Devolutions

[TUTORIAL] How to Enhance Your IIS Server Security with Client Certificates

THIS TUTORIAL THAT WILL TEACH YOU HOW TO CONFIGURE THIS FEATURE ON AN IIS SERVER

Certificates are easily deployed in an **Active Directory (AD)** infrastructure, but using them to manage access — especially to websites hosted on an **Internet Information Services (IIS)** server — can be challenging due to the lack of good documentation on the Internet. And so, I have created this tutorial that will teach you how to configure this feature on an IIS server. You can also use this as a quick and convenient “cheat sheet” for reference.

Why Should You Use this Feature?

This feature adds a layer of authentication to ensure the legitimacy of a client before they can reach a highly sensitive website. It can be configured in front of your websites, or as a subset of your websites. Only users that provide the right certificate will be granted access.

Is It Really Secure?

This form of authentication algorithm is enforced mathematically with asymmetric cryptography. **TLS** (formerly known as SSL) **client authentication** has been part of the **Transport Layer Protocol** for a long time, and it is an industry proven standard for secure communications.

This feature is also often used for compliance in large organizations that need to ensure that only authorized users can access internal websites.

Since this feature is part of the **TLS** standard, most servers, such as IIS, Apache, and Nginx, support it natively. Popular browsers (e.g. Internet Explorer, Chrome, Firefox, etc.) also support it natively.

Requirements

Here is what you need for this tutorial:

- Certificate Authority Certificate
- Server Certificate
- Client Certificate(s) (For users)

Before You Begin

If you need to generate the certificates, please view my previous blog post. After that is done, complete the following:

1. Install the **ca.crt** (*public key*) file in the following **IIS server** certificate store:
Local Computer -> Trusted Root Certification Authorities

2. Merge the **server.crt** (*public key*) and **server.key** (*private key*) files into a single file named **server.pfx** with the following command line:

```
openssl pkcs12 -export -out server.pfx -inkey server.key -in server.crt
```

You will be prompted to enter a password; make sure you use a strong one.

Install the resulting **server.pfx** file in the following **IIS server** certificate store:

Local Computer -> Personal

3. Each client that will access the server needs a certificate. Just like the server certificate above, both the **public key** (.crt) and **private key** (.key) will need to be merged into a single **<client name>.pfx** file. The **<client name>.pfx** file will need to be installed on the user's computer in the following store:

Current User -> Personal

I have tried to simplify this tutorial into easy-to-follow steps. I'll detail how to do it manually and also via PowerShell script. However, the scripts might need to be modified to match your environment.

How to Configure IIS

Step 1 - Enabling the Required Features

Enable *IIS Client Certificate Mapping Authentication* in the Windows' features dialog, which is in the `Internet Information Services -> World Wide Web Services -> Security` section (see image 1).

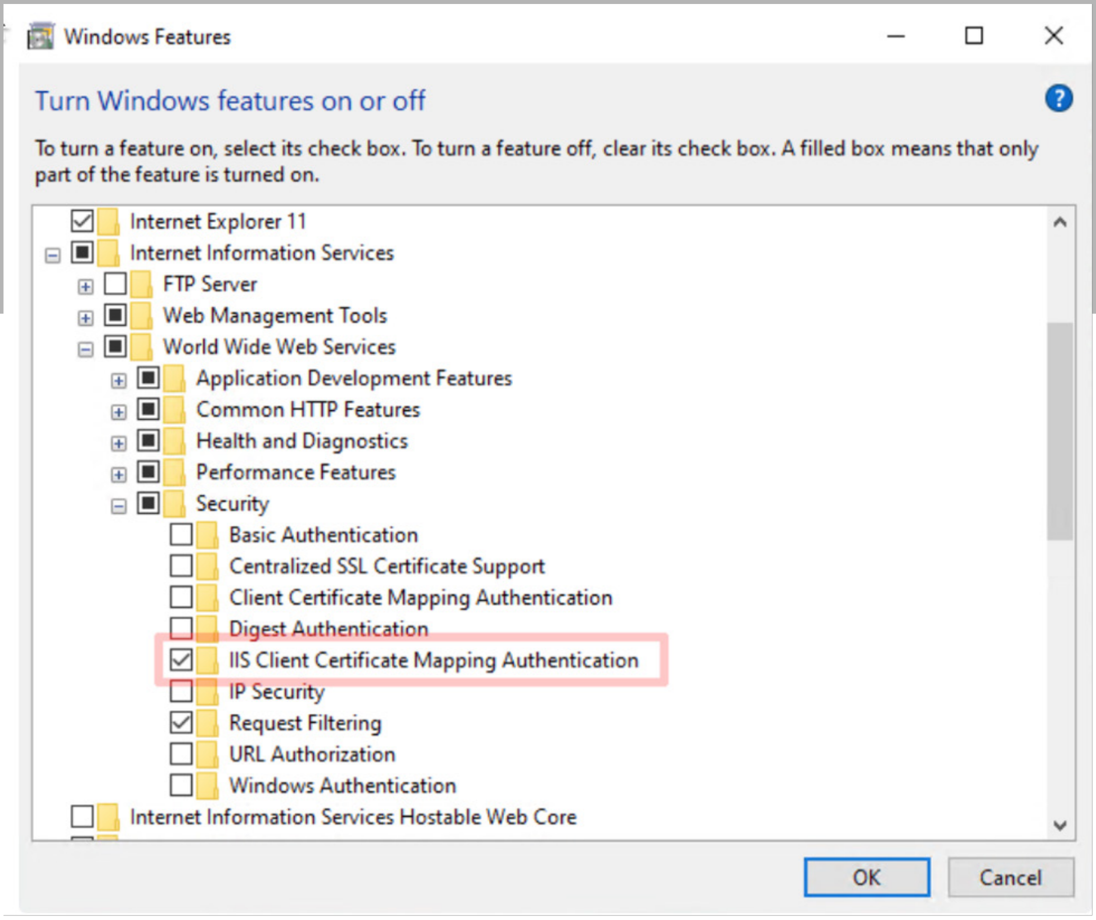
The Windows' features dialog can be opened using the following shortcut:

```
WIN + R -> optionalfeatures
```

On a **Windows Server**, you can enable this feature in the server configuration manager. It can also be enabled using the following PowerShell command:

```
Enable-WindowsOptionalFeature -Online -FeatureName IIS-IISCertificateMappingAuth
enticationEnable-WindowsOptionalFeature -Online -FeatureName IIS-IISCertificateM
appingAuthentication
```

Image 1 - Enabling IIS Client Certificate Mapping Authentication



To turn a feature on, select its check box. To turn a feature off, clear its check box. A filled box means that only part of the feature is turned on.

