Creation of Self-Signed Certificates with Multiple URL's

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Introduction

This document describes how to create a self-signed certificate that can be used by CloudCenter with multiple URL's.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Certificates
- Linux

Components Used

The information in this document is based on CentOS7.

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, make sure that you understand the potential impact of any command.

Problem

The certificates that come standard with CloudCenter, or which can be created with the use of the Cisco Call Manager (CCM) configuration wizard, do not have a Subject Alternative Name (SAN) which certain browsers, such as Google Chrome, treats as an error and warns you. This can be overridden, but without SAN's, a certificate can only be valid from one specific URL.

For example, if you have a certificate that is valid for the IP address of 10.11.12.13, if you have a Domain Name System (DNS) name of www.opencart.com, you receive a certificate error because that URL is not what the certificate is for (this is true even if www.opencart.com is listed in your hosts file as the one that belongs to 10.11.12.13). This can crop up if subtenants of CloudCenter are in the use of Single Sign On (SSO), as each SSO server has its own URL.

Solution

The easiest way to fix this issue is to create a new self-signed certificate that has SAN's which lists any URL that directs you to the same IP address. The guide is an attempt to apply best practices to this process.

Step 1. Navigate to the **root directory** and make a new folder to house the certificates:

```
sudo -s
cd /root
mkdir ca
```

Step 2. Navigate into the new folder and make subfolders to organize the certificates, private keys, and logs.

```
cd ca
mkdir certs crl newcerts private
chmod 700 private
touch index.txt
echo 1000 > serial
```

Step 3. Copy the contents of **CAopenssl.conf to /root/ca/openssl.cnf**

> **Note**: This file contains the configuration options for a Certificate Authority (CA) and default options that might be appropriate for CloudCenter.

Step 4. Generate a private key and certificate for the CA.

```
openssl genrsa -aes256 -out private/ca.key.pem 4096
chmod 400 private/ca.key.pem
openssl req -config openssl.cnf -key private/ca.key.pem -new -x509 -days 7300 -sha256 -
extensions v3_ca -out certs/ca.cert.pem
chmod 444 certs/ca.cert.pem
```

Step 5. Your CA is the ultimate way to verify that any certificate is valid, this certificate must never be accessed by unauthorized individuals and must never be exposed to the internet. Due to this restriction, you have to create an intermediate CA that signs the end certificate, this creates a break where if the intermediate authority certificate is compromised it can be revoked and a new one issued.

Step 6. Make a new subdirectory for the intermediate CA.

```
mkdir /root/ca/intermediate
cd /root/ca/intermediate/
mkdir certs crl csr newcerts private
chmod 700 private
touch index.txt
echo 1000 > serial
echo 1000 > /root/ca/intermediate/crlnumber
```

Step 7. Copy the contents of **Intermediateopenssl.conf** to **/root/ca/intermediate/openssl.cnf** .

> **Note**: This file contains nearly identical configuration options for the CA other than a few small tweaks to make it specific to an intermediate.

Step 8. Generate the intermediate key and certificate.

```
cd /root/ca
openssl genrsa -aes256 -out intermediate/private/intermediate.key.pem 4096
chmod 400 intermediate/private/intermediate.key.pem
openssl req -config intermediate/openssl.cnf -new -sha256 -key
intermediate/private/intermediate.key.pem -out intermediate/csr/intermediate.csr.pem
```

Step 9. Sign the intermediate certificate with the CA certificate, this builds a chain of trust that browser uses to verify a certificate's authenticity.

```
openssl ca -config openssl.cnf -extensions v3_intermediate_ca -days 3650 -notext -md sha256 -in
intermediate/csr/intermediate.csr.pem -out intermediate/certs/intermediate.cert.pem
chmod 444 intermediate/certs/intermediate.cert.pem
```

Step 10. Create a CA chain, since you do not want the CA on the internet, you can make a CA chain that browsers use to verify authenticity all the way up to the CA.

```
cat intermediate/certs/intermediate.cert.pem certs/ca.cert.pem > intermediate/certs/ca-
chain.cert.pem
chmod 444 intermediate/certs/ca-chain.cert.pem
```

