Concepts & Examples
ScreenOS Reference Guide

Volume 5:
Virtual Private Networks

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FCC Statement

The following information is for FCC compliance of Class A devices: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

The following information is for FCC compliance of Class B devices: The equipment described in this manual generates and may radiate radio-frequency energy. If it is not installed in accordance with Juniper Networks' installation instructions, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Caution: Changes or modifications to this product could void the user's warranty and authority to operate this device.

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Table of Contents

About This Volume

Volume 5: Virtual Private Networks describes virtual private network (VPN) concepts and ScreenOS VPN-specific features.

This volume contains the following chapters:

- Chapter 1, “Internet Protocol Security,” provides background information about IPsec, presents a flow sequence for Phase 1 in IKE negotiations in aggressive and main modes, and concludes with information about IKE and IPsec packet encapsulation.
- Chapter 2, “Public Key Cryptography,” provides an introduction to public key cryptography, certificate use, and certificate revocation list (CRL) use within the context of Public Key Infrastructure (PKI).
- Chapter 3, “Virtual Private Network Guidelines,” offers some useful information to help in the selection of the available VPN options. It also presents a packet flow chart to demystify VPN packet processing.
- Chapter 4, “Site-to-Site Virtual Private Networks,” provides extensive examples of VPN configurations connecting two private networks.
- Chapter 5, “Dialup Virtual Private Networks,” provides extensive examples of client-to-LAN communication using AutoKey IKE. It also details group IKE ID and shared IKE ID configurations.
- Chapter 6, “Layer 2 Tunneling Protocol,” explains Layer 2 Tunneling Protocol (L2TP) and provides configuration examples for L2TP and L2TP-over-IPsec.
- Chapter 7, “Advanced Virtual Private Network Features,” contains information and examples for the more advanced VPN configurations, such as NAT-Traversal, VPN monitoring, binding multiple tunnels to a single tunnel interface, and hub-and-spoke and back-to-back tunnel designs.
- Chapter 8, “AutoConnect-Virtual Private Networks,” describes how ScreenOS uses Next Hop Resolution Protocol (NHRP) messages to enable security devices to set up AutoConnect VPNs as needed. The chapter provides an example of a typical scenario in which AC-VPN might be used.

Document Conventions

This document uses the conventions described in the following sections:

Web User Interface Conventions

The Web user interface (WebUI) contains a navigational path and configuration settings. To enter configuration settings, begin by clicking a menu item in the navigation tree on the left side of the screen. As you proceed, your navigation path appears at the top of the screen, with each page separated by angle brackets.

The following example shows the WebUI path and parameters for defining an address:

> Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:
>
> Address Name: addr_1
> IP Address/Domain Name:
> IP/Netmask: (select), 10.2.2.5/32
> Zone: Untrust

To open Online Help for configuration settings, click the question mark (?) in the upper left of the screen.

The navigation tree also provides a Help > Config Guide configuration page to help you configure security policies and Internet Protocol Security (IPSec). Select an option from the list, and follow the instructions on the page. Click the ? character in the upper left for Online Help on the Config Guide.

Command Line Interface Conventions

The following conventions are used to present the syntax of command line interface (CLI) commands in text and examples.

In text, commands are in **boldface** type and variables are in *italic* type.

In examples:

- Variables are in *italic* type.
- Anything inside square brackets [ ] is optional.
- Anything inside braces { } is required.

- If there is more than one choice, each choice is separated by a pipe (|). For example, the following command means “set the management options for the ethernet1, the ethernet2, *or* the ethernet3 interface”:

  ```
  set interface { ethernet1 | ethernet2 | ethernet3 } manage
  ```

NOTE: When entering a keyword, you only have to type enough letters to identify the word uniquely. Typing set adm u whee j12fmt54 will enter the command set admin user wheezer j12fmt54. However, all the commands documented in this guide are presented in their entirety.

Naming Conventions and Character Types

ScreenOS employs the following conventions regarding the names of objects—such as addresses, admin users, auth servers, IKE gateways, virtual systems, VPN tunnels, and zones—defined in ScreenOS configurations:

- If a name string includes one or more spaces, the entire string must be enclosed within double quotes; for example:

  set address trust “local LAN” 10.1.1.0/24

- Any leading spaces or trailing text within a set of double quotes are trimmed; for example, “ local LAN ” becomes “local LAN”.

- Multiple consecutive spaces are treated as a single space.

- Name strings are case-sensitive, although many CLI keywords are case-insensitive. For example, “local LAN” is different from “local lan”.

ScreenOS supports the following character types:

- Single-byte character sets (SBCS) and multiple-byte character sets (MBCS). Examples of SBCS are ASCII, European, and Hebrew. Examples of MBCS—also referred to as double-byte character sets (DBCS)—are Chinese, Korean, and Japanese.

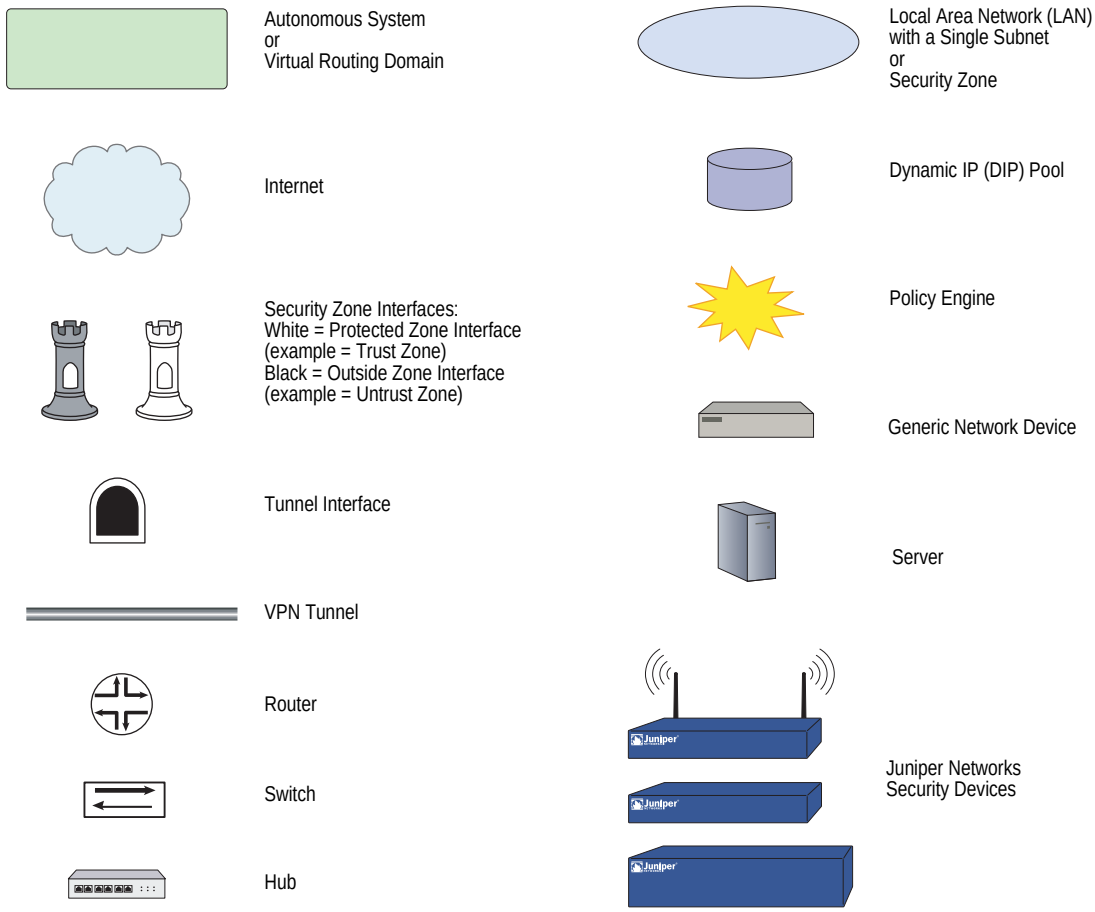
- ASCII characters from 32 (0x20 in hexadecimals) to 255 (0xff), except double quotes (“), which have special significance as an indicator of the beginning or end of a name string that includes spaces.

NOTE: A console connection only supports SBCS. The WebUI supports both SBCS and MBCS, depending on the character sets that your browser supports.

Illustration Conventions

Figure 1 shows the basic set of images used in illustrations throughout this volume.

Figure 1: Images in Illustrations



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Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need postsales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/customers/support/downloads/710059.pdf.
- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

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- Find CSC offerings—http://www.juniper.net/customers/support/
- Find product documentation—http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base—http://kb.juniper.net/
- Download the latest versions of software and review your release notes—http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications—http://www.juniper.net/alerts/
- Join and participate in the Juniper Networks Community Forum—http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Manager—http://www.juniper.net/customers/cm/
- To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool—https://tools.juniper.net/SerialNumberEntitlementSearch/

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You can open a case with JTAC on the Web or by telephone.

- Use the Case Manager tool in the CSC at http://www.juniper.net/customers/cm/.
- Call 1-888-314-JTAC (1-888-314-5822—toll free in USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, visit us at http://www.juniper.net/customers/support/requesting-support/.

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Chapter 1

Internet Protocol Security

This chapter introduces elements of Internet Protocol security (IPsec) and describes how they relate to virtual private network (VPN) tunneling. This chapter contains the following sections:

Introduction to Virtual Private Networks

A virtual private network (VPN) provides a means for securely communicating between remote computers across a public wide area network (WAN), such as the Internet.

A VPN connection can link two local area networks (LANs) or a remote dialup user and a LAN. The traffic that flows between these two points passes through shared resources such as routers, switches, and other network equipment that make up the public WAN. To secure VPN communication while passing through the WAN, the two participants create an IP security (IPsec) tunnel.

NOTE: The term *tunnel* does not denote either transport or tunnel mode (see "Modes" on page 4). It refers to the IPsec connection.

An IPsec tunnel consists of a pair of unidirectional Security Associations (SAs)—one at each end of the tunnel—that specify the security parameter index (SPI), destination IP address, and security protocol (Authentication Header or Encapsulating Security Payload) employed.

For more information about SPIs, see "Security Associations" on page 8. For more information about IPsec security protocols, see "Protocols" on page 5.

Through the SA, an IPsec tunnel can provide the following security functions:

- Privacy (through encryption)
- Content integrity (through data authentication)
- Sender authentication and—if using certificates—nonrepudiation (through data origin authentication)

The security functions you employ depend on your needs. If you only need to authenticate the IP packet source and content integrity, you can authenticate the packet without applying any encryption. On the other hand, if you are only concerned with preserving privacy, you can encrypt the packet without applying any authentication mechanisms. Optionally, you can both encrypt and authenticate the packet. Most network security designers choose to encrypt, authenticate, and replay-protect their VPN traffic.

ScreenOS supports IPsec technology for creating VPN tunnels with two kinds of key creation mechanisms:

- Manual Key
- AutoKey IKE with a preshared key or a certificate

IPsec Concepts

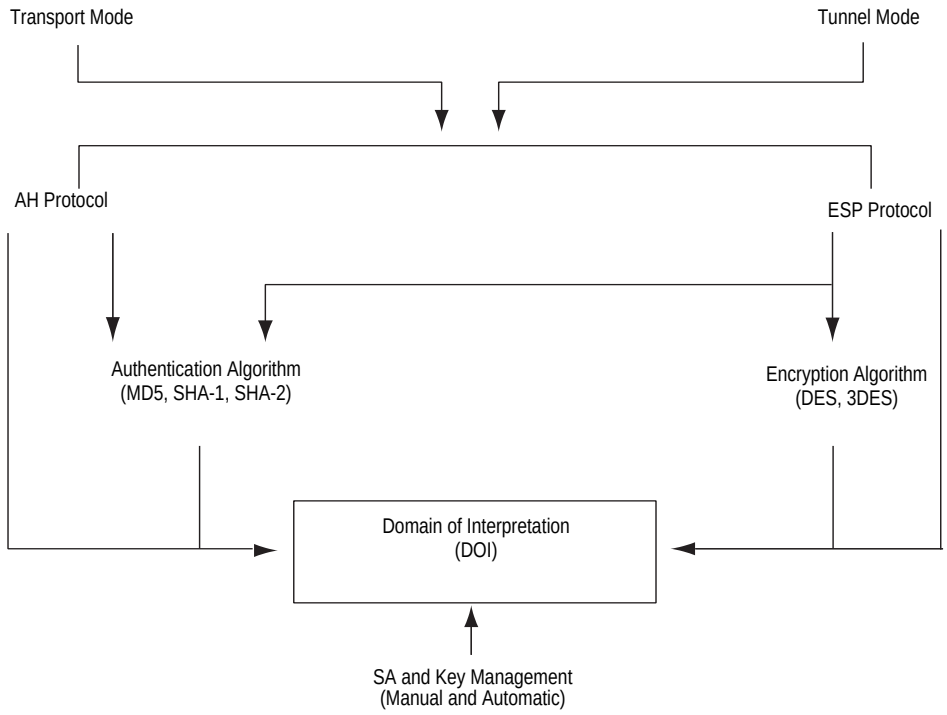
IP security (IPsec) is a suite of related protocols for cryptographically securing communications at the IP Packet Layer. IPsec consists of two modes and two main protocols:

- Transport and tunnel modes
- The Authentication Header (AH) protocol for authentication and the Encapsulating Security Payload (ESP) protocol for encryption (and authentication)

IPsec also provides methods for the manual and automatic negotiation of Security Associations (SAs) and key distribution, all the attributes for which are gathered in a Domain of Interpretation (DOI). Refer to RFC 2407 and RFC 2408.

Figure 2: IPsec Architecture

Note: ScreenOS does not support transport mode with AH.



NOTE: The IPsec Domain of Interpretation (DOI) is a document containing definitions for all the security parameters required for the successful negotiation of a VPN tunnel—essentially, all the attributes required for SA and IKE negotiations.

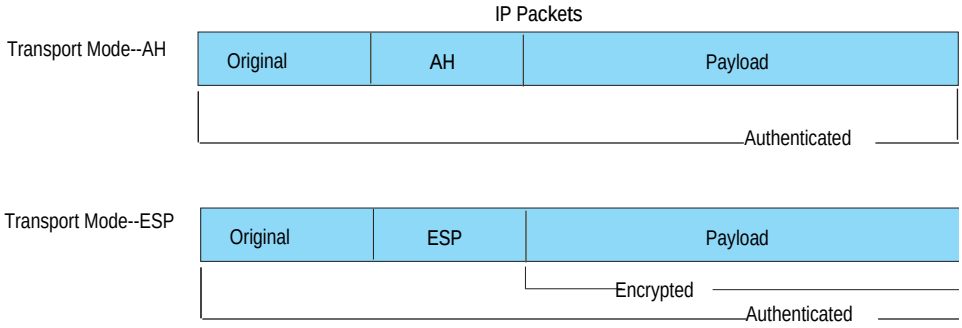
Modes

IPsec operates in one of two modes—transport or tunnel. When both ends of the tunnel are hosts, you can use either mode. When at least one of the endpoints of a tunnel is a security gateway, such as a router or firewall, you must use tunnel mode. Juniper Networks security devices always operate in tunnel mode for IPsec tunnels and transport mode for L2TP-over-IPsec tunnels.

Transport Mode

The original IP packet is not encapsulated within another IP packet, as shown in Figure 3. The entire packet can be authenticated (with AH), the payload can be encrypted (with ESP), and the original header remains in plaintext as it is sent across the WAN.

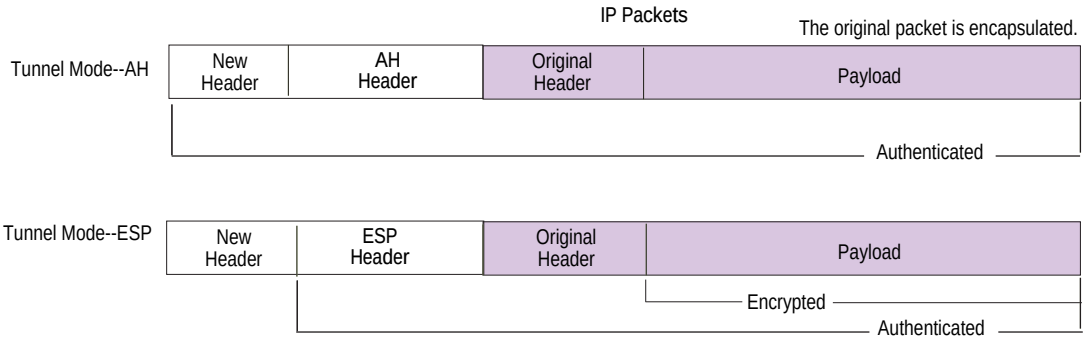
Figure 3: Transport Modes



Tunnel Mode

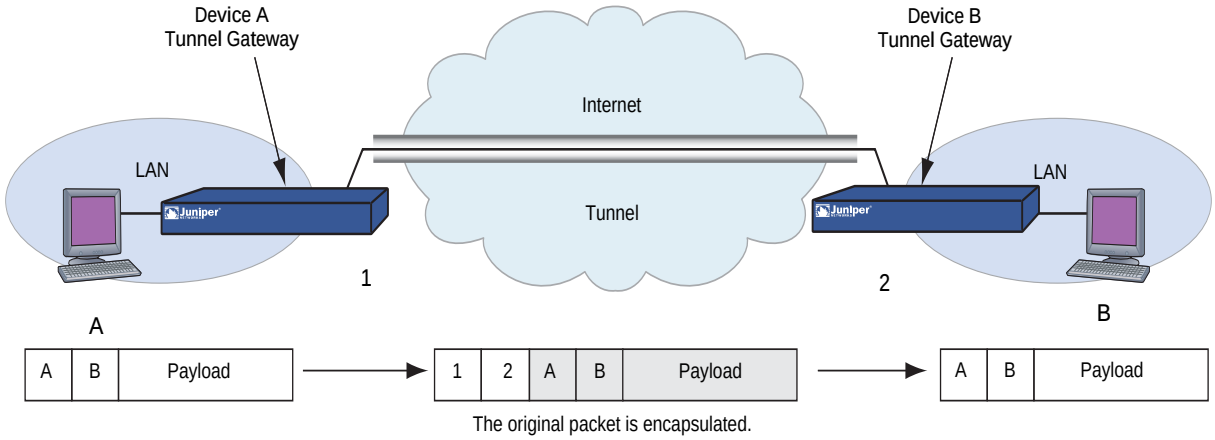
The entire original IP packet—payload and header—is encapsulated within another IP payload and a new header is prepended to it, as shown in Figure 4. The entire original packet can be encrypted, authenticated, or both. With AH, the AH and new headers are also authenticated. With ESP, the ESP header can also be authenticated.

Figure 4: Tunnel Modes



In a site-to-site VPN, the source and destination addresses used in the new header are the IP addresses of the outgoing interface (in NAT or route mode) or the VLAN1 IP address (in transparent mode); the source and destination addresses of the encapsulated packets are the addresses of the ultimate endpoints of the connection.

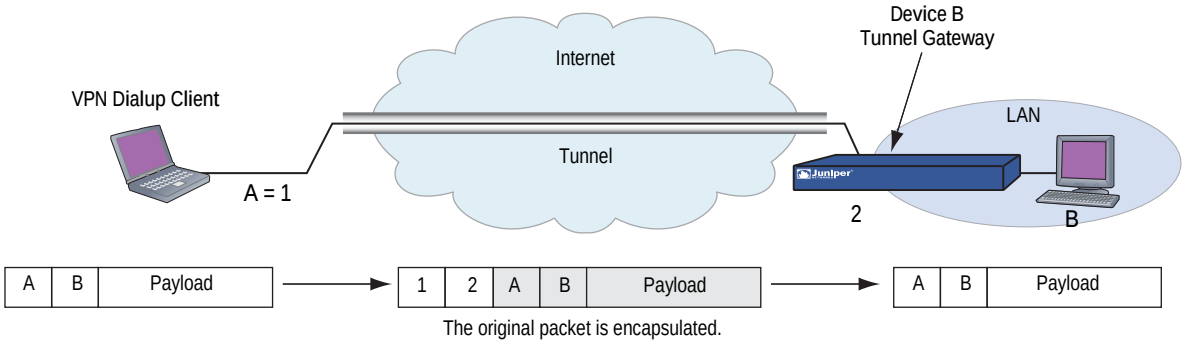
Figure 5: Site-to-Site VPN in Tunnel Mode



In a dialup VPN, there is no tunnel gateway on the VPN dialup client end of the tunnel; the tunnel extends directly to the client itself. In this case, on packets sent from the dialup client, both the new header and the encapsulated original header have the same IP address: that of the client's computer.

NOTE: Some VPN clients such as the NetScreen-Remote allow you to define a virtual inner IP address. In such cases, the virtual inner IP address is the source IP address in the original packet header of traffic originating from the client, and the IP address that the ISP dynamically assigns the dialup client is the source IP address in the outer header.

Figure 6: Dialup VPN in Tunnel Mode



Protocols

IPsec uses two protocols to secure communications at the IP Layer:

- Authentication Header (AH)—A security protocol for authenticating the source of an IP packet and verifying the integrity of its content
- Encapsulating Security Payload (ESP)—A security protocol for encrypting the entire IP packet (and authenticating its content)

Authentication Header

The Authentication Header (AH) protocol is used to verify the authenticity and integrity of the content and origin of a packet. You can authenticate the packet by the checksum calculated through a Hash Message Authentication Code (HMAC) using a secret key and the MD5, SHA-1 or SHA-2 hash functions.

- Message Digest version 5 (MD5)—Algorithm that produces a 128-bit hash (also called a *digital signature* or *message digest*) from a message of arbitrary length and a 16-byte key. The resulting hash is used, like a fingerprint of the input, to verify content and source authenticity and integrity.

- Secure Hash Algorithm-1 (SHA-1)—Algorithm that produces a 160-bit hash from a message of arbitrary length and a 20-byte key. It is generally regarded as more secure than MD5 because of the larger hashes it produces. Because the computational processing is done in the ASIC, the performance cost is negligible.

- Secure Hash Algorithm-2 (SHA-2)—Set of four algorithms named after their message digest length (in bits)—SHA2-224, SHA2-256, SHA2-384, and SHA2-512. These algorithms are generally regarded as more secure than SHA-1 because of the larger hashes they produce. This release of ScreenOS supports the SHA2-256 hash algorithm. The SHA2-256 algorithm produces a 256-bit hash from a message of arbitrary length and a 32-byte key.

NOTE: For more information about the MD5, SHA-1, and SHA2-256 hashing algorithms, refer to the following RFCs: (MD5) 1321, 2403; (SHA-1) 2404; (SHA2-256) 4753, 4868. For information about HMAC, refer to RFC 2104.

Encapsulating Security Payload

The Encapsulating Security Payload (ESP) protocol provides a means for ensuring privacy (encryption) and source authentication and content integrity (authentication). ESP in tunnel mode encapsulates the entire IP packet (header and payload) and then appends a new IP header to the now-encrypted packet. This new IP header contains the destination address needed to route the protected data through the network.

With ESP, you can both encrypt and authenticate, encrypt only, or authenticate only. For encryption, you can choose one of the following encryption algorithms:

- Data Encryption Standard (DES)—A cryptographic block algorithm with a 56-bit key.

- Triple DES (3DES)—A more powerful version of DES in which the original DES algorithm is applied in three rounds, using a 168-bit key. DES provides a significant performance savings but is considered unacceptable for many classified or sensitive material transfers.

- Advanced Encryption Standard (AES)—An emerging encryption standard which, when adopted by Internet infrastructures worldwide, will offer greater interoperability with other network security devices. ScreenOS supports AES with 128-bit, 192-bit, and 256-bit keys.

For authentication, you can use the MD5, SHA-1 or SHA2-256 algorithms.

NOTE: Even though it is possible to select NULL for authentication, it has been demonstrated that IPsec might be vulnerable to attack under such circumstances. Therefore, it is inadvisable to select NULL for authentication.

Key Management

Key distribution and management are critical to using VPNs successfully. IPsec supports both manual and automatic key-distribution methods.

Manual Key

With manual key encryption, administrators at both ends of a tunnel configure all the security parameters. This is a viable technique for small, static networks where the distribution, maintenance, and tracking of keys are not difficult. However, safely distributing manual-key configurations across great distances poses security issues. Aside from passing a key face-to-face, you cannot be completely sure that the key has not been compromised while in transit. Also, whenever you want to change the key, you are faced with the same security issues as when you initially distributed it.

AutoKey IKE

When you need to create and manage numerous tunnels, you need a method that does not require you to manually configure every element. IPsec supports the automated generation and negotiation of keys and security associations using the Internet Key Exchange (IKE) protocol. ScreenOS refers to such automated tunnel negotiation as *AutoKey IKE* and supports AutoKey IKE with preshared keys and AutoKey IKE with certificates.

AutoKey IKE with Preshared Keys

With AutoKey IKE which uses preshared keys to authenticate the participants in an IKE session, each side must configure and securely exchange the preshared key in advance. In this regard, the issue of secure key distribution is the same as that with manual keys. However, once distributed, an autokey, unlike a manual key, can automatically change its keys at predetermined intervals using the IKE protocol. Frequently changing keys greatly improves security, and automatically doing so greatly reduces key-management responsibilities. However, changing keys increases traffic overhead; therefore, doing so too often can reduce data transmission efficiency.

NOTE: A preshared key is a key for both encryption and decryption, which both participants must possess before initiating communication.

AutoKey IKE with Certificates

When using certificates to authenticate the participants during an AutoKey IKE negotiation, each side generates a public/private key pair (see “Public Key Cryptography” on page 29) and acquires a certificate (see “Certificates and CRLs” on page 35). As long as the issuing certificate authority (CA) is trusted by both sides, the participants can retrieve the peer’s public key and verify the peer’s signature. There is no need to keep track of the keys and SAs; IKE does so automatically.

NOTE: For examples of both Manual Key and AutoKey IKE tunnels, see “Site-to-Site Virtual Private Networks” on page 91.

Key Protection

Juniper Networks security devices protect VPN-persistent private keys against unauthorized access and modification. By enabling the key protection feature, the security device encrypts VPN persistent private keys, checks integrity of the key whenever the key is used, and destroys the key memory with different key patterns in the system.

The following types of VPN private keys are encrypted:

- PKI private keys (DSA/RSA/ECDSA)
- IKE preshared keys and preshared key seeds
- VPN manual keys (keys generated from passwords)

All VPN manual keys and keys generated from passwords are encrypted from plaintext to encrypted text using a master key (a hard-coded key). The same master key is used to decrypt the encrypted key back to plaintext. You cannot access the master key if you are accessing the system through any management interface. The AES (128-bit) encryption algorithm is used to encrypt the keys. The security device uses the single-parity-bit Error Detection Code (EDC) algorithm to detect key errors.

Enabling Key Protection

You can enable key protection through the WebUI or the CLI. The key protection feature is disabled by default.

WebUI

Configuration > Admin > Management: Select Enable Key Protection, then click Apply.

CLI

```
set key protection enable
save
```

Security Associations

A security association (SA) is a unidirectional agreement between the VPN participants regarding the methods and parameters to use in securing a communication channel. Full bidirectional communication requires at least two SAs, one for each direction.

An SA groups together the following components for securing communications:

- Security algorithms and keys
- Protocol mode (transport or tunnel)
- Key-management method (manual key or AutoKey IKE)

- SA lifetime

For outbound VPN traffic, the policy invokes the SA associated with the VPN tunnel. For inbound traffic, the security device looks up the SA by using the following triplet:

- Destination IP
- Security protocol (AH or ESP)
- Security parameter index (SPI) value

Tunnel Negotiation

For a manual key IPsec tunnel, because all of the security association (SA) parameters have been previously defined, there is no need to negotiate which SAs to use. In essence, the tunnel has already been established. When traffic matches a policy using that manual key tunnel or when a route involves the tunnel, the security device simply encrypts and authenticates the data, as you determined, and forwards it to the destination gateway.

To establish an AutoKey IKE IPsec tunnel, two phases of negotiations are required:

- In Phase 1, the participants establish a secure channel in which to negotiate the IPsec SAs.
- In Phase 2, the participants negotiate the IPsec SAs for encrypting and authenticating the ensuing exchanges of user data.

NOTE: Juniper Networks security devices support the newer version of the IKE protocol known as IKEv2. For more information about IKEv2 and how security devices establish security associations (SAs) using the IKEv2 protocol, see “IKE Version 2” on page 18.

Phase 1

Phase 1 of an AutoKey IKE tunnel negotiation consists of the exchange of proposals for how to authenticate and secure the channel. The exchange can be in one of two modes: aggressive or main. Using either mode, the participants exchange proposals for acceptable security services such as:

- Encryption algorithms (DES and 3DES) and authentication algorithms (MD5, SHA-1 or SHA2-256). For more information about these algorithms, see “Protocols” on page 5.
- A Diffie-Hellman group (see “Diffie-Hellman Exchange” on page 11).
- Preshared key or RSA/DSA certificates (see “AutoKey IKE” on page 7).

A successful Phase 1 negotiation concludes when both ends of the tunnel agree to accept at least one set of the Phase 1 security parameters proposed and then process them. Juniper Networks security devices support up to four proposals for Phase 1 negotiations, allowing you to define how restrictive a range of security parameters for key negotiation you will accept.

The predefined Phase 1 proposals that ScreenOS provides are as follows:

- Standard: pre-g2-aes128-sha and pre-g2-3des-sha
- Compatible: pre-g2-3des-sha, pre-g2-3des-md5, pre-g2-des-sha, and pre-g2-des-md5
- Basic: pre-g1-des-sha and pre-g1-des-md5

You can also define custom Phase 1 proposals.

Main and Aggressive Modes

Phase 1 can take place in either main or aggressive mode. The two modes are described below.

Main mode: The initiator and recipient send three two-way exchanges (six messages total) to accomplish the following services:

- First exchange (messages 1 and 2): Propose and accept the encryption and authentication algorithms.
- Second exchange (messages 3 and 4): Execute a DH exchange, and the initiator and recipient each provide a pseudo-random number.
- Third exchange (messages 5 and 6): Send and verify their identities.

The information transmitted in the third exchange of messages is protected by the encryption algorithm established in the first two exchanges. Thus, the participants' identities are not transmitted in the clear.

Aggressive mode: The initiator and recipient accomplish the same objectives, but only in two exchanges, with a total of three messages:

- First message: The initiator proposes the SA, initiates a DH exchange, and sends a pseudo-random number and its IKE identity.
- Second message: The recipient accepts the SA; authenticates the initiator; and sends a pseudo-random number, its IKE identity, and, if using certificates, the recipient's certificate.
- Third message: The initiator authenticates the recipient, confirms the exchange, and, if using certificates, sends the initiator's certificate.

Because the participants' identities are exchanged in the clear (in the first two messages), aggressive mode does not provide identity protection.

