Quick Note 63

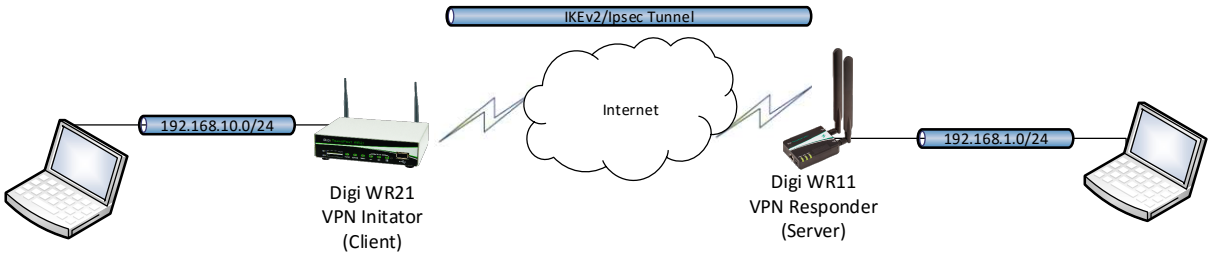
How To Configure IKEv2 VPN between TransPort WR routers using Open SSL Certificates

Contents

1 INTRODUCTION

1.1 Outline

This document describes how to create, upload SSL certificates and configure Digi TransPort WR routers to build a VPN tunnel using IKEv2.



1.2 Assumptions

This guide has been written for use by technically competent personnel with a good understanding of the communications technologies used in the product and of the requirements for their specific application. It also assumes a basic ability to access and navigate a Digi TransPort router.

This application note applies to:

Model: DIGI TransPort WR11/WR21

Firmware versions: 5169 and later

Please note: This application note has been specifically rewritten for firmware release 5169 and later and will not work on earlier versions of firmware. Please contact tech.support@digi.com if your require assistance in upgrading the firmware of the TransPort router.

1.3 Corrections

Requests for corrections or amendments to this application note are welcome and should be addressed to: tech.support@digi.com.
Requests for new application notes can be sent to the same address.

1.4 Version

Version	Status
1.0	Published

2 GENERATE TEST CERTIFICATES

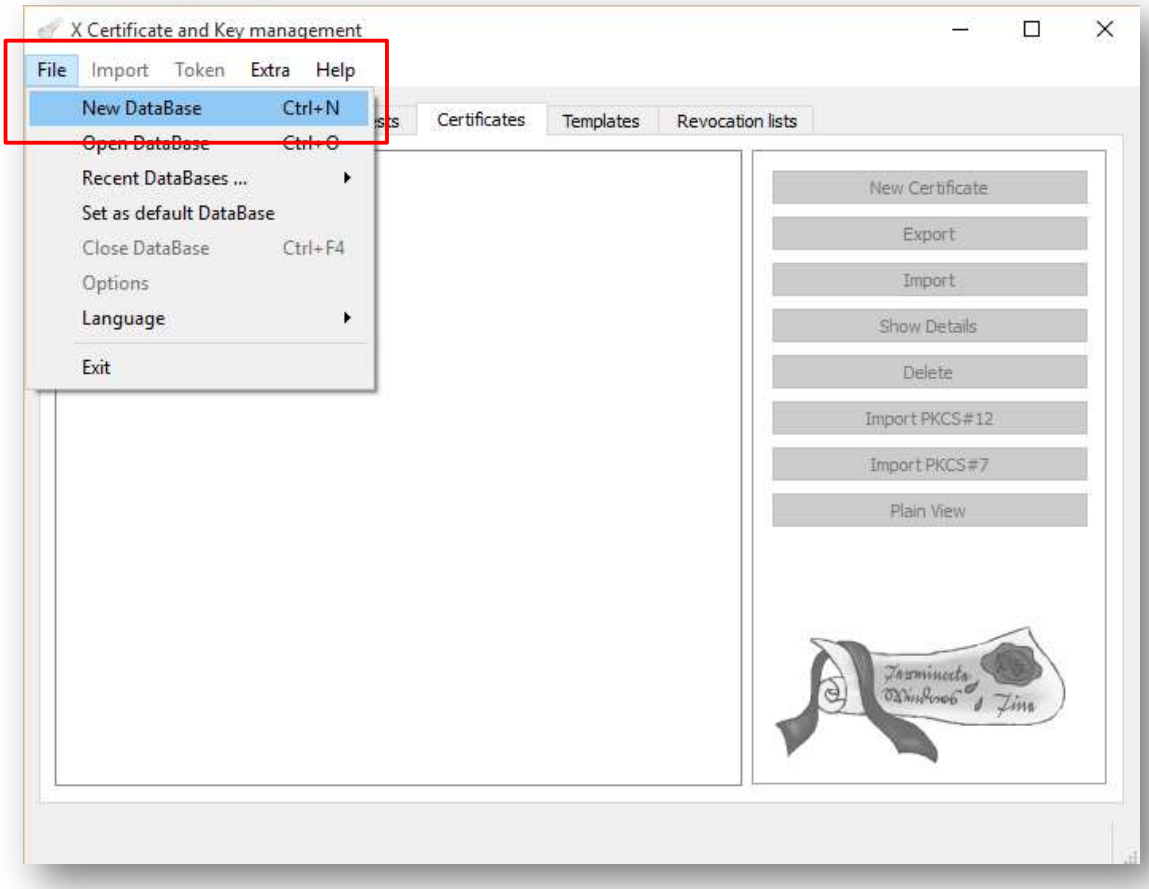
Note: If you already have certificates available, you can skip to section 3

In order to create the certificates that will be used in the IKEv2 VPN, XCA application ca be used. The first step is to download and install the latest release of XCA which can be found at: http://sourceforge.net/projects/xca/.

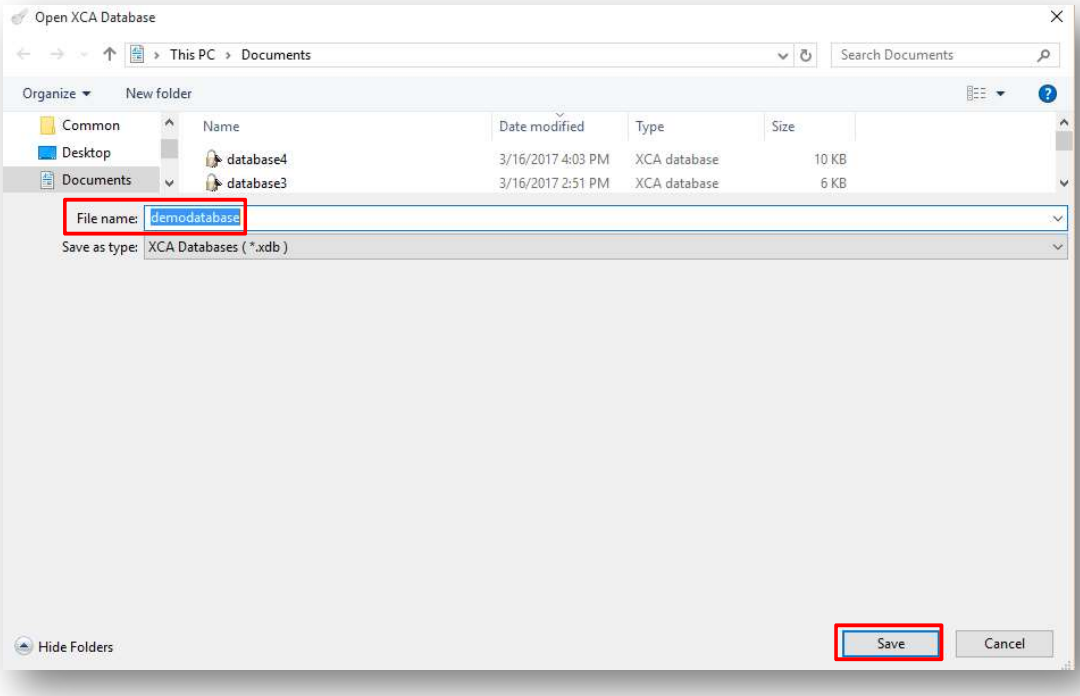
In this section will be explained how to create the Root CA certificate, the CA-Signed Host Certificates for both the Responder and the Initiator, and all the related Keys. Will be also shown how to export those certificates and keys in order to be then uploaded on the Transport routers.

2.1 Create a Root CA Certificate

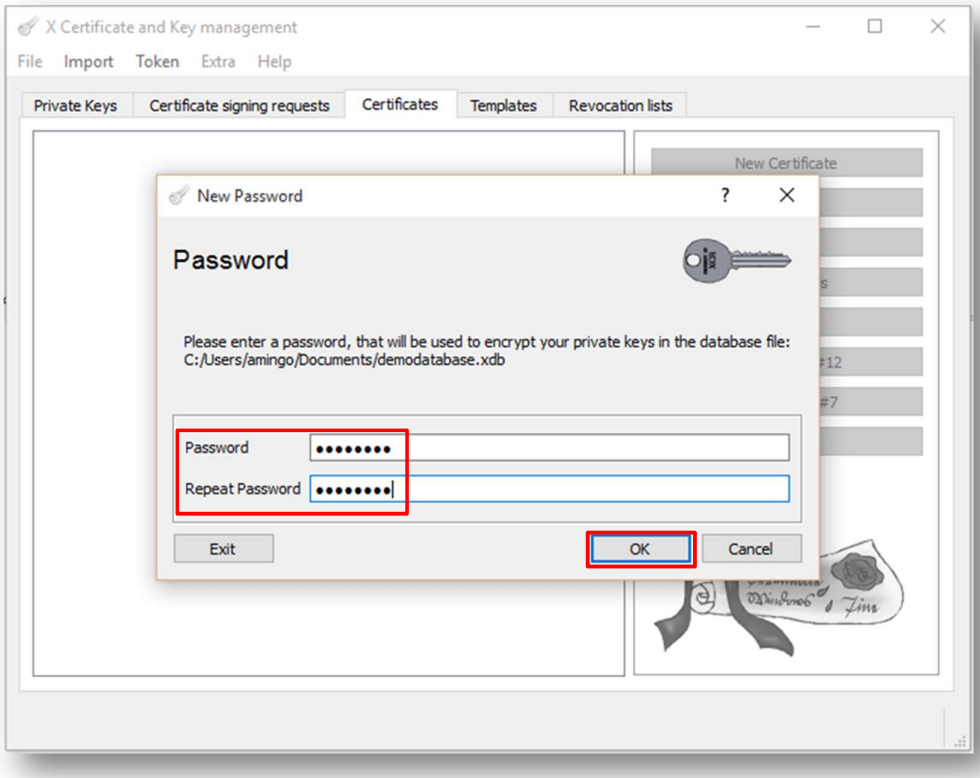
Open the XCA application, click on **File > New Database:**



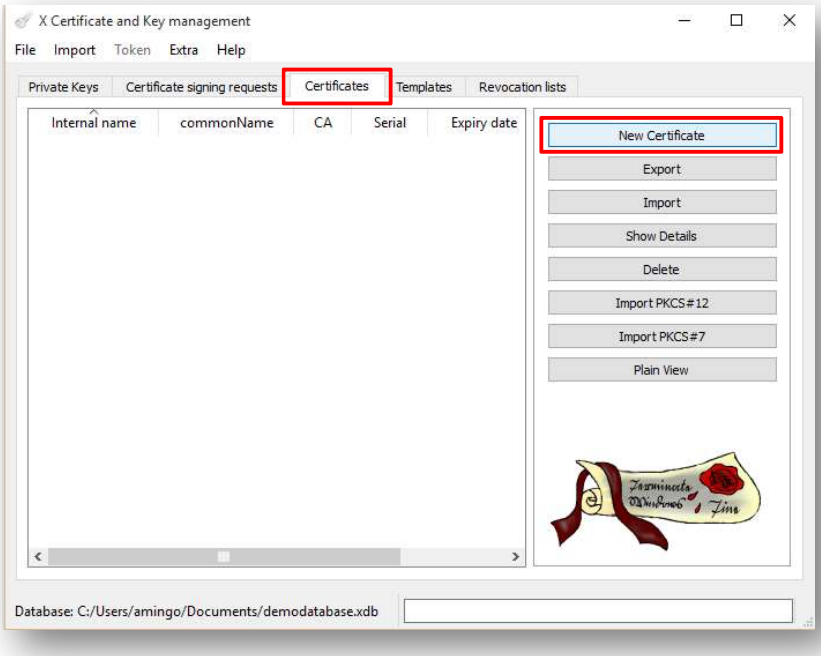
Chose a name for the Database and click "**Save**":



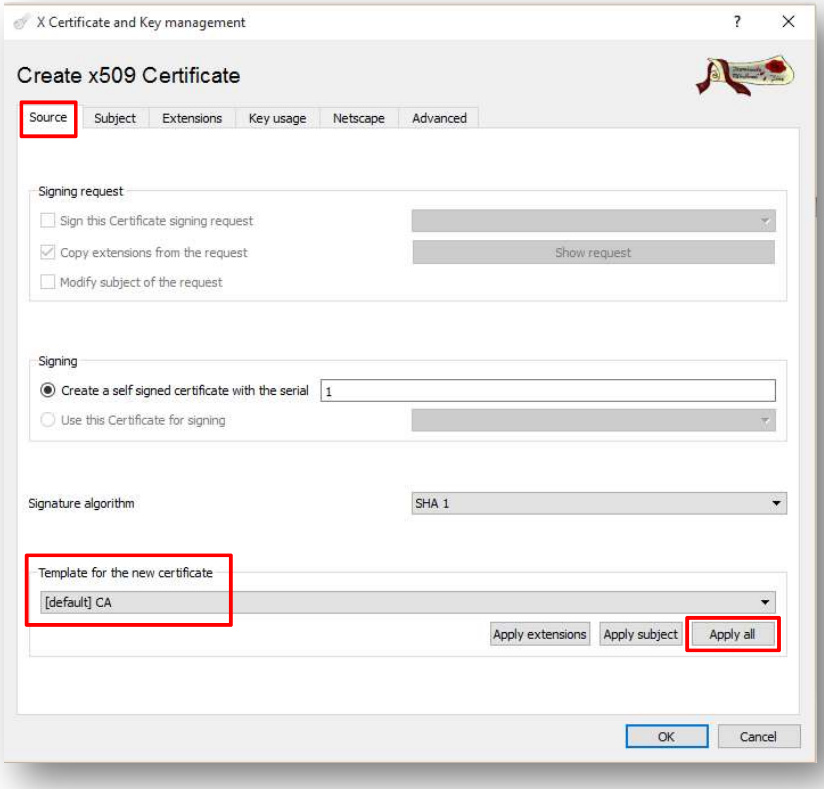
Chose a password for the Database and click "**OK**":



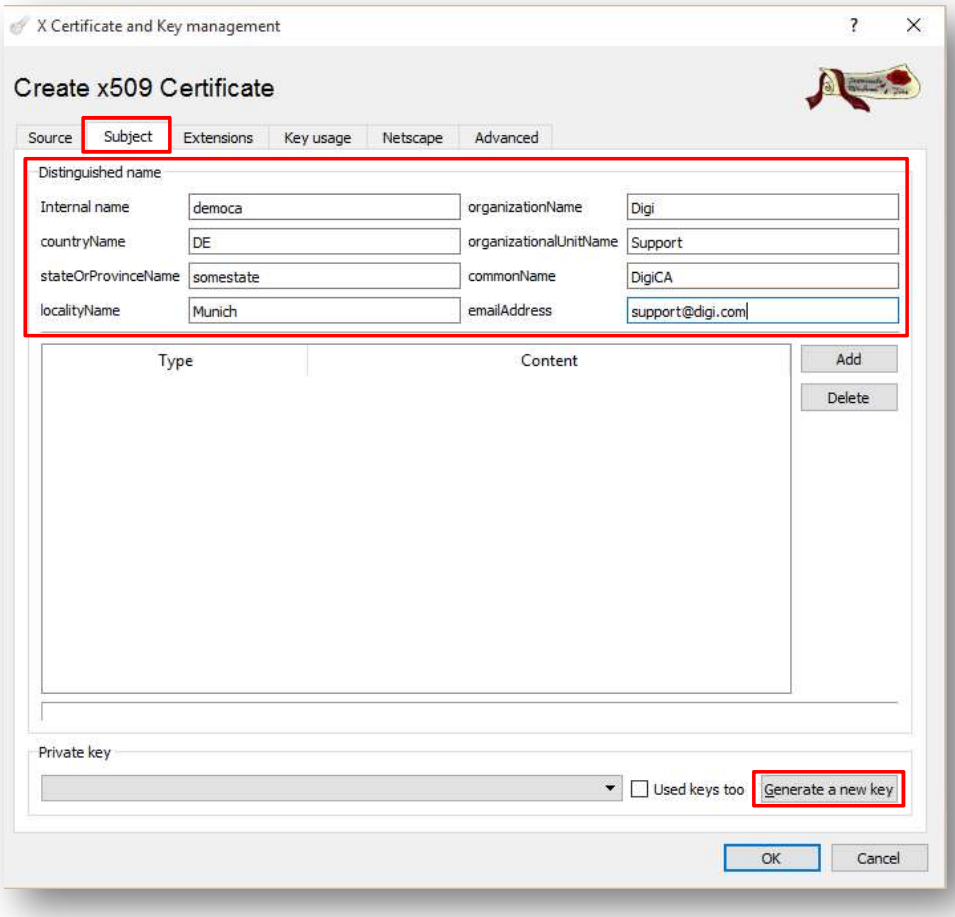
Under the "**Certificates**" tab, click on "**New Certficate**":



The "**Create x509 certificate**" window will be shown. In the "**Source**" tab check the "**Template for the new certificate**" and ensure that "**[default] CA**" is selected. Then click on "**Apply all**"



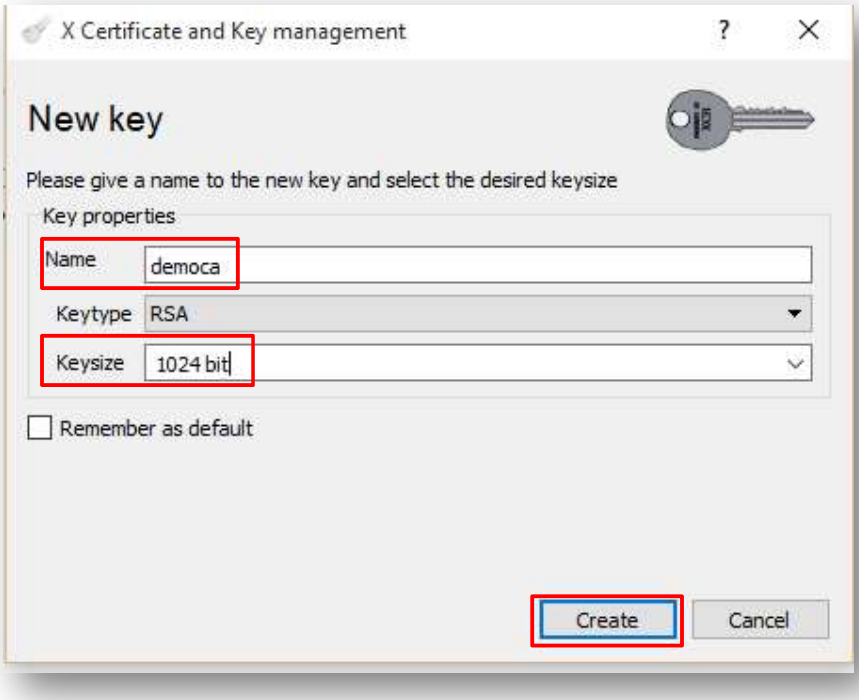
Go to the "**Subject**" tab, fill in all the information then click the "**Generate a new key**" button:



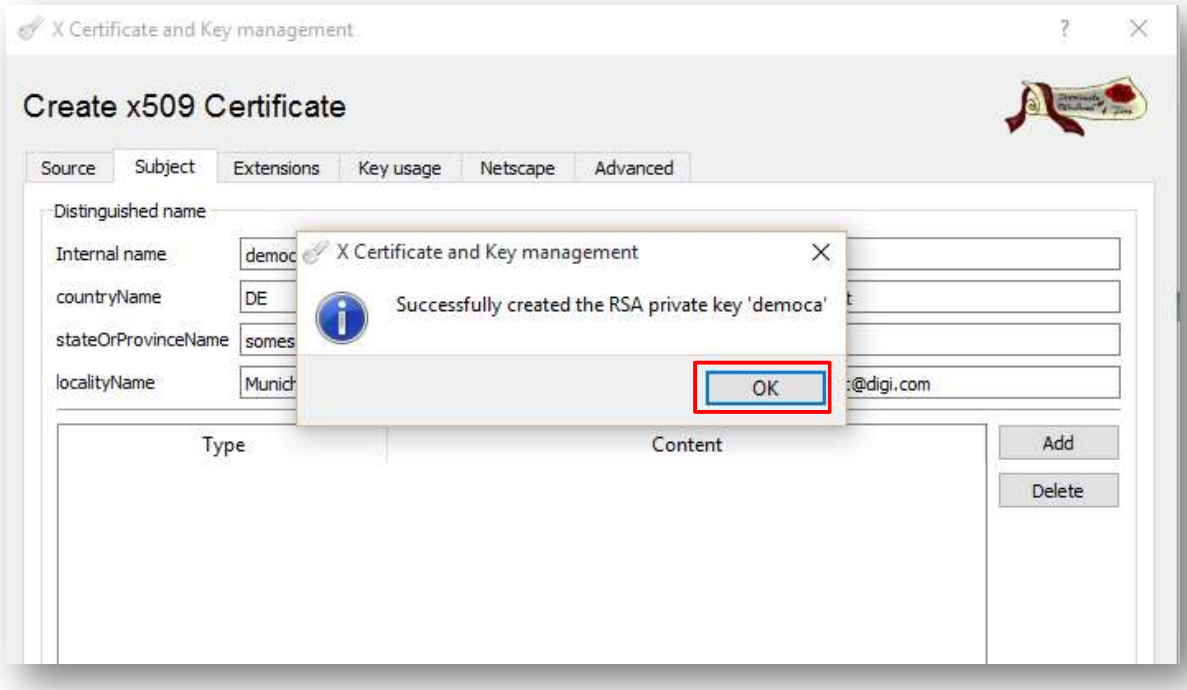
Where:

Parameter	Setting	Description
Internal name	democa	This is for display purposes in the tool only
Country Name	DE	The two-letter ISO 3166 abbreviation for your country.
State or Province Name	somestate	The state or province where your organization is legally located. Do not abbreviate.
Locality Name	Munich	The city where your organization is legally located. Do not abbreviate.
Organization Name	Digi	The exact legal name of your organization. Do not abbreviate your organization name.
Organizational Unit Name	Support	Section of the organization.
Common Name	DigiCA	In this example DigiCA will be used.
Email Address	support@digi.com	Enter your organization general email address.

