디지털 인증서를 사용하여 라우터와 PIX 간에 LAN-to-LAN IPSec 구성 방법

목차

소개

이 문서에서는 디지털 인증서를 사용하여 LAN-to-LAN IPSec을 구현하도록 Cisco 라우터 및 Cisco Secure PIX Firewall을 구성하는 방법을 설명합니다.이 구성을 수행하려면 다음 작업을 수행해야 합니다.

1. 라우터와 PIX를 구성합니다.
2. 라우터 및 PIX에서 디지털 인증서를 가져옵니다.
3. 라우터와 PIX에서 IKE 및 IPSec 정책을 구성하고 액세스 목록을 통해 IPSec을 사용하여 암호화할 트래픽(흥미로운 트래픽)을 정의합니다.

시작하기 전에

표기 규칙

문서 규칙에 대한 자세한 내용은 Cisco 기술 팁 표기 규칙을 참조하십시오.

사전 요구 사항

이 문서에 대한 특정 요건이 없습니다.

사용되는 구성 요소

이 문서의 정보는 아래 소프트웨어 및 하드웨어 버전을 기반으로 합니다.

- Cisco 1700 라우터
- Cisco IOS® 소프트웨어 버전 12.2(6)
- Cisco PIX Firewall 520
- PIX 방화벽 버전 6.0.1.

이 문서의 정보는 특정 랩 환경의 디바이스를 토대로 작성되었습니다.이 문서에 사용된 모든 디바이스는 초기화된(기본) 컨피그레이션으로 시작되었습니다.라이브 네트워크에서 작업하는 경우, 사용하기 전에 모든 명령의 잠재적인 영향을 이해해야 합니다.

배경 이론

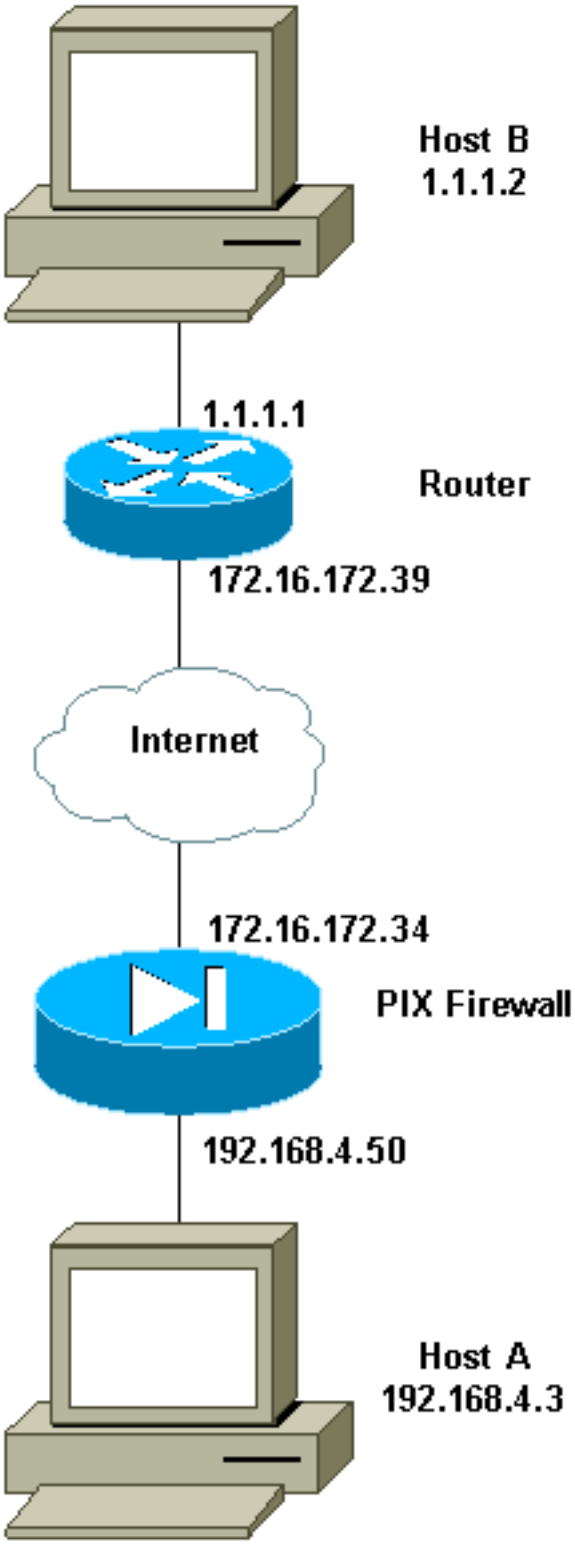
이 예제에서는 IPSec이 PIX에서 암호화하는 트래픽으로 호스트 A(소스 주소)의 네트워크 주소와 호스트 B(대상 주소)의 네트워크 주소를 정의했습니다.라우터의 access-list는 PIX에 있는 access-list의 미러 이미지입니다.

두 디바이스의 내부 LAN에 상주하는 호스트가 IPSec 터널을 통과하는 동안 전용 주소를 사용하도록 PIX와 라우터를 구성했습니다.PIX에서 **access-list** 및 **nat 0** 명령이 함께 작동합니다.192.168.4.0 네트워크의 호스트 A가 1.1.1.0 네트워크로 이동하면 액세스 목록은 NAT(Network Address Translation) 없이 192.168.4.0 네트워크 트래픽을 암호화할 수 있도록 허용합니다. 그러나 동일한 사용자가 다른 곳으로 이동하면 PAT(Port Address Translation)를 통해 172.16.172.57 주소로 변환됩니다. 라우터에서 route-**map** 및 **access-list** 명령은 1.1.1.0 네트워크 트래픽을 NAT 없이 암호화할 수 있도록 허용합니다.그러나 동일한 호스트 B가 다른 곳으로 이동하면 PAT를 통해 172.16.172.39 주소로 변환됩니다.

구성을 테스트하기 위해 PIX 방화벽 뒤에 있는 호스트 A에서 라우터 뒤에 있는 호스트 B로 ping했습니다.IP 패킷이 PIX 방화벽에 도달하면 액세스 목록과 일치하여 IPSec 협상을 시작했습니다.따라서 PIX는 개시자이고 라우터는 IPSec 협상 중에 응답자입니다.문제 해결을 위해 PIX 및 라우터 암호화 디버그를 모두 검토해야 합니다.

네트워크 다이어그램

이 문서에서는 아래 다이어그램에 표시된 네트워크 설정을 사용합니다.



라우터 및 PIX 방화벽 구성

구성

이 섹션에는 이 문서에서 설명하는 기능을 구성하기 위한 정보가 표시됩니다.