- ☑ Internet Explorer 11
- ■ Internet Information Services
  - ☐ FTP Server
  - ■ Web Management Tools
  - ■ World Wide Web Services
    - ■ Application Development Features
    - ■ Common HTTP Features
    - ■ Health and Diagnostics
    - ■ Performance Features
    - ■ Security
      - ☐ Basic Authentication
      - ☐ Centralized SSL Certificate Support
      - ☐ Client Certificate Mapping Authentication
      - ☐ Digest Authentication
      - ☑ IIS Client Certificate Mapping Authentication
      - ☐ IP Security
      - ☑ Request Filtering
      - ☐ URL Authorization
      - ☐ Windows Authentication
- ☐ Internet Information Services Hostable Web Core

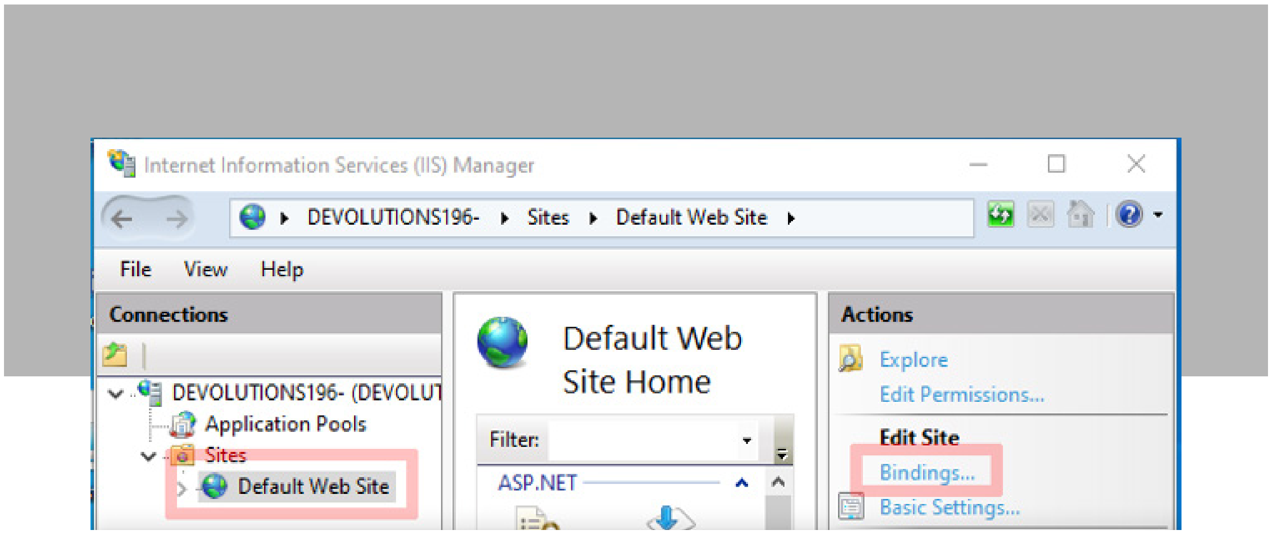
Step 2 - Configure an HTTPS Binding

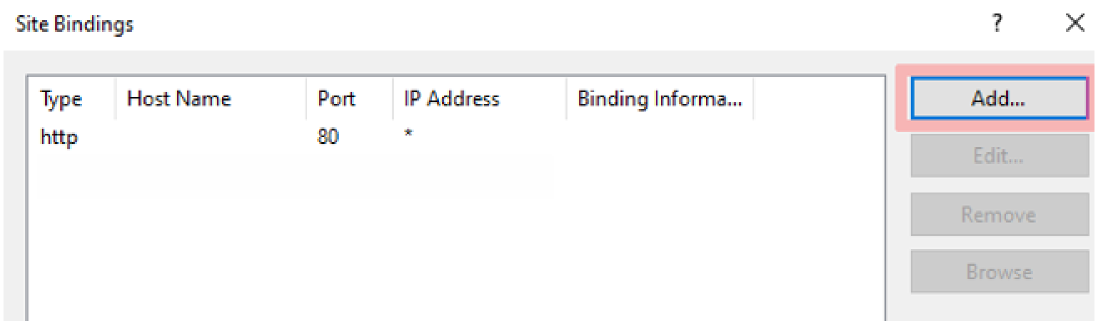
Configure your *SSL certificate* in the Site binding dialog in the IIS Manager. To open the Side Binding dialog, **select the website** where you want to enable this feature, and then click on ***Bindings***. Lastly, add an **HTTPS** binding and select your server certificate. An example is shown below (image 2 and 3):

Default Web Site -> Bindings... -> Add...

```
It can also be done with a few simple PowerShell commands:

# List certificates in the local machine personal store.
Get-ChildItem -Path CERT:LocalMachine/My

Thumbprint Subject
---------- -------
838E34D06C2FB5C80E99E6B6938C4127134B32A5 CN=localhost
6A11EAFFBB6A7E1F3CE11DAE82956D4F2973320E CN=mathmo.org, O=”MathMoOrganisation,
Inc.”, S=CA, C=US

# Create HTTPS binding if it doesn’t exists
New-WebBinding -name “Default Web Site” -Protocol https -Port 443

# Get the bindings
$bindings = Get-WebBinding -Name “Default Web Site”

# Configure the certificate mathmo.org for the bindings
$bindings.AddSslCertificate(“6A11EAFFBB6A7E1F3CE11DAE82956D4F2973320E”,’My’)
```

