IKEv1/IKEv2 بين مثال تكوين Cisco IOS و StrongSwan

المحتويات

المقدمة

يقدم هذا المستند مثالا لتكوين شبكة VPN من شبكة LAN إلى شبكة LAN (L2L) بين Cisco IOS® و StrongSwan. يتم تقديم كل من عمليات تكوين Internet Key Exchange الإصدار 1 (IKEv1) و Internet Key Exchange الإصدار 2 (IKEv2).

المتطلبات الأساسية

المتطلبات

توصي Cisco بأن تكون لديك معرفة بالمواضيع التالية:

- معرفة أساسية حول تكوينات لينوكس
- معرفة تكوينات VPN على Cisco IOS
- معرفة حول هذه البروتوكولات: IKEv2IKEv1أمان بروتوكول الإنترنت (IPSec)

المكونات المستخدمة

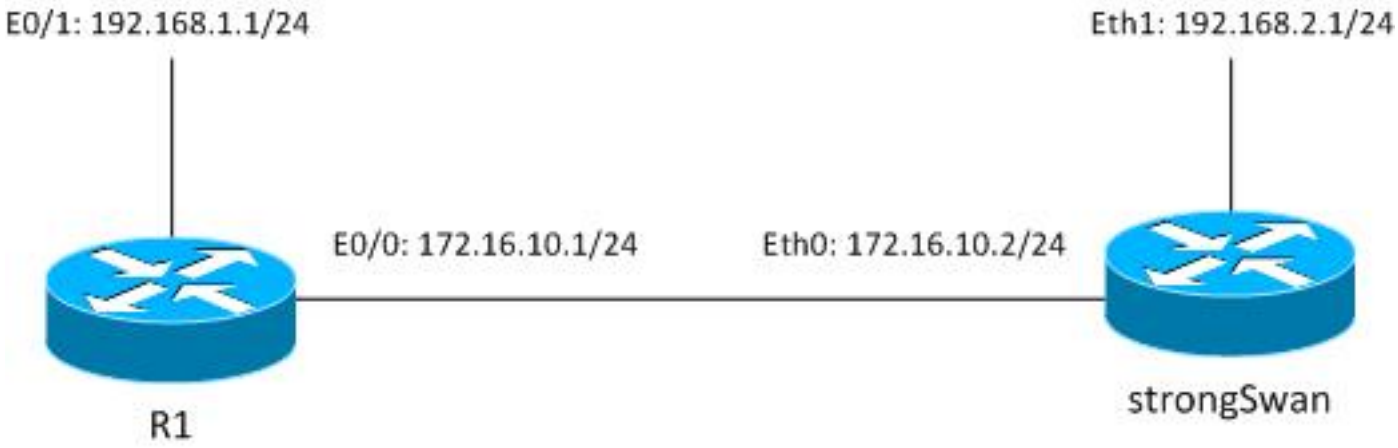
تستند المعلومات الواردة في هذا المستند إلى إصدارات البرامج التالية:

- IOS الإصدار 15.3T من Cisco
- StrongSwan 5.0.4
- Linux kernel 3.2.12

التكوين

الرسم التخطيطي للشبكة

والمخطط هو نفسه لكلا المثالين، وهو نفق L2L بين Cisco IOS و StrongSwan.



تتم حماية حركة المرور بين 24/192.168.1.0<->24/192.168.2.0.

شبكات VPN مفتوحة المصدر L2L IPSec

هناك العديد من مشاريع المصدر المفتوح التي تستخدم بروتوكولات Internet Key Exchange (IKE) و IPSec لإنشاء أنفاق L2L آمنة:

- الشبكة الحرة الآمنة الواسعة (WAN/Free Secure Wide-Area Networking): محفوظات، لا تتم المحافظة عليها بشكل فعال
- أدوات ipsSec: racon - لا يدعم الإصدار الثاني من بروتوكول IKEv2 وكواة لينوكس القديمة 2.6
- OpenWAN: دعم أساسي جدا ل IKEv2، نواة Linux الأقدم 2. 6 وواجهة برمجة التطبيقات (API) الأقدم، لم يتم الحفاظ عليها بشكل نشط
- تقنية StrongWan: تدعم امتدادات IKEv2 و EAP/mobility ونواة لينوكس الجديدة الإصدار x.3 والإصدارات الأحدث التي تستخدم واجهة برمجة تطبيقات NetKey (وهو اسم تطبيق IPSec الأصلي في Kernel 2.6 والإصدارات الأحدث)، والتي تتم صيانتها بشكل نشط وموثوقيتها بشكل جيد

حاليا، أفضل خيار هو عادة البجعة القوية. يشبه في التشكيل OpenWAN ومع ذلك هناك عدة إختلافات صغيرة. يركز هذا الدليل على تقنية StrongSwan وتكوين Cisco IOS.

IKEv1 بين Cisco IOS و StrongSwan

تكوين IOS من Cisco

```
crypto isakmp policy 10
 encr aes
 authentication pre-share
 group 5
crypto isakmp key cisco address 172.16.10.2

crypto ipsec transform-set TS esp-aes esp-sha-hmac
 mode tunnel

crypto map cmap 10 ipsec-isakmp
 set peer 172.16.10.2
 set transform-set TS
 match address cryptoacl

interface Ethernet0/1
 ip address 192.168.1.1 255.255.255.0

interface Ethernet0/0
 ip address 172.16.10.1 255.255.255.0
 crypto map cmap

ip access-list extended cryptoacl
 permit ip 192.168.1.0 0.0.0.255 192.168.2.0 0.0.0.255
```

تكوين strongWAN

يتعلق الجانب الأيسر ب StrongSwan والجانب الأيمن بعيد (Cisco IOS في هذا المثال).

/etc/ipsec.conf

```
config setup
        # strictcrlpolicy=yes
        # uniqueids = no
```

```
conn %default
ikelifetime=1440m
keylife=60m
rekeymargin=3m
keyingtries=1
keyexchange=ikev1
authby=secret

conn ciscoios
left=172.16.10.2 #strongswan outside address
leftsubnet=192.168.2.0/24 #network behind strongswan
leftid=172.16.10.2 #IKEID sent by strongswan
leftfirewall=yes
right=172.16.10.1 #IOS outside address
rightsubnet=192.168.1.0/24 #network behind IOS
rightid=172.16.10.1 #IKEID sent by IOS
auto=add
ike=aes128-md5-modp1536 #P1: modp1536 = DH group 5
esp=aes128-sha1 #P2
```

وبشكل افتراضي، يستخدم Cisco IOS العنوان كمعرف IKE - ولهذا السبب تم إستخدام العناوين ك "يمين" و"يسار". تدعم StrongSwan، مثل Cisco IOS، تشفير الجيل التالي (Suite B) - وبالتالي من الممكن إستخدام مفاتيح 4096 Diffie-Hellman (DH) مع AES256 و SHA512.

بالنسبة للمعلمة التلقائية، تم إستخدام الوسيطة "add". التي تجلب إلى النفق بعد الحصول على حركة مرور مثيرة للاهتمام. ولبدء التشغيل على الفور، يمكن إستخدام الوسيطة "start".

etc/ipsec.secrets/

```
PSK cisco : 172.16.10.1 172.16.10.2
```

بالنسبة ل IKEv1 يجب أن يكون كلا المفتاحين متماثلين، في هذا المثال "Cisco".

IKEv2 بين Cisco IOS و StrongSwan

تكوين IOS من Cisco

```
crypto ikev2 proposal ikev2proposal
encryption aes-cbc-128
integrity sha1
group 5

crypto ikev2 policy ikev2policy
match fvrf any
proposal ikev2proposal

crypto ikev2 keyring keys
peer strongswan
address 172.16.10.2
pre-shared-key local cisco
pre-shared-key remote cisco

crypto ikev2 profile ikev2profile
```

```
match identity remote address 172.16.10.2 255.255.255.255
                                authentication remote pre-share
                                 authentication local pre-share
                                             keyring local keys

                    crypto ipsec transform-set TS esp-aes esp-sha-hmac
                                                  mode tunnel

                                   crypto map cmap 10 ipsec-isakmp
                                             set peer 172.16.10.2
                                             set transform-set TS
                                  set ikev2-profile ikev2profile
                                         match address cryptoacl

                                             interface Ethernet0/1
                          ip address 192.168.1.1 255.255.255.0

                                             interface Ethernet0/0
                          ip address 172.16.10.1 255.255.255.0
                                               crypto map cmap

                                  ip access-list extended cryptoacl
              permit ip 192.168.1.0 0.0.0.255 192.168.2.0 0.0.0.255
```

تكوين strongWAN

هناك تغييران فقط بالمقارنة مع IKEv1 وهما تبادل المفاتيح وربما المفاتيح.