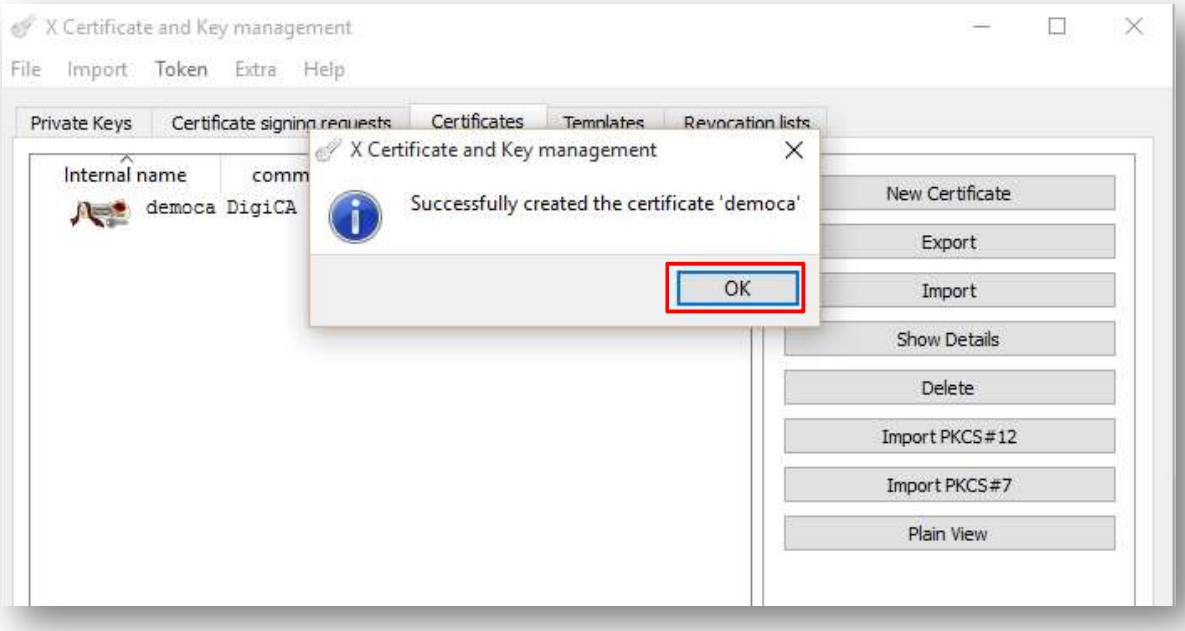
The "**New Key**" window will be shown, chose the name and Keysize and click on "Create":



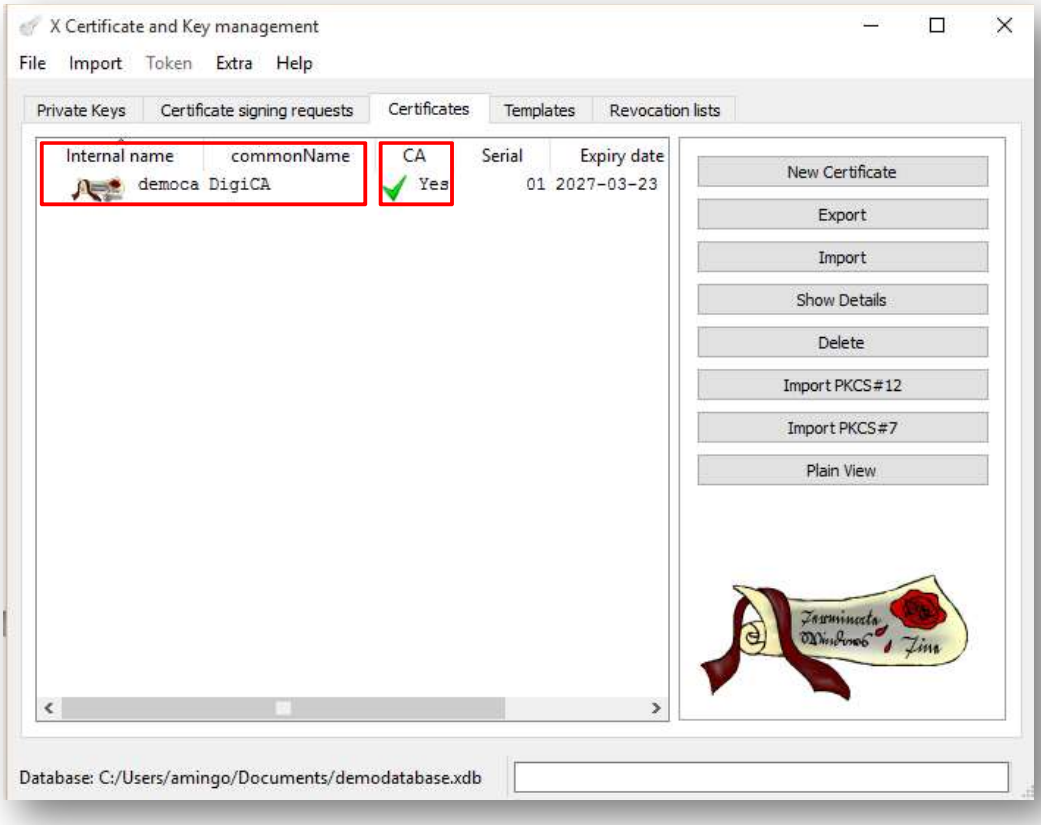
A pop-up window will show up as a confirmation of the Key creation:



Click "**OK**" to close this and click again "**OK**" in the main "**Create x509 certificate**" window to complete the creation of certificate. Again, a pop-up window will show up as a confirmation of the Certificate creation:



Click "**OK**" to close this and the certificate should now appear in the XCA main window with the "**CA : YES**" confirmation. If it does not say CA: YES, verify that you selected CA in the template and clicked Apply All.

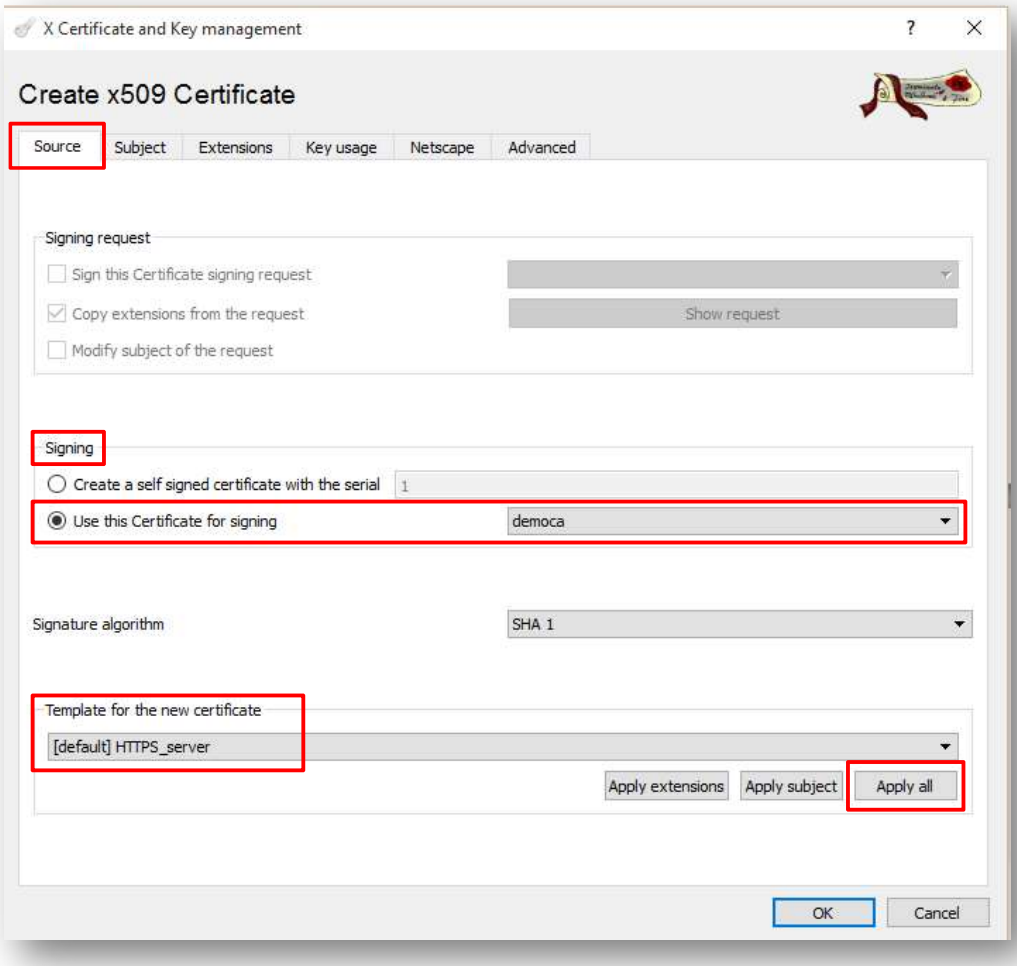


2.2 Create a CA-Signed Host Certificate (Responder)

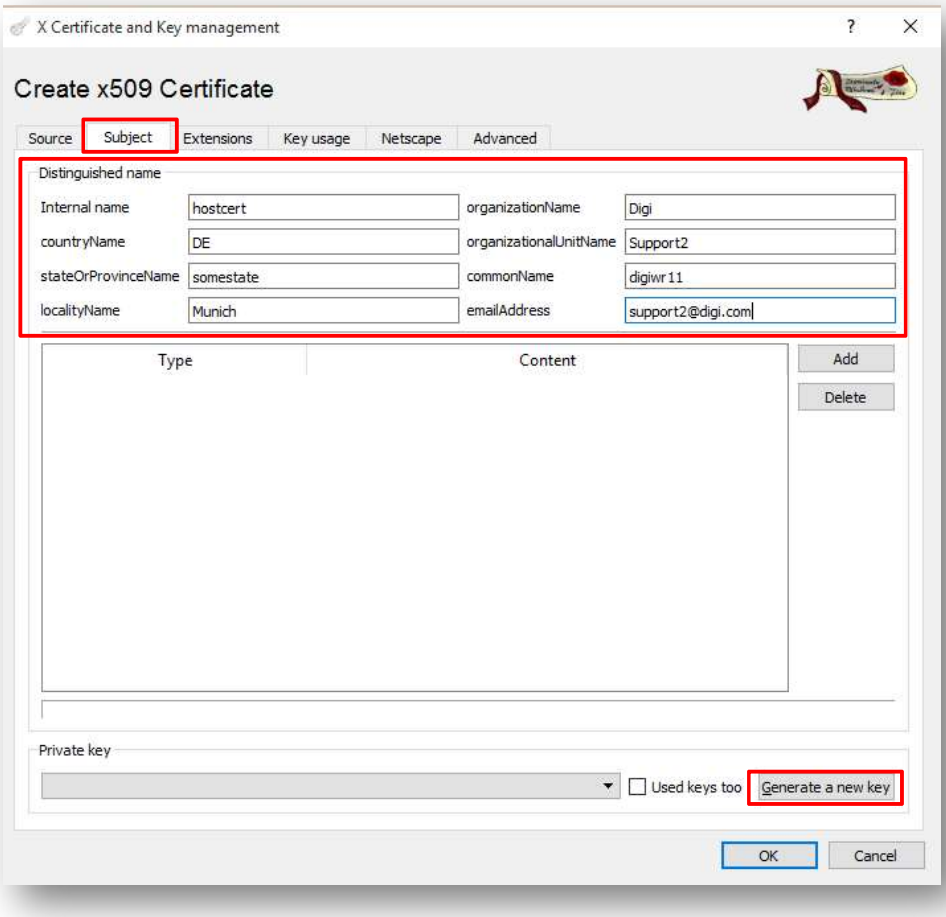
Under the "**Certificates**" tab, click again on "**New Certficate**" and the "**Create x509 certificate**" window will be shown.

In the "**Source**" tab check the "**Signing**" section and make sure to select "**Use this Certificate for signing**" and chose the previously created CA.

Under "**Template for the new certificate**" select "[**default] HTTPS_server**"and click "**Apply all**":



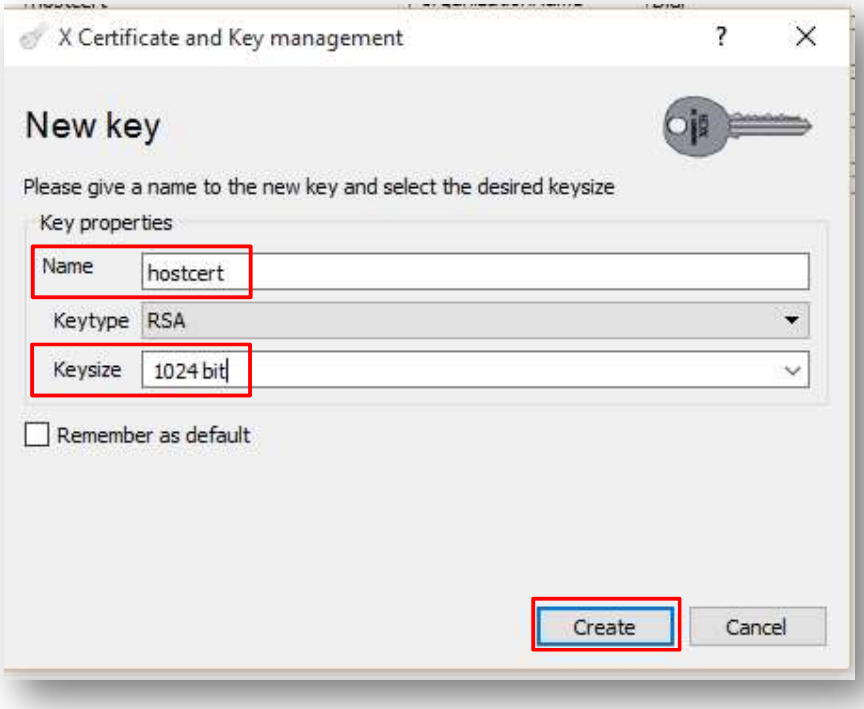
Go to the "**Subject**" tab, fill in all the information then click the "**Generate a new key**" button:



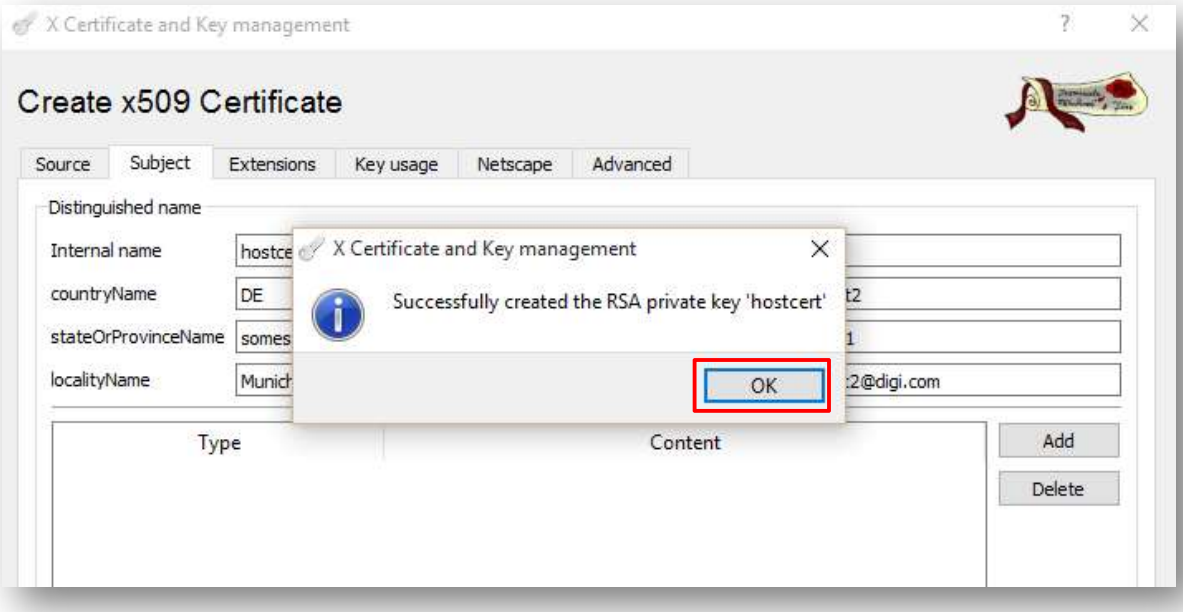
Where:

Parameter	Setting	Description
Internal name	hostcert	This is for display purposes in the tool, only
Country Name	DE	The two-letter ISO 3166 abbreviation for your country.
State or Province Name	somestate	The state or province where your organization is legally located. Do not abbreviate.
Locality Name	Munich	The city where your organization is legally located. Do not abbreviate.
Organization Name	Digi	The exact legal name of your organization. Do not abbreviate your organization name.
Organizational Unit Name	Support2	Section of the organization.
Common Name	digiwr11	In this example **digiwr11** will be used. This will be used as the router Identity for the IPSec tunnel settings on the **responder**
Email Address	support2@digi.com	Enter your organization general email address.