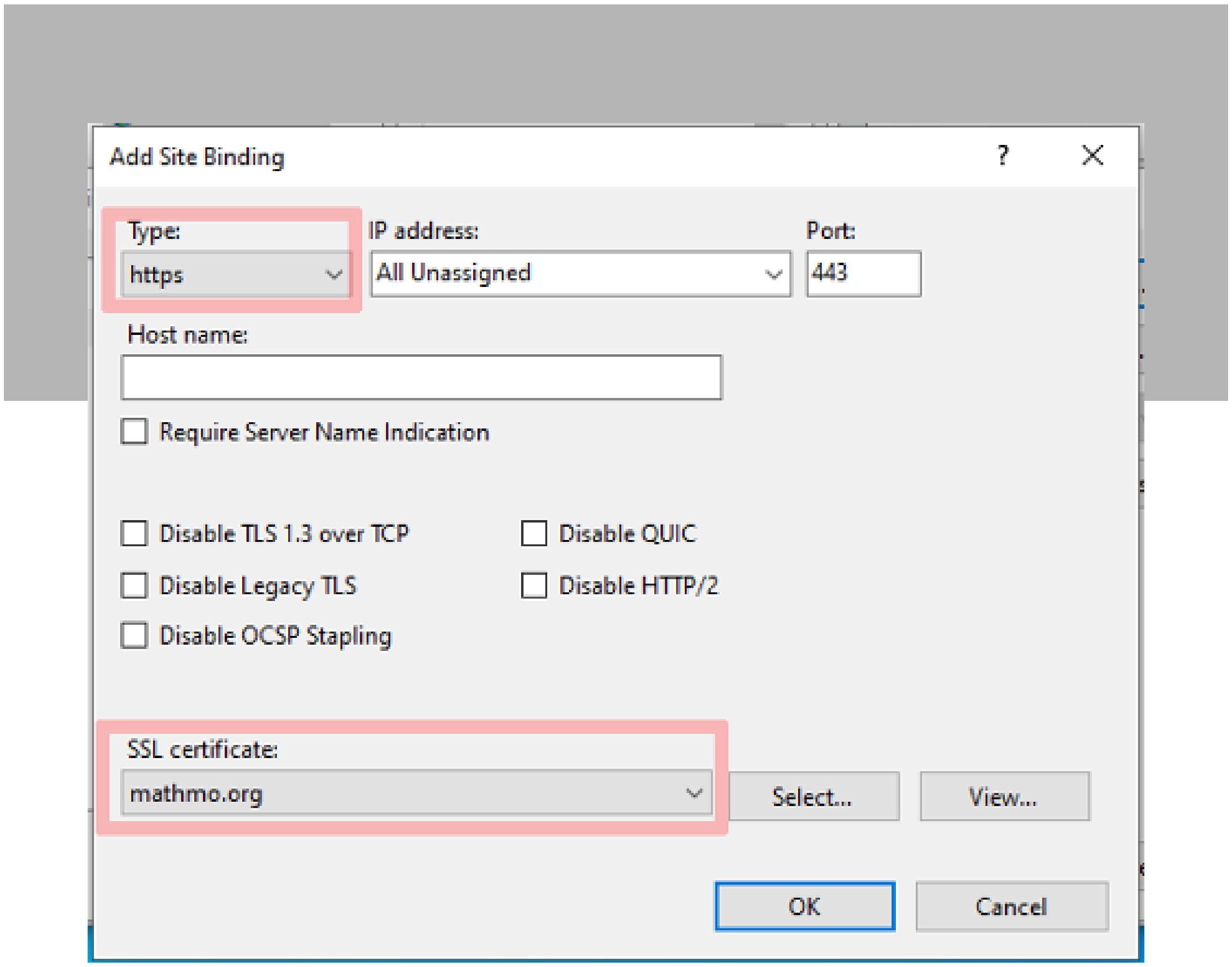
Image 2 – Opening the Site Binding Dialog




Site Bindings

Type	Host Name	Port	IP Address	Binding Informa...
http		80	*	

Image 3 - Configuring the Server Certificate for the HTTPS Binding


Add Site Binding

Type: https

IP address: All Unassigned

Port: 443

Host name:

☐ Require Server Name Indication

☐ Disable TLS 1.3 over TCP

☐ Disable QUIC

☐ Disable Legacy TLS

☐ Disable HTTP/2

☐ Disable OCSP Stapling

SSL certificate: mathmo.org

Step 3 - Enforce SSL on the Website

Ensure that your website requires SSL, and also that it requires a client certificate. This can be done by opening the SSL settings. To do this, select the website where you want to enable this feature, filter for the SSL settings, select it, and click on ***Open Feature***. In the examples show below (see images 4 and 5), the workflow is as follows:

Default Web Site -> Filter SSL Settings -> Select SSL Settings -> Open Feature

This can also be done with a PowerShell command:

```
Set-WebConfiguration -Location “Default Web Site” -Filter “system.webserver/
security/access” -Value “Ssl,SslNegotiateCert, SslRequireCert”
```

Image 4 - Opening the Website SSL Settings

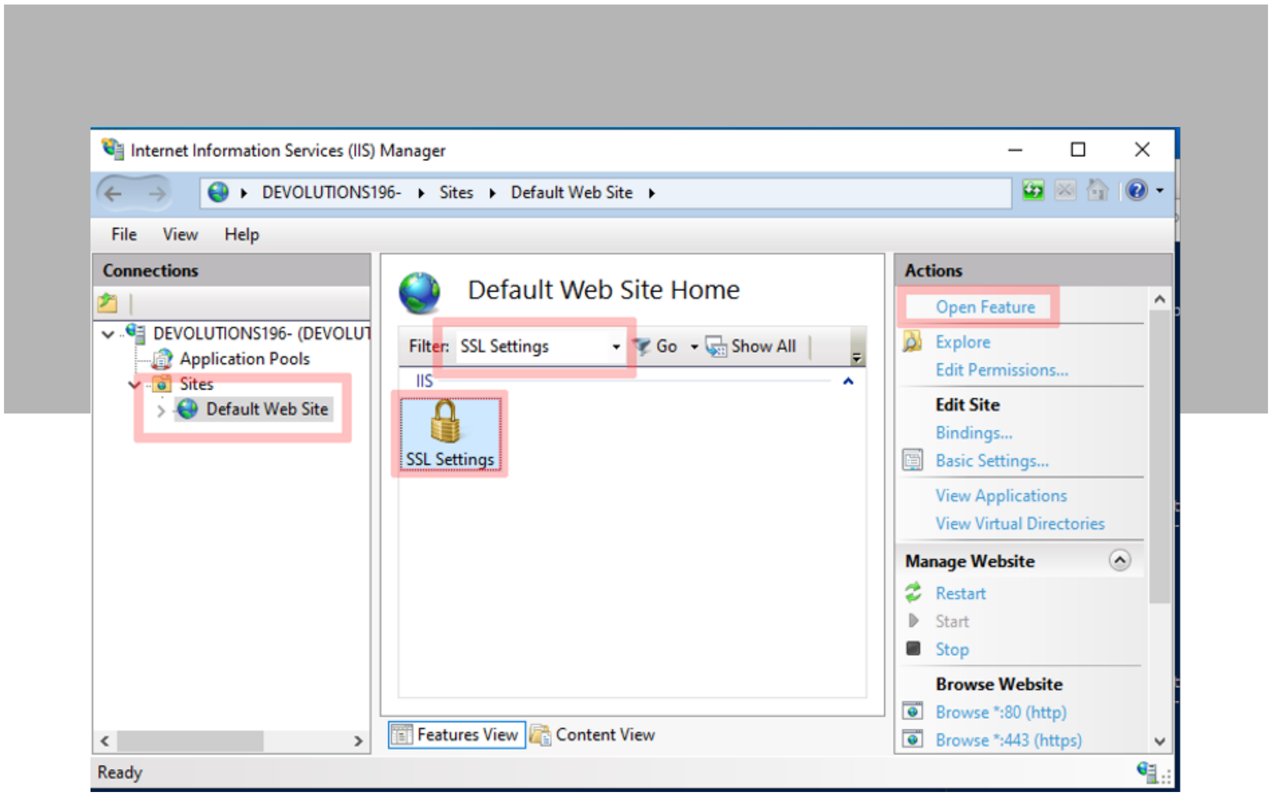
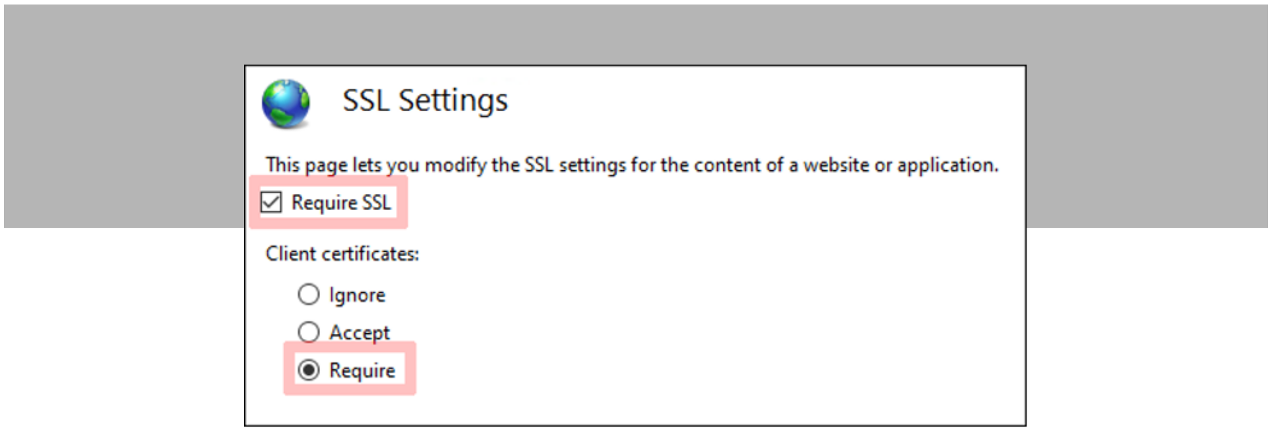


