# Dynamic LAN−to−LAN VPN between Cisco IOS Routers Using IOS CA on the Hub Configuration Example

## Document ID: 81552

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## Introduction

This document provides a sample configuration for Dynamic LAN to LAN VPN between Cisco IOS® Routers that use digital certificates while utilizing the IOS Certificate Authority (CA) feature. This document demonstrates how to configure the IOS CA server along with configuring a Cisco IOS Router in order to obtain an identity certificate via automatic enrollment.

## Prerequisites

### Requirements

There are no specific requirements for this document.

### Components Used

The information in this document is based on these software and hardware versions:

- Cisco 2851 Router that runs Cisco IOS Software Release 12.4(6) T
- Cisco 871 Router that runs Cisco IOS Software Release 12.3(14)YT1

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

### Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

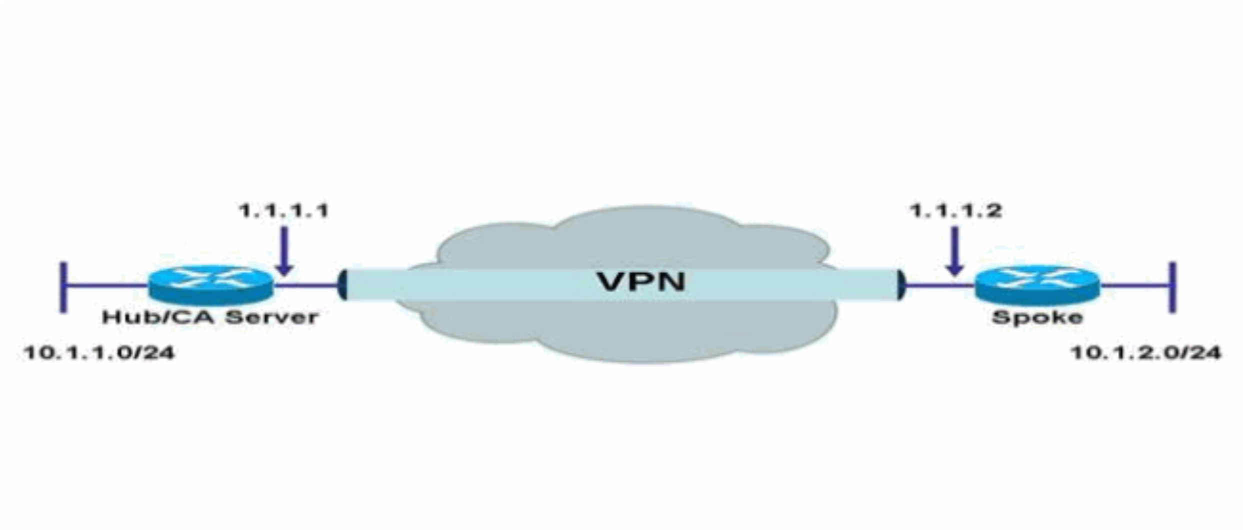
# Configure

In this section, you are presented with the information to configure the features described in this document.

**Note:** Use the Command Lookup Tool (registered customers only) to obtain more information on the commands used in this section.

## Network Diagram

This document uses this network setup:



## Configurations

This document uses these configurations:

- Configure IOS CA Server on the Router
- Authenticate and Enroll to an IOS CA Server
- Hub Configuration
- Spoke Configuration

### Configure IOS CA Server on the Router

Complete these steps in order to configure the IOS CA server on the router:

1. Issue the **crypto pki server** command in order to enter the parameters for the IOS CA server configuration.

   In this case, the label that is given to the IOS CA Server configuration is **cisco**. The label can be anything you would like.

   ```
   HubIOSCA(config)#crypto pki server cisco
   ```
2. Issue the **issuer−name** subcommand in order to define the certificate information.

   In this case, the common name (CN), locality (L), state (ST), and country code (C) are defined as shown here:

   ```
   HubIOSCA(cs-server)#issuer−name CN=iosca.cisco.com L=RTP ST=NC C=US
   ```

3. Issue the **grant** command.

   In this case, the IOS server automatically grants a certificate to the client.

   ```
   HubIOSCA(cs−server)#grant auto
   ```
4. Issue the **no shut** command in order to enable the IOS CA server.

   ```
   HubIOSCA(cs−server)#no shut
   ```

   After you enter this command, you are prompted to enter a passphrase to protect the private key.

   Some server settings cannot be changed after CA certificate generation. Enter a passphrase to protect the private key or enter **Return** to exit.