Step 11. Create a new key and certificate for the CCM.

```
openssl genrsa -out intermediate/private/ccm.com.key.pem 2048
openssl req -new -sha256 -key intermediate/private/ccm.com.key.pem -subj
"/C=US/ST=NC/O=Cisco/CN=ccm.com" -reqexts SAN -config <(cat intermediate/openssl.cnf <(printf
"[SAN]\nsubjectAltName=DNS:ccm.com,DNS:www.ccm.com,IP:10.11.12.13")) -out
intermediate/csr/ccm.com.csr
```

Step 12. This has all the required fields in the command and has to be edited manually.

- **/C=US** refers to the country (2 char limit)
- **/ST=NC** refers to the State and might include spaces
- **/O=Cisco** refers to the Organization
- **/CN=ccm.com** refers to the Common Name, this should be the main URL used to access the CCM.
- **SAN\nsubjectAltName=** are the alternative names, the common name should be on this list and there is no limit to how many SAN's you have.

Step 13. Sign the final certificate with the use of the intermediate certificate.

```
openssl ca -config intermediate/openssl.cnf -extensions server_cert -days 375 -notext -md sha256
-in intermediate/csr/ccm.com.csr -out intermediate/certs/ccm.com.cert.pem
```

Step 14. Verify that the certificate was signed correctly.

```
openssl verify -CAfile intermediate/certs/ca-chain.cert.pem intermediate/certs/ccm.com.cert.pem
```

Step 15. It can return either an OK or a Fail.

Step 16. Copy the new certificate, it's key, and the CA-chain to the **Catalina** folder.

```
cd /root/ca/intermediate/certs
cp ccm.com.cert.pem /usr/local/tomcat/conf/ssl/ccm.com.crt
cp ca-chain.cert.pem /usr/local/tomcat/conf/ssl/ca-chain.crt
cd ../private
cp ccm.com.key.pem /usr/local/tomcat/conf/ssl/ccm.com.key
```

Step 17. Grant cliqruser ownership and set permissions correctly.

```
chown cliqruser:cliqruser ccm.com.crt
chown cliqruser:cliqruser ccm.com.key
chown cliqruser:cliqruser ca-chain.crt
```

```
chmod 644 ccm.com.crt
chmod 644 ccm.com.key
chmod 644 ca-chain.crt
```

Step 18. Backup the **server.xml** file before you make any changes.

```
cd ..
cp server.xml server.xml.bak
```

Step 19. Edit **server.xml:**

1. Locate the section which starts with **<Connector port="10443" maxHttpHeaderSize="8192"**
2. Change **SSLCertificateFile** to point to ccm.com.crt
3. Change **SSLCertificateKeyFile** to point to ccm.com.key
4. Change **SSLCACertificateFile** to point to ca-chain.crt

Step 20. Restart Tomcat.

