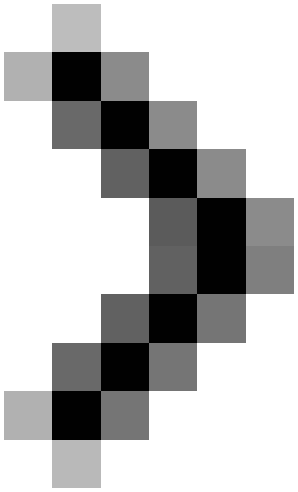
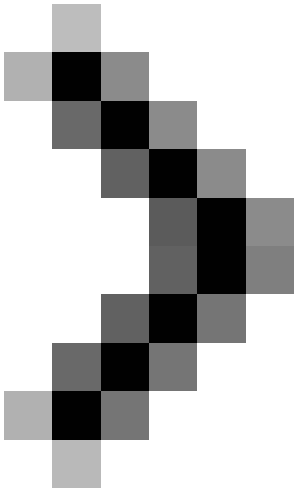
PKI Tutorial - Part 3: Installation

We went to the third part of the PKI tutorial series. In the first section, we have introduced you to an overview of PKI preparation and planning. Next in the second part, go into design mode and consider some of the best practice settings



Part 1: Planning



Part 2: Design

Martin Kiaer

We went to the third part of the PKI tutorial series. In the first section, we have introduced you to an overview of PKI preparation and planning. Next in the second part, go into design mode and consider some of the best practice settings. In this article, I will go over the technical issue and show you how to install PKI based on Microsoft Certificate Services in Windows Server 2003.

PKI settings

Based on some design results from the previous two parts, now let's start the PKI installation. Since this is a quick tutorial, we will only cover a few steps. At the end of this article, we will show you how to install a two-level architecture that includes an offline root CA and an online issuing CA in the same PKI using best practices. However, before starting the set, get used to some things.

In Figure 1, we have given a valid period for best practice for each CA at each level (based on the 3-level architecture for the complete master model). The advantage of this model is that it will ensure you always have consistency with the issued certificates at each level. If you only want to deploy the two-level architecture, simply delete the level 3 CA. The model will still be applied.

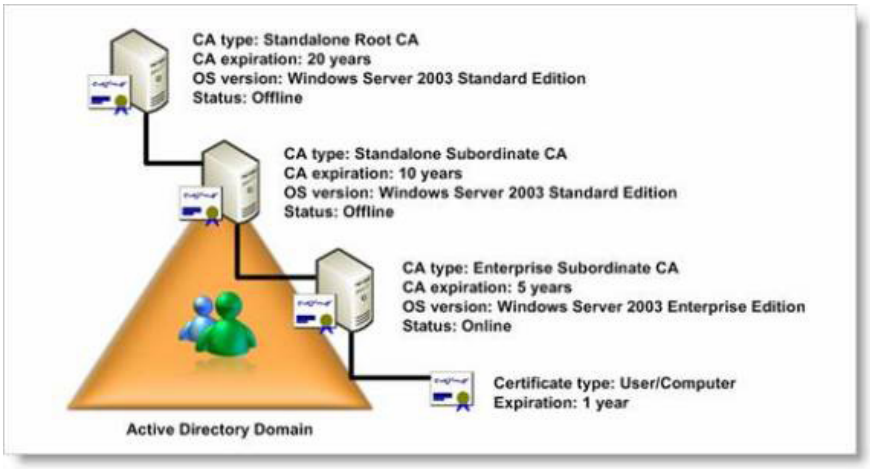


Figure 1: The most practical validity period for each CA at each level

Another thing that you should prepare before starting the installation is a text file called CAPolicy.inf. This file is used to customize your Windows Certificates Services configuration. In this file, you will find very important things like:

1. CDP statement
2. Certificate refresh settings such as valid period and key size
3. Links for CDP and AIA links
4. How is CRL frequency published?

Create the file in Notepad and save it to **% windir% capolicy.inf** (eg *C: Windowscapolicy.inf*).

Doing this task is really simple, by following the files in the step-by-step instructions below. With the things we provide below, let's dive into the technicalities of the problem.

Offline root CA installation

To install an offline root CA, you must do all of the following bullets:

1. Prepare the file CAPolicy.inf
2. Windows Certificate Services installation
3. Publish the CRL list
4. Run post-Configuration script

This is how it is done.

1. Install the server with Windows Server 2003 Standard Edition incl. SP1 or newer and ensure that it runs as a standalone server (ie not a member in any domain).

2. Create the required parameter replacements in the CAPOlicy.inf file below (marked with red)

```
[Version]
Signature="$Windows NT$"

[CertSrv_Server]
RenewalKeyLength=4096
RenewalValidityPeriod=Years
RenewalValidityPeriodUnits=20

[CRLDistributionPoint]
empty=true

[AuthorityInformationAccess]
empty=true

[PolicyStatementExtension]
Policies = AllIssuancePolicy
Critical = FALSE

[AllIssuancePolicy]
OID = 2.5.29.32.0
URL = http://cps.domain.com/cps.htm
```

Figure 2: File CAPolicy.inf

3. Copy the CAPolicy.INF file to **% windir% capolicy.inf**

4. Navigate to **Start Menu / Control Panel / Add or Remove Programs** | Click **Add / Remove Windows Components**

5. In the Windows Components Wizard, select **Certificates Services** and then click **Next**

6. Notice what is in the dialog box displayed. You should not rename the computer when Windows Certificate Services are installed, click **Yes**

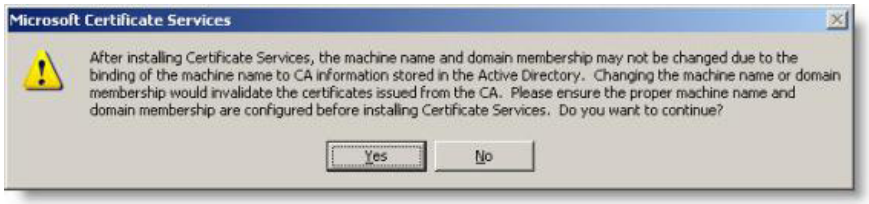


Figure 3

7 In the CA Type field, click **Stand-alone root CA** , check the ' **Use custom settings to generate the pair and CA certificate** ' **checkbox** and click **Next.**

Note :
Usually the root CAs of the enterprise and the subordinate CA options cannot be selected because this server is not a member in a domain.

