Application Note 25

Configure an IPsec VPN tunnel between a Digi Transport router and a Cisco router using Certificates and SCEP

UK Support

November 2015

Contents

1 INTRODUCTION

1.1 Outline

This application note is intended to explain how to create RSA key files, certificate requests, and how to use SCEP to retrieve a signed certificate from a Microsoft® Windows 2008 server for use with IPsec.

This document is a worked example of how to configure a Digi Transport and a Cisco® IOS based router to establish an IPsec tunnel between each other using signed certificates, RSA key files and Certificate Authority (CA) certificates. This will allow full secure connectivity between two private networks connected together via the Internet.

The Cisco is the VPN initiator.

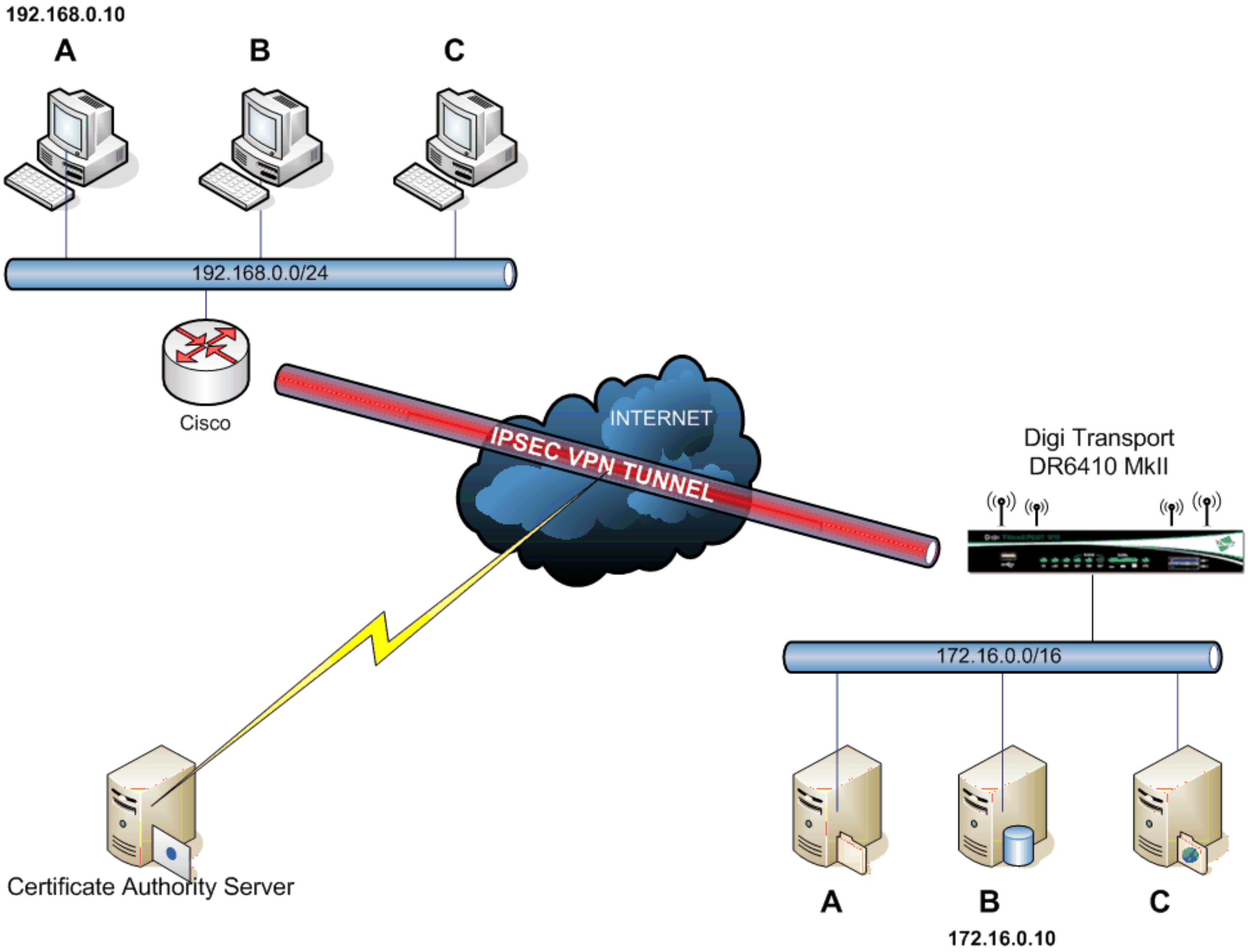
The Transport is the VPN server/responder.

In this working example all addresses used are private non routable addresses. The WAN network is configured to use a 10.x.x.x network range and is used to simulate the Internet.

Note: At the end of this document there is a brief description of the changes required in order to reverse the rolls of these routers

The advantages of using RSA certificates over pre-shared keys are;

- Scalable - pre-shared keys become unmanageable on large schemes
- Provides increased security over pre-shared keys



1.2 Digi Transport and Cisco VPN Terminology

There are differences in the terminology commonly used when dealing with Digi Transport and Cisco devices. In order to help understand the terms used when referring to the configuration of the different devices these will be discussed briefly.

The terms 'Phase 1', Internet Key Exchange (IKE) and ISAKMP are largely interchangeable in use. All are used to refer to, the settings used for and/or the actual process of the first stage of a VPN tunnel negotiation where during which the identity of the remote host is verified and a unique encryption key is generated in order to facilitate the next stage of the negotiation. Terms used to refer to the second stage of negotiations vary can vary a little more. Digi users will commonly use the terms Phase 2, IPsec and Eroute (a contraction of 'encrypted route'), Cisco users tend to use the term 'crypto map' to refer to the settings used or negotiating the second stage.

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.

This application note applies only to;

- **Router Model:** Any Digi Transport or Sarian branded router

  Firmware versions: 5123 or later.

  Configuration: This Application Note assumes that the Digi Transport product is set to its factory default. Most configuration commands are only shown if they differ from the factory default.

- **Cisco® Model:** For the purpose of this application note a Cisco 1720.

  Cisco® IOS: For the purpose of this application note the following was used;

  ```
  C1700 Software (C1700-K9SY7-M), Version 12.2(15)T
  ```

  When choosing a Cisco IOS ensure the feature set is compatible for IPsec and SCEP.

- **Microsoft® Operating System:** Microsoft® Windows 2008 Server with IIS (Internet Information Services) and Active Directory Certificate Services installed

2.1 Corrections

Requests for corrections or amendments to this application note are welcome and should be addressed to: uksupport@digi.com

Requests for new application notes can be sent to the same address.

2.2 Version

Version Number	Status
1.0	Published
1.1	Revised for new Transport web UI, Windows 2008 server, VPN negotiation debugging added.

2.3 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.

3 THE PUBLIC KEY INFRASTRUCTURE

3.1 Public Key Infrastructure terminology

The following terms are used frequently when referring to the Public Key Infrastructure (PKI), these explained, detailing their respective roles in security provision through the PKI.

3.1.1 Private Key

Each device creates its own private key. The private key is the basis for all the security for this method of IKE authentication and as such it is important that it is kept safe. Any user/device who gains access to the private key can then authenticate themselves as the owner of the certificate. Therefore if at any point there is suspicion that the privacy of a private key may have been compromised any certificates generated from this should be immediately revoked. A new private key should then be generated and this used to create new versions of any required public certificates.

Private Key files installed on a Transport router should be in the format of "priv*.pem" (e.g. privxxxx.pem). Private Key files of this format cannot be copied, renamed, or have their contents read, they can only be deleted. It should be noted that at the time of publication the Transport routers only support short (AKA 8.3) filenames so any files uploaded or generated on the router need to adhere to this.

3.1.2 Certificate Request

In order to receive a signed public key certificate from a CA, a certificate request is generated from the private key and sent to the CA for signing.

3.1.3 Public Key Certificate

The Certificate request is sent to a trusted CA. The CA digitally signs the certificate request thus creating a public key certificate. The digital signature provided can be thought of an electronic watermark.

The public key certificate is used to identify Router 'A' with the opposite router 'B' and vice versa.

3.1.4 Certificate Authority Certificate

The CA Certificate contains the public portion of the CA's public/private key pair which signed the certificate request.

3.2 Identity authentication using the PKI

Before the routers can begin to send and receive confidential data, they need to verify that the remote host is who it appears to be. When building a VPN this verification of identity is carried out through the use of the Internet Key Exchange (IKE) protocol in order to establish trust between the two devices involved in the negotiation.

To provide a simplified explanation of the use of the PKI for authentication we will consider the negotiation between two routers (A and B). In this example that both routers in this already trust the CAs that have signed the public certificates involved. In the example configuration later in this document both routers use certificates signed by the same CA. Therefore the signed signatures automatically trusted as each router uses the same CA to provide proof of identity. When using a single CA server for the purposes of signing certificates this is often referred to as a centralised CA. The use of multiple servers to act a CAs creates a hierarchical CA topology.

3.2.1 Certificate validation

Initially, each router will send its own signed Public Key Certificate to the other if it is available on the FLASH filing system. If it is not available, the remote unit must be able to access the file by some other means (*e.g.* previously uploaded manually). The router is able to verify that the received certificate is correct by hashing a value using information taken from the CA certificate and also carrying out a similar action using the remote host certificate, the results of the two processes are compared and if they are the same then the signature on the remote host certificate is considered valid. Once the validity of the public certificate has been checked then the next stage is to verify the remote host identity matches with the public certificate.

3.2.2 Remote host identity validation

The public/private key pair relies upon asymmetric encryption. This means that a different key is used to encrypt data than is used to decrypt data. If a public key is used to encrypt a message it can only be successfully decrypted using the private key that was used to generate the public key used.

Router A then needs to verify that it was router B that provided the certificate. It uses its own **Private Key** to sign (encrypt) a HASH which is created from other data unique to the negotiation. The signature is sent to **Router 'B'** which uses **Router 'A's** public key to verify the signature.

The certificates are used for authentication purposes only. A unique set of keys, applicable only to that IKE session are created for the secure transfer of data.

It is worth noting that on a transport router and CA certificate that is manually uploaded to the FFLASH will be treated as a trusted CA. Therefore if both routers public certificates have been signed by the same CA then the digital signature from the CA will be automatically trusted.

3.3 IPsec – Secure Data Transfer

Once the Identities of each router have been proved the transfer of secure data can begin. Dynamically generated Public and Private Keys are used to secure data, only this time the Private Key is used to de-crypt data and the Public Key is used to encrypt data.

Example (see diagram on page 3)

Router 'A' receives a confidential text document from **computer 'A'**. The text document should be sent in a secure manner over the Internet to **Router 'B'** then forwarded to **Server 'B'**.

Using the **Public Key** received from **Router 'B'**, **Router 'A'** encrypts the IP packets containing the text file and sends them to **Router 'B'** over the Internet connection via the VPN tunnel. **Router 'B'** uses its secure **Private Key** to decrypt the IP packets containing the text document and forwards them to **Server 'B'**.

This is highly secure because only the owner of the **Private Key** can de-crypt the data. So if the data is intercepted by a third party it is rendered useless without possession of the correct Private Key.

4 MICROSOFT® WINDOWS SERVER 2008 CONFIGURATION

4.1 Requirements

For a Microsoft® Windows server2008 to act as a CA the following services must be installed;

1. **Web Server (IIS)** (Internet Information Services)
2. **Active Directory Certificate Services**, including **Certification Authority** and **Network Device Enrollment Service** (AKA SCEP service).

Please note: The steps taken below are to configure a newly installed Windows 2008 server as a standalone CA server with no attachment to any Domain which simplifies the configuration process somewhat. If using a server in an already existing Domain then the steps required may differ. If there is a problem getting a working CA as part of an existing network then there are several Microsoft TechNet blog articles based around implementing various aspects of the PKI.

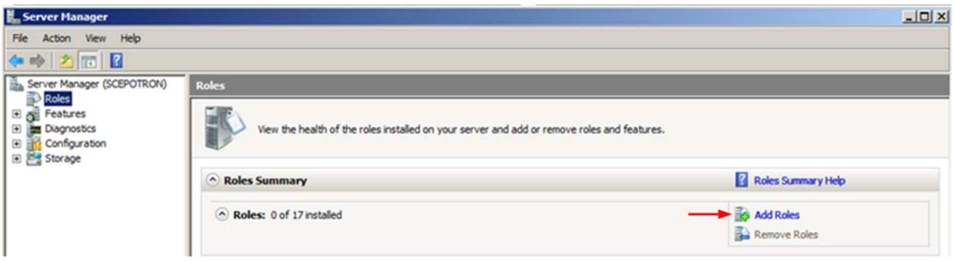
4.2 Configure the Microsoft® Windows Server 2008 as a Certificate Authority

4.2.1 Install SCEP Add-on for certificates

Login to the server with an appropriate System Administrator account

Start the Microsoft management console.

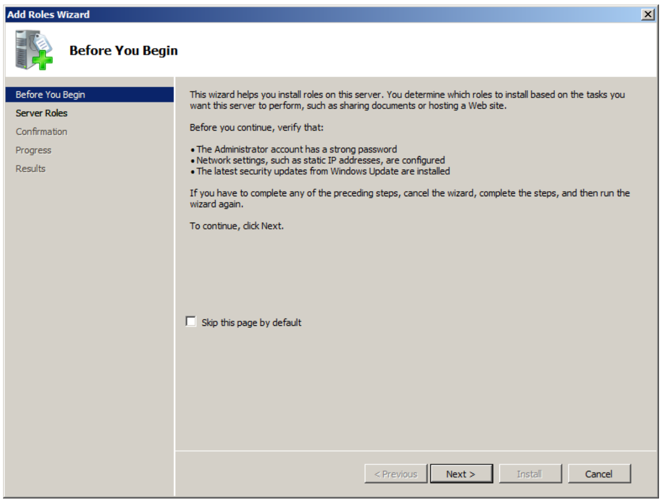
Select 'Roles' then click the 'Add Roles' link



View the health of the roles installed on your server and add or remove roles and features.

Roles: 0 of 17 installed

If the 'before you begin' window appears in the roles wizard, click next.



This wizard helps you install roles on this server. You determine which roles to install based on the tasks you want this server to perform, such as sharing documents or hosting a Web site.

Before you continue, verify that:

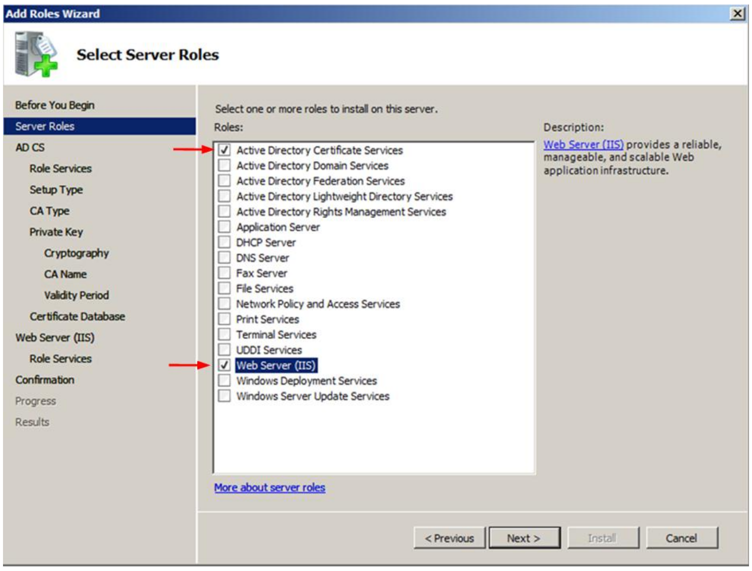
- The Administrator account has a strong password
- Network settings, such as static IP addresses, are configured
- The latest security updates from Windows Update are installed

If you have to complete any of the preceding steps, cancel the wizard, complete the steps, and then run the wizard again.

To continue, click Next.

□ Skip this page by default

Check the tick boxes marked 'Active Directory Certificate Services' and 'Web Server (IIS)', then click Next.



Select one or more roles to install on this server.

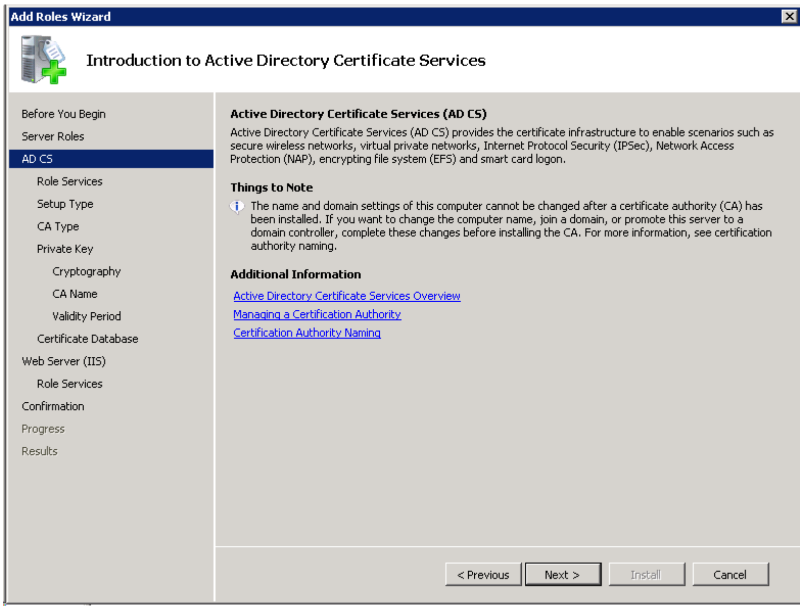
Roles:

- ☑ Active Directory Certificate Services
- ☐ Active Directory Domain Services
- ☐ Active Directory Federation Services
- ☐ Active Directory Lightweight Directory Services
- ☐ Active Directory Rights Management Services
- ☐ Application Server
- ☐ DHCP Server
- ☐ DNS Server
- ☐ Fax Server
- ☐ File Services
- ☐ Network Policy and Access Services
- ☐ Print Services
- ☐ Terminal Services
- ☐ UDDI Services
- ☑ Web Server (IIS)
- ☐ Windows Deployment Services
- ☐ Windows Server Update Services

Description:

Web Server (IIS) provides a reliable, manageable, and scalable Web application infrastructure.

The following informational notice will then be presented. Read this and when happy to proceed click Next.



Active Directory Certificate Services (AD CS)

Active Directory Certificate Services (AD CS) provides the certificate infrastructure to enable scenarios such as secure wireless networks, virtual private networks, Internet Protocol Security (IPSec), Network Access Protection (NAP), encrypting file system (EFS) and smart card logon.

Things to Note

The name and domain settings of this computer cannot be changed after a certificate authority (CA) has been installed. If you want to change the computer name, join a domain, or promote this server to a domain controller, complete these changes before installing the CA. For more information, see certification authority naming.

Additional Information

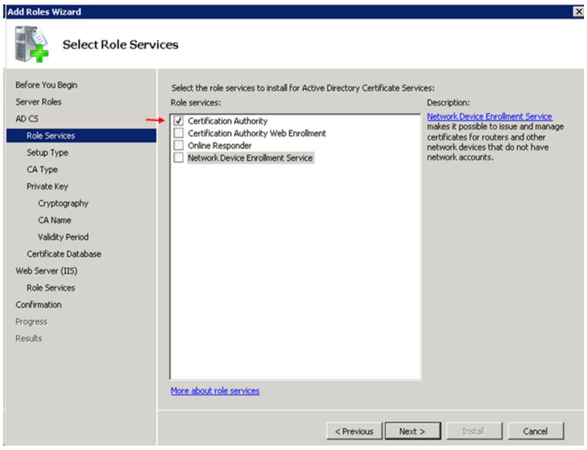
Active Directory Certificate Services Overview

Managing a Certification Authority

Certification Authority Naming

On the next screen, check the 'Certification Authority' box and click Next.

Please note; while we do also need to install the Network Device Enrolment Service that it's not possible to install this feature at the same time as the Certification Authority service. This service will need to be installed later.



Select Role Services

Select the role services to install for Active Directory Certificate Services:

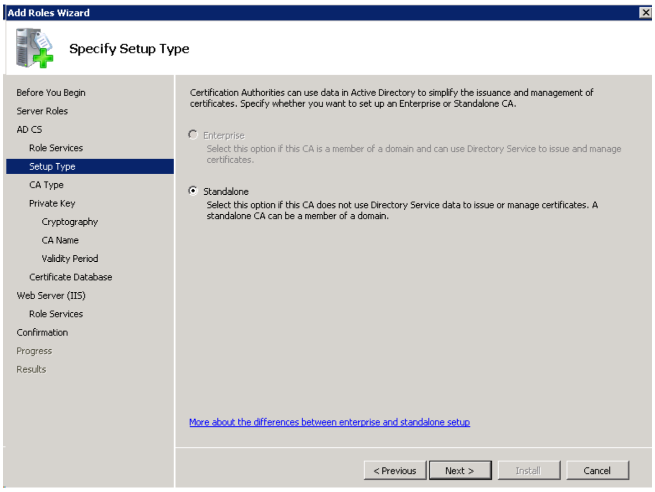
Role services:

☑ Certification Authority
□ Certification Authority Web Enrollment
□ Online Responder
□ Network Device Enrollment Service

Description:

Network Device Enrollment Service makes it possible to issue and manage certificates for routers and other network devices that do not have network accounts.

At the next screen select the Standalone option. This will be the only option available if the server is not part of a Domain. Click Next.



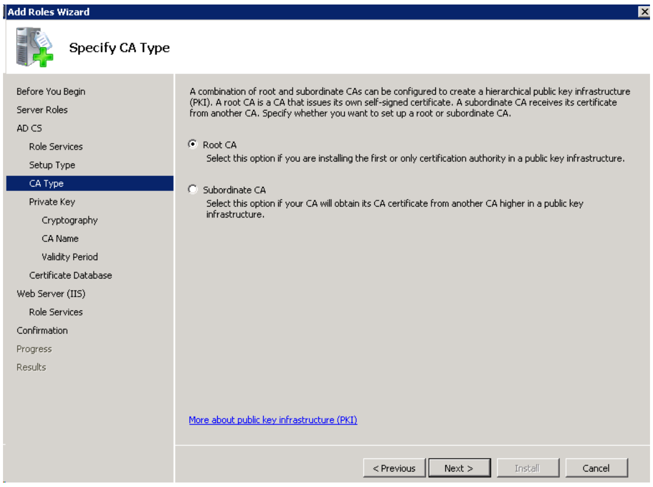
Specify Setup Type

Certification Authorities can use data in Active Directory to simplify the issuance and management of certificates. Specify whether you want to set up an Enterprise or Standalone CA.

○ Enterprise
Select this option if this CA is a member of a domain and can use Directory Service to issue and manage certificates.

● Standalone
Select this option if this CA does not use Directory Service data to issue or manage certificates. A standalone CA can be a member of a domain.

On the next screen select the Root CA option as this is the only CA that will be in use. Click Next



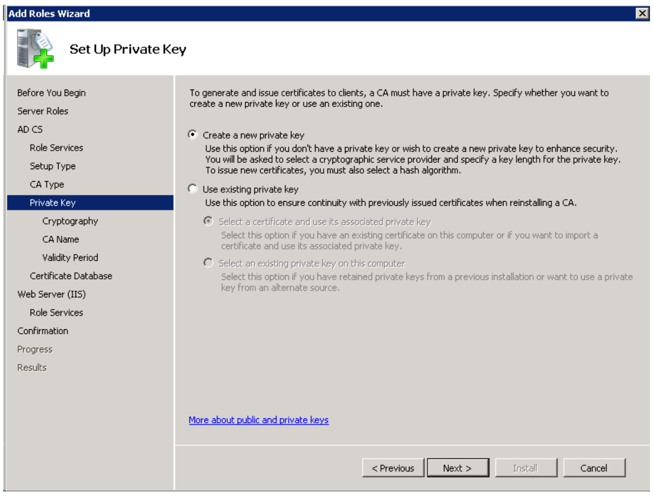
Specify CA Type

A combination of root and subordinate CAs can be configured to create a hierarchical public key infrastructure (PKI). A root CA is a CA that issues its own self-signed certificate. A subordinate CA receives its certificate from another CA. Specify whether you want to set up a root or subordinate CA.

● Root CA
Select this option if you are installing the first or only certification authority in a public key infrastructure.

○ Subordinate CA
Select this option if your CA will obtain its CA certificate from another CA higher in a public key infrastructure.

Select the option to use a new private key as we are not restoring a previously configured CA. Click Next.



To generate and issue certificates to clients, a CA must have a private key. Specify whether you want to create a new private key or use an existing one.

● Create a new private key
Use this option if you don't have a private key or wish to create a new private key to enhance security. You will be asked to select a cryptographic service provider and specify a key length for the private key. To issue new certificates, you must also select a hash algorithm.

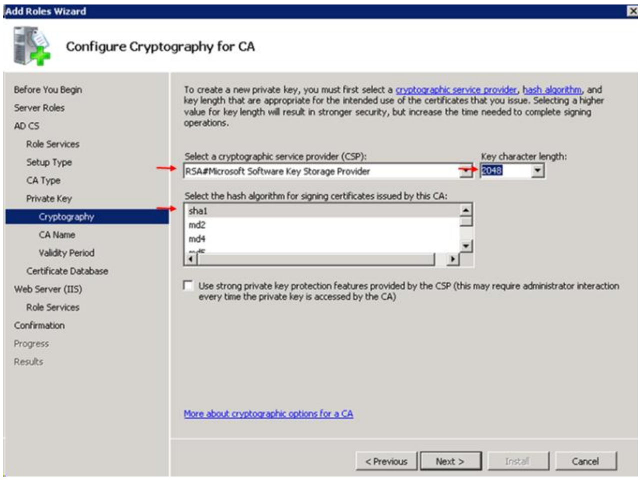
○ Use existing private key
Use this option to ensure continuity with previously issued certificates when reinstalling a CA.

● Select a certificate and use its associated private key
Select this option if you have an existing certificate on this computer or if you want to import a certificate and use its associated private key.

○ Select an existing private key on this computer
Select this option if you have retained private keys from a previous installation or want to use a private key from an alternate source.

More about public and private keys

Select a suitable cryptographic service provider, key size and hashing algorithm. Click Next.



To create a new private key, you must first select a cryptographic service provider, hash algorithm, and key length that are appropriate for the intended use of the certificates that you issue. Selecting a higher value for key length will result in stronger security, but increase the time needed to complete signing operations.

Select a cryptographic service provider (CSP): RSA#Microsoft Software Key Storage Provider

Key character length: 2048

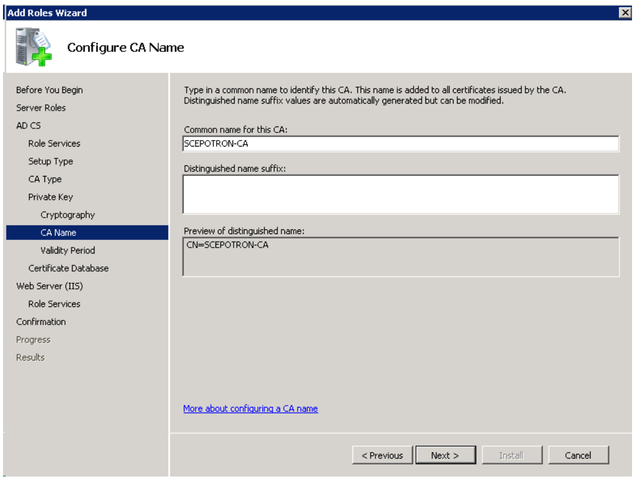
Select the hash algorithm for signing certificates issued by this CA:

sha1
md2
md4

□ Use strong private key protection features provided by the CSP (this may require administrator interaction every time the private key is accessed by the CA)

More about cryptographic options for a CA

Enter the desired Common Name and any require suffix for the CA. Click Next.



Type in a common name to identify this CA. This name is added to all certificates issued by the CA. Distinguished name suffix values are automatically generated but can be modified.

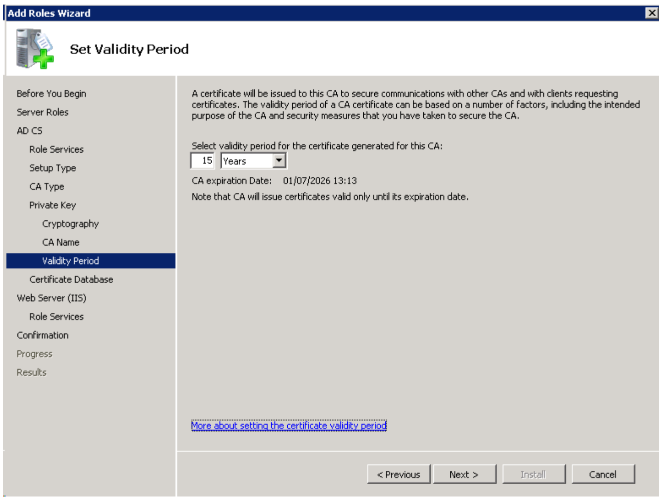
Common name for this CA: SCEPOTRON-CA

Distinguished name suffix:

Preview of distinguished name: CN=SCEPOTRON-CA

More about configuring a CA name

Choose a suitable length of time for the CA certificate to be valid. A certificate issued using this CA can in turn only be valid up to eh expired date of the CA itself. Click Next.



