在9800 WLC上为本地有效证书调配配置SCEP

目录

简介

本文档介绍如何通过Windows Server 2012中的Microsoft网络设备注册服务(NDES)和简单证书注册协议(SCEP)功能为接入点(AP)加入的本地有效证书(LSC)注册配置9800无线LAN控制器(WLC)R2标准。

先决条件

为了在Windows Server上成功执行SCEP，9800 WLC必须满足以下要求：

- 控制器和服务器之间必须有可达性。
- 控制器和服务器同步到同一NTP服务器，或共享相同的日期和时区（如果CA服务器与来自AP的时间不同，则AP在证书验证和安装方面存在问题）。

Windows Server必须先启用Internet信息服务(IIS)。

要求

思科建议您了解以下技术：

- 9800无线LAN控制器版本16.10.1或更高版本。

- Microsoft Windows Server 2012标准版。
- 私钥基础设施(PKI)和证书。

使用的组件

本文档中的信息基于以下软件和硬件版本：

- 9800-L WLC软件版本17.2.1。
- Windows Server 2012标准版R2。
- 3802接入点。

> **注意**：本文档中的服务器端配置特别是WLC SCEP，有关其他增强功能、安全性和证书服务器配置，请参阅Microsoft TechNet。

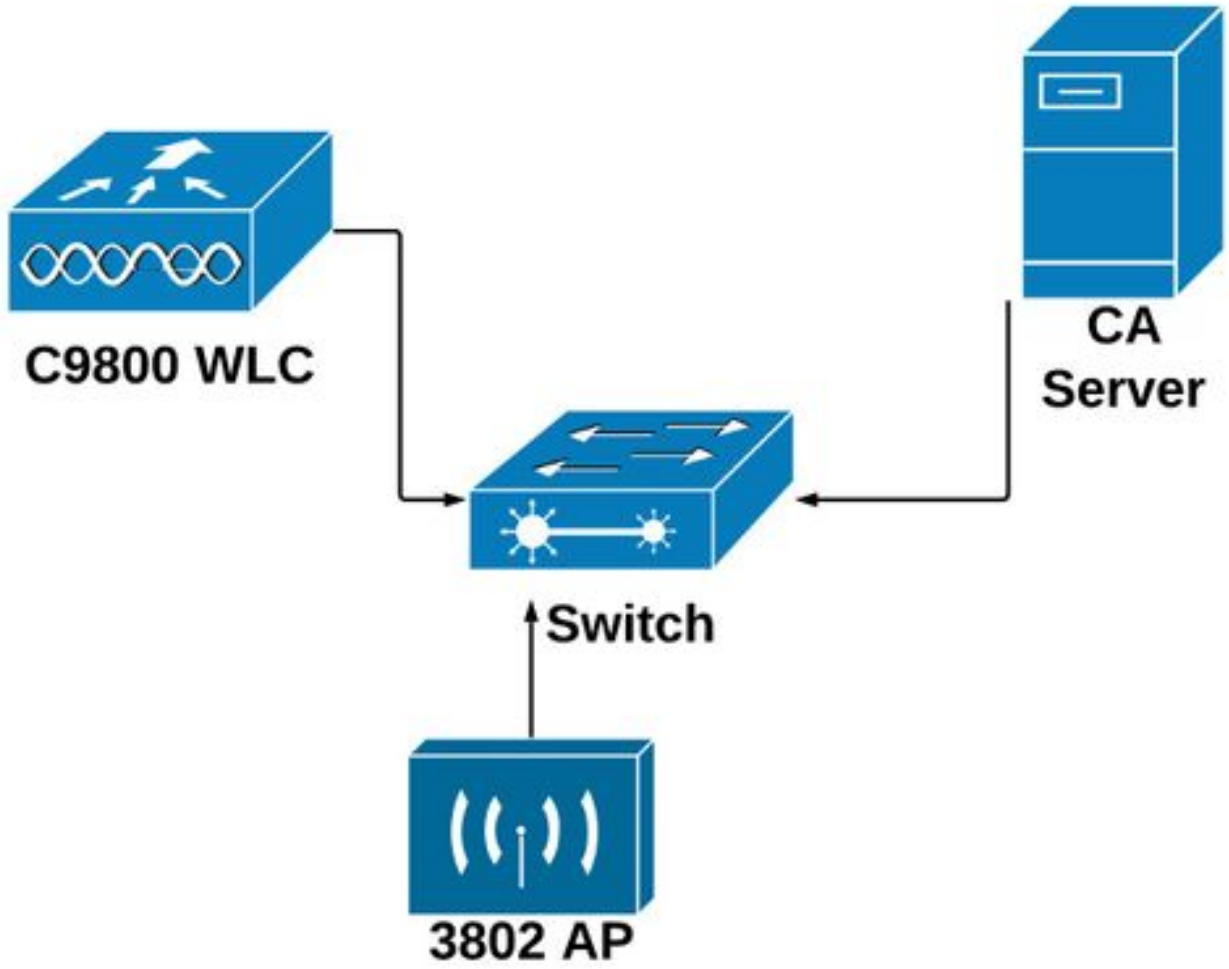
背景信息

新的LSC证书(证书颁发机构(CA)根证书和设备证书)必须安装在控制器上，才能最终在AP中下载。使用SCEP时，CA和设备证书从CA服务器接收，随后自动安装在控制器中。

为AP调配LSC时，会发生相同的认证过程；为此，控制器充当CA代理并帮助获取由CA为AP签名的证书请求（自生成）。

配置

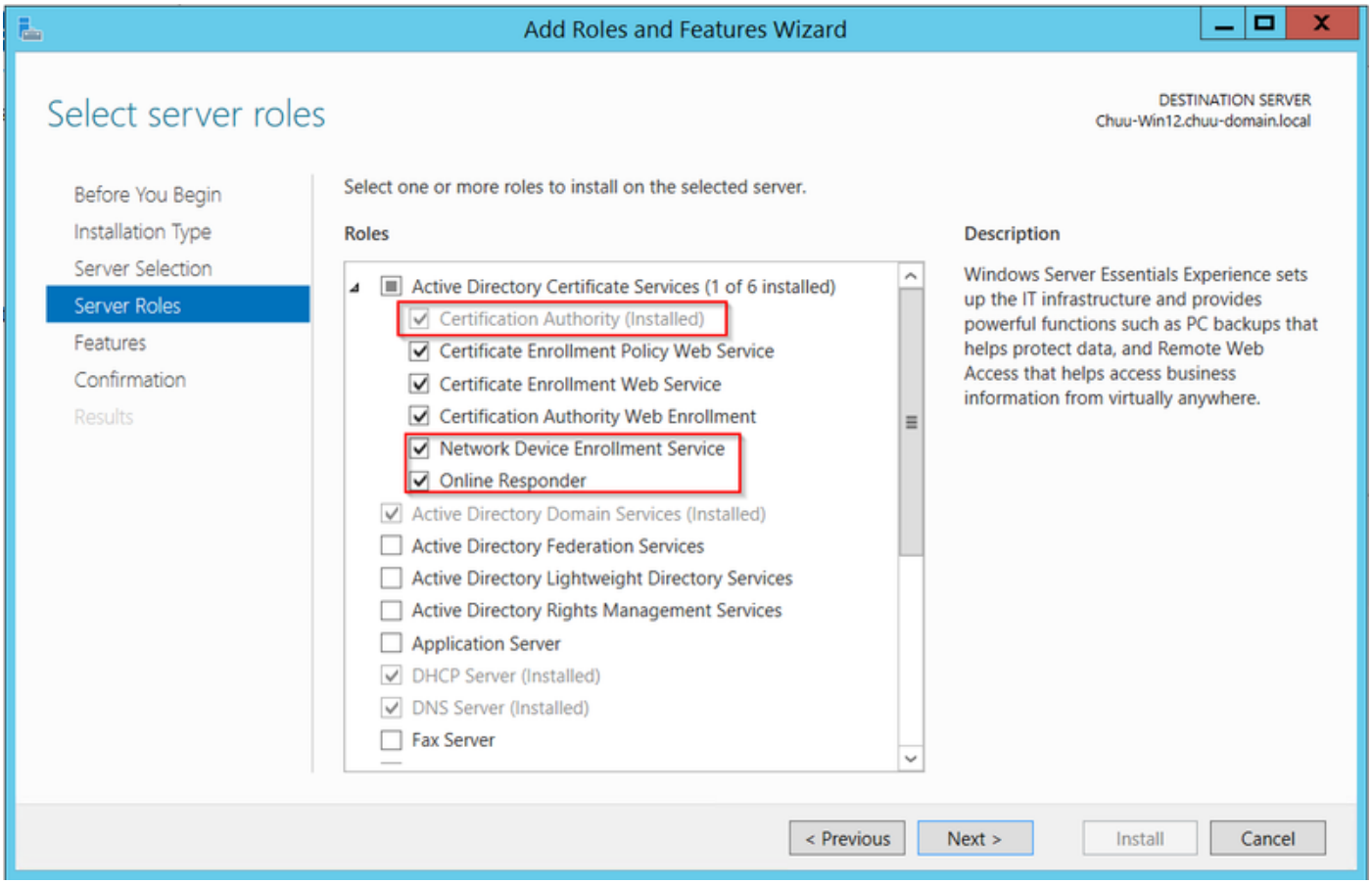
网络图



在Windows服务器中启用SCEP服务

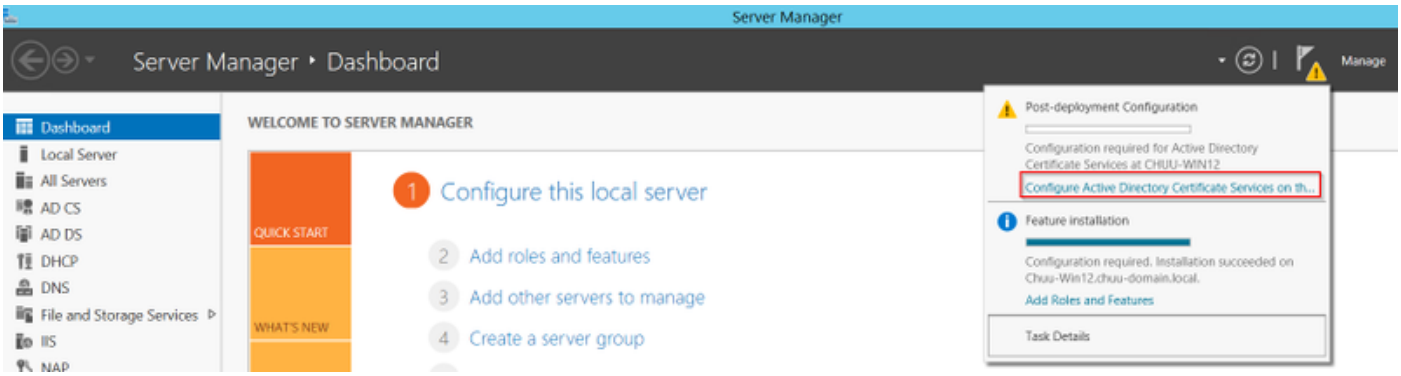
步骤1.在Server **Manager应**用程序中，选择**Manage**菜单，然后选择Add Roles and Features **选项以打开Add Roles and Features Configuration Wizard。**从中，选择用于SCEP服务器注册的服务器实例。

步骤2.验证是否已选择 Certification Authority、Network Device Enrollment Service**和**Online Responder功能，然后选择“下一步”:



