ClearPass Policy manager Cisco Switch Setup with CPPM

Technical Note

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Audience

This ClearPass Policy manager Cisco Switch Setup with CPPM is intended for system administrators and people who are integrating Aruba Networks Wireless Hardware with ClearPass 6.0.1.

Typographic Conventions

The following conventions are used throughout this manual to emphasize important concepts.

Type Style	Description
Italics	Used to emphasize important items and for the titles of books.
Boldface	Used to highlight navigation in procedures and to emphasize command names and parameter options when mentioned in text.
`Sample template code or HTML text`	Code samples are shown in a fixed-width font.
<angle brackets>	When used in examples or command syntax, text within angle brackets represents items you should replace with information appropriate to your specific situation. For example: ping <ipaddr> In this example, you would type “ping” at the system prompt exactly as shown, followed by the IP address of the system to which ICMP echo packets are to be sent. Do not type the angle brackets.

Contacting Support

Main Site	arubanetworks.com
Support Site	support.arubanetworks.com
Airheads Social Forums and Knowledge Base and Knowledge Base	community.arubanetworks.com
North American Telephone	1-800-943-4526 (Toll Free) 1-408-754-1200
International Telephones	http://www.arubanetworks.com/support-services/aruba-support-program/contact-support/
Software Licensing Site	https://licensing.arubanetworks.com/
End of Support information	www.arubanetworks.com/support-services/end-of-life-products/end-of-life-policy/
Wireless Security Incident Response Team (WSIRT)	http://www.arubanetworks.com/support-services/security-bulletins/
Support Email Addresses	
Americas and APAC	support@arubanetworks.com
EMEA	emea_support@arubanetworks.com
WSIRT Email Please email details of any security problem found in an Aruba product.	wsirt@arubanetworks.com

1. Introduction

The purpose of this document is to provide setup instructions for the Cisco 3750 12.2 (58) switch with the ClearPass Policy Manager (CPPM). This includes 802.1x, MAC, and Downloadable Access Control Lists (DACLs) authentications. Voice services will not be covered in this document.

Assumptions

Verify that a basic configuration of CPPM has been completed (setup and a generic catch-all radius service).

This document discussion uses an Aruba 3200 controller (192.168.99.5) as the DHCP server. Use of a DHCP server setup for the discussed VLANs is required.

Cisco switches support multiple authentication methods and many RADIUS options that are passed to the switch. This document discusses only a small subset of these features.

After each configuration change, exit the configure terminal mode and perform a “write memory” to save the configuration.

Requirements

- LAN Switch that supports 802.1x and MAC Authentication Bypass
- DHCP Server for the registration VLAN
- Current ClearPass Policy Manager release

Audience

This document is intended for network administrators deploying a network security solution.

Basic familiarity with most Cisco switches is assumed. For in-depth information about the features and functions of this appliance, refer to the ClearPass User Guide.

2. Switch Configuration

The first step is to perform the switch configuration. It is assumed that VLAN1 has been created for the switch with a correlating network-accessible IP address. This IP address must communicate with the CPPM Data IP address (unless a single IP address is configured in CPPM, in which case it is the management IP address).

Verify the switch can ping CPPM:

```
CPPM-Demo-3750# ping 192.168.99.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.99.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms

CPPM-Demo-3750#
```

In the event an error is received, verify the correct ip default-gateway is set and that the firewall is not blocking the switch-to-CPPM communication.

Enable the new access control commands and functions, to include advanced features, using the following command:

```
CPPM-Demo-3750#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
CPPM-Demo-3750(config)# aaa new-model
```

Add CPPM as the RADIUS server with the following commands:

```
CPPM-Demo-3750(config)# radius server cppm-demo
CPPM-Demo-3750(config-radius-server)# address ipv4 192.168.99.10
CPPM-Demo-3750(config-radius-server)# key aruba123
CPPM-Demo-3750(config-radius-server)# exit
CPPM-Demo-3750(config)#
```

"radius server" name of server (e.g. cppm-demo) is a new command. Older command uses "radius-server host 192.168.99.10 key aruba123".

Run the following command to enable 802.1x:

```
CPPM-Demo-3750(config)# dot1x system-auth-control
```

Use the following commands to set the switch to use RADIUS for AAA Authentication and Accounting:

```
CPPM-Demo-3750(config)# aaa authentication dot1x default group radius
CPPM-Demo-3750(config)# aaa authorization network default group radius
CPPM-Demo-3750(config)# aaa accounting dot1x default start-stop group radius
```

Add a AAA server for dynamic authorization:

```
CPPM-Demo-3750(config)# aaa server radius dynamic-author
CPPM-Demo-3750(config-locsvr-da-radius)# client 192.168.99.10 server-key aruba123
CPPM-Demo-3750(config-locsvr-da-radius)# port 3799
CPPM-Demo-3750(config-locsvr-da-radius)# auth-type all
CPPM-Demo-3750(config-locsvr-da-radius)# exit
CPPM-Demo-3750(config)#
```

The following VLAN numbers will be used:

Table 1 VLAN numbers

VLAN Number	Purpose
999	Users and Access Points
333	Untrusted Devices
200	VoIP Phones
60	Printers
50	Security Network

Use best practices to create standardized naming conventions that describe VLAN purposes and locations as displayed below:

```
CPPM-Demo-3750(config)# vlan 999
CPPM-Demo-3750(config-vlan)# name "Users and APs"
CPPM-Demo-3750(config-vlan)# exit
CPPM-Demo-3750(config)# vlan 333
CPPM-Demo-3750(config-vlan)# name "Untrusted Devices"
CPPM-Demo-3750(config-vlan)# exit
CPPM-Demo-3750(config)# vlan 200
CPPM-Demo-3750(config-vlan)# name "VoIP Phones"
CPPM-Demo-3750(config-vlan)# exit
CPPM-Demo-3750(config)# vlan 60
CPPM-Demo-3750(config-vlan)# name "Printers"
CPPM-Demo-3750(config-vlan)# exit
CPPM-Demo-3750(config)# vlan 50
CPPM-Demo-3750(config-vlan)# name "Security Network"
CPPM-Demo-3750(config-vlan)# exit
CPPM-Demo-3750(config)#
```

Note: CPPM-Demo-3750 is also the router.

Next, create interfaces on each VLAN. If the Cisco switch is not acting as the router (or does not have L3 capability), the VLANs and interface commands must be passed to the router. The run commands are as follows:

```
CPPM-Demo-3750(config)#interface vlan 999
CPPM-Demo-3750(config-if)# ip address 192.168.99.1 255.255.255.0
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.10
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.5
CPPM-Demo-3750(config-if)# exit
CPPM-Demo-3750(config)#interface vlan 333
CPPM-Demo-3750(config-if)# ip address 192.168.33.1 255.255.255.0
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.10
CPPM-Demo-3750(config-if)# ip helper-address 192.168.33.5
CPPM-Demo-3750(config-if)# exit
CPPM-Demo-3750(config)#interface vlan 200
CPPM-Demo-3750(config-if)# ip address 192.168.200.1 255.255.255.0
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.10
CPPM-Demo-3750(config-if)# ip helper-address 192.168.200.5
CPPM-Demo-3750(config-if)# exit
CPPM-Demo-3750(config)#interface vlan 60
CPPM-Demo-3750(config-if)# ip address 192.168.60.1 255.255.255.0
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.10
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.5
```

```
CPPM-Demo-3750(config-if)# exit
CPPM-Demo-3750(config)#interface vlan 50
CPPM-Demo-3750(config-if)# ip address 192.168.50.1 255.255.255.0
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.10
CPPM-Demo-3750(config-if)# ip helper-address 192.168.99.5
CPPM-Demo-3750(config-if)# exit
```

Notes:

192.168.99.5 is the DHCP server and will vary based on the local configuration. 192.168.99.10 refers to CPPM for the DHCP request in order for the device to be profiled.