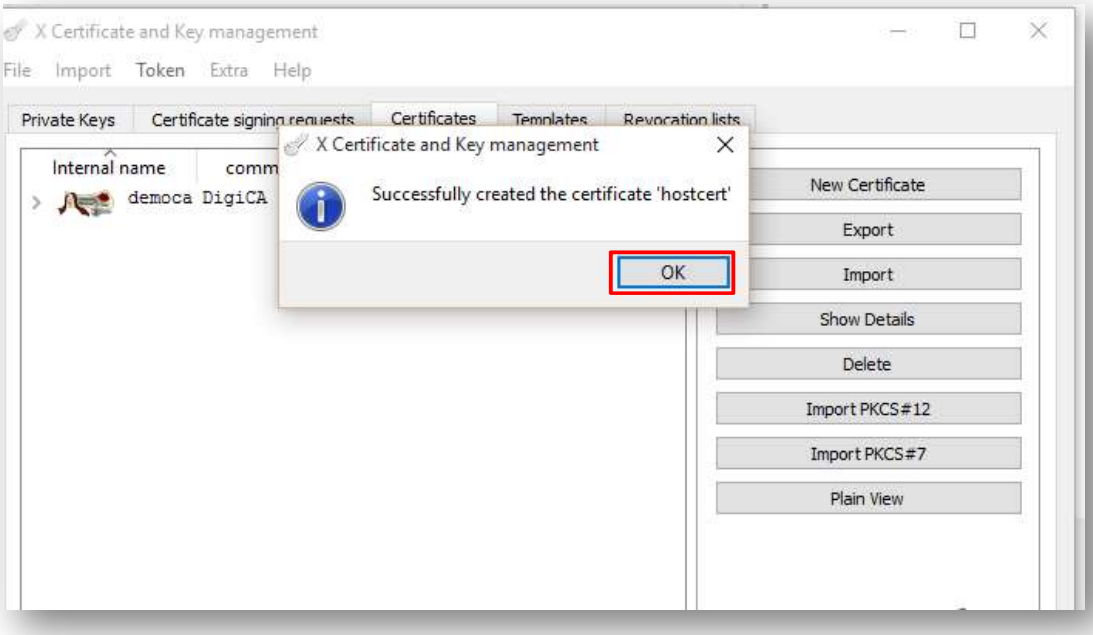
The "**New Key**" window will be shown, chose the name and Keysize and click on "Create":



A pop-up window will show up as a confirmation of the Key creation:

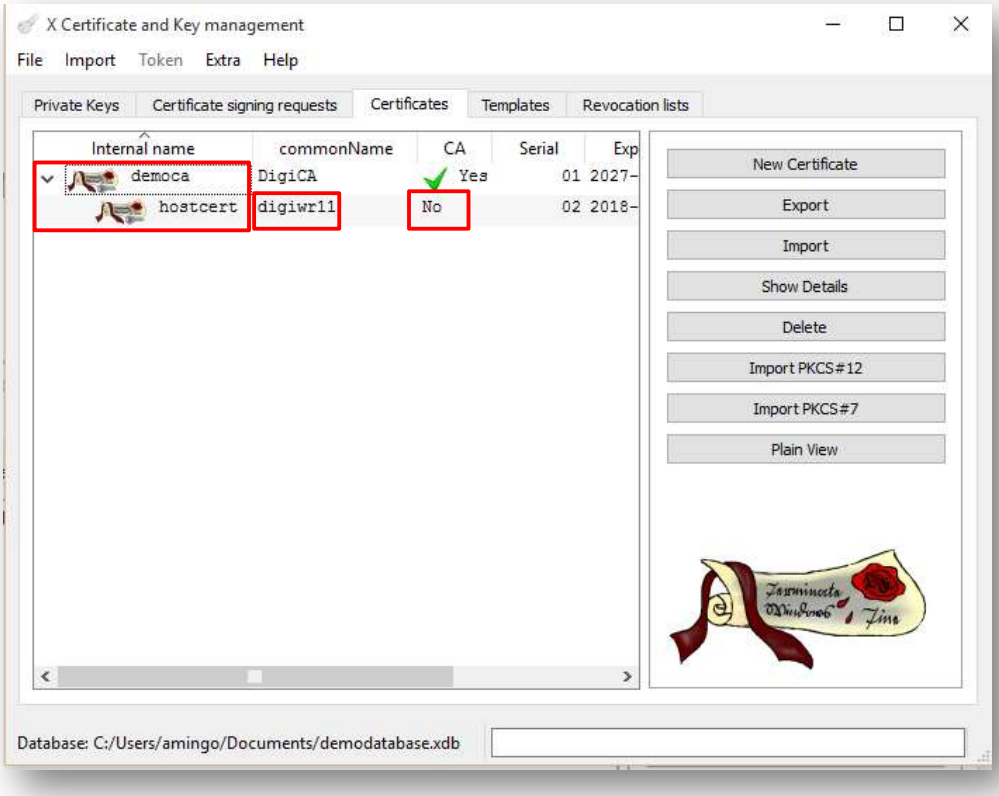


Click "**OK**" to close this and click again "**OK**" " in the main "**Create x509 certificate**" window to complete the creation of certificate. Again, a pop-up window will show up as a confirmation of the Certificate creation:



Click "**OK**" to close this and the certificate should now appear in the window under the CA certificate.

Please Note: the value in the Common Name field for this certificate, will be used as Responder ID in the IPsec tunnel settings.

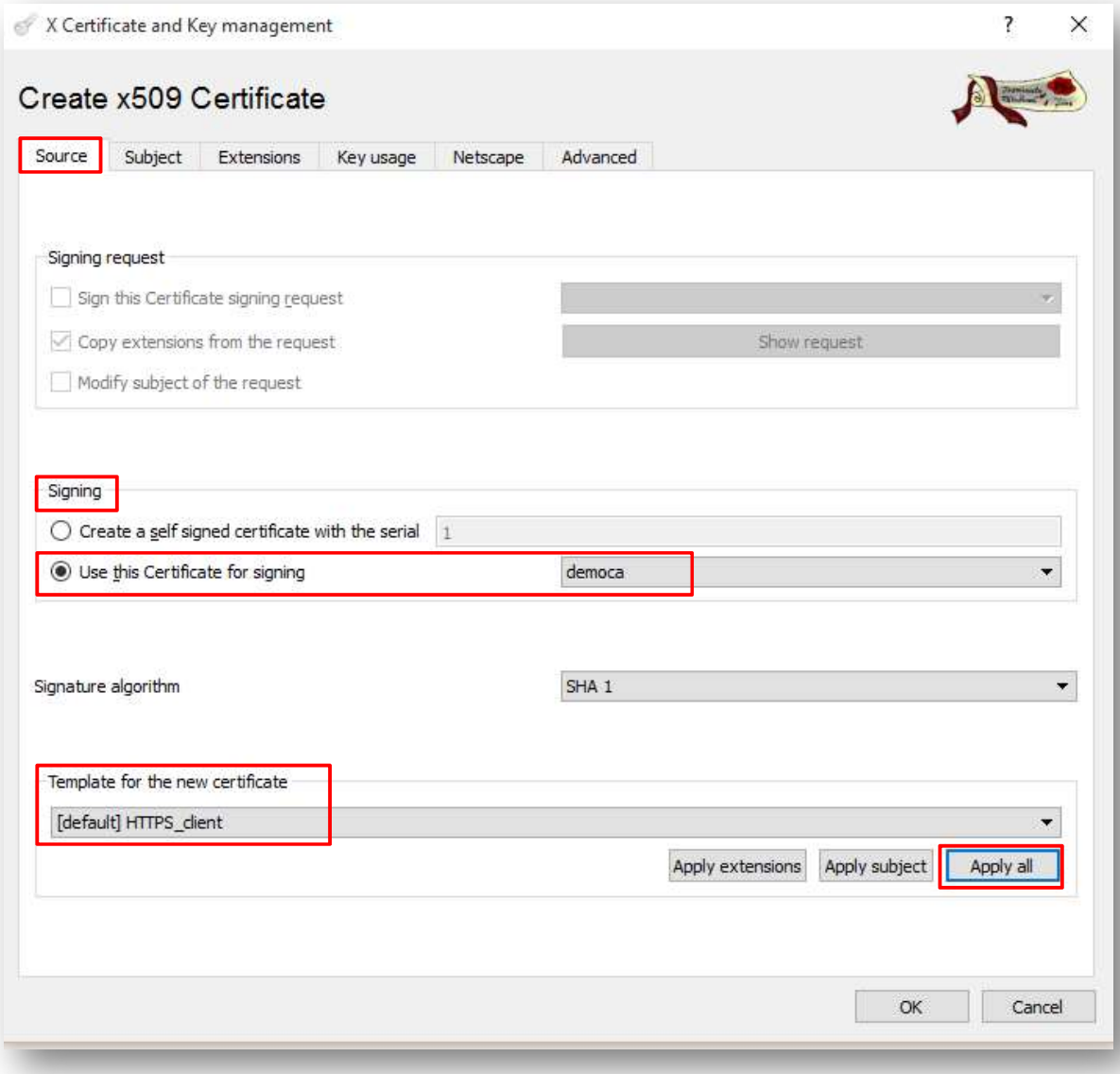


2.3 Create a CA-Signed Client Certificate (Initiator)

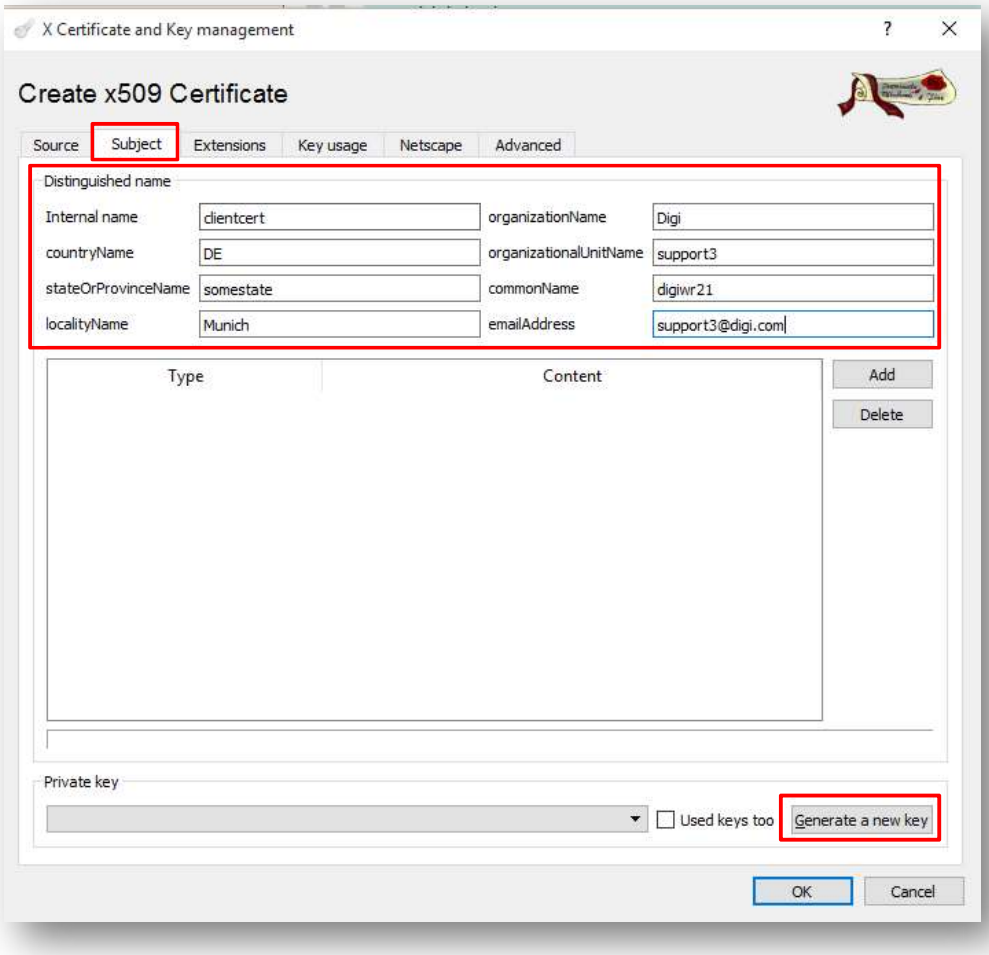
Under the "**Certificates**" tab, click again on "**New Certficate**" and the "**Create x509 certificate**" window will be shown.

In the "**Source**" tab check the "**Signing**" section and make sure to select "**Use this Certificate for signing**" and chose the previously created CA.

Under "**Template for the new certificate**" select "[**default] HTTPS_client**"and click "**Apply all**":



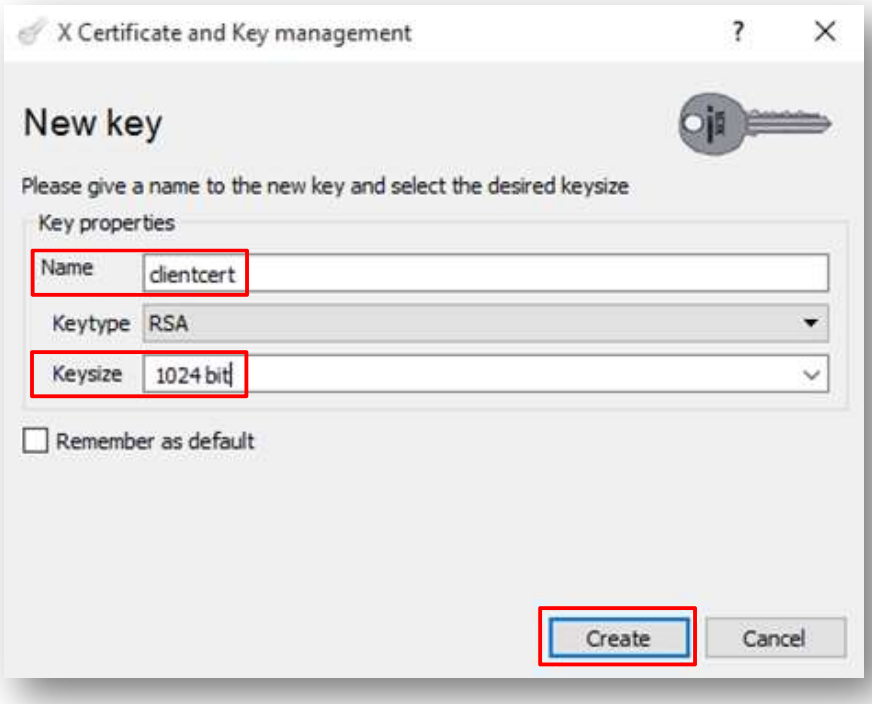
Go to the "**Subject**" tab, fill in all the information then click the "**Generate a new key**" button:



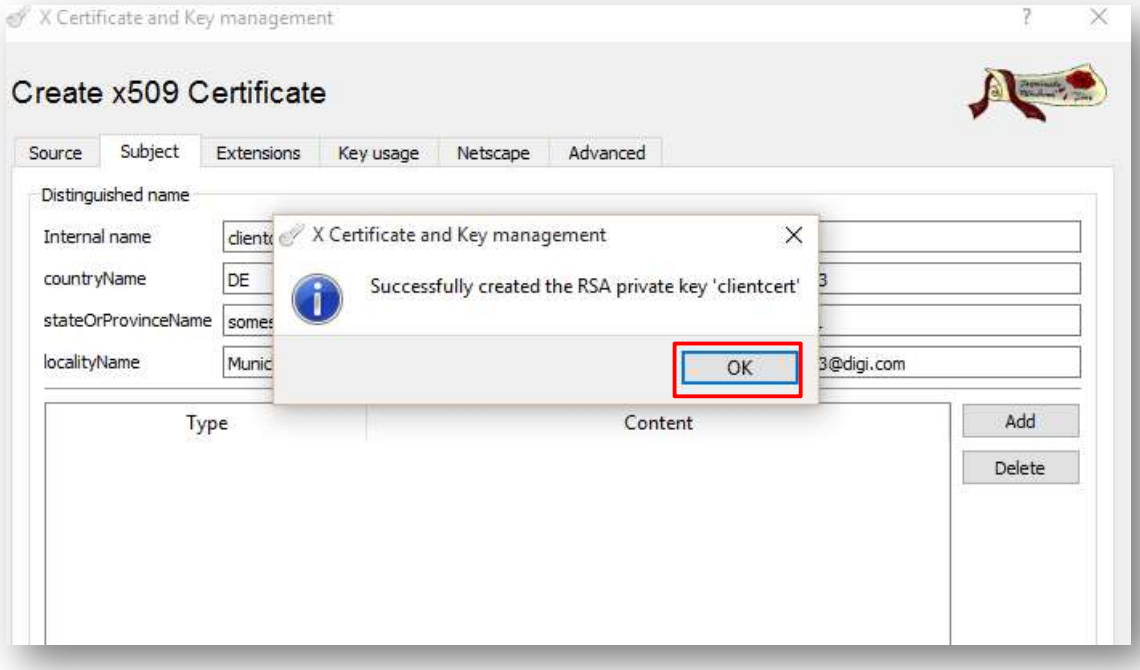
Where:

Parameter	Setting	Description
Internal name	clientcert	This is for display purposes in the tool only
Country Name	DE	The two-letter ISO 3166 abbreviation for your country.
State or Province Name	Somestate	The state or province where your organization is legally located. Do not abbreviate.
Locality Name	Munich	The city where your organization is legally located. Do not abbreviate.
Organization Name	Digi	The exact legal name of your organization. Do not abbreviate your organization name.
Organizational Unit Name	Support3	Section of the organization.
Common Name	digiwr21	In this example **digiwr21** will be used. This will be used as the router Identity for the IPSec tunnel settings on the initiator
Email Address	Support3@digi.com	Enter your organization general email address.

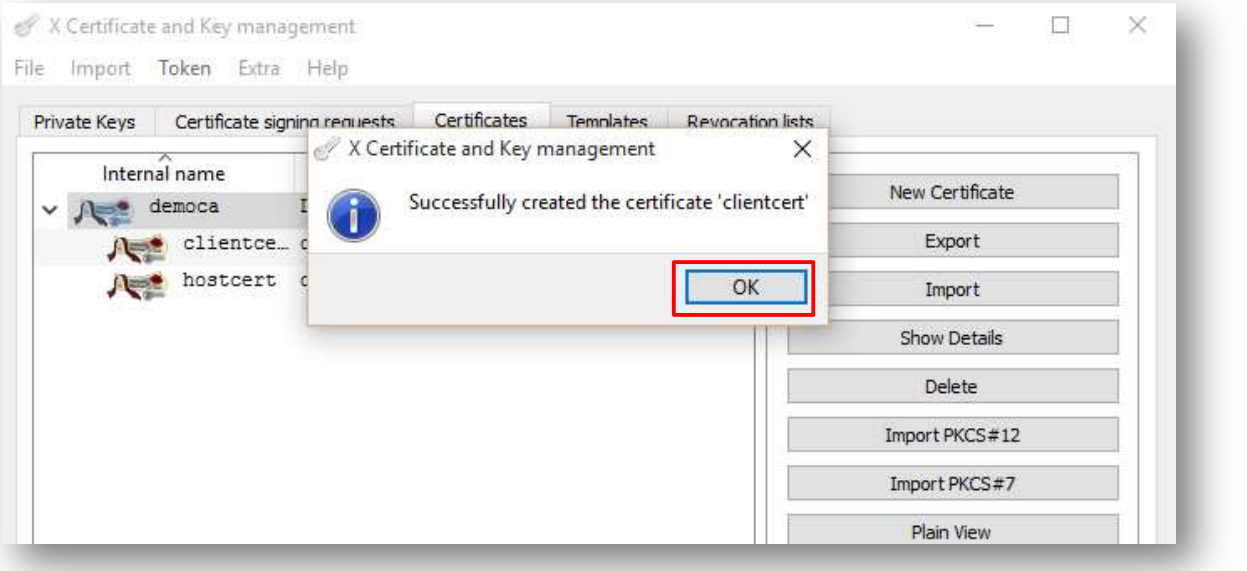
The "**New Key**" window will be shown, chose the name and Keysize and click on "Create":



A pop-up window will show up as a confirmation of the Key creation:

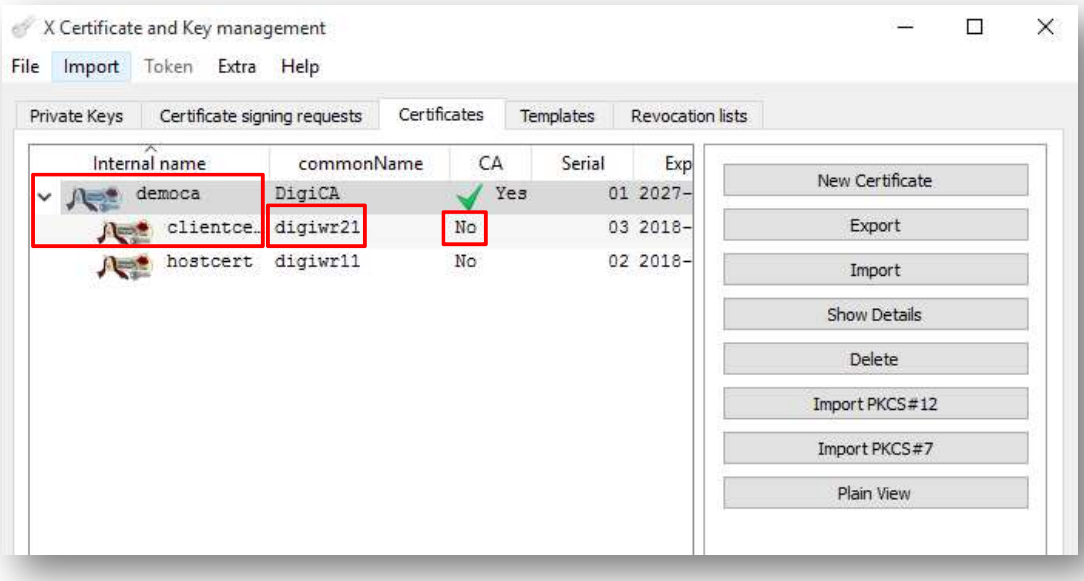


Click "**OK**" to close this and click again "OK" in the main "**Create x509 certificate**" window to complete the creation of certificate. Again, a pop-up window will show up as a confirmation of the Certificate creation:



Click "**OK**" to close this and the certificate should now appear in the window under the CA certificate:

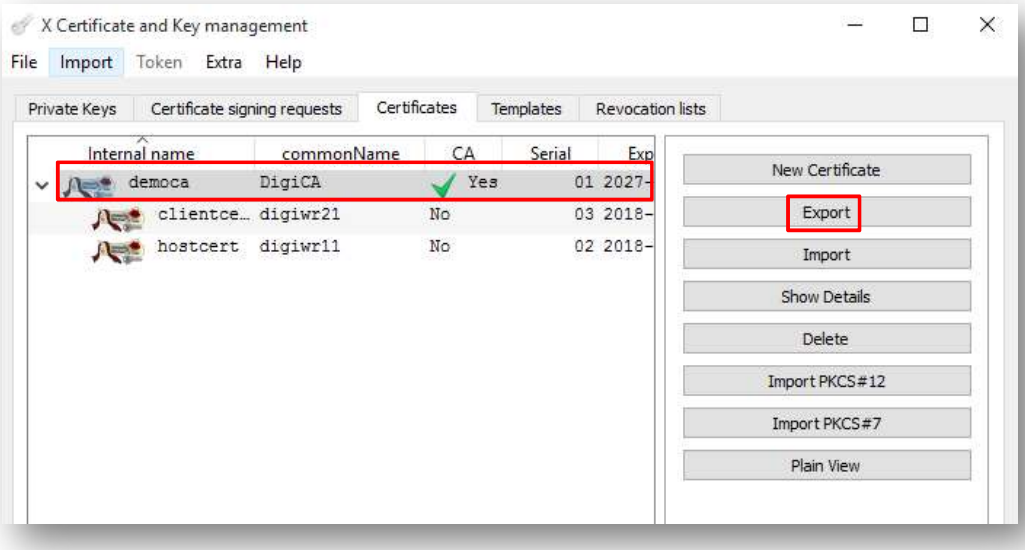
Please Note: the value in the Common Name field for this certificate, will be used as Initiator ID in the IPsec tunnel settings.



