Configure the ISE for Integration with an LDAP Server

Contents

Introduction

This document describes how to configure a Cisco Identity Services Engine (ISE) for integration with a Cisco LDAP server.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

The information this document is based on these software and hardware versions:

- Cisco ISE Version 1.3 with patch 2
- Microsoft Windows Version 7 x64 with OpenLDAP installed
- Cisco Wireless LAN Controller (WLC) Version 8.0.100.0
- Cisco AnyConnect Version 3.1 for Microsoft Windows
- Cisco Network Access Manager Profile Editor

> **Note**: This document is valid for setups that use LDAP as the external identity source for the ISE authentication and authorization.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

These authentication methods are supported with LDAP:

- Extensible Authentication Protocol â€“ Generic Token Card (EAP-GTC)
- Extensible Authentication Protocol â€“ Transport Layer Security (EAP-TLS)
- Protected Extensible Authentication Protocol â€“ Transport Layer Security (PEAP-TLS)

Configure

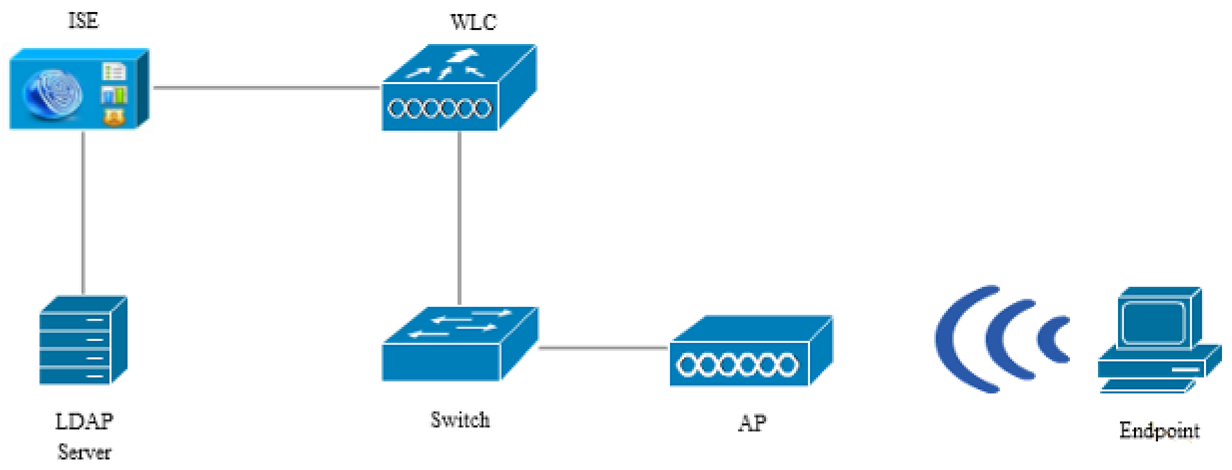
This section describes how to configure the network devices and integrate the ISE with an LDAP server.

Network Diagram

In this configuration example, the endpoint uses a wireless adapter in order to associate with the wireless network.

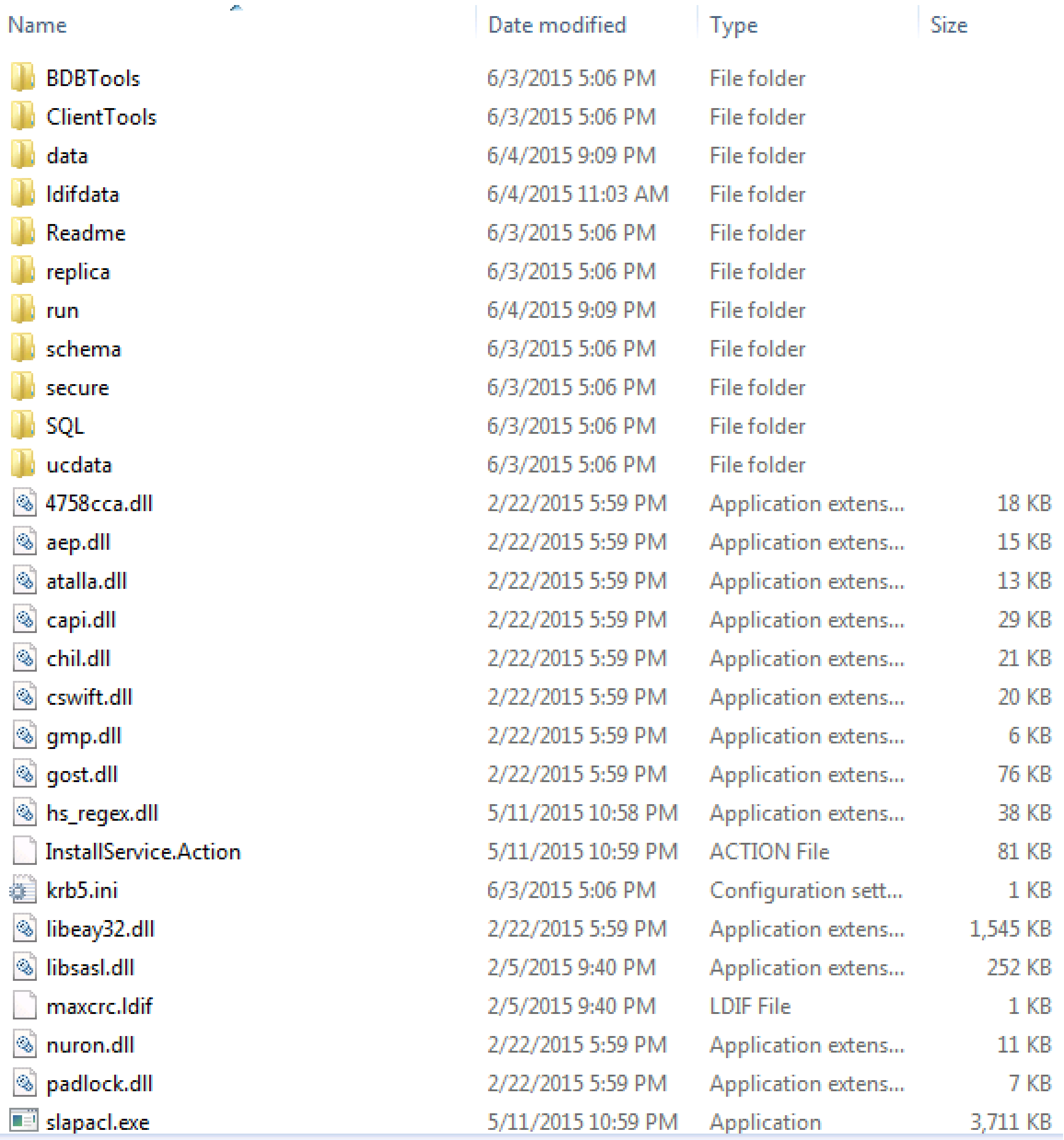
The Wireless LAN (WLAN) on the WLC is configured in order to authenticate the users via the ISE. On the ISE, LDAP is configured as an external identity store.

This image illustrates the network topology that is used:



Configure OpenLDAP

Installation of the OpenLDAP for Microsoft Windows is completed via the GUI, and it is straightforward. The default location is **C: > OpenLDAP**. After installation, you should see this directory:

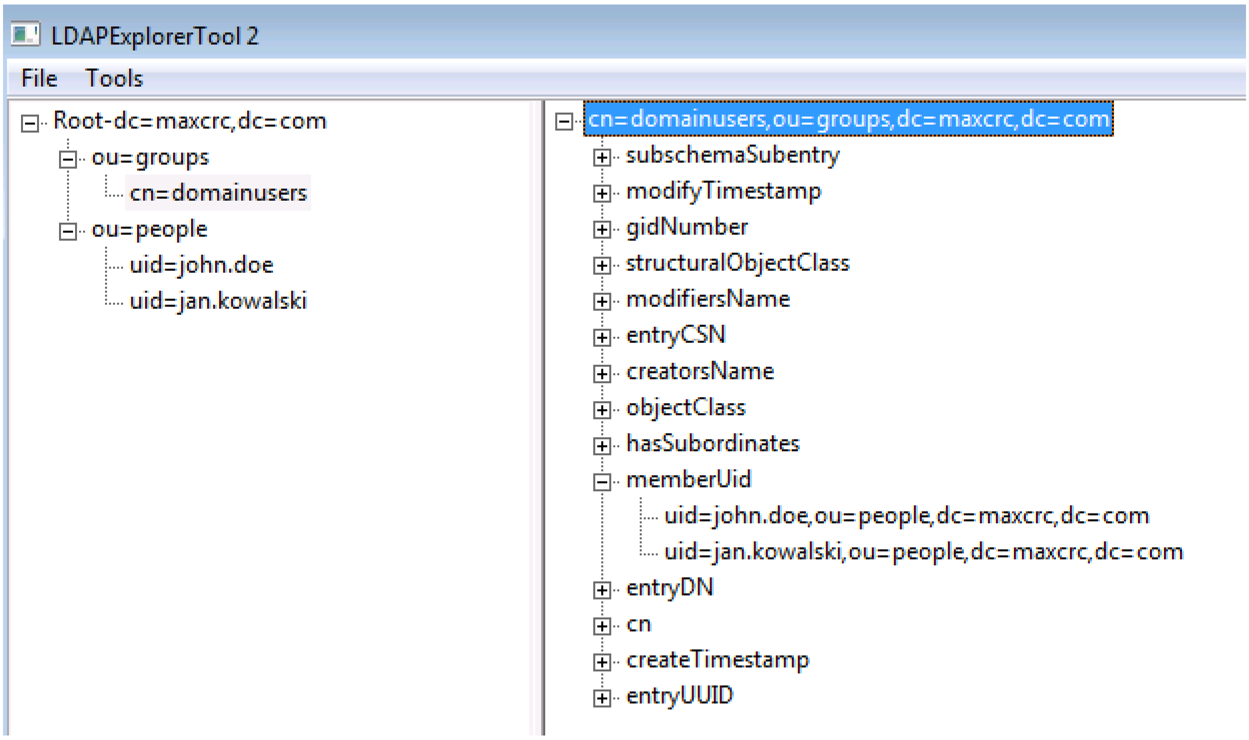


Name	Date modified	Type	Size
BDBTools	6/3/2015 5:06 PM	File folder	
ClientTools	6/3/2015 5:06 PM	File folder	
data	6/4/2015 9:09 PM	File folder	
ldifdata	6/4/2015 11:03 AM	File folder	
Readme	6/3/2015 5:06 PM	File folder	
replica	6/3/2015 5:06 PM	File folder	
run	6/4/2015 9:09 PM	File folder	
schema	6/3/2015 5:06 PM	File folder	
secure	6/3/2015 5:06 PM	File folder	
SQL	6/3/2015 5:06 PM	File folder	
ucdata	6/3/2015 5:06 PM	File folder	
4758cca.dll	2/22/2015 5:59 PM	Application extens...	18 KB
aep.dll	2/22/2015 5:59 PM	Application extens...	15 KB
atalla.dll	2/22/2015 5:59 PM	Application extens...	13 KB
capi.dll	2/22/2015 5:59 PM	Application extens...	29 KB
chil.dll	2/22/2015 5:59 PM	Application extens...	21 KB
cswift.dll	2/22/2015 5:59 PM	Application extens...	20 KB
gmp.dll	2/22/2015 5:59 PM	Application extens...	6 KB
gost.dll	2/22/2015 5:59 PM	Application extens...	76 KB
hs_regex.dll	5/11/2015 10:58 PM	Application extens...	38 KB
InstallService.Action	5/11/2015 10:59 PM	ACTION File	81 KB
krb5.ini	6/3/2015 5:06 PM	Configuration sett...	1 KB
libeay32.dll	2/22/2015 5:59 PM	Application extens...	1,545 KB
libsasl.dll	2/5/2015 9:40 PM	Application extens...	252 KB
maxcrc.ldif	2/5/2015 9:40 PM	LDIF File	1 KB
nuron.dll	2/22/2015 5:59 PM	Application extens...	11 KB
padlock.dll	2/22/2015 5:59 PM	Application extens...	7 KB
slapacl.exe	5/11/2015 10:59 PM	Application	3,711 KB