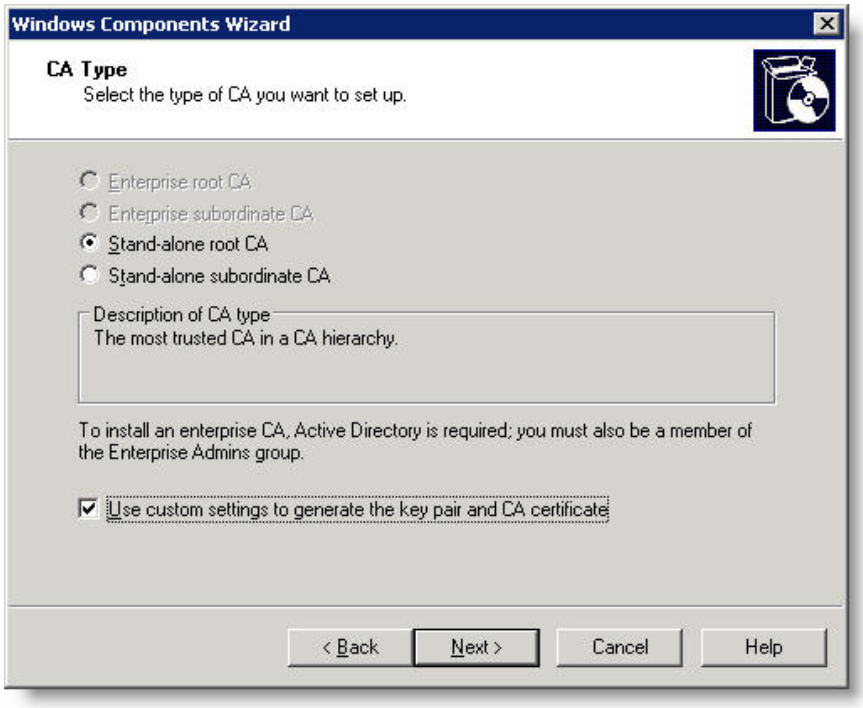


Figure 4

8. Select the CSP you want to use for the offline root CA. For simplicity, let's choose **Microsoft Strong Cryptographic Provider v1.0** , although another CSP can be selected, for example, if you have installed Hardware Security Module (HSM) and connected the server to an HSM solution, before catching early CA installation procedure.

Select the default **SHA-1** hash **algorithm**

Set the key length to **4096**

Make sure that both ' **Allow this CSP to interact with the desktop** ' and ' **Use an existing key** ' options are not selected. Click **Next** .

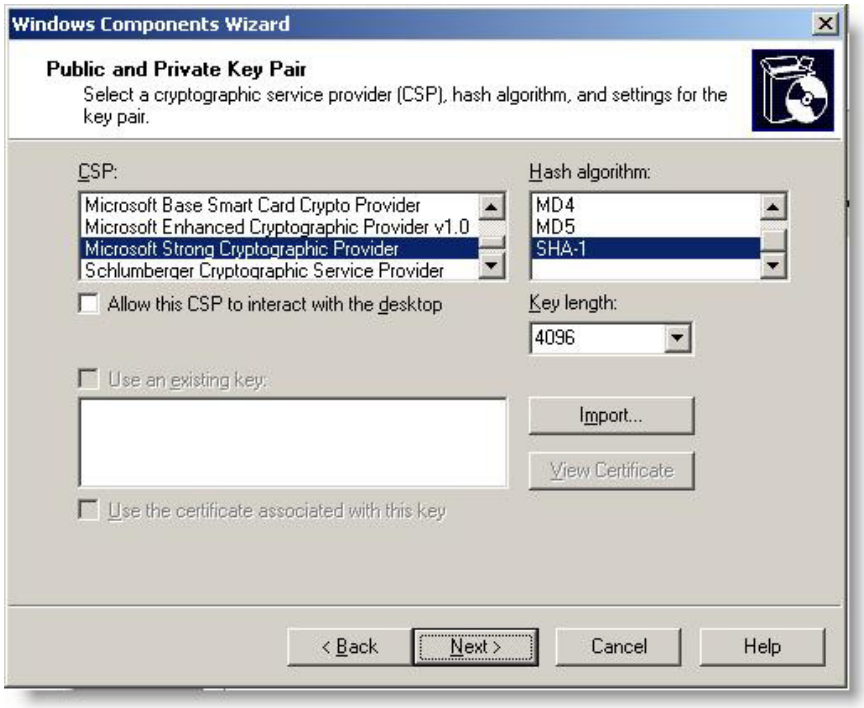


Figure 5

9. Enter the generic name for your root CA, configure the distinguished name suffix (**O = domain, C = local**) and set the validity period to **20 years** , then click **Next** .

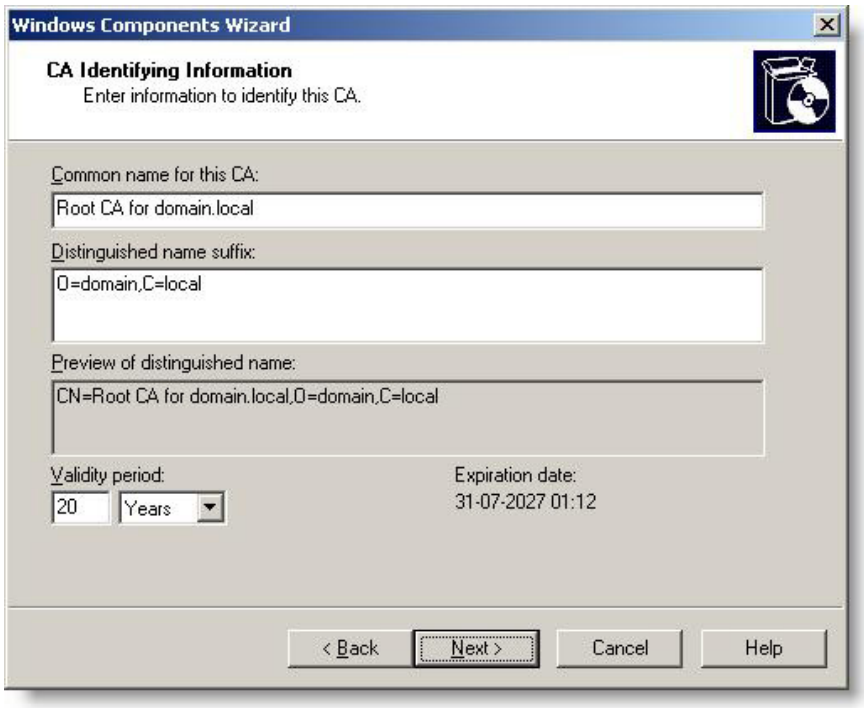


Figure 6

10. Accept the default proposal for the certificate database and log files, then click **Next** .

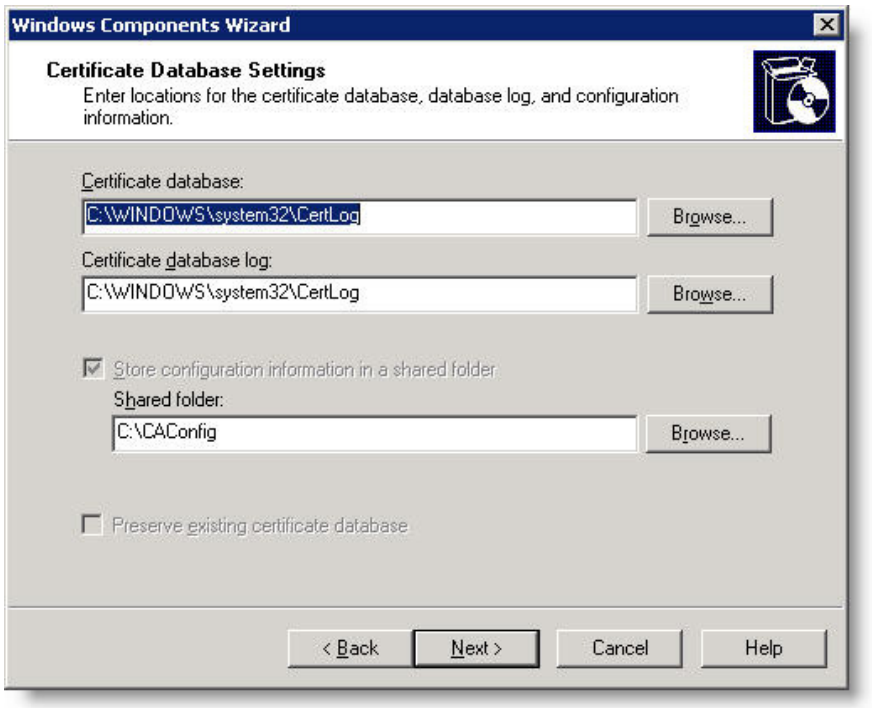


Figure 7

11. If this is an offline root CA, you do not need to install IIS (Internet Information Services) and that is why this dialog box is displayed. Click **OK** .

