Wireless Device Profiling and Policy Classification Engine on WLC

Last Updated: August, 2014

Overview

Cisco currently offers a rich set of features which provides device identification, onboarding, posture, and policy, through ISE. WLC has been enhanced with some of these capabilities. This document deals with basic configuration of device profiling and policy implementation through Cisco WLC.

This new feature (Profiling and Policy) on WLC does the profiling of devices based on protocols like HTTP and DHCP to identify the end devices on the network. Users can configure device based policies and enforce per user or per device policy on the network. The WLC will also display statistics based on per user or per device end points and policies applicable per device.

Wireless device profiling and policy classification engine enables simple BYOD deployments with visibility and user/wireless device policy integrated into the wireless controller.

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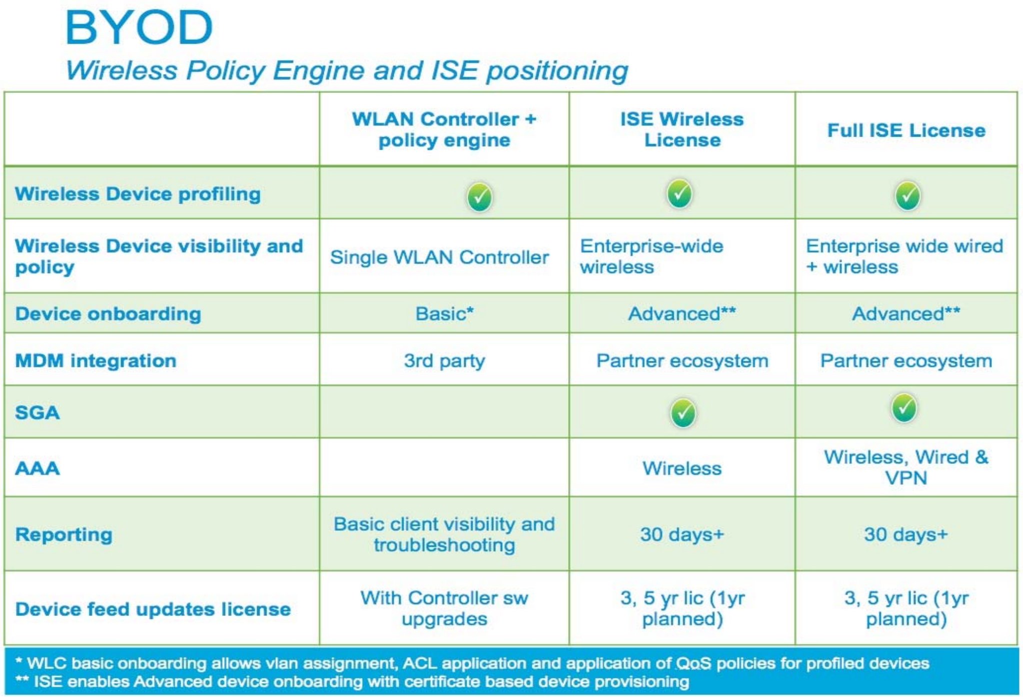

BYOD

Wireless Policy Engine and ISE positioning

	WLAN Controller + policy engine	ISE Wireless License	Full ISE License
Wireless Device profiling	✓	✓	✓
Wireless Device visibility and policy	Single WLAN Controller	Enterprise-wide wireless	Enterprise wide wired + wireless
Device onboarding	Basic*	Advanced**	Advanced**
MDM integration	3rd party	Partner ecosystem	Partner ecosystem
SGA		✓	✓
AAA		Wireless	Wireless, Wired & VPN
Reporting	Basic client visibility and troubleshooting	30 days+	30 days+
Device feed updates license	With Controller sw upgrades	3, 5 yr lic (1yr planned)	3, 5 yr lic (1yr planned)

* WLC basic onboarding allows vlan assignment, ACL application and application of QoS policies for profiled devices
** ISE enables Advanced device onboarding with certificate based device provisioning

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Scope, Objectives, and Expectations

Profiling and policy enforcement allows profiling of mobile devices and basic onboarding of the profiled devices to a specific VLAN assigns ACL and QOS, or configures session timeout. It can be configured as two separate components. The configuration on the WLC is based on defined parameters specific to clients joining the network. The policy attributes which are of interest are:

a. Role – Defines the user type or the user group the user belongs to, for example, student or employee.

b. Device – Defines the type of device, for example, Windows machine, Smart phone, Apple device such as iPad, iPhone and so on.

c. Location – Defines where the end point is connected on the network. Location represents AP group. APs can be divided or grouped according to the location and policy can be applied per AP group.

d. Time of day – Allows configuration to be defined at what time of the day end-points are allowed on the network.

e. EAP Type - Checks what EAP method the client is getting connected to.

The above parameters are configurable as policy match attributes. Once WLC has a match corresponding to the above parameters per end-point, policy enforcement comes into picture. Policy enforcement allows basic device on-boarding of mobile devices based on session attributes such as:

a. VLAN Assignment

b. ACL

c. Session Timeout

d. QoS

e. Sleeping Client–Timeout duration for a specific sleeping client (in hours)

The user can configure these policies and enforce end-points with specified policies. The wireless clients will be profiled based on MAC OUI, DHCP, HTTP user agent (valid Internet is required for successful HTTP profiling). The WLC uses these attributes and predefined classification profiles to identify devices.

Terminology

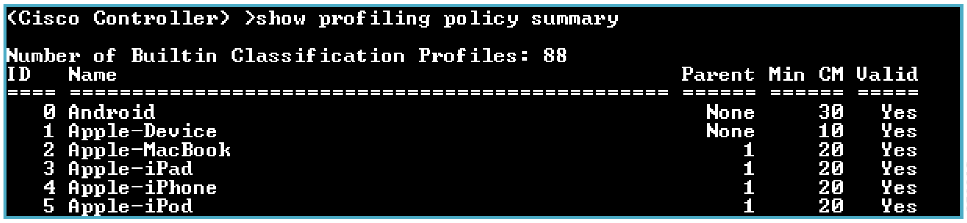
Term	Expansion
APM	AP Manager Interface
Dyn	Dynamic Interface
Mgmt	Management Interface
Port	Physical Gbps port
AP	Access Point
LAG	Link Aggregation
VSL	Virtual Switch Link
VLAN	Virtual LAN
SSO	Stateful Switchover
WiSM-2	Wireless Service Module-2

Profiling and Policy Configuration

In 7.5 release, only embedded or built-in profiles are available on the WLC through which it can identify devices.

In later releases, it should be possible to create user-defined profiles, which will take precedence over the embedded profiles. Currently there are 88 built-in profiles and can be viewed through WLC CLI prompt.

Go to WLC and run `show profiling policy summary`. For the purpose of this document we just displayed the first 6 profile.



```
(Cisco Controller) >show profiling policy summary

Number of Builtin Classification Profiles: 88
ID   Name                                             Parent Min CM Valid
==== ================================================ ====== ====== =====
   0 Android                                            None     30   Yes
   1 Apple-Device                                       None     10   Yes
   2 Apple-MacBook                                         1     20   Yes
   3 Apple-iPad                                            1     20   Yes
   4 Apple-iPhone                                          1     20   Yes
   5 Apple-iPod                                            1     20   Yes
```

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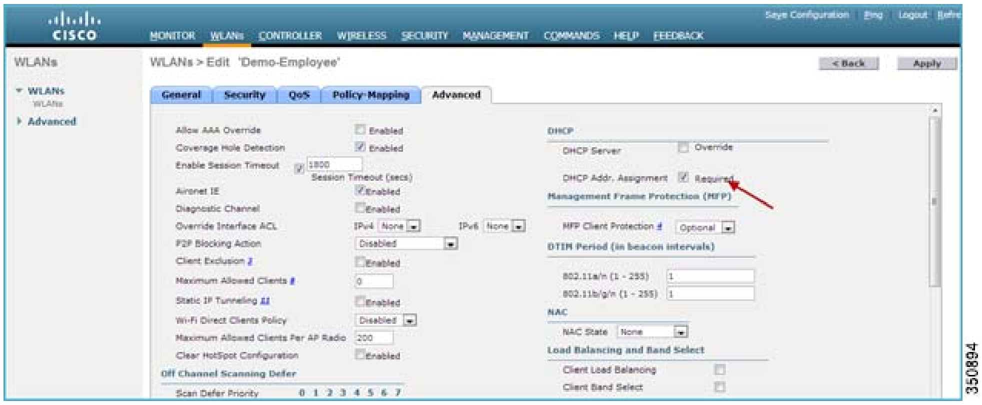
To configure device profiling on a WLAN through GUI, go to the WLAN (here we created WLAN Demo-Employee) and click **Advance**, then enable DHCP by checking the **Required** check box. After enabling the DHCP required option, scroll down and under **Local Client Profiling** enable **DHCP Profiling** and **HTTP Profiling** by checking the respective check boxes and click **Apply**.


Save Configuration | Ping | Logout | Refre
MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
WLANs
▼ WLANs
WLANs
▶ Advanced
< Back
Apply
General | Security | QoS | Policy-Mapping | Advanced
350894

WLANs > Edit 'Demo-Employee'

Allow AAA Override	□ Enabled
Coverage Hole Detection	☑ Enabled
Enable Session Timeout	☑ 1800 Session Timeout (secs)
Aironet IE	☑ Enabled
Diagnostic Channel	□ Enabled
Override Interface ACL	IPv4 None IPv6 None
P2P Blocking Action	Disabled
Client Exclusion 3	□ Enabled
Maximum Allowed Clients 8	0
Static IP Tunneling 11	□ Enabled
Wi-Fi Direct Clients Policy	Disabled
Maximum Allowed Clients Per AP Radio	200
Clear HotSpot Configuration	□ Enabled

Off Channel Scanning Defer

Scan Defer Priority 0 1 2 3 4 5 6 7

DHCP

DHCP Server	□ Override
DHCP Addr. Assignment	☑ Required

Management Frame Protection (MFP)

MFP Client Protection 4	Optional

DTIM Period (in beacon intervals)

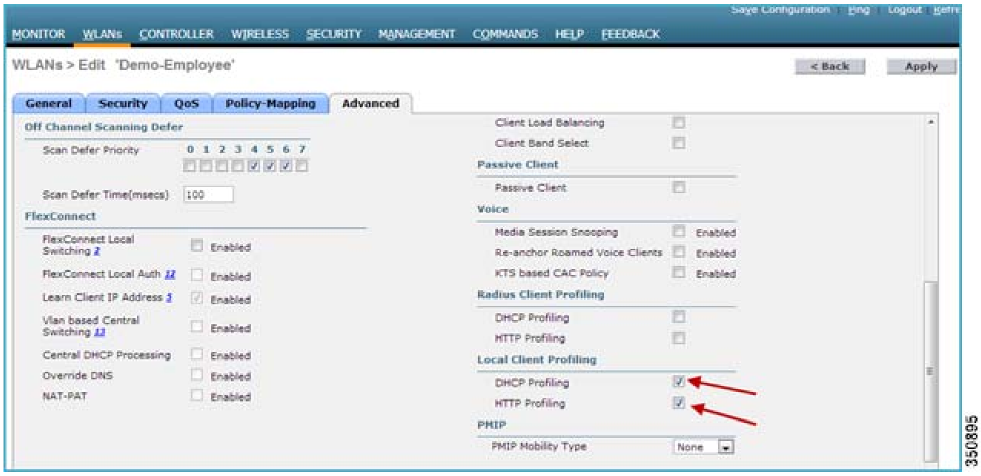
802.11a/n (1 - 255)	1
802.11b/g/n (1 - 255)	1

NAC

NAC State	None

Load Balancing and Band Select

Client Load Balancing	□
Client Band Select	□


Save Configuration | Ping | Logout | Refre
MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
< Back
Apply
General | Security | QoS | Policy-Mapping | Advanced
350895

WLANs > Edit 'Demo-Employee'

Off Channel Scanning Defer

Scan Defer Priority	0 1 2 3 4 5 6 7 □ □ □ □ ☑ ☑ ☑ □
Scan Defer Time(msecs)	100

FlexConnect

FlexConnect Local Switching 2	□ Enabled
FlexConnect Local Auth 12	□ Enabled
Learn Client IP Address 5	☑ Enabled
Vlan based Central Switching 13	□ Enabled
Central DHCP Processing	□ Enabled
Override DNS	□ Enabled
NAT-PAT	□ Enabled

Client Load Balancing	□
Client Band Select	□

Passive Client

Passive Client	□

Voice

Media Session Snooping	□ Enabled
Re-anchor Roamed Voice Clients	□ Enabled
KTS based CAC Policy	□ Enabled

Radius Client Profiling

DHCP Profiling	□
HTTP Profiling	□

Local Client Profiling

DHCP Profiling	☑
HTTP Profiling	☑

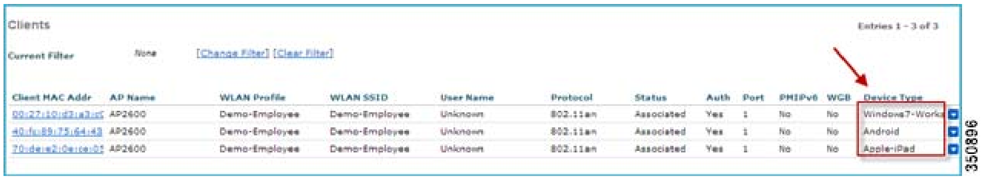
PMIP

PMIP Mobility Type	None

Note To configure profiling through ISE use Radius Client Profiling.

Now, try associating a client to the WLAN on which profiling is enabled. In our setup we associated an Apple iPad, an Android device and a Windows machine.

From the WLC main menu bar, navigate to **Monitor > Clients** and under **Device Type** column, notice that there are three devices associated to the WLAN and all of them are being profiled. See the below figure – Windows PC as Microsoft-Workstation, iPad as an Apple-iPad and Motorola Zoom as an Android device.



Clients

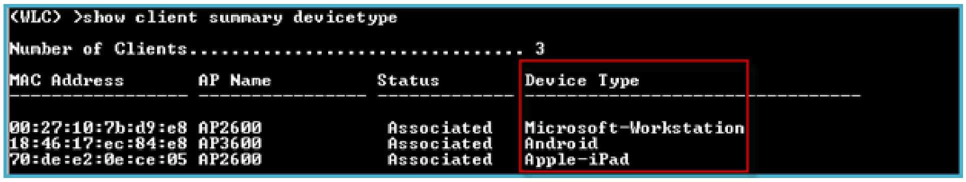
Entries 1 - 3 of 3

Current Filter None

Client MAC Addr	AP Name	WLAN Profile	WLAN SSID	User Name	Protocol	Status	Auth	Port	PMIPv6	WGB	Device Type
00:27:10:d3:a3:c(	AP2600	Demo-Employee	Demo-Employee	Unknown	802.11an	Associated	Yes	1	No	No	Windows7-Works
40:fc:89:75:64:43	AP2600	Demo-Employee	Demo-Employee	Unknown	802.11an	Associated	Yes	1	No	No	Android
70:de:e2:0e:ce:0!	AP2600	Demo-Employee	Demo-Employee	Unknown	802.11an	Associated	Yes	1	No	No	Apple-iPad

The same can be viewed from CLI as well, run a command `show client summary devicetype` to see the clients being profiled.

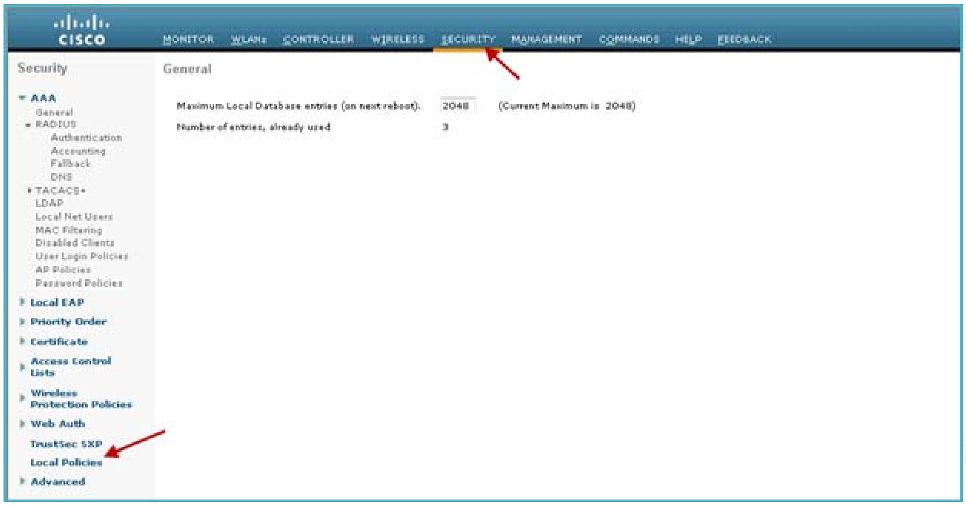
We clearly see that the client devices are classified under Device Type.



```
(WLC) >show client summary devicetype

Number of Clients................................ 3

MAC Address       AP Name           Status        Device Type
----------------- ----------------- ------------- --------------------------------

00:27:10:7b:d9:e8 AP2600             Associated   Microsoft-Workstation
18:46:17:ec:84:e8 AP3600             Associated   Android
70:de:e2:0e:ce:05 AP2600             Associated   Apple-iPad
```

Creating Policies on WLAN from WLC GUI

Once the policy has been configured you can create policies and apply them on the WLAN. On WLC menu bar, go to **Security > Local Policies** which will navigate you to the Policy List.

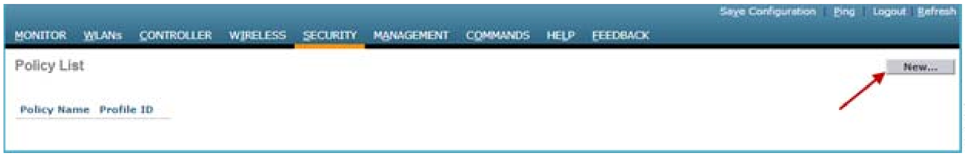


General

Maximum Local Database entries (on next reboot). 2048 (Current Maximum is 2048)

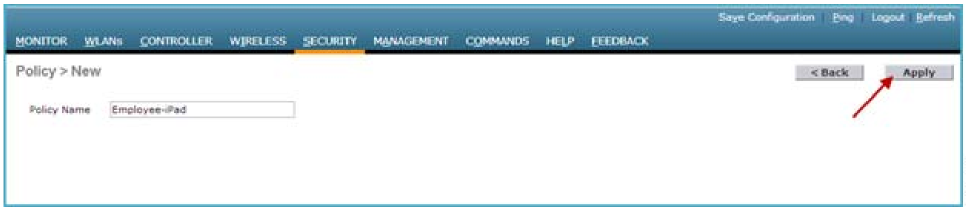
Number of entries, already used 3

In Policy List page, click **New** to create a Policy Name. In our set up we are using “Employee-iPad” as a policy-name but you can use any name to define your own policy.



Policy List

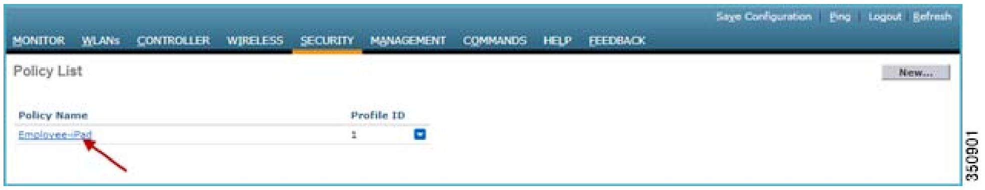
Policy Name Profile ID



Policy > New

Policy Name Employee-iPad

Once the Policy Name is created, click that policy name to configure the rules.



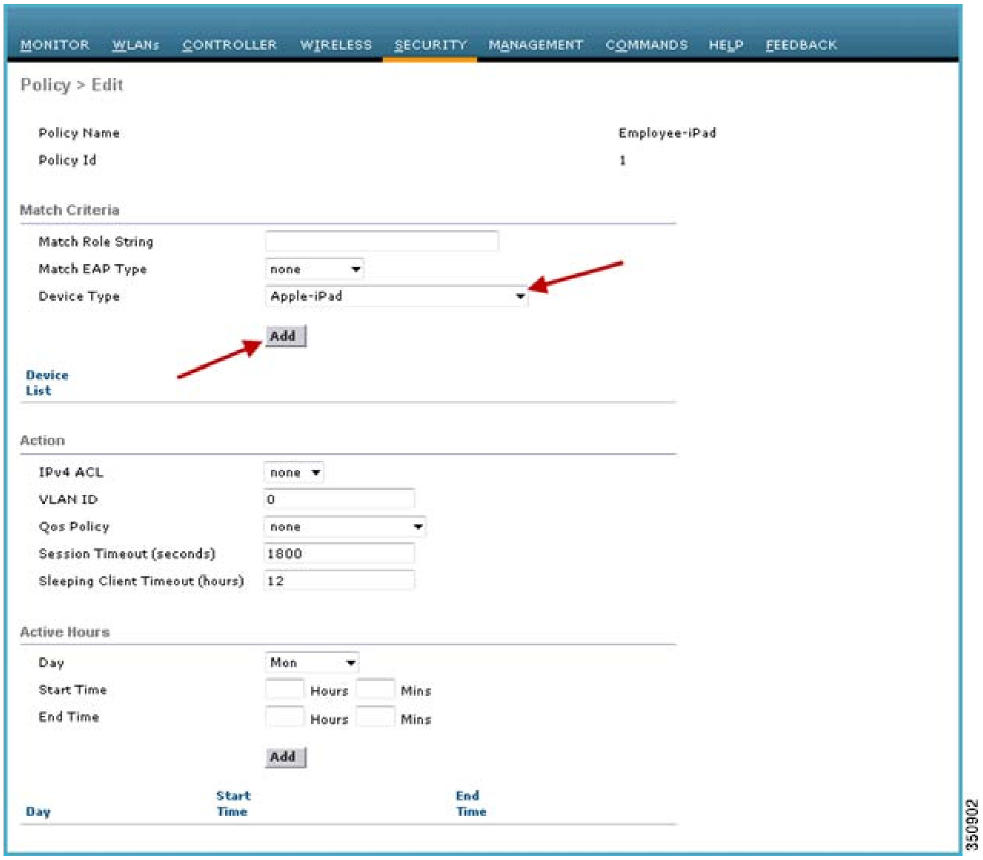
Policy List

Policy Name	Profile ID
Employee-iPad	1

Under **Policy Name**, you can create policies to match a Role, EAP Type and Device Type. You can also define what actions to take related to the Match criteria. In our setup we used Device Type for the Match Criteria but if required, you can use Role or EAP type as well.

To apply the policy based on a user device, go to **Device Type** and scroll down to select the device type from the drop down menu on which you want to enforce policy and then click **Add.**

Here we used Apple-iPad as a device type for **Match Criteria**.