Image 5 - SSL Settings


SSL Settings

This page lets you modify the SSL settings for the content of a website or application.

☑ Require SSL

Client certificates:

- ○ Ignore
- ○ Accept
- ● Require

Step 4 - Disable Anonymous Authentication

Ensure that you disable Anonymous Authentication on your website by going into the authentication settings (see images 6 and 7).

Default Web Site -> Authentication -> Open Feature

PowerShell command:

```
Set-WebConfigurationProperty -filter “/system.WebServer/security/authentication/
AnonymousAuthentication” -name enabled -value false -location “Default Web Site”
```

Image 6 - Opening the Authentication Settings

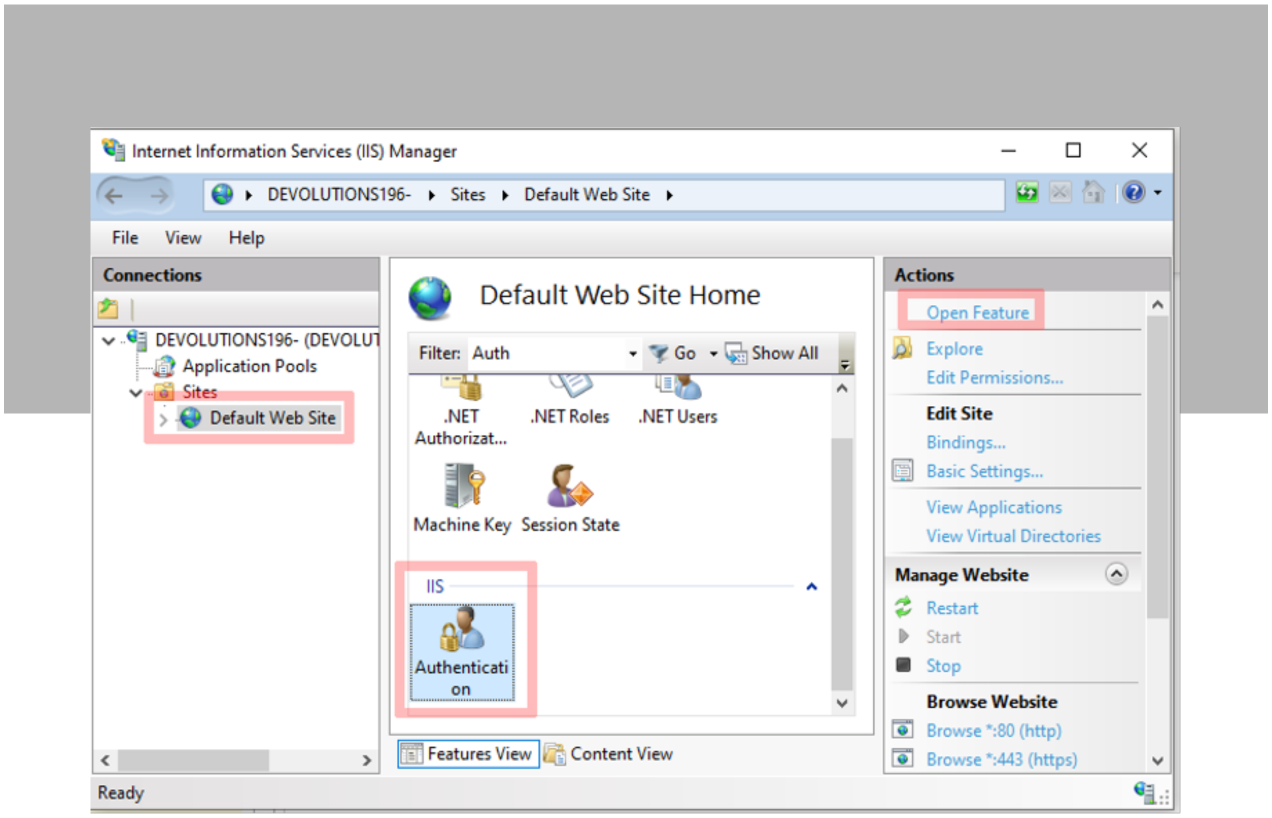
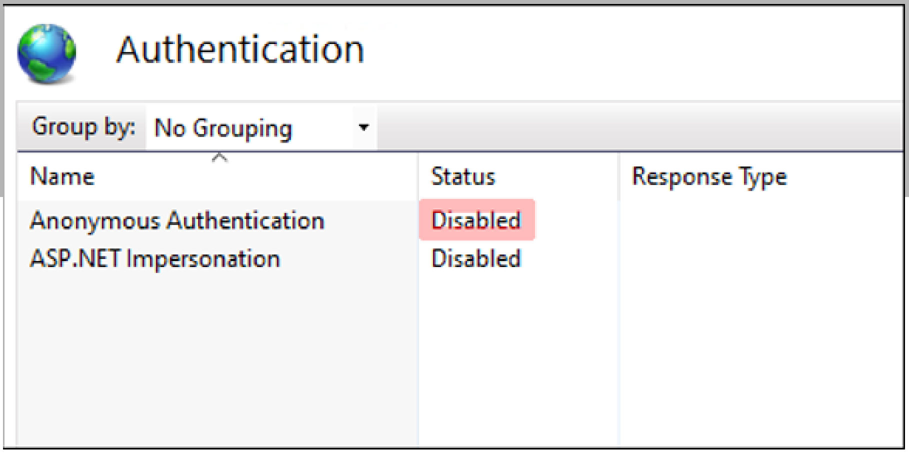