Figure 8

12. Click **Finish**

Figure 9

13. Click **Start / Programs / Administrative Tools / Certificate Authority**

14. Open your CA server panel, then right-click **Revoked Certificates** and select **All tasks / Publish**

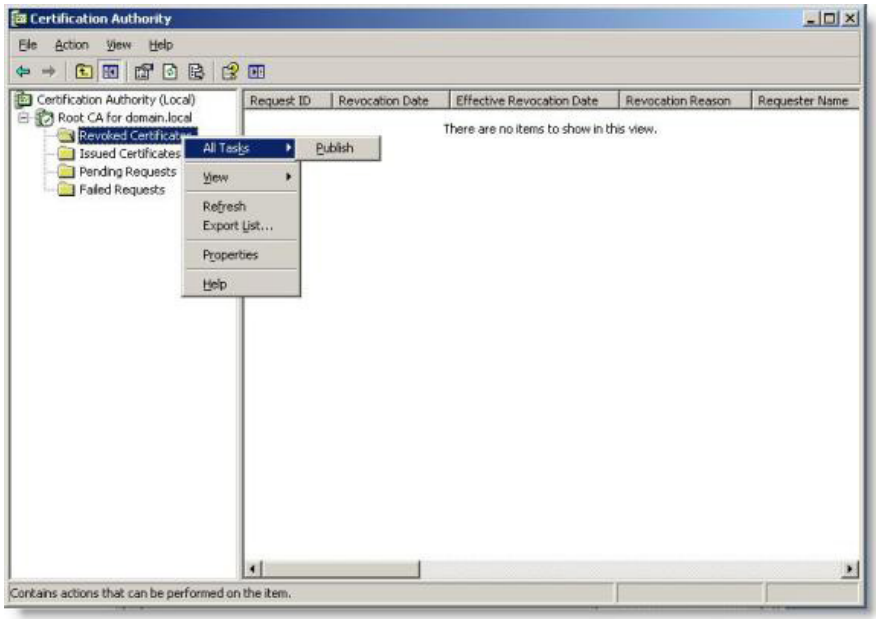


Figure 10

15. Select **New CRL** and click **OK**

16. Copy **% windir% system32certsrvcertenroll * .crt** and *** .crl** to the USB key. You will need these files for the next secondary CA to be installed.

17. You should also copy these files to the HTTP CDP location as indicated in the **caconfig.inf** file listed earlier.

18. Create the replacement of the required parameters in the file below (the part is red) and run the file from the command prompt.

```
@ECHO OFF
REM Filename: config-root.cmd
REM CA configuration script for a Windows Server 2003 CA
REM
REM The naming context applies to the individual organizations Active Directory
REM configuration
REM
SET myADnamingcontext=DC=domain,DC=local
REM
REM This variable directs to the HTTP publication location that is used for
REM the CRL and AIA publication
REM
SET myhttpPKIvroot=http://cdp.domain.com
REM
REM Because CRLs and CA certificates are published in the organizations Active
REM Directory, no specific LDAP server name is provided.
REM Set an dedicated server-name instead
REM if a known server should provide the CRLs and AIAs
REM
REM SET myLDAPserver=
REM
REM Map the namespace of Active Directory
REM
certutil.exe -setreg ca\DSConfigDN "CN=Configuration,%myADnamingcontext%"
REM
REM Configure CRL and AIA CDP
REM
REM By default, Certutil creates a registry value of type REG_SZ if a string is
REM specified as a parameter. Some registry values are expected as REG_MULTI_SZ. To
REM create a REG_MULTI_SZ instead of a REG_SZ, add a \n to the end of any value that
REM becomes part of the REG_MULTI_SZ
REM
certutil -setreg CA\CRLPublicationURLs
"1:%WINDIR%\system32\CertSrv\CertEnroll\%%3%%8%%9.crl\n2:%myhttpPKIvroot%/%
%3%%8%%9.crl\n14:ldap://%myLDAPserver%/CN=%%7%%8,CN=%%2,CN=CDP,CN=Publi
c Key Services,CN=Services,%%6%%10"
certutil -setreg CA\CACertPublicationURLs
"1:%WINDIR%\system32\CertSrv\CertEnroll\%%1_%%3%%4.crt\n2:%myhttpPKIvroot%/
%%1_%%3%%4.crt\n2:ldap://%myLDAPserver%/CN=%%7,CN=AIA,CN=Public Key
Services,CN=Services,%%6%%11"
REM
REM Configure CRL publication
REM
certutil -setreg CA\CRLPeriodUnits 180
certutil -setreg CA\CRLPeriod "Days"
REM
REM Set the CRL overlap
REM
certutil -setreg ca\CRLOverlapUnits 10
certutil -setreg ca\CRLOverlapPeriod "Days"
REM
REM Disable Delta CRL publication
REM
certutil -setreg CA\CRLDeltaPeriodUnits 0
REM
REM Set the validity period for issued certificates
REM
certutil -setreg ca\ValidityPeriodUnits 10
certutil -setreg ca\ValidityPeriod "Years"
REM
REM Restart the CA server service
REM
net stop certsvc & net start certsvc
REM
REM Repair CA file system shares and IIS virtual roots
REM
certutil -vroot
REM
REM Republish the CRL
REM The CRL publishing may immediately not work
REM after you restart the CA server service. If this behavior
REM occurs, try the certutil CRL command at a command
```

Figure 11
19. You are now done installing the root CA.

We mentioned earlier that there are many security reasons to keep root CAs and policy CAs offline. Only between issuing CAs in online mode. This is because policy and root CAs are kept offline, they are not members of a domain.

Install the enterprise CA that is publishing online

To install the enterprise CA that is online, you need to follow these steps:

1. Prepare the file CAPolicy.inf
2. Installing IIS (Internet Information Services)
3. Windows Certificate Services installation
4. Submit the CA child certificate request to the parent CA
5. Release the CA CA certificate
6. Install the CA CA certificate at the enterprise subordinate CA
7. Run post-Configuration script (configuration)
8. Publish the CRL list

Here's how to do it:

1. Install a server with Windows Server 2003 Enterprise Edition incl. SP1 or newer and make sure it is a member of the domain

2. Ensure that IIS is installed. However, there is also a note for this step. If you really want to do it simply, skip the IIS section. Such a caveat is so that you must correctly understand the PKI before ignoring the IIS component. The advantage of this approach is to make installation simpler and reduce the attack direction.