   ```
   Password:
   Re−enter password:
    Generating 1024 bit RSA keys, keys will be non−exportable...[OK]
    Exporting Certificate Server signing certificate and keys...
    Certificate Server enabled.
   ```

### Authenticate and Enroll to an IOS CA Server

The certificate server also has an automatically generated trustpoint of the same name. The trustpoint stores the certificate of the certificate server. After the router detects that a trustpoint is being used to store the certificate of the certificate server, the trustpoint locks so that it cannot be modified.

1. Before you configure the certificate server, you can issue the **crypto pki trustpoint** command in order to manually create and set up this trustpoint.

   This allows you to specify an alternative RSA key pair (using the **rsakeypair** command).

   **Note:** The automatically generated trustpoint and the certificate server certificate are not available for the certificate server device identity. Therefore, any command−line interface (CLI), such as the **ip http secure−trustpoint** command, that is used to specify the CA trustpoint to obtain certificates and authenticate the connecting certificate of the client must point to an additional trustpoint configured on the certificate server device.

   If the server is a root certificate server, it uses the RSA key pairs and several other attributes to generate a self−signed certificate. The associated CA certificate has these key usage extensions:

   - Digital Signature
   - Certificate Sign
   - Certificate Revocation List (CRL) Sign

   In this case, the HubIOSCA router is enrolled with a certificate using a different trustpoint in order to be able to establish a VPN tunnel with the spoke router. Define a trustpoint, as shown here (iosca is the name given to this new trustpoint):

   ```
   HubIOSCA(config)#crypto pki trustpoint iosca
   ```
2. Enter the enrollment URL, as shown here:

   ```
   HubIOSCA(ca−trustpoint)#enrollment url http://1.1.1.1:80
   ```

   In this case, a CRL revocation check is not done.

   ```
   HubIOSCA(ca−trustpoint)#revocation−check none
   ```
3. Issue the **crypto ca authenticate iosca** command in order to receive the root certificate.

```
HubIOSCA(config)#crypto ca authenticate iosca
```

The certificate has these attributes:

```
Fingerprint MD5: 441446A1 CA3C32B6 3B680204 452A00B2
      Fingerprint SHA1: 6C09E064 E4B09087 DDFFADCD 2E9C6853 1669BF39

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

4. Issue the **crypto ca enroll iosca** command in order to obtain the identity certificate.

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

Password:
Re−enter password:

   The subject name in the certificate includes: HubIOSCA.cisco.com
   Include the router serial number in the subject name? [yes/no]: no
   Include an IP address in the subject name? [no]: no
   Request certificate from CA? [yes/no]: yes
   Certificate request sent to Certificate Authority
   The show crypto ca certificate iosca verbose command shows the fingerprint.
```

5. Issue the **show crypto pki cert** command in order to verify that the certificates have been installed.

```
HubIOSCA#show crypto pki cert

Certificate
  Status: Available
  Certificate Serial Number: 02
  Certificate Usage: General Purpose
  Issuer:
    cn=iosca.cisco.com L\=RTP ST\=NC C\=US
  Subject:
    Name: HubIOSCA.cisco.com
    hostname=HubIOSCA.cisco.com
  Validity Date:
    start date: 19:11:55 UTC Aug 11 2006
    end   date: 19:11:55 UTC Aug 11 2007
  Associated Trustpoints: iosca

 CA Certificate
  Status: Available
  Certificate Serial Number: 01
  Certificate Usage: Signature
  Issuer:
    cn=iosca.cisco.com L\=RTP ST\=NC C\=US
  Subject:
    cn=iosca.cisco.com L\=RTP ST\=NC C\=US
  Validity Date:
    start date: 19:01:54 UTC Aug 11 2006
    end   date: 19:01:54 UTC Aug 10 2009
  Associated Trustpoints: iosca cisco
```

**Note:** Because the CA server is also an IPSec peer, the Hub router needs to authenticate and enroll to the CA server which is on the same router.