Take note of two directories in particular:

- **ClientTools** â€“ This directory includes a set of binaries that are used in order to edit the LDAP database.
- **ldifdata** â€“ This is the location in which you should store the files with LDAP objects.

Add this structure to the LDAP database:



LDAPExplorerTool 2

File Tools

```
Root-dc=maxcrc,dc=com
    ou=groups
        cn=domainusers
    ou=people
        uid=john.doe
        uid=jan.kowalski
```

```
cn=domainusers,ou=groups,dc=maxcrc,dc=com
    subschemaSubentry
    modifyTimestamp
    gidNumber
    structuralObjectClass
    modifiersName
    entryCSN
    creatorsName
    objectClass
    hasSubordinates
    memberUid
        uid=john.doe,ou=people,dc=maxcrc,dc=com
        uid=jan.kowalski,ou=people,dc=maxcrc,dc=com
    entryDN
    cn
    createTimestamp
    entryUUID
```

Under the *Root* directory, you must configure two Organizational Units (OUs). The *OU=groups* OU should have one child group (**cn=domainusers** in this example).

The *OU=people* OU defines the two user accounts that belong to the *cn=domainusers* group.

In order to populate the database, you must create the *ldif* file first. The previously mentioned structure was created from this file:

```
dn: ou=groups,dc=maxcrc,dc=com
changetype: add
ou: groups
description: All groups in organisation
objectclass: organizationalunit

dn: ou=people,dc=maxcrc,dc=com
changetype: add
ou: people
description: All people in organisation
objectclass: organizationalunit

dn: uid=john.doe,ou=people,dc=maxcrc,dc=com
changetype: add
objectClass: top
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
uid: john.doe
givenName: John
sn: Doe
cn: John Doe
mail: john.doe@example.com
userPassword: password

dn: uid=jan.kowalski,ou=people,dc=maxcrc,dc=com
changetype: add
```

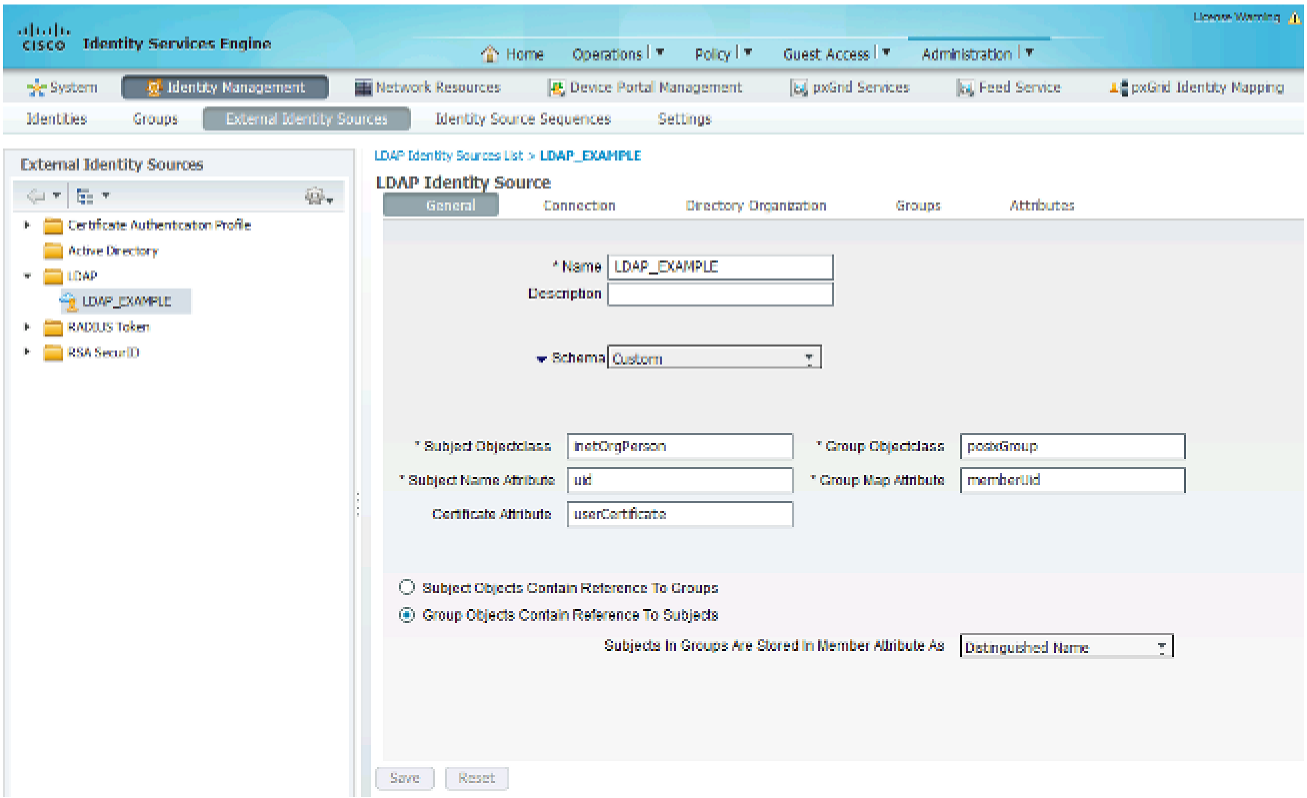
```
objectClass: top
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
uid: jan.kowalski
givenName: Jan
sn: Kowalski
cn: Jan Kowalski
mail: jan.kowalski@example.com
userPassword: password

dn: cn=domainusers,ou=groups,dc=maxcrc,dc=com
changetype: add
objectClass: top
objectClass: posixGroup
gidNumber: 678
memberUid: uid=john.doe,ou=people,dc=maxcrc,dc=com
memberUid: uid=jan.kowalski,ou=people,dc=maxcrc,dc=com
```

In order to add the objects to the LDAP database, use the **ldapmodify** binary:

```
C:\OpenLDAP\ClientTools>ldapmodify.exe -a -x -h localhost -p 389 -D "cn=Manager,
dc=maxcrc,dc=com" -w secret -f C:\OpenLDAP\ldifdata\test.ldif
ldap_connect_to_host: TCP localhost:389
ldap_new_socket: 496
ldap_prepare_socket: 496
ldap_connect_to_host: Trying ::1 389
ldap_pvt_connect: fd: 496 tm: -1 async: 0
attempting to connect:
connect success
adding new entry "ou=groups,dc=maxcrc,dc=com"

adding new entry "ou=people,dc=maxcrc,dc=com"

adding new entry "uid=john.doe,ou=people,dc=maxcrc,dc=com"

adding new entry "uid=jan.kowalski,ou=people,dc=maxcrc,dc=com"

adding new entry "cn=domainusers,ou=groups,dc=maxcrc,dc=com"
```

Integrate OpenLDAP with the ISE

Use the information that is provided in the images throughout this section in order to configure LDAP as an external identity store on the ISE.



* Name LDAP_EXAMPLE

Description

Schema Custom

* Subject Objectclass inetOrgPerson

* Group Objectclass posixGroup

* Subject Name Attribute uid

* Group Map Attribute memberUid

Certificate Attribute userCertificate

○ Subject Objects Contain Reference To Groups

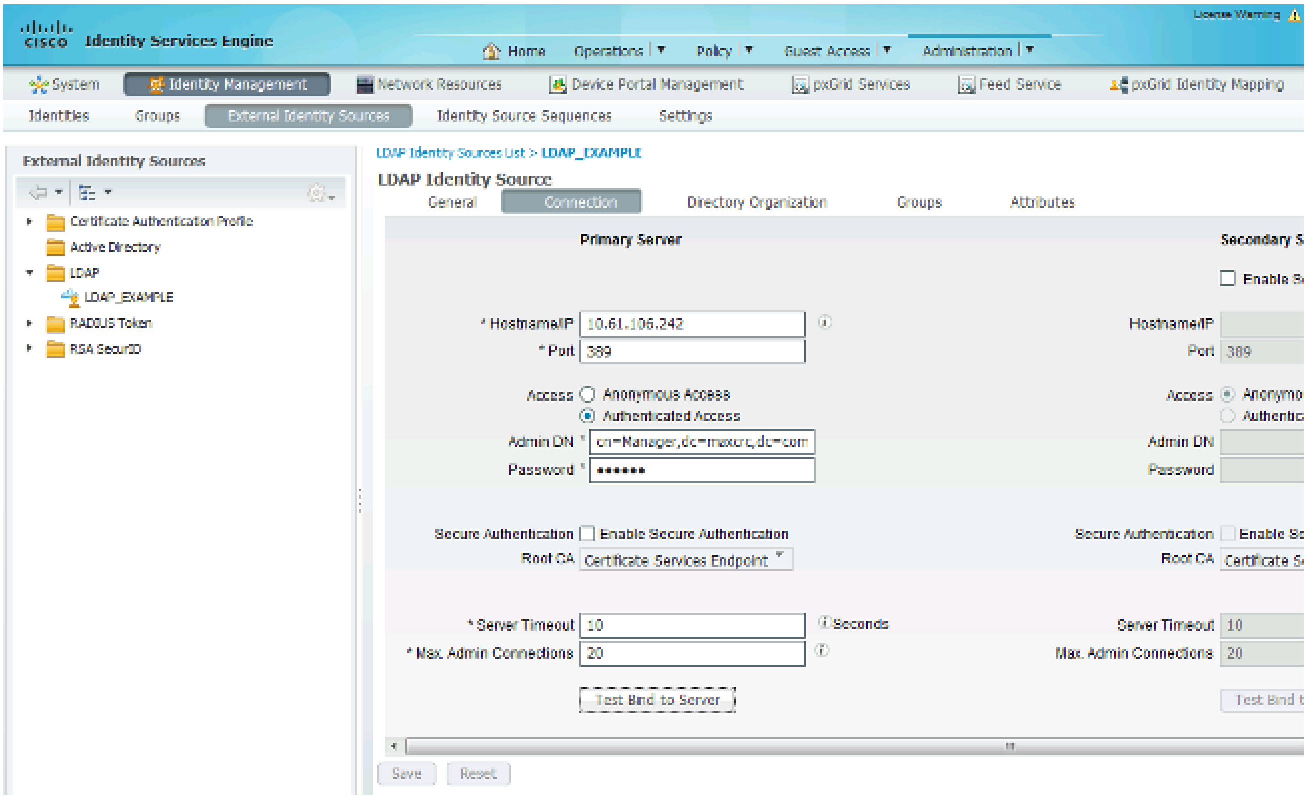
● Group Objects Contain Reference To Subjects