NOTE: When a dialup VPN user negotiates an AutoKey IKE tunnel with a preshared key, aggressive mode must be used. Note also that a dialup VPN user can use an email address, a fully qualified domain name (FQDN), or an IP address as its IKE ID. A dynamic peer can use either an email address or FQDN, but not an IP address.

Diffie-Hellman Exchange

A Diffie-Hellman (DH) exchange allows the participants to produce a shared secret value. The strength of the technique is that it allows the participants to create the secret value over an unsecured medium without passing the secret value through the wire. ScreenOS supports DH groups 1, 2, 5, and 14 for IKEv1 and IKEv2. The size of the prime modulus used in each group's calculation differs as follows:

- DH group 1: 768 bit
- DH group 2: 1024 bit
- DH group 5: 1536 bit
- DH group 14: 2048 bit

NOTE: The strength of DH group 1 security has depreciated, and we do not recommend its use.

The larger the modulus, the more secure the generated key is considered to be; however, the larger the modulus, the longer the key-generation process takes. Because the modulus for each DH group is a different size, the participants must agree to use the same group.

NOTE: If you configure multiple (up to four) proposals for Phase 1 negotiations, you can use different DH groups in all proposals. The same guideline applies to multiple proposals for Phase 2 negotiations.

Phase 2

After the participants have established a secure and authenticated channel, they proceed through Phase 2, in which they negotiate the SAs to secure the data to be transmitted through the IPsec tunnel.

Like the process for Phase 1, the participants exchange proposals to determine which security parameters to employ in the SA. A Phase 2 proposal also includes a security protocol—either Encapsulating Security Payload (ESP) or Authentication Header (AH)—and selected encryption and authentication algorithms. The proposal can also specify a DH group, if Perfect Forward Secrecy (PFS) is desired.

Regardless of the mode used in Phase 1, Phase 2 always operates in quick mode and involves the exchange of three messages.

Juniper Networks security devices support up to four proposals for Phase 2 negotiations, allowing you to define how restrictive a range of tunnel parameters you will accept. ScreenOS also provides a replay protection feature. Use of this feature does not require negotiation because packets are always sent with sequence numbers. You simply have the option of checking or not checking the sequence numbers. (For more information about replay protection, see “Replay Protection” on page 12.)

The predefined Phase 2 proposals that ScreenOS provides are as follows:

- Standard: g2-esp-3des-sha and g2-esp-aes128-sha
- Compatible: nopfs-esp-3des-sha, nopfs-esp-3des-md5, nopfs-esp-des-sha, and nopfs-esp-des-md5
- Basic: nopfs-esp-des-sha and nopfs-esp-des-md5

You can also define custom Phase 2 proposals.

In Phase 2, the peers also exchange proxy IDs. A proxy ID is a three-part tuple consisting of local IP address–remote IP address–service. The proxy ID for both peers must match, which means that the service specified in the proxy ID for both peers must be the same, and the local IP address specified for one peer must be the same as the remote IP address specified for the other peer.

NOTE: Phase 2 negotiations for IPv6 support Netscreen Redundancy Protocol (NSRP).

The CREATE_CHILD_SA exchange in an IKEv2 exchange corresponds to the Phase 2 negotiations in IKEv1. For more information, see “Initial Exchanges” on page 18.

Perfect Forward Secrecy

Perfect Forward Secrecy (PFS) is a method for deriving Phase 2 keys independent from and unrelated to the preceding keys. Alternatively, the Phase 1 proposal creates the key (the SKEYID_d key) from which all Phase 2 keys are derived. The SKEYID_d key can generate Phase 2 keys with a minimum of CPU processing. Unfortunately, if an unauthorized party gains access to the SKEYID_d key, all your encryption keys are compromised.

PFS addresses this security risk by forcing a new Diffie-Hellman key exchange to occur for each Phase 2 tunnel. Using PFS is thus more secure, although the rekeying procedure in Phase 2 might take slightly longer with PFS enabled.

Replay Protection

A replay attack occurs when somebody intercepts a series of packets and uses them later either to flood the system, causing a denial of service (DoS), or to gain entry to the trusted network. The replay-protection feature enables security devices to check every IPsec packet to see if it has been received previously. If packets arrive outside a specified sequence range, the security device rejects them.

IKE and IPsec Packets

An IPsec VPN tunnel consists of two major elements:

- Tunnel Setup: The peers first establish security associations (SAs), which define the parameters for securing traffic between themselves. The admins at each end can define the SAs manually, or the SAs can be defined dynamically through IKE Phase 1 and Phase 2 negotiations. Phase 1 can occur in either main or aggressive mode. Phase 2 always occurs in quick mode.

- Applied Security: IPsec protects traffic sent between the two tunnel endpoints by using the security parameters defined in the SAs that the peers agreed to during the tunnel setup. IPsec can be applied in one of two modes—transport or tunnel. Both modes support the two IPsec protocols—Encapsulating Security Payload (ESP) and Authentication Header (AH).

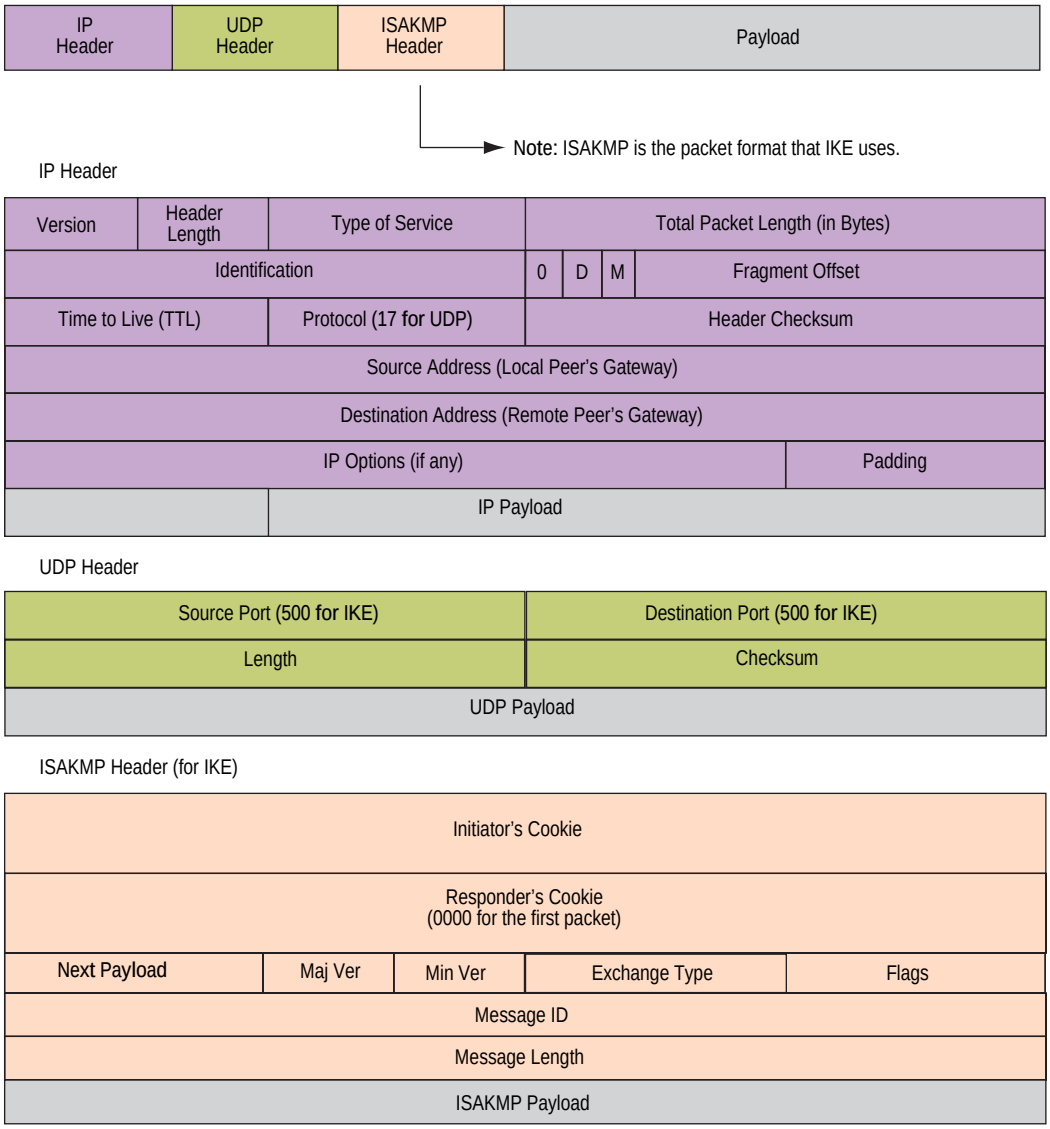
For an explanation of the packet processing that occurs during the IKE and IPsec stages of a VPN tunnel, see “IKE Packets” on page 13 and “IPsec Packets” on page 16. These sections show the packet headers for IKE and IPsec, respectively.

IKE Packets

When a clear-text packet arrives at the security device that requires tunneling and no active Phase 2 SA exists for that tunnel, the security device begins IKE negotiations (and drops the packet). The source and destination addresses in the IP packet header are those of the local and remote IKE gateways, respectively. In the IP packet payload, there is a UDP segment encapsulating an Internet Security Association and Key Management Protocol (ISAKMP), or IKE, packet. The format for IKE packets is the same for Phase 1 and Phase 2.

NOTE: When the initial IP packet is dropped, the source host resends it. Typically, by the time the second packet reaches the security device, IKE negotiations are complete and the security device protects it—and all subsequent packets in the session—with IPsec before forwarding it.

Figure 7: IKE Packet for Phases 1 and 2



The Next Payload field contains a number indicating one of the following payload types:

- 0002—SA Negotiation Payload: contains a definition for a Phase 1 or Phase 2 SA.
- 0004—Proposal Payload: can be a Phase 1 or Phase 2 proposal.
- 0008—Transform Payload: the transform payload gets encapsulated in a proposal payload which gets encapsulated in an SA payload.
- 0010—Key Exchange (KE) Payload: contains information necessary to perform a key exchange, such as a Diffie-Hellman public value.
- 0020—Identification (IDx) Payload.

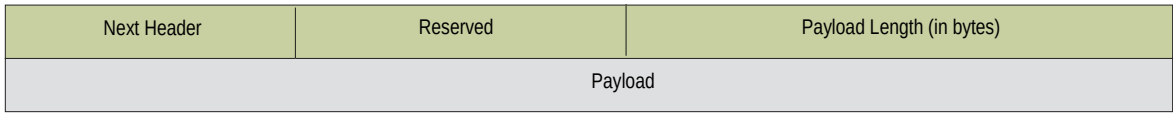
  - In Phase 1, IDii indicates the initiator ID, and IDir indicates the responder ID.
  - In Phase 2, IDui indicates the user initiator, and IDur indicates the user responder.

    The IDs are IKE ID types such as FQDN, U-FQDN, IP address, and ASN.1_DN.

- 0040—Certificate (CERT) Payload.
- 0080—Certificate Request (CERT_REQ) Payload.
- 0100—Hash (HASH) Payload: contains the digest output of a particular hash function.
- 0200—Signature (SIG) Payload: contains a digital signature.
- 0400—Nonce (Nx) Payload: contains some pseudo-random information necessary for the exchange).
- 0800—Notify Payload.
- 1000—ISAKMP Delete Payload.
- 2000—Vendor ID (VID) Payload: can be included anywhere in Phase 1 negotiations. ScreenOS uses it to mark support for Network Address Translation-Traversal (NAT-T).

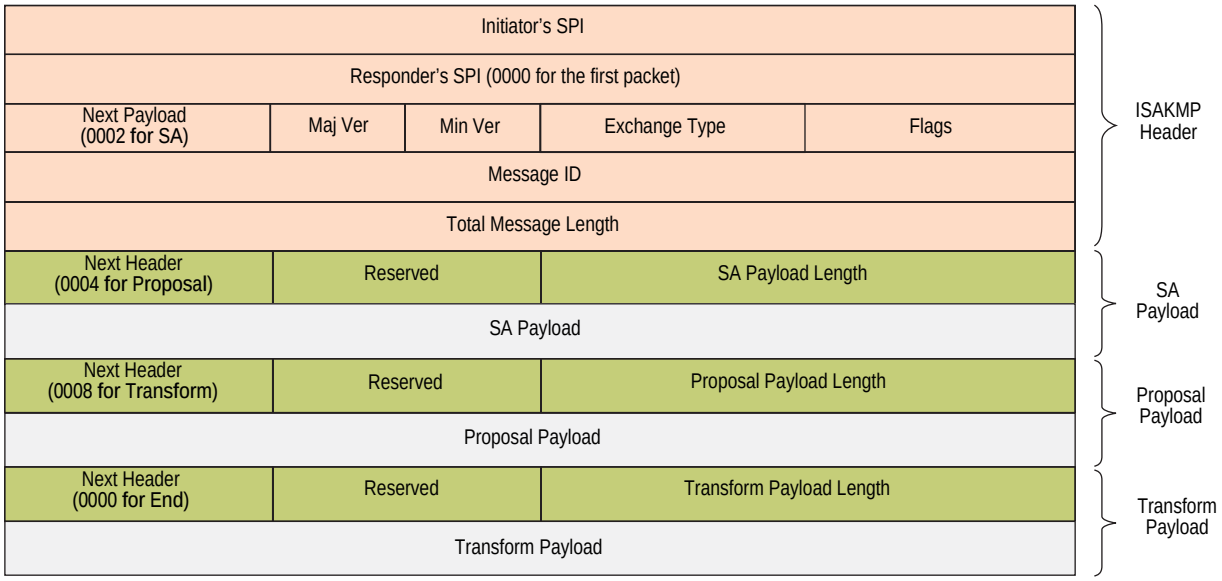
Each ISAKMP payload begins with the same generic header, as shown in Figure 8.

Figure 8: Generic ISAKMP Payload Header



There can be multiple ISAKMP payloads chained together, with each subsequent payload type indicated by the value in the Next Header field. A value of **0000** indicates the last ISAKMP payload. See Figure 9 on page 16 for an example.

Figure 9: ISAKMP Header with Generic ISAKMP Payloads

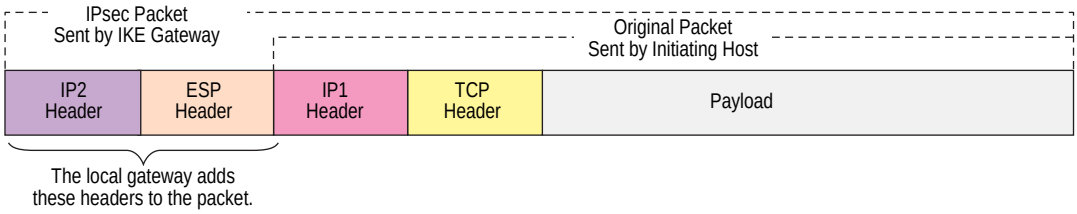


IPsec Packets

After IKE negotiations complete and the two IKE gateways have established Phase 1 and Phase 2 security associations (SAs), the security device applies IPsec protection to subsequent clear-text IP packets that hosts behind one IKE gateway send to hosts behind the other gateway (assuming that policies permit the traffic). If the Phase 2 SA specifies the Encapsulating Security Protocol (ESP) in tunnel mode, the packet looks like the one shown below. The security device adds two additional headers to the original packet that the initiating host sends.

NOTE: For information about ESP, see "Encapsulating Security Payload" on page 6. For information about tunnel mode, see "Tunnel Mode" on page 4.

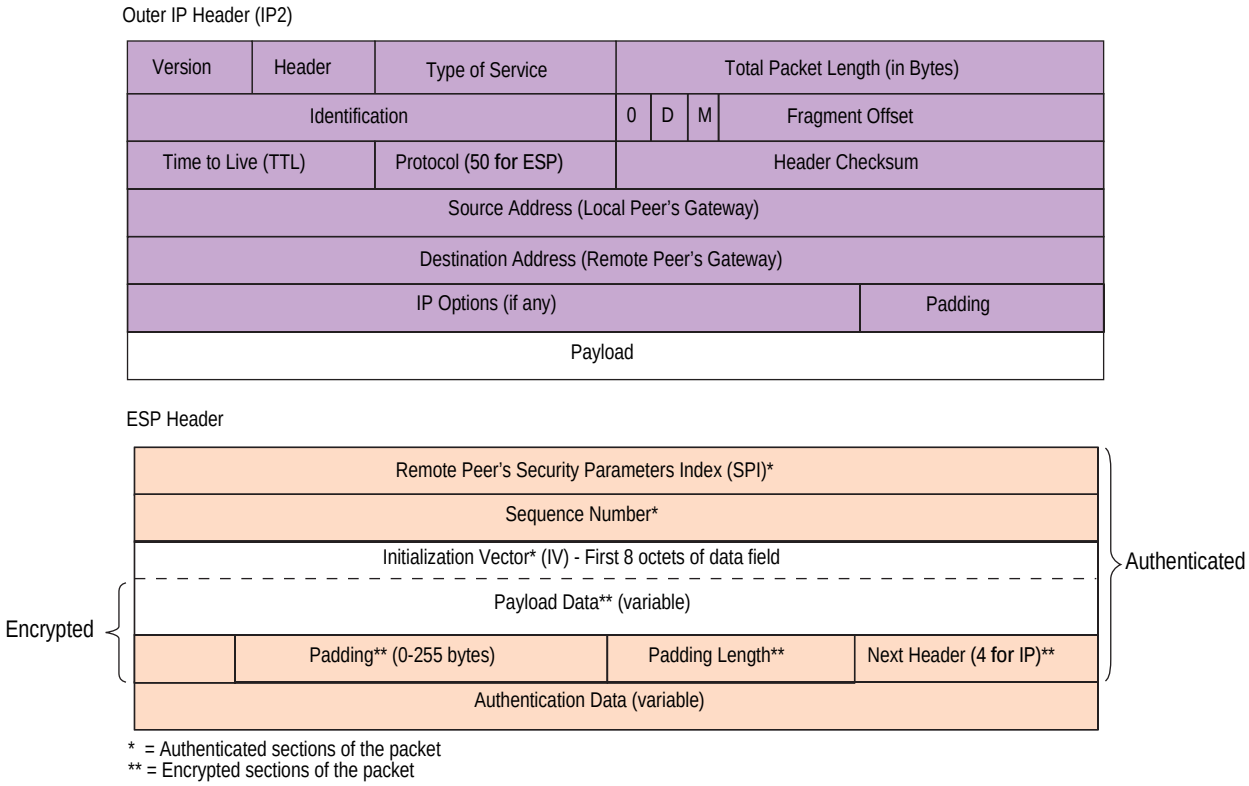
Figure 10: IPsec Packet—Encapsulating Security Payload in Tunnel Mode



As shown in Figure 10, the packet that the initiating host constructs includes the payload, the TCP header, and the inner IP header (IP1).

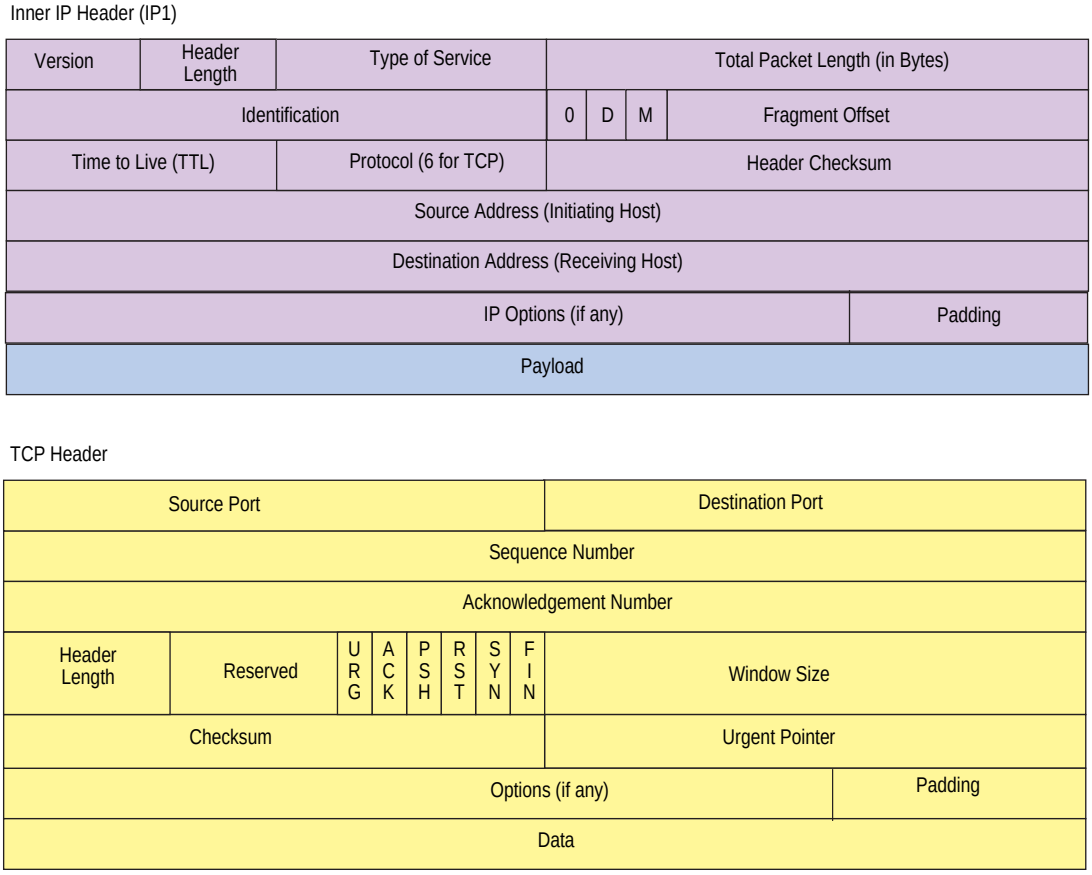
The outer IP header (IP2), which the security device adds, contains the IP address of the remote gateway as the destination IP address and the IP address of the local security device as the source IP address. The security device also adds an ESP header between the outer and inner IP headers. The ESP header contains information that allows the remote peer to properly process the packet when it receives it. This is illustrated in Figure 11 on page 17.

Figure 11: Outer IP Header (IP2) and ESP Header



The Next Header field indicates the type of data in the payload field. In tunnel mode, this value is 4, indicating IP-in-IP. If ESP is applied in transport mode, this value indicates a Transport Layer protocol such as 6 for TCP or 17 for UDP.

Figure 12: Inner IP Header (IP1) and TCP Header



IKE Version 2

Juniper Networks security devices support a newer version of the Internet Key Exchange protocol (IKE), known as IKE version 2 (IKEv2). IKEv2 brings together various aspects of exchanging keys between IPsec endpoints, such as NAT-T, extended authentication (xauth), and ISAKMP configuration, into a single protocol and preserves most of the features of the earlier version, including identity hiding, PFS, two phases of establishing SAs, and cryptographic negotiation.

IKEv2 performs mutual authentication between two IPsec endpoints and establishes an IKE SA known as *IKE_SA*, in which the IPsec endpoints share secret information to establish SAs for Encapsulating Security Payload (ESP) protocol, Authentication Header (AH), and a set of cryptographic algorithms to be used to protect IKE traffic. The SAs for ESP or AH that get set up through the IKE_SA are called *CHILD_SAs*.

IKEv2 supports three types of exchanges: initial, CREATE_CHILD_SA, and informational. Conceptually, IKEv2 IKE_SA and CHILD_SA are equivalent to IKEv1 Phase 1 SA and Phase 2 SA, respectively.

Initial Exchanges

The IPsec endpoints start an IKEv2 SA through an initial exchange. This consists of two exchanges: IKE_SA_INIT and IKE_AUTH.

IKE_SA_INIT Exchange

An IKE_SA_INIT exchange negotiates security suites, establishes the IKE_SA, and generates the SKEYSEED from which all keys are derived for the IKE_SA. Separate keys are computed for each direction. The initiator sends the following:

- HDR—Initiator's IKE header. The header contains the security parameter indexes (SPIs), version, and flags.
- SAi1—Cryptographic algorithms the initiator supports for the IKE_SA.
- KEi—Initiator's Diffie-Hellman value
- Ni—Initiator's nonce

The responder sends the response to the initiator request with the following:

- HDR—Responder's header
- SAr1—Cryptographic algorithms the responder supports for the IKE_SA.
- KEr—Responder's Diffie-Hellman value
- Nr—Responder's nonce
- [CERTREQ]—[Optional] Certificate request

IKE_AUTH Exchange

The IKE_AUTH exchange authenticates IKE endpoints and establishes the CHILD_SA. This exchange consists of a single request/response pair. The initiator starts using the new CHILD_SA immediately after receiving the responder's response; similarly, the responder starts using the new CHILD_SA immediately after sending the response to the initiator.

All messages following the initial exchange are cryptographically protected using the cryptographic algorithms and keys negotiated in the first two messages of the key exchange. These subsequent messages use the syntax of the encrypted payload. During the IKE_AUTH exchange, the endpoints exchange the following:

- HDR—Initiator's header
- IDi—Initiator's ID
- [CERT]—[Optional] Certificate
- [CERTREQ]—[Optional] Certificate Request
- IDr—Responder's ID
- AUTH—Authenticates the previous message and the initiator's identity
- SAi2—Initiator's SA
- TSi—Initiator's traffic selector
- TSr—Responder's traffic selector

The responder sends the following response:

- HDR—Responder's header
- IDr—Initiator's ID
- [CERT]—[Optional] Certificate
- AUTH—Authenticates the previous message and the initiator's identity
- SAr2—Responder's SA
- TSi—Initiator's traffic selector
- TSr—Responder's traffic selector

Of these messages, except the Header, all other payload are encrypted with the secret key generated by the endpoints.

CREATE_CHILD_SA Exchange

After the IPsec endpoints complete the initial exchanges, either endpoint can initiate the CREATE_CHILD_SA. This exchange rekeys a CHILD_SA or IKE_SA. This exchange consists of a single request/response pair and was referred to as a Phase 2 exchange in IKEv1.

All messages following the initial exchange are cryptographically protected using the cryptographic algorithms and keys negotiated in the first two messages of the IKE.

Informational Exchanges

IKEv2 uses informational exchanges to send and receive control messages, including dead peer detection (DPD).

Enabling IKEv2 on a Security Device

You can configure an existing IKEv1 gateway to support IKEv2. Such a converted gateway configuration functions only with IKEv2 peers, not IKEv1. When you configure your security device to support IKEv2, you should note the following differences between IKEv1 and IKEv2:

- Unlike IKEv1, where the IPsec endpoints negotiate the Diffie-Hellman (DH) group before agreeing on the DH group number, the IKEv2 initiator sends the DH group number in the first message of the IKE_INIT_SA exchange. If the initiator has multiple DH group proposals in its SA payload, the DH group that the initiator sends may not match the DH group the responder expects. In such cases, the responder notifies the initiator with the expected DH group number. The initiator responds to this message with the correct DH group number and restarts the IKE_INIT_SA exchange.
- The two endpoints in an IKEv2 SA do not negotiate the IKE_SA and CHILD_SA lifetimes; each endpoint can have its own lifetime. The endpoint with the shorter lifetime will rekey before the current IKE_SA or CHILD_SA expires (by default, 10 seconds earlier for IKE_SA and 60 seconds earlier for CHILD_SA), as long as the connection between the endpoints still needs this IKE_SA or

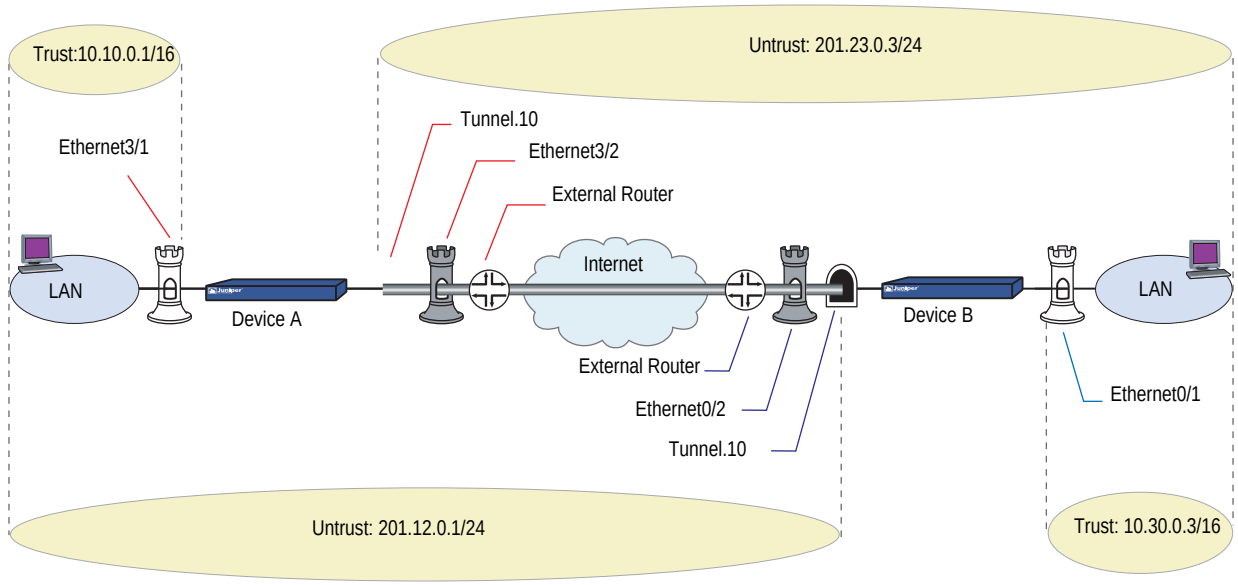
CHILD_SA. A CHILD_SA is considered no longer needed when there has been no traffic since the last rekey or the SA has timed out. An IKE_SA is no longer needed when all its CHILD_SAs are no longer needed.

- Authentication methods between the two negotiating IKE peers can be different; the endpoints do not negotiate the authentication methods.
- All CHILD_SAs close if their parent IKE_SA is closed.
- The two endpoints maintain only one IKE_SA; all other exchanges are carried out through CHILD_SAs.

Example: Configuring an IKEv2 Gateway

In the example shown in Figure 13, you create two VPN tunnels that use IKEv2 for automatic generation and negotiation of keys and security associations (SAs). These tunnels provide a secure connection between the two devices - Device B and Device A. A policy-based VPN is configured on Device A, while a route-based VPN is configured on Device B. For the Phase 1 and Phase 2 security levels, you specify standard and basic predefined proposals, respectively, on both the devices.