3. Replace the necessary parameters in the CAPOlicy.inf file below (the section marked with red).

```
[Version]
Signature="$Windows NT$"

[Certsrv_Server]
RenewalKeyLength=2048
RenewalValidityPeriod=Years
RenewalValidityPeriodUnits=5

[AuthorityInformationAccess]
URL=http://cdp.domain.com/CACertificateFile.crt

[CRLDistributionPoint]
URL=http://cdp.domain.com/CACRLFileName.crl
```

Figure 12: File CAPolicy.inf

4. Copy the **CAPolicy.INF** file **to% windir% capolicy.inf**

5. Navigate to **Start Menu / Control Panel / Add or Remove Programs** / click **Add / Remove Windows Components**

6. In the Windows Components Wizard, select **Certificates Services** and click **Next**

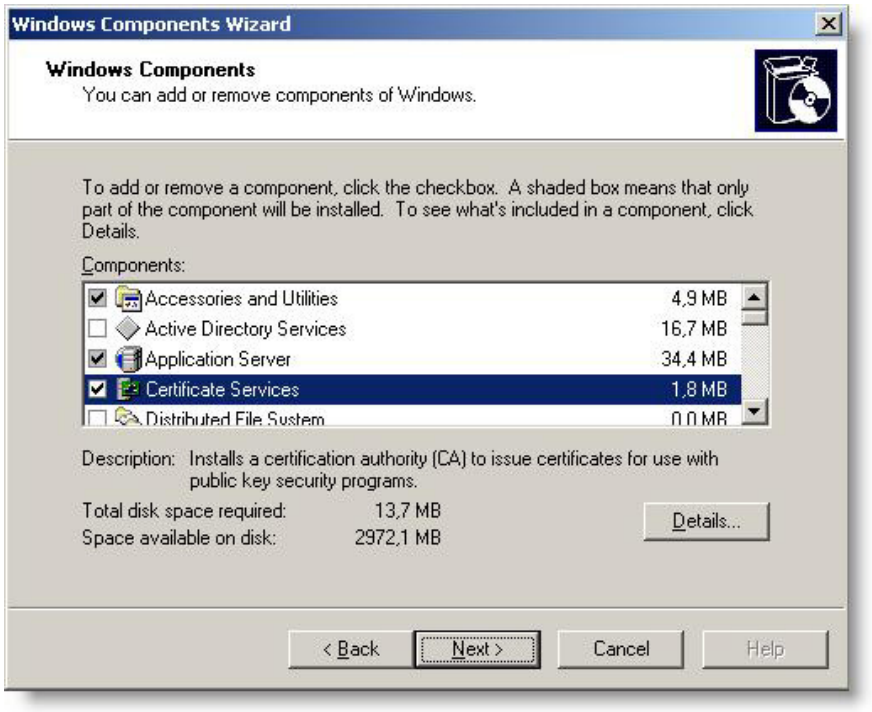


Figure 13

7. Note with what dialog box is displayed. You should not rename the computer when Windows Certificate Services are installed. Click **Yes**

8. In the CA Type field, click the Enterprise subordinate CA, and check the ' **Use custom settings to generate the pair and CA key' checkbox,** and then click **Next.**

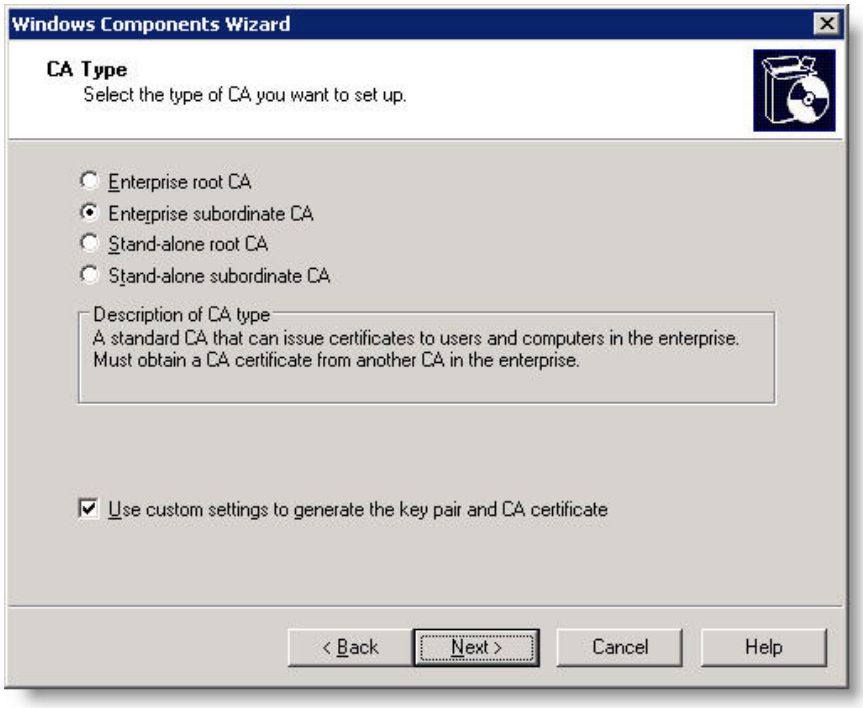


Figure 14

9. Select CSP to use for the issuing CA. For simplicity, we choose **Microsoft Strong Cryptographic Provider v1.0** , though you can also choose another CSP if you want, for example installing Hardware Security Module (HSM) and connecting the server to an HSM solution before start the CA installation procedure.

Select the default **SHA-1** hash **algorithm**

Set the key length to **2048**

Make sure that both the ' **Allow this CSP to interact with the desktop** ' and ' **Use an existing key** ' options are not **checked** . Click **Next** .