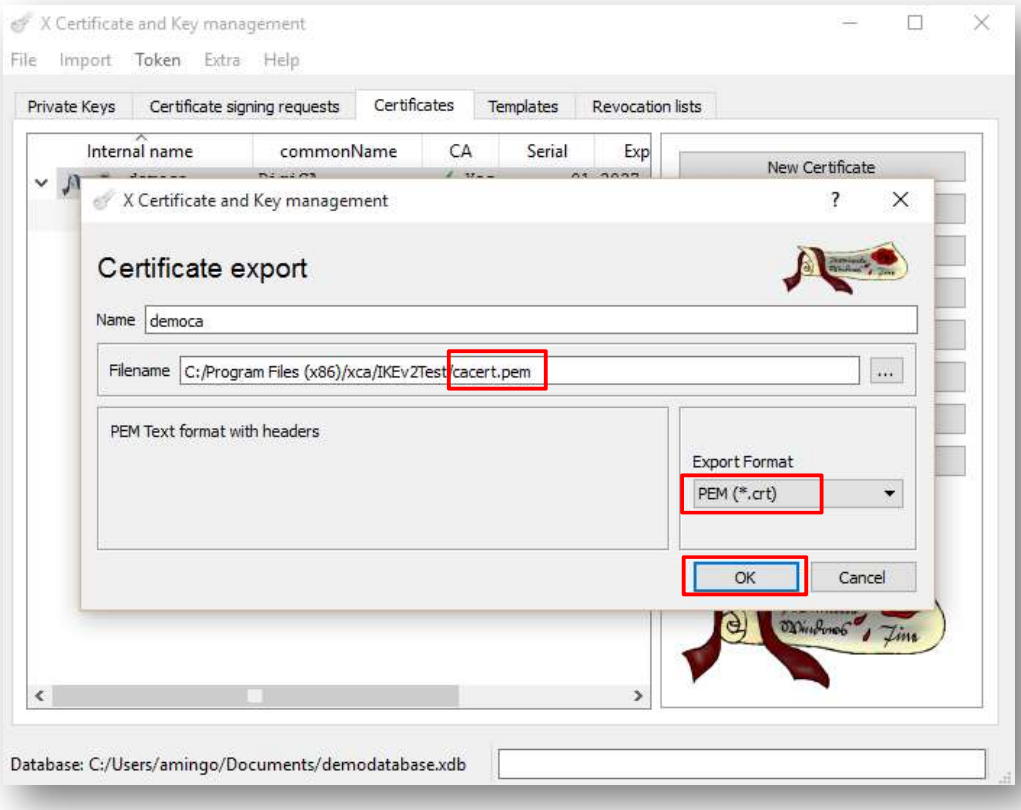
2.4 Export the certificates and keys in .PEM format

2.4.1 Export Certificates

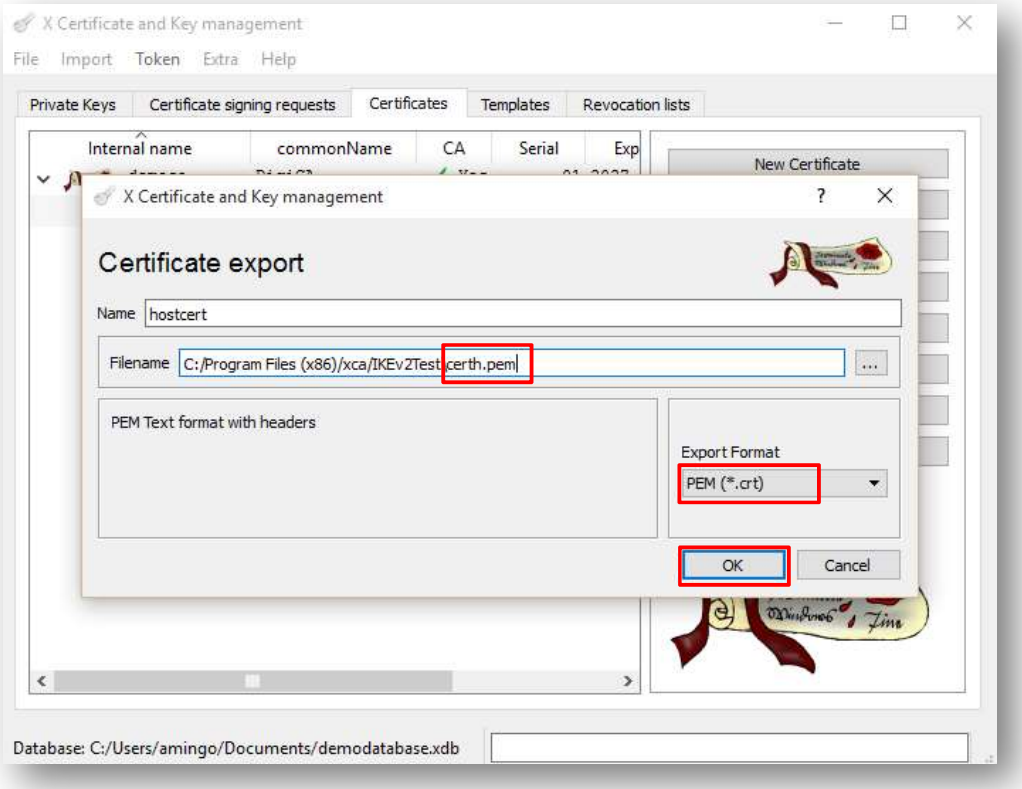
In the "**Certificates**" tab, highlight the CA certificate and click on "**Export**":

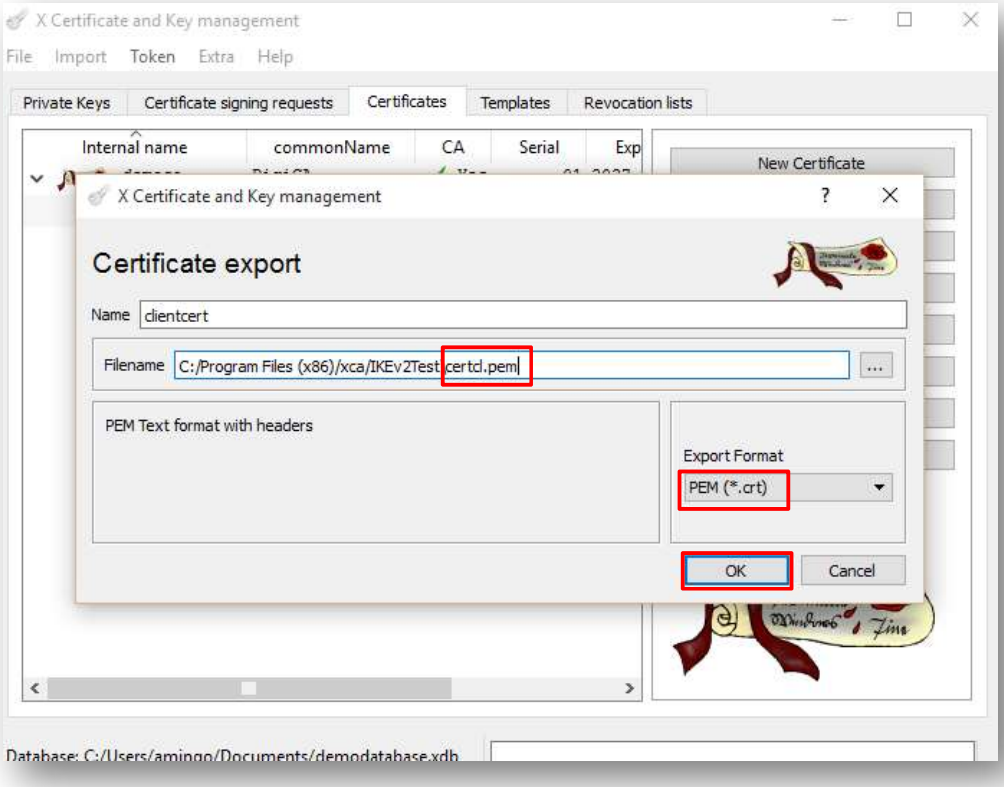


In the "**Certificate export**" window, select **PEM (*.crt)** as the export format and change the filename to **cacert.pem** and click "**OK**":



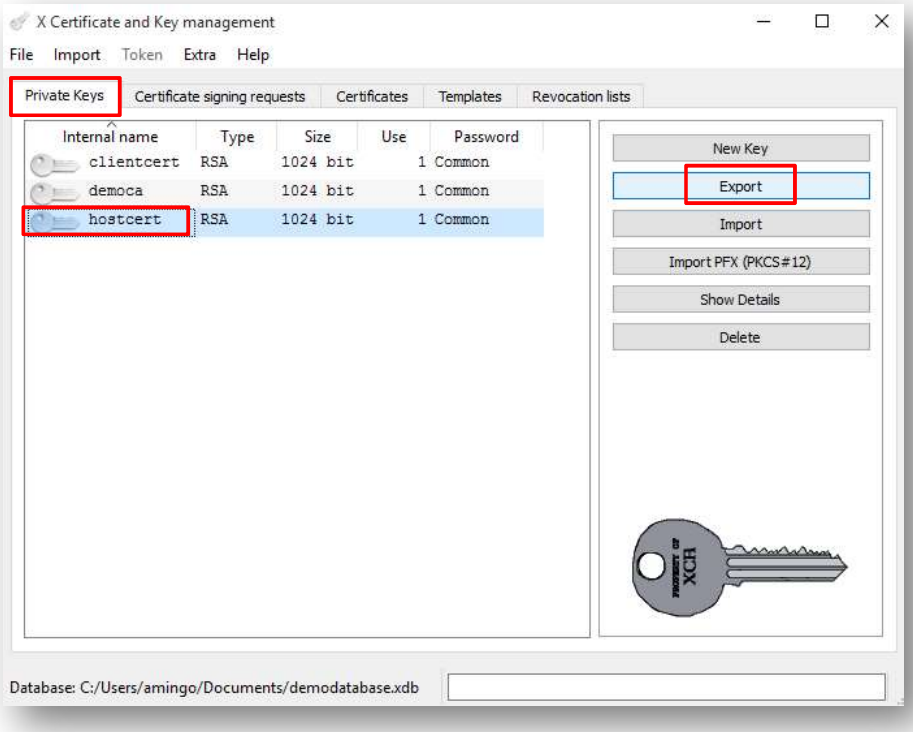
Repeat the previous step for the Client and Host certificate. Rename them **certh.pem** and **certcl.pem** :



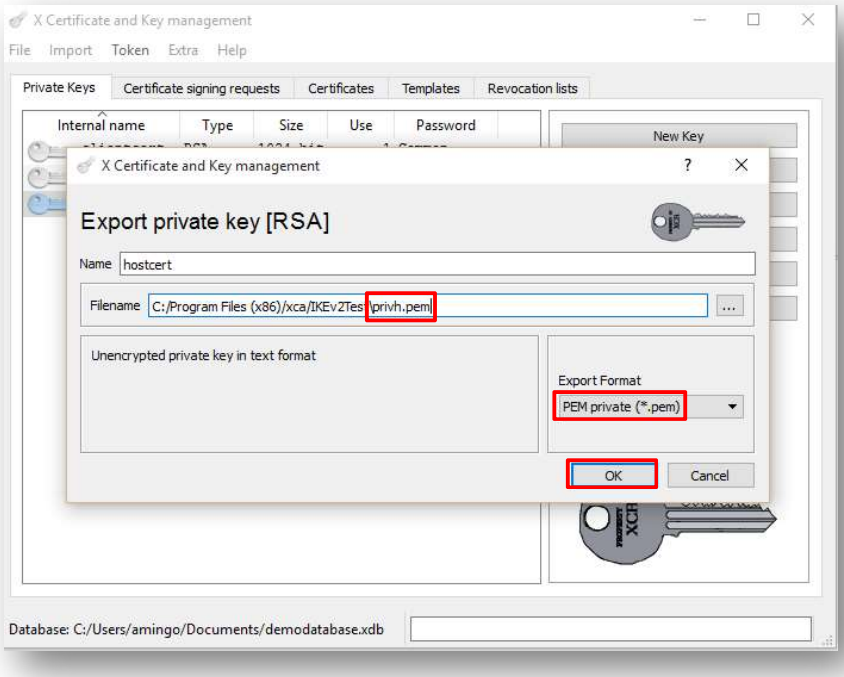


2.4.2 Export Keys

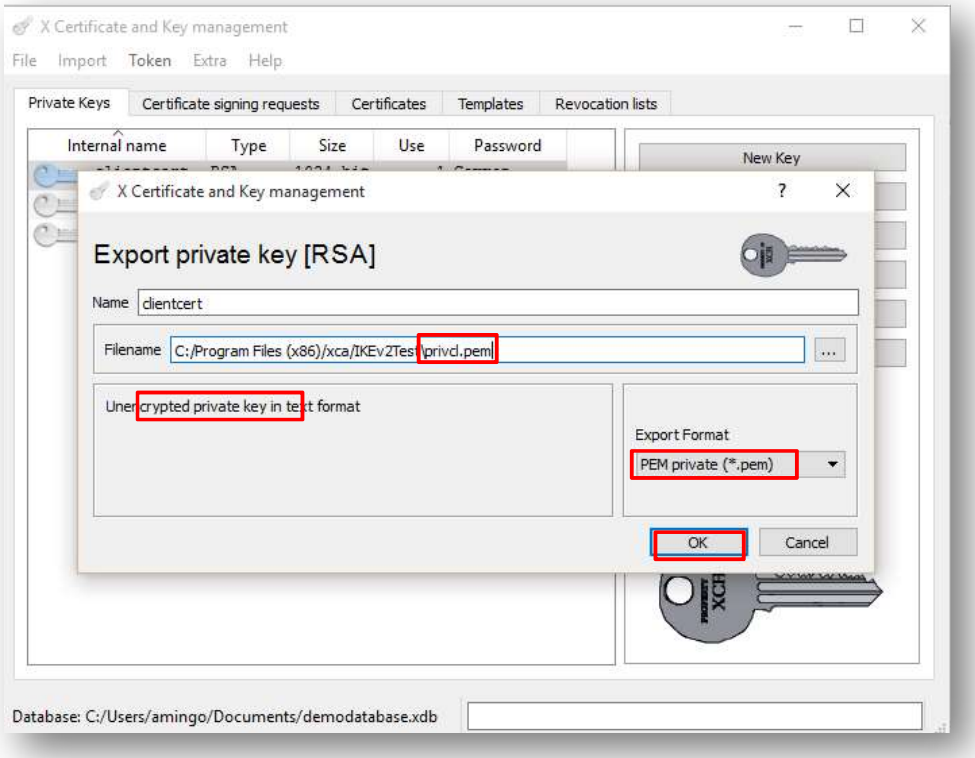
From the main XCA window, select the "**Private Keys**" tab, highlight the host certificate key and click the "**Export**" button:



In the "**Export Private Key [RSA]**" window, select **PEM private (*.pem)** as the export format and change the filename to **privh.pem** and click "**OK**":



Repeat the previous step for the Client key and name it **privcl.pem**:



After all the above steps are completed, the following files should now be available:

- **cacert.pem** : CA root certificate
- **certh.pem** : Responder certificate
- **certcl.pem** : Initiator certificate
- **privh.pem** : Responder private key
- **privcl.pem** : Initator private key

Please note: It is important that each file name do not exceed the 8.3 file format and to keep the file type and naming as the TransPort router will be searching for these and load them in the certificate management automatically.

3 DIGI ROUTERS CONFIGURATION

3.1 Responder configuration

The Responder configuration consists in uploading the certificates and the keys on the router, and then set UP the IKEv2 VPN to use them in the negotiation with the Initiator. All this aspects will be explained in the subsections below.

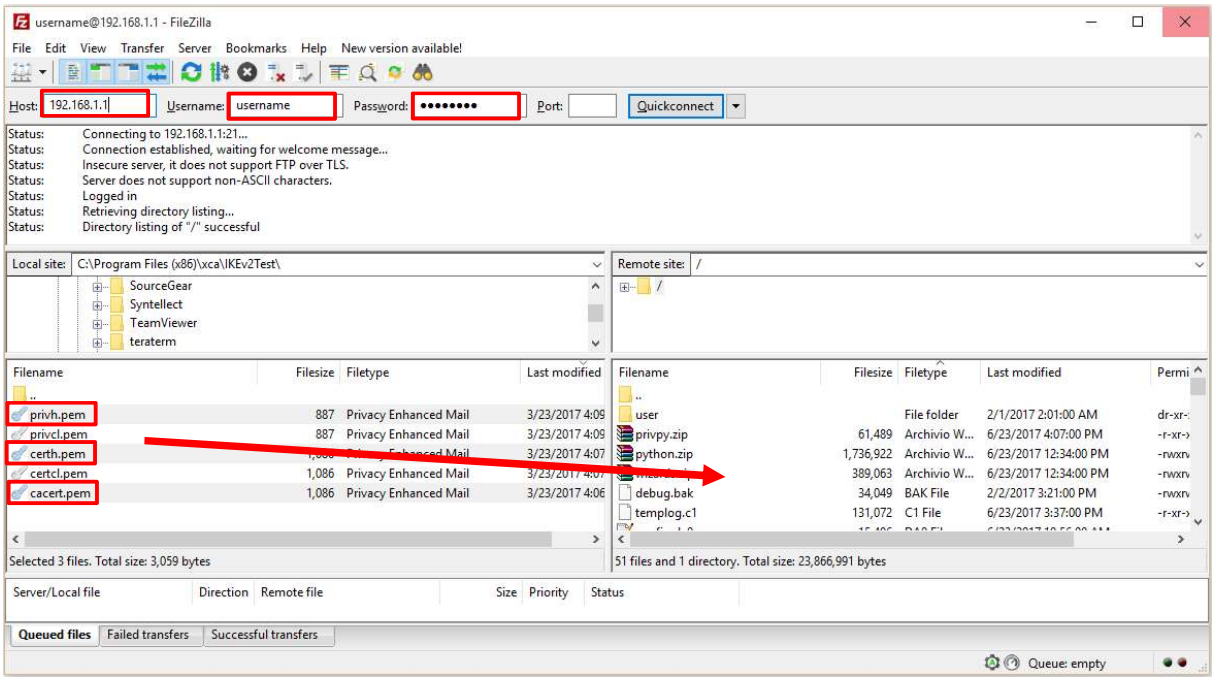
3.1.1 Upload Certficates and Keys

The upload of Certificates and Keys can be performed using an FTP client like Filezilla or using the TransPort WEB User Interface.

