Switch and Wireless LAN Controller Configuration Required to Support Cisco ISE Functions

To ensure Cisco ISE is able to interoperate with network switches and functions from Cisco ISE are successful across the network segment, you need to configure network switches with the necessary NTP, RADIUS/AAA, 802.1X, MAB, and other settings for communication with Cisco ISE.

Enable Your Switch to Support Standard Web Authentication

Ensure that you include the following commands in your switch configuration to enable standard Web Authenticating functions for Cisco ISE, including provisions for URL redirection upon authentication:

ip classless

ip route *0.0.0.0 0.0.0.0 10.1.2.3*

ip http server

```
! Must enable HTTP/HTTPS for URL-redirection on port 80/443
```

ip http secure-server

Local Username and Password Definition for Synthetic RADIUS Transactions

Enter the following command to enable the switch to talk to the Cisco ISE node as though it is the RADIUS server for this network segment:

username *test-radius* **password 0** *abcde123*

NTP Server Configuration to Ensure Accurate Log and Accounting Timestamps

Ensure that you specify the same NTP server as you have set in Cisco ISE at **Administration** > **System** > **Settings** > **System Time** by entering the following command:

ntp server *<IP_address>*|*<domain_name>*

Command to Enable AAA Functions

Enter the following commands to enable the various AAA functions between the switch and Cisco ISE, including 802.1X and MAB authentication functions:

aaa new-model

```
! Creates an 802.1X port-based authentication method list
```

aaa authentication dot1x default group radius

```
! Required for VLAN/ACL assignment

aaa authorization network default group radius

! Authentication & authorization for webauth transactions

aaa authorization auth-proxy default group radius

! Enables accounting for 802.1X and MAB authentications

aaa accounting dot1x default start-stop group radius

!

aaa session-id common

!

aaa accounting update periodic 5

! Update AAA accounting information periodically every 5 minutes

aaa accounting system default start-stop group radius

!

aaa server radius dynamic-author  <cr>

client  10.0.56.17  server-key  cisco

! Enables Cisco ISE to act as a AAA server when interacting with the client at IP address
10.0.56.17
```

RADIUS Server Configuration on the Switch

Configure the switch to interoperate with Cisco ISE acting as the RADIUS source server by entering the following commands:

```
!
radius-server attribute 6 on-for-login-auth

! Include RADIUS attribute 8 in every Access-Request

radius-server attribute 8 include-in-access-req

! Include RADIUS attribute 25 in every Access-Request

radius-server attribute 25 access-request include

! Wait 3 x 30 seconds before marking RADIUS server as dead

radius-server dead-criteria time 30 tries 3

! Use RFC-standard ports (1812/1813)
radius-server host <Cisco_ISE_IP_address> auth-port 1812 acct-port 1813 test usernametest-radius key
 0 <RADIUS-KEY>

!
radius-server vsa send accounting
!
```

```
radius-server vsa send authentication
!
! send RADIUS requests from the MANAGEMENT VLAN
ip radius source-interface <VLAN_number>
```

Note We recommend that you configure a dead-criteria time of 30 seconds with 3 retries to provide longer response times for RADIUS requests that use Active Directory for authentication.

Configure the Switch to Send RADIUS Accounting Start/Stop to Inline Posture Nodes

The network access device should be configured to send RADIUS accounting “Start” and “Stop” messages at the beginning and end of a session, respectively, with the remote device’s IP address in those messages to the Inline Posture nodes. The Inline Posture node associates the device IP address to any relevant authorization profiles downloaded over the life of a session. For example, a remote device may have an “unknown-compliance-state” authorization profile at initial login, then switch to a “compliant” authorization profile following CoA (assuming successful device posture assessment).

Command to Enable RADIUS Change of Authorization (CoA)

Specify the settings to ensure the switch is able to appropriately handle RADIUS Change of Authorization behavior supporting Posture functions from Cisco ISE by entering the following commands:

```
aaa server radius dynamic-author

client <ISE-IP> server-key 0 abcde123
```

Note Cisco ISE uses port 1700 (Cisco IOS software default) versus RFC default port 3799 for CoA. Existing Cisco Secure ACS 5.x customers may already have this set to port 3799 if they are using CoA as part of an existing ACS implementation.