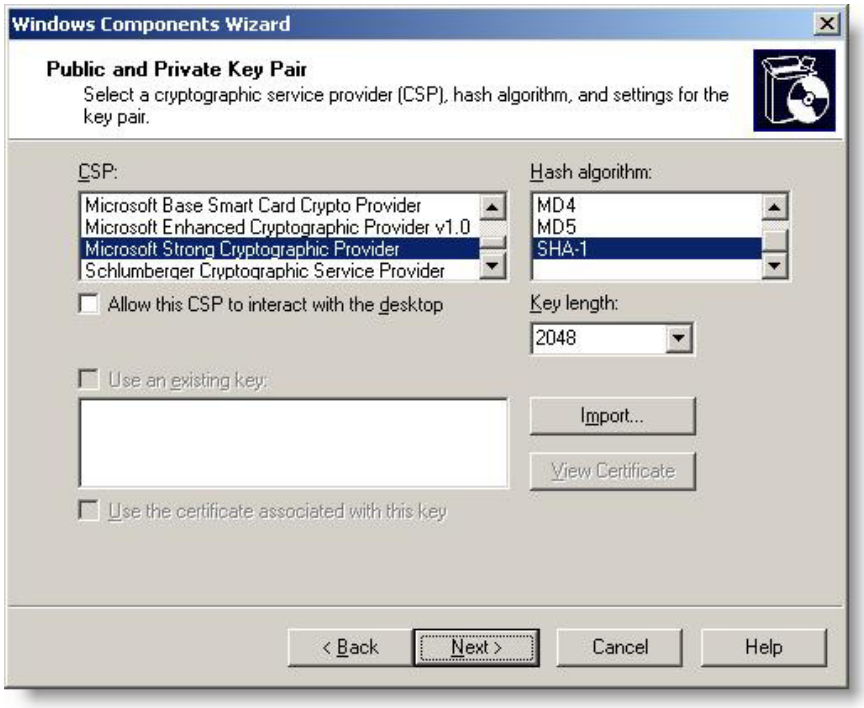


Figure 15

10. Enter a name for the issuing CA and set the validity period to **5 years** , then click **Next**

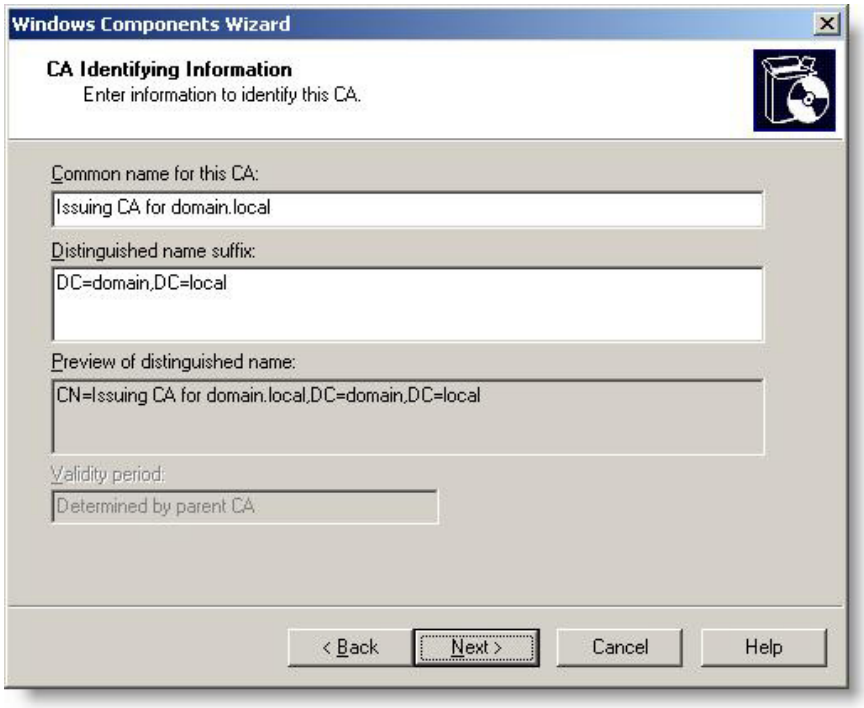


Figure 16

11. Accept the default offer for the certificate database and log files and click **Next**

12. The CA certificate request window is displayed. Choose **Save the request to a file** and enter the path and file name (the utility will automatically add the .req extension of the file). Copy the file to a USB key for later use. Click **Next** . We will use this required file in the following section.

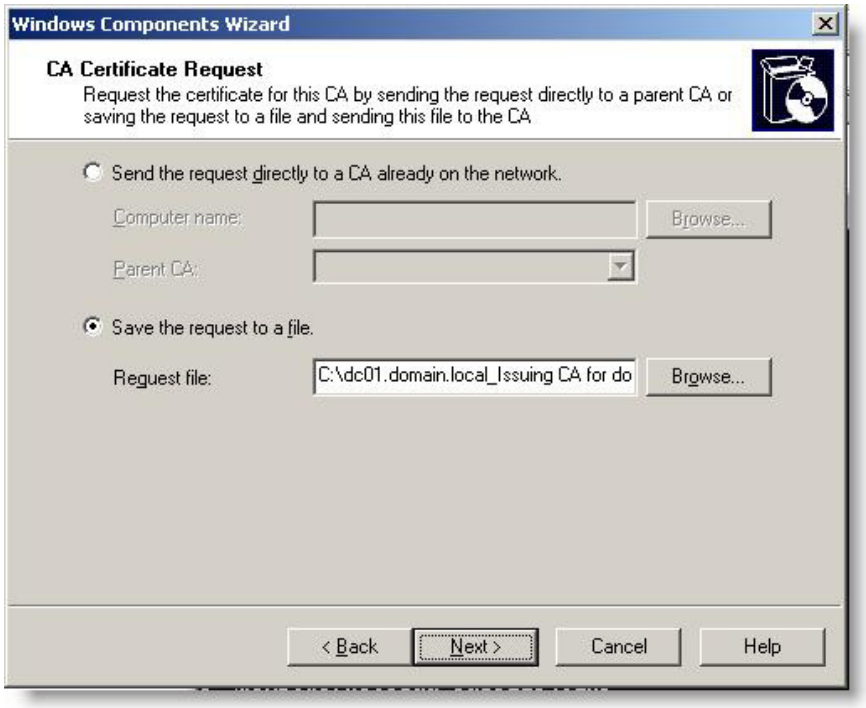


Figure 17

13. Some IIS application components will be added. Click **Yes**

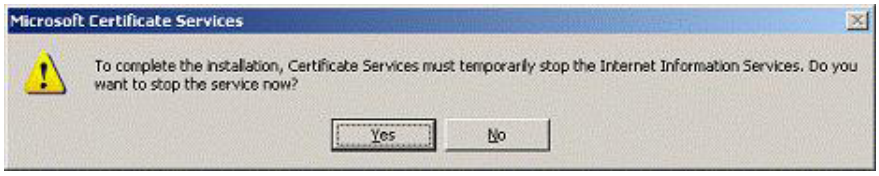


Figure 18

14. (Optional) If you do not have ASP support in IIS, follow what the dialog box displays. Click **Yes**

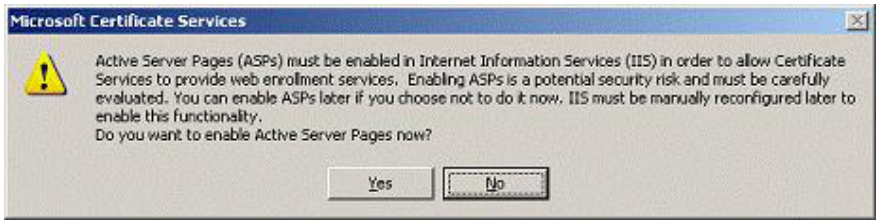


Figure 19

15. This is not done here, when a dialog box appears, you need to create a private key for your new issuing CA.

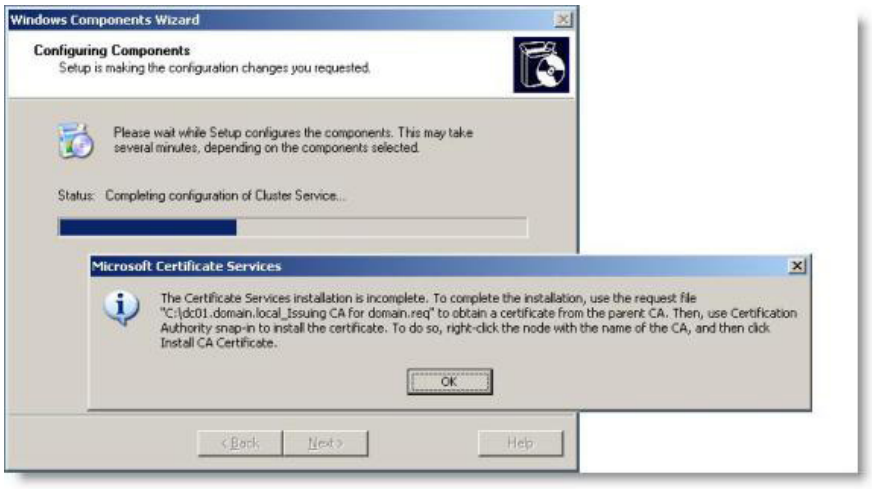


Figure 20

Click **OK** and continue

16. Click **Finish**

Figure 21

17. Before continuing, you should publish the certificate and revocation list for the root CA for Active Directory. This is done easily by following the steps below:

a) Copy both the *** .crt** and *** .crl** files generated during the installation of the root CA to the directory **% systemroot% system32certsrvcertenroll** on the issuing CA server.

