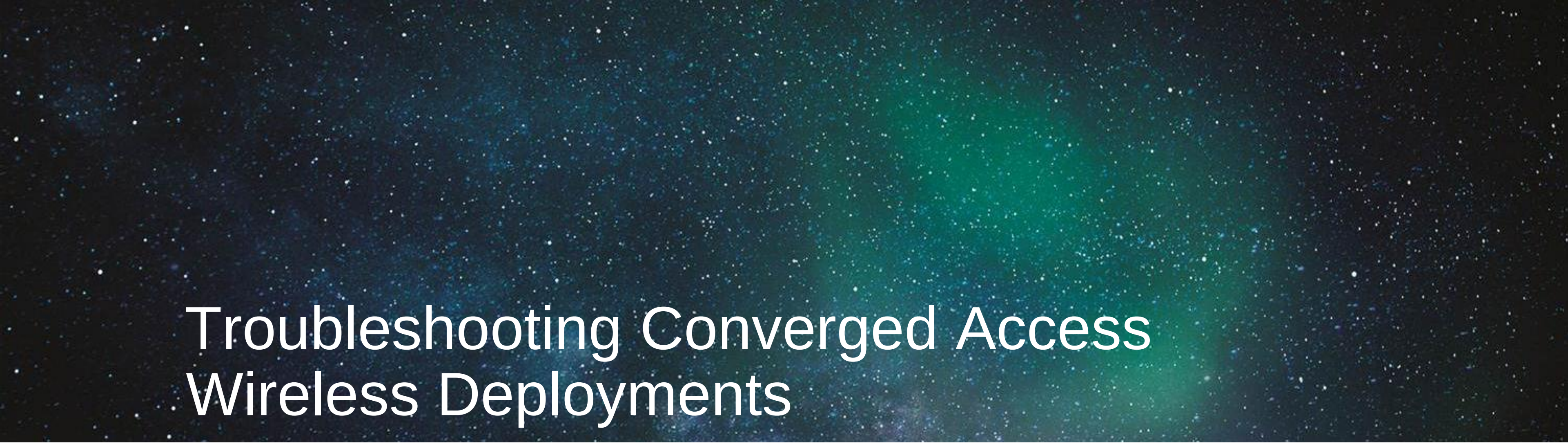
TOMORROW starts here.

Cisco live!



Troubleshooting Converged Access Wireless Deployments

BRKEWN-3021

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Troubleshooting Converged Access Wireless Deployments

BRKEWN-3021 Session Overview and Objectives

This session discusses troubleshooting techniques and best practices for the Cisco Converged Access Mobility Architecture.

We will cover how to troubleshoot mobility and client connectivity issues under the various deployment models, including Mobility Agents (MA), Mobility Controllers (MC), and Mobility Oracles (MO).

We will cover common information, tools, and debugs used by TAC to resolve issues. We will also review key issues to watch out for.

Agenda

- Converged Access (CA) Architecture
- Troubleshooting
- Common issues
- Summary

Converged Access Architecture

Agenda

Converged Access Architecture

- Hardware platforms
- Internal architecture
- Mobility overview

CA Architecture

Hardware Platforms

Catalyst WS-C3850

Directly connected APs

Up to 50 APs / 2000 users

Catalyst WS-C3650

Directly connected APs

Up to 25 APs / 1000 users

WLC CT-5760

Up to 1000 APs / 12000 clients

CA Architecture

Access Points

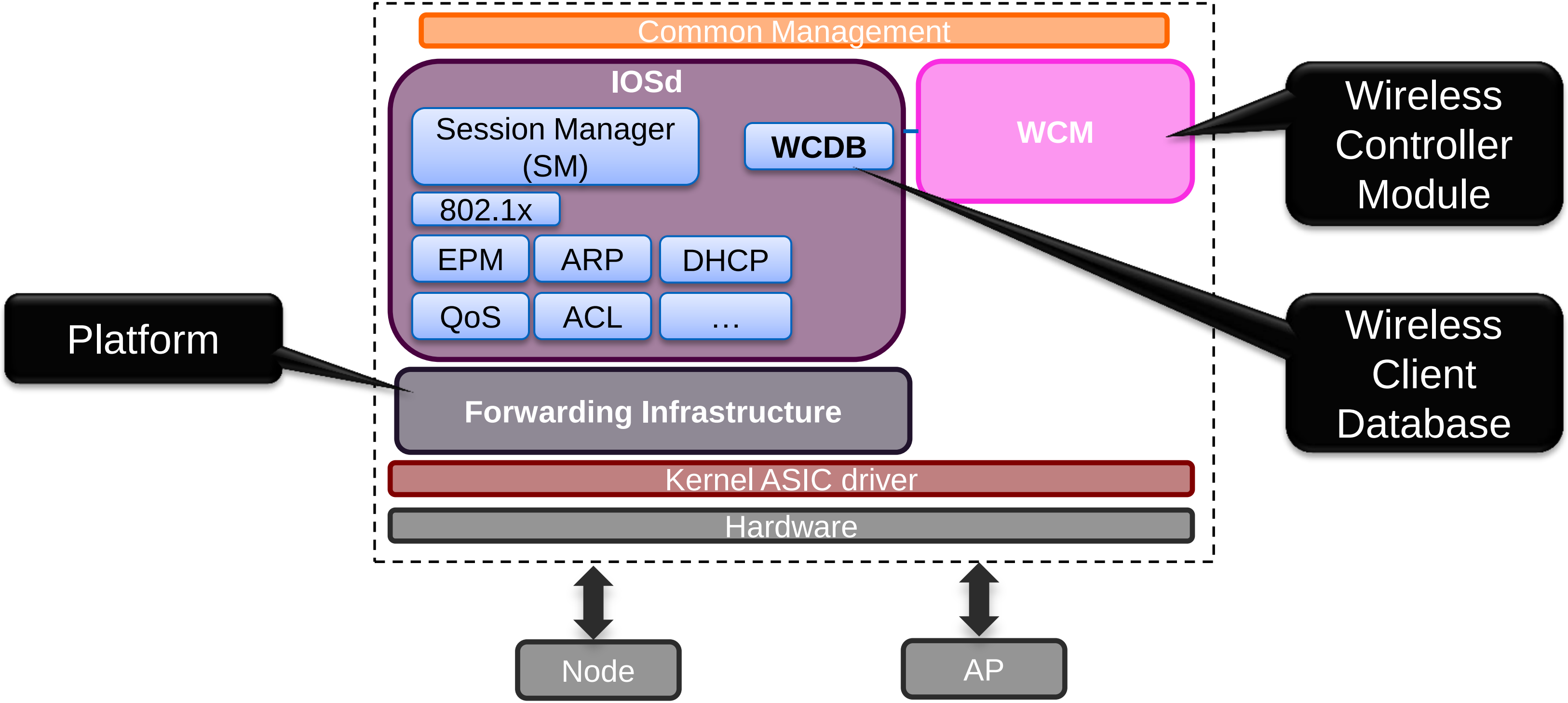
- AP 1040 / 1140
- AP 1260 / 3500
- AP 1600 / 2600
- AP 3600 + 11ac module
- AP 3700

AP modes:

- Local
- Monitor, SE-Connect, Sniffer

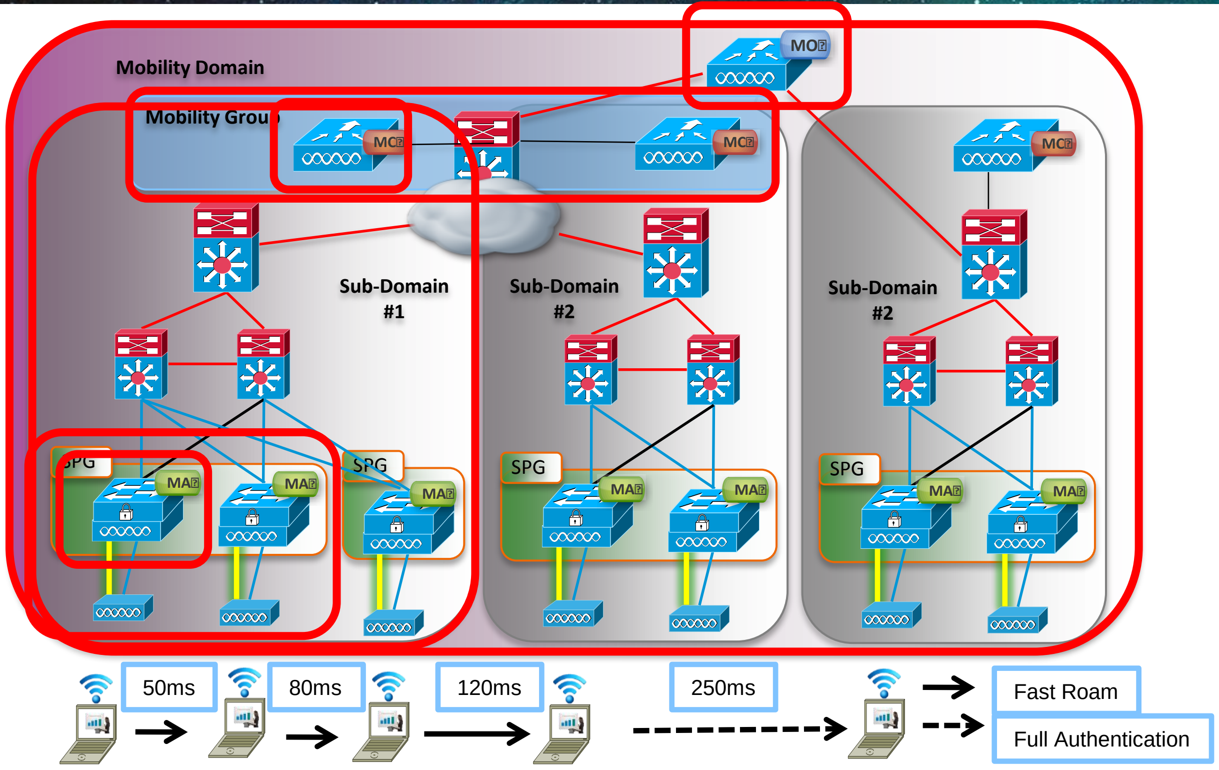
CA Architecture

Internal Components (Simplified Schema)



CA Architecture – Hierarchical Mobility

Components, Roles and Roaming



Physical Entities

MC Mobility Controller

MA Mobility Agent

MO Mobility Oracle

Logical Entities

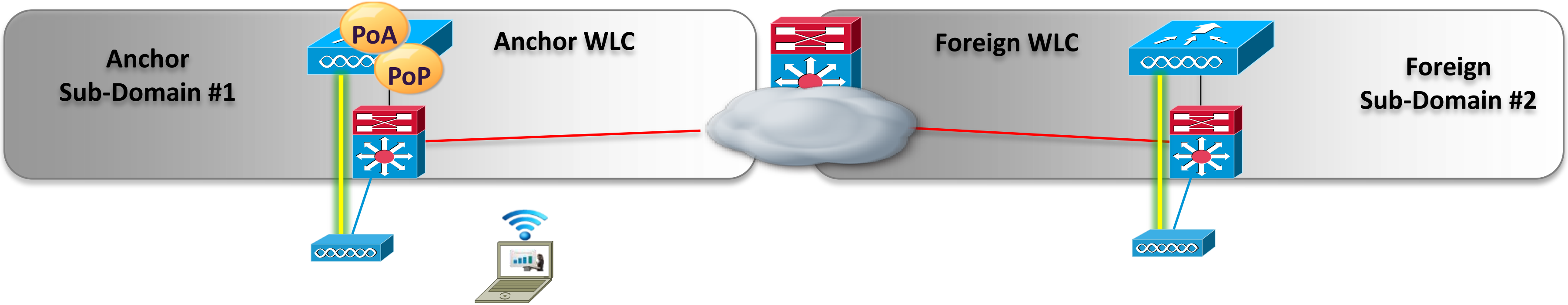
SPG Switch Peer Group

🟦 Mobility Group

🟪 Mobility Domain

CA Architecture – Mobility

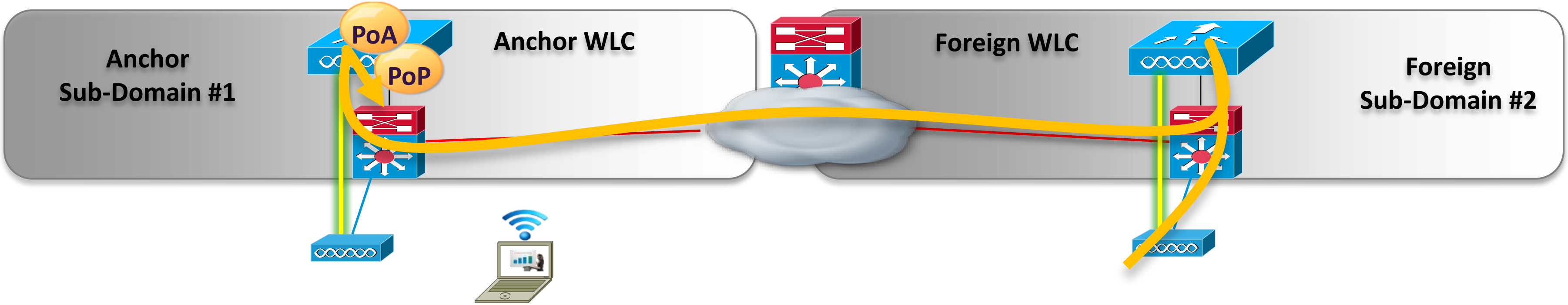
PoP and PoA



- Point of Presence (PoP) vs. Point of Attachment (PoA)
  - PoP is where the wireless user is seen to be within the wired portion of the network
  - PoA is where the wireless user has roamed to while mobile
- Before a user roams, PoP and PoA are in the same place

CA Architecture – Mobility

Sticky Anchoring



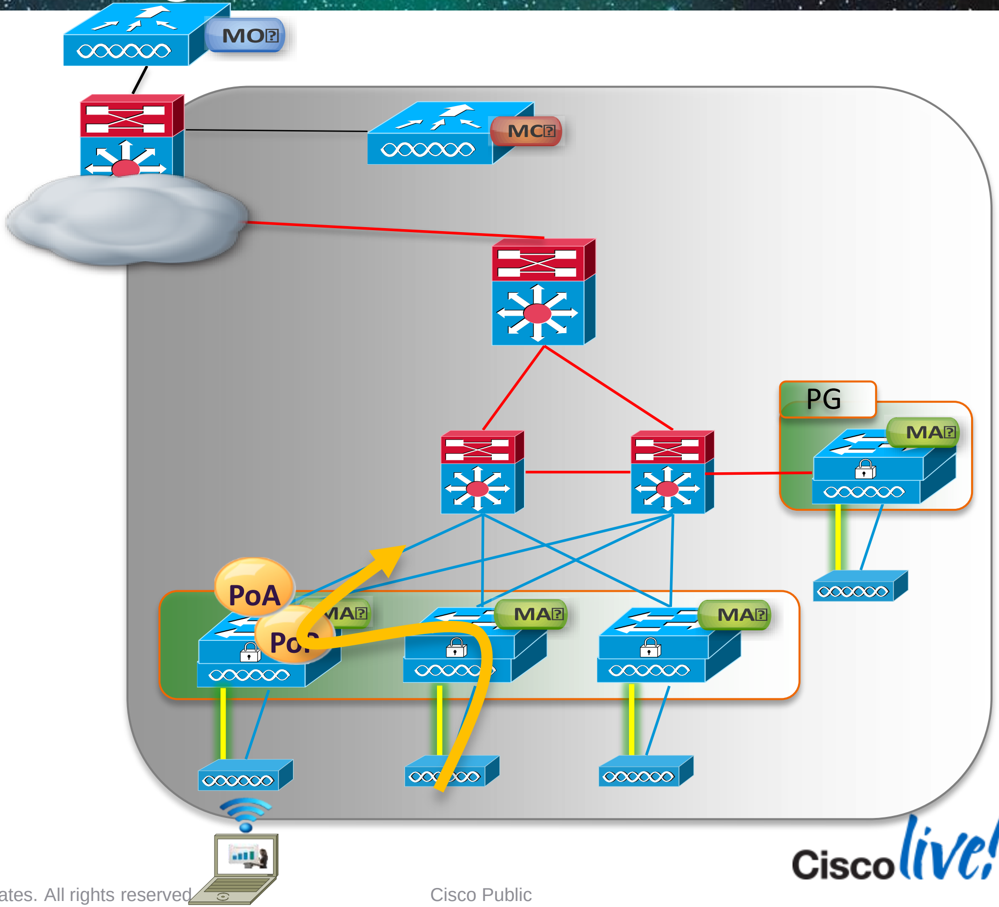
- Sticky Anchoring (default behaviour)
  - PoA moves with the user
  - PoP doesn't move with the user
- Can be disabled on a WLAN basis:

```
3850(config-wlan)# no mobility anchor sticky
```

CA Client Intra SPG Roaming

Roaming within the **same SPG**

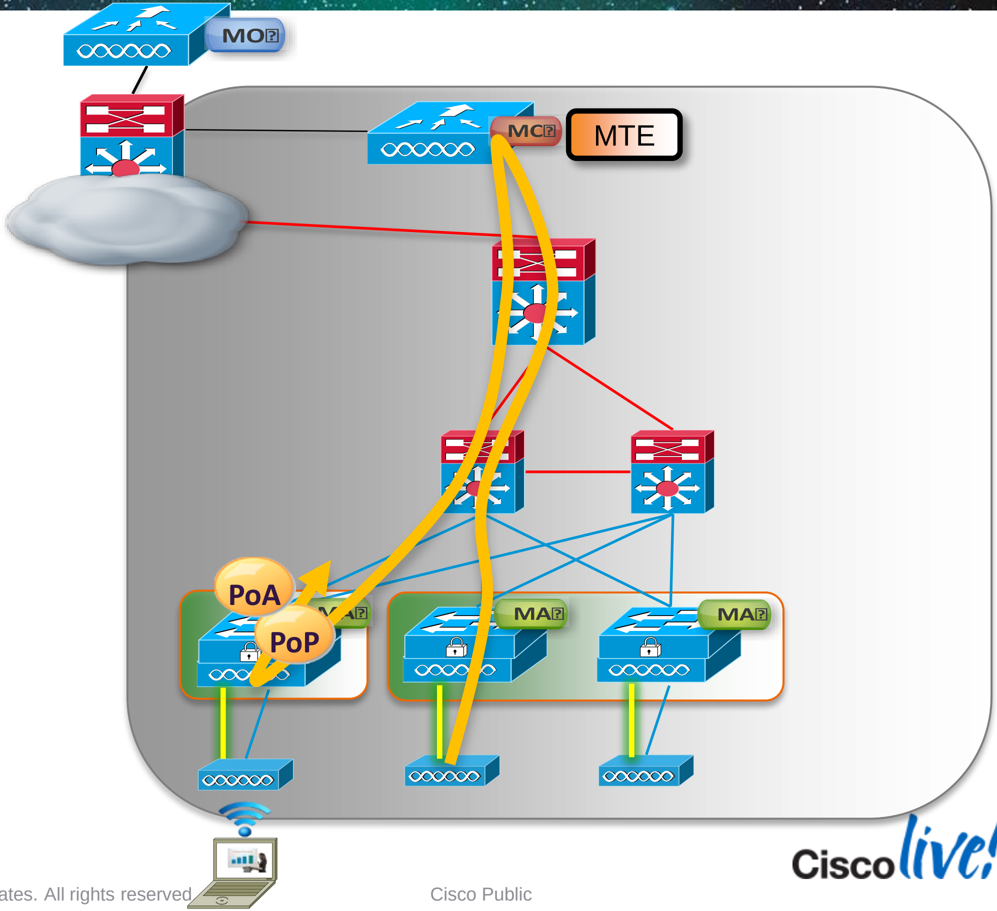
- With sticky anchor (default behaviour)
  - PoA moves to the new switch
  - PoP stays on the original switch
  - Traffic flows through the old switch (regardless of L2 or L3 roam)



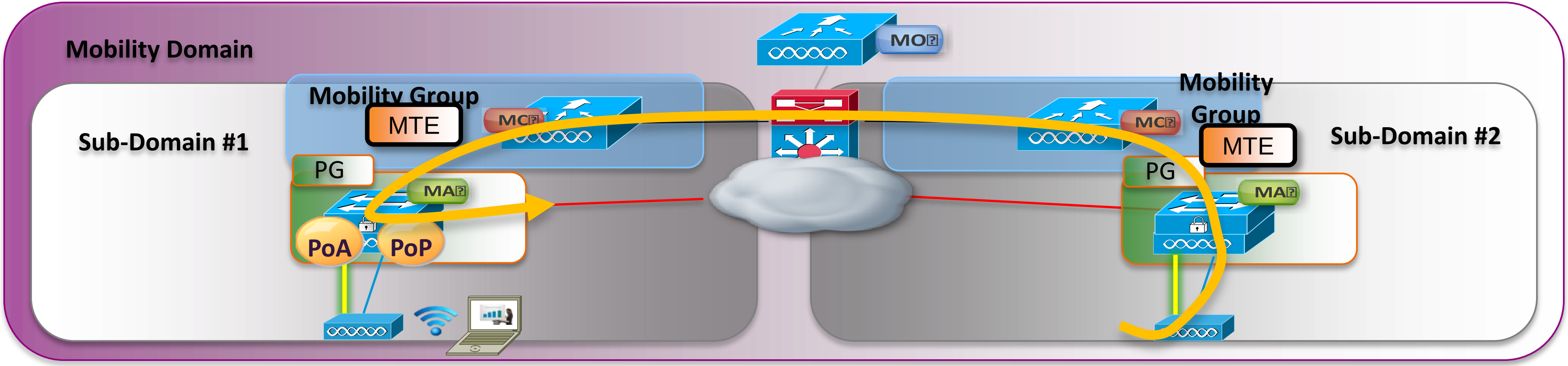
CA Client Inter SPG Roaming

Roaming to a **different SPG**, within the same sub-domain

- With sticky anchoring, even with L2 roam, PoP stays on original switch
- Traffic flows as illustrated
- MTE functionality is used
  - Mobility Tunnel Endpoint



CA Client Inter Sub-domain Roaming



Roaming to a **different sub-domain** within the same domain

- With sticky anchoring and L2 roam
  - PoA is moved to the new switch
  - PoP stays at the old switch
- Traffic flows through the MTEs

Troubleshooting

Agenda
Troubleshooting

- Troubleshooting Tools
- System level sanity check
- Traces vs. Debugs
- Licensing
- Mobility
- AP Join
- Client flow
- RRM

Troubleshooting Tools

What is needed…

- Problem definition
  - Identify the issue(s)
  - Reduce the scope of investigation
- Capture
  - L1: Spectrum Expert
  - L2/L3: Wireless sniffer trace (Omnipeek, AirPcap, Sniffer mode AP, etc..)
- Configuration check
  - Configuration analysis: WLC Config Analyser (WLCCA) – Coming soon!
- Debugging
  - Proper traces/debugs
  - Custom made tool
  - Editor tools (text processing)

System Level Sanity Check

- Memory utilisation
- CPU utilisation

Just an overview, for more details refer to:
BRKCRS-3146 - Troubleshooting Cisco Catalyst 3850 Series Switches

Available at CiscoLive365!