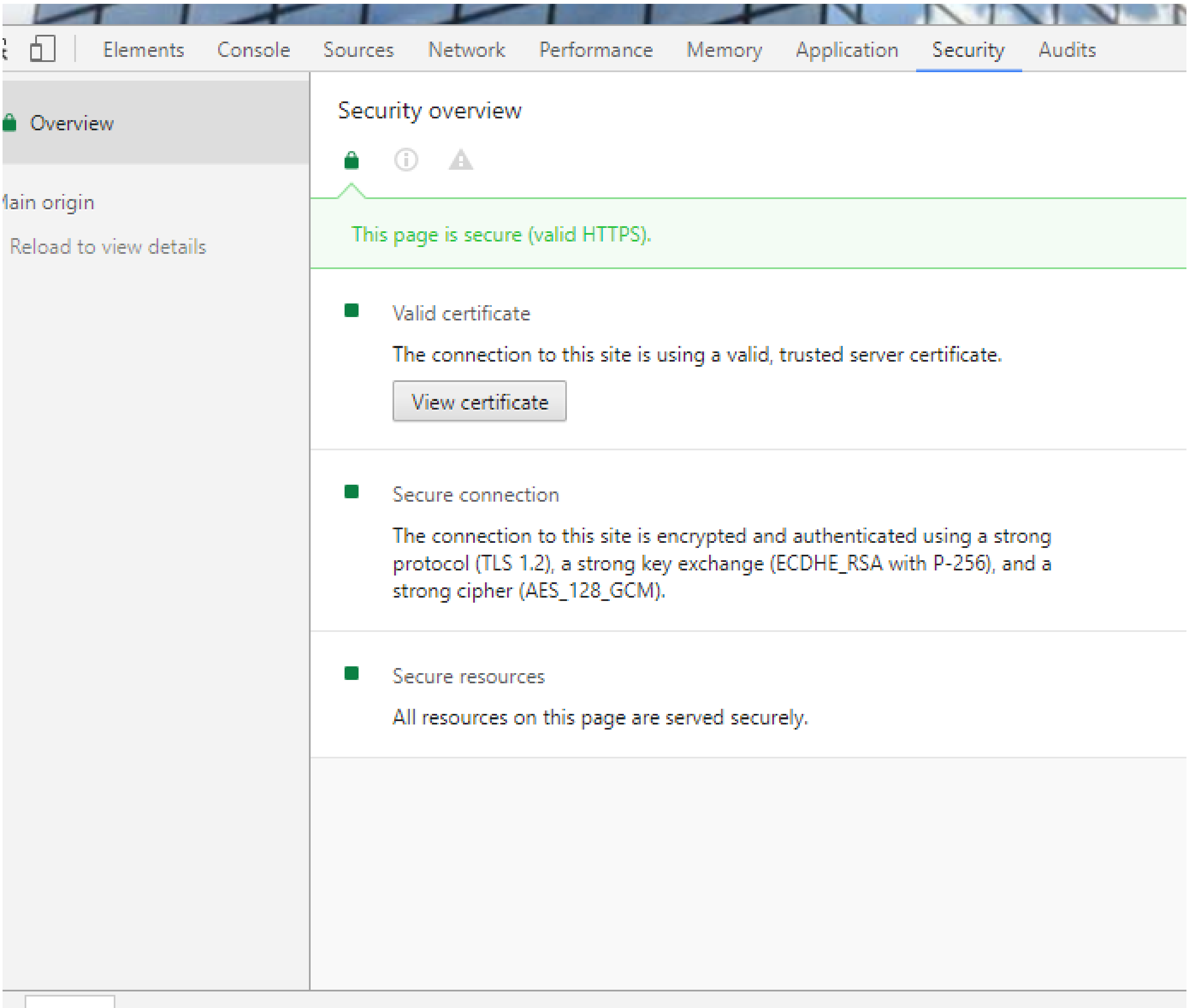
```
service tomcat stop
service tomcat start
```

Step 21. The CCM now uses the new certificate which is valid for all DNS names and IP addresses specified in Step 13.

Step 22. As the CA was created at the time of the guide, your browsers won't recognize it as valid by default, you have to manually import the certificate.

Step 23. Navigate to the **CCM** with the use of any valid URL and press **Ctrl+Shift+i**, this opens the developer tools.

Step 24. Select **View Certificate** as shown in the image.



Security overview

This page is secure (valid HTTPS).

Valid certificate

The connection to this site is using a valid, trusted server certificate.

