從Android strongSwan到Cisco IOS的IKEv2，帶EAP和RSA身份驗證

目錄

簡介

本文說明如何配置strongSwan的移動版本，以便通過網際網路金鑰交換版本2(IKEv2)協定訪問Cisco IOS®軟體VPN網關。

給出了三個示例：

- 使用strongSwan的Android電話，通過可擴展身份驗證協定 — 消息摘要5(EAP-MD5)身份驗證連線到Cisco IOS軟體VPN網關。
- 帶有strongSwan的Android電話，通過證書身份驗證(RSA)連線到Cisco IOS軟體VPN網關。
- Android電話，帶有strongSwan，通過網路地址轉換(NAT)連線到Cisco IOS軟體VPN網關。 在

VPN網關證書中要求具有兩個x509擴展使用者替代名稱。
還包括Cisco IOS軟體和strongSwan限制。

必要條件

需求

思科建議您瞭解以下主題：

- OpenSSL組態的基本知識
- Cisco IOS軟體命令列介面(CLI)配置基礎知識
- IKEv2基礎知識

採用元件

本文中的資訊係根據以下軟體和硬體版本：

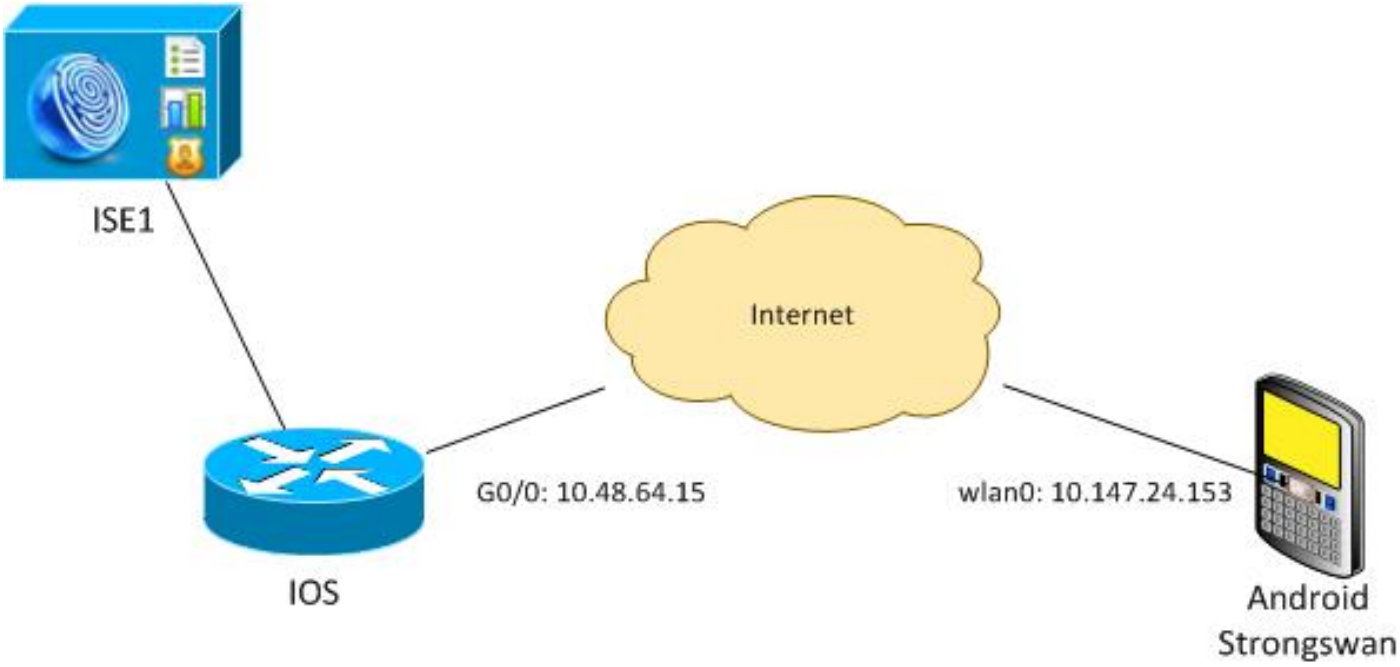
- Android 4.0或更高版本，帶strongSwan
- Cisco IOS軟體版本15.3T或更高版本
- Cisco Identity Services Engine(ISE)軟體1.1.4版及更新版本

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除（預設）的組態來啟動。如果您的網路正在作用，請確保您已瞭解任何指令可能造成的影響。

設定

> **附註**：
>
> 輸出直譯器工具(僅供已註冊客戶使用)支援某些**show**命令。使用輸出直譯器工具來檢視**show**命令輸出的分析。
>
> 使用 **debug 指令之前，請先參閱**有關 Debug 指令的重要資訊。

網路圖表



Android strongSwan使用Cisco IOS軟體網關建立IKEv2隧道，以便安全地訪問內部網路。

證書註冊

證書是基於EAP和基於RSA的身份驗證的先決條件。

在EAP身份驗證方案中，僅在VPN網關上需要證書。僅當軟體提供由Android上受信任的證書頒發機構(CA)簽名的證書時，客戶端才連線到Cisco IOS軟體。然後啟動客戶端的EAP會話，以對Cisco IOS軟體進行身份驗證。

對於基於RSA的身份驗證，兩個終端必須具有正確的證書。

將IP位址用作對等ID時，對憑證有其他要求。Android strongSwan驗證VPN網關的IP地址是否包含在x509擴展主題備用名稱中。如果沒有，Android將丟棄連線；這是良好的做法以及RFC 6125的建議。

OpenSSL作為CA使用，因為Cisco IOS軟體具有限制：它無法生成副檔名包含IP地址的證書。所有證書均由OpenSSL生成並匯入到Android和Cisco IOS軟體中。

在Cisco IOS軟體中，**subject-alt-name**命令可用於建立包含IP位址的擴充模組，但該命令僅適用於自簽名的憑證。思科錯誤ID CSCui44783「IOS ENH PKI capability to generate CSR with subject-alt-name extension」（IOS增強PKI使用使用者名稱擴展生成CSR的能力）是一個增強請求，允許Cisco IOS軟體為所有型別的註冊生成擴展。

以下是產生CA的命令範例：

```
#generate key
openssl genrsa -des3 -out ca.key 2048

#generate CSR
openssl req -new -key ca.key -out ca.csr

#remove protection
cp ca.key ca.key.org
```

```
openssl rsa -in ca.key.org -out ca.key

#self sign certificate
openssl x509 -req -days 365 -in ca.csr -signkey ca.key -out ca.crt
-extensions v3_req -extfile conf_global.crt
```

conf_global.crt是配置檔案。CA擴展應設定為TRUE:

```
[ req ]
default_bits              = 1024            # Size of keys
default_md                = md5                    # message digest algorithm
string_mask               = nombstr         # permitted characters
#string_mask              = pkix     # permitted characters
distinguished_name        = req_distinguished_name
req_extensions            = v3_req

[ v3_req ]
basicConstraints          = CA:TRUE
subjectKeyIdentifier      = hash
```

Cisco IOS軟體和Android生成證書的命令非常相似。此範例假設已經有一個用於對憑證進行簽名的CA:

```
#generate key
openssl genrsa -des3 -out server.key 2048

#generate CSR
openssl req -new -key server.key -out server.csr

#remove protection
cp server.key server.key.org
openssl rsa -in server.key.org -out server.key

#sign the cert and add Alternate Subject Name extension from
conf_global_cert.crt file with configuration
openssl x509 -req -in server.csr -CA ca.crt -CAkey ca.key -CAcreateserial
-out server.crt -days 365 -extensions v3_req -extfile conf_global_cert.crt

#create pfx file containig CA cert and server cert
openssl pkcs12 -export -out server.pfx -inkey server.key -in server.crt
-certfile ca.crt
```

conf_global_cert.crt是配置檔案。「備用使用者名稱」副檔名是一個鍵設定。在此示例中，CA擴展設定為FALSE:

```
[ req ]
default_bits              = 1024            # Size of keys
default_md                = md5                    # message digest algorithm
string_mask               = nombstr         # permitted characters
#string_mask              = pkix     # permitted characters
distinguished_name        = req_distinguished_name
req_extensions            = v3_req

[ v3_req ]
basicConstraints          = CA:FALSE
subjectKeyIdentifier      = hash
subjectAltName            = @alt_names

[alt_names]
IP.1                      = 10.48.64.15
```