步骤3.选择**"下**一步"两次，**然后**选择"完成"结束配置向导**。**等待服务器完成功能安装过程，然后选择"关闭"**以关**闭向导。

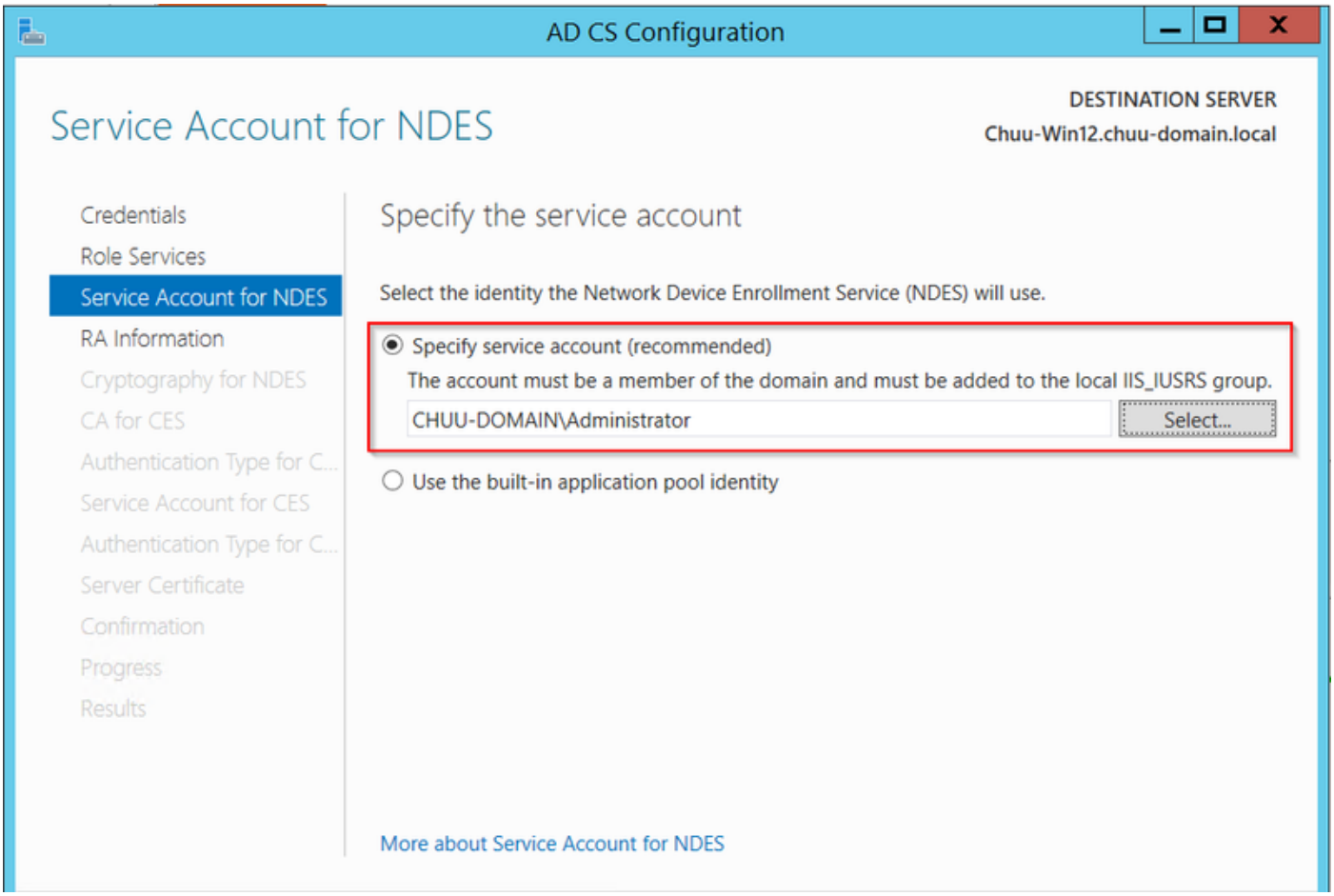
步骤4.安装完成后，"服务器管理器通知"图标中会显示警告图标。选择它并选择在目标服**务器上配置Active Directory服务选项**链接以启动**AD CS配置向**导菜单。



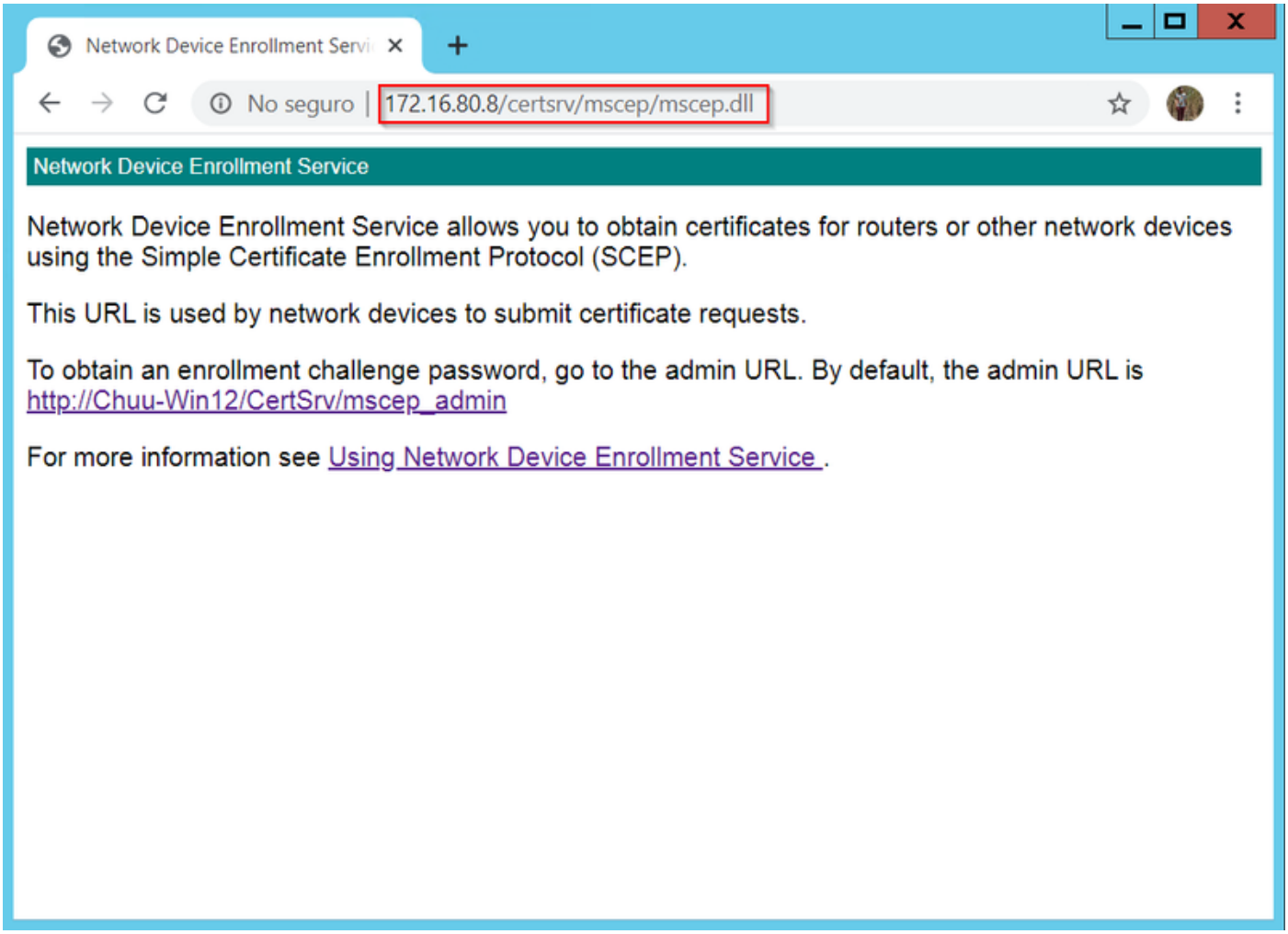
步骤5.在菜**单中选择**Network Device Enrollment Service和**Online Responder**角色服务，然后选择**Next**。

第6步。在NDES的**服务帐户中**，选择内置应用程序池或服务帐户之间的选项，然后选择**下一步**。

注意：如果服务帐户，请确保该帐户是IIS_IUSRS组**的一**部分。



步骤7.为下一屏幕选择“下一步”，然后让安装过程完成。安装后，SCEP URL可用于任何Web浏览器。导航至URL http://**<server ip>/certsrv/mscep/mscep.dll**，以验证服务是否可用。



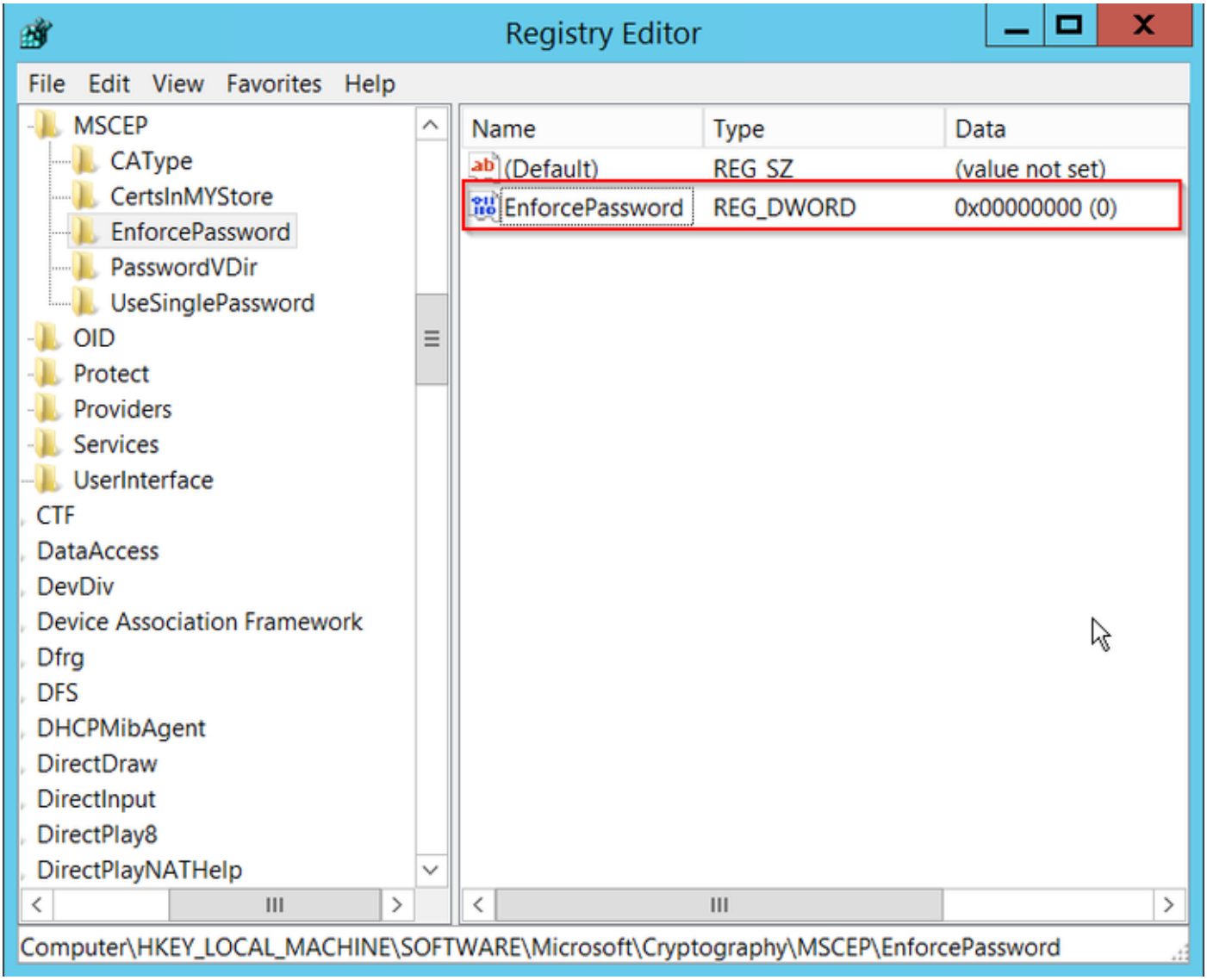
禁用SCEP注册质询密码要求

默认情况下，Windows Server在Microsoft SCEP(MSCEP)中注册之前使用动态质询密码对客户端和终端请求进行身份验证。 这要求管理员帐户浏览到Web GUI为每个请求生成按需密码（该密码必须包含在请求中）。控制器无法将此密码包含在它发送到服务器的请求中。要删除此功能，需要修改NDES服务器上的注册表项：

步骤1.打开注册表编辑器，在“开始”**菜单**中搜索**注册表**编辑。

步骤2.导航到**Computer > HKEY_LOCAL_MACHINE > SOFTWARE > Microsoft > Cryptography > MSCEP > EnforcePassword**

步骤3.将**EnforcePassword**值更改为0。如果已为0，则保留原样。



配置证书模板和注册表

证书及其关联密钥可在多个场景中使用，以用于CA服务器内应用策略定义的不同用途。应用策略存储在证书的扩展密钥使用(EKU)字段中。验证器会分析此字段，以验证客户端是否将其用于预期用途。要确保将正确的应用策略集成到WLC和AP证书，请创建正确的证书模板并将其映射到NDES注册表：