Memory Utilisation

Show Commands

```
3850-1#show processes memory sorted

System memory    : 1941580K total, 1109004K used, 832576K free, 118584K kernel reserved
Lowest(b)        : 215392912
PID      Text         Data      Stack     Heap      RSS       Total     Process
9136     56944        33900     92        3872      192152    323428    iosd
5542     15040        307580    92        3648      122832    595900    fed
9132     21980        557376    88        10544     105796    721672    wcm
6035     4            94196     116       88484     95508     113168    idope.py
5544     836          159180    88        4088      55092     330104    stack-mgr
10083    4            144128    236       18136     46260     240788
wnweb_paster.py
6203     3532         132904    88        872       45868     339972    ffm
6219     112          153364    88        7420      44208     225500    cli_agent
6204     1232         256752    88        9060      33124     363320    eicored
6195     52           113340    88        1188      24820     206348    pdsd
```

Memory Utilisation

Show Commands

```
3850-1#show processes memory detailed process iosd sorted

Processor Pool Total:  268435456 Used:  133113932 Free:  135321524
IOS Proce Pool Total:   16777216 Used:    9425820 Free:    7351396
 PID TTY  Allocated      Freed    Holding    Getbufs    Retbufs Process
   0   0  169226784   33615104  125812548          0          0 *Init*
 163   0    1534944          0    1558112     907264          0 NGWC DOT1X Proce
   0   0          0          0     918996          0          0 *MallocLite*
   0   0    7235404    5923276     618844   40708507    1348801 *Dead*
 275   0     933472     297340     572084          0          0 os_info_p provid
   1   0     524640       1544     547808          0          0 Chunk Manager
 342   0     270484          0     296652     102676          0 EEM ED Syslog
  33   0   48903984   39285468     292800          0          0 SPI PL client ap
 352   0     223176          0     246344          0          0 EEM Server
```

Memory Utilisation

Common Causes

Common Cause	Recommended Solution
Extensive config	Reduce the configuration to supported scale
Excessive memory allocated to trace buffers	Reset trace buffers to default sizes
DoS Attack/Punted traffic causing buffer depletion	Identify packets and block them using an ACL
Protocol flaps/re-convergence causing high transient memory utilisation	Identify reason for network instability
Memory leak caused by software bug	Open a TAC Service Request

CPU Utilisation

Show Commands

```
3850-1#show processes cpu sorted

Core 0: CPU utilization for five seconds: 3%; one minute: 5%;  five minutes: 5%
Core 1: CPU utilization for five seconds: 0%; one minute: 1%;  five minutes: 0%
Core 2: CPU utilization for five seconds: 0%; one minute: 0%;  five minutes: 0%
Core 3: CPU utilization for five seconds: 1%; one minute: 1%;  five minutes: 1%
PID    Runtime(ms) Invoked  uSecs   5Sec      1Min      5Min      TTY   Process
5542   1452240     25452052 57      0.63      0.59      0.56      1088  fed
9136   2528710     47631614 53      0.49      0.48      0.48      0     iosd
6206   918720      801369   1146    0.15      0.14      0.15      0     cpumemd
6200   75900       786850   96      0.05      0.01      0.03      0     mem_mgmt
6228   17950       2228827  8       0.05      0.05      0.01      0     snmp_subagent
9132   984350      37970483 25      0.05      0.12      0.11      0     wcm
1      1850        1066     1735    0.00      0.00      0.00      0     init
2      0           122      0       0.00      0.00      0.00      0     kthreadd
3      40          3323     12      0.00      0.00      0.00      0     migration/0
4      0           3        0       0.00      0.00      0.00      0     sirq-high/0
```

CPU Utilisation

Show Commands

```
3850-1#show processes cpu detailed process iosd sorted

Core 0: CPU utilization for five seconds: 8%; one minute: 4%; five minutes: 4%
Core 1: CPU utilization for five seconds: 0%; one minute: 5%; five minutes: 2%
Core 2: CPU utilization for five seconds: 0%; one minute: 0%; five minutes: 0%
Core 3: CPU utilization for five seconds: 1%; one minute: 3%; five minutes: 1%
PID    T C  TID    Runtime(ms) Invoked uSecs  5Sec      1Min     5Min     TTY   Process
                                               (%)       (%)      (%)
9136   L           2531310     4767539 53     1.16      0.62     0.52     0     iosd
9136   L 1  9136   2331260     4667549 0      1.06      0.52     0.43     0     iosd
9136   L 0  9919   200000      997609  0      0.10      0.10     0.08     0     iosd.fastpath
9136   L 1  9920   50          2282    0      0.00      0.00     0.00     0     iosd.aux
6      I           419250      38598   0      3.33      0.44     0.22     0       Check heaps
2      I           610         30677   0      0.00      0.00     0.00     0       Load Meter
3      I           0           9       0      0.00      0.00     0.00     0       SpanTree 4
```

Traces vs Debugs

- Traces are not displayed on console/terminal, but stored in a circular buffer
- Traces are “always-on”, you can change the level and filtering options
- Traces are less impactful on system performance

- **Traces are preferred for troubleshooting wireless issues!**

Using Traces

- Set the trace level to debug for the trace we want to collect

```
3850-1#set trace capwap ap event level debug
  debug   Debug-level messages (7)
  default Unset Trace Level Value
  err     Error conditions (3)
  info    Informational (6)
  warning Warning conditions (4)
```

  – To turn off the trace debugging, set the level back to default

- Set and remove the filter for the MAC address

```
3850-1#set trace capwap ap event filter mac xxxx.xxxx.xxxx
3850-1#set trace capwap ap event filter mac yyyy.yyyy.yyyy
3850-1#set trace capwap ap event filter none
```

Adding multiple addresses to the filter list

Using Traces

- To view unfiltered output:
  - `show trace message <feature>`

Feature list:
`show trace all-buffer settings`

- To view filtered output:
  - `show trace sys-filtered-traces`
  - `show trace messages <feature> filtered`

3.3+

- Several macros are available to enable sets of traces, example:
  - `set trace group-wireless-secure level debug`

- Clear a trace
  - `set trace control <feature> clear`
- Redirect the output to a file for easier offline analysis:
  - `show trace message <feature> | redirect tftp:…`
  - `show trace message <feature> | tee tftp:…`

File only

Console + File

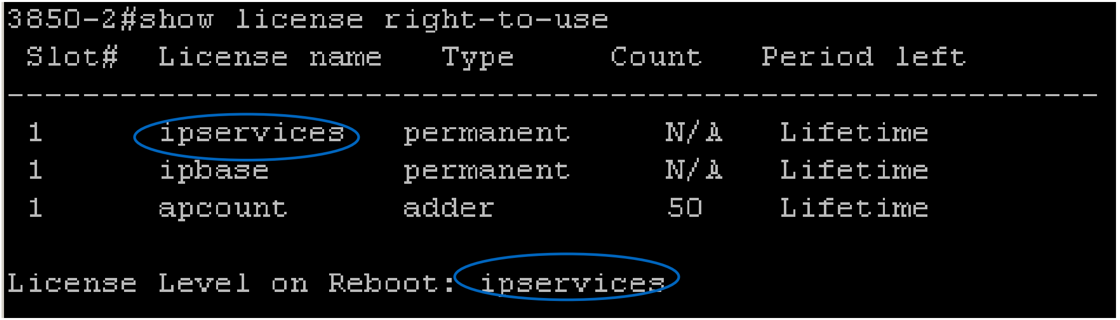
Getting Started

Before a client can join, basics must be covered:

- Licensing setup
- Establish mobility relationships
- Have APs to join the controllers

Licensing

- Must run **ipservices** or **ipbase** license to enable wireless services on 3850 / 3650

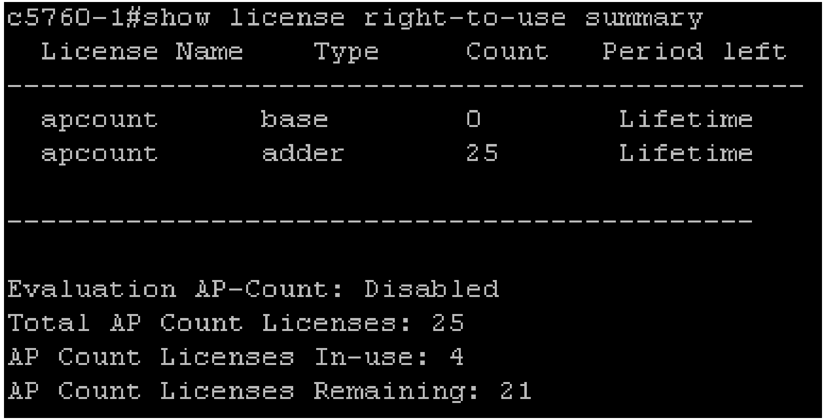


```
3850-2#show license right-to-use
 Slot#  License name    Type      Count    Period left
----------------------------------------------------------
 1       ipservices     permanent      N/A    Lifetime
 1       ipbase         permanent      N/A    Lifetime
 1       apcount        adder          50     Lifetime

License Level on Reboot: ipservices
```

- The 5760 does not have activated license levels, the image is already **ipservices**

AP Count Licenses

- AP count licenses are **applied at the MC** and are automatically provisioned and enforced at the MA
  - 3650 acting as MC can support up to 25 APs
  - 3850 acting as MC can support up to 50 APs
  - 5760 acting as MC can support up to 1000 APs



```
c5760-1#show license right-to-use summary
  License Name     Type      Count    Period left
-----------------------------------------------
  apcount       base         0         Lifetime
  apcount       adder        25        Lifetime

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

Evaluation AP-Count: Disabled
Total AP Count Licenses: 25
AP Count Licenses In-use: 4
AP Count Licenses Remaining: 21
```

Mobility Configuration

Mobility Agent and Mobility Controller

- The **3850 and 3650 are Mobility Agent** (MA) by default
- **AP licensing** is handled by the **Mobility Controller** (MC)
- Must either set a 3850/3650 as mobility controller or point it to another device acting as MC

Mobility Configuration

Mobility Agent and Mobility Controller

- To configure a 3850 as a MC:

```
MC(config)# wireless mobility controller
```

NOTE: This configuration change will require a reboot!

- To point the 3850 to a different MC:

```
MA(config)# wireless mobility controller ip a.b.c.d
```

- And on the MC (define the SPG and add an MA to it):

```
MC(config)#wireless mobility controller peer-group <SPG1>
MC(config)#wireless mobility controller peer-group <SPG1> member ip w.x.y.z
```

Mobility Troubleshooting

Show Commands

```
c5760-1#show wireless mobility summary

Mobility Role                                   : Mobility Controller
~cut~

Controllers configured in the Mobility Domain:

IP               Public IP        Group Name       Multicast IP     Link Status
-------------------------------------------------------------------------------
192.168.151.21   -                5760             0.0.0.0          UP   : UP

Switch Peer Group Name            : group1
~cut~

IP               Public IP              Link Status
--------------------------------------------------
192.168.151.11   192.168.151.11         UP   : UP
192.168.151.12   192.168.151.12         UP   : UP
```

Mobility Troubleshooting

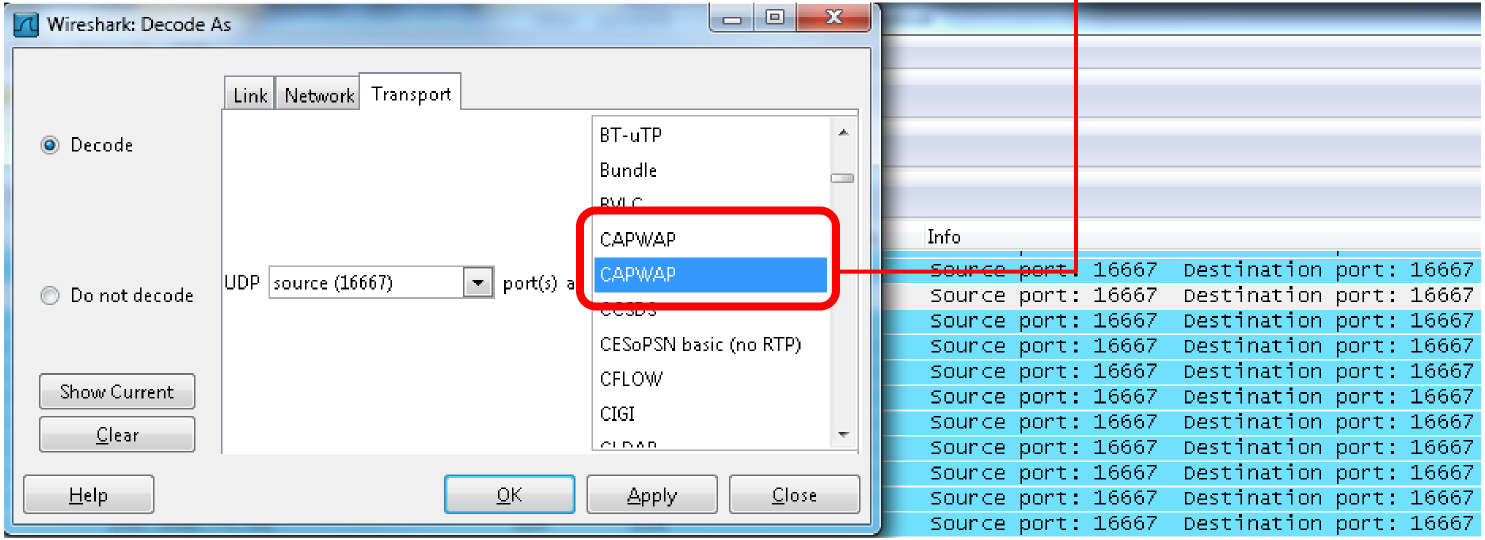
Protocols

- **Control Path**
  - UDP port 16666
  - CAPWAP (control) encapsulated
  - DTLS Encrypted
- **Data Path**
  - UDP port 16667
  - CAPWAP (data) encapsulated
- **Mobility Oracle**
  - UDP port 16668
  - CAPWAP (control) encapsulated
  - DTLS Encrypted

Mobility Troubleshooting

Capturing Data

- In wireshark, you can click on a **UDP port 16667** (data) packet
  - Right click -> Decode as -> CAPWAP Data (will be the 2nd CAPWAP entry in the list)



Wireshark: Decode As

● Decode

○ Do not decode

UDP source (16667) port(s) a

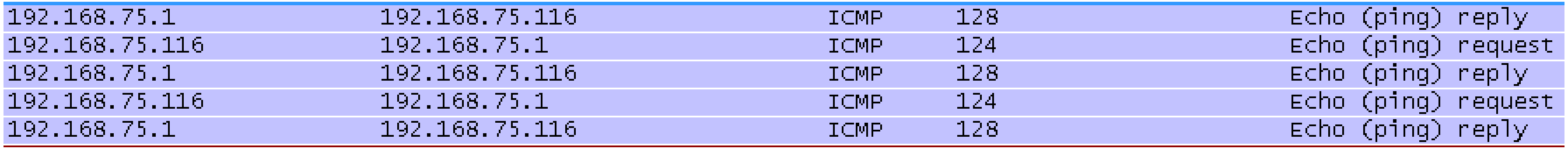
- BT-uTP
- Bundle
- BVLC
- CAPWAP
- CAPWAP
- CCSDS
- CESoPSN basic (no RTP)
- CFLOW
- CIGI
- CLDAP

```
Info
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
Source port: 16667   Destination port: 16667
```

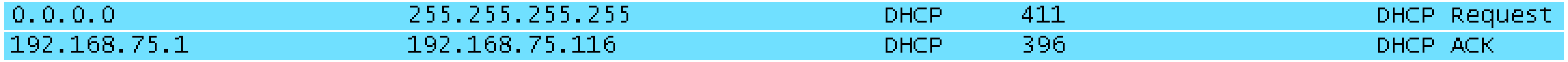
Mobility Troubleshooting

Capturing Data

- Now the traffic will be properly decoded and viewable:



```
192.168.75.1      192.168.75.116    ICMP   128         Echo (ping) reply
192.168.75.116    192.168.75.1      ICMP   124         Echo (ping) request
192.168.75.1      192.168.75.116    ICMP   128         Echo (ping) reply
192.168.75.116    192.168.75.1      ICMP   124         Echo (ping) request
192.168.75.1      192.168.75.116    ICMP   128         Echo (ping) reply
```



```
0.0.0.0           255.255.255.255   DHCP   411         DHCP Request
192.168.75.1      192.168.75.116    DHCP   396         DHCP ACK
```

- Allowing you to view communications such as ICMP or DHCP, to assist in packet loss diagnosis

Mobility Troubleshooting

Traces and Debugs

Traces

- set trace mobility handoff level debug
- set trace mobility keepalive level debug

Debugs

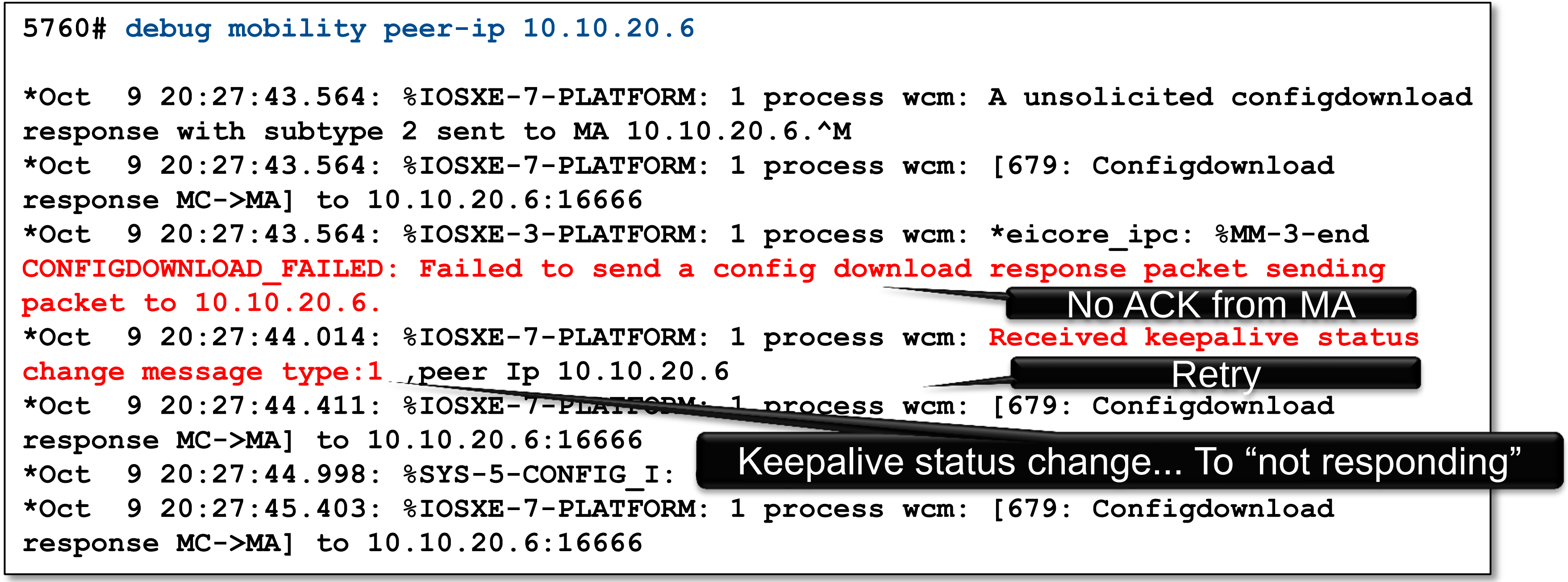
- debug mobility keep-alive
- debug mobility handoff
- debug mobility peer-ip w.x.y.z
- debug capwap ios event
- debug capwap ios error

MC-MA, or MA-MA troubleshooting

WLC internal capwap (WLC to WLC, etc)

Mobility Troubleshooting

MA Disconnected



```
5760# debug mobility peer-ip 10.10.20.6

*Oct  9 20:27:43.564: %IOSXE-7-PLATFORM: 1 process wcm: A unsolicited configdownload
response with subtype 2 sent to MA 10.10.20.6.^M
*Oct  9 20:27:43.564: %IOSXE-7-PLATFORM: 1 process wcm: [679: Configdownload
response MC->MA] to 10.10.20.6:16666
*Oct  9 20:27:43.564: %IOSXE-3-PLATFORM: 1 process wcm: *eicore_ipc: %MM-3-end
CONFIGDOWNLOAD_FAILED: Failed to send a config download response packet sending
packet to 10.10.20.6.
*Oct  9 20:27:44.014: %IOSXE-7-PLATFORM: 1 process wcm: Received keepalive status
change message type:1 ,peer Ip 10.10.20.6
*Oct  9 20:27:44.411: %IOSXE-7-PLATFORM: 1 process wcm: [679: Configdownload
response MC->MA] to 10.10.20.6:16666
*Oct  9 20:27:44.998: %SYS-5-CONFIG_I:
*Oct  9 20:27:45.403: %IOSXE-7-PLATFORM: 1 process wcm: [679: Configdownload
response MC->MA] to 10.10.20.6:16666
```

No ACK from MA

Retry

Keepalive status change... To “not responding”

AP Join

Config on 3850

- Enable wireless management

```
3850a(config)# wireless management interface vlan <1-4095>
```

What if “no…”?