/etc/ipsec.conf

```
                                    config setup
                               strictcrlpolicy=yes #
                                    uniqueids = no #

                                        conn %default
                                  ikelifetime=1440m
                                        keylife=60m
                                     rekeymargin=3m
                                      keyingtries=1
                                  keyexchange=ikev1
                                      authby=secret

                                        conn ciscoios
                                    left=172.16.10.2
                              leftsubnet=192.168.2.0/24
                                   leftid=172.16.10.2
                                    leftfirewall=yes
                                   right=172.16.10.1
                             rightsubnet=192.168.1.0/24
                                  rightid=172.16.10.1
                                             auto=add
                           ike=aes128-sha1-modp1536
                                    esp=aes128-sha1
                                 keyexchange=ikev2
```

/etc/ipsec.secrets

```
                                "PSK "cisco : 172.16.10.2
                                "PSK "cisco : 172.16.10.1
```

في IKEv2، يمكن أن تكون المفاتيح الخاصة بكل موقع مختلفة.

التحقق من الصحة

راجع قسم أستكشاف الأخطاء وإصلاحها لإجراءات التحقق.

استكشاف الأخطاء وإصلاحها

يوفر هذا القسم معلومات يمكنك استخدامها لاستكشاف أخطاء التكوين وإصلاحها.

IKEv1 بين Cisco IOS و StrongSwan

Cisco من IOS

```
R1#ping 192.168.2.1 source e0/1 repeat 1
```

إنشاء النفق الذي تم تشغيله بواسطة Cisco IOS

```
*May 24 18:02:48.464: IPSEC(sa_request): ,
  (key eng. msg.) OUTBOUND local= 172.16.10.1:500, remote= 172.16.10.2:500,
            local_proxy= 192.168.1.0/255.255.255.0/256/0,
           remote_proxy= 192.168.2.0/255.255.255.0/256/0,
        (Tunnel  esp-sha-hmac  esp-aes: transform= ESP, protocol),
                                    lifedur= 3600s and 4608000kb,
                spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
*May 24 18:02:48.465: ISAKMP:(0): SA request profile is (NULL)
*May 24 18:02:48.465: ISAKMP: Created a peer struct for 172.16.10.2, peer port 500
*May 24 18:02:48.465: ISAKMP: New peer created peer = 0xF334E7E0 peer_handle
                                                          0x80000006
*May 24 18:02:48.465: ISAKMP: Locking peer struct 0xF334E7E0, refcount 1 for
                                                        isakmp_initiator
*May 24 18:02:48.465: ISAKMP: local port 500, remote port 500
*May 24 18:02:48.465: ISAKMP: set new node 0 to QM_IDLE
*May 24 18:02:48.465: ISAKMP: Find a dup sa in the avl tree during calling
                                                    isadb_insert sa = F49C9890
*May 24 18:02:48.465: ISAKMP:(0):Can not start Aggressive mode, trying Main mode.
*May 24 18:02:48.465: ISAKMP:(0):found peer pre-shared key matching 172.16.10.2
*May 24 18:02:48.465: ISAKMP:(0): constructed NAT-T vendor-rfc3947 ID
*May 24 18:02:48.465: ISAKMP:(0): constructed NAT-T vendor-07 ID
*May 24 18:02:48.465: ISAKMP:(0): constructed NAT-T vendor-03 ID
*May 24 18:02:48.465: ISAKMP:(0): constructed NAT-T vendor-02 ID
*May 24 18:02:48.465: ISAKMP:(0):Input = IKE_MESG_FROM_IPSEC, IKE_SA_REQ_MM
*May 24 18:02:48.465: ISAKMP:(0):Old State = IKE_READ  New State = IKE_I_MM1

*May 24 18:02:48.465: ISAKMP:(0): beginning Main Mode exchange
*May 24 18:02:48.465: ISAKMP:(0): sending packet to 172.16.10.2 my_port 500
                                                    peer_port 500 (I) MM_NO_STATE
*May 24 18:02:48.465: ISAKMP:(0):Sending an IKE IPv4 Packet.
*May 24 18:02:48.466: ISAKMP (0): received packet from 172.16.10.2 dport 500
```

```
                                                    sport 500 Global (I) MM_NO_STATE
            May 24 18:02:48.466: ISAKMP:(0):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH*
      May 24 18:02:48.466: ISAKMP:(0):Old State = IKE_I_MM1  New State = IKE_I_MM2*

            May 24 18:02:48.466: ISAKMP:(0): processing SA payload. message ID = 0*
                    May 24 18:02:48.466: ISAKMP:(0): processing vendor id payload*
 May 24 18:02:48.466: ISAKMP:(0): vendor ID seems Unity/DPD but major 215 mismatch*
                              May 24 18:02:48.466: ISAKMP:(0): vendor ID is XAUTH*
                    May 24 18:02:48.466: ISAKMP:(0): processing vendor id payload*
                                May 24 18:02:48.466: ISAKMP:(0): vendor ID is DPD*
                    May 24 18:02:48.466: ISAKMP:(0): processing vendor id payload*
  May 24 18:02:48.466: ISAKMP:(0): vendor ID seems Unity/DPD but major 69 mismatch*
                     May 24 18:02:48.466: ISAKMP (0): vendor ID is NAT-T RFC 3947*
    May 24 18:02:48.466: ISAKMP:(0):found peer pre-shared key matching 172.16.10.2*
                       May 24 18:02:48.466: ISAKMP:(0): local preshared key found*
                    ... May 24 18:02:48.466: ISAKMP : Scanning profiles for xauth*
      May 24 18:02:48.466: ISAKMP:(0):Checking ISAKMP transform 1 against priority*
                                                                        policy 10
                             May 24 18:02:48.466: ISAKMP:      encryption AES-CBC*
                               May 24 18:02:48.466: ISAKMP:      keylength of 128*
                                       May 24 18:02:48.466: ISAKMP:      hash SHA*
                                May 24 18:02:48.466: ISAKMP:      default group 5*
                                 May 24 18:02:48.466: ISAKMP:      auth pre-share*
                           May 24 18:02:48.466: ISAKMP:      life type in seconds*
       May 24 18:02:48.466: ISAKMP:      life duration (VPI) of  0x0 0x1 0x51 0x80*
            May 24 18:02:48.466: ISAKMP:(0):atts are acceptable. Next payload is 0*
                    May 24 18:02:48.466: ISAKMP:(0):Acceptable atts:actual life: 0*
                           May 24 18:02:48.466: ISAKMP:(0):Acceptable atts:life: 0*
                     May 24 18:02:48.466: ISAKMP:(0):Fill atts in sa vpi_length:4*
           May 24 18:02:48.466: ISAKMP:(0):Fill atts in sa life_in_seconds:86400*
                May 24 18:02:48.466: ISAKMP:(0):Returning Actual lifetime: 86400*
                .May 24 18:02:48.466: ISAKMP:(0)::Started lifetime timer: 86400*

                    May 24 18:02:48.466: ISAKMP:(0): processing vendor id payload*
 May 24 18:02:48.466: ISAKMP:(0): vendor ID seems Unity/DPD but major 215 mismatch*
                              May 24 18:02:48.466: ISAKMP:(0): vendor ID is XAUTH*
                    May 24 18:02:48.466: ISAKMP:(0): processing vendor id payload*
                                May 24 18:02:48.466: ISAKMP:(0): vendor ID is DPD*
                    May 24 18:02:48.466: ISAKMP:(0): processing vendor id payload*
  May 24 18:02:48.466: ISAKMP:(0): vendor ID seems Unity/DPD but major 69 mismatch*
                     May 24 18:02:48.466: ISAKMP (0): vendor ID is NAT-T RFC 3947*
  May 24 18:02:48.466: ISAKMP:(0):Input = IKE_MESG_INTERNAL, IKE_PROCESS_MAIN_MODE*
      May 24 18:02:48.466: ISAKMP:(0):Old State = IKE_I_MM2  New State = IKE_I_MM2*

        May 24 18:02:48.466: ISAKMP:(0): sending packet to 172.16.10.2 my_port 500*
                                                    peer_port 500 (I) MM_SA_SETUP
                     .May 24 18:02:48.466: ISAKMP:(0):Sending an IKE IPv4 Packet*
    May 24 18:02:48.466: ISAKMP:(0):Input = IKE_MESG_INTERNAL, IKE_PROCESS_COMPLETE*
       May 24 18:02:48.466: ISAKMP:(0):Old State = IKE_I_MM2  New State = IKE_I_MM3*

 May 24 18:02:48.474: ISAKMP (0): received packet from 172.16.10.2 dport 500 sport*
                                                  Global (I) MM_SA_SETUP 500
            May 24 18:02:48.474: ISAKMP:(0):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH*
      May 24 18:02:48.474: ISAKMP:(0):Old State = IKE_I_MM3  New State = IKE_I_MM4*

            May 24 18:02:48.474: ISAKMP:(0): processing KE payload. message ID = 0*
         May 24 18:02:48.482: ISAKMP:(0): processing NONCE payload. message ID = 0*
    May 24 18:02:48.482: ISAKMP:(0):found peer pre-shared key matching 172.16.10.2*
                             May 24 18:02:48.482: ISAKMP:received payload type 20*
     May 24 18:02:48.482: ISAKMP (1003): His hash no match - this node outside NAT*
                             May 24 18:02:48.482: ISAKMP:received payload type 20*
                 May 24 18:02:48.482: ISAKMP (1003): No NAT Found for self or peer*
May 24 18:02:48.482: ISAKMP:(1003):Input = IKE_MESG_INTERNAL, IKE_PROCESS_MAIN_MODE*
    May 24 18:02:48.482: ISAKMP:(1003):Old State = IKE_I_MM4  New State = IKE_I_MM4*
```