Policy > Edit

Policy Name: Employee-iPad
Policy Id: 1

Match Criteria

Match Role String:
Match EAP Type: none
Device Type: Apple-iPad

Device List

Action

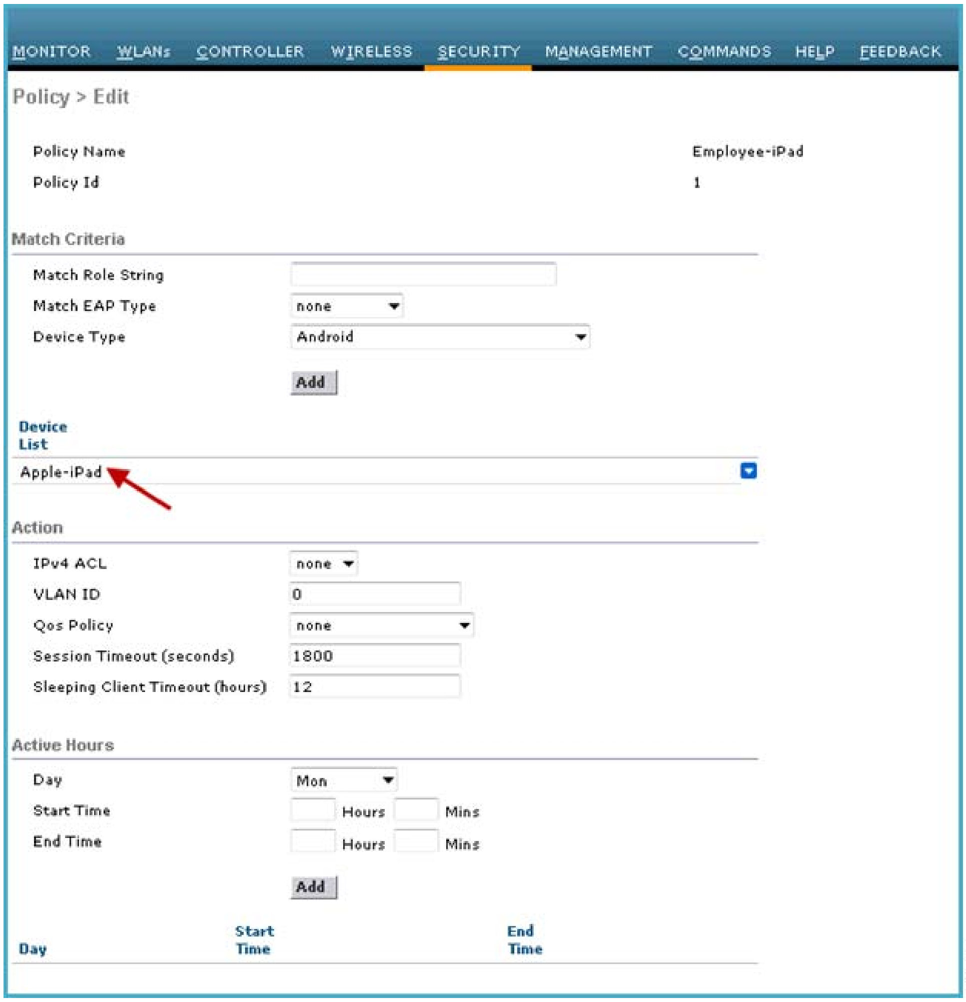
IPv4 ACL: none
VLAN ID: 0
Qos Policy: none
Session Timeout (seconds): 1800
Sleeping Client Timeout (hours): 12

Active Hours

Day: Mon
Start Time: Hours Mins
End Time: Hours Mins

Day	Start Time	End Time

The device type will appear under the **Device List** section.



Policy > Edit

Policy Name Employee-iPad

Policy Id 1

Match Criteria

Match Role String

Match EAP Type none

Device Type Android

Device List

Apple-iPad

Action

IPv4 ACL none

VLAN ID 0

Qos Policy none

Session Timeout (seconds) 1800

Sleeping Client Timeout (hours) 12

Active Hours

Day Mon

Start Time Hours Mins

End Time Hours Mins

Day	Start Time	End Time

Note There are 88 device profiles listed under **Device Type,** but you can add/list only 16 devices per policy.

Now to apply the appropriate action, choose from the parameters under the **Action** menu to enforce the Policy. There are five attributes ACL, VLAN ID, QoS Policy, Session Timeout and Sleeping Client Timeout. You can configure these attributes and enforce clients with specified policies. By default the Session timeout is 1800 seconds and Sleeping client timeout is 12 Hrs.

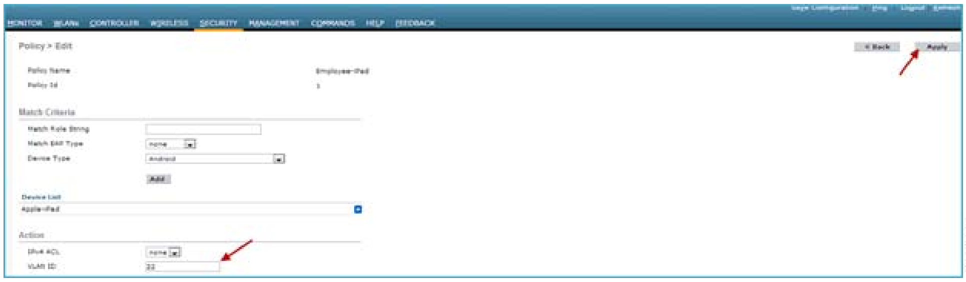
The **Sleeping Client** refers to the clients already in RUN state after successful web authentication and are allowed to sleep and wakeup without the need to re-authenticate through the login page. The sleep client's duration for which client needs to be remembered for re-authentication is based on user configuration.

The Sleeping Client timeout configuration set in policy overrides the global sleeping client timeout configuration set on WLAN. These configurations and details are discussed later in this document, refer Appendix-A.

Active Hours menu allows configuration to be defined/set for what time of the day clients are allowed on the network.

Note For the purpose of ease and demonstration only device parameters and VLAN attributes are used to do profiling and policy enforcement in our setup.

Now Assign a VLAN ID and click **Apply**.


MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
Save Configuration Ping Logout Refresh
< Back
Apply
Add

Policy > Edit

Policy Name: Employee-iPad
Policy Id: 1

Match Criteria

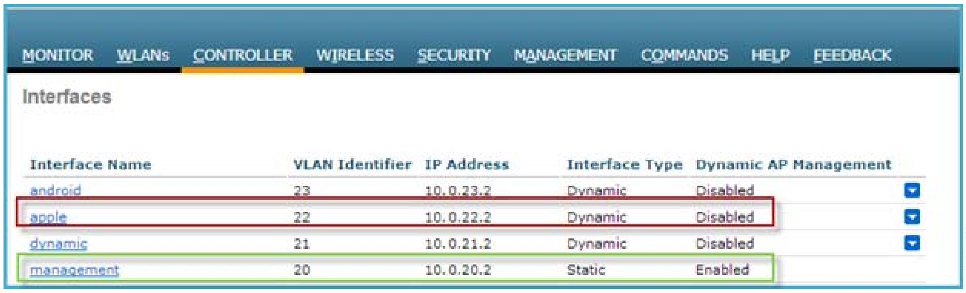
Match Role String:
Match EAP Type: none
Device Type: Android

Device List
Apple-iPad

Action
IPv4 ACL: none
VLAN ID: 22

350904

As discussed in previous sections, we created a separate interface on the WLC when enforcing policy through VLAN attributes. We have VLAN 20 for management and VLAN 22 for Employees iPads and Apple devices. Any iPad or Apple device connecting to a policy enforced WLAN will be redirected to a different VLAN. In the case of the given example, it is VLAN 22.


MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK

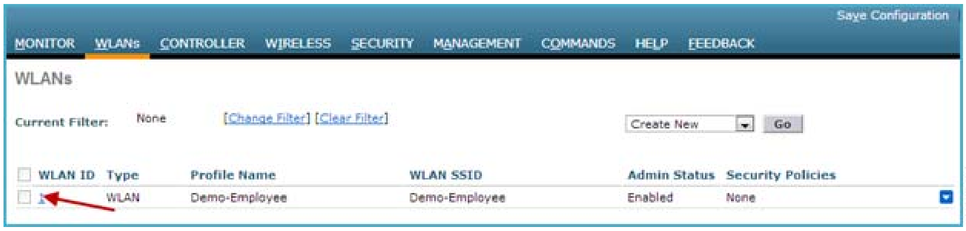
Interfaces

Interface Name	VLAN Identifier	IP Address	Interface Type	Dynamic AP Management
android	23	10.0.23.2	Dynamic	Disabled
apple	22	10.0.22.2	Dynamic	Disabled
dynamic	21	10.0.21.2	Dynamic	Disabled
management	20	10.0.20.2	Static	Enabled

350905

Mapping a Policy on WLAN

Go to WLANs from WLC menu and click the WLAN ID on which you want the policy to be implemented. As you can see in the **WLAN> General** tab, Interface/Interface Group is tied to management interface which is on VLAN 20.


Save Configuration
MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
Create New
Go

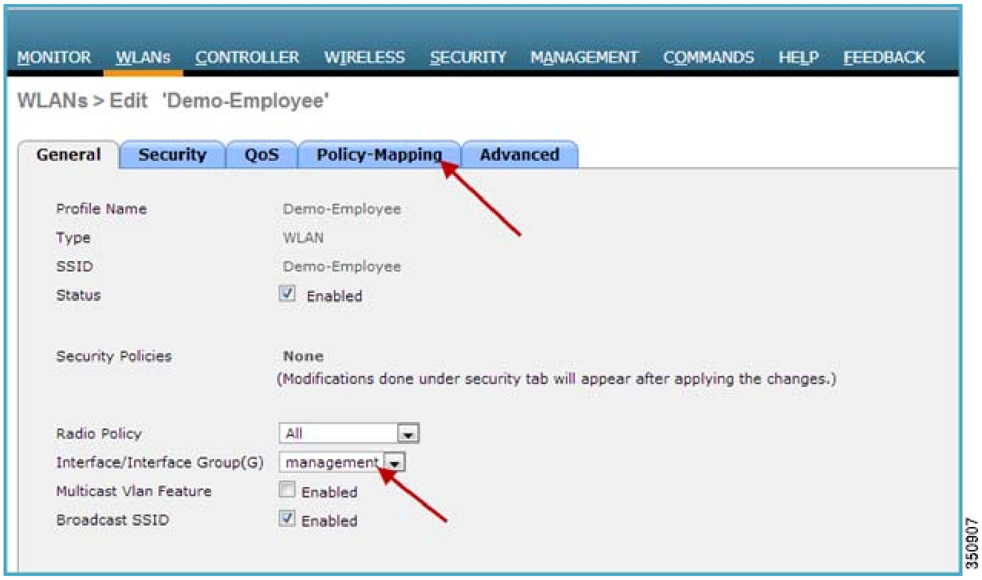
WLANs

Current Filter: None [Change Filter] [Clear Filter]

□ WLAN ID	Type	Profile Name	WLAN SSID	Admin Status	Security Policies
□ 1	WLAN	Demo-Employee	Demo-Employee	Enabled	None

350906

From the WLAN edit menu choose the Policy-Mapping tab.



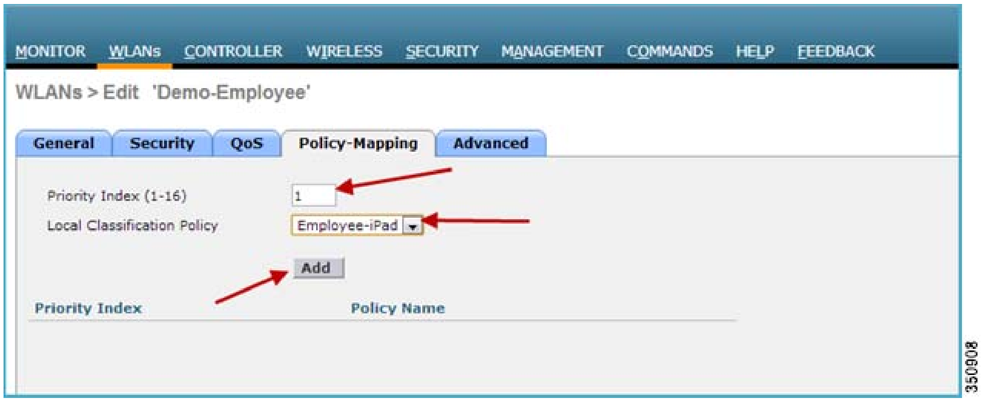
WLANs > Edit 'Demo-Employee'

Profile Name Demo-Employee
Type WLAN
SSID Demo-Employee
Status ☑ Enabled

Security Policies None
(Modifications done under security tab will appear after applying the changes.)

Radio Policy All
Interface/Interface Group(G) management
Multicast Vlan Feature ☐ Enabled
Broadcast SSID ☑ Enabled

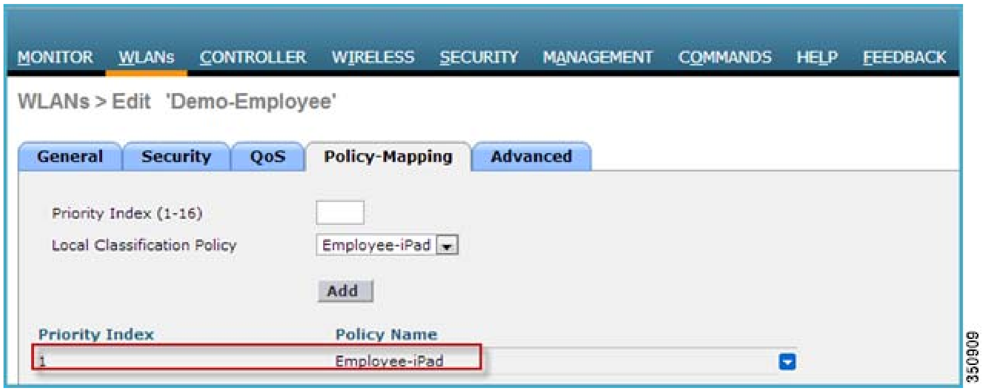
Set the **Priority index** to any value from 1-16. Then select the policy which you already created, from the **Local Policy** drop down menu. To Apply the policy on WLAN click **Add.** The policy will be mapped to WLAN and can be seen under Policy Name.



WLANs > Edit 'Demo-Employee'

Priority Index (1-16) 1
Local Classification Policy Employee-iPad

Priority Index	Policy Name

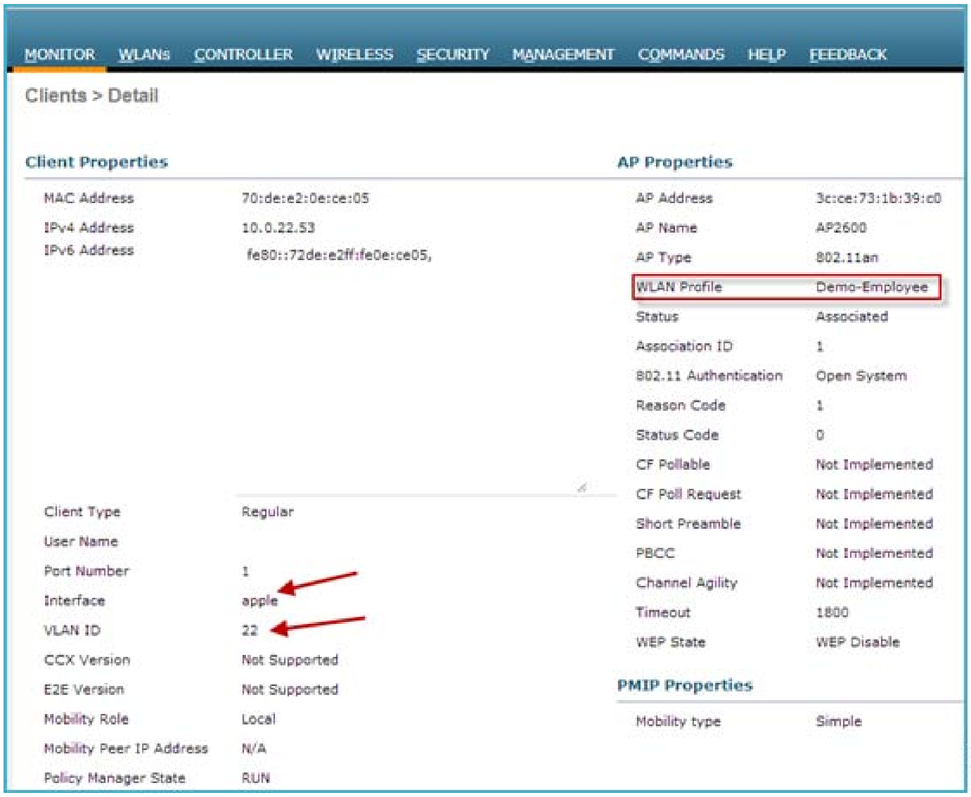


WLANs > Edit 'Demo-Employee'

Priority Index (1-16)
Local Classification Policy Employee-iPad

Priority Index	Policy Name
1	Employee-iPad

Now when an iPad associates to a policy enforced WLAN it is redirected to a VLAN tied to that policy. Scrolling down to Security Information will show you the local policy applied.



Clients > Detail

Client Properties

MAC Address	70:de:e2:0e:ce:05
IPv4 Address	10.0.22.53
IPv6 Address	fe80::72de:e2ff:fe0e:ce05,
Client Type	Regular
User Name	
Port Number	1
Interface	apple
VLAN ID	22
CCX Version	Not Supported
E2E Version	Not Supported
Mobility Role	Local
Mobility Peer IP Address	N/A
Policy Manager State	RUN

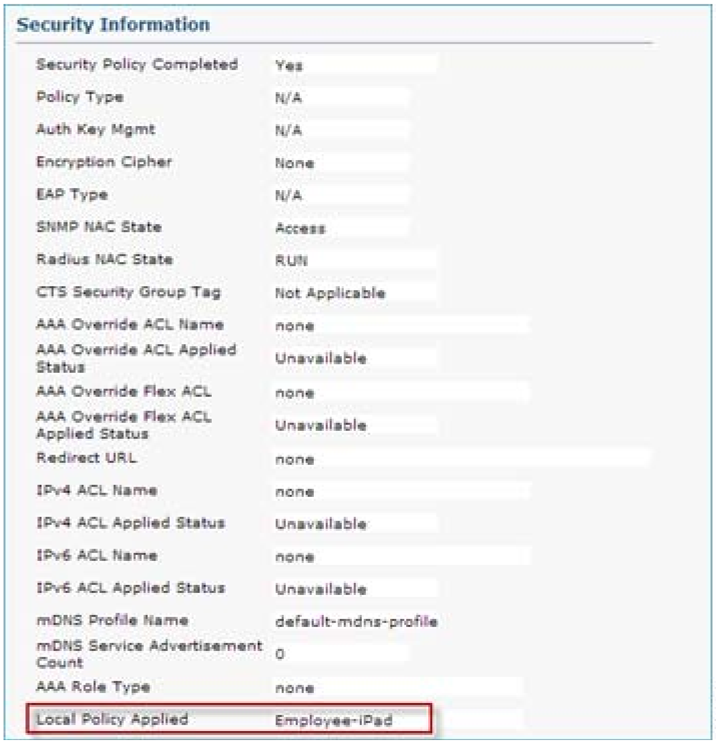
AP Properties

AP Address	3c:ce:73:1b:39:c0
AP Name	AP2600
AP Type	802.11an
WLAN Profile	Demo-Employee
Status	Associated
Association ID	1
802.11 Authentication	Open System
Reason Code	1
Status Code	0
CF Pollable	Not Implemented
CF Poll Request	Not Implemented
Short Preamble	Not Implemented
PBCC	Not Implemented
Channel Agility	Not Implemented
Timeout	1800
WEP State	WEP Disable

PMIP Properties

Mobility type	Simple

350910



Security Information

Security Policy Completed	Yes
Policy Type	N/A
Auth Key Mgmt	N/A
Encryption Cipher	None
EAP Type	N/A
SNMP NAC State	Access
Radius NAC State	RUN
CTS Security Group Tag	Not Applicable
AAA Override ACL Name	none
AAA Override ACL Applied Status	Unavailable
AAA Override Flex ACL	none
AAA Override Flex ACL Applied Status	Unavailable
Redirect URL	none
IPv4 ACL Name	none
IPv4 ACL Applied Status	Unavailable
IPv6 ACL Name	none
IPv6 ACL Applied Status	Unavailable
mDNS Profile Name	default-mdns-profile
mDNS Service Advertisement Count	0
AAA Role Type	none
Local Policy Applied	Employee-iPad

350911

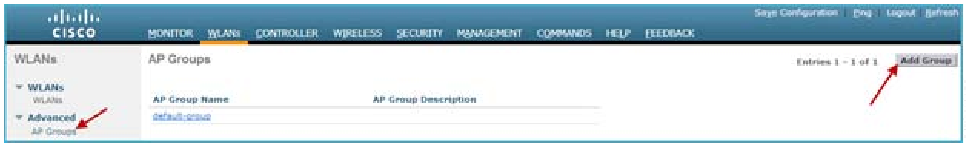
Mapping the Policy to an AP Group

Disable the WLAN on which you want to configure the policy.

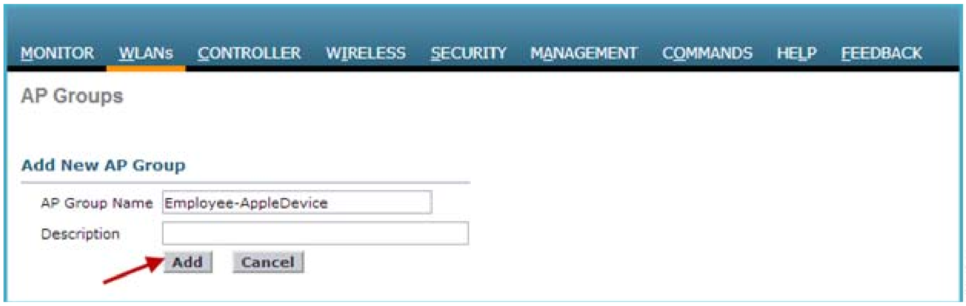
To apply the policy on an AP group we assume that you already have AP Groups configured on the WLC. If AP Groups has already been configured in your setup, please skip Step1 to 3.

If not, create an AP Group by going to WLC menu.

Step 1 Navigate to **WLANs > Advanced> AP** Groups and click **Add Group**.



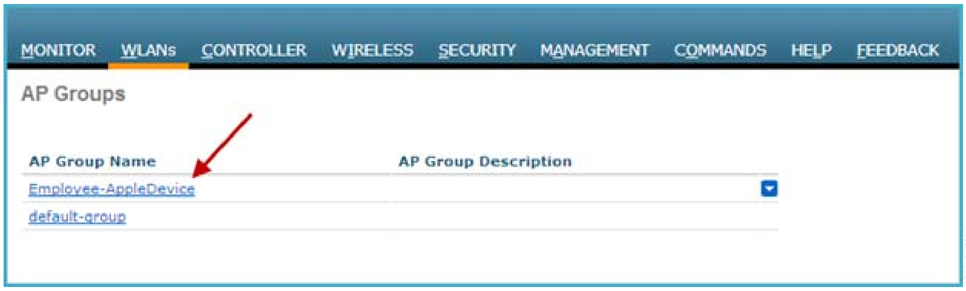
Then type in the name to define your AP Group Name and click **Add** button.


MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
AP Groups
Add New AP Group
Add
Cancel
350913

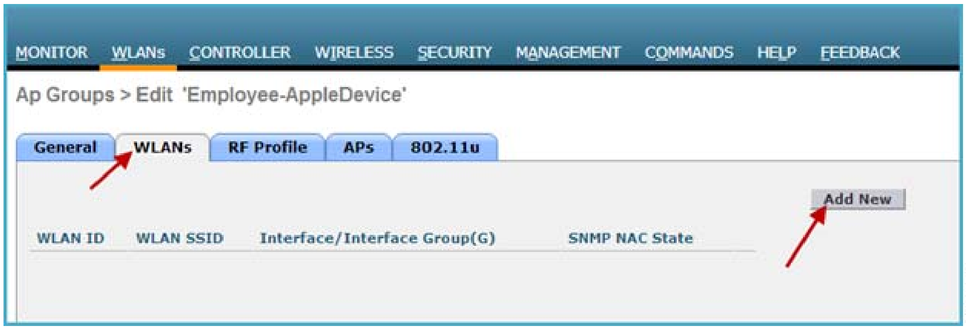
AP Group Name Employee-AppleDevice

Description

Step 2 Now click on the AP Group Name and then from the menu click WLANs and **Add New**


MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
AP Groups
350914

AP Group Name	AP Group Description
Employee-AppleDevice	
default-group	


MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
Ap Groups > Edit 'Employee-AppleDevice'
General
WLANs
RF Profile
APs
802.11u
Add New
WLAN ID
WLAN SSID
Interface/Interface Group(G)
SNMP NAC State
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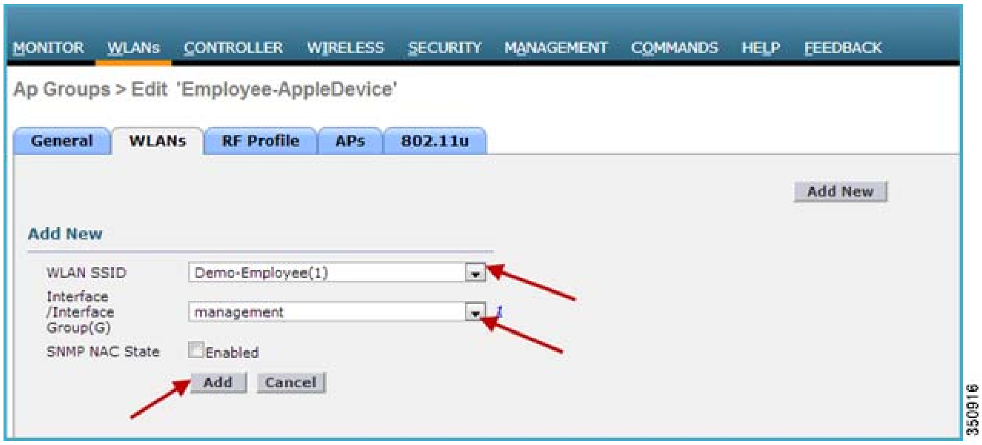
Step 3 From the drop down menu for WLAN SSID and Interface, select the required SSID and Interface respectively. Once selected click **Add** button to apply the selected WLAN on the AP Group.

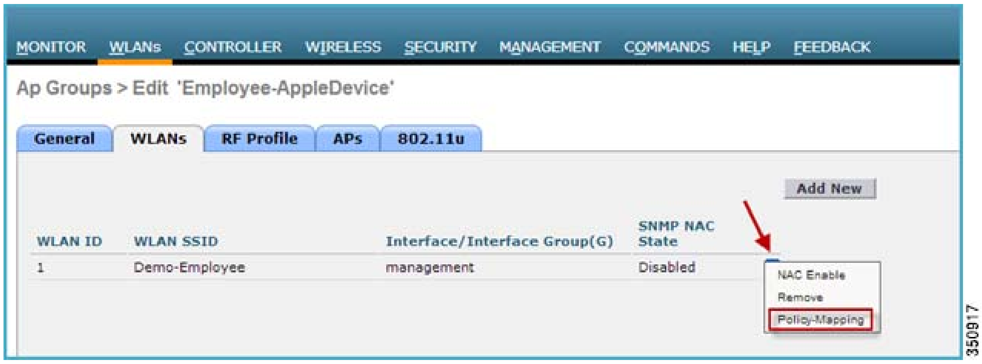


Ap Groups > Edit 'Employee-AppleDevice'

Add New

WLAN SSID	Demo-Employee(1)
Interface /Interface Group(G)	management
SNMP NAC State	□ Enabled

Step 4 Hover your mouse over the blue drop-down arrow for the desired WLAN on which you want to configure the Policy. Then select **Policy-Mapping** from the drop-down menu.

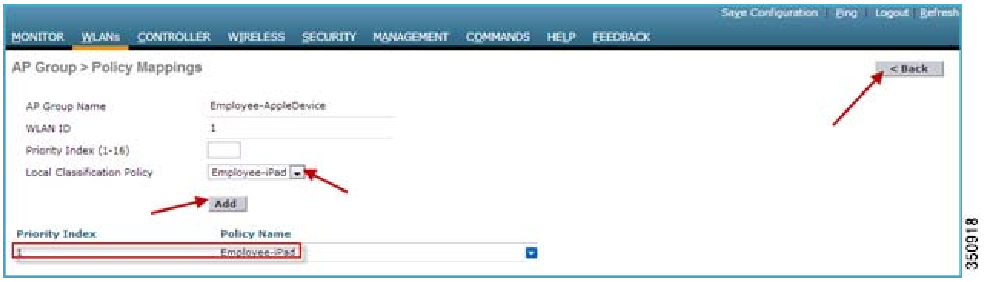


Ap Groups > Edit 'Employee-AppleDevice'

WLAN ID	WLAN SSID	Interface/Interface Group(G)	SNMP NAC State
1	Demo-Employee	management	Disabled

Step 5 Set the **Priority Index** to any value from 1-16, and then select the policy which you already created from Local Policy drop down list. To apply the policy on AP Group click **Add.** The policy will be mapped to AP Group and can be seen under Policy Name.

Click **Back** to go to the AP Group menu.

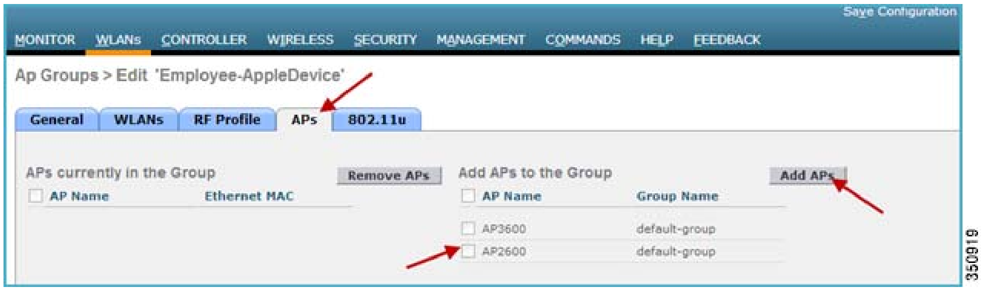


AP Group > Policy Mappings

AP Group Name	Employee-AppleDevice
WLAN ID	1
Priority Index (1-16)	
Local Classification Policy	Employee-iPad

Priority Index	Policy Name
1	Employee-iPad

Step 6 If the APs are not added to group go ahead and add them by selecting the AP and clicking the **Add APs** button. Here we added AP2600 to the AP Group.



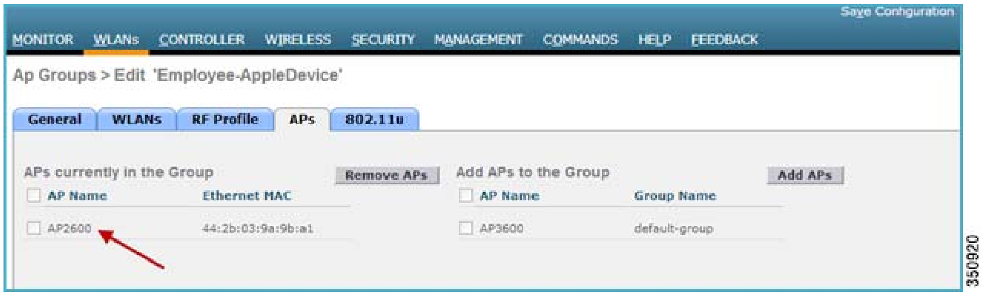
Ap Groups > Edit 'Employee-AppleDevice'

APs currently in the Group

□ AP Name	Ethernet MAC

Add APs to the Group

□ AP Name	Group Name
□ AP3600	default-group
□ AP2600	default-group



Ap Groups > Edit 'Employee-AppleDevice'

APs currently in the Group

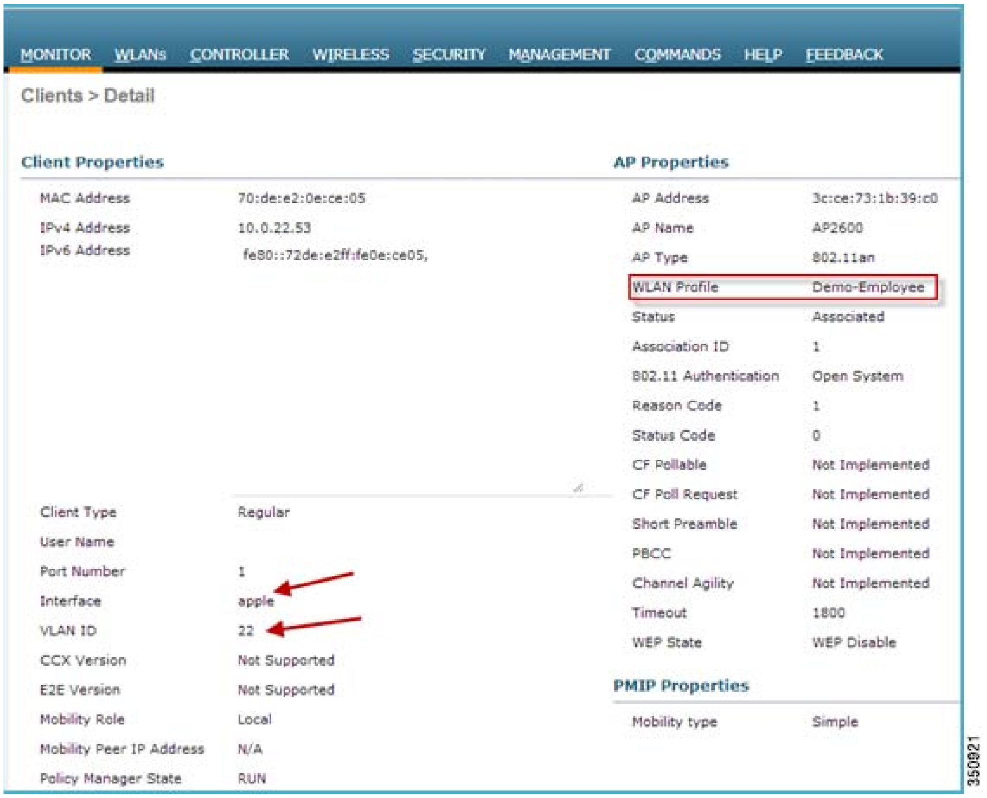
□ AP Name	Ethernet MAC
□ AP2600	44:2b:03:9a:9b:a1

Add APs to the Group

□ AP Name	Group Name
□ AP3600	default-group

Once the AP has joined the specific AP group then **Enable** the WLAN on which the policy is enforced.

Test the policy enforcement by associating an iPad/Client to the WLAN. Once the device is associated and profiled, it gets redirected to the VLAN matching the policy.



Clients > Detail

Client Properties

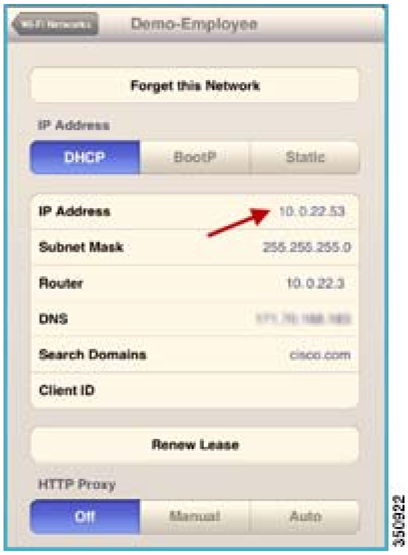
MAC Address	70:de:e2:0e:ce:05
IPv4 Address	10.0.22.53
IPv6 Address	fe80::72de:e2ff:fe0e:ce05,
Client Type	Regular
User Name	
Port Number	1
Interface	apple
VLAN ID	22
CCX Version	Not Supported
E2E Version	Not Supported
Mobility Role	Local
Mobility Peer IP Address	N/A
Policy Manager State	RUN

AP Properties

AP Address	3c:ce:73:1b:39:c0
AP Name	AP2600
AP Type	802.11an
WLAN Profile	Demo-Employee
Status	Associated
Association ID	1
802.11 Authentication	Open System
Reason Code	1
Status Code	0
CF Pollable	Not Implemented
CF Poll Request	Not Implemented
Short Preamble	Not Implemented
PBCC	Not Implemented
Channel Agility	Not Implemented
Timeout	1800
WEP State	WEP Disable

PMIP Properties

Mobility type	Simple



Demo-Employee

Forget this Network

IP Address

DHCP | BootP | Static

IP Address	10.0.22.53
Subnet Mask	255.255.255.0
Router	10.0.22.3
DNS	[redacted]
Search Domains	cisco.com
Client ID	

Renew Lease

HTTP Proxy

Off | Manual | Auto

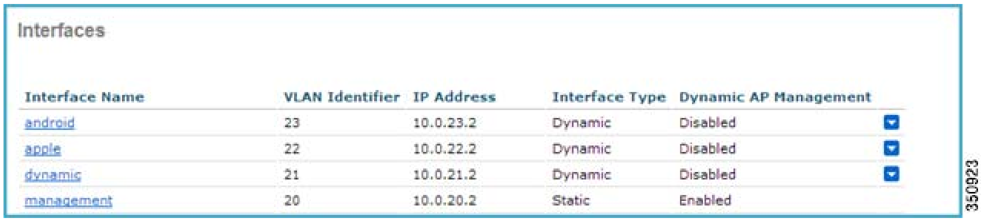
Note If your device is not being profiled correctly then the policy would not be enforced.

Example of Policy Enforcement on Other Device Types

Example

Policies were created for different device types (Android, Macbook, and Windows) coming into our network to be redirected to particular VLANs once they get profiled and policies are being enforced.

For this, dynamic interfaces such as “android” mapped to VLAN 23, Interface “apple” mapped to VLAN 22 and interface “dynamic” mapped to VLAN 21 was created.



Interfaces

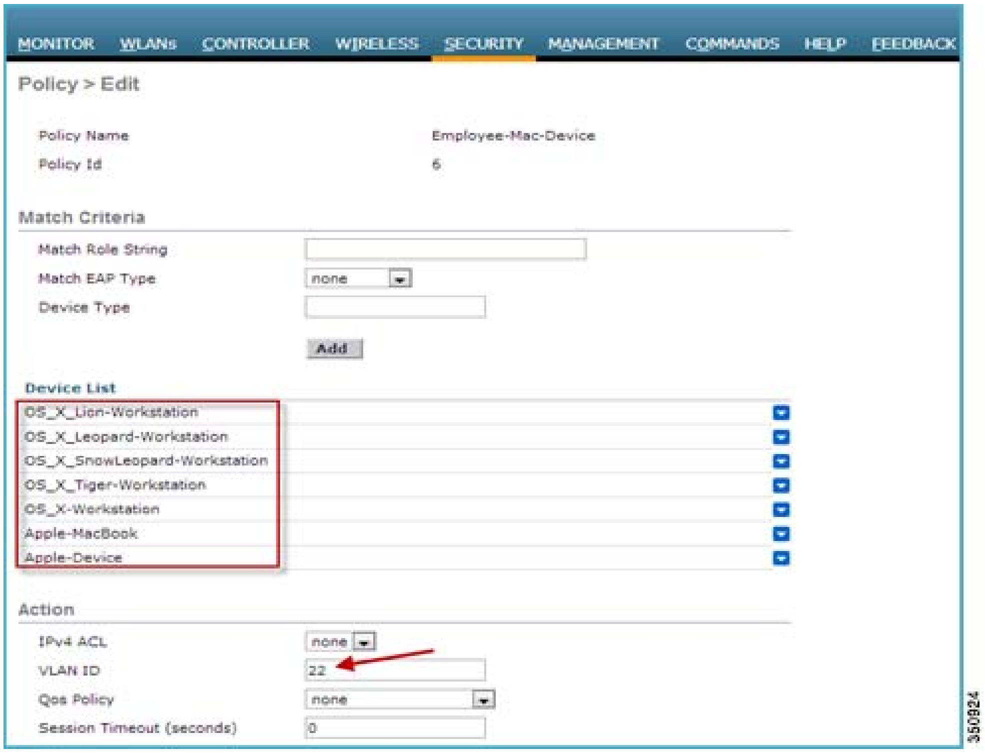
Interface Name	VLAN Identifier	IP Address	Interface Type	Dynamic AP Management
android	23	10.0.23.2	Dynamic	Disabled
apple	22	10.0.22.2	Dynamic	Disabled
dynamic	21	10.0.21.2	Dynamic	Disabled
management	20	10.0.20.2	Static	Enabled

In the following example, we are demonstrating profiling and policy implementation for Android and MAC devices.

For Employee MacBooks we created a policy name **Employee-Mac-Device** and added the Profiles from the WLC predefined profile list from the **Device Type** drop down menu.

Once the profile is matched, the policy enforcement is based on VLAN attribute. Here, the device should be redirected to VLAN 22 if it is a MacBook and to VLAN 23 if it is an Android device.

Policy "Employee-Mac-Device"



Policy > Edit

Policy Name Employee-Mac-Device

Policy Id 6

Match Criteria

Match Role String

Match EAP Type none

Device Type

Device List

OS_X_Lion-Workstation

OS_X_Leopard-Workstation

OS_X_SnowLeopard-Workstation

OS_X_Tiger-Workstation

OS_X-Workstation

Apple-MacBook

Apple-Device

Action

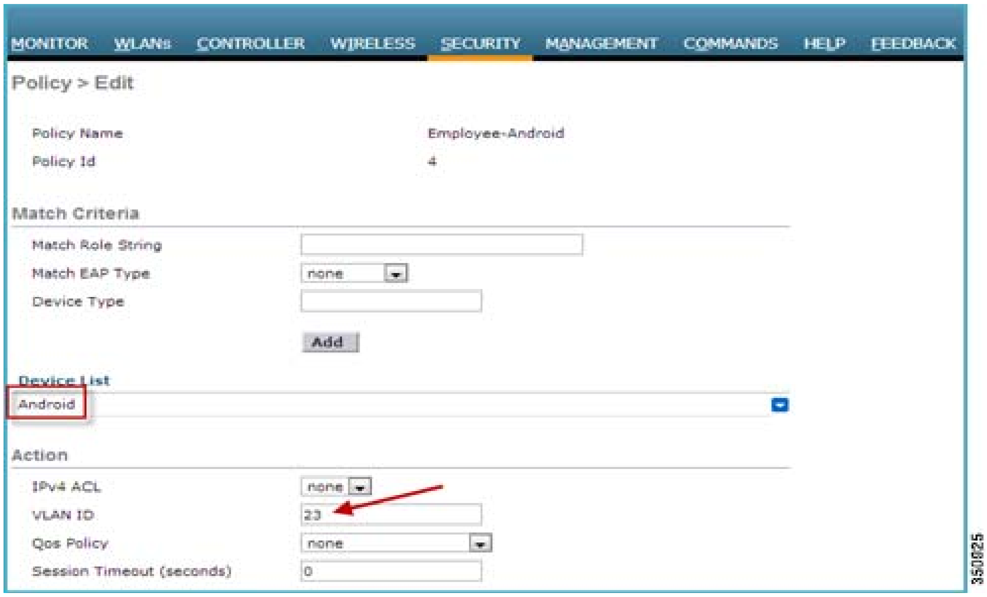
IPv4 ACL none

VLAN ID 22

Qos Policy none

Session Timeout (seconds) 0

Policy "Employee-Android"



Policy > Edit

Policy Name Employee-Android

Policy Id 4

Match Criteria

Match Role String

Match EAP Type none

Device Type

Device List

Android

Action

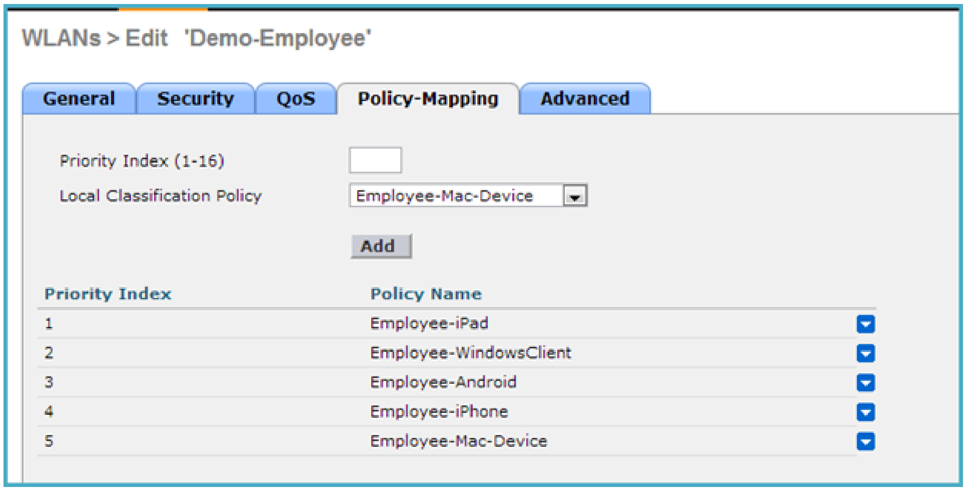
IPv4 ACL none

VLAN ID 23

Qos Policy none

Session Timeout (seconds) 0

These policies are mapped to the WLAN “Demo-Employee”



WLANs > Edit 'Demo-Employee'

Priority Index (1-16)

Local Classification Policy: Employee-Mac-Device

Priority Index	Policy Name
1	Employee-iPad
2	Employee-WindowsClient
3	Employee-Android
4	Employee-iPhone
5	Employee-Mac-Device

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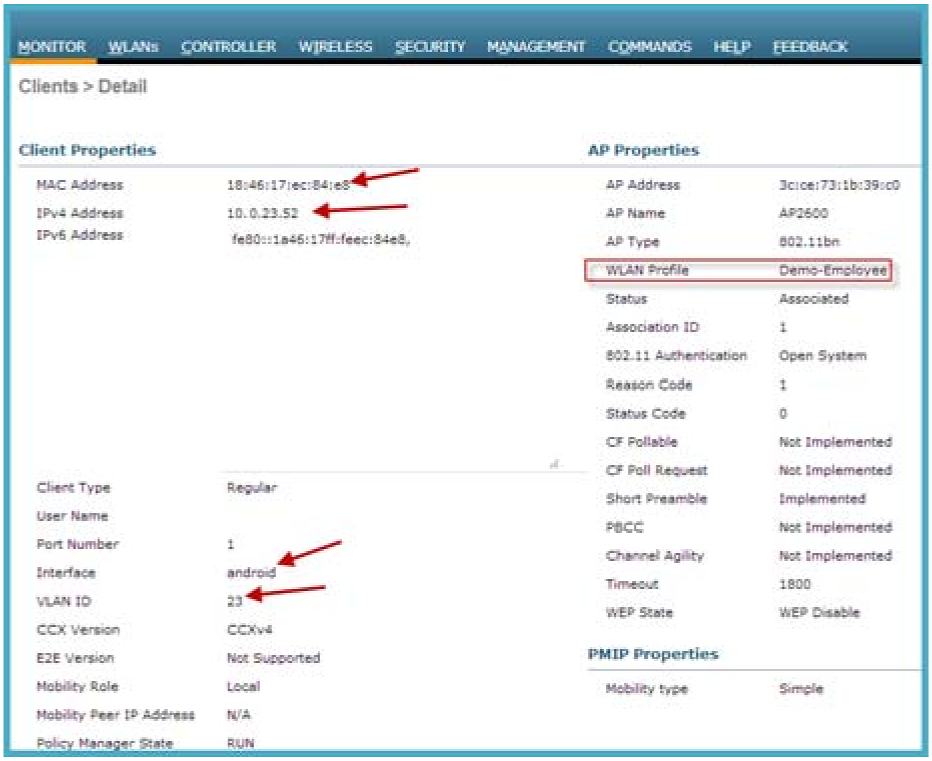
In the above example, an Android device and a Macbook is associated to SSID **Demo-Employee** and both the device is being redirected to the VLAN 23 and VLAN 22 respectively.