- Directly connected APs must be configured as **access** port in the wireless management vlan!

```
3850a(config)#interface gigabit1/0/10
3850a(config-if)#switchport mode access
3850a(config-if)#switchport access vlan 151
```

```
3850(config-if)#switchport mode trunk
Command rejected: Conflict with Capwap

3850(config-if)#switchport mode trunk
3850(config-if)#
```

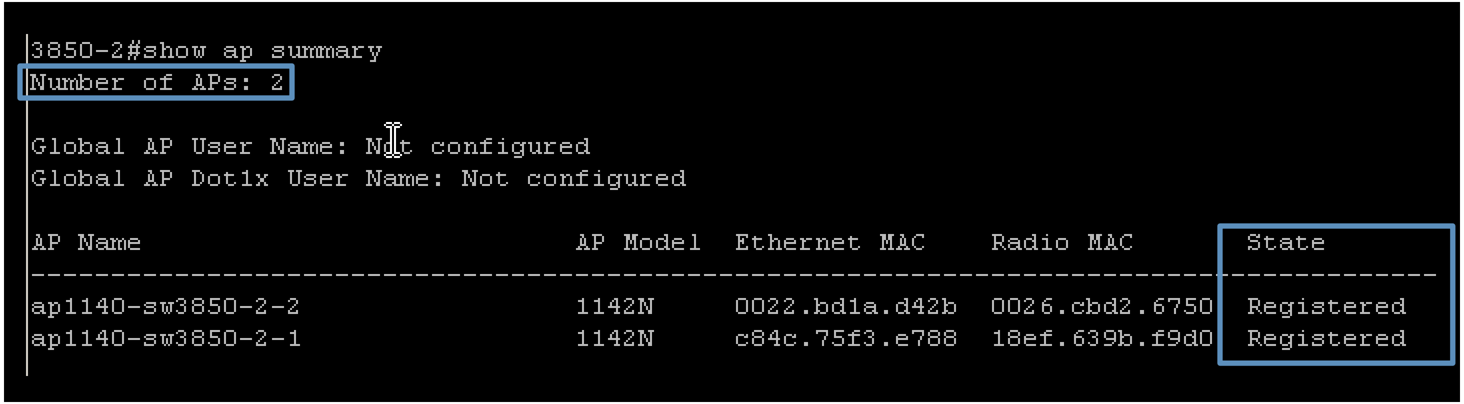
If AP exists on this port, WLC will reject switch to trunk port

However, if no AP is detected...

AP Join

Verify Directly Joined APs (MA and MC)

- show ap summary

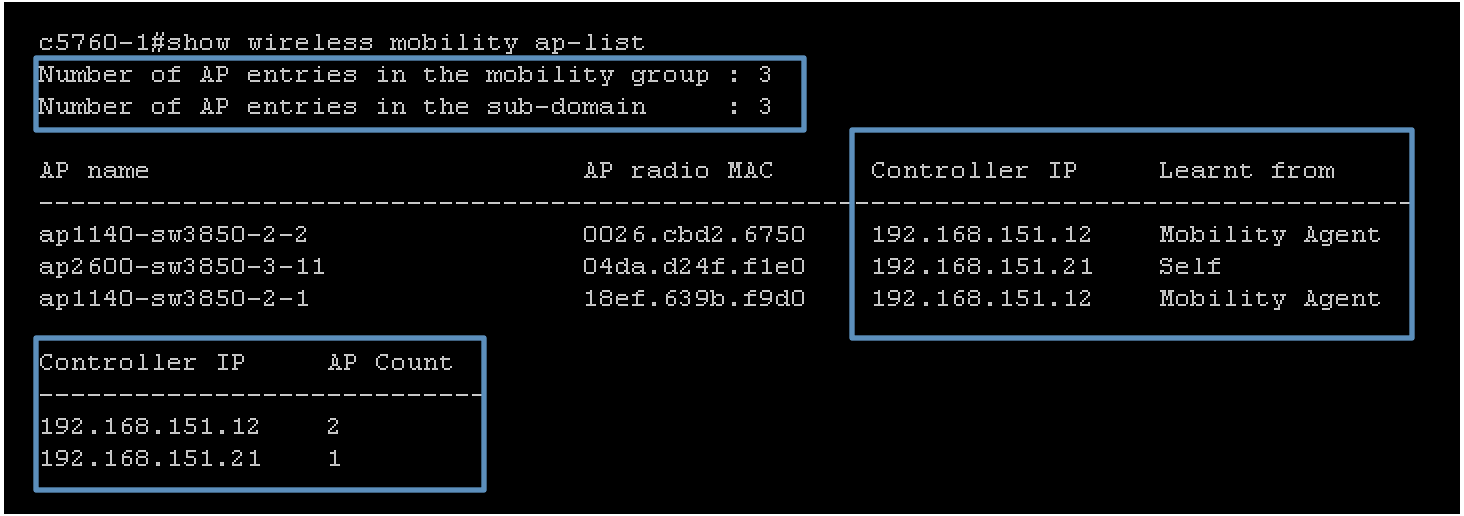


```
3850-2#show ap summary
Number of APs: 2

Global AP User Name: Not configured
Global AP Dot1x User Name: Not configured

AP Name                           AP Model  Ethernet MAC    Radio MAC       State
----------------------------------------------------------------------------------------
ap1140-sw3850-2-2                 1142N     0022.bd1a.d42b  0026.cbd2.6750  Registered
ap1140-sw3850-2-1                 1142N     c84c.75f3.e788  18ef.639b.f9d0  Registered
```

AP Join

Verify (sub-)domain Joined APs (MC)

- show wireless mobility ap-list



```
c5760-1#show wireless mobility ap-list
Number of AP entries in the mobility group : 3
Number of AP entries in the sub-domain     : 3

AP name                            AP radio MAC      Controller IP     Learnt from
------------------------------------------------------------------------------------
ap1140-sw3850-2-2                  0026.cbd2.6750    192.168.151.12    Mobility Agent
ap2600-sw3850-3-11                 04da.d24f.f1e0    192.168.151.21    Self
ap1140-sw3850-2-1                  18ef.639b.f9d0    192.168.151.12    Mobility Agent

Controller IP     AP Count
----------------------------
192.168.151.12    2
192.168.151.21    1
```

AP Configuration Modes

```
3850#ap name 3600a ?
  ap-groupname       Set groupname
  capwap             AP Capwap parameters
  cdp                Enable cdp
  command            Remote execute a command on Cisco AP
  console-redirect   Enable redirecting remote debug output of Cisco AP to console
  .../...

3850(config)#ap ?
  auth-list          Configure Access Point autho
  capwap             ap capwap parameters
  cdp                Enable/Disable CDP for all Cisco
  core-dump          Enable/Disable memory core dump
  country            Configure the country of operation
  dot11              Configures 802.11 parameters
.../...
```

Configure individual AP from here

Configure global AP parameters from here

AP Join Troubleshooting

Typical Issues

- Licensing
- Regulatory domain mismatch
- AP not on wireless management VLAN (3850)
- Certificate validation (time)

AP Join

Traces and Debugs

Traces

- set trace group-ap level debug
- set trace group-ap filter mac xxxx.xxxx.xxxx

Debugs

- debug capwap **ap** events
- debug capwap **ap** error

Note: No filter functionality

AP Join Troubleshooting

Licensing

```
[12/30/13 03:17:36.802 UTC f0e9 8531] 0026.cbd2.6750 License is denied for the AP,
calling the AP reset

[12/30/13 03:17:36.802 UTC f0ea 8531] 0026.cbd2.6750 Reset request sent to
192.168.151.13:44356

[12/30/13 03:17:36.802 UTC f0eb 8531] 0026.cbd2.6750 License check failed: License
is denied for the AP, calling the AP reset
```

- Is the MA configured to talk with an MC?

AP Join Troubleshooting

Licensing

- Verify: `3850-2#`**`show wireless mobility summary`**

```
Mobility Agent Summary:

Mobility Role                                     : Mobility Agent

Link Status is Control Link Status : Data Link Status

The status of Mobility Controller:

IP               Public IP             Link Status
------------------------------------------------
0.0.0.0          0.0.0.0               -    : -
```

- Fix: `3850-2(config)#`**`wireless mobility controller ip`** …

AP Join Troubleshooting

Invalid Country Code

```
*Dec 16 08:33:12.790: *%LWAPP-3-RD_ERR8: 1 wcm:  Country code (ES ) not configured
for AP 18:ef:63:9b:f9:d0
*Dec 16 08:33:12.791: *%LOG-3-Q_IND: 1 wcm:  Country code (ES ) not configured for
AP 18:ef:63:9b:f9:d0
*Dec 16 08:33:12.792: *%LWAPP-3-VALIDATE_ERR: 1 wcm:  Validation of SPAM Vendor
Specific Payload failed - AP  18:ef:63:9b:f9:d0
*Dec 16 08:33:12.793: *%LOG-3-Q_IND: 1 wcm:  Validation of SPAM Vendor Specific
Payload failed - AP  18:ef:63:9b:f9:d0
*Dec 16 08:33:12.793: *%LWAPP-3-RD_ERR8: 1 wcm:  Country code (ES ) not configured
for AP 18:ef:63:9b:f9:d0
*Dec 16 08:33:12.793: *%LWAPP-3-RD_ERR4: 1 wcm:  Invalid regulatory domain
802.11bg:-A     802.11a:-A for AP 18:ef:63:9b:f9:d0
```

- Verify:

```
3850-2#show wireless country configured
 Configured Country.............................: US  - United States
```

- Fix:

```
3850-2(config)#ap country ?
  WORD  Enter the country code (e.g. US,MX,IN) up to a maximum of 20 countries
```

Must shutdown 2.4 and 5

AP Join Troubleshooting - 3850

APs must be in Wireless Management VLAN

```
Oct  9 12:57:45.362: %IOSXE-7-PLATFORM: 1 process wcm: 64D9.8946.CA30 Received a
Discovery Request from 64:d9:89:46:ca:30 on an unsupported VLAN 1.
srcIp(172.29.129.178) dstIp(10.10.20.2) Dropping the discovery request. AP will not
be able to join as it is on a different vlan than management or AP manager vlan
Oct  9 12:57:45.362: %IOSXE-7-PLATFORM: 1 process wcm: 64D9.8946.CA30 Unable to
process Discovery Request from 64d9.8946.ca30 due to missing AP Manager interface,
discovery request received on interface 65535 vlanId 1 srcIp(172.29.129.178)
dstIp(255.255.255.255)
Oct  9 12:57:45.363: %IOSXE-3-PLATFORM: 1 process wcm: *spamApTask0: %CAPWAP-3-
DISC_WIRELESS_INTERFACE_ERR1: Unable to process discovery request from AP
64d9.8946.ca30 , VLAN (1) scrIp (172.29.129.178) dstIp(255.255.255.255), could not
get wireless interface belonging to this network
```

- Verify:

```
3850-2#show wireless interface summary
Interface Name Interface Type VLAN ID IP Address      IP Netmask     MAC Address
------------------------------------------------------------------------------------

Vlan151        Management      151     192.168.151.12  255.255.255.0  44ad.d96c.77cd
```

- Fix:

```
3850-2(config)#interface gi1/0/1
3850-2(config-if)#switchport access vlan 151
```

AP Join Troubleshooting - 5760

Certificate Validation

```
Jan  1 12:14:04.539: %IOSXE-7-PLATFORM: 1 process wcm: 64D9.8946.B640 Discovery
Request from 10.10.22.31:9618
Jan  1 12:14:04.539: %IOSXE-7-PLATFORM: 1 process wcm: 64D9.8946.B640 Join Priority
Processing status = 0, Incoming Ap's Priority 0, MaxLrads = 1000, joined Aps =0
Jan  1 12:14:04.539: %IOSXE-7-PLATFORM: 1 process wcm: 64D9.8946.B640 Validated
Discovery request with dest ip : 10.10.21.3 from AP  10.10.22.31. Response to be
sent using ip : 10.10.21.3


Jan  1 12:14:14.551: %IOSXE-3-PLATFORM: 1 process wcm: *spamApTask1: %DTLS-3-
HANDSHAKE_FAILURE: Failed to complete DTLS handshake with peer 10.10.22.31  Reason:
sslv3 alert bad certificate

5760#show clock
12:20:27.298 UTC Mon Jan 1 2001
```

AP on different subnet, no problem so far...

- Fix:

```
3850-2#clock set …
3850-2(config)#ntp server …
```

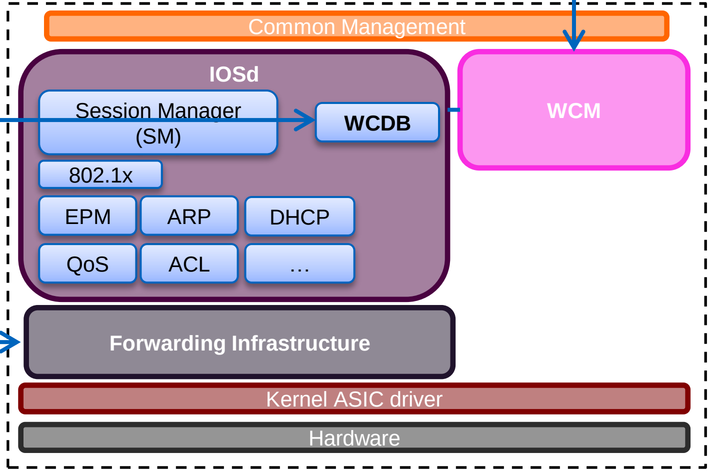
NTP!

Client Troubleshooting

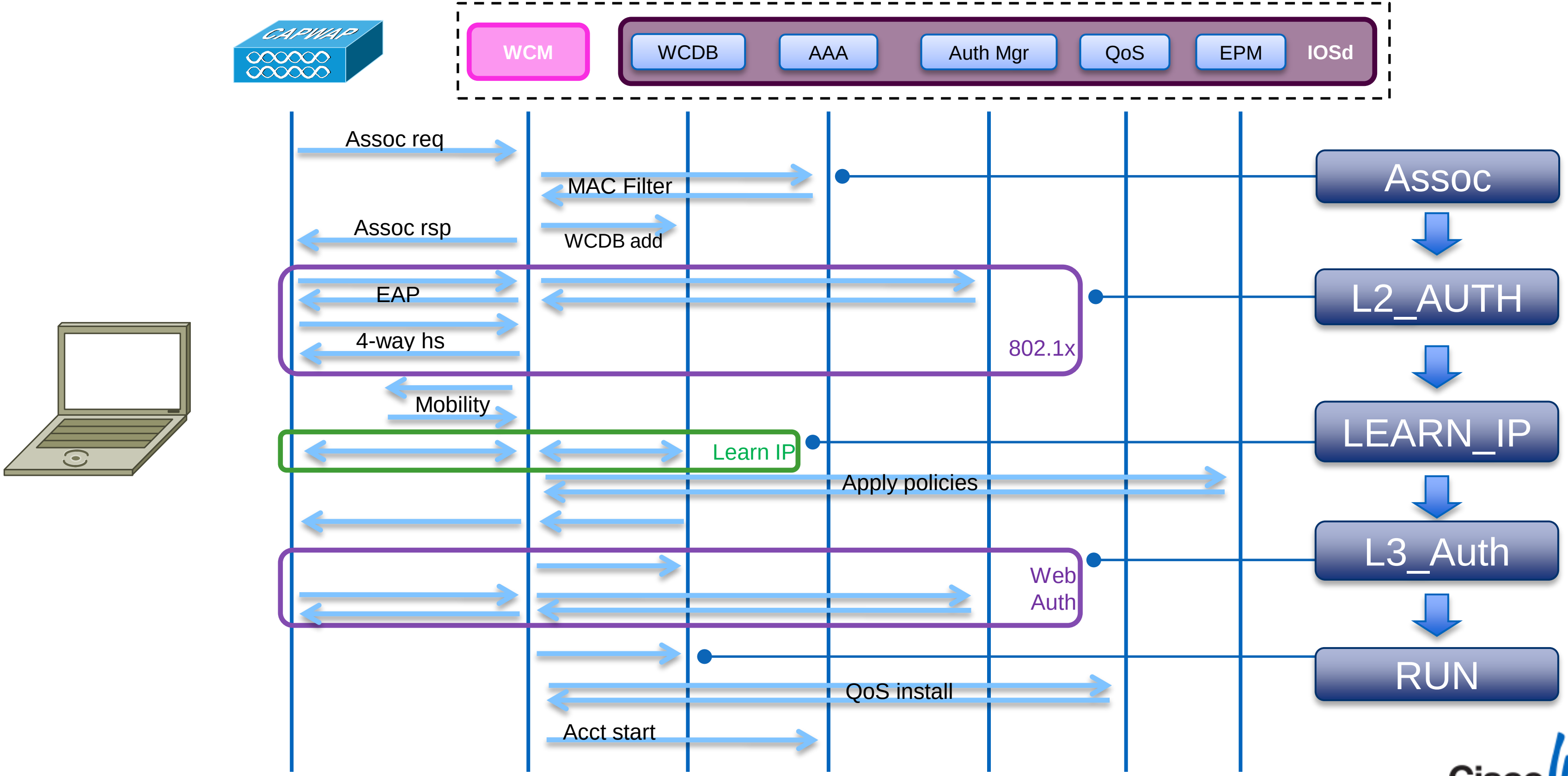
- 802.11 Authentication
- 802.11 (Re-)Association
- L2 Authentication (802.1x/PSK)
- Mobility discovery
- Client address learning
- L3 Authentication (Web-auth)
- Forwarding
- Roaming

Wireless Client Details

- Client information maintained in 3 main processes
- **WCM**
  - `show wireless client mac-address xxxx.xxxx.xxxx detail`
  - `show wireless client username <username>`
- **IOSd WCDB**
  - `show wcdb database all`
  - `show wcdb database xxxx.xxxx.xxxx`
- **Platform (FED)**
  - `show platform wcdb summary`
  - `show platform wcdb clientIndex <client-index> summary`



Client Flow and States



Client Troubleshooting

Traces and Debugs

Traces

- set trace group-wireless-client filter mac xxxx.xxxx.xxxx
- set trace group-wireless-client level debug

Open auth

- set trace group-wireless-secure filter mac xxxx.xxxx.xxxx
- set trace group-wireless-secure level debug

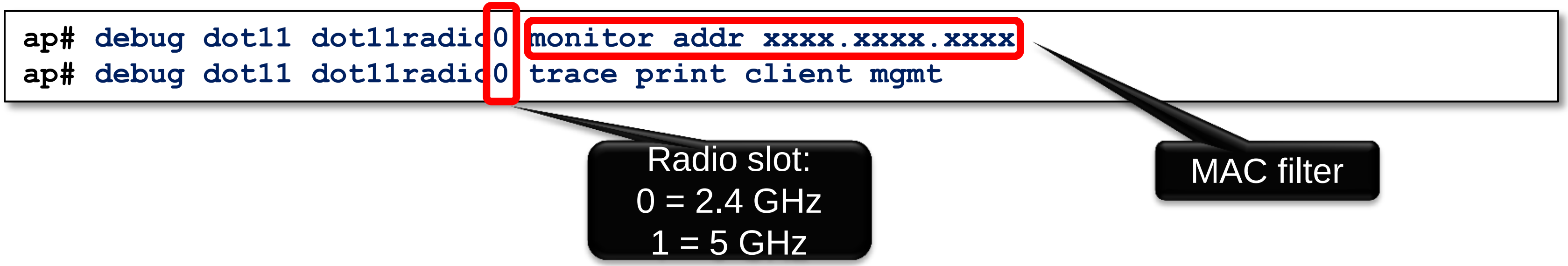
L2 auth (3.3SE+)

Debugs

- debug client mac-address xxxx.xxxx.xxxx
- debug wcm-dot1x trace
- debug wcm-dot1x event
- debug wcm-dot1x error

802.11 Authentication

- Handled by the Access Point
- Not visible at WLC logs/debugs
- Debugging has to be done at radio driver level (AP):



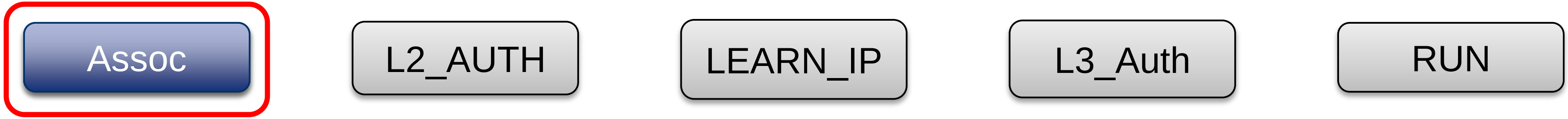
```
ap# debug dot11 dot11radio0 monitor addr xxxx.xxxx.xxxx
ap# debug dot11 dot11radio0 trace print client mgmt
```

Radio slot:
0 = 2.4 GHz
1 = 5 GHz

MAC filter

Client Flow

The Route Toward the RUN State!