Image 7 - Disabling Anonymous Authentication


Authentication

Group by: No Grouping

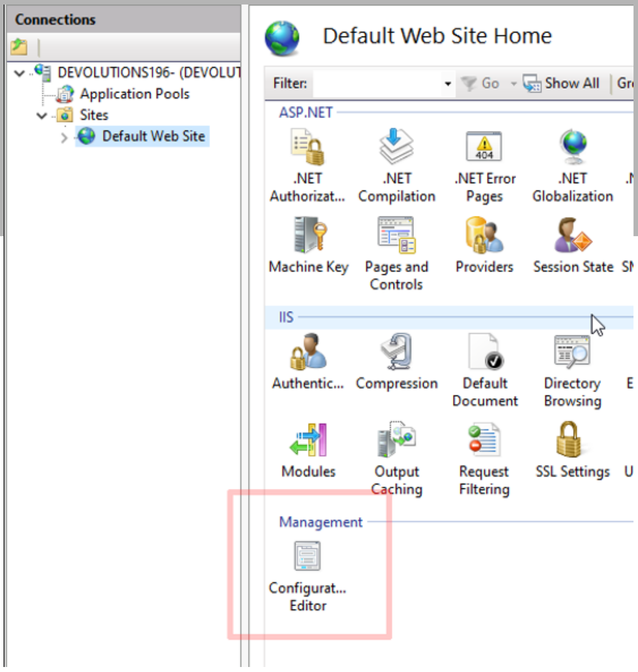
Name	Status	Response Type
Anonymous Authentication	Disabled	
ASP.NET Impersonation	Disabled	

Step 5 - Enable Client Authentication in IIS

You are now ready to enable the feature on your website!

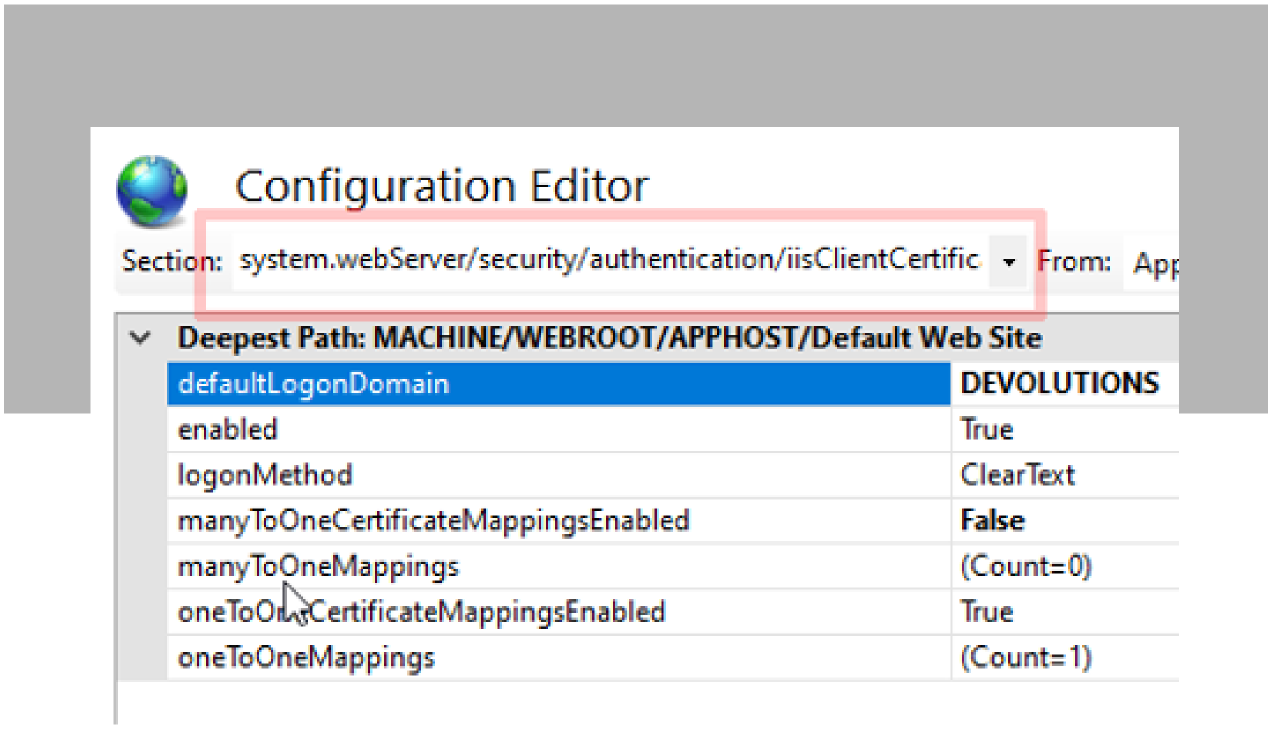
5.1 - Start by opening your website Configuration Editor.

Image 8 - Configuration Editor



5.2 - Go to the *system.webServer/security/authentication/iisClientCertificateMapping Authentication* section (see image 9).