Subjects In Groups Are Stored In Member Attribute As Distinguished Name

You can configure these attributes from the *General* tab:

- **Subject Objectclass** â€“ This field corresponds to the object class of the user accounts in the *ldif* file. As per the LDAP configuration. use one of these four classes:
  - Top
  - Person
  - OrganizationalPerson
  - InetOrgPerson
- **Subject Name Attribute** â€“ This is the attribute that is retrieved by the LDAP when the ISE inquires whether a specific user name is included in a database. In this scenario, you must use **john.doe** or **jan.kowalski** as the user name on the endpoint.
- **Group Objectclass** â€“ This field corresponds to the object class for a group in the *ldif* file. In this scenario, the object class for the *cn=domainusers* group is **posixGroup**.
- **Group Map Attribute** â€“ This attribute defines how the users are mapped to the groups. Under the *cn=domainusers* group in the *ldif* file, you can see two *memberUid* attributes that correspond to the users.

The ISE also offers some pre-configured schemas (Microsoft Active Directory, Sun, Novell):



LDAP Identity Source

Primary Server

- * Hostname/IP: 10.61.106.242
- * Port: 389
- Access: ○ Anonymous Access ● Authenticated Access
- Admin DN *: cn=Manager,dc=maxcrc,dc=com
- Password *: ••••••
- Secure Authentication: □ Enable Secure Authentication
- Root CA: Certificate Services Endpoint
- * Server Timeout: 10 Seconds
- * Max. Admin Connections: 20
- Test Bind to Server

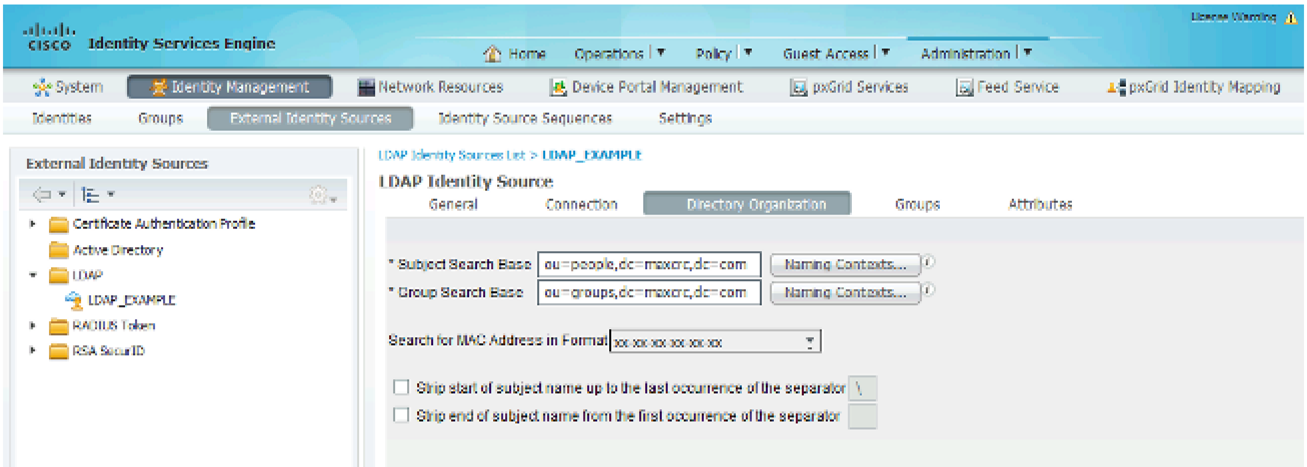
Secondary S

- □ Enable S
- Hostname/IP:
- Port: 389
- Access: ● Anonymo ○ Authentic
- Admin DN:
- Password:
- Secure Authentication: □ Enable Se
- Root CA: Certificate S
- Server Timeout: 10
- Max. Admin Connections: 20
- Test Bind t

After you set the correct IP address and administrative domain name, you can *Test Bind* to the server. At this point, you do not retrieve any subjects or groups because the search bases are not yet configured.

In the next tab, configure the Subject/Group Search Base. This is the *join* point for the ISE to the LDAP. You are able to retrieve only subjects and groups that are children of your joining point.

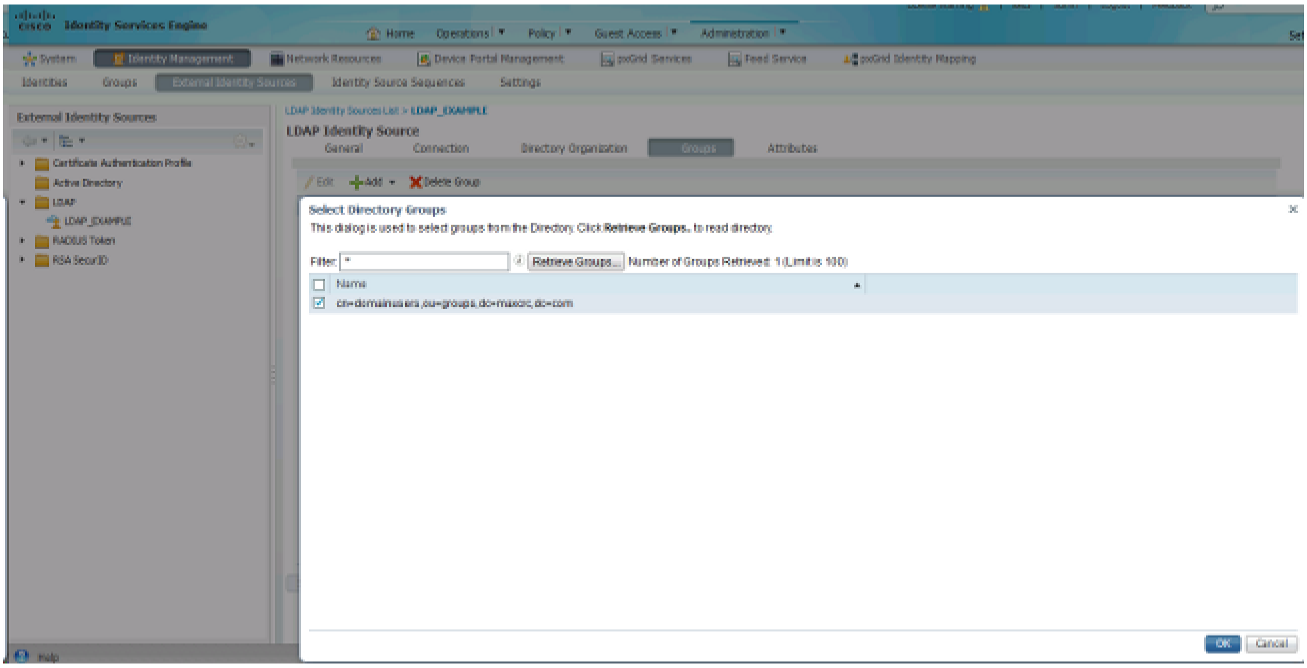
In this scenario, the subjects from the *OU=people* and the groups from the *OU=groups* are retrieved:



LDAP Identity Source

- * Subject Search Base: ou=people,dc=maxcrc,dc=com
- * Group Search Base: ou=groups,dc=maxcrc,dc=com
- Search for MAC Address in Format: xx-xx-xx-xx-xx-xx
- □ Strip start of subject name up to the last occurrence of the separator \
- □ Strip end of subject name from the first occurrence of the separator

From the *Groups* tab, you can import the groups from the LDAP on the ISE:



Select Directory Groups

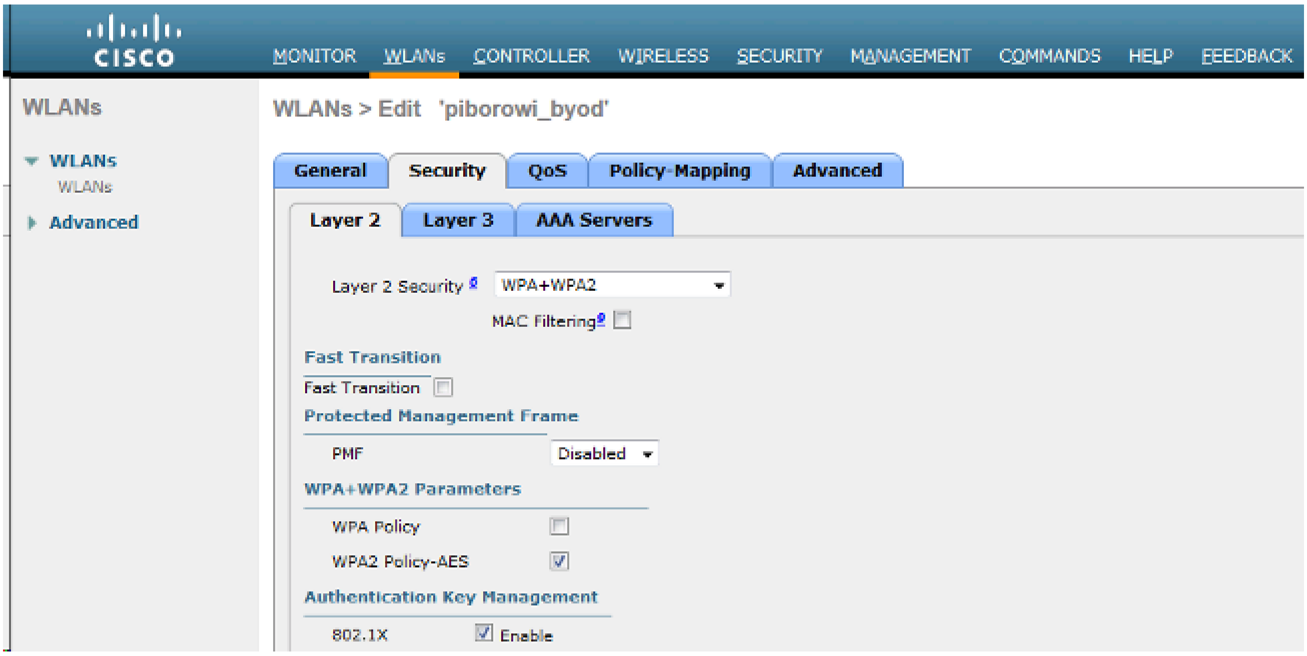
This dialog is used to select groups from the Directory. Click **Retrieve Groups..** to read directory.