Verify the RADIUS server settings and applicable VLANs router interfaces for the VLANs have been set prior to configuring a port to perform the 802.1x and MAC authentication bypass (also known as MAC authentication fallback).

Determine the interface type and numbering conventions using the "show interfaces description" command. The following list of interfaces (ports) will be displayed:

```
Fa = FastEthernet or 100Mbps
Gi = GigabitEthernet or 1,000Mbps
```

Use Fa1/0/24, which is the 24th copper port on our 3750. Use the following commands for port configuration:

Note: Interface type and numbering will differ from model to model.

```
CPPM-Demo-3750(config)# interface FastEthernet1/0/24
CPPM-Demo-3750(config-if)# switchport access vlan 333
CPPM-Demo-3750(config-if)# switchport mode access
CPPM-Demo-3750(config-if)# authentication order dot1x mab
CPPM-Demo-3750(config-if)# authentication priority dot1x mab
CPPM-Demo-3750(config-if)# authentication port-control auto
CPPM-Demo-3750(config-if)# authentication periodic
CPPM-Demo-3750(config-if)# authentication timer reauthenticate server
CPPM-Demo-3750(config-if)# mab
CPPM-Demo-3750(config-if)# dot1x pae authenticator
CPPM-Demo-3750(config-if)# dot1x timeout server-timeout 30
CPPM-Demo-3750(config-if)# dot1x timeout tx-period 10
CPPM-Demo-3750(config-if)# dot1x timeout supp-timeout 30
CPPM-Demo-3750(config-if)# dot1x max-req 3
CPPM-Demo-3750(config-if)# dot1x max-reauth-req 10
CPPM-Demo-3750(config-if)# spanning-tree portfast
CPPM-Demo-3750(config-if)# exit
```

Set the port to access mode (untagged) with an untagged VLAN of 333 (the untrusted devices VLAN).

MAC Authentication Bypass (MAB) permits the port to perform MAC authentication if the switch detects that the device is not 802.1x capable.

MAB occurs after 40 seconds:

(max-reauth-requests + 1) *tx-period = 802.1x authentication timeout.

The values provided for these port settings are for lab and evaluation tests only! Consult the Cisco document titled, ***Configuring 802.1X Port-Based Authentication***, and work with Cisco Support directly to determine the correct port settings for your environment.

Note: If CPPM goes offline, all users will gain access to VLAN Number 333.

In some circumstances, it may be necessary to set the default VLAN to 999.

The following commands must run in order for DACL's to work correctly:

```
CPPM-Demo-3750(config)# ip dhcp snooping
CPPM-Demo-3750(config)# ip device tracking
CPPM-Demo-3750(config)# radius-server vsa send authentication
```

3. 802.1x Service Setup

The CPPM profiles are applied globally but they must be referenced in an enforcement policy that is associated with a Service to be evaluated. Each Enforcement Profile can have an associated group of Network Access Devices (NADs).

Service setup requires a set of rules known as Enforcement Profiles. One profile will return VLAN 999 and one will return a Cisco DACL.

Adding Enforcement Profiles

VLAN 999

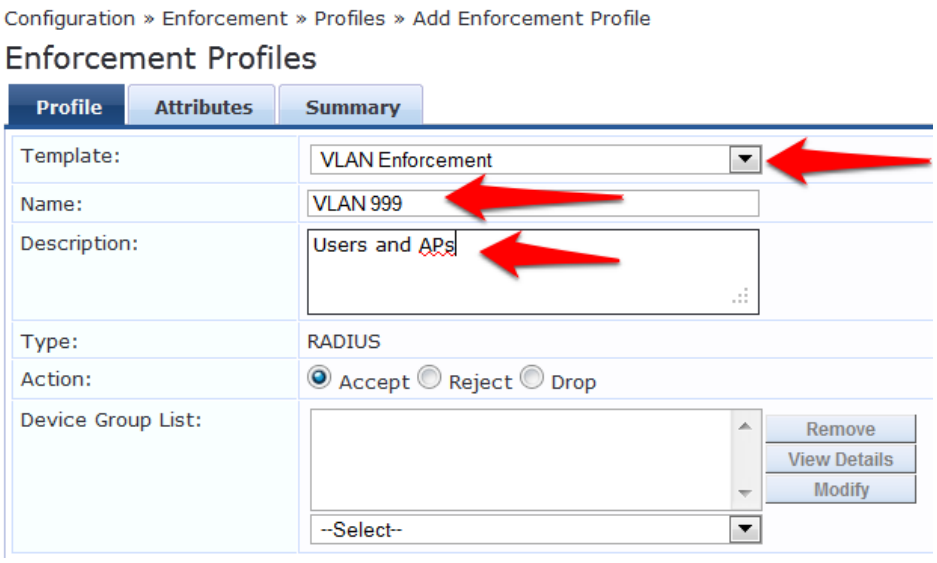
Navigate to **Configuration->Enforcement->Profiles**.

Figure 1 CPPM Enforcement Profiles

Click **Add Enforcement Profile** in the top right corner of the page.

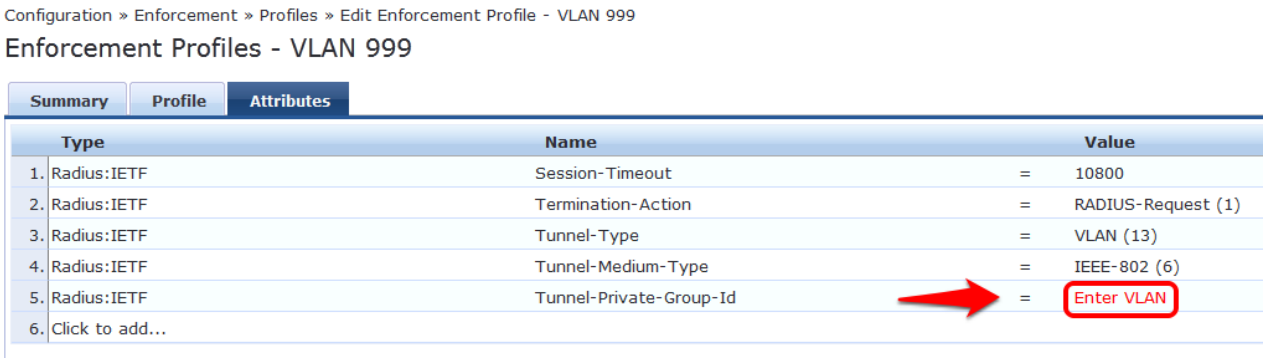
Enter the profile properties from Figure 1 Adding a new 802.1x Enforcement Profile below.

Figure 2 Adding a new 802.1x Enforcement Profile



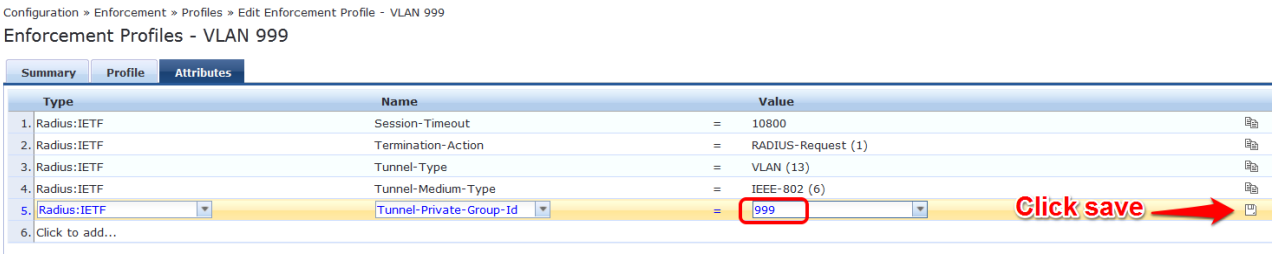
Click **Next** to display the Attributes tab.