May 24 18:02:48.482: ISAKMP:(1003):Send initial contact*
May 24 18:02:48.482: ISAKMP:(1003):SA is doing pre-shared key authentication using*
id type ID_IPV4_ADDR
May 24 18:02:48.482: ISAKMP (1003): ID payload*
next-payload : 8
type : 1
address : 172.16.10.1
protocol : 17
port : 500
length : 12
May 24 18:02:48.482: ISAKMP:(1003):Total payload length: 12*
May 24 18:02:48.482: ISAKMP:(1003): sending packet to 172.16.10.2 my_port 500*
peer_port 500 (I) MM_KEY_EXCH
.May 24 18:02:48.482: ISAKMP:(1003):Sending an IKE IPv4 Packet*
May 24 18:02:48.482: ISAKMP:(1003):Input = IKE_MESG_INTERNAL, IKE_PROCESS_COMPLETE*
May 24 18:02:48.482: ISAKMP:(1003):Old State = IKE_I_MM4 New State = IKE_I_MM5*

May 24 18:02:48.483: ISAKMP (1003): received packet from 172.16.10.2 dport 500*
sport 500 Global (I) MM_KEY_EXCH
May 24 18:02:48.483: ISAKMP:(1003): processing ID payload. message ID = 0*
May 24 18:02:48.483: ISAKMP (1003): ID payload*
next-payload : 8
type : 1
address : 172.16.10.2
protocol : 0
port : 0
length : 12
May 24 18:02:48.483: ISAKMP:(0):: peer matches *none* of the profiles*
May 24 18:02:48.483: ISAKMP:(1003): processing HASH payload. message ID = 0*
:May 24 18:02:48.483: ISAKMP:(1003):SA authentication status*
authenticated
May 24 18:02:48.483: ISAKMP:(1003):**SA has been authenticated with 172.16.10.2***
,/May 24 18:02:48.483: ISAKMP: Trying to insert a peer 172.16.10.1/172.16.10.2/500*
.and inserted successfully F334E7E0
May 24 18:02:48.483: ISAKMP:(1003):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH*
May 24 18:02:48.483: ISAKMP:(1003):Old State = IKE_I_MM5 New State = IKE_I_MM6*

May 24 18:02:48.483: ISAKMP:(1003):Input = IKE_MESG_INTERNAL, IKE_PROCESS_MAIN_MODE*
May 24 18:02:48.483: ISAKMP:(1003):Old State = IKE_I_MM6 New State = IKE_I_MM6*

May 24 18:02:48.487: ISAKMP:(1003):Input = IKE_MESG_INTERNAL, IKE_PROCESS_COMPLETE*
May 24 18:02:48.487: ISAKMP:(1003):Old State = IKE_I_MM6 New State = IKE_P1_COMPLETE*

May 24 18:02:48.487: ISAKMP:(1003):beginning Quick Mode exchange, M-ID of 2605730229*
May 24 18:02:48.487: ISAKMP:(1003):QM Initiator gets spi*
May 24 18:02:48.487: ISAKMP:(1003): sending packet to 172.16.10.2 my_port 500*
peer_port 500 (I) QM_IDLE
.May 24 18:02:48.487: ISAKMP:(1003):Sending an IKE IPv4 Packet*
,May 24 18:02:48.488: ISAKMP:(1003):Node 2605730229, Input = IKE_MESG_INTERNAL*
IKE_INIT_QM
May 24 18:02:48.488: ISAKMP:(1003):Old State = IKE_QM_READY New State = IKE_QM_I_QM1*
May 24 18:02:48.488: ISAKMP:(1003):Input = IKE_MESG_INTERNAL, IKE_PHASE1_COMPLETE*
= May 24 18:02:48.488: ISAKMP:(1003):Old State = IKE_P1_COMPLETE New State*
IKE_P1_COMPLETE

May 24 18:02:48.488: ISAKMP (1003): received packet from 172.16.10.2 dport 500*
sport 500 Global (I) QM_IDLE
May 24 18:02:48.488: ISAKMP:(1003): processing HASH payload. message ID = 2605730229*
May 24 18:02:48.488: ISAKMP:(1003): processing SA payload. message ID = 2605730229*
May 24 18:02:48.488: ISAKMP:(1003):Checking IPSec proposal 1*
May 24 18:02:48.488: ISAKMP: transform 1, ESP_AES*
:May 24 18:02:48.488: ISAKMP: attributes in transform*
May 24 18:02:48.488: ISAKMP: key length is 128*

```
                                May 24 18:02:48.488: ISAKMP:      authenticator is HMAC-SHA*
                                     (May 24 18:02:48.488: ISAKMP:      encaps is 1 (Tunnel*
                                  May 24 18:02:48.488: ISAKMP:      SA life type in seconds*
                           May 24 18:02:48.488: ISAKMP:      SA life duration (basic) of 3600*
                                May 24 18:02:48.488: ISAKMP:      SA life type in kilobytes*
                 May 24 18:02:48.488: ISAKMP:      SA life duration (VPI) of  0x0 0x46 0x50 0x0*
                                    .May 24 18:02:48.488: ISAKMP:(1003):atts are acceptable*
                       May 24 18:02:48.488: IPSEC(validate_proposal_request): proposal part #1*
                      ,May 24 18:02:48.488: IPSEC(validate_proposal_request): proposal part #1*
                          ,key eng. msg.) INBOUND local= 172.16.10.1:0, remote= 172.16.10.2:0)
                                              ,local_proxy= 192.168.1.0/255.255.255.0/256/0
                                              ,remote_proxy= 192.168.2.0/255.255.255.0/256/0
                                                   ,(protocol= ESP, transform= NONE  (Tunnel
                                                             ,lifedur= 0s and 0kb
                                                spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
                                                    May 24 18:02:48.488: Crypto mapdb : proxy_match*
                                                                src addr     : 192.168.1.0
                                                                dst addr     : 192.168.2.0
                                                                         protocol     : 0
                                                                         src port     : 0
                                                                         dst port     : 0
May 24 18:02:48.488: ISAKMP:(1003): processing NONCE payload. message ID = 2605730229*
   May 24 18:02:48.488: ISAKMP:(1003): processing ID payload. message ID = 2605730229*
   May 24 18:02:48.488: ISAKMP:(1003): processing ID payload. message ID = 2605730229*
      ,May 24 18:02:48.488: ISAKMP:(1003):Node 2605730229, Input = IKE_MESG_FROM_PEER*
                                                                                  IKE_QM_EXCH
             = May 24 18:02:48.488: ISAKMP:(1003):Old State = IKE_QM_I_QM1  New State*
                                                           IKE_QM_IPSEC_INSTALL_AWAIT
      (May 24 18:02:48.488: IPSEC(key_engine): got a queue event with 1 KMI message(s*
                                    May 24 18:02:48.488: Crypto mapdb : proxy_match*
                                                src addr     : 192.168.1.0
                                                dst addr     : 192.168.2.0
                                                        protocol     : 256
                                                          src port     : 0
                                                          dst port     : 0
           May 24 18:02:48.488: IPSEC(crypto_ipsec_create_ipsec_sas): Map found cmap*
   May 24 18:02:48.489: IPSEC(crypto_ipsec_sa_find_ident_head): reconnecting with the*
                                                same proxies and peer 172.16.10.2
                                    ,May 24 18:02:48.489: IPSEC(create_sa): sa created*
                                              ,sa) sa_dest= 172.16.10.1, sa_proto= 50)
                                                     ,(sa_spi= 0x4C0D0EF0(1275924208
                                       sa_trans= esp-aes esp-sha-hmac , sa_conn_id= 7
                                                   (sa_lifetime(k/sec)= (4608000/3600
                                    ,May 24 18:02:48.489: IPSEC(create_sa): sa created*
                                              ,sa) sa_dest= 172.16.10.2, sa_proto= 50)
                                                     ,(sa_spi= 0xC72072C6(3340792518
                                       sa_trans= esp-aes esp-sha-hmac , sa_conn_id= 8
                                                   (sa_lifetime(k/sec)= (4608000/3600
```

وفي كلتا المرحلتين، يكون بروتوكول إدارة المفاتيح وارتباط أمان الإنترنت (ISAKMP) و IPSec قيد التشغيل.