Assoc

L2_AUTH

LEARN_IP

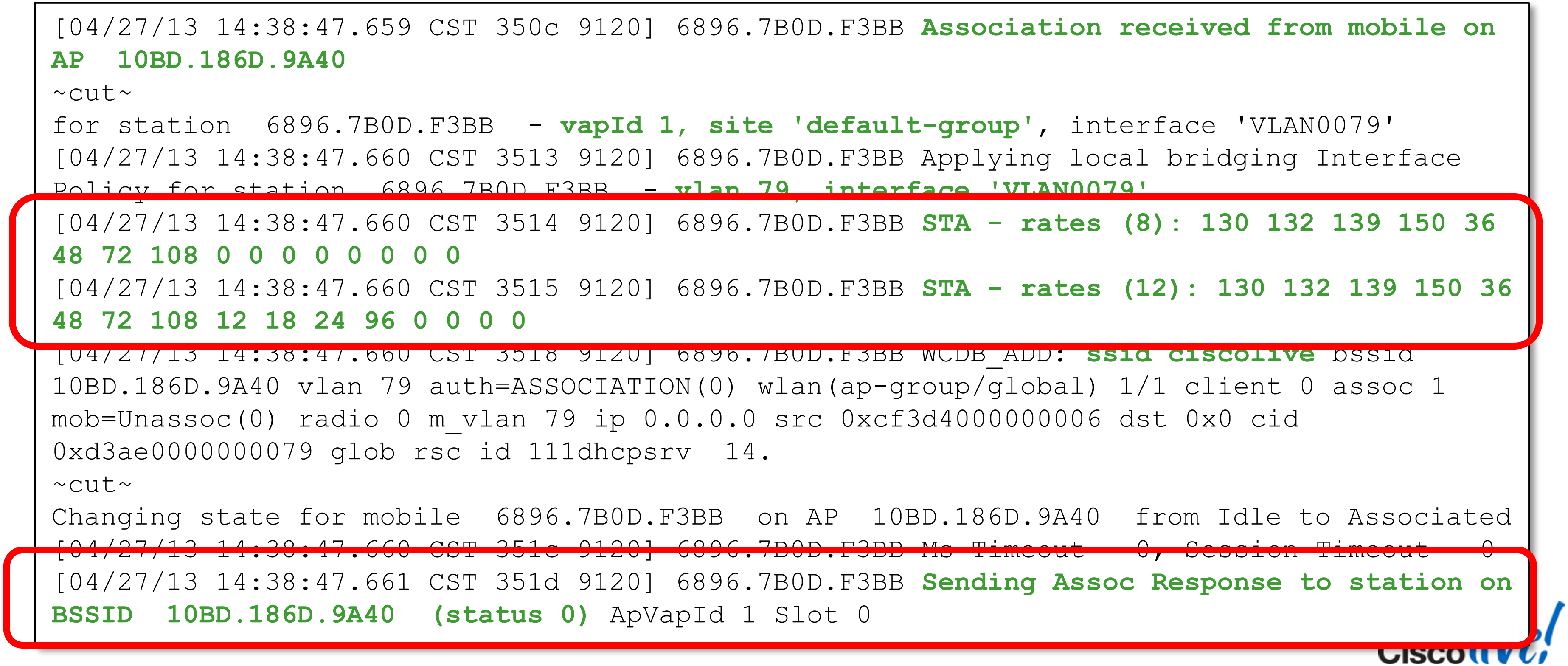
L3_Auth

RUN

Client Association

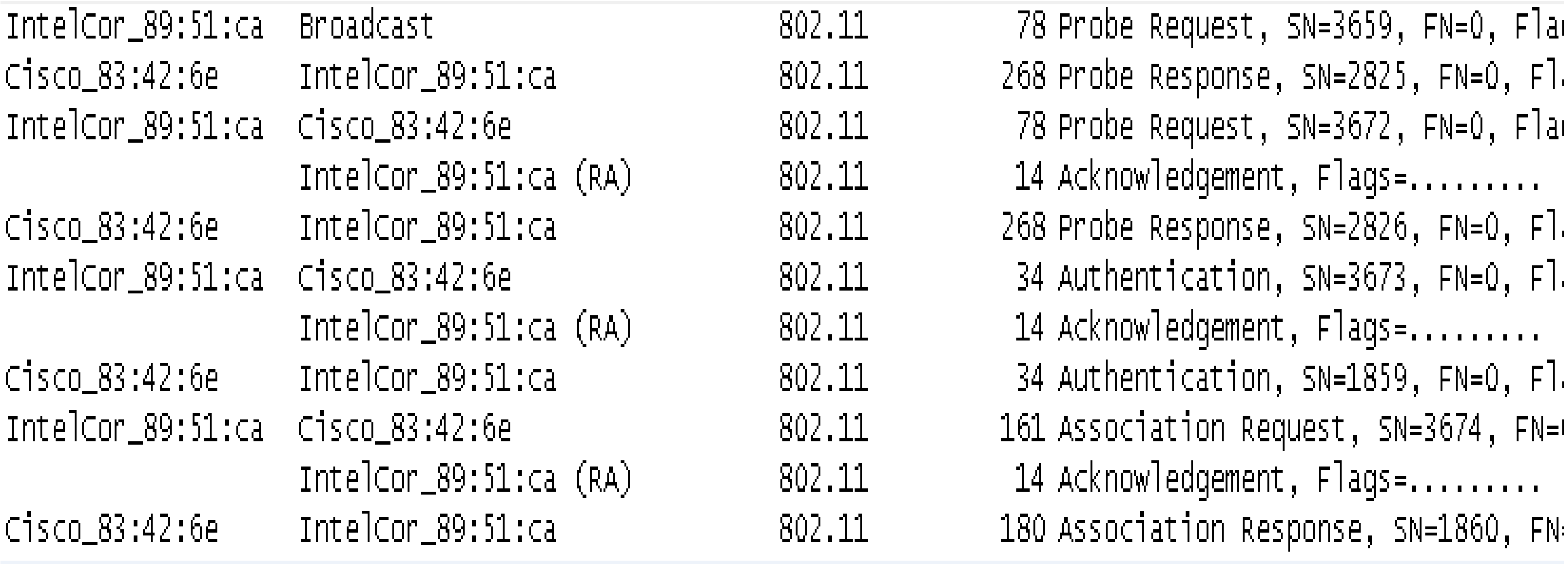
Success!

Assoc



```
[04/27/13 14:38:47.659 CST 350c 9120] 6896.7B0D.F3BB Association received from mobile on
AP  10BD.186D.9A40
~cut~
for station  6896.7B0D.F3BB  - vapId 1, site 'default-group', interface 'VLAN0079'
[04/27/13 14:38:47.660 CST 3513 9120] 6896.7B0D.F3BB Applying local bridging Interface
Policy for station  6896.7B0D.F3BB  - vlan 79, interface 'VLAN0079'
[04/27/13 14:38:47.660 CST 3514 9120] 6896.7B0D.F3BB STA - rates (8): 130 132 139 150 36
48 72 108 0 0 0 0 0 0 0 0
[04/27/13 14:38:47.660 CST 3515 9120] 6896.7B0D.F3BB STA - rates (12): 130 132 139 150 36
48 72 108 12 18 24 96 0 0 0 0
[04/27/13 14:38:47.660 CST 3518 9120] 6896.7B0D.F3BB WCDB_ADD: ssid ciscolive bssid
10BD.186D.9A40 vlan 79 auth=ASSOCIATION(0) wlan(ap-group/global) 1/1 client 0 assoc 1
mob=Unassoc(0) radio 0 m_vlan 79 ip 0.0.0.0 src 0xcf3d4000000006 dst 0x0 cid
0xd3ae0000000079 glob rsc id 111dhcpsrv  14.
~cut~
Changing state for mobile  6896.7B0D.F3BB  on AP  10BD.186D.9A40  from Idle to Associated
[04/27/13 14:38:47.660 CST 351c 9120] 6896.7B0D.F3BB Ms Timeout   0, Session Timeout   0
[04/27/13 14:38:47.661 CST 351d 9120] 6896.7B0D.F3BB Sending Assoc Response to station on
BSSID  10BD.186D.9A40  (status 0) ApVapId 1 Slot 0
```

Wireless PCAP



```
IntelCor_89:51:ca  Broadcast                  802.11    78 Probe Request, SN=3659, FN=0, Fla
Cisco_83:42:6e     IntelCor_89:51:ca          802.11   268 Probe Response, SN=2825, FN=0, Fl
IntelCor_89:51:ca  Cisco_83:42:6e             802.11    78 Probe Request, SN=3672, FN=0, Fla
                   IntelCor_89:51:ca (RA)     802.11    14 Acknowledgement, Flags=........
Cisco_83:42:6e     IntelCor_89:51:ca          802.11   268 Probe Response, SN=2826, FN=0, Fl
IntelCor_89:51:ca  Cisco_83:42:6e             802.11    34 Authentication, SN=3673, FN=0, Fl
                   IntelCor_89:51:ca (RA)     802.11    14 Acknowledgement, Flags=........
Cisco_83:42:6e     IntelCor_89:51:ca          802.11    34 Authentication, SN=1859, FN=0, Fl
IntelCor_89:51:ca  Cisco_83:42:6e             802.11   161 Association Request, SN=3674, FN=
                   IntelCor_89:51:ca (RA)     802.11    14 Acknowledgement, Flags=........
Cisco_83:42:6e     IntelCor_89:51:ca          802.11   180 Association Response, SN=1860, FN
```

Client Association

IE Processing

Assoc

```
STA - rates (12): 130 132 139 150 12 18 24 36 48 72 96 108 0 0 0 0
Processing RSN IE type 48, length 22 for mobile 00:16:ea:b2:04:36
```

- STA - rates

  Mandatory Rates (>128) = (#-128)/2

  Supported Rates (<128) = #/2

  1m,2m,5.5m,11m,6s,9s,12s,18s,24s,36s,48s,54s

- Processing **RSN IE type 48** WPA2-AES

  Processing WPA IE type 221 WPA-TKIP

For more info:
IEEE 802.11-2012
8.4.2.27 RSNE

Client Association

Association Response

Assoc

```
Sending Assoc Response to station on BSSID 00:26:cb:94:44:c0 (status 0) ApVapId 1
Slot 0
```

- **Slot 0** = B/G(2.4) Radio

  Slot 1 = A(5) Radio

- Sending Assoc Response **Status 0** = Success

  Anything other than Status 0 is Failure

Client Association

Typical Issues

Assoc

- Configuration related
  - Radio/WLAN shutdown
  - Data rate config mismatch
  - WMM policy mismatch
  - MAC filtering failure
- Scaling related
  - Max number of clients on radio interface
  - Call Admission Control (CAC)
- Client in exclusion list
- Client Idle

Client Association

Excluded Client

Assoc

- Client in exclusion list

```
*Dec 23 17:31:08.089: %IOSXE-7-PLATFORM: 1 process wcm: 0023.6907.e218 Ignoring
assoc request due to mobile in exclusion list or marked for deletion
```

- Check client exclusion

```
c5760-1# show wireless exclusionlist
```

- Remove a client from exclusion list (deauth)

```
c5760-1# wireless client mac-address xxxx.xxxx.xxxx deauthenticate
```

Client Idle

- Client state as Idle

```
3850-2# show wireless client summary
Number of Local Clients : 1

MAC Address    AP Name                              WLAN State            Protocol
----------------------------------------------------------------------------------
0023.6907.e218 ap1140-sw3850-2-2                    2    Idle            11n(2.4)
```

- Upon client association traces usually show…

```
Ignoring 802.11 assoc request from mobile pending deletion
```

- Different causes may lead to this state

Client Idle

- Examples of reasons for client idle:
  - CSCug75799 – fixed in 3.2.3SE+
  - Incorrect QoS config

  For more info see **BRKCRS-2890** - Converged Access Quality of Service

  Available at CiscoLive365!

- Collect client idle troubleshooting info:

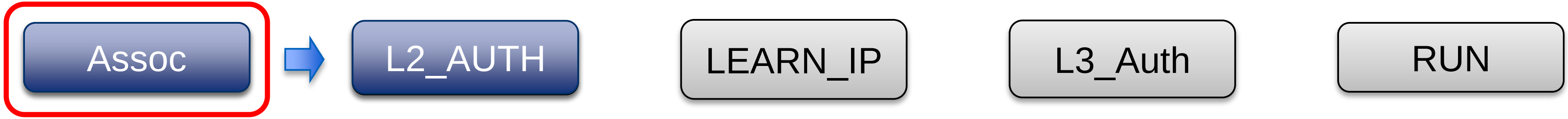
```
show tech-support platform wireless client mac-address xxxx.xxxx.xxxx
```

- Force deauth to recover the client:

```
wireless client mac-address xxxx.xxxx.xxxx deauthenticate forced
```

Client Flow

The Route Toward the RUN State!



Layer 2 Authentication

Show Client Status

L2_AUTH

- WCM

```
3850-2#show wireless client summary
Number of Local Clients : 1

MAC Address    AP Name                                    WLAN State              Protocol
--------------------------------------------------------------------------------
0023.6907.e218 ap1140-sw3850-2-2                          2    AUTHENTICATING     11g
```

- WCDB

```
3850-2#show wcdb database all

Mac Address    VlanId IP Address      Src If             Auth     Mob
-------------- ------ --------------- ------------------ -------- -------
0023.6907.e218    153 0.0.0.0         0x00C99740000006BC ASSOCIAT INIT
```

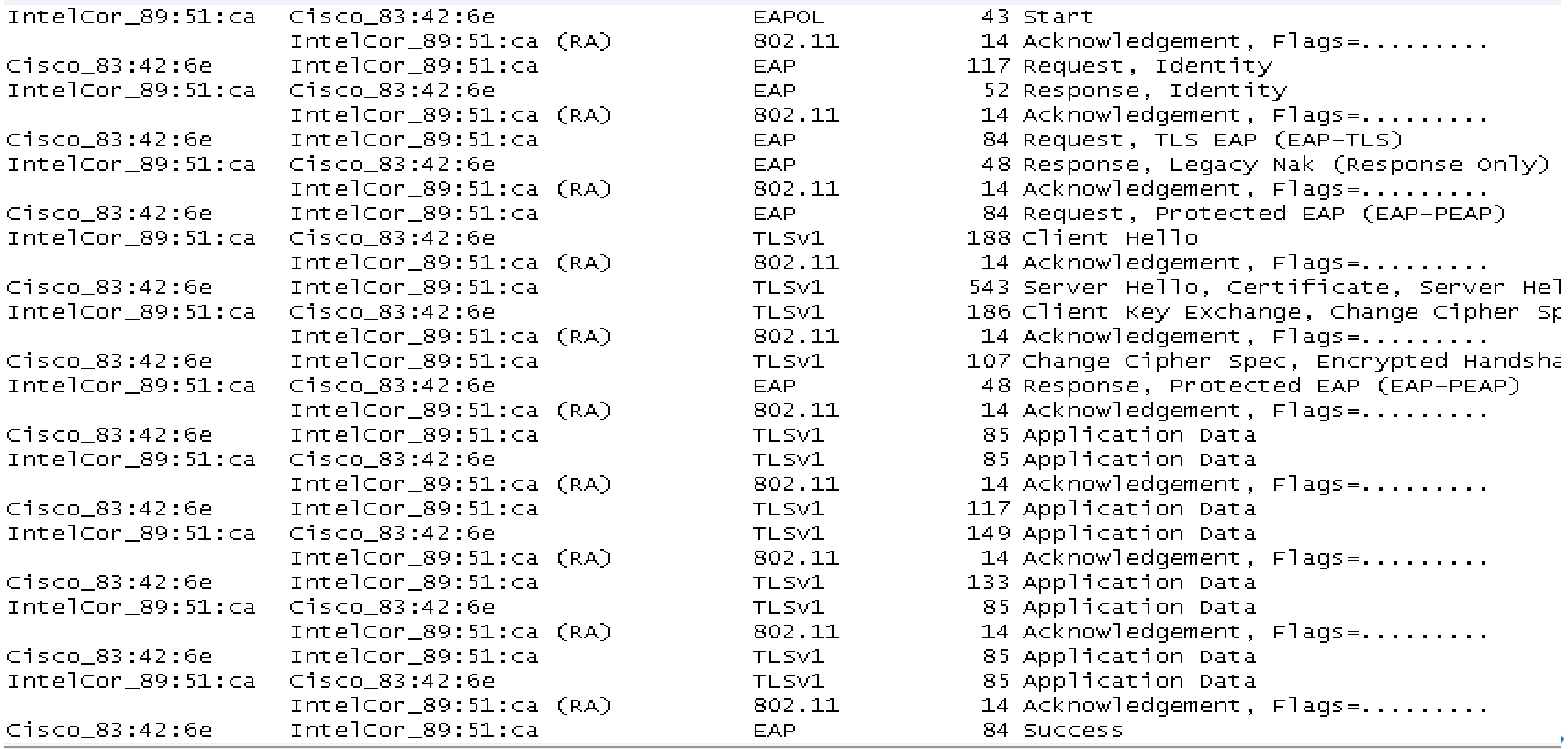
Layer 2 Authentication

802.1x Successful Authentication

L2_AUTH

```
0021.6a89.51ca Association received from mobile on AP  c8f9.f983.4260
0021.6a89.51ca Sending Assoc Response to station on BSSID  c8f9.f983.4260  (status 0)
ApVapId 2 Slot 1
0021.6a89.51ca 1XA: Session Start from wireless client
ACCESS-CORE-SM-CLIENT-SPI-NOTF: [0021.6a89.51ca, Ca2] Session start request from
Client[1] for 0021.6a89.51ca (method: Dot1X, method list: ACS, aaa id: 0x0000037C)
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca2] Posting !EAP_RESTART on Client 0x2000000E
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca2] Sending EAPOL packet
ACCESS-METHOD-DOT1X-INFO: [0021.6a89.51ca, Ca2] EAPOL packet sent to client 0x2000000E
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca2] Response sent to the server from
0x2000000E
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca2] 0x2000000E:request response action
AAA SRV(00000000): process authen req
AAA SRV(00000000): Authen method=SERVER_GROUP ACS
AAA SRV(00000000): protocol reply GET_CHALLENGE_RESPONSE for Authentication
AAA SRV(00000000): Return Authentication status=PASS
ACCESS-METHOD-DOT1X-INFO: [0021.6a89.51ca, Ca2] Received an EAP Success
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca2] Received Authz Success for the client
0x2000000E (0021.6a89.51ca)
```

Wireless PCAP



```
IntelCor_89:51:ca   Cisco_83:42:6e              EAPOL          43 Start
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           EAP           117 Request, Identity
IntelCor_89:51:ca   Cisco_83:42:6e              EAP            52 Response, Identity
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           EAP            84 Request, TLS EAP (EAP-TLS)
IntelCor_89:51:ca   Cisco_83:42:6e              EAP            48 Response, Legacy Nak (Response Only)
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           EAP            84 Request, Protected EAP (EAP-PEAP)
IntelCor_89:51:ca   Cisco_83:42:6e              TLSv1         188 Client Hello
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           TLSv1         543 Server Hello, Certificate, Server Hel
IntelCor_89:51:ca   Cisco_83:42:6e              TLSv1         186 Client Key Exchange, Change Cipher Sp
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           TLSv1         107 Change Cipher Spec, Encrypted Handsha
IntelCor_89:51:ca   Cisco_83:42:6e              EAP            48 Response, Protected EAP (EAP-PEAP)
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           TLSv1          85 Application Data
IntelCor_89:51:ca   Cisco_83:42:6e              TLSv1          85 Application Data
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           TLSv1         117 Application Data
IntelCor_89:51:ca   Cisco_83:42:6e              TLSv1         149 Application Data
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           TLSv1         133 Application Data
IntelCor_89:51:ca   Cisco_83:42:6e              TLSv1          85 Application Data
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           TLSv1          85 Application Data
IntelCor_89:51:ca   Cisco_83:42:6e              TLSv1          85 Application Data
                    IntelCor_89:51:ca (RA)      802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e      IntelCor_89:51:ca           EAP            84 Success
```