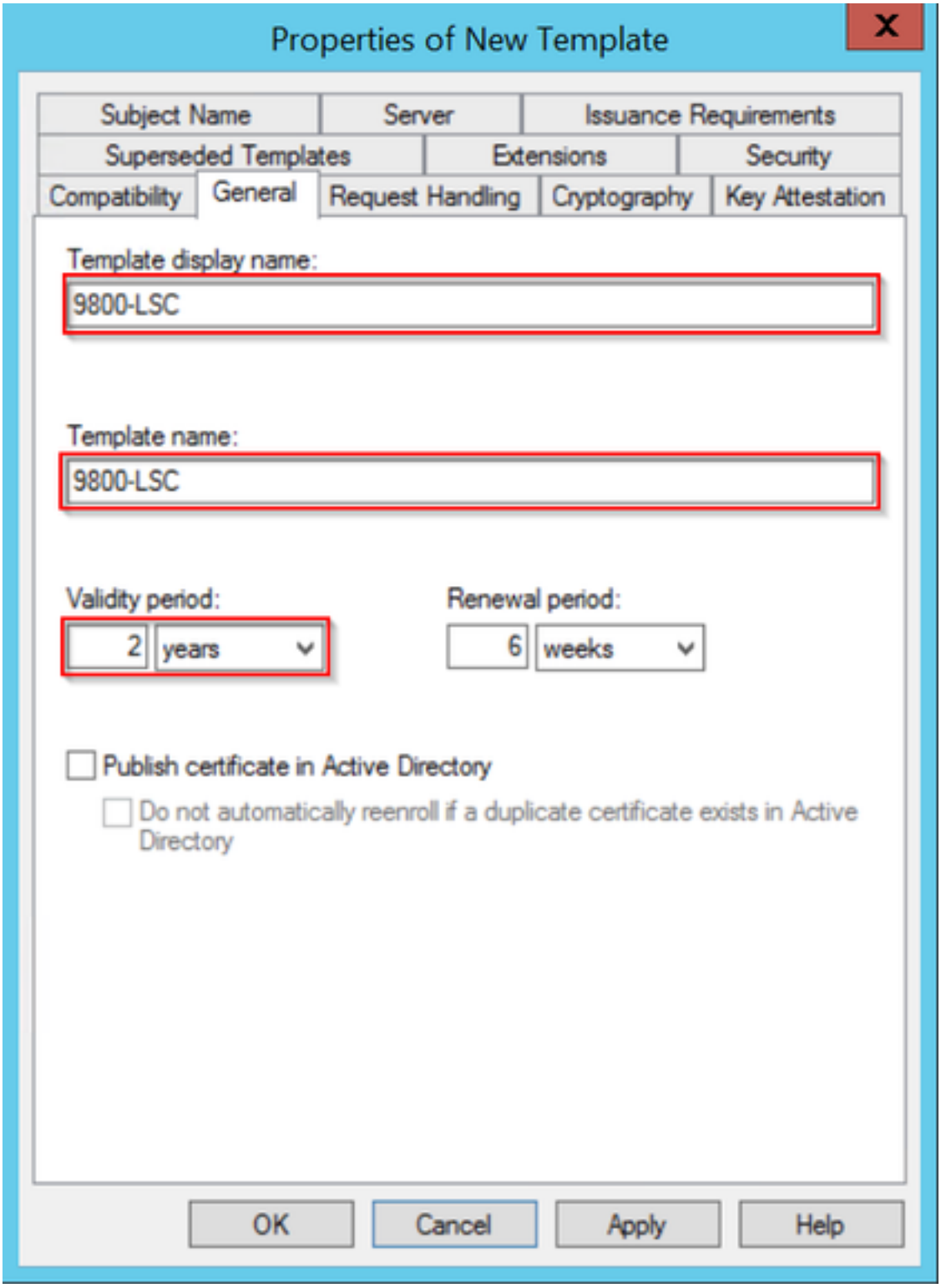
步骤1.导航至“开**始”>“管理工具”>“证书颁发机**构”。

步骤2.展开CA Server文件夹树，右键单击Certificate Templates文件夹**，然**后选择**Manage**。

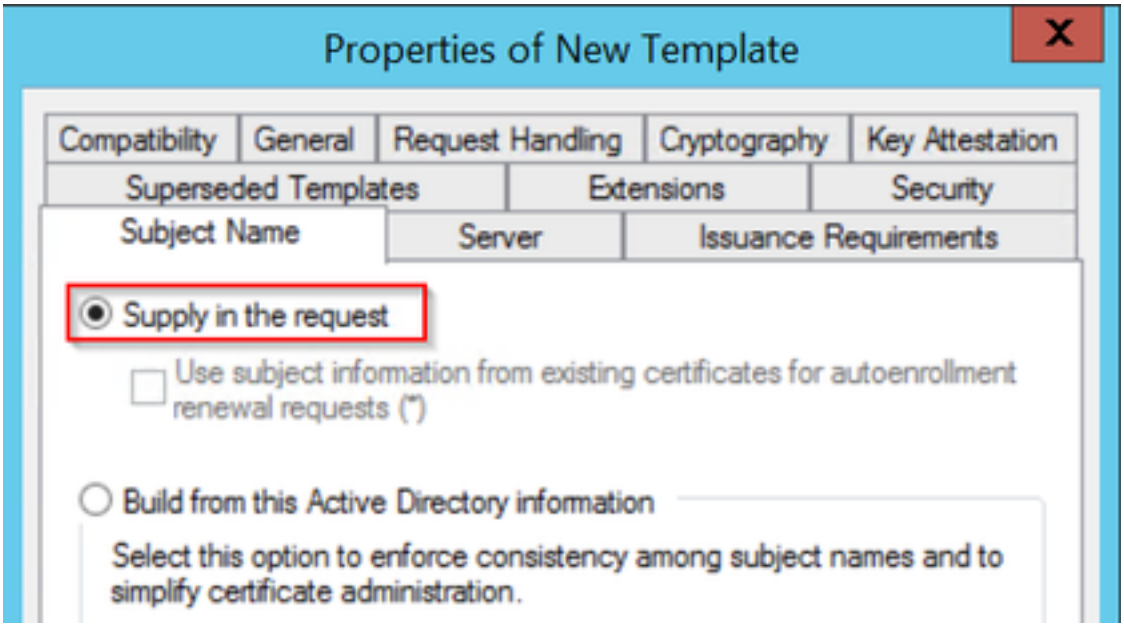
步骤3.右键单击“用户”**证**书模板，然后在上**下文菜**单中选择“复制模板”。

步骤4.导航至“**常**规”选项卡，根据需要更改模板名称和有效期，使所有其它选项保持未选中状态。

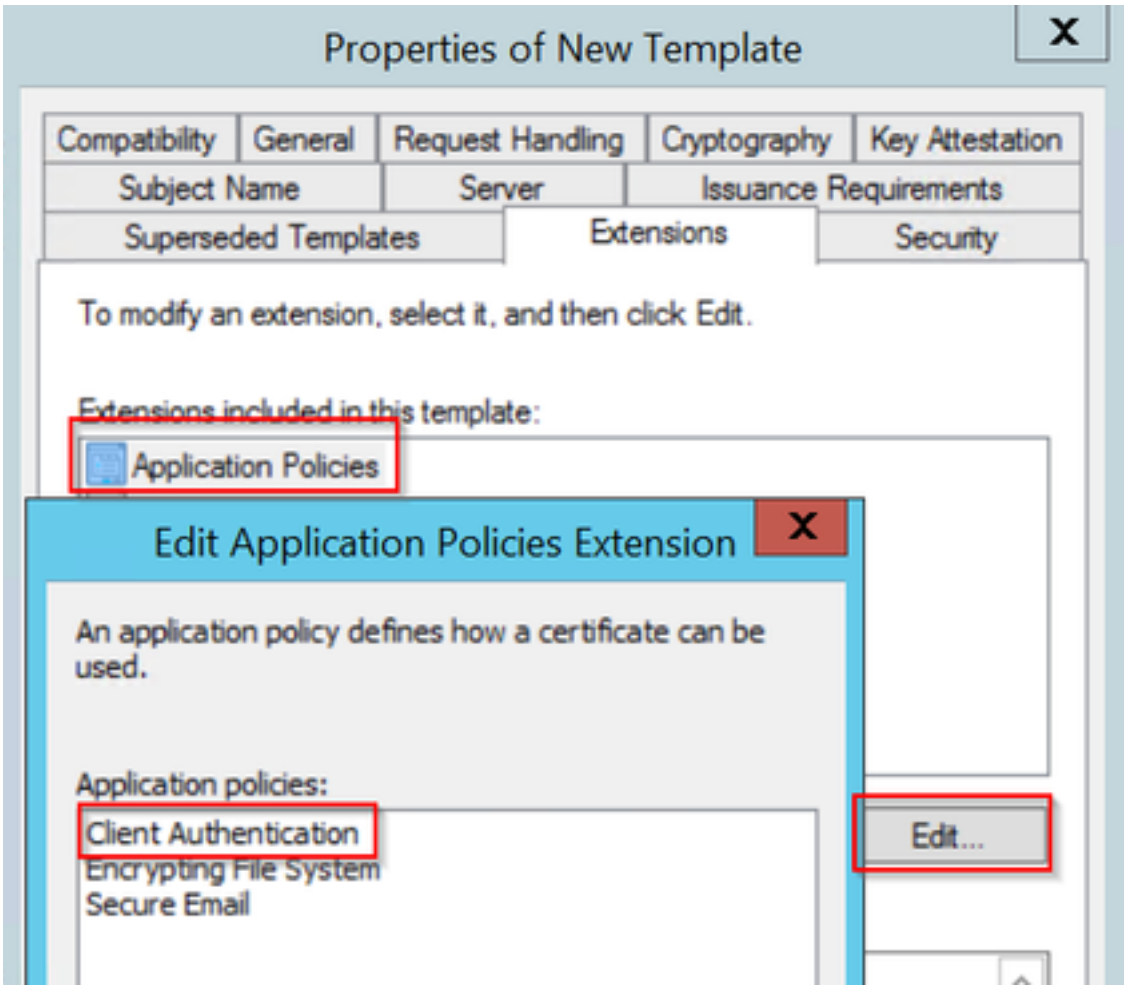
警告：当有效期被修改时，请确保其不超过证书颁发机构根证书的有效性。



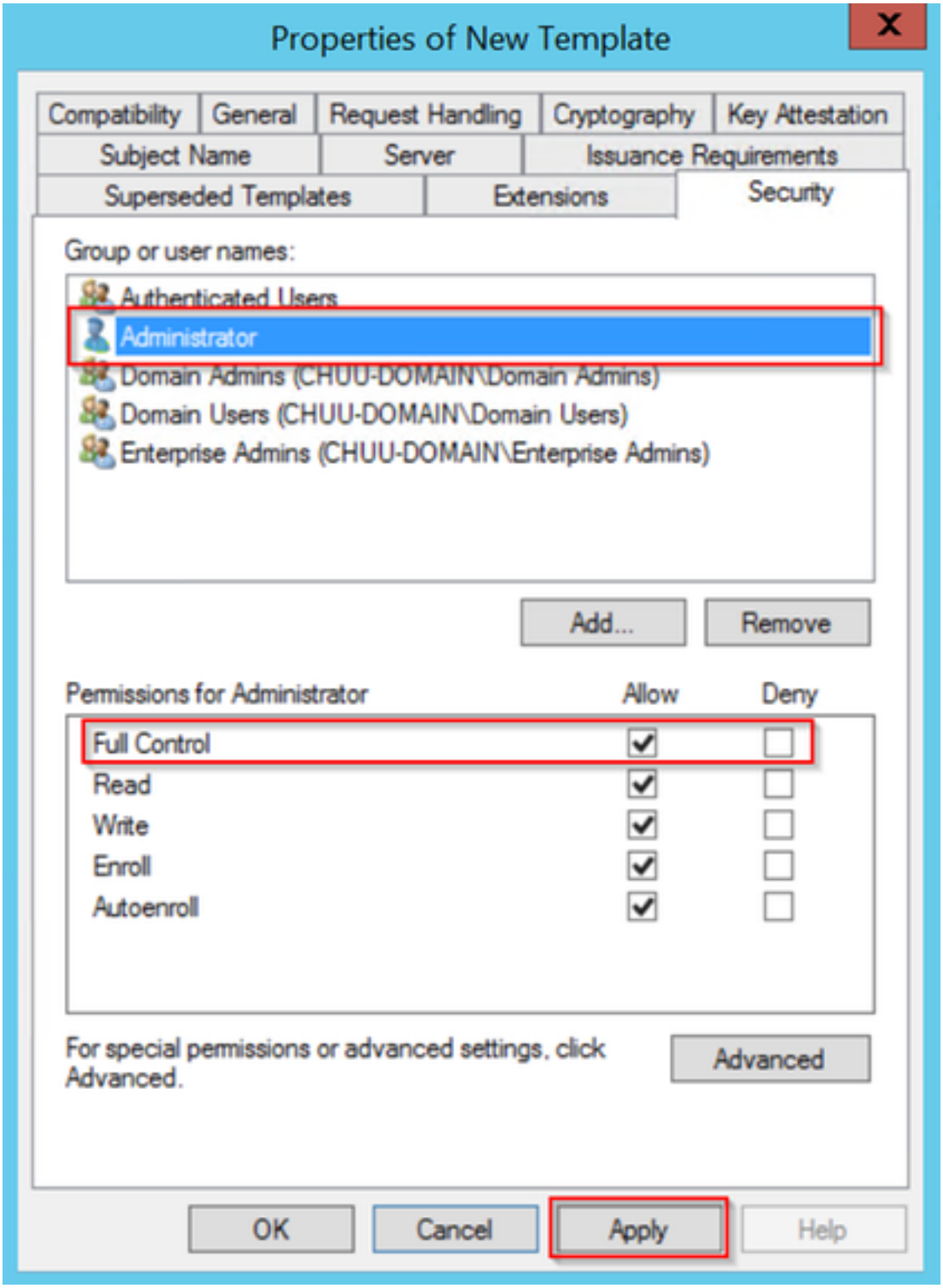
步骤5.定位至“主题**名称**”选项卡，确**保选中“请求**中的供应”。系统将显示一个弹出窗口，指示用户无需管理员批准即可获得其证书签名，请选择**OK**。



步骤6.导航至“扩**展**”选项卡，然后选择“应**用策**略”选项并选**择“编辑……**”按钮。确保“**客户端身**份验证”在**“应用策略**”窗口；否则，选择Add并添加。