Image 9 - Section Field


Configuration Editor
Section: system.webServer/security/authentication/iisClientCertific
From: App
Deepest Path: MACHINE/WEBROOT/APPHOST/Default Web Site

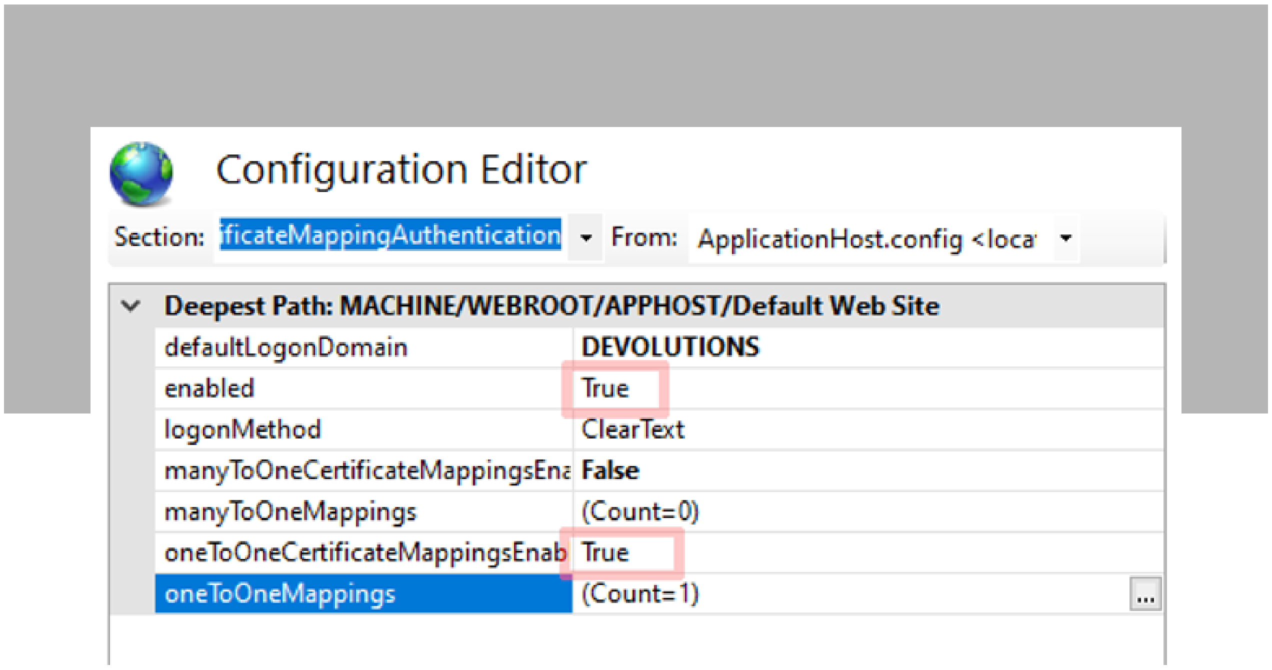
defaultLogonDomain	DEVOLUTIONS
enabled	True
logonMethod	ClearText
manyToOneCertificateMappingsEnabled	False
manyToOneMappings	(Count=0)
oneToOneCertificateMappingsEnabled	True
oneToOneMappings	(Count=1)

5.3 - Here you can choose to enable *manyToOneCertificateMappingsEnabled* or *oneToOneCertificateMappingsEnabled* (see image 10).

PowerShell

```
# enable certificate mapping authentication for Default Web Site
Set-WebConfigurationProperty -filter «/system.webServer/security/authentication/
iisClientCertificateMappingAuthentication» -name enabled -Value true -location
«Default Web Site»

# enable oneToOneCertificateMappings for Default Web Site
Set-WebConfigurationProperty -filter «/system.webServer/security/authentication/
iisClientCertificateMappingAuthentication» -name oneToOneCertificateMappings Enabled
-Value true -location «Default Web Site»

Image 10 - Enabling the Authentication Feature and the oneToOneMappings Sub-
Feature
```

Image 10 - Enabling the Authentication Feature and the oneToOneMappings Sub-Feature


Configuration Editor

Section: ficateMappingAuthentication From: ApplicationHost.config <loca

Deepest Path: MACHINE/WEBROOT/APPHOST/Default Web Site

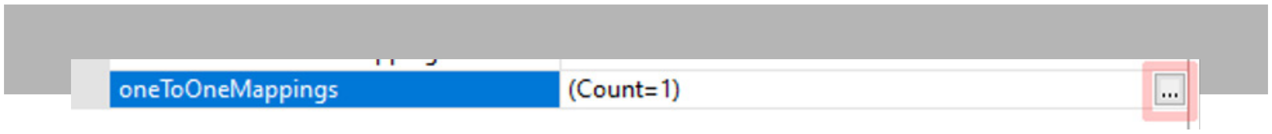
defaultLogonDomain	DEVOLUTIONS
enabled	True
logonMethod	ClearText
manyToOneCertificateMappingsEna	False
manyToOneMappings	(Count=0)
oneToOneCertificateMappingsEnab	True
oneToOneMappings	(Count=1)

We recommend the **oneToOneCertificateMappings**, as it requires users to have their own certificate and it is safer. However, **manyToOneMappings** can also be used. It will reduce the amount of management required, but it is a compromise on the security side of things. Having a single client certificate for a team or a group of users will **increase the risk** of it being leaked or compromised. The client certificate private key normally must stay on the endpoint where it has been generated.

5.4 - Open the oneToOneMappings Configuration

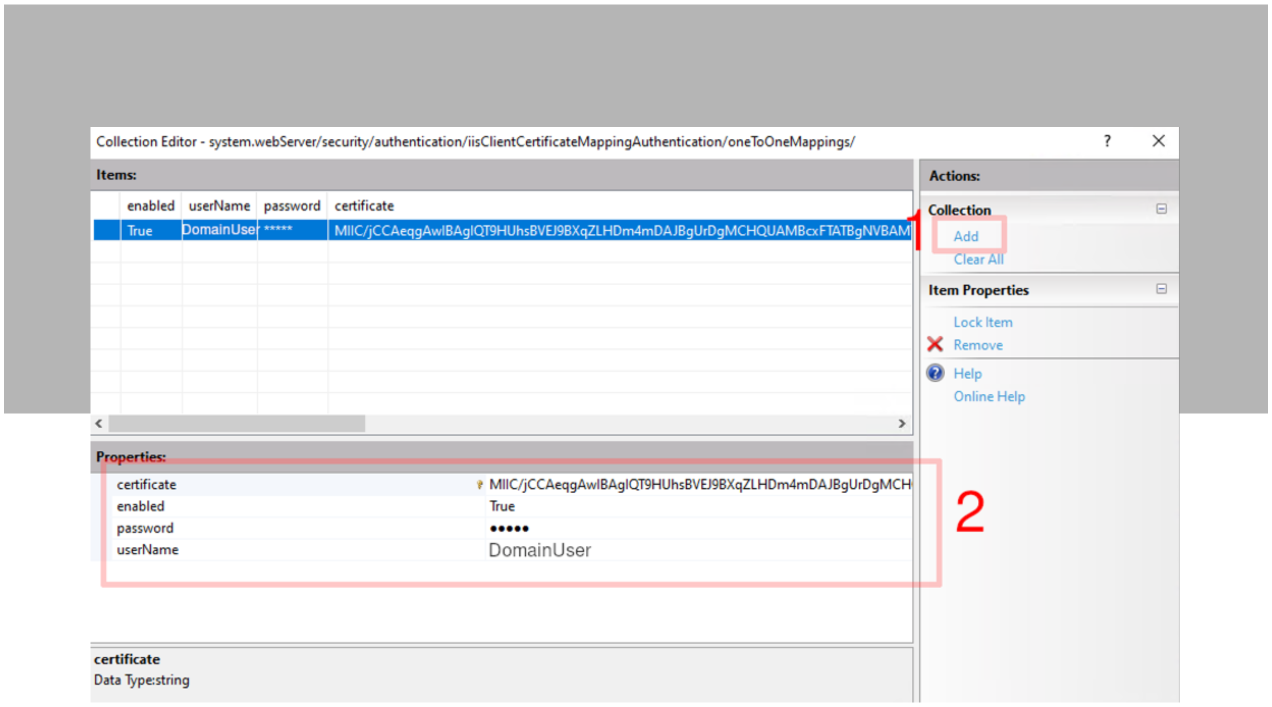
5.5 - In the dialog you can configure each user with their base64 encoded certificate **public key**** (*instructions on how to obtain it are provided at the end of this article*) and their **active directory** (AD) credentials (see images 11 and 12).