- 라우터 샘플 컨피그레이션
- PIX 샘플 컨피그레이션

라우터 샘플 컨피그레이션

```
1720-1#show running-config
Building configuration...

Current configuration : 8694 bytes
!
! Last configuration change at 20:17:48 PST Thu Jan 10
2002
! NVRAM config last updated at 20:19:27 PST Thu Jan 10
2002
!
version 12.2
no parser cache
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 1720-1
!
no logging buffered
enable secret 5 $1$6jAs$tNxI1a/2DYFAtPLyCDXjo/
enable password ww
!
username cisco password 0 cisco
username all
memory-size iomem 15
clock timezone PST -8
ip subnet-zero
no ip domain-lookup
ip domain-name cisco.com
!
ip ssh time-out 120
ip ssh authentication-retries 3
!
!
!
crypto ca identity vpn
 enrollment retry count 20
 enrollment mode ra
 enrollment url http://171.69.89.16:80
 query url ldap://171.69.89.16
crypto ca certificate chain vpn
 certificate 3B2FD652
 308202C4 3082022D A0030201 0202043B 2FD65230 0D06092A
864886F7 0D010105
  0500302D 310B3009 06035504 06130275 73310E30 0C060355
040A1305 63697363
  6F310E30 0C060355 040B1305 736A7670 6E301E17 0D303230
31313130 33303631
  345A170D 30333031 31313033 33363134 5A304E31 0B300906
03550406 13027573
  310E300C 06035504 0A130563 6973636F 310E300C 06035504
0B130573 6A76706E
  311F301D 06092A86 4886F70D 01090216 10313732 302D312E
63697363 6F2E636F
  6D305C30 0D06092A 864886F7 0D010101 0500034B 00304802
4100A085 B4A756F8
  CEB91F2E 52E2A23F 847EC95F 44F65AF2 EBC1F816 081CC61F
AB077482 F1FAD124
  2444B9F6 6B9EC48E 1B1EB5B9 D0E802BA B9A57048 EBB8CD18
773F0203 010001A3
  82011230 82010E30 0B060355 1D0F0404 030205A0 301B0603
```

```
551D1104 14301282
  10313732 302D312E 63697363 6F2E636F 6D302B06 03551D10
04243022 800F3230
  30323031 31313033 30363134 5A810F32 30303230 39323331
35333631 345A304F
  0603551D 1F044830 463044A0 42A040A4 3E303C31 0B300906
03550406 13027573
  310E300C 06035504 0A130563 6973636F 310E300C 06035504
0B130573 6A76706E
  310D300B 06035504 03130443 524C3130 1F060355 1D230418
30168014 46C1609C
  DBEA53EE 80A48060 1A96583B 0DF80D2F 301D0603 551D0E04
160414B1 2707AB30
  F7CFDC79 C554D1AE 3208EF16 CF96ED30 09060355 1D130402
30003019 06092A86
  4886F67D 07410004 0C300A1B 0456352E 30030204 B0300D06
092A8648 86F70D01
  01050500 03818100 E82DE82B AE5C7F80 EB9CED1A 306F36E6
437DA791 81D53CF3
  0E561C8A 7A168EDE 6728F371 3EB90B21 CC40E1F3 CA4ED98F
CDFA6E15 A2C0AA38
  4AE137C7 281AA7EC AD26D550 4E4AAA0B E0C588F8 661C4031
ACF35F7B 28330B64
  667E00E3 832AED7F 08D5EA3D 33CCB2BE E73DC41A B40A9B64
4CD2D98C 6943AE84
  55605741 E136A6BD
  quit
 certificate ra-sign 3B2FD319
  308202FF 30820268 A0030201 0202043B 2FD31930 0D06092A
864886F7 0D010105
  0500302D 310B3009 06035504 06130275 73310E30 0C060355
040A1305 63697363
  6F310E30 0C060355 040B1305 736A7670 6E301E17 0D303130
36313932 32303333
  315A170D 30343036 31393232 33333331 5A304531 0B300906
03550406 13027573
  310E300C 06035504 0A130563 6973636F 310E300C 06035504
0B130573 6A76706E
  31163014 06035504 03130D46 69727374 204F6666 69636572
30819F30 0D06092A
  864886F7 0D010101 05000381 8D003081 89028181 00E85434
395790E9 416ED13D
  72F1A411 333A0984 66B8F68A 0ECA7E2B CBC40C39 A21E2D8A
5F94772D 69846720
  73227891 E43D46B6 B2D1DDC5 385C5135 DB2075F1 4D252ACF
AC80DA4C 2111946F
  26F7193B 8EA1CA66 8332D2A1 5310B2D7 07C985A8 0B44CE37
BC95EAFF C328D4C6
  73B3B35E 0F6D25F5 DCAC6AFA 2DAAD6D1 47BB3396 E1020301
0001A382 01123082
  010E300B 0603551D 0F040403 02078030 2B060355 1D100424
3022800F 32303031
  30363139 32323033 33315A81 0F323030 33303732 37303233
3333315A 301B0603
  551D0904 14301230 1006092A 864886F6 7D07441D 31030201
00304F06 03551D1F
  04483046 3044A042 A040A43E 303C310B 30090603 55040613
02757331 0E300C06
  0355040A 13056369 73636F31 0E300C06 0355040B 1305736A
76706E31 0D300B06
  03550403 13044352 4C31301F 0603551D 23041830 16801446
C1609CDB EA53EE80
  A480601A 96583B0D F80D2F30 1D060355 1D0E0416 04147BD2
620C611F 3AC69FB3
```

```
  155FD8F9 8A7CF353 3A583009 0603551D 13040230 00301906
092A8648 86F67D07
  4100040C 300A1B04 56352E30 030204B0 300D0609 2A864886
F70D0101 05050003
  8181003A A6431D7D 1979DDF9 CC99D8F8 CC987F67 DBF67280
2A9418E9 C6255B08
  DECDE1C2 50FCB1A6 544F1D51 C214162E E2403DAB 2F1294C4
841240ED FD6F799C
  130A0B24 AC74DD74 C60EB5CD EC648631 E0B88B3F 3D19A2E1
6492958E 9F64746E
  45C080AE E5A6C245 7827D7B1 380A6FE8 A01D9022 7F52AD9C
B596743A 853549C5 771DA2
  quit
 certificate ra-encrypt 3B2FD318
  308202D0 30820239 A0030201 0202043B 2FD31830 0D06092A
864886F7 0D010105
  0500302D 310B3009 06035504 06130275 73310E30 0C060355
040A1305 63697363
  6F310E30 0C060355 040B1305 736A7670 6E301E17 0D303130
36313932 32303333

 315A170D 30343036 31393232 33333331 5A304531 0B300906
03550406 13027573
  310E300C 06035504 0A130563 6973636F 310E300C 06035504
0B130573 6A76706E
  31163014 06035504 03130D46 69727374 204F6666 69636572
30819F30 0D06092A
  864886F7 0D010101 05000381 8D003081 89028181 00BFC427
727E15E9 30CB1BCB
  C0EFFB2F 3E4916D4 EC365F57 C13D1356 6388E66D 7BCCBCB9
04DA2E7C C9639F31
  AF15E7B1 E698A33C 0EB447E4 B3B72EC8 766EADCF 9883E612
AD782E39 B0603A90
  0322CE78 D6735E07 BDC022F1 1164EC9E 31FC5309 9AA9DC1D
69ECC316 8727A6CB
  ADCFB488 FF904D6D 9D9E5778 05B24D4B BB5B4F5F 4D020301
0001A381 E43081E1
  300B0603 551D0F04 04030205 20301B06 03551D09 04143012
30100609 2A864886
  F67D0744 1D310302 0100304F 0603551D 1F044830 463044A0
42A040A4 3E303C31
  0B300906 03550406 13027573 310E300C 06035504 0A130563
6973636F 310E300C
  06035504 0B130573 6A76706E 310D300B 06035504 03130443
524C3130 1F060355
  1D230418 30168014 46C1609C DBEA53EE 80A48060 1A96583B
0DF80D2F 301D0603
  551D0E04 16041400 A7C3DD9F 9FAB0A25 E1485FC7 DB88A63F
78CE4830 09060355
  1D130402 30003019 06092A86 4886F67D 07410004 0C300A1B
0456352E 30030204
  B0300D06 092A8648 86F70D01 01050500 03818100 69105382
0BE0BA59 B0CD2652
  9C6A4585 940C7882 DCEB1D1E 610B8525 0C032A76 2C8758C2
F5CA1EF4 B946848A
  C49047D5 6D1EF218 FA082A00 16CCD9FC 42DF3B05 A8EF2AAD
151637DE 67885BB2
  BA0BB6A1 308F63FF 21C3CB00 9272257A 3C292645 FD62D486
C247F067 301C2FEE
  5CF6D12B 6CFA1DAA E74E8B8E 5B017A2E 5BB6C5F9
  quit
 certificate ca 3B2FD307
  308202E4 3082024D A0030201 0202043B 2FD30730 0D06092A
864886F7 0D010105
```

```
  0500302D 310B3009 06035504 06130275 73310E30 0C060355
040A1305 63697363
  6F310E30 0C060355 040B1305 736A7670 6E301E17 0D303130
36313932 32303234
  305A170D 32313036 31393232 33323430 5A302D31 0B300906
03550406 13027573
  310E300C 06035504 0A130563 6973636F 310E300C 06035504
0B130573 6A76706E
  30819F30 0D06092A 864886F7 0D010101 05000381 8D003081
89028181 00E8C25B
  EDF4A6EE A352B142 C16578F4 FBDAF45E 4F2F7733 8D2B8879
96138C63 1DB713BF
  753BF845 2D7E600F AAF4D75B 9E959513 BB13FF13 36696F48
86C464F2 CF854A66
  4F8E83F8 025F216B A44D4BB2 39ADD1A5 1BCCF812 09A19BDC
468EEAE1 B6C2A378
  69C81348 1A9CD61C 551216F2 8B168FBB 94CBEF37 E1D9A8F7
80BBC17F D1020301
  0001A382 010F3082 010B3011 06096086 480186F8 42010104
04030200 07304F06
  03551D1F 04483046 3044A042 A040A43E 303C310B 30090603
55040613 02757331
  0E300C06 0355040A 13056369 73636F31 0E300C06 0355040B
1305736A 76706E31
  0D300B06 03550403 13044352 4C31302B 0603551D 10042430
22800F32 30303130
  36313932 32303234 305A810F 32303231 30363139 32323332
34305A30 0B060355
  1D0F0404 03020106 301F0603 551D2304 18301680 1446C160
9CDBEA53 EE80A480
  601A9658 3B0DF80D 2F301D06 03551D0E 04160414 46C1609C
DBEA53EE 80A48060
  1A96583B 0DF80D2F 300C0603 551D1304 05300301 01FF301D
06092A86 4886F67D
  07410004 10300E1B 0856352E 303A342E 30030204 90300D06
092A8648 86F70D01
  01050500 03818100 7E3DBAC4 8CAE7D5A B19C0625 8780D222
F965A1A2 C0C25B84
  CBC5A203 BF50FAC4 9656699A 52D8CB46 40776237 87163118
8F3C0F47 D2CAA36B
  6AB34F99 AB71269E 78C0AC10 DA0B9EC5 AE448B46 701254CF
3EBC64C1 5DBB2EE5
  56C0140B B0C83497 D79FB148 80018F51 3A4B6174 590B85AA
9CE3B391 629406AA
  7CE9CC0D 01593E6B
  quit
!
crypto isakmp policy 10
 hash md5
crypto isakmp identity hostname
!
!
crypto ipsec transform-set myset esp-des esp-md5-hmac
!
!

crypto map vpn 10 ipsec-isakmp
 set peer 172.16.172.34
 set transform-set myset
 match address 130
!
!
!
!
```

```
!
interface Loopback0
 ip address 10.10.10.1 255.255.255.0
!
interface Loopback1
 ip address 121.1.1.1 255.255.255.0
!
interface Loopback88
 ip address 88.88.88.88 255.255.255.255
!
interface FastEthernet0
 ip address 172.16.172.39 255.255.255.240
ip nat outside
 speed auto
 crypto map vpn
!
interface Serial0
ip nat inside
 ip address 1.1.1.1 255.255.255.252
!
ip nat inside source route-map nonat interface
FastEthernet0 overload
ip classless
ip route 0.0.0.0 0.0.0.0 172.16.172.33
no ip http server
ip pim bidir-enable
!
access-list 120 deny   ip 1.1.1.0 0.0.0.255 192.168.4.0
0.0.0.255
access-list 120 permit ip 1.1.1.0 0.0.0.255 any
access-list 130 permit ip 1.1.1.0 0.0.0.255 192.168.4.0
0.0.0.255
route-map nonat permit 10
match ip address 120
!
line con 0
line aux 0
line vty 0 4
 exec-timeout 0 0
 password cisco
 no login
line vty 5 15
 login
!
no scheduler allocate
end
```

PIX 샘플 컨피그레이션

```
pix520-1# write terminal
Building configuration...
: Saved
:
PIX Version 6.0(1)
nameif ethernet0 outside security0
nameif ethernet1 inside security100
enable password 2KFQnbNIdI.2KYOU encrypted
passwd 2KFQnbNIdI.2KYOU encrypted
hostname pix520-1
domain-name vpn.com
fixup protocol ftp 21
fixup protocol http 80
fixup protocol h323 1720
```

```
fixup protocol rsh 514
fixup protocol smtp 25
fixup protocol sqlnet 1521
fixup protocol sip 5060
fixup protocol skinny 2000
names
access-list 130 permit ip 192.168.4.0 255.255.255.0
1.1.1.0 255.255.255.0
access-list 140 permit ip 192.168.4.0 255.255.255.0
1.1.1.0 255.255.255.0
no pager
logging on
logging monitor debugging
logging buffered debugging
logging trap debugging
logging history debugging
logging host outside 192.168.2.6
interface ethernet0 auto
interface ethernet1 auto
mtu outside 1500
mtu inside 1500
ip address outside 172.16.172.34 255.255.255.240
ip address inside 192.168.4.50 255.255.255.0
ip audit info action alarm
ip audit attack action alarm
no failover
failover timeout 0:00:00
failover poll 15
failover ip address outside 0.0.0.0
failover ip address inside 0.0.0.0
pdm history enable
arp timeout 14400
global (outside) 1 172.16.172.57 netmask 255.255.255.255
nat (inside) 0 access-list 140
nat (inside) 1 0.0.0.0 0.0.0.0 0 0
route outside 0.0.0.0 0.0.0.0 172.16.172.33 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 rpc
0:10:00
h323 0:05:00 sip 0:30:00 sip_media 0:02:00
timeout uauth 0:05:00 absolute
aaa-server TACACS+ protocol tacacs+
aaa-server RADIUS protocol radius
aaa-server mytest protocol tacacs+
aaa-server nasir protocol radius
snmp-server host outside 192.168.2.6
no snmp-server location
no snmp-server contact
snmp-server community public
snmp-server enable traps
floodguard enable
sysopt connection permit-ipsec
no sysopt route dnat
crypto ipsec transform-set myset esp-des esp-md5-hmac
crypto map mymap 5 ipsec-isakmp
crypto map mymap 5 match address 130
crypto map mymap 5 set peer 172.16.172.39
crypto map mymap 5 set transform-set myset
crypto map mymap interface outside
isakmp enable outside
isakmp policy 10 authentication rsa-sig
isakmp policy 10 encryption des
isakmp policy 10 hash md5
isakmp policy 10 group 1
```

```
isakmp policy 10 lifetime 86400
ca identity cisco 171.69.89.16:/cgi-bin 171.69.89.16
ca configure cisco ra 20 5
telnet 192.168.4.0 255.255.255.0 inside
telnet 171.69.89.82 255.255.255.255 inside
telnet 192.168.4.3 255.255.255.255 inside
telnet timeout 5
ssh 172.0.0.0 255.0.0.0 outside
ssh 171.0.0.0 255.255.255.0 outside
ssh 171.0.0.0 255.0.0.0 outside
ssh 171.0.0.0 255.0.0.0 inside
ssh timeout 60
terminal width 80
Cryptochecksum:c2d5976fc87875678356cf83b135bb8c
: end
[OK]
pix520-1#
```

인증서 가져오기

라우터에서 인증서 가져오기

이 섹션에서는 라우터에서 디지털 인증서를 가져오는 방법에 대해 설명합니다.