Filter: * Number of Groups Retrieved: 1 (Limit is 100)

	Name
☑	cn=domainusers,ou=groups,dc=maxcrc,dc=com

Configure the WLC

Use the information that is provided in these images in order to configure the WLC for 802.1x authentication:



WLANs > Edit 'piborowi_byod'

Layer 2 Security: WPA+WPA2

MAC Filtering ☐

Fast Transition

Fast Transition ☐

Protected Management Frame

PMF: Disabled

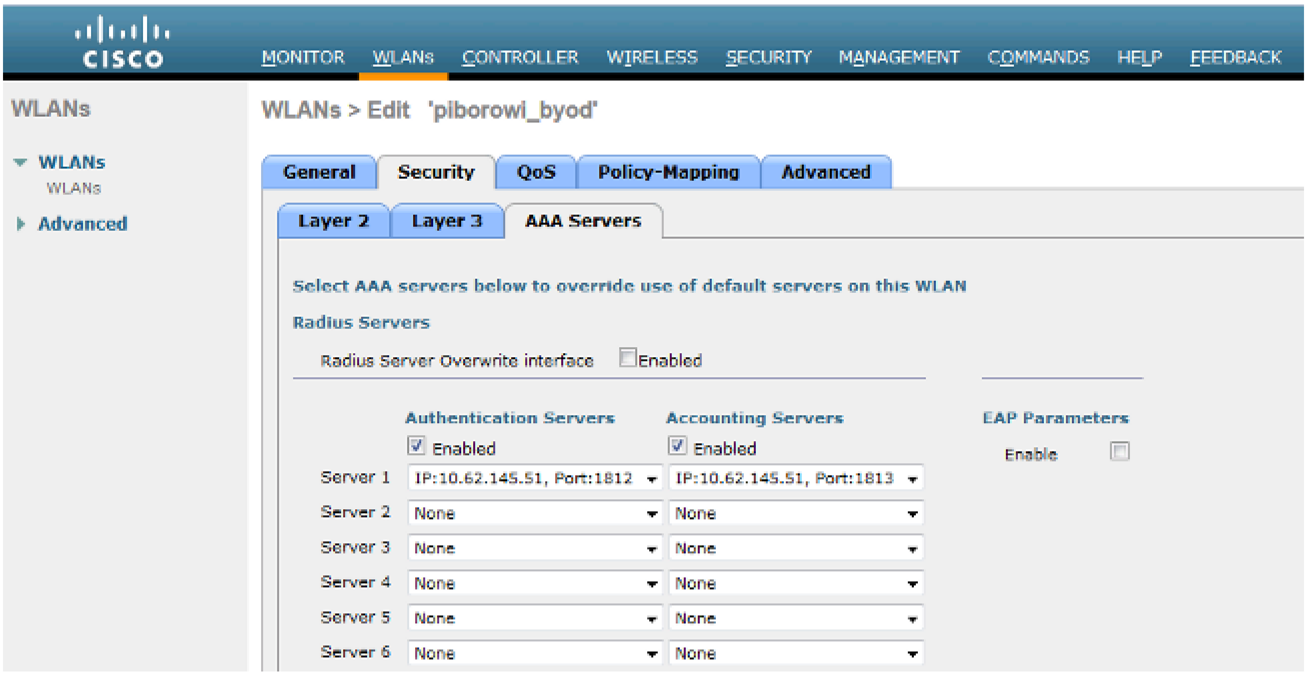
WPA+WPA2 Parameters

WPA Policy ☐

WPA2 Policy-AES ☑

Authentication Key Management

802.1X ☑ Enable



WLANs > Edit 'piborowi_byod'

Select AAA servers below to override use of default servers on this WLAN

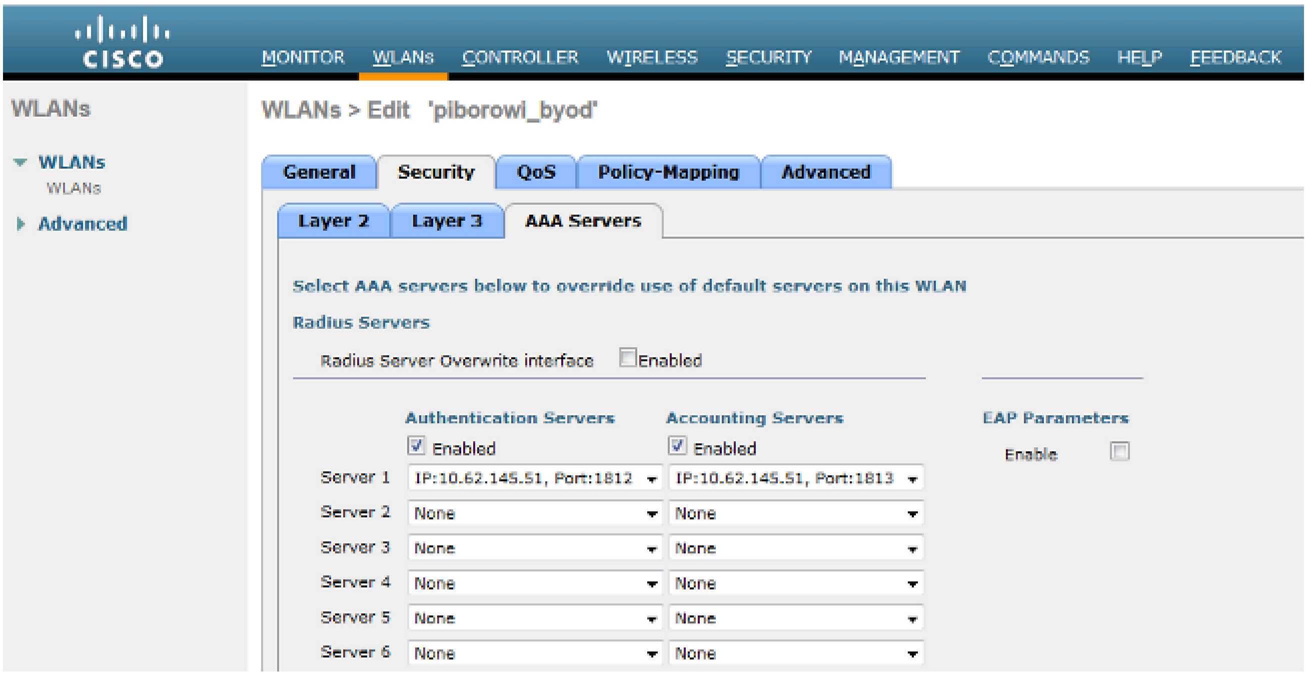
Radius Servers

Radius Server Overwrite interface □Enabled

	Authentication Servers	Accounting Servers
	☑ Enabled	☑ Enabled
Server 1	IP:10.62.145.51, Port:1812	IP:10.62.145.51, Port:1813
Server 2	None	None
Server 3	None	None
Server 4	None	None
Server 5	None	None
Server 6	None	None

EAP Parameters

Enable □


WLANs > Edit 'piborowi_byod'

Select AAA servers below to override use of default servers on this WLAN

Radius Servers

Radius Server Overwrite interface □Enabled

	Authentication Servers	Accounting Servers
	☑ Enabled	☑ Enabled
Server 1	IP:10.62.145.51, Port:1812	IP:10.62.145.51, Port:1813
Server 2	None	None
Server 3	None	None
Server 4	None	None
Server 5	None	None
Server 6	None	None