IOS من Cisco: التحقق من عدادات IPSec

```
R1#show crypto session detail
Crypto session current status

Code: C - IKE Configuration mode, D - Dead Peer Detection
K - Keepalives, N - NAT-traversal, T - cTCP encapsulation
   X - IKE Extended Authentication, F - IKE Fragmentation

Interface: Ethernet0/0
```

```
                                                    Uptime: 00:00:05
                                                Session status: UP-ACTIVE
                                (Peer: 172.16.10.2 port 500 fvrf: (none) ivrf: (none
                                                Phase1_id: 172.16.10.2
                                                        (Desc: (none
                        IKEv1 SA: local 172.16.10.1/500 remote 172.16.10.2/500 Active
                            Capabilities:(none) connid:1003 lifetime:23:59:54
                IPSEC FLOW: permit ip 192.168.1.0/255.255.255.0 192.168.2.0/255.255.255.0
                                        Active SAs: 2, origin: crypto map
                        Inbound:  #pkts dec'ed 0 drop 0 life (KB/Sec) 4164218/3594
                       Outbound: #pkts enc'ed 0 drop 0 life (KB/Sec) 4164218/3594A
```

بعد إرسال 100 حزمة:

```
                                        R1#ping 192.168.2.1 source e0/1 repeat 100
                                                .Type escape sequence to abort
                    :Sending 100, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds
                                    Packet sent with a source address of 192.168.1.1
                    !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
                                                !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
                      Success rate is 100 percent (100/100), round-trip min/avg/max = 4/4/5 ms
                                                                        R1#

                                                    R1#show crypto session detail
                                                    Crypto session current status

                                         Code: C - IKE Configuration mode, D - Dead Peer Detection
                                         K - Keepalives, N - NAT-traversal, T - cTCP encapsulation
                                            X - IKE Extended Authentication, F - IKE Fragmentation

                                                                Interface: Ethernet0/0
                                                                     Uptime: 00:00:09
                                                               Session status: UP-ACTIVE
                                (Peer: 172.16.10.2 port 500 fvrf: (none) ivrf: (none
                                                               Phase1_id: 172.16.10.2
                                                                       (Desc: (none
                                    IKEv1 SA: local 172.16.10.1/500 remote 172.16.10.2/500 Active
                                        Capabilities:(none) connid:1003 lifetime:23:59:50
                            IPSEC FLOW: permit ip 192.168.1.0/255.255.255.0 192.168.2.0/255.255.255.0
                                                    Active SAs: 2, origin: crypto map
                                    Inbound:  #pkts dec'ed 100 drop 0 life (KB/Sec) 4164202/3590
                                   Outbound: #pkts enc'ed 100 drop 0 life (KB/Sec) 4164202/3590
```

برنامج Cisco IOS: التحقق من معلمات IKEv1 و IPSec

```
                                                    R1#show crypto isakmp sa detail
                                       Codes: C - IKE configuration mode, D - Dead Peer Detection
                                                        K - Keepalives, N - NAT-traversal
                                    T - cTCP encapsulation, X - IKE Extended Authentication
                                                psk - Preshared key, rsig - RSA signature
                                                        renc - RSA encryption
                                                        IPv4 Crypto ISAKMP SA

.C-id  Local           Remote          I-VRF  Status Encr Hash   Auth DH Lifetime Cap

     ACTIVE aes  sha    psk  5  23:59:35           172.16.10.2     172.16.10.1  1003
                                                    Engine-id:Conn-id =  SW:3
```

```
R1#show crypto ipsec sa
 interface: Ethernet0/0
 Crypto map tag: cmap, local addr 172.16.10.1

 (protected vrf: (none
 (local  ident (addr/mask/prot/port): (192.168.1.0/255.255.255.0/0/0
 (remote ident (addr/mask/prot/port): (192.168.2.0/255.255.255.0/0/0
 current_peer 172.16.10.2 port 500
 {,PERMIT, flags={origin_is_acl
 pkts encaps: 100, #pkts encrypt: 100, #pkts digest: 100#
 pkts decaps: 100, #pkts decrypt: 100, #pkts verify: 100#
 pkts compressed: 0, #pkts decompressed: 0#
 pkts not compressed: 0, #pkts compr. failed: 0#
 pkts not decompressed: 0, #pkts decompress failed: 0#
 send errors 0, #recv errors 0#

 local crypto endpt.: 172.16.10.1, remote crypto endpt.: 172.16.10.2
 plaintext mtu 1438, path mtu 1500, ip mtu 1500, ip mtu idb Ethernet0/0
 (current outbound spi: 0xC72072C6(3340792518
 PFS (Y/N): N, DH group: none

 :inbound esp sas
 (spi: 0x4C0D0EF0(1275924208
 , transform: esp-aes esp-sha-hmac
 { ,in use settings ={Tunnel
 conn id: 7, flow_id: SW:7, sibling_flags 80000040, crypto map: cmap
 (sa timing: remaining key lifetime (k/sec): (4164202/3562
 IV size: 16 bytes
 replay detection support: Y
 (Status: ACTIVE(ACTIVE

 :inbound ah sas

 :inbound pcp sas

 :outbound esp sas
 (spi: 0xC72072C6(3340792518
 , transform: esp-aes esp-sha-hmac
 { ,in use settings ={Tunnel
 conn id: 8, flow_id: SW:8, sibling_flags 80000040, crypto map: cmap
 (sa timing: remaining key lifetime (k/sec): (4164202/3562
 IV size: 16 bytes
 replay detection support: Y
 (Status: ACTIVE(ACTIVE

 :outbound ah sas

 :outbound pcp sas
```

كلتا المرحلتين في طور العمل. يتم التفاوض على فهرس معلمات أمان IPSec (SPI). زاد العداد إلى 100 بعد إرسال 100 حزمة.

ستروسوان: إنشاء نفق

```
pluton# /etc/init.d/ipsec start

[May 24 20:02:48 localhost charon: 10[NET] received packet: from 172.16.10.1[500
 (to 172.16.10.2[500] (168 bytes
[ May 24 20:02:48 localhost charon: 10[ENC] parsed ID_PROT request 0 [ SA V V V V
 May 24 20:02:48 localhost charon: 10[IKE] received NAT-T (RFC 3947) vendor ID
 May 24 20:02:48 localhost charon: 10[IKE] received draft-ietf-ipsec-nat-t-ike-07
```

```
                                                                vendor ID
      May 24 20:02:48 localhost charon: 10[IKE] received draft-ietf-ipsec-nat-t-ike-03
                                                                vendor ID
    May 24 20:02:48 localhost charon: 10[IKE] received draft-ietf-ipsec-nat-t-ike-02\n
                                                                vendor ID
May 24 20:02:48 localhost charon: 10[IKE] 172.16.10.1 is initiating a Main Mode IKE_SA
May 24 20:02:48 localhost charon: 10[IKE] 172.16.10.1 is initiating a Main Mode IKE_SA
  [ May 24 20:02:48 localhost charon: 10[ENC] generating ID_PROT response 0 [ SA V V V
    May 24 20:02:48 localhost charon: 10[NET] sending packet: from 172.16.10.2[500] to
                                                        (bytes 140) [500]172.16.10.1
   May 24 20:02:48 localhost charon: 11[NET] received packet: from 172.16.10.1[500] to
                                                        (bytes 348) [500]172.16.10.2
                May 24 20:02:48 localhost charon: 11[ENC] parsed ID_PROT request 0
                                                        [ KE No V V V NAT-D NAT-D ]
            May 24 20:02:48 localhost charon: 11[ENC] generating ID_PROT response 0
                                                            [ KE No NAT-D NAT-D ]
     [May 24 20:02:48 localhost charon: 11[NET] sending packet: from 172.16.10.2[500
                                                    (to 172.16.10.1[500] (308 bytes
    [May 24 20:02:48 localhost charon: 12[NET] received packet: from 172.16.10.1[500
                                                    (to 172.16.10.2[500] (108 bytes
                May 24 20:02:48 localhost charon: 12[ENC] parsed ID_PROT request 0
                                                        [ (ID HASH N(INITIAL_CONTACT ]
   May 24 20:02:48 localhost charon: 12[CFG] looking for pre-shared key peer configs
                                        [matching 172.16.10.2...172.16.10.1[172.16.10.1
          "May 24 20:02:48 localhost charon: 12[CFG] selected peer config "ciscoios
    May 24 20:02:48 localhost charon: 12[IKE] IKE_SA ciscoios[2] established between
                                    [172.16.10.1]172.16.10.1...[172.16.10.2]172.16.10.2
    May 24 20:02:48 localhost charon: 12[IKE] IKE_SA ciscoios[2] established between
                                    [172.16.10.1]172.16.10.1...[172.16.10.2]172.16.10.2
      May 24 20:02:48 localhost charon: 12[IKE] scheduling reauthentication in 3289s
              May 24 20:02:48 localhost charon: 12[IKE] maximum IKE_SA lifetime 3469s
  [ May 24 20:02:48 localhost charon: 12[ENC] generating ID_PROT response 0 [ ID HASH
    May 24 20:02:48 localhost charon: 12[NET] sending packet: from 172.16.10.2[500] to
                                                        (bytes 76) [500]172.16.10.1
   May 24 20:02:48 localhost charon: 14[NET] received packet: from 172.16.10.1[500] to
                                                        (bytes 188) [500]172.16.10.2
      May 24 20:02:48 localhost charon: 14[ENC] parsed QUICK_MODE request 2605730229
                                                            [ HASH SA No ID ID ]
   May 24 20:02:48 localhost charon: 14[IKE] received 3600s lifetime, configured 1200s
 May 24 20:02:48 localhost charon: 14[IKE] received 4608000000 lifebytes, configured 0
   May 24 20:02:48 localhost charon: 14[ENC] generating QUICK_MODE response 2605730229
                                                            [ HASH SA No ID ID ]
    May 24 20:02:48 localhost charon: 14[NET] sending packet: from 172.16.10.2[500] to
                                                        (bytes 188) [500]172.16.10.1
   May 24 20:02:48 localhost charon: 15[NET] received packet: from 172.16.10.1[500] to
                                                        (bytes 60) [500]172.16.10.2
[ May 24 20:02:48 localhost charon: 15[ENC] parsed QUICK_MODE request 2605730229 [ HASH
   May 24 20:02:48 localhost charon: 15[IKE] CHILD_SA ciscoios{2} established with SPIs
                        c72072c6_i 4c0d0ef0_o and TS 192.168.2.0/24 === 192.168.1.0/24
   May 24 20:02:48 localhost charon: 15[IKE] CHILD_SA ciscoios{2} established with SPIs
                        c72072c6_i 4c0d0ef0_o and TS 192.168.2.0/24 === 192.168.1.0/24
         -- May 24 20:02:48 localhost vpn: + 172.16.10.1 192.168.1.0/24 == 172.16.10.1
                                                        192.168.2.0/24 == 172.16.10.2
```

