Configuring Internet Key Exchange for IPsec VPNs

This module describes how to configure the Internet Key Exchange (IKE) protocol for basic IP Security (IPsec) Virtual Private Networks (VPNs). IKE is a key management protocol standard that is used in conjunction with the IPsec standard. IPsec is an IP security feature that provides robust authentication and encryption of IP packets.

IPsec can be configured without IKE, but IKE enhances IPsec by providing additional features, flexibility, and ease of configuration for the IPsec standard.

IKE is a hybrid protocol, that implements the Oakley key exchange and Skeme key exchange inside the Internet Security Association Key Management Protocol (ISAKMP) framework. (ISAKMP, Oakley, and Skeme are security protocols implemented by IKE.)

Note

Security threats, as well as the cryptographic technologies to help protect against them, are constantly changing. For more information about the latest Cisco cryptographic recommendations, see the Next Generation Encryption (NGE) white paper.

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Creating IKE Policies

Restrictions for configuring AES IKE policy

- IPsec and long keys (the “k9” subsystem) must be supported.
- AES cannot encrypt IPsec and IKE traffic if an acceleration card is present.

```
enable
configure terminal
crypto isakmp policy 10
```
Troubleshooting Tips

- Clear (and reinitialize) IPsec SAs by using the `clear crypto sa` EXEC command.

Using the `clear crypto sa` command without parameters will clear out the full SA database, which will clear out active security sessions. You may also specify the `peer`, `map`, or `entry` keywords to clear out only a subset of the SA database. For more information, see the `clear crypto sa` command in the Cisco IOS Security Command Reference.

- The default policy and default values for configured policies do not show up in the configuration when you issue the `show running-config` command. To display the default policy and any default values within configured policies, use the `show crypto isakmp policy` command.

- Any IPsec transforms or IKE encryption methods that the current hardware does not support should be disabled; they are ignored whenever an attempt to negotiate with the peer is made.

If a user enters an IPsec transform or an IKE encryption method that the hardware does not support, a warning message will be generated. These warning messages are also generated at boot time. When an encrypted card is inserted, the current configuration is scanned. If any IPsec transforms or IKE encryption methods are found that are not supported by the hardware, a warning message will be generated.

Configuring IKE Authentication

After you have created at least one IKE policy in which you specified an authentication method (or accepted the default method), you need to configure an authentication method. IKE policies cannot be used by IPsec until the authentication method is successfully configured.

Before configuring IKE authentication, you must have configured at least one IKE policy, which is where the authentication method was specified (or RSA signatures was accepted by default).

To configure IKE authentication, you should perform one of the following tasks, as appropriate:

Configuring RSA Keys Manually for RSA Encrypted Nonces

This task can be performed only if a CA is not in use.

```
enable
cisco terminal
crypto key generate rsa general-keys modulus 360
crypto key generate ec keysize 256 label Router_1_Key
end
```
Optional Configuration using Named Key

```
enable
configure terminal
crypto key pubkey-chain rsa
named-key otherpeer.example.com
address 10.5.5.1
key-string
00302017 4A7D385B 1234EF29 335FC973
2DD50A37 C4F4B0FD 9DADE748 429618D5
18242BA3 2EDFBDD3 4296142A DDF7D3D8
08407685 2F2190A0 0B43F1BD 9A8A26DB
07953829 791FCDE9 A98420F0 6A82045B
90288A26 DBC64468 7789F76E EE21
quit
```

Optional Configuration using Addresses Key

```
enable
configure terminal
crypto key pubkey-chain rsa
addressed-key 10.1.1.2 encryption
address 10.5.5.1
key-string
00302017 4A7D385B 1234EF29 335FC973
2DD50A37 C4F4B0FD 9DADE748 429618D5
18242BA3 2EDFBDD3 4296142A DDF7D3D8
08407685 2F2190A0 0B43F1BD 9A8A26DB
07953829 791FCDE9 A98420F0 6A82045B
90288A26 DBC64468 7789F76E EE21
quit
```

Configuring Preshared Keys

**Note**

Preshared keys do not scale well with a growing network.

Restrictions for Mask Preshared Keys

- The SA cannot be established between the IPsec peers until all IPsec peers are configured for the same preshared key.