應該同時為Cisco IOS軟體和Android生成證書。

IP地址10.48.64.15屬於Cisco IOS軟體網關。為Cisco IOS軟體生成證書時，請確保將subjectAltName設定為10.48.64.15。Android將驗證從Cisco IOS軟體收到的證書，並嘗試在subjectAltName中查詢其IP地址。

Cisco IOS軟體

Cisco IOS軟體需要為基於RSA和基於EAP的身份驗證安裝正確的證書。

可以匯入Cisco IOS軟體的pfx檔案（即pkcs12容器）：

```
BSAN-2900-1(config)# crypto pki import TP pkcs12
http://10.10.10.1/server.pfx password 123456
% Importing pkcs12...
Source filename [server.pfx]?
CRYPTO_PKI: Imported PKCS12 file successfully.
```

使用show crypto pki certificates verbose命令驗證匯入是否成功：

```
BSAN-2900-1# show crypto pki certificates verbose
Certificate
 Status: Available
 Version: 3
 Certificate Serial Number (hex): 00A003C5DCDEFA146C
 Certificate Usage: General Purpose
 Issuer:
   cn=Cisco
   ou=Cisco TAC
   o=Cisco
   l=Krakow
   st=Malopolskie
   c=PL
  Subject:
    Name: IOS
    IP Address: 10.48.64.15
    cn=IOS
    ou=TAC
    o=Cisco
    l=Krakow
    st=Malopolska
    c=PL
 Validity Date:
   start date: 18:04:09 UTC Aug 1 2013
   end   date: 18:04:09 UTC Aug 1 2014
 Subject Key Info:
   Public Key Algorithm: rsaEncryption
   RSA Public Key: (2048 bit)
 Signature Algorithm: SHA1 with RSA Encryption
 Fingerprint MD5: 2C45BF10 0BACB98D 444F5804 1DC27ECF
 Fingerprint SHA1: 26B66A66 DF5E7D6F 498DD653 A2C164D7 4C7A7F8F
 X509v3 extensions:
   X509v3 Subject Key ID: AD598A9B 8AB6893B AB3CB8B9 28B2039C 78441E72
   X509v3 Basic Constraints:
       CA: FALSE
    X509v3 Subject Alternative Name:

        10.48.64.15
   Authority Info Access:
 Associated Trustpoints: TP
```

```
 Storage: nvram:Cisco#146C.cer
 Key Label: TP
 Key storage device: private config

CA Certificate
 Status: Available
 Version: 3
 Certificate Serial Number (hex): 00DC8EAD98723DF56A
 Certificate Usage: General Purpose
 Issuer:
   cn=Cisco
   ou=Cisco TAC
   o=Cisco
   l=Krakow
   st=Malopolskie
   c=PL
 Subject:
   cn=Cisco
   ou=Cisco TAC
   o=Cisco
   l=Krakow
   st=Malopolskie
   c=PL
 Validity Date:
   start date: 16:39:55 UTC Jul 23 2013
   end   date: 16:39:55 UTC Jul 23 2014
 Subject Key Info:
   Public Key Algorithm: rsaEncryption
   RSA Public Key: (2048 bit)
 Signature Algorithm: SHA1 with RSA Encryption
 Fingerprint MD5: 0A2432DC 33F0DC46 AAB23E26 ED474B7E
 Fingerprint SHA1: A50E3892 ED5C4542 FA7FF584 DE07B6E0 654A62D0
 X509v3 extensions:
   X509v3 Subject Key ID: 786F263C 0F5A1963 D6AD18F8 86DCE7C9 0185911E
   X509v3 Basic Constraints:
       CA: TRUE
   Authority Info Access:
 Associated Trustpoints: TP
 Storage: nvram:Cisco#F56ACA.cer

BSAN-2900-1#show ip int brief
Interface                  IP-Address      OK? Method Status          Protocol
GigabitEthernet0/0         10.48.64.15     YES NVRAM  up              up
```