Layer 2 Authentication

Typical Issues

L2_AUTH

- RADIUS server reachability
- Reject from RADIUS server
  - invalid credentials, certificate validation, max sessions…
- EAP timeout
- AAA override
- Incorrect Pre-Shared Key

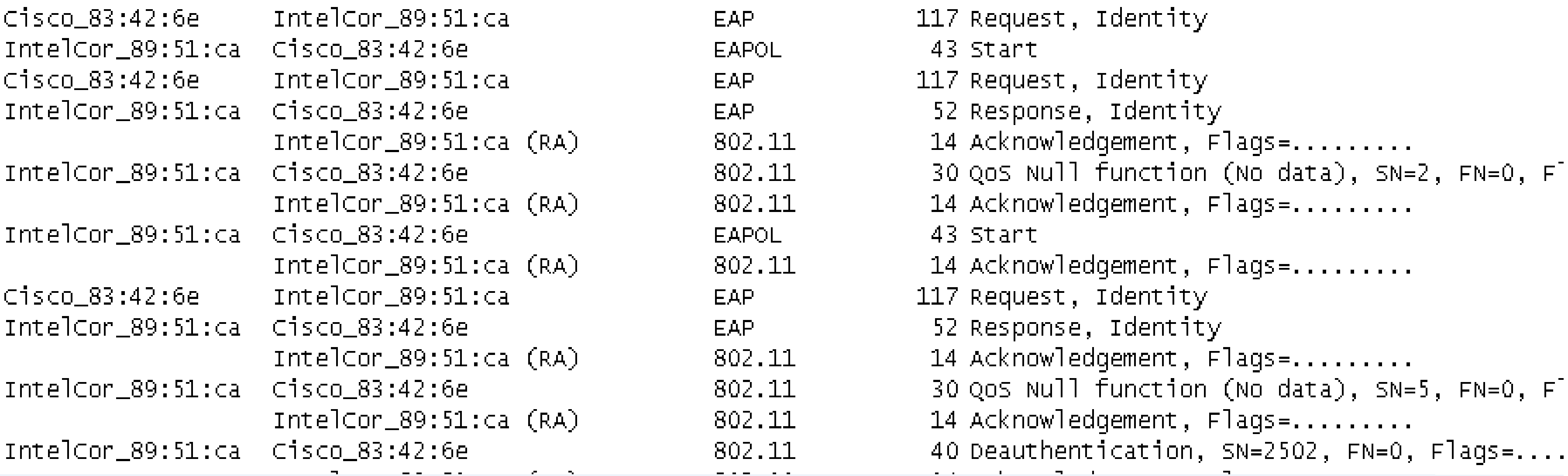
Layer 2 Authentication

802.1x Auth Fail – RADIUS Timeout

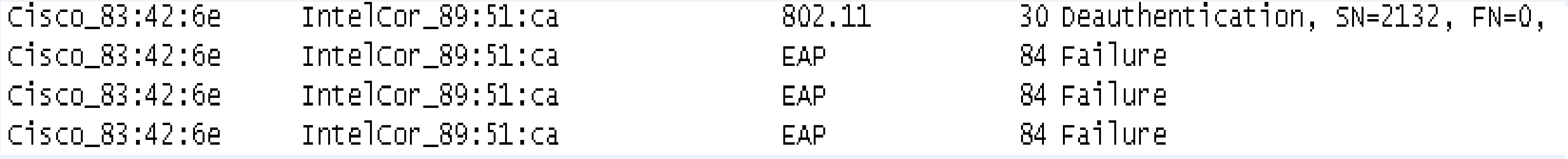
```
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca3] Posting EAPOL_EAP for 0x1A000001
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca3] 0x1A000001:entering response state
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca3] Response sent to the server from
0x1A000001
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca3] Received an EAP Fail
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca3] Posting EAP FAIL for 0x1A000001
ACCESS-CORE-SM-NOTF: [0021.6a89.51ca, Ca3] Authc failure from Dot1X (1), status AAA
Server Down (2) / event server dead (2)
ACCESS-CORE-SM-NOTF: [0021.6a89.51ca, Ca3] Highest prio method: INVALID, Authz method:
INVALID, Conn hdl: dot1x
ACCESS-CORE-SM-NOTF: [0021.6a89.51ca, Ca3] Client 0021.6a89.51ca, Method dot1x changing
state from 'Running' to 'Authc Failed'
0021.6a89.51ca 1XA: Authentication failed
0021.6a89.51ca 1XA: Sending deauth msg, Reason Code = 23
```

- Network connectivity issues?
- RADIUS server process running?

Wireless PCAP



```
Cisco_83:42:6e      IntelCor_89:51:ca                 EAP            117 Request, Identity
IntelCor_89:51:ca   Cisco_83:42:6e                    EAPOL           43 Start
Cisco_83:42:6e      IntelCor_89:51:ca                 EAP            117 Request, Identity
IntelCor_89:51:ca   Cisco_83:42:6e                    EAP             52 Response, Identity
                    IntelCor_89:51:ca (RA)            802.11          14 Acknowledgement, Flags=........
IntelCor_89:51:ca   Cisco_83:42:6e                    802.11          30 QoS Null function (No data), SN=2, FN=0, F
                    IntelCor_89:51:ca (RA)            802.11          14 Acknowledgement, Flags=........
IntelCor_89:51:ca   Cisco_83:42:6e                    EAPOL           43 Start
                    IntelCor_89:51:ca (RA)            802.11          14 Acknowledgement, Flags=........
Cisco_83:42:6e      IntelCor_89:51:ca                 EAP            117 Request, Identity
IntelCor_89:51:ca   Cisco_83:42:6e                    EAP             52 Response, Identity
                    IntelCor_89:51:ca (RA)            802.11          14 Acknowledgement, Flags=........
IntelCor_89:51:ca   Cisco_83:42:6e                    802.11          30 QoS Null function (No data), SN=5, FN=0, F
                    IntelCor_89:51:ca (RA)            802.11          14 Acknowledgement, Flags=........
IntelCor_89:51:ca   Cisco_83:42:6e                    802.11          40 Deauthentication, SN=2502, FN=0, Flags=....
```



```
Cisco_83:42:6e      IntelCor_89:51:ca                 802.11          30 Deauthentication, SN=2132, FN=0,
Cisco_83:42:6e      IntelCor_89:51:ca                 EAP             84 Failure
Cisco_83:42:6e      IntelCor_89:51:ca                 EAP             84 Failure
Cisco_83:42:6e      IntelCor_89:51:ca                 EAP             84 Failure
```

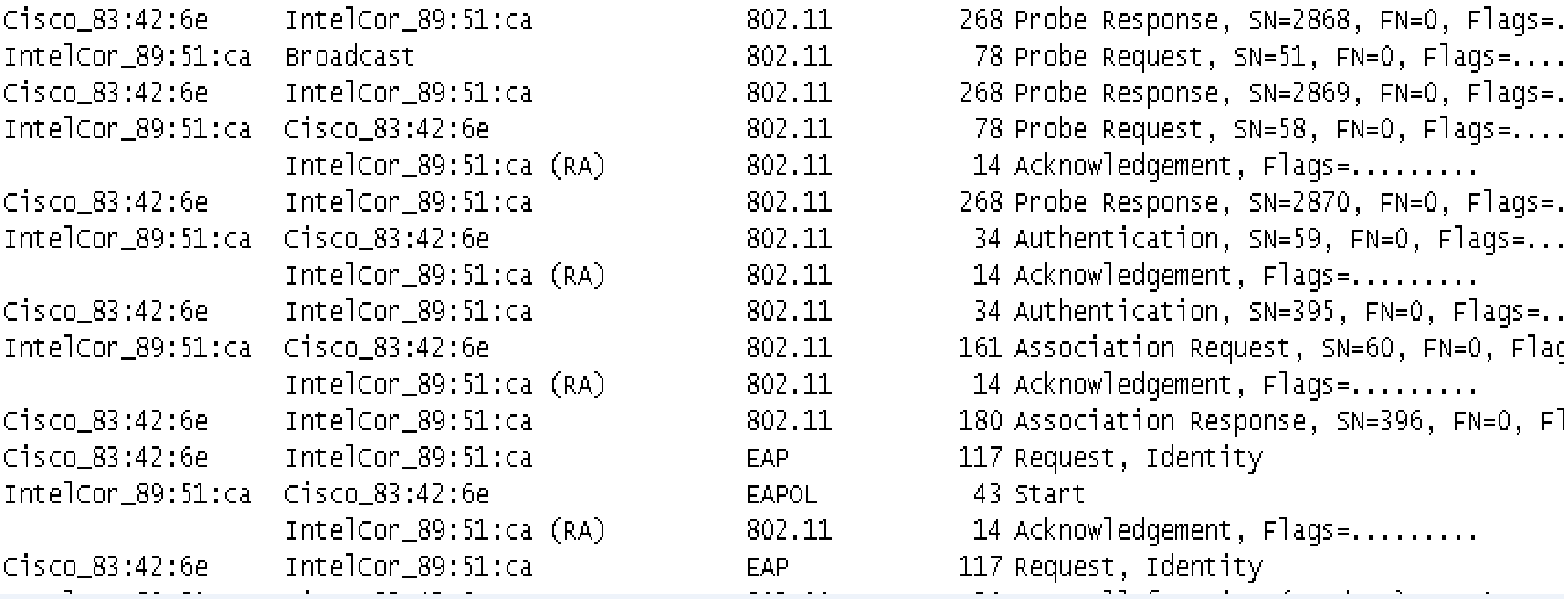
L2_AUTH

Layer 2 Authentication

EAP Timeout

```
[13:36:29.668] ACCESS-METHOD-DOT1X-INFO: [001a.7035.84d6, Ca2] EAPOL packet sent to
client 0x270001BD
[13:36:39.907] ACCESS-METHOD-DOT1X-NOTF: [001a.7035.84d6, Ca2] Received an EAP Timeout
[13:36:39.907] ACCESS-METHOD-DOT1X-DEB: [001a.7035.84d6, Ca2] Posting EAP_TIMEOUT for
0x270001BD
[13:36:39.907] ACCESS-METHOD-DOT1X-DEB: [001a.7035.84d6, Ca2] 0x270001BD:entering
timeout state
[13:36:39.907] ACCESS-METHOD-DOT1X-DEB: [001a.7035.84d6, Ca2] 0x270001BD:request timeout
action
[13:36:39.907] ACCESS-METHOD-DOT1X-DEB: [001a.7035.84d6, Ca2] 0x270001BD:entering idle
state
[13:36:39.907] ACCESS-METHOD-DOT1X-DEB: [001a.7035.84d6, Ca2] Posting AUTH_TIMEOUT on
Client 0x270001BD
[13:36:39.907] ACCESS-METHOD-DOT1X-DEB: [001a.7035.84d6, Ca2] 0x270001BD:exiting
authenticating state
[13:36:43.175] ACCESS-METHOD-DOT1X-NOTF: [001a.7035.84d6, Ca2] Override cfg -
SuppTimeout 10s  ReAuthMax 3, MaxReq 2, TxPeriod 30s
```

Wireless PCAP



```
Cisco_83:42:6e     IntelCor_89:51:ca          802.11       268 Probe Response, SN=2868, FN=0, Flags=.
IntelCor_89:51:ca  Broadcast                  802.11        78 Probe Request, SN=51, FN=0, Flags=....
Cisco_83:42:6e     IntelCor_89:51:ca          802.11       268 Probe Response, SN=2869, FN=0, Flags=.
IntelCor_89:51:ca  Cisco_83:42:6e             802.11        78 Probe Request, SN=58, FN=0, Flags=....
                   IntelCor_89:51:ca (RA)     802.11        14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          802.11       268 Probe Response, SN=2870, FN=0, Flags=.
IntelCor_89:51:ca  Cisco_83:42:6e             802.11        34 Authentication, SN=59, FN=0, Flags=...
                   IntelCor_89:51:ca (RA)     802.11        14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          802.11        34 Authentication, SN=395, FN=0, Flags=..
IntelCor_89:51:ca  Cisco_83:42:6e             802.11       161 Association Request, SN=60, FN=0, Flag
                   IntelCor_89:51:ca (RA)     802.11        14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          802.11       180 Association Response, SN=396, FN=0, Fl
Cisco_83:42:6e     IntelCor_89:51:ca          EAP          117 Request, Identity
IntelCor_89:51:ca  Cisco_83:42:6e             EAPOL         43 Start
                   IntelCor_89:51:ca (RA)     802.11        14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          EAP          117 Request, Identity
```

Layer 2 Authentication

EAP Timers

L2_AUTH

- **show run all | i wireless security dot1x**

```
wireless security dot1x eapol-key retries 2
wireless security dot1x eapol-key timeout 1000
wireless security dot1x group-key interval 3600

wireless security dot1x identity-request retries 2
wireless security dot1x identity-request timeout 30
wireless security dot1x request retries 2
wireless security dot1x request timeout 30
```

- Trace output

```
ACCESS-METHOD-DOT1X-NOTF: [001a.7035.84d6, Ca2] Override cfg
- SuppTimeout 30s, ReAuthMax 2, MaxReq 2, TxPeriod 30s
```

Layer 2 Authentication

L2_AUTH

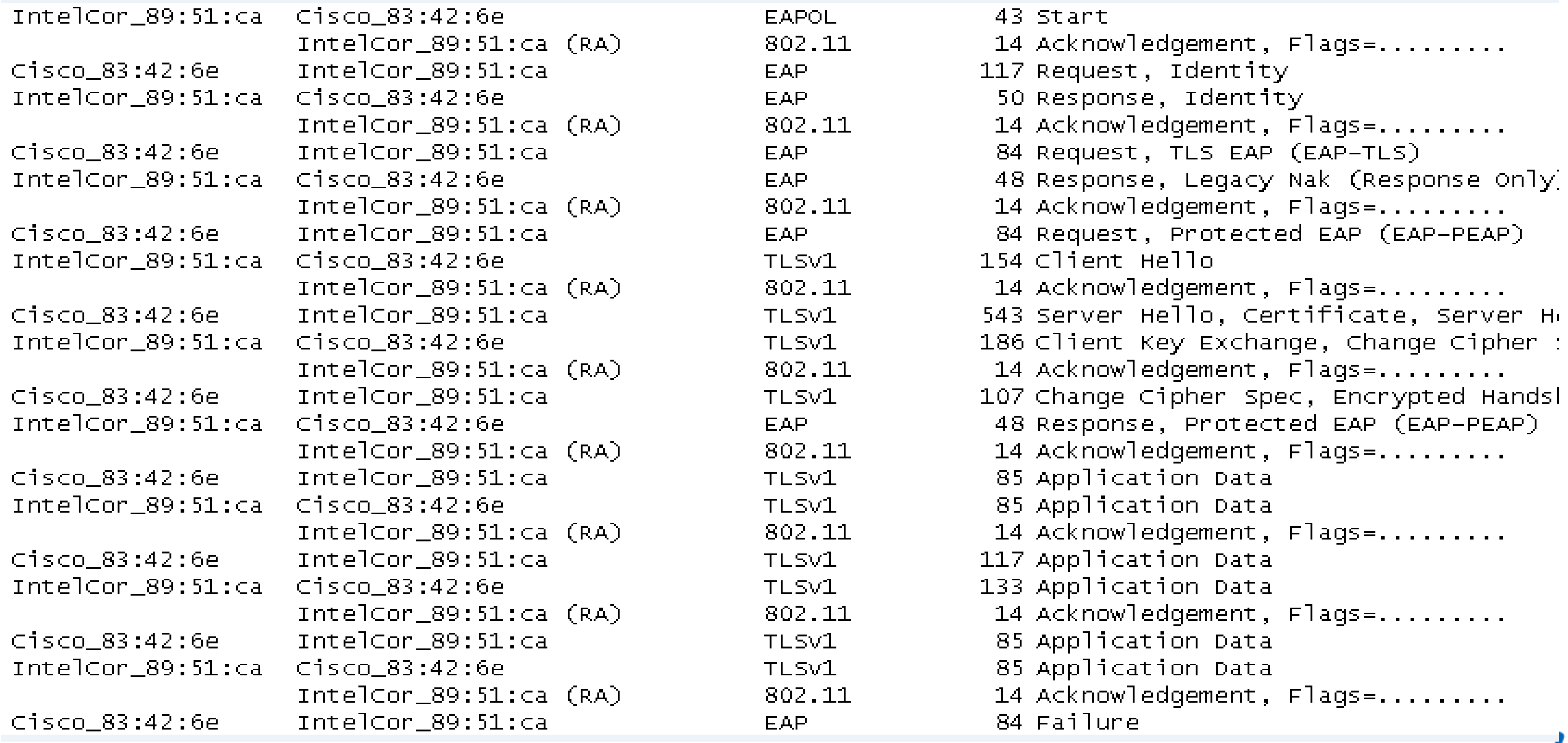
802.1x Auth Fail – Reject From AAA

```
0021.6a89.51ca Association received from mobile on AP  c8f9.f983.4260
0021.6a89.51ca Change state to AUTHCHECK (2) last state START (0)
0021.6a89.51ca Change state to 8021X_REQD (3) last state AUTHCHECK (2)
0021.6a89.51ca Session Manager Call Client 5bc380000003b, uid 41, capwap id
4cd1400000012,Flag 4, Audit-Session ID 0a6987b252838f4b00000029, method list ACS
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca3] 0xD1000017:entering request state
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca3] Sending EAPOL packet
0021.6a89.51ca 1XA: Received 802.11 EAPOL message (len 5) from mobile
0021.6a89.51ca 1XA: Received EAPOL-Start from mobile
ACCESS-METHOD-DOT1X-DEB: [0021.6a89.51ca, Ca3] Posting AUTH_ABORT for 0xD1000017
ACCESS-METHOD-DOT1X-NOTF: [0021.6a89.51ca, Ca3] Received an EAP Fail
ACCESS-CORE-SM-NOTF: [0021.6a89.51ca, Ca3] Authc failure from Dot1X (1), status Cred
Fail (1) / event fail (1)
```

- Incorrect credentials?
- User not found?
- Max sessions?
- Incorrect EAP method?

➡ AAA Server Logs

Wireless PCAP



```
IntelCor_89:51:ca  Cisco_83:42:6e             EAPOL          43 Start
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          EAP           117 Request, Identity
IntelCor_89:51:ca  Cisco_83:42:6e             EAP            50 Response, Identity
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          EAP            84 Request, TLS EAP (EAP-TLS)
IntelCor_89:51:ca  Cisco_83:42:6e             EAP            48 Response, Legacy Nak (Response Only
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          EAP            84 Request, Protected EAP (EAP-PEAP)
IntelCor_89:51:ca  Cisco_83:42:6e             TLSv1         154 Client Hello
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          TLSv1         543 Server Hello, Certificate, Server H
IntelCor_89:51:ca  Cisco_83:42:6e             TLSv1         186 Client Key Exchange, Change Cipher
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          TLSv1         107 Change Cipher Spec, Encrypted Handsl
IntelCor_89:51:ca  Cisco_83:42:6e             EAP            48 Response, Protected EAP (EAP-PEAP)
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          TLSv1          85 Application Data
IntelCor_89:51:ca  Cisco_83:42:6e             TLSv1          85 Application Data
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          TLSv1         117 Application Data
IntelCor_89:51:ca  Cisco_83:42:6e             TLSv1         133 Application Data
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          TLSv1          85 Application Data
IntelCor_89:51:ca  Cisco_83:42:6e             TLSv1          85 Application Data
                   IntelCor_89:51:ca (RA)     802.11         14 Acknowledgement, Flags=.........
Cisco_83:42:6e     IntelCor_89:51:ca          EAP            84 Failure
```

Layer 2 Authentication

802.1x Auth Fail – AAA Override

L2_AUTH

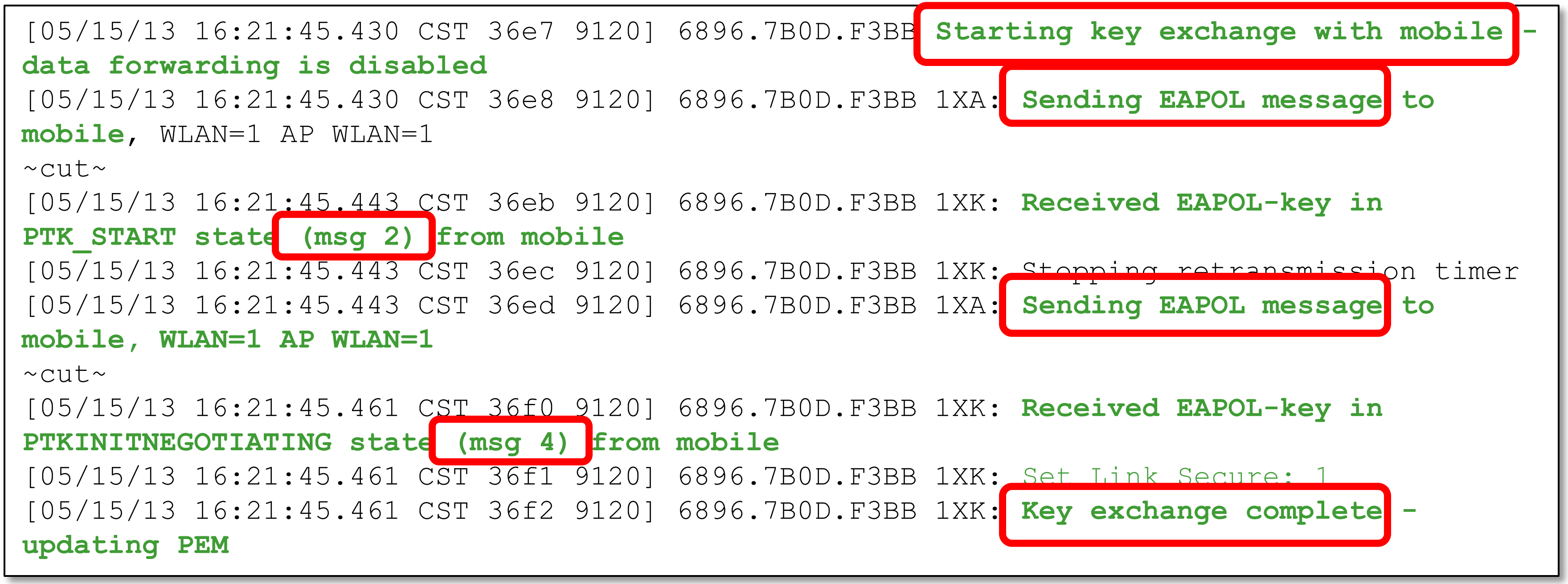
```
[12/23/13 17:30:49.480 UTC a 8531] 0023.6907.e218 misconfiguration: client vlan not
enable, therefore blacklist the client
[12/23/13 17:30:49.480 UTC b 8531] 0023.6907.e218 apfBlacklistMobileStationEntry2
(apf_ms.c:6241) Changing state for mobile  0023.6907.e218  on AP  0026.cbd2.6750  from
Idle to Exclusion-list (1)
[12/23/13 17:30:49.480 UTC c 8531] 0023.6907.e218 Reason code 0, Preset 1, AAA cause 1
[12/23/13 17:30:49.480 UTC d 8531] 0023.6907.e218 Scheduling deletion of Mobile Station:
(callerId: 44) in 10 seconds
[12/23/13 17:30:49.480 UTC e 8531] 0023.6907.e218 client is added to the exclusion list,
reason 6
```

- Incorrect VLAN pushed by AAA?
- VLAN not defined or disabled locally?