كلتا المرحلتين في طور العمل. يتم التفاوض حول نقاط الوصول الخاصة الصحيحة التي تحمي حركة المرور بين 24/192.168.2.0 و 24/192.168.1.0.

strongSwan: التحقق من حالة اتصال IPSec

```
                                                    pluton ~ # ipsec statusall
                :(Status of IKE charon daemon (strongSwan 5.0.4, Linux 3.2.12-gentoo, x86_64
```

```
                                uptime: 4 minutes, since May 24 20:02:15 2013
                             malloc: sbrk 393216, mmap 0, used 274064, free 119152
 worker threads: 8 of 16 idle, 7/1/0/0 working, job queue: 0/0/0/0, scheduled: 4
     loaded plugins: charon mysql sqlite aes des sha1 sha2 md5 random nonce x509
 revocation constraints pubkey pkcs1 pkcs8 pgp dnskey pem openssl gcrypt fips-prf
      gmp xcbc cmac hmac attr kernel-netlink resolve socket-default stroke updown
eap-identity eap-sim eap-aka eap-aka-3gpp2 eap-simaka-pseudonym eap-simaka-reauth
                            eap-md5 eap-gtc eap-mschapv2 eap-radius xauth-generic
                                                    :Listening IP addresses
                                                                 10.0.0.100
                                                               192.168.10.1
                                                                172.16.10.2
                                                                192.168.2.1
                                                                :Connections
                                     ciscoios:  172.16.10.2...172.16.10.1  IKEv1
          ciscoios:   local:  [172.16.10.2] uses pre-shared key authentication
          ciscoios:   remote: [172.16.10.1] uses pre-shared key authentication
                  ciscoios:   child:  192.168.2.0/24 === 192.168.1.0/24 TUNNEL
                                        :(Security Associations (1 up, 0 connecting
           ...[ciscoios[2]: ESTABLISHED 4 minutes ago, 172.16.10.2[172.16.10.2
                                                        [172.16.10.1]172.16.10.1
              ,*ciscoios[2]: IKEv1 SPIs: 278f22e3c3e5f606_i dbb5a27f3e0eccd1_r
                                     pre-shared key reauthentication in 50 minutes
    ciscoios[2]: IKE proposal: AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_1536
               ciscoios{2}:  INSTALLED, TUNNEL, ESP SPIs: c72072c6_i 4c0d0ef0_o
    ,(ciscoios{2}:  AES_CBC_128/HMAC_SHA1_96, 10000 bytes_i (100 pkts, 255s ago
                         bytes_o (100 pkts, 255s ago), rekeying in 11 minutes 10000
                                 ciscoios{2}:   192.168.2.0/24 === 192.168.1.0/24
```

تتوفر تفاصيل حول معلمات ISAKMP و IPSec التي تم التفاوض عليها.

strongSwan: التحقق من سياسة IPSec

```
                                                pluton ~ # ip -s xfrm policy
                                             src 192.168.1.0/24 dst 192.168.2.0/24 uid 0
(dir fwd action allow index 258 priority 1859 share any flag  (0x00000000
                                                              :lifetime config
                                  (limit: soft (INF)(bytes), hard (INF)(bytes
                               (limit: soft (INF)(packets), hard (INF)(packets
                                        (expire add: soft 0(sec), hard 0(sec
                                        (expire use: soft 0(sec), hard 0(sec
                                                     :lifetime current
                                                  (bytes), 0(packets)0
                                               - add 2013-05-24 20:02:48 use
                                             tmpl src 172.16.10.1 dst 172.16.10.2
     proto esp spi 0x00000000(0) reqid 2(0x00000002) mode tunnel
                                                 level required share any
         enc-mask ffffffff auth-mask ffffffff comp-mask ffffffff
                                             src 192.168.1.0/24 dst 192.168.2.0/24 uid 0
 (dir in action allow index 248 priority 1859 share any flag  (0x00000000
                                                              :lifetime config
                                  (limit: soft (INF)(bytes), hard (INF)(bytes
                               (limit: soft (INF)(packets), hard (INF)(packets
                                        (expire add: soft 0(sec), hard 0(sec
                                        (expire use: soft 0(sec), hard 0(sec
                                                     :lifetime current
                                                  (bytes), 0(packets)0
                               add 2013-05-24 20:02:48 use 2013-05-24 20:02:56
                                             tmpl src 172.16.10.1 dst 172.16.10.2
     proto esp spi 0x00000000(0) reqid 2(0x00000002) mode tunnel
                                                 level required share any
```

```
                enc-mask ffffffff auth-mask ffffffff comp-mask ffffffff
                                        src 192.168.2.0/24 dst 192.168.1.0/24 uid 0
      (dir out action allow index 241 priority 1859 share any flag  (0x00000000
                                                          :lifetime config
                                    (limit: soft (INF)(bytes), hard (INF)(bytes
                                (limit: soft (INF)(packets), hard (INF)(packets
                                          (expire add: soft 0(sec), hard 0(sec
                                          (expire use: soft 0(sec), hard 0(sec
                                                       :lifetime current
                                                  (bytes), 0(packets)0
                                add 2013-05-24 20:02:48 use 2013-05-24 20:02:56
                                        tmpl src 172.16.10.2 dst 172.16.10.1
          proto esp spi 0x00000000(0) reqid 2(0x00000002) mode tunnel
                                             level required share any
                enc-mask ffffffff auth-mask ffffffff comp-mask ffffffff
```

تتضمن التفاصيل السابقة جداول السياسات الداخلية.