Figure 3 802.1x Enforcement Profile Attributes tab



Click Select the RED value and enter the VLAN as number 999.

Figure 4 Configuring the VLAN as Value 999

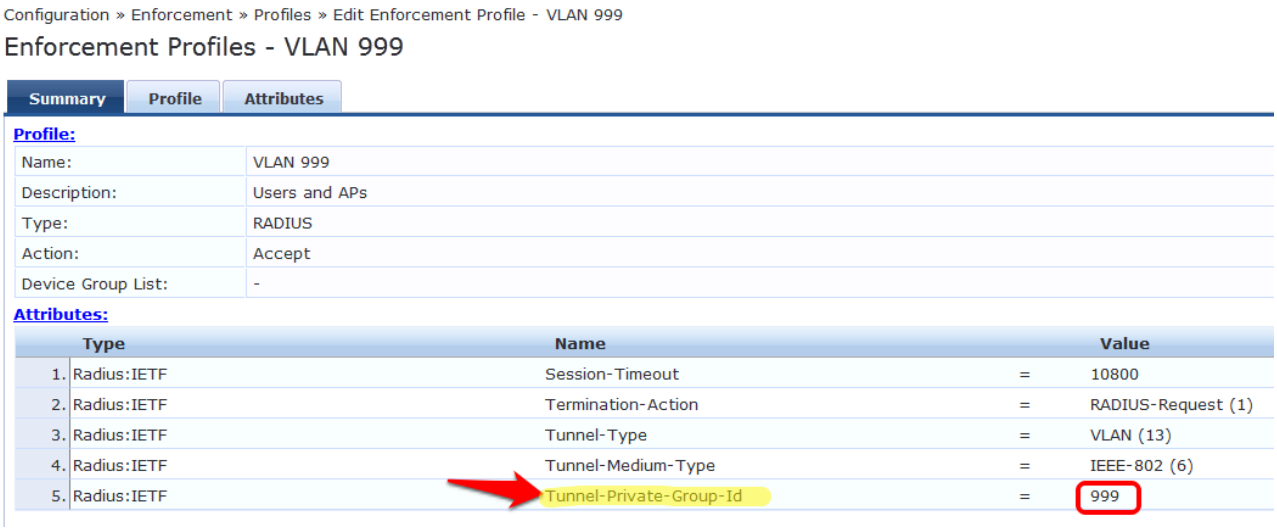


Click the **Save Disk** at the end of the line.

Click **Next** to review the settings and display the Profile Summary.

Note: Verify that the Tunnel-Private-Group-Id value is set to 999.

Figure 5 Tunnel-Private-Group-Id value is set to 999.



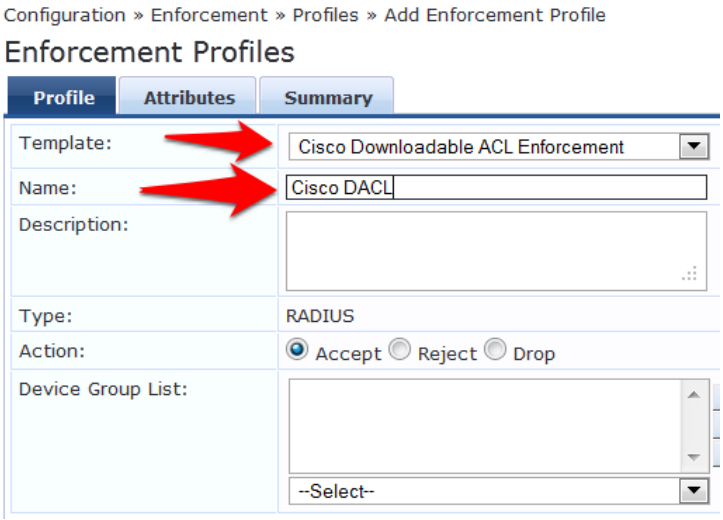
4. Cisco Downloadable ACL (DACL)

Navigate to **Configuration->Enforcement->Profiles**. Click **Add Enforcement Profile**.

Click **Add Enforcement Profile** in the top right corner of the page.

Enter the profile properties from Figure 5 Adding a Cisco ACL (DACL) Enforcement Profile below.

Figure 6 Adding a Cisco ACL (DACL) Enforcement Profile



Click **Next**.

Note the displayed screen has been auto-populated. Click **Next** to accept the default attributes. Select **Click to add.** Add additional profiles as applicable.

Click **Next** to verify the settings.

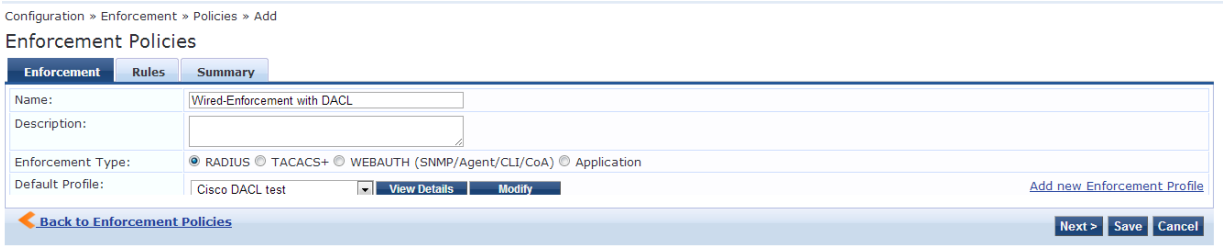
Click **Save**.

Adding Enforcement Policies

Enforcement Policies are always associated with a **Service** and a service can only have one policy.

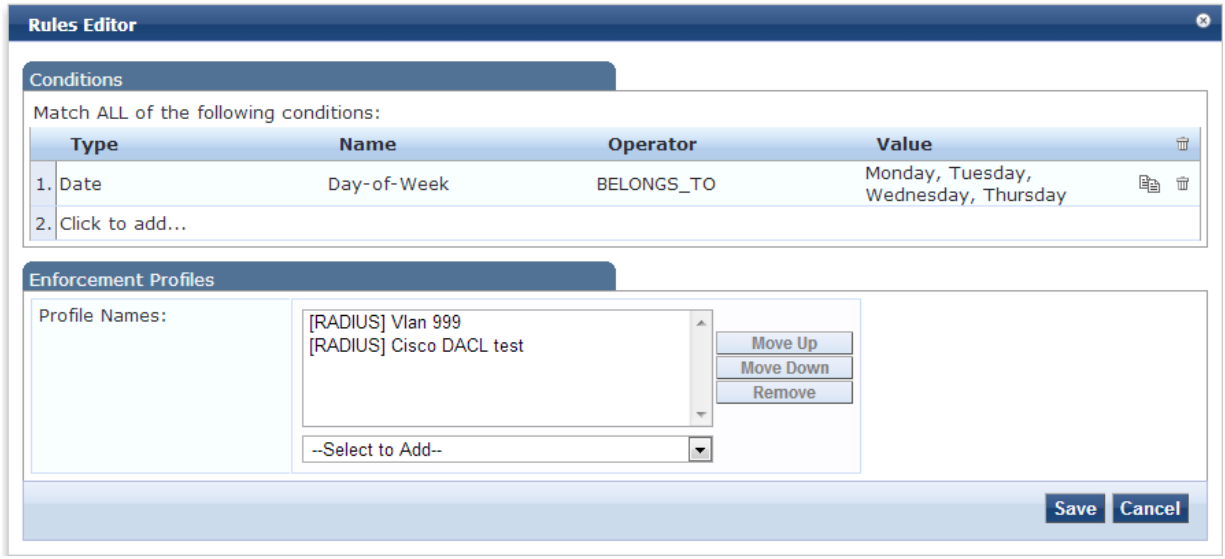
Navigate to **Configuration->Enforcement->Policies**. Click **Add Enforcement Policy**. Enter the profile properties to reflect the options as displayed below:

Figure 7 Adding Enforcement Policies



Click **Next**. Click **Add Rule**. Enter the profile properties to reflect the options as displayed below:

Figure 8 Adding Enforcement Policy profile properties



Click **Save**.