## Hub Configuration

**Hub Configuration**

```
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname HubIOSCA
!
boot-start-marker
boot-end-marker
!
logging buffered 4096 debugging
!
no aaa new-model
!
resource policy
!
ip cef
!
no ip domain lookup
ip domain name cisco.com
!
voice-card 0
 no dspfarm
!
! crypto pki server cisco
 issuer-name CN=iosca.cisco.com L=RTP ST=NC C=US
 grant auto
! crypto pki trustpoint cisco
 revocation-check crl
 rsakeypair cisco
!
! crypto pki trustpoint iosca
 enrollment url http://1.1.1.1:80
 revocation-check none
!

!--- Configure a certificate map that will be used
!--- in the ISAKMP profile.

crypto pki certificate map certmap 1
 issuer-name co cisco.com
!
crypto pki certificate chain cisco
 certificate ca 01

!--- Root certificate created when the IOS CA Server
!--- is enabled.

  3082022F 30820198 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  2B312930 27060355 04031320 696F7363 612E6369 73636F2E 636F6D20 4C3D5254
  &&
  0B1DAECA FE7388B8 D2B1EFF9 B1269F90 C418BCD1 C45A1B64 99C1A400 99897C7D
  9720A789 A374E8D1 E117CEE5 CD90F678 98ECFD46 7DF3C029 58B85899 74D34A52
  B489A610 8DED6FA7 7012D13B 1B822EB9 7F65BA
  quit
crypto pki certificate chain iosca
 certificate 02

!--- Identity certificate received from the IOS CA
!--- after trustpoint enrollment.

  30820213 3082017C A0030201 02020102 300D0609 2A864886 F70D0101 04050030
  2B312930 27060355 04031320 696F7363 612E6369 73636F2E 636F6D20 4C3D5254
  50205354 3D4E4320 433D5553 301E170D 30363038 31313139 31313535 5A170D30
  37303831 31313931 3135355A 30233121 301F0609 2A864886 F70D0109 02161248
  7562494F 5343412E 63697363 6F2E636F 6D30819F 300D0609 2A864886 F70D0101
  01050003 818D0030 81890281 8100B811 AD3AABA8 3EC63A04 40E4B3ED 1C783C22
  20C65122 6E560D22 2731CAD5 2CC56CBD 554C69FF 4AE3EA1B CAB25918 B249D32A
  A7861362 7E4257F3 855BD60F FBA8D33D 15F925C5 746B9144 97DCFFEE 4CD81070
  43C9343F 92C645BC 37E0EF26 5E04394B 67CC536E BFD920DE 52DC977D 830B3C60
  D3CB7003 578BB681 D307FF4F 629F0203 010001A3 4F304D30 0B060355 1D0F0404
  030205A0 301F0603 551D2304 18301680 14AC041C 685BDA03 4E71B7FB 59BAE0A3
  5422F759 1E301D06 03551D0E 04160414 6A60490F 5CC612A3 EA661102 9D645413
  41F9236F 300D0609 2A864886 F70D0101 04050003 818100BA 2DDC2D0A 5F7B4B3D
  8C8C770D 34AC1A17 EE91A89A 46FD5B9B 8550B2C5 8B8D31EC 29D8AC3A 8F4B1A96
  4C733B9D FD98BF42 2FDFC6B1 E1D762E1 3D4470BD CFC73DF8 E55D7C0A 871159C5
  544319B9 1DEC6563 75403B97 7567A81D 27F2688C E955CED7 6E9BC90F 7D3C4C94
  81EDA619 835AF696 8E4A8BF3 C54A242D 8DB5DE59 E5B37E
  quit

certificate ca 01

!--- Root certificate received from the IOS CA