IKEv2 بين Cisco IOS و StrongSwan

IOS من Cisco

```
R1#ping 192.168.2.1 source e0/1 repeat 1
```

إنشاء النفق الذي تم تشغيله بواسطة Cisco IOS

```
                                        , :(May 24 19:14:10.485: IPSEC(sa_request*
,key eng. msg.) OUTBOUND local= 172.16.10.1:500, remote= 172.16.10.2:500)
                                    ,local_proxy= 192.168.1.0/255.255.255.0/256/0
                                   ,remote_proxy= 192.168.2.0/255.255.255.0/256/0
                          ,(protocol= ESP, transform= esp-aes esp-sha-hmac  (Tunnel
                                                ,lifedur= 3600s and 4608000kb
                                  spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
      May 24 19:14:10.486: IKEv2:% Getting preshared key from profile keyring keys*
                          'May 24 19:14:10.486: IKEv2:% Matched peer block 'strongswan*
   May 24 19:14:10.486: IKEv2:Searching Policy with fvrf 0, local address 172.16.10.1*
                                    'May 24 19:14:10.486: IKEv2:Found Policy 'ikev2policy*
  May 24 19:14:10.486: IKEv2:(SA ID = 1):[IKEv2 -> Crypto Engine] Computing DH public*
                                                                  key, DH Group 5
   May 24 19:14:10.486: IKEv2:(SA ID = 1):[Crypto Engine -> IKEv2] DH key Computation*
                                                                        PASSED
      May 24 19:14:10.486: IKEv2:(SA ID = 1):Request queued for computation of DH key*
May 24 19:14:10.486: IKEv2:IKEv2 initiator - no config data to send in IKE_SA_INIT exch*
                  May 24 19:14:10.486: IKEv2:(SA ID = 1):Generating IKE_SA_INIT message*
                    May 24 19:14:10.486: IKEv2:(SA ID = 1):IKE Proposal: 1, SPI size: 0*
                                                          ,(initial negotiation)
                                                             Num. transforms: 4
                                    AES-CBC   SHA1   SHA96   DH_GROUP_1536_MODP/Group 5

      May 24 19:14:10.486: IKEv2:(SA ID = 1):Sending Packet [To 172.16.10.2:500/From*
                                                          [VRF i0:f0/172.16.10.1:500
    Initiator SPI : 9FFC38791FFEF212 - Responder SPI : 0000000000000000 Message id: 0
                                                  IKEv2 IKE_SA_INIT Exchange REQUEST
                                                               :Payload contents
 (SA KE N VID VID NOTIFY(NAT_DETECTION_SOURCE_IP) NOTIFY(NAT_DETECTION_DESTINATION_IP
```

```
May 24 19:14:10.486: IKEv2:(SA ID = 1):Insert SA*

May 24 19:14:10.495: IKEv2:(SA ID = 1):Received Packet [From 172.16.10.2:500/To*
                                                    [VRF i0:f0/172.16.10.1:500
  Initiator SPI : 9FFC38791FFEF212 - Responder SPI : 6CDC17F5B0B10C1A Message id: 0
                                            IKEv2 IKE_SA_INIT Exchange RESPONSE
                                                    :Payload contents
      (SA KE N NOTIFY(NAT_DETECTION_SOURCE_IP) NOTIFY(NAT_DETECTION_DESTINATION_IP
                                                  (NOTIFY(Unknown - 16404

            May 24 19:14:10.495: IKEv2:(SA ID = 1):Processing IKE_SA_INIT message*
                    May 24 19:14:10.495: IKEv2:(SA ID = 1):Verify SA init message*
            May 24 19:14:10.495: IKEv2:(SA ID = 1):Processing IKE_SA_INIT message*
                    May 24 19:14:10.495: IKEv2:(SA ID = 1):Checking NAT discovery*
                            May 24 19:14:10.495: IKEv2:(SA ID = 1):NAT not found*
     May 24 19:14:10.495: IKEv2:(SA ID = 1):[IKEv2 -> Crypto Engine] Computing DH*
                                                      secret key, DH Group 5
May 24 19:14:10.504: IKEv2:(SA ID = 1):[Crypto Engine -> IKEv2] DH key Computation*
                                                                    PASSED
May 24 19:14:10.504: IKEv2:(SA ID = 1):Request queued for computation of DH secret*
May 24 19:14:10.504: IKEv2:(SA ID = 1):[IKEv2 -> Crypto Engine] Calculate SKEYSEED*
                                                    and create rekeyed IKEv2 SA
         May 24 19:14:10.504: IKEv2:(SA ID = 1):[Crypto Engine -> IKEv2] SKEYSEED*
                                                    calculation and creation of
                                                        rekeyed IKEv2 SA PASSED
                May 24 19:14:10.504: IKEv2:(SA ID = 1):Completed SA init exchange*
                    May 24 19:14:10.504: IKEv2:(SA ID = 1):Check for EAP exchange*
           May 24 19:14:10.504: IKEv2:(SA ID = 1):Generate my authentication data*
     ,May 24 19:14:10.504: IKEv2:(SA ID = 1):Use preshared key for id 172.16.10.1*
                                                                      key len 5
 May 24 19:14:10.504: IKEv2:[IKEv2 -> Crypto Engine] Generate IKEv2 authentication*
                                                                        data
    May 24 19:14:10.504: IKEv2:[Crypto Engine -> IKEv2] IKEv2 authentication data*
                                                          generation PASSED
              May 24 19:14:10.504: IKEv2:(SA ID = 1):Get my authentication method*
         'May 24 19:14:10.504: IKEv2:(SA ID = 1):My authentication method is 'PSK*
                    May 24 19:14:10.504: IKEv2:(SA ID = 1):Check for EAP exchange*
               May 24 19:14:10.504: IKEv2:(SA ID = 1):Generating IKE_AUTH message*
   'May 24 19:14:10.504: IKEv2:(SA ID = 1):Constructing IDi payload: '172.16.10.1*
                                                      'of type 'IPv4 address
              May 24 19:14:10.504: IKEv2:(SA ID = 1):ESP Proposal: 1, SPI size: 4*
                                                    ,(IPSec negotiation)
                                                      Num. transforms: 3
                                                AES-CBC   SHA96   Don't use ESN
           .May 24 19:14:10.504: IKEv2:(SA ID = 1):Building packet for encryption*
                                                    :Payload contents
         (VID IDi AUTH SA TSi TSr NOTIFY(INITIAL_CONTACT) NOTIFY(SET_WINDOW_SIZE
                                 (NOTIFY(ESP_TFC_NO_SUPPORT) NOTIFY(NON_FIRST_FRAGS

                              May 24 19:14:10.505: IKEv2:(SA ID = 1):Sending Packet*
                                 [To 172.16.10.2:500/From 172.16.10.1:500/VRF i0:f0]
  Initiator SPI : 9FFC38791FFEF212 - Responder SPI : 6CDC17F5B0B10C1A Message id: 1
                                            IKEv2 IKE_AUTH Exchange REQUEST
                                                    :Payload contents
                                                              ENCR



                              May 24 19:14:10.522: IKEv2:(SA ID = 1):Received Packet*
                                 [From 172.16.10.2:500/To 172.16.10.1:500/VRF i0:f0]
  Initiator SPI : 9FFC38791FFEF212 - Responder SPI : 6CDC17F5B0B10C1A Message id: 1
                                            IKEv2 IKE_AUTH Exchange RESPONSE
                                                    :Payload contents
                                      (IDr AUTH SA TSi TSr NOTIFY(Unknown - 16403
```

```
                    May 24 19:14:10.522: IKEv2:(SA ID = 1):Process auth response notify*
                May 24 19:14:10.522: IKEv2:(SA ID = 1):Searching policy based on peer's*
                                        'identity '172.16.10.2' of type 'IPv4 address
    May 24 19:14:10.522: IKEv2:Searching Policy with fvrf 0, local address 172.16.10.1*
                                'May 24 19:14:10.522: IKEv2:Found Policy 'ikev2policy*
                            May 24 19:14:10.522: IKEv2:(SA ID = 1):Verify peer's policy*
                          May 24 19:14:10.522: IKEv2:(SA ID = 1):Peer's policy verified*
                May 24 19:14:10.522: IKEv2:(SA ID = 1):Get peer's authentication method*
          'May 24 19:14:10.522: IKEv2:(SA ID = 1):Peer's authentication method is 'PSK*
       May 24 19:14:10.522: IKEv2:(SA ID = 1):Get peer's preshared key for 172.16.10.2*
              May 24 19:14:10.522: IKEv2:(SA ID = 1):Verify peer's authentication data*
May 24 19:14:10.522: IKEv2:(SA ID = 1):Use preshared key for id 172.16.10.2, key len 5*
May 24 19:14:10.522: IKEv2:[IKEv2 -> Crypto Engine] Generate IKEv2 authentication data*
        May 24 19:14:10.522: IKEv2:[Crypto Engine -> IKEv2] IKEv2 authentication data*
                                                              generation PASSED
    May 24 19:14:10.522: IKEv2:(SA ID = 1):Verification of peer's authenctication data*
                                                                      PASSED
                          May 24 19:14:10.522: IKEv2:(SA ID = 1):Check for EAP exchange*
                    May 24 19:14:10.522: IKEv2:(SA ID = 1):Processing IKE_AUTH message*
                        :May 24 19:14:10.522: IKEv2:KMI/verify policy/sending to IPSec*
                         prot: 3 txfm: 12 hmac 2 flags 8177 keysize 128 IDB 0x0
                May 24 19:14:10.522: IPSEC(validate_proposal_request): proposal part #1*
               ,May 24 19:14:10.522: IPSEC(validate_proposal_request): proposal part #1*
                   ,key eng. msg.) INBOUND local= 172.16.10.1:0, remote= 172.16.10.2:0)
                                      ,local_proxy= 192.168.1.0/255.255.255.0/256/0
                                     ,remote_proxy= 192.168.2.0/255.255.255.0/256/0
                                          ,(protocol= ESP, transform= NONE  (Tunnel
                                                    ,lifedur= 0s and 0kb
                                   spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
                                       May 24 19:14:10.522: Crypto mapdb : proxy_match*
                                                    src addr     : 192.168.1.0
                                                    dst addr     : 192.168.2.0
                                                             protocol     : 0
                                                             src port     : 0
                                                             dst port     : 0
  .May 24 19:14:10.522: IKEv2:(SA ID = 1):IKEV2 SA created; inserting SA into database*
                                                  SA lifetime timer (86400 sec) started
                       May 24 19:14:10.522: IKEv2:(SA ID = 1):Session with IKE ID PAIR*
                                                    is UP (172.16.10.1 ,172.16.10.2)
                    May 24 19:14:10.522: IKEv2:IKEv2 MIB tunnel started, tunnel index 1*
                        May 24 19:14:10.522: IKEv2:(SA ID = 1):Load IPSEC key material*
          May 24 19:14:10.522: IKEv2:(SA ID = 1):[IKEv2 -> IPsec] Create IPsec SA into*
                                                                      IPsec database
                     May 24 19:14:10.522: IKEv2:(SA ID = 1):Asynchronous request queued*

                                                :(May 24 19:14:10.522: IKEv2:(SA ID = 1*
        (May 24 19:14:10.523: IPSEC(key_engine): got a queue event with 1 KMI message(s*
                                        May 24 19:14:10.523: Crypto mapdb : proxy_match*
                                                    src addr     : 192.168.1.0
                                                    dst addr     : 192.168.2.0
                                                           protocol     : 256
                                                             src port     : 0
                                                             dst port     : 0
             May 24 19:14:10.523: IPSEC(crypto_ipsec_create_ipsec_sas): Map found cmap*
         May 24 19:14:10.523: IPSEC(crypto_ipsec_sa_find_ident_head): reconnecting with*
                                                the same proxies and peer 172.16.10.2
                                    ,May 24 19:14:10.523: IPSEC(create_sa): sa created*
                                              ,sa) sa_dest= 172.16.10.1, sa_proto= 50)
                                                    ,(sa_spi= 0xDF405365(3745534821
                                      sa_trans= esp-aes esp-sha-hmac , sa_conn_id= 6
                                                    (sa_lifetime(k/sec)= (4608000/3600
                                    ,May 24 19:14:10.523: IPSEC(create_sa): sa created*
                                              ,sa) sa_dest= 172.16.10.2, sa_proto= 50)
                                                    ,(sa_spi= 0xC0CC116C(3234599276
```

```
                                  sa_trans= esp-aes esp-sha-hmac , sa_conn_id= 5
                                        (sa_lifetime(k/sec)= (4608000/3600
                        May 24 19:14:10.523: IPSEC: Expand action denied, notify RP*
        May 24 19:14:10.523: IKEv2:(SA ID = 1):[IPsec -> IKEv2] Creation of IPsec*
                                                        SA into IPsec database PASSED
```