Android

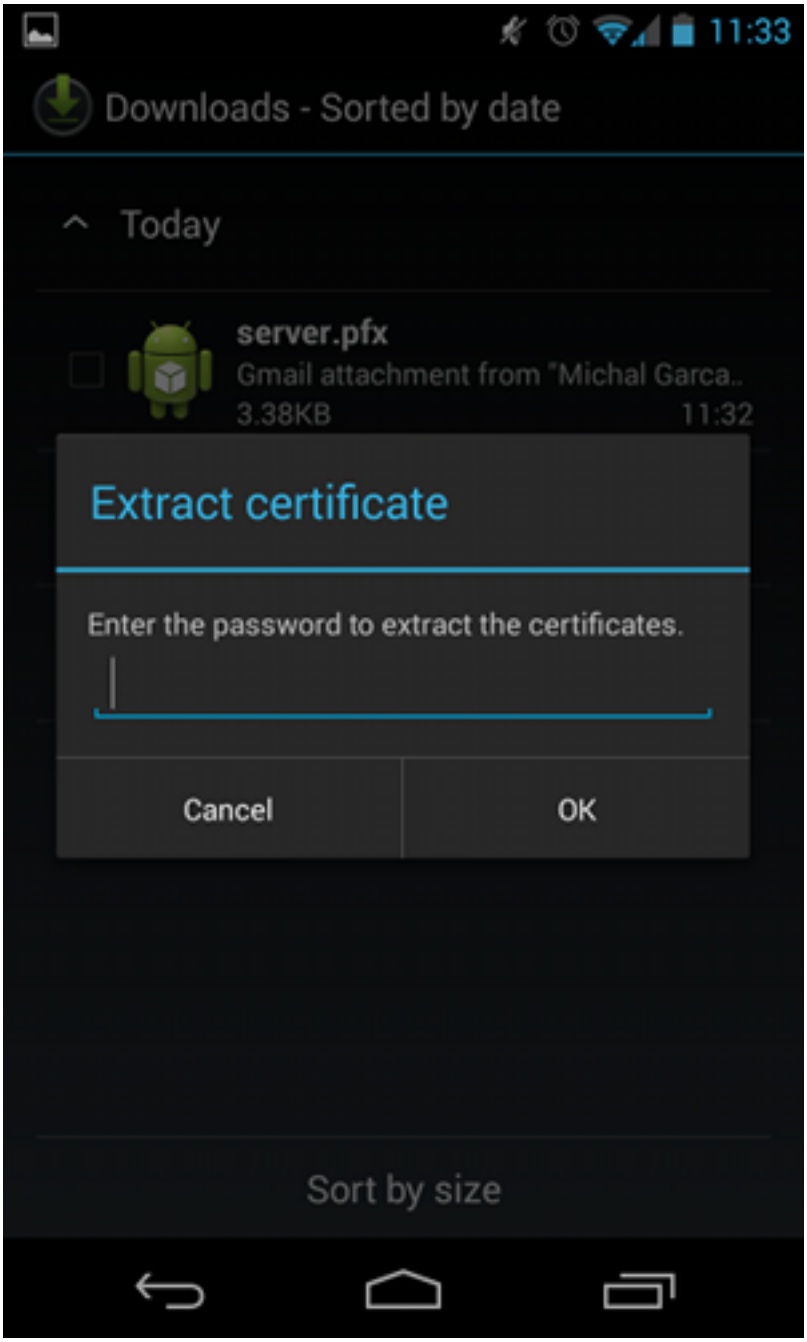
對於基於EAP的身份驗證，Andorid只需安裝正確的CA證書。

對於基於RSA的身份驗證，Andorid需要同時安裝CA證書及其自己的證書。

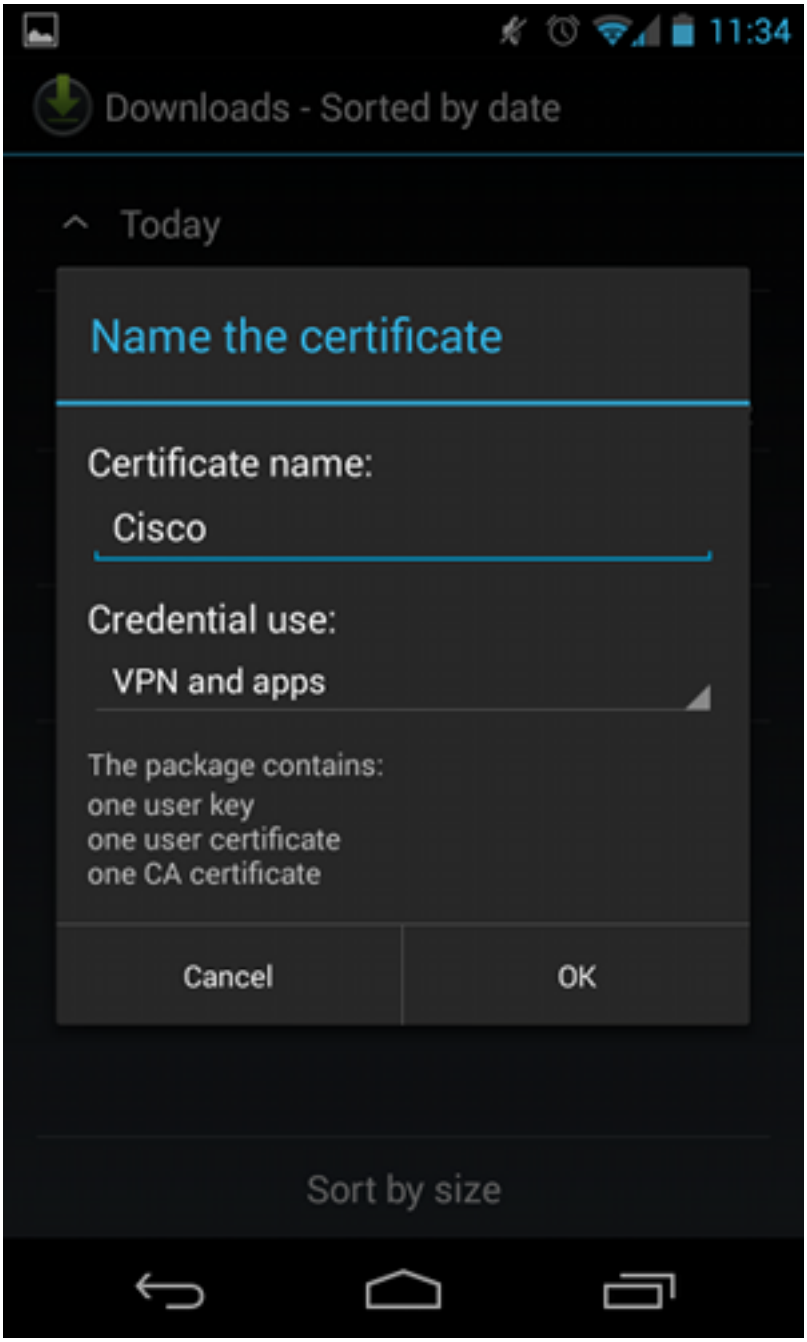
以下程式介紹如何安裝兩個憑證：

1. 通過電子郵件傳送pfx檔案，然後將其開啟。

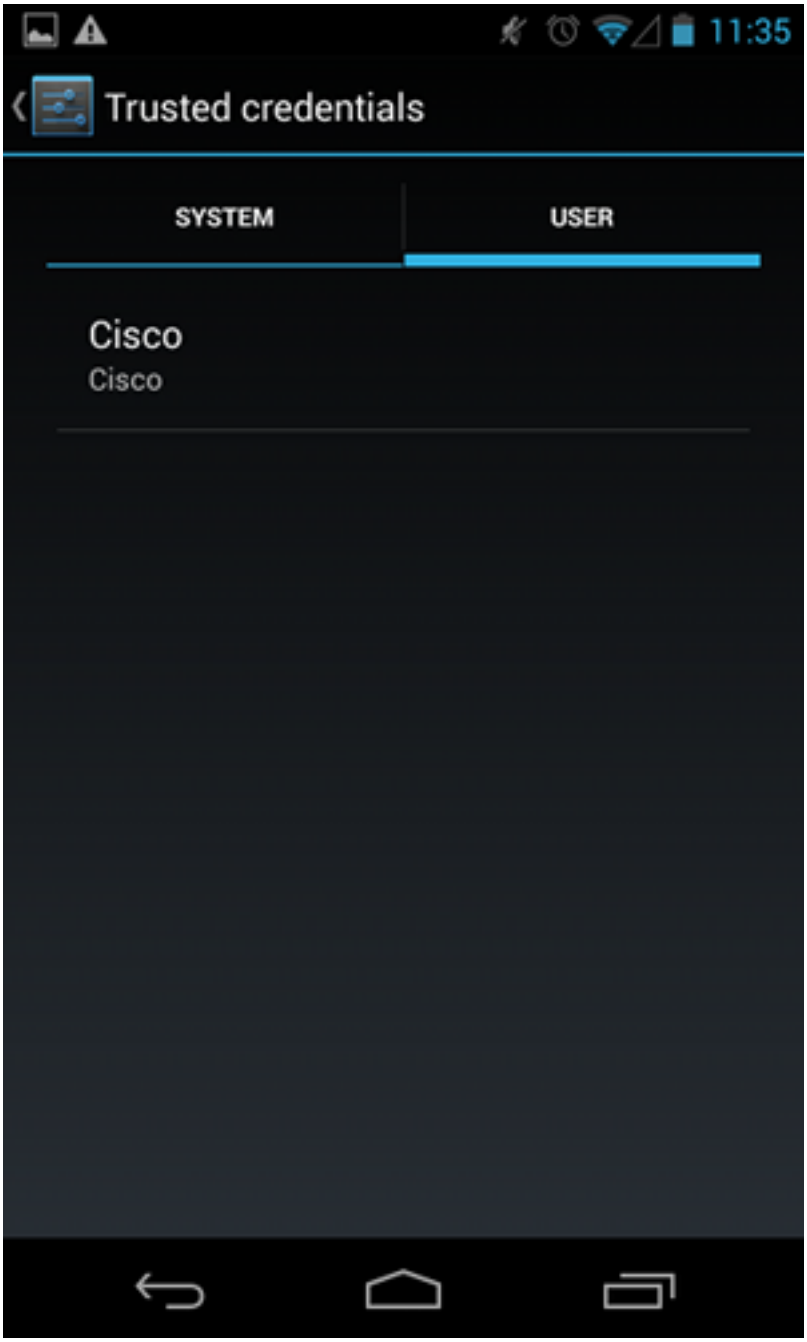
2. 提供生成pfx檔案時使用的密碼。



3. 提供匯入的證書的名稱。



4. 導覽至**Settings > Security > Trusted Credentials**，以驗證憑證安裝。新證書應顯示在使用者儲存中：



此時，使用者證書以及CA證書均已安裝。pfx檔案是一個包含使用者證書和CA證書的pkcs12容器。

Android在匯入證書時具有精確的要求。例如，要成功匯入CA證書，Android要求將x509v3擴展基本約束CA設定為TRUE。因此，當您生成CA或使用您自己的CA時，驗證它是否具有正確的副檔名非常重要：

```
pluton custom_ca # openssl x509 -in ca.crt -text
Certificate:
   Data&colon;
       Version: 3 (0x2)
       Serial Number:
           dc:8e:ad:98:72:3d:f5:6a
       Signature Algorithm: sha1WithRSAEncryption
       Issuer: C=PL, ST=Malopolskie, L=Krakow, O=Cisco, OU=Cisco TAC, CN=Cisco
<.....output omitted>

 X509v3 Basic Constraints:
                CA:TRUE

<.....output omitted>
```

EAP身份驗證

適用於EAP驗證的Cisco IOS軟體組態

IKEv2允許使用EAP協定棧來執行使用者身份驗證。VPN網關使用證書呈現自身。一旦客戶端信任該證書，客戶端就會響應網關的EAP請求身份。Cisco IOS軟體會使用該身分並向Authentication，authorization， and accounting(AAA)伺服器傳送Radius-Request訊息，並在要求者(Android)和驗證伺服器（存取控制伺服器[ACS]或ISE）之間建立EAP-MD5作業階段。