In this example, in order to upload the files, the connection to the Transport is done on the local LAN (so using the ETH o IP address of the router).

FTP:

Open an FTP connection (In this example, using FileZilla) to the TransPort router that acts as responder and Transfer the certificates and Key files to the root directory:



Where:

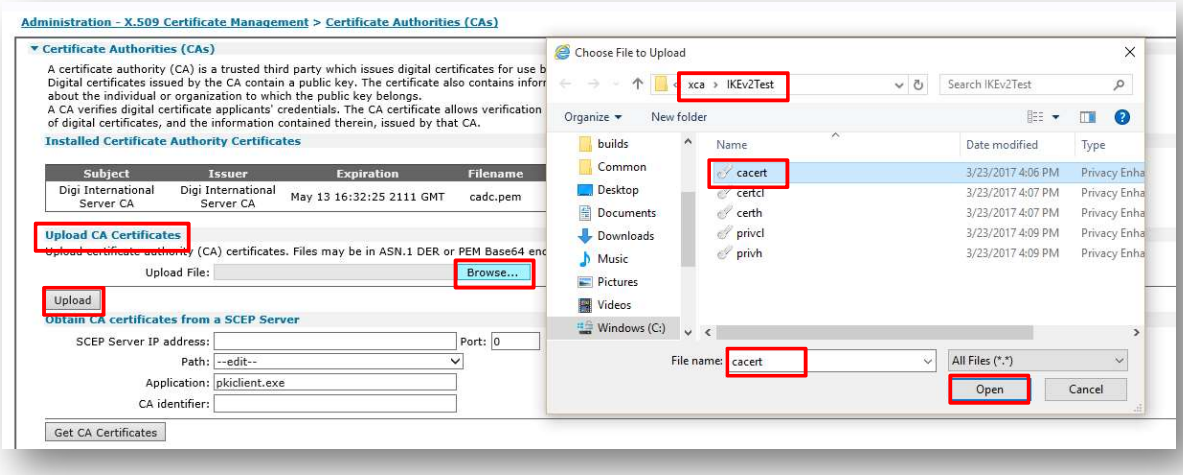
Parameter	Setting	Description
Host	192.168.1.1	IP Address of the TransPort router
Username	username	Username with Access Level : Super to log in to the TransPort router (default : username)
Password	password	Password for the user with Access Level : Super to log in to the TransPort router (default : password)
cacert.pem	-	CA Root certificate
certh.pem	-	Host Certificate
privh.pem	-	Host Private Key

Web GUI:

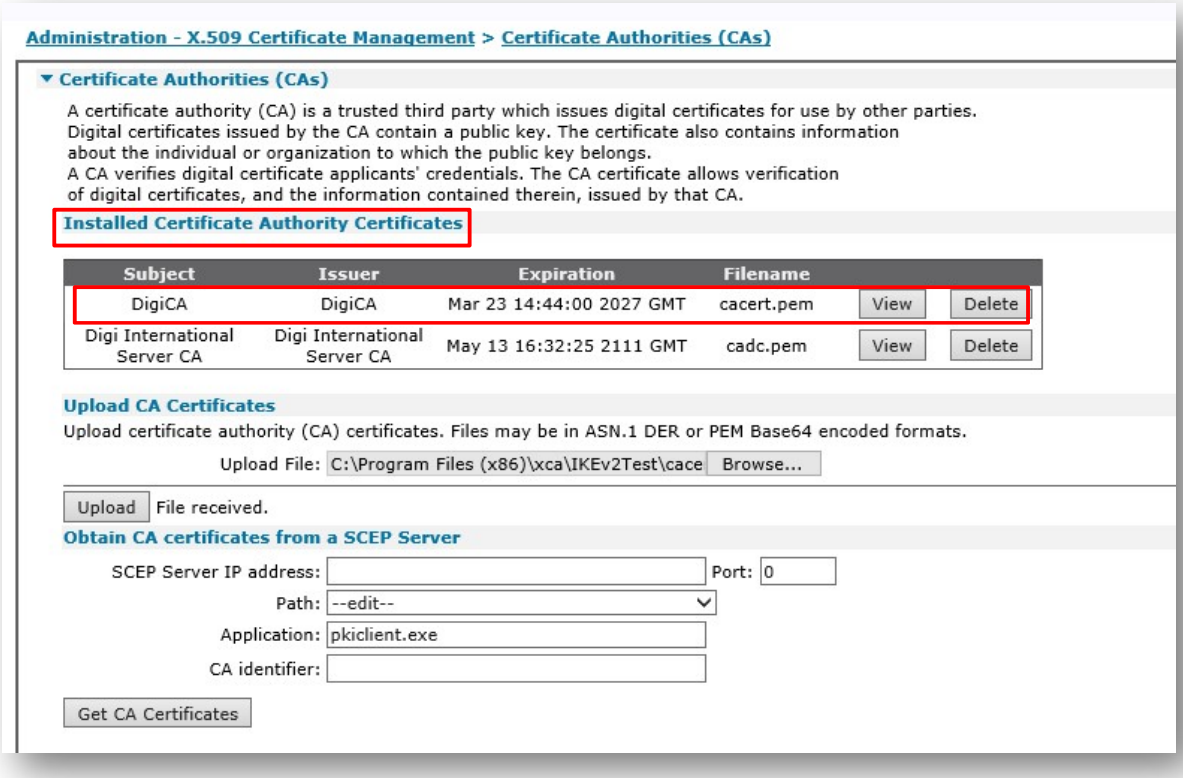
Open a web browser to the IP address of the TransPort router that acts as responder and do the following steps to upload each file:

ADMINISTRATION > X.509 CERTIFICATE MANAGEMENT > CERTIFICATE AUTHORITIES (CAs)

In the "**Upload CA Certificates**" section, click the "**Browse**" button, go to the file location where **cacert.pem** is located, select the file, click "**Open**" and then click **Upload:**

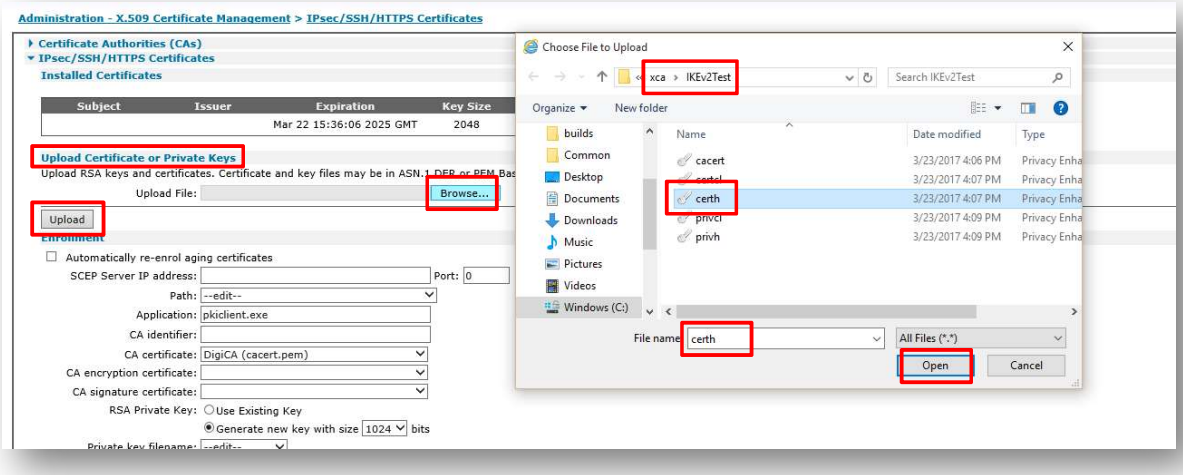


The **CA Certificate** should now appear under the **Installed Certificate Authority Certificates**

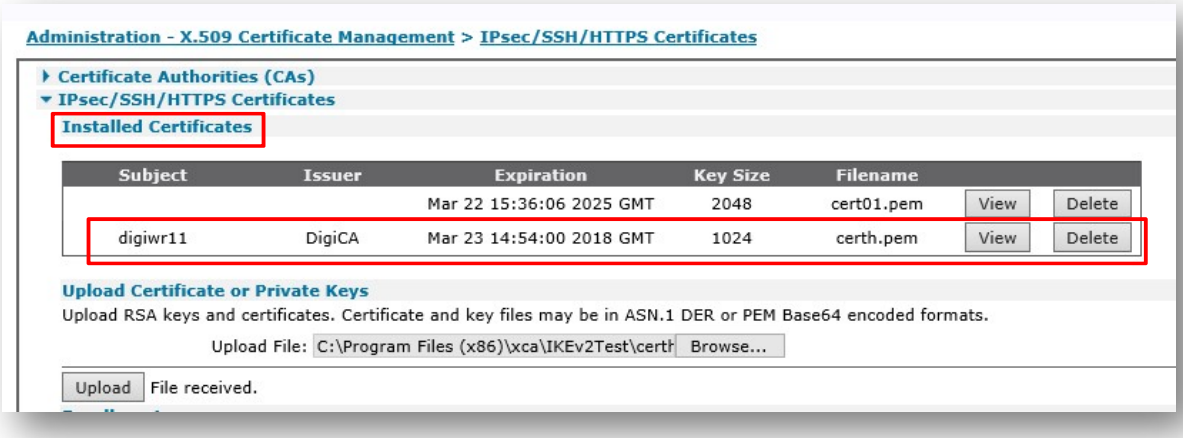


ADMINISTRATION > X.509 CERTIFICATE MANAGEMENT > IPSEC/SSH/HTTPS CERTIFICATES

In the "**Upload Certificates or Private Keys**" section, click the "**Browse**" button, go to the file location where **certh.pem** is located, select the file, click "**Open**" and then click **"Upload"**:

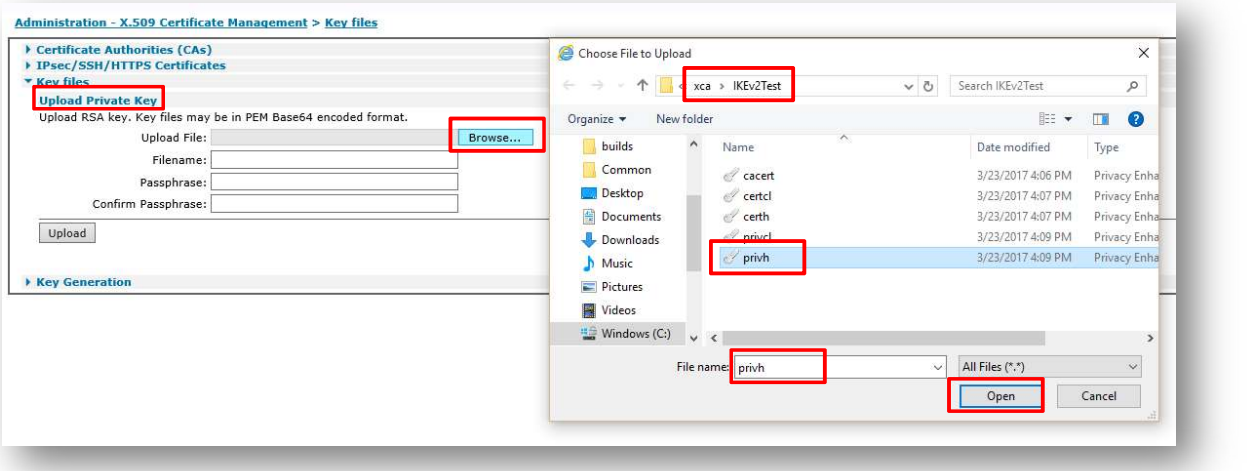


The Certificate should now appear under the **Installed Certificates:**



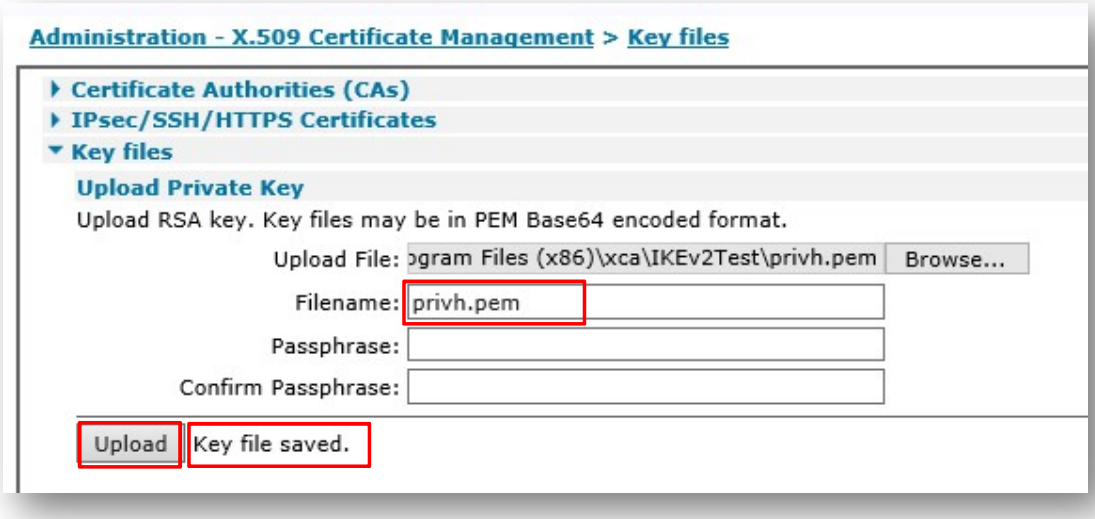
ADMINISTRATION > X.509 CERTIFICATE MANAGEMENT > KEY FILES

In the "**Upload Private Key**" section, click the "**Browse**" button, go to the file location where **privh.pem** is located, select the file, click "**Open**"



Type the file name "**privh.pem**" in the Filename field and click on "**Upload**".

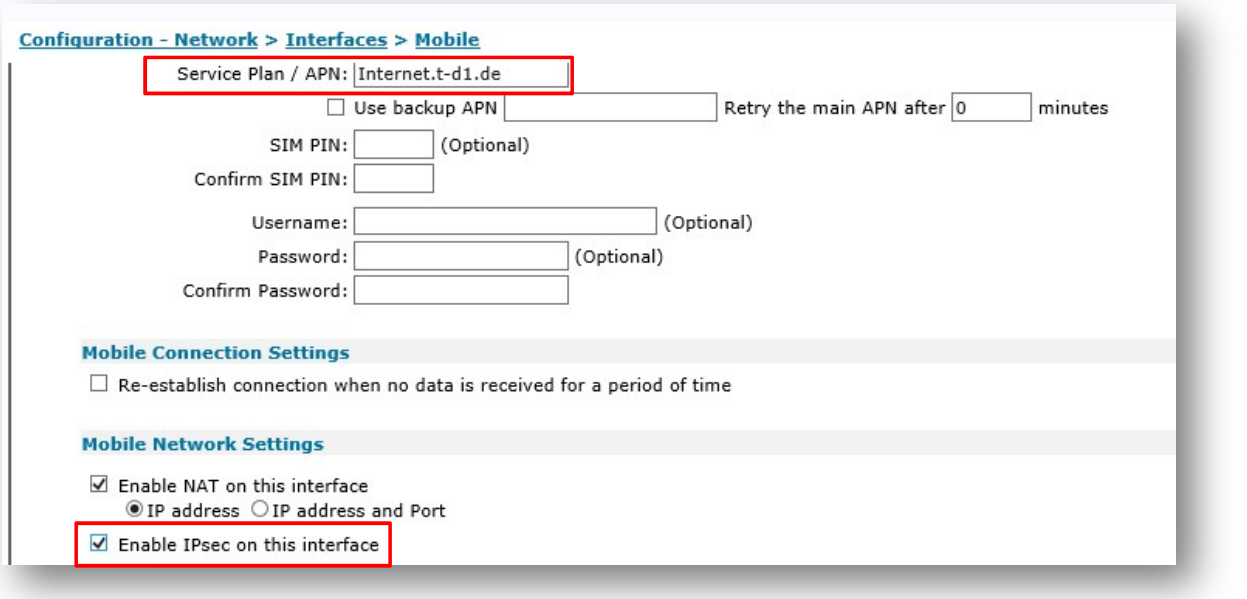
Before leaving the page, wait for the message "**Key file saved**" to be displayed to be sure that the upload is successful:



3.1.2 VPN Configuration

In this example the WAN Interface of the responder is the Mobile one, so on the PPP 1 interface the IPsec must be enabled:

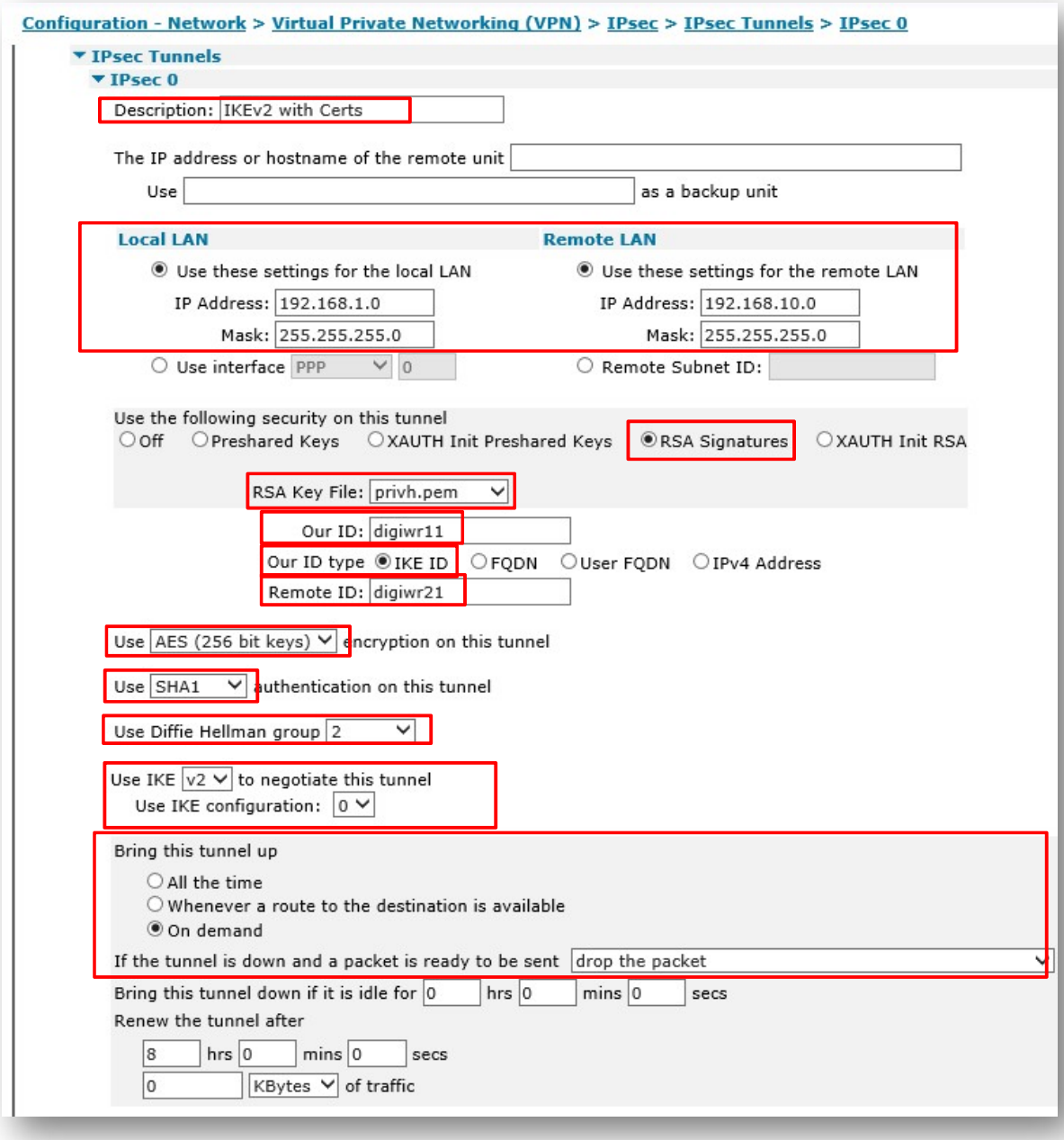
CONFIGURATION – NETWORK > INTERFACES > MOBILE