Layer 2 Authentication

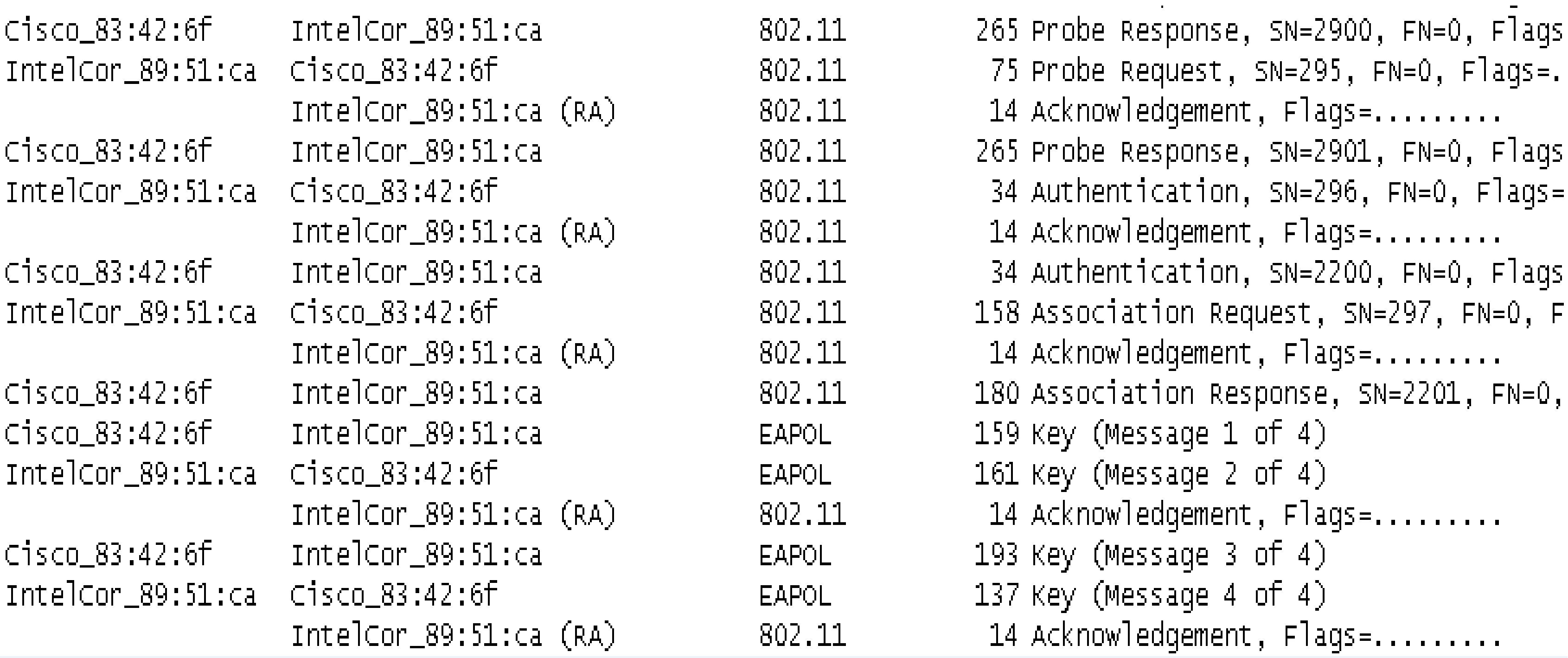
EAPOL Key Exchange

L2_AUTH



```
[05/15/13 16:21:45.430 CST 36e7 9120] 6896.7B0D.F3BB Starting key exchange with mobile -
data forwarding is disabled
[05/15/13 16:21:45.430 CST 36e8 9120] 6896.7B0D.F3BB 1XA: Sending EAPOL message to
mobile, WLAN=1 AP WLAN=1
~cut~
[05/15/13 16:21:45.443 CST 36eb 9120] 6896.7B0D.F3BB 1XK: Received EAPOL-key in
PTK_START state (msg 2) from mobile
[05/15/13 16:21:45.443 CST 36ec 9120] 6896.7B0D.F3BB 1XK: Stopping retransmission timer
[05/15/13 16:21:45.443 CST 36ed 9120] 6896.7B0D.F3BB 1XA: Sending EAPOL message to
mobile, WLAN=1 AP WLAN=1
~cut~
[05/15/13 16:21:45.461 CST 36f0 9120] 6896.7B0D.F3BB 1XK: Received EAPOL-key in
PTKINITNEGOTIATING state (msg 4) from mobile
[05/15/13 16:21:45.461 CST 36f1 9120] 6896.7B0D.F3BB 1XK: Set Link Secure: 1
[05/15/13 16:21:45.461 CST 36f2 9120] 6896.7B0D.F3BB 1XK: Key exchange complete -
updating PEM
```

Wireless PCAP



```
Cisco_83:42:6f     IntelCor_89:51:ca           802.11       265 Probe Response, SN=2900, FN=0, Flags
IntelCor_89:51:ca  Cisco_83:42:6f              802.11        75 Probe Request, SN=295, FN=0, Flags=.
                   IntelCor_89:51:ca (RA)      802.11        14 Acknowledgement, Flags=........
Cisco_83:42:6f     IntelCor_89:51:ca           802.11       265 Probe Response, SN=2901, FN=0, Flags
IntelCor_89:51:ca  Cisco_83:42:6f              802.11        34 Authentication, SN=296, FN=0, Flags=
                   IntelCor_89:51:ca (RA)      802.11        14 Acknowledgement, Flags=........
Cisco_83:42:6f     IntelCor_89:51:ca           802.11        34 Authentication, SN=2200, FN=0, Flags
IntelCor_89:51:ca  Cisco_83:42:6f              802.11       158 Association Request, SN=297, FN=0, F
                   IntelCor_89:51:ca (RA)      802.11        14 Acknowledgement, Flags=........
Cisco_83:42:6f     IntelCor_89:51:ca           802.11       180 Association Response, SN=2201, FN=0,
Cisco_83:42:6f     IntelCor_89:51:ca           EAPOL        159 Key (Message 1 of 4)
IntelCor_89:51:ca  Cisco_83:42:6f              EAPOL        161 Key (Message 2 of 4)
                   IntelCor_89:51:ca (RA)      802.11        14 Acknowledgement, Flags=........
Cisco_83:42:6f     IntelCor_89:51:ca           EAPOL        193 Key (Message 3 of 4)
IntelCor_89:51:ca  Cisco_83:42:6f              EAPOL        137 Key (Message 4 of 4)
                   IntelCor_89:51:ca (RA)      802.11        14 Acknowledgement, Flags=........
```

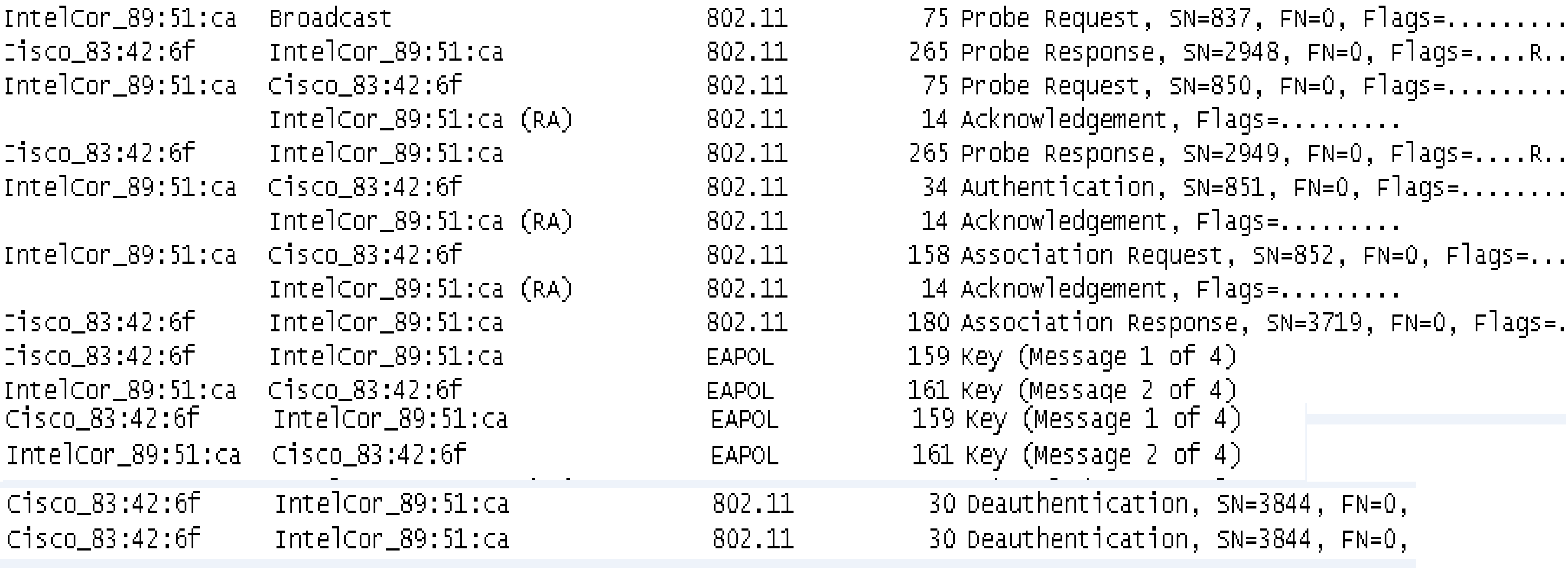
Layer 2 Authentication

EAPOL Key Exchange – Wrong PSK

L2_AUTH

```
0021.6a89.51ca 1XA: Using PSK
0021.6a89.51ca 1XK: Creating a PKC PMKID Cache entry (RSN 1)
0021.6a89.51ca 1XA: Initiating RSN PSK
0021.6a89.51ca Starting key exchange with mobile - data forwarding is disabled
0021.6a89.51ca 1XA: Sending EAPOL message to mobile, WLAN=1 AP WLAN=1
0021.6a89.51ca 1XA: Received EAPOL-Key from mobile
0021.6a89.51ca 1XK: Received EAPOL-key in PTK_START state (msg 2) from mobile
0021.6a89.51ca 1XA: 'key-response' timer expired
0021.6a89.51ca 1XA: Retransmit 1 of EAPOL-Key M1 (length 121)
0021.6a89.51ca Client authentication failed because the client did not respond to an
EAPOL-key message.SessionID().KeyMsg(1)
0021.6a89.51ca 1XA: Sending deauth msg, Reason Code = 15
0021.6a89.51ca Sent Deauthenticate to mobile with deauth reason code 15 on BSSID
1caa.076f.9e10  slot 1(caller dot1xapi_api.c:1576)
0021.6a89.51ca 1XA: Cleaning up dot1x
```

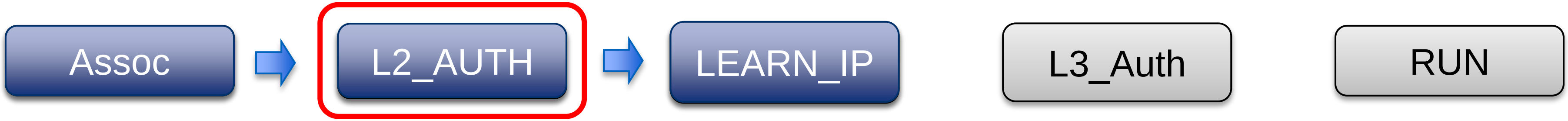
Wireless PCAP



```
IntelCor_89:51:ca   Broadcast                 802.11       75 Probe Request, SN=837, FN=0, Flags=........
Cisco_83:42:6f      IntelCor_89:51:ca         802.11      265 Probe Response, SN=2948, FN=0, Flags=....R..
IntelCor_89:51:ca   Cisco_83:42:6f            802.11       75 Probe Request, SN=850, FN=0, Flags=........
                    IntelCor_89:51:ca (RA)    802.11       14 Acknowledgement, Flags=........
Cisco_83:42:6f      IntelCor_89:51:ca         802.11      265 Probe Response, SN=2949, FN=0, Flags=....R..
IntelCor_89:51:ca   Cisco_83:42:6f            802.11       34 Authentication, SN=851, FN=0, Flags=........
                    IntelCor_89:51:ca (RA)    802.11       14 Acknowledgement, Flags=........
IntelCor_89:51:ca   Cisco_83:42:6f            802.11      158 Association Request, SN=852, FN=0, Flags=...
                    IntelCor_89:51:ca (RA)    802.11       14 Acknowledgement, Flags=........
Cisco_83:42:6f      IntelCor_89:51:ca         802.11      180 Association Response, SN=3719, FN=0, Flags=.
Cisco_83:42:6f      IntelCor_89:51:ca         EAPOL       159 Key (Message 1 of 4)
IntelCor_89:51:ca   Cisco_83:42:6f            EAPOL       161 Key (Message 2 of 4)
Cisco_83:42:6f      IntelCor_89:51:ca         EAPOL       159 Key (Message 1 of 4)
IntelCor_89:51:ca   Cisco_83:42:6f            EAPOL       161 Key (Message 2 of 4)
Cisco_83:42:6f      IntelCor_89:51:ca         802.11       30 Deauthentication, SN=3844, FN=0,
Cisco_83:42:6f      IntelCor_89:51:ca         802.11       30 Deauthentication, SN=3844, FN=0,
```

Client Flow

The Route Toward the RUN State!



IP Address Learning

LEARN_IP

- IP learning via IOSd modules
  - ARP

```
0023.6907.e218 WCDB_IP_BIND: w/ IPv4 192.168.40.108
ip_learn_type ARP add_delete 1,options_length 0
```

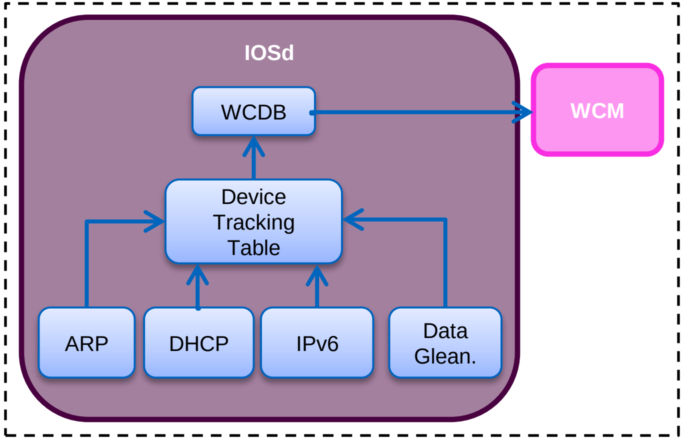
  - DHCP

```
0023.6907.e218 WCDB_IP_BIND: w/ IPv4 192.168.40.108
ip_learn_type DHCP add_delete 1,options_length 0
```

  - IPv6 NDP

```
0023.6907.e218 WCDB_CHANGE: auth=RUN(4) vlan 40
radio 0 client_id 0xe5cd800000068a
mobility=Local(1) src_int 0xfbb30000000671 dst_int
0x0 ackflag 2 reassoc_client 0 llm_notif 0 ip
0.0.0.0 ip_learn_type IPV6_NDP
```

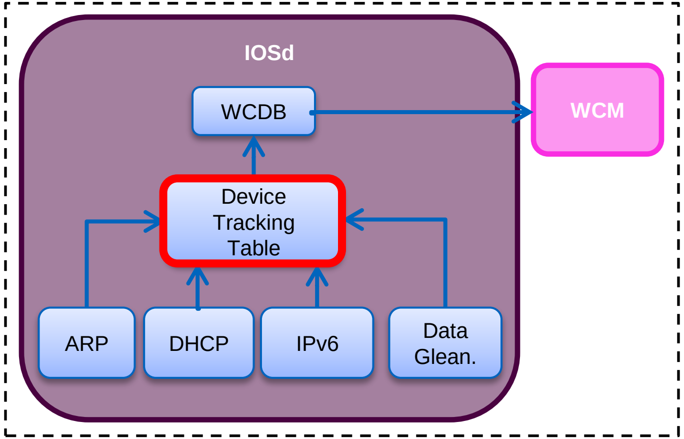
  - Data Gleaning (1st IP packet)
- If roaming, IP info exchanged via mobility



IP Address Learning

LEARN_IP

- IP Device Tracking Table (IPDT)
  - Enabled by default on 3.2.0 and above
  - Usage: Dynamic ACL / Inventory



- Verify IP Device Tracking Table

```
3850-2#show ip device tracking all
Global IP Device Tracking for clients = Enabled
Global IP Device Tracking Probe Count = 3
Global IP Device Tracking Probe Interval = 30
Global IP Device Tracking Probe Delay Interval = 0
-----------------------------------------------------------------------------------------
  IP Address     MAC Address    Vlan  Interface                Probe-Timeout     State    Source
-----------------------------------------------------------------------------------------
192.168.40.108  0023.6907.e218 40    Capwap3                    30              ACTIVE   DHCP
```

IP Address Learning

Show Client Status

LEARN_IP

- WCM

```
3850-2#show wireless client summary
Number of Local Clients : 1

MAC Address    AP Name                          WLAN State              Protocol
--------------------------------------------------------------------------------
0023.6907.e218 ap1140-sw3850-2-2                2    IPLEARN            11g
```

- WCDB

```
3850-2#show wcdb database all

Mac Address    VlanId IP Address      Src If             Auth     Mob
-------------- ------ --------------- ------------------ -------- -------
0023.6907.e218     40 0.0.0.0         0x00C99740000006BC LEARN_IP LOCAL
```

DHCP Snooping

Basic Config

LEARN_IP

- Must enable DHCP snooping if “**DHCP Required**” is set on the WLAN

- Enable **globally**

```
3850a(config)# ip dhcp snooping
```

- Enable on **client VLAN**(s)

```
3850a(config)# ip dhcp snooping vlan X,Y,…
```

- Apply **trust** on the interface(s) to the DHCP server

```
3850(config)#int gigabitEthernet 1/0/22
3850(config-if)#ip dhcp snooping trust
```

DHCP Snooping

Relay and DHCP Override

LEARN_IP

- If using an **ip-helper**, need to modify option 82 behaviour
  - “`no ip dhcp snooping information option`” on the **DHCP snooping** device

    or
  - “`ip dhcp relay information trusted`” (per interface) on the **DHCP relay** device
  - “`ip dhcp relay information trust-all`” (global configuration) on the relay device

- Need Layer 3 VLAN interface IP address for WLAN DHCP server override

```
3850a(config-wlan)# ip dhcp server ?
 A.B.C.D  Enter the override DHCP server's IP Address
```

DHCP Snooping

Traces and Debugs

Traces

- set trace dhcp filter mac xxxx.xxxx.xxxx
- set trace dhcp level debug

Debugs

- debug client mac-address xxxx.xxxx.xxxx
- debug ip dhcp snooping events,packet
- debug ip dhcp server events, packet
- debug wcdb error
- debug wcdb event
- debug ip device tracking