EAP Parameters

Enable □

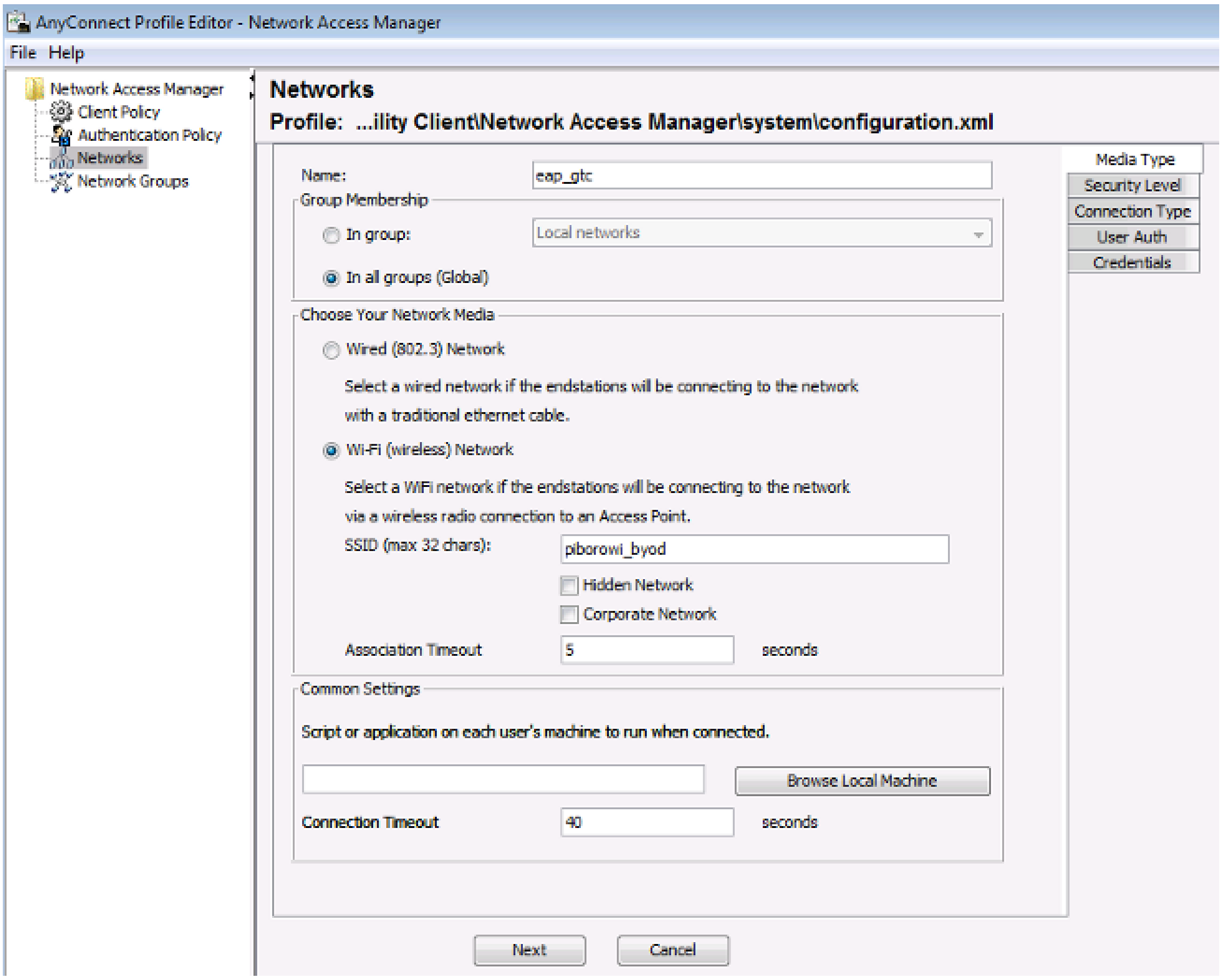
Configure EAP-GTC

One of the supported authentication methods for LDAP is EAP-GTC. It is available in Cisco AnyConnect, but you must install the Network Access Manager Profile Editor in order to configure the profile correctly.

You must also edit the Network Access Manager configuration, which (by default) is located here:

C: > ProgramData > Cisco > Cisco AnyConnect Secure Mobility Client > Network Access Manager > system > configuration.xml file

Use the information that is provided in these images in order to configure the EAP-GTC on the endpoint:



Networks

Profile: ...ility Client\Network Access Manager\system\configuration.xml

Name: eap_gtc

Group Membership

○ In group: Local networks

● In all groups (Global)

Choose Your Network Media

○ Wired (802.3) Network

Select a wired network if the endstations will be connecting to the network with a traditional ethernet cable.

● Wi-Fi (wireless) Network

Select a WiFi network if the endstations will be connecting to the network via a wireless radio connection to an Access Point.

SSID (max 32 chars): piborowi_byod

□ Hidden Network

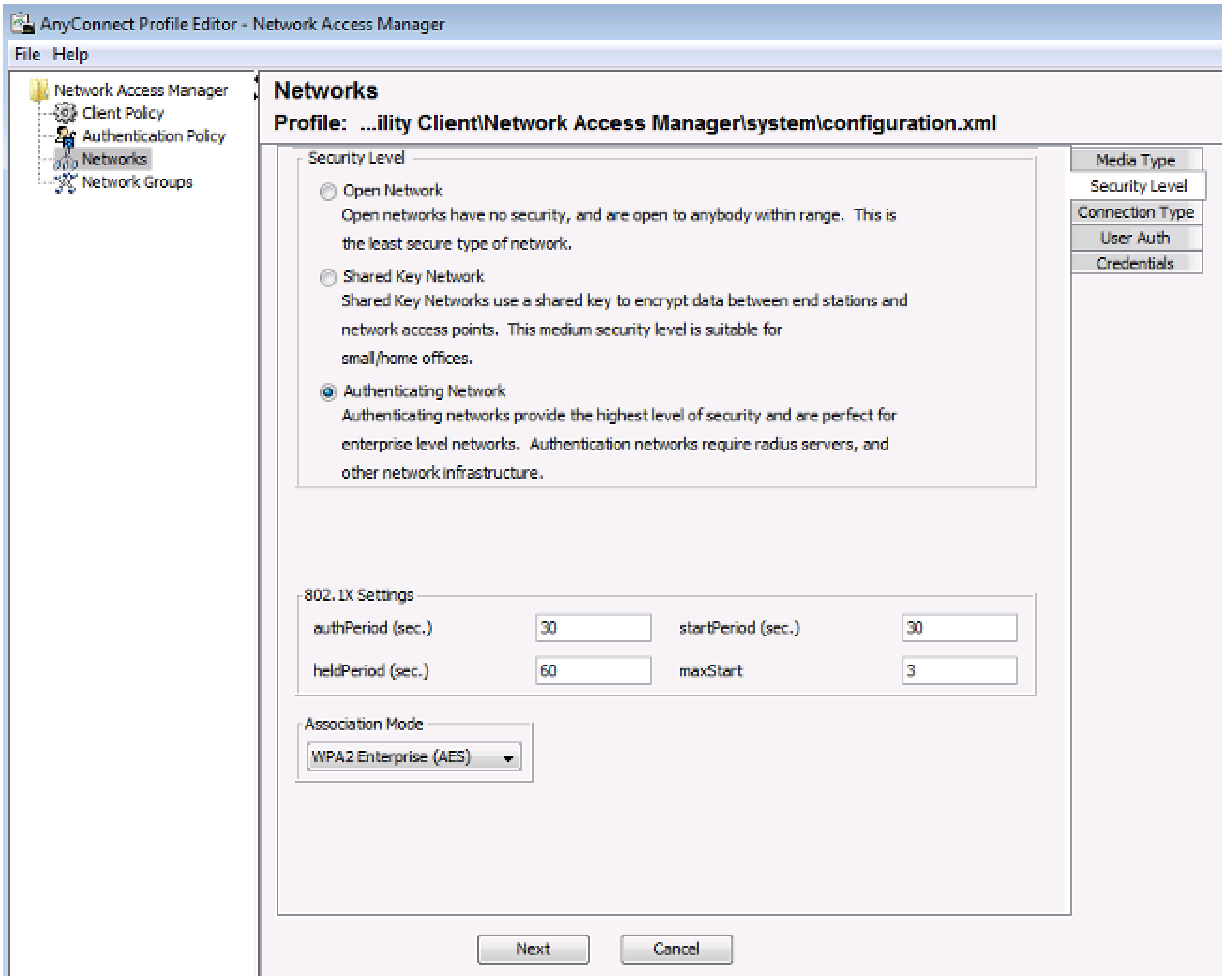
□ Corporate Network

Association Timeout 5 seconds

Common Settings

Script or application on each user's machine to run when connected.

Connection Timeout 40 seconds



AnyConnect Profile Editor - Network Access Manager

Networks

Profile: ...ility Client\Network Access Manager\system\configuration.xml

Security Level

○ Open Network
Open networks have no security, and are open to anybody within range. This is the least secure type of network.

○ Shared Key Network
Shared Key Networks use a shared key to encrypt data between end stations and network access points. This medium security level is suitable for small/home offices.

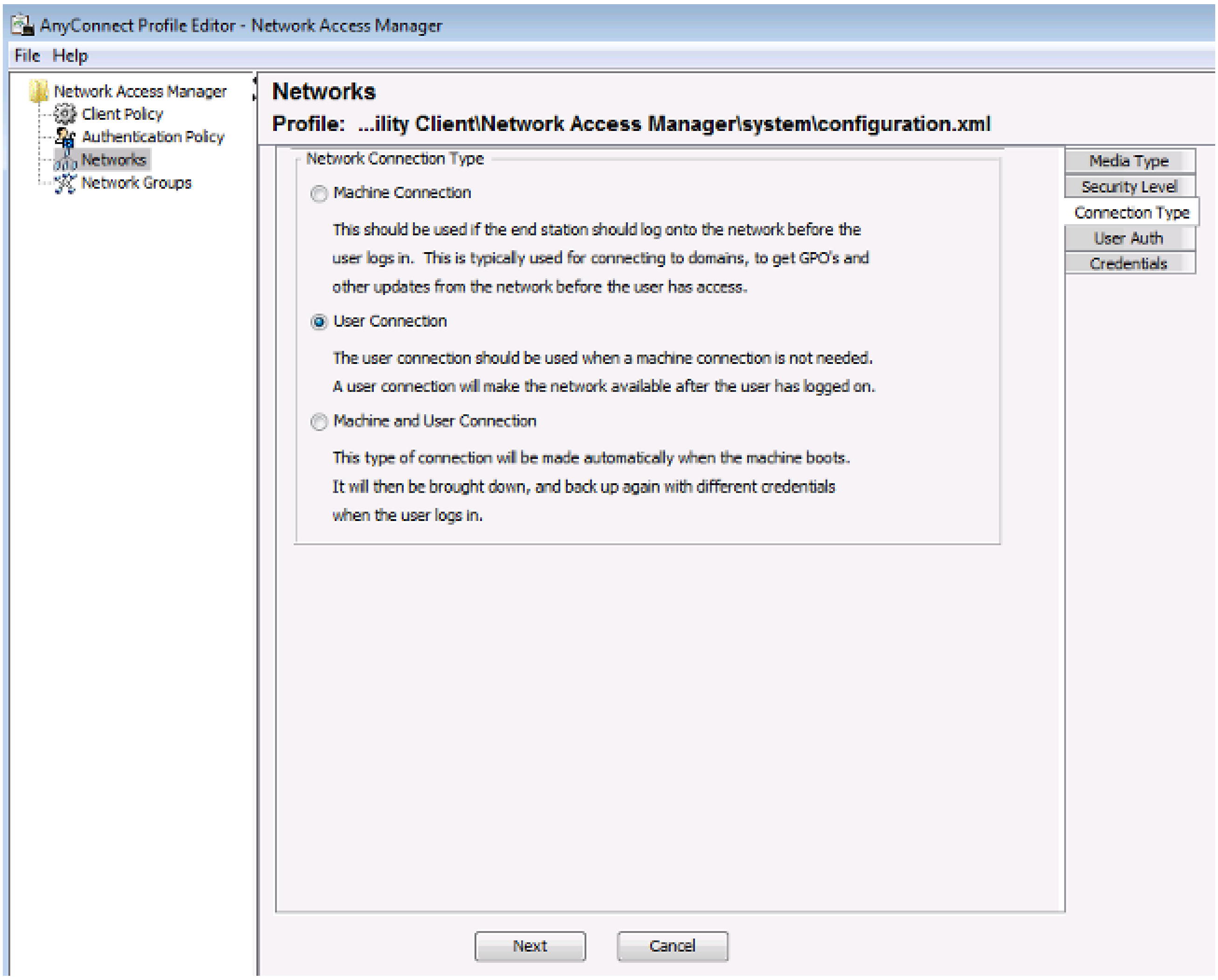
● Authenticating Network
Authenticating networks provide the highest level of security and are perfect for enterprise level networks. Authentication networks require radius servers, and other network infrastructure.