Command to Enable Device Tracking and DHCP Snooping

To help provide optional security-oriented functions from Cisco ISE, you can enable device tracking and DHCP snooping for IP substitution in dynamic ACLs on switch ports by entering the following commands:

```
! Optional
ip dhcp snooping
! Required!
ip device tracking
```

In RADIUS Accounting, the DHCP attributes are not sent by IOS sensor to Cisco ISE even when dhcp snooping is enabled. In such cases, the dhcp snooping should be enabled on the VLAN to make the DHCP active.

Use the following commands to enable dhcp snooping on VLAN:

```
ip dhcp snooping
ip dhcp snooping vlan 1-100
```

(VLAN range should include used for data and vlan)

Command to Enable 802.1X Port-Based Authentication

Enter the following commands to turn 802.1X authentication on for switch ports, globally:

```
dot1x system-auth-control
```

Command to Enable EAP for Critical Authentications

To support supplicant authentication requests over the LAN, enable EAP for critical authentications (Inaccessible Authentication Bypass) by entering the following command:

```
dot1x critical eapol
```

Command to Throttle AAA Requests Using Recovery Delay

When a critical authentication recovery event takes place, you can configure the switch to automatically introduce a delay (in seconds) to ensure Cisco ISE is able to launch services again following recovery by entering the following command:

```
authentication critical recovery delay 1000
```

VLAN Definitions Based on Enforcement States

Enter the following commands to define the VLAN names, numbers, and SVIs based on known enforcement states in your network. Create the respective VLAN interfaces to enable routing between networks. This can be especially helpful to handle multiple sources of traffic passing over the same network segments—traffic from both PCs and the IP phone through which the PC is connected to the network, for example.

Note The first IP helper goes to the DHCP server and the second IP helper sends a copy of the DHCP request to the inline posture node for profiling.

```
vlan <VLAN_number>

name ACCESS!

vlan <VLAN_number>
```

```
name VOICE
!
interface <VLAN_number>
description ACCESS
ip address 10.1.2.3 255.255.255.0
ip helper-address <DHCP_Server_IP_address>
ip helper-address <Cisco_ISE_IP_address>
!
interface <VLAN_number>
description VOICE
ip address 10.2.3.4 255.255.255.0
ip helper-address <DHCP_Server_IP_address>
```

Local (Default) ACLs Definition on the Switch

Enable these functions on older switches (with Cisco IOS software releases earlier than 12.2(55)SE) to ensure Cisco ISE is able to perform the dynamic ACL updates required for authentication and authorization by entering the following commands:

```
ip access-list extended ACL-ALLOW
 permit ip any any
!
ip access-list extended ACL-DEFAULT
  remark DHCP
  permit udp any eq bootpc any eq bootps
  remark DNS
  permit udp any any eq domain
  remark Ping
  permit icmp any any
  remark Ping
  permit icmp any any
  remark PXE / TFTP
  permit udp any any eq tftp
  remark Allow HTTP/S to ISE and WebAuth portal
permit tcp any host <Cisco_ISE_IP_address> eq www
permit tcp any host <Cisco_ISE_IP_address> eq 443
permit tcp any host <Cisco_ISE_IP_address> eq 8443
permit tcp any host <Cisco_ISE_IP_address> eq 8905
permit udp any host <Cisco_ISE_IP_address> eq 8905
permit udp any host <Cisco_ISE_IP_address> eq 8906
permit tcp any host <Cisco_ISE_IP_address> eq 8080
permit udp any host <Cisco_ISE_IP_address> eq 9996
remark Drop all the rest
  deny ip any any log
!
! The ACL to allow URL-redirection for WebAuth
ip access-list extended ACL-WEBAUTH-REDIRECT
  permit tcp any any eq www
 permit tcp any any eq 443
```

Note This configuration on the WLC my increase CPU utilization and raises the risk of system instability. This is an IOS issue and does not adversely affect Cisco ISE.

Enable Cisco Trustsec Switch Ports

To ensure Cisco ISE is able to interoperate with an existing Cisco Trustsec deployment, use the following procedure to ensure that you have enabled all of the functions necessary on the switch.