A certificate will be issued to this CA to secure communications with other CAs and with clients requesting certificates. The validity period of a CA certificate can be based on a number of factors, including the intended purpose of the CA and security measures that you have taken to secure the CA.

Select validity period for the certificate generated for this CA:

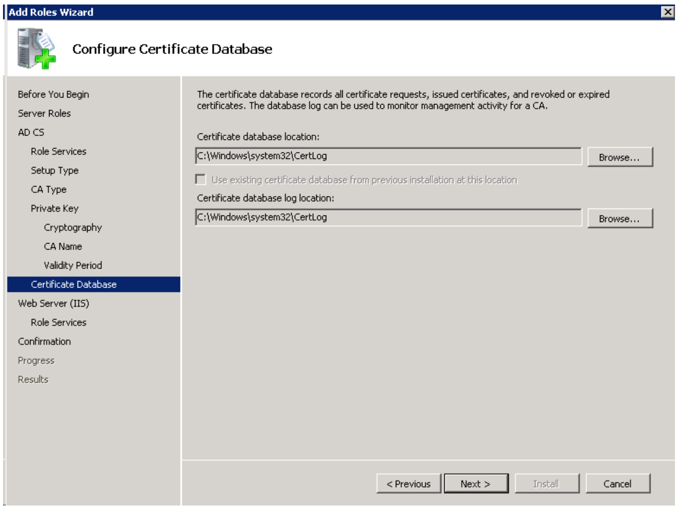
15 Years

CA expiration Date: 01/07/2026 13:13

Note that CA will issue certificates valid only until its expiration date.

More about setting the certificate validity period

Choose a location for the certificate database and log files to be located. Click Next.



The certificate database records all certificate requests, issued certificates, and revoked or expired certificates. The database log can be used to monitor management activity for a CA.

Certificate database location:

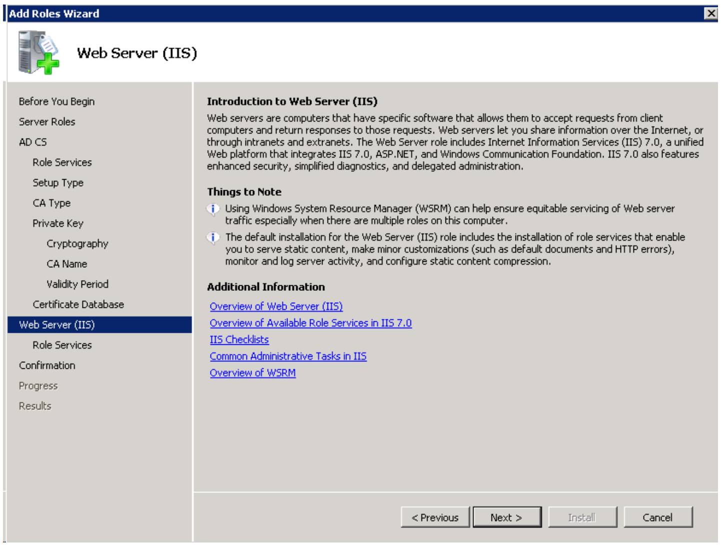
C:\Windows\system32\CertLog

□ Use existing certificate database from previous installation at this location

Certificate database log location:

C:\Windows\system32\CertLog

The next screen will provide information on installing the IIS service. Read this then click Next.



Introduction to Web Server (IIS)

Web servers are computers that have specific software that allows them to accept requests from client computers and return responses to those requests. Web servers let you share information over the Internet, or through intranets and extranets. The Web Server role includes Internet Information Services (IIS) 7.0, a unified Web platform that integrates IIS 7.0, ASP.NET, and Windows Communication Foundation. IIS 7.0 also features enhanced security, simplified diagnostics, and delegated administration.

Things to Note

- Using Windows System Resource Manager (WSRM) can help ensure equitable servicing of Web server traffic especially when there are multiple roles on this computer.
- The default installation for the Web Server (IIS) role includes the installation of role services that enable you to serve static content, make minor customizations (such as default documents and HTTP errors), monitor and log server activity, and configure static content compression.

Additional Information

Overview of Web Server (IIS)

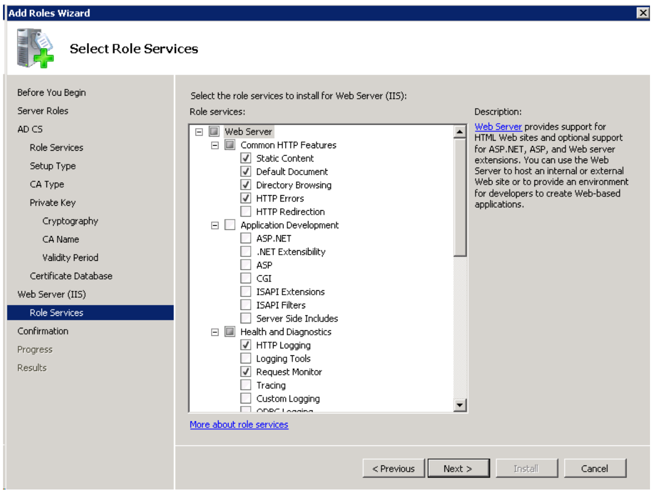
Overview of Available Role Services in IIS 7.0

IIS Checklists

Common Administrative Tasks in IIS

Overview of WSRM

For this application the default options are sufficient. Click Next.



Select the role services to install for Web Server (IIS):

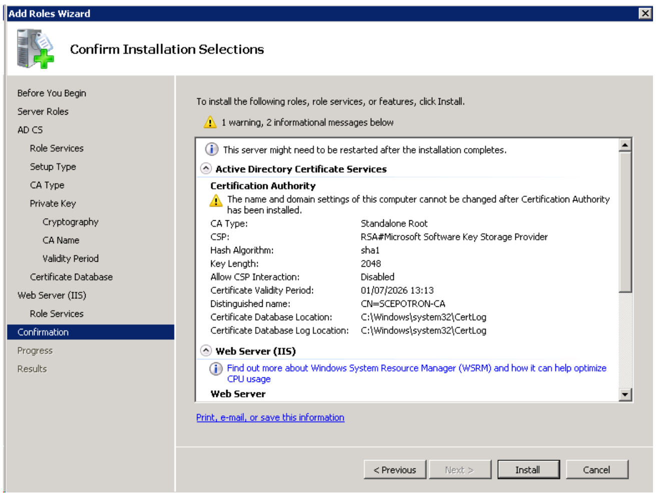
Role services:

- ▣ Web Server
  - ▣ Common HTTP Features
    - ☑ Static Content
    - ☑ Default Document
    - ☑ Directory Browsing
    - ☑ HTTP Errors
    - □ HTTP Redirection
  - □ Application Development
    - □ ASP.NET
    - □ .NET Extensibility
    - □ ASP
    - □ CGI
    - □ ISAPI Extensions
    - □ ISAPI Filters
    - □ Server Side Includes
  - ▣ Health and Diagnostics
    - ☑ HTTP Logging
    - □ Logging Tools
    - ☑ Request Monitor
    - □ Tracing
    - □ Custom Logging
    - □ ODBC Logging

Description:

Web Server provides support for HTML Web sites and optional support for ASP.NET, ASP, and Web server extensions. You can use the Web Server to host an internal or external Web site or to provide an environment for developers to create Web-based applications.

Review the options chosen, then click install to begin the installation process.



To install the following roles, role services, or features, click Install.

⚠ 1 warning, 2 informational messages below

ⓘ This server might need to be restarted after the installation completes.

Active Directory Certificate Services

Certification Authority

⚠ The name and domain settings of this computer cannot be changed after Certification Authority has been installed.

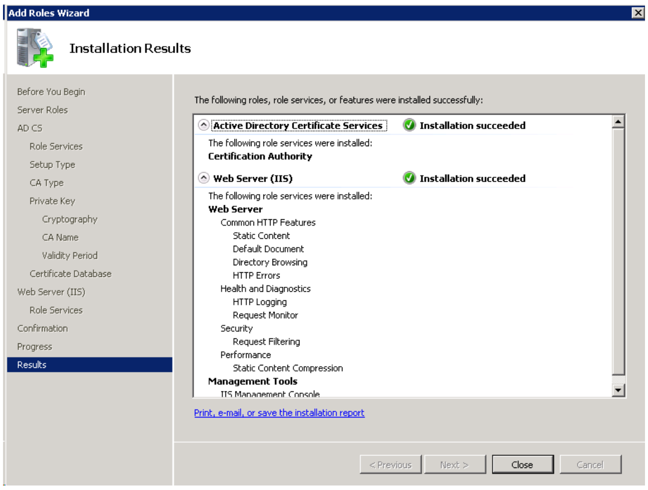
CA Type:	Standalone Root
CSP:	RSA#Microsoft Software Key Storage Provider
Hash Algorithm:	sha1
Key Length:	2048
Allow CSP Interaction:	Disabled
Certificate Validity Period:	01/07/2026 13:13
Distinguished name:	CN=SCEPOTRON-CA
Certificate Database Location:	C:\Windows\system32\CertLog
Certificate Database Log Location:	C:\Windows\system32\CertLog

Web Server (IIS)

ⓘ Find out more about Windows System Resource Manager (WSRM) and how it can help optimize CPU usage

Web Server

The installation of the CA and IIS services will begin. After the installation is complete the server will present a summary window that details what has been installed and if any error occurred. Review this and click close.



The following roles, role services, or features were installed successfully:

Active Directory Certificate Services ✓ **Installation succeeded**

The following role services were installed:

Certification Authority

Web Server (IIS) ✓ **Installation succeeded**

The following role services were installed:

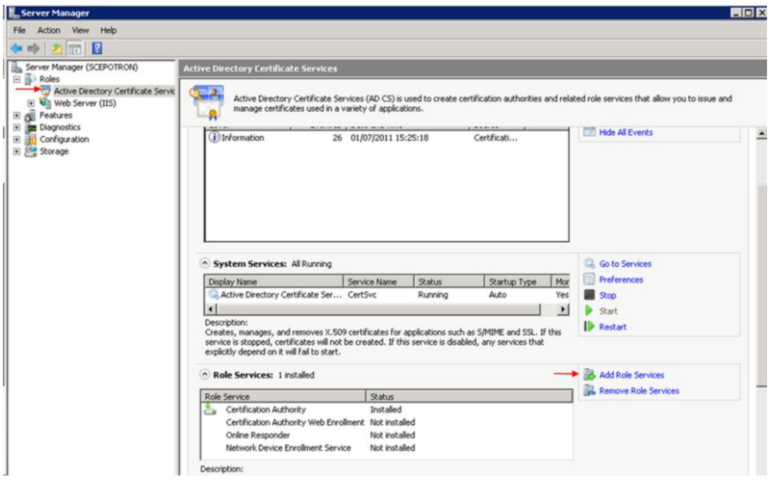
Web Server

- Common HTTP Features
  - Static Content
  - Default Document
  - Directory Browsing
  - HTTP Errors
- Health and Diagnostics
  - HTTP Logging
  - Request Monitor
- Security
  - Request Filtering
- Performance
  - Static Content Compression

Management Tools

- IIS Management Console

To install the Remote Device Enrollment Service In the Microsoft Management console browse to Active Directory Certificate services, then click the ‘Add Role Services’ link.



Active Directory Certificate Services (AD CS) is used to create certification authorities and related role services that allow you to issue and manage certificates used in a variety of applications.

Information 26 01/07/2011 15:25:18 Certificati...

System Services: All Running

Display Name	Service Name	Status	Startup Type	Mor
Active Directory Certificate Ser...	CertSvc	Running	Auto	Yes

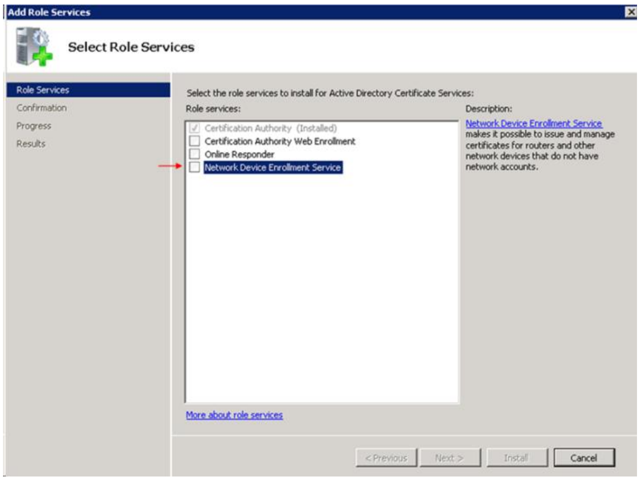
Description:
Creates, manages, and removes X.509 certificates for applications such as S/MIME and SSL. If this service is stopped, certificates will not be created. If this service is disabled, any services that explicitly depend on it will fail to start.

Role Services: 1 installed

Role Service	Status
Certification Authority	Installed
Certification Authority Web Enrollment	Not installed
Online Responder	Not installed
Network Device Enrollment Service	Not installed

Description:

This will start the relevant wizard. Check the box to add the Network Device Enrollment Service.



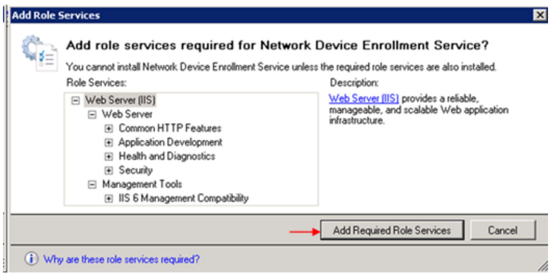
Select the role services to install for Active Directory Certificate Services:

Role services:

☑ Certification Authority (Installed)
□ Certification Authority Web Enrollment
□ Online Responder
□ Network Device Enrollment Service

Description:
Network Device Enrollment Service makes it possible to issue and manage certificates for routers and other network devices that do not have network accounts.

The server will then present a notification of the other dependencies that will also need to be installed. Click the button to add these to the installation.


Add Role Services
Add Required Role Services
Cancel
Why are these role services required?

Add role services required for Network Device Enrollment Service?

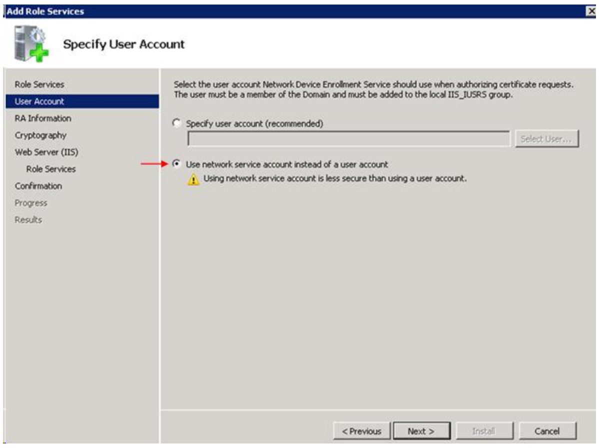
You cannot install Network Device Enrollment Service unless the required role services are also installed.

Role Services:

- Web Server (IIS)
  - Web Server
    - Common HTTP Features
    - Application Development
    - Health and Diagnostics
    - Security
  - Management Tools
    - IIS 6 Management Compatibility

Description:
Web Server (IIS) provides a reliable, manageable, and scalable Web application infrastructure.

Then Click next on the wizard screen. Then select the option to use a network service account. Click Next.



Specify User Account

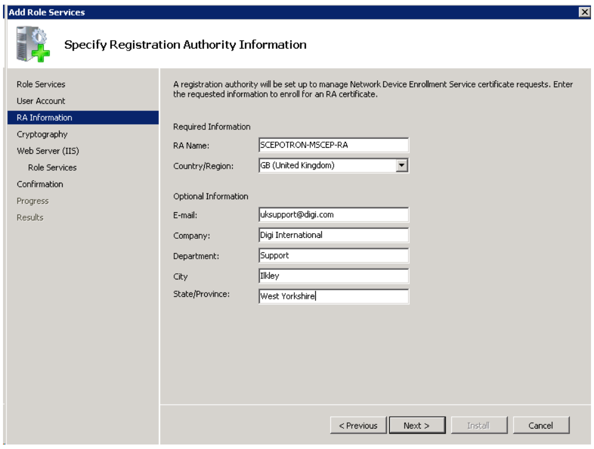
Select the user account Network Device Enrollment Service should use when authorizing certificate requests. The user must be a member of the Domain and must be added to the local IIS_IUSRS group.

○ Specify user account (recommended)

● Use network service account instead of a user account

⚠ Using network service account is less secure than using a user account.

Enter registration authority information. Enter appropriate company information and click Next.



Specify Registration Authority Information

A registration authority will be set up to manage Network Device Enrollment Service certificate requests. Enter the requested information to enroll for an RA certificate.

Required Information

RA Name: SCEPOTRON-MSCEP-RA

Country/Region: GB (United Kingdom)

Optional Information

E-mail: uksupport@digi.com

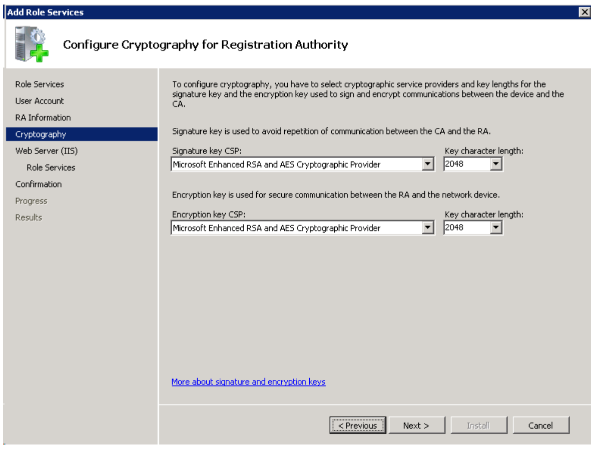
Company: Digi International

Department: Support

City Ilkley

State/Province: West Yorkshire

Select suitable cryptography settings for the registration authority. Click Next.



Configure Cryptography for Registration Authority

To configure cryptography, you have to select cryptographic service providers and key lengths for the signature key and the encryption key used to sign and encrypt communications between the device and the CA.

Signature key is used to avoid repetition of communication between the CA and the RA.

Signature key CSP: Microsoft Enhanced RSA and AES Cryptographic Provider

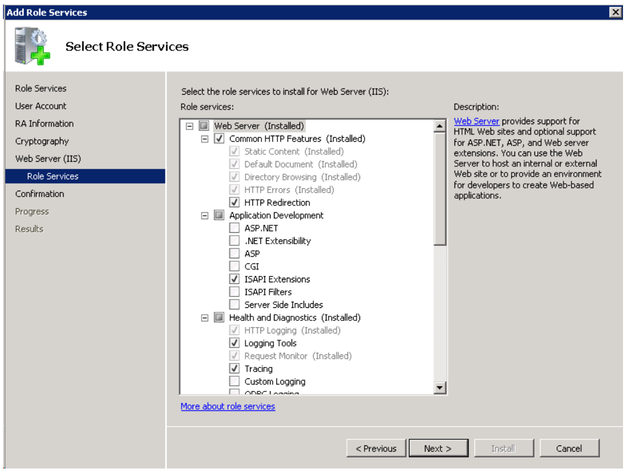
Key character length: 2048

Encryption key is used for secure communication between the RA and the network device.

Encryption key CSP: Microsoft Enhanced RSA and AES Cryptographic Provider

Key character length: 2048

The next screen details the update to the IIs installed again. Click next on this, the next screen highlights the dependencies that are required for the SCEP service installation. Click Next.



Select Role Services

Select the role services to install for Web Server (IIS):

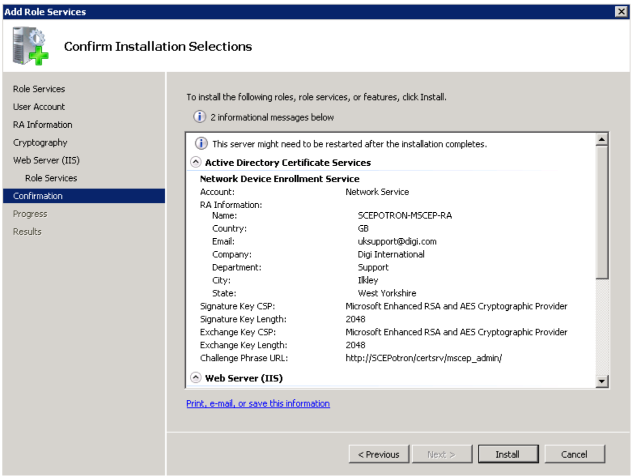
Role services:

```
⊟ ▣ Web Server (Installed)
    ⊟ ☑ Common HTTP Features (Installed)
          ☑ Static Content (Installed)
          ☑ Default Document (Installed)
          ☑ Directory Browsing (Installed)
          ☑ HTTP Errors (Installed)
          ☑ HTTP Redirection
    ⊟ ▣ Application Development
          □ ASP.NET
          □ .NET Extensibility
          □ ASP
          □ CGI
          ☑ ISAPI Extensions
          □ ISAPI Filters
          □ Server Side Includes
    ⊟ ▣ Health and Diagnostics (Installed)
          ☑ HTTP Logging (Installed)
          ☑ Logging Tools
          ☑ Request Monitor (Installed)
          ☑ Tracing
          □ Custom Logging
          □ ODBC Logging
```

Description:

Web Server provides support for HTML Web sites and optional support for ASP.NET, ASP, and Web server extensions. You can use the Web Server to host an internal or external Web site or to provide an environment for developers to create Web-based applications.

Then review the chosen options and click install to proceed with the installation of the updated roles.



Confirm Installation Selections

To install the following roles, role services, or features, click Install.

ⓘ 2 informational messages below

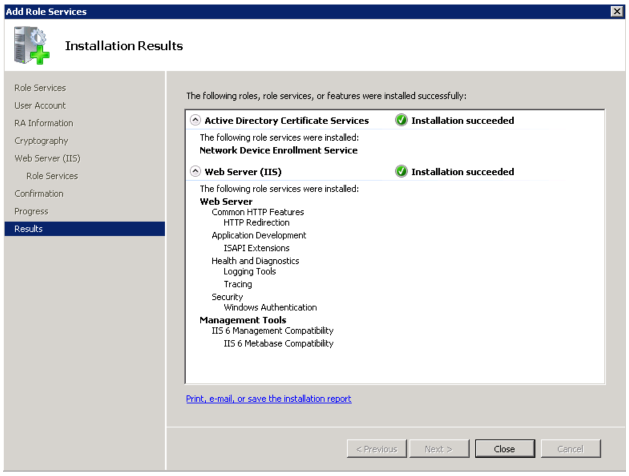
ⓘ This server might need to be restarted after the installation completes.

Active Directory Certificate Services

```
Network Device Enrollment Service
Account:                     Network Service
RA Information:
   Name:                        SCEPOTRON-MSCEP-RA
   Country:                     GB
   Email:                       uksupport@digi.com
   Company:                     Digi International
   Department:                  Support
   City:                        Ilkley
   State:                       West Yorkshire
Signature Key CSP:           Microsoft Enhanced RSA and AES Cryptographic Provider
Signature Key Length:        2048
Exchange Key CSP:            Microsoft Enhanced RSA and AES Cryptographic Provider
Exchange Key Length:         2048
Challenge Phrase URL:        http://SCEPotron/certsrv/mscep_admin/
```

Web Server (IIS)

There will then be a summary screen of features that have been installed.



Installation Results

The following roles, role services, or features were installed successfully:

Active Directory Certificate Services ✓ **Installation succeeded**

The following role services were installed:
Network Device Enrollment Service

Web Server (IIS) ✓ **Installation succeeded**

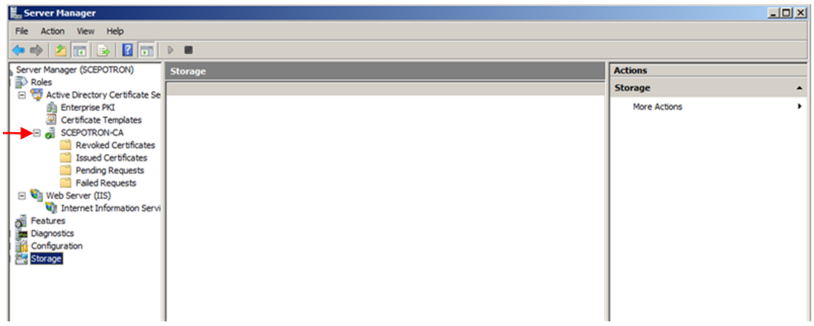
```
The following role services were installed:
Web Server
   Common HTTP Features
      HTTP Redirection
   Application Development
      ISAPI Extensions
   Health and Diagnostics
      Logging Tools
      Tracing
   Security
      Windows Authentication
Management Tools
   IIS 6 Management Compatibility
      IIS 6 Metabase Compatibility
```

Finally a dialogue box will appear containing a URL to use for SCEP enrolment.

IMPORTANT: Make a permanent note of this URL. This will be needed every time when creating certificates with this CA; http://<hostname>/certsrv/mscep/mscep.dll where <hostname> is the hostname or IP address of the CA server.

4.2.2 Check the CA Certificate service is running

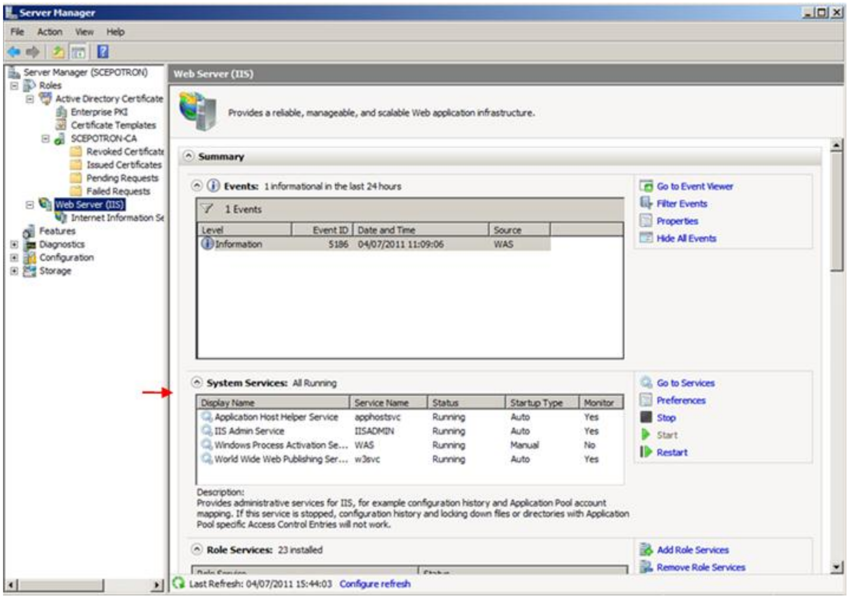
To check the CA Certificate service is running, check the server manger MMC. There should be a green circle with a tick in it next to the CA, as per the picture below.



If the service is not running there will be a white circle with a black dot inside it. To start the service right click on the CA object , highlight 'all tasks', then select 'start service'.

4.2.3 Check IIS and SCEP service status

To check that both IIS and SCEP are running OK using the server management console browsr to web server (IIS) heading in the roles section. This shows the status and if IIS services is running.



Provides a reliable, manageable, and scalable Web application infrastructure.

Events: 1 informational in the last 24 hours

1 Events

Level	Event ID	Date and Time	Source
Information	5186	04/07/2011 11:09:06	WAS

System Services: All Running

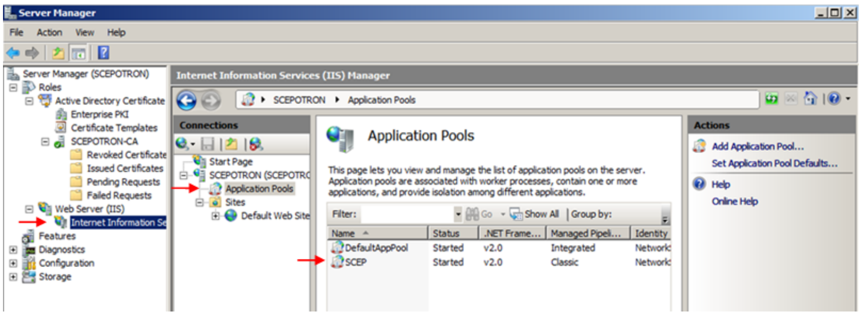
Display Name	Service Name	Status	Startup Type	Monitor
Application Host Helper Service	apphostsvc	Running	Auto	Yes
IIS Admin Service	IISADMIN	Running	Auto	Yes
Windows Process Activation Se...	WAS	Running	Manual	No
World Wide Web Publishing Ser...	w3svc	Running	Auto	Yes

Description:
Provides administrative services for IIS, for example configuration history and Application Pool account mapping. If this service is stopped, configuration history and locking down files or directories with Application Pool specific Access Control Entries will not work.