- The mask preshared key must be distinctly different for remote users requiring varying levels of authorization. A new preshared key should be configured for each level of trust and correct keys must be assigned to the correct parties. Otherwise, an untrusted party may obtain access to protected data.

```
enable
configure terminal
crypto isakmp identity address
crypto isakmp key sharedkeystring address 192.168.1.33 no-xauth
crypto isakmp key sharedkeystring address 10.0.0.1
end
```

Configuring IKE Mode Configuration

```
enable
configure terminal
```
ип local pool pool1 172.16.23.0 172.16.23.255
crypto isakmp client configuration address-pool local pool1
def

**Configuration Examples for an IKE Configuration**

**Example: Creating IKE Policies**

This section contains the following examples, which show how to configure an AES IKE policy and a 3DES IKE policy.

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**Note**

Cisco no longer recommends using 3DES; instead, you should use AES. For more information about the latest Cisco cryptographic recommendations, see the [Next Generation Encryption (NGE) white paper](#).

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**Example: Creating an AES IKE Policy**

The following example is sample output from the `show running-config` command. In this example, the AES 256-bit key is enabled.

Current configuration : 1665 bytes
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname "Router1"
!
ip subnet-zero
!
no ip domain lookup
!
ip audit notify log
ip audit po max-events 100
!
crypto isakmp policy 10
  encryption aes 256
  authentication pre-share
  lifetime 180

crypto isakmp key cisco123 address 10.0.110.1
!
crypto ipsec transform-set aesset esp-aes 256 esp-sha-hmac
  mode transport
  .
  .
  .

Configuring Internet Key Exchange for IPsec VPNs
Example: Creating 3DES IKE Policies

This example creates two IKE policies, with policy 15 as the highest priority, policy 20 as the next priority, and the existing default priority as the lowest priority. It also creates a preshared key to be used with policy 20 with the remote peer whose IP address is 192.168.224.33.

crypto isakmp policy 15
  encryption 3des
  hash md5
  authentication rsa-sig
  group 2
  lifetime 5000
!
crypto isakmp policy 20
  authentication pre-share
  lifetime 10000
!
crypto isakmp key 1234567890 address 192.168.224.33

In the example, the encryption DES of policy default would not appear in the written configuration because this is the default value for the encryption algorithm parameter.

If the `show crypto isakmp policy` command is issued with this configuration, the output is as follows:

Protection suite priority 15
  encryption algorithm:3DES - Triple Data Encryption Standard (168 bit keys)
  hash algorithm:Message Digest 5
  authentication method:Rivest-Shamir-Adleman Signature
  Diffie-Hellman group:#2 (1024 bit)
  lifetime:5000 seconds, no volume limit
Protection suite priority 20
  encryption algorithm:DES - Data Encryption Standard (56 bit keys)
  hash algorithm:Secure Hash Standard
  authentication method:preshared Key
  Diffie-Hellman group:#1 (768 bit)
  lifetime:10000 seconds, no volume limit
Default protection suite
  encryption algorithm:DES - Data Encryption Standard (56 bit keys)
  hash algorithm:Secure Hash Standard
  authentication method:Rivest-Shamir-Adleman Signature
  Diffie-Hellman group:#1 (768 bit)
  lifetime:86400 seconds, no volume limit

Note that although the output shows “no volume limit” for the lifetimes, you can configure only a time lifetime (such as 86,400 seconds); volume-limit lifetimes are not configurable.

Example: Configuring IKE Authentication

The following example shows how to manually specify the RSA public keys of two IPsec peer-- the peer at 10.5.5.1 uses general-purpose keys, and the other peer uses special-usage keys:

crypto key pubkey-chain rsa
  named-key otherpeer.example.com
  address 10.5.5.1
  key-string
  005C300D 06092A86 4886F70D 01010105
  00034B00 30480241 00C5E23B 55D6AB22
  04AEF1BA A54028A6 9ACC01C5 129D99E4
  64CAB820 847E9969 DFOB4E4C 73A05DD0

Configuring Internet Key Exchange for IPsecVPNs

Example: Creating 3DES IKE Policies
Verifying IKE Policies

Router# show crypto isakmp policy

Global IKE policy
Protection suite of priority 1
  encryption algorithm: Three key triple DES
  hash algorithm: Secure Hash Standard
  authentication method: Pre-Shared Key
  Diffie-Hellman group: $5 (1536 bit)
  lifetime: 86400 seconds, no volume limit

Verifying RSA Keys

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

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<th>Usage</th>
<th>IP-Address/VRF</th>
<th>Keyring</th>
<th>Name</th>
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Configuring Internet Key Exchange for IPsec VPNs
## Additional References

### Related Documents

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### Standards

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### MIBs

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RFCs

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<td>RFC 2409</td>
<td>The Internet Key Exchange (IKE)</td>
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<td>RFC 2412</td>
<td>The OAKLEY Key Determination Protocol</td>
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Technical Assistance

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