b) Run the following script from the command window in the same directory on the issuing CA. You must run the script as a member user of Cert Publishers Group in Active Directory (usually a domain administrator).

```
@echo off
for %%c in (*.crt) do certutil -addstore -f Root "%%c"
for %%c in (*.crl) do certutil -addstore -f Root "%%c"
for %%c in (*.crt) do certutil -dspublish -f "%%c" Rootca
for %%c in (*.crt) do certutil -dspublish -f "%%c" Subca
for %%c in (*.crl) do certutil -dspublish -f "%%c"
gpupdate /force
```

Figure 22

The script will automatically handle the entire file name and complete the necessary commands

18. Make sure you have the certificate request file created in step 12. Log in to the root CA server

19. From the root CA server, click **Start / Programs / Administrative Tools / Certificate Authority**

20. Open the CA server panel, right-click the server name. Click **All tasks / Submit new request .**

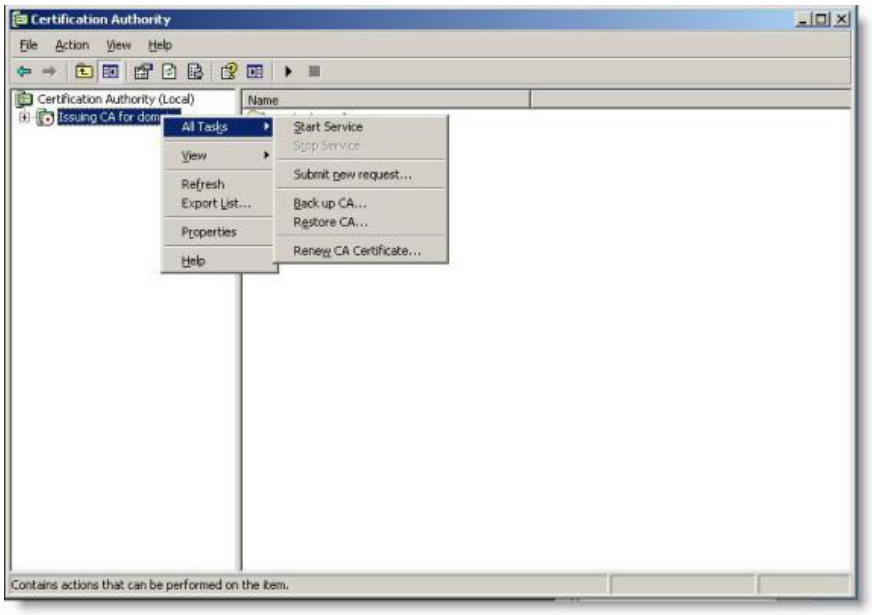


Figure 23

21. Locate the required file created in step 12 and click **OK**

22. In the left pane, click **Pending Requests** . Locate the certificate request in the right pane / right-click the certificate request and select **All Tasks / Issue**

23. Next, we need to export the certificate. In the left pane, click **Issued Certificates** . In the right pane, right-click the certificate, and then click **Open**

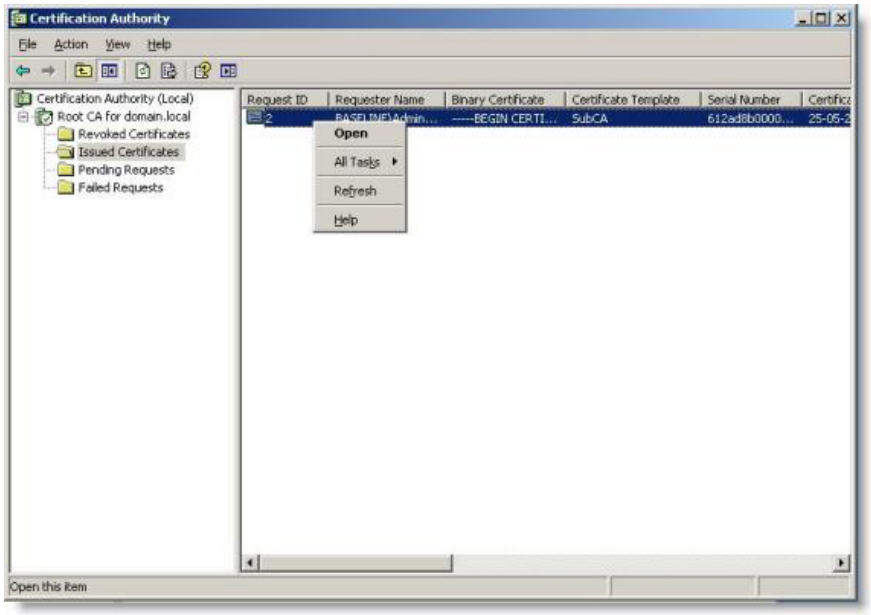


Figure 24

24. Click the Details tab and click **Copy to file .**

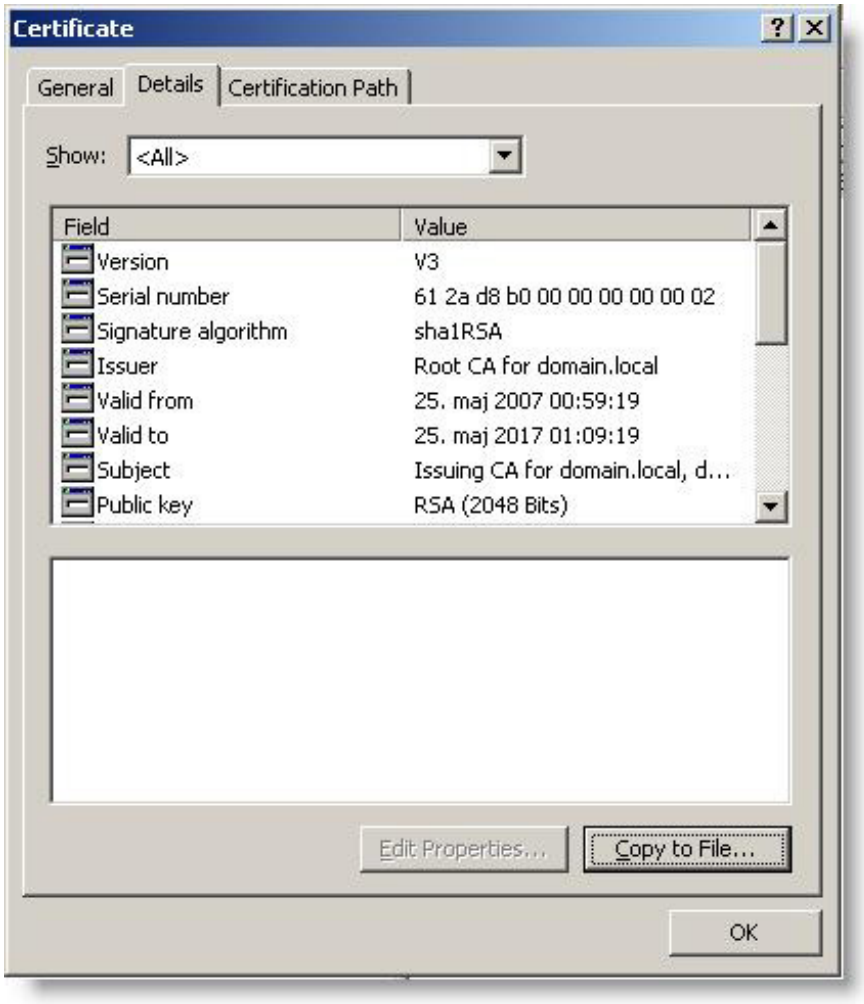


Figure 25

25. Certificate Export Wizard is displayed. Click **Next**

Figure 26

26. Select ' **Cryptografic Message Syntax Standard .** ' and ' **Include all certificates in path certification if possible** '. Click **Next**