Parameter	Setting	Description
Service Plan/APN	internet	Enter the APN of your mobile provider
Enable IPSec on this interface	✓	Enable IPSec on PPP 1 interface

Then, the IPsec tunnel must be configured with the following settings:

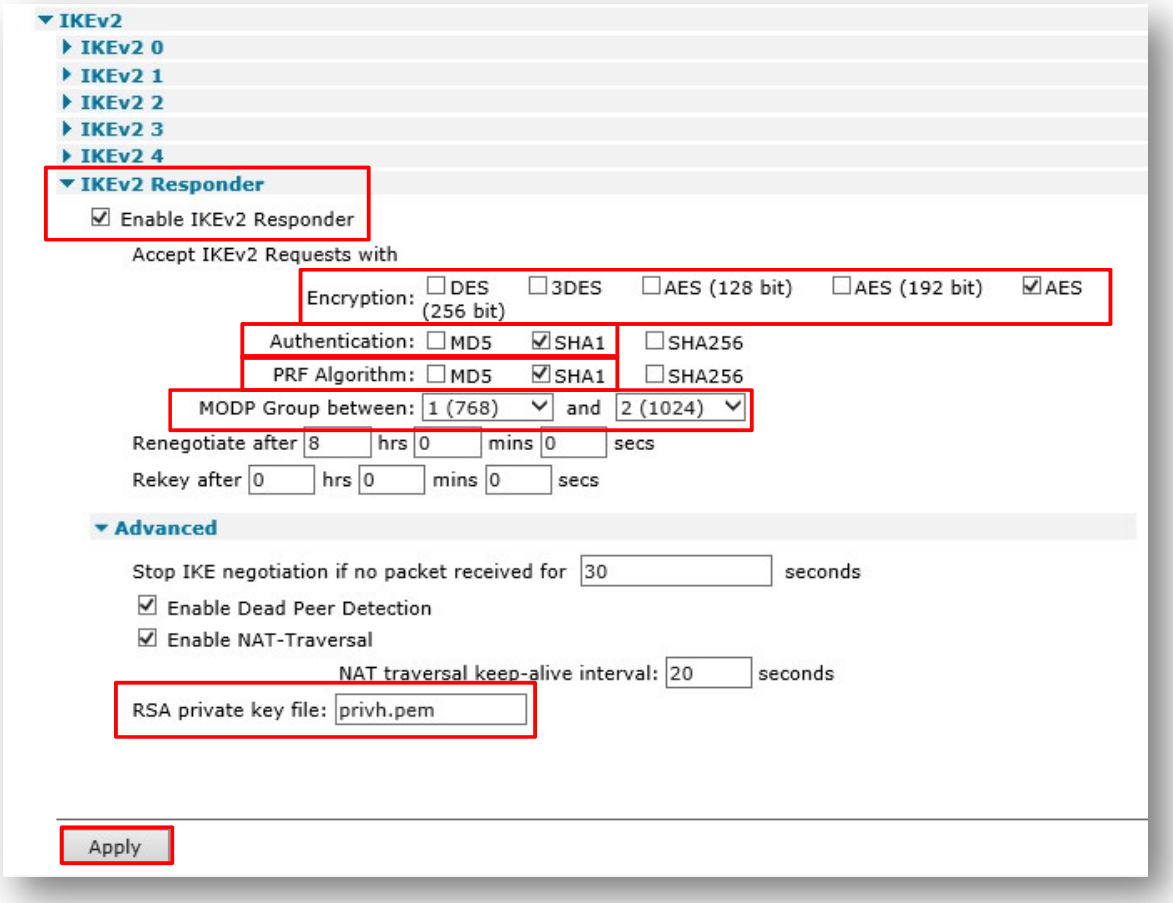
CONFIGURATION – NETWORK > VIRTUAL PRIVATE NETWORKING (VPN) > IPSEC > IPSEC TUNNELS > IPSEC 0-9 > IPSEC 0



Parameter	Setting	Description
Description	Ikev2 with Certs	Description of the IPsec tunnel
Local LAN IP Address	192.168.1.0	Use this IP address for the local LAN subnet. This is usually the IP address of the router's Ethernet interface or that of a specific device on the local subnet
Local LAN Mask	255.255.255.0	Use this IP mask for the local LAN subnet. The mask sets the range of IP addresses that will be allowed to use the IPsec tunnel.
Remote LAN IP Address	192.168.10.0	Use this IP address for the remote LAN subnet. This is usually the IP address of the peer's Ethernet interface or that of a specific device on the local subnet
Remote LAN Mask	255.255.255.0	Use this IP mask for the remote LAN subnet. The mask sets the range of IP addresses that will be allowed to use the IPsec tunnel.
Use the following security on this tunnel	RSA Signatures	Select RSA signature security for this tunnel to use the uploaded certificates
RSA Key File	privh.pem	Private key file used for the responder
Our ID	digiwr11	ID that is matching the **CN** of the certificate in the first router (**responder**)
Our ID type	IKE ID	Defines how the remote peer is to process the Our ID configuration. Set to IKE ID to match the information used in the certificate
Remote ID	digiwr21	Remote ID that is matching the **CN** in the second router certificate (**initiator**)
Use ( ) encryption on this tunnel	AES (256 bit keys)	The ESP encryption protocol to use with this IPsec tunnel
Use ( ) Authentication on this tunnel	SHA1	The ESP authentication algorithm to use with this IPsec tunnel
Use Diffie Hellman group ( )	2	The Diffie Hellman (DH) group to use when negotiating new IPsec SAs.
Use IKE n to negotiate this tunnel	v2	The IKE version to use to negotiate this IPsec tunnel.
Use IKE configuration	0	The IKE configuration instance to use with this Eroute when the router is configured as an Initiator (so left as default in this case, it makes no difference as this router will no act as initiator)
Bring this tunnel up	On Demand	Controls how the IPsec tunnel is brought up.
If this tunnel is down and a packet is ready to be sent	Drop the packet	Defines the action that is performed when the IPsec tunnel is down and a packet needs to be sent

Then, the IKEv2 responder section must be configured with the following settings:

CONFIGURATION - NETWORK > VIRTUAL PRIVATE NETWORKING (VPN) > IPSEC > IKEv2 > IKEv2 RESPONDER and > ADVANCED



Parameter	Setting	Description
Encryption	AES (256 bit)	Defines the encryption algorithm used
Authentication	SHA1	Defines the authentication algorithm used.
PRF Algorithm	SHA1	Defines the PRF (Pseudo Random Function) algorithm used
MODP Group between x and y	1(778) and 2(1024)	The acceptable range for MODP group.
Advanced > RSA private key file	**privh.pem**	The name of a X.509 certificate file holding the router's private part of the public/private key pair used in certificate exchanges. In this case is the Private key file used for the responder

3.2 Initiator configuration

The Initiator configuration consists in uploading the certificates and the keys on the router, and then set UP the IKEv2 VPN to use them in the negotiation with the Responder. All these aspects will be explained in the subsections below.

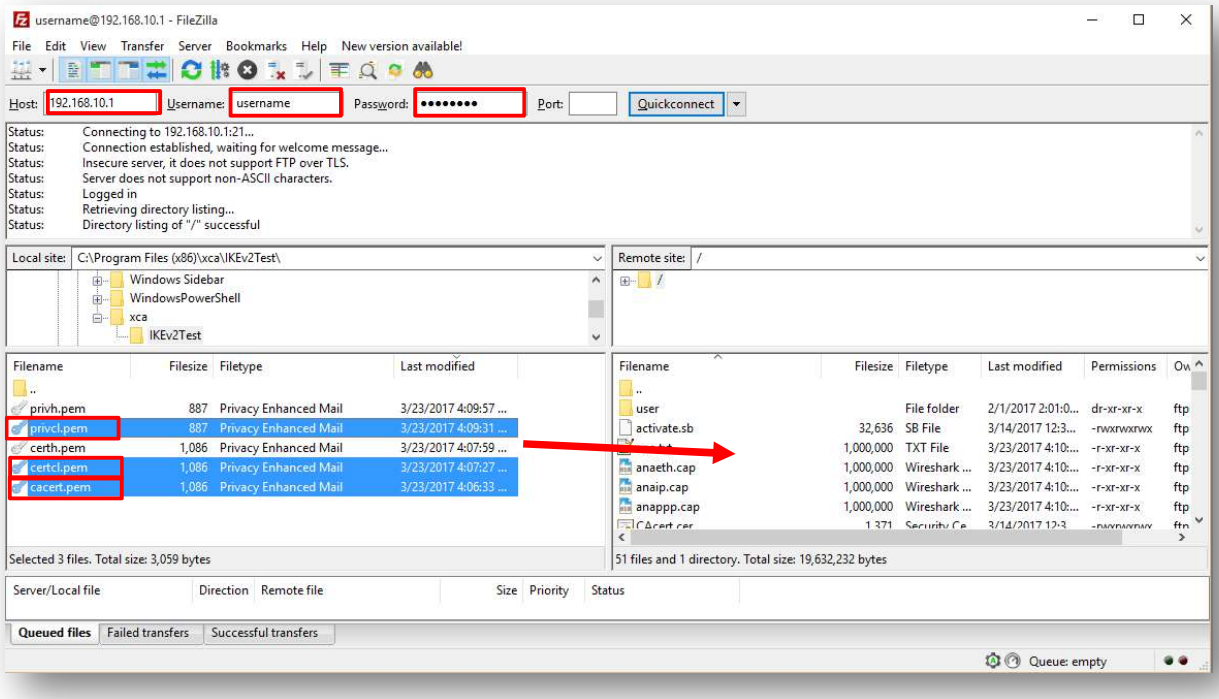
3.2.1 Upload Certificates and Keys

The upload of Certificates and Keys can be performed using an FTP client like Filezilla or using the TransPort WEB User Interface.

In this example, in order to upload the files, the connection to the Transport is done on the local LAN (so using the ETH o IP address of the router).

FTP:

Open an FTP connection (In this example, using FileZilla) to the TransPort router that acts as initiator and transfer the certificates and Key files to the root directory:



Where:

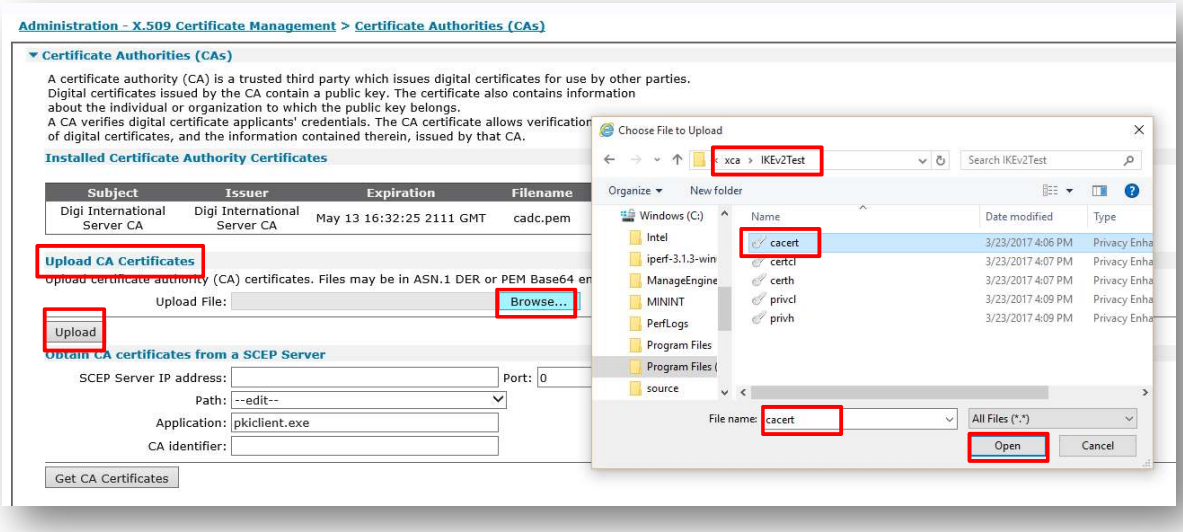
Parameter	Setting	Description
Host	192.168.10.1	IP Address of the TransPort router
Username	username	Username with Access Level : Super to log in to the TransPort router (default : username)
Password	password	Password for the user with Access Level : Super to log in to the TransPort router (default : password)
cacert.pem	-	CA Root certificate
certcl.pem	-	Host Certificate
privcl.pem	-	Host Private Key

Web GUI:

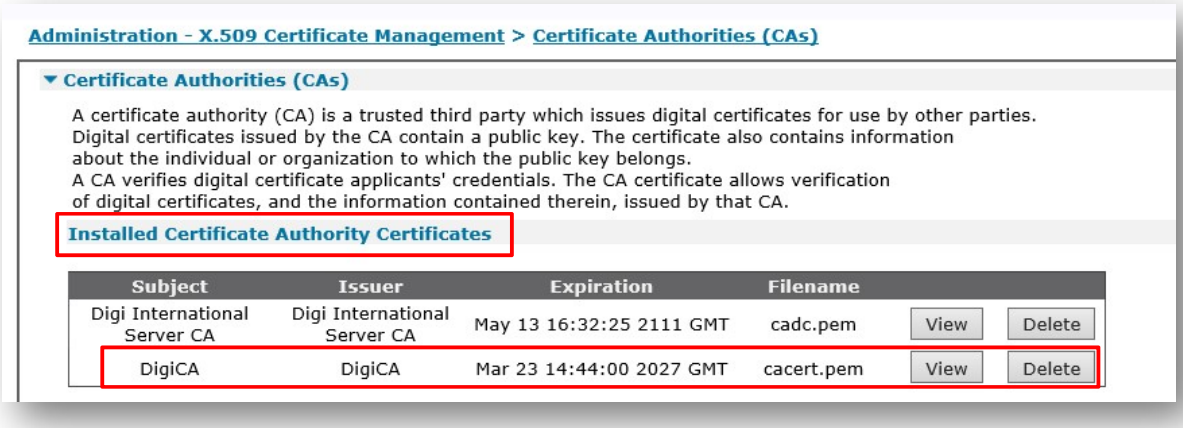
Open a web browser to the IP address of the TransPort router that acts as initiator and do the following steps to upload each file:

ADMINISTRATION > X.509 CERTIFICATE MANAGEMENT > CERTIFICATE AUTHORITIES (CAs)

In the "**Upload CA Certificates**" section, click the "**Browse**" button, go to the file location where **cacert.pem** is located, select the file, click "**Open**" and then click **Upload:**

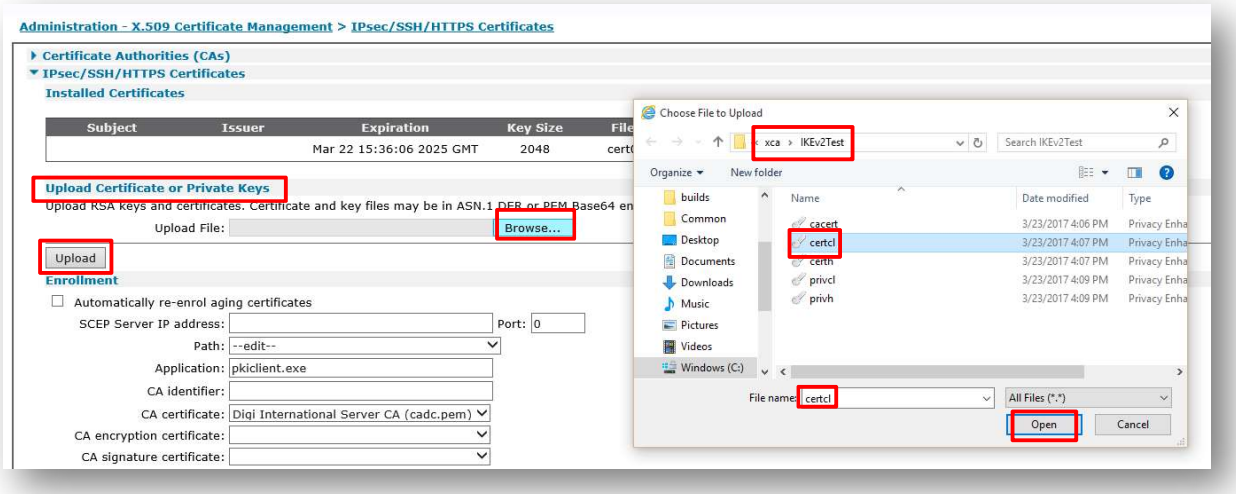


The **CA Certificate** should now appear under the **Installed Certificate Authority Certificates**

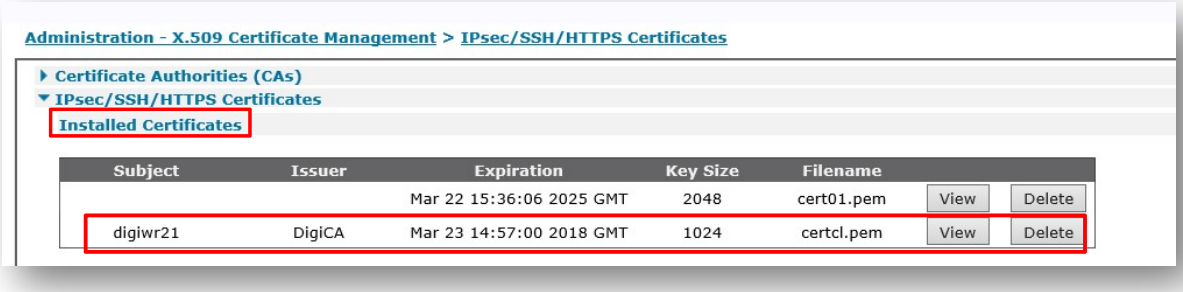


ADMINISTRATION > X.509 CERTIFICATE MANAGEMENT > IPSEC/SSH/HTTPS CERTIFICATES

In the "**Upload Certificates or Private Keys**" section, click the "**Browse**" button, go to the file location where **certcl.pem** is located, select the file, click "**Open**" and then click **"Upload"**:

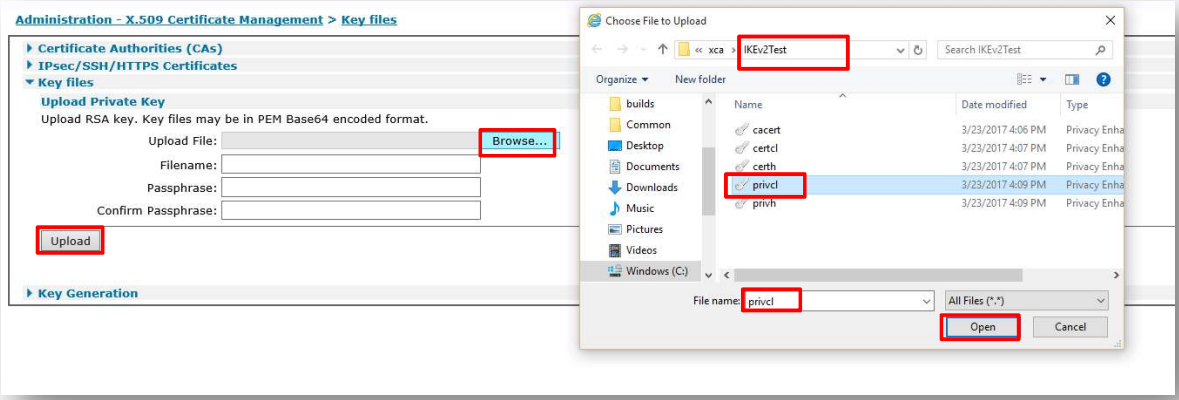


The Certificate should now appear under the **Installed Certificates:**



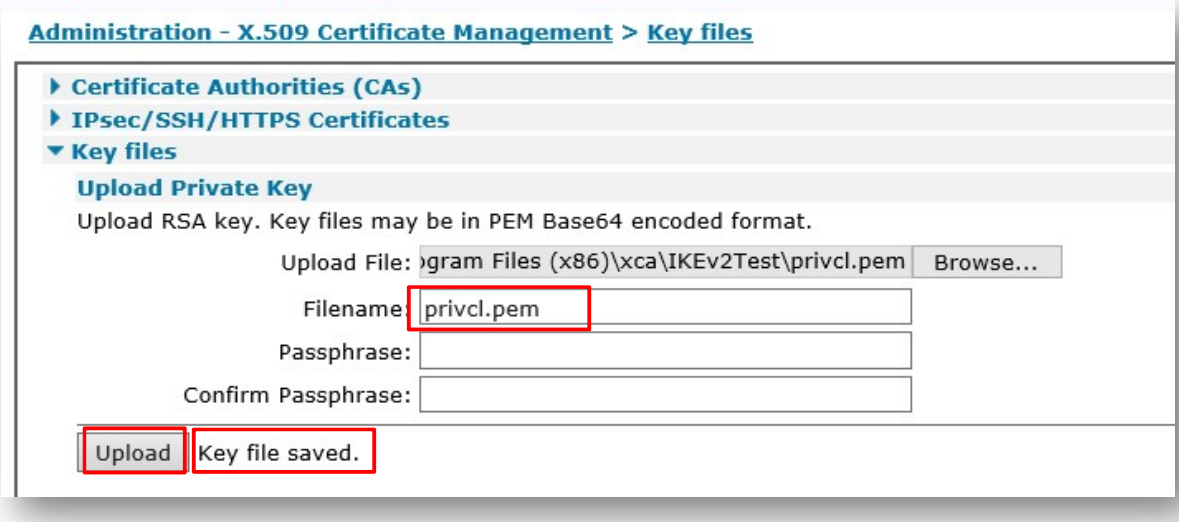
ADMINISTRATION > X.509 CERTIFICATE MANAGEMENT > KEY FILES

In the "**Upload Private Key**" section, click the "**Browse**" button, go to the file location where **privcl.pem** is located, select the file, click "**Open**"



Type the file name "**privcl.pem**" in the Filename field and click on "**Upload**".