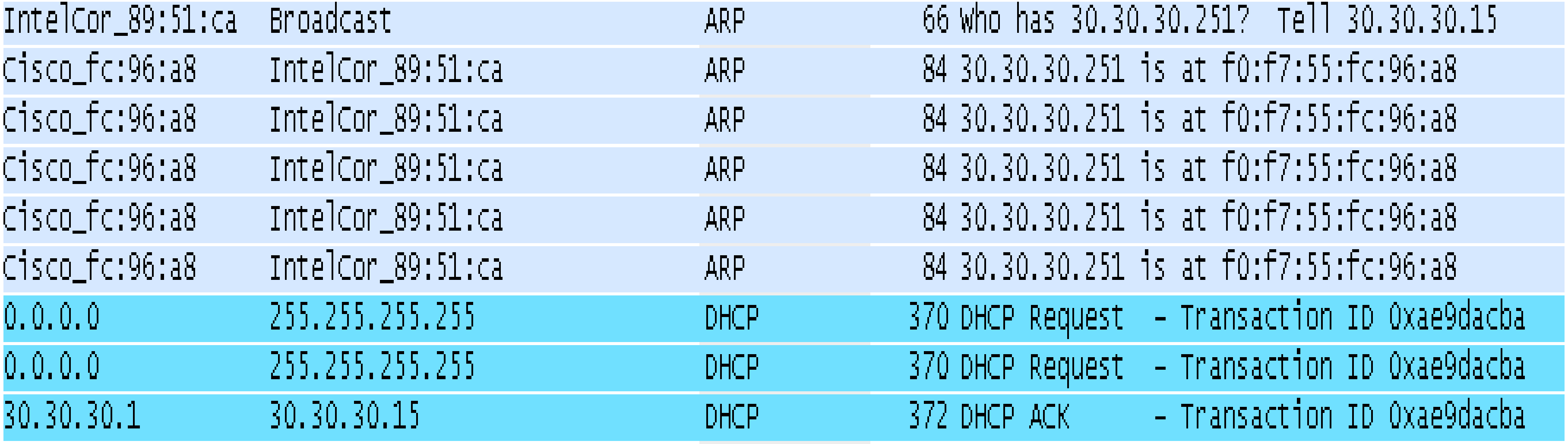
Viewing Client DHCP Handshake

Trace

LEARN_IP

```
dhcp pkt processing routine is called for pak with SMAC = 0021.6a89.51ca and SRC_ADDR = 0.0.0.0
sending dhcp packet outafter processing with SMAC = 0021.6a89.51ca and SRC_ADDR = 0.0.0.0
DHCPD: Got overriding information from client db
DHCPD: Reload workspace interface Vlan30 tableid 0.
DHCPD: tableid for 0.0.0.0 on Vlan30 is 0
DHCPD: DHCPREQUEST received from client 0100.216a.8951.ca.
DHCPD: address 30.30.30.2 mask 255.255.255.0
DHCPD: Sending DHCPACK to client 0100.216a.8951.ca (30.30.30.2).
DHCPD: no option 125
0021.6a89.51ca MS got the IP, resetting the Reassociation Count 0 for client
[WCDB] wcdb_ffcp_cb: client (0021.6a89.51ca) client (0x72468000005ae): FFCP operation (UPDATE)
return code (0)
dhcp pkt processing routine is called for pak with SMAC = 0021.6a89.51ca and SRC_ADDR =
30.30.30.2
sending dhcp packet outafter processing with SMAC = 0021.6a89.51ca and SRC_ADDR = 30.30.30.2
DHCPD: Got overriding information from client db
DHCPD: Reload workspace interface Vlan30 tableid 0.
DHCPD: tableid for 0.0.0.0 on Vlan30 is 0
DHCPD: DHCPINFORM received from client 0100.216a.8951.ca (30.30.30.2).
DHCPD: Sending DHCPACK to client 0100.216a.8951.ca (30.30.30.2).
```

Wireless PCAP



```
IntelCor_89:51:ca   Broadcast           ARP     66 Who has 30.30.30.251?  Tell 30.30.30.15
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
0.0.0.0             255.255.255.255     DHCP   370 DHCP Request  - Transaction ID 0xae9dacba
0.0.0.0             255.255.255.255     DHCP   370 DHCP Request  - Transaction ID 0xae9dacba
30.30.30.1          30.30.30.15         DHCP   372 DHCP ACK      - Transaction ID 0xae9dacba
```

DHCP Snooping

Not Getting an IP Address

LEARN_IP

```
0021.6a89.51ca Adding mobile on LWAPP AP  1caa.076f.9e10 (1)
0021.6a89.51ca Association received from mobile on AP  1caa.076f.9e10
0021.6a89.51ca WCDB_ADD: ssid Webauth bssid c8f9.f983.4260 vlan 12 auth=ASSOCIATION(0)
0021.6a89.51ca Change state to L2AUTHCOMPLETE (4) last state AUTHCHECK (2)
 0021.6a89.51ca Change state to DHCP_REQD (7) last state L2AUTHCOMPLETE (4)
 dhcp pkt processing routine is called for pak with SMAC = 0021.6a89.51ca and SRC_ADDR =
0.0.0.0
DHCPD: Sending notification of DISCOVER:
 DHCPD: DHCPDISCOVER received from client 0100.216a.8951.ca on interface Vlan12.
 DHCPD: there is no address pool for 10.105.135.178.
dhcp pkt processing routine is called for pak with SMAC = 0021.6a89.51ca and SRC_ADDR =
0.0.0.0
```

IPv6 Snooping

Basic Config

LEARN_IP

- Enable IPv6 unicast-routing

```
5760-1(config)#ipv6 unicast-routing
```

- Enable IPv6 snooping on the VLAN

```
5760-1(config)#vlan configuration 40
5760-1(config-vlan-config)#ipv6 snooping
```

- Configure RA guard policy

Required on 5760

```
5760-1(config)#ipv6 nd raguard policy raguard-router
5760-1(config-nd-raguard)#trusted-port
5760-1(config-nd-raguard)#device-role router
```

- Apply the RA guard policy to the uplink

```
5760-1(config)#interface Te1/0/1
5760-1(config-if)#ipv6 nd raguard attach-policy raguard-router
```

IPv6 Snooping

Show Client Details

LEARN_IP

```
3850-2# show wireless client mac-address 0023.6907.e218 detail

Client MAC Address : 0023.6907.e218
Client Username : user
AP MAC Address : 0026.cbd2.6750
AP Name: ap1140-sw3850-2-2
AP slot : 0
Client State : Associated
Wireless LAN Id : 2
Wireless LAN Name: ciscolive
BSSID : 0026.cbd2.6751
~
IPv4 Address : Unknown
IPv6 Address : 2001:40:0:1:223:69ff:fe07:e218
               2001:40:0:1:8879:8efc:3968:c4e
               fe80::223:69ff:fe07:e218
```

IPv6 Snooping

Traces and Debugs

Traces

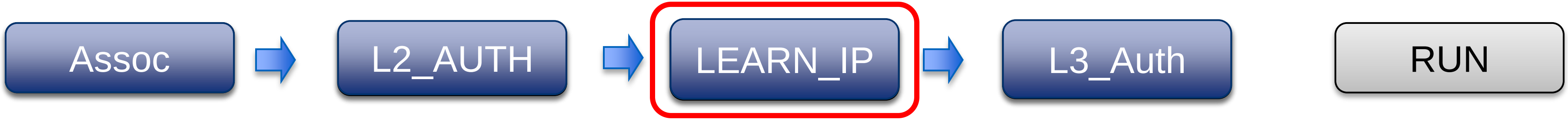
- set trace ipv6-snooping filter mac xxxx.xxxx.xxxx
- set trace ipv6-snooping ndp-inspection level debug
- set trace ipv6-snooping raguard level debug
- set trace ipv6-snooping errors level debug

Debugs

- debug ipv6 snooping
- debug wcdb ipv6
- debug mobility ipv6 events
- debug mobility ipv6 events
- debug client mac-address xxxx.xxxx.xxxx

Client Flow

The Route Toward the RUN State!



Web Authentication

Basic Config

L3_Auth

```
ip http server
ip http authentication local
ip http secure-server
!
parameter-map type webauth global
 type webauth
 virtual-ip ipv4 192.0.2.1
!
parameter-map type webauth ciscolive-webauth
 type webauth | consent | both
```

HTTPS
redirect + login

HTTP server

Global Parameter Map

Named Param Map

AAA

Named Map → WLAN

- Local Web-Auth (LWA)
  - Web-Auth vs. Consent
  - Local users vs. RADIUS
  - Custom pages
- Central Web-Auth (CWA)
  - External pages
  - ISE

Web Authentication

Basic Config – Central Web Authentication with ISE

L3_Auth

Some key differences as compared to normal RADIUS scenario:

- MAC authentication
- RFC 3576 support (CoA)
- Redirect ACL (different than CUWN)
  - redirects all **ALLOWED** traffic to ISE

Web Authentication

Captive Portal Bypass

L3_Auth

- Apple feature to detect a captive portal (“Captive Network Assistant”)
- Blank page shown if using self-signed SSL certificate on the WLC for Web-Auth
  - When the CNA browser is closed the device disconnects, hence Web-Auth cannot be completed
- Force to use full feature browser instead of CNA, using captive portal bypass on WLC:

```
3850-1(config)# captive-portal-bypass
```

- iOS 7 support as of IOS-XE 3.2.3

Web Authentication

Show Client Status

L3_Auth

- WCM

```
3850-2#show wireless client summary
Number of Local Clients : 1

MAC Address    AP Name                          WLAN State              Protocol
--------------------------------------------------------------------------------
0023.6907.e218 ap1140-sw3850-2-2                1    WEBAUTH_PEND       11g
```

- WCDB

```
3850-2#show wcdb database all

Mac Address    VlanId IP Address      Src If             Auth     Mob
-------------- ------ --------------- ------------------ -------- -------
0023.6907.e218    153 192.168.153.2   0x00C99740000006BC L3_AUTH  LOCAL
```

Web Authentication

Traces and Debugs

L3_Auth

Traces

- set trace group-wireless-client level debug
  set trace group-wireless-client filter mac xxxx.xxxx.xxxx
- set trace dhcp level debug
  set trace dhcp filter mac xxxx.xxxx.xxxx
- set trace access-session level debug
  set trace access-session filter mac xxxx.xxxx.xxxx
- set trace mobility handoff level debug
  set trace mobility handoff filter mac xxxx.xxxx.xxxx

Roam / Guest anchor

Debugs

- debug client mac-address xxxx.xxxx.xxxx
- debug ip http all
- debug ip admission all
- debug access-session all
- debug ip tcp socket error
- debug ip http url

Captive bypass

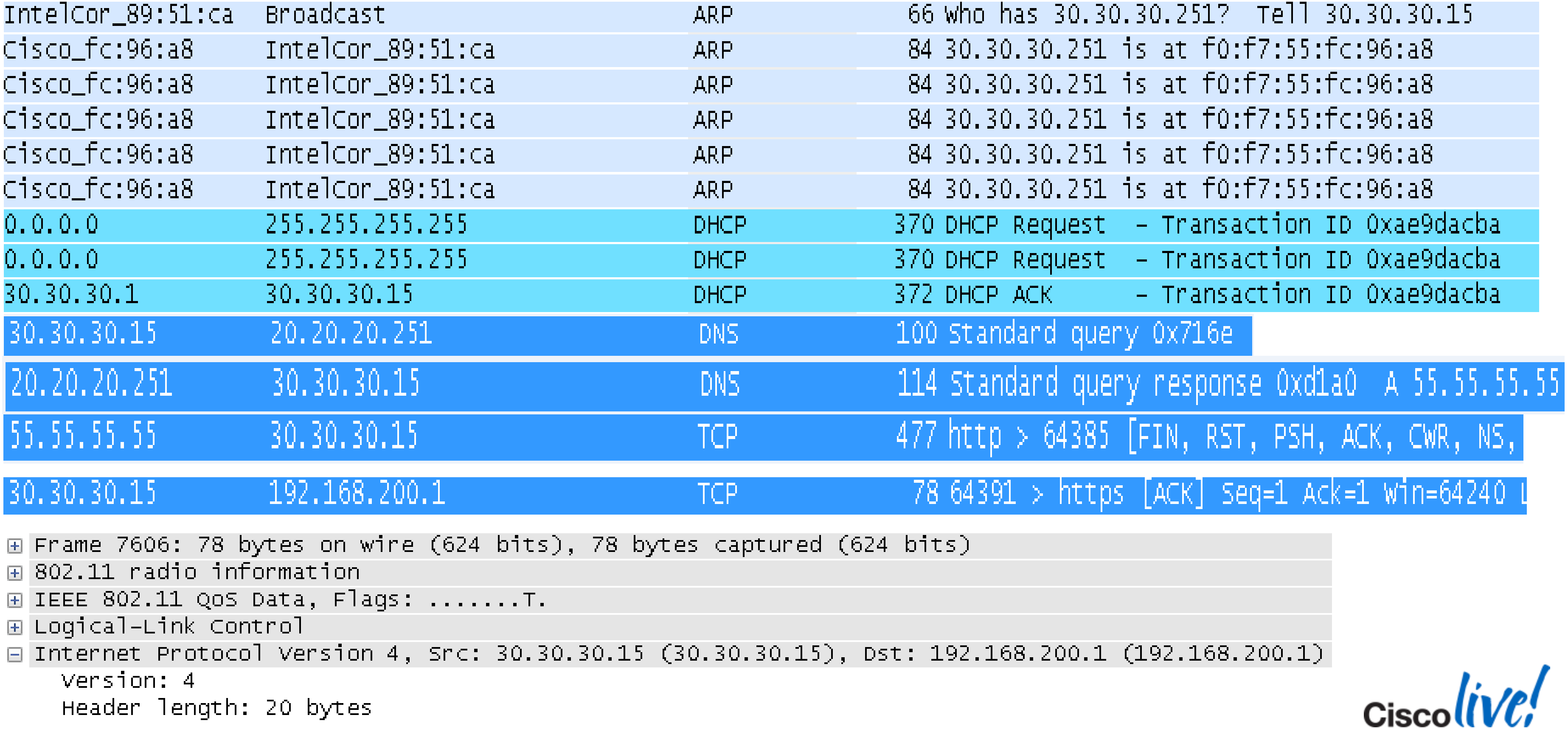
Web Authentication

Successful Auth

L3_Auth

```
0021.6a89.51ca Association received from mobile on AP  1caa.076f.9e10
0021.6a89.51ca Change state to L2AUTHCOMPLETE (4) last state AUTHCHECK (2)
0021.6a89.51ca WEBAUTH: Using method list local_webauth
[WCDB] ==Update event: client (0021.6a89.51ca) client id:(0x5e200000000026) vlan (30-
>30) global_wlan (9->9) auth_state (L2_AUTH_DONE->LEARN_IP) mob_state (INIT->LOCAL)
DHCPD: DHCPREQUEST received from client 0100.216a.8951.ca.
DHCPD: address 30.30.30.4 mask 255.255.255.0
DHCPD: creating ARP entry (30.30.30.4, 0021.6a89.51ca).
ACCESS-CORE-SM-NOTF: [0021.6a89.51ca, Ca2] Authc success from WebAuth (3), status OK (0)
/ event success (0)
[0021.6a89.51ca, Ca2] Queued AUTHC SUCCESS from WebAuth for session 0x43000017
(0021.6a89.51ca)
0021.6a89.51ca WEBAUTH: IOS Auth Event - Authentication Success!
0021.6a89.51ca Change state to WEBAUTH_NOL3SEC (14) last state WEBAUTH_REQD (8)
0021.6a89.51ca Change state to AUTHZ_WAIT (19) last state WEBAUTH_NOL3SEC (14)
0021.6a89.51ca Client in AUTHZ_WAIT state, advance to RUN
```

Wireless PCAP



```
IntelCor_89:51:ca   Broadcast           ARP     66 Who has 30.30.30.251?  Tell 30.30.30.15
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
Cisco_fc:96:a8      IntelCor_89:51:ca   ARP     84 30.30.30.251 is at f0:f7:55:fc:96:a8
0.0.0.0             255.255.255.255     DHCP   370 DHCP Request  - Transaction ID 0xae9dacba
0.0.0.0             255.255.255.255     DHCP   370 DHCP Request  - Transaction ID 0xae9dacba
30.30.30.1          30.30.30.15         DHCP   372 DHCP ACK      - Transaction ID 0xae9dacba
30.30.30.15         20.20.20.251        DNS    100 Standard query 0x716e
20.20.20.251        30.30.30.15         DNS    114 Standard query response 0xd1a0  A 55.55.55.55
55.55.55.55         30.30.30.15         TCP    477 http > 64385 [FIN, RST, PSH, ACK, CWR, NS,
30.30.30.15         192.168.200.1       TCP     78 64391 > https [ACK] Seq=1 Ack=1 Win=64240 L
```

```
⊞ Frame 7606: 78 bytes on wire (624 bits), 78 bytes captured (624 bits)
⊞ 802.11 radio information
⊞ IEEE 802.11 QoS Data, Flags: .......T.
⊞ Logical-Link Control
⊟ Internet Protocol Version 4, Src: 30.30.30.15 (30.30.30.15), Dst: 192.168.200.1 (192.168.200.1)
    Version: 4
    Header length: 20 bytes
```

Web Authentication

Typical Issues

L3_Auth

- No redirect to login page
- Unable to submit login page
- Logout pop-up
- Success redirect

Web Authentication

No Redirect to Login Page

L3_Auth

- DNS resolution
  - Check DHCP pool
  - Check client config

Test: point the browser to an IP addr: http://1.2.3.4/

- Incorrect Pre-auth ACL
  - Allowed traffic doesn’t trigger a redirect
- Max connections (per client / global)

Web Authentication

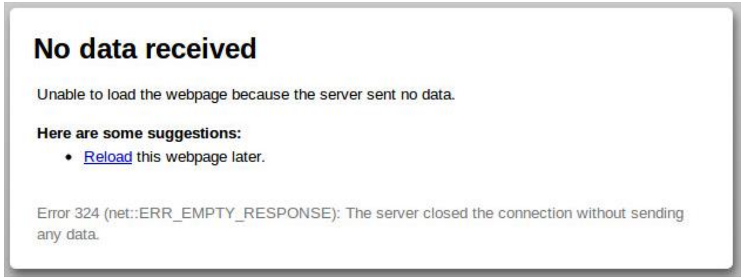
No Redirect to Login Page

L3_Auth

- Max HTTP connections

```
%AP-1-AUTH_PROXY_HTTP_CONNS_EXCEEDED: IP-address 192.168.153.9 has exceeded the max HTTP
connections | AuditSessionID c0a8971552c68f9c00000033
```

- Example of browser errors



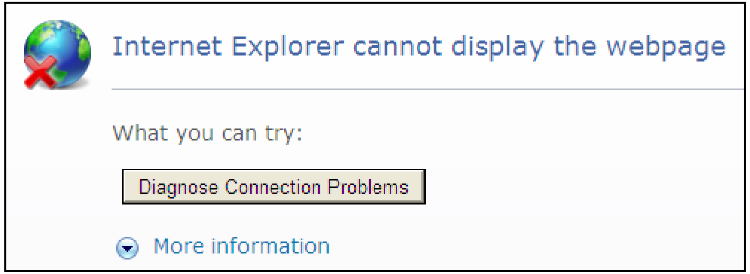
No data received

Unable to load the webpage because the server sent no data.

Here are some suggestions:

- Reload this webpage later.

Error 324 (net::ERR_EMPTY_RESPONSE): The server closed the connection without sending any data.



Internet Explorer cannot display the webpage

What you can try:

Web Authentication

No Redirect to Login Page

- Check auth-proxy status

```
c5760-1# show ip admission cache
Authentication Proxy Cache
Total Sessions: 2 Init Sessions: 1
 Client MAC 001a.7035.84d6 Client IP 192.168.153.9 IPv6 ::, State INIT, Method Webauth
 Client MAC 0023.6907.e218 Client IP 192.168.153.2 IPv6 ::, State AUTHZ, Method Webauth
```

- To modify the allowed max HTTP connections

```
parameter-map type webauth global|<named>
 max-http-conns <1-200>
```

Named takes precedence over **global**

Default: 20

Web Authentication

Unable to Submit Login Page

L3_Auth

- Incorrect login page path
  - All pages (**login, success, failure, expired**) must be provided
    - Custom pages:

```
c5760-1(config)# parameter-map type webauth ciscolive-webauth
   custom-page login device flash:login.html
   custom-page login expired device flash:loginexpired.html
   custom-page failure device flash:loginfail.html
   custom-page success device flash:loginsuccess.html
```

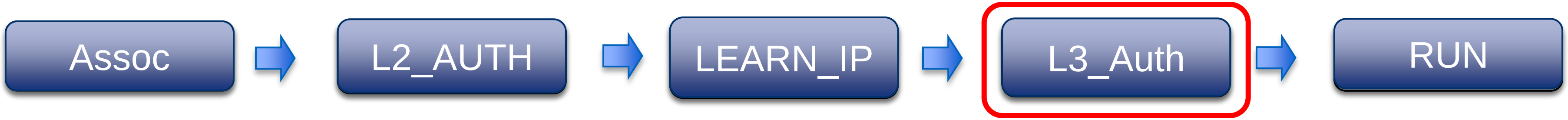
    - External pages

```
c5760-1(config-params-parameter-map)# redirect ?
  for-login    Redirect for login
  on-failure   Redirect On-Failure
  on-success   Redirect On-Success
  portal       External Portal
```

- Code errors in customised/external login page

Client Flow

The Route Toward the RUN State!



Run!