1. 라우터의 호스트 이름 및 IP 도메인 이름을 구성합니다(아직 구성하지 않은 경우).
   ```
   1720-1# hostname 1720-1
   1720-1# ip domain-name cisco.com
   ```
   참고: 라우터가 라우터에 할당하는 호스트 이름 및 IP 도메인 이름에 따라 IPSec에서 사용하는 키 및 인증서에 FQDN(정규화된 도메인 이름)을 할당하므로 호스트 이름과 도메인 이름이 필요합니다.예를 들어, 인증서의 이름은 "router"의 라우터 호스트 이름과 "cisco.com"의 라우터 IP 도메인 이름을 기반으로 "router.cisco.com"입니다.
2. IKE 키 관리 메시지를 서명 및 암호화하는 데 사용되는 라우터의 RSA 키 쌍을 생성합니다.라우터에 대한 인증서를 얻으려면 키 쌍을 생성해야 합니다.
   ```
   1720-1(config)#crypto key generate rsa
   The name for the keys will be: 1720-1.cisco.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.

   How many bits in the modulus [512]:
   Generating RSA keys ...
   [OK]

   1720-1(config)#
   ```
   show crypto **key mypubkey rsa** 명령을 사용하여 라우터의 RSA 키 쌍을 확인합니다.
   ```
   1720-1#sh cr key mypubkey rsa
   % Key pair was generated at: 19:26:22 PST Jan 10 2002
   Key name: 1720-1.cisco.com
    Usage: General Purpose Key
    Key Data:
     305C300D 06092A86  4886F70D 01010105 00034B00 30480241 00A085B4 756F8CE
     B91F2E52 E2A23F84 7EC95F44 F65AF2EB C1F81608 1CC61FAB 077482F1 FAD12424
     44B9F66B 9EC48E1B 1EB5B9D0 E802BAB9 A57048EB B8CD1877 3F020301 0001

   % Key pair was generated at: 19:26:24 PST Jan 10 2002
   Key name: 1720-1.cisco.com.server
    Usage: Encryption Key
    Key Data:
     307C300D 06092A86 4886F70D 01010105 00036B00 30680261 00C653F7 2AE7E397
   ```

```
  0041E273 BFCC0E35 E7AF9874 A73B77E8 B15EF54A CA2417AD AB75BAD9 BA1540F4
  3DB849BD B70DF4D8 EBBBE7ED AB93BE4B 5C1E9E6A 560A9C8A 12D7CBE3 060DBE7E
  8C1667AE 93993049 DA362602 4E4D9EF8 2F8C4777 30F9F958 7F020301 0001

1720-1#
```

3. 라우터와 CA 간의 통신 매개변수를 구성하기 위해 CA(인증 기관) 서버를 선언합니다.등록 기관을 사용하는 경우 RA(등록 기관) 모드도 지정합니다.라우터에서 적절한 CRL(certificate revocation list)에 액세스할 수 없는 경우에도 라우터에서 다른 피어 인증서를 수락하려면 crl optional 명령을 사용합니다.

```
1720-1(config)#  crypto ca identity vpn
1720-1(ca-identity)#enrollment url http://171.69.89.16:80
1720-1(ca-identity)# query url ldap://171.69.89.16
1720-1(ca-identity)# enrollment retry count 20
1720-1(ca-identity)# enrollment retry period 5
1720-1(ca-identity)# enrollment mode ra
1720-1(ca-identity)#exit
```

4. 라우터는 CA의 공개 키를 포함하는 CA의 자체 서명 인증서를 가져와 CA를 인증해야 합니다.CA는 자체 인증서에 서명하므로 CA 관리자에게 문의하여 CA 인증서의 지문을 비교하여 CA의 공개 키를 수동으로 인증해야 합니다.이 예에서는 명령문으로 입력하는 대신 CA 인증서를 받은 후 두 개의 핑거프린트를 비교하여 공개 키를 수동으로 인증합니다.

```
1720-1(config)#cr ca authenticate vpn
Certificate has the following attributes:
Fingerprint: 1FCDF2C8 2DEDA6AC 4819D4C4 B4CFF2F5
% Do you accept this certificate? [yes/no]: y
1720-1(config)#
```

sh crypto ca cert 명령을 사용하여 CA 및 RA 인증서를 보고 인증이 성공했는지 확인합니다.

```
1720-1#sh cr ca cert
RA Signature Certificate
  Status: Available
  !--- The authentication was successful. Certificate Serial Number: 3B2FD319 Key Usage:
Signature Issuer: OU = sjvpn O = cisco C = us Subject: CN = First Officer OU = sjvpn O =
cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity
Date: start date: 14:03:31 PST Jun 19 2001 end date: 14:33:31 PST Jun 19 2004 Associated
Identity: vpn RA KeyEncipher Certificate Status: Available
!--- The authentication was successful. Certificate Serial Number: 3B2FD318 Key Usage:
Encryption Issuer: OU = sjvpn O = cisco C = us Subject: CN = First Officer OU = sjvpn O =
cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity
Date: start date: 14:03:31 PST Jun 19 2001 end date: 14:33:31 PST Jun 19 2004 Associated
Identity: vpn CA Certificate Status: Available
!--- The authentication was successful. Certificate Serial Number: 3B2FD307 Key Usage:
General Purpose Issuer: OU = sjvpn O = cisco C = us Subject: OU = sjvpn O = cisco C = us
CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity Date: start date:
14:02:40 PST Jun 19 2001 end date: 14:32:40 PST Jun 19 2021 Associated Identity: vpn
```

5. 라우터의 각 RSA 키 쌍에 대해 CA에서 서명된 인증서를 가져옵니다.범용 RSA 키를 생성한 경우 라우터에 하나의 RSA 키 쌍이 있으며 하나의 인증서만 필요합니다.특수 사용 RSA 키를 생성한 경우 라우터에는 RSA 키 쌍 2개가 있으며 인증서 2개가 필요합니다.라우터 인증서가 CA 서버에 구성된 경우 라우터 인증서를 수동으로 부여하려면 CA 관리자에게 문의해야 합니다.또한 등록 시 비밀번호를 제공해야 하도록 CA 서버가 구성된 경우 CA 관리자에게 이 비밀번호를 문의하십시오.이 예에서 CA 서버는 등록 중에 비밀번호를 제공할 필요가 없도록 설정되었습니다.

```
1720-1(config)#cr ca enroll vpn
%
% 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.
```

```
Password:
Re-enter password:

% The subject name in the certificate will be: 1720-1.cisco.com
% Include the router serial number in the subject name? [yes/no]: n
% Include an IP address in the subject name? [yes/no]: n
Request certificate from CA? [yes/no]: y
% Certificate request sent to Certificate Authority
% The certificate request fingerprint will be displayed.
% The 'show crypto ca certificate' command will also show the fingerprint.

1720-1(config)#    Fingerprint:  A1D6C28B 6575AD08 F0B656D4 7161F76F

3d09h: CRYPTO_PKI: status = 102: certificate request pending
```

등록 명령을 실행한 후 라우터는 CA 서버와 통신하고 인증서를 얻으려고 시도합니다.이 시간 동안 CA 서버가 인증서의 수동 인증을 요구하도록 구성된 경우 는 CA 관리자에게 문의해야 합니다.sh crypto ca cert 명령을 사용하여 라우터 인증서를 보고 등록이 성공했는지 확인합니다.다음 예에서는 인증서가 승인되지 않았습니다.

```
1720-1#sh crypto ca cert
RA Signature Certificate
  Status: Available
  Certificate Serial Number: 3B2FD319
  Key Usage: Signature
  Issuer:
    OU = sjvpn
     O = cisco
     C = us
  Subject:
    CN = First Officer
     OU = sjvpn
     O = cisco
     C = us
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us
  Validity Date:
    start date: 14:03:31 PST Jun 19 2001
    end   date: 14:33:31 PST Jun 19 2004
  Associated Identity: vpn

RA KeyEncipher Certificate
  Status: Available
  Certificate Serial Number: 3B2FD318
  Key Usage: Encryption
  Issuer:
    OU = sjvpn
     O = cisco
     C = us
  Subject:
    CN = First Officer
     OU = sjvpn
     O = cisco
     C = us
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us
  Validity Date:
    start date: 14:03:31 PST Jun 19 2001
    end   date: 14:33:31 PST Jun 19 2004
  Associated Identity: vpn

CA Certificate
  Status: Available
```

```
  Certificate Serial Number: 3B2FD307
  Key Usage: General Purpose
  Issuer:
    OU = sjvpn
     O = cisco
     C = us
  Subject:
    OU = sjvpn
     O = cisco
     C = us
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us
  Validity Date:
    start date: 14:02:40 PST Jun 19 2001
    end   date: 14:32:40 PST Jun 19 2021
  Associated Identity: vpn


Certificate
  Subject Name Contains:
    Name: 1720-1.cisco.com
 Status: Pending
!--- The certificate is still pending. Key Usage: General Purpose Fingerprint: A1D6C28B
6575AD08 F0B656D4 7161F76F Associated Identity: vpn
```

다음 예제 출력은 CA에서 인증서를 수신했음을 보여줍니다.

```
3d09h: %CRYPTO-6-CERTRET: Certificate received from Certificate Authority 1720-1#sh crypto
ca cert
Certificate
  Status: Available
  !--- This status indicates that the certificates were successfully received. Certificate
Serial Number: 3B2FD652 Key Usage: General Purpose Issuer: OU = sjvpn O = cisco C = us
Subject Name Contains: Name: 1720-1.cisco.com CRL Distribution Point: CN = CRL1, OU =
sjvpn, O = cisco, C = us Validity Date: start date: 19:06:14 PST Jan 10 2002 end date:
19:36:14 PST Jan 10 2003 Associated Identity: vpn RA Signature Certificate Status:
Available Certificate Serial Number: 3B2FD319 Key Usage: Signature Issuer: OU = sjvpn O =
cisco C = us Subject: CN = First Officer OU = sjvpn O = cisco C = us CRL Distribution
Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity Date: start date: 14:03:31 PST Jun
19 2001 end date: 14:33:31 PST Jun 19 2004 Associated Identity: vpn RA KeyEncipher
Certificate Status: Available Certificate Serial Number: 3B2FD318 Key Usage: Encryption
Issuer: OU = sjvpn O = cisco C = us Subject: CN = First Officer OU = sjvpn O = cisco C = us
CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity Date: start date:
14:03:31 PST Jun 19 2001 end date: 14:33:31 PST Jun 19 2004 Associated Identity: vpn CA
Certificate Status: Available Certificate Serial Number: 3B2FD307 Key Usage: General
Purpose Issuer: OU = sjvpn O = cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn,
O = cisco, C = us Validity Date: start date: 14:02:40 PST Jun 19 2001 end date: 14:32:40
PST Jun 19 2021 Associated Identity: vpn
```

6. CRL에 대해 CA를 수동으로 요청할 수 있습니다.라우터에서 CRL을 업데이트하려면 다음 명령을 사용합니다.

```
1720-1(config)#crypto ca crl request vpn
1720-1(config)#exit
```

show crypto **ca crls** 명령을 사용하여 CRL을 봅니다.

```
1720-1#sh crypto ca crls
CRL Issuer Name:
    OU = sjvpn, O = cisco, C = us
    LastUpdate: 16:17:34 PST Jan 10 2002
    NextUpdate: 17:17:34 PST Jan 11 2002
    Retrieved from CRL Distribution Point:
      LDAP: CN = CRL1, OU = sjvpn, O = cisco, C = us

1720-1#
```

7. write **mem** 명령을 실행하여 컨피그레이션을 저장합니다.

```
1720-1# wr m
Building configuration?
[OK]
1720-1#
```

PIX에서 인증서 가져오기

PIX 방화벽에서 인증서를 가져오려면 라우터와 동일한 단계를 수행합니다.그러나 PIX 명령 구문은 다릅니다.

1. 호스트 이름 및 IP 도메인 이름을 설정합니다.

   ```
   hostname pix520-1
   domain-name vpn.com
   ```

2. RSA 키 쌍을 생성합니다.

   ```
   pix520-1(config)#  ca generate rsa key 512
   ```

   show ca mypubkey rsa 명령을 사용하여 RSA 키 쌍을 표시합니다.