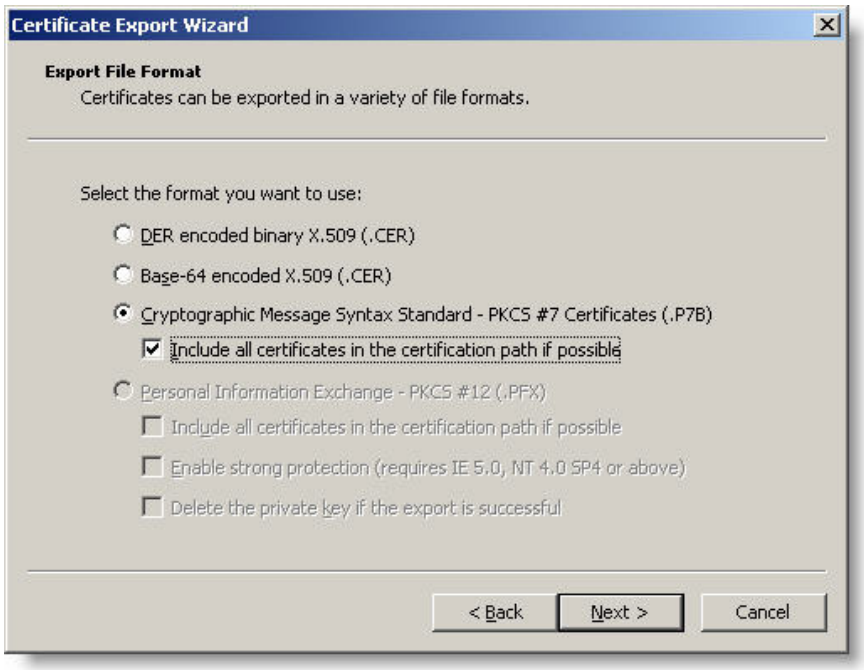


Figure 27

27. Save the certificate to the same USB key used in step 12. Click **Next**

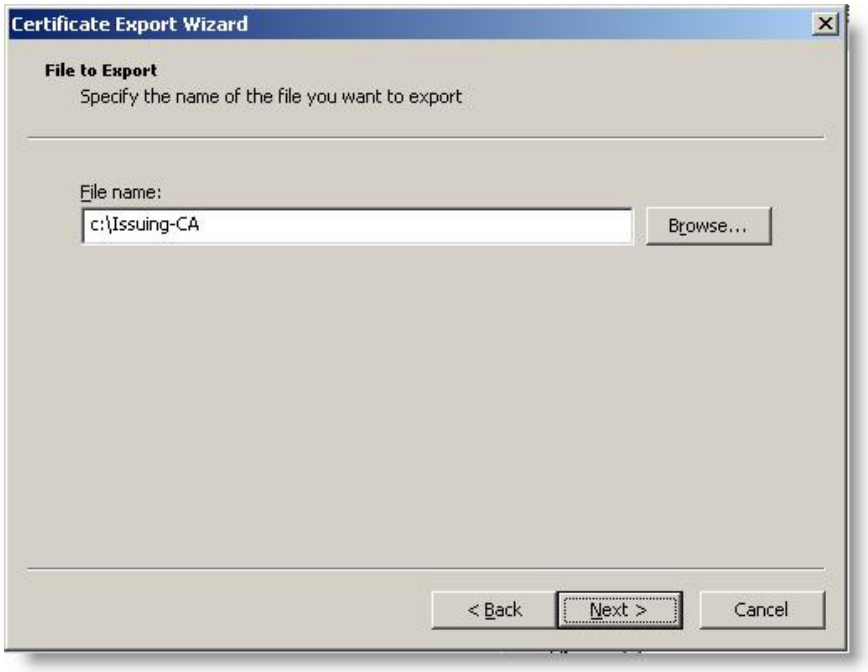


Figure 28

28. Click **Finish** and click **OK**

29. Now go back to the CA release and click **Start / Programs / Administrative Tools / Certificate Authority**

30. Open the CA server panel and right-click the server name. Click **All tasks / Install CA certificate .**

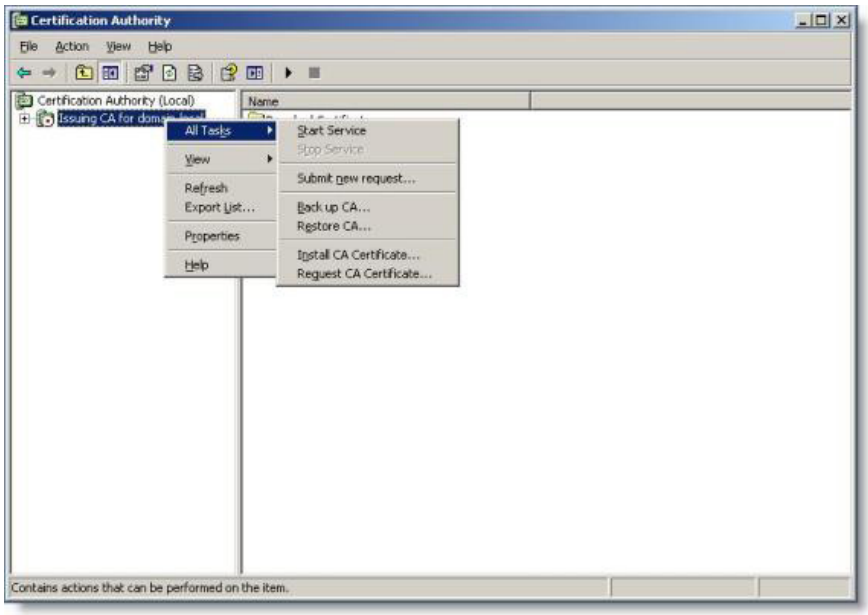


Figure 29

31. Locate the issued certificate in step 27 and click **OK**

32. Open the CA server panel and right-click the server name. Click **Start service**

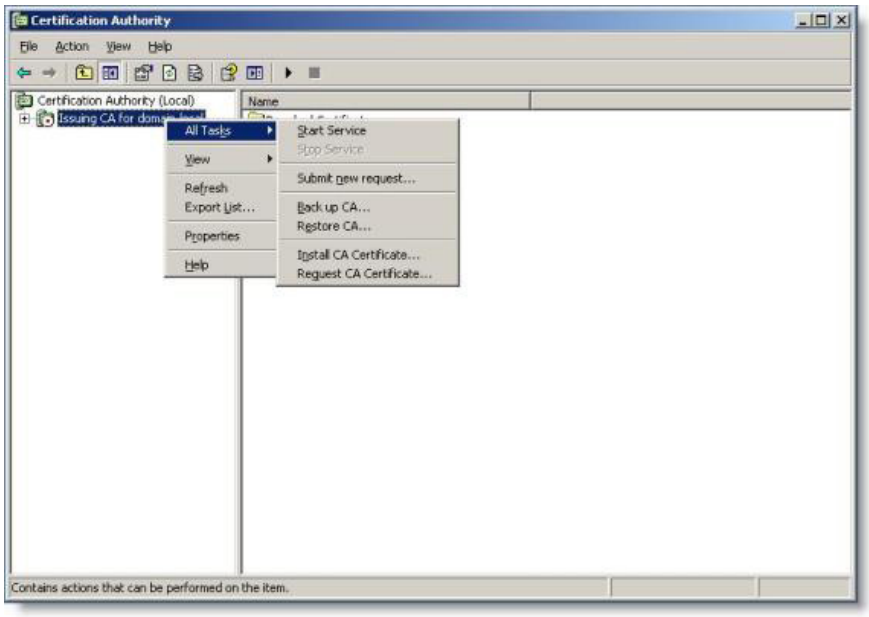


Figure 30

33. Copy **% windir% system32certsrvcertenroll * .crt** and *** .crl** to the USB key. You need to copy these files to the web server that is being used as distribution points for Certificate Distribution Points (CDP) certificates using the HTTP protocol. This is the CDP URL based on HTTP that you defined in the issuing CAs.

Note :
This task should be scheduled and run automatically

34. Make the necessary changes to the parameters in the file below (highlighted in red) and run the file from the command prompt

```
@ECHO OFF
REM Filename: config-issue.cmd
REM
REM CA configuration script for a Windows Server 2003 CA
REM
REM The naming context applies to the individual organizations Active Directory
REM configuration
REM
SET myADnamingcontext=DC=domain,DC=local
REM
REM This variable directs to the HTTP publication location that is used for
REM the CRL and AIA publication
REM
SET myhttpPKIvroot=http://cdp.domain.com
REM
REM Because CRLs and CA certificates are published in the organizations Active
REM Directory, no specific LDAP server name is provided.
REM Set an dedicated server-name instead
REM if a known server should provide the CRLs and AIAs
REM
REM SET myLDAPserver=
REM
REM Map the namespace of Active Directory
REM
certutil.exe -setreg ca\DSConfigDN "CN=Configuration,%myADnamingcontext%"
REM
REM Configure CRL and AIA CDP
REM
REM By default, Certutil creates a registry value of type REG_SZ if a string is
REM specified as a parameter. Some registry values are expected as REG_MULTI_SZ. To
REM create a REG_MULTI_SZ instead of a REG_SZ, add a \n to the end of any value that
REM becomes part of the REG_MULTI_SZ
REM
certutil -setreg CA\CRLPublicationURLs
"1:%WINDIR%\system32\CertSrv\CertEnroll\%%3%%8%%9.crl\n2:%myhttpPKIvroot%/%