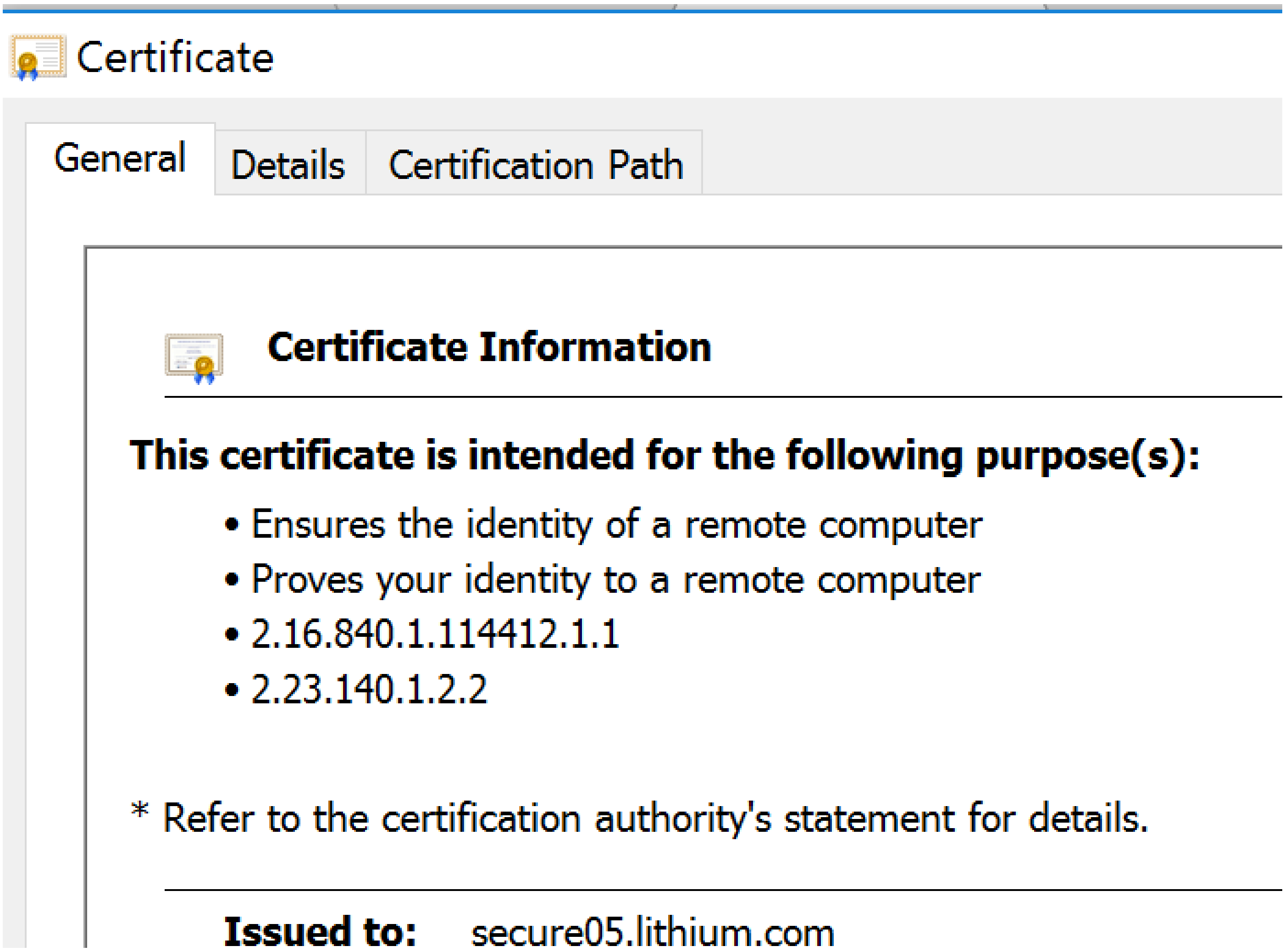
Secure connection

The connection to this site is encrypted and authenticated using a strong protocol (TLS 1.2), a strong key exchange (ECDHE_RSA with P-256), and a strong cipher (AES_128_GCM).

Secure resources

All resources on this page are served securely.

Step 25. Select **Details** as shown in the image.