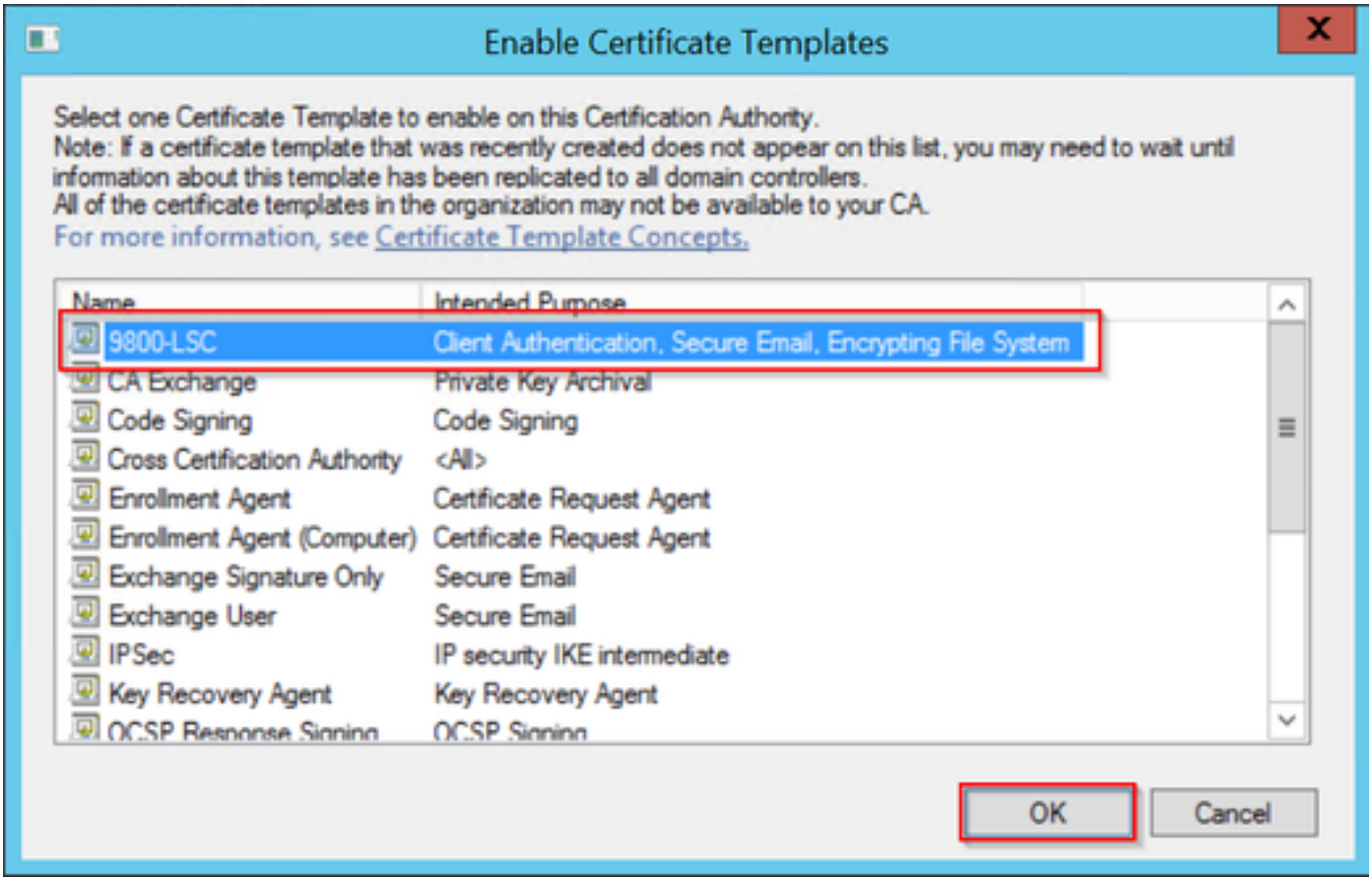
步骤7.导航至“安全”选项卡，确保在Windows Server中启用SCEP服务的步骤6中定义的服务帐户具有模板的完全控制权限，然后选择“应用”和“**确定”**。



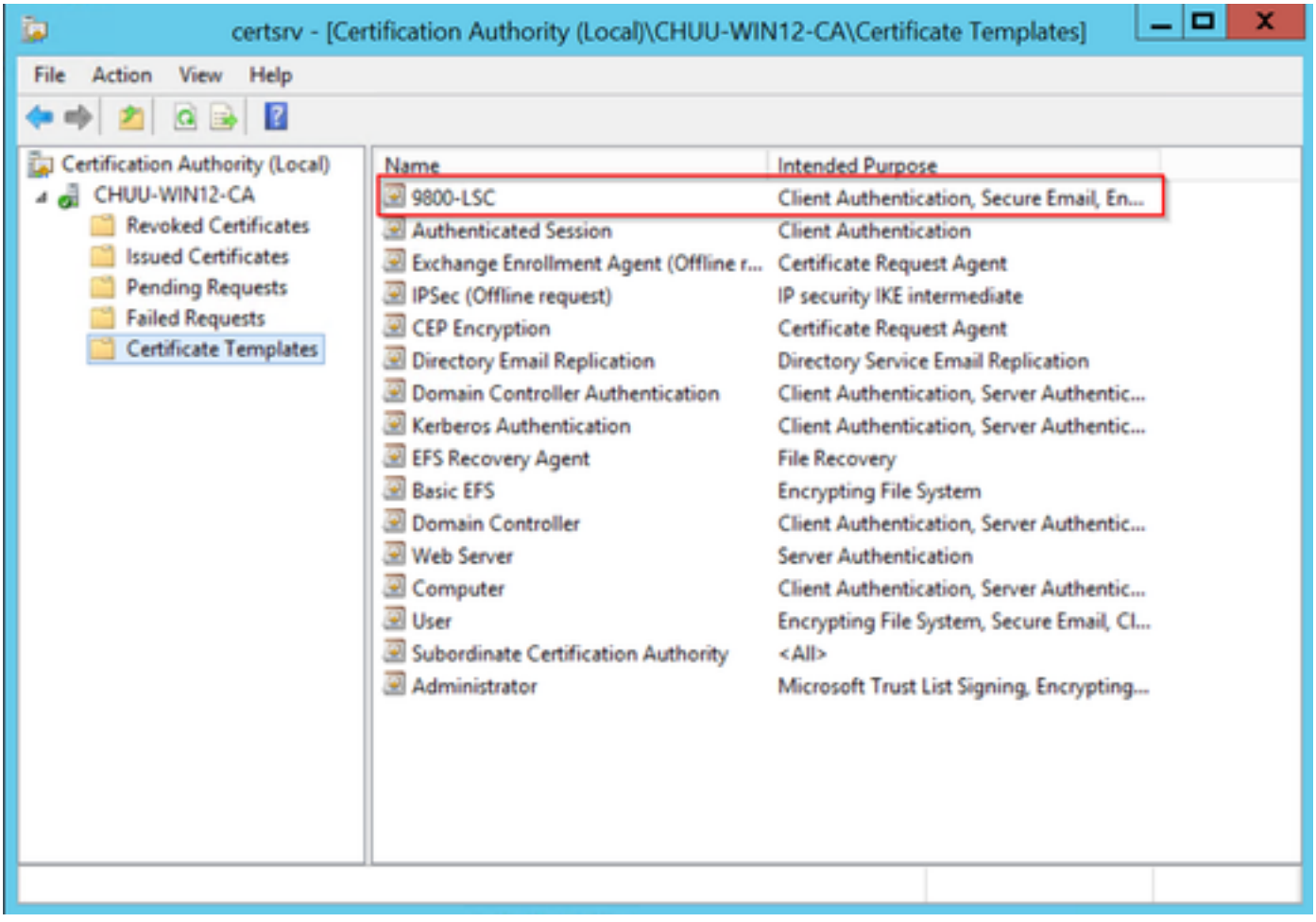
步骤8.返回“证**书颁发**机构”窗口，右键单击“证书模**板”文**件夹，然后选**择“新建”>“要颁发的证书模板**”。

步骤9.选择之前创建的证书模板（在本例中为9800-LSC），然后选择**OK**。

> **注意：**新创建的证书模板可能需要更长的时间才能在多个服务器部署中列出，因为它需要在所有服务器中复制。



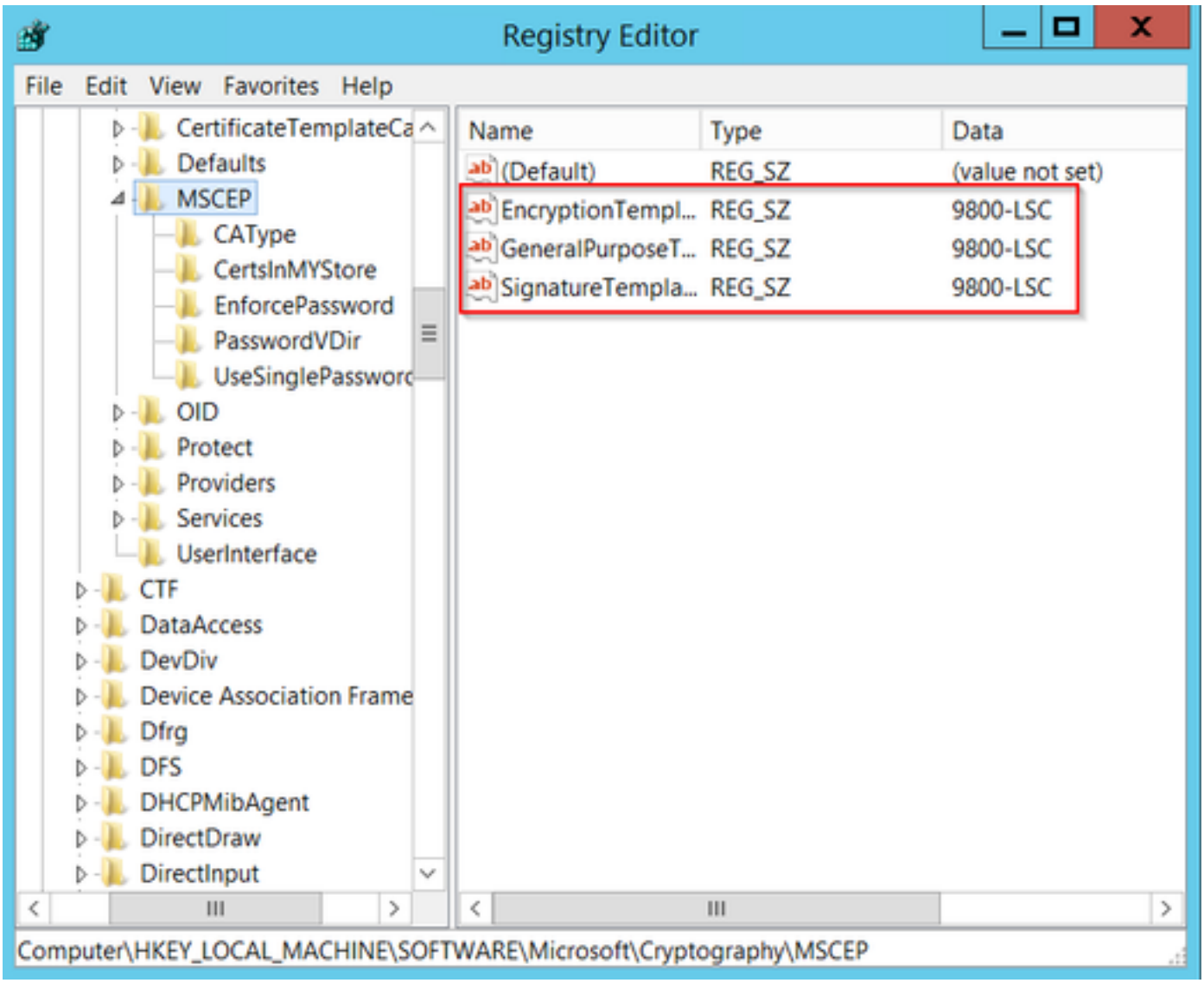
新证书模板现在列在“证书模板”(Certificate Templates)**文件夹**内容中。



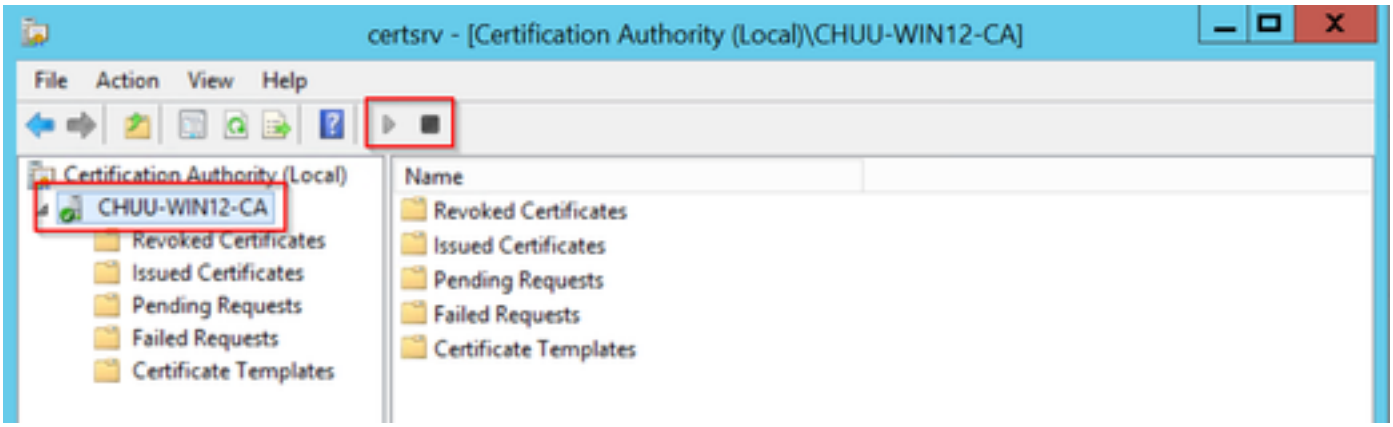
步骤10.返回到“注**册表编**辑器”窗口，然**后导航到“计算机”>** HKEY_LOCAL_MACHINE **>“软件**