   ```
   pix520-1(config)# sh ca mypubkey rsa

   % Key pair was generated at: 04:54:34 Jan 11 2002

   Key name: pix520-1.vpn.com
    Usage: General Purpose Key
    Key Data:
     305c300d 06092a86 4886f70d 01010105 00034b00 30480241 009d95d5 e1147546
     1f9ef873 81a36256 4b81388b 188fbcb6 40fc4c56 c1801311 ff450cca e8d715c3
     ffb8fa28 d347120f aeba9972 3a88321c a71c1c7f ef29b810 2f020301 0001
   pix520-1(config)#
   ```

3. CA 서버를 선언합니다.

   ```
   pix520-1(config)# ca identity cisco 171.69.89.16 171.69.89.16
   pix520-1(config)# ca configure cisco ra 20 5
   ```

4. CA를 인증합니다.

   ```
   pix520-1(config)# ca authenticate cisco

   Certificate has the following attributes:

   Fingerprint: 1fcdf2c8 2deda6ac 4819d4c4 b4cff2f5
   pix520-1(config)#
   ```

   PIX에서 CA 인증서를 보려면 show ca cert 명령을 사용합니다.

   ```
   pix520-1(config)# sh ca cert
   CA Certificate
     Status: Available !--- The authentication was successful. Certificate Serial Number:
   3b2fd307 Key Usage: General Purpose OU = sjvpn O = cisco C = us CRL Distribution Point: CN
   = CRL1, OU = sjvpn, O = cisco, C = us Validity Date: start date: 22:02:40 Jun 19 2001 end
   date: 22:32:40 Jun 19 2021 RA Signature Certificate Status: Available !--- The
   authentication was successful. Certificate Serial Number: 3b2fd319 Key Usage: Signature CN
   = First Officer OU = sjvpn O = cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn,
   O = cisco, C = us Validity Date: start date: 22:03:31 Jun 19 2001 end date: 22:33:31 Jun 19
   2004 RA KeyEncipher Certificate Status: Available !--- The authentication was successful.
   Certificate Serial Number: 3b2fd318 Key Usage: Encryption CN = First Officer OU = sjvpn O =
   cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity
   Date: start date: 22:03:31 Jun 19 2001 end date: 22:33:31 Jun 19 2004
   ```

5. CRL에 대한 CA를 요청합니다.

   ```
   pix520-1(config)# ca enroll cisco  171.69.89.16
   %
   % Start certificate enrollment ..
   ```

```
% The subject name in the certificate will be: pix520-1.vpn.com

% Certificate request sent to Certificate Authority
% The certificate request fingerprint will be displayed.

pix520-1(config)#     Fingerprint:  6961df68 d3b5e667 8903a66b 969eee64

CRYPTO_PKI: status = 102: certificate request pending
CRYPTO_PKI: status = 102: certificate request pending
```

CA에서 인증서를 부여했습니다!

```
pix520-1(config)#
pix520-1(config)# show ca cert
Certificate
  Status: Available
!--- The enrollment was successful. Certificate Serial Number: 3b2fd653 Key Usage: General
Purpose Subject Name Name: pix520-1.vpn.com CRL Distribution Point: CN = CRL1, OU = sjvpn,
O = cisco, C = us Validity Date: start date: 04:13:45 Jan 11 2002 end date: 04:43:45 Jan 11
2003 RA Signature Certificate Status: Available !--- The enrollment was successful.
Certificate Serial Number: 3b2fd319 Key Usage: Signature CN = First Officer OU = sjvpn O =
cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us Validity
Date: start date: 22:03:31 Jun 19 2001 end date: 22:33:31 Jun 19 2004 CA Certificate
Status: Available !--- The enrollment was successful. Certificate Serial Number: 3b2fd307
Key Usage: General Purpose OU = sjvpn O = cisco C = us CRL Distribution Point: CN = CRL1,
OU = sjvpn, O = cisco, C = us Validity Date: start date: 22:02:40 Jun 19 2001 end date:
22:32:40 Jun 19 2021 RA KeyEncipher Certificate Status: Available !--- The enrollment was
successful. Certificate Serial Number: 3b2fd318 Key Usage: Encryption CN = First Officer OU
= sjvpn O = cisco C = us CRL Distribution Point: CN = CRL1, OU = sjvpn, O = cisco, C = us
Validity Date: start date: 22:03:31 Jun 19 2001 end date: 22:33:31 Jun 19 2004 pix520-
1(config)# pix520-1(config)# ca crl request cisco
```

6. sh ca crl 명령을 사용하여 CRL을 봅니다.

```
pix520-1(config)# sh ca crl

CRL:
    CRL Issuer Name:
        OU = sjvpn, O = cisco, C = us
    LastUpdate: 00:17:34 Jan 11 2002

    NextUpdate: 01:17:34 Jan 12 2002

pix520-1(config)#
```

7. PIX에 인증서를 저장하려면 다음 명령을 사용합니다.

```
pix520-1(config)# ca save all

pix520-1(config)#
```

다음을 확인합니다.

이 섹션에서는 컨피그레이션이 제대로 작동하는지 확인하는 데 사용할 수 있는 정보를 제공합니다.

일부 **show 명령은** 출력 인터프리터 툴 에서 지원되는데(등록된 고객만), 이 툴을 사용하면 **show 명령 출력의 분석 결과를 볼 수 있습니다.**

show 명령은 PIX 및 라우터에서 실행할 수 있습니다.

- **show crypto isakmp sa** - 피어에서 현재 IKE SA(Security Association)를 모두 봅니다.
- **show crypto ipsec sa** - 현재 IPSec 보안 연결에서 사용하는 설정을 표시합니다.

- **show crypto engine connections active** - (Router에만 해당) 암호화 및 암호 해독된 패킷에 대한 현재 연결 및 정보를 표시합니다.
- **show crypto ca crls** - (라우터에만 해당) 라우터의 현재 CRL을 표시합니다.
- **show crypto ca certificates** - (라우터에만 해당) 라우터의 라우터, CA 서버 및 RA 인증서를 표시합니다.CDP(인증서 배포 지점)도 표시합니다.
- **show ca certificates** - (PIX에만 해당) PIX, CA 및 RA 인증서를 표시합니다.라우터와 달리 CDP는 표시되지 않습니다.
- **show ca crl** - (PIX에만 해당) PIX의 CRL을 표시합니다.
- **show clock** - 라우터/PIX의 현재 시간(활성화 모드에서)을 표시합니다.

라우터의 샘플 출력 show 명령

```
1720-1#sh cr isa sa
dst             src             state          conn-id    slot
172.16.172.39   172.16.172.34   QM_IDLE            110       0

1720-1#sh cr map
        Interfaces using crypto map mymap:

Crypto Map "vpn" 10 ipsec-isakmp
        Peer = 172.16.172.34
        Extended IP access list 130
            access-list 130 permit ip 1.1.1.0 0.0.0.255 192.168.4.0 0.0.0.255
        Current peer: 172.16.172.34
        Security association lifetime: 4608000 kilobytes/3600 seconds
        PFS (Y/N): N
        Transform sets={ myset, }
        Interfaces using crypto map vpn:
                FastEthernet0
        Interfaces using crypto map certificate:

1720-1#sh cr isa policy
Protection suite of priority 10
        encryption algorithm:   DES - Data Encryption Standard
(56 bit keys).
        hash algorithm:         Message Digest 5
        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
1720-1#
1720-1#sh cr ipsec sa

interface: FastEthernet0
    Crypto map tag: vpn, local addr. 172.16.172.39

   local  ident (addr/mask/prot/port):
   (1.1.1.0/255.255.255.0/0/0)
   remote ident (addr/mask/prot/port):
   (192.168.4.0/255.255.255.0/0/0)
   current_peer: 172.16.172.34
     PERMIT, flags={origin_is_acl,}
```

```
    #pkts encaps: 3, #pkts encrypt: 3, #pkts digest 3
    #pkts decaps: 3, #pkts decrypt: 3, #pkts verify 3
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0,
#pkts decompress failed: 0
    #send errors 0, #recv errors 0

     local crypto endpt.: 172.16.172.39,
 remote crypto endpt.: 172.16.172.34
     path mtu 1500, media mtu 1500
     current outbound spi: 3803A0C1

     inbound esp sas:
      spi: 0xD740971C(3611334428)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 200, flow_id: 1,
crypto map: vpn
        sa timing: remaining key lifetime
(k/sec): (4607999/3150)
        IV size: 8 bytes
        replay detection support: Y

     inbound ah sas:

     inbound pcp sas:

     outbound esp sas:
      spi: 0x3803A0C1(939761857)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 201, flow_id: 2,
crypto map: vpn
        sa timing: remaining key lifetime
(k/sec): (4607999/3141)
        IV size: 8 bytes
        replay detection support: Y

     outbound ah sas:

     outbound pcp sas:


1720-1#

1720-1# sh cr en conn ac

  ID Interface       IP-Address      State   Algorithm               Encrypt  Decrypt
 110 FastEthernet0   172.16.172.39    set    HMAC_MD5+DES_56_CB        0        0
 114 FastEthernet0   172.16.172.39   alloc   NONE                      0        0
 115 FastEthernet0   172.16.172.39   alloc   NONE                      0        0
 116 FastEthernet0   172.16.172.39   alloc   NONE                      0        0
 117 FastEthernet0   172.16.172.39   alloc   NONE                      0        0
 200 FastEthernet0   172.16.172.39    set    HMAC_MD5+DES_56_CB        0        3
 201 FastEthernet0   172.16.172.39    set    HMAC_MD5+DES_56_CB        3        0


1720-1#sh clock
01:06:41.786 PST Fri Jan 11 2002
```

PIX show 명령의 샘플 출력

```
pix520-1# sh cr isa sa
```

```
Total     : 1
Embryonic : 0
        dst             src         state     pending    created
   172.16.172.39   172.16.172.34   QM_IDLE         0           1
pix520-1#

pix520-1# sh cr map

Crypto Map: "mymap" interfaces: { outside }

Crypto Map "mymap" 5 ipsec-isakmp
        Peer = 172.16.172.39
        access-list 130 permit ip
   192.168.4.0 255.255.255.0 1.1.1.0 255.255.255.0 (hitcnt=91)
        Current peer: 172.16.172.39
        Security association lifetime:
4608000 kilobytes/28800 seconds
        PFS (Y/N): N
        Transform sets={ myset, }
pix520-1# sh cr isa policy
Protection suite of priority 10
        encryption algorithm:   DES - Data Encryption Standard (
56 bit keys).
        hash algorithm:         Message Digest 5
        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
pix520-1#
pix520-1# sh cr ipsec sa


interface: outside
    Crypto map tag: mymap, local addr. 172.16.172.34

   local  ident (addr/mask/prot/port):
   (192.168.4.0/255.255.255.0/0/0)
   remote ident (addr/mask/prot/port):
   (1.1.1.0/255.255.255.0/0/0)
   current_peer: 172.16.172.39
     PERMIT, flags={origin_is_acl,}
    #pkts encaps: 3, #pkts encrypt: 3, #pkts digest 3
    #pkts decaps: 3, #pkts decrypt: 3, #pkts verify 3
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0,
#pkts decompress failed: 0
    #send errors 2, #recv errors 0

     local crypto endpt.: 172.16.172.34, remote
 crypto endpt.: 172.16.172.39
     path mtu 1500, ipsec overhead 56, media mtu 1500
     current outbound spi: d740971c

     inbound esp sas:
      spi: 0x3803a0c1(939761857)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
```

```
        slot: 0, conn id: 4, crypto map: mymap
        sa timing: remaining key lifetime
(k/sec): (4607999/2971)
        IV size: 8 bytes
        replay detection support: Y


     inbound ah sas:


     inbound pcp sas:


     outbound esp sas:
      spi: 0xd740971c(3611334428)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 3, crypto map: mymap
        sa timing: remaining key lifetime
(k/sec): (4607999/2971)
        IV size: 8 bytes
        replay detection support: Y


     outbound ah sas:


     outbound pcp sas:


pix520-1#  pix520-1#  sh cr en
Crypto Engine Connection Map:
    size = 8, free = 6, used = 2, active = 2
pix520-1#

pix520-1# sh clock
09:27:54 Jan 11 2002
pix520-1#
```

문제 해결

이 섹션에서는 컨피그레이션 문제를 해결하는 데 사용할 수 있는 정보를 제공합니다.