!--- after trustpoint authentication.

  3082022F 30820198 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  2B312930 27060355 04031320 696F7363 612E6369 73636F2E 636F6D20 4C3D5254
  50205354 3D4E4320 433D5553 301E170D 30363038 31313139 30313534 5A170D30
  39303831 30313930 3135345A 302B3129 30270603 55040313 20696F73 63612E63
  6973636F 2E636F6D 204C3D52 54502053 543D4E43 20433D55 5330819F 300D0609
  2A864886 F70D0101 01050003 818D0030 81890281 8100C368 246CFD63 86BA2F7C
  626160C6 37EDC62F 3293B6B3 A006ED81 9038D4F3 2A20577D C8D88BEF FD5E427A
  5D5B3471 E4D3EDF9 9EBC51C7 1768BD45 7D2E90B0 059F72AE 35F7E4E5 15AE3233
  A50F2A8E 950A34D4 1620C98C 20FFB14B DF446F5E 4612F6EC 5B457D9B AB9BD937
  B29691F9 FDBCBF21 860323FF 1A1C9D7B 39A41C4B 13310203 010001A3 63306130
  0F060355 1D130101 FF040530 030101FF 300E0603 551D0F01 01FF0404 03020186
  301F0603 551D2304 18301680 14AC041C 685BDA03 4E71B7FB 59BAE0A3 5422F759
  1E301D06 03551D0E 04160414 AC041C68 5BDA034E 71B7FB59 BAE0A354 22F7591E
  300D0609 2A864886 F70D0101 04050003 81810099 256FCF71 084766ED BDE8F6D8
  F158BDF0 D1875B0A 57A3FBB8 DD8EF9AD E5BB3E95 3A65893B B11DBE9A 6E593701
  0B1DAECA FE7388B8 D2B1EFF9 B1269F90 C418BCD1 C45A1B64 99C1A400 99897C7D
  9720A789 A374E8D1 E117CEE5 CD90F678 98ECFD46 7DF3C029 58B85899 74D34A52
  B489A610 8DED6FA7 7012D13B 1B822EB9 7F65BA
  quit

!--- Configure IPSEC phase 1 parameters.

crypto isakmp policy 10
 hash md5
!

!--- Configure ISAKMP profile for the dynamic
!--- LAN to LAN tunnel.

crypto isakmp profile l2lvpn
   ca trust-point iosca
   match certificate certmap
!
crypto ipsec transform-set strong ah-md5-hmac esp-des
!

!--- Configure dynamic crypto map.

crypto dynamic-map dynmap 10
 set transform-set strong
 set isakmp-profile l2lvpn

!--- Configure crypto map that will be applied on
```

```
!--- the physical interface.

crypto map mymap 10 ipsec-isakmp dynamic dynmap
!
interface GigabitEthernet0/0
 ip address 14.1.21.199 255.255.252.0
 duplex auto
 speed auto
 no keepalive

!--- Apply crypto map to the physical interface.

interface GigabitEthernet0/1
 ip address 1.1.1.1 255.255.255.0
 duplex auto
 speed auto
 crypto map mymap
!
interface FastEthernet0/2/0
!
interface FastEthernet0/2/1
!
interface FastEthernet0/2/2
!
interface FastEthernet0/2/3
!
interface Vlan1
 ip address 10.1.1.254 255.255.255.0
!
ip route 0.0.0.0 0.0.0.0 GigabitEthernet0/1
!
ip http server
no ip http secure-server
!
control-plane
!
line con 0
line aux 0
line vty 0 4
 login
!
scheduler allocate 20000 1000
!
webvpn context Default_context
 ssl authenticate verify all
 !
 no inservice
!
End
```