">“Microsoft”>“加密”>“MSCEP”。

步骤11.编辑EncryptionTemplate、GeneralPurposeTemplate和SignatureTemplate注册表，使其指向新创建的证书模板。



步骤12.重新启动NDES服务器，因此返回“证书颁发机构”窗口，在服务器名称上选择，然后轻松选择**停止和播放按钮。**



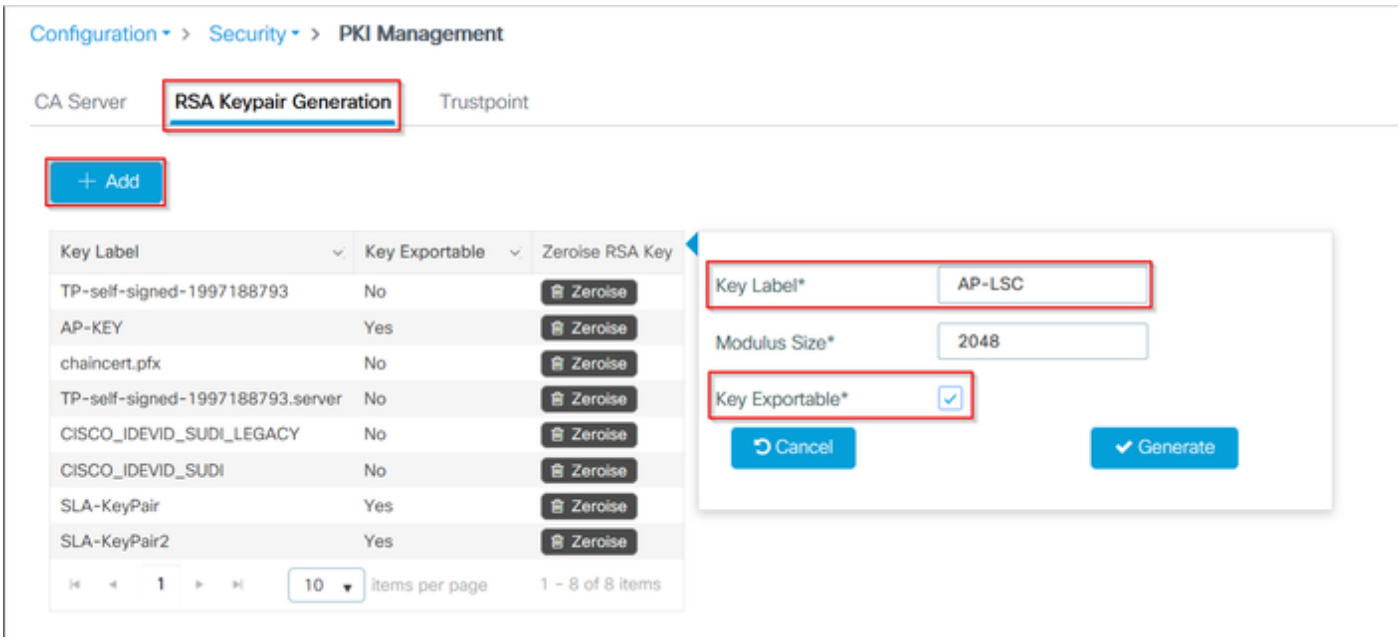
配置9800设备信任点

控制器需要定义信任点以在AP调配后对其进行身份验证。信任点包括9800设备证书，以及从同一

CA服务器（本例中为Microsoft CA）获取的CA根证书。 要在信任点中安装证书，它必须包含主题属性以及与其关联的一对RSA密钥。配置通过网络界面或命令行执行。

步骤1.导航至**Configuration > Security > PKI Management**并选择**RSA Keypair Generation选**项卡。选择**+ Add按**钮。

步骤2.定义与密钥对关联的标签，并确保选中“可导**出”**复选框。



步骤1和步骤2的CLI配置，在本配置示例中，密钥对是使用标签AP-LSC和模数大小2048位生成的：

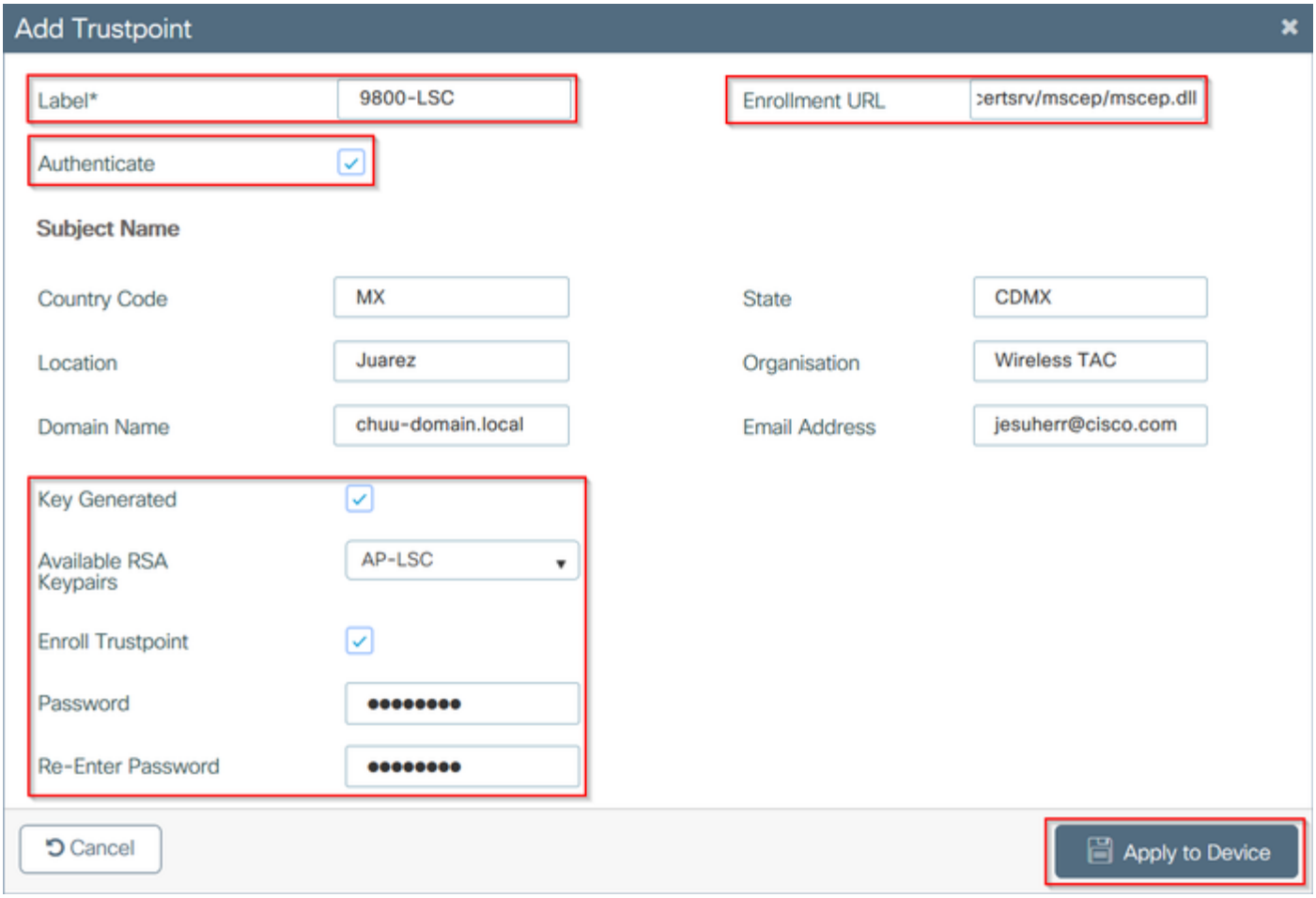
```
9800-L(config)#crypto key generate rsa exportable general-keys modulus


The name for the keys will be: AP-LSC

% The key modulus size is 2048 bits
% Generating 2048 bit RSA keys, keys will be exportable...
[OK] (elapsed time was 1 seconds)
```

步骤3.在同一部分中，选择Trustpoint选**项**卡，然后选择**+ Add按**钮。

步骤4.使用设备信息填写信任点详细信息，然后选择“应**用到设备”**：

- **标签**字段是与信任点关联的名称
- 对于**注册URL**，请使用“在Windows服务器中启**用SCEP服务”部分步骤7中定**义的
- 选中**Authenticate**复选框，以便下载CA证书
- “**域名”**字段被置为证书请求的公用名称属性
- 选中**Key Generated**复选框，下拉菜单显示，选择步骤2中生成的密钥对
- 选中Enroll **Trustpoint复选框**，两个密码字段显示；键入密码。这用于将证书密钥与设备证书和CA证书链接

  警告：9800控制器不支持多层服务器链进行LSC安装，因此根CA必须是签署来自控制器和AP的证书请求的CA。



步骤3和4的CLI配置：

警告：主题名称配置行必须采用LDAP语法格式，否则控制器不接受它。

```
9800-L(config)#crypto pki trustpoint
```

```
9800-L(ca-trustpoint)#enrollment url http://
```

```
9800-L(ca-trustpoint)#subject-name C=
```

```
9800-L(ca-trustpoint)#rsakeypair
```

```
9800-L(ca-trustpoint)#revocation-check none
9800-L(ca-trustpoint)#exit
```

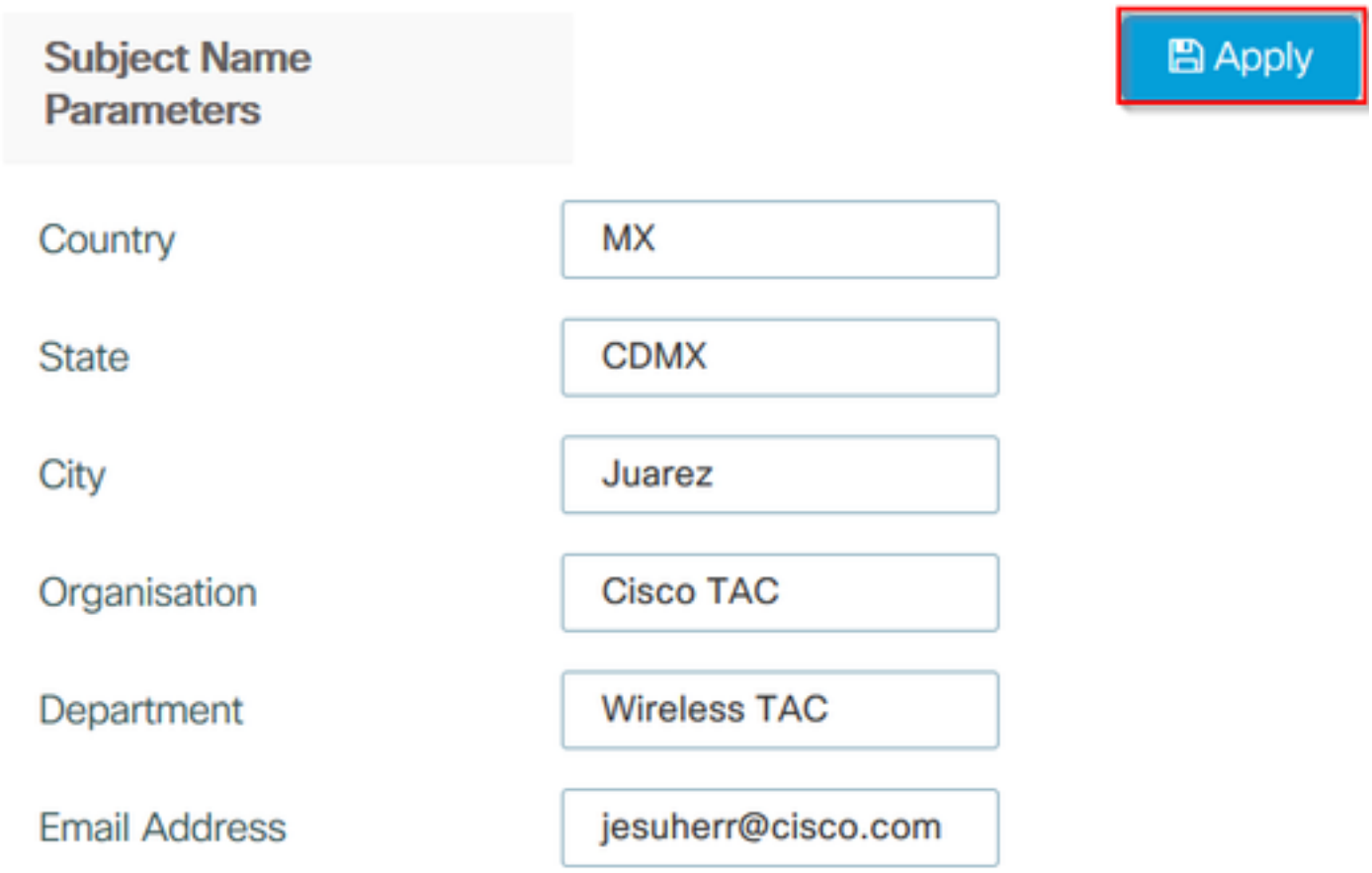
```
9800-L(config)#crypto pki authenticate

Certificate has the following attributes:
       Fingerprint MD5: E630EAE6 FB824658 690EB0F5 638D7224
      Fingerprint SHA1: 97070ACD CAD03D5D 0C1A6085 19992E0D 6B8C4D8B

% Do you accept this certificate? [yes/no]: yes
Trustpoint CA certificate accepted.
9800-L(config)#crypto pki enroll <trustpoint name>
%
% Start certificate enrollment ..
% Create a challenge password. You will need to verbally provide this
   password to the CA Administrator in order to revoke your certificate.
   For security reasons your password will not be saved in the configuration.
   Please make a note of it.

Password:
Re-enter password:

% The subject name in the certificate will include: C=MX, ST=CDMX, L=Juarez, O=Wireless TAC,
CN=9800-L.chuu-domain.local/emailAddress=jesuherr@cisco.com
% The subject name in the certificate will include: 9800-L.alzavala.local
% Include the router serial number in the subject name? [yes/no]: no
% Include an IP address in the subject name? [no]: no
Request certificate from CA? [yes/no]: yes
% Certificate request sent to Certificate Authority
% The 'show crypto pki certificate verbose AP-LSC' commandwill show the fingerprint.
```