Show Client Status

RUN

- WCM

```
3850-2#show wireless client summary
Number of Local Clients : 1

MAC Address    AP Name                                 WLAN State              Protocol
--------------------------------------------------------------------------------
0023.6907.e218 ap1140-sw3850-2-2                       2    UP                 11g
```

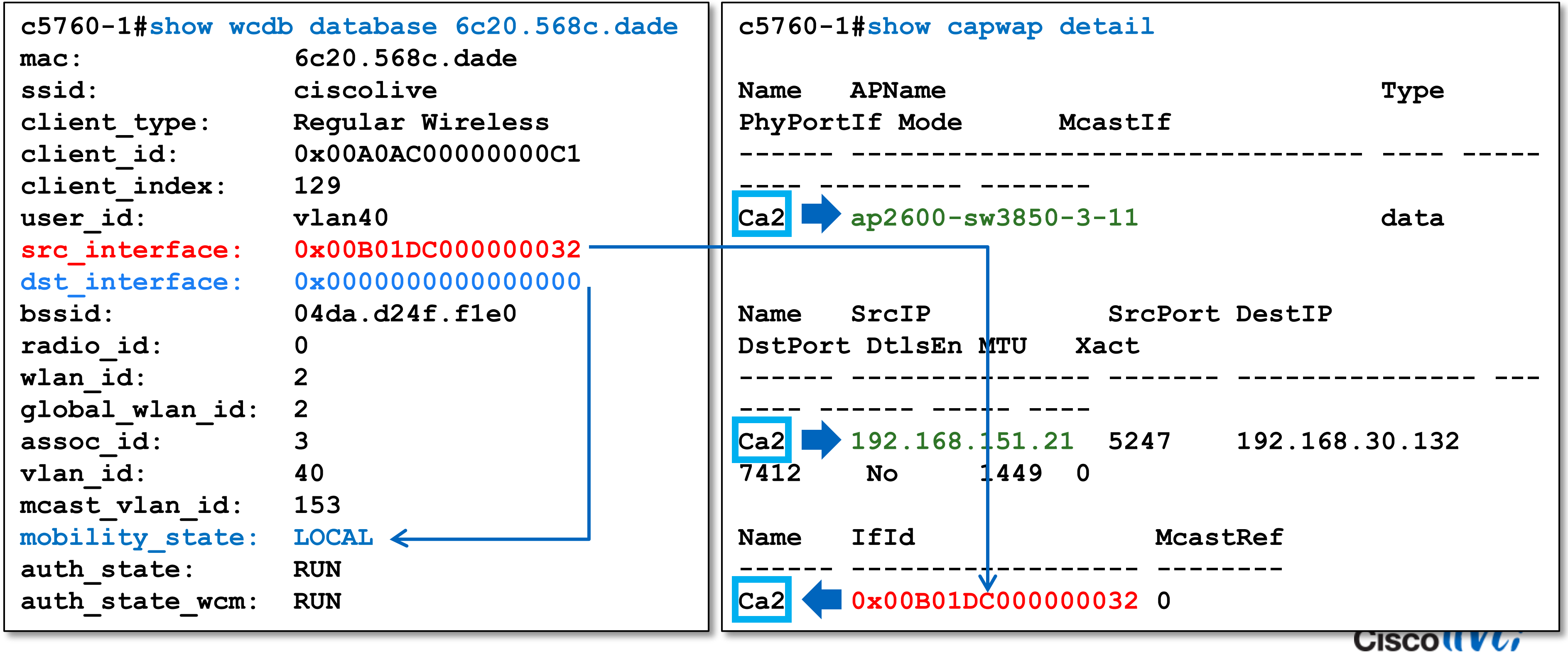
- WCDB

```
3850-2#show wcdb database all

Mac Address    VlanId IP Address      Src If             Auth     Mob
-------------- ------ --------------- ------------------ -------- -------
0023.6907.e218    153 192.168.153.2   0x00C99740000006BC RUN      LOCAL
```

Traffic Forwarding Path

First Association – Mobility state: Local

RUN



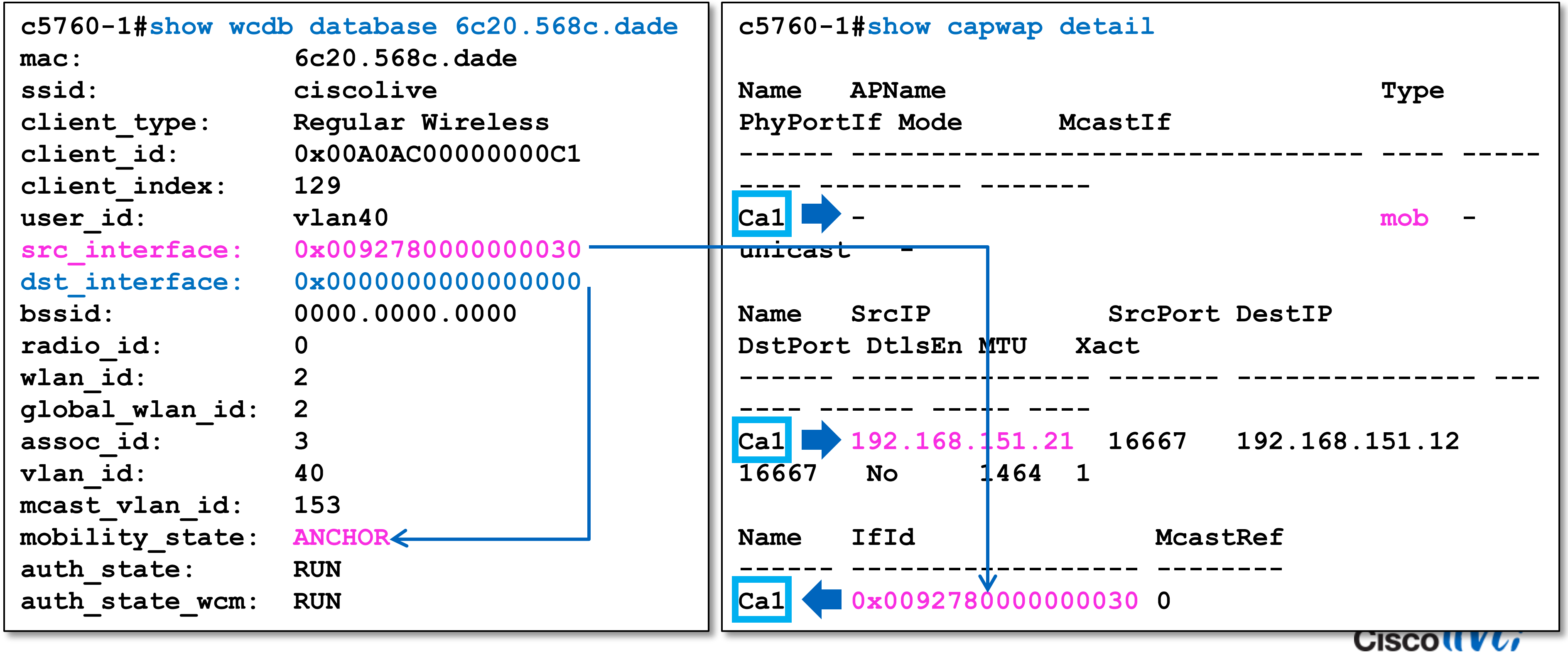
```
c5760-1#show wcdb database 6c20.568c.dade
mac:                 6c20.568c.dade
ssid:                ciscolive
client_type:         Regular Wireless
client_id:           0x00A0AC00000000C1
client_index:        129
user_id:             vlan40
src_interface:       0x00B01DC000000032
dst_interface:       0x0000000000000000
bssid:               04da.d24f.f1e0
radio_id:            0
wlan_id:             2
global_wlan_id:      2
assoc_id:            3
vlan_id:             40
mcast_vlan_id:       153
mobility_state:      LOCAL
auth_state:          RUN
auth_state_wcm:      RUN
```

```
c5760-1#show capwap detail

Name   APName                              Type
PhyPortIf Mode      McastIf
------ ----------------------------------- ---- -----
---- --------- -------
Ca2    ap2600-sw3850-3-11                  data


Name   SrcIP           SrcPort DestIP
DstPort DtlsEn MTU   Xact
------ --------------- ------- --------------- ---
---- ------ ----- ----
Ca2    192.168.151.21  5247    192.168.30.132
7412    No     1449  0

Name   IfId                McastRef
------ ------------------- --------
Ca2    0x00B01DC000000032  0
```

Traffic Forwarding Path

Handoff – Sticky Anchoring - Mobility State: Anchor

RUN



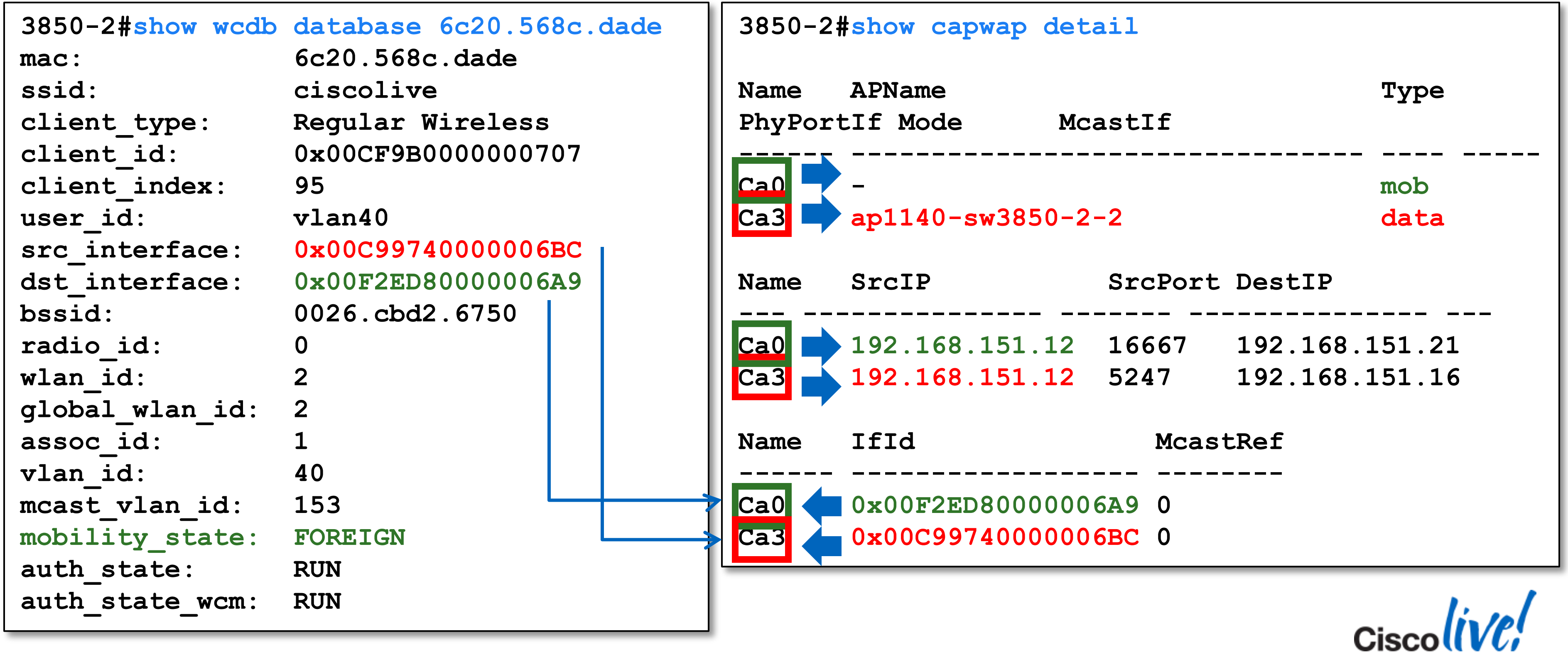
```
c5760-1#show wcdb database 6c20.568c.dade
mac:                6c20.568c.dade
ssid:               ciscolive
client_type:        Regular Wireless
client_id:          0x00A0AC00000000C1
client_index:       129
user_id:            vlan40
src_interface:      0x0092780000000030
dst_interface:      0x0000000000000000
bssid:              0000.0000.0000
radio_id:           0
wlan_id:            2
global_wlan_id:     2
assoc_id:           3
vlan_id:            40
mcast_vlan_id:      153
mobility_state:     ANCHOR
auth_state:         RUN
auth_state_wcm:     RUN
```

```
c5760-1#show capwap detail

Name   APName                              Type
PhyPortIf Mode      McastIf
------ ----------------------------------- ---- -----
---- --------- -------
Ca1    -                                   mob  -
unicast   -

Name   SrcIP           SrcPort DestIP
DstPort DtlsEn MTU   Xact
------ --------------- ------- --------------- ---
---- ------ ----- ----
Ca1    192.168.151.21  16667   192.168.151.12
16667   No     1464  1

Name   IfId               McastRef
------ ------------------ --------
Ca1    0x0092780000000030 0
```

Traffic Forwarding Path

Handoff – Sticky Anchoring - Mobility State: Foreign

RUN



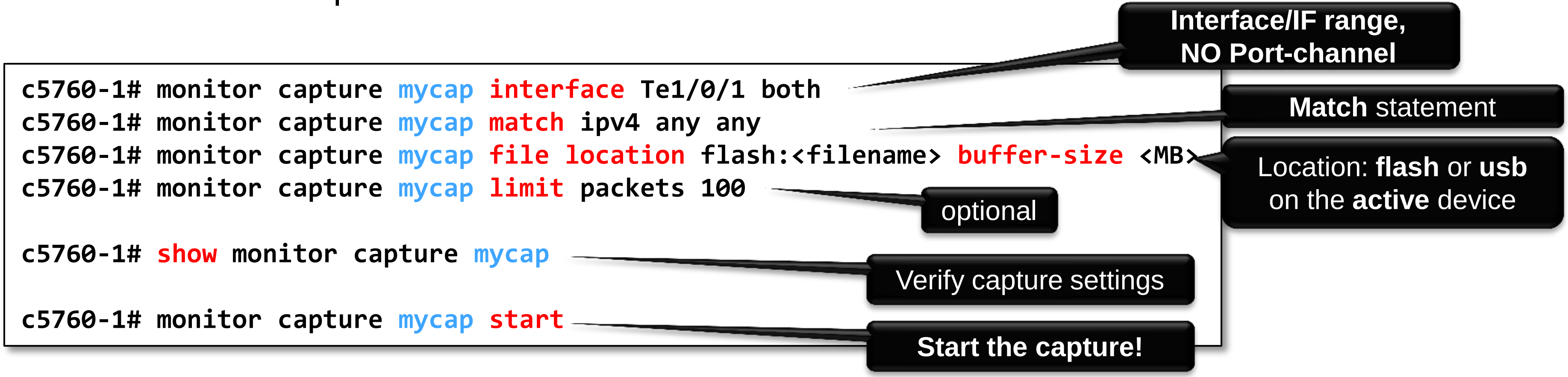
```
3850-2#show wcdb database 6c20.568c.dade
mac:                6c20.568c.dade
ssid:               ciscolive
client_type:        Regular Wireless
client_id:          0x00CF9B0000000707
client_index:       95
user_id:            vlan40
src_interface:      0x00C99740000006BC
dst_interface:      0x00F2ED80000006A9
bssid:              0026.cbd2.6750
radio_id:           0
wlan_id:            2
global_wlan_id:     2
assoc_id:           1
vlan_id:            40
mcast_vlan_id:      153
mobility_state:     FOREIGN
auth_state:         RUN
auth_state_wcm:     RUN
```

```
3850-2#show capwap detail

Name   APName                            Type
PhyPortIf Mode      McastIf
------ --------------------------------- ---- -----
Ca0    -                                 mob
Ca3    ap1140-sw3850-2-2                 data

Name   SrcIP           SrcPort DestIP
--- --------------- ------- --------------- ---
Ca0    192.168.151.12  16667   192.168.151.21
Ca3    192.168.151.12  5247    192.168.151.16

Name   IfId               McastRef
------ ------------------ --------
Ca0    0x00F2ED80000006A9 0
Ca3    0x00C99740000006BC 0
```

When Traces Aren’t Enough

Wireshark Support

- **Version 3.3** introduced the ability to capture traffic on a switch port and store it in a buffer:
  - Remote packet capture capability
  - Traffic can be uploaded off of flash and decoded in Wireshark!



```
c5760-1# monitor capture mycap interface Te1/0/1 both
c5760-1# monitor capture mycap match ipv4 any any
c5760-1# monitor capture mycap file location flash:<filename> buffer-size <MB>
c5760-1# monitor capture mycap limit packets 100

c5760-1# show monitor capture mycap

c5760-1# monitor capture mycap start
```

Interface/IF range, NO Port-channel

Match statement

Location: **flash** or **usb** on the **active** device

optional

Verify capture settings

Start the capture!

When Traces Aren’t Enough

Wireless Capture

- Many times, traces/debugs will indicate the point of failure, but the root cause requires a wireless packet capture
- Mac OS X 10.6 and above
- Windows 7 with Netmon 3.4
- Omnipeek
- AP in Sniffer Mode
- For more information, see this supportforum article:
  - https://supportforums.cisco.com/docs/DOC-24502

Radio Resource Management

- AP specific RRM metrics – only on the MA

MA

```
3850#show ap dot11 24ghz channel
Automatic Channel Assignment
  Channel Assignment Mode                : AUTO
  Channel Update Interval                : 600 seconds
  Anchor time (Hour of the day)          : 0
  Channel Update Contribution            : SN..
  Channel Assignment Leader              : 5760 (10.10.21.3)
  DCA Sensitivity Level                  : MEDIUM (10 dB)
  Channel Energy Levels
      Minimum                            : -82
      Average                            : -82
      Maximum                            : -82
  Channel Dwell Times
      Minimum                            : 4 hours 0 minutes
      Average                            : 4 hours 0 minutes
      Maximum                            : 4 hours 0 minutes
  802.11b Auto-RF Channel List
  802.11b Auto-RF Allowed Channel List: 1,6,11
  Auto-RF Unused Channel List               : 2,3,4,5,7,8,9,10
```

- RRM RF Group functions either MA or MC only devices having local APs will show stats:

MC

```
5760#show ap dot11 24ghz channel
Automatic Channel Assignment
  Channel Assignment Mode                : AUTO
  Channel Update Interval                : 600 seconds
  Anchor time (Hour of the day)          : 0
  Channel Update Contribution            : SN..
  Channel Assignment Leader              : 5760 (10.10.21.3)
  Last Run                               : 21 seconds ago
  DCA Sensitivity Level                  : MEDIUM (10 dB)
  Channel Energy Levels
      Minimum                            : unknown
      Average                            : unknown
      Maximum                            : unknown
  Channel Dwell Times
      Minimum                            : unknown
      Average                            : unknown
      Maximum                            : unknown
  802.11b Auto-RF Channel List
  802.11b Auto-RF Allowed Channel List : 1,6,11
  Auto-RF Unused Channel List               : 2,3,4,5,7,8,9,10
```

Radio Resource Management

Traces and Debugs

Traces

- set trace rrm channel level debug
- set trace rrm power level debug
- set trace rrm group level debug

Debugs

- debug rrm channel
- debug rrm power
- debug rrm group

Radio Resource Management

Country Mismatch on MC/MA

```
[12/30/13 10:52:03.054 UTC 39 8531] Radio Resource Management: Group 802.11a attempting
to join group IP Address 192.168.151.21, ctrl count 1
[12/30/13 10:52:03.054 UTC 3a 8531] Radio Resource Management: Group 802.11bg attempting
to join group IP Address 192.168.151.21, ctrl count 1
[12/30/13 10:52:03.068 UTC 3b 8531] Radio Resource Management: Group received join
failure from 802.11a 00.00.00.00.00.00(    0) (192.168.151.21) for reason Non matching
country code
[12/30/13 10:52:03.068 UTC 3c 8531] Radio Resource Management: Group received join
failure from 802.11bg 00.00.00.00.00.00(    0) (192.168.151.21) for reason Non matching
country code
[12/30/13 10:52:03.068 UTC 3d 8531] Radio Resource Management: Group validated join
failure from 802.11a 00.00.00.00.00.00(    0) for reason Non matching country code
[12/30/13 10:52:03.068 UTC 3e 8531] Radio Resource Management: Group validated join
failure from 802.11bg 00.00.00.00.00.00(    0) for reason Non matching country code
```

- The country code config must match on all WLCs

Useful Commands

- **`show tech-support wireless`**

  To be provided when opening a TAC Case, equivalent to a “show run-config” from CUWN

- **`show run all | section <>`**

  Useful for viewing default settings

  Recommended to use with output modifier

- **`show wireless client summary`**

  Shows all clients connected on the current MA/MC, it will list the AP name and frequency, or the IP address of the anchor location

- **`show wcdb database all`**

  This will output all of the clients, along with the VLAN, IP address, and mobility state

Common Issues

Bugs to Watch Out For

- CSCue76684 – 3850 switch or 5760 controller fails boot after configuration is saved
  - Fixed in 3.2(1)SE

- Copying & pasting multiple commands through SSH can cause character drops, rendering some of the commands ineffective
  - This does not occur when connecting via Telnet
  - Workaround is to add leading spaces to your commands so that the spaces are dropped and the commands are entered properly

Key Takeaways

- Understand the CA components and client flow
- Understand the mobility hierarchy and design your network accordingly for proper roaming behaviour
- Watch out for the simple stuff!
  - Mobility Config
  - Licensing
  - AP Join
  - DHCP Snooping
- We can use a combination of show commands, debugs and traces to collect information
- Always collect “show tech wireless” for TAC Cases

Q & A

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