Certificate

Certificate Information

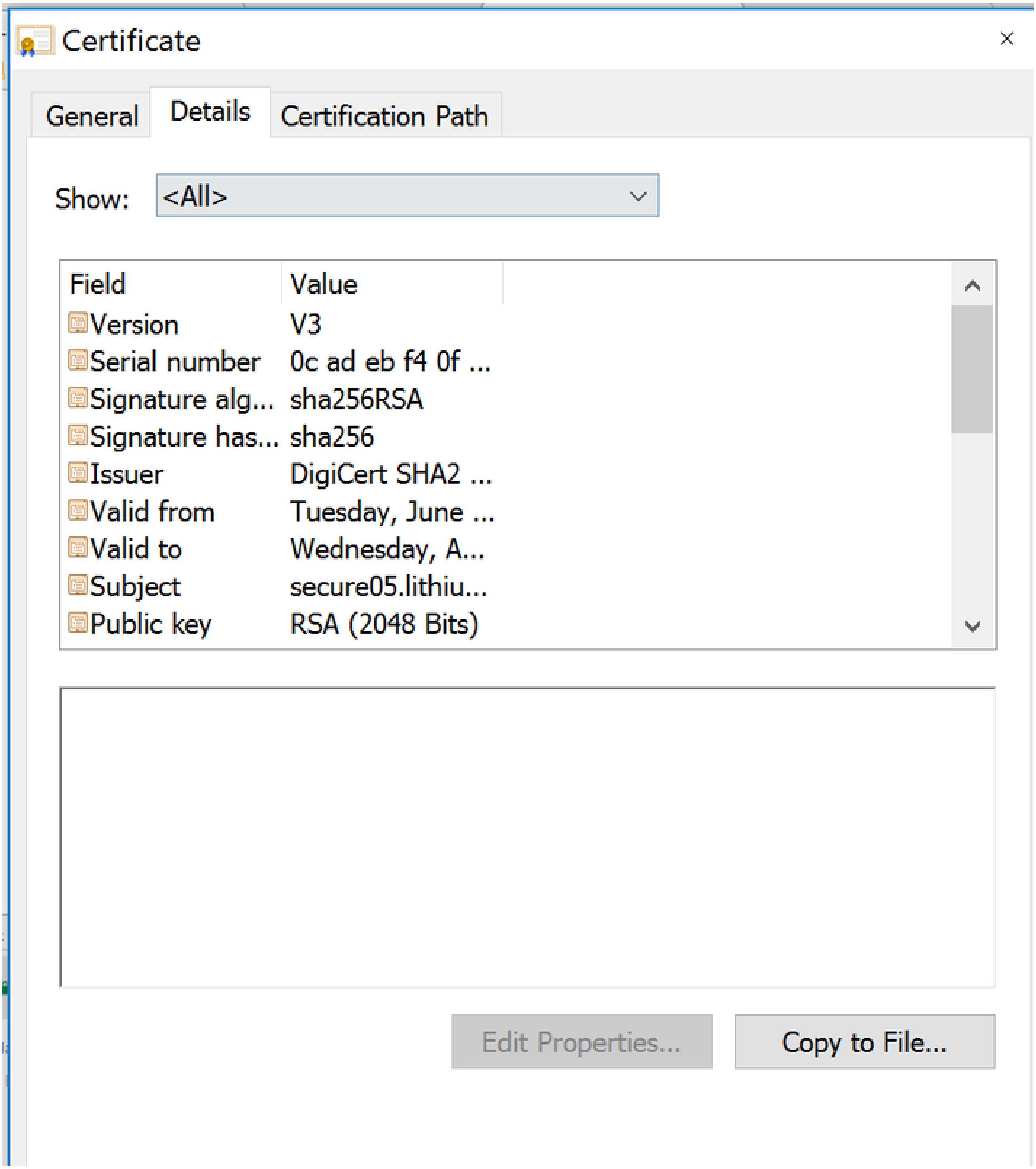
This certificate is intended for the following purpose(s):

- Ensures the identity of a remote computer
- Proves your identity to a remote computer
- 2.16.840.1.114412.1.1
- 2.23.140.1.2.2

* Refer to the certification authority's statement for details.