تم رفع جلسة IKEv2 وتم إنشاء IPSec SA الذي يحمي حركة المرور بين 24/192.168.1.0 و 24/192.168.2.0.

IOS من Cisco: التحقق من عدادات IPSec

```
                                                        R1#show crypto session detail
                                                        Crypto session current status

                                        Code: C - IKE Configuration mode, D - Dead Peer Detection
                                        K - Keepalives, N - NAT-traversal, T - cTCP encapsulation
                                           X - IKE Extended Authentication, F - IKE Fragmentation

                                                                    Interface: Ethernet0/0
                                                                          Uptime: 00:00:09
                                                                Session status: UP-ACTIVE
                                                    (Peer: 172.16.10.2 port 500 fvrf: (none) ivrf: (none
                                                                     Phase1_id: 172.16.10.2
                                                                           (Desc: (none
                                        IKEv2 SA: local 172.16.10.1/500 remote 172.16.10.2/500 Active
                                               Capabilities:(none) connid:1 lifetime:23:59:51
                        IPSEC FLOW: permit ip 192.168.1.0/255.255.255.0 192.168.2.0/255.255.255.0
                                                            Active SAs: 2, origin: crypto map
                                                Inbound:  #pkts dec'ed 0 drop 0 life (KB/Sec) 4375820/3590
                                                Outbound: #pkts enc'ed 0 drop 0 life (KB/Sec) 4375820/3590
```

بعد إرسال 100 حزمة:

```
                                                        R1#ping 192.168.2.1 source 192.168.1.1 repeat 100
                                                                        .Type escape sequence to abort
                                    :Sending 100, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds
                                                     Packet sent with a source address of 192.168.1.1
                                    !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
                                                                    !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
                                      Success rate is 100 percent (100/100), round-trip min/avg/max = 1/4/5 ms
                                                                                                R1#


                                                        R1#show crypto session detail
                                                        Crypto session current status

                                        Code: C - IKE Configuration mode, D - Dead Peer Detection
                                        K - Keepalives, N - NAT-traversal, T - cTCP encapsulation
                                           X - IKE Extended Authentication, F - IKE Fragmentation

                                                                    Interface: Ethernet0/0
                                                                          Uptime: 00:00:15
                                                                Session status: UP-ACTIVE
                                                    (Peer: 172.16.10.2 port 500 fvrf: (none) ivrf: (none
                                                                     Phase1_id: 172.16.10.2
                                                                           (Desc: (none
                                        IKEv2 SA: local 172.16.10.1/500 remote 172.16.10.2/500 Active
                                               Capabilities:(none) connid:1 lifetime:23:59:45
                        IPSEC FLOW: permit ip 192.168.1.0/255.255.255.0 192.168.2.0/255.255.255.0
                                                            Active SAs: 2, origin: crypto map
```

```
Inbound:  #pkts dec'ed 100 drop 0 life (KB/Sec) 4375803/3585
Outbound: #pkts enc'ed 100 drop 0 life (KB/Sec) 4375803/3585
```

زاد العداد بمقدار 100.

برنامج Cisco IOS: التحقق من معلمات IKEv2 و IPSec

يحتوي برنامج Cisco IOS على إحصائيات/تفاصيل رائعة لجلسة عمل IKEv2:

```
R1#show crypto ikev2 sa detailed
                IPv4 Crypto IKEv2  SA

Tunnel-id Local                 Remote                fvrf/ivrf            Status
1         none/none             READY       172.16.10.2/500       172.16.10.1/500
Encr: AES-CBC, keysize: 128, Hash: SHA96, DH Grp:5, Auth sign: PSK, Auth verify: PSK
                                        Life/Active Time: 86400/152 sec
                                             CE id: 1019, Session-id: 3
                                    Status Description: Negotiation done
                  Local spi: 9FFC38791FFEF212       Remote spi: 6CDC17F5B0B10C1A
                                               Local id: 172.16.10.1
                                              Remote id: 172.16.10.2
                       Local req msg id:  2              Remote req msg id:  0
                       Local next msg id: 2              Remote next msg id: 0
                       Local req queued:  2              Remote req queued:  0
                       Local window:      5              Remote window:      1
                                    DPD configured for 0 seconds, retry 0
                                            .Fragmentation not configured
                                   .Extended Authentication not configured
                                               NAT-T is not detected
                                  Cisco Trust Security SGT is disabled
                                               Initiator of SA : Yes

                                                   IPv6 Crypto IKEv2  SA


                                                R1#show crypto ipsec sa

                                                 interface: Ethernet0/0
                                       Crypto map tag: cmap, local addr 172.16.10.1

                                                (protected vrf: (none
                          (local  ident (addr/mask/prot/port): (192.168.1.0/255.255.255.0/0/0
                          (remote ident (addr/mask/prot/port): (192.168.2.0/255.255.255.0/0/0
                                             current_peer 172.16.10.2 port 500
                                              {,PERMIT, flags={origin_is_acl
                                pkts encaps: 100, #pkts encrypt: 100, #pkts digest: 100#
                                pkts decaps: 100, #pkts decrypt: 100, #pkts verify: 100#
                                           pkts compressed: 0, #pkts decompressed: 0#
                                    pkts not compressed: 0, #pkts compr. failed: 0#
                               pkts not decompressed: 0, #pkts decompress failed: 0#
                                             send errors 0, #recv errors 0#

                           local crypto endpt.: 172.16.10.1, remote crypto endpt.: 172.16.10.2
                        plaintext mtu 1438, path mtu 1500, ip mtu 1500, ip mtu idb Ethernet0/0
                                       (current outbound spi: 0xC0CC116C(3234599276
                                                PFS (Y/N): N, DH group: none

                                                          :inbound esp sas
                                                 (spi: 0xDF405365(3745534821
                                              , transform: esp-aes esp-sha-hmac
```

```
                                                { ,in use settings ={Tunnel
      conn id: 6, flow_id: SW:6, sibling_flags 80000040, crypto map: cmap
                (sa timing: remaining key lifetime (k/sec): (4375803/3442
                                                        IV size: 16 bytes
                                                replay detection support: Y
                                                     (Status: ACTIVE(ACTIVE

                                                              :inbound ah sas

                                                             :inbound pcp sas

                                                           :outbound esp sas
                                                  (spi: 0xC0CC116C(3234599276
                                          , transform: esp-aes esp-sha-hmac
                                                { ,in use settings ={Tunnel
      conn id: 5, flow_id: SW:5, sibling_flags 80000040, crypto map: cmap
                (sa timing: remaining key lifetime (k/sec): (4375803/3442
                                                        IV size: 16 bytes
                                                replay detection support: Y
                                                     (Status: ACTIVE(ACTIVE

                                                              :outbound ah sas

                                                            :outbound pcp sas
```