Role Services: 23 installed

Last Refresh: 04/07/2011 15:44:03

To check that the SCEP service has started OK, click on the 'Internet Information Service (IIS) Manager' section. Then in main window click on Application Pools. This will display the 'Application Pools' where the status of the SCEP service can be checked.



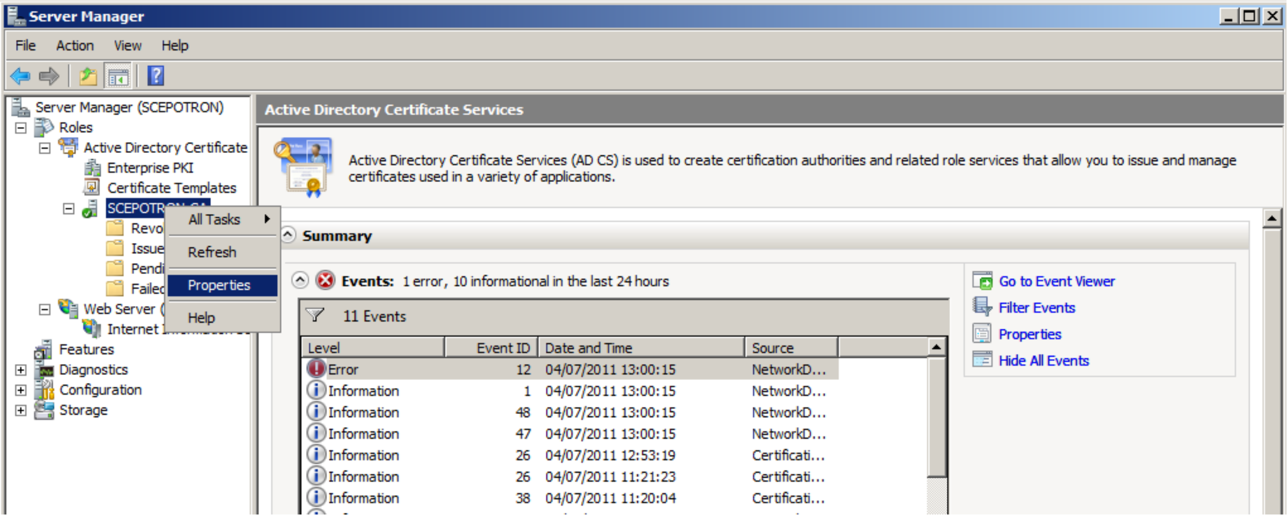
This page lets you view and manage the list of application pools on the server. Application pools are associated with worker processes, contain one or more applications, and provide isolation among different applications.

Name	Status	.NET Frame...	Managed Pipeli...	Identity
DefaultAppPool	Started	v2.0	Integrated	Network
SCEP	Started	v2.0	Classic	Network

4.3 Automatic Enrolment

This is an optional stage, without configuring this feature the initial certificate request will be left in a pending state. At this point the CA administrator will need to manually either approve or reject the certificate request. A 2nd request will need to be made after this has been done in order to automatically download the router certificate. Not using automatic Enrolment increases the security of the CA service but also increases the amount of administration time required.

To enable this feature open the Certificate Authority console, right click on the CA and select **Properties**.



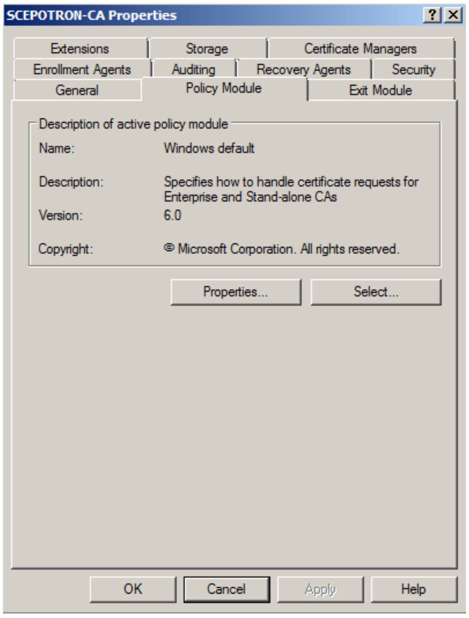
Active Directory Certificate Services (AD CS) is used to create certification authorities and related role services that allow you to issue and manage certificates used in a variety of applications.

Events: 1 error, 10 informational in the last 24 hours

11 Events

Level	Event ID	Date and Time	Source
Error	12	04/07/2011 13:00:15	NetworkD...
Information	1	04/07/2011 13:00:15	NetworkD...
Information	48	04/07/2011 13:00:15	NetworkD...
Information	47	04/07/2011 13:00:15	NetworkD...
Information	26	04/07/2011 12:53:19	Certificati...
Information	26	04/07/2011 11:21:23	Certificati...
Information	38	04/07/2011 11:20:04	Certificati...

In the **Properties** window select the **Policy Module** tab.



Description of active policy module

Name: Windows default

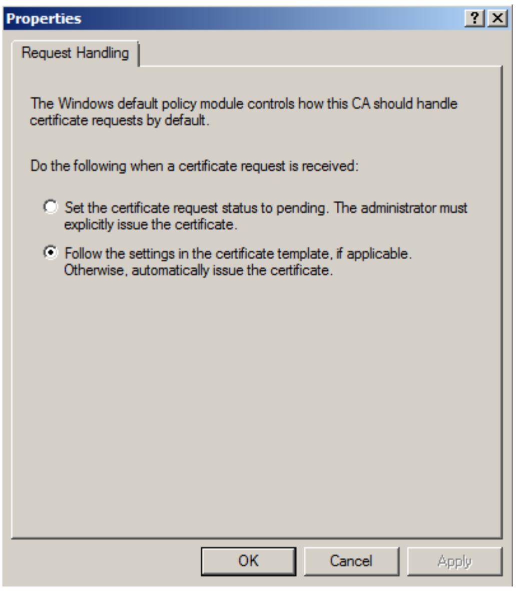
Description: Specifies how to handle certificate requests for Enterprise and Stand-alone CAs

Version: 6.0

Copyright: © Microsoft Corporation. All rights reserved.

Whilst in the **Policy Module** tab click the **Properties** button.

Select **Follow the settings in the certificate template, if applicable. Otherwise, automatically issue the certificate**.



The Windows default policy module controls how this CA should handle certificate requests by default.

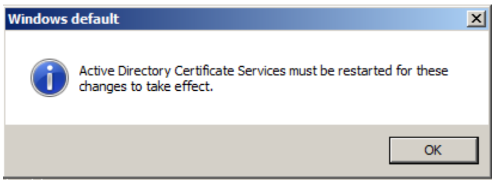
Do the following when a certificate request is received:

○ Set the certificate request status to pending. The administrator must explicitly issue the certificate.

● Follow the settings in the certificate template, if applicable. Otherwise, automatically issue the certificate.

Click **OK** and again **OK** on the **Policy Module** tab.

Note: A warning dialogue box like the one below should be displayed stating that for the configuration change to take effect, Active Directory Certificate Services must be stopped and started again.



Active Directory Certificate Services must be restarted for these changes to take effect.

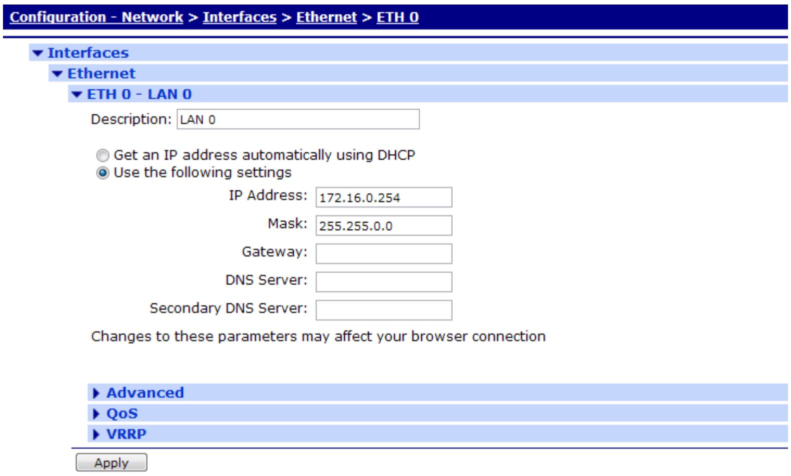
Despite stopping and starting the service, during the process of creating this document the only reliable method of ensuring the configuration change took effect, to allowed automated enrolling, was to restart the Windows server.

5 TRANSPORT VPN SERVER - CERTIFICATES

5.1 LAN Interface Configuration

The following configures the Ethernet local area network IP address for the VPN server.

Browse to **Configuration – Network > Interfaces > Ethernet > Eth 0**



Configuration - Network > Interfaces > Ethernet > ETH 0

Description: LAN 0

○ Get an IP address automatically using DHCP
● Use the following settings

IP Address: 172.16.0.254
Mask: 255.255.0.0
Gateway:
DNS Server:
Secondary DNS Server:

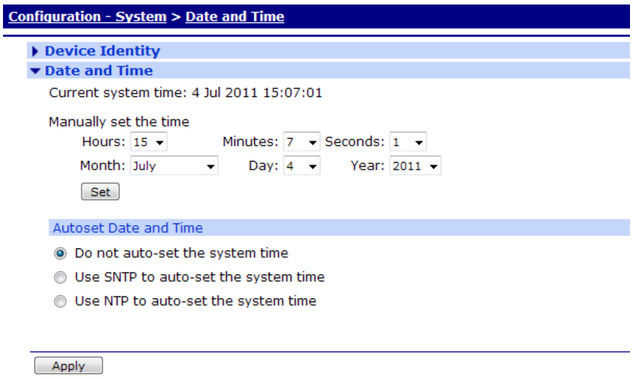
Changes to these parameters may affect your browser connection

Parameter	Setting	Description
IP Address:	172.16.0.254	Configures the IP address for the LAN
Mask:	255.255.0.0	Configures the subnet mask for the LAN

5.2 Date and Time

Any certificates stored on the router flash will have a validity period. Therefore it is important that the Transport is configured with the correct time and date as the incorrect date/time set on the router is one of the most common issues encountered when attempting to use certificates when

Browse to; **Configuration – System > Date and Time.**



Configuration - System > Date and Time

Current system time: 4 Jul 2011 15:07:01

Manually set the time

Hours: 15 Minutes: 7 Seconds: 1
Month: July Day: 4 Year: 2011

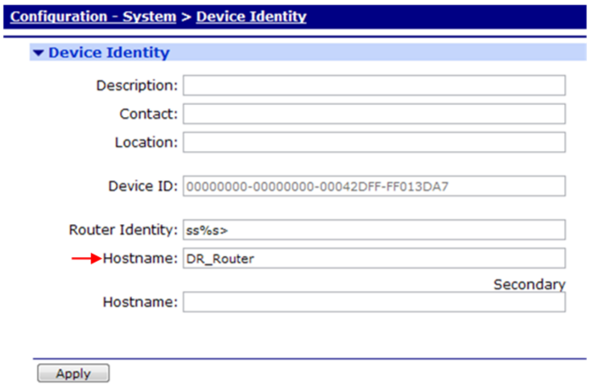
● Do not auto-set the system time
○ Use SNTP to auto-set the system time
○ Use NTP to auto-set the system time

Amend the time and date as appropriate and click the **Set** button.

5.3 Hostname

Configure the hostname of the router.

Browse to **Configuration - System > Device Identity** and enter the router hostname and click Apply.



Configuration - System > Device Identity

▾ Device Identity

Description:

Contact:

Location:

Device ID: 00000000-00000000-00042DFF-FF013DA7

Router Identity: ss%s>

Hostname: DR_Router

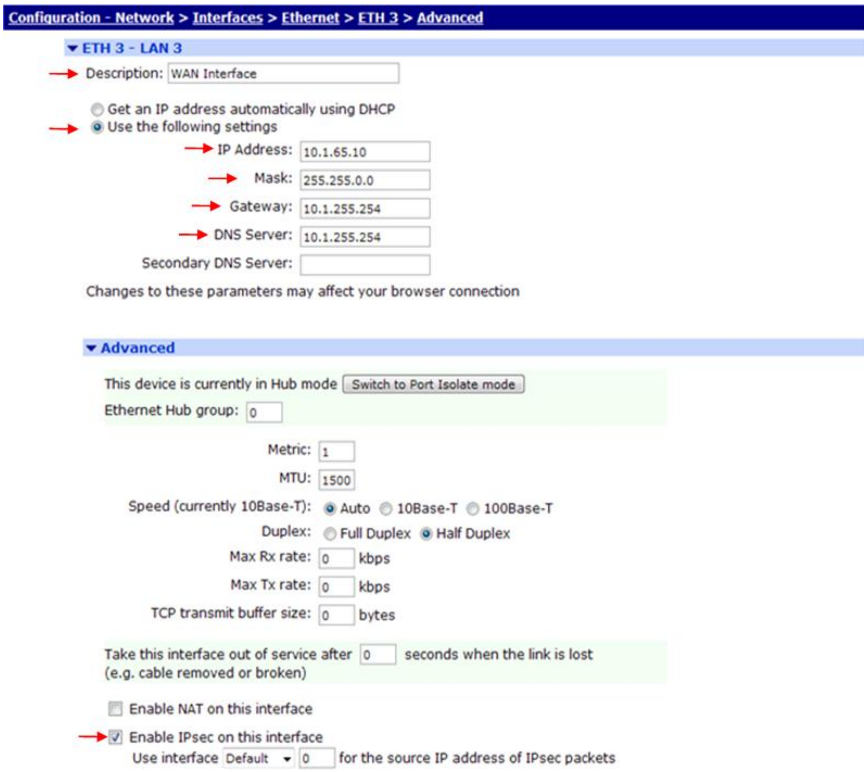
Secondary Hostname:

Please note: The hostname should be a unique identifier for the router; The hostname is only for identification and system management and does not take any part in the certificate process.

5.4 WAN Interface Configuration

Enter the details of the IP Address, subnet mask and gateway and also enable IPsec on this interface.

Browse to **Configuration - Network > Interfaces > Ethernet > ETH 3**



Configuration - Network > Interfaces > Ethernet > ETH 3 > Advanced

▾ ETH 3 - LAN 3

Description: WAN Interface

○ Get an IP address automatically using DHCP

● Use the following settings

IP Address: 10.1.65.10

Mask: 255.255.0.0

Gateway: 10.1.255.254

DNS Server: 10.1.255.254

Secondary DNS Server:

Changes to these parameters may affect your browser connection

▾ Advanced

This device is currently in Hub mode

Ethernet Hub group: 0

Metric: 1

MTU: 1500

Speed (currently 10Base-T): ● Auto ○ 10Base-T ○ 100Base-T

Duplex: ○ Full Duplex ● Half Duplex

Max Rx rate: 0 kbps

Max Tx rate: 0 kbps

TCP transmit buffer size: 0 bytes

Take this interface out of service after 0 seconds when the link is lost (e.g. cable removed or broken)

□ Enable NAT on this interface

☑ Enable IPsec on this interface

Use interface Default 0 for the source IP address of IPsec packets

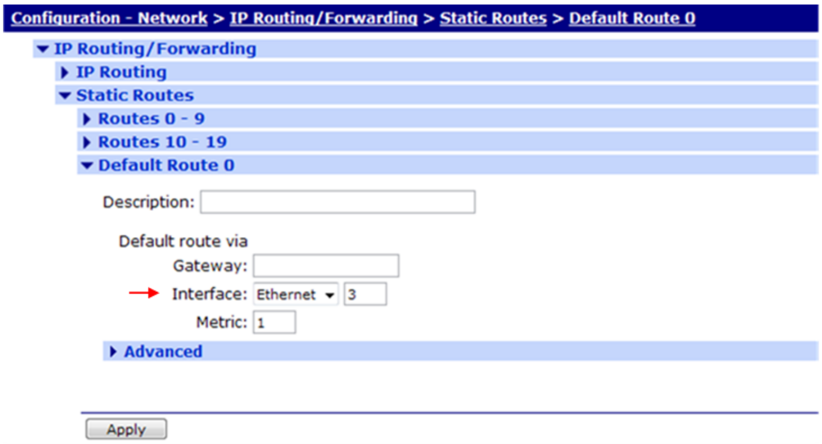
Parameter	Setting	Description
Description	WAN Interface	A free text field to provide a friendly name.
IP Address	10.1.65.10	Configures the IP Address of the interface
Subnet Mask	255.255.0.0	Sets the subnet mask for the IP address assigned
Gateway	10.1.255.254	Sets the gateway for the network on this interface
DNS Server	10.1.255.254	Sets the DNS Server for the interface
Enable IPsec on this interface	checked	Enables IPsec on ETH 3*

*This option is found under the advanced section of the Ethernet interface configuration.

5.5 Configure the Default Route

To ensure that Eth 3 is configured as the default route.

Browse to **Configuration - Network > IP Routing/Forwarding > Static Routes > Default Route 0**



Description:

Default route via

Gateway:

Interface: Ethernet 3

Metric: 1

Parameter	Setting	Description
Interface Entity type	Ethernet	Sets the WAN interface entity type
Interface Instance number	3	Sets the instance number of the entity type chosen.

Please Note: As the gateway was configured on the WAN interface setting a gateway on this page is not required or advised.

5.6 Certificate Enrolment

5.6.1 Download CA certificates.

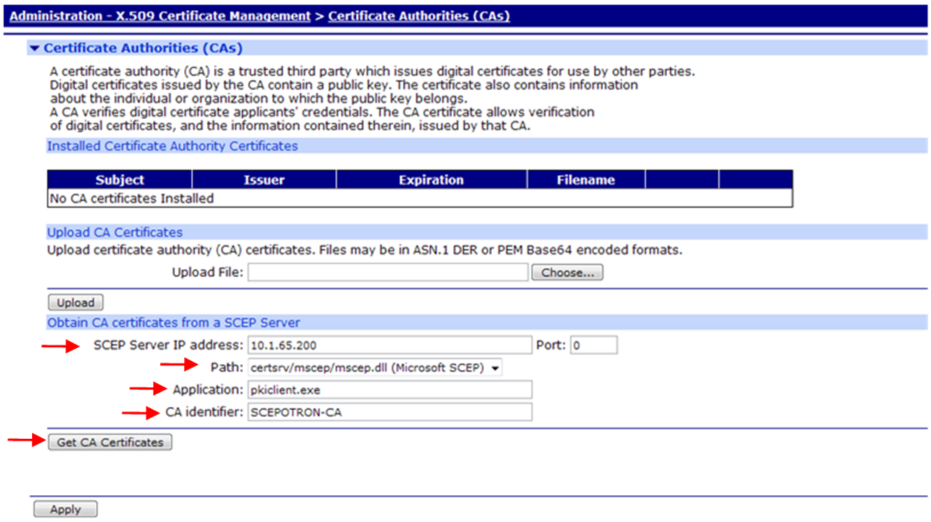
The router must first have access to the server CA certificate(s). Some servers require the use of more than one CA certificate. In this case the Microsoft® Windows 2008 server requires 3 CA certificates before SCEP will work. For other servers, just one certificate may be used for all three tasks. Check the server vendor for details.

The tasks these certificates are used for are:

- **CA certificate**. This is the certificate that will contain the public key portion of the key used to sign the certificate request.
- **CA encryption certificate**. This certificate is used to encrypt the data the client will send to the server.
- **CA signature certificate**. This is attached to the reply from the CA which is validated by the client. The public key from this certificate is used to verify the signature.

Browse to **Administration – X.509 certificate management > Certificate Authorities (CAs)**

To receive the CA certificates fill in the fields marked and press **Get CA Certificates.**



Administration - X.509 Certificate Management > Certificate Authorities (CAs)

▼ Certificate Authorities (CAs)

A certificate authority (CA) is a trusted third party which issues digital certificates for use by other parties.
Digital certificates issued by the CA contain a public key. The certificate also contains information
about the individual or organization to which the public key belongs.
A CA verifies digital certificate applicants' credentials. The CA certificate allows verification
of digital certificates, and the information contained therein, issued by that CA.

Installed Certificate Authority Certificates

Subject	Issuer	Expiration	Filename		
No CA certificates Installed					

Upload CA Certificates

Upload certificate authority (CA) certificates. Files may be in ASN.1 DER or PEM Base64 encoded formats.

Upload File:

Obtain CA certificates from a SCEP Server

SCEP Server IP address: 10.1.65.200 Port: 0

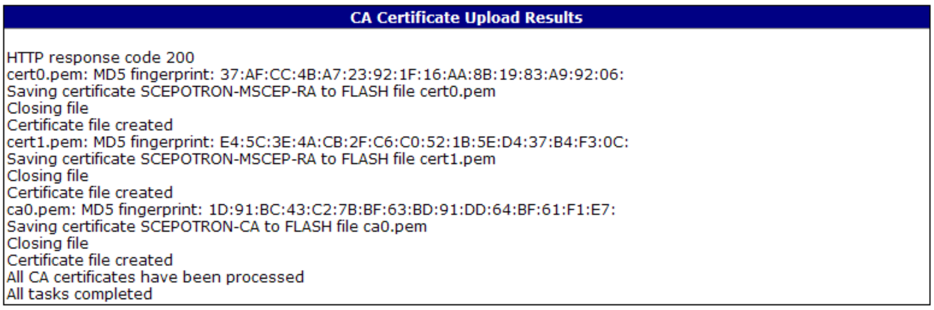
Path: certsrv/mscep/mscep.dll (Microsoft SCEP)

Application: pkiclient.exe

CA identifier: SCEPOTRON-CA

Parameter	Setting	Description
SCEP server IP Adderss	CA server IP address	CA server IP address
Port	0	MS SCEP uses HTTP to carry the requests, If this parameter is non-zero, the unit will use this value as the destination port rather than the default of 80
Path	certsrv/mscep/mscep.dll	Select Microsoft SCEP from drop down list and the path will be entered automatically
Application	pkiclient.exe	This represents the SCEP application on the server
CA Identifier	ACP	CA identifier

After clicking 'Get CA Certificates', the process starts and output detailing the progress of CA certificate collection is shown bellow.



CA Certificate Upload Results

```
HTTP response code 200
cert0.pem: MD5 fingerprint: 37:AF:CC:4B:A7:23:92:1F:16:AA:8B:19:83:A9:92:06:
Saving certificate SCEPOTRON-MSCEP-RA to FLASH file cert0.pem
Closing file
Certificate file created
cert1.pem: MD5 fingerprint: E4:5C:3E:4A:CB:2F:C6:C0:52:1B:5E:D4:37:B4:F3:0C:
Saving certificate SCEPOTRON-MSCEP-RA to FLASH file cert1.pem
Closing file
Certificate file created
ca0.pem: MD5 fingerprint: 1D:91:BC:43:C2:7B:BF:63:BD:91:DD:64:BF:61:F1:E7:
Saving certificate SCEPOTRON-CA to FLASH file ca0.pem
Closing file
Certificate file created
All CA certificates have been processed
All tasks completed
```

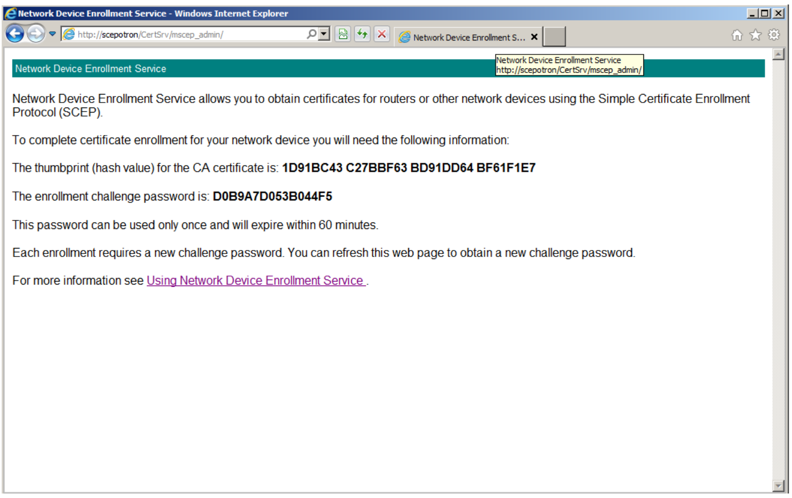
Please note: If a hierarchical CA is used the router will download more than one CA certificate (one for each CA that is involved in the chain). On firmware releases prior to 5132 multiple CA certificates will be downloaded but may not all be saved correctly with the 'ca' prefix to indicate a CA certificate. Therefore the need to rename CA certificates from the 'cert' prefix to the 'ca' prefix to ensure that the certificates are used correctly during the SCEP process. Carefully reading the certificate collection results will indicate what each certificate was saved as. These can then be renamed by the 'execute a command' web page using the <ren> command.

5.6.2 Obtain a Challenge Password for the Certificate Request.

This password is generally obtained from the SCEP CA server by way of WEB server, or a phone call to the CA Server Administrator. For the SCEP server, browse to a web interface. If the server requires a challenge password, it will be displayed on the page along with the CA certificate fingerprint.

This challenge password is usually only valid once and for a short period of time, in this case 60 minutes, meaning that a certificate request must be created within the 60 minutes after retrieving the challenge password.

From a PC browse to the following Microsoft® CA server web page using URL changing the host name of the CA server http://<hostname>/mscep/mscep.dll, click the link to browse to the URL that will provide the challenge password. The server will ask for a suitable username/password to view the page.


Network Device Enrollment Service - Windows Internet Explorer
http://scepotron/CertSrv/mscep_admin/
Network Device Enrollment S...
Network Device Enrollment Service
http://scepotron/CertSrv/mscep_admin/

Network Device Enrollment Service

Network Device Enrollment Service allows you to obtain certificates for routers or other network devices using the Simple Certificate Enrollment Protocol (SCEP).

To complete certificate enrollment for your network device you will need the following information:

The thumbprint (hash value) for the CA certificate is: **1D91BC43 C27BBF63 BD91DD64 BF61F1E7**

The enrollment challenge password is: **D0B9A7D053B044F5**

This password can be used only once and will expire within 60 minutes.

Each enrollment requires a new challenge password. You can refresh this web page to obtain a new challenge password.

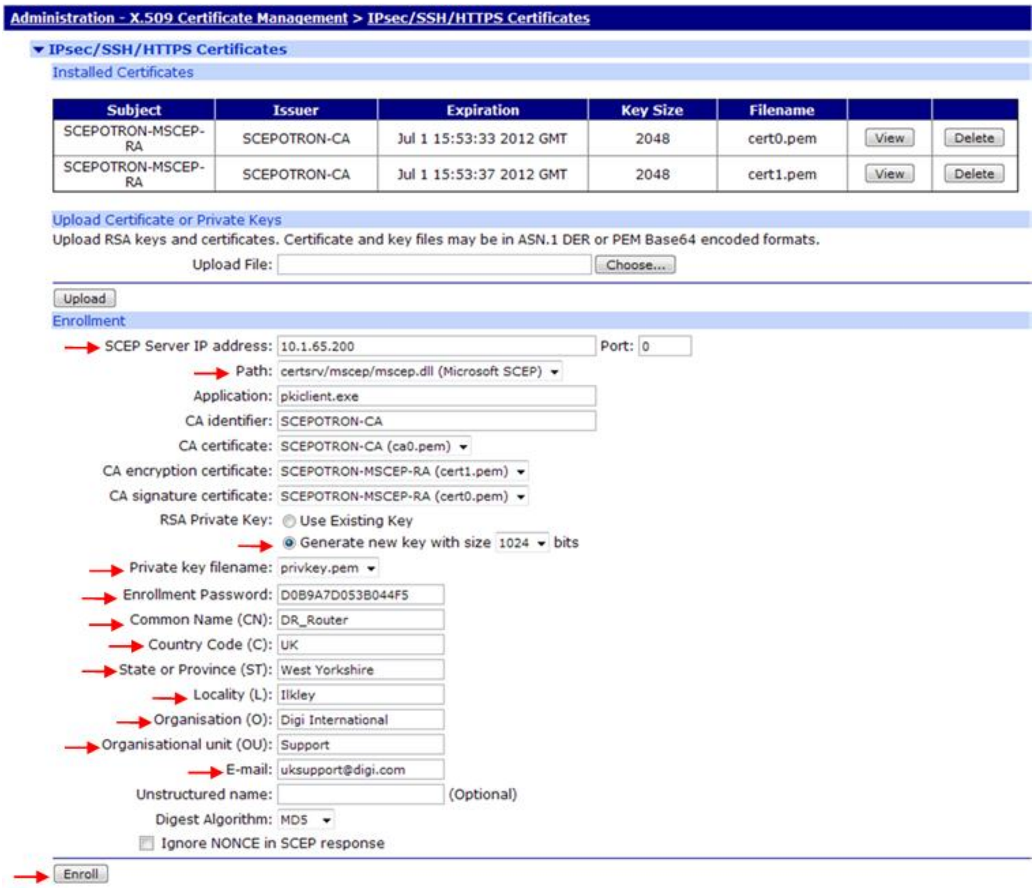
For more information see Using Network Device Enrollment Service .

5.6.3 Configure the Certificate Request page

Browse to **Administration – X.509 certificate management > IPsec/SSH/HTTPS certificates**

Enter the above challenge password and configure all other fields as appropriate. These details will form part of the certificate request and thus form part of the signed public key certificate. Note that there is the option to use an already existing private key. If automatic enrolment process is not being used ensure to use this option on the second SCEP request.