문제 해결 명령

일부 **show 명령은** 출력 인터프리터 툴 에서 지원되는데(등록된 고객만), 이 툴을 사용하면 **show 명령 출력의 분석 결과를 볼 수 있습니다.**

참고: debug 명령을 실행하기 전에 디버그 명령에 대한 중요 정보를 참조하십시오.

다음 디버그가 두 IPSec 피어 모두에서 실행 중이어야 합니다.

- **debug crypto isakmp** - (라우터 및 PIX) 1단계 중 오류를 표시합니다.
- **debug crypto ipsec** - (라우터 및 PIX) 2단계 중 오류를 표시합니다.
- **debug crypto engine** - (라우터에만 해당) 암호화 엔진의 정보를 표시합니다.
- **debug crypto pki transactions** - (라우터에만 해당) PKI(라우터 공개 키 인프라) 트랜잭션에 대한 정보를 표시합니다.
- **debug crypto pki messages** - (라우터에만 해당) PKI 입력/출력 메시지에 대한 정보를 표시합니

다.

- **debug crypto ca** - (PIX에만 해당) PKI 트랜잭션 및 입력/출력 메시지에 대한 정보를 표시합니다.

보안 연결을 모두 지우려면 두 피어에서 모두 수행해야 합니다.PIX 명령은 활성화 모드에서 수행됩니다.router 명령은 비활성화 모드에서 수행됩니다.

- **clear crypto isakmp sa** - (PIX) 1단계 보안 연결을 지웁니다.
- **clear crypto ipsec sa** - (PIX) 2단계 보안 연결을 지웁니다.
- **clear crypto isakmp** - (라우터) 1단계 보안 연결을 지웁니다.
- **clear crypto sa** - (라우터) 2단계 보안 연결을 지웁니다.

라우터의 샘플 인증서 디버그

이 섹션에서는 CA 서버에서 인증서를 가져오는 동안 다음 PKI debug 명령을 실행할 때 라우터의 디버그를 보여줍니다.이 디버그는 성공적인 세션 중에 가져왔습니다.

```
1720-1#debug cr pki transactions
Crypto PKI Trans debugging is on
1720-1#debug cr pki messages
Crypto PKI Msg debugging is on


1720-1(config)#cr ca authenticate vpn
Certificate has the following attributes:
Fingerprint: 1FCDF2C8 2DEDA6AC 4819D4C4 B4CFF2F5
% Do you accept this certificate? [yes/no]:
08:48:10: CRYPTO_PKI: Sending CA Certificate Request:
GET /cgi-bin/pkiclient.exe?operation=GetCACert&message =vpn HTTP/1.0


08:48:10: CRYPTO_PKI: can not resolve server name/IP address
08:48:10: CRYPTO_PKI: Using unresolved IP Address 171.69.89.16
08:48:10: CRYPTO_PKI: http connection opened
08:48:11: CRYPTO_PKI: HTTP response header:
 HTTP/1.1 200 OK
Date: Fri, 11 Jan 2002 19:10:53 Pacific Standard Time
Server: Entrust/VPNConnector v5.0
Connection: close
Content-Type: application/x-x509-ra-ca-certs

Content-Type indicates we have received CA and RA certificates.

08:48:11: CRYPTO_PKI:CA and RA certs:

08:48:11:      30 82 08 EA 06 09 2A 86 48 86 F7 0D 01 07 02 A0
08:48:11:      82 08 DB 30 82 08 D7 02 01 01 31 00 30 0B 06 09
08:48:11:      2A 86 48 86 F7 0D 01 07 01 A0 82 08 BF 30 82 02
 !--- Hex data omitted. 08:48:11: 14 06 03 55 04 03 13 0D 46 69 72 73 74 20 4F 66 08:48:11: 66
69 63 65 72 30 81 9F 30 0D 06 09 2A 86 48 86 08:48:11: 80 01 8F 51 3A 4B 61 74 59 0B 85 AA 9C E3
B3 91 08:48:11: 62 94 06 AA 7C E9 CC 0D 01 59 3E 6B 31 00 08:48:11: 08:48:11: CRYPTO_PKI: Error:
Certificate, private key or CRL was not found while selecting certificate chain 08:48:11:
CRYPTO_PKI: WARNING: A certificate chain could not be constructed while selecting certificate
status 08:48:11: CRYPTO_PKI: Error: Certificate, private key or CRL was not found while
selecting certificate chain 08:48:11: CRYPTO_PKI: WARNING: A certificate chain could not be
constructed while selecting certificate status 08:48:11: CRYPTO_PKI: crypto_process_ra_certs()
For:vpn 08:48:11: CRYPTO_PKI: crypto_set_ra_pubkey() (using global_auth_context) 08:48:11:
CRYPTO_PKI: crypto_set_ra_pubkey() (using global_auth_context) 08:48:11: CRYPTO_PKI: transaction
GetCACert completed 08:48:11: CRYPTO_PKI: CA certificate received. 08:48:11: CRYPTO_PKI: CA
```

```
certificate received. % Please answer 'yes' or 'no'. % Do you accept this certificate? [yes/no]:
y
1720-1(config)#
08:49:08: CRYPTO_PKI: crypto_process_ra_certs() For:vpn

1720-1(config)#cr ca enroll vpn
%
% 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.

Password:
Re-enter password:

% The subject name in the certificate will be: 1720-1.cisco.com
% Include the router serial number in the subject name? [yes/no]: n
% Include an IP address in the subject name? [yes/no]: n
Request certificate from CA? [yes/no]: y
% Certificate request sent to Certificate Authority
% The certificate request fingerprint will be displayed.
% The 'show crypto ca certificate' command will also show
% the fingerprint.

1720-1(config)#    Fingerprint:  CB9730B0 5EAAEBCB CC04C77B 2B7F253D

08:51:09: CRYPTO_PKI: transaction PKCSReq completed
08:51:09: CRYPTO_PKI: status:
08:51:10: CRYPTO_PKI:Write out pkcs#10 content:272
08:51:10:      30 82 01 0C 30 81 B7 02 01 00 30 21 31 1F 30 1D
08:51:10:      06 09 2A 86 48 86 F7 0D 01 09 02 16 10 31 37 32
!--- Hex data omitted. 08:51:10: 8F 87 32 4A 25 27 2A 9B 17 F1 1F C5 67 1E 2A D2 08:51:10:
08:51:10: CRYPTO_PKI:Enveloped Data ... 08:51:10: 30 80 06 09 2A 86 48 86 F7 0D 01 07 03 A0 80
30 !--- Hex data omitted. 08:51:10: 2F C8 94 16 FE 2F 1B 00 00 00 00 00 00 00 00 00 08:51:10: 00
08:51:10: 08:51:10: CRYPTO_PKI:Signed Data 1311 bytes 08:51:10: 30 80 06 09 2A 86 48 86 F7 0D 01
07 02 A0 80 30 08:51:10: 80 02 01 01 31 0E 30 0C 06 08 2A 86 48 86 F7 0D !--- Hex data omitted.
08:51:10: D0 56 7D 24 59 9C DE 00 00 00 00 00 00 00 00 08:51:10: 08:51:10: CRYPTO_PKI: can not
resolve server name/IP address 08:51:10: CRYPTO_PKI: Using unresolved IP Address 171.69.89.16
08:51:10: CRYPTO_PKI: http connection opened 08:51:13: CRYPTO_PKI: received msg of 656 bytes
08:51:13: CRYPTO_PKI: HTTP response header: HTTP/1.1 200 OK Date: Fri, 11 Jan 2002 19:13:55
Pacific Standard Time Server: Entrust/VPNConnector v5.0 Connection: close Content-Type:
application/x-pki-message 08:51:13: CRYPTO_PKI:Received pki message: 487 types 08:51:13: 30 82
01 E3 06 09 2A 86 48 86 F7 0D 01 07 02 A0 !--- Hex data omitted. 08:51:13: E6 E3 CC 8B 6C 5E 74
9E 6A 0B 7D E1 B7 31 A0 EF 08:51:13: 02 1B C6 F3 C2 B9 86 08:51:13: 08:51:13: CRYPTO_PKI: signed
attr: pki-message-type: 13 01 33 08:51:13: 08:51:13: CRYPTO_PKI: signed attr: pki-status: 13 01
33 08:51:13: 08:51:13: CRYPTO_PKI: signed attr: pki-recipient-nonce: 08:51:13: 04 20 32 46 37 30
36 35 37 45 39 44 43 31 36 31 08:51:13: 39 31 34 39 30 32 33 34 46 35 42 44 30 46 41 31
08:51:13: 46 34 08:51:13: 08:51:13: CRYPTO_PKI: signed attr: pki-transaction-id: 08:51:13: 13 20
35 33 43 46 43 31 35 30 37 36 42 33 35 42 08:51:13: 37 30 42 43 42 39 39 36 44 36 42 46 39 32 38
30 08:51:13: 37 35 08:51:13: 08:51:13: CRYPTO_PKI: status = 102: certificate request pending
08:51:13: CRYPTO_PKI:Write out getcert initial content:84 08:51:13: 30 52 30 2D 31 0B 30 09 06
03 55 04 06 13 02 75 08:51:13: 73 31 0E 30 0C 06 03 55 04 0A 13 05 63 69 73 63 08:51:13: 6F 31
0E 30 0C 06 03 55 04 0B 13 05 73 6A 76 70 08:51:13: 6E 30 21 31 1F 30 1D 06 09 2A 86 48 86 F7 0D
01 08:51:13: 09 02 16 10 31 37 32 30 2D 31 2E 63 69 73 63 6F 08:51:13: 2E 63 6F 6D 08:51:13:
08:51:13: CRYPTO_PKI:Enveloped Data ... 08:51:13: 30 80 06 09 2A 86 48 86 F7 0D 01 07 03 A0 80
30 !--- Hex data omitted. 08:51:13: 08:51:13: CRYPTO_PKI:Signed Data 1738 bytes 08:51:13: 30 80
06 09 2A 86 48 86 F7 0D 01 07 02 A0 80 30 !--- Hex data omitted. 08:51:14: 59 DA 00 00 00 00 00
00 00 00 08:51:14: 08:51:14: CRYPTO_PKI: can not resolve server name/IP address 08:51:14:
CRYPTO_PKI: Using unresolved IP Address 171.69.89.16 08:51:14: CRYPTO_PKI: http connection
opened 08:51:36: CRYPTO_PKI: received msg of 656 bytes 08:51:36: CRYPTO_PKI: HTTP response
header: HTTP/1.1 200 OK Date: Fri, 11 Jan 2002 19:13:58 Pacific Standard Time Server:
Entrust/VPNConnector v5.0 Connection: close Content-Type: application/x-pki-message 08:51:36:
```

```
CRYPTO_PKI:Received pki message: 487 types 08:51:36: 30 82 01 E3 06 09 2A 86 48 86 F7 0D 01 07
02 A0 08:51:36: 82 01 D4 30 82 01 D0 02 01 01 31 0E 30 0C 06 08 !--- Hex data omitted. 08:51:36:
E6 E3 CC 8B 6C 5E 74 9E 6A 0B 7D E1 B7 31 A0 EF 08:51:36: 02 1B C6 F3 C2 B9 86 08:51:36:
08:51:36: CRYPTO_PKI: signed attr: pki-message-type: 13 01 33 08:51:36: 08:51:36: CRYPTO_PKI:
signed attr: pki-status: 13 01 33 08:51:36: 08:51:36: CRYPTO_PKI: signed attr: pki-recipient-
nonce: 08:51:36: 04 20 32 46 37 30 36 35 37 45 39 44 43 31 36 31 08:51:36: 39 31 34 39 30 32 33
34 46 35 42 44 30 46 41 31 08:51:36: 46 34 08:51:36: 08:51:36: CRYPTO_PKI: signed attr: pki-
transaction-id: 08:51:36: 13 20 35 33 43 46 43 31 35 30 37 36 42 33 35 42 08:51:36: 37 30 42 43
42 39 39 36 44 36 42 46 39 32 38 30 08:51:36: 37 35 08:51:36: 08:51:36: CRYPTO_PKI: status =
102: certificate request pending 08:51:46: CRYPTO_PKI: All sockets are closed. 08:51:56:
CRYPTO_PKI: All sockets are closed. 08:52:36: CRYPTO_PKI: resend GetCertInitial, 1 08:52:36:
CRYPTO_PKI: resend GetCertInitial for session: 0 08:52:36: CRYPTO_PKI: can not resolve server
name/IP address 08:52:36: CRYPTO_PKI: Using unresolved IP Address 171.69.89.16 08:52:36:
CRYPTO_PKI: http connection opened 08:52:38: CRYPTO_PKI: received msg of 1647 bytes 08:52:38:
CRYPTO_PKI: HTTP response header: HTTP/1.1 200 OK Date: Fri, 11 Jan 2002 19:15:20 Pacific
Standard Time Server: Entrust/VPNConnector v5.0 Connection: close Content-Type: application/x-
pki-message 08:52:38: CRYPTO_PKI:Received pki message: 1478 types 08:52:38: 30 82 05 C2 06 09 2A
86 48 86 F7 0D 01 07 02 A0 !--- Hex data omitted. 08:52:38: B4 0D EC 6D 61 9B 08:52:38:
08:52:38: CRYPTO_PKI: signed attr: pki-message-type: 13 01 33 08:52:38: 08:52:38: CRYPTO_PKI:
signed attr: pki-status: 13 01 30 08:52:38: 08:52:38: CRYPTO_PKI: signed attr: pki-recipient-
nonce: 08:52:38: 04 20 32 41 35 44 31 31 42 34 43 39 46 31 34 32 08:52:38: 30 30 38 34 32 43 35
45 38 36 44 44 43 41 45 44 08:52:38: 33 34 08:52:38: 08:52:38: CRYPTO_PKI: signed attr: pki-
transaction-id: 08:52:38: 13 20 35 33 43 46 43 31 35 30 37 36 42 33 35 42 08:52:38: 37 30 42 43
42 39 39 36 44 36 42 46 39 32 38 30 08:52:38: 37 35 08:52:38: 08:52:38: CRYPTO_PKI: status =
100: certificate is granted !--- Certificate is granted by the CA. 08:52:38: CRYPTO_PKI:Verified
signed data 985 bytes: 08:52:38: 30 82 03 D5 06 09 2A 86 48 86 F7 0D 01 07 03 A0 !--- Hex data
omitted. 08:52:38: 39 DE 0A 10 3B D1 17 30 79 83 E0 54 D9 59 47 13 08:52:38: 86 9A E5 5D F8 45
3D 61 63 08:52:38: 08:52:38: CRYPTO_PKI:Decrypted enveloped content: 08:52:38: 30 82 02 F3 06 09
2A 86 48 86 F7 0D 01 07 02 A0 08:52:38: 82 02 E4 30 82 02 E0 02 01 01 31 00 30 0B 06 09 !--- Hex
data omitted. 08:52:39: CE 33 54 B3 4A 62 23 65 6E B1 83 D9 7C 24 87 A5 08:52:39: E8 FF D8 50 6F
31 00 08:52:39: 08:52:39: CRYPTO_PKI: All enrollment requests completed. 08:52:39: %CRYPTO-6-
CERTRET: Certificate received from Certificate Authority 08:52:49: CRYPTO_PKI: All enrollment
requests completed.
```