## Spoke Configuration

**Spoke Configuration**

```
version 12.3
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Spoke
!
boot-start-marker
boot-end-marker
!
```

```
no aaa new-model
!
resource policy
!
ip subnet-zero
ip cef
!
no ip dhcp use vrf connected
!
ip domain name cisco.com
no ip ips deny-action ips-interface

!--- Configure a trustpoint that this router will use
!--- to authenticate and enroll to the IOS CA Server.

crypto pki trustpoint iosca
 enrollment url http://1.1.1.1:80
 revocation-check none
!

!--- Configure a certificate map that will be
!--- used in the ISAKMP profile.

crypto pki certificate map certmap 1
 issuer-name co cisco.com
!
crypto pki certificate chain iosca
 certificate 03
  30820210 30820179 A0030201 02020103 300D0609 2A864886 F70D0101 04050030
  2B312930 27060355 04031320 696F7363 612E6369 73636F2E 636F6D20 4C3D5254
  50205354 3D4E4320 433D5553 301E170D 30363038 31313139 31373137 5A170D30
  37303831 31313931 3731375A 3020311E 301C0609 2A864886 F70D0109 02160F53
  706F6B65 2E636973 636F2E63 6F6D3081 9F300D06 092A8648 86F70D01 01010500
  03818D00 30818902 818100A3 98320490 640B33E8 85E3920C D0BF30F0 038BCFFF
  64F1AD1A 7AA1DC92 9D4C160B 905B7FED F468AC3C 32B5F09B 38DC714E 8ADB227F
  7E779259 CC54EDA1 D3CFDDCC 3EB707E3 E5C44059 2097773C 80011AD3 C65CA3BB
  82656432 0A305CF4 13D6E3E2 918377EC 0299C91A 87D99287 B44CBDB8 A482F138
  5FC365FD 0853D869 A9260302 03010001 A34F304D 300B0603 551D0F04 04030205
  A0301F06 03551D23 04183016 8014AC04 1C685BDA 034E71B7 FB59BAE0 A35422F7
  591E301D 0603551D 0E041604 14F4DCD0 90A2DB61 7C70F86B 496D3213 592F94D3
  9D300D06 092A8648 86F70D01 01040500 03818100 300D3A37 94A561E1 CB38C49F
  BBB0D19B C2AE09E4 7DFA4ABC 53B53DBB CBE39BCB 903262C9 06AEBE90 2DEE15EE
  F343D93A 77D94A24 4BC1EC72 28CE386B B2D9A124 64031AD5 0C8DC97F 76792024
  702C849E 13B8CF21 A303FF5B C41EF2B7 77B31117 ED514324 EF8242B7 548E36A6
  391540C9 2D913570 6D103F49 DE0CC14C 49C404FF
  quit
 certificate ca 01
  3082022F 30820198 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  2B312930 27060355 04031320 696F7363 612E6369 73636F2E 636F6D20 4C3D5254
  50205354 3D4E4320 433D5553 301E170D 30363038 31313139 30313534 5A170D30
  39303831 30313930 3135345A 302B3129 30270603 55040313 20696F73 63612E63
  6973636F 2E636F6D 204C3D52 54502053 543D4E43 20433D55 5330819F 300D0609
  2A864886 F70D0101 01050003 818D0030 81890281 8100C368 246CFD63 86BA2F7C
  626160C6 37EDC62F 3293B6B3 A006ED81 9038D4F3 2A20577D C8D88BEF FD5E427A
  5D5B3471 E4D3EDF9 9EBC51C7 1768BD45 7D2E90B0 059F72AE 35F7E4E5 15AE3233
  A50F2A8E 950A34D4 1620C98C 20FFB14B DF446F5E 4612F6EC 5B457D9B AB9BD937
  B29691F9 FDBCBF21 860323FF 1A1C9D7B 39A41C4B 13310203 010001A3 63306130
  0F060355 1D130101 FF040530 030101FF 300E0603 551D0F01 01FF0404 03020186
  301F0603 551D2304 18301680 14AC041C 685BDA03 4E71B7FB 59BAE0A3 5422F759
  1E301D06 03551D0E 04160414 AC041C68 5BDA034E 71B7FB59 BAE0A354 22F7591E
  300D0609 2A864886 F70D0101 04050003 81810099 256FCF71 084766ED BDE8F6D8
  F158BDF0 D1875B0A 57A3FBB8 DD8EF9AD E5BB3E95 3A65893B B11DBE9A 6E593701
  0B1DAECA FE7388B8 D2B1EFF9 B1269F90 C418BCD1 C45A1B64 99C1A400 99897C7D
  9720A789 A374E8D1 E117CEE5 CD90F678 98ECFD46 7DF3C029 58B85899 74D34A52
  B489A610 8DED6FA7 7012D13B 1B822EB9 7F65BA
  quit
```

```
username cisco password 0 ww

!--- Configure IPSEC phase 1 parameters.

crypto isakmp policy 10
 hash md5

!--- Configure ISAKMP profile for the
!--- LAN 2 LAN tunnel.

crypto isakmp profile l2lvpn
   ca trust-point iosca
   match certificate certmap
!
crypto ipsec transform-set strong ah-md5-hmac esp-des

!--- Configure crypto map that will pull
!--- the ISAKMP profile created.

crypto map mymap 10 ipsec-isakmp
 set peer 1.1.1.1
 set transform-set strong
 set isakmp-profile l2lvpn
 match address 100
!
interface FastEthernet0
!
interface FastEthernet1
!
interface FastEthernet2
!
interface FastEthernet3

!--- Apply LAN to LAN crypto map on the
!--- physical interface.

interface FastEthernet4
 ip address 1.1.1.2 255.255.255.0
 no ip proxy-arp
 ip route-cache flow
 duplex auto
 speed auto
 crypto map mymap
!
interface Dot11Radio0
 no ip address
 shutdown
 speed basic-1.0 basic-2.0 basic-5.5 6.0 9.0 basic-11.0 12.0 18.0
 24.0 36.0 48.0 54.0
 station-role root
!
interface Vlan1
 ip address 10.1.2.254 255.255.255.0
!
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet4
!
no ip http server
no ip http secure-server
!
access-list 100 permit ip 10.1.2.0 0.0.0.255 10.1.1.0 0.0.0.255
!
control-plane
!
line con 0
 no modem enable
```

```
line aux 0
line vty 0 4
 login
!
scheduler max-task-time 5000
end
```

# Verify

There is currently no verification procedure available for this configuration.

# Troubleshoot

## Certificate authentication fails for a L2L tunnel.

Sometimes, IPsec negotiation may fail when you use a valid CA certificate for ISAKMP authentication. The VPN tunnel negotiation works with pre−shared keys because the pre−shared keys are really small packets. If the certificate authentication needs to send the entire certificate across, this creates big packets which gets fragmented. Fragmentation prevents the certificate to be properly authenticated between the devices.

Lower the MTU and switch to full−duplex in order to solve this problem. Set the MTU value to a size that does not have to be fragmented:

```
Router(config)#interface type [slot_#/]port_#
Router(config-if)#ip mtu MTU_size_in_bytes
```

# Related Information

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