Step 1 Enter configuration mode for all of the access switch ports:
interface range FastEthernet0/1-8

Step 2 Enable the switch ports for access mode (instead of trunk mode):
switchport mode access

Step 3 Statically configure the access VLAN. This provides local provisioning the access VLANs and is required for open-mode authentication:
switchport access <*VLAN_number*>

Step 4 Statically configure the voice VLAN:
switchport voice <*VLAN_number*>

Step 5 Enable open-mode authentication. Open-mode allows traffic to be bridged onto the data and voice VLANs before authentication is completed. We strongly recommend using a port-based ACL in a production environment to prevent unauthorized access.
! Enables pre-auth access before AAA response; subject to port ACL **authentication open**

Step 6 Apply a port-based ACL to determine which traffic should be bridged by default from unauthenticated endpoints onto the access VLAN. Because you should allow all access first and enforce policy later, you should apply ACL-ALLOW to permit all traffic through the switch port. You have already created a default ISE authorization to allow all traffic for now because we want complete visibility and do not want to impact the existing end-user experience yet.
! An ACL must be configured to prepend dACLs from AAA server. **ip access-group ACL-ALLOW in**

Note Prior to Cisco IOS software Release 12.2(55)SE on DSBU switches, a port ACL is required for dynamic ACLs from a RADIUS AAA server to be applied. Failure to have a default ACL will result in assigned dACLs being ignored by the switch. With Cisco IOS software Release12.2(55)SE, a default ACL will be automatically generated and applied.

Note We are using ACL-ALLOW at this point in the lab because we want to enable 802.1X port-based authentication, but without any impact to the existing network. In a later exercise, we will apply a different ACL-DEFAULT, which blocks undesired traffic for a production environment.

Step 7 Enable Multi-Auth host mode. Multi-Auth is essentially a superset of Multi-Domain Authentication (MDA). MDA only allows a single endpoint in the data domain. When multi-auth is configured, a single authenticated phone is allowed in the voice domain (as with MDA) but an unlimited number of data devices can be authenticated in the data domain.
! Allow voice + multiple endpoints on same physical access port **authentication host-mode multi-auth**

Note Multiple data devices (whether virtualized devices or physical devices connected to a hub) behind an IP phone can exacerbate the access ports' physical link-state awareness.

Step 8 Enable various authentication method options:
! Enable re-authentication **authentication periodic** ! Enable re-authentication via RADIUS Session-Timeout **authentication timer reauthenticate server authentication event fail action next-method authentication event server dead action authorize** <*VLAN_number*> **authentication event server alive action reinitialize** ! IOS Flex-Auth authentication should do 802.1X then MAB **authentication order dot1x mab authentication priority dot1x mab**

Step 9 Enable 802.1X port control on the switchport:
! Enables port-based authentication on the interface **authentication port-control auto authentication violation restrict**

Step 10 Enable MAC Authentication Bypass (MAB):

! Enable MAC Authentication Bypass (MAB) **mab**

Step 11 Enable 802.1X on the switchport
! Enables 802.1X authentication on the interface **dot1x pae authenticator**

Step 12 Set the retransmit period to 10 seconds:
dot1x timeout tx-period *10*

Note The dot1x tx-period timeout should be set to 10 seconds. Do not change this unless you understand the implications.

Step 13 Enable the portfast feature:
spanning-tree portfast

Command to Enable EPM Logging

Set up standard logging functions on the switch to support possible troubleshooting/recording for Cisco ISE functions:

epm logging

Command to Enable SNMP Traps

Ensure the switch is able to receive SNMP trap transmissions from Cisco ISE over the appropriate VLAN in this network segment:

snmp-server community public RO

snmp-server trap-source <*VLAN_number*>

Command to Enable SNMP v3 Query for Profiling

Configure the switch to ensure SNMP v3 polling takes place as intended to support Cisco ISE profiling services. First, configure the SNMP settings in Cisco ISE by choosing **Administration** > **Network Resources** > **Network Devices** > **Add | Edit** > **SNMP Settings**.

Snmp-server user <*name*> <*group*> **v3 auth md5** <*string*> **priv des** <*string*>

snmp-server group <*group*> **v3 priv**

snmp-server group <*group*> **v3 priv context** *vlan-1*

Note The **snmp-server group** <*group*> **v3 priv context** *vlan-1* command must be configured for each context. The **snmp show context** command lists all the context information.