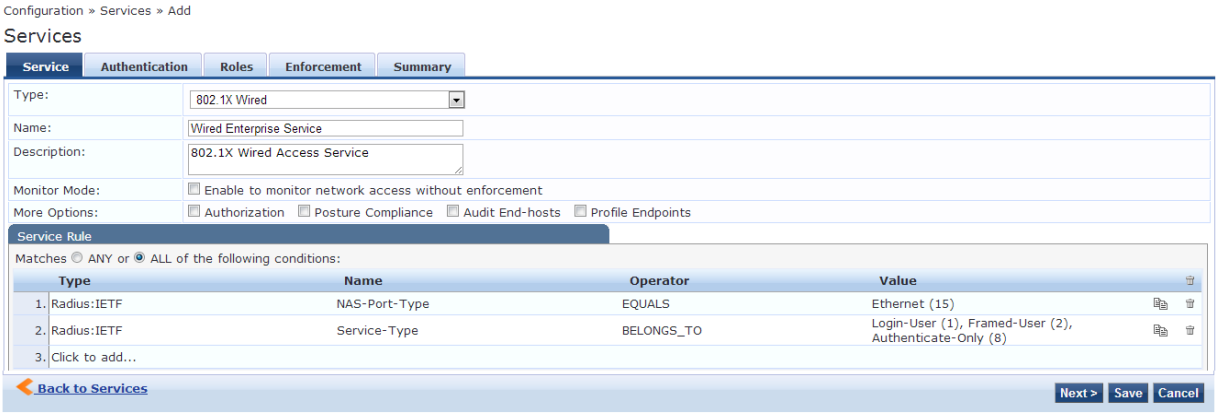
Click **Next**.

Click **Save.**

Creating the Service

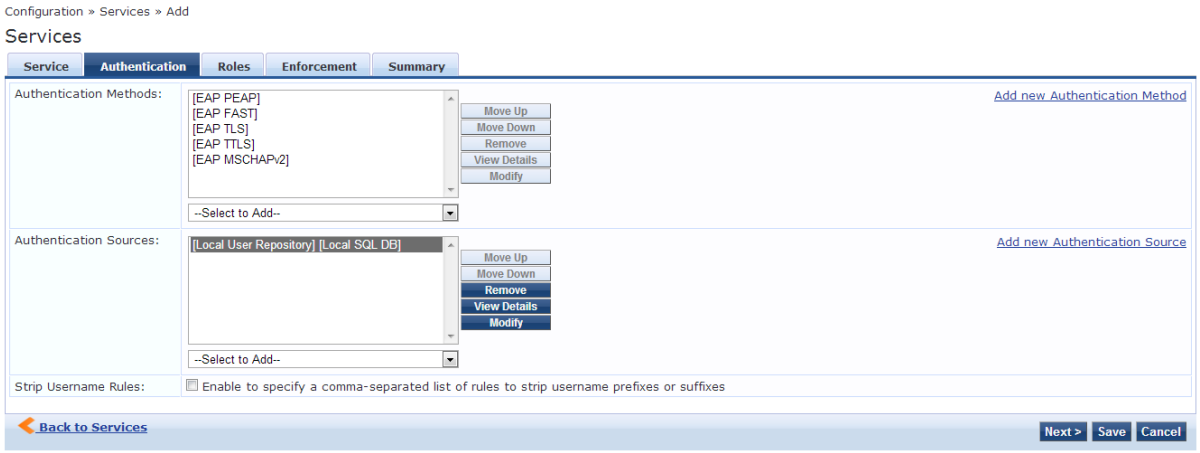
Navigate to **Configuration->Services**. Click **802.1X Wired**. Enter the profile properties to reflect the options as displayed below:

Figure 9 Creating the 802.1x Wired Service



Click **Next**. Select the Authentication Sources: [Local User Repository]… as displayed below:

Figure 10 Selecting the Authentication Sources: [Local User Repository]

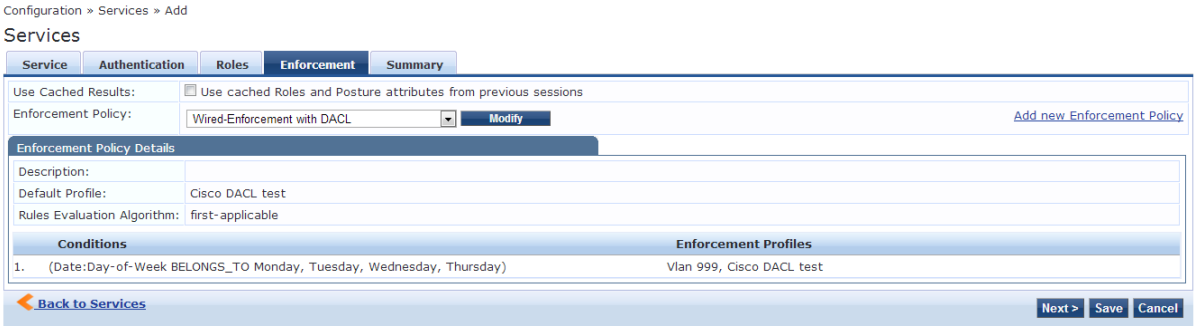


Click **Next**.

Note: Role Mapping will not be set up at this time. Click **Next**.

Enter the profile properties to reflect the options as displayed below:

Figure 11 802.1x Wired Service Enforcement properties



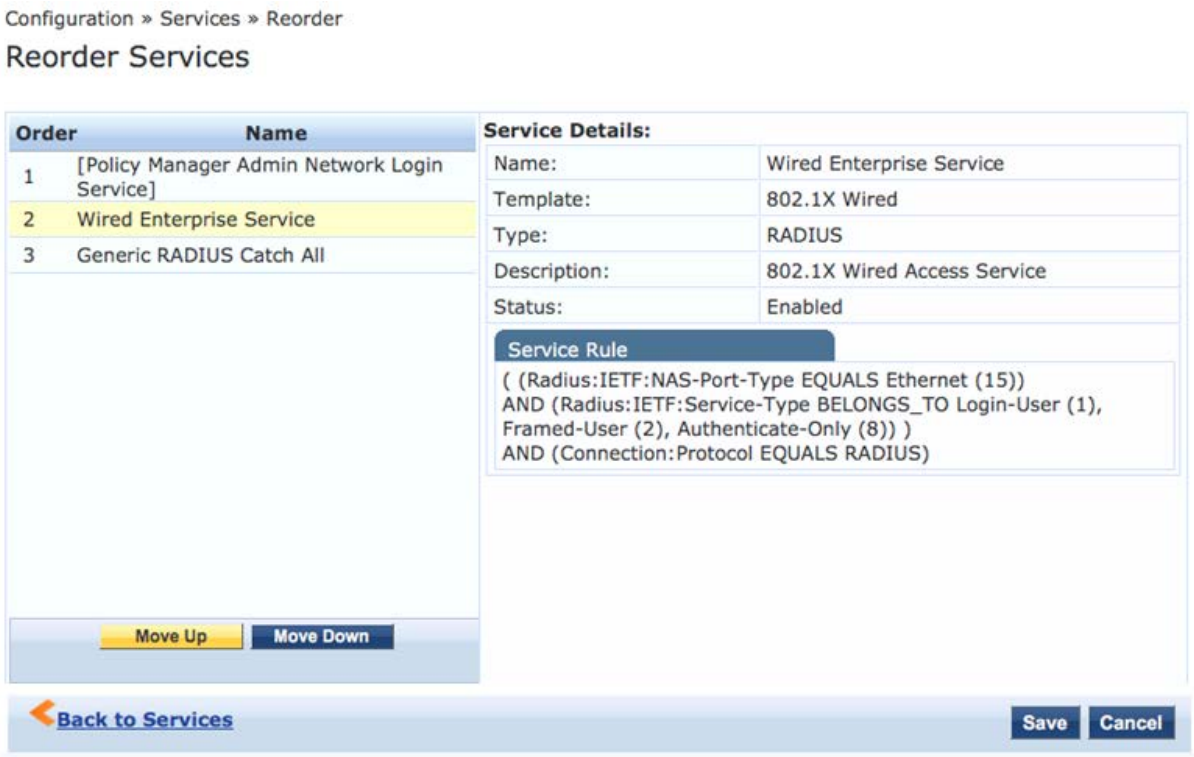
Click **Next**. Click **Save**.

Reorder Services

Reordering is important as CPPM evaluates requests against the service rules of each service configured in the order in which these services are defined. The service associated with the first matching service rule is then associated with this request.

At the **Configuration->Services** tab, navigate to the newly created service and click **Reorder** to the profile properties to reflect as displayed below:

Figure 12 Reorder Services list



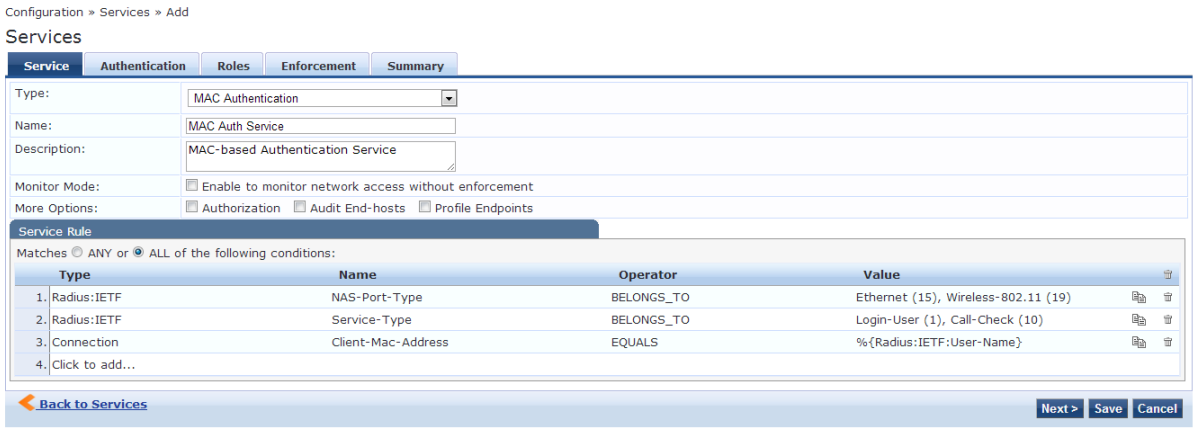
5. MAC Authentication Service Setup

Previously, the MAC Authentication Bypass was physically enabled via the switch. This configuration setup permits non-802.1x devices to authenticate via their MAC address.

Note: MAC addresses are easily falsified and it recommended that a profiler service is used to verify the MAC address. Profilers inspect the DHCP request for an added level of security.

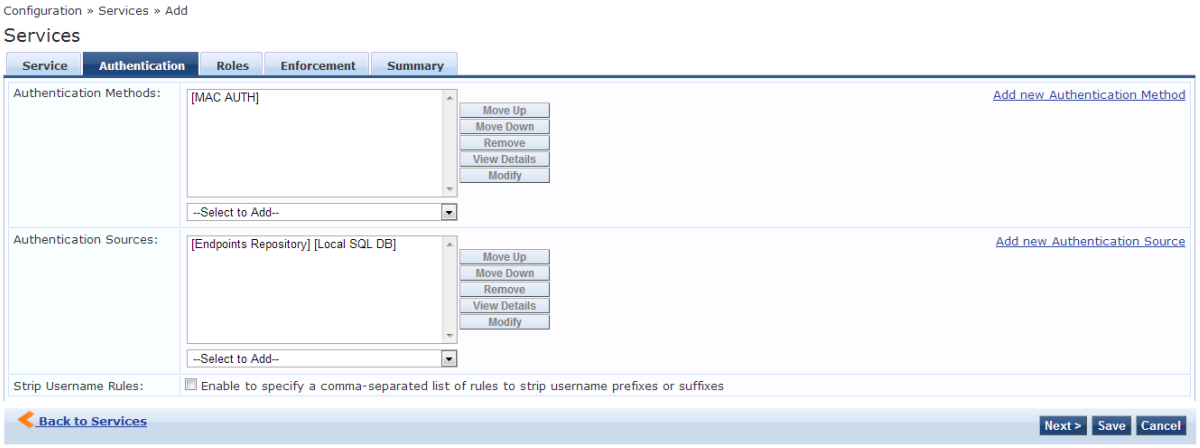
Navigate to **Configuration->Services**. Click **Add Service**. Enter the profile properties to reflect the options as displayed below:

Figure 13 Adding a non-802.1x MAC authentication Service



Click **Next**. The Authentication Method is preset to MAC AUTH and the Authentication Source is preset to Endpoints Repository displayed:

Figure 14 Configuring a non-802.1x MAC Authentication Method and Authentication Source



Click **Next**. Role Mapping will not be set up at this time. Click **Next**.

Click **Next** to accept the default Enforcement Policy.

Click **Next**. Click **Save**.