成功進行EAP-MD5身份驗證後（如Radius-Accept消息所示），Cisco IOS軟體使用配置模式將IP地址推送到客戶端，並繼續流量選擇器協商。

請注意，Android已傳送IKEID=cisco（如配置）。 Cisco IOS軟體上收到的此IKEID與「ikev2配置檔案PROF」匹配。

```
aaa new-model
aaa authentication login eap-list-radius group radius
aaa authorization network IKE2_AUTHOR_LOCAL local

crypto pki trustpoint TP
 revocation-check none

crypto ikev2 authorization policy IKE2_AUTHOR_POLICY
 pool POOL
!
crypto ikev2 proposal ikev2-proposal
 encryption aes-cbc-128
 integrity sha1
 group 14
!
crypto ikev2 policy ikev2-policy
 proposal ikev2-proposal
!
!
crypto ikev2 profile PROF
 match identity remote key-id cisco
 authentication remote eap query-identity
 authentication local rsa-sig
 pki trustpoint TP
 aaa authentication eap eap-list-radius
 aaa authorization group eap list IKE2_AUTHOR_LOCAL IKE2_AUTHOR_POLICY
 aaa authorization user eap cached
 virtual-template 1

crypto ipsec transform-set 3DES-MD5 esp-aes esp-sha-hmac
 mode tunnel
!
crypto ipsec profile PROF
 set transform-set 3DES-MD5
 set ikev2-profile PROF

interface GigabitEthernet0/0
 ip address 10.48.64.15 255.255.255.128
```

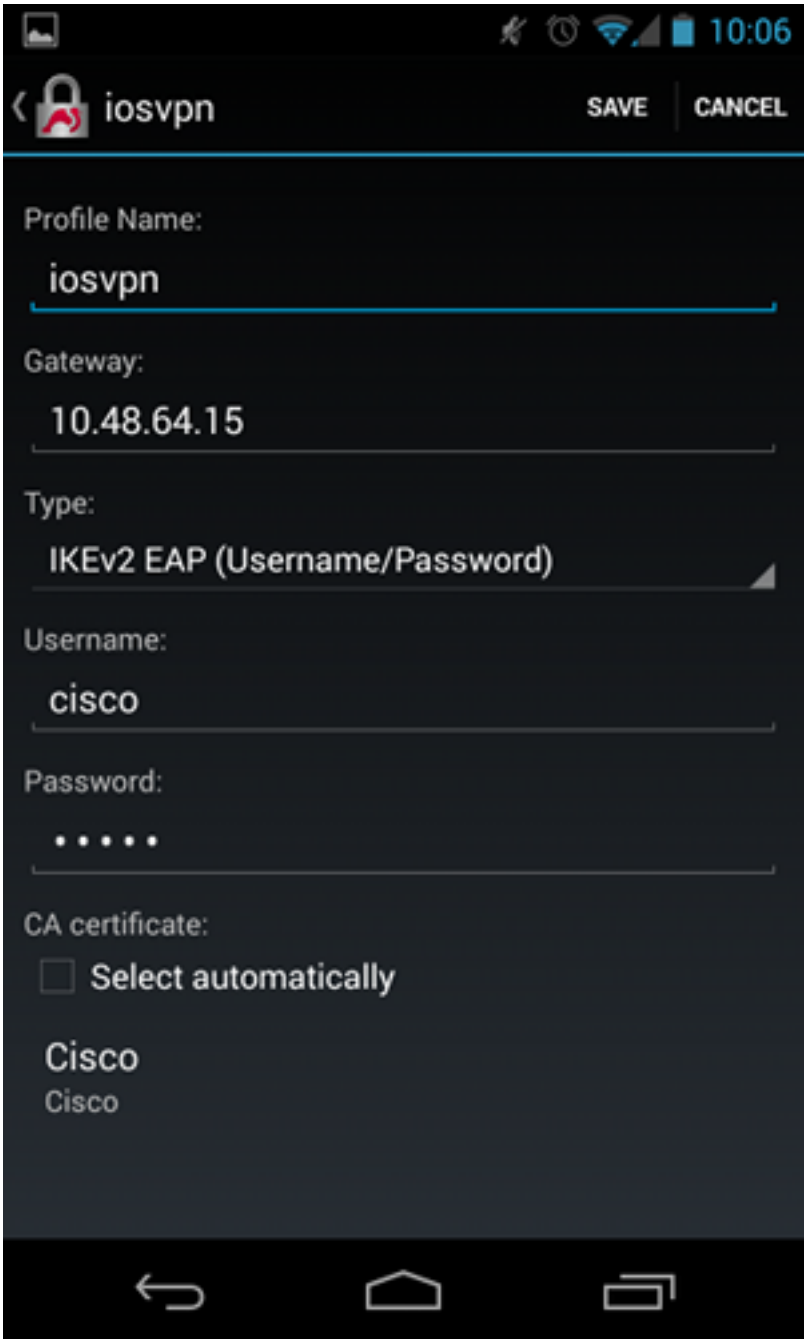
```
interface Virtual-Template1 type tunnel
 ip unnumbered GigabitEthernet0/0
 tunnel mode ipsec ipv4
 tunnel protection ipsec profile PROF

ip local pool POOL 192.168.0.1 192.168.0.10

radius-server host 10.48.66.185 key cisco
```

EAP身份驗證的Android配置

Android strongSwan必須已配置EAP:

1. 禁用自動證書選擇；否則，將在第三個資料包中傳送100個或更多的CERT_REQ。

2. 選擇在上一步中匯入的特定證書(CA);使用者名稱和密碼應該與AAA伺服器上的相同。



EAP身份驗證測試

在Cisco IOS軟體中，這些是EAP身份驗證最重要的調試。為了清楚起見，大多數輸出均被省略：

```
debug crypto ikev2 error
debug crypto ikev2 internal
debug radius authentication
debug radius verbose

IKEv2:New ikev2 sa request admitted
IKEv2:(SA ID = 1):Searching policy based on peer's identity 'cisco' of type
'FQDN'
IKEv2:(1): Choosing IKE profile PROF
IKEv2:Sending certificates as X509 certificates

RADIUS(00000025): Send Access-Request to 10.48.66.185:1645 id 1645/4,len 110
RADIUS: Received from id 1645/4 10.48.66.185:1645, Access-Challenge, len 79
RADIUS(00000025): Send Access-Request to 10.48.66.185:1645 id 1645/5,len 141
RADIUS: Received from id 1645/5 10.48.66.185:1645, Access-Challenge, len 100
RADIUS(00000025): Send Access-Request to 10.48.66.185:1645 id 1645/6,len 155
RADIUS: Received from id 1645/6 10.48.66.185:1645, Access-Accept, len 76

IKEv2:(SA ID = 1):SM Trace-> SA: I_SPI=AABAB198FACAAEDE R_SPI=D61F37C4DC875001
(R) MsgID = 00000004 CurState: R_PROC_EAP_RESP Event: EV_RECV_EAP_SUCCESS

IKEv2:IKEv2 local AAA author request for 'IKE2_AUTHOR_POLICY'
IKEv2:Received group author attributes: ipv4-pool: POOL, route-accept any tag:1
distance:1
IKEv2:Allocated addr 192.168.0.2 from local pool POOL
IKEv2:(SA ID = 1):SM Trace-> SA: I_SPI=AABAB198FACAAEDE R_SPI=D61F37C4DC875001
(R) MsgID = 00000005 CurState: R_VERIFY_AUTH Event:
   EV_OK_RECD_VERIFY_IPSEC_POLICY
%LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state
to up
```

Android日誌顯示：

```
00[DMN] Starting IKE charon daemon (strongSwan 5.1.0dr2,
Linux 3.4.0-perf-gf43c3d9, armv7l)
00[KNL] kernel-netlink plugin might require CAP_NET_ADMIN capability
00[LIB] loaded plugins: androidbridge charon android-log openssl fips-prf
random nonce pubkey pkcs1 pkcs8 pem xcbc hmac socket-default kernel-netlink
00[LIB] unable to load 9 plugin features (9 due to unmet dependencies)
00[JOB] spawning 16 worker threads
13[IKE] initiating IKE_SA android[1] to 10.48.64.15
13[ENC] generating IKE_SA_INIT request 0 [ SA KE No N(NATD_S_IP) N(NATD_D_IP) ]
13[NET] sending packet: from 10.147.24.153[45581] to 10.48.64.15[500]
(648 bytes)
11[NET] received packet: from 10.48.64.15[500] to 10.147.24.153[45581]
(497 bytes)
11[ENC] parsed IKE_SA_INIT response 0 [ SA KE No V V N(NATD_S_IP) N(NATD_D_IP)
CERTREQ N(HTTP_CERT_LOOK) ]
11[ENC] received unknown vendor ID:
43:49:53:43:4f:2d:44:45:4c:45:54:45:2d:52:45:41:53:4f:4e
11[ENC] received unknown vendor ID:
46:4c:45:58:56:50:4e:2d:53:55:50:50:4f:52:54:45:44
11[IKE] faking NAT situation to enforce UDP encapsulation
11[IKE] cert payload ANY not supported - ignored
11[IKE] sending cert request for "C=PL, ST=Malopolskie, L=Krakow, O=Cisco,
OU=Cisco TAC, CN=Cisco"
11[IKE] establishing CHILD_SA android
```