PIX의 샘플 인증서 디버그

이 섹션에서는 CA 서버에서 인증서를 가져오는 동안 다음 PKI debug 명령을 실행할 때 PIX의 디버그를 보여줍니다.이 디버그는 성공적인 세션 중에 가져왔습니다.

```
pix520-1(config)#
pix520-1(config)# debug cr ca
pix520-1(config)#


pix520-1(config)# ca configure cisco ra 20 5

pix520-1(config)# ca authenticate cisco

CI thread sleeps!
Crypto CA thread wakes up!
CRYPTO_PKI: http connection opened
Certificate has the following attributes:

Fingerprint: 1fcdf2c8 2deda6ac 4819d4c4 b4cff2f5

PKI: key process suspended and continued
CRYPTO_PKI: WARNING: A certificate chain could not
be constructed while selecting certificate status

CRYPTO_PKI: WARNING: A certificate chain could not
be constructed while selecting certificate status
```

```
CRYPTO_PKI: Name: CN = First Officer, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = First Officer, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: transaction GetCACert completed
CRYPTO_PKI: Name: CN = First Officer, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = First Officer, OU = sjvpn, O = cisco, C = us
Crypto CA thread sleeps!
pix520-1(config)# !
pix520-1(config)# sh ca cert
CA
CRYPTO_PKI: Name: OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = CRL1, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = First Officer, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = CRL1, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = First Officer, OU = sjvpn, O = cisco, C = us
CRYPTO_PKI: Name: CN = CRL1, OU = sjvpn, O = cisco, C = us Certificate
  Status: Available
  Certificate Serial Number: 3b2fd307
  Key Usage: General Purpose
    OU = sjvpn
     O = cisco
     C = us
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us
  Validity Date:
    start date: 22:02:40 Jun 19 2001

    end   date: 22:32:40 Jun 19 2021


RA Signature Certificate
    Certificate Serial Number: 3b2fd319
  Key Usage: Signature
    CN = First Officer
     OU = sjvpn
     O = cisco
     C = us
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us
  Validity Date:
    start date: 22:03:31 Jun 19 2001

    end   date: 22:33:31 Jun 19 2004


RA KeyEncipher Certificate
  Status: Available
  Certificate Serial Number: 3b2fd318
  Key Usage: Encryption
    CN = First Officer
     OU = sjvpn
     O = cisco
     C = us
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us
  Validity Date:
    start date: 22:03:31 Jun 19 2001

    end   date: 22:33:31 Jun 19 2004



pix520-1(config)#
Status: Available
```

```
pix520-1(config)#  ca enroll cisco 171.69.89.16

CI thread sleeps!
% Crypto CA thread wakes up!
% Start certificate enrollment ..

% The subject name in the certificate will be: pix520-1.vpn.com


% Certificate request sent to Certificate Authority
% The certificate request fingerprint will be displayed.

pix520-1(config)#     Fingerprint:  bc923bc0 ee66b336 08a513b1 a226c5c8

CRYPTO_PKI: transaction PKCSReq completed
CRYPTO_PKI: status:
Crypto CA thread sleeps!
PKI: key process suspended and continued
CRYPTO_PKI: http connection opened
CRYPTO_PKI:  received msg of 656 bytes
CRYPTO_PKI: WARNING: Certificate, private key or CRL was
not found while selecting CRL

CRYPTO_PKI: signed attr: pki-message-type:
13 01 33
CRYPTO_PKI: signed attr: pki-status:
13 01 33
CRYPTO_PKI: signed attr: pki-recipient-nonce:
04 20 30 36 38 33 34 44 35 46 30 44 31 37 42 39 42 30 30 44
37 37 42 33 44 37 39 42 45 43 43 43 41 41
CRYPTO_PKI: signed attr: pki-transaction-id:
13 20 64 38 32 36 37 37 34 33 31 39 62 65 65 31 62 65 34 36
65 33 63 32 38 37 66 61 65 31 31 36 64 32
CRYPTO_PKI: status = 102: certificate request pending
CRYPTO_PKI: All sockets are closed.
 CRYPTO_PKI: All sockets are closed.
CRYPTO_PKI: resend GetCertInitial for session: 0
CRYPTO_PKI: http connection opened
!--- The certificate has been granted by CA! CRYPTO_PKI: received msg of 1720 bytes CRYPTO_PKI:
WARNING: Certificate, private key or CRL was not found while selecting CRL PKI: key process
suspended and continued CRYPTO_PKI: signed attr: pki-message-type: 13 01 33 CRYPTO_PKI: signed
attr: pki-status: 13 01 30 CRYPTO_PKI: signed attr: pki-recipient-nonce: 04 20 34 42 41 36 31 31
31 42 42 35 42 38 42 43 44 31 36 31 34 30 34 44 45 34 45 33 33 41 34 41 46 36 CRYPTO_PKI: signed
attr: pki-transaction-id: 13 20 64 38 32 36 37 37 34 33 31 39 62 65 65 31 62 65 34 36 65 33 63
32 38 37 66 61 65 31 31 36 64 32 CRYPTO_PKI: status = 100: certificate is granted CRYPTO_PKI:
WARNING: Certificate, private key or CRL was not found while selecting CRL CRYPTO_PKI: All
enrollment requests completed. CRYPTO_PKI: All enrollment requests completed. CRYPTO_PKI:
WARNING: Certificate, private key or CRL was not found while selecting CRL
```