Note: If the router has only a single CA certificate it will automatically choose this in the following page. IF the router has multiple CA certificates ensure that the certificate of the server that is being requested has been selected.



Administration - X.509 Certificate Management > IPsec/SSH/HTTPS Certificates

▾ IPsec/SSH/HTTPS Certificates

Installed Certificates

Subject	Issuer	Expiration	Key Size	Filename		
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:33 2012 GMT	2048	cert0.pem	View	Delete
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:37 2012 GMT	2048	cert1.pem	View	Delete

Upload Certificate or Private Keys

Upload RSA keys and certificates. Certificate and key files may be in ASN.1 DER or PEM Base64 encoded formats.

Upload File: Choose...

Upload

Enrollment

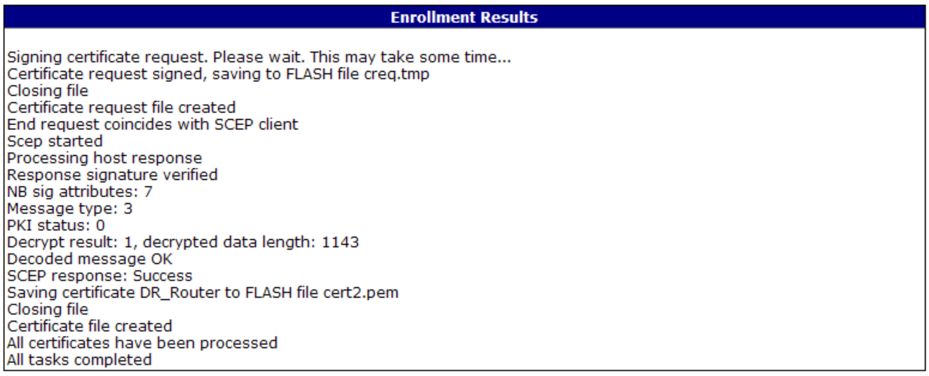
SCEP Server IP address: 10.1.65.200 Port: 0
Path: certsrv/mscep/mscep.dll (Microsoft SCEP)
Application: pkiclient.exe
CA identifier: SCEPOTRON-CA
CA certificate: SCEPOTRON-CA (ca0.pem)
CA encryption certificate: SCEPOTRON-MSCEP-RA (cert1.pem)
CA signature certificate: SCEPOTRON-MSCEP-RA (cert0.pem)
RSA Private Key: ○ Use Existing Key
● Generate new key with size 1024 bits
Private key filename: privkey.pem
Enrollment Password: D0B9A7D053B044F5
Common Name (CN): DR_Router
Country Code (C): UK
State or Province (ST): West Yorkshire
Locality (L): Ilkley
Organisation (O): Digi International
Organisational unit (OU): Support
E-mail: uksupport@digi.com
Unstructured name: (Optional)
Digest Algorithm: MD5
□ Ignore NONCE in SCEP response

Enroll

Parameter	Setting	Description
Challenge Password:	D0B9A7D053B044F5	Enter the Challenge Password issued by the SCEP server
Country:	UK	Enter a two character representation of the country
Common Name:	DR_Router	Enter a Common Name for the router's ID*
Locality:	Ilkley	The Location of the unit
Organisation:	Digi International	An appropriate Company name
Organisational Unit:	Support	An appropriate organisational unit
State:	West Yorkshire	State or County or Province
Email Address:	uksupport@digi.com	An appropriate email Address
Unstructured Name:		Optional descriptive text
Digest Algorithm:	MD5	Choose either MD5 or SHA1. This is used when signing the certificate request
New Key Size:	1024	Size of the private key in bits
Private Key filename:	privkey.pem	Enter a name for the private key (must be prefixed with "priv" and have a .pem extension).

NOTE: * The **Common Name** (case sensitive) field is important as this will be used as the ID for the device for the IKE negotiations.

Click the **Enrol** button. Some indication of the progress as the router generates the Private Key file (if applicable) and certificate request as follows;



```
Signing certificate request. Please wait. This may take some time...
Certificate request signed, saving to FLASH file creq.tmp
Closing file
Certificate request file created
End request coincides with SCEP client
Scep started
Processing host response
Response signature verified
NB sig attributes: 7
Message type: 3
PKI status: 0
Decrypt result: 1, decrypted data length: 1143
Decoded message OK
SCEP response: Success
Saving certificate DR_Router to FLASH file cert2.pem
Closing file
Certificate file created
All certificates have been processed
All tasks completed
```

The above example shows the SCEP response as success, There are three possible responses;

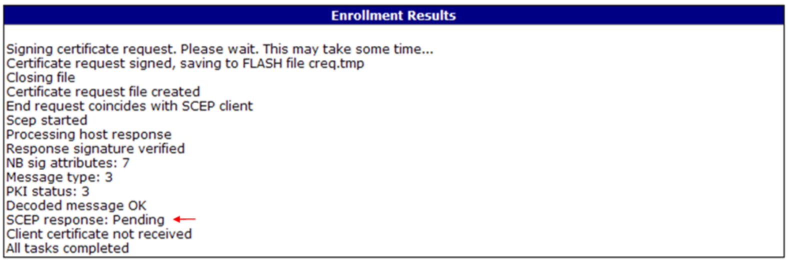
Failure - The request failed. Check that the correct CA certificates have been used. Check that the challenge password is correct. Check that the correct certificate request has been specified, and that the correct private key has been used. Check the server logs to see what the problem is.

Pending - The server has the request, but hasn't signed it yet. It may require some input by the System Administrator. The unit should poll the server occasionally until the certificate is returned. However, if certificate request has been allowed having contacted the System Administrator simply press the **Enroll** button again rather than wait for the Transport to re-poll.

Success - The response should contain the signed certificate.

5.6.4 Administrator approved enrolment

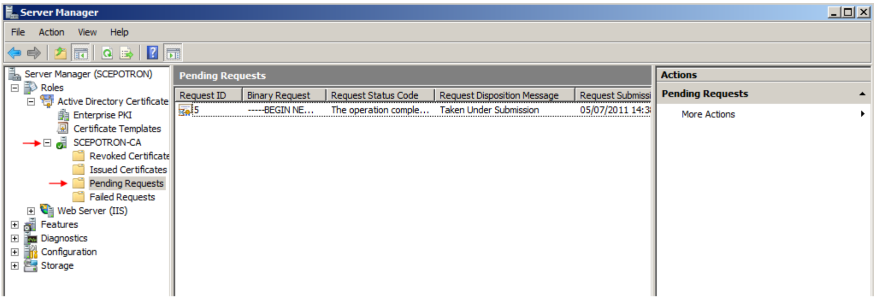
If automatic enrolment has been configured correctly then this section is not required. An example certificate request output below shows the SCEP certificate request is left in the pending state. In this case then the SCEP server administrator needs to manually enrol the device prior to the router being able to obtain its certificate.



Enrollment Results

```
Signing certificate request. Please wait. This may take some time...
Certificate request signed, saving to FLASH file creq.tmp
Closing file
Certificate request file created
End request coincides with SCEP client
Scep started
Processing host response
Response signature verified
NB sig attributes: 7
Message type: 3
PKI status: 3
Decoded message OK
SCEP response: Pending
Client certificate not received
All tasks completed
```

Log in to the SCEP Server with an appropriate System Administrator account. Start the server a management console and browse to the pending folder of the CA.

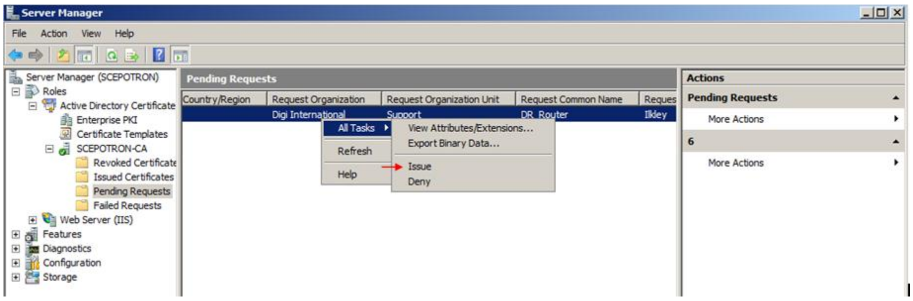


Pending Requests

Request ID	Binary Request	Request Status Code	Request Disposition Message	Request Submissi
5	-----BEGIN NE...	The operation comple...	Taken Under Submission	05/07/2011 14:3

Right-click the pending certificate and highlight the '**All Tasks**' option which will reveal another menu.

From the new menu select the '**Issue**' option to sign the certificate request. If there is more than one certificate request pending, then check the request is for the correct device by scrolling sideway and checking the common name that is listed in the certificate request.



Pending Requests

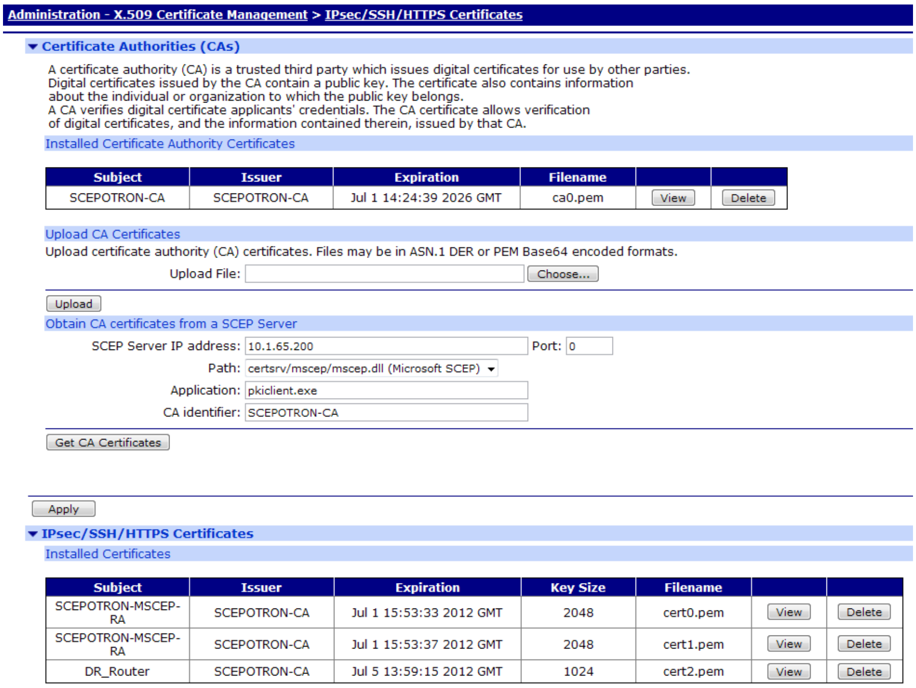
Country/Region	Request Organization	Request Organization Unit	Request Common Name	Reques
	Digi International	Support	DR_Router	Ilkley

Once the certificate request has been signed the router will automatically re-poll the CA server over time or re-poll manually by again clicking on the **Enroll** button as before.

There should now be a success message indicating that the certificate request has been signed and returned by the CA as shown below. This router now has a public key.

5.7 Reviewing certificates on Transport routers

If during the VPN configuration process there are problems with the VPN negotiation and a certificate error is suspected it may be useful to manually check the contents of any certificates that are located on a router, or alternatively delete incorrect/unused certificates. This can be done by clicking the relevant "**View**" button that is visible for each of the certificates that are on the router. The screen print below shows all the downloaded certificates



Administration - X.509 Certificate Management > IPsec/SSH/HTTPS Certificates

▼ Certificate Authorities (CAs)

A certificate authority (CA) is a trusted third party which issues digital certificates for use by other parties.
Digital certificates issued by the CA contain a public key. The certificate also contains information
about the individual or organization to which the public key belongs.
A CA verifies digital certificate applicants' credentials. The CA certificate allows verification
of digital certificates, and the information contained therein, issued by that CA.

Installed Certificate Authority Certificates

Subject	Issuer	Expiration	Filename		
SCEPOTRON-CA	SCEPOTRON-CA	Jul 1 14:24:39 2026 GMT	ca0.pem	View	Delete

Upload CA Certificates

Upload certificate authority (CA) certificates. Files may be in ASN.1 DER or PEM Base64 encoded formats.

Upload File: Choose...

Upload

Obtain CA certificates from a SCEP Server

SCEP Server IP address: 10.1.65.200 Port: 0
Path: certsrv/mscep/mscep.dll (Microsoft SCEP)
Application: pkiclient.exe
CA identifier: SCEPOTRON-CA

Get CA Certificates

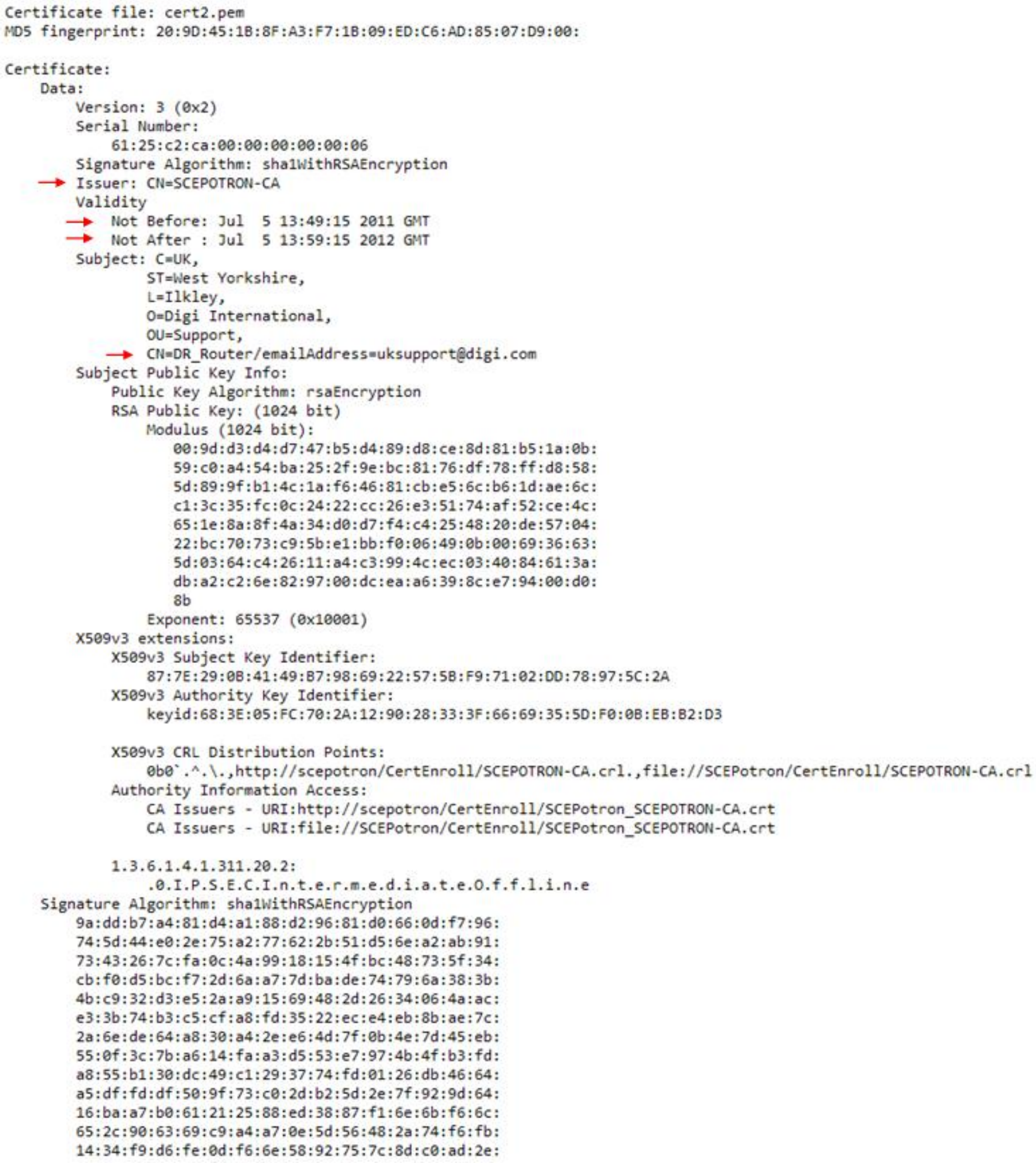
Apply

▼ IPsec/SSH/HTTPS Certificates

Installed Certificates

Subject	Issuer	Expiration	Key Size	Filename		
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:33 2012 GMT	2048	cert0.pem	View	Delete
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:37 2012 GMT	2048	cert1.pem	View	Delete
DR_Router	SCEPOTRON-CA	Jul 5 13:59:15 2012 GMT	1024	cert2.pem	View	Delete

Clicking on the view button opens the certificate so this can be review. Below is a portion of the output of a just issued DR64 router certificate. Highlights on the portions that are most commonly needed to be checked.



```
Certificate file: cert2.pem
MD5 fingerprint: 20:9D:45:1B:8F:A3:F7:1B:09:ED:C6:AD:85:07:D9:00:

Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            61:25:c2:ca:00:00:00:00:00:06
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: CN=SCEPOTRON-CA
        Validity
            Not Before: Jul  5 13:49:15 2011 GMT
            Not After : Jul  5 13:59:15 2012 GMT
        Subject: C=UK,
                ST=West Yorkshire,
                L=Ilkley,
                O=Digi International,
                OU=Support,
                CN=DR_Router/emailAddress=uksupport@digi.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (1024 bit)
                Modulus (1024 bit):
                   00:9d:d3:d4:d7:47:b5:d4:89:d8:ce:8d:81:b5:1a:0b:
                   59:c0:a4:54:ba:25:2f:9e:bc:81:76:df:78:ff:d8:58:
                   5d:89:9f:b1:4c:1a:f6:46:81:cb:e5:6c:b6:1d:ae:6c:
                   c1:3c:35:fc:0c:24:22:cc:26:e3:51:74:af:52:ce:4c:
                   65:1e:8a:8f:4a:34:d0:d7:f4:c4:25:48:20:de:57:04:
                   22:bc:70:73:c9:5b:e1:bb:f0:06:49:0b:00:69:36:63:
                   5d:03:64:c4:26:11:a4:c3:99:4c:ec:03:40:84:61:3a:
                   db:a2:c2:6e:82:97:00:dc:ea:a6:39:8c:e7:94:00:d0:
                   8b
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            X509v3 Subject Key Identifier:
                87:7E:29:0B:41:49:B7:98:69:22:57:5B:F9:71:02:DD:78:97:5C:2A
            X509v3 Authority Key Identifier:
                keyid:68:3E:05:FC:70:2A:12:90:28:33:3F:66:69:35:5D:F0:0B:EB:B2:D3

            X509v3 CRL Distribution Points:
                0b0`.^.\.,http://scepotron/CertEnroll/SCEPOTRON-CA.crl.,file://SCEPotron/CertEnroll/SCEPOTRON-CA.crl
            Authority Information Access:
                CA Issuers - URI:http://scepotron/CertEnroll/SCEPotron_SCEPOTRON-CA.crt
                CA Issuers - URI:file://SCEPotron/CertEnroll/SCEPotron_SCEPOTRON-CA.crt

            1.3.6.1.4.1.311.20.2:
                .0.I.P.S.E.C.I.n.t.e.r.m.e.d.i.a.t.e.O.f.f.l.i.n.e
    Signature Algorithm: sha1WithRSAEncryption
        9a:dd:b7:a4:81:d4:a1:88:d2:96:81:d0:66:0d:f7:96:
        74:5d:44:e0:2e:75:a2:77:62:2b:51:d5:6e:a2:ab:91:
        73:43:26:7c:fa:0c:4a:99:18:15:4f:bc:48:73:5f:34:
        cb:f0:d5:bc:f7:2d:6a:a7:7d:ba:de:74:79:6a:38:3b:
        4b:c9:32:d3:e5:2a:a9:15:69:48:2d:26:34:06:4a:ac:
        e3:3b:74:b3:c5:cf:a8:fd:35:22:ec:e4:eb:8b:ae:7c:
        2a:6e:de:64:a8:30:a4:2e:e6:4d:7f:0b:4e:7d:45:eb:
        55:0f:3c:7b:a6:14:fa:a3:d5:53:e7:97:4b:4f:b3:fd:
        a8:55:b1:30:dc:49:c1:29:37:74:fd:01:26:db:46:64:
        a5:df:fd:df:50:9f:73:c0:2d:b2:5d:2e:7f:92:9d:64:
        16:ba:a7:b0:61:21:25:88:ed:38:87:f1:6e:6b:f6:6c:
        65:2c:90:63:69:c9:a4:a7:0e:5d:56:48:2a:74:f6:fb:
        14:34:f9:d6:fe:0d:f6:6e:58:92:75:7c:8d:c0:ad:2e:
```

6 CISCO® VPN INITIATOR - CERTIFICATES

The following Cisco® configuration is denoted as follows;

General description is shown using the "Arial" font with points of interest in **bold**.

The command prompt is shown using the "courier new" font.

User input is shown using the "courier new" font in bold text.

Any dialogue returned by the Cisco® is shown using the "courier new" font in italic text.

6.1 General Setup

6.1.1 Set the Real Time Clock

Any certificates stored in the Cisco® private NVRAM will have a validity period. Therefore it is important that the Cisco® is configured with the correct time and date.

```
Router#clock set 10:10:50 6 july 2011
```

6.1.2 Enter Global Configuration Mode

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
```

6.1.3 Configure a Password for Privileged Mode

```
Router(config)#enable secret xxxxxxxxxxx
```

6.1.4 Configure a Hostname and Domain name

In this example the fully qualified domain name will be cisco.scepmatic5000.com

```
Router(config)#hostname Cisco
```

```
Cisco(config)# ip domain-name scepomatic5000.com
```

Note: Notice that the command prompt has now changed to the hostname

6.1.5 Configure the IP Address of a DNS Server

```
Cisco(config)#ip name-server 217.34.133.20
```

6.2 Ethernet Configuration

Select **FastEtherneto** as the Ethernet interface to configure. This command will put router into configure interface (config-if) mode.

```
Cisco(config)#interface FastEthernet0
```

6.2.1 Configure the internal LAN address of the router

```
Cisco(config-if)#ip address 192.168.0.254 255.255.255.0
```

Configure the speed of the Ethernet interface

```
Cisco(config-if)#speed 100
```

```
Cisco(config-if)#full-duplex
```

6.2.2 Activate the Fast Ethernet Interface

By default the FastEtherneto interface will be in a shutdown or inactive state. Therefore the Ethernet interface should be made active as follows;

```
Cisco(config-if)#no shutdown
```

After the no shutdown command is issued there should be some indication that the interface is active (assuming that eh Ethernet cable is connected);

```
Jul  6 10:51:36.259: %LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0, changed state to up
```

6.2.3 Configure the outside WAN address of the router

```
Cisco(config-if)#interface Ethernet 0
```

```
Cisco(config-if)#ip address 10.1.65.12 255.255.0.0
```

```
Cisco(config-if)#full-duplex
```

```
Cisco(config-if)#no shutdown
```

After the no shutdown command is issued there should be some indication that the interface is active (assuming that eh Ethernet cable is connected);

```
Jul  6 10:51:19.563: %LINEPROTO-5-UPDOWN: Line protocol on Interface
Ethernet0, changed state to up
```

6.2.4 Exit config-if mode

```
Cisco(config-if)#exit
```

6.2.5 Configure the Default Gateway

```
Cisco(config)#ip default-gateway 10.1.255.254
```

6.2.6 Enable classless routing (CIDR) behaviour

```
Cisco(config)#ip classless
```

6.2.7 Configure the Default Route IP route

```
Cisco(config)#ip route 0.0.0.0 0.0.0.0 10.1.255.254
```

6.3 Generate the RSA Key Pair

The Cisco® RSA key pairs are used to sign and encrypt IKE messages. The RSA key pair must be generated before the router can request a certificate from the CA.

Use the following command whilst in global configuration mode.

```
Cisco(config)#crypto key generate rsa
The name for the keys will be: Cisco.scepomatic5000.com
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.
```

6.3.1 Specify the Key Length in Bits

```
How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys ...[OK]

Jul  6 11:05:16.871: %SSH-5-ENABLED: SSH 1.5 has been enabled
```

6.4 Configure the CA

6.4.1 Certificate Authority Server Declaration

Before the router can obtain a signed certificate, a valid CA must be declare. The following command declares the CA that will be used, if a domain name is used ensure it will resolve to an IP address that the Cisco® can connect to .

This command puts the router into **ca-identity** configuration mode.

```
Cisco(config)# crypto ca identity 10.1.65.200
```

6.4.2 Configure the SCEP URL

Enter the url presented at the end of installing the SCEP add-on facility on the CA server. The format is http://<server>:80/certsrv/mscep/mscep.dll , where <server> is the FQDN or IP address of the CA server, if the hostname is used, the previously configured DNS sevrer must be able to resolve the configured hostname and the router must be able to connect to it.

```
Cisco(ca-trustpoint)#enrollment url http://10.1.65.200/certsrv/mscep/mscep.dll
```

If a host name for the CA server is to been used the router should provide output similar to that used below.

```
Translating "server.domain.com"...domain server (217.34.133.20) [OK]
```

6.4.3 Registration Authority (RA) Mode

The Microsoft® CA Server provides a Registration Authority (RA), therefore the Cisco® needs to be put into **RA mode** as follows.

```
Cisco(ca-trustpoint)#enrollment mode ra
```

6.4.4 Set Certificate Revocation List to Optional

The following command enables the router to accept the other Peer's certificates even if the CRL (Certificate Revocation List) is not accessible to the router.

```
Cisco(ca-trustpoint)#crl optional
```

6.4.5 Exit ca-trustpoint mode.

```
Cisco(ca-trustpoint)#exit
```

6.5 Using SCEP to retrieve the CA certificates

6.5.1 Authenticate the CA

The router is required to authenticate the CA by retrieving the CA's self signed certificate which contains the CA's public key.

```
Cisco(config)#crypto ca authenticate 10.1.65.200

Certificate has the following attributes:

Fingerprint: 1D91BC43 C27BBF63 BD91DD64 BF61F1E7
```

6.5.2 Accept the CA Certificate

At this point it is required to accept or decline the CA's certificate.

```
% Do you accept this certificate? [yes/no]: yes
Trustpoint CA certificate accepted.
```

6.6 Using SCEP to Enrol the Certificate Request

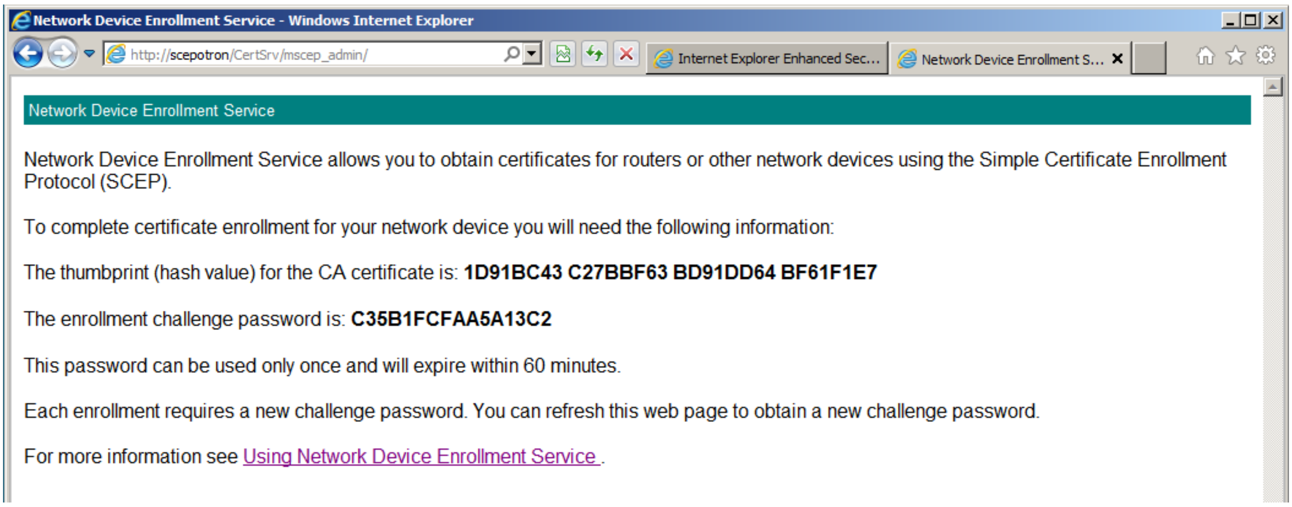
```
Cisco(config)#crypto ca enroll 10.1.65.200


% Start certificate enrollment ..
% Create a challenge password. You will need to verbally provide this
   password to the CA Administrator in order to revoke your certificate.
   For security reasons your password will not be saved in the
configuration.
   Please make a note of it.
```

6.7 Obtain a Challenge Password for the Certificate Request.

The router will now prompted for a challenge password from the CA Server. This password is generally obtained from the SCEP CA server by way of WEB server, or a phone call to the CA Server Administrator. For the Microsoft® SCEP server, browse to a web interface. If the server requires a challenges password, it will be displayed on the page along with the CA certificate fingerprint.

This challenge password is usually only valid once and for a short period of time, in this case 60 minutes, meaning that a certificate request must be created within the 60 minutes after retrieving the challenge password.

From a PC browse to the following Microsoft® CA server web page using URL http://<hostname>/mscep/mscep.dll (as detailed in "Microsoft® 2008 server Configuration) and make a note of the challenge password.


Network Device Enrollment Service - Windows Internet Explorer
http://scepotron/CertSrv/mscep_admin/
Internet Explorer Enhanced Sec...
Network Device Enrollment S...

Network Device Enrollment Service

Network Device Enrollment Service allows you to obtain certificates for routers or other network devices using the Simple Certificate Enrollment Protocol (SCEP).

To complete certificate enrollment for your network device you will need the following information:

The thumbprint (hash value) for the CA certificate is: **1D91BC43 C27BBF63 BD91DD64 BF61F1E7**

The enrollment challenge password is: **C35B1FCFAA5A13C2**

This password can be used only once and will expire within 60 minutes.

Each enrollment requires a new challenge password. You can refresh this web page to obtain a new challenge password.

For more information see Using Network Device Enrollment Service .

6.7.1 Enter the Challenge Password

Note: The router does not echo back the password as it is type, but for the purpose of this application note I have entered plain text.