Image 11 - Button to open the oneToOneMappings configuration



oneToOneMappings	(Count=1)

Image 12 - Configuring a User


Collection Editor - system.webServer/security/authentication/iisClientCertificateMappingAuthentication/oneToOneMappings/

Items:

enabled	userName	password	certificate
True	DomainUser	*****	MIIC/jCCAeqgAwIBAgIQT9HUhsBVEJ9BXqZLHDm4mDAJBgUrDgMCHQUAMBcxFTATBgNVBAM

Properties:

certificate	MIIC/jCCAeqgAwIBAgIQT9HUhsBVEJ9BXqZLHDm4mDAJBgUrDgMCH
enabled	True
password	●●●●●
userName	DomainUser

certificate
Data Type:string

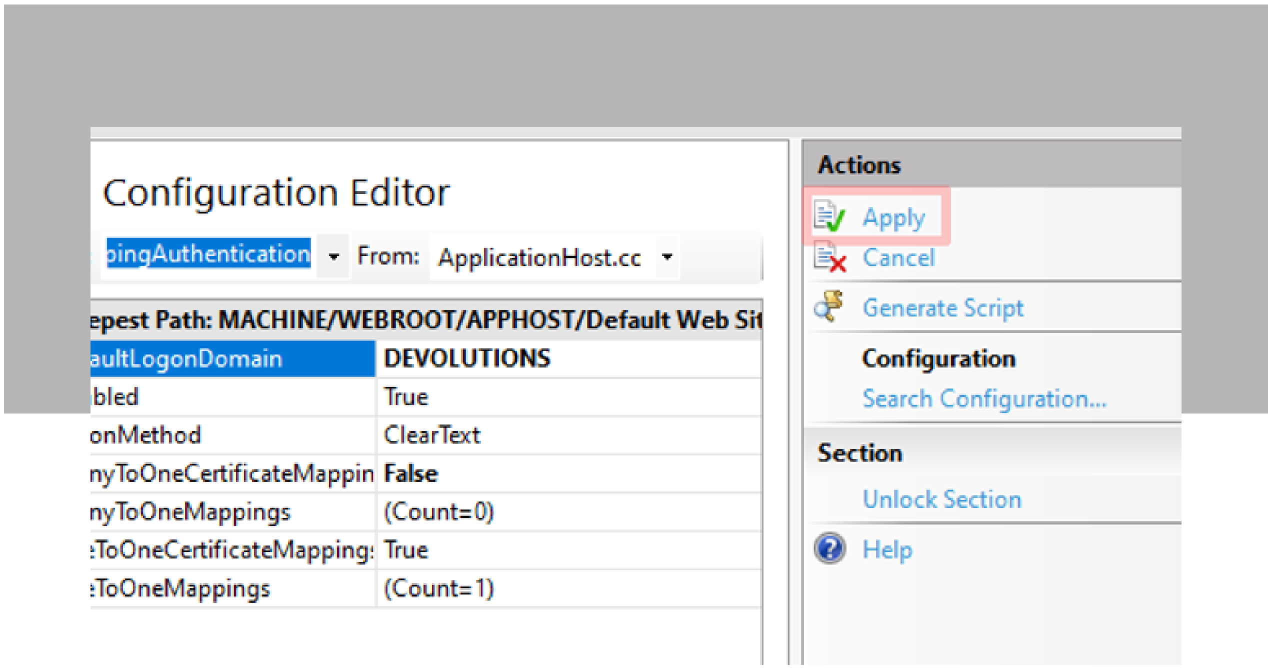
PowerShell

```
# get the oneToOneMappings collection
$collection = Get-IISConfigSection -SectionPath “system.webServer/security/
authentication/iisClientCertificateMappingAuthentication” -Location “Default Web
Site” | Get-IISConfigCollection -CollectionName “oneToOneMappings”

$username = Read-Host “Username?”
$password = Read-Host “Password?”
$b64CertificatePublicKey = Read-Host “Base64 Certificate Public key?”

# create mapping in the oneToOneCertificateMappings
New-IISConfigCollectionElement -ConfigCollection $collection -ConfigAttribute @
{“enabled” = “True”; “userName” = $username; “password” = $password; “certificate”
= $b64CertificatePublicKey}
```

Make sure that the user has read access to the site folder!

5.6 - Close the Collection Editor and Apply the New Configuration Editor Settings (see image 13).