라우터의 샘플 IPSec 디버그

이 섹션에서는 두 IPSec 피어가 IPSec 터널을 협상하는 동안 라우터의 IPSec 디버그를 보여줍니다 .

```
1720-1#debug crypto ipsec
1720-1#debug crypto isakmp
1720-1#debug crypto engine
1720-1#sh debug
Cryptographic Subsystem:
```

```
  Crypto ISAKMP debugging is on
  Crypto Engine debugging is on
  Crypto IPSEC debugging is on
1720-1#

3d11h: ISAKMP (0:0): received packet from 172.16.172.34 (N) NEW SA
3d11h: ISAKMP: local port 500, remote port 500
3d11h: ISAKMP (0:110): processing SA payload. message ID = 0
3d11h: ISAKMP (0:110): Checking ISAKMP transform 1 against
priority 10 policy
3d11h: ISAKMP:      encryption DES-CBC
3d11h: ISAKMP:      hash MD5
3d11h: ISAKMP:      default group 1
3d11h: ISAKMP:      auth RSA sig
!--- IKE phase one is accepting certificates as the authentication method. 3d11h: ISAKMP
(0:110): atts are acceptable. Next payload is 3 3d11h: CryptoEngine0: generate alg parameter
3d11h: CryptoEngine0: CRYPTO_ISA_DH_CREATE(hw)(ipsec) 3d11h: CRYPTO_ENGINE: Dh phase 1 status: 0
3d11h: ISAKMP (0:110): SA is doing RSA signature authentication using id type ID_FQDN 3d11h:
ISAKMP (0:110): sending packet to 172.16.172.34 (R) MM_SA_SETUP 3d11h: ISAKMP (0:110): received
packet from 172.16.172.34 (R) MM_SA_SETUP 3d11h: ISAKMP (0:110): processing KE payload. message
ID = 0 3d11h: CryptoEngine0: generate alg parameter 3d11h: CryptoEngine0:
CRYPTO_ISA_DH_SHARE_SECRET(hw)(ipsec) 3d11h: ISAKMP (0:110): processing NONCE payload. message
ID = 0 3d11h: CryptoEngine0: calculate pkey hmac for conn id 110 3d11h: CryptoEngine0:
CRYPTO_ISA_IKE_HMAC(hw)(ipsec) 3d11h: CryptoEngine0: create ISAKMP SKEYID for conn id 110 3d11h:
CryptoEngine0: CRYPTO_ISA_SA_CREATE(hw)(ipsec) 3d11h: ISAKMP (0:110): SKEYID state generated
3d11h: ISAKMP (0:110): processing CERT_REQ payload. message ID = 0 3d11h: ISAKMP (0:110): peer
wants a CT_X509_SIGNATURE cert 3d11h: ISAKMP (0:110): peer want cert issued by OU = sjvpn, O =
cisco, C = us 3d11h: ISAKMP (0:110): processing vendor id payload 3d11h: ISAKMP (0:110):
processing vendor id payload 3d11h: ISAKMP (0:110): processing vendor id payload 3d11h: ISAKMP
(0:110): speaking to another IOS box! 3d11h: ISAKMP (0:110): sending packet to 172.16.172.34 (R)
MM_KEY_EXCH 3d11h: ISAKMP (0:110): received packet from 172.16.172.34 (R) MM_KEY_EXCH 3d11h:
CryptoEngine0: CRYPTO_ISA_IKE_DECRYPT(hw)(ipsec) 3d11h: ISAKMP (0:110): processing ID payload.
message ID = 0 3d11h: ISAKMP (0:110): processing CERT payload. message ID = 0 3d11h: ISAKMP
(0:110): processing a CT_X509_SIGNATURE cert 3d11h: ISAKMP (0:110): processing SIG payload.
message ID = 0 3d11h: ISAKMP (110): sa->peer.name = , sa->peer_id.id.id_fqdn.fqdn = pix520-
1.vpn.com 3d11h: Crypto engine 0: RSA decrypt with public key 3d11h: CryptoEngine0:
CRYPTO_RSA_PUB_DECRYPT 3d11h: CryptoEngine0: generate hmac context for conn id 110 3d11h:
CryptoEngine0: CRYPTO_ISA_IKE_HMAC(hw)(ipsec) 3d11h: ISAKMP (0:110): SA has been authenticated
with 172.16.172.34 3d11h: ISAKMP (110): ID payload next-payload : 6 type : 2 protocol : 17 port
: 500 length : 20 3d11h: ISAKMP (110): Total payload length: 24 3d11h: CryptoEngine0: generate
hmac context for conn id 110 3d11h: CryptoEngine0: CRYPTO_ISA_IKE_HMAC(hw)(ipsec) 3d11h: Crypto
engine 0: RSA encrypt with private key 3d11h: CryptoEngine0: CRYPTO_RSA_PRIV_ENCRYPT 3d11h:
CRYPTO_ENGINE: key process suspended and continued 3d11h: CryptoEngine0: clear dh number for
conn id 1 3d11h: CryptoEngine0: CRYPTO_ISA_DH_DELETE(hw)(ipsec) 3d11h: CryptoEngine0:
CRYPTO_ISA_IKE_ENCRYPT(hw)(ipsec) 3d11h: ISAKMP (0:110): sending packet to 172.16.172.34 (R)
QM_IDLE 3d11h: ISAKMP (0:110): received packet from 172.16.172.34 (R) QM_IDLE 3d11h:
CryptoEngine0: CRYPTO_ISA_IKE_DECRYPT(hw)(ipsec) 3d11h: CryptoEngine0: generate hmac context for
conn id 110 3d11h: CryptoEngine0: CRYPTO_ISA_IKE_HMAC(hw)(ipsec) 3d11h: ISAKMP (0:110):
processing HASH payload. message ID = -140325145 3d11h: ISAKMP (0:110): processing SA payload.
message ID = -140325145 3d11h: ISAKMP (0:110): Checking IPSec proposal 1 3d11h: ISAKMP:
transform 1, ESP_DES 3d11h: ISAKMP: attributes in transform: 3d11h: ISAKMP: encaps is 1 3d11h:
ISAKMP: SA life type in seconds 3d11h: ISAKMP: SA life duration (basic) of 28800 3d11h: ISAKMP:
SA life type in kilobytes 3d11h: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0 3d11h:
ISAKMP: authenticator is HMAC-MD5 3d11h: validate proposal 0 3d11h: ISAKMP (0:110): atts are
acceptable. 3d11h: IPSEC(validate_proposal_request): proposal part #1, (key eng. msg.) INBOUND
local= 172.16.172.39, remote= 172.16.172.34, local_proxy= 1.1.1.0/255.255.255.0/0/0 (type=4),
remote_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-
hmac , lifedur= 0s and 0kb, spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4 3d11h: validate
proposal request 0 3d11h: ISAKMP (0:110): processing NONCE payload. message ID = -140325145
3d11h: ISAKMP (0:110): processing ID payload. message ID = -140325145 3d11h: ISAKMP (0:110):
processing ID payload. message ID = -140325145 3d11h: ISAKMP (0:110): asking for 1 spis from
ipsec 3d11h: IPSEC(key_engine): got a queue event... 3d11h: IPSEC(spi_response): getting spi
3611334428 for SA from 172.16.172.39 to 172.16.172.34 for prot 3 3d11h: ISAKMP: received ke
message (2/1) 3d11h: CryptoEngine0: generate hmac context for conn id 110 3d11h: CryptoEngine0:
```

```
CRYPTO_ISA_IKE_HMAC(hw)(ipsec) 3d11h: CryptoEngine0: CRYPTO_ISA_IKE_ENCRYPT(hw)(ipsec) 3d11h:
ISAKMP (0:110): sending packet to 172.16.172.34 (R) QM_IDLE 3d11h: ISAKMP (0:110): received
packet from 172.16.172.34 (R) QM_IDLE 3d11h: CryptoEngine0: CRYPTO_ISA_IKE_DECRYPT(hw)(ipsec)
3d11h: CryptoEngine0: generate hmac context for conn id 110 3d11h: CryptoEngine0:
CRYPTO_ISA_IKE_HMAC(hw)(ipsec) 3d11h: ipsec allocate flow 0 3d11h: ipsec allocate flow 0 3d11h:
CryptoEngine0: CRYPTO_ISA_IPSEC_KEY_CREATE(hw)(ipsec) 3d11h: CryptoEngine0:
CRYPTO_ISA_IPSEC_KEY_CREATE(hw)(ipsec) 3d11h: ISAKMP (0:110): Creating IPSec SAs 3d11h: inbound
SA from 172.16.172.34 to 172.16.172.39 (proxy 192.168.4.0 to 1.1.1.0) 3d11h: has spi 0xD740971C
and conn_id 200 and flags 4 3d11h: lifetime of 28800 seconds 3d11h: lifetime of 4608000
kilobytes 3d11h: outbound SA from 172.16.172.39 to 172.16.172.34 (proxy 1.1.1.0 to 192.168.4.0 )
3d11h: has spi 939761857 and conn_id 201 and flags C 3d11h: lifetime of 28800 seconds 3d11h:
lifetime of 4608000 kilobytes 3d11h: ISAKMP (0:110): deleting node -140325145 error FALSE reason
"quick mode done (await()" 3d11h: IPSEC(key_engine): got a queue event... 3d11h:
IPSEC(initialize_sas): , (key eng. msg.) INBOUND local= 172.16.172.39, remote= 172.16.172.34,
local_proxy= 1.1.1.0/255.255.255.0/0/0 (type=4), remote_proxy= 192.168.4.0/255.255.255.0/0/0
(type=4), protocol= ESP, transform= esp-des esp-md5-hmac , lifedur= 28800s and 4608000kb, spi=
0xD740971C(3611334428), conn_id= 200, keysize= 0, flags= 0x4 3d11h: IPSEC(initialize_sas): ,
(key eng. msg.) OUTBOUND local= 172.16.172.39, remote= 172.16.172.34, local_proxy=
1.1.1.0/255.255.255.0/0/0 (type=4), remote_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac , lifedur= 28800s and 4608000kb, spi=
0x3803A0C1(939761857), conn_id= 201, keysize= 0, flags= 0xC 3d11h: IPSEC(create_sa): sa created,
(sa) sa_dest= 172.16.172.39, sa_prot= 50, sa_spi= 0xD740971C(3611334428), sa_trans= esp-des esp-
md5-hmac , sa_conn_id= 200 3d11h: IPSEC(create_sa): sa created, (sa) sa_dest= 172.16.172.34,
sa_prot= 50, sa_spi= 0x3803A0C1(939761857), sa_trans= esp-des esp-md5-hmac , sa_conn_id= 201
3d11h: ISAKMP (0:108): purging SA., sa=811A823C, delme=811A823C 3d11h: CryptoEngine0: delete
connection 108 3d11h: CryptoEngine0: CRYPTO_ISA_SA_DELETE(hw)(ipsec) 3d11h: ISAKMP (0:107):
purging SA., sa=811FE440, delme=811FE440 3d11h: CryptoEngine0: delete connection 107 3d11h:
CryptoEngine0: CRYPTO_ISA_SA_DELETE(hw)(ipsec) 1720-1#
```

PIX의 샘플 IPSec 디버깅

이 섹션에서는 두 IPSec 피어가 IPSec 터널을 협상하는 동안 PIX의 IPSec 디버그를 보여줍니다.

```
pix520-1# debug crypto ipsec
pix520-1# debug crypto isakmp
pix520-1# sh debug
debug crypto ipsec 1
debug crypto isakmp 1
debug fover status
        tx      Off
        rx      Off
        open    Off
        cable   Off
        txdmp   Off
        rxdmp   Off
        ifc     Off
        rxip    Off
        txip    Off
        get     Off
        put     Off
        verify  Off
        switch  Off
        fail    Off
        fmsg    Off

ISAKMP (0): beginning Main Mode exchange

crypto_isakmp_process_block: src 172.16.172.39,
dest 172.16.172.34
OAK_MM exchange
ISAKMP (0): processing SA payload. message ID = 0
```

```
ISAKMP (0): Checking ISAKMP transform 1 against
priority 10 policy
ISAKMP:      encryption DES-CBC
ISAKMP:      hash MD5
ISAKMP:      default group 1
ISAKMP:      auth RSA sig
ISAKMP (0): atts are acceptable. Next payload is 0
ISAKMP (0): SA is doing RSA signature authentication
using id type ID_FQDN
return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 172.16.172.39,
dest 172.16.172.34
OAK_MM exchange
ISAKMP (0): processing KE payload. message ID = 0

ISAKMP (0): processing NONCE payload. message ID = 0

ISAKMP (0): processing CERT_REQ payload. message ID = 0
ISAKMP (0): peer wants a CT_X509_SIGNATURE cert
ISAKMP (0): processing vendor id payload

ISAKMP (0): speaking to another IOS box!

ISAKMP (0): ID payload
        next-payload : 6
        type         : 2
        protocol     : 17
        port         : 500
        length       : 20
ISAKMP (0): Total payload length: 24
return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 172.16.172.39,
dest 172.16.172.34
OAK_MM exchange
ISAKMP (0): processing ID payload. message ID = 0
ISAKMP (0): processing CERT payload. message ID = 0
ISAKMP (0): processing a CT_X509_SIGNATURE cert
ISAKMP (0): processing SIG payload. message ID = 0
ISAKMP (0): sa->peer.name = , sa->peer_id.id.id_fqdn.fqdn =
1720-1.cisco.com
ISAKMP (0): SA has been authenticated

ISAKMP (0): beginning Quick Mode exchange,
M-ID of -140325145:f7a2cee7IPSEC(key_engine):
got a queue event...
IPSEC(spi_response): getting spi 0x3803a0c1(939761857)
  for SA from 172.16.172.39 to 172.16.172.34 for prot 3

return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 172.16.172.39,
dest 172.16.172.34
OAK_QM exchange
oakley_process_quick_mode:
OAK_QM_IDLE
ISAKMP (0): processing SA payload.
message ID = 4154642151
ISAKMP : Checking IPSec proposal 1

ISAKMP: transform 1, ESP_DES
ISAKMP:   attributes in transform:
ISAKMP:      encaps is 1
ISAKMP:      SA life type in seconds
ISAKMP:      SA life duration (basic) of 28800
ISAKMP:      SA life type in kilobytes
```

```
ISAKMP:      SA life duration (VPI)
of  0x0 0x46 0x50 0x0
ISAKMP:      authenticator is HMAC-MD5
ISAKMP (0): atts are acceptable.
IPSEC(validate_proposal_request): proposal part #1,
  (key eng. msg.) dest= 172.16.172.39,
    src= 172.16.172.34,
    dest_proxy= 1.1.1.0/255.255.255.0/0/0 (type=4),
    src_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 0s and 0kb,
    spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4

ISAKMP (0): processing NONCE payload.
message ID = 4154642151

ISAKMP (0): processing ID payload.
message ID = 4154642151
ISAKMP (0): processing ID payload.
message ID = 4154642151
ISAKMP (0): processing NOTIFY payload 24576
        protocol 3 spi 3611334428,
    message ID = 4154642151
ISAKMP (0): processing responder lifetime
ISAKMP (0): responder lifetime of 3600s
ISAKMP (0): Creating IPSec SAs
        inbound SA from   172.16.172.39 to
172.16.172.34 (proxy  1.1.1.0 to 192.168.4.0)
        has spi 939761857 and conn_id 4 and flags 4
        lifetime of 3600 seconds
        lifetime of 4608000 kilobytes
        outbound SA from   172.16.172.34 to
172.16.172.39 (proxy  192.168.4.0 to  1.1.1.0)
        has spi 3611334428 and conn_id 3 and flags 4
        lifetime of 3600 seconds
        lifetime of 4608000 kilobytes
IPSEC(key_engine): got a queue event...
IPSEC(initialize_sas): ,
  (key eng. msg.) dest= 172.16.172.34, src= 172.16.172.39,
    dest_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
    src_proxy= 1.1.1.0/255.255.255.0/0/0 (type=4),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0x3803a0c1(939761857), conn_id= 4, keysize= 0,
flags= 0x4
IPSEC(initialize_sas): ,
  (key eng. msg.) src= 172.16.172.34, dest= 172.16.172.39,
    src_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
    dest_proxy= 1.1.1.0/255.255.255.0/0/0 (type=4),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0xd740971c(3611334428), conn_id= 3, keysize= 0,
flags= 0x4

return status is IKMP_NO_ERROR

pix520-1(config)#
```