%3%%8%%9.crl\n14:ldap://%myLDAPserver%/CN=%%7%%8,CN=%%2,CN=CDP,CN=Publi
c Key Services,CN=Services,%%6%%10"
certutil -setreg CA\CACertPublicationURLs
"1:%WINDIR%\system32\CertSrv\CertEnroll\%%1_%%3%%4.crt\n2:%myhttpPKIvroot%/
%%1_%%3%%4.crt\n2:ldap://%myLDAPserver%/CN=%%7,CN=AIA,CN=Public Key
Services,CN=Services,%%6%%11"
REM
REM Configure CRL publication
REM
certutil -setreg CA\CRLPeriodUnits 180
certutil -setreg CA\CRLPeriod "Days"
REM
REM Set the CRL overlap
REM
certutil -setreg ca\CRLOverlapUnits 10
certutil -setreg ca\CRLOverlapPeriod "Days"
REM
REM Disable Delta CRL publication
REM
certutil -setreg CA\CRLDeltaPeriodUnits 0
REM
REM Set the validity period for issued certificates
REM
certutil -setreg ca\ValidityPeriodUnits 2
certutil -setreg ca\ValidityPeriod "Years"
REM
REM Restart the CA server service
REM
net stop certsvc & net start certsvc
REM
REM Repair CA file system shares and IIS virtual roots
REM
certutil -vroot
REM
REM Republish the CRL
REM The CRL publishing may immediately not work
REM after you restart the CA server service. If this behavior
```

Figure 31
35. Open your CA server panel and right-click **Revoked Certificates** . Then click **All tasks / Publish**

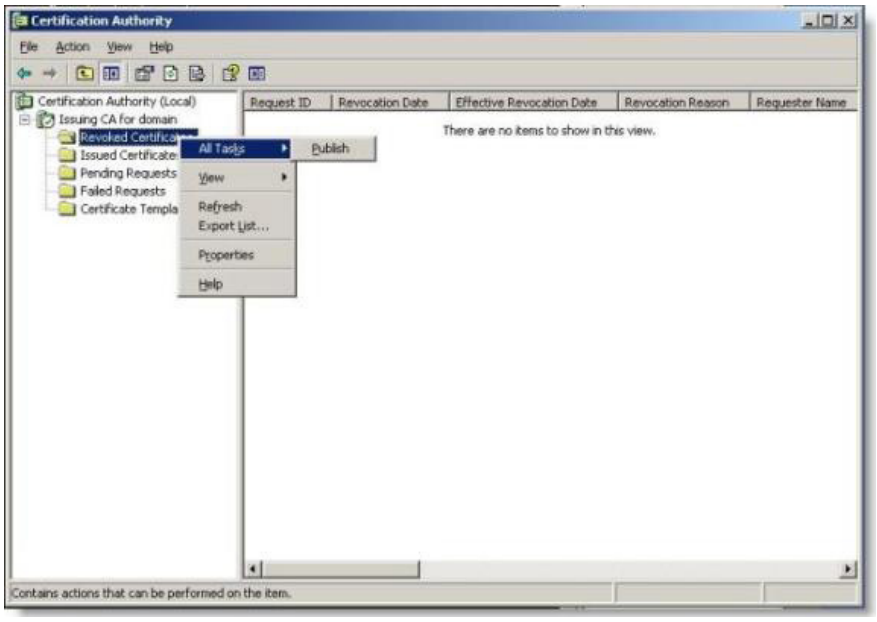


Figure 32

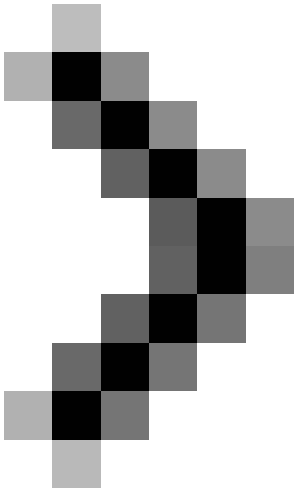
36. Select **New CRL** and click **OK**

37. Finally, complete

Conclude

In this article, I have discussed some brief tutorials on best practices for implementing PKI with a combination of both CA application offline and CA publishing online for businesses. . You should understand that the script used for publishing the root CA certificate and CRL file for the local storage of the issuing CA and Active Directory requires a change if you use the 3-level architecture. This is because the policy CA also needs to be published for the local certificate store of the issuing CA for the business and also needs to be published for Active Directory.

To some extent, you might think this third part is too cumbersome, especially in executing an online issuing CA. But when you follow the instructions, you will see that it is really necessary to implement a complete PKI that is scalable and secure. In the final part of this series, I will show you how to verify the settings and maintain and troubleshoot a PKI with a few simple steps.



Part 4: Troubleshooting

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