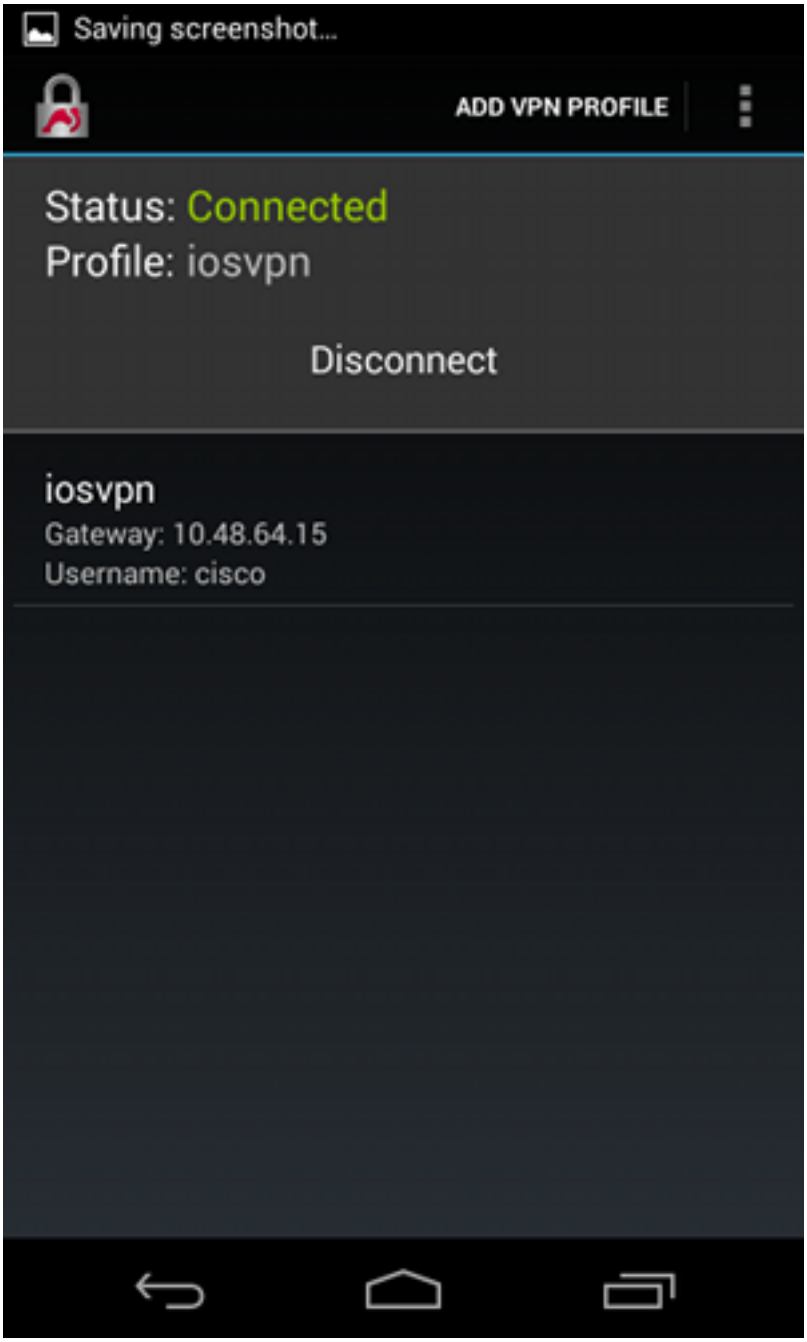
```
11[ENC] generating IKE_AUTH request 1 [ IDi N(INIT_CONTACT) CERTREQ
CP(ADDR ADDR6 DNS DNS6) N(ESP_TFC_PAD_N) SA TSi TSr N(MOBIKE_SUP)
11[NET] sending packet: from 10.147.24.153[35564] to 10.48.64.15[4500]
(508 bytes)
10[NET] received packet: from 10.48.64.15[4500] to 10.147.24.153[35564]
(1292 bytes)
10[ENC] parsed IKE_AUTH response 1 [ V IDr CERT AUTH EAP/REQ/ID ]
10[IKE] received end entity cert "C=PL, ST=Malopolska, L=Krakow, O=Cisco,
OU=TAC, CN=IOS"
10[CFG] using certificate "C=PL, ST=Malopolska, L=Krakow, O=Cisco, OU=TAC,
CN=IOS"
10[CFG] using trusted ca certificate "C=PL, ST=Malopolskie, L=Krakow, O=Cisco,
OU=Cisco TAC, CN=Cisco"
10[CFG] reached self-signed root ca with a path length of 0
10[IKE] authentication of '10.48.64.15' with RSA signature successful
10[IKE] server requested EAP_IDENTITY (id 0x3B), sending 'cisco'
10[ENC] generating IKE_AUTH request 2 [ EAP/RES/ID ]
10[NET] sending packet: from 10.147.24.153[35564] to 10.48.64.15[4500]
(76 bytes)
09[NET] received packet: from 10.48.64.15[4500] to 10.147.24.153[35564]
(76 bytes)
09[ENC] parsed IKE_AUTH response 2 [ EAP/REQ/TLS ]
09[IKE] server requested EAP_TLS authentication (id 0x59)
09[IKE] EAP method not supported, sending EAP_NAK
09[ENC] generating IKE_AUTH request 3 [ EAP/RES/NAK ]
09[NET] sending packet: from 10.147.24.153[35564] to 10.48.64.15[4500]
(76 bytes)
08[NET] received packet: from 10.48.64.15[4500] to 10.147.24.153[35564]
(92 bytes)
08[ENC] parsed IKE_AUTH response 3 [ EAP/REQ/MD5 ]
08[IKE] server requested EAP_MD5 authentication (id 0x5A)
08[ENC] generating IKE_AUTH request 4 [ EAP/RES/MD5 ]
08[NET] sending packet: from 10.147.24.153[35564] to 10.48.64.15[4500]
(92 bytes)
07[NET] received packet: from 10.48.64.15[4500] to 10.147.24.153[35564]
(76 bytes)
07[ENC] parsed IKE_AUTH response 4 [ EAP/SUCC ]
07[IKE] EAP method EAP_MD5 succeeded, no MSK established
07[IKE] authentication of 'cisco' (myself) with EAP
07[ENC] generating IKE_AUTH request 5 [ AUTH ]
07[NET] sending packet: from 10.147.24.153[35564] to 10.48.64.15[4500]
(92 bytes)
06[NET] received packet: from 10.48.64.15[4500] to 10.147.24.153[35564]
(236 bytes)
06[ENC] parsed IKE_AUTH response 5 [ AUTH CP(ADDR) SA TSi TSr N(SET_WINSIZE)
N(ESP_TFC_PAD_N) N(NON_FIRST_FRAG) ]
06[IKE] authentication of '10.48.64.15' with EAP successful
06[IKE] IKE_SA android[1] established between
10.147.24.153[cisco]...10.48.64.15[10.48.64.15]
06[IKE] scheduling rekeying in 35421s
06[IKE] maximum IKE_SA lifetime 36021s
06[IKE] installing new virtual IP 192.168.0.1
06[IKE] received ESP_TFC_PADDING_NOT_SUPPORTED, not using ESPv3 TFC padding
06[IKE] CHILD_SA android{1} established with SPIs c776cb4f_i ea27f072_o and
TS 192.168.0.1/32 === 0.0.0.0/0
06[DMN] setting up TUN device for CHILD_SA android{1}
06[DMN] successfully created TUN device
```