Figure 13: IKEv2 Gateway Connecting Two Security Devices



WebUI (Device A)

1. **Configuring the IKEv2 Gateway**
   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gateway Name: Device B
   Version:
   IKEv2: (select)
   Remote Gateway:
   Static IP Address: (select), IPv4 Address/Hostname: 201.23.0.3

   > Advanced: Enter the following, then click Return to set the advanced options and return to the basic configuration page:

   IKEv2 Auth Method: Enable
   Self: rsa-sig
   Peer: preshare
   Preshared Key: GsbBPO0MNXYgXGsOetCXf8qaR8n5AUVlLQ==
   Outgoing interface: ethernet3/2
   Security Level:
   Predefined: (select, Standard)
   Preferred Certificate (optional)
   Local cert: CN=but CN=nsisg2000.netscreen.com.CN=rsa-key.CN
   Peer CA: OU=Secure Server Certification Authority.O=RSA
   Peer Type: X509-SIG

2. **Configuring the VPN**
   VPNs > Autokey IKE > New: Enter the following, then click Advanced:

   VPN Name: Device B
   Remote Gateway: (select)
   Predefined: (select), Device B

   > Advanced: Enter the following advanced settings, then click Return to set the advanced options and return to the basic configuration page:

   Security Level
   Predefined: (select, Basic)

3. **Configuring the Route**
   Network > Routing > Routing Entries > Configuration: Enter the following, then click OK:

   Virtual Router name: untrust-vr
   IP Address / Netmask: 10.30.0.3/16
   Next Hop: Gateway (select)
   Interface: ethernet3/2

4. **Creating Policies**
   Policy > Policies (From: Untrust, To: Trust) New: Enter the following, then click OK:

   Source Address:
   New Address: 10.30.0.3/16
   Destination Address:
   New address: 10.10.0.1/16
   Service: (select), Any

Action: (select), Tunnel
Tunnel: (select), Device B

Policy > Policies (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
New Address: 10.10.0.1/16
Destination Address:
New address: 10.30.0.3/16
Service: (select), Any
Action: (select), Tunnel
Tunnel: (select), Device B

WebUI (Device B)

1. Configuring the IKEv2 Gateway

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: Device A
Version:
IKEv2: (select)
Remote Gateway:
Static IP Address: (select), IPv4 Address/Hostname: 201.12.0.1

> Advanced: Enter the following, then click Return to set the advanced options and return to the basic configuration page:

IKEv2 Auth Method: Enable
Self: preshare
Peer: rsa-sig
Preshared Key: 3to5BAFpNn3thBsncQCmBYF5ThnQVfMlEQ==
Outgoing interface: ethernet0/2
Security Level:
Predefined: (select, Standard)
Preferred Certificate (optional)
Local cert: None
Peer CA: CN=netscreen.OU=qa
Peer Type: X509-SIG

2. Configuring the Tunnel Interface

Network > Interfaces > New: Enter the following, then click OK:

Tunnel Interface Name: tunnel.10
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet0/2 (trust-vr)

3. Configuring the VPN and Proxy-ID

VPNs > Autokey IKE > New: Enter the following, then click Advanced:

VPN Name: Device A
Remote Gateway: (select)
Predefined: (select), Device A

> Advanced: Enter the following advanced settings, then click Return to set the advanced options and return to the basic configuration page:

Security Level
Predefined: (select, Basic)
Bind to: Tunnel Interface (select): Select tunnel.10, Untrust-Tun from the drop-down list

Proxy-ID: (select)
Local IP / Netmask: 10.30.0.0/16
Remote IP / Netmask: 10.10.0.0/16
Service: ANY

4. Configuring the Route

Network > Routing > Routing Entries > Configuration: Enter the following, then click OK:

Virtual Router name: trust-vr
IP Address / Netmask: 10.10.0.1/16
Next Hop: Gateway (select)
Interface: tunnel.10

CLI (Device A)

1. Configuring Addresses

```
set address trust 10.10.0.1 10.10.0.1/16
set address untrust 10.30.0.3 10.30.0.3/16
```

2. Configuring the IKEv2 Gateway

```
set ike gateway ikev2 "Device B" address 201.23.0.3 outgoing-interface
    "ethernet3/2" preshare "GsbBPO0MNXYgXGsOetCXf8qaR8n5AUVILQ==
    proposal "standard"
set ike gateway ikev2 "Device B" auth-method self rsa-sig peer preshare
set ike gateway ikev2 "Device B" cert my-cert-hash
    361A26F4CDE8696D10FF1C767D00AD8CCC3BF4CE
set ike gateway ikev2 "Device B" cert peer-ca-hash
    0E9290B27AA8BAF65D3C9229AFE8F31DB953B2DA
```

NOTE: The local and peer certificates are generated by the device. The certificates will not work if you copy this part to the device.

---

3. Setting the IKE_SA Soft Lifetime

```
set ike ikev2 ike-sa-soft-lifetime 60
```

4. Configuring the VPN

```
set vpn "Device B" gateway "Device B" no-replay tunnel idletime 0 proposal
    "basic"
```

5. Configuring the Route

```
set route 10.30.0.3/16 interface ethernet3/2
```

6. Configuring Policies

```
set policy id 4 from untrust to trust 10.30.0.3 10.10.0.1 any tunnel vpn
    "Device B" id 0x1 pair-policy 3
set policy id 3 from trust to untrust 10.10.0.1 10.30.0.3 any tunnel vpn
    "Device B" id 0x1 pair-policy 4
```

CLI (Device B)

1. **Configuring the IKEv2 Gateway**

```
set ike gateway ikev2 "Device A" address 201.12.0.1 outgoing-interface
    "ethernet0/2" preshare "3to5BAFpNn3thBsncQCmBYF5ThnQVfMlEQ=="
    proposal "standard"
set ike gateway ikev2 "Device A" auth-method self preshare peer rsa-sig
set ike gateway ikev2 "Device A" cert peer-ca-hash
    5BA819E4775F1DBAB039C48A0DAE21583DC5A916
```

2. **Configuring the VPN**

```
set vpn "Device A" gateway "Device A" no-replay tunnel idletime 0 proposal
    "basic"
```

3. **Binding the VPN to a Tunnel**

```
set vpn "Device A" id 0x2 bind interface tunnel.10
```

4. **Creating a VPN Proxy Configuration**

```
set vpn "Device A" proxy-id local-ip 10.30.0.0/16 remote-ip 10.10.0.0/16 any
```

5. **Configuring the Route**

```
set route 10.10.0.1/16 interface tunnel.10
```

6. **Setting Policy Permit**

```
set policy id 4 from untrust to trust 10.30.0.3 10.10.0.1 any permit
set policy id 3 from trust to untrust 10.10.0.1 10.30.0.3 any permit
```

Authentication Using Extensible Authentication Protocol

In addition to supporting authentication using public key signatures and shared secrets, IKEv2 supports authentication using Extensible Authentication Protocol (EAP). By using EAP, IKEv2 can leverage existing authentication infrastructure and credential databases, because EAP allows users to choose a method suitable for existing credentials and provides an easy means of separation of the IKEv2 responder (VPN gateway) from the RADIUS server that acts as the EAP authentication endpoint.

Juniper Networks security devices support authentication using EAP in the following ways:

- Security device as the VPN gateway—When the security device acts as the VPN gateway, it provides only EAP passthrough and supports a RADIUS server as the authentication server. In this implementation, the security device supports EAP-Message Digest 5 (EAP-MD5), EAP-Transport Layer Security (EAP-TLS), EAP-Tunneled TLS (EAP-TTLS), and EAP-Protected EAP (EAP-PEAP) passthrough. The security device neither times out for the connections nor provides accounting support.

- Security device as the VPN client—When the security device acts as the VPN client, it supports only the EAP-MD5 supplicant (client) functionality for IKEv2.

IKEv2 EAP Passthrough

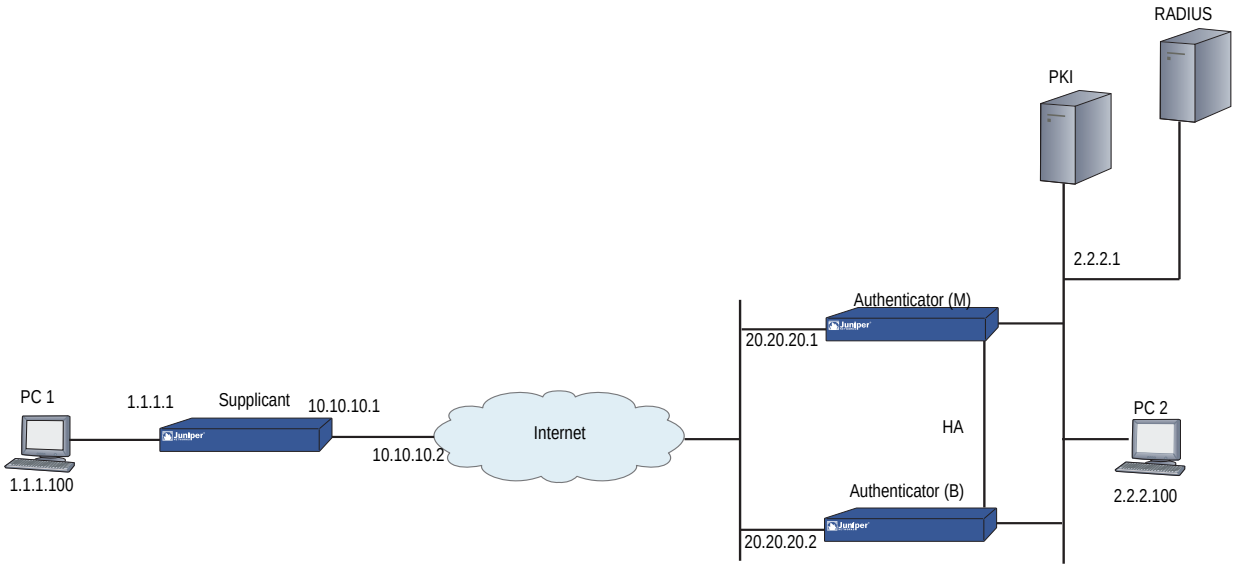
When you enable a Juniper Networks security device to use EAP to authenticate a client with a RADIUS authentication server, the security device acts as a proxy (authenticator) and passes the EAP messages between the client (supplicant) and the RADIUS (authentication) server. During EAP exchanges, the security device decapsulates the EAP messages in IKEv2 messages from the peer, encapsulates them into RADIUS messages, and sends them to the RADIUS server.

When the RADIUS server responds to the authentication requests, the security device decapsulates the EAP messages, encapsulates them into IKEv2 messages, and sends them to the peer. After the RADIUS server has authenticated the client, if there is a shared secret generated during the exchange, the security device extracts the shared secret from the RADIUS Access-Accept message and uses it to generate the AUTH payload. In this way, the security device passes the EAP messages between a client and an authentication server.

Example

The following example explains the steps involved in setting up IKEv2 EAP authentication for an authenticator and a supplicant.

Figure 14: Setting Up IKEv2 EAP Authentication



You can set up the IKEv2 EAP using the WebUI or the CLI.

WebUI (Authenticator)

1. **Setting Up Auth-Server**
   Select Configuration > Auth > Auth Servers > New: Enter the following, then click OK:

   Name: rad1
   Auth-server IP address: 10.155.43.201
   RADIUS secret: netscreen
   Account Type: IKEv2EAP (check)

2. Setting Up IKE

Select VPN > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: v2-gw3
Version: IKEv2 (select)
IP address of the remote gateway: 10.10.10.1

> Click Advanced. Configure the following advanced setting, then click Return to return to the basic Gateway configuration page:

Phase1 Proposal (select): rsa-g2-3des-sha

Select VPN > AutoKey Advanced > Gateway > EAP: Perform the following actions:

IKEv2 EAP authentication: (check)
Authenticator: (select)
Auth-server name: rad1
Send-id-Req: (check)

Select VPN > AutoKey Advanced > Gateway > Edit: Perform the following actions, then click OK:

edit on the gateway (select)

> Click Advanced. Configure the following advanced settings, then click Return to return to the basic Gateway configuration page:

IKEv2 Auth: (check)
self: rsa-sig
peer:eap
Outgoing interface: loopback.3
Local cert: my-cert 1

CLI (Authenticator)

1. Auth-Server Configuration

```
set auth-server "rad1" server-name "10.155.43.201"
set auth-server "rad1" account-type eap-ikev2
set auth-server "rad1" radius secret netscreen
```

2. IKE Configuration

```
set ike gateway ikev2 "v2-gw3" dialup "Peer2" outgoing-interface "loopback.3"
    preshare abcd1234 proposal "rsa-g2-3des-sha"
set ike gateway ikev2 "v2-gw3" cert my-cert 1
set ike gateway ikev2 "v2-gw3" cert peer-ca all
set ike gateway ikev2 v2-gw3 eap authenticator passthrough rad1 send-id-req
set ike gateway ikev2 "v2-gw3" auth-method self rsa-sig peer eap
set vpn "v2-vpn3" gateway "v2-gw3" no-replay tunnel idletime 0 proposal
    "g2-esp-3des-sha"
```

WebUI (Supplicant)

1. Setting Up IKE

Select VPN > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: v2-gw3
Version: IKEv2 (select)
IP address of the remote gateway: 20.20.20.1

> Click Advanced. Configure the following advanced setting, then click Return to return to the basic Gateway configuration page:

Phase1 Proposal (select): rsa-g2-3des-sha

Select VPN > AutoKey Advanced > Gateway > Edit: Perform the following actions, then click OK:

Gateway: (select)

> Click Advanced. Configure the following advanced setting, then click Return to return to the basic Gateway configuration page:

IKEv2 Auth: (check)
self: eap
peer: rsa-sig
Outgoing interface: loopback.3
Local cert: my-cert 1

CLI (Supplicant)

IKE Configuration

```
set ike gateway ikev2 "v2-gw3" address 203.203.203.1 local-id
    "Peer2@spg.juniper.net" outgoing-interface "loopback.3" preshare abcd1234
    proposal "rsa-g2-3des-sha"
set ike gateway ikev2 "v2-gw3" cert my-cert 1
set ike gateway ikev2 "v2-gw3" cert peer-ca all
set ike gateway ikev2 v2-gw3 eap supplicant md5 username test1 password abcd1
set ike gateway ikev2 "v2-gw3" auth-method self eap peer rsa-sig
set vpn “v2-vpn3” gateway “v2-gw3” no-replay tunnel idleitem 0 proposal
    “g2-esp-3des-sha”
```

Chapter 2

Public Key Cryptography

This chapter provides an introduction to public key cryptography and the use of certificates and certificate revocation lists (CRLs) within the context of Public Key Infrastructure (PKI). This chapter includes the following topics:

Introduction to Public Key Cryptography

In public key cryptography, a public/private key pair is used to encrypt and decrypt data. Data encrypted with a public key, which the owner makes available to the public, can only be decrypted with the corresponding private key, which the owner keeps secret and protected. For example, if Alice wants to send Bob an encrypted message, Alice can encrypt it with Bob's public key and send it to him. Bob then decrypts the message with his private key.

The reverse is also useful; that is, encrypting data with a private key and decrypting it with the corresponding public key. This is known as creating a digital signature. For example, if Alice wants to present her identity as the sender of a message, she can encrypt the message with her private key and send the message to Bob. Bob then decrypts the message with Alice's public key, thus verifying that Alice is indeed the sender.

Public/private key pairs also play an important role in the use of digital certificates. The procedure for signing a certificate (by a CA) and then verifying the signature (by the recipient) works as shown in the following subsections.

Signing a Certificate

1. The certificate authority (CA) that issues a certificate hashes the certificate by using a hash algorithm (MD5, SHA-1 or SHA2-256) to generate a digest.

2. The CA then "signs" the certificate by encrypting the digest with its private key. The result is a digital signature.

3. The CA then sends the digitally signed certificate to the person who requested it.

Verifying a Digital Signature

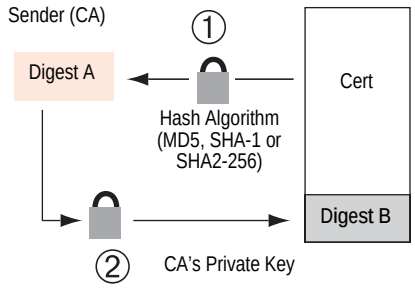
1. When the recipient gets the certificate, the recipient also generates another digest by applying the same hash algorithm (MD5, SHA-1 or SHA2-256) on the certificate file.

2. The recipient uses the CA's public key to decrypt the digital signature.

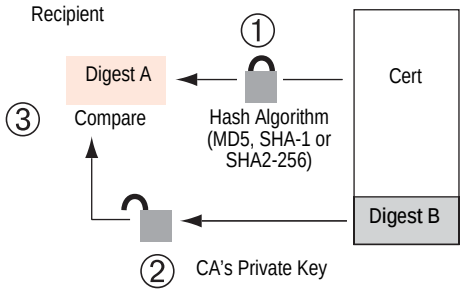
3. The recipient compares the decrypted digest with the digest just generated. If the two match, the recipient can confirm the integrity of the CA's signature and, by extension, the integrity of the accompanying certificate.

Figure 15: Digital Signature Verification

1. Using either the MD5, SHA-1 or SHA2-256 hash algorithm, the CA makes digest A from the certificate.
2. Using the its private key, the CA encrypts digest A. The result is digest B, the digital signature.
3. The CA sends the digitally signed certificate to the person who requested it.



1. Using either MD5, SHA-1 or SHA2-256, the recipient makes digest A from the certificate.
2. Using the CA's public key, the recipient decrypts digest B.
3. The recipient compares digest A with digest B. If they match, the recipient knows that the certificate has not been tampered with.



The procedure for digitally signing messages sent between two participants in an IKE session works very similarly, with the following differences:

- Instead of making a digest from the CA certificate, the sender makes it from the data in the IP packet payload.
- Instead of using the CA's public/private key pair, the participants use the sender's public/private key pair.

Elliptic Curve Digital Signature Algorithm

Juniper Networks security devices use Elliptic Curve Cryptography (ECC) to generate the Elliptic Curve Digital Signature Algorithm (ECDSA) key pair.

In addition to RSA and DSA, you can also generate an ECDSA public/private key pair using ECDSA. The public key size of an ECDSA key is smaller than a DSA public key. The performance speed of an ECDSA key, at higher security levels, is faster than DSA or RSA. For information about ECDSA, see RFCs 3279 and 4754.

Like DSA and RSA certificates, you can use IKEv1 with ECDSA-based certificates (see RFC 2409). You can use three different ECDSA signatures with IKEv1. Each of these signatures uses a particular elliptic curve group and hash function (see RFC 4753).

Digital Signature Algorithm	Elliptic Curve Group	Hash Function
ECDSA-256	256-bit	SHA-256
ECDSA-384	384-bit	SHA-384
ECDSA-512	512-bit	SHA-512

The current version of ScreenOS uses the SHA2-256 hashing algorithm and supports the secp256r1 parameter type of elliptic curve only.

To generate an ECDSA public/private key pair:

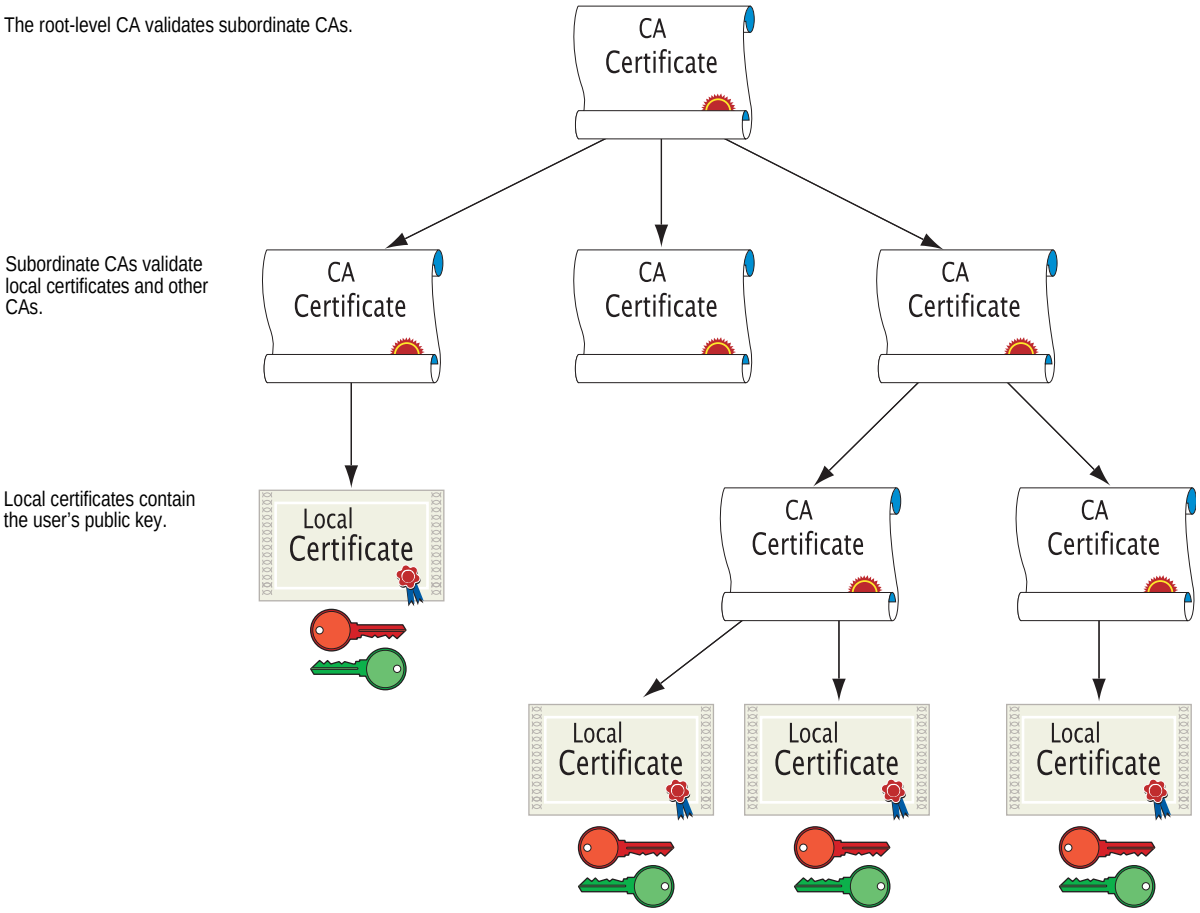
exec pki ecdsa new-key *secp256r1*

The ECDSA key length is defined in the elliptic curve domain parameter string secp256r1. The curve domain parameters conform to ANSI X9.62-1998 specifications.

Public Key Infrastructure

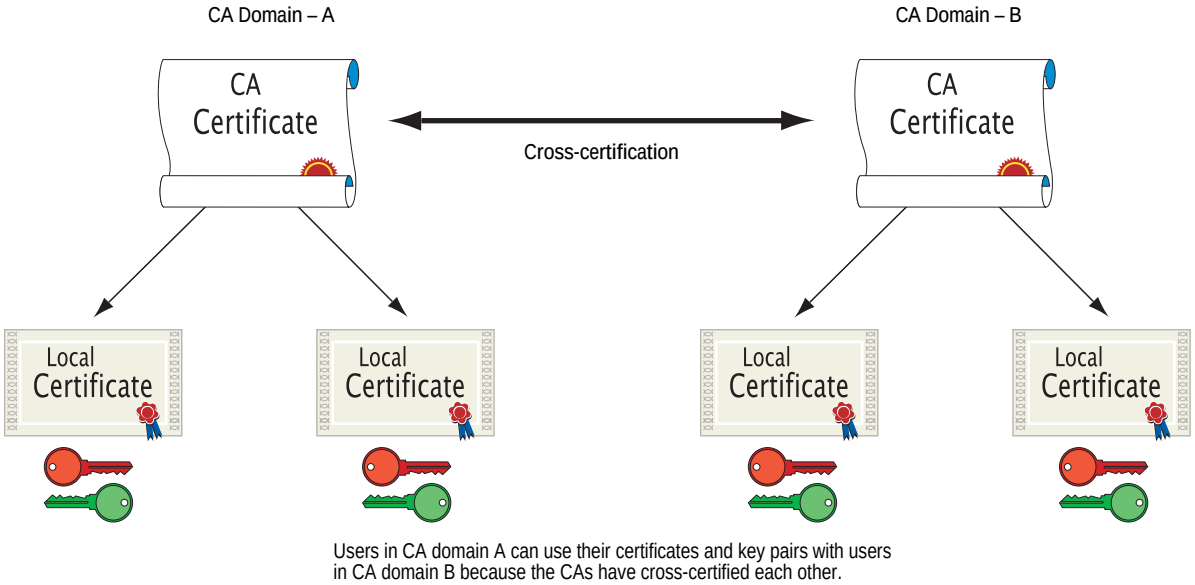
Public Key Infrastructure (PKI) refers to the hierarchical structure of trust required for the successful implementation of public key cryptography. To verify the trustworthiness of a certificate, you must be able to track a path of certified CAs from the one issuing your local certificate back to a root authority of a CA domain.

Figure 16: PKI Hierarchy of Trust—CA Domain



If certificates are used solely within an organization, that organization can have its own CA domain within which a company CA issues and validates certificates among its employees. If that organization later wants its employees to be able to exchange their certificates with those from another CA domain (for example, with employees at another organization that also has its own CA domain), the two CAs can develop cross-certification; that is, they can agree to trust the authority of each other. In this case, the PKI structure does not extend vertically but does extend horizontally.

Figure 17: Cross-Certification



For convenience and practicality, the PKI must be transparently managed and implemented. Toward this goal, ScreenOS does the following:

1. Generates a public/private key pair when you create a certificate request.
2. Supplies that public key as part of the certificate request in the form of a text file for transmission to a Certificate Authority (CA) for certificate enrollment (PKCS10 file).
3. Supports loading the local certificate, the CA certificate, and the certificate revocation list (SubinterfaceCRL) into the unit.

NOTE: The Certificate Authority usually provides a CRL. Although you can load a CRL into the security device, you cannot view it once loaded.

You can also specify an interval for refreshing the CRL online. For more information about CRLs, see “Certificates and CRLs” on page 35.

4. Provides certificate delivery when establishing an IPsec tunnel.
5. Supports certificate path validation upward through eight levels of CA authorities in the PKI hierarchy.

6. Supports the PKCS #7 cryptographic standard, which means the security device can accept X.509 certificates and CRLs packaged within a PKCS #7 envelope. PKCS #7 support allows you to submit multiple X.509 certificates within a single PKI request. You can now configure PKI to validate all the submitted certificates from the issuing CA at one time.

NOTE: ScreenOS supports a PKCS #7 file size of up to 7 Kilobytes.

7. Supports online CRL retrieval through LDAP or HTTP.

Certificates and CRLs

A digital certificate is an electronic means for verifying your identity through the word of a trusted third party, known as a Certificate Authority (CA). The CA server you use can be owned and operated by an independent CA or by your own organization, in which case you become your own CA. If you use an independent CA, you must contact them for the addresses of their CA and CRL servers (for obtaining certificates and certificate revocation lists) and for the information they require when submitting personal certificate requests. When you are your own CA, you determine this information yourself.

NOTE: ScreenOS supports the following CAs: Baltimore, Entrust, Microsoft, Netscape, RSA Keon, and Verisign.

ScreenOS contains a CA certificate for authenticating downloads from the antivirus (AV) pattern file server and the Deep Inspection (DI) attack object database server. For more information about the AV pattern file server, see “Antivirus Scanning” on page 4-64. For more information about the DI attack object database server, see “Attack Object Database Server” on page 4-124.

To use a digital certificate to authenticate your identity when establishing a secure VPN connection, you must first do the following:

- Generate a key in the security device, send it to a CA to obtain a personal certificate (also known as a *local* certificate), and load the certificate in the security device.
- Obtain a CA certificate for the CA that issued the personal certificate (basically verifying the identity of the CA verifying you), and load the CA certificate in the security device. You can perform this task manually, or you can perform this task automatically using Simple Certificate Enrollment Protocol (SCEP).
- If the certificate does not contain a certificate distribution point (CDP) extension, and you cannot automatically retrieve the CRL through LDAP or HTTP, you can retrieve a CRL manually and load that in the security device.

During the course of business, there are several events that make it necessary to revoke a certificate. You might wish to revoke a certificate if you suspect that it has been compromised or when a certificate holder leaves a company. Managing certificate revocations and validation can be accomplished locally (which is a limited solution) or by referencing a CA's CRL, which you can automatically access online at daily, weekly, or monthly intervals or at the default interval set by the CA.

To obtain a signed digital certificate using the manual method, you must complete several tasks in the following order:

1. Generate a public/private key pair.
2. Fill out the certificate request.
3. Submit your request to your CA of choice.
4. After you receive your signed certificate, you must load it into the security device along with the CA certificate.

You now have the following items for the following uses:

- A local certificate for the security device, to authenticate your identity with each tunnel connection
- A CA Certificate (their public key), to be used to verify the peer's certificate
- If the Certificate Revocation List (CRL) was included with the CA certificate, a CRL to identify invalid certificates

---

NOTE: A CRL might accompany a CA certificate and be stored in the ScreenOS database. Alternatively, the CA certificate might contain the CRL URL (either LDAP or HTTP) for a CRL that is stored in the CA's database. If the CRL is unobtainable by either method, you can manually enter a CRL URL in the security device, as explained in "Configuring CRL Settings" on page 40.

When you receive these files (the certificate files typically have the extension .cer, and the CRL typically has the extension .crl), load them into your security device using the procedure described in "Requesting a Certificate Manually" on page 37.

NOTE: If you are planning to use email to submit a PKCS10 file to obtain your certificates, you must properly configure your ScreenOS settings so that you can send email to your system administrator. You have to set your primary and secondary DNS servers and specify the SMTP server and email address settings.

Requesting a Certificate Manually

When you request a certificate, the security device generates a key pair. The public key becomes incorporated in the request itself and, eventually, in the digitally signed local certificate you receive from the CA.

In the following example, the security administrator is making a certificate request for Michael Zhang in the Development department at Juniper Networks in Sunnyvale, California. The certificate is going to be used for a security device at IP address 10.10.5.44. The administrator instructs the security device to send the request through email to the security administrator at *admin@juniper.net*. The security administrator then copies and pastes the request in the certificate request text field at the CA's certificate enrollment site. After the enrollment process is complete, the CA usually sends the certificates through email back to the security administrator.

NOTE: A special certificate identity string, called *domain-component*, is available only through the CLI. Devices can use this value in certificates for IPsec logon to VPN gateways. For example, the device could use this as a Group IKE ID, accepting ASN1_DN type IKE identities containing "DC = Engineering, DC = NewYork".

Before generating a certificate request, make sure that you have set the system clock and assigned a hostname and domain name to the security device. (If the security device is in an NSRP cluster, replace the hostname with a cluster name. For more information, see "Creating an NSRP Cluster" on page 11-31.)