Client details for Android Device:



Clients > Detail

Client Properties

MAC Address	18:46:17:ec:84:e8
IPv4 Address	10.0.23.52
IPv6 Address	fe80::1a46:17ff:feec:84e8,
Client Type	Regular
User Name	
Port Number	1
Interface	android
VLAN ID	23
CCX Version	CCXv4
E2E Version	Not Supported
Mobility Role	Local
Mobility Peer IP Address	N/A
Policy Manager State	RUN

AP Properties

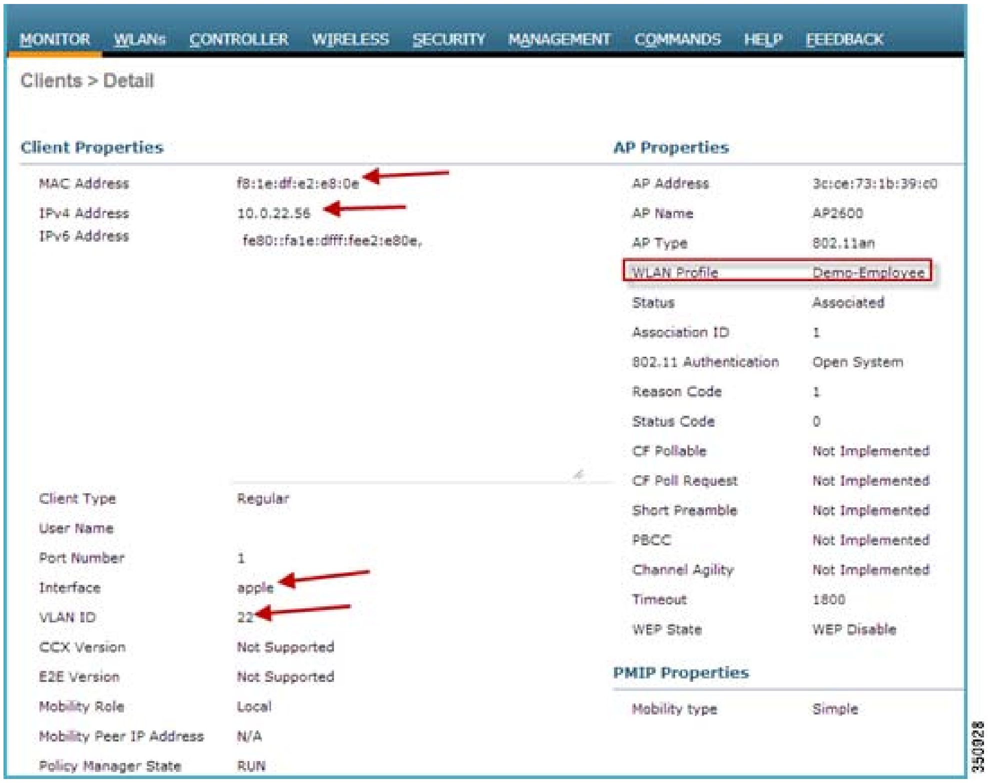
AP Address	3c:ce:73:1b:39:c0
AP Name	AP2600
AP Type	802.11bn
WLAN Profile	Demo-Employee
Status	Associated
Association ID	1
802.11 Authentication	Open System
Reason Code	1
Status Code	0
CF Pollable	Not Implemented
CF Poll Request	Not Implemented
Short Preamble	Implemented
PBCC	Not Implemented
Channel Agility	Not Implemented
Timeout	1800
WEP State	WEP Disable

PMIP Properties

Mobility type	Simple

350937

Client details for Apple MacBook:



Clients > Detail

Client Properties

MAC Address	f8:1e:df:e2:e8:0e
IPv4 Address	10.0.22.56
IPv6 Address	fe80::fa1e:dfff:fee2:e80e,
Client Type	Regular
User Name	
Port Number	1
Interface	apple
VLAN ID	22
CCX Version	Not Supported
E2E Version	Not Supported
Mobility Role	Local
Mobility Peer IP Address	N/A
Policy Manager State	RUN

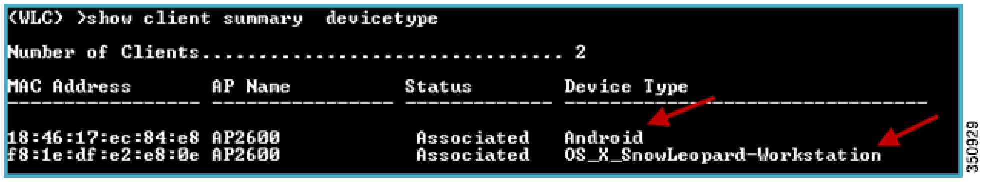
AP Properties

AP Address	3c:ce:73:1b:39:c0
AP Name	AP2600
AP Type	802.11an
WLAN Profile	Demo-Employee
Status	Associated
Association ID	1
802.11 Authentication	Open System
Reason Code	1
Status Code	0
CF Pollable	Not Implemented
CF Poll Request	Not Implemented
Short Preamble	Not Implemented
PBCC	Not Implemented
Channel Agility	Not Implemented
Timeout	1800
WEP State	WEP Disable

PMIP Properties

Mobility type	Simple

Device Profile:



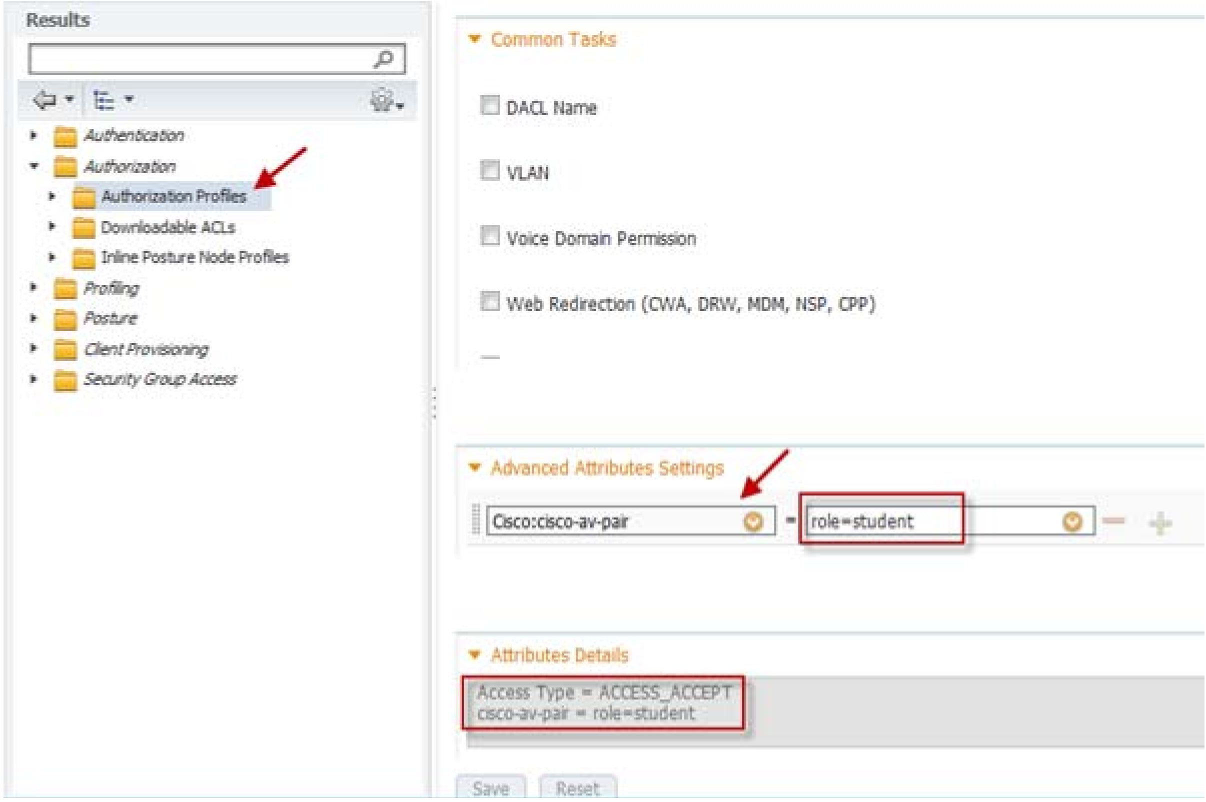
```
(WLC) >show client summary  devicetype

Number of Clients................................ 2

MAC Address       AP Name          Status        Device Type
----------------- ---------------- ------------- ---------------------------------

18:46:17:ec:84:e8 AP2600            Associated   Android
f8:1e:df:e2:e8:0e AP2600            Associated   OS_X_SnowLeopard-Workstation
```

Role Based Policy

Role is identified as a Cisco AV-pair from the AAA server and a user needs to configure the role as per user on the AAA server as:

```
Cisco:cisco-av-pair= role= <role-type>
```

The following example shows the role type “student” configured on ISE.



□ DACL Name

□ VLAN

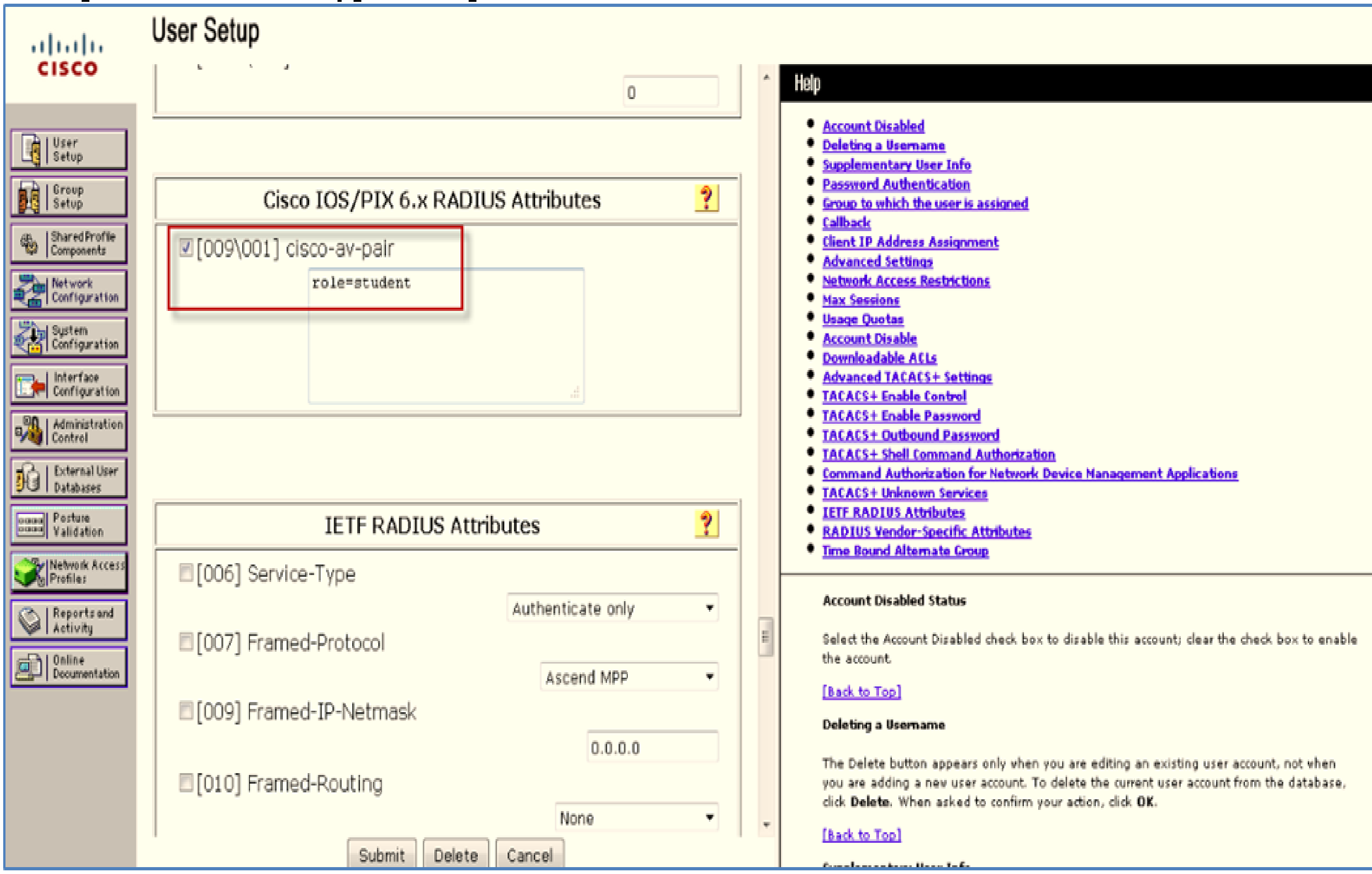
□ Voice Domain Permission

□ Web Redirection (CWA, DRW, MDM, NSP, CPP)

Cisco:cisco-av-pair = role=student

Access Type = ACCESS_ACCEPT
cisco-av-pair = role=student

Example of similar role type configured on ACS:



0

Cisco IOS/PIX 6.x RADIUS Attributes

☑ [009\001] cisco-av-pair
role=student

IETF RADIUS Attributes

☐ [006] Service-Type: Authenticate only

☐ [007] Framed-Protocol: Ascend MPP

☐ [009] Framed-IP-Netmask: 0.0.0.0

☐ [010] Framed-Routing: None

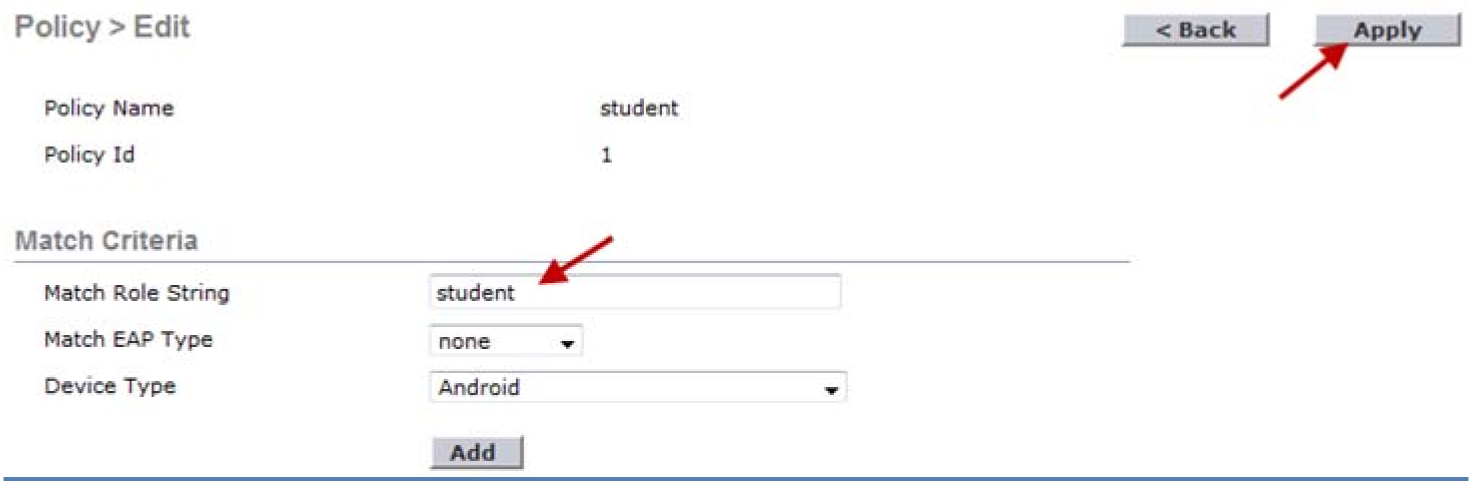
Account Disabled Status

Select the Account Disabled check box to disable this account; clear the check box to enable the account.

Deleting a Username

The Delete button appears only when you are editing an existing user account, not when you are adding a new user account. To delete the current user account from the database, click **Delete**. When asked to confirm your action, click **OK**.

Now, to apply the role based policy on WLC, navigate to **Policy > Edit** page and under **Match Criteria** define the **Match Role String** that the user created earlier on the AAA server. In the example, the **Match Role String** is configured as **student**. Once the policy is created, the user can tie the policy to a specific WLAN (with L2 Security set to 802.1x).



Policy > Edit

Policy Name student

Policy Id 1

Match Criteria

Match Role String student

Match EAP Type none

Device Type Android

Flex-Connect Support

The following table explains the Policy application support matrix for FlexConnect mode.

Flex Operation	Feature Support	Comments
Central Switched	Yes	The policy application will work for central switching as per design.
Local Switched	Partial support	Only VLAN override is supported.
Central Authentication	Yes	The policy application will work as per design.
Local Authentication	No	No local authentication support.
Standalone mode	No	When in standalone mode the clients will be out of policy. The clients need to be centrally authenticated to get the policies applied again. Same would apply for external web-authenticated clients.

Limitations

- When local profiling is enabled, radius profiling is not allowed on a particular WLAN, both configurations are mutually exclusive.
- If AAA override is enabled and you get any AAA attributes from AAA server other than role type, the configured policy action is not applied. The AAA override attributes will have higher precedence.

- Wired clients behind the WGB won’t be profiled and policy action will not be done.
- Only the first Policy rule which matches will be given precedence. Each policy profile will have an associated policy rule which will be used for matching the policies.
- Only sixteen policies per WLAN can be configured and globally sixty four policies will be allowed.
- Policy action will be done after L2 authentication is complete or after L3 authentication or when device sends http traffic and gets the device profiled. Due to which certain scenarios profiling and policy actions will happen more than once per client.
- This release will support only IPv4 clients to be profiled.
- No support for WGB wired clients for profiling as http profiling is not supported on WGB wired clients

Summary

- By default profiling is disabled on all WLANs.
- Each WLAN can have mapped profiling policies configured.
- Each Policy can have matching Role Type, Device Type, EAP type configured and an associated policy index mapped.
- The policy index signifies which policy needs to be matched first.
- The corresponding policy name will be deduced from the policy Index.
- The policy matching will exit at the first policy match and the corresponding policy action attributes will be set per client.
- The order of applying the policies per client will be based on security type.
- If a device is profiled once, the client is stored and the corresponding policy actions is applied.

Note See Cisco Wireless Device Profiling and Policy video for more information on setup and configuration.

Show Commands

```
show user <username> devices
show client wlan <WLAN Id>
show client wlan <WLAN Id> device-type <ipad | ipod | macbook ..>
show wlan <wlan-id>
```

Debug Commands

```
debug policy [events|errors] <enable|disables>
Debugs for profiler will be enabled by the existing "debug profiling <enable | disable>"
CLI
```

Commands to Configure Profiling through CLI

```
config wlan disable<wlan-id>
config wlan profiling <radius/local> <all/dhcp/http> enable <wlan-id>
config wlan enable <wlan-id>
```

Commands to Configure Policy through CLI

```
config policy <policy-name> create
config policy <policy-name> match device-type add <device name>
config policy <policy-name>action vlan  <enable|disable> <vlan #>
config wlan policy add <policy index number>  <policy-name> <WLAN Id>
```

To configure the policy and match it to a corresponding AP group, we need the policy Index also, which signifies which policies need to be matched first. The CLI command will be:

```
config wlan apgroup policy add <policy index number> <policy-name> <apgroup name> <WLAN
Id>
```

To configure the policy and match it with time of day, the CLI command will be:

```
config policy <policy-name>active add hours <08:00 – 17:00> days <Mon | Tue | Wed | Thurs
| Fri | Daily | Weekdays >
```

To configure the policy match with EAP type, the CLI command will be:

```
config policy <policy-name> match eap-type add <peap | leap | eap-fast | eap-tls>
```

For policy action as ACL, the CLI command will be:

```
config policy <policy-name> action acl <acl-name> <enable/disable>
```

For policy action as QoS, the CLI command will be:

```
config policy<policy-name>  action qos <bronze | gold | platinum | silver>
<enable|disable>
```

For policy action as Session-Timeout, the CLI command will be:

```
config policy <policy-name> action session-timeout <timeout in sec> <enable|disable>
```

For policy action as Sleeping Client Timeout, the CLI command will be:

```
config policy <policy-name> action sleeping-client-timeout <enable|disable><timeout in
hours>
```

Appendix-A

Sleeping Client Support

Currently in 7.4 release, guest client devices connected to the WLC on web-auth enabled WLANs have to enter login credentials every time the client goes to sleep and wakes up.

From 7.5 release, clients already in RUN state after successful web authentication are allowed to sleep and wakeup without the need to re-authenticate through the login page. The sleep client duration for which client needs to be remembered for re-authentication is based on the configuration.