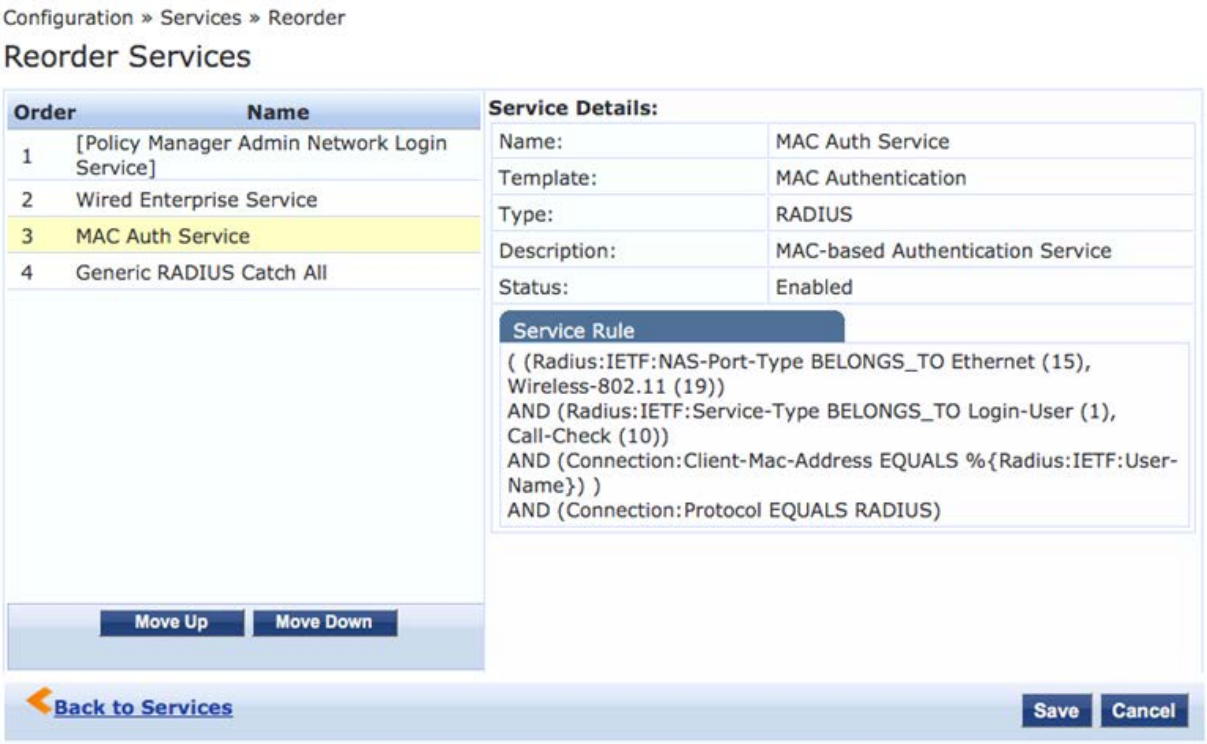
Reorder Services

Reordering is important as CPPM evaluates requests against the service rules of each service configured, in the order in which these services are defined. The service associated with the first matching service rule is then associated with this request.

At the **Configuration->Services** tab, navigate to the newly created service and click **Reorder** to the profile properties to reflect as displayed below:

Note: When working with multiple 802.1x services, it is important to order them from most specific to least specific with the generic RADIUS catch all service being last.

Figure 15 Reordering a non-802.1x MAC authentication Service



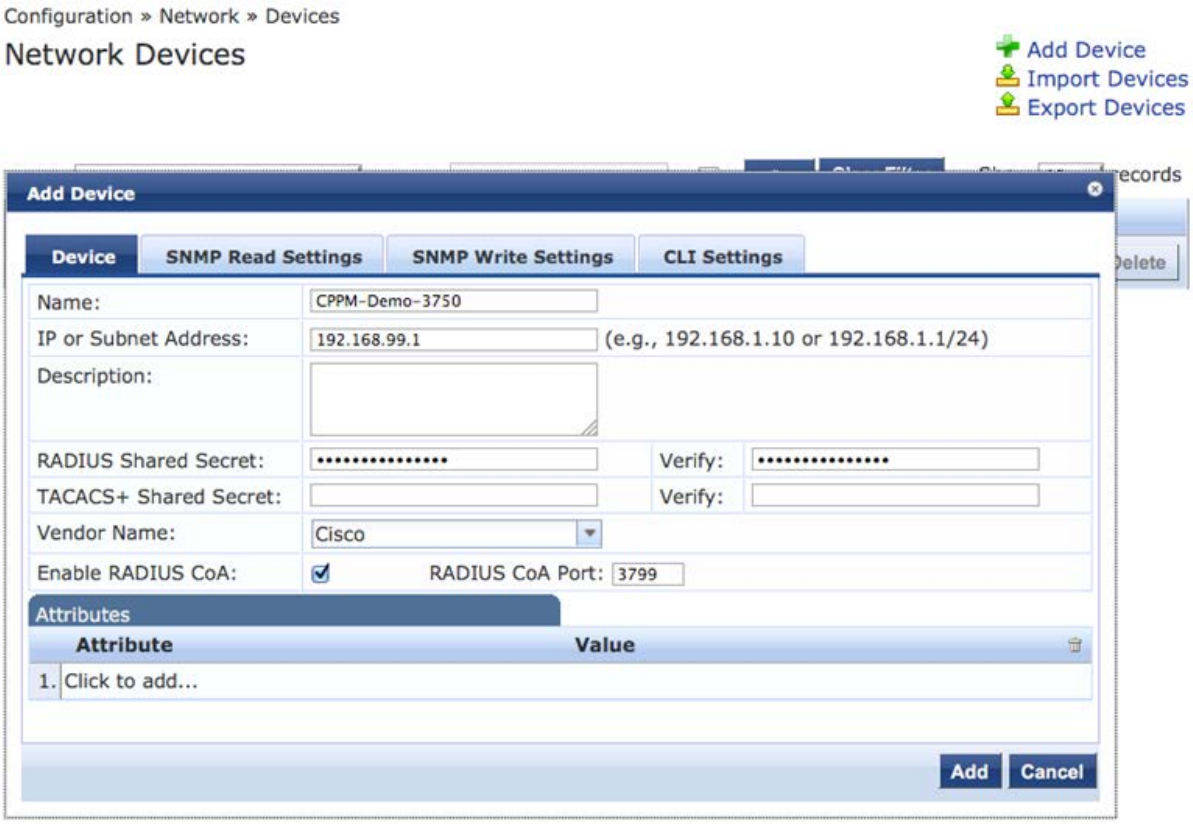
Click **Save**.

6. Adding a Network Device (Switch)

To connect with CPPM using the supported protocols, a Network Access Device (NAD) must belong to the global list of devices in the Policy Manager database.

The switch to be used must be set up as a Network Device in CPPM prior to testing the services.

Navigate to **Configuration->Network->Devices**. Click **Add Device**. Enter the profile properties to reflect the options as displayed below (Note: the RADIUS Shared Secret is “aruba123” which was configured earlier on the Cisco switch via the command `client 192.168.99.10 server-key aruba123`):



Click **Add** to save this device to the Network Devices list.

7. Adding a Test User Account

CPPM requires a local user account to test the 802.1x service. All local accounts in CPPM must have a Role.

Navigate to **Configuration->Identity->Roles**. Click **Add Roles**. Enter the profile properties to reflect the options as displayed below:

Figure 16 Adding a TestRole user

Click **Save**.

To create a user account, navigate to **Configuration->Identity->Local Users**. Click **Add User**.

