose Category Code is "Vendor-specified Protected" (wlan.fixed.category_code == 126). The payload should show the PC make/model in ASCII:



```
0060  17 35 02 02 00 3d 00 00  dd 21 00 17 35 01 1f 00   ·5···=·· ·!··5···
0070  03 03 00 96 16 01 00 01  06 4c 45 4e 4f 56 4f 0a   ········ ·LENOVO·
0080  32 30 58 58 53 33 4a 43  30 31 00 dd 0e 00 17 35   20XXS3JC 01·····5
0090  05 01 f2 9c 3e f1 21 e0  11 31 00                  ····>·!· ·1·
```

Client debugs on AP

Start debugs

```
terminal monitor

debug client 38:87:D5:09:33:EB
```

(have the client under test associate to the AP)

Stop debugs

```
undebug all

terminal monitor disable
```

What to look for in the AP debugs

Look for an INTEL_DEO_ANALYTICS line, as the AP parses an incoming ACTION frame from the client, for example:

```
Aug 5 21:12:13 kernel: [*08/05/2022 21:12:13.0674] [1659733933: 67444] [AP480
Aug 5 21:12:13 kernel: [*08/05/2022 21:12:13.0675] CLSM[38:87:D5:09:33:EB]: US
Aug 5 21:12:13 kernel: [*08/05/2022 21:12:13.0676] CLSM[38:87:D5:09:33:EB]: IN
```

OTA packet capture

In this example, a MacBook running Wireless Diagnostics was used. See Collect Packet Captures Over the Air on a MacBook.

You should see the client sending one or more ACTION frames that are CCMP protected (wlan.ccmp.extiv && wlan.fc.type_subtype == 0x000d). As these frames are encrypted, you will not be able to read the payload (look to the EPC for that, or a span from the AP's switchport.)

If the client is not sending CCMP-protected management frames, then make sure that PMF is set to optional or mandatory.

To verify that the 9800 is correctly configured to advertise Intel Analytics, look at the beacon frame or probe response. Find a vendor specific tag with the Cisco OUI (00:40:96 - i.e. wlan.tag.oui == 0x004096). The next octet (in the Vendor Specific OUI Type field) will have a value of 0x2c - this is the DEO_IE. The following octet is bit-encoded; its fourth-least-significant bit is the Intel Analytics bit.

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