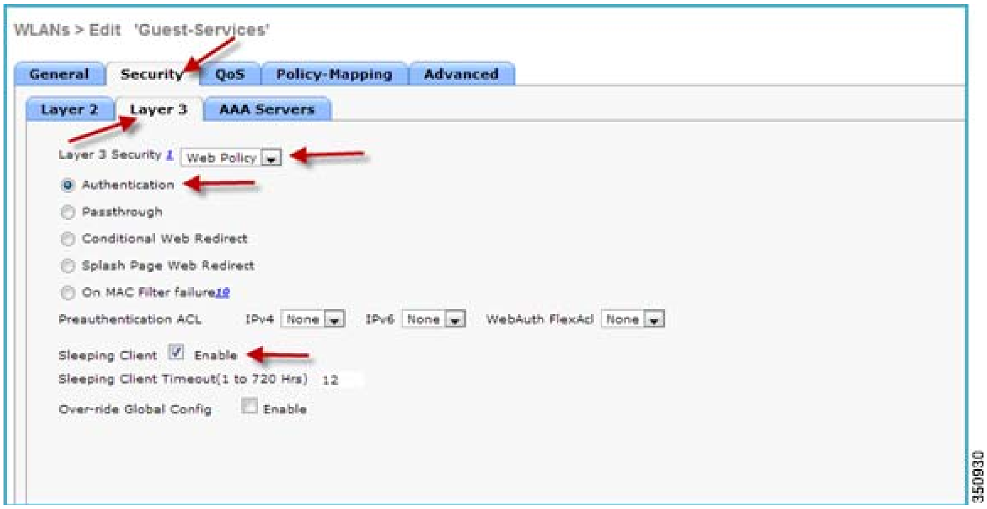
Other salient features are as follows:

- Feature is configurable per wlan.
- Supported only for L3 security enabled WLANs. Not applicable to Guest LAN or Remote LAN.
- Sleep client duration is configurable for 1hrs to 30days (720 Hrs) with a default value set to 12 hours. This duration is configurable on WLAN as well as on the policy mapped to the WLAN. The policy mapped configuration takes precedence over WLAN configuration.
- The maximum number of sleeping clients supported is based on the platform.
  - WiSM/5508 – 1000
  - 7500/8500 – 9000
  - 2500 – 500
- Flex connect AP Support – Sleep client support feature works with flexconnect mode AP's in local switching case for both internal and external web-auth.
- High Availability– Only configuration sync is supported. Sleep cache entries are not synchronized across active and standby.

WLAN Configuration for Sleeping Client

As sleeping client is only supported for L3 security WLANs, navigate to the particular WLAN on which you want to enable the sleeping client feature. Navigate to **Security > Layer 3** and select **Web Policy** from the Layer 3 Security drop-down list.

Select the radio button **Authentication** and enable **Sleeping Client** by checking the box as shown in the image below.



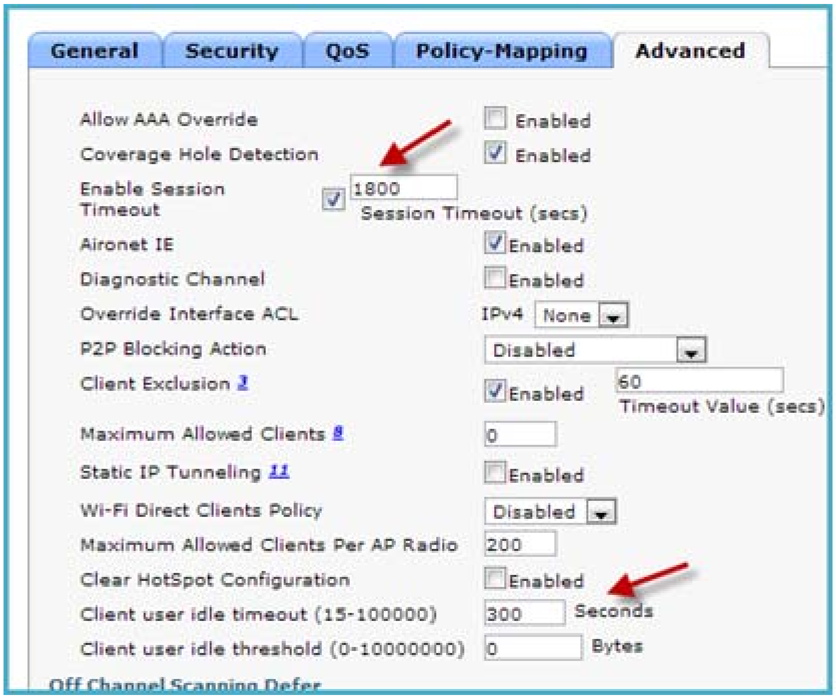
Layer 3 Security 1 Web Policy

● Authentication
○ Passthrough
○ Conditional Web Redirect
○ Splash Page Web Redirect
○ On MAC Filter failure10

Preauthentication ACL IPv4 None IPv6 None WebAuth FlexAcl None

Sleeping Client ☑ Enable
Sleeping Client Timeout(1 to 720 Hrs) 12
Over-ride Global Config □ Enable

Navigate to **Advanced** tab and make sure that the session timeout is greater than the client idle timeout, otherwise the sleeping client entry would not be created.



Allow AAA Override □ Enabled
Coverage Hole Detection ☑ Enabled
Enable Session Timeout ☑ 1800 Session Timeout (secs)
Aironet IE ☑ Enabled
Diagnostic Channel □ Enabled
Override Interface ACL IPv4 None
P2P Blocking Action Disabled
Client Exclusion 3 ☑ Enabled 60 Timeout Value (secs)
Maximum Allowed Clients 8 0
Static IP Tunneling 11 □ Enabled
Wi-Fi Direct Clients Policy Disabled
Maximum Allowed Clients Per AP Radio 200
Clear HotSpot Configuration □ Enabled
Client user idle timeout (15-100000) 300 Seconds
Client user idle threshold (0-10000000) 0 Bytes
Off Channel Scanning Defer

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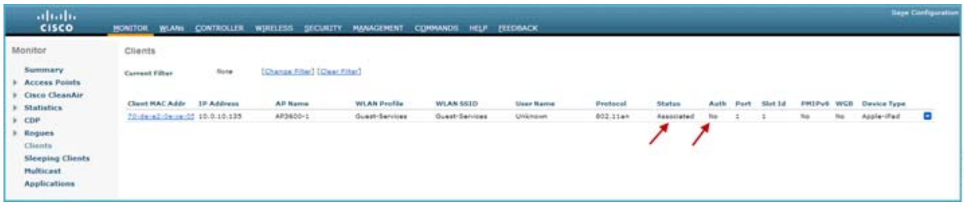
Now connect a client to the WLAN on which sleeping client feature is enabled. Then navigate to Monitor > Clients, the status of the client shows that it is in **Associated** state but Not Authenticated as username/password required for web-auth.



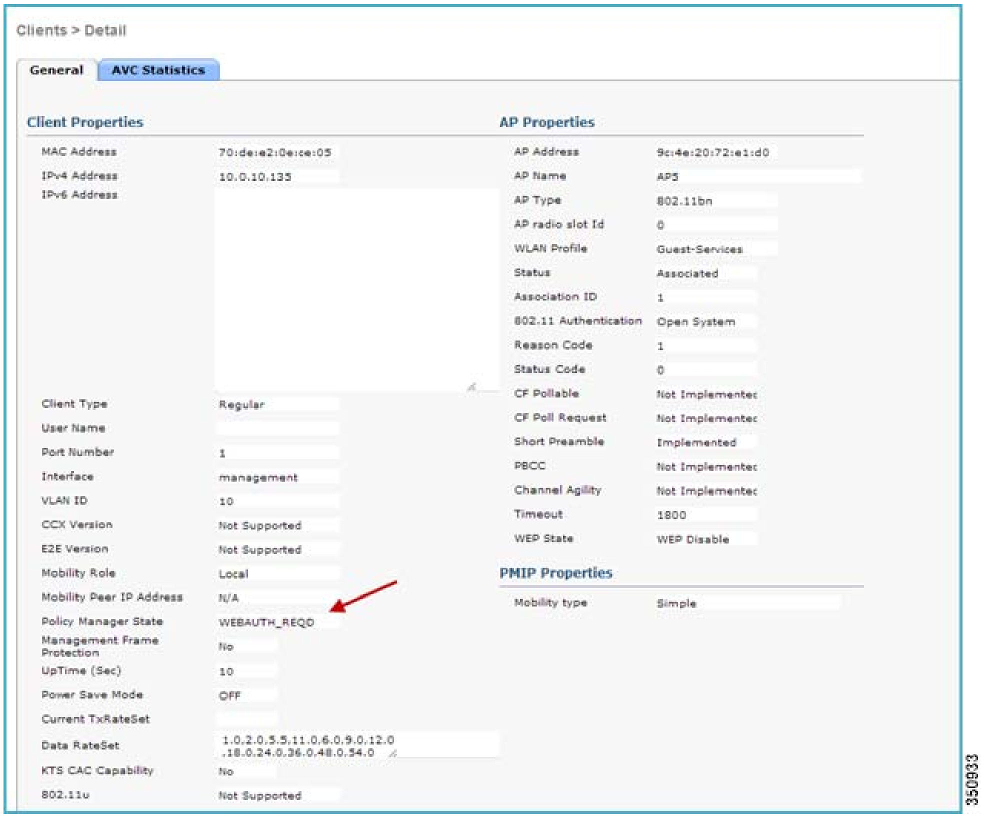
Clients

Current Filter None [Change Filter] [Clear Filter]

Client MAC Addr	IP Address	AP Name	WLAN Profile	WLAN SSID	User Name	Protocol	Status	Auth	Port	Slot Id	PMIPv6	WGB	Device Type
[illegible]	10.0.10.135	AP3600-1	Guest-Services	Guest-Services	Unknown	802.11an	Associated	No	1	1	No	No	Apple-iPad

350932

Under **Client Properties** menu, it is seen that the client is in Web-auth required state.



Client Properties

MAC Address	70:de:e2:0e:ce:05
IPv4 Address	10.0.10.135
IPv6 Address	
Client Type	Regular
User Name	
Port Number	1
Interface	management
VLAN ID	10
CCX Version	Not Supported
E2E Version	Not Supported
Mobility Role	Local
Mobility Peer IP Address	N/A
Policy Manager State	WEBAUTH_REQD
Management Frame Protection	No
UpTime (Sec)	10
Power Save Mode	OFF
Current TxRateSet	
Data RateSet	1.0,2.0,5.5,11.0,6.0,9.0,12.0 ,18.0,24.0,36.0,48.0,54.0
KTS CAC Capability	No
802.11u	Not Supported

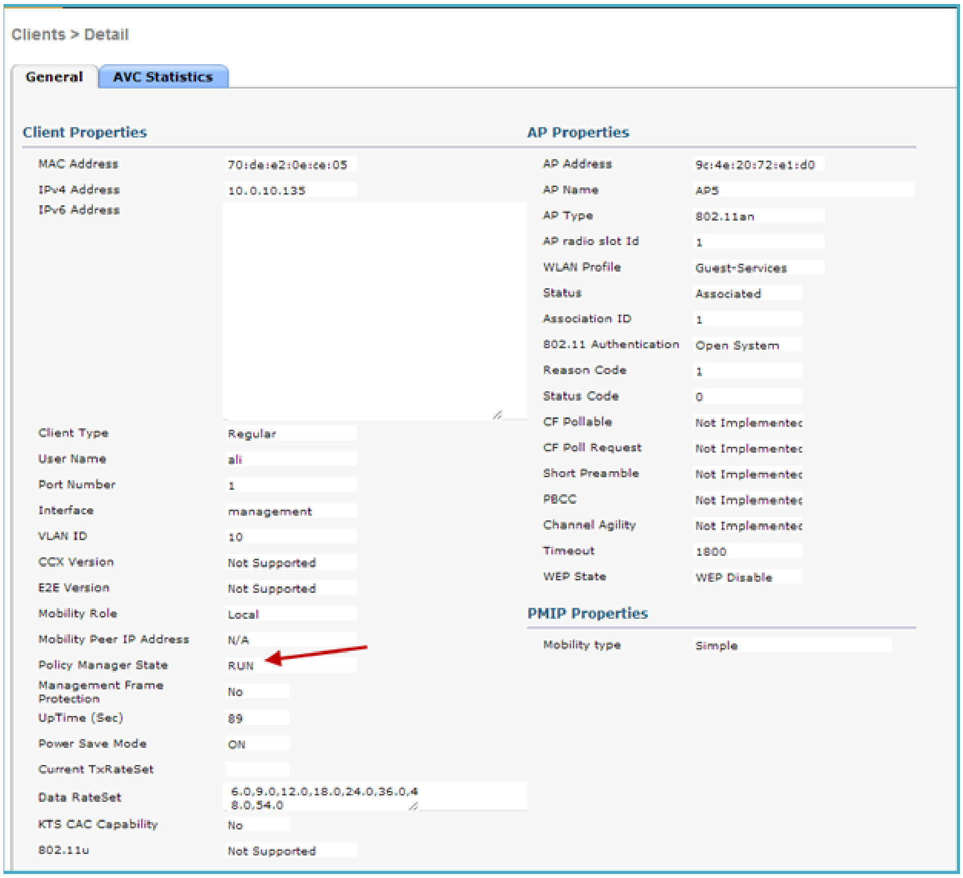
AP Properties

AP Address	9c:4e:20:72:e1:d0
AP Name	AP3
AP Type	802.11bn
AP radio slot Id	0
WLAN Profile	Guest-Services
Status	Associated
Association ID	1
802.11 Authentication	Open System
Reason Code	1
Status Code	0
CF Pollable	Not Implementec
CF Poll Request	Not Implementec
Short Preamble	Implemented
PBCC	Not Implementec
Channel Agility	Not Implementec
Timeout	1800
WEP State	WEP Disable

PMIP Properties

Mobility type	Simple

After entering the appropriate login credentials for web-auth, the client get authenticated and moves to RUN state.



Clients > Detail

Client Properties

MAC Address	70:de:e2:0e:ce:05
IPv4 Address	10.0.10.135
IPv6 Address	
Client Type	Regular
User Name	ali
Port Number	1
Interface	management
VLAN ID	10
CCX Version	Not Supported
E2E Version	Not Supported
Mobility Role	Local
Mobility Peer IP Address	N/A
Policy Manager State	RUN
Management Frame Protection	No
UpTime (Sec)	89
Power Save Mode	ON
Current TxRateSet	
Data RateSet	6.0,9.0,12.0,18.0,24.0,36.0,48.0,54.0
KTS CAC Capability	No
802.11u	Not Supported

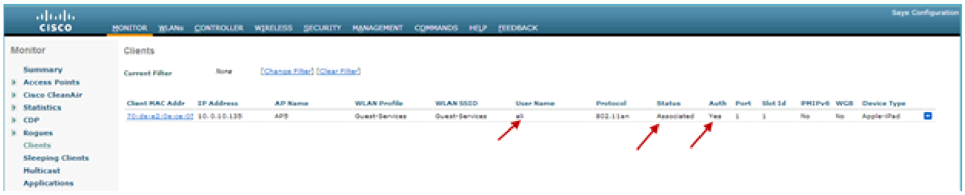
AP Properties

AP Address	9c:4e:20:72:e1:d0
AP Name	AP5
AP Type	802.11an
AP radio slot Id	1
WLAN Profile	Guest-Services
Status	Associated
Association ID	1
802.11 Authentication	Open System
Reason Code	1
Status Code	0
CF Pollable	Not Implementec
CF Poll Request	Not Implementec
Short Preamble	Not Implementec
PBCC	Not Implementec
Channel Agility	Not Implementec
Timeout	1800
WEP State	WEP Disable

PMIP Properties

Mobility type	Simple

After successful web-auth, the user is successfully authenticated.

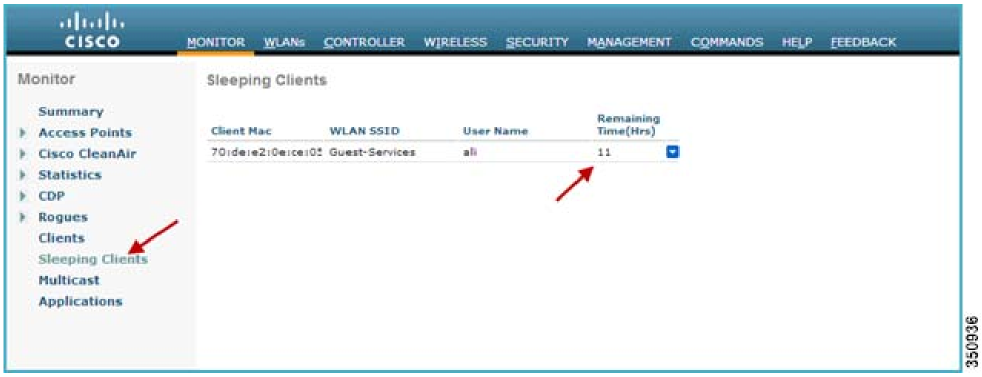


Clients

Current Filter None [Change Filter] [Clear Filter]

Client MAC Addr	IP Address	AP Name	WLAN Profile	WLAN SSID	User Name	Protocol	Status	Auth	Port	Slot Id	PMIPv6	WGB	Device Type
70:de:e2:0e:ce:05	10.0.10.135	AP5	Guest-Services	Guest-Services	ali	802.11an	Associated	Yes	1	1	No	No	Apple-iPad

Now if the client configured is idle for 300 seconds (default idle timeout value) or disconnects from the WLAN it is connected to, then the client will move to sleeping clients. Click **Sleeping Clients** option to check if the client entry exists.



Sleeping Clients

Client Mac	WLAN SSID	User Name	Remaining Time(Hrs)
70:de:e2:0e:ce:0!	Guest-Services	ali	11

Once the client is moved to the Sleeping Clients, the timeout session starts and the remaining time before the client entry is deleted/cleared is displayed.

If the client wakes up or joins back to the same WLAN, it doesn’t require re-authentication.

Sleeping Client CLI commands

To enable the sleeping-client feature on wlan:

```
(controller) >config  wlan custom-web  sleep-client  enable/disable <wlan-id>
```

To configure sleeping-client interval on wlan:

```
(controller) > config  wlan  custom-web  sleep-client   timeout   <1- 720hours> <wlan-id>
```

To check sleep client configuration on wlan:

```
(controller) > show wlan <wlan-id>
```

To delete any unwanted sleeping-client entries:

```
(controller) > config  custom-web  sleep-client   delete  <mac-addr>
```

To show summary of all the sleeping-client entries:

```
(controller) > show  custom-web   sleep-client   summary
```

To show the details of sleeping-client entry based on mac address:

```
(controller) > show  custom-web  sleep-client  detail  <mac-addr>
```

Native Profiling and Policy in CUWN Release 8.0

In release 8.0, two major enhancements were introduced related to Native Profiling and Policy classification feature on WLC:

- New attributes added to Local Policy
- Dynamic MAC OUI and Device Profile updates

AVC/mDNS Profiles Attached to Local Policies

Prior to release 8.0, all clients associated with a WLAN/SSID pick the same AVC/mDNS profile mapped to the WLAN and allow the services configured for the profile. In release 8.0, a AVC/mDNS profile can be mapped to a local policy for a client with a particular device type. This ensures that each Local policy can be configured with a different AVC/mDNS profile name based on AAA override, to restrict the policy from being able to use the services not allowed by the profile on the same WLAN.

Profiling and Policy Engine on WLC

In this section, you will configure and implement Profiling and Policy on a Cisco WLC running AireOS 8.0 code.

The profiling and policy enforcement are configured as two separate components. The configuration on the WLC is based on defined parameters specific to clients joining the network. The policy attributes which are of interest are:

a. Role—Defines the user type or the user group the user belongs to, for example, student or employee.

b. Device—Device defines the type of device, for example, Windows machine, Smart phone, Apple devices such as iPad, iPhone, and so on.

c. Time of day—Allows configuration to be defined at what time of the day, the end-points are allowed on the network.

d. EAP Type—Checks what EAP method the client is getting connected to.

The above parameters are configurable as policy match attributes. Once WLC has a match corresponding to the above parameters per end-point, policy enforcement comes into picture. Policy enforcement is based on session attributes such as:

- VLAN
- IPv4 ACL
- Session Timeout
- QoS
- Sleeping Client Timeout
- Flexconnect ACL
- AVC Profile (added in release8.0)
- mDNS Profile (added in release 8.0)
- Avg.Data Rate (added in release 8.0)
- Avg. Real Time Data Rate (added in release 8.0)

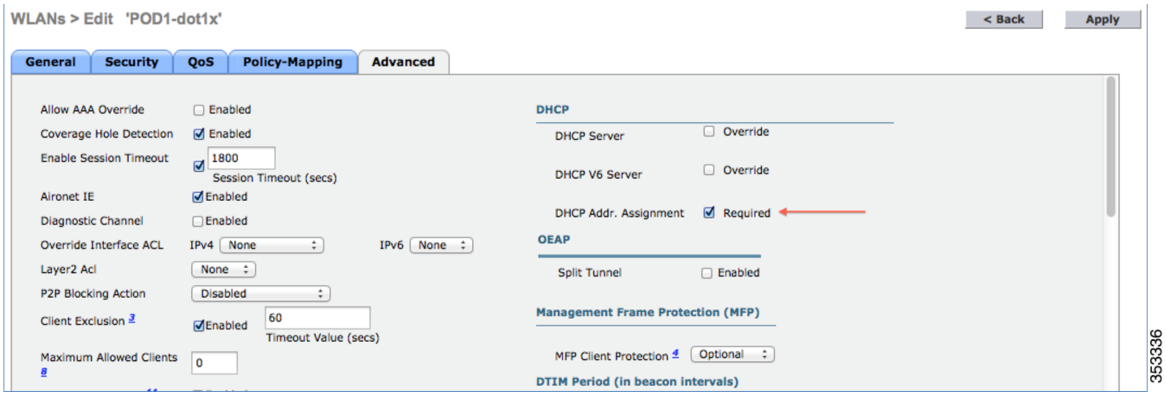
- Burst Data Rate (added in release 8.0)

You can configure these policies and enforce end-points with specified policies. The wireless clients will be profiled based on the MAC OUI, DHCP, HTTP user agent (valid Internet required for successful HTTP profiling). The WLC uses these attributes and predefined classification profiles to identify devices.

Profiling and Policy Configuration

Complete these steps:

Step 1 To configure device profiling on a WLAN, go to the specific WLAN (with 802.1x security configured) on which you want to implement Native profiling and policy and click the **Advanced** tab. In the **Allow AAA Override** field, uncheck the **Enabled** check box if it is checked. In the **DHCP** area, in the **DHCP Addr. Assignment** field, check the **Required** check box.