定义AP注册参数和更新管理信任点

AP注册使用先前定义的信任点详细信息来确定控制器将证书请求转发到的服务器详细信息。由于控制器用作证书注册的代理，因此它需要了解证书请求中包含的主题参数。配置通过网络界面或命令行执行。

步骤1.导航至**Configuration > Wireless > Access Points**，然后展开**LSC Provision**菜单。

步骤2.使用AP证**书请求**中填充的属性填充Subject Name Parameters，然后选择**Apply**。

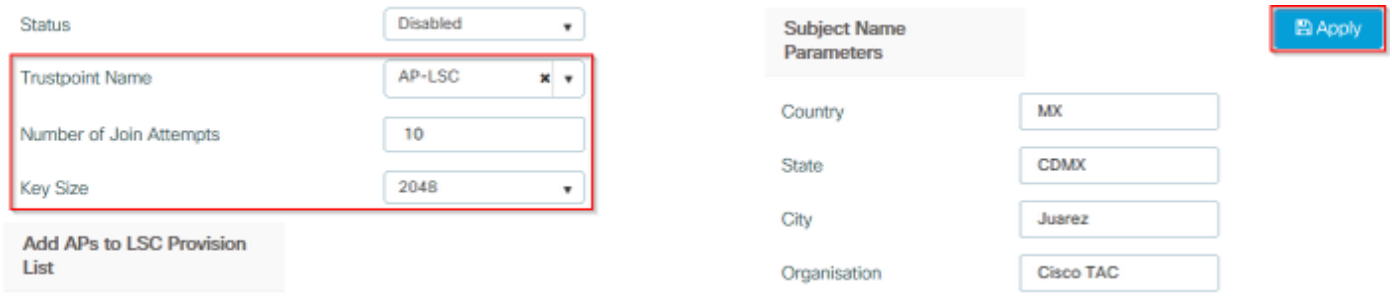


步骤1和2的CLI配置：

```
9800-L(config)#ap lsc-provision subject-name-parameter country
```

> **注**：必须严格遵守限制为2个字符（如国家/地区代码）的Subject-name-parameters，因为9800 WLC不验证这些属性。
> 有关详细信息，请参阅缺陷CSCvo72999 作为参考。

步骤3.在同一菜单中，从下拉列表中选择先前定义的信任点，指定AP加入尝试次数（这定义了再次使用MIC之前加入尝试次数），并设置证书密钥大小。然后，单击 **Apply**。



步骤3的CLI配置：

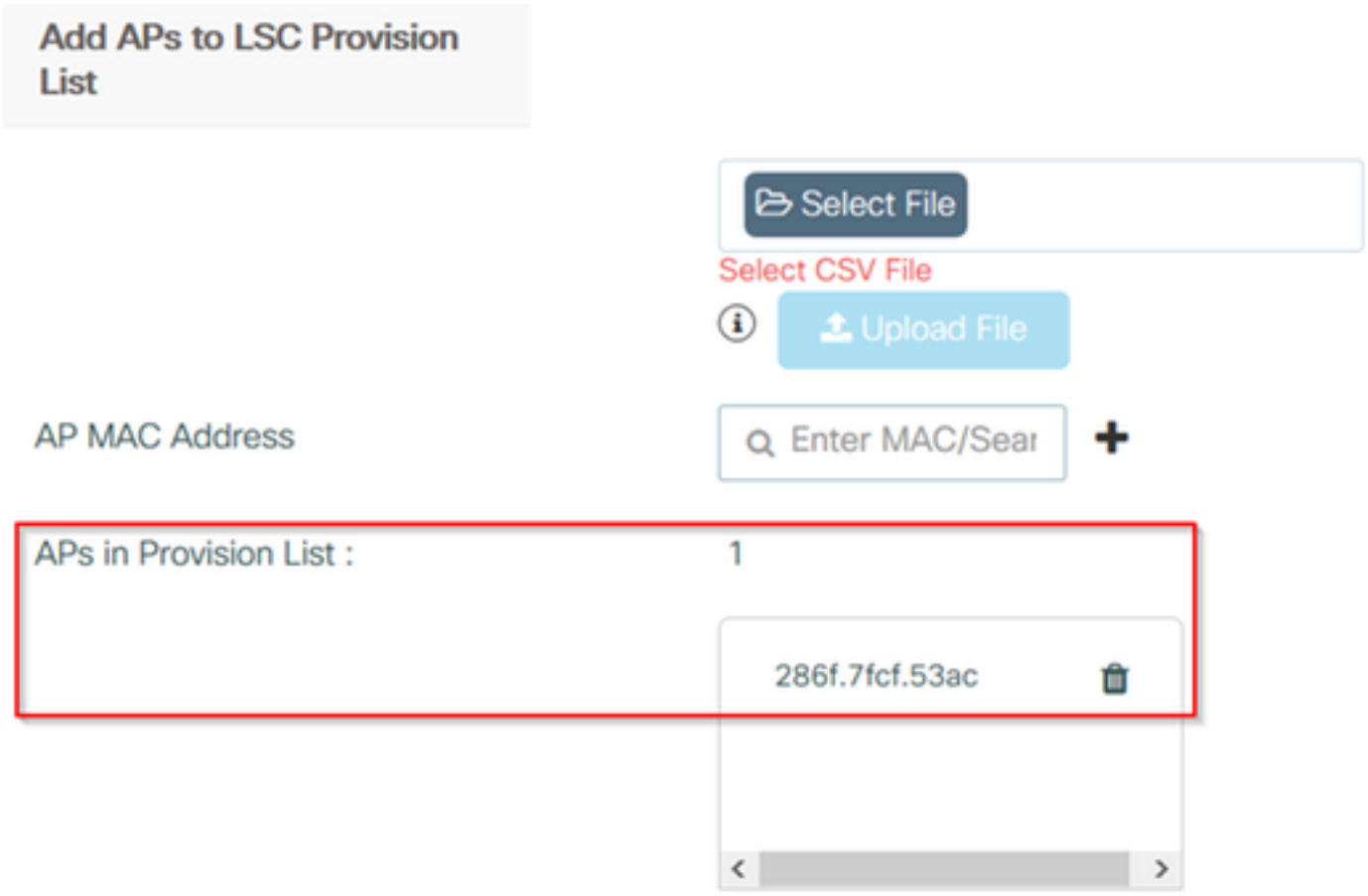
```
9800-L(config)#ap lsc-provision join-attempt
```

```
9800-L(config)#ap lsc-provision trustpoint
```

```
9800-L(config)#ap lsc-provision key-size
```

步骤4.（可选）可以为加入控制器或MAC地址列表中定义的特定AP的所有AP触发AP LSC调配。在同一菜单中，在文本字段中输入格式为xxxx.xxxx.xxxx的AP以太网MAC地址，然后单**击+**符号。或者，上传包含AP MAC地址的csv文件，选择该文件，然后选择**上传文件**。

注意：控制器跳过csv文件中无法从其加入的AP列表中识别的任何MAC地址。



步骤4的CLI配置：

```
9800-L(config)#ap lsc-provision mac-address
```

第五步： 从“状**态”标**签旁的下**拉菜单中选择“已启用”**或“调配列表”，然后单击“应用”以触发AP LSC登记。

注意：AP开始证书请求、下载和安装。完全安装证书后，AP将重新启动，并使用新证书启动加入过程。

提示：如果AP LSC调配通过预生产控制器与调配列表一起使用完成，则在调配证书后不要删除AP条目。如果完成此操作，并且AP回退到MIC并加入同一预生产控制器，则其LSC证书将被清除。

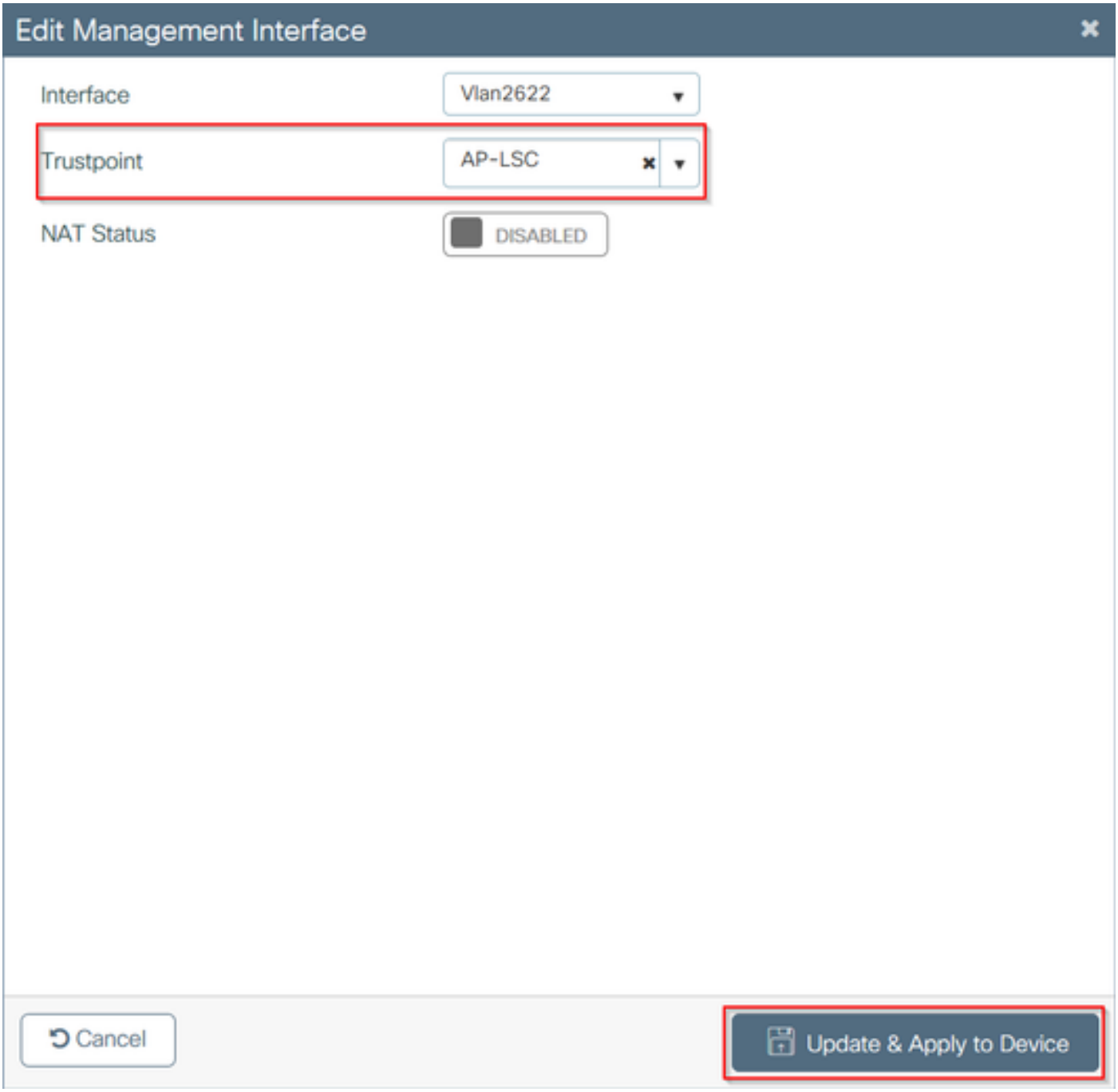
步骤5的CLI配置：

```
9800-L(config)#ap lsc-provision
In Non-WLANCC mode APs will be provisioning with RSA certificates with specified key-size
configuration. In WLANCC mode APs will be provisioning with EC certificates with a 384 bit key
by-default or 256 bit key if configured.
Are you sure you want to continue? (y/n): y If specific AP list provisioning is preferred then
use: 9800-L(config)#ap lsc-provision provision-list
```

步骤6.导航至**Configuration > Interface > Wireless**并选择管理接口。在Trustpoint字**段中**，从下拉菜单中选择新信任点，然后单击**Update & Apply to Device**。

警告：如果LSC已启用，但9800 WLC的信任点引用MIC或SSC，则AP会尝试与LSC一起加入，以获取已配置的加入尝试次数。达到最大尝试次数限制后，AP将回退到MIC并重新加入，但是由于LSC调配已启用，AP将请求新的LSC。这会导致CA服务器持续为同一个AP签署证书，并且AP陷入加入请求 — 重启循环。

注意：更新管理信任点以使用LSC证书后，新AP将无法将控制器与MIC连接。目前不支持打开调配窗口。如果您需要安装新的AP，则需要先前为其调配由与管理信任点中的CA相同的CA签名的LSC。