Image 13 - Applying the Changes


Configuration Editor

pingAuthentication From: ApplicationHost.cc

epest Path: MACHINE/WEBROOT/APPHOST/Default Web Sit

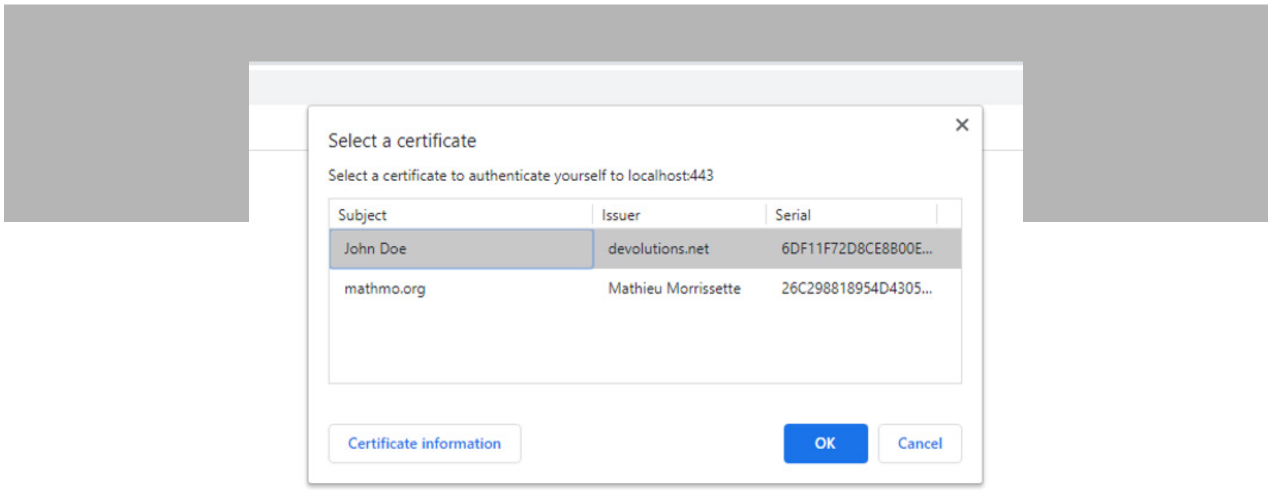
aultLogonDomain	DEVOLUTIONS
bled	True
onMethod	ClearText
nyToOneCertificateMappin	False
nyToOneMappings	(Count=0)
:ToOneCertificateMapping:	True
:ToOneMappings	(Count=1)

It is recommended that you restart your website.

Results

If everything works the way it is supposed to, then accessing the website using a popular browser should prompt a dialog box that forces the user to select a certificate to authenticate themselves before accessing the server (see image 14).

Image 14 - TLS Client Authentication Dialog in Google Chrome


Select a certificate

Select a certificate to authenticate yourself to localhost:443

Subject	Issuer	Serial
John Doe	devolutions.net	6DF11F72D8CE8B00E...
mathmo.org	Mathieu Morrissette	26C298818954D4305...

Click here for additional resources.

Note: If you followed this blog to generate self-signed certificates, then the client public key is located in the **client1.crt file**. The header -----**BEGIN CERTIFICATE**----- and footer -----**END CERTIFICATE**----- and line breaks must be removed. View the example below:

File: **client1.crt**

```
-----BEGIN CERTIFICATE-----
MIICUjCCAfegAwIBAgIUbfEfctjOiwDqqBR1vupzjdN4qI0wCgYIKoZIzj0EAwIwgZ8xC
zAJBgNVBAYTAkNBMQswCQYDVQQIDAJRQzESMBAGA1UEBwwJTGF2YWx0cmllMRkwFwYDVQQKDB
BEZXZvbHV0aW9ucyBpbmMuMREwDwYDVQQLDAhTZWN1cml0eTEYMBYGA1UEAwwPZGV2b2x1dGl
vbnMubmV0MScwJQYJKoZIhvcNAQkBFhhzZWN1cml0eUBkZXZvbHV0aW9ucy5uZXQwH
hcNMjAwNjI1MTUwMjMyWhcNMjMwMzIyMTUwMjMyWjCBlzELMAkGA1UEBhMCQ0ExC
zAJBgNVBAgMAlFDMRIwEAYDVQQHDAlMYXZhbHRyaWUxGTAXBgNVBAoMEERldm9sdXRpb
25zIGluYy4xETAPBgNVBAsMCFNlY3VyaXR5MREwDwYDVQQDDAhKb2huIERvZTEmMCQGCSqGSIb
3DQEJARYXSm9obkRvZUBkZXZvbHV0aW9ucy5uZXQwWTATBgcqhkjOPQIBBggqhkjOPQMBBwN
CAAT/kLSLRnKIdewU9Ze8KuZbuz7y1PfhTMEfV7ZQ3gRfSxGdRBxftaNFPtxjkmO9hVowyp
tUR8UvGc9Ia8rRX6NwoxcwFTATBgNVHSUEDDAKBggrBgEFBQcDAjAKBggqhkjOPQQDAgNJADB
GAiEAwvtbZNwzaf1RMvanSGorJwxYSSBiPIUg0YmyfIpG6pwCIQCoE9+V3/2ULCj9NtzEYsW2u
PojMQ3ddr1CpE2m07yIdQ==
-----END CERTIFICATE-----
```

Should be changed to:

```
MIICUjCCAfegAwIBAgIUbfEfctjOiwDqqBR1vupzjdN4qI0wCgYIKoZIzj0EAwIwgZ8xC
zAJBgNVBAYTAkNBMQswCQYDVQQIDAJRQzESMBAGA1UEBwwJTGF2YWx0cmllMRkwFwYDVQQKDB
BEZXZvbHV0aW9ucyBpbmMuMREwDwYDVQQLDAhTZWN1cml0eTEYMBYGA1UEAwwPZGV2b2x1dGl
vbnMubmV0MScwJQYJKoZIhvcNAQkBFhhzZWN1cml0eUBkZXZvbHV0aW9ucy5uZXQwH
hcNMjAwNjI1MTUwMjMyWhcNMjMwMzIyMTUwMjMyWjCBlzELMAkGA1UEBhMCQ0ExC
zAJBgNVBAgMAlFDMRIwEAYDVQQHDAlMYXZhbHRyaWUxGTAXBgNVBAoMEERldm9sdXRpb
25zIGluYy4xETAPBgNVBAsMCFNlY3VyaXR5MREwDwYDVQQDDAhKb2huIERvZTEmMCQGCSqGSIb
3DQEJARYXSm9obkRvZUBkZXZvbHV0aW9ucy5uZXQwWTATBgcqhkjOPQIBBggqhkjOPQMBBwN
CAAT/kLSLRnKIdewU9Ze8KuZbuz7y1PfhTMEfV7ZQ3gRfSxGdRBxftaNFPtxjkmO9hVowyp
tUR8UvGc9Ia8rRX6NwoxcwFTATBgNVHSUEDDAKBggrBgEFBQcDAjAKBggqhkjOPQQDAgNJADB
GAiEAwvtbZNwzaf1RMvanSGorJwxYSSBiPIUg0YmyfIpG6pwCIQCoE9+V3/2ULCj9NtzEYsW2u
PojMQ3ddr1CpE2m07yIdQ==
```

I hope this tutorial is helpful for you. Please let me know if you would like me to create a tutorial to enable this feature on Apache, Nginx, or other servers!