User ID - test

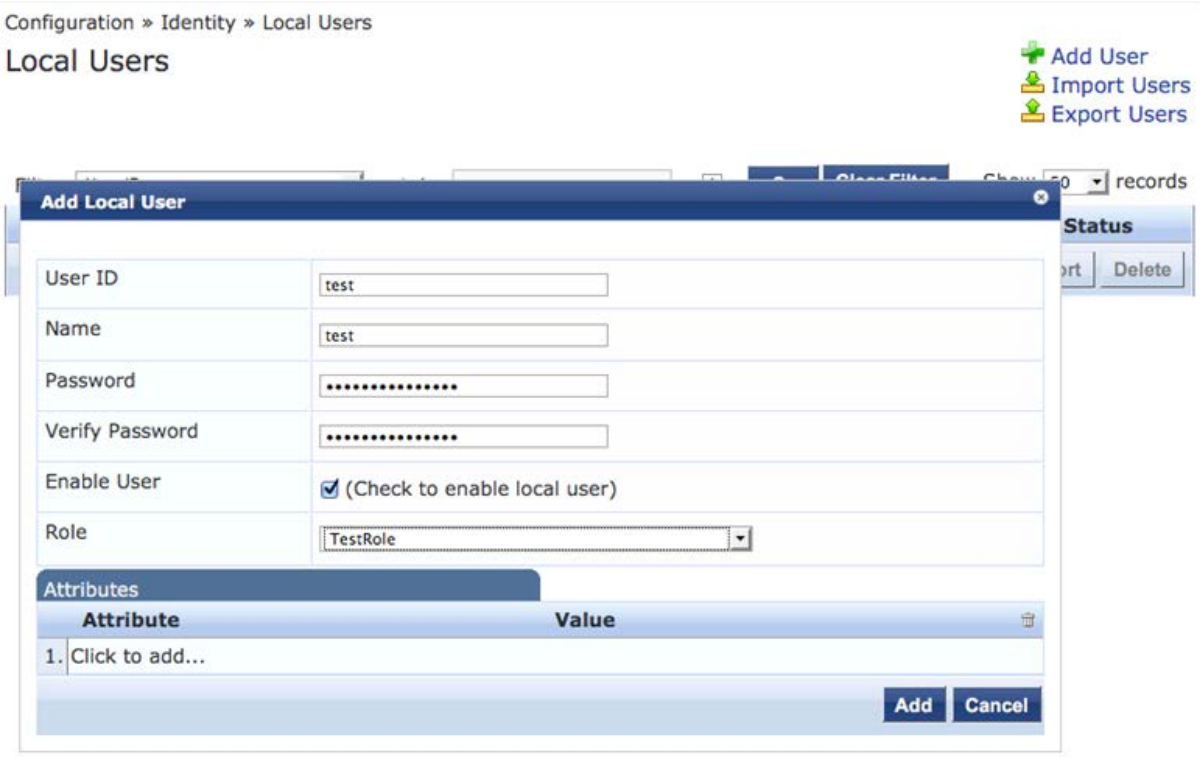
Password – test123

Checkbox - set to Enable User

Role – TestRole

Enter the profile properties to reflect the options as displayed below:

Figure 17 Adding Local User properties



Click **Add**.

Setup is now complete.

8. Testing the 802.1x Service with Access Tracker

Access Tracker provides a real-time display of system activity. It logs authentication attempts received from a list of network devices.

Navigate to **Monitoring & Reporting->Access Tracker**.

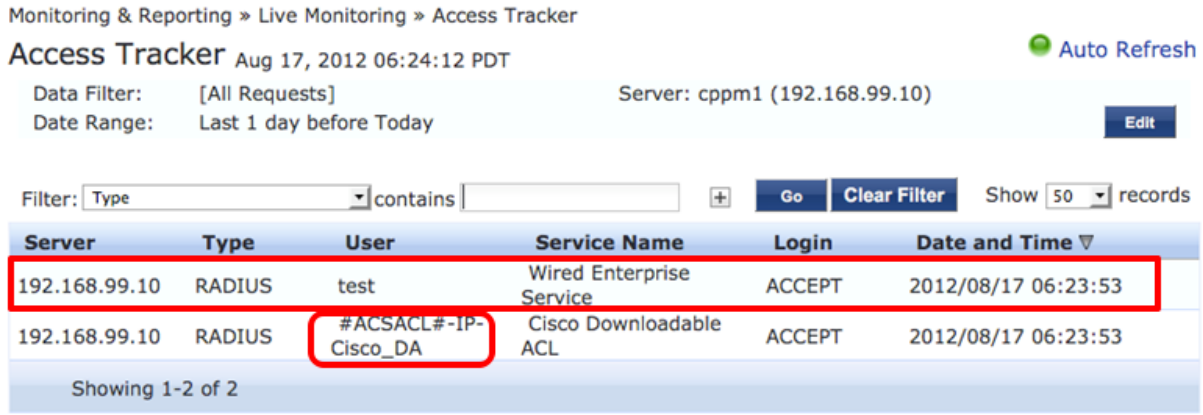
Figure 18 Testing a 802.1x Service Access Tracker

Verify the Auto Refresh is enabled (green) and filters are cleared. Click the AutoRefresh icon/text to change the status as applicable.

Important! Log in AFTER the network cable has been plugged in to the test network device.

Enter the log in credentials when prompted. Verify the profile properties are similar to the options as displayed below:

Figure 19 Populating an Access Tracker profile properties



The first entry is the test computer authenticating for network access.

The last entry is the Cisco switch requesting the Downloadable ACL, (DACL) information from CPPM.

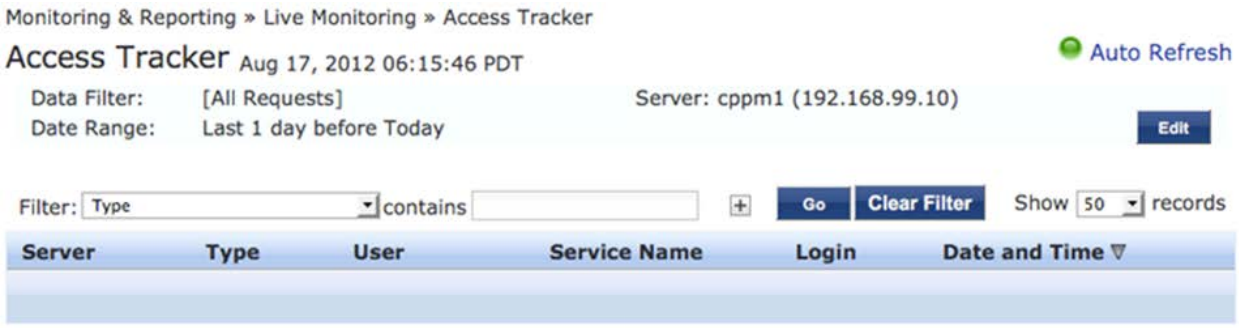
If the ACSACL is RED, in the second row above, verify the commands are entered as discussed in the Switch Configuration section of this document. If the user authentication fields are RED, in the first row above, verify the (enabled) account credentials.

9. Testing the MAC Authentication Service with **Access Tracker**

Note: Use a network device that does not support 802.1x.

Navigate to **Monitoring & Reporting->Access Tracker**.

Figure 20 Access Tracker window

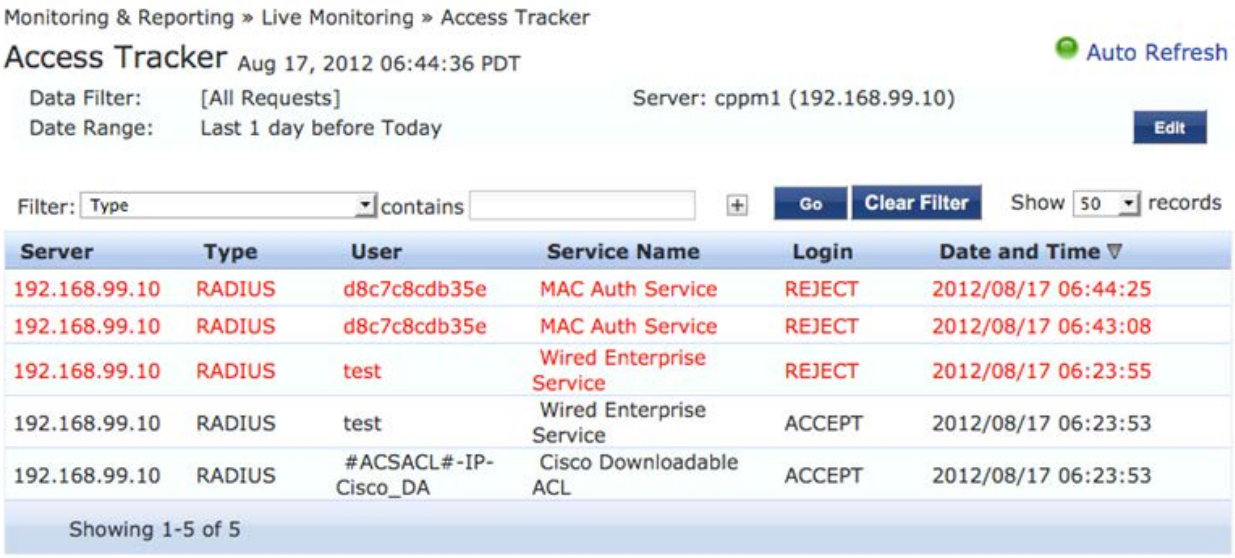


Verify the Auto Refresh is enabled (green) and filters are cleared. Click the AutoRefresh icon/text to change the status as applicable.