步骤6的CLI配置：

```
9800-L(config)#wireless management trustpoint
```

验证

验证控制器证书安装

要验证9800 WLC信任点中是否存在LSC信息，请发出命令**show crypto pki certificates verbose <trustpoint name>**，两个证书与为LSC调配和注册创建的信任点相关联。在本示例中，信任点名称为“microsoft-ca”（仅显示相关输出）：

```
9800-L#show crypto pki certificates verbose microsoft-ca
Certificate
  Status: Available
  Version: 3
  Certificate Usage: General Purpose
  Issuer:
    cn=CHUU-WIN12-CA
    dc=chuu-domain
    dc=local
  Subject:
    Name: 9800-L.alzavala.local
    cn=9800-L.chuu-domain.local/emailAddress=jesuherr@cisco.com
    o=Wireless TAC
    l=Juarez
    st=CDMX
    c=MX
    hostname=9800-L.alzavala.local
  CRL Distribution Points:
    ldap:///CN=CHUU-WIN12-CA,CN=Chuu-
Win12,CN=CDP,CN=Public%20Key%20Services,CN=Services,CN=Coint
Validity Date:
start date: 04:25:59 Central May 11 2020
end date: 04:25:59 Central May 11 2022 Subject Key Info: Public Key Algorithm: rsaEncryption RSA
Public Key: (2048 bit) Signature Algorithm: SHA256 with RSA Encryption [...] Authority Info
Access: CA ISSUERS: ldap:///CN=CHUU-WIN12-
CA,CN=AIA,CN=Public%20Key%20Services,CN=Services,CN=Configuration,DC=chuu-
domain,DC=local?cACertificate?base?objectClass=certificationAuthority [...] CA Certificate
  Status: Available
  Version: 3
  Certificate Serial Number (hex): 37268ED56080CB974EF3806CCACC77EC
  Certificate Usage: Signature
  Issuer:
    cn=CHUU-WIN12-CA
    dc=chuu-domain
    dc=local
  Subject:
    cn=CHUU-WIN12-CA
    dc=chuu-domain
    dc=local
 Validity Date:
start date: 05:58:01 Central May 10 2019
end date: 06:08:01 Central May 10 2024 Subject Key Info: Public Key Algorithm: rsaEncryption RSA
Public Key: (2048 bit) Signature Algorithm: SHA256 with RSA Encryption
```

检验9800 WLC LSC配置

要验证有关无线管理信任点的详细信息，请运行show wireless management trustpoint命令，确保正确的信任点（本例中包含LSC详细信息的信任点，AP-LSC）正在使用，并标记为“可用”：

```
9800-L#show wireless management trustpoint

Trustpoint  Name : AP-LSC
Certificate Info : Available
Certificate Type : LSC
Certificate Hash : 9e5623adba5307facf778e6ea2f5082877ea4beb
Private key Info : Available
```

要验证有关AP LSC调配配置的详细信息以及添加到调配列表的AP列表，请运行show ap lsc-provision summary命令。确保显示正确的设置状态：

```
9800-L#show ap lsc-provision summary
AP LSC-provisioning : Enabled for all APs
Trustpoint used for LSC-provisioning : AP-LSC
LSC Revert Count in AP reboots : 10

AP LSC Parameters :
Country : MX
State : CDMX
City : Juarez
Orgn : Cisco TAC
Dept : Wireless TAC
Email : josuvill@cisco.com
Key Size : 2048
EC Key Size : 384 bit

AP LSC-provision List :

Total number of APs in provision list: 2

Mac Addresses :
--------------
xxxx.xxxx.xxxx
xxxx.xxxx.xxxx
```

验证接入点证书安装

要验证AP中安装的证书，请从AP CLI运行show crypto 命令，请确保CA根证书和设备证书都存在（输出仅显示相关数据）：

```
AP3802#show crypto

[...]
------------------------------------------------------------------------------ LSC: Enabled
----------------------------- Device Certificate -----------------------------
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            73:00:00:00:0b:9e:c4:2e:6c:e1:54:84:96:00:00:00:00:00:0b
    Signature Algorithm: sha256WithRSAEncryption
        Issuer: DC=local, DC=chuu-domain, CN=CHUU-WIN12-CA
        Validity
            Not Before: May 13 01:22:13 2020 GMT
            Not After : May 13 01:22:13 2022 GMT
        Subject: C=MX, ST=CDMX, L=Juarez, O=Cisco TAC, CN=ap3g3-
286F7FCF53AC/emailAddress=josuvill@cisco.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
                Public-Key: (2048 bit)

----------------------------- Root Certificate ------------------------------
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            32:61:fb:93:a8:0a:4a:97:42:5b:5e:32:28:29:0d:32
    Signature Algorithm: sha256WithRSAEncryption
        Issuer: DC=local, DC=chuu-domain, CN=CHUU-WIN12-CA
        Validity
            Not Before: May 10 05:58:01 2019 GMT
            Not After : May 10 05:58:01 2024 GMT
        Subject: DC=local, DC=chuu-domain, CN=CHUU-WIN12-CA
```

```
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
                Public-Key: (2048 bit)
```

如果使用交换机端口dot1x身份验证的LSC，则可以从AP验证是否启用了端口身份验证。

```
AP3802#show ap authentication status
AP dot1x feature is disabled.
```

注意：要为AP启用端口dot1x，需要使用虚设值为AP配置文件或AP配置中的AP定义dot1x凭证。

故障排除

常见问题

1. 如果模板在服务器注册表中未正确映射，或者如果服务器需要密码质询，则拒绝9800 WLC或AP的证书请求。
2. 如果IIS默认站点被禁用，SCEP服务也被禁用，因此信任点中定义的URL无法访问，并且9800 WLC不发送任何证书请求。
3. 如果服务器和9800 WLC之间的时间未同步，则不会安装证书，因为时间有效性检查失败。

调试和日志命令

使用以下命令排除9800控制器证书注册故障：

```
9800-L#debug crypto pki transactions
9800-L#debug crypto pki validation
9800-L#debug crypto pki scep
```

要排除故障并监控AP注册，请使用以下命令：

```
AP3802#debug capwap client payload
AP3802#debug capwap client events
```

在AP命令行中，**show logging**显示AP是否存在证书安装问题，并提供有关未安装证书原因的详细信息：

```
[...]
Mar 19 19:39:13 kernel: *03/19/2020 19:39:13.3429] AP has joined controller 9800-L Mar 19
19:39:13 kernel: 03/19/2020 19:39:13.3500] SELinux: initialized (dev mtd_inodefs, type
mtd_inodefs), not configured for labeling Mar 19 19:39:13 kernel: *03/19/2020 19:39:13.5982]
Generating a RSA private key Mar 19 19:39:14 kernel: *03/19/2020 19:39:13.5989]
..................... Mar 19 19:39:15 kernel: *03/19/2020 19:39:14.4179] .. Mar 19 19:39:15
kernel: *03/19/2020 19:39:15.2952] writing new private key to '/tmp/lsc/priv_key' Mar 19
19:39:15 kernel: *03/19/2020 19:39:15.2955] ----- Mar 19 19:39:15 kernel: *03/19/2020
19:39:15.5421] cen_validate_lsc: Verification failed for certificate: Mar 19 19:39:15 kernel:
*03/19/2020 19:39:15.5421] countryName = MX Mar 19 19:39:15 kernel: *03/19/2020 19:39:15.5421]
stateOrProvinceName = CDMX Mar 19 19:39:15 kernel: *03/19/2020 19:39:15.5421] localityName =
Juarez Mar 19 19:39:15 kernel: *03/19/2020 19:39:15.5421] organizationName = cisco-tac Mar 19
19:39:15 kernel: *03/19/2020 19:39:15.5421] commonName = ap3g3- Mar 19 19:39:15 kernel:
*03/19/2020 19:39:15.5421] emailAddress = jesuherr@cisco.com Mar 19 19:39:15 kernel: *03/19/2020
19:39:15.5427] LSC certificates/key failed validation! Mar 19 19:39:15 kernel: *03/19/2020
```

19:39:15.5427]

成功注册尝试示例

这是之前为成功注册控制器及其关联AP而提到的调试的输出。

CA根证书导入到9800 WLC:

```
[...]
Certificate has the following attributes: Fingerprint MD5: E630EAE6 FB824658 690EB0F5 638D7224
Fingerprint SHA1: 97070ACD CAD03D5D 0C1A6085 19992E0D 6B8C4D8B % Do you accept this certificate?
[yes/no]: yes CRYPTO_PKI_SCEP: Client sending GetCACert request CRYPTO_PKI: Sending CA
Certificate Request: GET /certsrv/mscep/mscep.dll/pkiclient.exe?operation=GetCACert&message=AP-
LSC HTTP/1.0 User-Agent: Mozilla/4.0 (compatible; MSIE 5.0; Cisco PKI) Host: 172.16.80.8
CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: http connection opened
CRYPTO_PKI: Sending HTTP message CRYPTO_PKI: Reply HTTP header: HTTP/1.0 User-Agent: Mozilla/4.0
(compatible; MSIE 5.0; Cisco PKI) Host: 172.16.80.8 CRYPTO_PKI: unlocked trustpoint AP-LSC,
refcount is 0 CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: Header length
received: 192 CRYPTO_PKI: parse content-length header. return code: (0) and content-length :
(3638) CRYPTO_PKI: Complete data arrived CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0
CRYPTO_PKI: Reply HTTP header: HTTP/1.1 200 OK Content-Type: application/x-x509-ca-ra-cert
Server: Microsoft-IIS/8.5 X-Powered-By: ASP.NET Date: Tue, 19 May 2020 21:47:34 GMT Connection:
close Content-Length: 3638 Content-Type indicates we have received CA and RA certificates.
CRYPTO_PKI_SCEP: Client received CA and RA certificate
CRYPTO_PKI:crypto_process_ca_ra_cert(trustpoint=AP-LSC) The PKCS #7 message contains 3
certificates. CRYPTO_PKI:crypto_pkcs7_extract_ca_cert found cert CRYPTO_PKI: Bypassing SCEP
capabilities request 0 CRYPTO_PKI: transaction CRYPTO_REQ_CA_CERT completed CRYPTO_PKI: CA
certificate received. CRYPTO_PKI: CA certificate received. CRYPTO_PKI:
crypto_pki_get_cert_record_by_cert() CRYPTO_PKI: crypto_pki_authenticate_tp_cert() CRYPTO_PKI:
trustpoint AP-LSC authentication status = 0 Trustpoint CA certificate accepted.
```

9800 WLC设备注册：

```
[...]
CRYPTO_PKI: using private key AP-LSC for enrollment CRYPTO_PKI_SCEP: Client sending GetCACert
request CRYPTO_PKI: Sending CA Certificate Request: GET
/certsrv/mscep/mscep.dll/pkiclient.exe?operation=GetCACert&message=AP-LSC HTTP/1.0 User-Agent:
Mozilla/4.0 (compatible; MSIE 5.0; Cisco PKI) Host: 172.16.80.8 CRYPTO_PKI: locked trustpoint
AP-LSC, refcount is 1 CRYPTO_PKI: http connection opened CRYPTO_PKI: Sending HTTP message
CRYPTO_PKI: Reply HTTP header: HTTP/1.0 User-Agent: Mozilla/4.0 (compatible; MSIE 5.0; Cisco
PKI) Host: 172.16.80.8 CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0 CRYPTO_PKI: locked
trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: Header length received: 192 CRYPTO_PKI: parse
content-length header. return code: (0) and content-length : (3638) CRYPTO_PKI: Complete data
arrived CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0 CRYPTO_PKI: Reply HTTP header:
HTTP/1.1 200 OK Content-Type: application/x-x509-ca-ra-cert Server: Microsoft-IIS/8.5 X-Powered-
By: ASP.NET Date: Tue, 19 May 2020 21:48:33 GMT Connection: close Content-Length: 3638 Content-
Type indicates we have received CA and RA certificates. CRYPTO_PKI_SCEP: Client received CA and
RA certificate CRYPTO_PKI:crypto_process_ca_ra_cert(trustpoint=AP-LSC) The PKCS #7 message
contains 3 certificates. CRYPTO_PKI:crypto_pkcs7_insert_ra_certs found RA certs
CRYPTO_PKI:crypto_pkcs7_insert_ra_certs found RA certs CRYPTO_PKI_SCEP: Client Sending GetCACaps
request with msg = GET /certsrv/mscep/mscep.dll/pkiclient.exe?operation=GetCACaps&message=AP-LSC
HTTP/1.0 User-Agent: Mozilla/4.0 (compatible; MSIE 5.0; Cisco PKI) Host: 172.16.80.8 CRYPTO_PKI:
locked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: http connection opened CRYPTO_PKI: Sending
HTTP message CRYPTO_PKI: Reply HTTP header: HTTP/1.0 User-Agent: Mozilla/4.0 (compatible; MSIE
5.0; Cisco PKI) Host: 172.16.80.8 CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0
CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: Header length received: 171
CRYPTO_PKI: parse content-length header. return code: (0) and content-length : (34) CRYPTO_PKI:
Complete data arrived CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0 CRYPTO_PKI: Reply
HTTP header: HTTP/1.1 200 OK Content-Type: text/plain Server: Microsoft-IIS/8.5 X-Powered-By:
ASP.NET Date: Tue, 19 May 2020 21:48:33 GMT Connection: close Content-Length: 34 CRYPTO_PKI:
HTTP header content length is 34 bytes CRYPTO_PKI_SCEP: Server returned capabilities: 92
```