WebUI

1. **Certificate Generation**
   Objects > Certificates > New: Enter the following, then click Generate:

   Name: Michael Zhang
   Phone: 408-730-6000
   Unit/Department: Development
   Organization: Juniper Networks
   County/Locality: Sunnyvale
   State: CA
   Country: US
   E-mail: mzhang@juniper.net
   IP Address: 10.10.5.44
   Write to file: (select)
   RSA: (select)
   Create new key pair of *1024* length: (select)

   The device generates a PKCS #10 file and prompts you to send the file through email, save the file to disk, or automatically enroll through the Simple Certificate Enrollment Protocol (SCEP).

   Select the E-mail to option, type admin@juniper.net, then click OK.

NOTE: Some CAs do not support an email address in a certificate. If you do not include an email address in the local certificate request, you cannot use an email address as the local IKE ID when configuring the security device as a dynamic peer. Instead, you can use a fully qualified domain name (if it is in the local certificate), or you can leave the local ID field empty. By default the security device sends its *hostname.domainname*. If you do not specify a local ID for a dynamic peer, enter the *hostname.domainname* of that peer on the device at the other end of the IPsec tunnel in the peer ID field.

The value 1024 indicates the bit length of the key pair. If you are using the certificate for SSL (see "Secure Sockets Layer" on page 3-8), be sure to use a bit length that your browser also supports.

Using the email address assumes that you have already configured the IP address for your SMTP server: set admin mail server-name { *ip_addr* | *dom_name* }.

2. Certificate Request

The security administrator opens the file and copies its contents, taking care to copy the entire text but not any blank spaces before or after the text. (Start at "-----BEGIN CERTIFICATE REQUEST-----", and end at "-----END CERTIFICATE REQUEST-----".)

The security administrator then follows the certificate request directions at the CA's website, pasting the PKCS #10 file in the appropriate field when required.

3. Certificate Retrieval

When the security administrator receives the certificate from the CA through email, the administrator forwards it to you. Copy it to a text file, and save it to your workstation (to be loaded to the security device later through the WebUI) or to a TFTP server (to be loaded later through the CLI).

CLI

1. Certificate Generation

```
set pki x509 dn country-name US
set pki x509 dn email mzhang@juniper.net
set pki x509 dn ip 10.10.5.44
set pki x509 dn local-name "Santa Clara"
set pki x509 dn name "Michael Zhang"
set pki x509 dn org-name "Juniper Networks"
set pki x509 dn org-unit-name Development
set pki x509 phone 408-730-6000
set pki x509 dn state-name CA
set pki x509 default send-to admin@juniper.net
exec pki rsa new-key 1024
```

NOTE: Using the email address assumes that you have already configured the IP address for your SMTP server: set admin mail server-name { *ip_addr* | *dom_name* }.

The certificate request is sent through email to admin@juniper.net.

2. **Certificate Request**
   The security administrator opens the file and copies its contents, taking care to copy the entire text but not any blank spaces before or after the text. (Start at "-----BEGIN CERTIFICATE REQUEST-----", and end at "-----END CERTIFICATE REQUEST-----".)

   The security administrator then follows the certificate request directions at the CA's website, pasting the PKCS #10 file in the appropriate field when required.

3. **Certificate Retrieval**
   When the security administrator receives the certificate from the CA through email, the administrator forwards it to you. Copy it to a text file, and save it to your workstation (to be loaded to the security device later through the WebUI) or to a TFTP server (to be loaded later through the CLI).

Loading Certificates and Certificate Revocation Lists

The CA returns the following three files to you for loading onto the security device:

- A CA certificate, which contains the CA's public key
- A local certificate that identifies your local machine (your public key)
- A CRL, which lists any certificates revoked by the CA

For the WebUI example, you have downloaded the files to a directory named C:\certs\ns on the administrator's workstation. For the CLI example, you have downloaded the TFTP root directory on a TFTP server with IP address 198.168.1.5.

NOTE: Juniper Networks security devices (including virtual systems) configured with ScreenOS 2.5 or later support loading multiple local certificates from different CAs.

This example illustrates how to load two certificate files named auth.cer (CA certificate) and local.cer (your public key), along with the CRL file named distrust.crl.

WebUI

1. Objects > Certificates: Select Load Cert, then click Browse.
2. Navigate to the C:\certs directory, select auth.cer, then click Open.

   The directory path and filename (C:\certs\ns\auth.cer) appear in the File Browse field.
3. Click Load.

   The auth.cer certificate file loads.
4. Objects > Certificates: Select Load Cert, then click Browse.

5. Navigate to the C:\certs directory, select local.cer, then click Open.

   The directory path and filename (C:\certs\ns\local.cer) appear in the File Browse field.

6. Click Load.

   The auth.cer certificate file loads.

7. Objects > Certificates: Select Load CRL, then click Browse.

8. Navigate to the C:\certs directory, select distrust.crl, then click Open.

9. Click Load.

   The distrust.crl CRL file loads.

CLI

```
exec pki x509 tftp 198.168.1.5 cert-name auth.cer
exec pki x509 tftp 198.168.1.5 cert-name local.cer
exec pki x509 tftp 198.168.1.5 crl-name distrust.crl
```

Configuring CRL Settings

In Phase 1 negotiations, participants check the CRL list to see if certificates received during an IKE exchange are still valid. If a CRL is not loaded in the ScreenOS database, the security device tries to retrieve the CRL through the LDAP or HTTP CRL location defined within the certificate itself. If there is no URL defined in the certificate, the security device uses the URL of the server that you define for that CA certificate. If you do not have the CA certificate loaded in the device (for example, an intermediate CA of the certificate chain received during IKE exchange), you cannot resolve the CRL server URL for that CA. In this case, you can specify the CRL server URL in the Default Cert Validation Settings section of the WebUI (see the next page). A CRL server URL entered here is used only when the CA certificate is not present in the device. There is no pre-defined default URL.

NOTE: The CRL distribution point extension (.cdp) in an X509 certificate can be either an HTTP URL or an LDAP URL.

With ScreenOS 2.5 and later, you can disable the checking of a CRL's digital signature when you load the CRL. However, disabling CRL certificate checking compromises the security of your device.

In this example, you first configure the Entrust CA server to check the CRL daily by connecting to the LDAP server at 2.2.2.121 and locating the CRL file. You then configure default certificate-validation settings to use the company's LDAP server at 10.1.1.200, also checking the CRL every day.

NOTE: The index (IDX) number for the Entrust CA certificate is 1. To view a list of the IDX numbers for all the CA certificates loaded on a security device, use the following CLI command: get pki x509 list ca-cert.

WebUI

Objects > Certificates (Show: CA) > Server Settings (for NetScreen): Enter the following, then click OK:

X509 Cert_Path Validation Level: Full
CRL Settings:
URL Address: ldap:///CN=Entrust,CN=en2001,CN=PublicKeyServices,
CN=Services,CN=Configuration,DC=EN2001,DC=com?CertificateRevocati
onList?base?objectclass=CRLDistributionPoint
LDAP Server: 2.2.2.121
Refresh Frequency: Daily

Objects > Certificates > Default Cert Validation Settings: Enter the following, then click OK:

X509 Certificate Path Validation Level: Full
Certificate Revocation Settings:
Check Method: CRL
URL Address:
ldap:///CN=NetScreen,CN=safecert,CN=PublicKeyServices,
CN=Services,CN=Configuration,DC=SAFECERT,DC=com?CertificateRevoc
ationList?base?objectclass=CRLDistributionPoint
LDAP Server: 10.1.1.200

CLI

```
set pki authority 1 cert-path full
set pki authority 1 cert-status crl url “ldap:///CN=Entrust,CN=en2001,
    CN=PublicKeyServices,CN=Services,CN=Configuration,DC=EN2000,DC=com?
    CertificateRevocationList?base?objectclass=CRLDistributionPoint”
set pki authority 1 cert-status crl server-name 2.2.2.121
set pki authority 1 cert-status crl refresh daily
set pki authority default cert-path full
set pki authority default cert-status crl url “ldap:///CN=NetScreen,
    CN=safecert,CN=PublicKeyServices,CN=Services,CN=Configuration,DC=SAFE
    CERT,
    DC=com?CertificateRevocationList?base?objectclass=CRLDistributionPoint”
set pki authority default cert-status crl server-name 10.1.1.200
set pki authority default cert-status crl refresh daily
save
```

Obtaining a Local Certificate Automatically

To use a digital certificate to authenticate your identity when establishing a secure VPN connection, you must first do the following:

- Obtain a certificate authority (CA) certificate from which you intend to obtain a personal certificate, and then load the CA certificate in the security device.
- Obtain a local certificate (also known as a personal certificate) from the CA whose CA certificate you have previously loaded, and then load the local certificate in the security device. You can perform this task manually, or automatically using Simple Certificate Enrollment Protocol (SCEP).

Because the manual method of requesting local certificates has steps requiring you to copy information from one certificate to another, it can be a somewhat lengthy process. To bypass these steps, you can use the automatic method.

Note that, before using SCEP, you must perform the following tasks:

- Configure and enable DNS. (See “Domain Name System Support” on page 2-221.)
- Set the system clock. (See “System Clock” on page 2-258.)
- Assign a hostname and domain name to the security device. (If the security device is in an NSRP cluster, replace the hostname with a cluster name. For more information, see “Creating an NSRP Cluster” on page 11-31.)

In this example, you use the automatic method to request a local certificate. You use SCEP with the Verisign CA. You set the following CA settings:

- Full certificate path validation
- RA CGI: http://ipsec.verisign.com/cgi-bin/pkiclient.exe

NOTE: The Common Gateway Interface (CGI) is a standard way for a Web server to pass a user request to an application program and to receive data back. CGI is part of the HyperText Transfer Protocol (HTTP). You must specify an RA CGI path even if the RA does not exist. If the RA does not exist, use the value specified for the CA CGI.

- CA CGI: http://ipsec.verisign.com/cgi-bin/pkiclient.exe
- Automatic integrity confirmation of CA certificates
- CA ID, which identifies a SCEP server, where Verisign SCEP server uses a domain name, such as juniper.net or a domain set up by Verisign for your company
- Challenge password
- Automatic certificate polling every 30 minutes (the default is no polling)

You then generate an RSA key pair, specifying a key length of 1024 bits, and initiate the SCEP operation to request a local certificate from the Verisign CA with the above CA settings.

When using the WebUI, you refer to CA certificates by name. When using the CLI, you refer to CA certificates by index (IDX) number. In this example, the IDX number for the Verisign CA is “1.” To see the IDX numbers for CA certificates, use the following command: `get pki x509 list ca-cert`. The output displays an IDX number and an ID number for each certificate. Note the IDX number and use that when referencing the CA certificate in commands.

WebUI

1. CA Server Settings

Objects > Certificates > Show CA > Server Settings (for Verisign): Enter the following, then click OK:

X509 certificate path validation level: Full
SCEP Settings:
RA CGI: http://ipsec.verisign.com/cgi-bin/pkiclient.exe
CA CGI: http://ipsec.verisign.com/cgi-bin/pkiclient.exe

> Advanced: Enter the following advanced settings, then click Return to return to the basic CA Server Settings configuration page:

Polling Interval: 30
Certificate Authentication: Auto
Certificate Renew: 14

2. Local Certificate Request

Objects > Certificates > New: Enter the following, then click Generate:

Name: Michael Zhang
Phone: 408-730-6000
Unit/Department: Development
Organization: Juniper Networks
County/Locality: Sunnyvale
State: CA
Country: US
Email: mzhang@juniper.net
IP Address: 10.10.5.44
Key Pair Information
RSA: (select)
Create new key pair of **1024** length.

NOTE: The value 1024 indicates the bit length of the key pair. If you are using the certificate for SSL, be sure to use a bit length that your browser also supports.

Issue the get pki x509 pkcs CLI command to have the security device generate a PKCS #10 file and then, do one of the following:

- Send the PKCS #10 certificate request file to an email address
- Save it to disk
- Automatically enroll by sending the file to a CA that supports the Simple Certificate Enrollment Protocol (SCEP)

3. Automatic Enrollment

Select the Automatically enroll to option, select the Existing CA server settings option, then select Verisign from the drop-down list.

Contact Verisign to inform them of your certificate request. They must authorize the certificate request before you can download the certificate.

CLI

1. **CA Server Settings**

```
set pki authority 1 cert-path full
set pki authority 1 scep ca-cgi “http://ipsec.verisign.com/cgi-bin
    /pkiclient.exe”
set pki authority 1 scep ra-cgi “http://ipsec.verisign.com/cgi-bin
    /pkiclient.exe”
set pki authority 1 scep polling-int 30
set pki authority 1 scep renew-start 14
```

NOTE: The Common Gateway Interface (CGI) is a standard way for a Web server to pass a user request to an application program and to receive data back. CGI is part of the HyperText Transfer Protocol (HTTP).

You must specify an RA CGI path even if the RA does not exist. If the RA does not exist, use the value specified for the CA CGI.

2. **Local Certificate Request**

```
set pki x509 dn country-name US
set pki x509 dn email mzhang@juniper.net
set pki x509 dn ip 10.10.5.44
set pki x509 dn local-name “Santa Clara”
set pki x509 dn name “Michael Zhang”
set pki x509 dn org-name “Juniper Networks”
set pki x509 dn org-unit-name Development
set pki x509 phone 408-730-6000
set pki x509 dn state-name CA
exec pki rsa new 1024
```

3. **Automatic Enrollment**

```
exec pki x509 scep 1
```

If this is the first certificate request from this CA, a prompt appears presenting a fingerprint value for the CA certificate. You must contact the CA to confirm that this is the correct CA certificate.

Contact Verisign to inform them of your certificate request. They must authorize the certificate request before you can download the certificate.

Automatic Certificate Renewal

You can enable the security device to automatically renew certificates it acquired through Simple Certificate Enrollment Protocol (SCEP). This feature saves you from having to remember to renew certificates on the security device before they expire, and, by the same token, helps maintain valid certificates at all times.

This feature is disabled by default. You can configure the security device to automatically send out a request to renew a certificate before it expires. You can set the time when you want the security device to send out the certificate renewal request in number of days and minutes before the expiration date. By setting different times for each certificate, you prevent the security device from having to renew all certificates at the same time.

For this feature to work, the security device must be able to reach the SCEP server, and the certificate must be present on the security device during the renewal process. Furthermore, for this feature to work, you must also ensure that the CA issuing the certificate can do the following:

- Support automatic approval of certificate requests.
- Return the same DN (Domain Name). In other words, the CA cannot modify the subject name and SubjectAltName extension in the new certificate.

You can enable and disable the automatic SCEP certificate-renewal feature for all SCEP certificates or for individual certificates.

Key-Pair Generation

A security device holds pregenerated keys in memory. The number of pregenerated keys depends on the device model. During normal operation, the security device can manage to have enough keys available to renew certificates by generating a new key every time it uses one. The process of generating a key usually goes unnoticed as the device has time to generate a new key before one is needed. In the event that the security device renews a great number of certificates at once, thus using up keys rapidly, it might run out of pregenerated keys and have to generate them promptly for each new request. In this case, the generation of keys might affect the performance of the security device, especially in a high-availability (HA) environment where the performance of the security device might slow down for a number of minutes.

The number of pregenerated key pairs on a security device depends on the model. For more information, refer to the datasheet for your Juniper Networks security product.

Online Certificate Status Protocol

When a security device performs an operation that uses a certificate, it is usually important to verify the validity of that certificate. Certificates might have become invalid through expiration or revocation. The default way to check the status of certificates is to use certificate revocation lists (CRLs). The Online Certificate Status Protocol (OCSP) is an alternative way to check the status of certificates. OCSP can provide additional information about certificates and provide status checks in a more timely manner.

When a security device uses OCSP, it is referred to as the *OCSP client* (or *requester*). This client sends a verification request to a server device called the *OCSP responder*. ScreenOS supports RSA Keon and Verisign as OCSP responders. The client's request contains the identity of the certificate to check. Before the security device can perform any OCSP operation, you must configure it to recognize the location of the OCSP responder.

NOTE: We have also successfully tested with the Valicert OCSP responder during an extensive evaluation in the past.

After receiving the request, the OCSP responder confirms that the status information for the certificate is available, then returns the current status to the security device. The response of the OCSP responder contains the certificate's revocation status, the name of the responder, and the validity interval of the response. Unless the response is an error message, the responder signs the response using the responder's private key. The security device verifies the validity of the responder's signature by using the certificate of the responder. The certificate of the responder may either be embedded in the OCSP response, or stored locally and specified in the OCSP configuration. If the certificate is stored locally, use the following command to specify the locally stored certificate:

set pki authority *id_num1* **cert-status ocsp cert-verify id** *id_num2*

id_num1 identifies the CA certificate that issued the certificate being verified, and *id_num2* identifies the locally stored certificate the device uses to verify the signature on the OCSP response.

If the certificate of the responder is not embedded in the OCSP response or stored locally, then the security device verifies the signature by using the CA certificate that issued the certificate in question.

You can use CLI commands to configure a security device for OCSP. Most of these commands use an identification number to associate the revocation reference URL with the CA certificate. You can obtain this ID number using the following CLI command:

get pki x509 list ca-cert

NOTE: The security device dynamically assigns the ID number to the CA certificate when you list the CA certificates. This number might change after you modify the certificate store.

Specifying a Certificate Revocation Check Method

To specify the revocation check method (CRL, OCSP, or none) for a certificate of a particular CA, use the following CLI syntax:

set pki authority *id_num* **cert-status revocation-check { CRL | OCSP | none }**

where *id_num* is the identification number for the certificate.

The following example specifies OCSP revocation checking:

```
set pki authority 3 cert-status revocation-check ocsp
```

The ID number 3 identifies the certificate of the CA.

Viewing Status Check Attributes

To display the status check attributes for a particular CA, use the following CLI syntax:

get pki authority *id_num* **cert-status**

where *id_num* is the identification number for the certificate issued by the CA.

To display the status check attributes for the CA that issued certificate 7:

```
get pki authority 7 cert-status
```

Specifying an Online Certificate Status Protocol Responder URL

To specify the URL string of an OCSP responder for a particular certificate, use the following CLI syntax:

set pki authority *id_num* **cert-status ocsp url** *url_str*

To specify the URL string of an OCSP responder (http:\\192.168.10.10) for the CA with certificate at index 5, use the following CLI syntax:

```
set pki authority 5 cert-status ocsp url http:\\192.168.10.10
```

To remove the URL (http:\\192.168.2.1) of a CRL server for a certificate 5:

```
unset pki authority 5 cert-status ocsp url http:\\192.168.2.1
```

Removing Status Check Attributes

To remove all certificate status check attributes for a CA that issued a particular certificate, use the following syntax:

unset pki authority *id_num* **cert-status**

To remove all revocation attributes related to certificate 1:

```
unset pki authority 1 cert-status
```

Self-Signed Certificates

A self-signed certificate is a certificate that is signed by and issued to the same entity; that is, the issuer and the subject of the certificate are the same. For example, the CA certificates of all root certificate authorities (CAs) are self-signed.

A security device automatically generates a self-signed certificate when powering up—if there is no certificate already configured for Secure Sockets Layer (SSL), which is the case when you first power it up. The security device that creates an auto-generated self-signed certificate is the only device that uses it. The device never exports this certificate outside itself. Even if the security device is in a NetScreen Redundancy Protocol (NSRP) cluster, it does not include the auto-generated self-signed certificate with other types of certificates when synchronizing PKI objects among other members in the cluster. (NSRP members do exchange manually generated self-signed certificates. For information about manually generating self-signed certificates, see “Manually Creating Self-Signed Certificates” on page 50.)

Although you cannot export an auto-generated self-signed certificate, you can copy its subject name and fingerprint. You can then deliver this to a remote admin who can later use the subject name and fingerprint to verify the self-signed certificate received during SSL negotiations. Checking the subject name and fingerprint is an important precaution against man-in-the-middle attacks in which someone intercepts an SSL connection attempt and pretends to be the targeted security device by responding with his own self-signed certificate. (For more information about verifying a self-signed certificate, see “Certificate Validation” on page 49.)

You can use a self-signed certificate when making a Secure Sockets Layer (SSL) connection to the security device. When you manage the device through the WebUI, SSL can provide authentication and encryption to secure your administrative traffic. You can even configure a security device to redirect an administrative connection attempt using HTTP (default port 80) to SSL (default port 443).

NOTE: For more information about SSL, including the HTTP-to-SSL redirect mechanism, see “Secure Sockets Layer” on page 3-8.

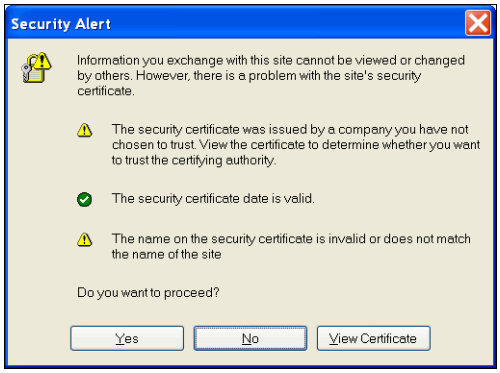
By default, the security device makes the auto-generated self-signed certificate available for use with SSL negotiations. It is the default SSL certificate. If you later install a CA-signed certificate or you configure the security device to generate another self-signed certificate, you can use one of these other certificates for SSL. If you delete the auto-generated self-signed certificate and do not assign another certificate for SSL use, the security device automatically generates another self-signed certificate the next time the device reboots.

NOTE: To learn how to create another self-signed certificate, see “Manually Creating Self-Signed Certificates” on page 50. To learn how to delete an auto-generated self-signed certificate, see “Deleting Self-Signed Certificates” on page 56.

Certificate Validation

During an SSL handshake, the security device authenticates itself by sending a certificate to the SSL client. When the security device sends a self-signed certificate, the SSL client cannot validate it by checking the issuing CA's signature because no CA issued it. When the security device presents a self-signed certificate for use in establishing an SSL session, the browser on the admin's computer tries to validate it with a CA certificate in its CA store. When it fails to find such an authority, the browser displays a message such as that shown in Figure 18, prompting the admin to accept or refuse the certificate.

Figure 18: Security Alerts for Self-Signed Certificates



If this is the first time connecting to the security device after its initial bootup, the system clock might be inaccurate. Consequently, the validity period on the certificate might also be inaccurate. Even if you set the system clock and then regenerate a self-signed certificate, the browser can never find an authenticating CA, so the administrator must be prepared to see one of the above messages each time the security device uses a self-signed certificate for an SSL connection.

Without recourse to the certificate validation of an impartial third-party CA, the administrator logging in through SSL might wonder if the received self-signed certificate is indeed from the security device to which he is attempting to connect. (After all, the certificate might be from an interloper using a man-in-the-middle attack in an attempt to masquerade as the security device.) The admin can validate the certificate by using the subject name and fingerprint of the self-signed certificate. You can deliver the subject name and fingerprint to the admin so that the admin can validate the self-signed certificate when the security device later provides it to authenticate itself.

To see the subject name and fingerprint of an auto-generated self-signed certificate, use the following command:

```
device-> get pki x509 cert system
. . .
    CN=0043022002000186,CN=system generated,CN=self-signed,
. . .
finger print (md5) <e801eae4 56699fbc 324e38f2 4cfa5d47>
finger print (sha) <0113f5ec 6bd6d32b 4ef6ead9 f809eead 3a71435b>
```

NOTE: You cannot view the details of an auto-generated self-signed certificate through the WebUI.

After viewing the subject name and fingerprint, you can copy and deliver them (using a secure out-of-band method of your choice) to the admin that is later going to connect to the security device through SSL. When the admin's SSL client receives the certificate from the security device during the SSL handshake, the admin can compare the subject name and fingerprint in the received certificate with those that received earlier out-of-band. If they match, the admin knows that the certificate is authentic. Because there is no trusted third-party CA authority to authenticate the certificate, wIthout the subject name and fingerprint to compare, the remote admin cannot know for sure if the certificate is genuine.

Manually Creating Self-Signed Certificates

The security device automatically generates a self-signed certificate when you first power up the device so that it can support SSL for the initial connection. However, you might want to generate a different self-signed certificate from the one that the security device automatically generates. The following are some possible reasons for replacing the auto-generated self-signed certificate with an admin-defined self-signed certificate:

- The auto-generated self-signed certificate uses a fixed key size of 1024 bits. Your needs might require a larger or smaller key size, which you can control when generating your own self-signed key.
- You might want to use a certificate with a different subject name from the one that is automatically created.
- You might have a need for multiple self-signed certificates. On security devices that support virtual systems, the root system can share the auto-generated self-signed certificate with all the virtual systems. However, vsys administrators might prefer to generate their own self-signed certificates and then require their administrators to check the subject name and fingerprint of these specific certificates instead of the attributes of a shared certificate.

NOTE: Unlike an auto-generated self-signed certificate, which never passes outside the device in which it is created, a manually generated self-signed certificate is included with other certificates when a security device in an NSRP cluster synchronizes PKI objects with other members in the cluster.

Although you can configure various components of a self-signed certificate—such as the distinguished name (DN) fields, the subject alternative name, and the key size—the following common name (CN) elements always appear at the end of the DN:

"CN = *dev_serial_num*, CN = NetScreen self-signed"

Although the primary intended use of a self-signed certificate is to provide immediate out-of-the-box support for making a Secure Sockets Layer (SSL) connection to a security device, you can potentially use this certificate as you would any other CA-signed certificate. The uses for a self-signed certificate can include the following:

- Making a Secure Sockets Layer (SSL) connection to protect administrative traffic to a security device
- Securing traffic between Network and Security Manager (NSM) and a security device
- Authenticating IKE peers when establishing VPN tunnels

NOTE: For the current ScreenOS release, we support self-signed certificates only for use with SSL.

Setting an Admin-Defined Self-Signed Certificate

In this example, you define the following components of a self-signed certificate for use with SSL:

- Distinguished Name/Subject Name:
  - Name: 4ssl
  - Organization: jnpr
  - FQDN: www.juniper.net
- Key type and length: RSA, 1024 bits

After defining it, you generate the certificate and view it. You can then copy the subject name and fingerprint (also referred to as a "thumbprint") for distribution to other admins logging in through SSL to manage the security device.

When an admin attempts to log in using SSL, the security device sends him this certificate. The admin can open the certificate and compare the subject name and fingerprint in the certificate with the information received previously. If they match, the admin knows that the certificate is authentic.

WebUI

1. Define the Certificate Attributes

Objects > Certificates > New: Enter the following, then click Generate:

Certificate Subject Information:
- Name: 4ssl
- Organization: jnpr
- FQDN: www.juniper.net

Key Pair Information:
- RSA: (select)
- Create new key pair of **1024** length.

2. Generate the Self-Signed Certificate

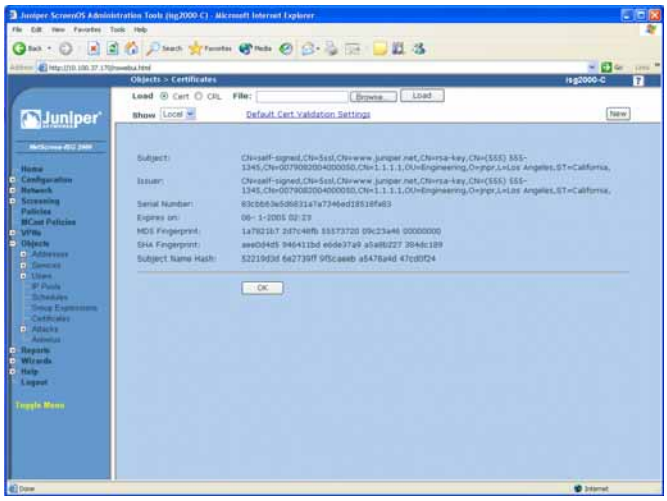
After the security device completes the key generation it composes a certificate request. Click Generate Self-Signed Cert.

3. View the Self-Signed Certificate

Objects > Certificates > Show Local: Click Detail for the certificate that you just created.

The Certificate Details page appears, as shown in Figure 19.

Figure 19: Certificate Details



You can copy the subject name and fingerprint from this page and communicate it to other administrators who intend to use SSL when managing the security device. When they initiate an SSL connection, they can then use this information to ensure that the certificate they receive is indeed from the security device.

CLI

1. Define the Certificate Attributes

```
set pki x509 dn name 4ssl
set pki x509 dn org-name jnpr
set pki x509 cert-fqdn www.juniper.net
save
```

2. Generate the Self-Signed Certificate

To generate a public/private key pair, which the Juniper Networks security device uses in its certificate request, enter the following command:

```
exec pki rsa new-key 1024
```

After the security device generates a key pair, it composes the following certificate request:

```
-----BEGIN CERTIFICATE REQUEST-----
MIIB0jCCATsCAQAwZTENMAsGA1UEChMESk5QUjEZMBcGA1UEAxMQMDA0MzAyMj
    Aw
MjAwMDE4NjEQMA4GA1UEAxMHcnNhLWtleTEYMBYGA1UEAxMPd3d3Lmp1bmlwZ
    XIu
bmV0MQ0wCwYDVQQDEwQ1c3NsMIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQK
    BgQDP
aAtelkL4HxQmO1w1jv9NMmrWnzdVYnGrKrXnw2MaB3xEgouWrlymEkZetA2ouKeA
D24SL0h1YvJ7Sd9PvkhwHOnvP1zkOCWA84TgvxBzcAyeBnS1UpSwcC0admX0Da6
    T
80EUuGrmUWodddRFUc8o5d2VGTUOM7WgcFDZRSGQGwIDAQABoC0wKwYJKoZIh
    vcN
AQkOMR4wHDAaBgNVHREEEzARgg93d3cuanVuaXBlci5uZXQwDQYJKoZIhvcNAQEF
BQADgYEAgvDXI4H905y/2+k4omo9Y4XQrgq44Rj3jqXAYYMgQBd0Q8HoyL5NE3+i
QUkiYjMTWO2wIWzEr4u/tdAISEVTu03achZa3zIkUtn8sD/VYKhFlyPCBVvMiaHd
FzIHUgBuMrr+awowJDG6wARhR75w7pORXy7+aAmvIjew8YRre9s=
-----END CERTIFICATE REQUEST-----
```

To learn the ID number for the key pair, use the following command:

```
get pki x509 list key-pair

Getting OTHER PKI OBJECT ...
IDX  ID num     X509 Certificate Subject Distinguish Name
=========================================================
0000 176095259
     CN=4ssl,CN=www.juniper.net,CN=rsa-key,CN=0043022002000186,
     O=jnpr,
=========================================================
```

To generate the self-signed certificate, enter the following command, referencing the key-pair ID number that you learned from the output of the previous command:

```
exec pki x509 self-signed-cert key-pair 176095259
```

3. View the Self-Signed Certificate

To view the self-signed certificate that you have just created, enter the following command:

```
get pki x509 list local-cert

    Getting LOCAL CERT ...
    IDX  ID num     X509 Certificate Subject Distinguish Name
    ========================================================
    0000 176095261 LOCAL CERT friendly name <29>
    LOCAL CERT friendly name <29>
    CN=self-signed,CN=4ssl,CN=www.juniper.net,CN=rsa-key,CN=004302200200
        0186,
        O=jnpr,
    Expire on 10-19-2009 17:20, Issued By:
    CN=self-signed,CN=4ssl,CN=www.juniper.net,CN=rsa-key,CN=004302200200
        0186,
        O=jnpr,
    ========================================================
```

To view the certificate in more detail, enter the following command using the ID number of the certificate:

```
get pki x509 cert 176095261

    -0001 176095261 LOCAL CERT friendly name <29>
    CN=self-signed,CN=4ssl,CN=www.juniper.net,CN=rsa-key,CN=0043022002
        000186,
        O=jnpr,
    Expire on 10-19-2009 17:20, Issued By:
    CN=self-signed,CN=4ssl,CN=www.juniper.net,CN=rsa-key,CN=004302200200
        0186,
        O=jnpr,
    Serial Number: <9d1c03365a5caa172ace4f82bb5ec9da>
    subject alt name extension:
    email(1): (empty)
    fqdn(2): (www.juniper.net)
    ipaddr(7): (empty)
    no renew
    finger print (md5) <be9e0280 02bdd9d1 175caf23 6345198e>
    finger print (sha) <87e0eee0 c06f9bac 9098bd02 0e631c1b 26e37e0e>
    subject name hash: <d82be8ae 4e71a576 2e3f06fc a98319a3 5c8c6c27>
    use count: <1>
    flag <00000000>
```

You can copy the subject name and fingerprint from this output and communicate it to other administrators who intend to use SSL when managing the security device. When they initiate an SSL connection, they can then use this information to ensure that the certificate they receive is indeed from the security device.