WLANs > Edit 'POD1-dot1x'

Allow AAA Override □ Enabled
Coverage Hole Detection ☑ Enabled
Enable Session Timeout ☑ 1800 Session Timeout (secs)
Aironet IE ☑ Enabled
Diagnostic Channel □ Enabled
Override Interface ACL IPv4 None IPv6 None
Layer2 Acl None
P2P Blocking Action Disabled
Client Exclusion 3 ☑ Enabled 60 Timeout Value (secs)
Maximum Allowed Clients 8 0

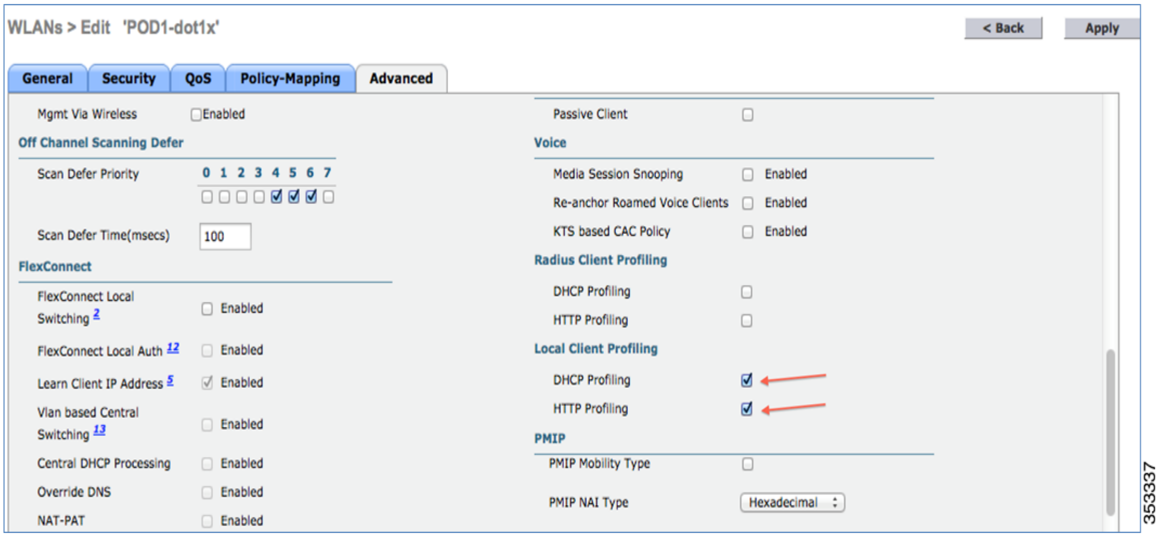
DHCP
DHCP Server □ Override
DHCP V6 Server □ Override
DHCP Addr. Assignment ☑ Required

OEAP
Split Tunnel □ Enabled

Management Frame Protection (MFP)
MFP Client Protection 4 Optional

DTIM Period (in beacon intervals)

Step 2 In the **Local Client Profiling** area, check the check boxes corresponding to DHCP Profiling and HTTP Profiling if they are not checked and click **Apply**.



WLANs > Edit 'POD1-dot1x'

Mgmt Via Wireless □ Enabled

Off Channel Scanning Defer
Scan Defer Priority 0 1 2 3 4 5 6 7
□ □ □ □ ☑ ☑ ☑ □
Scan Defer Time(msecs) 100

FlexConnect
FlexConnect Local Switching 2 □ Enabled
FlexConnect Local Auth 12 □ Enabled
Learn Client IP Address 5 ☑ Enabled
Vlan based Central Switching 13 □ Enabled
Central DHCP Processing □ Enabled
Override DNS □ Enabled
NAT-PAT □ Enabled

Passive Client □

Voice
Media Session Snooping □ Enabled
Re-anchor Roamed Voice Clients □ Enabled
KTS based CAC Policy □ Enabled

Radius Client Profiling
DHCP Profiling □
HTTP Profiling □

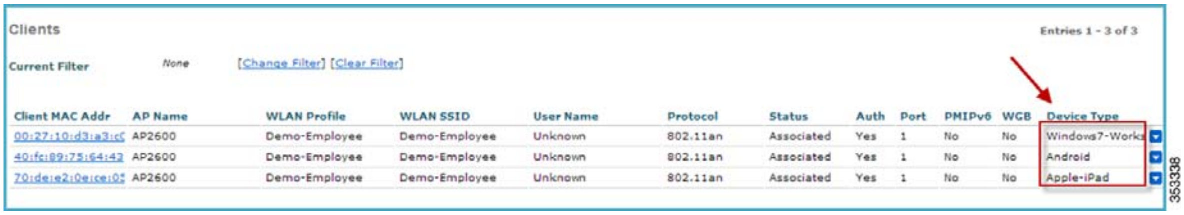
Local Client Profiling
DHCP Profiling ☑
HTTP Profiling ☑

PMIP
PMIP Mobility Type □
PMIP NAI Type Hexadecimal

Now, associate a client to the WLAN on which profiling is enabled.

From the WLC main menu, go to **Monitor > Clients.** The profiled devices are listed under the **Device Type** column.

Notice that there are three devices associated to the WLAN, and all of them are being profiled in the following example.



Clients

Entries 1 - 3 of 3

Current Filter None [Change Filter] [Clear Filter]

Client MAC Addr	AP Name	WLAN Profile	WLAN SSID	User Name	Protocol	Status	Auth	Port	PMIPv6	WGB	Device Type
00:27:10:d3:a3:c	AP2600	Demo-Employee	Demo-Employee	Unknown	802.11an	Associated	Yes	1	No	No	Windows7-Works
40:fc:89:75:64:43	AP2600	Demo-Employee	Demo-Employee	Unknown	802.11an	Associated	Yes	1	No	No	Android
70:de:e2:0e:ce:0	AP2600	Demo-Employee	Demo-Employee	Unknown	802.11an	Associated	Yes	1	No	No	Apple-iPad

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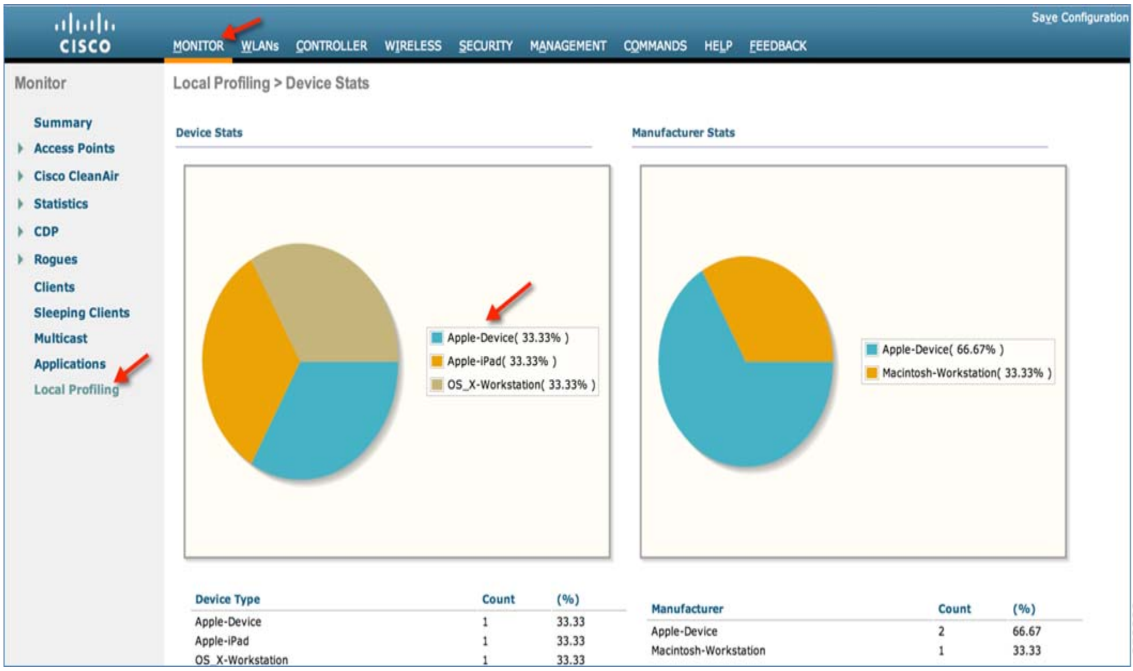
Also, the Local Profiling option under the Monitor page provides the administrator a better understanding of the kind of devices that exists in the network. The local profiling option, which was introduced in CUWN 7.6 release, enables viewing the basic device statuses.



Device Type	Count	(%)
Apple-Device	1	33.33
Apple-iPad	1	33.33
OS_X-Workstation	1	33.33

Manufacturer	Count	(%)
Apple-Device	2	66.67
Macintosh-Workstation	1	33.33

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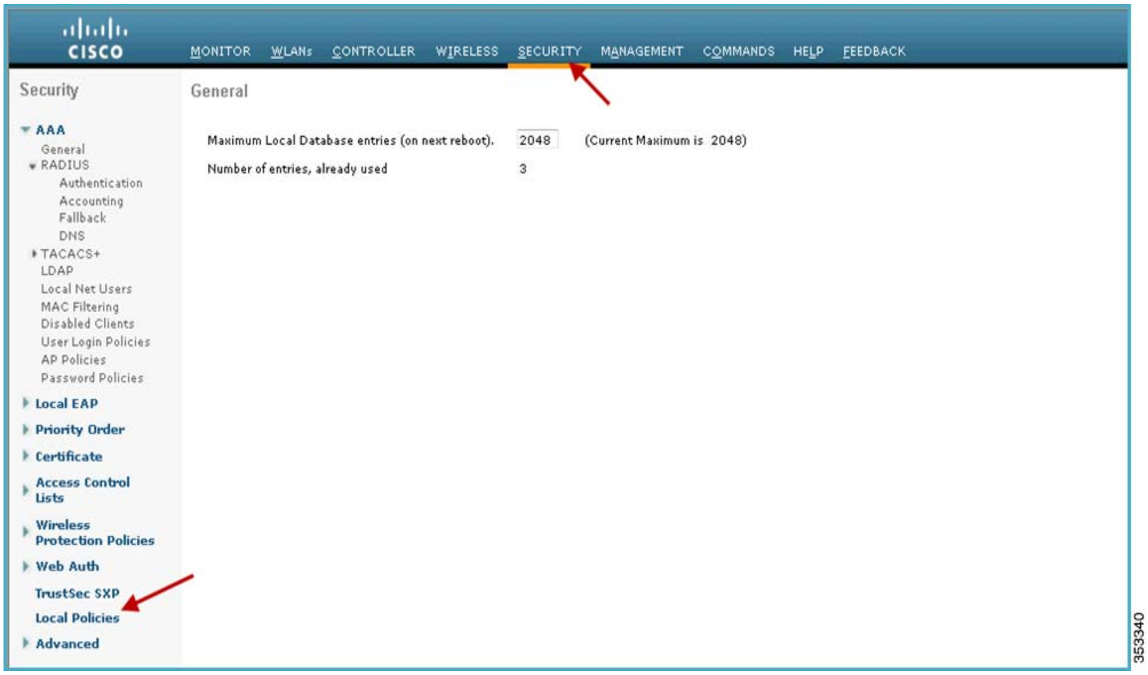
Creating Policies on WLAN from the WLC GUI

Step 3 Once profiling is configured, you can create Local policies and apply them on the WLAN. From the WLC main menu, go to **Security > Local Policies.**

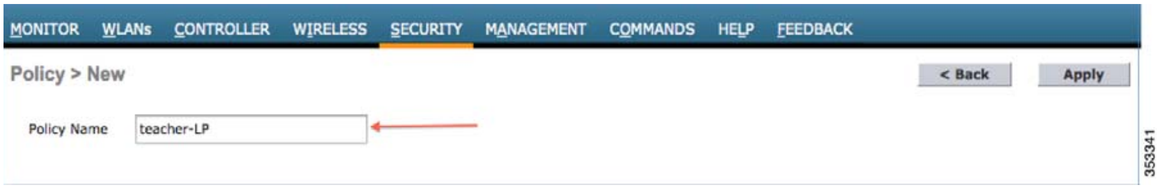


General

Maximum Local Database entries (on next reboot). 2048 (Current Maximum is 2048)

Number of entries, already used 3

Step 4 When in the Local Policy List, click **New** to create a Policy Name. In this example, **teacher-LP** is used as a policy name, but you can use any name to define your own policy.



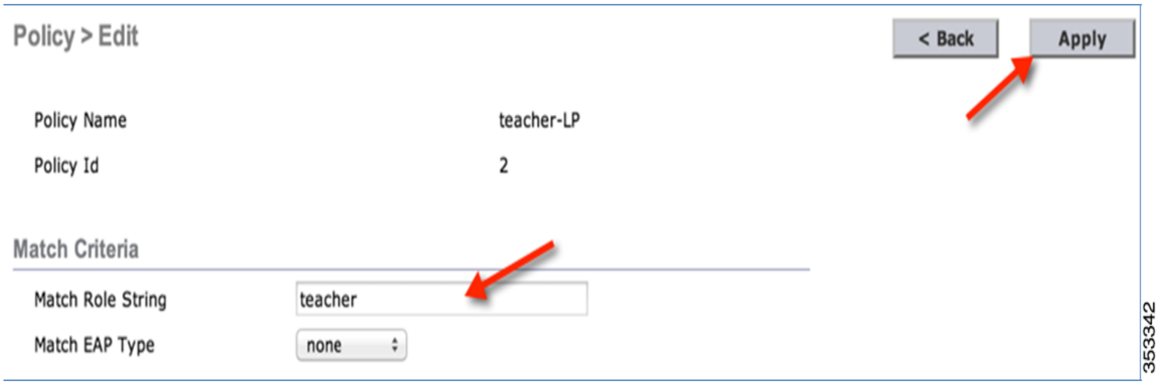
Policy > New

Policy Name teacher-LP

Once Policy Name is configured, you can create policies to match a Role, EAP Type, and Device Type. Also, you can define the required actions related to the Match criteria. In this example, we use User Role and Device Type to Match Criteria, but you can use any other type if required.

Note Ensure that the Match Role string is the same as AAA defined role name. In this example, it is configured as teacher.

Step 5 In the **Match Role String** text box, enter a user role, for example, **teacher**. From the **Match EAP Type** drop-down list, choose the EAP type that you want to match the clients to, else, leave as is and click **Apply**.



Policy > Edit

Policy Name teacher-LP

Policy Id 2

Match Criteria

Match Role String teacher

Match EAP Type none

Step 6 To apply the policy based on a user device, in the **Device List** area, from the **Device Type** drop-down list, choose the device type on which you want to enforce the policy and then click **Add**. In this example, Apple-iPad is used as a device type for Match Criteria. You can add other devices as well from the Device Type drop-down list.

Note If you do not want to match any device type, then do not configure the **Device Type** option. There are 156 default device profiles that the users can choose from the **Device Type** drop-down list, but only 16 can be applied per policy.

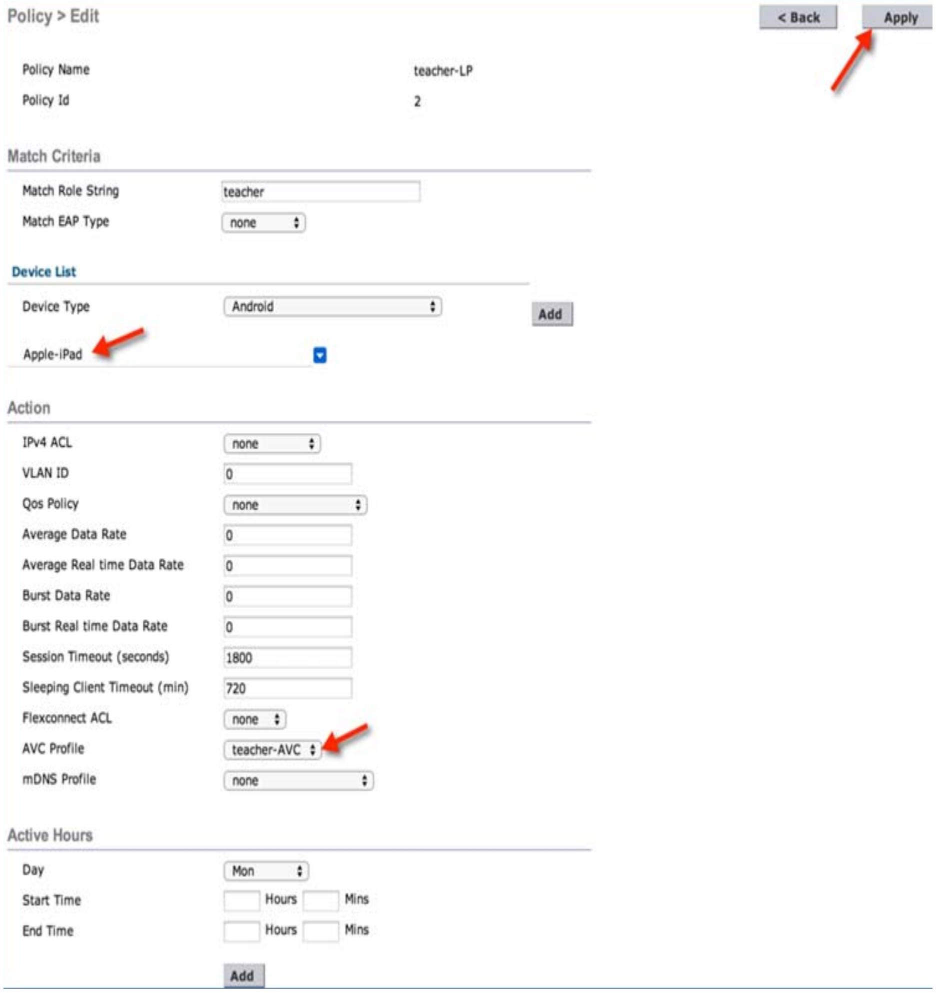
Step 7 To apply the appropriate action, choose from the parameters under the **Action** area to enforce the policy. In the following example, only the **AVC Profile** attribute is selected, but you can select other attributes as well according to your network requirement and then click **Apply**.

AVC Configuration

In this example, two AVC profiles (teacher-AVC and student-AVC) are created. The **teacher-AVC** profile is configured to just mark some applications, while the **student-AVC** profile is configured to **drop** applications such as YouTube, BitTorrent and so on.

If there are no AVC profiles configured on the WLC, go ahead and create them.

See the Application Visibility and Control Feature Deployment Guide for AVC configuration.



Policy Name teacher-LP
Policy Id 2

Match Criteria

Match Role String teacher
Match EAP Type none

Device List

Device Type Android

Apple-iPad

Action

IPv4 ACL none
VLAN ID 0
Qos Policy none
Average Data Rate 0
Average Real time Data Rate 0
Burst Data Rate 0
Burst Real time Data Rate 0
Session Timeout (seconds) 1800
Sleeping Client Timeout (min) 720
Flexconnect ACL none
AVC Profile teacher-AVC
mDNS Profile none

Active Hours

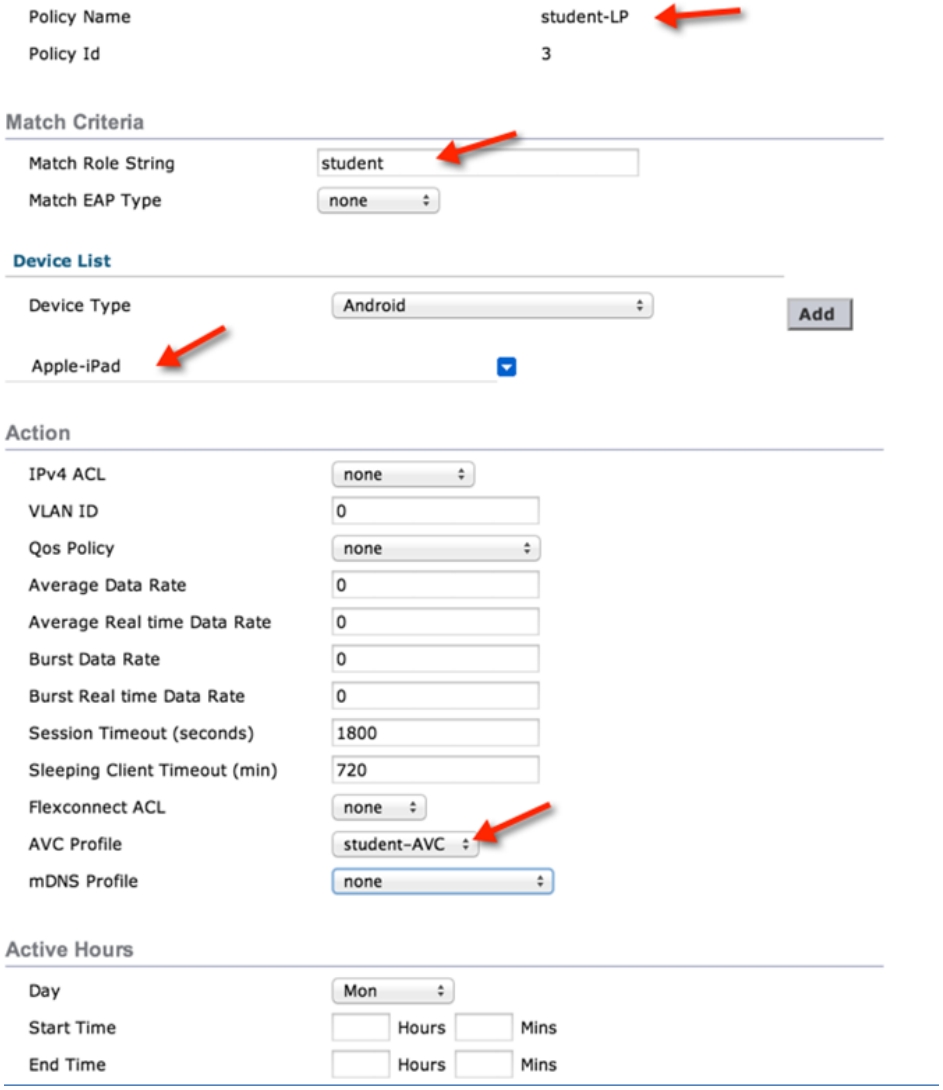
Day Mon
Start Time Hours Mins
End Time Hours Mins

Step 8 You can have multiple policies with different role types and different AVC Profiles set on the same WLAN. In this example, we created one more local policy for student role as student-LP.

Note Ensure that the Match Role string is the same with Radius Server defined role name (student).

To apply the policy based on a user device, in the **Device List** area, from the **Device Type** drop-down list, choose the device type (Apple-iPad) on which you want to enforce the policy and then click **Add**.

To apply the appropriate action, choose from the parameters under the **Action** area to enforce the policy. Select an AVC profile from the **AVC Profile** drop-down list. In this example, the AVC profile (student-AVC) is already created. Click **Apply**.



Policy Name	student-LP
Policy Id	3

Match Criteria

Match Role String	student
Match EAP Type	none

Device List

Device Type	Android	Add
Apple-iPad		

Action

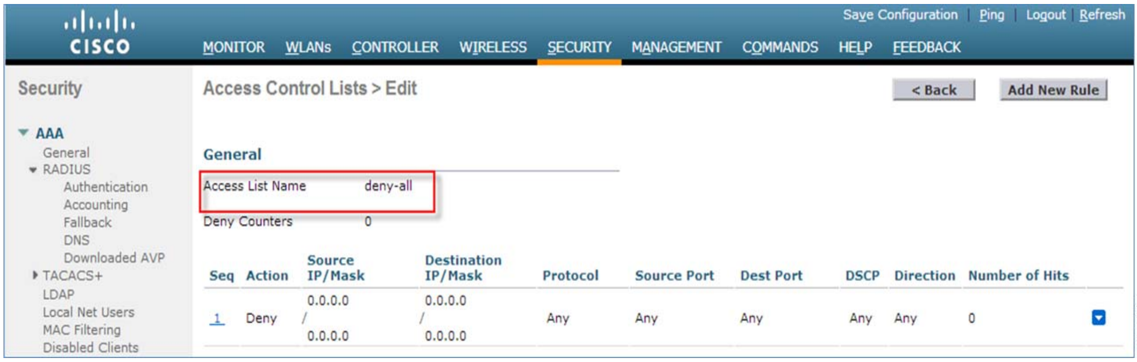
IPv4 ACL	none
VLAN ID	0
Qos Policy	none
Average Data Rate	0
Average Real time Data Rate	0
Burst Data Rate	0
Burst Real time Data Rate	0
Session Timeout (seconds)	1800
Sleeping Client Timeout (min)	720
Flexconnect ACL	none
AVC Profile	student-AVC
mDNS Profile	none

Active Hours

Day	Mon	
Start Time	Hours	Mins
End Time	Hours	Mins

Step 9 Create a default local policy for any other device.