CA_CAP_RENEWAL CA_CAP_S alz_9800(config)#HA_1 CA_CAP_SHA_256 CA_CAP_SHA_512 CRYPTO_PKI: transaction CRYPTO_REQ_CERT completed CRYPTO_PKI: status: %PKI-6-CSR_FINGERPRINT: CSR Fingerprint MD5 : 9BFBA438303487562E888087168F05D4 CSR Fingerprint SHA1: 58DC7DB84C632A7307631A97A6ABCF65A3DEFEEF CRYPTO_PKI: Certificate Request Fingerprint MD5: 9BFBA438 30348756 2E888087 168F05D4 CRYPTO_PKI: Certificate Request Fingerprint SHA1: 58DC7DB8 4C632A73 07631A97 A6ABCF65 A3DEFEEF PKI:PKCS7 to issuer cn=CHUU-WIN12-CA,dc=chuu-domain,dc=local serial 18 00 00 00 38 DB 68 64 C0 52 C0 0F 0E 00 00 00 00 00 38 CRYPTO_PKI: Deleting cached key having key id 65 CRYPTO_PKI: Attempting to insert the peer's public key into cache CRYPTO_PKI:Peer's public inserted successfully with key id 66 CRYPTO_PKI: Expiring peer's cached key with key id 66 PKI: Trustpoint AP-LSC has no router cert PKI: Signing pkcs7 with AP-LSC trustpoint temp self-signed cert CRYPTO_PKI_SCEP: Client sending PKCSReq CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: http connection opened CRYPTO_PKI: Sending HTTP message CRYPTO_PKI: Reply HTTP header: HTTP/1.0 Host: 172.16.80.8 CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0 CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 2 CRYPTO_PKI: Header length received: 188 CRYPTO_PKI: parse content-length header. return code: (0) and content-length : (2807) CRYPTO_PKI: Complete data arrived CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: received msg of 2995 bytes CRYPTO_PKI: Reply HTTP header: HTTP/1.1 200 OK Content-Type: application/x-pki-message Server: Microsoft-IIS/8.5 X-Powered-By: ASP.NET Date: Tue, 19 May 2020 21:48:33 GMT Connection: close Content-Length: 2807 CRYPTO_PKI: Prepare global revocation service providers CRYPTO_PKI: Deleting cached key having key id 66 CRYPTO_PKI: Attempting to insert the peer's public key into cache CRYPTO_PKI:Peer's public inserted successfully with key id 67 CRYPTO_PKI: Expiring peer's cached key with key id 67 CRYPTO_PKI: Remove global revocation service providers The PKCS #7 message has 1 verified signers. signing cert: issuer cn=CHUU-WIN12-CA,dc=chuu-domain,dc=local serial 1800037A239DF5180C0672C0000037 Signed Attributes: CRYPTO_PKI_SCEP: Client received CertRep - GRANTED (AF58BA9313638026C5DC151AF474723F) CRYPTO_PKI: status = 100: certificate is granted The PKCS #7 message contains 1 certs and 0 crls. Newly-issued Router Cert: issuer=cn=CHUU-WIN12-CA,dc=chuu-domain,dc=local serial=1800043245DC93E1D943CA70000043 start date: 21:38:34 Central May 19 2020 end date: 21:38:34 Central May 19 2022 Router date: 21:48:35 Central May 19 2020 %PKI-6-CERT_INSTALL: An ID certificate has been installed under Trustpoint : AP-LSC Issuer-name : cn=CHUU-WIN12-CA,dc=chuu-domain,dc=local Subject-name : cn=9800-L.chuu-domain.local/emailAddress=jesuherr@cisco.com,o=Wireless TAC,l=Juarez,st=CDMX,c=MX,hostname=alz_9800.alzavala.local Serial-number: 1800000043245DC93E1D943CA7000000000043 End-date : 2022-05-19T21:38:34Z Received router cert from CA CRYPTO_PKI: Not adding alz_9800.alzavala.local to subject-alt-name field because : Character allowed in the domain name. Calling pkiSendCertInstallTrap to send alert CRYPTO_PKI: All enrollment requests completed for trustpoint AP-LSC

从控制器端发出AP注册调试输出，对于加入9800 WLC的每个AP，此输出会重复多次：

[...]
CRYPTO_PKI: (A6964) Session started - identity selected (AP-LSC) CRYPTO_PKI: Doing re-auth to fetch RA certificate. CRYPTO_PKI_SCEP: Client sending GetCACert request CRYPTO_PKI: Sending CA Certificate Request: GET /certsrv/mscep/mscep.dll/pkiclient.exe?operation=GetCACert&message=AP-LSC HTTP/1.0 User-Agent: Mozilla/4.0 (compatible; MSIE 5.0; Cisco PKI) Host: 172.16.80.8 CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 2 CRYPTO_PKI: http connection opened CRYPTO_PKI: Sending HTTP message CRYPTO_PKI: Reply HTTP header: HTTP/1.0 User-Agent: Mozilla/4.0 (compatible; MSIE 5.0; Cisco PKI) Host: 172.16.80.8 CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: locked trustpoint AP-LSC, refcount is 2 CRYPTO_PKI: Header length received: 192 CRYPTO_PKI: parse content-length header. return code: (0) and content-length : (3638) CRYPTO_PKI: Complete data arrived CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 1 CRYPTO_PKI: Reply HTTP header: HTTP/1.1 200 OK Content-Type: application/x-x509-ca-ra-cert Server: Microsoft-IIS/8.5 X-Powered-By: ASP.NET Date: Tue, 19 May 2020 21:51:03 GMT Connection: close Content-Length: 3638 Content-Type indicates we have received CA and RA certificates. CRYPTO_PKI_SCEP: Client received CA and RA certificate
CRYPTO_PKI:crypto_process_ca_ra_cert(trustpoint=AP-LSC) The PKCS #7 message contains 3 certificates. CRYPTO_PKI:crypto_pkcs7_insert_ra_certs found RA certs
CRYPTO_PKI:crypto_pkcs7_insert_ra_certs found RA certs CRYPTO_PKI: Capabilites already obtained CA_CAP_RENEWAL CA_CAP_SHA_1 CA_CAP_SHA_256 CA_CAP_SHA_512 PKCS10 request is compulsory CRYPTO_PKI: byte 2 in key usage in PKCS#10 is 0x5 May 19 21: alz_9800(config)#51:04.985: CRYPTO_PKI: all usage CRYPTO_PKI: key_usage is 4 CRYPTO_PKI: creating trustpoint clone Proxy-AP-LSC8 CRYPTO_PKI: Creating proxy trustpoint Proxy-AP-LSC8 CRYPTO_PKI: Proxy enrollment request trans id = 7CBB299A2D9BC77DBB1A8716E6474C0C CRYPTO_PKI: Proxy forwading an enrollment request

```
CRYPTO_PKI: using private key AP-LSC for enrollment CRYPTO_PKI: Proxy send CA enrollment request with trans id: 7CBB299A2D9BC77DBB1A8716E6474C0C CRYPTO_PKI: No need to re-auth as we have RA in place CRYPTO_PKI: Capabilites already obtained CA_CAP_RENEWAL CA_CAP_SHA_1 CA_CAP_SHA_256 CA_CAP_SHA_512 CRYPTO_PKI: transaction CRYPTO_REQ_CERT completed CRYPTO_PKI: status: PKI:PKCS7 to issuer cn=CHUU-WIN12-CA,dc=chuu-domain,dc=local serial 18 00 00 00 38 DB 68 64 C0 52 C0 0F 0E 00 00 00 00 00 38 CRYPTO_PKI: Deleting cached key having key id 67 CRYPTO_PKI: Attempting to insert the peer's public key into cache CRYPTO_PKI:Peer's public inserted successfully with key id 68 CRYPTO_PKI: Expiring peer's cached key with key id 68 PKI: Trustpoint Proxy-AP-LSC8 has no router cert and loaded PKI: Signing pkcs7 with Proxy-AP-LSC8 trustpoint temp self-signed cert CRYPTO_PKI_SCEP: Client sending PKCSReq CRYPTO_PKI: locked trustpoint Proxy-AP-LSC8, refcount is 2 CRYPTO_PKI: http connection opened CRYPTO_PKI: Sending HTTP message CRYPTO_PKI: Reply HTTP header: HTTP/1.0 Host: 172.16.80.8 CRYPTO_PKI: unlocked trustpoint Proxy-AP-LSC8, refcount is 1 CRYPTO_PKI: locked trustpoint Proxy-AP-LSC8, refcount is 2 CRYPTO_PKI: locked trustpoint Proxy-AP-LSC8, refcount is 3 CRYPTO_PKI: Header length received: 188 CRYPTO_PKI: parse content-length header. return code: (0) and content-length : (2727) CRYPTO_PKI: Complete data arrived CRYPTO_PKI: unlocked trustpoint Proxy-AP-LSC8, refcount is 2 CRYPTO_PKI: received msg of 2915 bytes CRYPTO_PKI: Reply HTTP header: HTTP/1.1 200 OK Content-Type: application/x-pki-message Server: Microsoft-IIS/8.5 X-Powered-By: ASP.NET Date: Tue, 19 May 2020 21:51:03 GMT Connection: close Content-Length: 2727 CRYPTO_PKI: Prepare global revocation service providers CRYPTO_PKI: Deleting cached key having key id 68 CRYPTO_PKI: Attempting to insert the peer's public key into cache CRYPTO_PKI:Peer's public inserted successfully with key id 69 CRYPTO_PKI: Expiring peer's cached key with key id 69 CRYPTO_PKI: Remove global revocation service providers The PKCS #7 message has 1 alz_9800(config)# verified signers. signing cert: issuer cn=CHUU-WIN12-CA,dc=chuu-domain,dc=local serial 1800037A239DF5180C0672C0000037 Signed Attributes: CRYPTO_PKI_SCEP: Client received CertRep - GRANTED (7CBB299A2D9BC77DBB1A8716E6474C0C) CRYPTO_PKI: status = 100: certificate is granted The PKCS #7 message contains 1 certs and 0 crls. Received router cert from CA CRYPTO_PKI: Enrollment poroxy callback status: CERT_REQ_GRANTED CRYPTO_PKI: Proxy received router cert from CA CRYPTO_PKI: Rcvd request to end PKI session A6964. CRYPTO_PKI: PKI session A6964 has ended. Freeing all resources. CRYPTO_PKI: unlocked trustpoint AP-LSC, refcount is 0 CRYPTO_PKI: Cleaning RA certificate for TP : AP-LSC CRYPTO_PKI: All enrollment requests completed for trustpoint Proxy-AP-LSC8. CRYPTO_PKI: All enrollment requests completed for trustpoint Proxy-AP-LSC8. CRYPTO_PKI: unlocked trustpoint Proxy-AP-LSC8, refcount is 1 CRYPTO_PKI: All enrollment requests completed for trustpoint Proxy-AP-LSC8. CRYPTO_CS: removing trustpoint clone Proxy-AP-LSC8
```

来自AP端的AP注册调试输出：

```
[DEC] CAPWAP_CONFIGURATION_UPDATE_REQUEST(7) seq 40 len 407
..Vendor Type: SPAM_VENDOR_ID_PAYLOAD(104) vendId 409600
...Vendor SubType: CERTIFICATE_PARAMETER_PAYLOAD(63) vendId 409600
LSC set retry number from WLC: 1

Generating a RSA private key
...
.............................
writing new private key to '/tmp/lsc/priv_key'
-----
[ENC] CAPWAP_WTP_EVENT_REQUEST(9)
...Vendor SubType: LSC_CERTIFICATE_PAYLOAD(64) Len 1135 Total 1135
[ENC] CAPWAP_CONFIGURATION_UPDATE_RESPONSE(8)
.Msg Elem Type: CAPWAP_MSGELE_RESULT_CODE(33) Len 8 Total 8
[DEC] CAPWAP_CONFIGURATION_UPDATE_REQUEST(7) seq 41 len 20
..Vendor Type: SPAM_VENDOR_ID_PAYLOAD(104) vendId 409600
...Vendor SubType: LSC_CERTIFICATE_PAYLOAD(64) vendId 409600
LSC_CERT_ENROLL_PENDING from WLC

[ENC] CAPWAP_CONFIGURATION_UPDATE_RESPONSE(8)
.Msg Elem Type: CAPWAP_MSGELE_RESULT_CODE(33) Len 8 Total 8
Received Capwap watchdog update msg.
[DEC] CAPWAP_CONFIGURATION_UPDATE_REQUEST(7) seq 42 len 1277
..Vendor Type: SPAM_VENDOR_ID_PAYLOAD(104) vendId 409600
...Vendor SubType: LSC_CERTIFICATE_PAYLOAD(64) vendId 409600
LSC_ENABLE: saving ROOT_CERT
```

```
[ENC] CAPWAP_CONFIGURATION_UPDATE_RESPONSE(8)
.Msg Elem Type: CAPWAP_MSGELE_RESULT_CODE(33) Len 8 Total 8
[DEC] CAPWAP_CONFIGURATION_UPDATE_REQUEST(7) seq 43 len 2233
..Vendor Type: SPAM_VENDOR_ID_PAYLOAD(104) vendId 409600
...Vendor SubType: LSC_CERTIFICATE_PAYLOAD(64) vendId 409600
LSC_ENABLE: saving DEVICE_CERT

SC private key written to hardware TAM

root: 2:  LSC enabled
AP Rebooting: Reset Reason - LSC enabled
```

通过SCEP注册LSC的配置示例到此结束。