Certificate Auto-Generation

The first time the security device powers up, it automatically generates a self-signed certificate. The primary purpose of this certificate is to support SSL immediately after the initial bootup of a security device. To see this certificate, use the following CLI command:

```
get pki x509 cert system
    CN=0010062001000021,CN=system generated,CN=self-signed,
    Expire on 08- 3-2014 16:19, Issued By:
    CN=0010062001000021,CN=system generated,CN=self-signed,
    Serial Number: <c927f2044ee0cf8dc931cdb1fc363119>
    finger print (md5) <fd591375 83798574 88b3e698 62890b5d>
    finger print (sha) <40a1bda8 dcd628fe e9deaee1 92a2783c 817e26d9>
    subject name hash: <0324d38d 52f814fe 647aba3a 86eda7d4 a7834581>
```

By default, the security device automatically generates a self-signed certificate during the bootup process if the following conditions are met:

- No automatically generated self-signed certificate exists on the device.
- No certificate has been assigned for use with SSL.

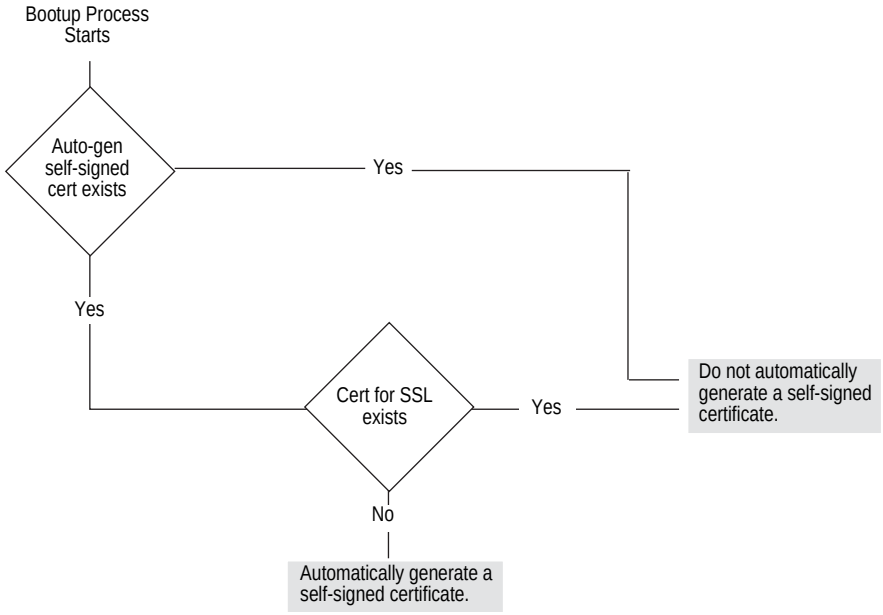
You can use the following command to see if a certificate is already configured for SSL:

```
get ssl
web SSL enable.
web SSL port number(443).
web SSL cert: Default - System Self-Signed Cert.
web SSL cipher(RC4_MD5).
```

In the above output, you can see that SSL is using the automatically generated (“System”) self-signed certificate.

Figure 20 shows the decision path for certificate generation that the security device takes when booting up.

Figure 20: Decision Path for Certificate Auto-Generation



If you delete the automatically generated self-signed certificate, assign another certificate for use with SSL, and then reset the device, the security device does not regenerate another self-signed certificate during the bootup process. If you next change the SSL configuration so that no certificate is assigned to it and then reset the device, the security device does automatically regenerate a new self-signed certificate during the next bootup process.

Deleting Self-Signed Certificates

You can delete a self-signed certificate that is automatically or manually generated as you can with any type of certificate. Perhaps you obtain a CA-signed certificate that you prefer to use for SSL instead of a self-signed certificate. For whatever reason, to delete the auto-generated self-signed certificate, use the following CLI command:

```
delete pki object-id system
```

To delete an admin-configured self-signed certificate, use the following command, where *id_num* is the ID number of the certificate that you want to delete:

```
delete pki object-id id_num
```

If you delete the auto-generated self-signed certificate and then later want the security device to generate another one, do the following:

- Assign no other certificate for SSL (You can use the following command: unset ssl cert).
- Reset the security device.

The security device can redirect HTTP traffic (default port 80) sent to the device itself to SSL (default port 443). Therefore, to ensure that a certificate is available for SSL, during the bootup process, the security device always checks if an auto-generated self-signed certificate exists or if another certificate has been assigned for SSL to use. If there is no auto-generated self-signed certificate and no other certificate is assigned for SSL use, the security device automatically generates a self-signed certificate.

NOTE: You can only delete an automatically generated self-signed certificate through the CLI.

To learn the ID number for a certificate, use the following command: get pki x509 list local-cert.

For information about the redirection of HTTP traffic to SSL, see “Redirecting HTTP to SSL” on page 3-11.

Chapter 3
Virtual Private Network Guidelines

ScreenOS offers a variety of cryptographic options for configuring a virtual private network (VPN) tunnel. Even when you are configuring a simple tunnel, you must make choices. The goals of the first half of this chapter are to first summarize all the choices for a basic site-to-site VPN and a basic dialup VPN and to then present one or more reasons for choosing one option or another.

The second half of the chapter explores the difference between policy-based and route-based VPN tunnels. It also examines the packet flow for a route-based and policy-based site-to-site AutoKey IKE VPN tunnel to see the outbound and inbound processing stages that a packet undergoes. The chapter concludes with some VPN configuration tips to keep in mind when configuring a tunnel.

This chapter contains the following sections:

Cryptographic Options

When configuring a virtual private network (VPN), you must make many decisions about the cryptography you want to use. Questions arise about which Diffie-Hellman (DH) group is the right one to choose, which encryption algorithm provides the best balance between security and performance, and so on. This section presents all the cryptographic options required to configure a basic site-to-site VPN tunnel and a basic dialup VPN tunnel and explains one or more benefits about each one to help you make your decisions.

The first decision that you must make is whether the tunnel is for a site-to-site VPN tunnel (between two security devices) or whether it is for a dialup VPN (from the NetScreen-Remote VPN client to a security device). Although this is a networking decision, the distinction between the two types of tunnels affects some cryptographic options. Therefore, the options are presented in two different figures:

- "Site-to-Site Cryptographic Options" explains Figure 21, "Cryptographic Options for a Site-to-Site VPN Tunnel," on page 61.
- "Dialup VPN Options" explains Figure 22, "Cryptographic Options for a Dialup VPN Tunnel," on page 68.

After you decide whether you are going to configure a site-to-site tunnel or a dialup tunnel, you can refer to either Figure 21 on page 61 or Figure 22 on page 68 for guidance. Each figure presents the cryptographic choices that you must make while configuring the tunnel. Following each figure are reasons for choosing each option that appears in the figure.

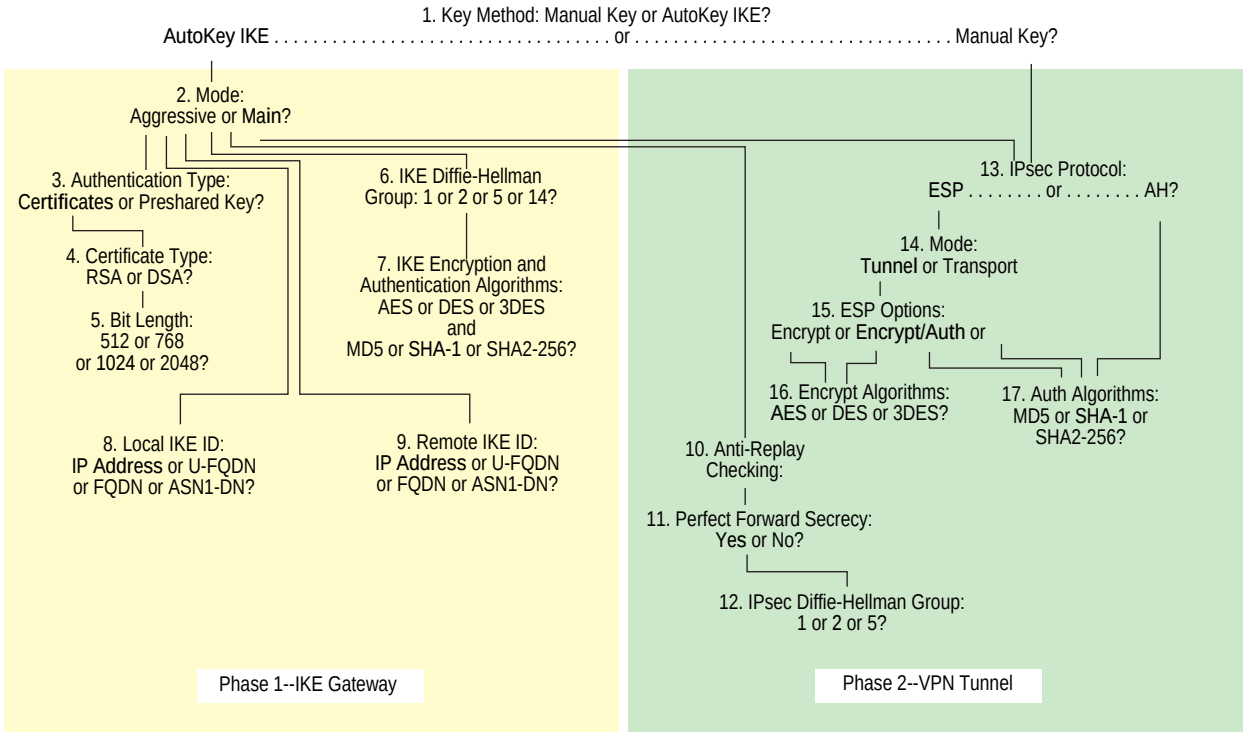
NOTE: Examples for configuring both kinds of tunnels are in Chapter 4, "Site-to-Site Virtual Private Networks," and Chapter 5, "Dialup Virtual Private Networks."

Site-to-Site Cryptographic Options

When configuring a basic site-to-site VPN tunnel, you must choose among the cryptographic options shown in Figure 21. Advantages for each option follow the figure.

NOTE: Figure 21 on page 61 shows recommended options in boldface. For background information about the different IPsec options, see "Internet Protocol Security" on page 5-1.

Figure 21: Cryptographic Options for a Site-to-Site VPN Tunnel



1. Key Method: Manual Key or AutoKey IKE?

AutoKey IKE

- Recommended
- Provides automatic key renewal and key freshness, thereby increasing security

Manual Key

- Useful for debugging IKE problems
- Eliminates IKE negotiation delays when establishing a tunnel

2. Mode: Aggressive or Main?

Aggressive

Required when the IP address of one of the IPsec peers is dynamically assigned and a preshared key is used

Main

- Recommended
- Provides identity protection
- Can be used when the dialup user has a static IP address or if certificates are used for authentication

3. Authentication Type: Preshared Key or Certificates?

Certificates

- Recommended
- Greater security than provided by preshared keys because you can validate certificates with a certificate authority (CA) (For more information, see “Public Key Cryptography” on page 5-29.)

Preshared Key

Easier to use and faster to set up because it does not require a Public Key Infrastructure (PKI)

4. Certificate Type: RSA or DSA?

This depends on the CA from whom you get your certificates. There is no advantage of one certificate type over the other.

5. Bit Length: 512 or 768 or 1024 or 2048?

512

Incurs the least processing overhead

768

- Provides more security than 512 bits
- Incurs less processing overhead than 1024 and 2048 bits

1024

- Recommended
- Provides more security than 512 and 768 bits
- Incurs less processing overhead than 2048 bits

2048

Provides the most security

6. IKE Diffie-Hellman Group: 1 or 2 or 5 or 14?

Diffie-Hellman Group 1

- Incurs less processing overhead than DH groups 2, 5 and 14
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 2

- Recommended
- Incurs less processing overhead than DH groups 5 and 14
- Provides more security than DH group 1
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 5

- Provides more security that DH groups 1 and 2

- Incurs less processing overhead than DH group 14

Diffie-Hellman Group 14

- Provides the most security

7. IKE Encrypt and Auth Algorithms: AES or DES or 3DES and MD5 or SHA-1 or SHA2-256?

AES

- Recommended
- Cryptographically stronger than DES and 3DES if key lengths are all equal
- Processing acceleration provided in Juniper Networks security hardware
- Approved encryption algorithm for Federal Information Processing Standards (FIPS) and Common Criteria EAL4 standards

DES

- Incurs less processing overhead than 3DES and AES
- Useful when the remote peer does not support AES

3DES

- Provides more cryptographic security than DES
- Processing acceleration provided in Juniper Networks security hardware

MD5

- Incurs less processing overhead than SHA-1 and SHA2-256

SHA-1

- Recommended
- Provides more cryptographic security than MD5
- Incurs less processing overhead than SHA2-256
- The only authentication algorithm that FIPS accepts

SHA2-256

- Provides more cryptographic security than SHA-1

8. Local IKE ID: IP Address (Default) or U-FQDN or FQDN or ASN1-DN?

IP Address

- Recommended
- Can only be used if the local security device has a static IP address
- Default IKE ID when using a preshared key for authentication
- Can be used with a certificate if the IP address appears in the SubjectAltName field

U-FQDN
User-Fully Qualified Domain Name (U-FQDN—an email address): Can be used with a preshared key or a certificate if the U-FQDN appears in the SubjectAltName field

FQDN
- Fully Qualified Domain Name (FQDN): Can be used with a preshared key or a certificate if the FQDN appears in the SubjectAltName field
- Useful for VPN gateways that have dynamic IP addresses
- Default IKE ID when using RSA or DSA certificates for authentication

ASN1-DN
- Can be used only with certificates
- Useful if the CA does not support the SubjectAltName field in the certificates it issues

9. Remote IKE ID: IP Address (Default) or U-FQDN or FQDN or ASN1-DN?

IP Address
- Recommended
- Does not require you to enter a remote IKE ID for a peer at a static IP address when using preshared keys for authentication and the peer is a security device
- Can be used for a device with a static IP address
- Can be used with a preshared key or a certificate if the IP address appears in the SubjectAltName field

U-FQDN
User-Fully Qualified Domain Name (U-FQDN—an email address): Can be used with a preshared key or a certificate if the U-FQDN appears in the SubjectAltName field

FQDN
- Fully Qualified Domain Name (FQDN): Can be used with a preshared key or a certificate if the FQDN appears in the SubjectAltName field
- Useful for VPN gateways that have dynamic IP addresses
- Does not require you to enter a remote IKE ID when using certificates for authentication and the peer is a security device

ASN1-DN
- Can be used only with certificates
- Useful if the CA does not support the SubjectAltName field in the certificates it issues

10. Anti-Replay Checking: No or Yes?

Yes
- Recommended

- Enables the recipient to check sequence numbers in packet headers to prevent denial of service (DoS) attacks caused when a malefactor resends intercepted IPsec packets

No

Disabling this might resolve compatibility issues with third-party peers

11. Perfect Forward Secrecy: No or Yes?

Yes

- Recommended
- Perfect Forward Secrecy (PFS): Provides increased security because the peers perform a second DH exchange to produce the key used for IPsec encryption/decryption

No

- Provides faster tunnel setup
- Incurs less processing during Phase 2 IPsec negotiations

12. IPsec Diffie-Hellman Group: 1 or 2 or 5 or 14?

Diffie-Hellman Group 1

- Incurs less processing overhead than DH groups 2, 5 and 14
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 2

- Recommended
- Incurs less processing overhead than DH groups 5 and 14
- Provides more security than DH group 1
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 5

- Provides more security that DH groups 1 and 2
- Incurs less processing overhead than DH group 14

Diffie-Hellman Group 14

- Provides the most security

13. IPsec Protocol: ESP or AH?

ESP

- Recommended
- Encapsulating Security Payload (ESP): Can provide both confidentiality through encryption and encapsulation of the original IP packet and integrity through authentication
- Can provide either encryption alone or authentication alone

AH

Authentication Header (AH): Provides authentication of the entire IP packet, including the IPsec header and outer IP header

14. Mode: Tunnel or Transport?

Tunnel

- Recommended
- Conceals the original IP header, thereby increasing privacy

Transport

Required for L2TP-over-IPsec tunnel support

15. ESP Options: Encrypt or Encrypt / Auth or Auth?

Encrypt

- Provides faster performance and incurs less processing overhead than using encrypt/auth
- Useful when you require confidentiality but do not require authentication

Encrypt / Auth

- Recommended
- Useful when you want confidentiality and authentication

Auth

Useful when you want authentication but do not require confidentiality. Perhaps when the information is not secret, but it is important to establish that the information truly comes from the person who claims to send it and that nobody tampered with the content while in transit.

16. Encrypt Algorithms: AES or DES or 3DES?

AES

- Recommended
- Cryptographically stronger than DES and 3DES if key lengths are all equal
- Processing acceleration provided in Juniper Networks security hardware
- Approved encryption algorithm for FIPS and Common Criteria EAL4 standards

DES

- Incurs less processing overhead than 3DES and AES
- Useful when the remote peer does not support AES

3DES

- Provides more cryptographic security than DES
- Processing acceleration provided in Juniper Networks security hardware

17. Auth Algorithms: MD5 or SHA-1 or SHA2-256?

MD5

Incurs less processing overhead than SHA-1

SHA-1

- Recommended
- Provides more cryptographic security than MD5

SHA2-256

- Provides more cryptographic security than SHA-1

Using the recommended options from the previous list, a generic site-to-site VPN configuration between two security devices with static IP addresses would consist of the following components:

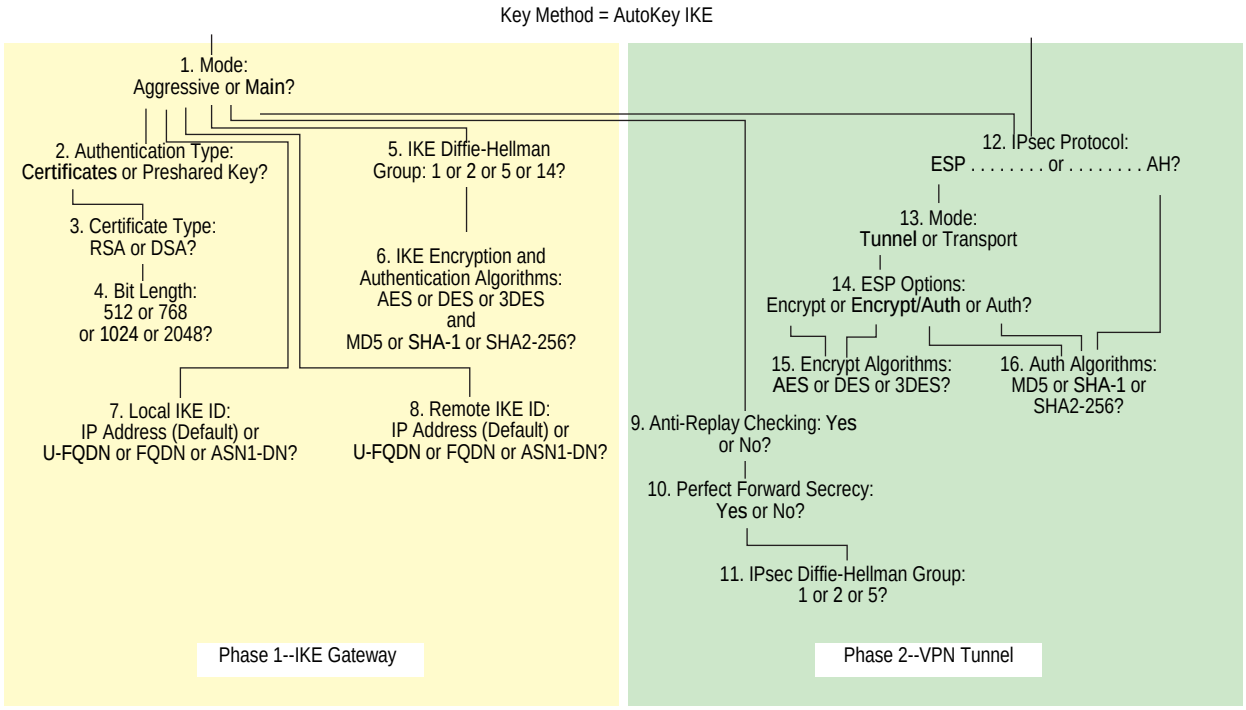
■ AutoKey IKE	■ Perfect Forward Secrecy (PFS) = yes
■ Main mode	■ Phase 2 DH group 2
■ 1024-bit certificates (RSA or DSA)	■ Encapsulating Security Payload (ESP)
■ Phase 1 DH group 2	■ Tunnel mode
■ Encryption = AES	■ Encryption/Authentication
■ Authentication = SHA-1	■ Encryption = AES
■ IKE ID = IP address (default)	■ Authentication = SHA-1
■ Anti-replay protection = yes	

Dialup VPN Options

When configuring a basic dialup VPN tunnel, you must choose among the cryptographic options shown in Figure 22. Advantages for each option follow the figure.

NOTE: Figure 22 shows recommended options in **boldface**. For background information about the different IPsec options, see “Internet Protocol Security” on page 5-1.

Figure 22: Cryptographic Options for a Dialup VPN Tunnel



1. Mode: Aggressive or Main?

Aggressive

- Recommended
- Required when the IP address of one of the IPsec peers is dynamically assigned and a preshared key is used
- Can be used with either certificates or preshared keys for authentication

Main

Provides identity protection

2. Authentication Type: Preshared Key or Certificates?

Certificates

- Recommended
- Greater security than provided by preshared keys because you can validate certificates with a certificate authority (CA) (For more information, see “Public Key Cryptography” on page 5-29.)

Preshared Key

Easier to use and faster to set up because it does not require a Public Key Infrastructure (PKI)

3. Certificate Type: RSA or DSA?

This depends on the CA from whom you get your certificates. There is no advantage of one certificate type over the other.

4. Bit Length: 512 or 768 or 1024 or 2048?

512

Incurs the least processing overhead

768

- Provides more security than 512 bits
- Incurs less processing overhead than 1024 and 2048 bits

1024

- Recommended
- Provides more security than 512 and 768 bits
- Incurs less processing overhead than 2048 bits

2048

Provides the most security

5. IKE Diffie-Hellman Group: 1 or 2 or 5 or 14?

Diffie-Hellman Group 1

- Incurs less processing overhead than DH groups 2, 5 and 14
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 2

- Recommended
- Incurs less processing overhead than DH groups 5 and 14
- Provides more security than DH group 1
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 5

- Incurs less processing overhead than DH group 14
- Provides more security than DH groups 1 and 2

Diffie-Hellman Group 14

- Provides the most security

6. IKE Encrypt and Auth Algorithms: AES or DES or 3DES and MD5 or SHA-1 or SHA2-256?

AES

- Recommended
- Cryptographically stronger than DES and 3DES if key lengths are all equal
- Processing acceleration provided in Juniper Networks security hardware
- Approved encryption algorithm for FIPS and Common Criteria EAL4 standards

DES

- Incurs less processing overhead than 3DES and AES
- Useful when the remote peer does not support AES

3DES

- Provides more cryptographic security than DES
- Processing acceleration provided in Juniper Networks security hardware

MD5

- Incurs less processing overhead than SHA-1 and SHA2-256

SHA-1

- Recommended
- Provides more cryptographic security than MD5
- Incurs less processing overhead than SHA2-256

SHA2-256

- Provides more cryptographic security than SHA-1

7. Local IKE ID: IP Address (Default) or U-FQDN or FQDN or ASN1-DN?

IP Address (Default)

- Does not require you to enter an IKE ID for a device with a static IP address
- Can be used for a device with a static IP address
- Can be used with a preshared key or a certificate if the IP address appears in the SubjectAltName field

U-FQDN

- Recommended
- User-Fully Qualified Domain Name (U-FQDN—an email address): Can be used with a preshared key or a certificate if the U-FQDN appears in the SubjectAltName field

FQDN

- Fully Qualified Domain Name (FQDN): Can be used with a preshared key or a certificate if the FQDN appears in the SubjectAltName field
- Useful for VPN gateways that have dynamic IP addresses

ASN1-DN

- Can be used only with certificates
- Useful if the CA does not support the SubjectAltName field in the certificates it issues

8. Remote IKE ID: IP Address (Default) or U-FQDN or FQDN or ASN1-DN?

IP Address (Default)

- Does not require you to enter an IKE ID for a device with a static IP address
- Can be used for a device with a static IP address
- Can be used with a preshared key or a certificate if the IP address appears in the SubjectAltName field

U-FQDN

- Recommended
- User-Fully Qualified Domain Name (U-FQDN—an email address): Can be used with a preshared key or a certificate if the U-FQDN appears in the SubjectAltName field

FQDN

- Fully Qualified Domain Name (FQDN): Can be used with a preshared key or a certificate if the FQDN appears in the SubjectAltName field
- Useful for VPN gateways that have dynamic IP addresses

ASN1-DN

- Can be used only with certificates
- Useful if the CA does not support the SubjectAltName field in the certificates it issues

9. Anti-Replay Checking: No or Yes?

Yes

- Recommended
- Enables the recipient to check sequence numbers in packet headers to prevent denial of service (DoS) attacks caused when a malefactor resends intercepted IPsec packets

No

Disabling this might resolve compatibility issues with third-party peers

10. Perfect Forward Secrecy: No or Yes?

Yes

- Recommended
- Perfect Forward Secrecy (PFS): Provides increased security because the peers perform a second DH exchange to produce the key used for IPsec encryption/decryption

No

- Provides faster tunnel setup
- Incurs less processing during Phase 2 IPsec negotiations

11. IPsec Diffie-Hellman Group: 1 or 2 or 5 or 14?

Diffie-Hellman Group 1

- Incurs less processing overhead than DH groups 2, 5 and 14
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- Recommended
- Incurs less processing overhead than DH groups 5 and 14
- Provides more security than DH group 1
- Processing acceleration provided in Juniper Networks security hardware

Diffie-Hellman Group 5

- Provides more security than DH groups 1 and 2
- Incurs less processing overhead than DH group 14

Diffie-Hellman Group 14

- Provides the most security

12. IPsec Protocol: ESP or AH?

ESP

- Recommended
- Encapsulating Security Payload (ESP): Can provide both confidentiality through encryption and encapsulation of the original IP packet and integrity through authentication
- Can provide either encryption alone or authentication alone

AH

Authentication Header (AH): Provides authentication of the entire IP packet, including the IPsec header and outer IP header.

13. Mode: Tunnel or Transport?

Tunnel

- Recommended
- Conceals the original IP header, thereby increasing privacy

Transport

Required for L2TP-over-IPsec tunnel support

14. ESP Options: Encrypt or Encrypt / Auth or Auth?

Encrypt

- Provides faster performance and incurs less processing overhead than using encrypt/auth
- Useful when you require confidentiality but do not require authentication

Encrypt / Auth

- Recommended
- Useful when you want confidentiality and authentication

Auth

Useful when you want authentication but do not require confidentiality. Perhaps when the information is not secret, but it is important to establish that the information truly comes from the person who claims to send it and that nobody tampered with the content while in transit.

15. Encrypt Algorithms: AES or DES or 3DES?

AES

- Recommended
- Cryptographically stronger than DES and 3DES if key lengths are all equal
- Processing acceleration provided in Juniper Networks security hardware
- Approved encryption algorithm for FIPS and Common Criteria EAL4 standards

DES

- Incurs less processing overhead than 3DES and AES
- Useful when the remote peer does not support AES

3DES

- Provides more cryptographic security than DES
- Processing acceleration provided in Juniper Networks security hardware

16. Auth Algorithms: MD5 or SHA-1 or SHA2-256?

MD5

- Incurs less processing overhead than SHA-1 and SHA2-256

SHA-1

- Recommended
- Incurs less processing overhead than SHA2-256
- Provides more cryptographic security than MD5

SHA2-256

- Provides more cryptographic security than the MD5 and SHA-1

Using the recommended options from the above list, a generic dialup VPN configuration between two security devices with static IP addresses would consist of the following components:

■ Aggressive mode	■ Perfect Forward Secrecy (PFS) = yes
■ 1024-bit certificates (RSA or DSA)	■ Phase 2 DH group 2
■ Phase 1 DH group 2	■ Encapsulating Security Payload (ESP)
■ Encryption = AES	■ Tunnel mode
■ Authentication = SHA-1	■ Encryption/Authentication
■ IKE ID = U-FQDN (email address)	■ Encryption = AES
■ Anti-replay protection = yes	■ Authentication = SHA-1

Cryptographic Policy

A root admin user or a read-write admin user with a cryptographic role can configure a cryptographic policy on the security device. For information on role attributes, see “Role Attributes” on page 3-38.

To create a cryptographic policy:

```
set crypto-policy
```

You then configure all cryptographic attributes for the policy, such as encryption and authentication algorithms, authentication method, mode of operation, Diffie-Hellman (DH) Group, and Phase 1 and Phase 2 security associations (SA) lifetime values.

To set the attributes for a new cryptographic policy:

```
set crypto-policy
set encrypt-alg aes256
set auth-alg sha2-256
set dh group2
set auth-method rsa-sig
set mode aggressive
set p1-sa-lifetime upper-threshold days 1
set p2-sa-lifetime upper-threshold days 1
save
```

NOTE: You must use the CLI to configure a cryptographic policy.