- If no other ACL is applied in the Local policy, then any other device, other than Apple-iPad, will be able to access the applications because the final filter function of all policies is **Allow all**. In order to block all applications on all devices except Apple-iPad, create a **deny all** ACL and apply it on the Local Policy and then apply that policy on the WLAN as the last resort. See the configuration examples in the following screenshots.
- On the WLC, create an ACL to deny all IPv4 flow.



Access Control Lists > Edit

General

Access List Name deny-all

Deny Counters 0

Seq	Action	Source IP/Mask	Destination IP/Mask	Protocol	Source Port	Dest Port	DSCP	Direction	Number of Hits
1	Deny	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	Any	Any	Any	Any	Any	0

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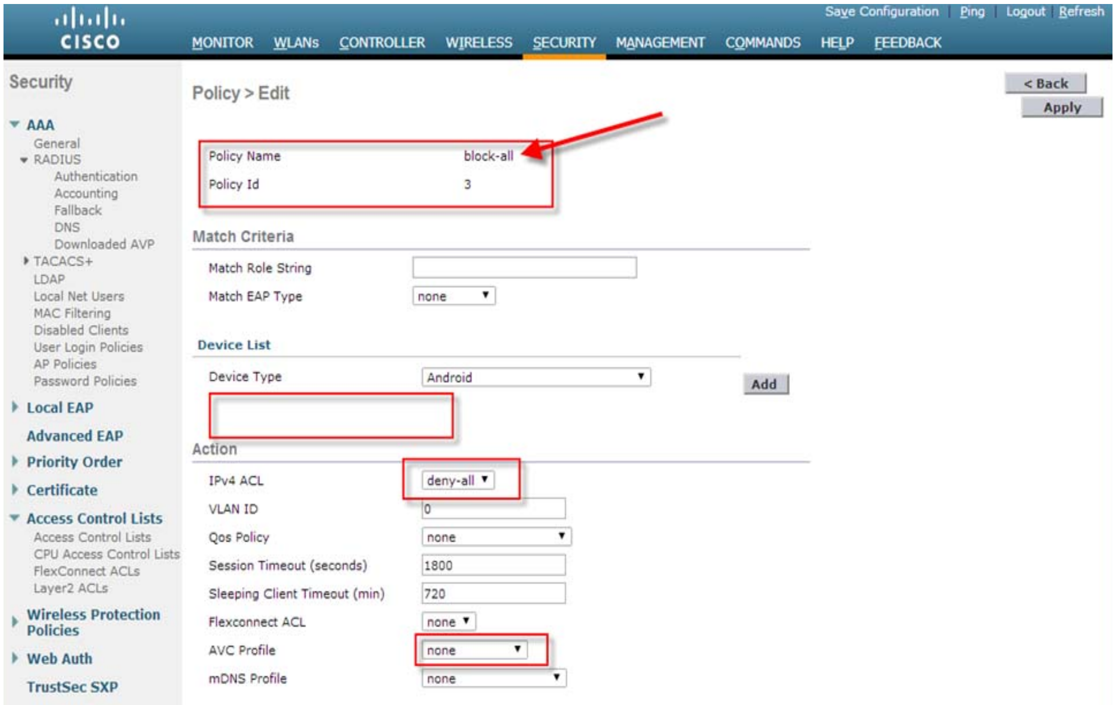
- Create a Local Policy Block-all and apply the deny all ACL to it, do not choose any device roles or profiles.



Policy > Edit

Policy Name block-all

Policy Id 3

Match Criteria

Match Role String

Match EAP Type none

Device List

Device Type Android

Action

IPv4 ACL deny-all

VLAN ID 0

Qos Policy none

Session Timeout (seconds) 1800

Sleeping Client Timeout (min) 720

Flexconnect ACL none

AVC Profile none

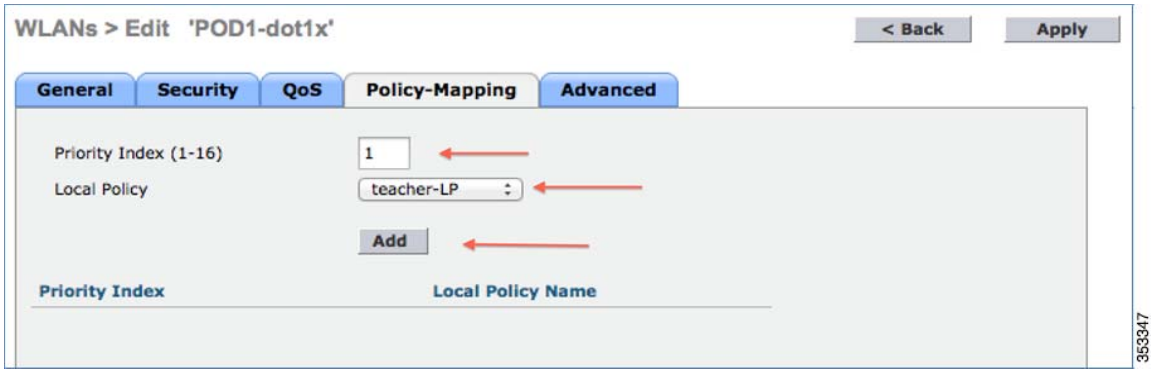
mDNS Profile none

Mapping Policy on WLAN

Complete these steps:

Step 1 Go to WLANs from the WLC menu and click the WLAN ID on which you want the policy to be implemented. From the WLAN edit menu, click the **Policy-Mapping** tab.

Set the Priority index to any value from 1-16. From the **Local Policy** drop-down list, choose the policy which you have already created. To apply the policy on the WLAN, click **Add**. The policy is mapped to the WLAN and can be seen under Policy Name.



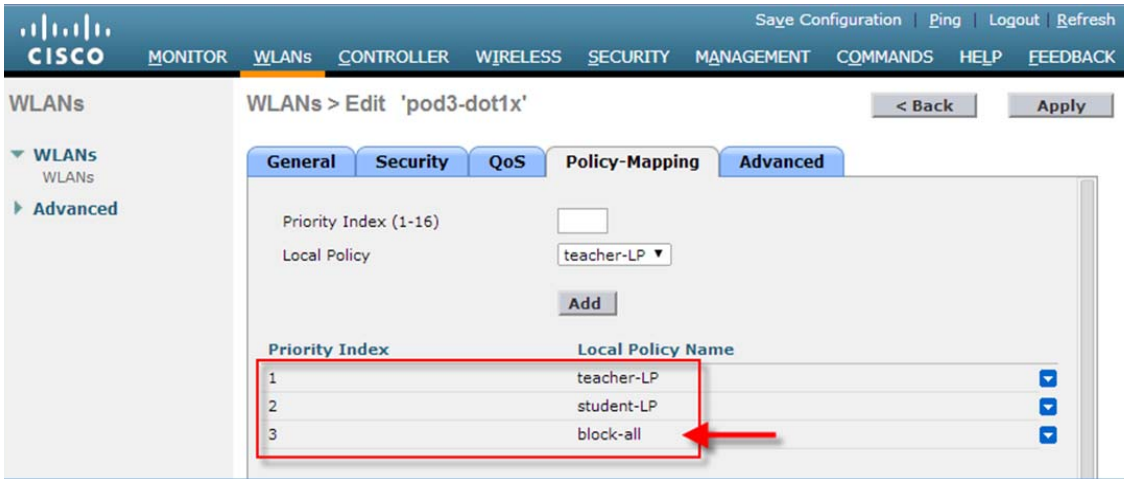
WLANs > Edit 'POD1-dot1x'

Priority Index (1-16): 1

Local Policy: teacher-LP

Priority Index	Local Policy Name

Step 2 Add the appropriate policies to Policy-Mapping under WLAN.



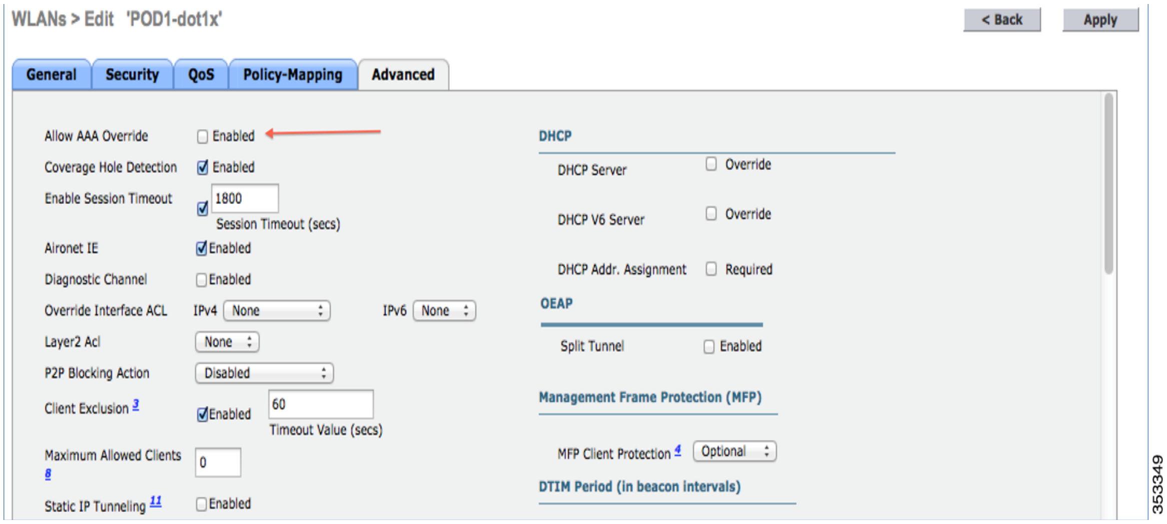
WLANs > Edit 'pod3-dot1x'

Priority Index (1-16):

Local Policy: teacher-LP

Priority Index	Local Policy Name
1	teacher-LP
2	student-LP
3	block-all

Step 3 In the **Advanced** tab, in the **Allow AAA Override** field, uncheck the **enabled** check box if it is checked.


WLANs > Edit 'POD1-dot1x'

Allow AAA Override □ Enabled
Coverage Hole Detection ☑ Enabled
Enable Session Timeout ☑ 1800 Session Timeout (secs)
Aironet IE ☑ Enabled
Diagnostic Channel □ Enabled
Override Interface ACL IPv4 None IPv6 None
Layer2 Acl None
P2P Blocking Action Disabled
Client Exclusion [3] ☑ Enabled 60 Timeout Value (secs)
Maximum Allowed Clients [8] 0
Static IP Tunneling [11] □ Enabled

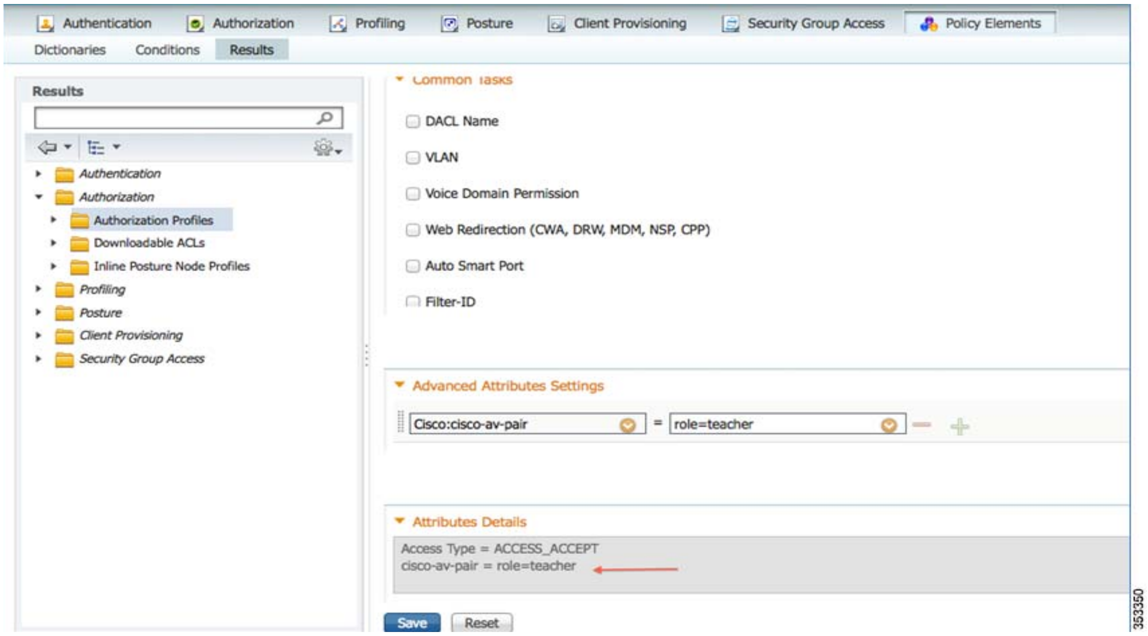
DHCP
DHCP Server □ Override
DHCP V6 Server □ Override
DHCP Addr. Assignment □ Required

OEAP
Split Tunnel □ Enabled

Management Frame Protection (MFP)
MFP Client Protection [4] Optional

DTIM Period (in beacon intervals)

Step 4 Check if the AAA role is configured properly, and applied on the Radius Server (in this example, it is Cisco ISE). The AAA role name on the ISE must match the role string defined in the local policy. See the ISE settings below.



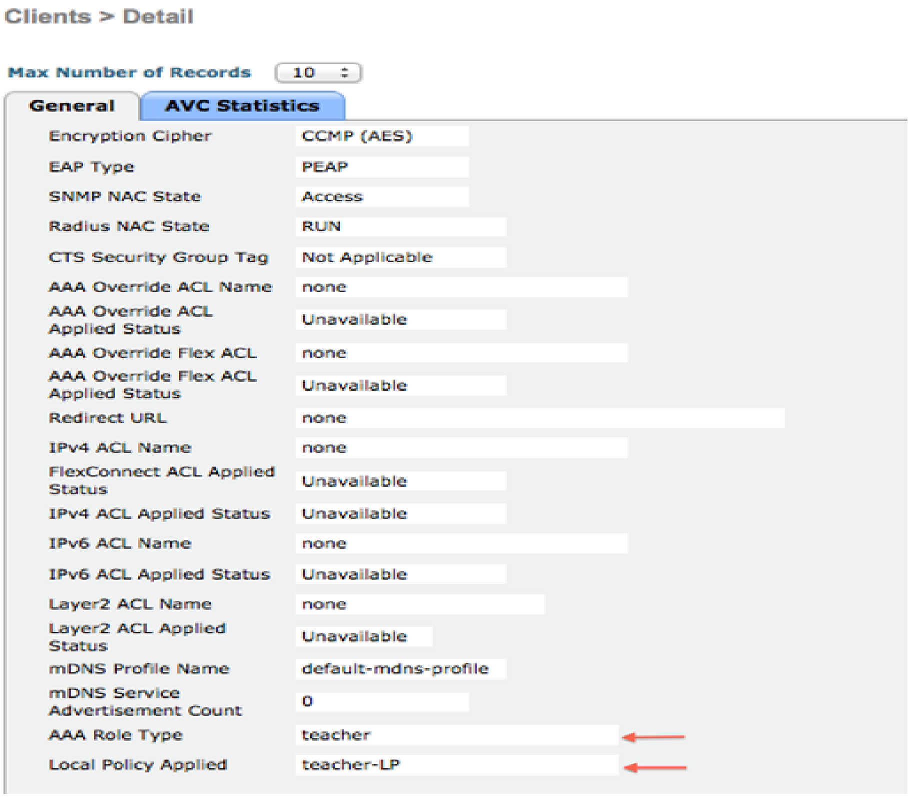
Common Tasks
□ DACL Name
□ VLAN
□ Voice Domain Permission
□ Web Redirection (CWA, DRW, MDM, NSP, CPP)
□ Auto Smart Port
□ Filter-ID

Advanced Attributes Settings
Cisco:cisco-av-pair = role=teacher

Attributes Details
Access Type = ACCESS_ACCEPT
cisco-av-pair = role=teacher

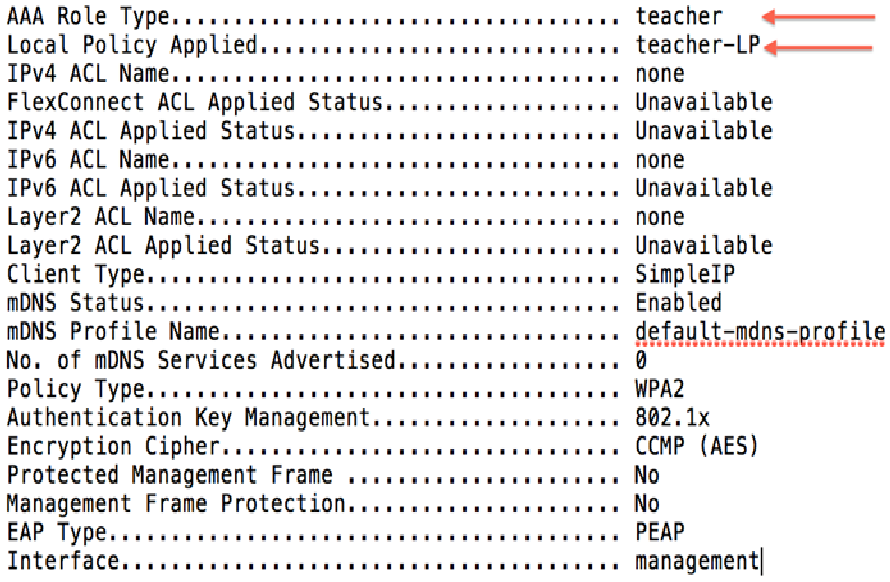
Once the client associates to SSID with teacher credentials through Apple iPad, it should be able to access the Internet and different applications per its AVC profile (teacher-AVC) configuration. If the user tries to connect from any device other than Apple iPad, then it will not be able to access the Internet.

To verify if the policy (teacher-LP) is applied, from the WLC GUI, go to **Monitor > Clients,** and then click the Client MAC address. In the **Security Information** area, you should see the policy in the **Local Policy Applied** text box.



Encryption Cipher	CCMP (AES)
EAP Type	PEAP
SNMP NAC State	Access
Radius NAC State	RUN
CTS Security Group Tag	Not Applicable
AAA Override ACL Name	none
AAA Override ACL Applied Status	Unavailable
AAA Override Flex ACL	none
AAA Override Flex ACL Applied Status	Unavailable
Redirect URL	none
IPv4 ACL Name	none
FlexConnect ACL Applied Status	Unavailable
IPv4 ACL Applied Status	Unavailable
IPv6 ACL Name	none
IPv6 ACL Applied Status	Unavailable
Layer2 ACL Name	none
Layer2 ACL Applied Status	Unavailable
mDNS Profile Name	default-mdns-profile
mDNS Service Advertisement Count	0
AAA Role Type	teacher
Local Policy Applied	teacher-LP

To verify if the policy is applied, from WLC CLI prompt run the following command—**`show client detail <mac_address>`** and then scroll down to the end to see the applied profile.



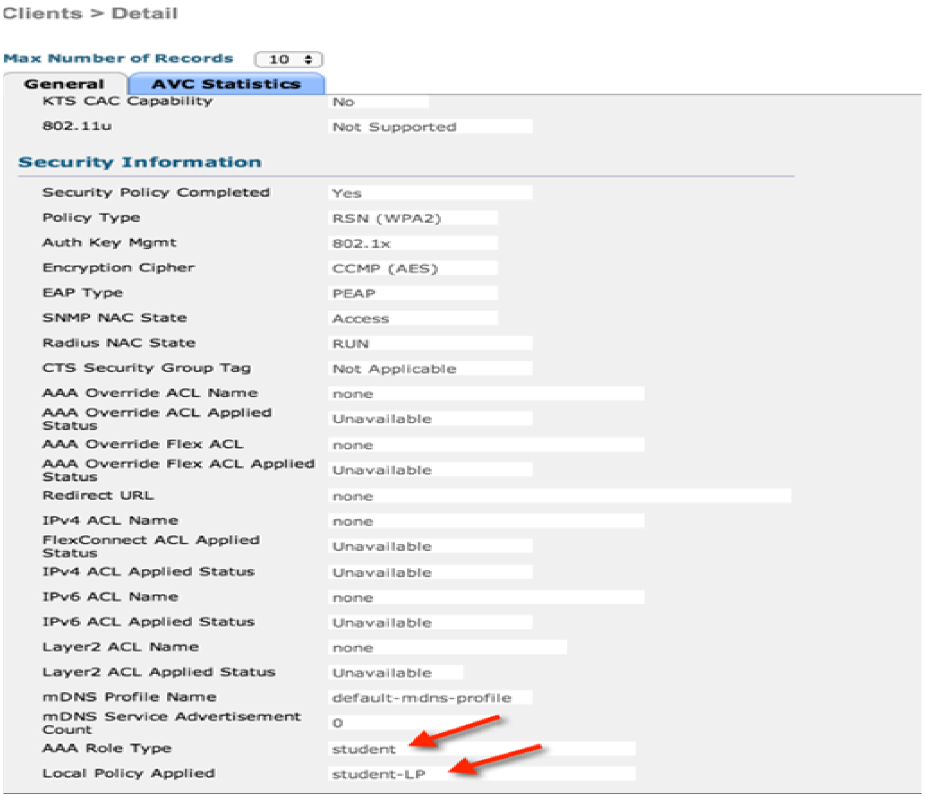
```
AAA Role Type................................... teacher
Local Policy Applied............................ teacher-LP
IPv4 ACL Name................................... none
FlexConnect ACL Applied Status.................. Unavailable
IPv4 ACL Applied Status......................... Unavailable
IPv6 ACL Name................................... none
IPv6 ACL Applied Status......................... Unavailable
Layer2 ACL Name................................. none
Layer2 ACL Applied Status....................... Unavailable
Client Type..................................... SimpleIP
mDNS Status..................................... Enabled
mDNS Profile Name............................... default-mdns-profile
No. of mDNS Services Advertised................. 0
Policy Type..................................... WPA2
Authentication Key Management................... 802.1x
Encryption Cipher............................... CCMP (AES)
Protected Management Frame ..................... No
Management Frame Protection..................... No
EAP Type........................................ PEAP
Interface....................................... management
```

To verify if the policy is applied from the WLC:

```
AVC Profile Name:........................................ teacher-AVC
```

Similarly, try to connect to the same WLAN/SSID using student credentials with the user role **student**, you should see another policy applied (student-AVC).