此範例顯示如何驗證Cisco IOS軟體上的狀態：

```
BSAN-2900-1#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: Virtual-Access1
Uptime: 00:02:12
Session status: UP-ACTIVE
Peer: 10.147.24.153 port 60511 fvrf: (none) ivrf: (none)
     Phase1_id: cisco
     Desc: (none)
 IKEv2 SA: local 10.48.64.15/4500 remote 10.147.24.153/60511 Active
         Capabilities:NX connid:1 lifetime:23:57:48
 IPSEC FLOW: permit ip 0.0.0.0/0.0.0.0 host 192.168.0.2
       Active SAs: 2, origin: crypto map
       Inbound:  #pkts dec'ed 40 drop 0 life (KB/Sec) 4351537/3468
       Outbound: #pkts enc'ed 5 drop 0 life (KB/Sec) 4351542/3468

BSAN-2900-1#show crypto ikev2 sa detailed
 IPv4 Crypto IKEv2  SA

Tunnel-id Local                 Remote                fvrf/ivrf         Status
1         10.48.64.15/4500      10.147.24.153/60511   none/none         READY
     Encr: AES-CBC, keysize: 128, Hash: SHA96, DH Grp:14, Auth sign: RSA,
Auth verify: EAP
     Life/Active Time: 86400/137 sec
     CE id: 1002, Session-id: 2
     Status Description: Negotiation done
     Local spi: D61F37C4DC875001       Remote spi: AABAB198FACAAEDE
     Local id: 10.48.64.15
     Remote id: cisco
     Remote EAP id: cisco
     Local req msg id:  0              Remote req msg id:  6
     Local next msg id: 0              Remote next msg id: 6
     Local req queued:  0              Remote req queued:  6
     Local window:      5              Remote window:      1
     DPD configured for 0 seconds, retry 0
     Fragmentation not configured.
     Extended Authentication configured.
     NAT-T is detected  outside
     Cisco Trust Security SGT is disabled
     Assigned host addr: 192.168.0.2
     Initiator of SA : No
```

以下圖顯示如何驗證Android上的狀態：


Saving screenshot...
ADD VPN PROFILE
Status: Connected
Profile: iosvpn
Disconnect
iosvpn
Gateway: 10.48.64.15
Username: cisco

RSA身份驗證

用於RSA身份驗證的Cisco IOS軟體配置

在Rivest-Shamir-Adleman(RSA)身份驗證中，Android傳送證書以便向Cisco IOS軟體進行身份驗證。這就是需要將該流量繫結到特定IKEv2配置檔案的證書對映的原因。不需要使用者EAP身份驗證。

以下示例說明如何為遠端對等體設定RSA身份驗證：

```
crypto pki certificate map CERT_MAP 10
 subject-name co android

crypto ikev2 profile PROF
 match certificate CERT_MAP
```

```
authentication remote rsa-sig
authentication local rsa-sig
pki trustpoint TP
aaa authorization group cert list IKE2_AUTHOR_LOCAL IKE2_AUTHOR_POLICY
virtual-template 1
```

用於RSA身份驗證的Android配置

使用者證書已被使用者證書替換：

RSA身份驗證測試

在Cisco IOS軟體中，這些是RSA身份驗證最重要的調試。為了清楚起見，大多數輸出均被省略：

```
debug crypto ikev2 error
debug crypto ikev2 internal
```

```
debug crypto pki transactions
debug crypto pki validation
debug crypto pki messages

IKEv2:New ikev2 sa request admitted
IKEv2:(SA ID = 1):Searching policy based on peer's identity 'cn=android,ou=TAC,
o=Cisco,l=Krakow,st=Malopolska,c=PL' of type 'DER ASN1 DN'
IKEv2:(1): Choosing IKE profile PROF
IKEv2:Sending certificates as X509 certificates
IKEv2:(SA ID = 1):Peer's authentication method is 'RSA'
IKEv2:Peer has sent X509 certificates
CRYPTO_PKI: Found a issuer match
CRYPTO_PKI: (9000B) Certificate is verified
CRYPTO_PKI: (9000B) Certificate validation succeeded
IKEv2:(SA ID = 1):[Crypto Engine -> IKEv2] Verification of signed
authentication data PASSED

IKEv2:IKEv2 local AAA author request for 'IKE2_AUTHOR_POLICY'
IKEv2:Received group author attributes: ipv4-pool: POOL, route-accept any tag:1
distance:1
IKEv2:Allocated addr 192.168.0.3 from local pool POOL
IKEv2:(SA ID = 1):SM Trace-> SA: I_SPI=E53A57E359A8437C R_SPI=A03D273FC75EEBD9
(R) MsgID = 00000001 CurState: R_VERIFY_AUTH Event:
EV_OK_RECD_VERIFY_IPSEC_POLICY
%LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state
to up
```

Android日誌顯示：

```
00[DMN] Starting IKE charon daemon (strongSwan 5.1.0dr2,
Linux 3.4.0-perf-gf43c3d9, armv7l)
00[KNL] kernel-netlink plugin might require CAP_NET_ADMIN capability
00[LIB] loaded plugins: androidbridge charon android-log openssl fips-prf
random nonce pubkey pkcs1 pkcs8 pem xcbc hmac socket-default
00[LIB] unable to load 9 plugin features (9 due to unmet dependencies)
00[JOB] spawning 16 worker threads
05[CFG] loaded user certificate 'C=PL, ST=Malopolska, L=Krakow, O=Cisco,
OU=TAC, CN=android' and private key
05[CFG] loaded CA certificate 'C=PL, ST=Malopolskie, L=Krakow, O=Cisco,
OU=Cisco TAC, CN=Cisco'

05[IKE] initiating IKE_SA android[4] to 10.48.64.15
05[ENC] generating IKE_SA_INIT request 0 [ SA KE No N(NATD_S_IP) N(NATD_D_IP) ]
05[NET] sending packet: from 10.147.24.153[34697] to 10.48.64.15[500]
(648 bytes)
10[NET] received packet: from 10.48.64.15[500] to 10.147.24.153[34697]
(497 bytes)
10[ENC] parsed IKE_SA_INIT response 0 [ SA KE No V V N(NATD_S_IP) N(NATD_D_IP)
CERTREQ N(HTTP_CERT_LOOK) ]
10[ENC] received unknown vendor ID:
43:49:53:43:4f:2d:44:45:4c:45:54:45:2d:52:45:41:53:4f:4e
10[ENC] received unknown vendor ID:
46:4c:45:58:56:50:4e:2d:53:55:50:50:4f:52:54:45:44
10[IKE] faking NAT situation to enforce UDP encapsulation
10[IKE] cert payload ANY not supported - ignored
10[IKE] sending cert request for "C=PL, ST=Malopolskie, L=Krakow, O=Cisco,
OU=Cisco TAC, CN=Cisco"
10[IKE] authentication of 'C=PL, ST=Malopolska, L=Krakow, O=Cisco, OU=TAC,
CN=android' (myself) with RSA signature successful
10[IKE] sending end entity cert "C=PL, ST=Malopolska, L=Krakow, O=Cisco,
OU=TAC, CN=android"
10[IKE] establishing CHILD_SA android
10[ENC] generating IKE_AUTH request 1 [ IDi CERT N(INIT_CONTACT) CERTREQ
```

```
AUTH CP(ADDR ADDR6 DNS DNS6) N(ESP_TFC_PAD_N) SA
10[NET] sending packet: from 10.147.24.153[44527] to 10.48.64.15[4500]
(1788 bytes)
12[NET] received packet: from 10.48.64.15[4500] to 10.147.24.153[44527]
(1420 bytes)
12[ENC] parsed IKE_AUTH response 1 [ V IDr CERT AUTH CP(ADDR) SA TSi TSr
N(SET_WINSIZE) N(ESP_TFC_PAD_N) N(NON_FIRST_FRAG)
12[IKE] received end entity cert "C=PL, ST=Malopolska, L=Krakow, O=Cisco,
OU=TAC, CN=IOS"
12[CFG] using certificate "C=PL, ST=Malopolska, L=Krakow, O=Cisco, OU=TAC,
CN=IOS"
12[CFG] using trusted ca certificate "C=PL, ST=Malopolskie, L=Krakow, O=Cisco,
OU=Cisco TAC, CN=Cisco"
12[CFG] reached self-signed root ca with a path length of 0
12[IKE] authentication of '10.48.64.15' with RSA signature successful
12[IKE] IKE_SA android[4] established between 10.147.24.153[C=PL,
ST=Malopolska, L=Krakow, O=Cisco, OU=TAC,
CN=android]...10.48.64.15[10.48.64.15]
12[IKE] scheduling rekeying in 35413s
12[IKE] maximum IKE_SA lifetime 36013s
12[IKE] installing new virtual IP 192.168.0.3
12[IKE] received ESP_TFC_PADDING_NOT_SUPPORTED, not using ESPv3 TFC padding
12[IKE] CHILD_SA android{4} established with SPIs ecb3af87_i b2279175_o and
TS 192.168.0.3/32 === 0.0.0.0/0
12[DMN] setting up TUN device for CHILD_SA android{4}
12[DMN] successfully created TUN device
```