```
Password: C35B1FCFAA5A13C2

Re-enter password: C35B1FCFAA5A13C2


% The fully-qualified domain name in the certificate will be:
Cisco.scepomatic5000.com

% The subject name in the certificate will be: Cisco.scepomatic5000.com
```

Type **NO** when prompted to include the router's serial number in the certificate request

```
% Include the router serial number in the subject name? [yes/no]: no
```

Type **NO** when prompted to include the router IP address in the certificate request

```
% Include an IP address in the subject name? [no]: no
```

Type **YES** to request a certificate from the CA.

```
Request certificate from CA? [yes/no]: yes


% Certificate request sent to Certificate Authority
% The certificate request fingerprint will be displayed.
% The 'show crypto ca certificate' command will also show the
fingerprint.


Cisco(config)#    Fingerprint:  67948EB0 ADA7C83C 4DD505CB DB5415D7
```

6.8 Issuing a Signed Certificate on Microsoft® Windows Server 2008.

If the Microsoft® CA server is **not** configured for automatic enrolment then it will return a **pending** message to the router

```
Jul  6 12:10:25.849: CRYPTO_PKI: status = 102: certificate request pending
Jul  6 12:10:42.849: CRYPTO_PKI: status = 102: certificate request pending
```

Login to the SCEP server and issue the certificate as detailed in **Section 6.4.4**. Once the certificate request has been signed then wait for the router to automatically re-poll the CA server according to the retry counters set in the Cisco® configuration.

There should now be a success message indicating that the certificate request has been signed and returned by the CA as shown below. This is the routers public key.

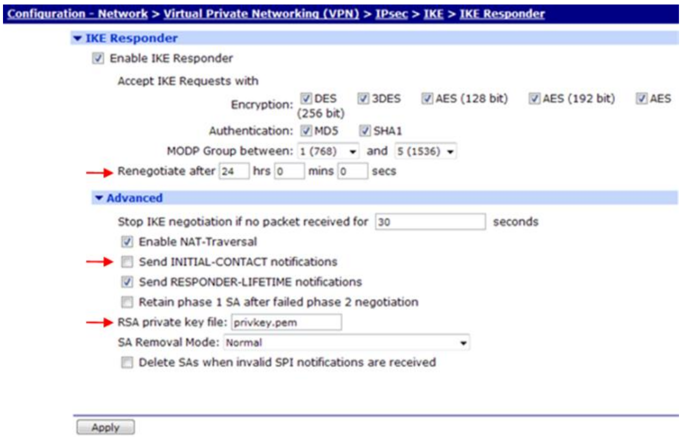
```
Jul  6 12:13:42.723: %CRYPTO-6-CERTRET: Certificate received from Certificate
Authority
```

6.9 Configure IKE (Internet Key Exchange)

IKE is the first stage in establishing a secure link between two endpoints. The VPN Server will act as the IKE 'responder' and as such will not initiate VPN tunnels. By default the DR64 responder setup is configured to accept the full range of authentication and encryption algorithms available.

Browse to **Configuration - Network > Virtual Private Networking (VPN) > IPsec > IKE > IKE Responder**

Set the IKE lifetime to 24hrs (86400s), drop down the **Advanced** options, un-tick send initial contact notifications and enter the file name of the private key file and click **Apply**.



Configuration - Network > Virtual Private Networking (VPN) > IPsec > IKE > IKE Responder

▼ IKE Responder

☑ Enable IKE Responder

Accept IKE Requests with

Encryption: ☑ DES ☑ 3DES ☑ AES (128 bit) ☑ AES (192 bit) ☑ AES (256 bit)

Authentication: ☑ MD5 ☑ SHA1

MODP Group between: 1 (768) and 5 (1536)

Renegotiate after 24 hrs 0 mins 0 secs

▼ Advanced

Stop IKE negotiation if no packet received for 30 seconds

☑ Enable NAT-Traversal

☐ Send INITIAL-CONTACT notifications

☑ Send RESPONDER-LIFETIME notifications

☐ Retain phase 1 SA after failed phase 2 negotiation

RSA private key file: privkey.pem

SA Removal Mode: Normal

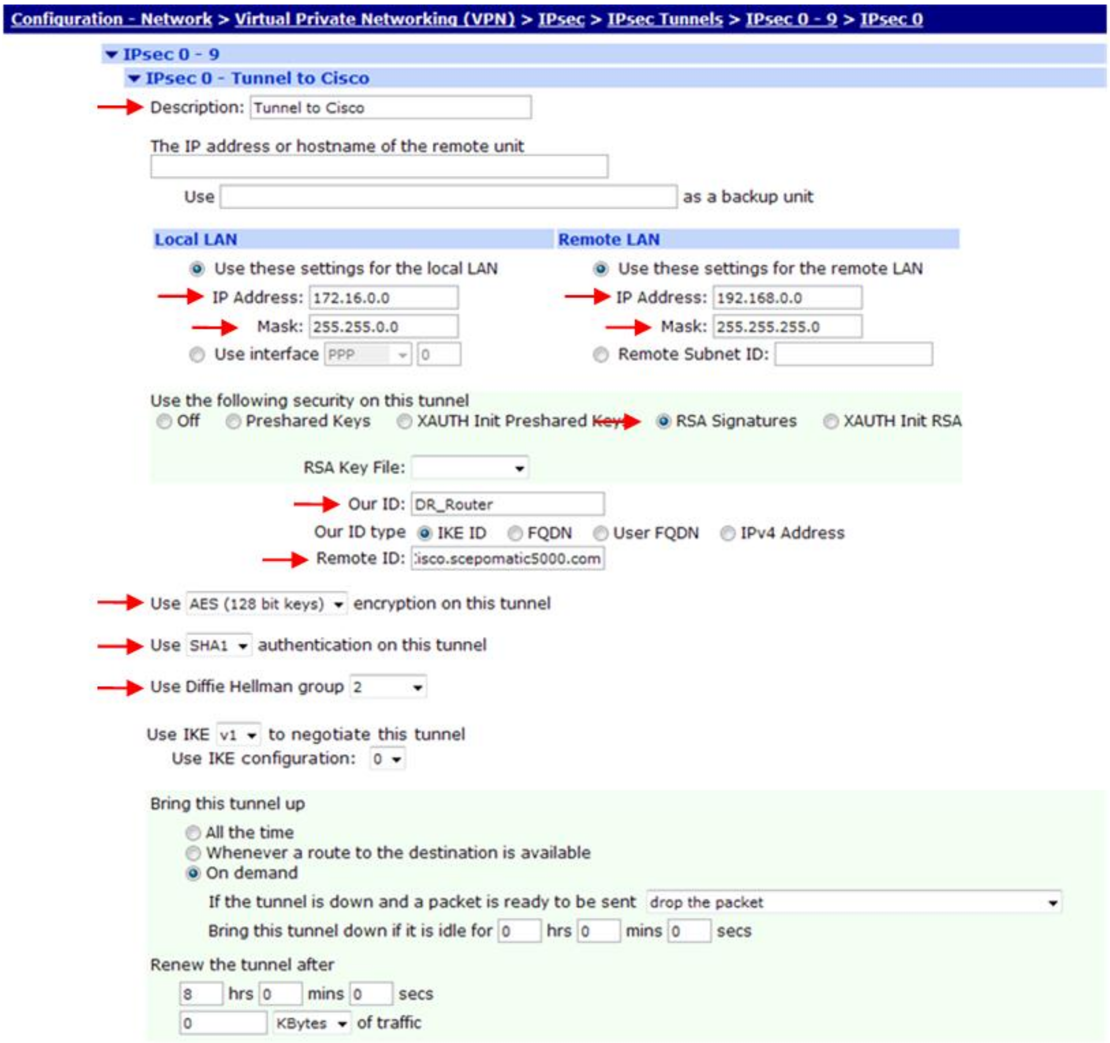
☐ Delete SAs when invalid SPI notifications are received

Parameter	Setting	Description
Renegotiate after	24hrs	Sets the IKE lifetime
Send ININTIAL-CONTACT notifications	Un-checked	Prevents initial contact notification option being used
RSA private key file:	privkey.pem	Enter the name of the private key file

6.10 Configure IPsec

The IPsec itself is configured in the IPsec Tunnels section (also often referred to as an Eroute or encrypted route). The IPsec instances define the characteristics of the encrypted routes *i.e.* local and remote subnets, authentication and encryption methods etc.

Browse to **Configuration - Network > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec 0 - 9 > IPsec 0**



Configuration - Network > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec 0 - 9 > IPsec 0

▾ IPsec 0 - 9

▾ IPsec 0 - Tunnel to Cisco

Description: Tunnel to Cisco

The IP address or hostname of the remote unit

Use [ ] as a backup unit

Local LAN	Remote LAN
● Use these settings for the local LAN	● Use these settings for the remote LAN
IP Address: 172.16.0.0	IP Address: 192.168.0.0
Mask: 255.255.0.0	Mask: 255.255.255.0
○ Use interface PPP 0	○ Remote Subnet ID:

Use the following security on this tunnel

○ Off ○ Preshared Keys ○ XAUTH Init Preshared Keys ● RSA Signatures ○ XAUTH Init RSA

RSA Key File:

Our ID: DR_Router

Our ID type ● IKE ID ○ FQDN ○ User FQDN ○ IPv4 Address

Remote ID: :isco.scepomatic5000.com

Use AES (128 bit keys) encryption on this tunnel

Use SHA1 authentication on this tunnel

Use Diffie Hellman group 2

Use IKE v1 to negotiate this tunnel

Use IKE configuration: 0

Bring this tunnel up

○ All the time

○ Whenever a route to the destination is available

● On demand

If the tunnel is down and a packet is ready to be sent drop the packet

Bring this tunnel down if it is idle for 0 hrs 0 mins 0 secs

Renew the tunnel after

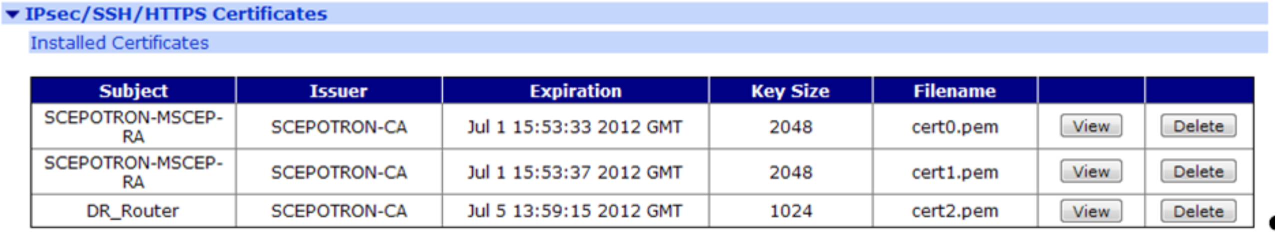
8 hrs 0 mins 0 secs

0 KBytes of traffic

Parameter	Setting	Description
Description	Tunnel to Cisco	A friendly name
Local LAN IP address:	172.16.0.0	Enter the local subnet IP address
Local LAN subnet mask:	255.255.0.0	Enter the local subnet mask
Remote LAN subnet IP address:	192.168.0.0	Enter the remote subnet IP address
Remote LAN subnet mask:	255.255.255.0	Enter the remote subnet mask
Authentication method	RSA Signatures	Select RSA signatures for the authentication method
Our ID:	DR_Router	Common name specified in our public key *
Peer ID:	Cisco.scepomatic5000.com	Enter the Cisco® fully qualified domain name (FQDN).
Encryption Method	AES (128 bit)	Select AES 128 as the encryption algorithm **
Authentication Method	SHA1	Select SHA1 as the authentication algorithm **
Diffie Hellman group	2	Sets ESP the Diffie Hellman group (AKA PFS group)**

* To check the common name used in the public key

Browse to **Administration – X.509 certificate management > IPsec/SSH/HTTPS certificates**



Subject	Issuer	Expiration	Key Size	Filename		
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:33 2012 GMT	2048	cert0.pem	View	Delete
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:37 2012 GMT	2048	cert1.pem	View	Delete
DR_Router	SCEPOTRON-CA	Jul 5 13:59:15 2012 GMT	1024	cert2.pem	View	Delete

click **view**. Now be able to view the certificate and see the entry in the **common name** field.

** The **authentication** and **encryption** algorithms must match exactly the settings in the peer IPsec router.

7 CONFIGURE IKE AND IPSEC – CISCO®

7.1 Configure IKE (Internet Key Exchange)

IKE is the first stage in establishing a secure link between two endpoints. The VPN client will act as the IKE 'initiator' and as such will make first contact with the VPN server. This allows the Cisco® to have a dynamic IP address on its WAN interface and therefore there is no requirement for the VPN server to know the Cisco® IP address. The Cisco® current IP address will be included each time IKE is negotiated.

Whilst in global configuration mode define the IKE policy to use. Policies are uniquely identified by the policy number define and can create multiple IKE policies each with an entirely different set of IKE parameters.

The following parameter will define IKE (isakmp) **policy 1** and will put the router in **config-isakmp** mode.

```
Cisco(config)#crypto isakmp policy 1
```

The following command specifies the IKE encryption algorithm

```
Cisco(config-isakmp)#encryption aes
```

The following command specifies the IKE hash algorithm

```
Cisco(config-isakmp)#hash sha
```

The following command specifies the IKE security association lifetime (seconds)

Note: It is advisable to set the IKE duration set to the same or lesser value to that of the VPN Server.

```
Cisco(config-isakmp)#lifetime 86400
```

The following command configures the Cisco® to use its hostname as its identity during the IKE negotiations.

```
Cisco(config-isakmp)#crypto isakmp identity hostname
```

7.2 Configure IPsec Transform-Set

The following command creates an **IPsec Transform-set**. The name of the transform-set is named **myset**. The IPsec transform-set **myset**, will use **AES** (128 bit) for the ESP encryption algorithm and **MD5** for the ESP authentication algorithm. This command will put the router in **cfg-crypto-trans** mode.

```
Cisco(config)# crypto ipsec transform-set transport-test esp-aes 128 esp-
sha-hmac
```

Exit **cfg-crypto-trans** mode.

```
Cisco(cfg-crypto-trans)#exit
```

7.3 Configure the Crypto Map

The following crypto map allows the IPsec security associations to be negotiated during the IKE session. The crypto map specifies the settings that the Cisco® will use when establishing security associations with the peer. These settings must fall within the thresholds set by the VPN server if the IPsec security associations are to establish successfully.

Starting in global configuration mode create a crypto map called **vpn** with a sequence number of **10**. This will put the router in **config-crypto-map** mode.

```
Cisco(config)#crypto map vpn 10 ipsec-isakmp

% NOTE: This new crypto map will remain disabled until a peer
        and a valid access list have been configured.
```

Specify the peers (VPN Server) IP address to be associated with this crypto map. The Cisco® will send all IPsec encrypted traffic associated with this crypto map to this peer.

```
Cisco(config-crypto-map)#set peer 10.1.65.10
```

Set the IPsec security association lifetime to 28800 seconds.

Note: It is advisable to set the IKE duration set to the same or lesser value to that of the VPN Server.

```
Cisco(config-crypto-map)# set security-association lifetime seconds 28800
```

The following command specifies which transform-set is to be associated with the crypto map. Specify that transform-set **myset** to be associated with this crypto map **vpn**.

```
Cisco(config-crypto-map)#set transform-set transport-test
```

The following command names the **extended access list** which is to be associated with this crypto map. The **access list** specify will determine what traffic is to be passed through the IPsec tunnel.

Specify **access-list 101** (access list 101 will be created later).

```
Cisco(config-crypto-map)#match address 101
```

Exit **config-crypto-map** mode.

```
Cisco(config-crypto-map)#exit
```

7.4 Create the IPsec Access List

Create an extended access list. An extended access list will allows to filter on both the source and destination IP address rather than just the source IP address as with a standard access list. This is important as the router needs to allow encrypted IPsec traffic to be initiated from both directions. This command will put the router in **config-ext-nacl** mode for access list "101".

```
Cisco(config)# ip access-list extended 101
```

Create access list with an ID of 101* as specified in crypto map **vpn**. The access list will allow traffic from the IP subnet 192.168.0.0/24 to 172.16.0.0/16 (and vice versa) to pass freely through the IPsec tunnel.

*For extended access lists the access list ID must be within the range of 101 to 199 inclusive.

```
Cisco(config-ext-nacl)# permit ip 192.168.0.0 0.0.0.255 172.16.0.0
0.0.255.255
```

Associate Crypto Map to the WAN Interface.

Enter **config-if** mode for interface Fast Ethernet 0

```
Cisco(config)#interface Ethernet0
```

Associate **crypto map test-vpn** with **Ethernet 0**

```
Cisco(config-if)#crypto map test-vpn
```

Type **crtl z** to return to global mode.

```
Cisco(config-if)#
```

7.5 Saving the Configuration

Important: The following command is very important as it includes saving the RSA keys to private NV RAM. RSA keys are NOT saved with certain other methods of saving.

```
Cisco#copy system:running-config nvram:startup-config

Destination filename [startup-config]?
Building configuration...
[OK]
```

8 TESTING – CISCO® VPN INITIATOR

8.1 Display IKE Information

First generate some traffic from the Cisco LAN to the Transport LAN.

```
Cisco#show crypto isakmp policy
Protection suite of priority 1
        encryption algorithm:   AES - Advanced Encryption Standard (128
bit keys).
        hash algorithm:         Secure Hash Standard
        authentication method:  Rivest-Shamir-Adleman Signature
        Diffie-Hellman group:   #1 (768 bit)
        lifetime:               86400 seconds, no volume limit
Default protection suite
        encryption algorithm:   DES - Data Encryption Standard (56 bit
keys).
        hash algorithm:         Secure Hash Standard
        authentication method:  Rivest-Shamir-Adleman Signature
        Diffie-Hellman group:   #1 (768 bit)
        lifetime:               86400 seconds, no volume limit
```

Display Crypto Map Configuration

```
Cisco#show crypto map tag test-vpn
Cisco#show crypto map tag test-vpn
Crypto Map "test-vpn" 10 ipsec-isakmp
        Peer = 10.1.65.10
        Extended IP access list 101
            access-list 101 permit ip 192.168.0.0 0.0.0.255 172.16.0.0
0.0.255.255
        Current peer: 10.1.65.10
        Security association lifetime: 4608000 kilobytes/28800 seconds
        PFS (Y/N): N
        Transform sets={
                transport-test,
        }
        Interfaces using crypto map test-vpn:
                Ethernet0
```

8.2 Display Transform Set Configuration

```
Cisco#show crypto ipsec transform-set


Transform set transport-test: { esp-aes esp-sha-hmac  }
   will negotiate = { Tunnel,  },
```

8.3 Display List of All RSA Public Keys On the Cisco Router

```
Cisco#show crypto key pubkey-chain rsa
Codes: M - Manually configured, C - Extracted from certificate

Code Usage         IP-Address/VRF        Keyring          Name
C    Signing                             default          X.500 DN name:
                              CN = SCEPOTRON-CA

C    General                             default          DR_Router

Cisco#
```

8.4 Display the Cisco Routers RSA Public Keys

```
Cisco#show crypto key mypubkey rsa
% Key pair was generated at: 12:09:53 UTC Jul 6 2011
Key name: Cisco.scepomatic5000.com
 Usage: General Purpose Key
 Key is not exportable.
 Key Data:
  30819F30 0D06092A 864886F7 0D010101 05000381 8D003081 89028181 00A65BE4
  E63ABC86 FE941136 11BA199E 83A42489 CA1F4BA4 46AD07EB 65658052 5EAD4212
  AE700126 BB8D7F4A 3D708CA7 80F38A70 A3679F02 E0AC75F2 375D4235 35D4D53D
  12D90BAE 01484C8D 7F73676E 37564852 96EC3A93 470648DB 5D8D54AF CA7053CE
  A1122040 35F68692 28E9827D 57BAB9B5 77D58CCB F69F366F 9540C9B7 45020301 0001
% Key pair was generated at: 05:18:44 UTC Jul 7 2011
Key name: Cisco.scepomatic5000.com.server
 Usage: Encryption Key
 Key is not exportable.
 Key Data:
  307C300D 06092A86 4886F70D 01010105 00036B00 30680261 00AE796D A63C6F8A
  913E06EE 34C76C07 1EFBBA92 1B5F3599 3FC0673F 10737F16 F66F6EAE D6E30071
  8F314768 FEAAB24A FAAF5728 11DA31AC 541BED97 8CBB198B 1AC7AE3F 0581039F
  799CFC4E FAC50E1F A018BFD0 C8133EB1 E6EDB4B8 EBA80950 6B020301 0001
Cisco#
```

8.5 Display Information about the Router, CA and RA Certificates

```
Cisco#show crypto ca certificates
Certificate
  Status: Available
  Certificate Serial Number: 6120A901000000000008
  Certificate Usage: General Purpose
  Issuer:
    CN = SCEPOTRON-CA
  Subject:
    Name: Cisco.scepomatic5000.com
    OID.1.2.840.113549.1.9.2 = Cisco.scepomatic5000.com
  CRL Distribution Point:
    http://scepotron/CertEnroll/SCEPOTRON-CA.crl
  Validity Date:
    start date: 11:02:23 UTC Jul 6 2011
    end   date: 11:12:23 UTC Jul 6 2012
    renew date: 00:00:00 UTC Jan 1 1970
  Associated Trustpoints: 10.1.65.200

CA Certificate
  Status: Available
  Certificate Serial Number: 67E5E20F8B7B799140B561AE0C4DA469
  Certificate Usage: Signature
  Issuer:
    CN = SCEPOTRON-CA
  Subject:
    CN = SCEPOTRON-CA
  Validity Date:
    start date: 14:14:48 UTC Jul 1 2011
    end   date: 14:24:39 UTC Jul 1 2026
  Associated Trustpoints: 10.1.65.200
```

8.6 Display Information About the IPsec SAs

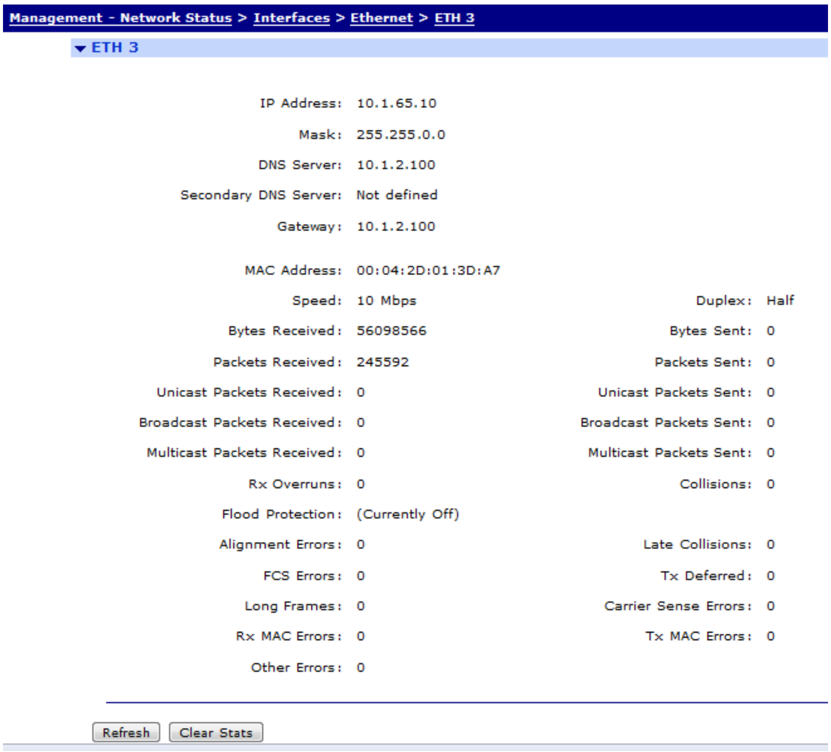
```
Cisco#show crypto ipsec sa
interface: Ethernet0
    Crypto map tag: test-vpn, local addr. 10.1.65.12

   protected vrf:
   local  ident (addr/mask/prot/port): (192.168.0.0/255.255.255.0/0/0)
   remote ident (addr/mask/prot/port): (172.16.0.0/255.255.0.0/0/0)
   current_peer: 10.1.65.10:500
     PERMIT, flags={origin_is_acl,}
    #pkts encaps: 2, #pkts encrypt: 2, #pkts digest 2
    #pkts decaps: 2, #pkts decrypt: 2, #pkts verify 2
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 1, #recv errors 0

     local crypto endpt.: 10.1.65.12, remote crypto endpt.: 10.1.65.10
     path mtu 1500, media mtu 1500
     current outbound spi: BC507856

     inbound esp sas:
      spi: 0xFFC4C117(4291084567)
        transform: esp-aes esp-sha-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 2000, flow_id: 1, crypto map: test-vpn
        sa timing: remaining key lifetime (k/sec): (4401498/27655)
        IV size: 16 bytes
        replay detection support: Y

     inbound ah sas:

     inbound pcp sas:

     outbound esp sas:
      spi: 0xBC507856(3159390294)
        transform: esp-aes esp-sha-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 2001, flow_id: 2, crypto map: test-vpn
        sa timing: remaining key lifetime (k/sec): (4401498/27655)
        IV size: 16 bytes
        replay detection support: Y

     outbound ah sas:

     outbound pcp sas:

Cisco#
```

9 CHECKING STATUS OF VPN ON THE TRANSPORT ROUTER

9.1 Check the WAN Link is Active

When browsing the Transport web interface, view the status of any interface. The following screen shot shows the status of the exit interface interface. The presence of an IP address in the **IP Address** filed shows status and statistics.

Browse to **Management - Network Status > Interfaces > Ethernet > ETH 3**



IP Address:	10.1.65.10		
Mask:	255.255.0.0		
DNS Server:	10.1.2.100		
Secondary DNS Server:	Not defined		
Gateway:	10.1.2.100		
MAC Address:	00:04:2D:01:3D:A7		
Speed:	10 Mbps	Duplex:	Half
Bytes Received:	56098566	Bytes Sent:	0
Packets Received:	245592	Packets Sent:	0
Unicast Packets Received:	0	Unicast Packets Sent:	0
Broadcast Packets Received:	0	Broadcast Packets Sent:	0
Multicast Packets Received:	0	Multicast Packets Sent:	0
Rx Overruns:	0	Collisions:	0
Flood Protection:	(Currently Off)		
Alignment Errors:	0	Late Collisions:	0
FCS Errors:	0	Tx Deferred:	0
Long Frames:	0	Carrier Sense Errors:	0
Rx MAC Errors:	0	Tx MAC Errors:	0
Other Errors:	0		

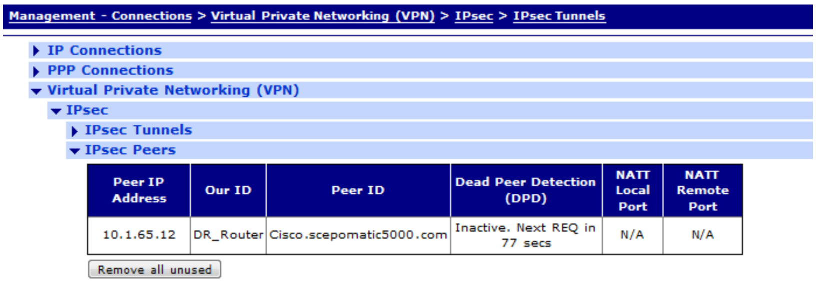
9.2 Check the IPsec Tunnel is Active

In the **Management - Connections > Virtual Private Networking (VPN)** section it is possible to check the status of the IPsec VPN tunnel

9.2.1 IPsec PEERS

The IPSec Peers shows the WAN address or hostnames of all the VPN Clients/Hosts that are currently connected to the transport router.

Browse to **Management - Connections > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels**

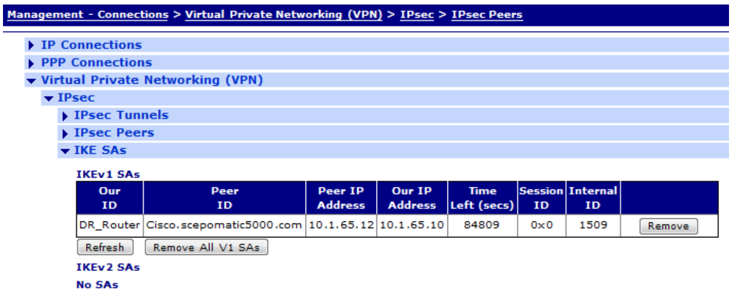

Management - Connections > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels
IP Connections
PPP Connections
Virtual Private Networking (VPN)
IPsec
IPsec Tunnels
IPsec Peers
Remove all unused

Peer IP Address	Our ID	Peer ID	Dead Peer Detection (DPD)	NATT Local Port	NATT Remote Port
10.1.65.12	DR_Router	Cisco.scepomatic5000.com	Inactive. Next REQ in 77 secs	N/A	N/A

9.2.2 IKE SAs

The IKE SAs status page shows the current active IKE security associations.

Browse to **Management - Connections > Virtual Private Networking (VPN) > IPsec > IKE SAs**


Management - Connections > Virtual Private Networking (VPN) > IPsec > IPsec Peers
IP Connections
PPP Connections
Virtual Private Networking (VPN)
IPsec
IPsec Tunnels
IPsec Peers
IKE SAs

IKEv1 SAs

Our ID	Peer ID	Peer IP Address	Our IP Address	Time Left (secs)	Session ID	Internal ID	
DR_Router	Cisco.scepomatic5000.com	10.1.65.12	10.1.65.10	84809	0x0	1509	Remove

Refresh
Remove All V1 SAs

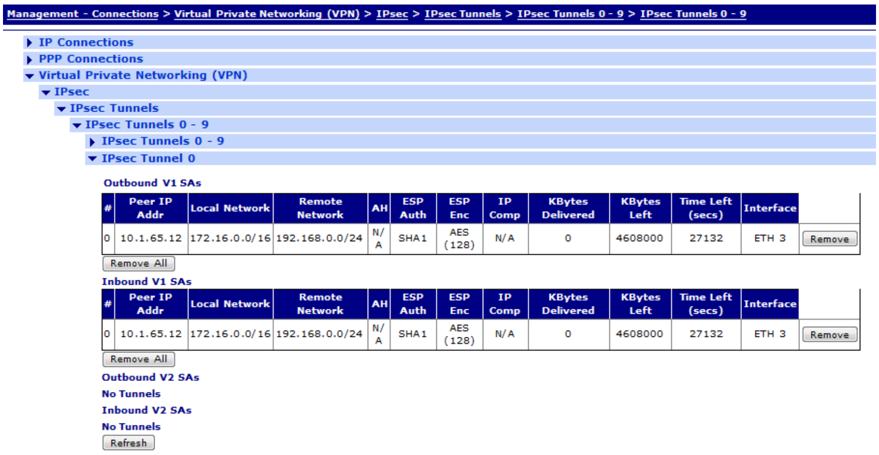
IKEv2 SAs

No SAs

9.2.3 IPsec SAs

The IPSec SAs status page shows the current active IPsec security associations. Each IPsec VPN tunnel has IPsec security associations for both inbound and outbound traffic.

Browse to **Management - Connections > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec Tunnels 0 - 9 > IPsec Tunnel 0**


Management - Connections > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec Tunnels 0 - 9 > IPsec Tunnels 0 - 9
IP Connections
PPP Connections
Virtual Private Networking (VPN)
IPsec
IPsec Tunnels
IPsec Tunnels 0 - 9
IPsec Tunnels 0 - 9
IPsec Tunnel 0

Outbound V1 SAs

#	Peer IP Addr	Local Network	Remote Network	AH	ESP Auth	ESP Enc	IP Comp	KBytes Delivered	KBytes Left	Time Left (secs)	Interface	
0	10.1.65.12	172.16.0.0/16	192.168.0.0/24	N/A	SHA1	AES (128)	N/A	0	4608000	27132	ETH 3	Remove

Inbound V1 SAs

#	Peer IP Addr	Local Network	Remote Network	AH	ESP Auth	ESP Enc	IP Comp	KBytes Delivered	KBytes Left	Time Left (secs)	Interface	
0	10.1.65.12	172.16.0.0/16	192.168.0.0/24	N/A	SHA1	AES (128)	N/A	0	4608000	27132	ETH 3	Remove

Outbound V2 SAs

No Tunnels

Inbound V2 SAs

No Tunnels

9.3 Test the IPsec Routing

When an IP packet is received by a VPN router it must meet certain criteria for it to be passed through the VPN tunnel. On the transport router the source and destination IP address MUST match that of one of the configured Eroutes and IPsec SAs. In the case of the Cisco® the addresses need to match that of the access list(s) configured for the tunnel group, the Cisco router will accept all inbound traffic by default, the access list applies to traffic outbound on the interface.

In brief, the VPN tunnel in this application note will pass data from network on subnet **192.168.0.0/24** to network on subnet **172.16.0.0/16** and vice versa (see diagram on page 3).

Using the Transport analyser trace we will see evidence of data being routed through the IPsec VPN Tunnel. In this example **computer A** (192.168.0.10) will ping **Server B** (172.16.0.1).

To view the Transport analyser trace browse to **Management - Analyser > Trace**.

Items of particular interest have been highlighted in red in the decoded IP packets.

The Transport router receives an ICMP PING (echo request) on interface Eth 0 from Server B (172.16.0.10) to be routed via the VPN tunnel to Computer A (192.168.0.10).

```
-----   11-7-2011  10:42:10.600   ------
   45 00 00 26 00 06 00 00 F9 01 55 0D AC 10 00 0A     E.......ù.U.....
   C0 A8 00 01 08 00 39 7B 18 F8 00 06 01 78 00 00     ......9..ø...x..
   00 01 58 01 4C 0C 00 00 00 00 00 00 00 00 00 00     ..X.L...........
   00 00                                               ..

   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 26          Length:        38
   00 06          ID:            6
   00 00          Frag Offset:   0
                  Congestion:    Normal
                                 May Fragment
                                 Last Fragment
   F9             TTL:           249
   01             Proto:         ICMP
   55 0D          Checksum:      21773
   AC 10 00 0A    Src IP:        172.16.0.10
   C0 A8 00 01    Dst IP:        192.168.0.10
   ICMP:
   08             Type:          ECHO REQ
   00             Code:          0
   39 7B          Checksum:      31545
   ----------
```

The PING is passed to the Eth 3 interface for routing over the WAN connection.

```
-----   11-7-2011  10:42:10.600   ------
45 00 00 26 00 06 00 00 F8 01 56 0D AC 10 00 0A     E.......ø.V.....
C0 A8 00 01 08 00 39 7B 18 F8 00 06 01 78 00 00     ......9..ø...x..
00 01 58 01 4C 0C                                   ..X.L.

ER 0-Cisco.scepomatic5000.com From LOC TO REMIFACE: ETH 3
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
```

```
00 26          Length:        38
00 06          ID:            6
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
F8             TTL:           248
01             Proto:         ICMP
56 0D          Checksum:      22029
AC 10 00 0A    Src IP:        172.16.0.10
C0 A8 00 01    Dst IP:        192.168.0.10
ICMP:
08             Type:          ECHO REQ
00             Code:          0
39 7B          Checksum:      31545
----------
```

The PING is then encapsulated in an ESP Packet.

Note: the source IP addresses is now that of the WAN interface of Transport router (10.1.65.10) and the destination IP address is that of the WAN Interface of the Cisco® Router (10.1.65.12).

```
-----   11-7-2011  10:42:10.600   ------
45 00 00 68 00 12 00 00 FA 32 2A 3A 0A 01 41 0A     E..h.....2....A.
0A 01 41 0C 21 96 68 93 00 00 00 06 05 A8 BC 5C     ..A..-h".........
B8 EB C9 48 17 C0 05 1A E8 77 CC C2 CA 1D 13 4D     .ë.H....èw.....M
90 5A 3E BA 13 8E 9F A4 44 FA F5 FD 26 C3 99 8A     �Z...Ž..D..ý..™Š
AB 00 ED 5E 49 38 36 F0 BD 56 3D 33 2E 60 69 3D     ..í.I86..V.3..i.
7E 4D 64 05 51 89 0C F9 78 1F 1C C3 FB 82 40 26     .Md.Q‰.ùx...û...
7E 8E DB CE F6 9C 13 60                             .ŽÛÎöœ..

IP (Final) From LOC TO REM    IFACE: ETH 3
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 68          Length:        104
00 12          ID:            18
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
```

```
FA              TTL:            250
32              Proto:          ESP
2A 3A           Checksum:       10810
0A 01 41 0A     Src IP:         10.1.65.10
0A 01 41 0C     Dst IP:         10.1.65.12
----------
```

The Transport router receives an ESP packet on the WAN interface (ETH 3) from the Cisco® router (10.1.65.12). The ESP packet contains the Ping (echo) reply from Computer A.

```
-----   11-7-2011  10:42:10.610   ------
45 00 00 68 00 18 00 00 FF 32 25 34 0A 01 41 0C     E..h.....2.4..A.
0A 01 41 0A BC 50 78 58 00 00 00 06 A4 B1 1E B0     ..A..PxX.....±.°
A6 74 13 08 C1 F8 F2 87 DC F2 DC 2E 16 4C 75 0A     .t...øò‡ÜòÜ..Lu.
C3 41 D4 18 D2 40 FE D2 12 20 56 95 87 7C F0 E5     .AÔ.Ò.þÒ..V•‡..å
EC C7 D8 E2 52 93 8C 83 D8 ED 59 39 7C B8 C1 EC     ..ØâR“ŒƒØíY9....
4C E2 4B 5A 4F CC 9E 14 9F F3 AC A8 A2 C3 FB D0     LâKZO.ž..ó....ûÐ
80 73 90 8E 94 F5 E1 06                             €s�Ž”.á.

IP (In) From REM TO LOC       IFACE: ETH 3
45             IP Ver:        4
               Hdr Len:       20
00             TOS:           Routine
               Delay:         Normal
               Throughput:    Normal
               Reliability:   Normal
00 68          Length:        104
00 18          ID:            24
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
FF             TTL:           255
32             Proto:         ESP
25 34          Checksum:      9524
0A 01 41 0C    Src IP:        10.1.65.12
0A 01 41 0A    Dst IP:        10.1.65.10
----------
```

The Transport router decrypts the ESP packet, this is now visible as an echo reply packet destined for the server on ETH 0.

NOTE: The source IP address is now that of Computer A (192.168.0.10) and the destination IP address is that of Server B (172.16.0.10). At this point the packet is still seen as an incoming packet on the WAN interface.

```
-----   11-7-2011  10:42:10.610   ------
45 00 00 26 00 08 00 00 F9 01 55 0B C0 A8 00 01     E.......ù.U.....
AC 10 00 0A 00 00 41 7B 18 F8 00 06 01 78 00 00     ......A..ø...x..
00 01 58 01 4C 0C                                   ..X.L.
```

```
IP (Cont) From REM TO LOC     IFACE: ETH 3
45              IP Ver:         4
                Hdr Len:        20
00              TOS:            Routine
                Delay:          Normal
                Throughput:     Normal
                Reliability:    Normal
00 26           Length:         38
00 08           ID:             8
00 00           Frag Offset:    0
                Congestion:     Normal
                                May Fragment
                                Last Fragment
F9              TTL:            249
01              Proto:          ICMP
55 0B           Checksum:       21771
C0 A8 00 01     Src IP:         192.168.0.10
AC 10 00 0A     Dst IP:         172.16.0.10
ICMP:
00              Type:           ECHO REPLY
00              Code:           0
41 7B           Checksum:       31553
----------
```

The PING REPLY is routed out of interface Ethernet 0 to Server B (172.16.0.10).

```
-----   11-7-2011   10:42:10.610   ------
45 00 00 26 00 08 00 00 F8 01 56 0B C0 A8 00 01     E.......ø.V.....
AC 10 00 0A 00 00 41 7B 18 F8 00 06 01 78 00 00     ......A..ø...x..
00 01 58 01 4C 0C                                   ..X.L.

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 26          Length:        38
00 08          ID:            8
00 00          Frag Offset:   0
               Congestion:    Normal
                              May Fragment
                              Last Fragment
F8             TTL:           248
01             Proto:         ICMP
56 0B          Checksum:      22027
C0 A8 00 01    Src IP:        192.168.0.10
AC 10 00 0A    Dst IP:        172.16.0.10
ICMP:
00             Type:          ECHO REPLY
00             Code:          0
41 7B          Checksum:      31553
----------
```

10 TROUBLSHOOTING VPN NEGOTIATIONS

If problems are encountered while configuring the VPN it is possible to collect debug from both devices in order to determine the cause of the VPN negotiation failure. Usually when debugging VPN issues the device acting as the responder for the negotiation will be the device that provides the most useful debug.

10.1 Debugging the Transport router

10.1.1 Check the event log

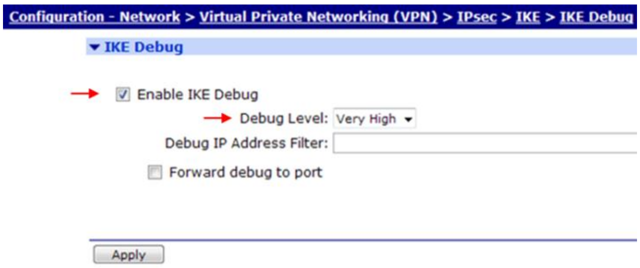
The first stage in tracing a problem with a VPN is to check the event log. The information stated in this is valuable in providing insight as to what to check initially. If in the event log there are no messages that

10.1.2 Collect the IKE/IPsec debug

Initially we need to enable the IKE entity to collect the debug information.

Browse to **Configuration - Network > Virtual Private Networking (VPN) > IPsec > IKE > IKE Debug**

Tick the 'Enable IKE Debug' option and select the level of debug to be collected. Click Apply.



Configuration - Network > Virtual Private Networking (VPN) > IPsec > IKE > IKE Debug

▾ IKE Debug

☑ Enable IKE Debug

Debug Level: Very High

Debug IP Address Filter:

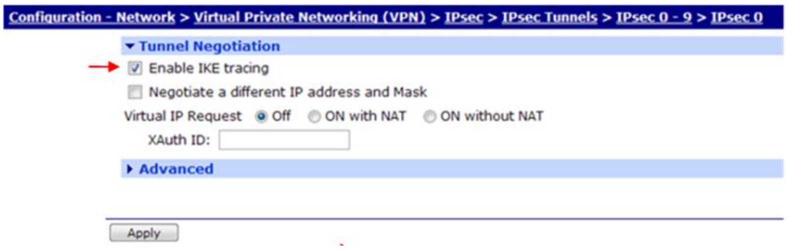
□ Forward debug to port

Parameter	Setting	Description
Enable IKE Debug	checked	Enable the IKE debug
Debug Level	Very High	Sets the level of detail of information

The option to add a 'Debug IP Address Filter' is not going to be used in this instance as we only have a single tunnel configured. This free text field can be used to filter in/out specific IP addresses to make reading easier. The use of this field is similar to the other filters that found in the main analyser trace. See Reference Manual for more detail.

Next browse to **Configuration - Network > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec 0 - 9 > IPsec 0**

In the tunnel negotiation drop down list tick the 'Enable IKE tracing' box. Click Apply.



Configuration - Network > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec 0 - 9 > IPsec 0

▾ Tunnel Negotiation

☑ Enable IKE tracing

□ Negotiate a different IP address and Mask

Virtual IP Request ● Off ○ ON with NAT ○ ON without NAT

XAuth ID:

▸ Advanced

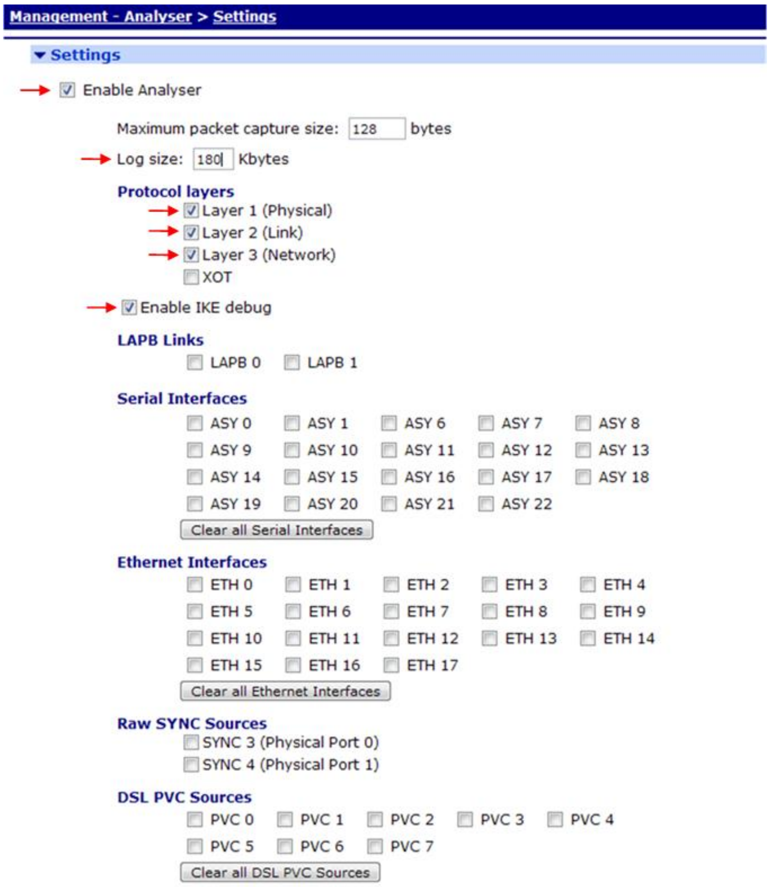
Parameter	Setting	Description

Enable IKE tracing	checked	Enable the IPsec debug

Now need to configure the analyser to collect the debugging information. When doing this it is also useful to configure the analyser to trace IKE/NAT-T packets that are being sent and received, not only does this help break the IKE debug in easier to read segments it can also highlight issues, or instance if only outbound packets are observed in a trace this would indicate that the remote device is not reachable or responding.

Browse to **Management - Analyser > Settings**

Ensure that the highlighted options are selected and that all other ticked boxes are **un-ticked**. Click Apply.



Management - Analyser > Settings

▾ Settings

☑ Enable Analyser

Maximum packet capture size: 128 bytes

Log size: 180 Kbytes

Protocol layers

☑ Layer 1 (Physical)

☑ Layer 2 (Link)

☑ Layer 3 (Network)

□ XOT

☑ Enable IKE debug

LAPB Links

□ LAPB 0 □ LAPB 1

Serial Interfaces

□ ASY 0 □ ASY 1 □ ASY 6 □ ASY 7 □ ASY 8

□ ASY 9 □ ASY 10 □ ASY 11 □ ASY 12 □ ASY 13

□ ASY 14 □ ASY 15 □ ASY 16 □ ASY 17 □ ASY 18

□ ASY 19 □ ASY 20 □ ASY 21 □ ASY 22

Clear all Serial Interfaces

Ethernet Interfaces

□ ETH 0 □ ETH 1 □ ETH 2 □ ETH 3 □ ETH 4

□ ETH 5 □ ETH 6 □ ETH 7 □ ETH 8 □ ETH 9

□ ETH 10 □ ETH 11 □ ETH 12 □ ETH 13 □ ETH 14

□ ETH 15 □ ETH 16 □ ETH 17

Clear all Ethernet Interfaces

Raw SYNC Sources

□ SYNC 3 (Physical Port 0)

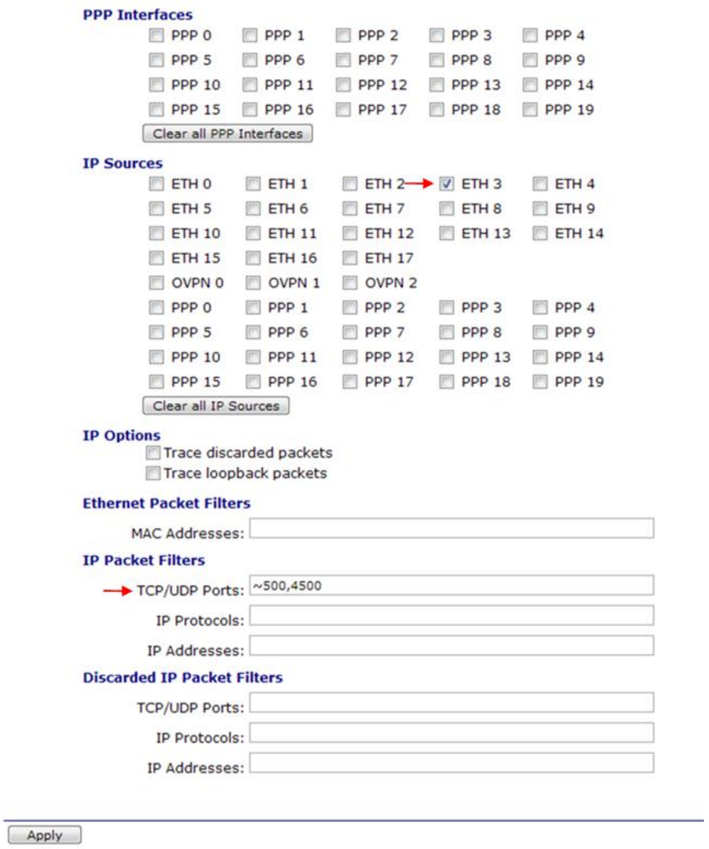
□ SYNC 4 (Physical Port 1)

DSL PVC Sources

□ PVC 0 □ PVC 1 □ PVC 2 □ PVC 3 □ PVC 4

□ PVC 5 □ PVC 6 □ PVC 7

Clear all DSL PVC Sources



PPP Interfaces

□ PPP 0 □ PPP 1 □ PPP 2 □ PPP 3 □ PPP 4
□ PPP 5 □ PPP 6 □ PPP 7 □ PPP 8 □ PPP 9
□ PPP 10 □ PPP 11 □ PPP 12 □ PPP 13 □ PPP 14
□ PPP 15 □ PPP 16 □ PPP 17 □ PPP 18 □ PPP 19

Clear all PPP Interfaces

IP Sources

□ ETH 0 □ ETH 1 □ ETH 2 ☑ ETH 3 □ ETH 4
□ ETH 5 □ ETH 6 □ ETH 7 □ ETH 8 □ ETH 9
□ ETH 10 □ ETH 11 □ ETH 12 □ ETH 13 □ ETH 14
□ ETH 15 □ ETH 16 □ ETH 17
□ OVPN 0 □ OVPN 1 □ OVPN 2
□ PPP 0 □ PPP 1 □ PPP 2 □ PPP 3 □ PPP 4
□ PPP 5 □ PPP 6 □ PPP 7 □ PPP 8 □ PPP 9
□ PPP 10 □ PPP 11 □ PPP 12 □ PPP 13 □ PPP 14
□ PPP 15 □ PPP 16 □ PPP 17 □ PPP 18 □ PPP 19

Clear all IP Sources

IP Options

□ Trace discarded packets
□ Trace loopback packets

Ethernet Packet Filters

MAC Addresses:

IP Packet Filters

TCP/UDP Ports: ~500,4500
IP Protocols:
IP Addresses:

Discarded IP Packet Filters

TCP/UDP Ports:
IP Protocols:
IP Addresses:

Apply

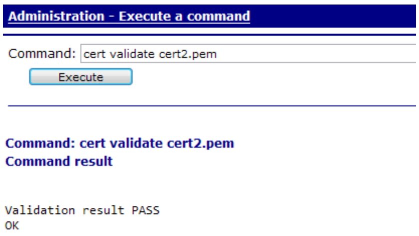
Parameter	Setting	Description
Enable Analyser	Ticked	Enables the Analyser
Log size	180	Set the file size of the analyser trace (180 is the maximum)
Protocol Layer – Layer 1	Ticked	Enables tracing on layer 1
Protocol Layer – Layer 2	Ticked	Enables tracing on layer 2
Protocol Layer – Layer 3	Ticked	Enables tracing on layer 3
Enable IKE Debug	Ticked	Collects the generated IKE/IPsec debug information
IP source – Eth 3	Ticked	Traces the IP source of the Ethernet 3 interface*
IP Packet filters –TCP/UDP ports	~500,4500	Include packets with a source or destination port number of either 500 or 4500**

* Ethernet 3 is being traced in this instance as it is being used as the WAN interface that is being used for the VPN negotiation. If using a different interface, ensure that the trace is set to the correct IP source. Additionally it is a common error when using the analyser to trace a PPP interface that the PPP source is traced accidentally.

** The tilde character '~' instructs the analyser to include the values that follow. When using this character it means that any port number **not** listed is excluded from the analyser trace. Port 500 is IKE traffic, port 4500 is used for NAT-T traffic.

Reading the analyser trace

Validate certificates



Command: cert validate cert2.pem

Command: cert validate cert2.pem
Command result

```
Validation result PASS
OK
```

Cert Validate <filename>

11 CONFIGURATION FILES

11.1 Transport Configuration

This is the configuration file from the Transport router used in this application note.

```
eth 0 descr "LAN 0"
eth 0 IPaddr "172.16.0.254"
eth 0 mask "255.255.0.0"
eth 0 ipanon ON
eth 1 descr "LAN 1"
eth 2 descr "LAN 2"
eth 3 descr "LAN 3"
eth 3 IPaddr "10.1.65.10"
eth 3 mask "255.255.0.0"
eth 3 DNSserver "10.1.255.254"
eth 3 gateway "10.1.255.254"
eth 3 ipsec 1
eth 3 ipanon ON
eth 4 descr "ATM PVC 0"
eth 4 do_nat 2
eth 5 descr "ATM PVC 1"
eth 5 do_nat 2
eth 6 descr "ATM PVC 2"
eth 6 do_nat 2
eth 7 descr "ATM PVC 3"
eth 7 do_nat 2
eth 8 descr "ATM PVC 4"
eth 8 do_nat 2
eth 9 descr "ATM PVC 5"
eth 9 do_nat 2
eth 10 descr "ATM PVC 6"
eth 10 do_nat 2
eth 11 descr "ATM PVC 7"
eth 11 do_nat 2
eth 12 descr "Logical"
eth 13 descr "Logical"
eth 14 descr "Logical"
eth 15 descr "Logical"
eth 16 descr "Logical"
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 "eth"
def_route 0 ll_add 3
eroute 0 descr "Tunnel to Cisco"
eroute 0 peerid "Cisco.scepomatic5000.com"
eroute 0 ourid "DR_Router"
eroute 0 locip "172.16.0.0"
eroute 0 locmsk "255.255.0.0"
eroute 0 remip "192.168.0.0"
eroute 0 remmsk "255.255.255.0"
eroute 0 ESPauth "SHA1"
eroute 0 ESPenc "AES"
eroute 0 authmeth "RSA"
eroute 0 dhgroup 2
eroute 0 enckeybits 128
eroute 0 debug ON
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"
ppp 0 timeout 300
ppp 1 name "ADSL"
ppp 1 l1iface "AAL"
ppp 1 username "Enter ADSL Username"
ppp 1 IPaddr "0.0.0.0"
ppp 1 timeout 0
ppp 1 immoos ON
ppp 1 echo 10
ppp 1 echodropcnt 5
ppp 3 defpak 16
ppp 4 defpak 16
ike 0 ltime 86400
ike 0 initialcontact OFF
ike 0 privrsakey "privkey.pem"
ike 0 deblevel 4
ana 0 anon ON
ana 0 l1on ON
ana 0 lapdon 0
ana 0 lapbon 0
ana 0 ipfilt "~500,4500"
ana 0 ikeon ON
ana 0 logsize 45
cmd 0 unitid "ss%s>"
cmd 0 cmdnua "99"
cmd 0 hostname "DR_Router"
cmd 0 tremto 1200
cmd 0 web_suffix ".wb2"
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
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 challenge_pwd "318308B716A1892B"
creq 0 country "UK"
creq 0 commonname "DR_Router"
creq 0 locality "Ilkley"
creq 0 orgname "Digi International"
creq 0 org_unit "Support"
creq 0 state "West Yorkshire"
creq 0 email "uksupport@digi.com"
creq 0 digest "MD5"
scep 0 host "10.1.65.200"
scep 0 path "certsrv/mscep/mscep.dll"
scep 0 caident "SCEPOTRON-CA"
scep 0 keyfile "privkey.pem"
scep 0 reqfile "creq.tmp"
scep 0 cafile "ca0.pem"
scep 0 caencfile "cert1.pem"
scep 0 casigfile "cert0.pem"
```

11.2 Cisco® Configuration

This is the configuration file from the Cisco® client VPN initiator used in this application note.

```
Cisco#show run
Building configuration...