To verify if the policy (student-LP) is applied, from WLC GUI, go to **Monitor > Clients** and then click the Client MAC address. In the **Security Information** area, you should see the policy in the **Local Policy Applied** text box.

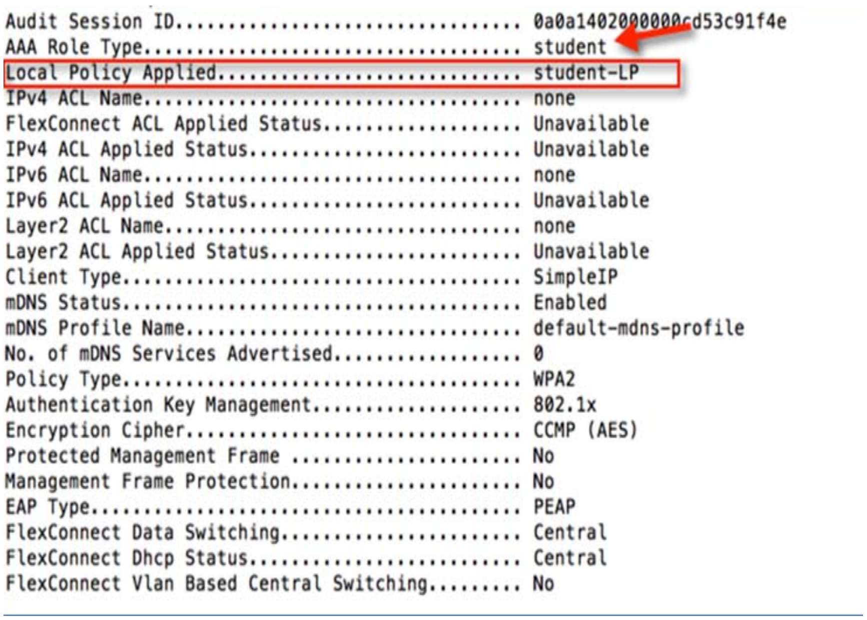


KTS CAC Capability	No
802.11u	Not Supported

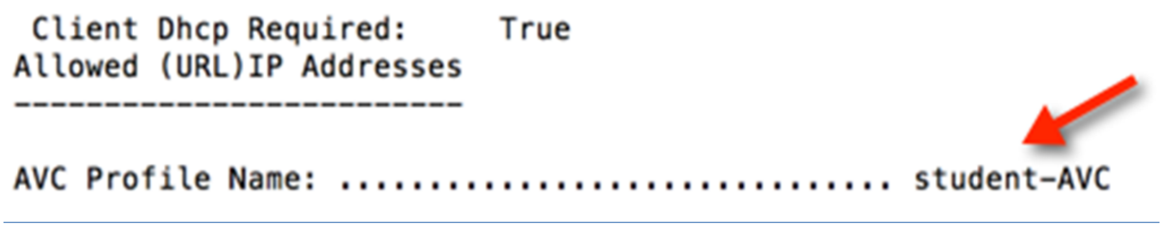
Security Information

Security Policy Completed	Yes
Policy Type	RSN (WPA2)
Auth Key Mgmt	802.1x
Encryption Cipher	CCMP (AES)
EAP Type	PEAP
SNMP NAC State	Access
Radius NAC State	RUN
CTS Security Group Tag	Not Applicable
AAA Override ACL Name	none
AAA Override ACL Applied Status	Unavailable
AAA Override Flex ACL	none
AAA Override Flex ACL Applied Status	Unavailable
Redirect URL	none
IPv4 ACL Name	none
FlexConnect ACL Applied Status	Unavailable
IPv4 ACL Applied Status	Unavailable
IPv6 ACL Name	none
IPv6 ACL Applied Status	Unavailable
Layer2 ACL Name	none
Layer2 ACL Applied Status	Unavailable
mDNS Profile Name	default-mdns-profile
mDNS Service Advertisement Count	0
AAA Role Type	student
Local Policy Applied	student-LP

To verify if the policy is applied, from WLC CLI prompt, run the following command—**`show client detail`** ***`<mac_address>`*** and then scroll down to the end to see the applied profile.



```
Audit Session ID................................. 0a0a1402000000cd53c91f4e
AAA Role Type.................................... student
Local Policy Applied............................. student-LP
IPv4 ACL Name.................................... none
FlexConnect ACL Applied Status................... Unavailable
IPv4 ACL Applied Status.......................... Unavailable
IPv6 ACL Name.................................... none
IPv6 ACL Applied Status.......................... Unavailable
Layer2 ACL Name.................................. none
Layer2 ACL Applied Status........................ Unavailable
Client Type...................................... SimpleIP
mDNS Status...................................... Enabled
mDNS Profile Name................................ default-mdns-profile
No. of mDNS Services Advertised.................. 0
Policy Type...................................... WPA2
Authentication Key Management.................... 802.1x
Encryption Cipher................................ CCMP (AES)
Protected Management Frame ...................... No
Management Frame Protection...................... No
EAP Type......................................... PEAP
FlexConnect Data Switching....................... Central
FlexConnect Dhcp Status.......................... Central
FlexConnect Vlan Based Central Switching......... No
```

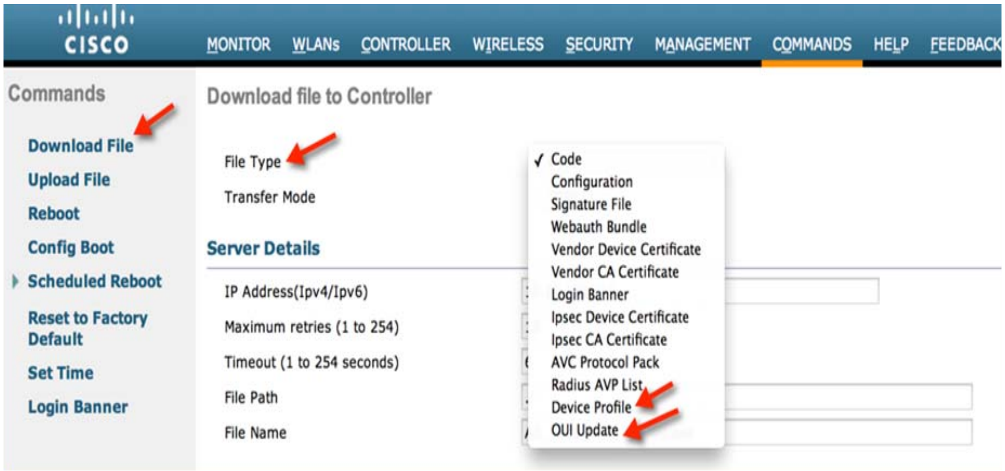


```
 Client Dhcp Required:     True
Allowed (URL)IP Addresses
-------------------------

AVC Profile Name: ............................... student-AVC
```

Dynamic MAC OUI and Device Profile Update

In CUWN release 8.0, the WLC administrator can update the MAC OUIs and device profiles on the WLC. The IEEE file containing the OUIs must be downloaded and saved as a .txt file from the following location: http://standards.ieee.org/develop/regauth/oui/oui.txt. Download the .txt file to the WLC, using tftp/ftp.

Apart from the OUI update, the WLC also has a mechanism to update the device profiles. Device profiles refers to the different types of devices that the WLC can profile. In release 8.0, the WLC supports profiling 156 types of devices, by default. When a new device profile is updated by the ISE team, the WLC must integrate the new profile to be on par with the ISE. This feature is implemented to take care of both the OUI updates as well as the device profile updates.



Downloading MAC-OUI Through the WLC GUI

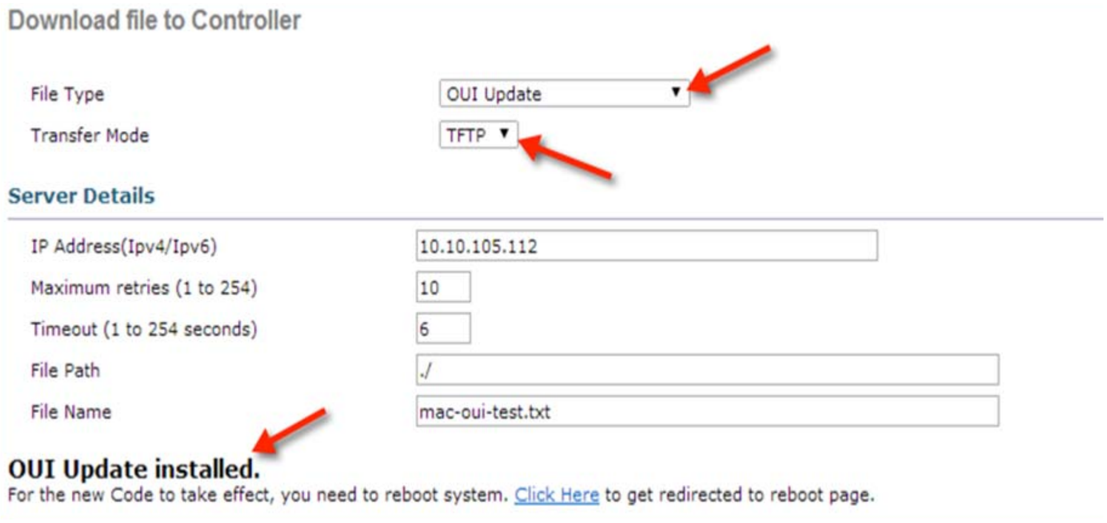
Complete these steps:

Step 1 From WLC main menu, go to **Commands > Download File**.

Step 2 From the **File Type** drop-down list, choose **OUI Update**.

Step 3 From the **Transfer Mode** drop-down list, choose **TFTP** or **FTP**.

Step 4 Provide the appropriate information under Server Details and click **Download**.


Download file to Controller

File Type: OUI Update

Transfer Mode: TFTP

Server Details

IP Address(Ipv4/Ipv6): 10.10.105.112

Maximum retries (1 to 254): 10

Timeout (1 to 254 seconds): 6

File Path: ./

File Name: mac-oui-test.txt

OUI Update installed.

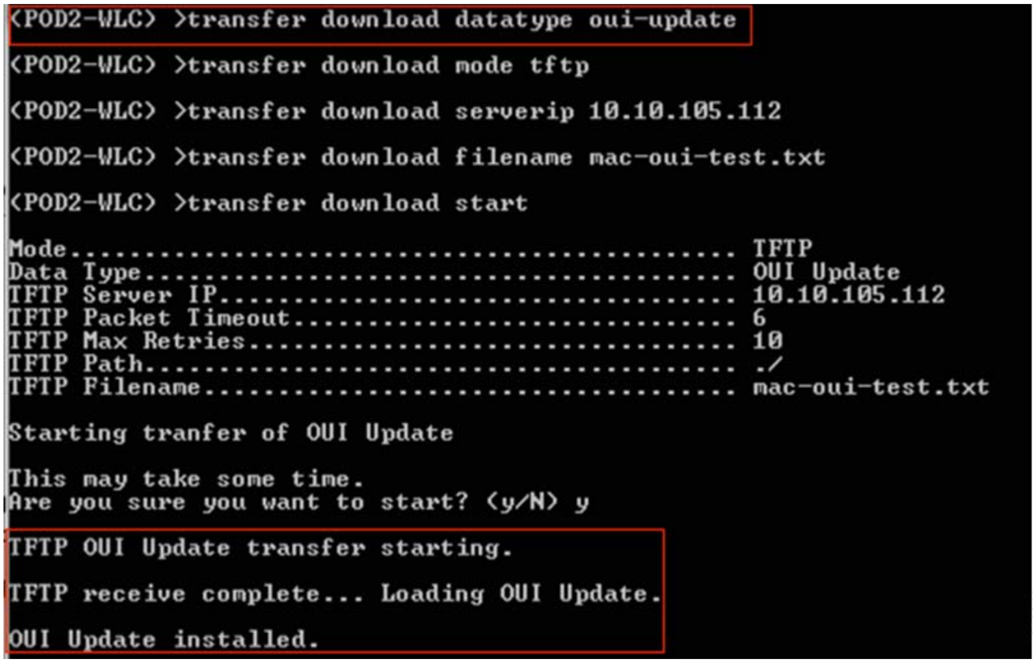
For the new Code to take effect, you need to reboot system. Click Here to get redirected to reboot page.

Note The WLC is not required to reboot after the download. This is a cosmetic error which will be corrected in the next update. The bug ID is CSCup84476.

Downloading MAC-OUI Through the WLC CLI

The following CLI command downloads the IEEE oui.txt file to the WLC:

```
<WLC> transfer download datatype oui-update
```



```
(POD2-WLC) >transfer download datatype oui-update

(POD2-WLC) >transfer download mode tftp

(POD2-WLC) >transfer download serverip 10.10.105.112

(POD2-WLC) >transfer download filename mac-oui-test.txt

(POD2-WLC) >transfer download start

Mode........................................... TFTP
Data Type...................................... OUI Update
TFTP Server IP................................. 10.10.105.112
TFTP Packet Timeout............................ 6
TFTP Max Retries............................... 10
TFTP Path...................................... ./
TFTP Filename.................................. mac-oui-test.txt

Starting tranfer of OUI Update

This may take some time.
Are you sure you want to start? (y/N) y

TFTP OUI Update transfer starting.

TFTP receive complete... Loading OUI Update.

OUI Update installed.
```

Updating Device Profile Through the GUI

Complete these steps:

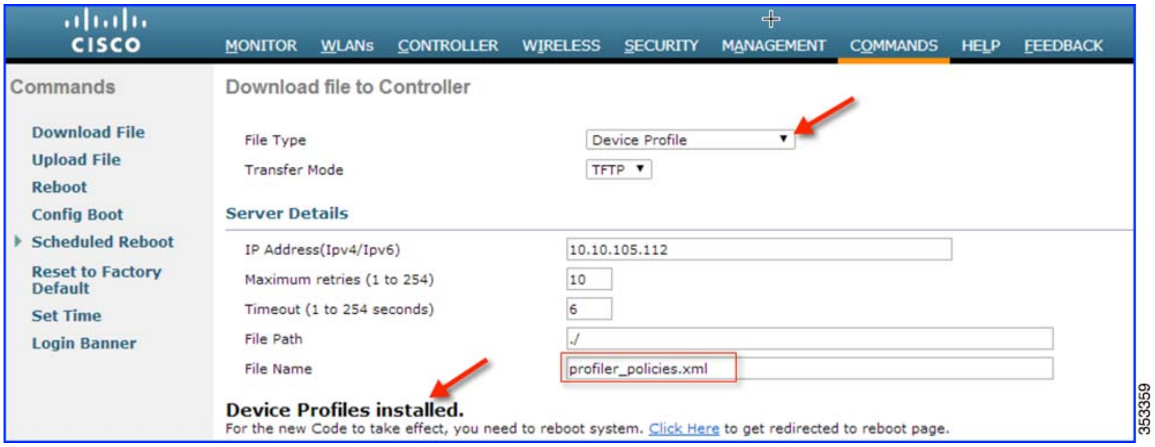
Step 1 From the WLC main menu, go to **Commands > Download File**.

Step 2 From the **File Type** drop-down list, choose **Device Profile**.

Step 3 From the **Transfer Mode** drop-down list, choose **TFTP** or **FTP.**

Step 4 Provide the appropriate information under Server Details and then click **Download**.

Note The Profile update file is an XML file containing the device profiles. A new GUI option is added to enable you to download the device profiles file to the WLC.



Download file to Controller

File Type: Device Profile

Transfer Mode: TFTP

Server Details

IP Address(Ipv4/Ipv6): 10.10.105.112

Maximum retries (1 to 254): 10

Timeout (1 to 254 seconds): 6

File Path: ./

File Name: profiler_policies.xml

Device Profiles installed.

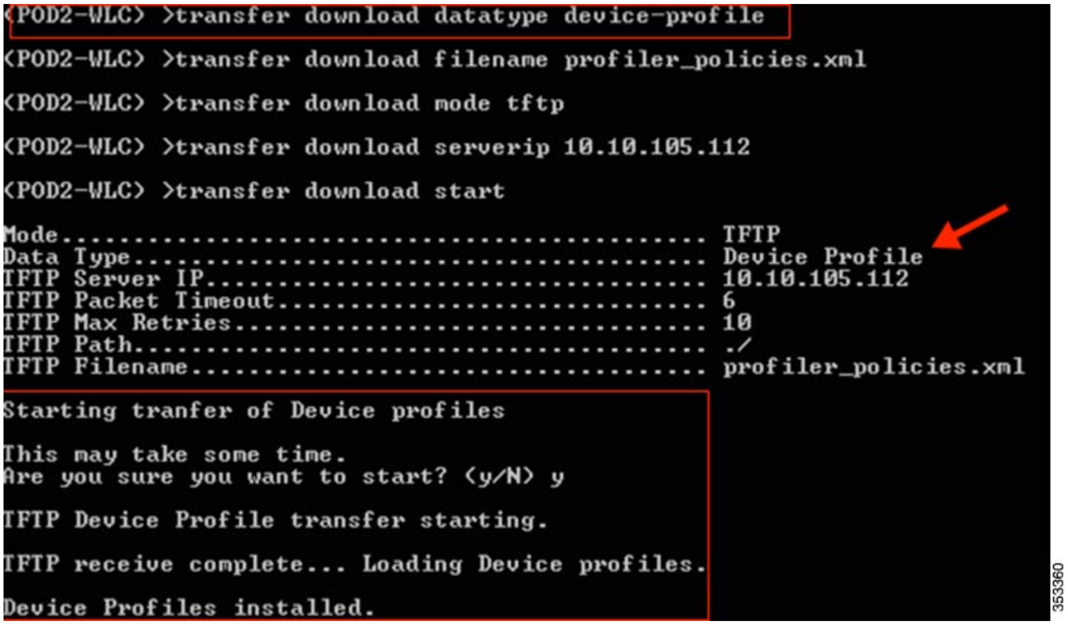
For the new Code to take effect, you need to reboot system. Click Here to get redirected to reboot page.

Note The WLC is not required to reboot after the download. This is a cosmetic error which will be corrected in the next update. The bug ID is CSCup84476.

Updating Device Profile Through the CLI

The following CLI command is used to enable downloading device profiles to the WLC:

```
<WLC> transfer download datatype device-profile
```

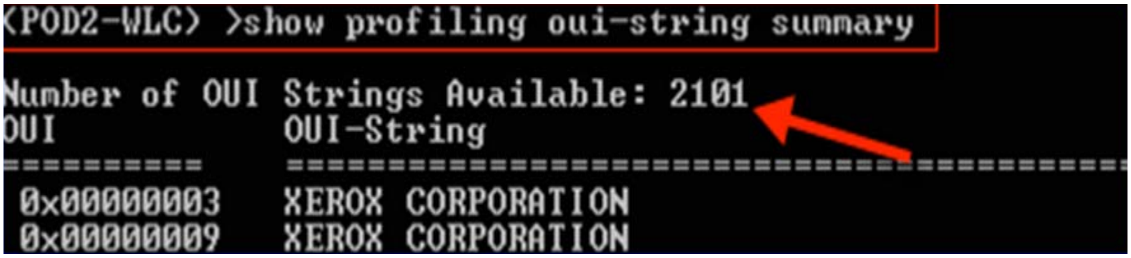


```
(POD2-WLC) >transfer download datatype device-profile

(POD2-WLC) >transfer download filename profiler_policies.xml

(POD2-WLC) >transfer download mode tftp

(POD2-WLC) >transfer download serverip 10.10.105.112

(POD2-WLC) >transfer download start

Mode.......................................... TFTP
Data Type..................................... Device Profile
TFTP Server IP................................ 10.10.105.112
TFTP Packet Timeout........................... 6
TFTP Max Retries.............................. 10
TFTP Path..................................... ./
TFTP Filename................................. profiler_policies.xml

Starting tranfer of Device profiles

This may take some time.
Are you sure you want to start? (y/N) y

TFTP Device Profile transfer starting.

TFTP receive complete... Loading Device profiles.

Device Profiles installed.
```

Note Both the OUI file and device profiles file are independent of each other, and even if one of them needs to be updated, the other will still work.

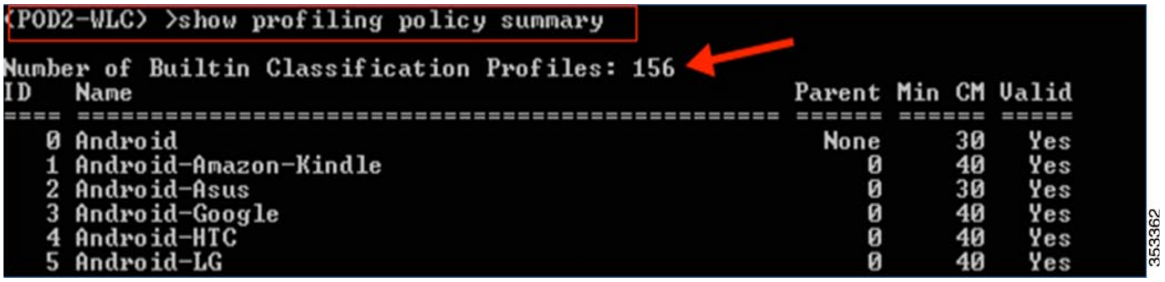
For example, if the customers want to update only the OUIs, they must download only the OUI file to the WLC. The existing device profiles will remain as it is, and only the OUIs will get updated.

The new CLI command—**`show profiling oui-string summary`**, can be executed to check the updated MAC OUIs, if any.



```
(POD2-WLC) >show profiling oui-string summary

Number of OUI Strings Available: 2101
OUI           OUI-String
==========    ==========================================
 0x00000003   XEROX CORPORATION
 0x00000009   XEROX CORPORATION
```

The existing CLI command—**`show profiling policy summary`**, can be executed to check the updated profiles, if any.



```
(POD2-WLC) >show profiling policy summary

Number of Builtin Classification Profiles: 156
ID   Name                                            Parent  Min CM Valid
==== =============================================== ====== ====== =====
   0 Android                                           None     30   Yes
   1 Android-Amazon-Kindle                                0     40   Yes
   2 Android-Asus                                         0     30   Yes
   3 Android-Google                                       0     40   Yes
   4 Android-HTC                                          0     40   Yes
   5 Android-LG                                           0     40   Yes
```

Limitations

- Wired clients behind the WGB will not be profiled and policy action will not be done.
- Only 16 policies per WLAN can be configured, and globally 64 policies will be allowed.
- Only 16 device profiles (device types) can be added per policy.
- Policy action will be done after L2 authentication or L3 authentication is complete or when the device sends HTTP traffic and gets the device profiled. Thus, certain scenarios such as profiling and policy actions will happen more than once per client.
- This release will support only IPv4 clients to be profiled.
- No support for WGB wired clients for profiling because HTTP profiling is not supported on WGB wired clients.

Summary

- By default, profiling is disabled on all WLANs.
- Each WLAN can have mapped profiling policies configured.
- Each Policy can have matching Role Type, Device Type, and EAP type configured and an associated policy index mapped.
- The policy index signifies which policy needs to be matched first.

- The corresponding policy name will be deduced from the policy Index.
- The policy matching will exit at the first policy match and the corresponding policy action attributes will be set per client.
- The order of applying the policies per client will be based on the security type.