If the SNMP Request times out and there is no connectivity issue, then you can increase the Timeout value.

Command to Enable MAC Notification Traps for Profiler to Collect

Configure your switch to transmit the appropriate MAC notification traps so that the Cisco ISE Profiler function is able to collect information on network endpoints:

mac address-table notification change

mac address-table notification mac-move

snmp trap mac-notification change added

snmp trap mac-notification change removed

RADIUS Idle-Timeout Configuration on the Switch

To configure the RADIUS Idle-timeout on a switch, use the following command:

`Switch(config-if)#` **authentication timer** *inactivity*
where *inactivity* is interval of inactivity in seconds, after which client activity is considered unauthorized.

In Cisco ISE, you can enable this option for any Authorization Policies to which such a session inactivity timer should apply from **Policy** > **Policy Elements** > **Results** > **Authorization** > **Authorization Profiles**.

Wireless LAN Controller Configuration for iOS Supplicant Provisioning

To support Apple iOS-based devices (iPhone/iPad) switching from one SSID to another on the same wireless access point, be sure to configure the Wireless LAN Controller (WLC) to enable the “FAST SSID change” function. This function helps ensure iOS-based devices are able to more quickly switch between SSIDs.

`WLC (config)#` **FAST SSID change**
You might see the following error message while trying to connect to a wireless network for some of the Apple iOS-based devices:

```
Could not scan for Wireless Networks.
```

You can ignore this error message because this does not affect the authentication of the device.

Wireless LAN Controller Support for Apple Devices

Apple devices include the Apple Captive Network Assistant (CNA) feature, which detects captive networks (like the Cisco ISE WebAuth page), but it interferes with the portal redirection required to support guests and personal devices.

You can bypass this feature by enabling the **web-auth captive-bypass** command on the Wireless LAN Controller (WLC):

```
WLC > config network web-auth captive-bypass enable

Web-auth support for Captive-Bypass will be enabled.

You must reset system for this setting to take effect.

WLC > save config

Are you sure you want to save? (y/n) y

Configuration Saved!

WLC >
```

Configuring ACLs on the Wireless LAN Controller for MDM Interoperability

You must configure ACLs on the wireless LAN controller for use in authorization policy to redirect nonregistered devices and certificate provisioning. Your ACLs should be in the following sequence.

Step 1 Allow all outbound traffic from server to client.

Step 2 (Optional) Allow ICMP inbound traffic from client to server for troubleshooting.

Step 3 Allow access to MDM server for unregistered and noncompliant devices to download the MDM agent and proceed with compliance checks.

Step 4 Allow all inbound traffic from client to server to ISE for Web Portal and supplicant, and certificate provisioning flows.

Step 5 Allow inbound DNS traffic from client to server for name resolution.