Current configuration : 5741 bytes
!
! No configuration change since last restart
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Cisco
!
logging queue-limit 100
!
memory-size iomem 15
ip subnet-zero
!
!
ip domain name scepomatic5000.com
ip name-server 10.1.65.1
!
!
!
crypto ca trustpoint 10.1.65.200
 enrollment mode ra
 enrollment url http://10.1.65.200:80/certsrv/mscep/mscep.dll
 crl optional
!
crypto ca certificate chain 10.1.65.200
 certificate 6120A901000000000008
  30820404 308202EC A0030201 02020A61 20A90100 00000000 08300D06 092A8648
  86F70D01 01050500 30173115 30130603 55040313 0C534345 504F5452 4F4E2D43
  41301E17 0D313130 37303631 31303232 335A170D 31323037 30363131 31323233
  5A302931 27302506 092A8648 86F70D01 09021318 43697363 6F2E7363 65706F6D
  61746963 35303030 2E636F6D 30819F30 0D06092A 864886F7 0D010101 05000381
  8D003081 89028181 00A65BE4 E63ABC86 FE941136 11BA199E 83A42489 CA1F4BA4
  46AD07EB 65658052 5EAD4212 AE700126 BB8D7F4A 3D708CA7 80F38A70 A3679F02
  E0AC75F2 375D4235 35D4D53D 12D90BAE 01484C8D 7F73676E 37564852 96EC3A93
  470648DB 5D8D54AF CA7053CE A1122040 35F68692 28E9827D 57BAB9B5 77D58CCB
  F69F366F 9540C9B7 45020301 0001A382 01C23082 01BE300B 0603551D 0F040403
  0205A030 1D060355 1D0E0416 0414615A DF4FDD4A 6B3CC32F DD343487 1FB44544
  D2A2301F 0603551D 23041830 16801468 3E05FC70 2A129028 333F6669 355DF00B
  EBB2D330 6B060355 1D1F0464 30623060 A05EA05C 862C6874 74703A2F 2F736365
  706F7472 6F6E2F43 65727445 6E726F6C 6C2F5343 45504F54 524F4E2D 43412E63
  726C862C 66696C65 3A2F2F53 4345506F 74726F6E 2F436572 74456E72 6F6C6C2F
  53434550 4F54524F 4E2D4341 2E63726C 30819806 082B0601 05050701 0104818B
  30818830 4206082B 06010505 07300286 36687474 703A2F2F 73636570 6F74726F
  6E2F4365 7274456E 726F6C6C 2F534345 506F7472 6F6E5F53 4345504F 54524F4E
  2D43412E 63727430 4206082B 06010505 07300286 3666696C 653A2F2F 53434550
  6F74726F 6E2F4365 7274456E 726F6C6C 2F534345 506F7472 6F6E5F53 4345504F
  54524F4E 2D43412E 63727430 26060355 1D110101 FF041C30 1A821843 6973636F
  2E736365 706F6D61 74696335 3030302E 636F6D30 3F06092B 06010401 82371402
  04321E30 00490050 00530045 00430049 006E0074 00650072 006D0065 00640069
  00610074 0065004F 00660066 006C0069 006E0065 300D0609 2A864886 F70D0101
  05050003 82010100 4F673F24 BCBC91C3 9EDD49A4 9E7A600C 14B5098F AB2A157B
  D46134B6 FB01B9CF 539F5780 86783339 0E11F966 B7588739 83614CDA B8B9306D
  150BC850 1FFB184B 9F7EC42D C961608E D82A935F B94C7EE2 DDCE84B6 94B91A06
  8575A9A7 E46FAFD5 CD689A41 0A0134CC ABEF1FFD 5E33976A DE24A830 F196D27E
  0097A112 77F5F81F B0ACD3DE 382A2D33 0B7E79FC 9CB3EAB2 EF70B769 489969D1
  1C0C04C7 B1EE0E11 8054F176 48D4267A B8B2C679 15A72661 D780C624 F1FB2B8A
  FF4FC2D9 F55414EE 87D32712 FFA46C04 B8BBFAE3 07717E64 692163F1 537C4E13
  E7E2ABC1 50410783 C081E926 00F5CFF6 BE3EC2FF 0FAB925E 2F67E925 87E912DE
  1E0B1822 C15A0B04
  quit
 certificate ca 67E5E20F8B7B799140B561AE0C4DA469
  30820309 308201F1 A0030201 02021067 E5E20F8B 7B799140 B561AE0C 4DA46930
  0D06092A 864886F7 0D010105 05003017 31153013 06035504 03130C53 4345504F
  54524F4E 2D434130 1E170D31 31303730 31313431 3434385A 170D3236 30373031
  31343234 33395A30 17311530 13060355 0403130C 53434550 4F54524F 4E2D4341
  30820122 300D0609 2A864886 F70D0101 01050003 82010F00 3082010A 02820101
  00A54564 99A2B9E8 3321B8A8 AD71AD40 6F880603 9E38A1A3 12F2329A 64EE944F
  00358A24 2806100B C783CF4C 6F0D318E 6DCA1682 36ECD7DF EED0B3AD FCE874A4
  BE13F143 6B10D242 6D73FC77 4BB9E75F CB2EF600 12E7AA60 61F03A7D 43CCAD0A
  8DA74881 6940FF95 82B6E6E5 0838BD42 213B1884 40279223 9887FF37 062BC840
  28469B0A F9489048 3576F120 25EEE57C 7F2F5DFC A1148C6B 70D948C6 636B35E8
  95DBED50 318BE4D5 90A3D256 9DEB5650 24DB09D3 AD9996C9 4FC9D5EA A6559442
  69389674 A724C46E 108410C7 E860655D 08C26D6E BAA169FF 689353E3 CE35ABB5
  9235A0F7 8199947A A23672B7 2E91FCA6 171677AB 165EFBCF F8FD7113 0FF5F0C7
  89020301 0001A351 304F300B 0603551D 0F040403 02018630 0F060355 1D130101
  FF040530 030101FF 301D0603 551D0E04 16041468 3E05FC70 2A129028 333F6669
  355DF00B EBB2D330 1006092B 06010401 82371501 04030201 00300D06 092A8648
  86F70D01 01050500 03820101 00370678 17862FCE 41EE9DD2 266066DD 0E71A07C
  EAB324E5 8DAAA87D 7F2460CF D2F685B4 DAB0DAE2 D65AA7E3 FDBA2139 6568324E
  8F2789FF A2D33DEE CF56D10F AE4373F6 5F3B2F79 3E22CCEE F76DDB0D 2D114877
  20356E77 DB1CD1E1 401994B3 C4D9E69A DD331B0B 8738C055 F6B133E4 AAFB7E86
  FE58D3DB 4072E736 91B53B22 B486F470 CFD0E0A8 0492F220 7400FCFC 0A6870A5
  C9AA8FFE 8E59A553 9C190625 9B0D34BB A0C43FAF BD54ACF4 6D7C3BCE 908D1E68
  CEB20553 2019CD9B 700200DD A9B7A92C 2E703923 B2A4C55A 52859E5E A4D4B4BF
  56B6E47D 36863E3F E062B79D 0F619206 F3F21169 9907B118 C43F346E 50F76F54
  3B91AEF7 9B3E70A0 09613083 05
  quit
!
!
crypto isakmp policy 1
 encr aes
crypto isakmp identity hostname
crypto isakmp keepalive 120
!
crypto isakmp peer address 10.1.65.10
!
!
crypto ipsec transform-set transport-test esp-aes esp-sha-hmac
!
crypto map test-vpn 10 ipsec-isakmp
 set peer 10.1.65.10
 set security-association lifetime seconds 28800
 set transform-set transport-test
 match address 101
!
!
!
!
interface BRI0
 no ip address
 shutdown
!
interface Ethernet0
 ip address 10.1.65.12 255.255.0.0
 full-duplex
 crypto map test-vpn
!
interface FastEthernet0
 ip address 192.168.0.254 255.255.255.0
 speed 100
 full-duplex
!
ip default-gateway 10.1.255.254
ip classless
ip route 0.0.0.0 0.0.0.0 10.1.255.254
no ip http server
no ip http secure-server
!
!
!
ip access-list extended access-list
!
access-list 101 permit ip 192.168.0.0 0.0.0.255 172.16.0.0 0.0.255.255
!
!
line con 0
 speed 115200
line aux 0
line vty 0 4
 login
!
end

Cisco#
```

11.3 Transport Firmware Versions

This is the firmware \ hardware information from the Transport Router used in this application note

```
Ss81319>ati5
Digi TransPort DR64-00A2-DE2-XX(MkII) Ser#:81319 HW Revision:
Software Build Ver5131.  Jun 16 2011 02:25:03  9W
ARM Bios Ver 6.07 v35 197MHz B128-M128-F300-O8001,0 MAC:00042d013da7
Power Up Profile: 0
Async Driver              Revision: 1.19  Int clk
Ethernet Hub Driver       Revision: 1.11
Firewall                  Revision: 1.0
EventEdit                 Revision: 1.0
Timer Module              Revision: 1.1
AAL                       Revision: 1.0
ADSL                      Revision: 1.0
(B)USBHOST                Revision: 1.0
L2TP                      Revision: 1.10
PPTP                      Revision: 1.00
TACPLUS                   Revision: 1.00
MySQL                     Revision: 0.01
LAPB                      Revision: 1.12
X25 Layer                 Revision: 1.19
MACRO                     Revision: 1.0
PAD                       Revision: 1.4
X25 Switch                Revision: 1.7
V120                      Revision: 1.16
TPAD Interface            Revision: 1.12
SCRIBATSK                 Revision: 1.0
BASTSK                    Revision: 1.0
ARM Sync Driver           Revision: 1.18
TCP (HASH mode)           Revision: 1.14
TCP Utils                 Revision: 1.13
PPP                       Revision: 1.19
WEB                       Revision: 1.5
SMTP                      Revision: 1.1
FTP Client                Revision: 1.5
FTP                       Revision: 1.4
IKE                       Revision: 1.0
PollANS                   Revision: 1.2
PPPOE                     Revision: 1.0
BRIDGE                    Revision: 1.1
MODEM CC (NO MODULE)      Revision: 1.4
FLASH Write               Revision: 1.2
Command Interpreter       Revision: 1.38
SSLCLI                    Revision: 1.0
OSPF                      Revision: 1.0
BGP                       Revision: 1.0
QOS                       Revision: 1.0
RADIUS Client             Revision: 1.0
SSH Server                Revision: 1.0
SCP                       Revision: 1.0
CERT                      Revision: 1.0
LowPrio                   Revision: 1.0
Tunnel                    Revision: 1.2
OVPN                      Revision: 1.2
TEMPLOG                   Revision: 1.0
Wi-Fi                     Revision: 2.0
iDigi                     Revision: 2.0
OK
```

11.4 Cisco® Firmware Version

This is the firmware \ hardware information from the Cisco® client VPN initiator used in this application note

```
Cisco#show ver
Cisco Internetwork Operating System Software
IOS (tm) C1700 Software (C1700-K9SY7-M), Version 12.2(15)T,  RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Tue 11-Mar-03 13:48 by ccai
Image text-base: 0x80008120, data-base: 0x80F66160

ROM: System Bootstrap, Version 12.0(3)T, RELEASE SOFTWARE (fc1)

Cisco uptime is 3 hours, 19 minutes
System returned to ROM by power-on
System restarted at 11:27:47 UTC Sat Jul 9 2011
System image file is "flash:c1700-k9sy7-mz.122-15.T.bin"


This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

cisco 1720 (MPC860T) processor (revision 0x501) with 41780K/7372K bytes of memory.
Processor board ID JAD04120D5Y (4124128204), with hardware revision 0000
MPC860T processor: part number 0, mask 32
Bridging software.
X.25 software, Version 3.0.0.
Basic Rate ISDN software, Version 1.1.
1 Ethernet/IEEE 802.3 interface(s)
1 FastEthernet/IEEE 802.3 interface(s)
1 ISDN Basic Rate interface(s)
32K bytes of non-volatile configuration memory.
16384K bytes of processor board System flash (Read/Write)

Configuration register is 0x3922

Cisco#
```

12 ALTERNATE CONFIGURATION

Up to now this application note has discussed configuring the Transport router as a head end VPN server/responder and the Cisco® router as the Client VPN initiator.

With only a few amendments to the above configurations can configure the Transport to be the VPN initiator and the Cisco® to be the VPN responder. This is particularly useful to create an IPsec tunnel to a Cisco® using say, a Transport router that is using GPRS/EDGE/3G/HSDPA as the WAN interface where it is common that the router is issued with a dynamic IP address from the GPRS provider. In such a case the Cisco® has no way of knowing the WAN address of the remote unit and therefore is unable to initiate a VPN connection.

12.1 Cisco® Responder Configuration.

In addition to the configuration specified in this application note the creation if a dynamic map is needed. This allows the Cisco® to negotiate a VPN connection from an unknown dynamic IP address.

In global configuration mode, create a dynamic map named **test-dynmap** with a sequence number of **1**. The following command will put the router in **config-crypto-map** mode.

```
cisco(config)#crypto dynamic-map test-dynmap 1
```

The following command specifies which transform-set is to be associated with the crypto dynamic map. Specify that transform-set **transport-test** to be associated with this crypto dynamic map **test-dynmap**.

```
cisco(config-crypto-map)#set transform-set transport-test
```

The following command names the **extended access list** which is to be associated with this crypto dynamic map. The **access list** that specified will determine what traffic is to be passed through the IPsec tunnel.

```
cisco(config-crypto-map)#match address 101
```

Type "**exit**" to go back into global configuration mode.

```
cisco(config-crypto-map)#exit

cisco(config)#
```

Next create a new crypto map and associate the new dynamic map.

First remove the **crypto map** in the previous configuration by entering the same commands used to create it but proceed each command with the word **no**.

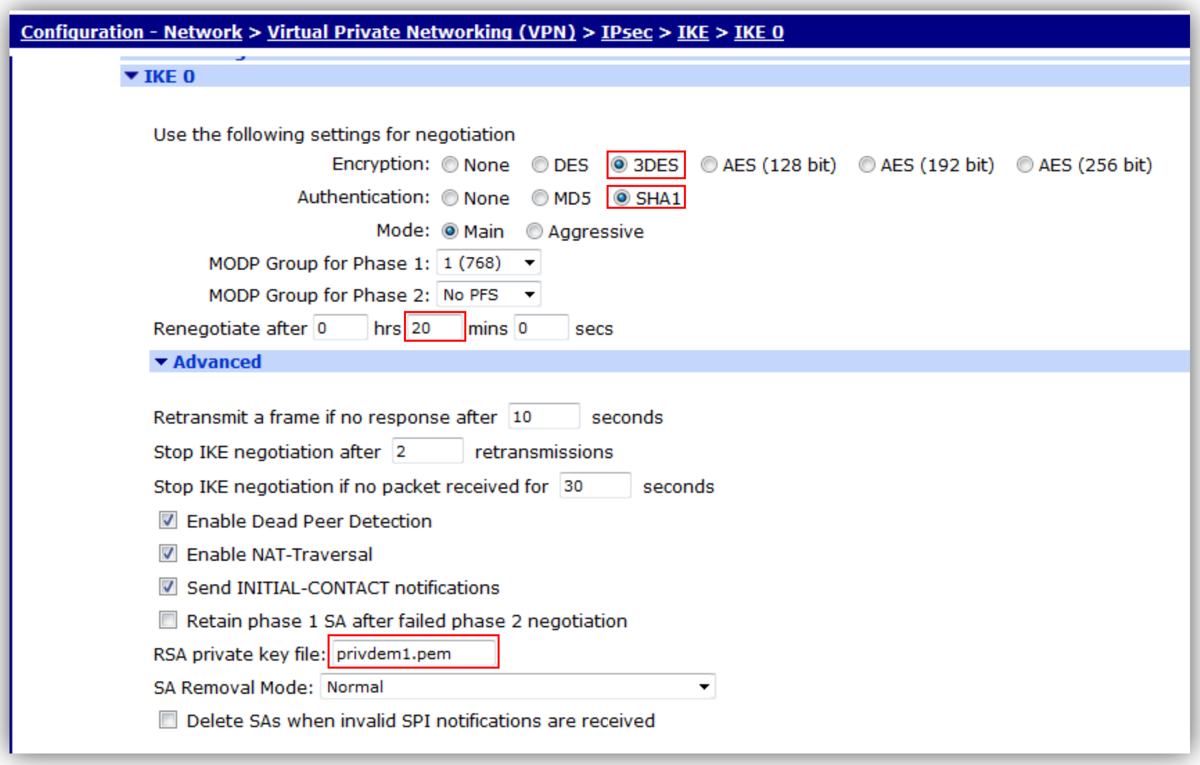
Create the new crypto map named **dynamic-vpn** and configure it to use the new dynamic map **transport-dynmap**.

```
cisco(config)#crypto map dynamic-vpn 20 ipsec-isakmp dynamic transport-
dynmap
```

12.2 Transport Initiator Configuration - IKE

Instead of configuring the IKE responder parameters as detailed in item 7.1 configure an IKE initiator session as follows;

Browse to **CONFIGURE → IPsec → IKE → IKE 0**



Configuration - Network > Virtual Private Networking (VPN) > IPsec > IKE > IKE 0

▼ IKE 0

Use the following settings for negotiation

Encryption: ○ None ○ DES ● 3DES ○ AES (128 bit) ○ AES (192 bit) ○ AES (256 bit)

Authentication: ○ None ○ MD5 ● SHA1

Mode: ● Main ○ Aggressive

MODP Group for Phase 1: 1 (768)

MODP Group for Phase 2: No PFS

Renegotiate after 0 hrs 20 mins 0 secs

▼ Advanced

Retransmit a frame if no response after 10 seconds

Stop IKE negotiation after 2 retransmissions

Stop IKE negotiation if no packet received for 30 seconds

☑ Enable Dead Peer Detection

☑ Enable NAT-Traversal

☑ Send INITIAL-CONTACT notifications

□ Retain phase 1 SA after failed phase 2 negotiation

RSA private key file: privdem1.pem

SA Removal Mode: Normal

□ Delete SAs when invalid SPI notifications are received

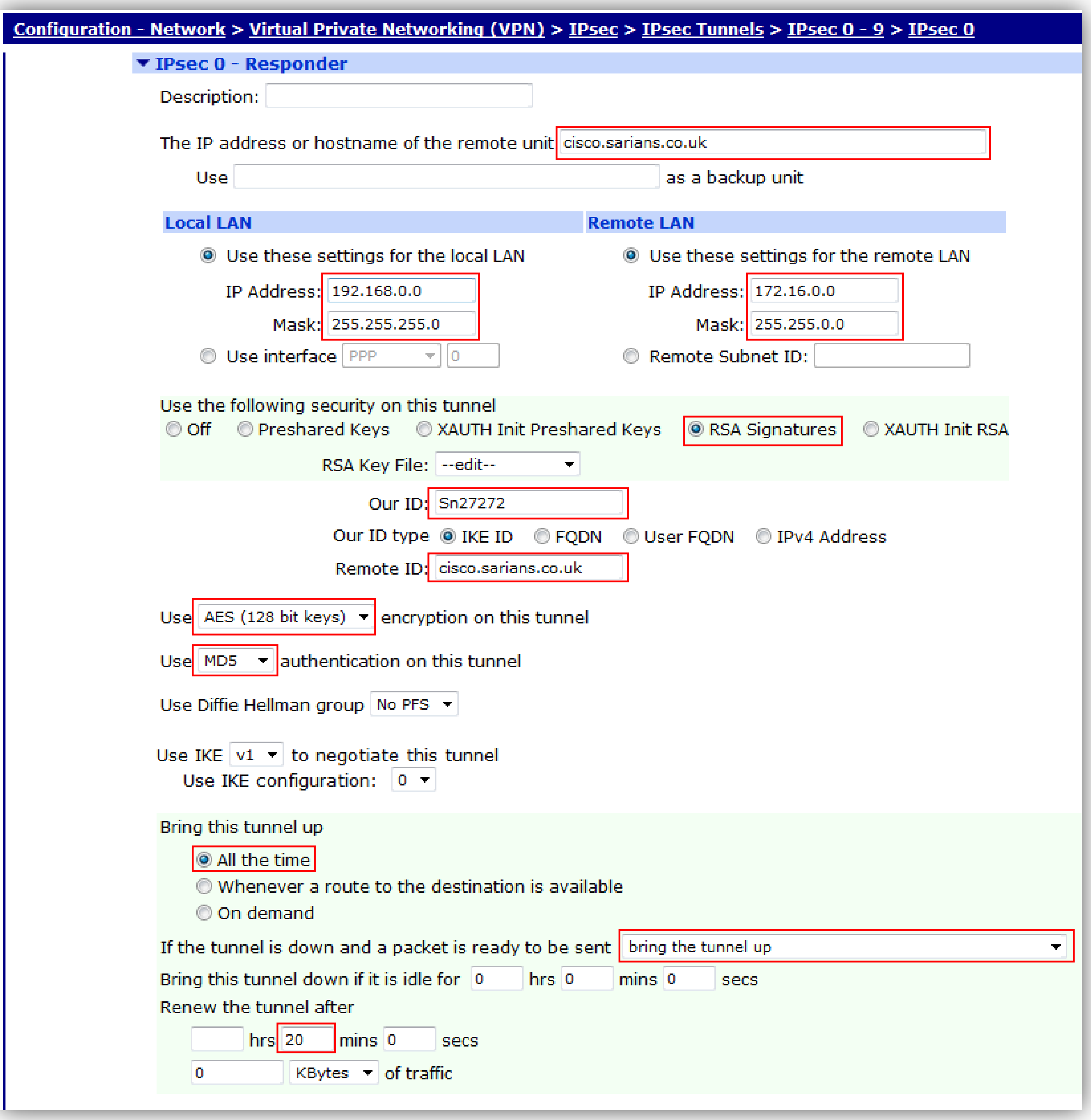
Parameter	Setting	Description
Encryption Algorithm:	3DES	Select 3DES for the IKE encryption algorithm *
Authentication algorithm:	MD5	Select MD5 for the IKE Authentication algorithm *
Duration (s):	1200	Enter 1200 seconds for the IKE lifetime **
NAT traversal enabled:	YES	Enable NAT traversal
RSA private key file:	privdem1.pem	Enter the name of the private key file

* The encryption/authentication algorithms must be within the threshold set by the Cisco® VPN server/responder.

** It is advisable to set the IKE duration set to the same or lesser value to that of the Cisco® VPN Server/responder.

12.3 Transport Initiator Configuration – IPsec

Browse to **CONFIGURE → IPsec → IPsec EROUTES → EROUTE 0**



Configuration - Network > Virtual Private Networking (VPN) > IPsec > IPsec Tunnels > IPsec 0 - 9 > IPsec 0

▼ IPsec 0 - Responder

Description:

The IP address or hostname of the remote unit: cisco.sarians.co.uk

Use as a backup unit

Local LAN

● Use these settings for the local LAN

IP Address: 192.168.0.0

Mask: 255.255.255.0

○ Use interface PPP 0

Remote LAN

● Use these settings for the remote LAN

IP Address: 172.16.0.0

Mask: 255.255.0.0

○ Remote Subnet ID:

Use the following security on this tunnel

○ Off ○ Preshared Keys ○ XAUTH Init Preshared Keys ● RSA Signatures ○ XAUTH Init RSA

RSA Key File: --edit--

Our ID: Sn27272

Our ID type ● IKE ID ○ FQDN ○ User FQDN ○ IPv4 Address

Remote ID: cisco.sarians.co.uk

Use AES (128 bit keys) encryption on this tunnel

Use MD5 authentication on this tunnel

Use Diffie Hellman group No PFS

Use IKE v1 to negotiate this tunnel

Use IKE configuration: 0

Bring this tunnel up

● All the time

○ Whenever a route to the destination is available

○ On demand

If the tunnel is down and a packet is ready to be sent bring the tunnel up

Bring this tunnel down if it is idle for 0 hrs 0 mins 0 secs

Renew the tunnel after

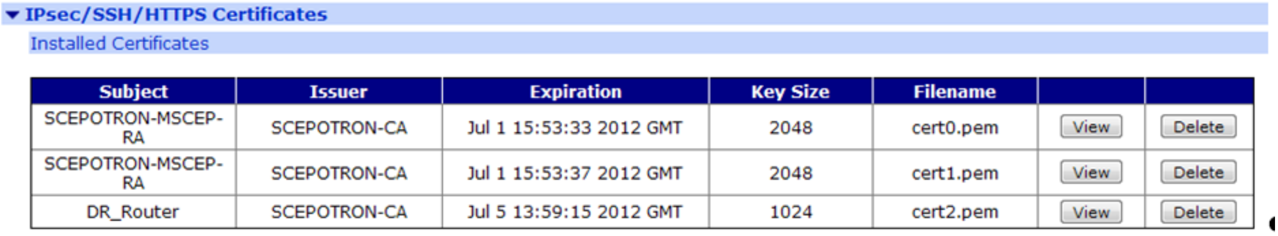
hrs 20 mins 0 secs

0 KBytes of traffic

Parameter	Setting	Description
Peer IP/hostname:	cisco.sarians.co.uk	Enter the Cisco® public IP address or fully qualified domain name
Peer ID:	cisco.sarians.co.uk	Enter the Cisco® fully qualified domain name
Our ID:	Sn27272	Common name specified in our public key *
Local subnet IP address:	192.168.0.0	Enter the local subnet IP address
Local subnet mask:	255.255.255.0	Enter the local subnet mask
Remote subnet IP address:	172.16.0.0	Enter the remote subnet IP address
Remote subnet mask:	255.255.0.0	Enter the remote subnet mask
ESP authentication algorithm:	MD5	Select MD5 as the authentication algorithm **
ESP encryption algorithm:	AES	Select AES as the encryption algorithm **
ESP encrypt key length (bits):	128	Set the ESP key length to 128 bits **
Duration (s):	1200	Enter 1200 seconds for the IPsec lifetime
No SA action	Use IKE	If no SA action then Use IKE
Create SAs automatically	Yes	Create Security Associations automatically
Authentication method:	RSA Signatures	Select RSA signatures for the authentication method

* To check the common name used in the public key

Browse to **Administration – X.509 certificate management > IPsec/SSH/HTTPS certificates**



▾ IPsec/SSH/HTTPS Certificates

Installed Certificates

Subject	Issuer	Expiration	Key Size	Filename		
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:33 2012 GMT	2048	cert0.pem	View	Delete
SCEPOTRON-MSCEP-RA	SCEPOTRON-CA	Jul 1 15:53:37 2012 GMT	2048	cert1.pem	View	Delete
DR_Router	SCEPOTRON-CA	Jul 5 13:59:15 2012 GMT	1024	cert2.pem	View	Delete

click **view**. This will open the certificate and see the entry in the **common name** field.

** The **authentication** and **encryption** algorithms must be within the threshold set by the Cisco VPN responder.

12.3.1 Identifying the CA certificates

To complete the previous task normally need to determine which certificate is used for what task. For the purpose of this application note these have already been determined but for future reference the following information will be useful

If only one CA certificate is returned, it is a trivial task. When three are returned, to display the certificates using the 'view' button having selected a CA certificate from the drop down list and investigate the attributes of the certificate.

Identifying the CA certificate:

This certificate will have matching Issuer and Subject fields. It may have a V3 extension which shows something like…

```
X509v3 Basic Constraints: critical
                CA: TRUE
```

Identifying the encryption certificate:

This certificate will have an Issuer which matches the CA certificate. It will probably have a V3 extension something like…

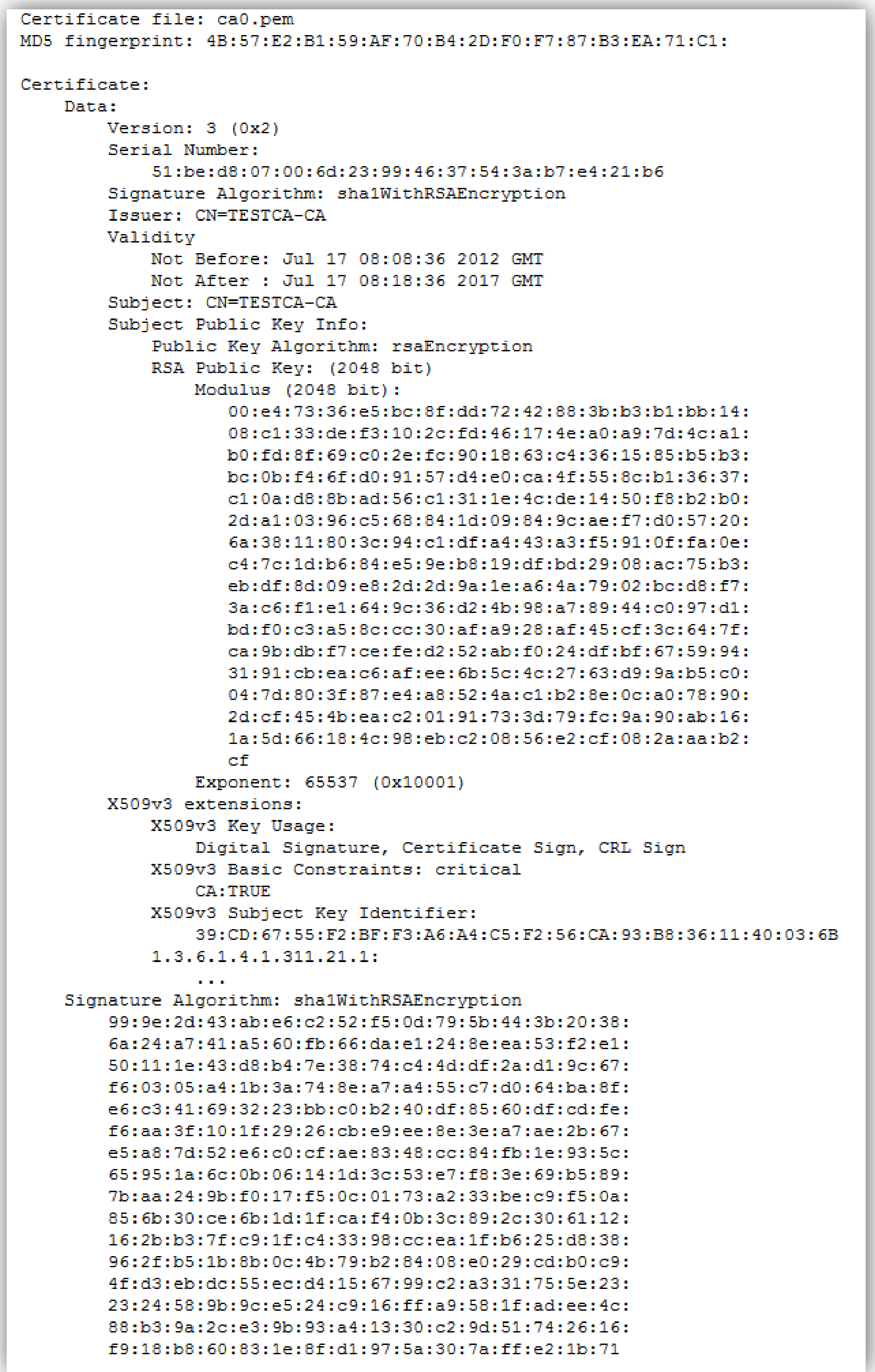
```
X509v3 Key Usage: critical
                Key Encipherment, Data Encipherment
```

Identifying the signature certificate:

This certificate will have an Issuer which matches the CA certificate. It will probably have a V3 extension something like…

```
X509v3 Key Usage: critical
                Digital Signature, Non Repudiation
```

Here is an example screen shot of the same page after clicking a 'view' button to determine which of the CA certificates is the encryption certificate.