To make all cryptographic-related configurations conform to the new cryptographic policy, you must restart the security device.

Route-Based and Policy-Based Tunnels

The configuration of a security device for VPN support is particularly flexible. You can create route-based and policy-based VPN tunnels. Additionally, each type of tunnel can use Manual Key or AutoKey IKE to manage the keys used for encryption and authentication.

With policy-based VPN tunnels, a tunnel is treated as an object (or a building block) that together with source, destination, service, and action, comprises a policy that permits VPN traffic. (Actually, the VPN policy action is *tunnel*, but the action *permit* is implied, if unstated). In a policy-based VPN configuration, a policy specifically references a VPN tunnel by name.

With route-based VPNs, the policy does not specifically reference a VPN tunnel. Instead, the policy references a destination address. When the security device does a route lookup to find the interface through which it must send traffic to reach that address, it finds a route through a tunnel interface, which is bound to a specific VPN tunnel.

NOTE: Typically, a tunnel interface is bound to a single tunnel. You can also bind a tunnel interface to multiple tunnels. For more information, see “Multiple Tunnels per Tunnel Interface” on page 5-271.

Thus, with a policy-based VPN tunnel, you can consider a tunnel as an element in the construction of a policy. With a route-based VPN tunnel, you can consider a tunnel as a means for delivering traffic, and the policy as a method for either permitting or denying the delivery of that traffic.

The number of policy-based VPN tunnels that you can create is limited by the number of policies that the device supports. The number of route-based VPN tunnels that you create is limited by the number of route entries or the number of tunnel interfaces that the device supports—whichever number is lower.

A route-based VPN tunnel configuration is a good choice when you want to conserve tunnel resources while setting granular restrictions on VPN traffic. Although you can create numerous policies referencing the same VPN tunnel, each policy creates an individual IPsec security association (SA) with the remote peer, each of which counts as an individual VPN tunnel. With a route-based approach to VPNs, the regulation of traffic is not coupled to the means of its delivery. You can configure dozens of policies to regulate traffic flowing through a single VPN tunnel between two sites, and there is just one IPsec SA at work. Also, a route-based VPN configuration allows you to create policies referencing a destination reached through a VPN tunnel in which the action is *deny*, unlike a policy-based VPN configuration, in which—as stated earlier—the action must be *tunnel*, implying *permit*.

Another advantage that route-based VPNs offer is the exchange of dynamic routing information through VPN tunnels. You can enable an instance of a dynamic routing protocol, such as Border Gateway Protocol (BGP), on a tunnel interface that is bound to a VPN tunnel. The local routing instance exchanges routing information through the tunnel with a neighbor enabled on a tunnel interface bound to the other end.

When a tunnel does not connect large networks running dynamic routing protocols and you do not need to conserve tunnels or define various policies to filter traffic through the tunnel, a policy-based tunnel makes sense. Also, because there is no network beyond a dialup VPN client, policy-based VPN tunnels can be a good choice for dialup VPN configurations.

That said, when the dialup client supports a virtual internal IP address—which the NetScreen-Remote does—there are also compelling reasons for using a route-based VPN configuration. A route-based dialup VPN tunnel offers the following benefits:

- You can bind its tunnel interface to any zone to require or not require policy enforcement.
- You can define routes to force traffic through the tunnel, unlike a policy-based VPN configuration.
- A route-based VPN tunnel simplifies the addition of a spoke to a hub-and-spoke configuration (see “Creating Hub-and-Spoke VPNs” on page 5-327).
- You can adjust the proxy ID to accept any IP address from the dialup VPN client by configuring the remote client’s address as 255.255.255.255/32.
- You can define one or more Mapped IP (MIP) addresses on the tunnel interface.

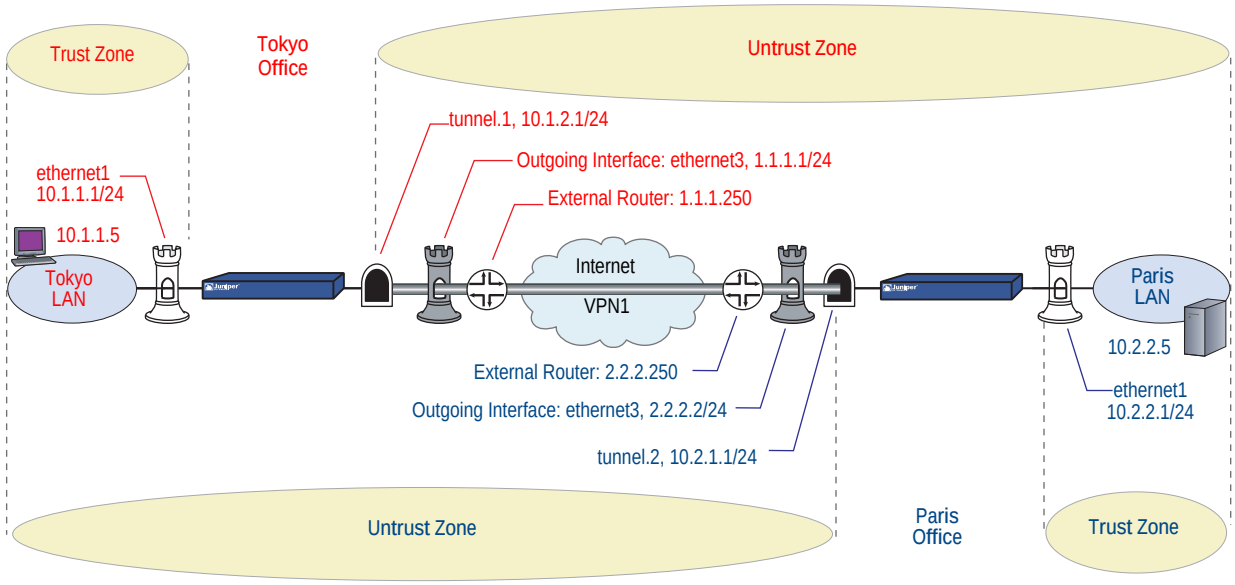
NOTE: For an example of a route-based VPN configuration for a dialup client, see “Route-Based Dialup VPN, Dynamic Peer” on page 5-180.

Packet Flow: Site-to-Site VPN

To better understand how the various components comprising the creation of an IPsec tunnel work in relation to each other, this section looks at the processing of a packet flow through a tunnel—both when a security device sends outbound VPN traffic and when it receives inbound VPN traffic. The processing for a route-based VPN is presented, followed by an addendum noting the two places in the flow that differ for a policy-based VPN.

A company based in Tokyo has just opened a branch office in Paris and needs to connect the two sites through an IPsec tunnel. The tunnel uses AutoKey IKE, the ESP protocol, AES for encryption, SHA-1 for authentication using a preshared key, and has anti-replay checking enabled. The security devices protecting each site are in NAT mode, and all the zones are in the trust-vr routing domain. The addresses are as shown in Figure 23 on page 77.

Figure 23: Site-to-Site VPN Tunnel



The path of a packet coming from 10.1.1.5/32 in the Tokyo LAN and going to 10.2.2.5/32 in the Paris LAN through an IPsec tunnel proceeds as described in the following subsections.

Tokyo (Initiator)

1. The host at 10.1.1.5 sends a packet destined for 10.2.2.5 to 10.1.1.1, which is the IP address ethernet1 and is the default gateway configured in the TCP/IP settings of host.

2. The packet arrives at ethernet1, which is bound to the Trust zone.

3. If you have enabled SCREEN options such as IP spoof detection for the Trust zone, the security device activates the SCREEN module at this point. SCREEN checking can produce one of the following three results:

   - If a SCREEN mechanism detects anomalous behavior for which it is configured to block the packet, the security device drops the packet and makes an entry in the event log.

   - If a SCREEN mechanism detects anomalous behavior for which it is configured to record the event but not block the packet, the security device records the event in the SCREEN counters list for ethernet1 and proceeds to the next step.

   - If the SCREEN mechanisms detect no anomalous behavior, the security device proceeds to the next step.

   If you have not enabled any SCREEN options for the Trust zone, the security device immediately proceeds to the next step.

4. The session module performs a session lookup, attempting to match the packet with an existing session.

   If the packet does not match an existing session, the security device performs First Packet Processing, a procedure involving the remaining steps.

   If the packet matches an existing session, the security device performs Fast Processing, using the information available from the existing session entry to process the packet. Fast Processing bypasses the route and policy lookups because the information generated by the bypassed steps has already been obtained during the processing of the first packet in the session.

5. The address-mapping module checks if a Mapped IP (MIP) configuration uses the destination IP address 10.2.2.5. Because 10.2.2.5 is not used in a MIP configuration, the security device proceeds to the next step. (For information about packet processing when MIPs, VIPs, or destination address translation [NAT-dst] is involved, see “Packet Flow for NAT-Dst” on page 8-29.)

6. To determine the destination zone, the route module does a route lookup for 10.2.2.5. (The route module uses the ingress interface to determine which virtual router to use for the route lookup.) It finds a route entry directing traffic to 10.2.2.5 through the tunnel.1 interface bound to a VPN tunnel named “vpn1”. The tunnel interface is in the Untrust zone. By determining the ingress and egress interfaces, the security device has thereby determined the source and destination zones and can now do a policy lookup.

7. The policy engine does a policy lookup between the Trust and Untrust zones (as determined by the corresponding ingress and egress interfaces). The action specified in the policy matching the source address and zone, destination address and zone, and service is permit.

8. The IPsec module checks if an active Phase 2 security association (SA) exists with the remote peer. The Phase 2 SA check can produce either of the following results:

   - If the IPsec module discovers an active Phase 2 SA with that peer, it proceeds to step 10.

   - If the IPsec module does not discover an active Phase 2 SA with that peer, it drops the packet and triggers the IKE module.

9. The IKE module checks if an active Phase 1 SA exists with the remote peer. The Phase 1 SA check can produce either of the following results:

   - If the IKE module discovers an active Phase 1 SA with the peer, it uses this SA to negotiate a Phase 2 SA.

   - If the IKE module does not discover an active Phase 1 SA with that peer, it begins Phase 1 negotiations in main mode, and then Phase 2 negotiations.

10. The IPsec module puts an ESP header and then an outer IP header on the packet. Using the address specified as the outgoing interface, it puts 1.1.1.1 as the source IP address in the outer header. Using the address specified for remote gateway, it puts 2.2.2.2 as the destination IP address in the outer header. Next, it encrypts the packet from the payload to the next header field in the original IP header. Then, it authenticates the packet from the ESP trailer to the ESP header.

11. The security device sends the encrypted and authenticated packet destined for 2.2.2.2 through the outgoing interface (ethernet3) to the external router at 1.1.1.250.

Paris (Recipient)

1. The packet arrives at 2.2.2.2, which is the IP address of ethernet3, an interface bound to the Untrust zone.

2. Using the SPI, destination IP address, and IPsec protocol contained in the outer packet header, the IPsec module attempts to locate an active Phase 2 SA with the initiating peer along with the keys to authenticate and decrypt the packet. The Phase 2 SA check can produce one of the following three results:

   - If the IPsec module discovers an active Phase 2 SA with the peer, it proceeds to step 4.

   - If the IPsec module does not discover an active Phase 2 SA with the peer but it can match an inactive Phase 2 SA using the source IP address but not the SPI, it drops the packet, makes an event log entry, and sends a notification that it received a bad SPI to the initiating peer.

   - If the IPsec module does not discover an active Phase 2 SA with that peer, it drops the packet and triggers the IKE module.

3. The IKE module checks if an active Phase 1 SA exists with the remote peer. The Phase 1 SA check can produce either of the following results:

   - If the IKE module discovers an active Phase 1 SA with the peer, it uses this SA to negotiate a Phase 2 SA.

   - If the IKE module does not discover an active Phase 1 SA with that peer, it begins Phase 1 negotiations in main mode, and then Phase 2 negotiations.

4. The IPsec module performs an anti-replay check. This check can produce one of two results:

   - If the packet fails the anti-replay check, because it detects a sequence number that the security device has already received, the security device drops the packet.

   - If the packet passes the anti-replay check, the security device proceeds to the next step.

5. The IPsec module attempts to authenticate the packet. The authentication check can produce one of two results:

   - If the packet fails the authentication check, the security device drops the packet.

   - If the packet passes the authentication check, the security device proceeds to the next step.

6. Using the Phase 2 SA and keys, the IPsec module decrypts the packet, uncovering its original source address (10.1.1.5) and its ultimate destination (10.2.2.5). It learns that the packet came through vpn1, which is bound to tunnel.1. From this point forward, the security device treats the packet as if its ingress interface is tunnel.1 instead of ethernet3. It also adjusts the anti-replay sliding window at this point.

7. If you have enabled SCREEN options for the Untrust zone, the security device activates the SCREEN module at this point. SCREEN checking can produce one of the following three results:

   - If a SCREEN mechanism detects anomalous behavior for which it is configured to block the packet, the security device drops the packet and makes an entry in the event log.

   - If a SCREEN mechanism detects anomalous behavior for which it is configured to record the event but not block the packet, the security device records the event in the SCREEN counters list for ethernet3 and proceeds to the next step.

   - If the SCREEN mechanisms detect no anomalous behavior, the security device proceeds to the next step.

8. The session module performs a session lookup, attempting to match the packet with an existing session. It then either performs First Packet Processing or Fast Processing.

   If the packet matches an existing session, the security device performs Fast Processing, using the information available from the existing session entry to process the packet. Fast Processing bypasses all but the last two steps (encrypting the packet and forwarding it) because the information generated by the bypassed steps has already been obtained during the processing of the first packet in the session.

9. The address-mapping module checks if a Mapped IP (MIP) or Virtual IP (VIP) configuration uses the destination IP address 10.2.2.5. Because 10.2.2.5 is not used in a MIP or VIP configuration, the security device proceeds to the next step.

10. The route module first uses the ingress interface to determine the virtual router to use for the route lookup; in this case, the trust-vr. It then performs a route lookup for 10.2.2.5 in the trust-vr and discovers that it is accessed through ethernet1. By determining the ingress interface (tunnel.1) and the egress interface (ethernet1), the security device can thereby determine the source and destination zones. The tunnel.1 interface is bound to the Untrust zone, and ethernet1 is bound to the Trust zone. The security device can now do a policy lookup.

11. The policy engine checks its policy list from the Untrust zone to the Trust zone and finds a policy that grants access.

12. The security device forwards the packet through ethernet1 to its destination at 10.2.2.5.

Addendum: Policy-Based VPN

The packet flow for a policy-based VPN configuration differs from that of a route-based VPN configuration at two points: the route lookup and the policy lookup.

Tokyo (Initiator)

The first stages of the outbound packet flow are the same for both route-based and policy-based VPN configurations until the route lookup and subsequent policy lookup occur:

- Route Lookup: To determine the destination zone, the route module does a route lookup for 10.2.2.5. Not finding an entry for that specific address, the route module resolves it to a route through ethernet3, which is bound to the Untrust zone. By determining the ingress and egress interfaces, the security device has thereby determined the source and destination zones, and can now perform a policy lookup.

- Policy Lookup: The policy engine does a policy lookup between the Trust and Untrust zones. The lookup matches the source address and zone, destination address and zone, and service and finds a policy that references a VPN tunnel named vpn1.

The security device then forwards the packet through ethernet1 to its destination at 10.2.2.5.

Paris (Recipient)

Most stages of the inbound packet flow on the recipient's end are the same for both route-based and policy-based VPN configurations except that the tunnel is not bound to a tunnel interface, but to a tunnel zone. The security device learns that the packet came through vpn1, which is bound to the Untrust-Tun tunnel zone, whose carrier zone is the Untrust zone. Unlike route-based VPNs, the security device considers ethernet3 to be the ingress interface of the decrypted packet—not tunnel.1.

The flow changes after packet decryption is complete. At this point, the route and policy lookups differ:

- Route Lookup: The route module performs a route lookup for 10.2.2.5 and discovers that it is accessed through ethernet1, which is bound to the Trust zone. By learning that the Untrust zone is the source zone (because vpn1 is bound to the Untrust-Tun tunnel zone, whose carrier zone is the Untrust zone) and by determining the destination zone based on the egress interface (ethernet1 is bound to the Trust zone), the security device can now check for a policy from the Untrust to the Trust zones that references vpn1.
- Policy Lookup: The policy engine checks its policy list from the Untrust zone to the Trust zone and finds a policy that references a VPN tunnel named vpn1 and that grants access to 10.2.2.5.

The security device then forwards the packet to its destination.

Tunnel Configuration Guidelines

This section offers some guidelines for configuring VPN tunnels. When configuring an IPsec VPN tunnel, you might want to consider the following:

- ScreenOS supports up to four proposals for Phase 1 negotiations and up to four proposals for Phase 2 negotiations. A peer must be configured to accept at least one Phase 1 proposal and one Phase 2 proposal proffered by the other peer. For information about Phase 1 and Phase 2 IKE negotiations, see “Tunnel Negotiation” on page 5-9.
- If you want to use certificates for authentication and there is more than one local certificate loaded on the security device, you must specify which certificate you want each VPN tunnel configuration to use. For more information about certificates, see “Public Key Cryptography” on page 5-29.
- For a basic policy-based VPN:
  - Use user-defined addresses in the policy, not the pre-defined address “Any”.
  - The addresses and service specified in policies configured at both ends of the VPN must match.
  - Use symmetric policies for bidirectional VPN traffic.
- The proxy ID for both peers must match, which means that the service specified in the proxy ID for both peers is the same, and the local IP address specified for one peer is the same as the remote IP address specified for the other peer.

NOTE: The proxy ID is a three-part tuple consisting of local IP address–remote IP address–service.

- For a route-based VPN configuration, the proxy ID is user-configurable.
- For a policy-based VPN configuration, the security device—by default—derives the proxy ID from the source address, destination address, and service specified in the policy that references that VPN tunnel in the policy list. You can also define a proxy ID for a policy-based VPN that supersedes the derived proxy ID.

The simplest way to ensure that the proxy IDs match is to use 0.0.0.0/0 for the local address, 0.0.0.0/0 for the remote address, and "any" for the service. Instead of using the proxy ID for access control, you use policies to control the traffic to and from the VPN. For examples of VPN configurations with user-configurable proxy IDs, see the route-based VPN examples in "Site-to-Site Virtual Private Networks" on page 5-91.

NOTE: When the remote address is the virtual internal address of a dialup VPN client, use 255.255.255.255/32 for the remote IP address /netmask in the proxy ID.

- As long as the peers' proxy ID settings match, it does not matter if one peer defines a route-based VPN and the other defines a policy-based VPN. If peer-1 uses a policy-based VPN configuration and peer-2 uses a route-based VPN configuration, then peer-2 must define a proxy ID that matches the proxy ID derived from peer-1's policy. If peer-1 performs Source Network Address Translation (NAT-src) using a DIP pool, use the address and netmask for the DIP pool as the remote address in peer-2's proxy ID. For example:

When the DIP Pool Is:	Use This in the Proxy ID:
1.1.1.8 – 1.1.1.8	1.1.1.8/32
1.1.1.20 – 1.1.1.50	1.1.1.20/26
1.1.1.100 – 1.1.1.200	1.1.1.100/25
1.1.1.0 – 1.1.1.255	1.1.1.0/24

For more information about proxy IDs when used with NAT-src and NAT-dst, see "VPN Sites with Overlapping Addresses" on page 5-152.

NOTE: Peer-1 can also define a proxy ID that matches peer-2's proxy ID. Peer-1's user-defined proxy ID supersedes the proxy ID that the security device derives from the policy components.

- Because proxy IDs support either a single service or all services, the service in a proxy ID derived from a policy-based VPN referencing a service group is considered as "any".
- When both peers have static IP addresses, they can each use the default IKE ID, which is their IP addresses. When a peer or dialup user has a dynamically assigned IP address, that peer or user must use another type of IKE ID. An FQDN is a good choice for a dynamic peer and a U-FQDN (email address) is a good choice for a dialup user. You can use both FQDN and U-FQDN IKE ID types with preshared keys and certificates (if the FQDN or U-FQDN appears in

the SubjectAltName field in the certificate). If you use certificates, the dynamic peer or dialup user can also use all or part of the ASN1-DN as the IKE ID.

Route-Based Virtual Private Network Security Considerations

Although route changes do not affect policy-based VPNs, route-based VPNs are a different matter. The security device can route packets through a route-based VPN tunnel with a combination of static routes and dynamic routing protocols. As long as no route change occurs, the security device consistently encrypts and forwards packets destined for tunnel interfaces bound to route-based VPN tunnels.

However, when using VPN monitoring with a route-based VPN tunnel configuration, the state of a tunnel might change from up to down. When this occurs, all route table entries referencing the tunnel interface bound to that tunnel change to inactive. Then, when the security device does a route lookup for traffic originally intended to be encrypted and sent through a tunnel bound to that tunnel interface, it bypasses the route referencing the tunnel interface and searches for a route with the next longest match. The route that it finds might be the default route. Using this route, the security device would then send the traffic unencrypted (that is, in *clear* or *plain text*) out through a non-tunnel interface to the public WAN.

To avoid rerouting traffic originally intended for a VPN tunnel to the public WAN in clear text, you can configure the security device to reroute such traffic to another tunnel, reroute it to a leased line, or just drop it, by using one of the following work-arounds:

- “Null Route” on page 5-84 (drops traffic when the route to the tunnel interface becomes inactive)
- “Dialup or Leased Line” on page 5-86 (reroutes traffic to an alternate secure path when the route to the tunnel interface becomes inactive)
- “Decoy Tunnel Interface” on page 5-89 (drops traffic when the route to the tunnel interface becomes inactive)
- “Virtual Router for Tunnel Interfaces” on page 5-90 (drops traffic when the route to the tunnel interface becomes inactive)
- “Reroute to Another Tunnel” on page 5-90 (reroutes traffic to an alternate VPN tunnel when the route to the tunnel interface becomes inactive)

Null Route

If the state of a VPN tunnel changes to “down,” the security device changes any route referencing that tunnel interface to “inactive.” If the route to the tunnel interface becomes unavailable and the next choice is the default route (for example), then the security device uses the default route to forward the traffic originally intended for the VPN tunnel. To avoid sending traffic in plain text out to the public WAN when a route change occurs, you can make use of a null route. A null route targets the same destination address as the route through the tunnel interface, but it instead points the traffic to the Null interface. The Null interface is a logical interface that drops traffic sent to it. You give the null route a higher metric (farther from zero) than the route using the tunnel interface so that the null route is less preferred.

NOTE: Releases prior to ScreenOS 5.1.0 do not support a null interface. However, you can use a decoy tunnel interface to accomplish the same objective. For information, see “Decoy Tunnel Interface” on page 5-89.

For example, if you create a static route through tunnel.1 to a remote LAN with the IP address 10.2.2.0/24, it automatically receives the default value of 1 for its metric:

```
set vrouter trust-vr route 10.2.2.0/24 interface tunnel.1
get route
…
Dest-Routes for <trust-vr> (4 entries)
```

	ID	IP-Prefix	Interface	Gateway	P	Pref	Mtr	Vsys
*	3	0.0.0.0/0	eth3	1.1.1.250	S	20	1	Root
*	2	1.1.1.0/24	eth3	0.0.0.0	C	0	0	Root
*	1	10.1.1.0/24	eth1	0.0.0.0	C	0	0	Root
*	4	10.2.2.0/24	tun.1	0.0.0.0	S	20	1	Root

In the above routing table, an asterisk (*) indicates that a route is active, S indicates a static route, and “C” indicates a connected route.

In the routing table above, the security device has two routes to reach any address in the 10.2.2.0/24 subnet. The first choice is route #4 because it has the longest match with that address. The second choice is the default route (0.0.0.0/0).

If you then add another route to 10.2.2.0/24 through the Null interface and give it a value greater than 1, that route becomes the second routing choice to any address in the 10.2.2.0/24 subnet. If the route to 10.2.2.0/24 through tunnel.1 becomes inactive, then the security device uses the route to the Null interface. The security device forwards traffic for 10.2.2.0/24 to that interface, and then drops it.

```
set vrouter trust-vr route 10.2.2.0/24 interface null metric 10
get route
…
Dest-Routes for <trust-vr> (5 entries)
```

	ID	IP-Prefix	Interface	Gateway	P	Pref	Mtr	Vsys
*	3	0.0.0.0/0	eth3	1.1.1.250	S	20	1	Root
*	2	1.1.1.0/24	eth3	0.0.0.0	C	0	0	Root
*	1	10.1.1.0/24	eth1	0.0.0.0	C	0	0	Root
	4	10.2.2.0/24	tun.1	0.0.0.0	S	20	1	Root
*	5	10.2.2.0/24	null	0.0.0.0	S	20	10	Root

In the routing table above, the route to 10.2.2.0/24 through tunnel.1 is inactive (indicated by the absence of an asterisk in the far left column). Therefore, the security device searches for the next route that has the longest match to the destination address, and it finds route #5. (The next choice after route #5 is the

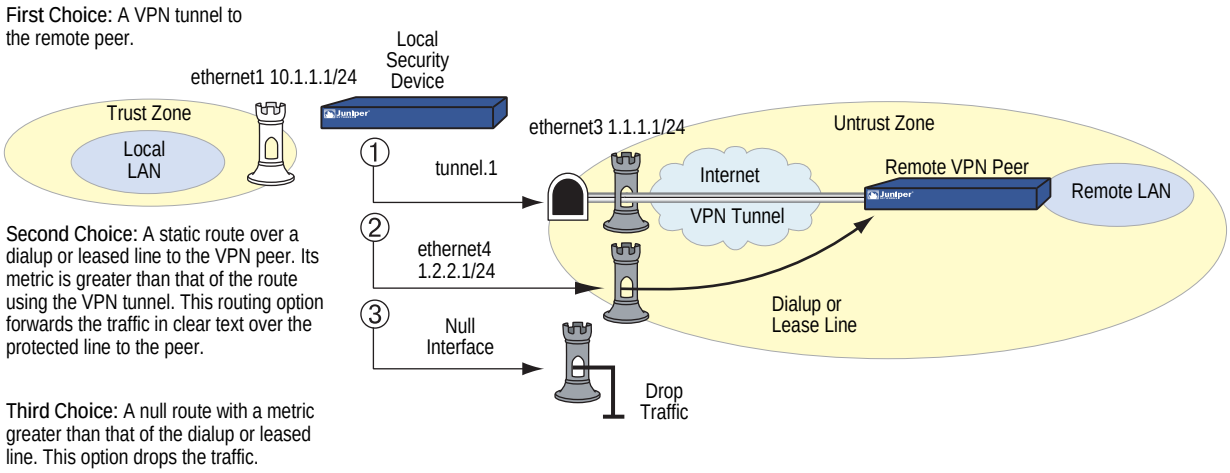
default route with ID #3.) The security device then forwards traffic for 10.2.2.0/24 to the null interface, which drops the traffic. As a result, if the route using tunnel.1 becomes inactive, the security device drops traffic for 10.2.2.0/24 rather than using route #3 to forward it out ethernet3 as clear text to the router at 1.1.1.250.

Dialup or Leased Line

If you do not want to drop traffic to a remote peer when the tunnel to that peer becomes inactive, you can add an alternate route to that peer that flows over a dialup or leased line. This alternate route uses the same destination IP address as that in the route through the VPN tunnel, but it has a different egress interface and a less-preferred metric. If the route through the VPN tunnel becomes inactive, then the security device reroutes traffic to the remote peer through the dialup or leased line.

When using a dialup or leased line as the next-choice route, there is still the possibility that both the first- and second-choice routes can become inactive at the same time. Then the security device resorts to the third choice, which might be the default route. In anticipation of such a situation, you can make the dialup or leased line route the second choice and the null route the third choice (see “Null Route” on page 5-84). Figure 24 shows how these options for handling a routing failover can work together.

Figure 24: Routing Failover Alternatives for VPN Traffic



VPN Failover to Leased Line or Null Route

In this example, you want traffic from the branch office behind Device A to reach the corporate network behind Device B over a secure VPN connection. If the tunnel fails, you then want traffic to flow over a leased line to the corporate office. If both the VPN tunnel and the leased line fail, you want Device A to drop the traffic rather than send it out onto the Internet in cleartext.

You create three routes on Device A to reach 10.2.2.0/24 and assign each a different metric:

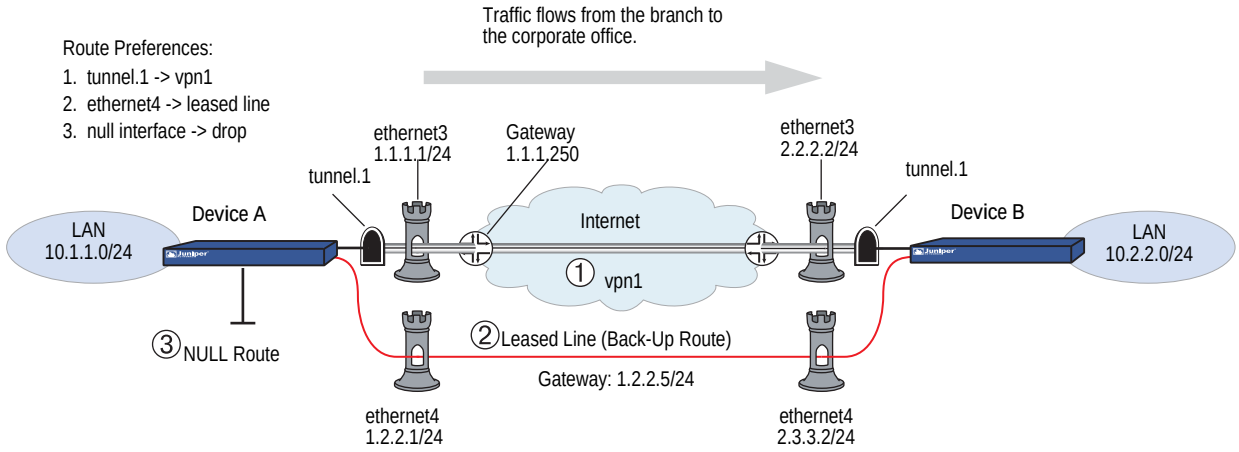
- Preferred Route—use tunnel.1, which is bound to vpn1 (metric = 1)
- Secondary Route—use ethernet4 and the gateway at 1.2.2.5 to use the leased line (metric = 2)
- Tertiary Route—use the null interface to drop traffic (metric = 10)

When you create the preferred route, you use the default metric for a static route, which is 1. You assign a metric of 2 to the secondary route; that is, the backup route over the leased line (shown in Figure 25 on page 87). The metric is less than that of the preferred route through the VPN tunnel. The security device does not use the secondary route unless the preferred route through the VPN tunnel fails.