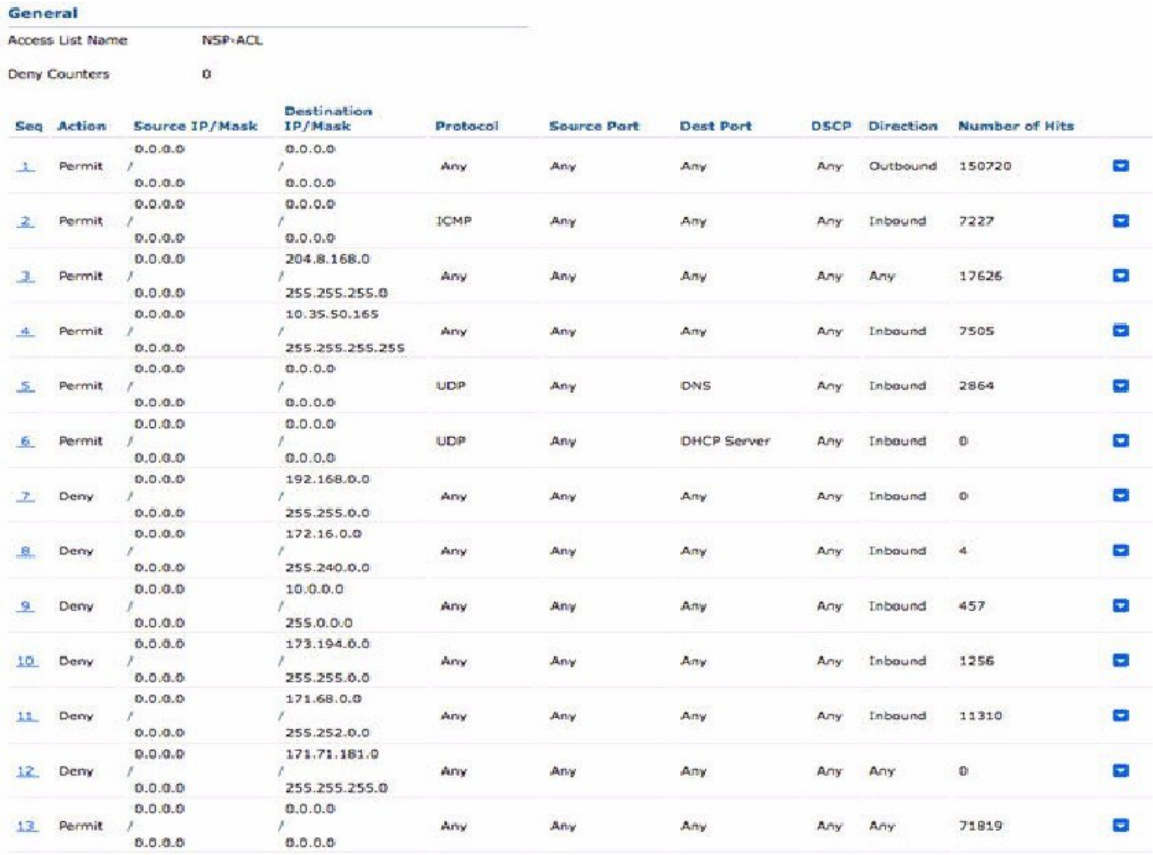
Step 6 Allow inbound DHCP traffic from client to server for IP addresses.

Step 7 Deny all inbound traffic from client to server to corporate resources for redirection to ISE (as per your company policy).

Step 8 (Optional) Permit the rest of the traffic.

The following example shows the ACLs for redirecting a nonregistered device to the BYOD flow. In this example, the Cisco ISE ip address is 10.35.50.165, the internal corporate network ip address is 192.168.0.0 and 172.16.0.0 (to redirect), and the MDM server subnet is 204.8.168.0.

Figure 1: ACLs for Redirecting Nonregistered Device



General

Access List Name NSP-ACL

Deny Counters 0

Seq	Action	Source IP/Mask	Destination IP/Mask	Protocol	Source Port	Dest Port	DSCP	Direction	Number of Hits
1	Permit	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	Any	Any	Any	Any	Outbound	150720
2	Permit	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	ICMP	Any	Any	Any	Inbound	7227
3	Permit	0.0.0.0 / 0.0.0.0	204.8.168.0 / 255.255.255.0	Any	Any	Any	Any	Any	17626
4	Permit	0.0.0.0 / 0.0.0.0	10.35.50.165 / 255.255.255.255	Any	Any	Any	Any	Inbound	7505
5	Permit	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	UDP	Any	DNS	Any	Inbound	2864
6	Permit	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	UDP	Any	DHCP Server	Any	Inbound	0
7	Deny	0.0.0.0 / 0.0.0.0	192.168.0.0 / 255.255.0.0	Any	Any	Any	Any	Inbound	0
8	Deny	0.0.0.0 / 0.0.0.0	172.16.0.0 / 255.240.0.0	Any	Any	Any	Any	Inbound	4
9	Deny	0.0.0.0 / 0.0.0.0	10.0.0.0 / 255.0.0.0	Any	Any	Any	Any	Inbound	457
10	Deny	0.0.0.0 / 0.0.0.0	173.194.0.0 / 255.255.0.0	Any	Any	Any	Any	Inbound	1256
11	Deny	0.0.0.0 / 0.0.0.0	171.68.0.0 / 255.252.0.0	Any	Any	Any	Any	Inbound	11310
12	Deny	0.0.0.0 / 0.0.0.0	171.71.181.0 / 255.255.255.0	Any	Any	Any	Any	Any	0
13	Permit	0.0.0.0 / 0.0.0.0	0.0.0.0 / 0.0.0.0	Any	Any	Any	Any	Any	71819