Plug in the non-802.1x network device to port 24.

Note: the MAC Authentication service request failed.

Figure 21 A non-802.1x network device fails MAC Authentication Service

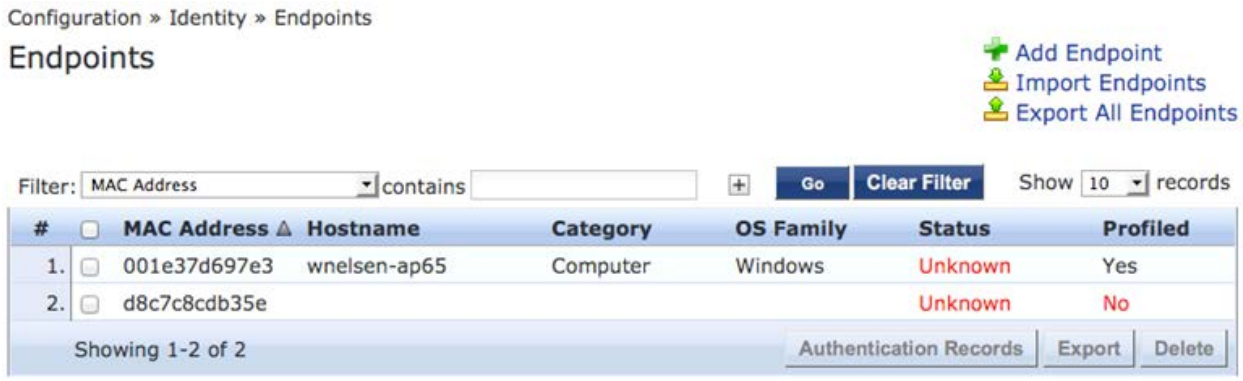


This is the expected behavior as the device is unknown.

Unplug the non-802.1x network device.

Navigate to **Configuration->Identity->Endpoints**. Select the MAC address of the non-802.1x device to connect as applicable.

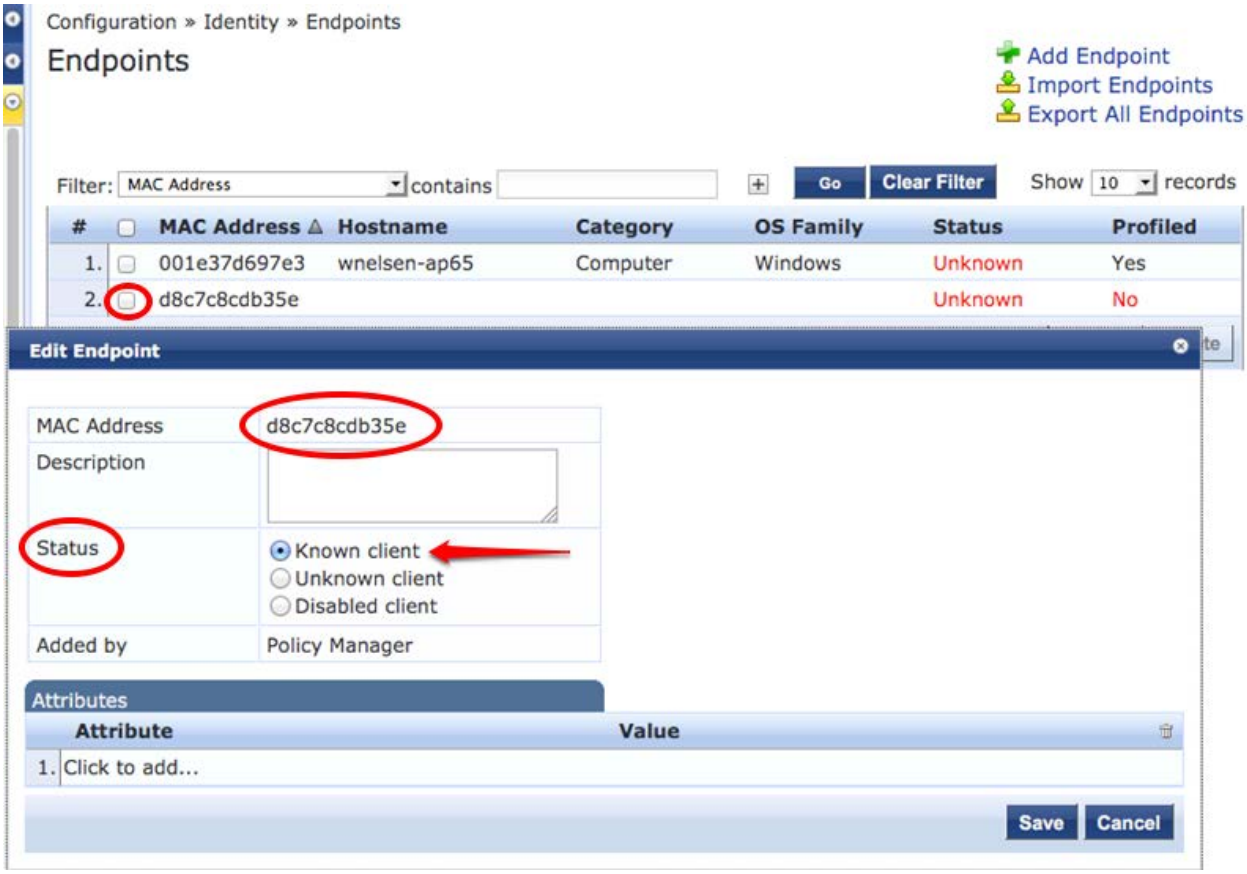
Figure 22 Configuring the Endpoints of a non-802.1x network device



Select the status of a device, by checking the box of the desired device, e.g. ‘d8c7c7cdb35c’ in the screen shot below, to display the Edit Endpoint dialog box.

Change the ‘Status’ to ‘Known client’ as displayed below:

Figure 23 Editing the Endpoint properties of a non-802.1x network device



Click **Save**.

Plug in the non-802.1x network device to port 24.

Navigate to **Monitoring & Reporting->Access Tracker**. Note the device is properly authenticated.

10. Troubleshooting

Problem:

I see the Downloadable ACL request is successful, but when I check the ACL for the device on the Cisco switch, it is empty.

Solution:

Verify the syntax of the DACL list in CPPM. If there is one ACL in the list that does not match the proper Cisco ACL syntax, then the entire list will be ignored.

Problem:

I do not see any incoming requests in Access Tracker.

Solution:

Navigate to **Monitoring & Reporting->Event Viewer**. Look for a Yellow entry. The most common mistake is either a RADIUS key mismatch or the IP address for the switch is incorrect in **Configuration->Network->Devices**. Another possibility is that your switch is using the wrong VLAN to attempt to communicate with CPPM. If necessary, run the following command in configure terminal mode on the Cisco switch:

```
CPPM-Demo-3750(config)#ip radius source-interface vlan 999
```

This will force all RADIUS requests to use VLAN 999.