在Cisco IOS軟體中，RSA用於簽名和驗證；在上一個場景中，使用EAP進行驗證：

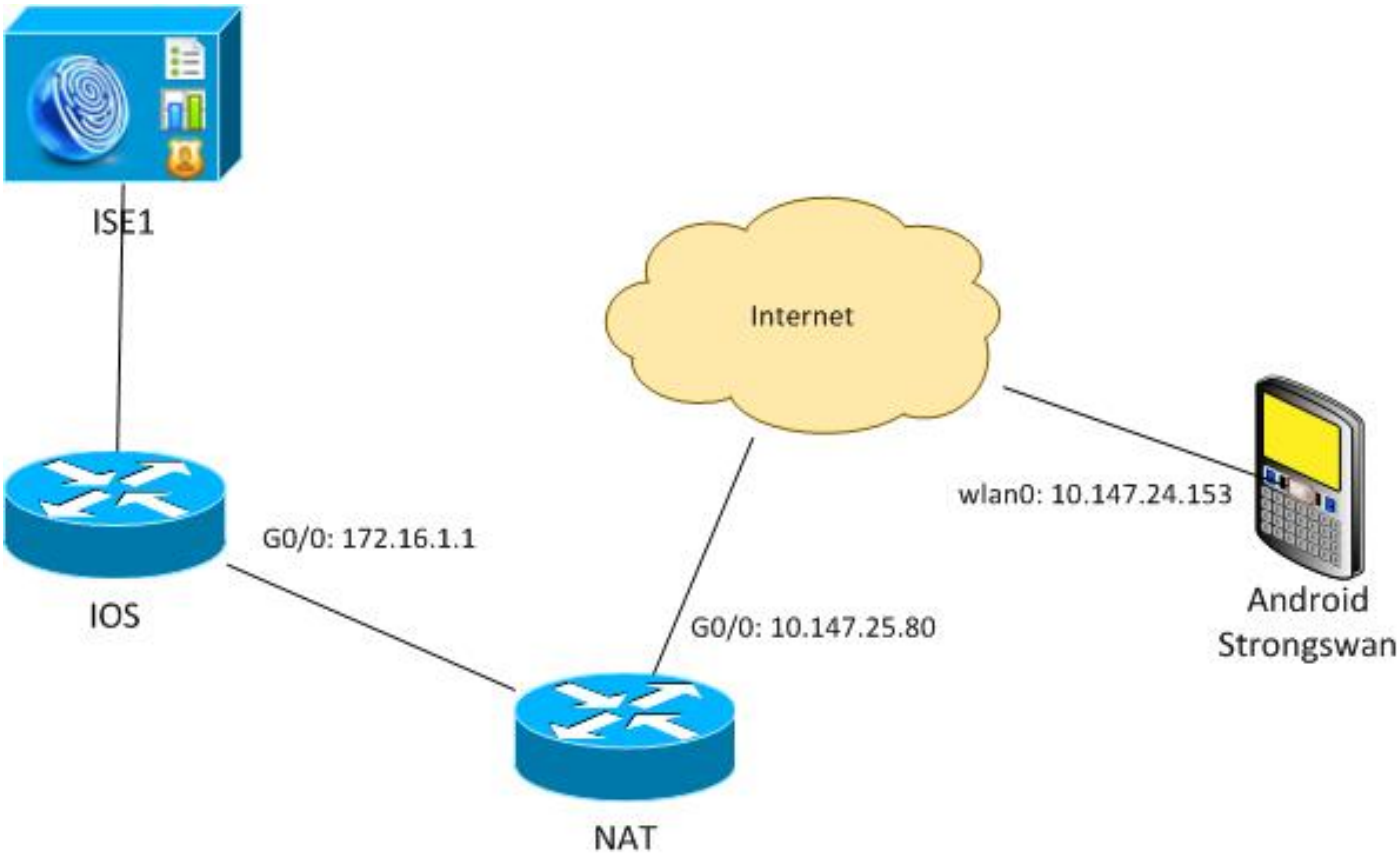
```
BSAN-2900-1#show crypto ikev2 sa detailed
 IPv4 Crypto IKEv2  SA

Tunnel-id Local                 Remote                fvrf/ivrf          Status
1         10.48.64.15/4500      10.147.24.153/44527   none/none          READY
     Encr: AES-CBC, keysize: 128, Hash: SHA96, DH Grp:14, Auth sign: RSA,
Auth verify: RSA
     Life/Active Time: 86400/16 sec
     CE id: 1010, Session-id: 3
     Status Description: Negotiation done
     Local spi: A03D273FC75EEBD9       Remote spi: E53A57E359A8437C
     Local id: 10.48.64.15
     Remote id: cn=android,ou=TAC,o=Cisco,l=Krakow,st=Malopolska,c=PL
     Local req msg id:  0              Remote req msg id:  2
     Local next msg id: 0              Remote next msg id: 2
     Local req queued:  0              Remote req queued:  2
     Local window:      5              Remote window:      1
     DPD configured for 0 seconds, retry 0
     Fragmentation not configured.
     Extended Authentication not configured.
     NAT-T is detected  outside
     Cisco Trust Security SGT is disabled
     Assigned host addr: 192.168.0.3
     Initiator of SA : No
```

Android上的狀態驗證與上一個場景中的狀態驗證類似。

NAT後的VPN網關 — strongSwan和Cisco IOS軟體限制

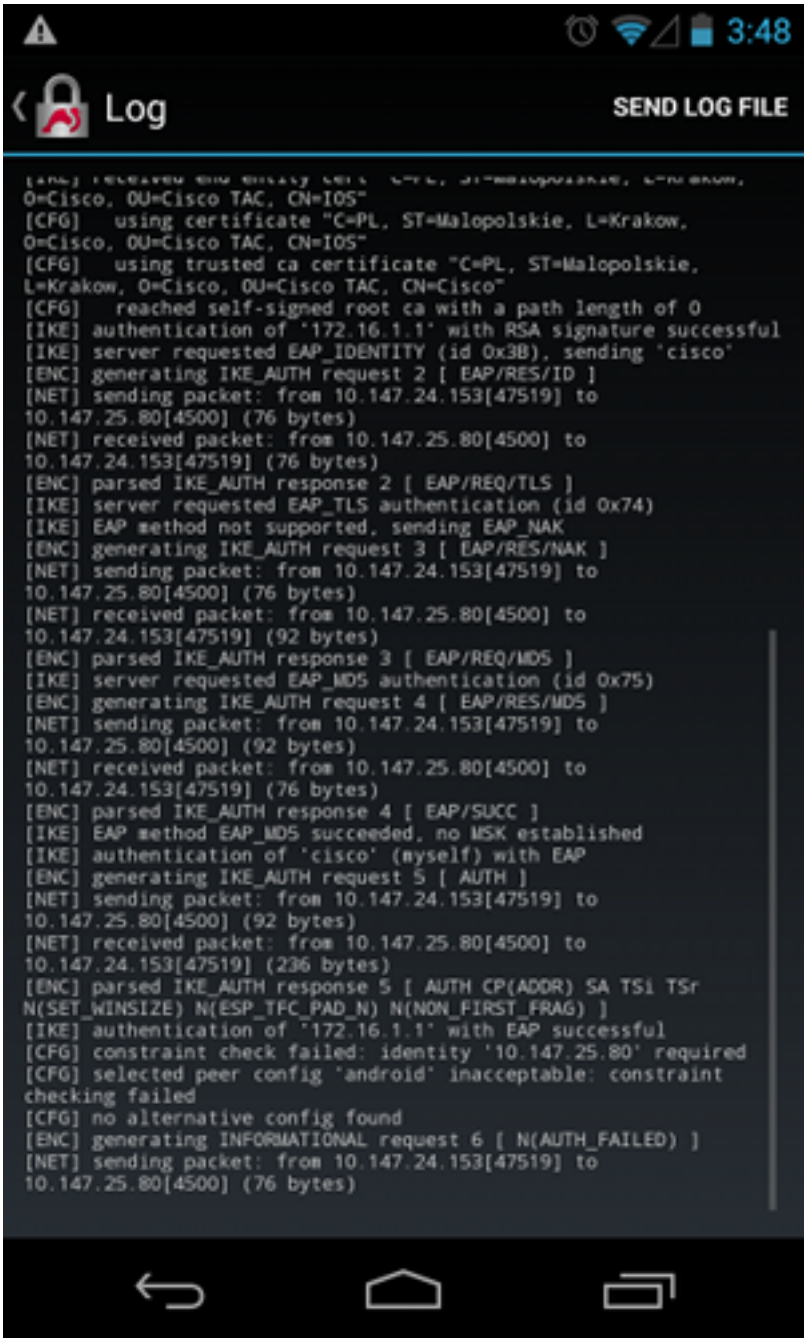
以下範例說明strongSwan憑證驗證的限制。

假設Cisco IOS軟體VPN網關IP地址從172.16.1.1靜態轉換為10.147.25.80。使用EAP身份驗證。



還假設Cisco IOS軟體證書具有用於172.16.1.1和10.147.25.80的使用者替代名稱。

在成功進行EAP身份驗證後，Android會執行驗證並嘗試在Android配置(10.147.25.80)中使用的Subject Alternative Name擴展中的對等體的IP地址。驗證失敗：

