

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

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## 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/Catalyst/Cisco Wireless Wave 2 / Wi-Fi 6/6E/7 APs

## Requirements

- 9800 must have Cisco IOS XE® 17.6.1 or later installed
- The WLAN must have Protected Management Frames (PMF) enabled or optional
- 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 Cisco bug ID [CSCwc57807](#) for 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**

**Network Assurance**

[DNA Spaces](#)

Network Assurance Configuration



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.

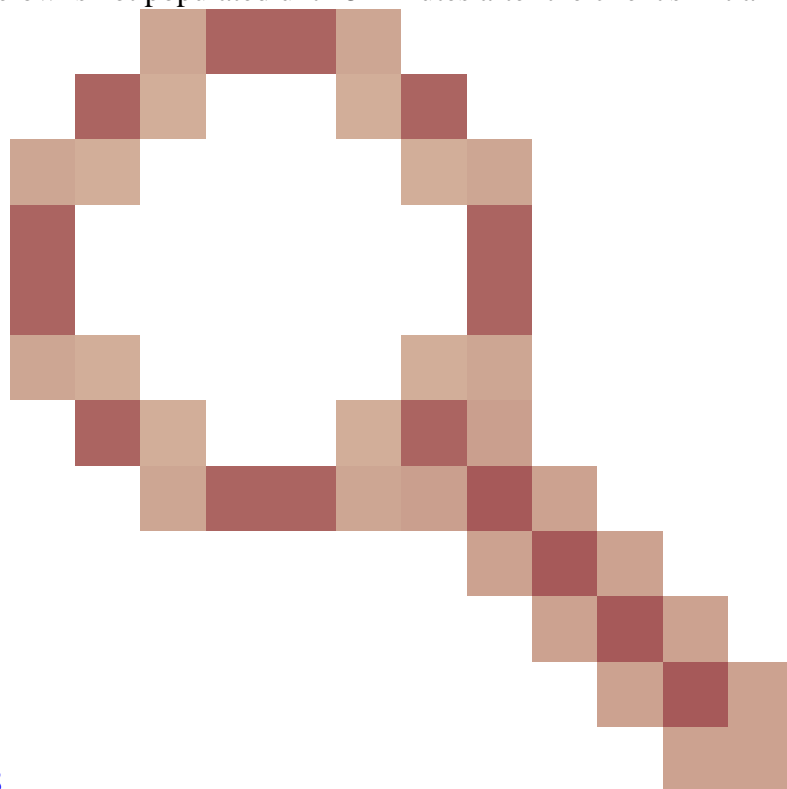
### 9800 CLI

- 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:  
(Note: the PC Analytics data as shown below is not populated until 5 minutes after the client's initial



association. Cisco bug ID [CSCwp19148](#) has been filed to address this limitation.)

```
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:

Client

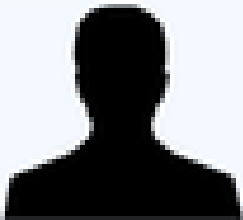
360 View

General

QOS Statistics

ATF Statistics

General



User Name

N/A

MAC Address

36da.2624.f622

Deauthenticate


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:

## Client

360 View **General** QOS Statistics ATF Statistics Mot

**Client Properties** AP Properties Security Information Clie

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 (statistics viewable 5 minutes after the client's initial association):

## Client

360 View **General** QOS Statistics ATF Statistics Mobility History Call Statistics

Client Properties AP Properties Security Information **Client Statistics** QOS Properties EoGRE

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

### 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	20XS3JC 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] [AP4800
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]: IM
```

## 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.

## Intel adapter driver version note

Beginning with the 23.50.0 Intel driver bundle, all supported adapters **apparently** have the same 23.x driver version (as seen in Windows Device Manager.) However, depending on the adapter model and host CPU, a different internal driver version (which is what's reported to Intel Analytics) may be in use - for example, the AX211 driver from the 23.90.0 bundle running on an Intel Core i7 13th Gen has an "outer" driver version of 23.90.0.2; however, once you drill into the driver details, the "inner" driver version turns out really to be 23.50.4.2.