Issued to: secure05.lithium.com

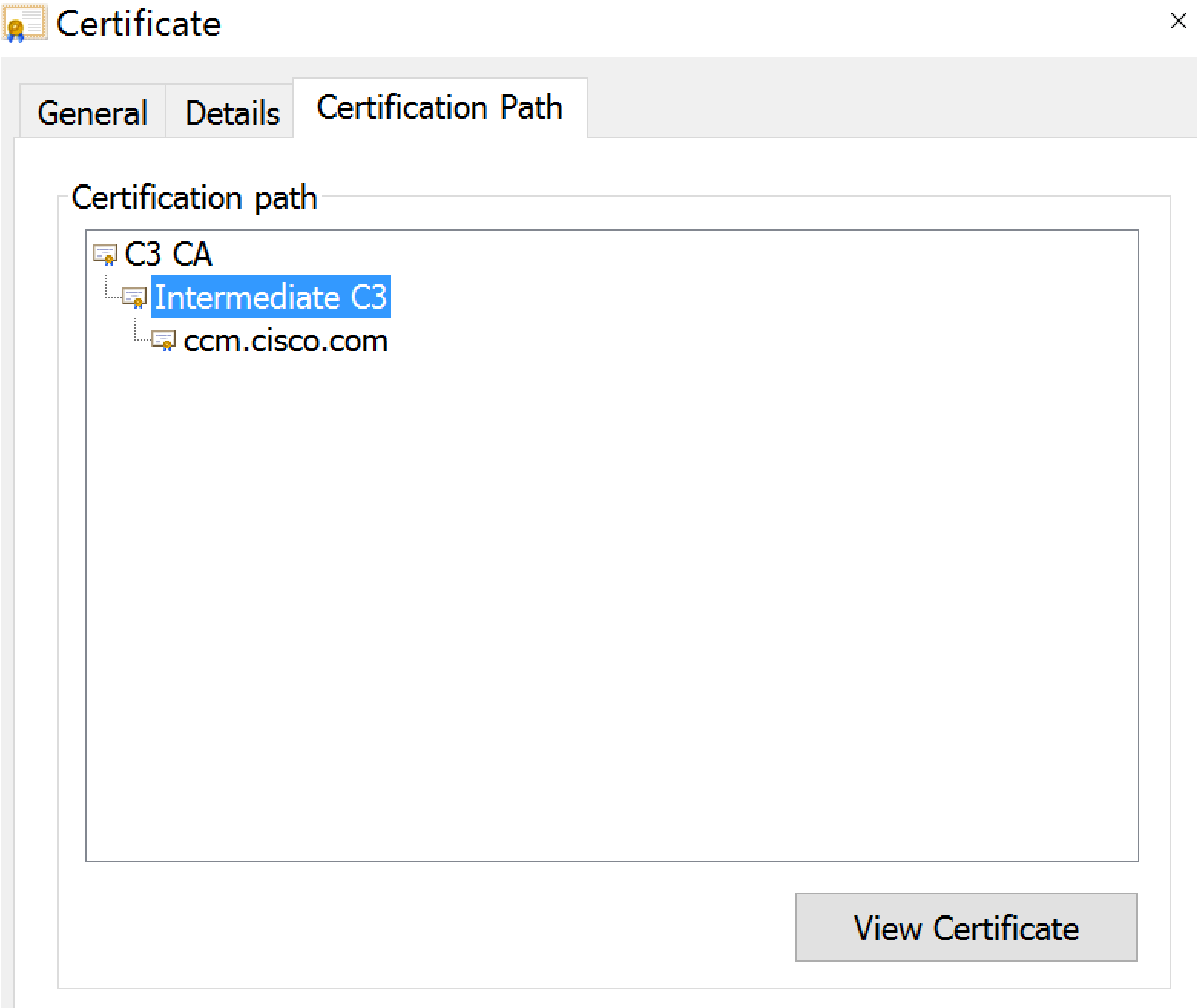
Step 26. Select **Copy To File** as shown in the image.



Show: <All>

Field	Value
Version	V3
Serial number	0c ad eb f4 0f ...
Signature alg...	sha256RSA
Signature has...	sha256
Issuer	DigiCert SHA2 ...
Valid from	Tuesday, June ...
Valid to	Wednesday, A...
Subject	secure05.lithiu...
Public key	RSA (2048 Bits)

Step 27. If you get errors about an untrusted CA, then navigate to **Certification Path** to view the Intermediate and Root certificate. You can click on them and view their certificate and also copy those to files as shown in the image.



Step 28. Once you have the certificates downloaded, follow your Operating System's (OS) or Browser's instructions to install these certificates as trusted authority and intermediate authorities.