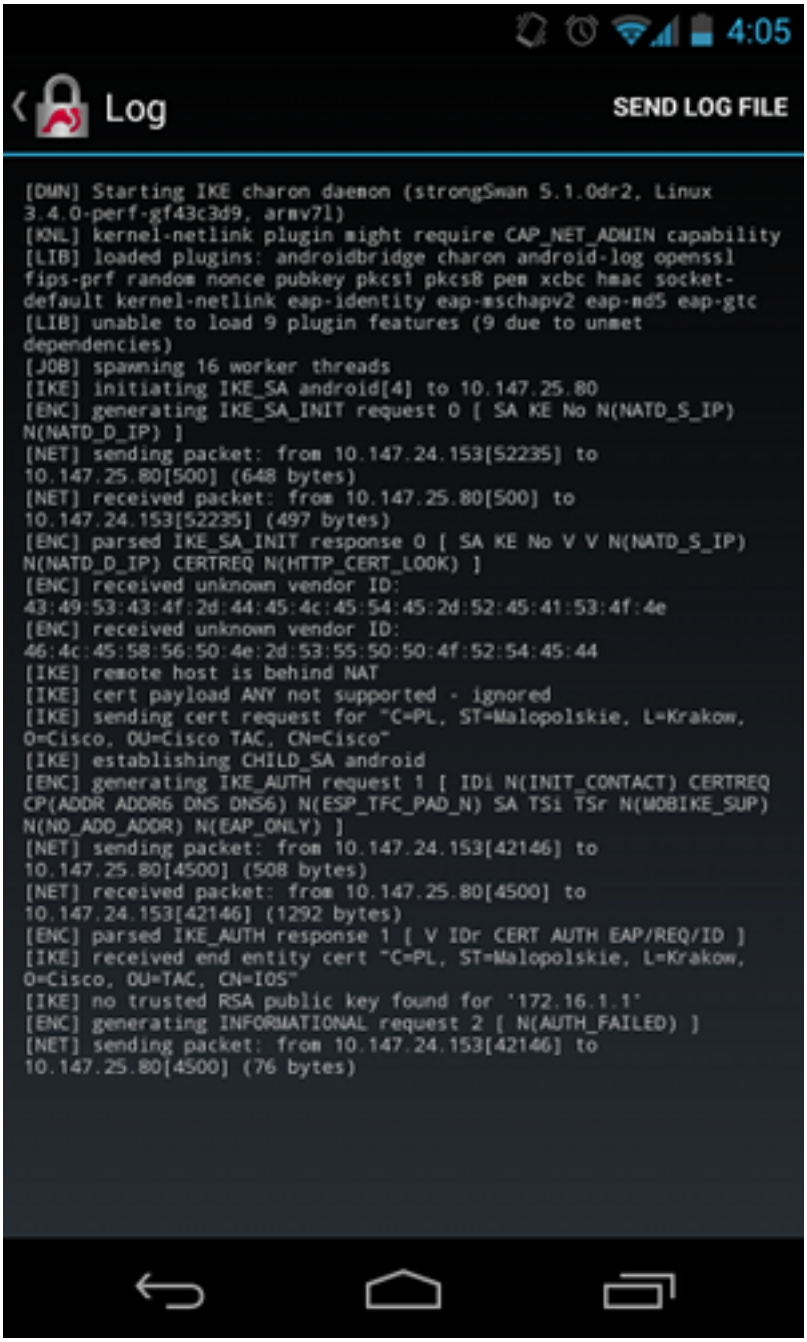


日誌顯示：

```
constraint check failed: identity '10.147.25.80' required
```

發生此失敗的原因是Android只能讀取第一個主題備用名稱副檔名(172.16.1.1)。

現在，假設Cisco IOS軟體證書的兩個地址都以使用者備用名稱顯示，但順序相反：10.147.25.80和172.16.1.1。 Android在第三個資料包中收到IKEID(即VPN網關(172.16.1.1)的IP地址)時執行驗證：



現在日誌顯示：

```
no trusted RSA public key found for '172.16.1.1'
```

因此，當Android收到IKEID時，它需要在主題備用名稱中查詢IKEID，並且只能使用第一個IP地址。

> **附註**：在EAP身份驗證中，Cisco IOS軟體傳送的IKEID預設為IP地址。在RSA身份驗證中，預設情況下，IKEID是證書DN。使用ikev2配置檔案下的**identity**命令手動更改這些值。

驗證

驗證和測試步驟在配置示例中提供。

疑難排解

本節提供的資訊可用於對組態進行疑難排解。

strongSwan CA Multiple CERT_REQ

當strongSwan上的證書設定為Automatic Selection（預設值）時，Android會在第三個資料包中傳送本地儲存中所有受信任證書的CERT_REQ。Cisco IOS軟體可能會捨棄該要求，因為它將大量憑證要求識別為拒絕服務攻擊：

```
*Jul 15 07:54:13: IKEv2:number of cert req exceeds the reasonable limit (100)
```

DVTI上的通道來源

雖然在虛擬通道介面(VTI)上設定通道來源非常普遍，但此處並不是必須的。假定**tunnel source**指令位於動態VTI(DVTI)下：

```
interface Virtual-Template1 type tunnel
 ip unnumbered GigabitEthernet0/0
 tunnel source GigabitEthernet0/0
 tunnel mode ipsec ipv4
 tunnel protection ipsec profile PROF
```

身份驗證後，如果Cisco IOS軟體嘗試建立從虛擬模板克隆的虛擬訪問介面，則會返回錯誤：

```
*Aug  1 13:34:22 IKEv2:Allocated addr 192.168.0.9 from local pool POOL
*Aug  1 13:34:22 IKEv2:(SA ID = 1):Set received config mode data
*Aug  1 13:34:22 IKEv2:% DVTI create request sent for profile PROF with PSH
index 1
*Aug  1 13:34:22 IKEv2:Failed to process KMI delete SA message with error 4
*Aug  1 13:34:24 IKEv2:Got a packet from dispatcher
*Aug  1 13:34:24 IKEv2:Processing an item off the pak queue
*Aug  1 13:34:24 IKEv2:Negotiation context locked currently in use
```

故障發生兩秒後，Cisco IOS軟體會收到來自Android的重新傳輸的IKE_AUTH。該資料包將被丟棄。

Cisco IOS軟體錯誤和增強功能要求

- 思科漏洞ID CSCui46418，「IOS Ikev2 ip address sent as identity for RSA authentication.」只要strongSwan在憑證中尋找IKEID以便執行驗證時能看到正確的使用者替代名稱（IP位址），這個錯誤就不會有問題。
- 思科錯誤ID CSCui44976，「IOS PKI錯誤地顯示X509v3擴展主題備用名稱」。僅當使用者替代名稱中有多個IP位址時，才會發生此錯誤。僅顯示最後一個IP地址，但這不影響證書使用。整個證書都將被正確傳送和處理。
- 思科錯誤ID CSCui44783，「IOS ENH PKI能夠使用subject-alt-name擴展生成CSR。」
- 思科漏洞ID CSCui44335，「ASA ENH Certificate x509 extensions displayed.」

相關資訊

- Cisco IOS 15.3 VPN配置指南
- Cisco IOS 15.3命令參考
- Cisco IOS Flex VPN配置指南
- 技術支援與文件 - Cisco Systems