잠재적 문제

이 섹션에서는 라우터와 PIX에서 인증서를 얻는 동안 발생하는 일반적인 오류의 증상, 원인 및 해결에 대해 설명합니다.

ISAKMP ID 불일치

라우터와 PIX는 IPSec에서 사용하는 키 및 인증서에 FQDN을 할당합니다.IKE 또는 1단계 협상 중에 라우터/IOS는 인증서의 FQDN을 확인합니다.따라서 PIX와 라우터 모두에서 주소 대신 ISAKMP ID를 호스트 이름으로 사용해야 합니다.다음 예에서 라우터/IOS는 인증서의 FQDN을 확인합니다.

```
ISAKMP (0): SA is doing RSA signature authentication using
    id type ID_FQDN return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 172.16.172.39, d
    est 172.16.172.34
```

라우터 디버그:

```
3d15h: CryptoEngine0: CRYPTO_ISA_DH_CREATE(hw)(ipsec)
3d15h: CRYPTO_ENGINE: Dh phase 1 status: 0
3d15h: ISAKMP (152): My ID configured as IPv4 Addr,
    but Addr not in Cert!
3d15h: ISAKMP (152): Using FQDN as My ID
3d15h: ISAKMP (0:152): SA is doing RSA signature
    authentication using id type ID _FQDN
3d15h: ISAKMP (0:152): sending packet to 172.16.172.34 (R)
    MM_SA_SETUP
3d15h: ISAKMP (0:152): received packet from 172.16.172.34 (R)
    MM_SA_SETUP


3d15h: ISAKMP (0:162): processing a CT_X509_SIGNATURE cert
3d15h: %CRYPTO-6-IKMP_NO_ID_CERT_ADDR_MATCH: ID of
    172.16.172.34   (type 1) an
    certificate addr with 172.16.172.34
3d15h: ISAKMP (0:162): processing SIG payload.
    message ID = 0
3d15h: Crypto engine 0: RSA decrypt with public key
```

PIX 디버그:

```
ISAKMP (0): beginning Main Mode exchange

crypto_isakmp_process_block: src 172.16.172.39, dest 172.16.172.34
OAK_MM exchange
ISAKMP (0): processing SA payload. message ID = 0

ISAKMP (0): Checking ISAKMP transform 1 against priority 10 policy
ISAKMP:      encryption DES-CBC
ISAKMP:      hash MD5
ISAKMP:      default group 1
ISAKMP:      auth RSA sig
ISAKMP (0): atts are acceptable. Next payload is 0
ISAKMP (0): SA is doing RSA signature authentication using id type ID_IPV4_ADDR
return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 172.16.172.39, dest 172.16.172.34
OAK_MM exchange
ISAKMP (0): processing KE payload. message ID = 0

ISAKMP (0): processing NONCE payload. message ID = 0

ISAKMP (0): processing vendor id payload

ISAKMP (0): speaking to another IOS box!
```

```
ISAKMP (0): ID payload
        next-payload : 9
        type         : 1
        protocol     : 17
        port         : 500
        length       : 8
ISAKMP (0): Total payload length: 12
return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 172.16.172.39, dest 172.16.172.34
OAK_MM exchange
ISAKMP (0): processing ID payload. message ID = 0
ISAKMP (0): processing CERT payload. message ID = 0
ISAKMP (0): processing a CT_X509_SIGNATURE cert
return status is IKMP_ERR_RETRANS
```

시간 및 날짜 불일치

PIX와 라우터의 인증서는 다음 예와 같이 특정 시간 간격 동안 유효합니다.

```
Certificate
  Status: Available
  Certificate Serial Number: 3b2fd653
  Key Usage: General Purpose
  Subject Name
    Name: pix520-1.vpn.com
  CRL Distribution Point:
    CN = CRL1, OU = sjvpn, O = cisco, C = us

     Validity Date:
!--- The certificates are valid between the start and end date. start date: 04:13:45 Jan 11 2002
end date: 04:43:45 Jan 11 2003
```

다음 **show** 명령 출력은 시간 간격도 보여줍니다.

```
1720-1#sh crypto ca crls
CRL Issuer Name:
    OU = sjvpn, O = cisco, C = us
    LastUpdate: 16:17:34 PST Jan 10 2002
    NextUpdate: 17:17:34 PST Jan 11 2002
    Retrieved from CRL Distribution Point:
      LDAP: CN = CRL1, OU = sjvpn, O = cisco, C = us
```

라우터 또는 PIX의 클럭 날짜 및 시간이 인증서의 시작 및 종료 날짜와 CRL의 다음/마지막 업데이트 사이에 있지 않으면 1단계 협상 중에 다음 오류가 발생합니다.

라우터 디버그:

```
CRYPTO_PKI: New CRL Not Yet Valid
  (router time not synched to CA?)
   CRL published: 16:17:34 PST Jan 10 2002
     Router time: 16:07:02 PST Feb 28 1993acket to
 172.16.172.34 (R) MM_KEY_EXCH
00:07:01: ISAKMP (0:10): received packet from
    172.16.172.34 (R) MM_KEY_EXCH
```

이 예에서 라우터 시간은 16:07:02 2월 28 1993으로 설정되었으며, 이는 CA에서 요구하는 유효 시간 사이에 속하지 않습니다.문제를 해결하려면 라우터에서 적절한 시간을 설정합니다.

```
1720-1#clock set 01:05:01 january 11 2002
1720-1#sh clock
01:05:04.903 PST Fri Jan 11 2002
1720-1#
```

HTTP/TCP 포트 80 차단됨

라우터와 PIX는 CA 서버와의 인증 및 등록 과정에서 TCP 포트 80을 사용합니다.등록 또는 인증 문제가 있는 경우 라우터/PIX와 CA 서버 간에 HTTP/TCP 포트 80이 차단되지 않는지 확인합니다.

PIX/라우터에 CRL이 없음

PIX/라우터에서 crl optional 명령을 지정하지 않았으므로 이 두 디바이스 모두 1단계 협상 중에 CRL을 확인합니다.CRL이 없으면 다음 오류가 표시됩니다.

PIX 디버그:

```
ISAKMP (0): processing CERT payload.
    message ID = 0
ISAKMP (0): processing a CT_X509_SIGNATURE cert
CRYPTO_PKI: status = 0: poll CRL
CI thread sleeps!
Crypto CA thread wakes up!
CRYPTO_PKI: Name: CN = CRL1, OU = sjvpn,
    O = cisco, C = us
CRYPTO_PKI: ldap_bind() succeeded.
Fail to verify and insert CRL

CRYPTO_PKI: the current router time:
    02:58:08 Jan 12 2002

CRYPTO_PKI: the last CRL update time:
    00:17:34 Jan 11 2002

CRYPTO_PKI: the next CRL update time:
    01:17:34 Jan 12 2002

CRYPTO_PKI: server timer behind router:
    nextUpdate: 3c3f8eae, now: 3c3fa640
CRYPTO_PKI: status = 275: failed to insert CRL
CRYPTO_PKI: transaction GetCRL completed
CRYPTO_PKI:  blocking callback
    received status: 105
Crypto CA thread sleeps!
CI thread wakes up!
ISAKMP (0): Unknown error in cert
    validation, 65535
return status is IKMP_ERR_RETRANS
```

이 문제를 해결하려면 ca crl **request ca *nickname* 명령**을 실행하여 CA 서버에서 인증서를 가져옵니다.cr ca crl **request Cisco를** 사용했습니다.

인증서 및 RSA 키 쌍 삭제

라우터 또는 PIX에서 디지털 인증서 또는 RSA 키 쌍을 삭제해야 할 수 있습니다.

라우터 인증서 및 RSA 키 쌍 삭제

명령:

- **no crypto ca identity** *ca nickname* **-** 라우터 인증서를 삭제합니다.
- **crypto key zeroize rsa** - RSA 키 쌍을 삭제합니다.

인증서를 삭제하려면 아래 예를 따르십시오.

```
1720-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
1720-1(config)#no crypto ca identity vpn
% Removing an identity will destroy all certificates received from
 the related Certificate Authority.

Are you sure you want to do this? [yes/no]: y
% Be sure to ask the CA administrator to revoke your certificates.

No enrollment sessions are currently active.

1720-1(config)#
1720-1#sh cr ca cert
1720-1#
!--- The certificates are no longer available.
```

라우터에서 RSA 키 쌍을 삭제하려면 다음 예를 따르십시오.

```
1720-1(config)#crypto key zeroize rsa
% Keys to be removed are named 1720-1.cisco.com.
Do you really want to remove these keys? [yes/no]: y
1720-1(config)#.

1720-1#sh crypto key mypubkey rsa
1720-1#
!-- The RSA key pairs are no longer available.
```

PIX 인증서 및 RSA 키 쌍 삭제

명령:

- **no ca identity** *ca 별칭* **-** PIX에서 인증서를 삭제합니다.
- **ca zeroize rsa** - PIX에서 RSA 키 쌍을 삭제합니다.

PIX에서 인증서를 삭제하려면 다음 예를 따르십시오.

```
pix520-1(config)# no ca identity cisco
% Removing the identity will destroy all certificates.
% Be sure to ask the CA administrator to revoke your certificates.

pix520-1(config)# sh cr ca cert
pix520-1(config)#
!--- The certificates are no longer available.
```

PIX에서 RSA 키 쌍을 삭제하려면 다음 예를 따르십시오.

```
pix520-1(config)# ca zeroize rsa

pix520-1(config)# sh ca mypubkey rsa
!--- The RSA key pairs are no longer available.
```

관련 정보

- IPSec 지원 페이지
- PIX 지원 페이지
- RFC(Request for Comments)
- Technical Support - Cisco Systems