802.1X Settings

authPeriod (sec.)	30	startPeriod (sec.)	30
heldPeriod (sec.)	60	maxStart	3

Association Mode

WPA2 Enterprise (AES)



Networks

Profile: ...ility Client\Network Access Manager\system\configuration.xml

Network Connection Type

○ Machine Connection

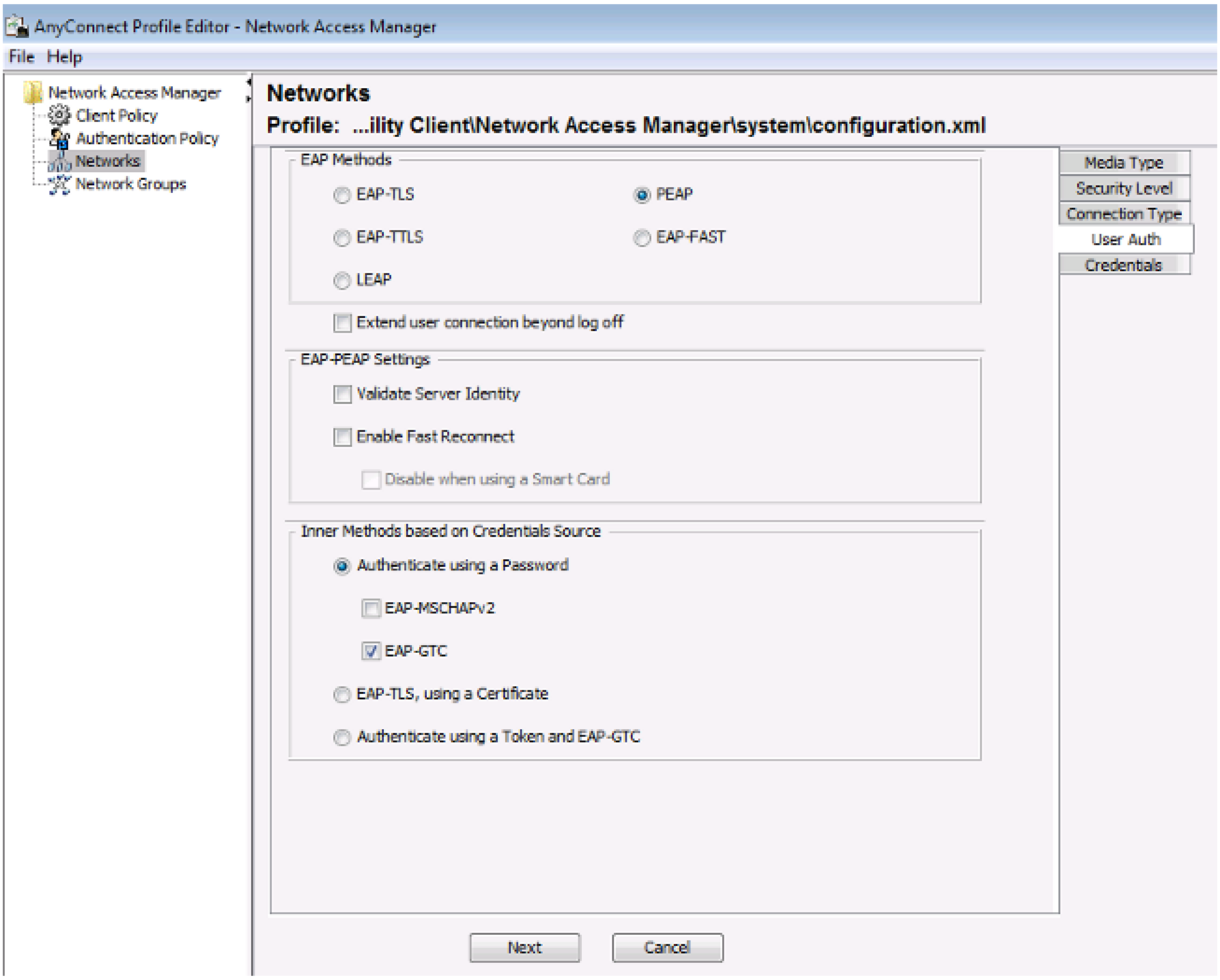
This should be used if the end station should log onto the network before the user logs in. This is typically used for connecting to domains, to get GPO's and other updates from the network before the user has access.

● User Connection

The user connection should be used when a machine connection is not needed. A user connection will make the network available after the user has logged on.

○ Machine and User Connection

This type of connection will be made automatically when the machine boots. It will then be brought down, and back up again with different credentials when the user logs in.



AnyConnect Profile Editor - Network Access Manager

Networks

Profile: ...ility Client\Network Access Manager\system\configuration.xml

EAP Methods

○ EAP-TLS ● PEAP

○ EAP-TTLS ○ EAP-FAST

○ LEAP

□ Extend user connection beyond log off

EAP-PEAP Settings

□ Validate Server Identity

□ Enable Fast Reconnect

□ Disable when using a Smart Card

Inner Methods based on Credentials Source

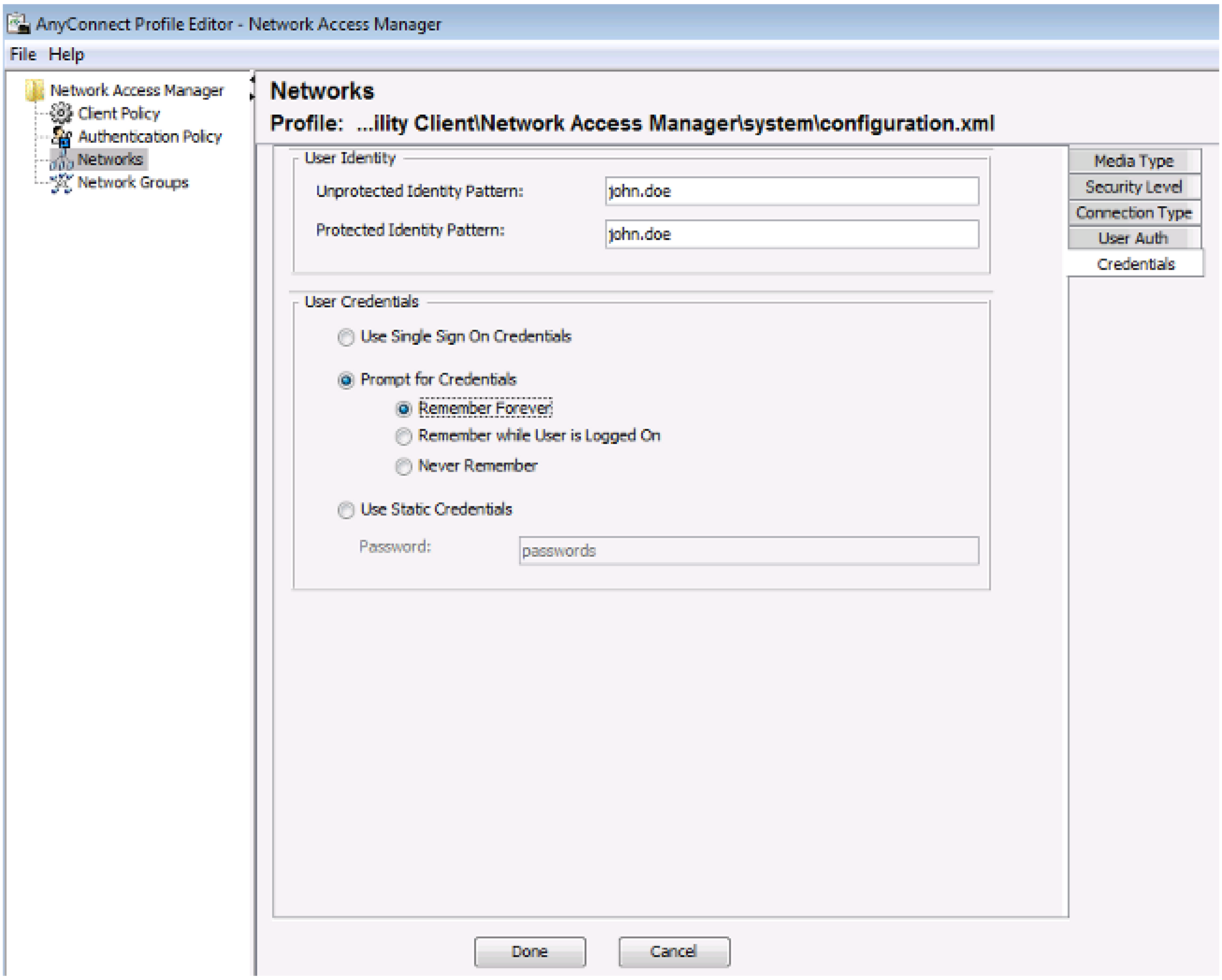
● Authenticate using a Password

□ EAP-MSCHAPv2

☑ EAP-GTC

○ EAP-TLS, using a Certificate

○ Authenticate using a Token and EAP-GTC



Networks

Profile: ...ility Client\Network Access Manager\system\configuration.xml

User Identity

Unprotected Identity Pattern: john.doe

Protected Identity Pattern: john.doe

User Credentials

○ Use Single Sign On Credentials

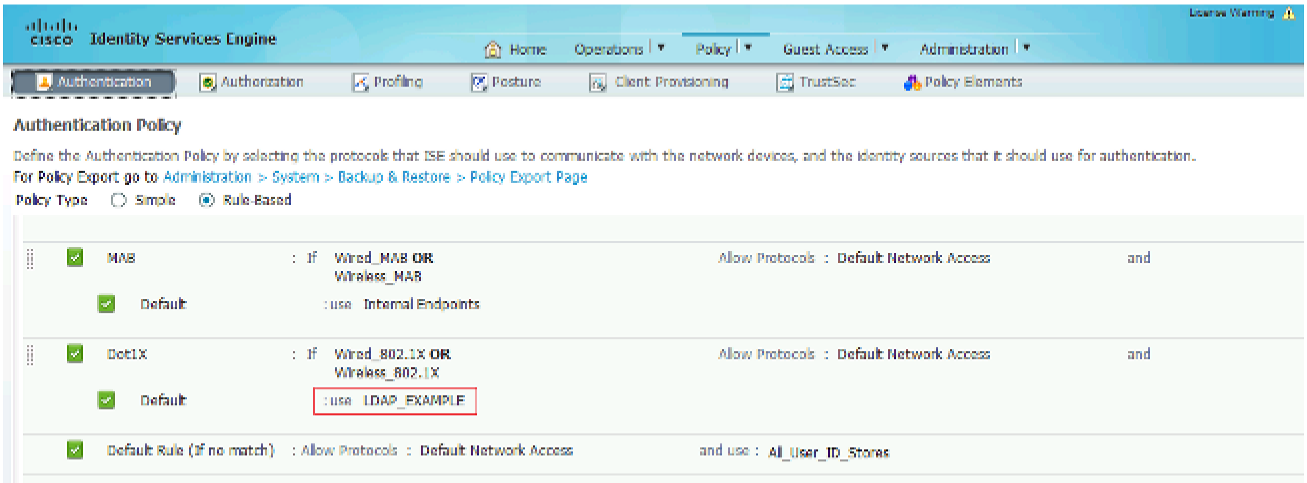
● Prompt for Credentials

- ● Remember Forever
- ○ Remember while User is Logged On
- ○ Never Remember

○ Use Static Credentials

Password: passwords

Use the information that is provided in these images in order to change the authentication and authorization policies on the ISE:



Authentication Policy

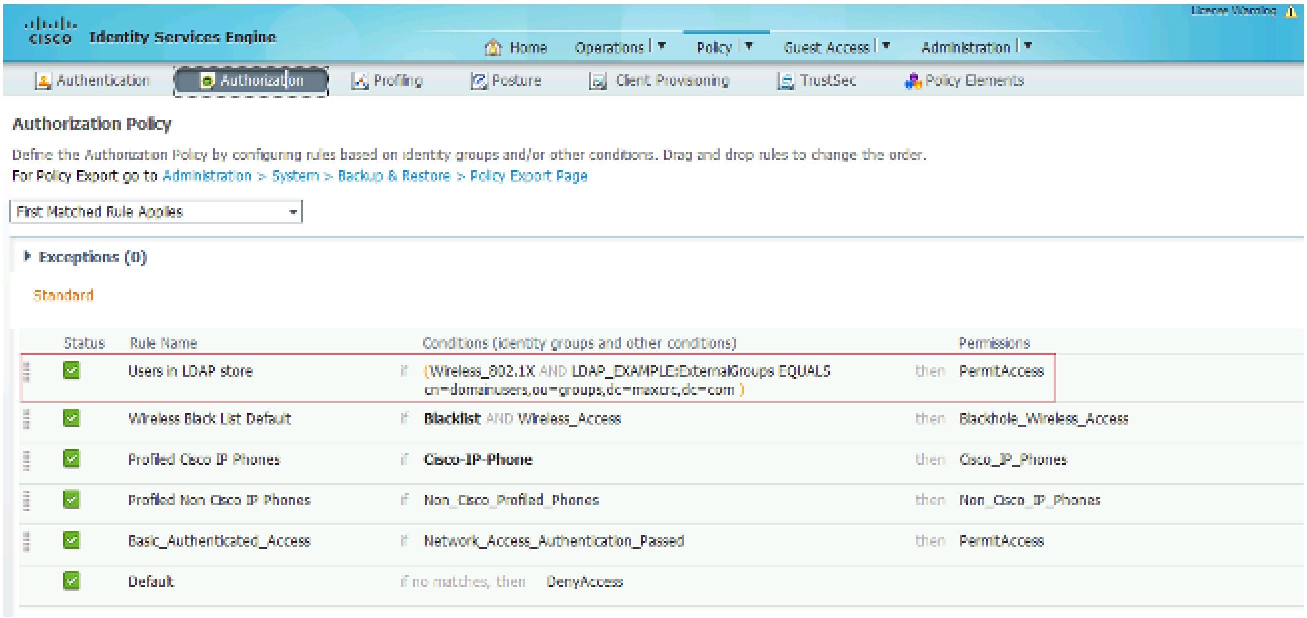
Define the Authentication Policy by selecting the protocols that ISE should use to communicate with the network devices, and the identity sources that it should use for authentication.
For Policy Export go to Administration > System > Backup & Restore > Policy Export Page

Policy Type ○ Simple ● Rule-Based

☑ MAB : If Wired_MAB OR Wireless_MAB Allow Protocols : Default Network Access and
☑ Default :use Internal Endpoints

☑ Dot1X : If Wired_802.1X OR Wireless_802.1X Allow Protocols : Default Network Access and
☑ Default :use LDAP_EXAMPLE

☑ Default Rule (If no match) : Allow Protocols : Default Network Access and use : All_User_ID_Stores



Authorization Policy

Define the Authorization Policy by configuring rules based on identity groups and/or other conditions. Drag and drop rules to change the order.
For Policy Export go to Administration > System > Backup & Restore > Policy Export Page

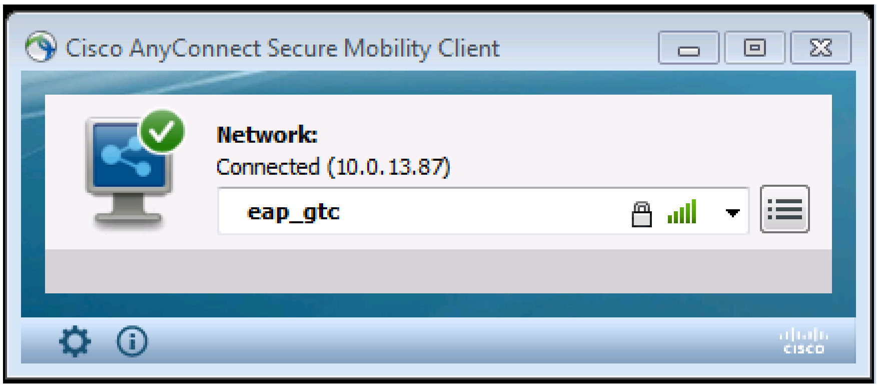
First Matched Rule Applies

▸ Exceptions (0)

Standard

Status	Rule Name		Conditions (identity groups and other conditions)		Permissions
✓	Users in LDAP store	if	(Wireless_802.1X AND LDAP_EXAMPLE:ExternalGroups EQUALS cn=domainusers,ou=groups,dc=maxcrc,dc=com)	then	PermitAccess
✓	Wireless Black List Default	if	**Blacklist** AND Wireless_Access	then	Blackhole_Wireless_Access
✓	Profiled Cisco IP Phones	if	**Cisco-IP-Phone**	then	Cisco_IP_Phones
✓	Profiled Non Cisco IP Phones	if	Non_Cisco_Profiled_Phones	then	Non_Cisco_IP_Phones
✓	Basic_Authenticated_Access	if	Network_Access_Authentication_Passed	then	PermitAccess
✓	Default	if no matches, then	DenyAccess		

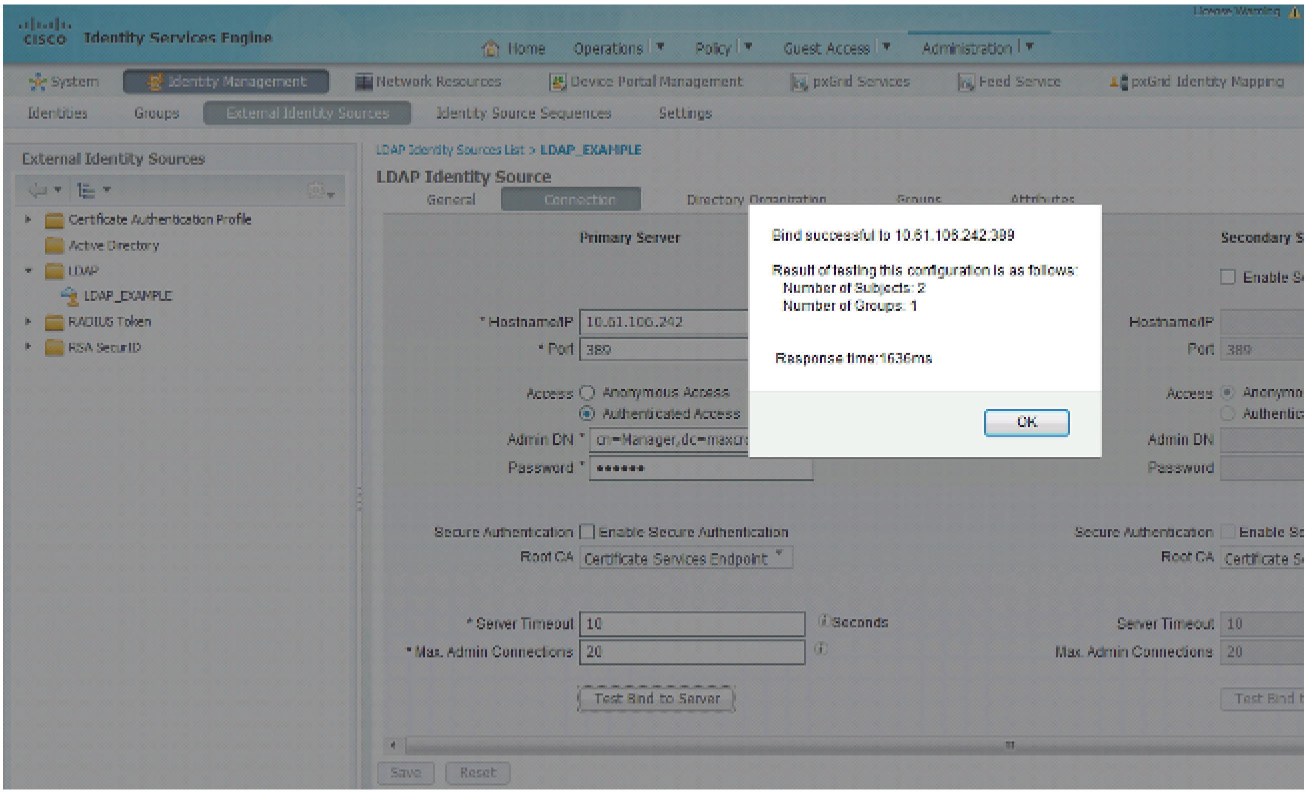
After you apply the configuration, you should be able to connect to the network:



Network:
Connected (10.0.13.87)
eap_gtc

Verify

In order to verify the LDAP and ISE configurations, retrieve the subjects and groups with a test connection to the server:



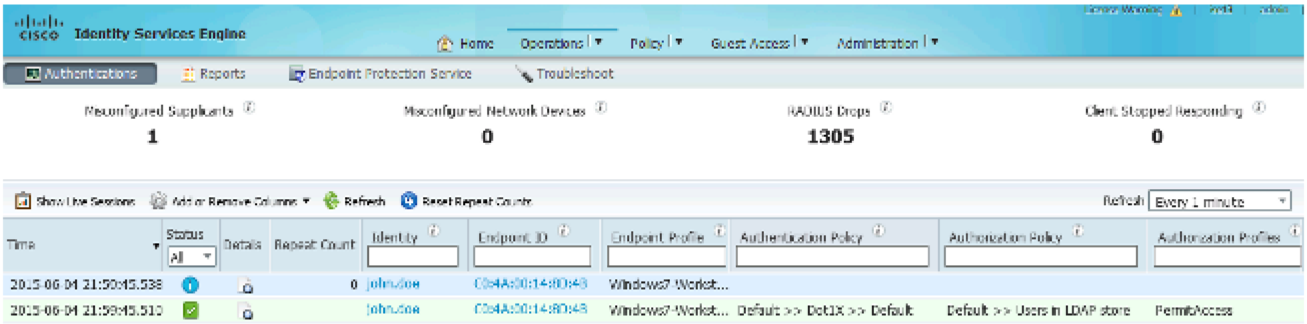
Bind successful to 10.61.106.242:389

Result of testing this configuration is as follows:
Number of Subjects: 2
Number of Groups: 1

Response time:1636ms

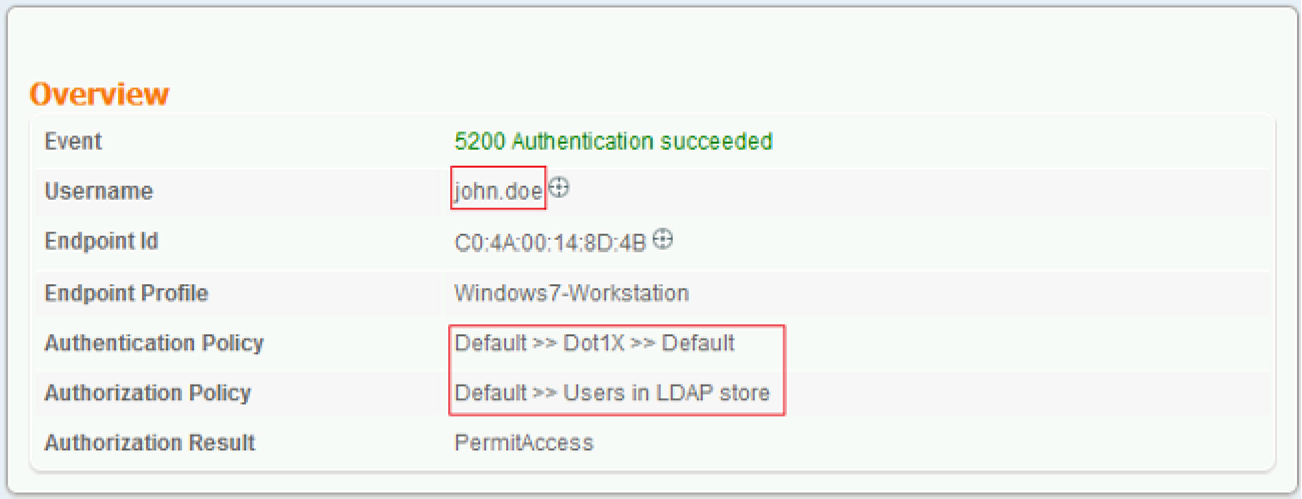
* Hostname/IP	10.61.106.242
* Port	389
Access	○ Anonymous Access ● Authenticated Access
Admin DN *	cn=Manager,dc=maxcr
Password *	••••••
Secure Authentication	□ Enable Secure Authentication
Root CA	Certificate Services Endpoint
* Server Timeout	10 Seconds
* Max. Admin Connections	20

These images illustrate a sample report from the ISE:



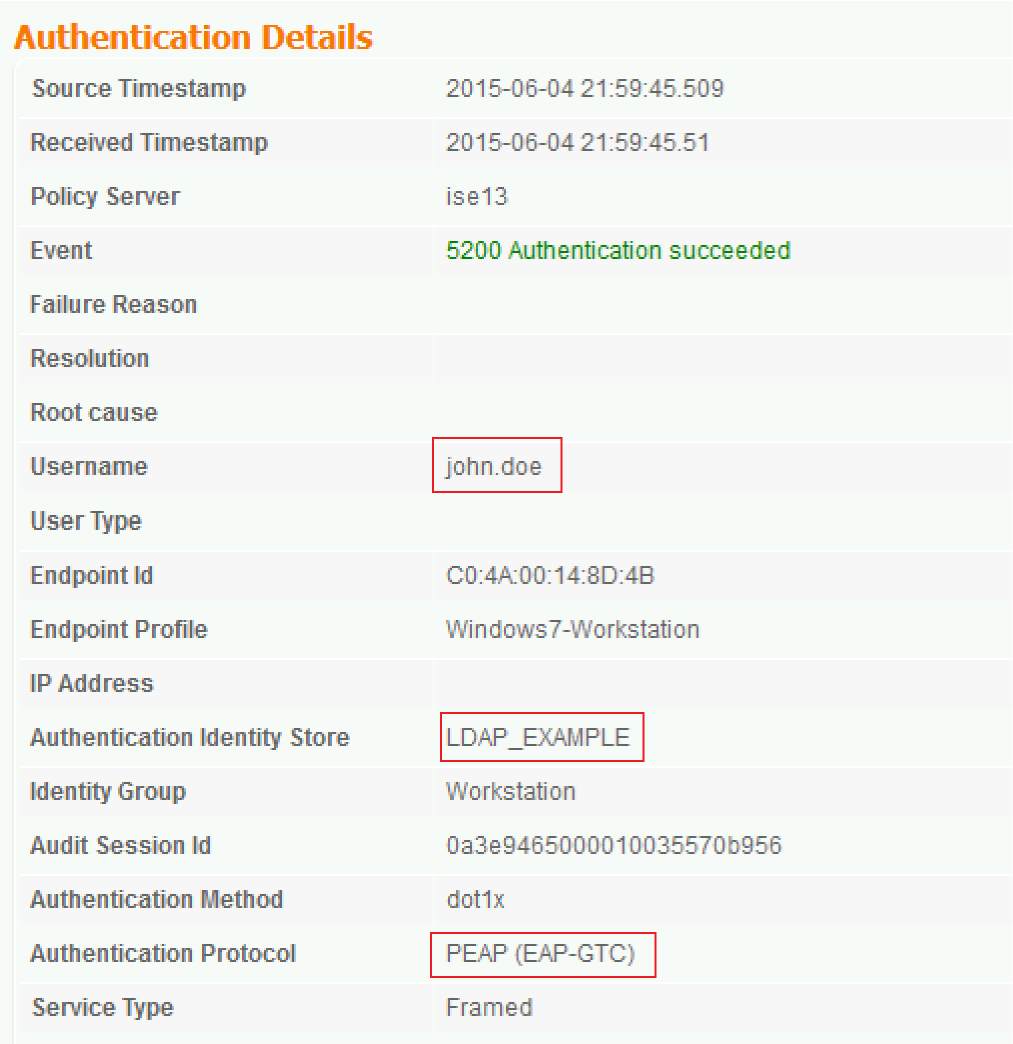
Misconfigured Supplicants	Misconfigured Network Devices	RADIUS Drops	Client Stopped Responding
1	0	1305	0

Time	Status	Details	Repeat Count	Identity	Endpoint ID	Endpoint Profile	Authentication Policy	Authorization Policy	Authorization Profiles
2015-06-04 21:59:45.538	i		0	john.doe	C0:4A:00:14:8D:4B	Windows7-Workst...			
2015-06-04 21:59:45.510	✓			john.doe	C0:4A:00:14:8D:4B	Windows7-Workst...	Default >> Dot1X >> Default	Default >> Users in LDAP store	PermitAccess



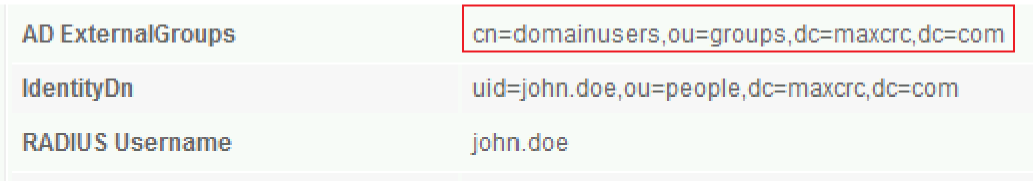
Overview

Event	5200 Authentication succeeded
Username	john.doe
Endpoint Id	C0:4A:00:14:8D:4B
Endpoint Profile	Windows7-Workstation
Authentication Policy	Default >> Dot1X >> Default
Authorization Policy	Default >> Users in LDAP store
Authorization Result	PermitAccess



Authentication Details

Source Timestamp	2015-06-04 21:59:45.509
Received Timestamp	2015-06-04 21:59:45.51
Policy Server	ise13
Event	5200 Authentication succeeded
Failure Reason	
Resolution	
Root cause	
Username	john.doe
User Type	
Endpoint Id	C0:4A:00:14:8D:4B
Endpoint Profile	Windows7-Workstation
IP Address	
Authentication Identity Store	LDAP_EXAMPLE
Identity Group	Workstation
Audit Session Id	0a3e9465000010035570b956
Authentication Method	dot1x
Authentication Protocol	PEAP (EAP-GTC)
Service Type	Framed



AD ExternalGroups	cn=domainusers,ou=groups,dc=maxcrc,dc=com
IdentityDn	uid=john.doe,ou=people,dc=maxcrc,dc=com
RADIUS Username	john.doe

Troubleshoot

This section describes some common errors that are encountered with this configuration and how to troubleshoot them:

- After installation of the OpenLDAP, if you encounter an error to indicate that a **gssapi.dll** is missing, restart Microsoft Windows.

- It might not be possible to edit the *configuration.xml* file for Cisco AnyConnect directly. Save your new configuration in another location and then use it to replace the old file.

- In the authentication report, there is this error message:

  <#root>

  ```
  Authentication method is not supported by any applicable identity store
  ```

This error message indicates that the method you picked is not supported by LDAP.

Ensure that the *Authentication Protocol* in the same report shows one of the supported methods (EAP-GTC, EAP-TLS, or PEAP-TLS).

- In the authentication report, if you notice that the subject was not found in the identity store, the user name from the report does not match the *Subject Name Attribute* for any user in the LDAP database.

In this scenario, the value was set to **uid** for this attribute, which means that the ISE looks to the *uid* values for the LDAP user when it attempts to find a match.

- If the subjects and groups are not retrieved correctly during a *bind to server* test, it is an incorrect configuration for the search bases.

Remember that the LDAP hierarchy must be specified from the leaf-to-root and *dc* (can consist of multiple words).

Tip: In order to troubleshoot EAP authentication on the WLC side, refer to the EAP Authentication with WLAN Controllers (WLC) Configuration Example Cisco document.