ستروسوان: إنشاء نفق

```
[May 24 21:14:10 localhost charon: 08[NET] received packet: from 172.16.10.1[500
                                                    (to 172.16.10.2[500] (400 bytes
          May 24 21:14:10 localhost charon: 08[ENC] parsed IKE_SA_INIT request 0
                                        [ (SA KE No V V N(NATD_S_IP) N(NATD_D_IP ]
               May 24 21:14:10 localhost charon: 08[ENC] received unknown vendor
                    ID: 43:49:53:43:4f:2d:44:45:4c:45:54:45:2d:52:45:41:53:4f:4e
            :May 24 21:14:10 localhost charon: 08[ENC] received unknown vendor ID
                                 46:4c:45:58:56:50:4e:2d:53:55:50:50:4f:52:54:45:44
   May 24 21:14:10 localhost charon: 08[IKE] 172.16.10.1 is initiating an IKE_SA
   May 24 21:14:10 localhost charon: 08[IKE] 172.16.10.1 is initiating an IKE_SA
     May 24 21:14:10 localhost charon: 08[ENC] generating IKE_SA_INIT response 0
                                [ (SA KE No N(NATD_S_IP) N(NATD_D_IP) N(MULT_AUTH ]
 [May 24 21:14:10 localhost charon: 08[NET] sending packet: from 172.16.10.2[500
                                                    (to 172.16.10.1[500] (376 bytes
[May 24 21:14:10 localhost charon: 07[NET] received packet: from 172.16.10.1[500
                                                    (to 172.16.10.2[500] (284 bytes
 May 24 21:14:10 localhost charon: 07[ENC] parsed IKE_AUTH request 1 [ V IDi AUTH
   [ (SA TSi TSr N(INIT_CONTACT) N(SET_WINSIZE) N(ESP_TFC_PAD_N) N(NON_FIRST_FRAG
      May 24 21:14:10 localhost charon: 07[CFG] looking for peer configs matching
                                    [any]...172.16.10.1[172.16.10.1%]172.16.10.2
        'May 24 21:14:10 localhost charon: 07[CFG] selected peer config 'ciscoios
   May 24 21:14:10 localhost charon: 07[IKE] authentication of '172.16.10.1' with
                                                          pre-shared key successful
,May 24 21:14:10 localhost charon: 07[IKE] received ESP_TFC_PADDING_NOT_SUPPORTED
                                                        not using ESPv3 TFC padding
(May 24 21:14:10 localhost charon: 07[IKE] authentication of '172.16.10.2' (myself
                                                          with pre-shared key
  May 24 21:14:10 localhost charon: 07[IKE] IKE_SA ciscoios[2] established between
                                    [172.16.10.1]172.16.10.1...[172.16.10.2]172.16.10.2
  May 24 21:14:10 localhost charon: 07[IKE] IKE_SA ciscoios[2] established between
                                    [172.16.10.1]172.16.10.1...[172.16.10.2]172.16.10.2
    May 24 21:14:10 localhost charon: 07[IKE] scheduling reauthentication in 3247s
           May 24 21:14:10 localhost charon: 07[IKE] maximum IKE_SA lifetime 3427s
 May 24 21:14:10 localhost charon: 07[IKE] CHILD_SA ciscoios{2} established with
```

```
            SPIs c0cc116c_i df405365_o and TS 192.168.2.0/24 === 192.168.1.0/24
 May 24 21:14:10 localhost charon: 07[IKE] CHILD_SA ciscoios{2} established with
            SPIs c0cc116c_i df405365_o and TS 192.168.2.0/24 === 192.168.1.0/24
  -- May 24 21:14:10 localhost vpn: + 172.16.10.1 192.168.1.0/24 == 172.16.10.1
                                                  192.168.2.0/24 == 172.16.10.2
```

تبدو تفاصيل إنشاء النفق مماثلة قليلا ل IKEv1.

strongSwan: التحقق من حالة اتصال IPSec

```
                                                  pluton ~ # ipsec statusall
    :(Status of IKE charon daemon (strongSwan 5.0.4, Linux 3.2.12-gentoo, x86_64
                                    uptime: 2 minutes, since May 24 21:13:27 2013
                                malloc: sbrk 393216, mmap 0, used 274864, free 118352
  worker threads: 8 of 16 idle, 7/1/0/0 working, job queue: 0/0/0/0, scheduled: 4
      loaded plugins: charon mysql sqlite aes des sha1 sha2 md5 random nonce x509
           revocation constraints pubkey pkcs1 pkcs8 pgp dnskey pem openssl gcrypt
            fips-prf gmp xcbc cmac hmac attr kernel-netlink resolve socket-default
     stroke updown eap-identity eap-sim eap-aka eap-aka-3gpp2 eap-simaka-pseudonym
           eap-simaka-reauth eap-md5 eap-gtc eap-mschapv2 eap-radius xauth-generic
                                                        :Listening IP addresses
                                                             10.0.0.100
                                                           192.168.10.1
                                                            192.168.2.1
                                                            172.16.10.2
                                                            :Connections
                                      ciscoios:  172.16.10.2...172.16.10.1  IKEv2
           ciscoios:   local:  [172.16.10.2] uses pre-shared key authentication
           ciscoios:   remote: [172.16.10.1] uses pre-shared key authentication
                   ciscoios:   child:  192.168.2.0/24 === 192.168.1.0/24 TUNNEL
                                        :(Security Associations (1 up, 0 connecting
          ...[ciscoios[2]: ESTABLISHED 116 seconds ago, 172.16.10.2[172.16.10.2
                                                    [172.16.10.1]172.16.10.1
              ,*ciscoios[2]: IKEv2 SPIs: 12f2fe1f7938fc9f_i 1a0cb1b0f517dc6c_r
                                     pre-shared key reauthentication in 52 minutes
    ciscoios[2]: IKE proposal: AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_1536
              ciscoios{2}:  INSTALLED, TUNNEL, ESP SPIs: c0cc116c_i df405365_o
    ,(ciscoios{2}:  AES_CBC_128/HMAC_SHA1_96, 10000 bytes_i (100 pkts, 102s ago
                         bytes_o (100 pkts, 102s ago), rekeying in 12 minutes 10000
                                ciscoios{2}:   192.168.2.0/24 === 192.168.1.0/24
```

strongSwan: التحقق من سياسة IPSec

```
                                                  pluton ~ # ip -s xfrm policy
                                          src 192.168.1.0/24 dst 192.168.2.0/24 uid 0
(dir fwd action allow index 1154 priority 1859 share any flag  (0x00000000
                                                        :lifetime config
                                    (limit: soft (INF)(bytes), hard (INF)(bytes
                                (limit: soft (INF)(packets), hard (INF)(packets
                                          (expire add: soft 0(sec), hard 0(sec
                                          (expire use: soft 0(sec), hard 0(sec
                                                       :lifetime current
                                                  (bytes), 0(packets)0
                                              - add 2013-05-24 21:14:10 use
                                        tmpl src 172.16.10.1 dst 172.16.10.2
       proto esp spi 0x00000000(0) reqid 2(0x00000002) mode tunnel
                                                level required share any
           enc-mask ffffffff auth-mask ffffffff comp-mask ffffffff
```

```
                                        src 192.168.1.0/24 dst 192.168.2.0/24 uid 0
(dir in action allow index 1144 priority 1859 share any flag  (0x00000000
                                                        :lifetime config
                                (limit: soft (INF)(bytes), hard (INF)(bytes
                            (limit: soft (INF)(packets), hard (INF)(packets
                                      (expire add: soft 0(sec), hard 0(sec
                                      (expire use: soft 0(sec), hard 0(sec
                                                    :lifetime current
                                                (bytes), 0(packets)0
                            add 2013-05-24 21:14:10 use 2013-05-24 21:14:23
                                        tmpl src 172.16.10.1 dst 172.16.10.2
        proto esp spi 0x00000000(0) reqid 2(0x00000002) mode tunnel
                                            level required share any
            enc-mask ffffffff auth-mask ffffffff comp-mask ffffffff
                                        src 192.168.2.0/24 dst 192.168.1.0/24 uid 0
(dir out action allow index 1137 priority 1859 share any flag  (0x00000000
                                                        :lifetime config
                                (limit: soft (INF)(bytes), hard (INF)(bytes
                            (limit: soft (INF)(packets), hard (INF)(packets
                                      (expire add: soft 0(sec), hard 0(sec
                                      (expire use: soft 0(sec), hard 0(sec
                                                    :lifetime current
                                                (bytes), 0(packets)0
                            add 2013-05-24 21:14:10 use 2013-05-24 21:14:23
                                        tmpl src 172.16.10.2 dst 172.16.10.1
        proto esp spi 0x00000000(0) reqid 2(0x00000002) mode tunnel
                                            level required share any
            enc-mask ffffffff auth-mask ffffffff comp-mask ffffffff
```

معلومات ذات صلة

- أوبنسوان
- وثائق مستخدم StrongSwan
- دليل تكوين FlexVPN و Internet Key Exchange الإصدار 2، Cisco IOS الإصدار 15M&T
- الدعم التقني والمستندات - Cisco Systems

حول هذه الترجمة
ترجمت Cisco هذا المستند باستخدام مجموعة من التقنيات الآلية والبشرية لتقديم محتوى دعم للمستخدمين في جميع أنحاء العالم بلغتهم الخاصة. يُرجى ملاحظة أن أفضل ترجمة آلية لن تكون دقيقة كما هو الحال مع الترجمة الاحترافية التي يقدمها مترجم محترف. تخلي Cisco Systems مسئوليتها عن دقة هذه الترجمات وتُوصي بالرجوع دائمًا إلى المستند الإنجليزي الأصلي (الرابط متوفر).