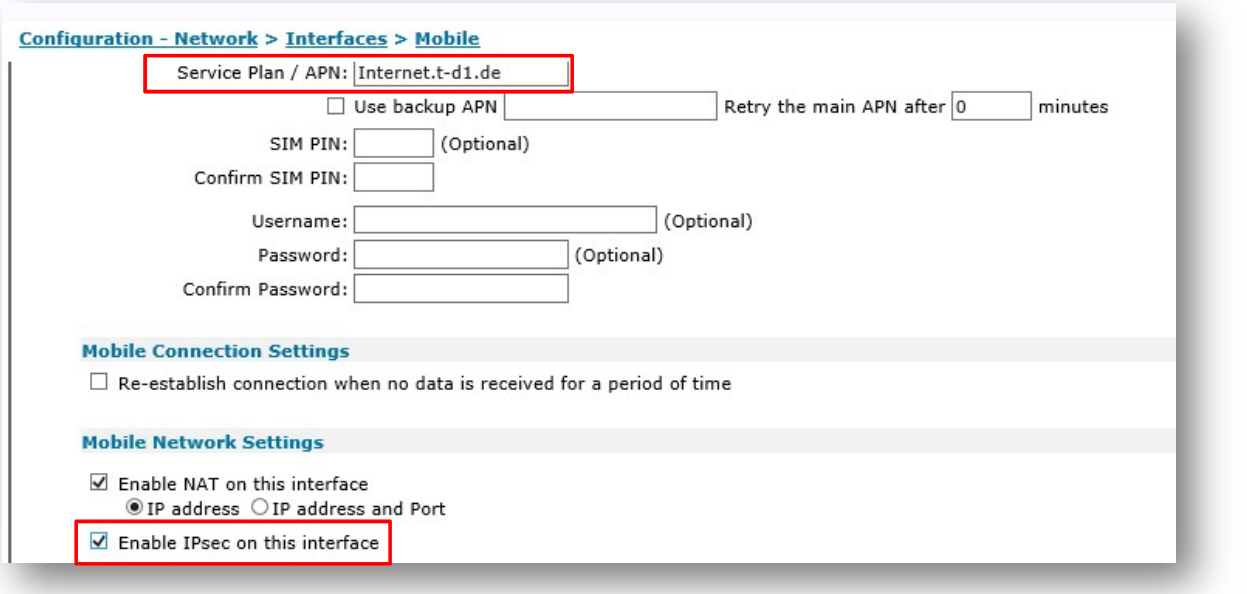
Before leaving the page, wait for the message "**Key file saved**" to be displayed to be sure that the upload is successful:



3.2.2 VPN Configuration

In this example the WAN Interface of the responder is the Mobile one, so on the PPP 1 interface the IPsec must be enabled:

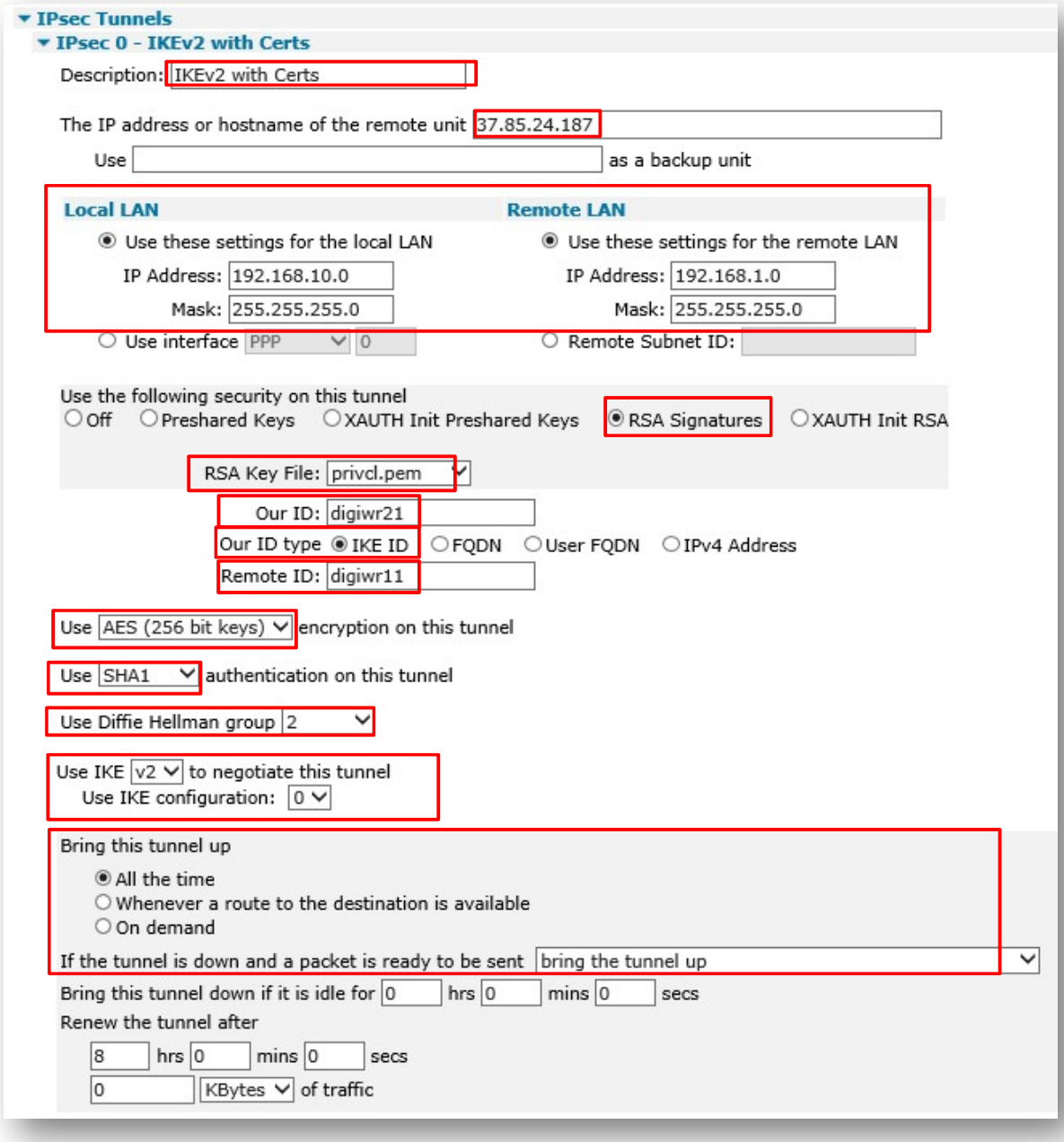
CONFIGURATION – NETWORK > INTERFACES > MOBILE



Parameter	Setting	Description
Service Plan/APN	internet	Enter the APN of your mobile provider
Enable IPSec on this interface	✓	Enable IPSec on PPP 1 interface

Then, the IPsec tunnel must be configured with the following settings:

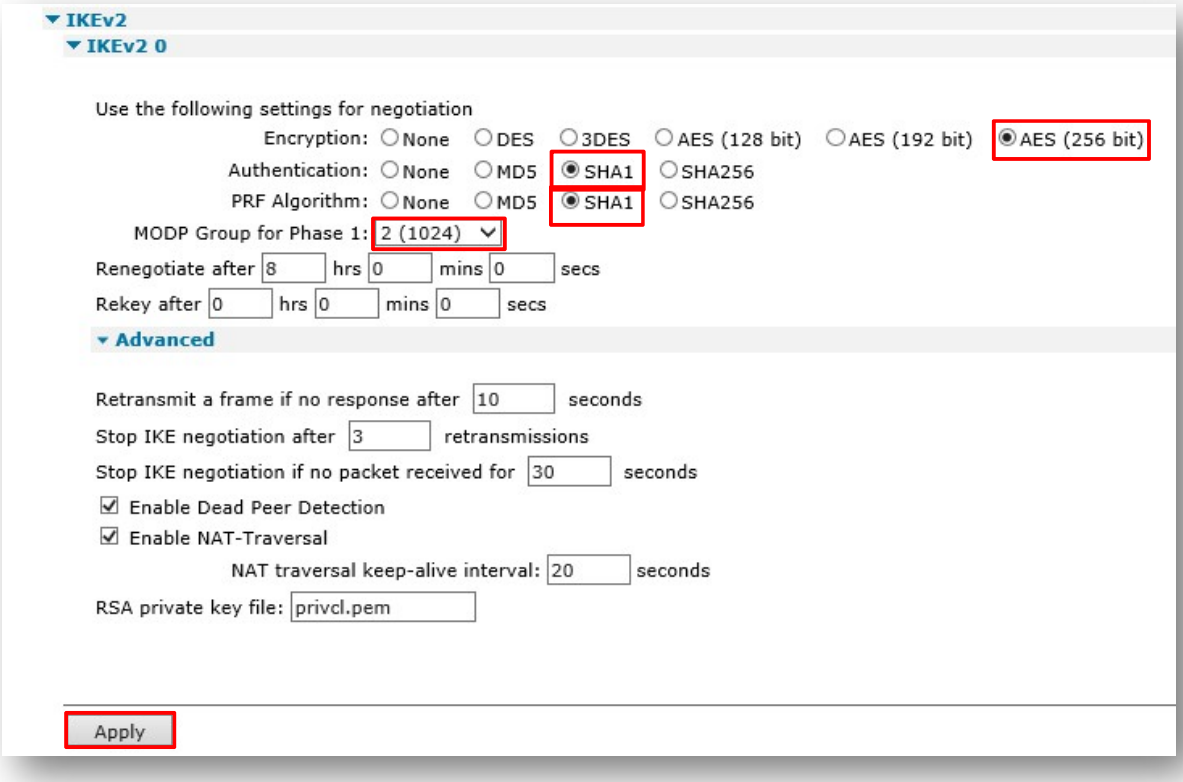
CONFIGURATION – NETWORK > VIRTUAL PRIVATE NETWORKING (VPN) > IPSEC > IPSEC TUNNELS > IPSEC 0-9 > IPSEC 0



Where:

Parameter	Setting	Description
Description	Ikev2 with Certs	Description of the IPsec tunnel
The IP address or hostname of the remote unit	37.85.24.187	The IP address or hostname of the remote IPsec peer that a VPN will be initiated to.
Local LAN IP Address	192.168.10.0	Use this IP address for the local LAN subnet. This is usually the IP address of the router's Ethernet interface or that of a specific device on the local subnet
Local LAN Mask	255.255.255.0	Use this IP mask for the local LAN subnet. The mask sets the range of IP addresses that will be allowed to use the IPsec tunnel.
Remote LAN IP Address	192.168.1.0	Use this IP address for the remote LAN subnet. This is usually the IP address of the peer's Ethernet interface or that of a specific device on the local subnet
Remote LAN Mask	255.255.255.0	Use this IP mask for the remote LAN subnet. The mask sets the range of IP addresses that will be allowed to use the IPsec tunnel.
Use the following security on this tunnel	**RSA Signatures**	Select RSA signature security for this tunnel to use the uploaded certificates
RSA Key File	**privcl.pem**	Private key file used for the responder
Our ID	**digiwr21**	ID that is matching the **CN** of the certificate in the first router (**initiator**)
Our ID type	IKE ID	Defines how the remote peer is to process the Our ID configuration. Set to IKE ID to match the information used in the certificate
Remote ID	**digiwr11**	Remote ID that is matching the **CN** in the second router certificate (**responder**)
Use ( ) encryption on this tunnel	AES (256 bit keys)	The ESP encryption protocol to use with this IPsec tunnel
Use ( ) Authentication on this tunnel	SHA1	The ESP authentication algorithm to use with this IPsec tunnel
Use Diffie Hellman group ( )	2	The Diffie Hellman (DH) group to use when negotiating new IPsec SAs.
Use IKE n to negotiate this tunnel	**v2**	The IKE version to use to negotiate this IPsec tunnel.
Use IKE configuration	0	The IKE configuration instance to use with this Eroute when the router is configured as an Initiator
Bring this tunnel up	All the time	This controls how the IPsec tunnel is brought up, for the initiator "All the time" option is chosen
If this tunnel is down and a packet is ready to be sent	Bring the tunnel up	Defines the action that is performed when the IPsec tunnel is down and a packet needs to be sent. For the initiator in this AN the "bring the tunnel up" option is chosen

CONFIGURATION – NETWORK > VIRTUAL PRIVATE NETWORKING (VPN) > IPSEC > IKEv2 > IKEv2 0 and > ADVANCED



Parameter	Setting	Description
Encryption	AES (256 bit)	The encryption algorithm used
Authentication	SHA1	The authentication algorithm used
PRF Algorithm	SHA1	The PRF (Pseudo Random Function) algorithm used
MODP Group for Phase 1	2 (1024)	Sets the key length used in the IKE Diffie-Hellman exchange to 768 bits (group 1) or 1024 bits (group 2). In this example group 2 is chosen to enable a 1024 bit key length
Advanced > RSA private key file	**privcl.pem**	The name of a X.509 certificate file holding the router's private part of the public/private key pair used in certificate exchanges. In this case is the Private key file used for the initiator.

4 TESTING

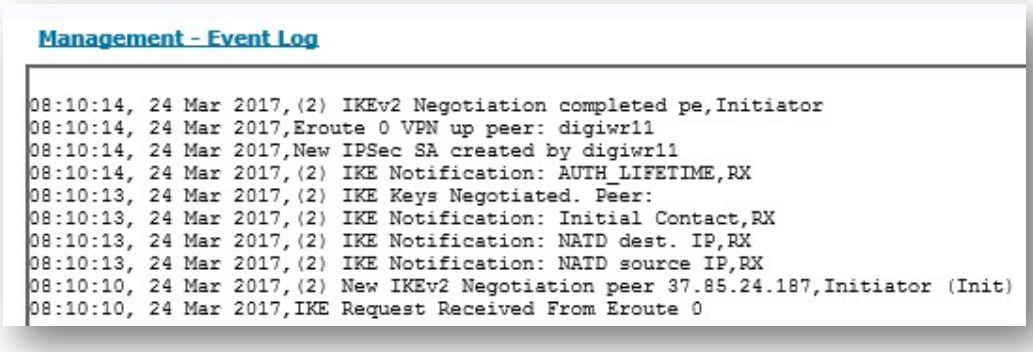
4.1 Check the IPsec tunnel is UP

This section will show that the IPSec tunnel has been established between the Initiator and the Responder.

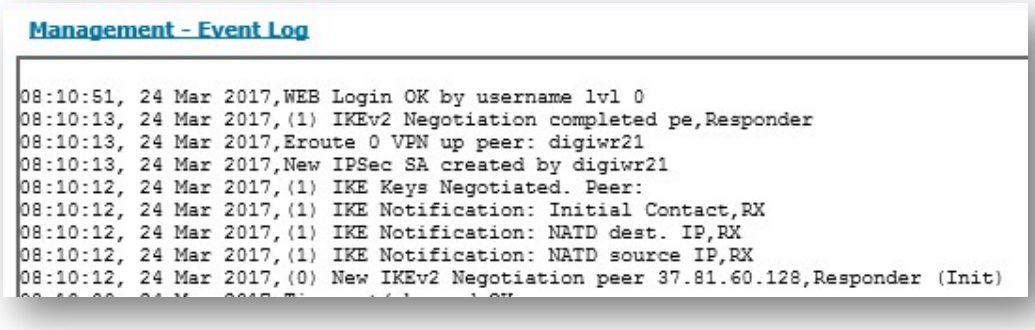
The Event log will show the IKEv2 negotiation start and ends successfully in both routers:

MANAGEMENT – EVENT LOG

Initiator:



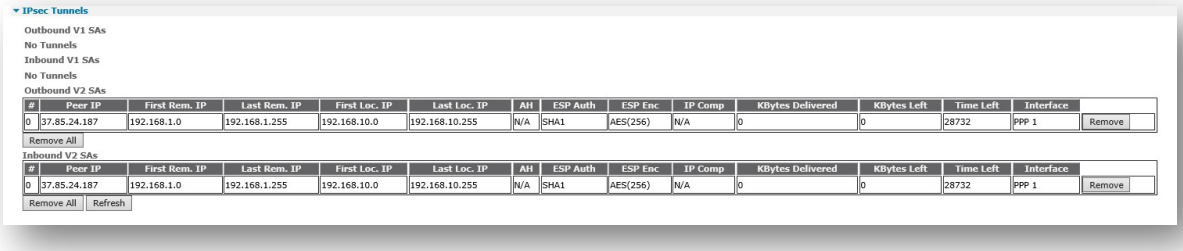
Responder:



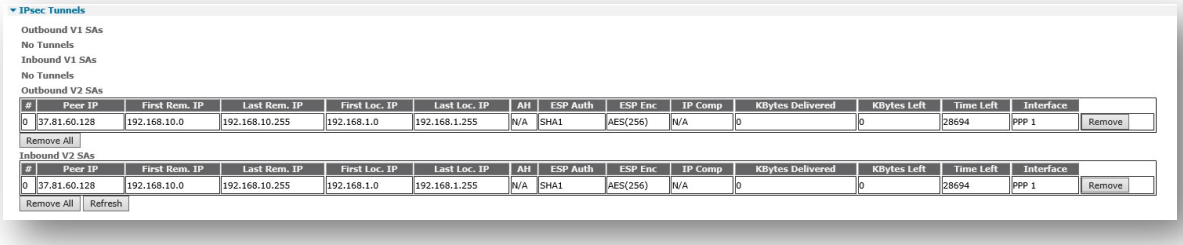
After that, in the connections status section IPsec and IKE v2 SAs will be displayed:

MANAGEMENT - CONNECTIONS > VIRTUAL PRIVATE NETWORKING (VPN) > IPSEC > IPSEC TUNNELS

Initiator:

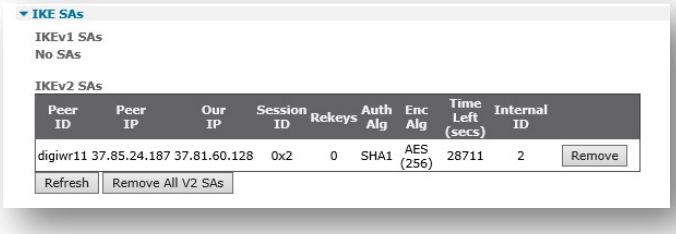


Responder:

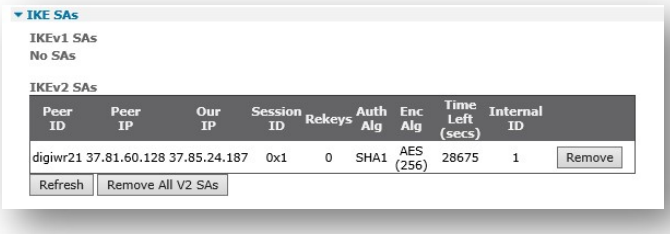


MANAGEMENT - CONNECTIONS > VIRTUAL PRIVATE NETWORKING (VPN) > IPSEC > IKE SAS

Initiator:



Responder:

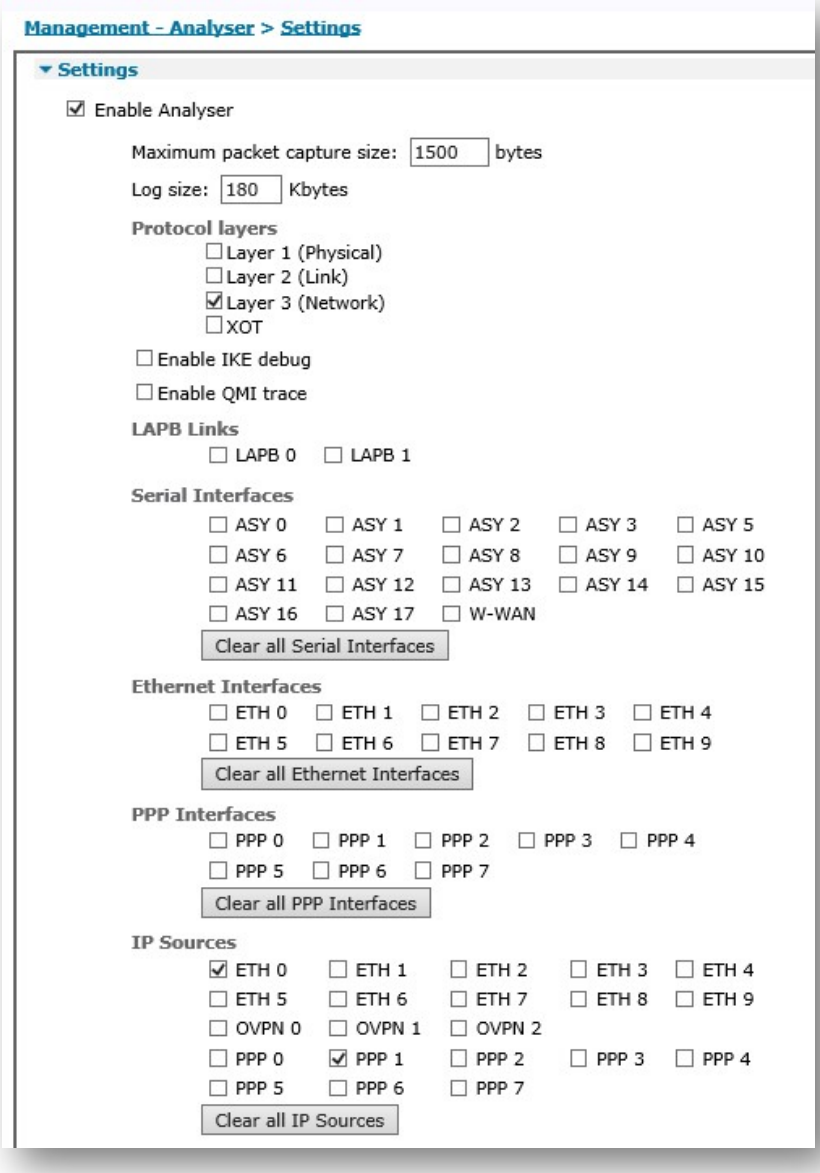


In case of issues in the negotiation, take an IKE/IPsec trace following this guide: http://ftp1.digi.com/support/documentation/QN_045_How_To_setup_analyser_To_Get_IKE_IPsec_trace.pdf.
Please note that debug settings section for IKE, even if using IKEv2, is under general IKE configuration, as there is not a specific one for v2.

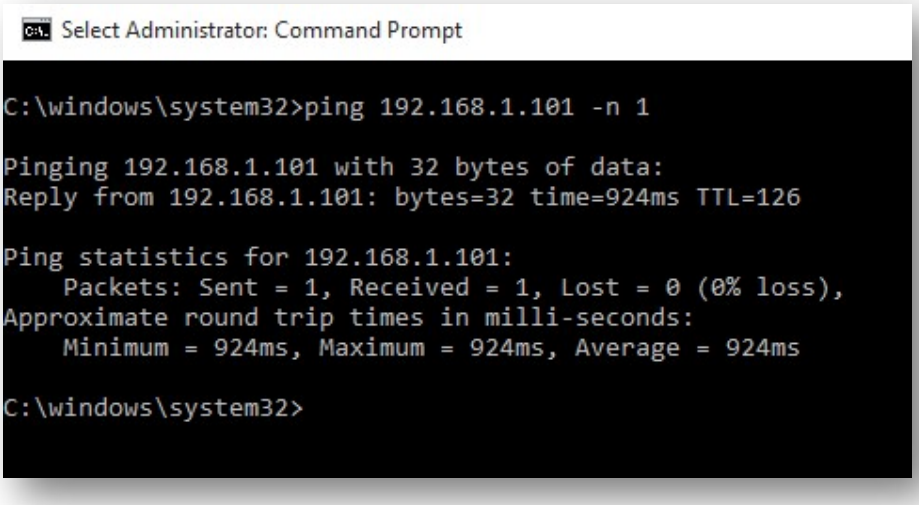
4.2 Check the Traffic passes through the IPsec tunnel

This section will show traffic passing across the tunnel. An easy way to test it, is to make a PING from a laptop connected to the ETH of the Initiator to one connected behind the responder. Before do that, to check how this traffic is handled by the router, the analyser section in the initator router (but the same can be done on the responder) must be configured as follows:

MANAGEMENT - ANALYSER > SETTINGS



Once the analyser is configured, do the ping from the laptop on initiator side:



Then, check the trace, it will show that the ICMP request/reply packets will be sent through the tunnel 0:

MANAGEMENT - ANALYSER > TRACE

```
-----   24-3-2017  08:28:10.110   ------
   45 00 00 3C 75 1B 00 00 80 01 38 8C C0 A8 0A 64     E..<u.....8....d
   C0 A8 01 65 08 00 0E 46 00 01 3F 15 61 62 63 64     ...e...F..?.abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

   IP (In) From REM TO LOC       IFACE: ETH 0
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   75 1B          ID:            29979
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   80             TTL:           128
   01             Proto:         ICMP
   38 8C          Checksum:      14476
   C0 A8 0A 64    Src IP:        192.168.10.100
   C0 A8 01 65    Dst IP:        192.168.1.101
   ICMP:
   08             Type:          ECHO REQ
   00             Code:          0
   0E 46          Checksum:      17934
   ----------
-----   24-3-2017  08:28:10.110   ------
45 00 00 3C 75 1B 00 00 7F 01 39 8C C0 A8 0A 64     E..<u.....9....d
C0 A8 01 65 08 00 0E 46 00 01 3F 15 61 62 63 64     ...e...F..?.abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
```

```
75 76 77 61 62 63 64 65 66 67 68 69                  uvwabcdefghi

ER 0-digiwr11 From LOC TO REM IFACE: PPP 1
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
75 1B          ID:            29979
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
7F             TTL:           127
01             Proto:         ICMP
39 8C          Checksum:      14732
C0 A8 0A 64    Src IP:        192.168.10.100
C0 A8 01 65    Dst IP:        192.168.1.101
ICMP:
08             Type:          ECHO REQ
00             Code:          0
0E 46          Checksum:      17934
----------
-----   24-3-2017  08:28:10.110   ------
45 00 00 78 00 1B 00 00 FA 32 20 58 25 51 3C 80     E..x.....2 X%Q<.
25 55 18 BB 86 65 7E 91 00 00 00 1B 24 B3 D5 85     %U...e~.....$...
C2 5B 0B 82 9C 49 AD AE C9 E9 A4 23 0E 46 7C F1     .[...I.....#.F|.
90 73 AB 4C 9B DA FF 7D 59 7C AE 8D AA 7B 90 BF     .s.L...}Y|...{..
33 3C 10 04 AC 7C 51 59 0F 54 CA A9 DA 80 5B 5F     3<...|QY.T....[_
82 DD 5A 44 71 47 70 FA AC D0 22 F4 E9 CA 8E 27     ..ZDqGp..."....'
2C 45 43 CB 93 4C C9 50 9E 09 CB DF D7 BC 63 25     ,EC..L.P......c%
E0 23 EB 04 CB 54 CE 90                             .#...T..

IP (Final) From LOC TO REM    IFACE: PPP 1
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 78          Length:        120
00 1B          ID:            27
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
FA             TTL:           250
32             Proto:         ESP
20 58          Checksum:      8280
25 51 3C 80    Src IP:        37.81.60.128
25 55 18 BB    Dst IP:        37.85.24.187
----------
   -----   24-3-2017  08:28:11.040   ------
   45 00 00 78 00 15 00 00 F4 32 26 5E 25 55 18 BB     E..x.....2&^%U..
   25 51 3C 80 AB 00 EC B3 00 00 00 15 22 15 C5 15     %Q<.........."...
   54 A9 77 EB 5E 0D 21 65 A0 CC 27 42 88 D3 2B 88     T.w.^.!e..'B..+.
   22 C3 DB 74 E0 9E 7E 2C A3 F0 C0 7E 1C 5A 3B 41     "..t..~,...~.Z;A
   1C C6 40 73 51 93 1A F7 A7 EB 8D 54 2E 55 E8 5B     ..@sQ......T.U.[
   B8 DE 62 7C 3B 6B 0E AE 93 40 99 2A 44 E2 51 B3     ..b|;k...@.*D.Q.
   8E 14 44 EE C6 26 68 A7 14 69 12 C4 CD 25 86 F1     ..D..&h..i...%..
   C8 10 37 E1 F9 F5 49 B6                             ..7...I.
```

```
   IP (In) From REM TO LOC       IFACE: PPP 1
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 78          Length:        120
   00 15          ID:            21
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   F4             TTL:           244
   32             Proto:         ESP
   26 5E          Checksum:      9822
   25 55 18 BB    Src IP:        37.85.24.187
   25 51 3C 80    Dst IP:        37.81.60.128
   ----------
   -----   24-3-2017  08:28:11.040   ------
   45 00 00 3C 54 14 00 00 7F 01 5A 93 C0 A8 01 65     E..<T.....Z....e
   C0 A8 0A 64 00 00 16 46 00 01 3F 15 61 62 63 64     ...d...F..?.abcd
   65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
   75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

   IP (Cont) From REM TO LOC     IFACE: PPP 1
   45             IP Ver:        4
                  Hdr Len:       20
   00             TOS:           Routine
                  Delay:         Normal
                  Throughput:    Normal
                  Reliability:   Normal
   00 3C          Length:        60
   54 14          ID:            21524
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   7F             TTL:           127
   01             Proto:         ICMP
   5A 93          Checksum:      23187
   C0 A8 01 65    Src IP:        192.168.1.101
   C0 A8 0A 64    Dst IP:        192.168.10.100
   ICMP:
   00             Type:          ECHO REPLY
   00             Code:          0
   16 46          Checksum:      17942
   ----------
-----   24-3-2017  08:28:11.040   ------
45 00 00 3C 54 14 00 00 7E 01 5B 93 C0 A8 01 65     E..<T...~.[....e
C0 A8 0A 64 00 00 16 46 00 01 3F 15 61 62 63 64     ...d...F..?.abcd
65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74     efghijklmnopqrst
75 76 77 61 62 63 64 65 66 67 68 69                 uvwabcdefghi

IP (Final) From LOC TO REM    IFACE: ETH 0
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 3C          Length:        60
```

```
54 14          ID:            21524
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
7E             TTL:           126
01             Proto:         ICMP
5B 93          Checksum:      23443
C0 A8 01 65    Src IP:        192.168.1.101
C0 A8 0A 64    Dst IP:        192.168.10.100
ICMP:
00             Type:          ECHO REPLY
00             Code:          0
16 46          Checksum:      17942
----------
```

CONFIGURATION FILES

This is the config.da0 file used for the purpose of this Application Note on the Responder side:

```
Command: config c show
Command result

eth 0 IPaddr "192.168.1.1"
eth 0 ipanon ON
lapb 0 ans OFF
lapb 0 tinact 120
lapb 1 tinact 120
lapb 3 dtemode 0
lapb 4 dtemode 0
lapb 5 dtemode 0
lapb 6 dtemode 0
ip 0 cidr ON
def_route 0 ll_ent "ppp"
def_route 0 ll_add 1
eroute 0 descr "IKEv2 with Certs"
eroute 0 peerid "digiwr21"
eroute 0 ourid "digiwr11"
eroute 0 locip "192.168.1.0"
eroute 0 locmsk "255.255.255.0"
eroute 0 remip "192.168.10.0"
eroute 0 remmsk "255.255.255.0"
eroute 0 ESPauth "SHA1"
eroute 0 ESPenc "AES"
eroute 0 authmeth "RSA"
eroute 0 ikever 2
eroute 0 dhgroup 2
eroute 0 enckeybits 256
eroute 0 privkey "privh.pem"
dhcp 0 IPmin "192.168.1.100"
dhcp 0 respdelms 500
dhcp 0 mask "255.255.255.0"
dhcp 0 gateway "192.168.1.1"
dhcp 0 DNS "192.168.1.1"
sntp 0 server "time.devicecloud.com"
dyndns 0 ifent "default"
ppp 0 timeout 300
ppp 1 name "W-WAN (HSPA 3G)"
ppp 1 phonenum "*98*1#"
ppp 1 IPaddr "0.0.0.0"
ppp 1 timeout 0
ppp 1 ipsec 1
ppp 1 use_modem 1
ppp 1 aodion 1
ppp 1 autoassert 1
ppp 1 ipanon ON
ppp 1 r_chap OFF
ppp 3 defpak 16
ppp 4 defpak 16
web 0 prelogin_info ON
ftpcli 0 hostname "ftp1.digi.com"
ftpcli 0 directory "support/firmware/transport/radio_module_firmware/he910d"
ike2 0 rencalgs "AES"
ike2 0 renckeybits 256
ike2 0 rauthalgs "SHA1"
```

```
ike2 0 rprfalgs "SHA1"
ike2 0 rdhmaxgroup 2
ike2 0 privrsakey "privh.pem"
modemcc 0 info_asy_add 3
modemcc 0 init_str "+CGQREQ=1"
modemcc 0 init_str1 "+CGQMIN=1"
modemcc 0 apn "Internet.t-d1.de"
modemcc 0 link_retries 10
modemcc 0 stat_retries 30
modemcc 0 sms_interval 1
modemcc 0 sms_access 1
modemcc 0 sms_concat 0
modemcc 0 init_str_2 "+CGQREQ=1"
modemcc 0 init_str1_2 "+CGQMIN=1"
modemcc 0 apn_2 "Your.APN.goes.here"
modemcc 0 link_retries_2 10
modemcc 0 stat_retries_2 30
modemcc 0 sms_access_2 1
modemcc 0 sms_concat_2 0
ana 0 anon ON
ana 0 l2on OFF
ana 0 xoton OFF
ana 0 lapdon 0
ana 0 lapbon 0
ana 0 maxdata 1500
ana 0 logsize 180
cmd 0 unitid "ss%s>"
cmd 0 cmdnua "99"
cmd 0 hostname "digi.router"
cmd 0 tremto 1200
cmd 0 rcihttp ON
user 0 access 0
user 1 name "username"
user 1 epassword "KD5lSVJDVVg="
user 1 access 0
user 2 access 0
user 3 access 0
user 4 access 0
user 5 access 0
user 6 access 0
user 7 access 0
user 8 access 0
user 9 access 0
local 0 transaccess 2
sslcli 0 verify 10
sslsvr 0 certfile "cert01.pem"
sslsvr 0 keyfile "privrsa.pem"
ssh 0 hostkey1 "privSSH.pem"
ssh 0 nb_listen 5
ssh 0 v1 OFF
cloud 0 ssl ON

Power Up Profile: 0
OK
```

This is the config.da0 file used for the purpose of this Application Note on the Initiator side:

```
Command: config c show
Command result

eth 0 IPaddr "192.168.10.1"
eth 0 ipanon ON
lapb 0 ans OFF
lapb 0 tinact 120
lapb 1 tinact 120
lapb 3 dtemode 0
lapb 4 dtemode 0
lapb 5 dtemode 0
lapb 6 dtemode 0
ip 0 cidr ON
def_route 0 ll_ent "ppp"
def_route 0 ll_add 1
eroute 0 descr "IKEv2 with Certs"
eroute 0 peerip "37.85.24.187"
eroute 0 peerid "digiwr11"
eroute 0 ourid "digiwr21"
eroute 0 locip "192.168.10.0"
eroute 0 locmsk "255.255.255.0"
eroute 0 remip "192.168.1.0"
eroute 0 remmsk "255.255.255.0"
eroute 0 ESPauth "SHA1"
eroute 0 ESPenc "AES"
eroute 0 authmeth "RSA"
eroute 0 nosa "TRY"
eroute 0 autosa 2
eroute 0 ikever 2
eroute 0 dhgroup 2
eroute 0 enckeybits 256
eroute 0 privkey "privcl.pem"
dhcp 0 IPmin "192.168.1.100"
dhcp 0 respdelms 500
dhcp 0 mask "255.255.255.0"
dhcp 0 gateway "192.168.1.1"
dhcp 0 DNS "192.168.1.1"
sntp 0 server "time.devicecloud.com"
dyndns 0 ifent "default"
ppp 0 timeout 300
ppp 1 name "W-WAN"
ppp 1 phonenum "*98*1#"
ppp 1 IPaddr "0.0.0.0"
ppp 1 timeout 0
ppp 1 ipsec 1
ppp 1 use_modem 1
ppp 1 aodion 1
ppp 1 autoassert 1
ppp 1 ipanon ON
ppp 1 r_chap OFF
ppp 3 defpak 16
ppp 4 defpak 16
web 0 prelogin_info ON
ike2 0 iencalg "AES"
ike2 0 ienckeybits 256
ike2 0 idhgroup 2
ike2 0 privrsakey "privcl.pem"
modemcc 0 asy_add 4
modemcc 0 info_asy_add 2
```

```
modemcc 0 init_str "+CGQREQ=1"
modemcc 0 init_str1 "+CGQMIN=1"
modemcc 0 apn "Internet.t-d1.de"
modemcc 0 link_retries 10
modemcc 0 stat_retries 30
modemcc 0 sms_interval 1
modemcc 0 sms_access 1
modemcc 0 sms_concat 0
modemcc 0 init_str_2 "+CGQREQ=1"
modemcc 0 init_str1_2 "+CGQMIN=1"
modemcc 0 apn_2 "Your.APN.goes.here"
modemcc 0 link_retries_2 10
modemcc 0 stat_retries_2 30
modemcc 0 sms_access_2 1
modemcc 0 sms_concat_2 0
ana 0 anon ON
ana 0 l2on OFF
ana 0 xoton OFF
ana 0 lapdon 0
ana 0 lapbon 0
ana 0 maxdata 1500
ana 0 logsize 180
cmd 0 unitid "ss%s>"
cmd 0 cmdnua "99"
cmd 0 hostname "digi.router"
cmd 0 asyled_mode 2
cmd 0 tremto 1200
cmd 0 rcihttp ON
user 0 access 0
user 1 name "username"
user 1 epassword "KD5lSVJDVVg="
user 1 access 0
user 2 access 0
user 3 access 0
user 4 access 0
user 5 access 0
user 6 access 0
user 7 access 0
user 8 access 0
user 9 access 0
local 0 transaccess 2
sslcli 0 verify 10
sslsvr 0 certfile "cert01.pem"
sslsvr 0 keyfile "privrsa.pem"
ssh 0 hostkey1 "privSSH.pem"
ssh 0 nb_listen 5
ssh 0 v1 OFF
creq 0 digest "MD5"
scep 0 cafile "cadc.pem"
scep 0 keybits 1024
templog 0 mo_autooff ON
cloud 0 ssl ON

Power Up Profile: 0
OK
```