Finally, you add a NULL route with a metric of 10. If the preferred route fails and then the secondary route fails, the security device drops all packets. All the security zones are in the trust-vr routing domain.

NOTE: This example shows only the configuration for four routes—three for the failovers plus the default route—on Device A.

Figure 25: Routing Failover to a Leased Line and Then to a Null Route



WebUI (Device A)

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250
Metric: 1

Network > Routing > Routing Entries > trust-vr New: Enter the following and then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0
Metric: 1

Network > Routing > Routing Entries > trust-vr New: Enter the following and then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: ethernet4
Gateway IP Address: 1.2.2.5
Metric: 2

Network > Routing > Routing Entries > trust-vr New: Enter the following and then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

CLI (Device A)

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.2.2.0/24 interface tunnel.1
set vrouter trust-vr route 10.2.2.0/24 interface ethernet4 gateway 1.2.2.5 metric
    2
set vrouter trust-vr route 10.2.2.0/24 interface null metric 10
save
```

You can verify that the new routes are present by executing the get route command.

```
device-C-> get route


IPv4 Dest-Routes for <untrust-vr> (0 entries)
--------------------------------------------------------------------------------
H: Host C: Connected S: Static A: Auto-Exported
I: Imported R: RIP P: Permanent D: Auto-Discovered
iB: IBGP eB: EBGP O: OSPF E1: OSPF external type 1
E2: OSPF external type 2


IPv4 Dest-Routes for <trust-vr> (7 entries)
--------------------------------------------------------------------------------
   ID          IP-Prefix      Interface         Gateway   P Pref    Mtr      Vsys
--------------------------------------------------------------------------------
*   8           0.0.0.0/0         eth1/1     10.100.37.1   S   20      1      Root
*   7         1.1.1.1/32          eth1/2         0.0.0.0   H    0      0      Root
*   3     192.168.1.1/32             mgt         0.0.0.0   H    0      0      Root
*   2     192.168.1.0/24             mgt         0.0.0.0   C    0      0      Root
*   4     10.100.37.0/24          eth1/1         0.0.0.0   C    0      0      Root
*   5   10.100.37.170/32          eth1/1         0.0.0.0   H    0      0      Root
*   6         1.1.1.0/24          eth1/2         0.0.0.0   C    0      0      Root
```

The route table entry with ID 5 directs traffic for 10.2.2.0/24 to tunnel.1 and then through the VPN tunnel. It is the preferred route for traffic to reach the 10.2.2.0 network. If that tunnel fails, the next best route is route entry 6 over a leased line through a gateway at 1.2.2.5. If the connection for route entry 6 fails, route entry 7 becomes the next best route, and the security device directs traffic for 10.2.2.0/24 to the null interface, which then drops it.

Decoy Tunnel Interface

Instead of failing over traffic from a VPN tunnel to a null interface (and then dropping it), you can use a nonfunctioning tunnel interface to accomplish the same objective.

NOTE: Releases prior to ScreenOS 5.1.0 do not support a null interface (see “Null Route” on page 5-84). However, you can use a decoy tunnel interface to accomplish the same objective.

To set up a decoy tunnel interface, do the following:

1. Create a second tunnel interface, but do not bind it to a VPN tunnel. Instead, bind it to a tunnel zone that is in the same virtual routing domain as the first tunnel interface.

NOTE: If a tunnel interface is bound to a tunnel zone, its status is always up.

---

2. Define a second route to the same destination using this second tunnel interface, and assign it a higher metric (farther from zero) than the preferred route.

   If the state of the functioning tunnel interface changes from up to down and the route table entry referencing that interface becomes inactive, all subsequent route lookups find this second route to the nonfunctioning tunnel interface. The security device forwards traffic to the second tunnel interface and because it is not bound to a VPN tunnel, the device drops the traffic.

Virtual Router for Tunnel Interfaces

To avoid the case where the route through a VPN tunnel becomes deactivated and then fails over traffic originally intended to pass through the tunnel to the default route, you can create a special virtual routing domain exclusively for VPN traffic. To set this up, take the following steps:

1. Create a separate virtual router to use for all routes pointing to tunnel interfaces and name it, for example, “VR-VPN.”

2. Create a security zone—named, for example, “VPN zone”—and bind it to VR-VPN.

3. Bind all tunnel interfaces to the VPN zone, and also put all addresses for remote sites that you want to reach through VPN tunnels in this zone.

4. Configure static routes in all other virtual routers to VR-VPN for traffic that you want encrypted and sent through the tunnels. If necessary, define static routes for decrypted traffic from VR-VPN to the other virtual routers. Such routes are necessary to allow inbound VPN traffic through the tunnel if it is initiated from the remote site.

   If the state of a tunnel interface changes from up to down, the security device still forwards traffic to VR-VPN, where—because the state of the route to that interface is now inactive and there are no other matching routes—the security device drops the traffic.

Reroute to Another Tunnel

You can configure two or more VPN tunnels to the same remote peer. If one tunnel goes down, the security device can then reroute traffic through another VPN tunnel. For information and examples about configuring redundant VPN tunnels, see the following:

- “Active-to-Backup Tunnel Failover” on page 11-57
- “Configuring Dual Active Tunnels” on page 11-76
- “Configuring Tunnel Failover Weights” on page 11-83

Chapter 4

Site-to-Site Virtual Private Networks

This chapter explains how to configure a site-to-site virtual private network (VPN) tunnel between two Juniper Networks security devices. It examines route-based and policy-based VPN tunnels, presents the various elements that you must consider when setting up a tunnel, and offers several examples.

This chapter contains the following sections:

Site-to-Site VPN Configurations

An IPsec VPN tunnel exists between two gateways, and each gateway needs an IP address. When both gateways have static IP addresses, you can configure the following kinds of tunnels:

- Site-to-Site VPN, AutoKey IKE tunnel (with a preshared key or certificates)
- Site-to-Site VPN, Manual Key tunnel

When one gateway has a static address and the other has a dynamically assigned address, you can configure the following kind of tunnel:

- Dynamic Peer Site-to-Site VPN, AutoKey IKE tunnel (with a preshared key or certificates)

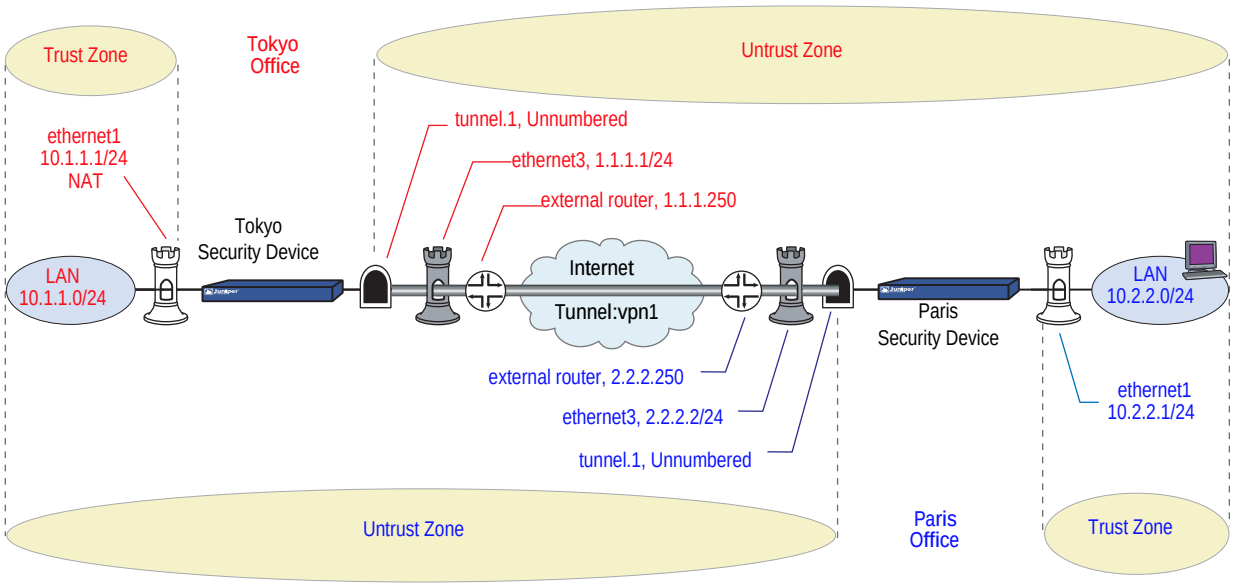
As used here, a static site-to-site VPN involves an IPsec tunnel connecting two sites, each with a security device operating as a secure gateway. The physical interface or subinterface used as the outgoing interface on both devices has a fixed IP address, and the internal hosts also have static IP addresses. If the security device is in transparent mode, it uses the VLAN1 address as the IP address for the outgoing interface. With a static site-to-site VPN, hosts at either end of the tunnel can initiate the VPN tunnel setup because the IP address of the remote gateway remains constant and thus reachable.

If the outgoing interface of one of the security devices has a dynamically assigned IP address, that device is termed a dynamic peer and the VPN is configured differently. With a dynamic peer site-to-site VPN, only hosts behind the dynamic peer can initiate the VPN tunnel setup because only their remote gateway has a fixed IP address and is thus reachable from their local gateway. However, after a tunnel is established between a dynamic peer and a static peer, hosts behind either gateway can initiate VPN traffic if the destination hosts have fixed IP addresses.

NOTE: For background information about the available VPN options, see “Internet Protocol Security” on page 1. For guidance when choosing among the various options, see “Virtual Private Network Guidelines” on page 59.

The configuration of a site-to-site VPN tunnel requires the coordination of the tunnel configuration with that of other settings—interfaces, addresses, routes, and policies. The three example VPN configurations in this section are set in the following context: an office in Tokyo wants to communicate securely with an office in Paris through an IPsec VPN tunnel.

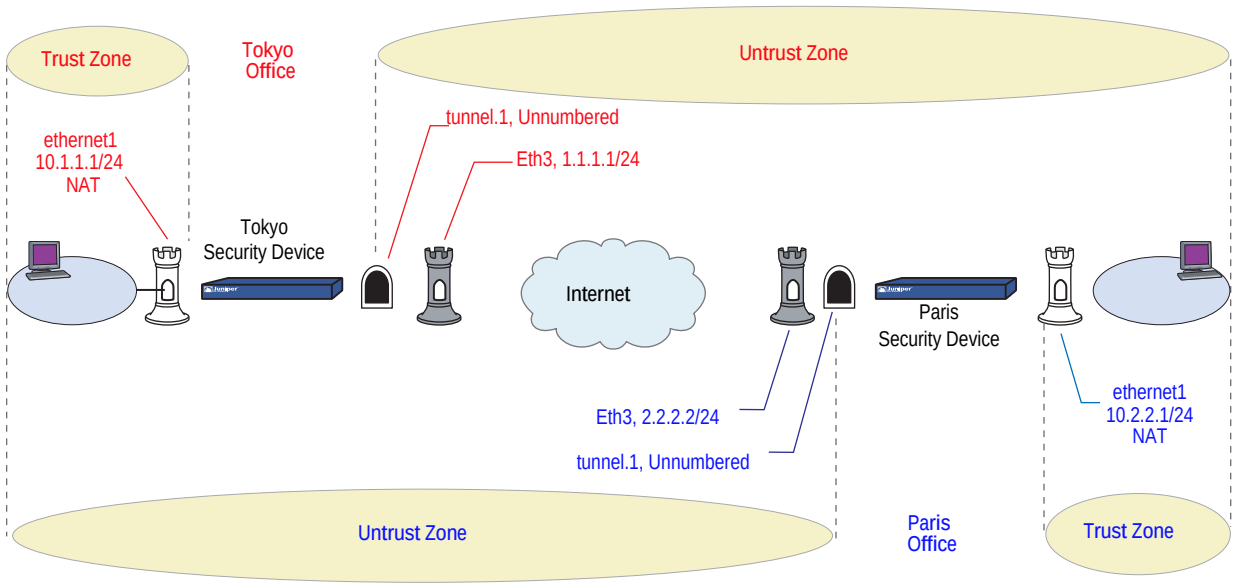
Figure 26: Site-to-Site VPN Tunnel Configuration



The administrators in both offices configure the following settings:

- Interfaces – Security Zones and Tunnel
- Addresses
- VPN (one of the following)
  - AutoKey IKE
  - Dynamic Peer
  - Manual Key
- Routes
- Policies

Figure 27: Site-to-Site Tunnel Configuration—Interfaces



1. Interfaces – Security Zones and Tunnel

The admin at the Tokyo office configures the security zone and tunnel interfaces with the settings that appear in the upper half of Figure 27. The admin at the Paris office does likewise with the settings that appear in the lower half of the figure.

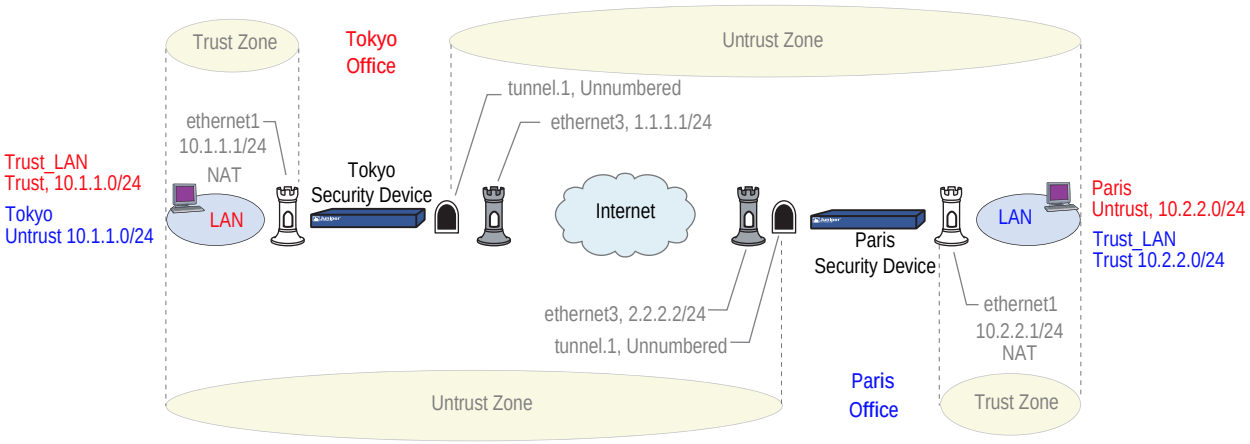
Ethernet3 is going to be the outgoing interface for VPN traffic and the remote gateway for VPN traffic sent from the other end of the tunnel.

Ethernet1 is in NAT mode so each admin can assign IP addresses to all the internal hosts, yet when traffic passes from the Trust zone to the Untrust zone, the security device translates the source IP address in the packet headers to the address of the Untrust zone interface, ethernet3—1.1.1.1 for Tokyo, and 2.2.2.2 for Paris.

For a route-based VPN, each admin binds the tunnel interface tunnel.1 to the VPN tunnel vpn1. By defining a route to the address space of the remote office LAN, the security device can direct all traffic bound for that LAN to the tunnel.1 interface and thus through the tunnel to which tunnel.1 is bound.

Because policy-based NAT services are not needed, a route-based VPN configuration does not require tunnel.1 to have an IP address/netmask, and a policy-based VPN configuration does not even require a tunnel interface.

Figure 28: Site-to-Site Tunnel Configuration—Addresses



2. Addresses

The admins define addresses for later use in inbound and outbound policies. The admin at the Tokyo office defines the addresses that appear in the upper half of Figure 28. The admin at the Paris office does likewise with the addresses that appear in the lower half of the figure.

For policy-based VPNs, the security device derives proxy IDs from policies. Because the proxy IDs used by the security devices at both ends of the VPN tunnel must match perfectly, you cannot use the predefined address "ANY," whose IP address is 0.0.0.0/0, at one end of the tunnel if you use a more specific address at the other end. For example:

If the proxy ID in Tokyo is as follows:

From: 0.0.0.0/0
To: 10.2.2.0/24
Service: ANY

And if the proxy ID in Paris is as follows:

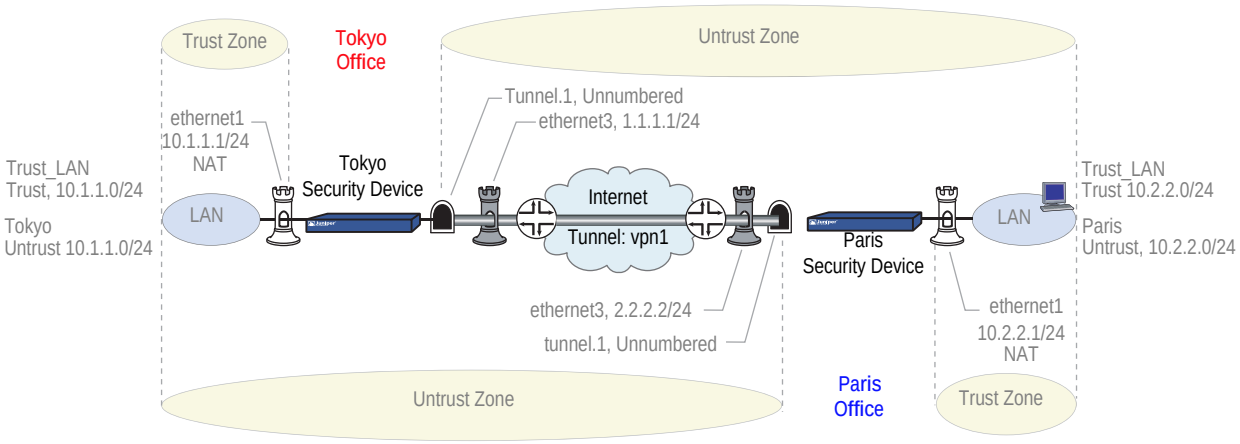
To: 10.1.1.0/24
From: 10.2.2.0/24
Service: ANY

Then the proxy IDs do not match, and IKE negotiations will fail.

NOTE: Beginning with ScreenOS 5.0.0, you can also define proxy IDs for VPN tunnels referenced in policy-based VPN configurations.

For route-based VPNs, you can use "0.0.0.0/0–0.0.0.0/0–any" to define the local and remote IP addresses and service type for a proxy ID. You can then use more restrictive policies to filter the inbound and outbound VPN traffic by source address, destination address, and service type.

Figure 29: Site-to-Site Tunnel Configuration—VPN Tunnel



3. VPN

You can configure one of the following three VPNs:

- AutoKey IKE

  The AutoKey IKE method uses a preshared key or a certificate to refresh—that is, change—the encryption and authentication keys automatically at user-defined intervals (known as key lifetimes). Essentially, frequently updating these keys strengthens security, although excessively short lifetimes might reduce overall performance.

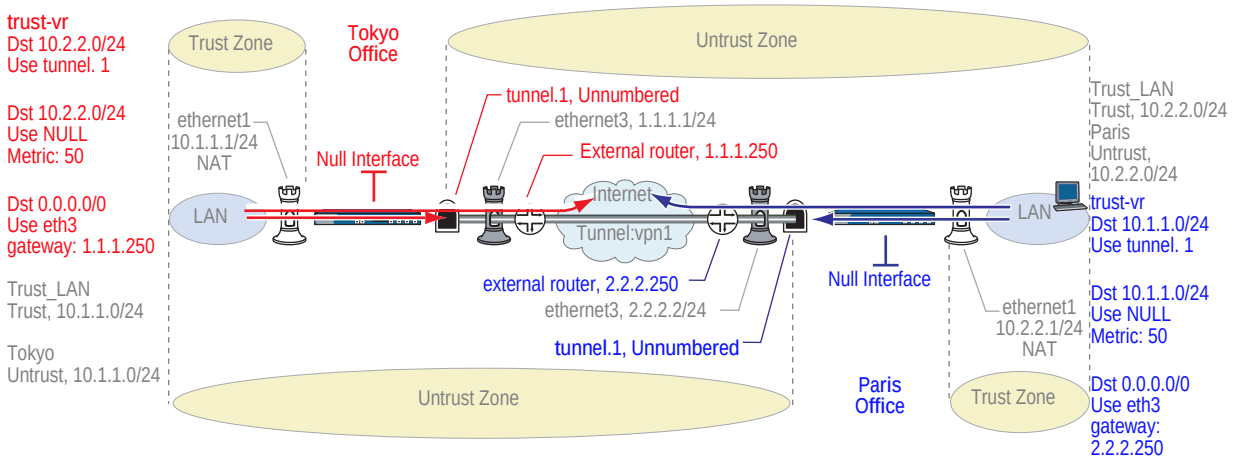
- Dynamic Peer

  A dynamic peer is a remote gateway that has a dynamically assigned IP address. Because the IP address of the remote peer might be different each time IKE negotiations begin, hosts behind the peer must initiate VPN traffic. Also—if using a preshared key for authentication—the peer must send an IKE ID during the first message of Phase 1 negotiations in aggressive mode to identify itself.

- Manual Key

  The Manual Key method requires you to set and update the encryption and authentication keys manually. This method is a viable option for a small set of VPN tunnels.

Figure 30: Site-to-Site Tunnel Configuration—Routes



4. Routes

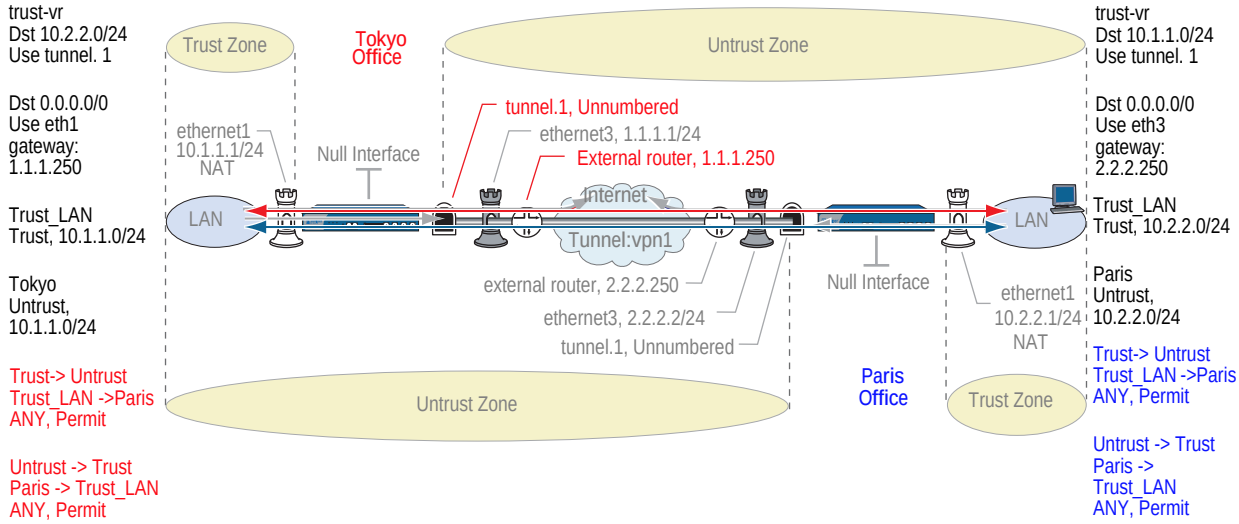
The admins at each site must configure at least the following routes:

- A route for traffic to reach an address on the remote LAN to use tunnel.1
- A default route for all other traffic, including the outer VPN tunnel traffic, to reach the internet through ethernet3 and then the external router beyond it—1.1.1.250 for the Tokyo office and 2.2.2.250 for Paris. The external router is the default gateway to which the security device forwards any traffic for which it does not have a specific route in its routing table.

NOTE: If the security device at the Tokyo office receives its external IP address dynamically from its ISP (that is, from the point of view of the Paris office, the security device at the Tokyo office is its dynamic peer), then the ISP automatically provides the Tokyo device with its default gateway IP address.

- A null route so that if the state of tunnel.1 ever changes to “down” and any route referencing tunnel.1 becomes deactivated, the security device does not use the default route to forward traffic destined to the remote LAN unencrypted out ethernet3. A null route uses the remote LAN as the destination address, but it points traffic to the Null interface, a logical interface that drops traffic sent to it. You give the null route a higher metric (farther from zero) than the route to the remote LAN using tunnel.1, making the null route less preferred than the route referencing the tunnel.1 interface.

Figure 31: Site-to-Site Tunnel Configuration—Policies



5. Policies

The admins at each site define policies to permit traffic between the two offices:

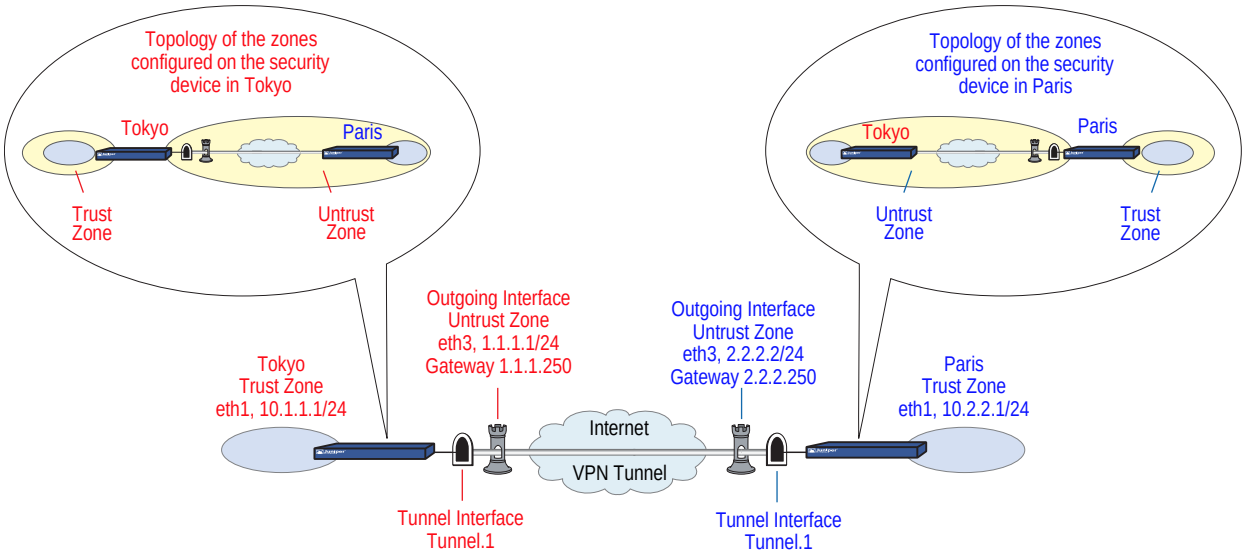
- A policy permitting any kind of traffic from “Trust_LAN” in the Trust zone to “Paris” or “Tokyo” in the Untrust zone
- A policy permitting any kind of traffic from “Paris” or “Tokyo” in the Untrust zone to “Trust_LAN” in the Trust zone

Because the preferred route to the remote site specifies tunnel.1, which is bound to the VPN tunnel vpn1, the policy does not need to reference the VPN tunnel.

Route-Based Site-to-Site VPN, AutoKey IKE

In this example, an AutoKey IKE tunnel using either a preshared secret or a pair of certificates (one at each end of the tunnel) provides the secure connection between the Tokyo and Paris offices. For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined “Compatible” set of proposals for Phase 2. All zones are in the trust-vr.

Figure 32: Route-Based Site-to-Site VPN, AutoKey IKE



Setting up a route-based AutoKey IKE tunnel using either a preshared secret or certificates, involves the following steps:

1. Assign IP addresses to the physical interfaces bound to the security zones and to the tunnel interface.

2. Configure the VPN tunnel, designate its outgoing interface in the Untrust zone, bind it to the tunnel interface, and configure its proxy-ID.

3. Enter the IP addresses for the local and remote endpoints in the address books for the Trust and Untrust zones.

4. Enter a default route to the external router in the trust-vr, a route to the destination through the tunnel interface, and a null route to the destination. You assign a higher metric (farther from zero) to the null route so that it becomes the next-choice route to the destination. Then, if the state of the tunnel interface changes to “down” and the route referencing that interface becomes inactive, the security device uses the null route, which essentially drops any traffic sent to it, rather than the default route, which forwards unencrypted traffic.

5. Set up policies for VPN traffic to pass between each site.

In the following examples, the preshared key is h1p8A24nG5. It is assumed that both participants already have RSA certificates and are using Entrust as the certificate authority (CA). (For information about obtaining and loading certificates, see “Certificates and CRLs” on page 35.)

WebUI (Tokyo)

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24

   Select the following, then click OK:

   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Untrust (trust-vr)
   Unnumbered: (select)
   Interface: ethernet3 (trust-vr)

2. **Addresses**
   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Trust_LAN
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

   Policy > Policy Elements > > Addresses > List > New: Enter the following, then click OK:

   Address Name: Paris_Office
   IP Address/Domain Name:
   IP/Netmask: (select), 10.2.2.0/24
   Zone: Untrust

3. **VPN**
   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gateway Name: To_Paris
   Security Level: Custom
   Remote Gateway Type:
   Static IP Address: (select), IP Address/Hostname: 2.2.2.2

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (for Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Main (ID Protection)

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (for Custom Security Level): rsa-g2-3des-sha
Preferred certificate (optional)
Peer CA: Entrust
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Tokyo_Paris
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Paris

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Security Level: Compatible
Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.1.1.0/24
Remote IP / Netmask: 10.2.2.0/24
Service: ANY

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: Tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To Paris
Source Address: Trust_LAN
Destination Address: Paris_Office
Service: ANY
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) > New: Enter the following, then click OK:

Name: From Paris
Source Address: Paris_Office
Destination Address: Trust_LAN
Service: ANY
Action: Permit
Position at Top: (select)

WebUI (Paris)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. Addresses

Policy > Policy Elements > > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Trust

Policy > Policy Elements > > Addresses > List > New: Enter the following, then click OK:

Address Name: Tokyo_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Tokyo
Security Level: Custom
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 1.1.1.1

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Main (ID Protection)

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (for Custom Security Level): rsa-g2-3des-sha
Preferred certificate (optional)
Peer CA: Entrust
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

Name: Paris_Tokyo
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Tokyo

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Security Level: Compatible
Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.2.2.0/24
Remote IP / Netmask: 10.1.1.0/24
Service: ANY

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To_Tokyo
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Tokyo_Office
Service: ANY
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Name: From_Tokyo
Source Address:
Address Book Entry: (select), Tokyo_Office
Destination Address:
Address Book Entry: (select), Trust_LAN
Service: ANY
Action: Permit
Position at Top: (select)

CLI (Tokyo)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust Paris_Office 10.2.2.0/24
```

3. VPN

Preshared Key

```
set ike gateway To_Paris address 2.2.2.2 main outgoing-interface ethernet3
    preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn Tokyo_Paris gateway To_Paris sec-level compatible
set vpn Tokyo_Paris bind interface tunnel.1
set vpn Tokyo_Paris proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.2.0/24 any
```

(or)

Certificate

```
set ike gateway To_Paris address 2.2.2.2 main outgoing-interface ethernet3
    proposal rsa-g2-3des-sha
set ike gateway To_Paris cert peer-ca 1
set ike gateway To_Paris cert peer-cert-type x509-sig
set vpn Tokyo_Paris gateway To_Paris sec-level compatible
set vpn Tokyo_Paris bind interface tunnel.1
set vpn Tokyo_Paris proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.2.0/24 any
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get ike ca.

---

4. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.2.2.0/24 interface tunnel.1
set vrouter trust-vr route 10.2.2.0/24 interface null metric 10
```

5. Policies

```
set policy top name "To Paris" from trust to untrust Trust_LAN Paris_Office any
    permit
set policy top name "From Paris" from untrust to trust Paris_Office Trust_LAN any
    permit
save
```

CLI (Paris)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.2.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address trust Trust_LAN 10.2.2.0/24
set address untrust Tokyo_Office 10.1.1.0/24
```

3. VPN

Preshared Key

```
set ike gateway To_Tokyo address 1.1.1.1 main outgoing-interface ethernet3
    preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn Paris_Tokyo gateway To_Tokyo sec-level compatible
set vpn Paris_Tokyo bind interface tunnel.1
set vpn Paris_Tokyo proxy-id local-ip 10.2.2.0/24 remote-ip 10.1.1.0/24 any
```

(or)

Certificate

```
set ike gateway To_Tokyo address 1.1.1.1 main outgoing-interface ethernet3
    proposal rsa-g2-3des-sha
set ike gateway To_Tokyo cert peer-ca 1
set ike gateway To_Tokyo cert peer-cert-type x509-sig
set vpn Paris_Tokyo gateway To_Tokyo sec-level compatible
set vpn Paris_Tokyo bind interface tunnel.1
set vpn Paris_Tokyo proxy-id local-ip 10.2.2.0/24 remote-ip 10.1.1.0/24 any
```

4. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.1.1.0/24 interface null metric 10
```

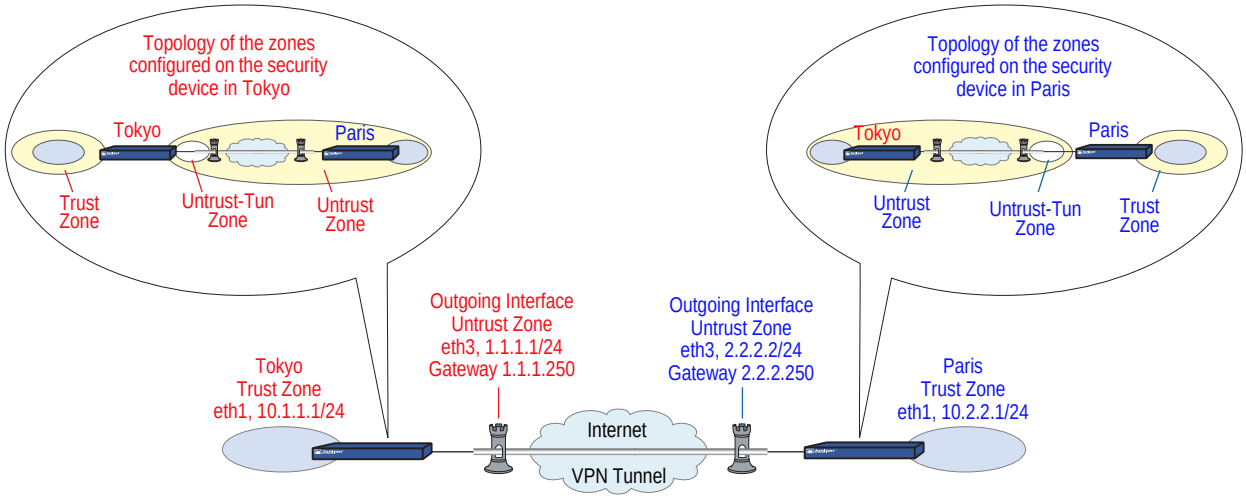
5. Policies

```
set policy top name “To Tokyo” from trust to untrust Trust_LAN Tokyo_Office any
    permit
set policy top name “From Tokyo” from untrust to trust Tokyo_Office Trust_LAN any
    permit
save
```

Policy-Based Site-to-Site VPN, AutoKey IKE

In this example, an AutoKey IKE tunnel using either a preshared secret or a pair of certificates (one at each end of the tunnel) provides the secure connection between the Tokyo and Paris offices. For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined “Compatible” set of proposals for Phase 2. All zones are in the trust-vr.