```
Certificate file: ca0.pem
MD5 fingerprint: 4B:57:E2:B1:59:AF:70:B4:2D:F0:F7:87:B3:EA:71:C1:

Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            51:be:d8:07:00:6d:23:99:46:37:54:3a:b7:e4:21:b6
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: CN=TESTCA-CA
        Validity
            Not Before: Jul 17 08:08:36 2012 GMT
            Not After : Jul 17 08:18:36 2017 GMT
        Subject: CN=TESTCA-CA
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (2048 bit)
                Modulus (2048 bit):
                   00:e4:73:36:e5:bc:8f:dd:72:42:88:3b:b3:b1:bb:14:
                   08:c1:33:de:f3:10:2c:fd:46:17:4e:a0:a9:7d:4c:a1:
                   b0:fd:8f:69:c0:2e:fc:90:18:63:c4:36:15:85:b5:b3:
                   bc:0b:f4:6f:d0:91:57:d4:e0:ca:4f:55:8c:b1:36:37:
                   c1:0a:d8:8b:ad:56:c1:31:1e:4c:de:14:50:f8:b2:b0:
                   2d:a1:03:96:c5:68:84:1d:09:84:9c:ae:f7:d0:57:20:
                   6a:38:11:80:3c:94:c1:df:a4:43:a3:f5:91:0f:fa:0e:
                   c4:7c:1d:b6:84:e5:9e:b8:19:df:bd:29:08:ac:75:b3:
                   eb:df:8d:09:e8:2d:2d:9a:1e:a6:4a:79:02:bc:d8:f7:
                   3a:c6:f1:e1:64:9c:36:d2:4b:98:a7:89:44:c0:97:d1:
                   bd:f0:c3:a5:8c:cc:30:af:a9:28:af:45:cf:3c:64:7f:
                   ca:9b:db:f7:ce:fe:d2:52:ab:f0:24:df:bf:67:59:94:
                   31:91:cb:ea:c6:af:ee:6b:5c:4c:27:63:d9:9a:b5:c0:
                   04:7d:80:3f:87:e4:a8:52:4a:c1:b2:8e:0c:a0:78:90:
                   2d:cf:45:4b:ea:c2:01:91:73:3d:79:fc:9a:90:ab:16:
                   1a:5d:66:18:4c:98:eb:c2:08:56:e2:cf:08:2a:aa:b2:
                   cf
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            X509v3 Key Usage:
                Digital Signature, Certificate Sign, CRL Sign
            X509v3 Basic Constraints: critical
                CA:TRUE
            X509v3 Subject Key Identifier:
                39:CD:67:55:F2:BF:F3:A6:A4:C5:F2:56:CA:93:B8:36:11:40:03:6B
            1.3.6.1.4.1.311.21.1:
                ...
    Signature Algorithm: sha1WithRSAEncryption
        99:9e:2d:43:ab:e6:c2:52:f5:0d:79:5b:44:3b:20:38:
        6a:24:a7:41:a5:60:fb:66:da:e1:24:8e:ea:53:f2:e1:
        50:11:1e:43:d8:b4:7e:38:74:c4:4d:df:2a:d1:9c:67:
        f6:03:05:a4:1b:3a:74:8e:a7:a4:55:c7:d0:64:ba:8f:
        e6:c3:41:69:32:23:bb:c0:b2:40:df:85:60:df:cd:fe:
        f6:aa:3f:10:1f:29:26:cb:e9:ee:8e:3e:a7:ae:2b:67:
        e5:a8:7d:52:e6:c0:cf:ae:83:48:cc:84:fb:1e:93:5c:
        65:95:1a:6c:0b:06:14:1d:3c:53:e7:f8:3e:69:b5:89:
        7b:aa:24:9b:f0:17:f5:0c:01:73:a2:33:be:c9:f5:0a:
        85:6b:30:ce:6b:1d:1f:ca:f4:0b:3c:89:2c:30:61:12:
        16:2b:b3:7f:c9:1f:c4:33:98:cc:ea:1f:b6:25:d8:38:
        96:2f:b5:1b:8b:0c:4b:79:b2:84:08:e0:29:cd:b0:c9:
        4f:d3:eb:dc:55:ec:d4:15:67:99:c2:a3:31:75:5e:23:
        23:24:58:9b:9c:e5:24:c9:16:ff:a9:58:1f:ad:ee:4c:
        88:b3:9a:2c:e3:9b:93:a4:13:30:c2:9d:51:74:26:16:
        f9:18:b8:60:83:1e:8f:d1:97:5a:30:7a:ff:e2:1b:71
```

```
Cisco#show crypto isakmp sa

 f_vrf/i_vrf  dst          src          state      conn-id        slot

    /     10.1.65.10   10.1.65.12   QM_IDLE       1              0
```

```
Cisco#show crypto ipsec sa

interface: Ethernet0
    Crypto map tag: test-vpn, local addr. 10.1.65.12

   protected vrf:
   local  ident (addr/mask/prot/port): (192.168.0.0/255.255.255.0/0/0)
   remote ident (addr/mask/prot/port): (172.16.0.0/255.255.0.0/0/0)
   current_peer: 10.1.65.10:500
     PERMIT, flags={origin_is_acl,}
    #pkts encaps: 4, #pkts encrypt: 4, #pkts digest 4
    #pkts decaps: 4, #pkts decrypt: 4, #pkts verify 4
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 5, #recv errors 0

     local crypto endpt.: 10.1.65.12, remote crypto endpt.: 10.1.65.10
     path mtu 1500, media mtu 1500
     current outbound spi: BC507854

     inbound esp sas:
      spi: 0x23CFA195(600809877)
        transform: esp-aes esp-sha-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 2000, flow_id: 1, crypto map: test-vpn
        sa timing: remaining key lifetime (k/sec): (4596288/23208)
        IV size: 16 bytes
        replay detection support: Y

     inbound ah sas:

     inbound pcp sas:
```

```
   outbound esp sas:
    spi: 0xBC507854(3159390292)
      transform: esp-aes esp-sha-hmac ,
      in use settings ={Tunnel, }
      slot: 0, conn id: 2001, flow_id: 2, crypto map: test-vpn
      sa timing: remaining key lifetime (k/sec): (4596288/23208)
      IV size: 16 bytes
      replay detection support: Y

   outbound ah sas:

   outbound pcp sas:
```

```
Cisco#debug ip packet 101
IP packet debugging is on for access list 101
Cisco#
Jul  6 14:57:25.727: IP: s=192.168.0.1 (FastEthernet0), d=172.16.0.254 (Ethernet0), g=10.1.65.1, len 34, forward
```

Event log;

```
15:29:45, 12 Jul 2011,DTR Down ASY 0
15:29:37, 12 Jul 2011,DTR Up ASY 0
12:30:19, 12 Jul 2011,Eventlog Counters Reset
12:17:56, 12 Jul 2011,CMD 26 Error Result: basver
10:17:31, 12 Jul 2011,(2544) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
02:07:28, 12 Jul 2011,Eroute 0 VPN down peer: Cisco.scepomatic5000.com
02:07:28, 12 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Timed Out
18:17:34, 11 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Timed Out
18:07:31, 11 Jul 2011,(3003) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
18:07:28, 11 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
18:07:28, 11 Jul 2011,(3003) New Phase 2 IKE Session 10.1.65.12,Responder
12:30:19, 11 Jul 2011,Eventlog Counters Reset
11:56:44, 11 Jul 2011,Par change by dunno, eth 3 gateway to 10.1.255.254
11:56:44, 11 Jul 2011,Par change by dunno, eth 3 DNSserver to 10.1.255.254
11:56:44, 11 Jul 2011,Par change by dunno, eth 3 descr to WAN Interface
10:42:04, 11 Jul 2011,Par change by WEB 24, eth 3 ethanon to OFF
10:42:04, 11 Jul 2011,Par change by WEB 24, eth 0 ethanon to OFF
10:41:37, 11 Jul 2011,Par change by dunno, ana 0 ipfilt to 80
10:40:16, 11 Jul 2011,Par change by WEB 24, eth 3 ethanon to ON
10:40:16, 11 Jul 2011,Par change by WEB 24, eth 0 ethanon to ON
10:38:45, 11 Jul 2011,Par change by dunno, ana 0 ikeon to 0
10:38:44, 11 Jul 2011,Par change by dunno, ana 0 xoton to 0
10:38:44, 11 Jul 2011,Par change by dunno, ana 0 ipaddfilt to ~192.168.1.10,
172.16.0.10,10.1.65
```

```
10:38:44, 11 Jul 2011,Par change by dunno, ana 0 ipfilt to
10:32:41, 11 Jul 2011,DTR Down ASY 0
10:32:32, 11 Jul 2011,CMD 0 Error Result: ti5
10:32:30, 11 Jul 2011,CMD 0 Error Result: ti5
10:32:29, 11 Jul 2011,CMD 0 Error Result: Ti5
10:31:40, 11 Jul 2011,DTR Up ASY 0
10:17:06, 11 Jul 2011,(2545) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
10:17:03, 11 Jul 2011,Eroute 0 VPN up peer: Cisco.scepomatic5000.com
10:17:03, 11 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
10:17:03, 11 Jul 2011,(2545) New Phase 2 IKE Session 10.1.65.12,Responder
10:17:01, 11 Jul 2011,(2544) IKE Keys Negotiated. Peer:
10:17:00, 11 Jul 2011,(2544) New Phase 1 IKE Session 10.1.65.12,Responder
12:29:48, 10 Jul 2011,Eventlog Counters Reset
16:42:12, 09 Jul 2011,(1509) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
12:29:48, 09 Jul 2011,Eventlog Counters Reset
08:40:06, 09 Jul 2011,Eroute 0 VPN down peer: Cisco.scepomatic5000.com
08:40:06, 09 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Timed Out
00:42:15, 09 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Timed Out
00:40:09, 09 Jul 2011,(1977) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
00:40:07, 09 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
00:40:07, 09 Jul 2011,(1977) New Phase 2 IKE Session 10.1.65.12,Responder
16:42:18, 08 Jul 2011,(1510) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
16:42:15, 08 Jul 2011,Eroute 0 VPN up peer: Cisco.scepomatic5000.com
16:42:15, 08 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
16:42:15, 08 Jul 2011,(1510) New Phase 2 IKE Session 10.1.65.12,Responder
16:42:13, 08 Jul 2011,(1509) IKE Keys Negotiated. Peer:
16:42:13, 08 Jul 2011,(1509) New Phase 1 IKE Session 10.1.65.12,Responder
13:54:56, 08 Jul 2011,(321) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
12:29:48, 08 Jul 2011,Eventlog Counters Reset
05:31:41, 08 Jul 2011,Eroute 0 VPN down peer: Cisco.scepomatic5000.com
05:31:41, 08 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Timed Out
21:54:59, 07 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Timed Out
21:31:44, 07 Jul 2011,(769) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
21:31:41, 07 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
21:31:41, 07 Jul 2011,(769) New Phase 2 IKE Session 10.1.65.12,Responder
14:00:46, 07 Jul 2011,Par change by dunno, ike 0 initialcontact to Off
13:55:02, 07 Jul 2011,(323) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
13:54:59, 07 Jul 2011,Eroute 0 VPN up peer: Cisco.scepomatic5000.com
13:54:59, 07 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
13:54:59, 07 Jul 2011,(323) New Phase 2 IKE Session 10.1.65.12,Responder
13:54:58, 07 Jul 2011,(320) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
13:54:57, 07 Jul 2011,(321) IKE Keys Negotiated. Peer:
13:54:56, 07 Jul 2011,(321) New Phase 1 IKE Session 10.1.65.12,Responder
12:29:48, 07 Jul 2011,Eventlog Counters Reset
12:08:00, 07 Jul 2011,(320) IKE Keys Negotiated. Peer:
12:08:00, 07 Jul 2011,(320) New Phase 1 IKE Session 10.1.65.12,Responder
12:07:56, 07 Jul 2011,(317) IKE SA Removed. Peer: Cisco.scepomatic5000.com,WEB
12:06:22, 07 Jul 2011,(315) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
12:06:21, 07 Jul 2011,(317) IKE Keys Negotiated. Peer:
12:06:21, 07 Jul 2011,(317) New Phase 1 IKE Session 10.1.65.12,Responder
09:38:28, 07 Jul 2011,(313) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
09:38:27, 07 Jul 2011,(315) IKE Keys Negotiated. Peer:
09:38:27, 07 Jul 2011,(315) New Phase 1 IKE Session 10.1.65.12,Responder
09:37:05, 07 Jul 2011,(10) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
09:37:04, 07 Jul 2011,(313) IKE Keys Negotiated. Peer:
```

```
09:37:03, 07 Jul 2011,(313) New Phase 1 IKE Session 10.1.65.12,Responder
21:19:31, 06 Jul 2011,Eroute 0 VPN down peer: Cisco.scepomatic5000.com
21:19:31, 06 Jul 2011,IPSec SA Deleted ID Cisco.scepomatic5000.com,Dead Peer Detected
16:14:14, 06 Jul 2011,(12) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Successful
Negotiation
16:14:12, 06 Jul 2011,Eroute 0 VPN up peer: Cisco.scepomatic5000.com
16:14:12, 06 Jul 2011,New IPSec SA created by Cisco.scepomatic5000.com
16:14:12, 06 Jul 2011,(12) New Phase 2 IKE Session 10.1.65.12,Responder
16:14:10, 06 Jul 2011,(8) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
16:14:09, 06 Jul 2011,(10) IKE Keys Negotiated. Peer:
16:14:09, 06 Jul 2011,(10) New Phase 1 IKE Session 10.1.65.12,Responder
16:09:04, 06 Jul 2011,(6) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
16:09:02, 06 Jul 2011,(8) IKE Keys Negotiated. Peer:
16:09:02, 06 Jul 2011,(8) New Phase 1 IKE Session 10.1.65.12,Responder
16:07:16, 06 Jul 2011,Par change by dunno, ana 0 ipfilt to ~500,4500
16:06:58, 06 Jul 2011,Par change by dunno, ana 0 ipfilt to 80
16:06:40, 06 Jul 2011,(4) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
16:06:39, 06 Jul 2011,(6) IKE Keys Negotiated. Peer:
16:06:39, 06 Jul 2011,(6) New Phase 1 IKE Session 10.1.65.12,Responder
16:06:30, 06 Jul 2011,Par change by dunno, eroute 0 debug to On
16:06:09, 06 Jul 2011,Par change by dunno, ike 0 deblevel to 4
16:05:45, 06 Jul 2011,Par change by WEB 24, eth 3 ipanon to ON
16:05:45, 06 Jul 2011,Par change by WEB 24, eth 0 ipanon to ON
16:04:37, 06 Jul 2011,(2) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
16:04:36, 06 Jul 2011,(4) IKE Keys Negotiated. Peer:
16:04:36, 06 Jul 2011,(4) New Phase 1 IKE Session 10.1.65.12,Responder
15:57:53, 06 Jul 2011,(1) IKE SA Removed. Peer: Cisco.scepomatic5000.com,Duplicate SA
15:57:52, 06 Jul 2011,(2) IKE Keys Negotiated. Peer:
15:57:51, 06 Jul 2011,(2) New Phase 1 IKE Session 10.1.65.12,Responder
15:53:04, 06 Jul 2011,(1) IKE Keys Negotiated. Peer:
15:53:04, 06 Jul 2011,(1) New Phase 1 IKE Session 10.1.65.12,Responder
15:52:02, 06 Jul 2011,Par change by WEB 23, eth 3 ipsec to 1
15:48:15, 06 Jul 2011,Par change by dunno, ana 0 asyon to 0
15:48:15, 06 Jul 2011,Par change by dunno, ana 0 ikeon to 1
15:27:23, 06 Jul 2011,DTR Down ASY 0
13:22:46, 06 Jul 2011,Par change by dunno, eroute 0 remmsk to 255.255.255.0
13:22:46, 06 Jul 2011,Par change by dunno, eroute 0 remip to 192.168.0.0
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 enckeybits to 128
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 dhgroup to 2
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 authmeth to RSA
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 ESPenc to AES
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 ESPauth to SHA1
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 locmsk to 255.255.0.0
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 locip to 172.16.0.0
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 ourid to DR_Router
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 peerid to Cisco.scepomatic5000.com
13:22:26, 06 Jul 2011,Par change by dunno, eroute 0 peerip to
13:00:27, 06 Jul 2011,Par change by dunno, ike 0 ltime to 86400
12:58:13, 06 Jul 2011,GP socket connected: 10.1.65.10:1581 -> 10.1.65.200:80
12:58:13, 06 Jul 2011,TCP Req: 0.0.0.0:1581 -> 10.1.65.200:80
12:58:04, 06 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 318308B716A1892B
12:54:55, 06 Jul 2011,Par change by ASY 0, eth 0 gateway to !
12:54:39, 06 Jul 2011,Par change by ASY 0, eth 0 ipaddr to 172.16.0.254
12:53:46, 06 Jul 2011,DTR Up ASY 0
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 authmeth to Off
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 proto to Off
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 IPCOMPalg to Off
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 ESPauth to Off
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 AHauth to Off
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 mode to Tunnel
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 peerip to cisco.scepomatic5000.com
12:52:47, 06 Jul 2011,Par change by dunno, eroute 0 descr to Tunnel to Cisco
```

```
12:42:51, 06 Jul 2011,Par change by dunno, ike 0 privrsakey to privkey.pem
12:29:40, 06 Jul 2011,Eventlog Counters Reset
09:59:52, 06 Jul 2011,DTR Down ASY 0
09:59:44, 06 Jul 2011,DTR Up ASY 0
09:54:54, 06 Jul 2011,DTR Down ASY 0
09:48:48, 06 Jul 2011,GP socket connected: 10.1.65.10:4000 -> 10.1.3.14:49615
09:48:13, 06 Jul 2011,Par change by dunno, ana 0 lapbon to 0
09:47:46, 06 Jul 2011,DTR Up ASY 0
16:33:39, 05 Jul 2011,DTR Down ASY 0
16:33:34, 05 Jul 2011,CMD 0 Error Result: en
16:33:32, 05 Jul 2011,CMD 0 Error Result: ``````````````````en
16:32:54, 05 Jul 2011,DTR Up ASY 0
16:13:11, 05 Jul 2011,GP socket connected: 10.1.65.10:1580 -> 10.1.65.200:80
16:13:11, 05 Jul 2011,TCP Req: 0.0.0.0:1580 -> 10.1.65.200:80
16:13:02, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to E4315ED8D44C0A56
16:11:26, 05 Jul 2011,DTR Down ASY 0
15:59:51, 05 Jul 2011,GP socket connected: 10.1.65.10:1579 -> 10.1.65.200:80
15:59:51, 05 Jul 2011,TCP Req: 0.0.0.0:1579 -> 10.1.65.200:80
15:59:42, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 0AC0A21A821DE4DC
15:43:10, 05 Jul 2011,GP socket connected: 10.1.65.10:1578 -> 10.1.65.200:80
15:43:10, 05 Jul 2011,TCP Req: 0.0.0.0:1578 -> 10.1.65.200:80
15:42:47, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 9F5728C8AF0F2A93
15:36:05, 05 Jul 2011,GP socket connected: 10.1.65.10:1577 -> 10.1.65.200:80
15:36:05, 05 Jul 2011,TCP Req: 0.0.0.0:1577 -> 10.1.65.200:80
15:35:46, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to E3C87C5ADABE999A
15:32:13, 05 Jul 2011,GP socket connected: 10.1.65.10:1576 -> 10.1.65.200:80
15:32:13, 05 Jul 2011,TCP Req: 0.0.0.0:1576 -> 10.1.65.200:80
15:32:04, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to A9AB390322518CCC
15:30:49, 05 Jul 2011,GP socket connected: 10.1.65.10:1575 -> 10.1.65.200:80
15:30:49, 05 Jul 2011,TCP Req: 0.0.0.0:1575 -> 10.1.65.200:80
15:30:40, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 974A907253992A2B
15:30:16, 05 Jul 2011,GP socket connected: 10.1.65.10:1574 -> 10.1.65.200:80
15:30:16, 05 Jul 2011,TCP Req: 0.0.0.0:1574 -> 10.1.65.200:80
15:29:44, 05 Jul 2011,GP socket connected: 10.1.65.10:1573 -> 10.1.65.200:80
15:29:44, 05 Jul 2011,TCP Req: 0.0.0.0:1573 -> 10.1.65.200:80
15:29:35, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 04187E904D3B5FDF
15:28:59, 05 Jul 2011,GP socket connected: 10.1.65.10:1572 -> 10.1.65.200:80
15:28:59, 05 Jul 2011,TCP Req: 0.0.0.0:1572 -> 10.1.65.200:80
14:59:31, 05 Jul 2011,GP socket connected: 10.1.65.10:1571 -> 10.1.65.200:80
14:59:31, 05 Jul 2011,TCP Req: 0.0.0.0:1571 -> 10.1.65.200:80
14:58:48, 05 Jul 2011,GP socket connected: 10.1.65.10:1570 -> 10.1.65.200:80
14:58:48, 05 Jul 2011,TCP Req: 0.0.0.0:1570 -> 10.1.65.200:80
14:54:16, 05 Jul 2011,GP socket connected: 10.1.65.10:1569 -> 10.1.65.200:80
14:54:16, 05 Jul 2011,TCP Req: 0.0.0.0:1569 -> 10.1.65.200:80
14:54:07, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 5EC8FF0DFDFD13BA
14:53:08, 05 Jul 2011,GP socket connected: 10.1.65.10:1568 -> 10.1.65.200:80
14:53:08, 05 Jul 2011,TCP Req: 0.0.0.0:1568 -> 10.1.65.200:80
14:38:31, 05 Jul 2011,GP socket connected: 10.1.65.10:1567 -> 10.1.65.200:80
14:38:31, 05 Jul 2011,TCP Req: 0.0.0.0:1567 -> 10.1.65.200:80
14:38:22, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 97DBF7317A6F6D46
12:29:35, 05 Jul 2011,USB-2 device 1 connected: OHCI root hub
12:29:35, 05 Jul 2011,USB-1 device 1 connected: OHCI root hub
12:29:34, 05 Jul 2011,ETH 17 up
12:29:34, 05 Jul 2011,ETH 16 up
12:29:34, 05 Jul 2011,ETH 15 up
12:29:34, 05 Jul 2011,ETH 14 up
12:29:34, 05 Jul 2011,ETH 13 up
12:29:34, 05 Jul 2011,ETH 12 up
12:29:34, 05 Jul 2011,ETH 0 up
12:29:32, 05 Jul 2011,Power-up[],Reboot command
12:29:32, 05 Jul 2011,GPRS using SIM 1 (not present)
12:29:32, 05 Jul 2011,Eventlog Counters Reset
```

```
12:29:15, 05 Jul 2011,Reboot
12:27:08, 05 Jul 2011,Sustained high CPU usage,ike:81036B68,Q,M:0,IKE not running
12:26:47, 05 Jul 2011,Par change by WEB 24, def_route 0 ll_add to 3
12:26:27, 05 Jul 2011,Par change by dunno, eth 3 gateway to 10.1.2.100
12:26:27, 05 Jul 2011,Par change by dunno, eth 3 DNSserver to 10.1.2.100
12:26:27, 05 Jul 2011,Par change by dunno, eth 3 mask to 255.255.0.0
12:26:27, 05 Jul 2011,Par change by dunno, eth 3 IPaddr to 10.1.65.10
12:20:47, 05 Jul 2011,GP socket connected: 10.1.65.10:1566 -> 10.1.65.200:80
12:20:47, 05 Jul 2011,TCP Req: 0.0.0.0:1566 -> 10.1.65.200:80
12:20:22, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 11388563D6798BA9
12:19:23, 05 Jul 2011,GP socket connected: 10.1.65.10:1565 -> 10.1.65.200:80
12:19:23, 05 Jul 2011,TCP Req: 0.0.0.0:1565 -> 10.1.65.200:80
12:18:58, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 2D37A3E05BD080B8
12:16:51, 05 Jul 2011,GP socket connected: 10.1.65.10:1564 -> 10.1.65.200:80
12:16:51, 05 Jul 2011,TCP Req: 0.0.0.0:1564 -> 10.1.65.200:80
12:16:28, 05 Jul 2011,Par change by dunno, scep 0 casigfile to cert0.pem
12:16:28, 05 Jul 2011,Par change by dunno, scep 0 caencfile to cert1.pem
12:15:06, 05 Jul 2011,GP socket connected: 10.1.65.10:1563 -> 10.1.65.200:80
12:15:06, 05 Jul 2011,TCP Req: 0.0.0.0:1563 -> 10.1.65.200:80
12:14:58, 05 Jul 2011,Par change by dunno, scep 0 challenge_pwd to 36AFA50B5CEA12AC
12:14:58, 05 Jul 2011,Par change by dunno, scep 0 casigfile to
12:14:58, 05 Jul 2011,Par change by dunno, scep 0 caencfile to
12:01:22, 05 Jul 2011,USB-2 device 1 connected: OHCI root hub
12:01:21, 05 Jul 2011,USB-1 device 1 connected: OHCI root hub
12:01:21, 05 Jul 2011,ETH 17 up
12:01:21, 05 Jul 2011,ETH 16 up
12:01:21, 05 Jul 2011,ETH 15 up
12:01:21, 05 Jul 2011,ETH 14 up
12:01:21, 05 Jul 2011,ETH 13 up
12:01:21, 05 Jul 2011,ETH 12 up
12:01:21, 05 Jul 2011,ETH 0 up
12:01:20, 05 Jul 2011,Power-up[],Reboot command
12:01:20, 05 Jul 2011,GPRS using SIM 1 (not present)
12:01:20, 05 Jul 2011,Eventlog Counters Reset
12:00:57, 05 Jul 2011,Reboot
11:58:53, 05 Jul 2011,DTR Up ASY 0
08:49:38, 05 Jul 2011,DTR Down ASY 0
08:49:38, 05 Jul 2011,DTR Up ASY 0
08:49:37, 05 Jul 2011,DTR Down ASY 0
08:49:37, 05 Jul 2011,DTR Up ASY 0
08:49:37, 05 Jul 2011,DTR Down ASY 0
08:49:36, 05 Jul 2011,DTR Up ASY 0
08:49:36, 05 Jul 2011,DTR Down ASY 0
08:49:36, 05 Jul 2011,DTR Up ASY 0
08:49:35, 05 Jul 2011,DTR Down ASY 0
08:49:35, 05 Jul 2011,DTR Up ASY 0
08:49:35, 05 Jul 2011,DTR Down ASY 0
08:49:34, 05 Jul 2011,DTR Up ASY 0
08:49:34, 05 Jul 2011,DTR Down ASY 0
```