Figure 33: Policy-Based Site-to-Site VPN, AutoKey IKE



Setting up the AutoKey IKE tunnel using AutoKey IKE, with either a preshared secret or certificates, involves the following steps:

1. Define security zone interface IP addresses.
2. Make address book entries for the local and remote end entities.
3. Define the remote gateway and key exchange mode, and specify either a preshared secret or a certificate.
4. Create the Autokey IKE VPN.
5. Set a default route to the external router.
6. Configure policies.

In the following examples, the preshared key is h1p8A24nG5. It is assumed that both participants already have RSA certificates and are using Entrust as the certificate authority (CA). (For information about obtaining and loading certificates, see “Certificates and CRLs” on page 35.)

WebUI (Tokyo)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Paris_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Paris
Security Level: Custom
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 2.2.2.2

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click OK to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Main (ID Protection)

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click OK to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Main (ID Protection)
Preferred certificate (optional)
Peer CA: Entrust
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Tokyo_Paris
Security Level: Compatible
Remote Gateway: Predefined: (select), To_Paris

4. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To/From Paris
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Paris_Office
Service: ANY
Action: Tunnel
Tunnel VPN: Tokyo_Paris
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

WebUI (Paris)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Tokyo_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Tokyo
Security Level: Custom
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 1.1.1.1

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Main (ID Protection)

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Main (ID Protection)
Preferred certificate (optional)
Peer CA: Entrust
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Paris_Tokyo
Security Level: Compatible
Remote Gateway: Predefined: (select), To_Tokyo

4. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To/From Tokyo
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Tokyo_Office
Service: ANY
Action: Tunnel
Tunnel VPN: Paris_Tokyo
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

CLI (Tokyo)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. Addresses

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust paris_office 10.2.2.0/24
```

3. VPN

Preshared Key

```
set ike gateway to_paris address 2.2.2.2 main outgoing-interface ethernet3
    preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn tokyo_paris gateway to_paris sec-level compatible
```

(or)

Certificates

```
set ike gateway to_paris address 2.2.2.2 main outgoing-interface ethernet3
    proposal rsa-g2-3des-sha
set ike gateway to_paris cert peer-ca 1
set ike gateway to_paris cert peer-cert-type x509-sig
set vpn tokyo_paris gateway to_paris sec-level compatible
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get ike ca.

4. Route

set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250

5. Policies

set policy top name "To/From Paris" from trust to untrust Trust_LAN paris_office any tunnel vpn tokyo_paris
set policy top name "To/From Paris" from untrust to trust paris_office Trust_LAN any tunnel vpn tokyo_paris
save

CLI (Paris)

1. Interfaces

set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.2.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24

2. Addresses

set address trust Trust_LAN 10.2.2.0/24
set address untrust tokyo_office 10.1.1.0/24

3. VPN

Preshared Key

set ike gateway to_tokyo address 1.1.1.1 main outgoing-interface ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn paris_tokyo gateway to_tokyo sec-level compatible

(or)

Certificates

set ike gateway to_tokyo address 1.1.1.1 main outgoing-interface ethernet3 proposal rsa-g2-3des-sha
set ike gateway to_tokyo cert peer-ca 1
set ike gateway to_tokyo cert peer-cert-type x509-sig
set vpn paris_tokyo gateway to_tokyo tunnel proposal nopfs-esp-3des-sha

4. Route

set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250

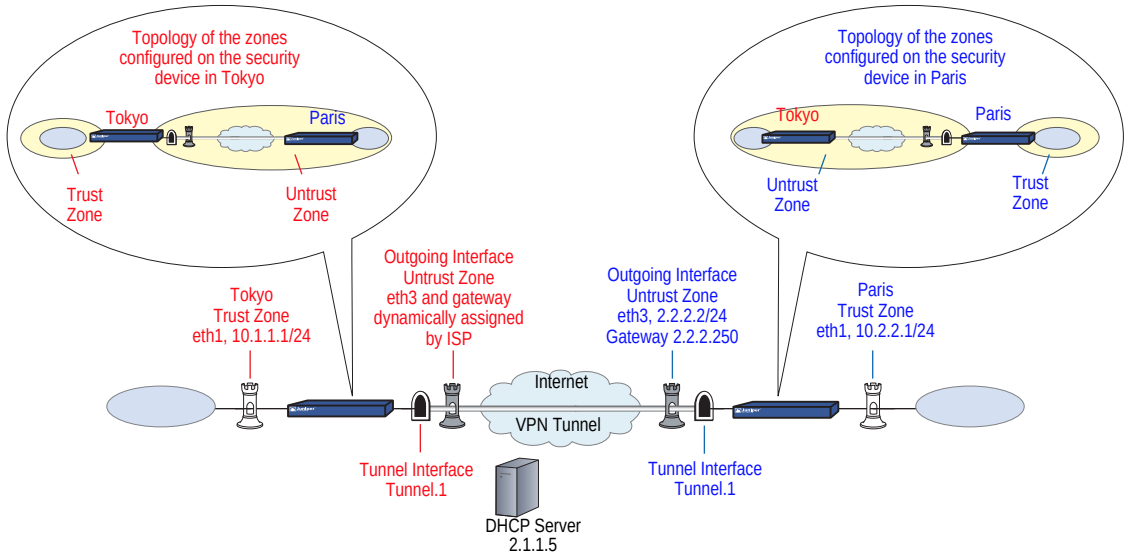
5. Policies

set policy top name "To/From Tokyo" from trust to untrust Trust_LAN tokyo_office any tunnel vpn paris_tokyo
set policy top name "To/From Tokyo" from untrust to trust tokyo_office Trust_LAN any tunnel vpn paris_tokyo
save

Route-Based Site-to-Site VPN, Dynamic Peer

In this example, an AutoKey IKE VPN tunnel using either a preshared key or a pair of certificates (one at each end of the tunnel) provides a secure connection between security devices protecting the Tokyo and Paris offices. The Untrust zone interface for the Paris security device has a static IP address. The ISP serving the Tokyo office assigns the IP address for the Untrust zone interface dynamically through DHCP. Because only the Paris security device has a fixed address for its Untrust zone, VPN traffic must originate from hosts in the Tokyo office. After a tunnel has been established, traffic through the tunnel can originate from either end. All security and tunnel zones are in the trust-vr.

Figure 34: Route-Based Site-to-Site VPN, Dynamic Peer



The preshared key is h1p8A24nG5. It is assumed that both participants already have RSA certificates from the certificate authority (CA) Verisign and that the email address *pmason@abc.com* appears in the local certificate on Device A. (For information about obtaining and loading certificates, see “Certificates and CRLs” on page 35.) For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the “Compatible” set of proposals for Phase 2.

You enter three routes on the security devices at each end of the VPN tunnel:

- A default route to the external router in the trust-vr
- A route to the destination through the tunnel interface
- A null route to the destination. You assign a higher metric (farther from zero) to the null route so that it becomes the next-choice route to the destination. Then, if the state of the tunnel interface changes to “down” and the route referencing that interface becomes inactive, the security device uses the null route, which essentially drops any traffic sent to it, rather than the default route, which forwards unencrypted traffic.

Finally, you configure policies to permit bidirectional traffic between the two sites.

WebUI (Tokyo)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click Apply:

Zone Name: Untrust

Enter the following, then click OK:

Obtain IP using DHCP: (select)

NOTE: You cannot specify the IP address of the DHCP server through the WebUI; however, you can do so through the CLI.

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Paris_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Paris
Security Level: Custom
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 2.2.2.2

Preshared Key

Preshared Key: h1p8A24nG5
Local ID: pmason@abc.com
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

(or)

Certificates

Local ID: pmason@abc.com
Outgoing Interface: ethernet3

NOTE: The U-FQDN "pmason@abc.com" must appear in the SubjectAltName field in the certificate.

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Tokyo_Paris
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Paris

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface: (select), tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.1.1.0/24
Remote IP / Netmask: 10.2.2.0/24
Service: ANY

4. **Routes**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 0.0.0.0

NOTE: The ISP provides the gateway IP address dynamically through DHCP.

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 10.2.2.0/24
   Gateway: (select)
   Interface: Tunnel.1
   Gateway IP Address: 0.0.0.0

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 10.2.2.0/24
   Gateway: (select)
   Interface: Null
   Gateway IP Address: 0.0.0.0
   Metric: 10

5. **Policies**

   Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Trust_LAN
   Destination Address:
   Address Book Entry: (select), Paris_Office
   Service: Any
   Action: Permit
   Position at Top: (select)

   Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Paris_Office
   Destination Address:
   Address Book Entry: (select), Trust_LAN
   Service: Any
   Action: Permit
   Position at Top: (select)

WebUI (Paris)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address: 2.2.2.2/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Tokyo_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Tokyo
Security Level: Custom
Remote Gateway Type:
Dynamic IP Address: (select), Peer ID: pmason@abc.com

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Paris_Tokyo
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Tokyo

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface: (select), tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.2.2.0/24
Remote IP / Netmask: 10.1.1.0/24
Service: ANY

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: (select), 2.2.2.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Tokyo_Office
Service: Any
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Tokyo_Office
Destination Address:
Address Book Entry: (select), Trust_LAN
Service: Any
Action: Permit
Position at Top: (select)

CLI (Tokyo)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 dhcp client
set interface ethernet3 dhcp client settings server 1.1.1.5
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust Paris_Office 10.2.2.0/24
```

3. VPN

Preshared Key

```
set ike gateway To_Paris address 2.2.2.2 aggressive local-id pmason@abc.com
    outgoing-interface ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn Tokyo_Paris gateway To_Paris tunnel sec-level compatible
set vpn Tokyo_Paris bind interface tunnel.1
set vpn Tokyo_Paris proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.2.0/24 any
```

(or)

Certificates

```
set ike gateway To_Paris address 2.2.2.2 aggressive local-id pmason@abc.com
    outgoing-interface ethernet3 proposal rsa-g2-3des-sha
set ike gateway To_Paris cert peer-ca 1
set ike gateway To_Paris cert peer-cert-type x509-sig
set vpn Tokyo_Paris gateway To_Paris tunnel sec-level compatible
set vpn Tokyo_Paris bind interface tunnel.1
set vpn Tokyo_Paris proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.2.0/24 any
```

NOTE: The U-FQDN "pmason@abc.com" must appear in the SubjectAltName field in the certificate.

The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get ike ca.

---

4. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3
set vrouter trust-vr route 10.2.2.0/24 interface tunnel.1
set vrouter trust-vr route 10.2.2.0/24 interface null metric 10
```

NOTE: The ISP provides the gateway IP address dynamically through DHCP, so you cannot specify it here.

---

5. Policies

```
set policy top from trust to untrust Trust_LAN Paris_Office any permit
set policy top from untrust to trust Paris_Office Trust_LAN any permit
save
```

CLI (Paris)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.2.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address trust Trust_LAN 10.2.2.0/24
set address untrust Tokyo_Office 10.1.1.0/24
```

3. VPN

Preshared Key

```
set ike gateway To_Tokyo dynamic pmason@abc.com aggressive outgoing-interface
    ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn Paris_Tokyo gateway To_Tokyo tunnel sec-level compatible
set vpn Paris_Tokyo bind interface tunnel.1
set vpn Paris_Tokyo proxy-id local-ip 10.2.2.0/24 remote-ip 10.1.1.0/24 any
```

(or)

Certificates

```
set ike gateway To_Tokyo dynamic pmason@abc.com aggressive outgoing-interface
    ethernet3 proposal rsa-g2-3des-sha
set ike gateway To_Tokyo cert peer-ca 1
set ike gateway To_Tokyo cert peer-cert-type x509-sig
set vpn Paris_Tokyo gateway To_Tokyo tunnel sec-level compatible
set vpn Paris_Tokyo bind interface tunnel.1
set vpn Paris_Tokyo proxy-id local-ip 10.2.2.0/24 remote-ip 10.1.1.0/24 any
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get ike ca.

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.1.1.0/24 interface null metric 10
```

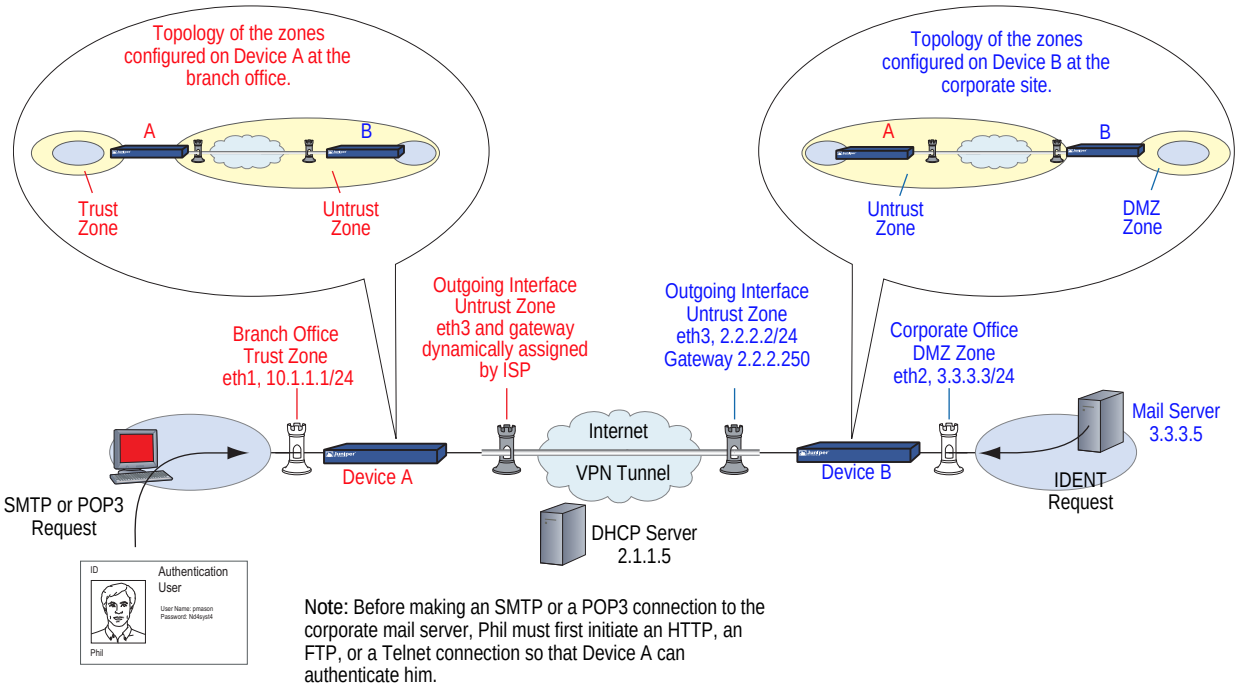
5. **Policies**

```
set policy top from trust to untrust Trust_LAN Tokyo_Office any permit
set policy top from untrust to trust Tokyo_Office Trust_LAN any permit
save
```

Policy-Based Site-to-Site VPN, Dynamic Peer

In this example, a VPN tunnel securely connects the users in the Trust zone behind Device A to the mail server in the corporate DMZ zone, protected by Device B. The Untrust zone interface for Device B has a static IP address. The ISP serving Device A assigns the IP address for its Untrust zone interface dynamically through DHCP. Because only Device B has a fixed address for its Untrust zone, VPN traffic must originate from hosts behind Device A. After Device A has established the tunnel, traffic through the tunnel can originate from either end. All zones are in the trust-vr routing domain.

Figure 35: Policy-Based Site-to-Site VPN, Dynamic Peer



Note: Before making an SMTP or a POP3 connection to the corporate mail server, Phil must first initiate an HTTP, an FTP, or a Telnet connection so that Device A can authenticate him.

In this example, the local auth user Phil (login name: pmason; password: Nd4syst4) wants to get his email from the mail server at the corporate site. When he attempts to do so, he is authenticated twice: first, Device A authenticates him locally before allowing traffic from him through the tunnel; second, the mail server program authenticates him, sending the IDENT request through the tunnel.

NOTE: Because Phil is an authentication user, before he can make an SMTP of POP3 request, he must first initiate an HTTP, FTP, or Telnet connection so that Device A can respond with a firewall user/login prompt to authenticate him. After Device A authenticates him, he has permission to contact the corporate mail server through the VPN tunnel.

The mail server can send the IDENT request through the tunnel only if the Device A and B administrators add a custom service for it (TCP, port 113) and set up policies allowing that traffic through the tunnel to the 10.10.10.0/24 subnet.

The preshared key is h1p8A24nG5. It is assumed that both participants already have RSA certificates from the certificate authority (CA) Verisign and that the email address *pmason@abc.com* appears in the local certificate on Device A. (For information about obtaining and loading certificates, see “Certificates and CRLs” on page 35.) For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined “Compatible” set of proposals for Phase 2.

WebUI (Device A)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Obtain IP using DHCP: (select)

NOTE: You cannot specify the IP address of the DHCP server through the WebUI; however, you can do so through the CLI.

---

2. User

Objects > Users > Local > New: Enter the following, then click OK:

User Name: pmason
Status: Enable
Authentication User: (select)
User Password: Nd4syst4
Confirm Password: Nd4syst4

3. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trusted_network
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Mail_Server
IP Address/Domain Name:
IP/Netmask: (select), 3.3.3.5/32
Zone: Untrust

4. **Services**

   Policy > Policy Elements > Services > Custom > New: Enter the following, then click OK:

   Service Name: Ident
   Service Timeout:
   Use protocol default: (select)
   Transport Protocol: TCP (select)
   Source Port: Low 0, High 65535
   Destination Port: Low 113, High 113

   Policy > Policy Elements > Services > Group > New: Enter the following, move the following services, then click OK:

   Group Name: Remote_Mail
   Group Members << Available Members:
   HTTP
   FTP
   Telnet
   Ident
   MAIL
   POP3

5. **VPN**

   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gateway Name: To_Mail
   Security Level: Custom
   Remote Gateway Type:
   Static IP Address: (select), IP Address/Hostname: 2.2.2.2

Preshared Key

Preshared Key: h1p8A24nG5
Local ID: pmason@abc.com
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

(or)

Certificates

Local ID: pmason@abc.com
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

Name: branch_corp
Security Level: Compatible
Remote Gateway Tunnel: To_Mail

6. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 0.0.0.0

NOTE: The ISP provides the gateway IP address dynamically through DHCP.

---

7. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Trusted_network
Destination Address:
Address Book Entry: (select), Mail_Server
Service: Remote_Mail
Action: Tunnel
VPN Tunnel: branch_corp
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

Authentication: (select)
Auth Server: Local
User: (select), Local Auth User - pmason

WebUI (Device B)

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet2): Enter the following, then click OK:

   Zone Name: DMZ
   Static IP: (select this option when present)
   IP Address/Netmask: 3.3.3.3/24

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 2.2.2.2/24

2. **Addresses**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Mail Server
   IP Address/Domain Name:
   IP/Netmask: (select), 3.3.3.5/32
   Zone: DMZ

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: branch office
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Untrust

3. **Services**

   Policy > Policy Elements > Services > Custom > New: Enter the following, then click OK:

   Service Name: Ident
   Service Timeout:
   Use protocol default: (select)
   Transport Protocol: TCP (select)
   Source Port: Low 0, High 65535
   Destination Port: Low 113, High 113

   Policy > Policy Elements > Services > Groups > New: Enter the following, move the following services, then click OK:

   Group Name: Remote_Mail
   Group Members << Available Members:
   Ident
   MAIL
   POP3

4. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_branch
Security Level: Custom
Remote Gateway Type:
Dynamic IP Address: (select), Peer ID: pmason@abc.com

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: corp_branch
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_branch

5. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

6. Policies

Policies > (From: DMZ, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Mail_Server
Destination Address:
Address Book Entry: (select), branch_office
Service: Remote_Mail
Action: Tunnel
VPN Tunnel: corp_branch
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

CLI (Device A)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 dhcp client
set interface ethernet3 dhcp client settings server 1.1.1.5
```

2. User

```
set user pmason password Nd4syst4
```

3. Addresses

```
set address trust “trusted network” 10.1.1.0/24
set address untrust “mail server” 3.3.3.5/32
```

4. Services

```
set service ident protocol tcp src-port 0-65535 dst-port 113-113
set group service remote_mail
set group service remote_mail add http
set group service remote_mail add ftp
set group service remote_mail add telnet
set group service remote_mail add ident
set group service remote_mail add mail
set group service remote_mail add pop3
```

5. VPN

Preshared Key

```
set ike gateway to_mail address 2.2.2.2 aggressive local-id pmason@abc.com
    outgoing-interface ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn branch_corp gateway to_mail sec-level compatible
```

(or)

Certificates

```
set ike gateway to_mail address 2.2.2.2 aggressive local-id pmason@abc.com
    outgoing-interface ethernet3 proposal rsa-g2-3des-sha
set ike gateway to_mail cert peer-ca 1
set ike gateway to_mail cert peer-cert-type x509-sig
set vpn branch_corp gateway to_mail sec-level compatible
```

NOTE: The U-FQDN “pmason@abc.com” must appear in the SubjectAltName field in the certificate.

The number 1 is the CA ID number. To discover the CA’s ID number, use the following command: get ike ca.

6. Route

set vrouter trust-vr route 0.0.0.0/0 interface ethernet3

NOTE: The ISP provides the gateway IP address dynamically through DHCP.

7. Policies

set policy top from trust to untrust “trusted network” “mail server” remote_mail tunnel vpn branch_corp auth server Local user pmason
set policy top from untrust to trust “mail server” “trusted network” remote_mail tunnel vpn branch_corp
save

CLI (Device B)

1. Interfaces

set interface ethernet2 zone dmz
set interface ethernet2 ip 3.3.3.3/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24

2. Addresses

set address dmz “mail server” 3.3.3.5/32
set address untrust “branch office” 10.1.1.0/24

3. Services

set service ident protocol tcp src-port 0-65535 dst-port 113-113
set group service remote_mail
set group service remote_mail add ident
set group service remote_mail add mail
set group service remote_mail add pop3

4. VPN

Preshared Key

set ike gateway to_branch dynamic pmason@abc.com aggressive outgoing-interface ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn corp_branch gateway to_branch tunnel sec-level compatible

(or)

Certificates

set ike gateway to_branch dynamic pmason@abc.com aggressive outgoing-interface ethernet3 proposal rsa-g2-3des-sha
set ike gateway to_branch cert peer-ca 1
set ike gateway to_branch cert peer-cert-type x509-sig
set vpn corp_branch gateway to_branch sec-level compatible

NOTE: The number 1 is the CA ID number. To discover the CA’s ID number, use the following command: get ike ca.

5. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250

6. **Policies**
   set policy top from dmz to untrust “mail server” “branch office” remote_mail
   tunnel vpn corp_branch
   set policy top from untrust to dmz “branch office” “mail server” remote_mail
   tunnel vpn corp_branch
   save

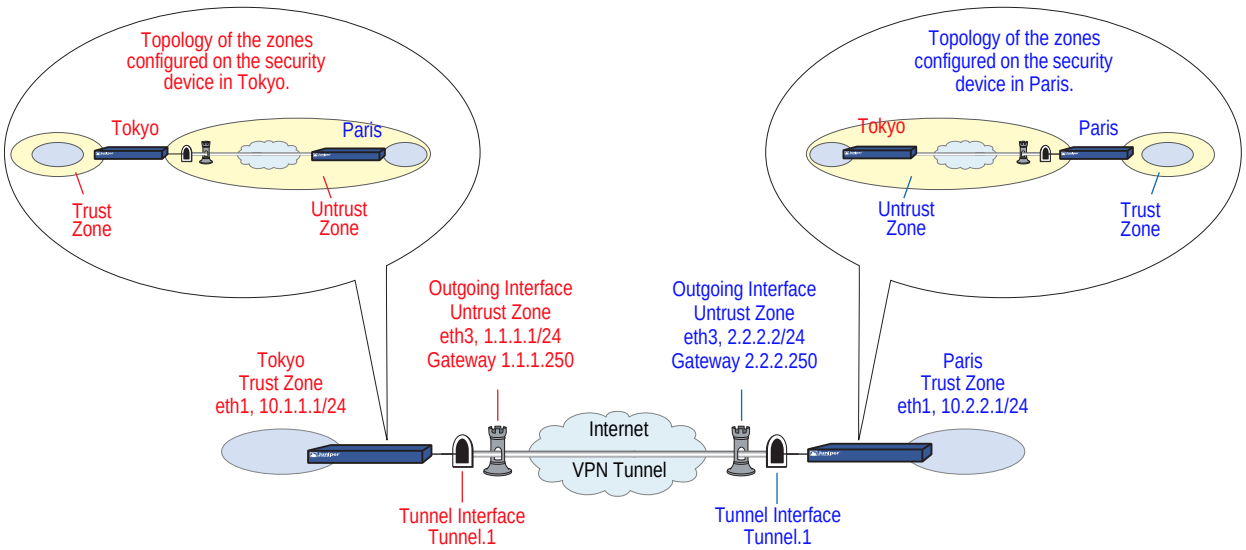
Route-Based Site-to-Site VPN, Manual Key

In this example, a Manual Key tunnel provides a secure communication channel between offices in Tokyo and Paris. The Trust zones at each site are in NAT mode. The addresses are as follows:

- Tokyo:
  - Trust zone interface (ethernet1): 10.1.1.1/24
  - Untrust zone interface (ethernet3): 1.1.1.1/24
- Paris:
  - Trust zone interface (ethernet1): 10.2.2.1/24
  - Untrust zone interface (ethernet3): 2.2.2.2/24

The Trust and Untrust security zones are all in the trust-vr routing domain. The Untrust zone interface (ethernet3) serves as the outgoing interface for the VPN tunnel.

Figure 36: Route-Based Site-to-Site VPN, Manual Key



To set up the tunnel, perform the following steps on the security devices at both ends of the tunnel:

1. Assign IP addresses to the physical interfaces bound to the security zones and to the tunnel interface.

2. Configure the VPN tunnel, designate its outgoing interface in the Untrust zone, and bind it to the tunnel interface.

3. Enter the IP addresses for the local and remote endpoints in the address books for the Trust and Untrust zones.

4. Enter a default route to the external router in the trust-vr, a route to the destination through the tunnel interface, and a null route to the destination. You assign a higher metric (farther from zero) to the null route so that it becomes the next-choice route to the destination. Then, if the state of the tunnel interface changes to “down” and the route referencing that interface becomes inactive, the security device uses the null route, which essentially drops any traffic sent to it, rather than the default route, which forwards unencrypted traffic.

5. Set up policies for VPN traffic to pass between each site.

WebUI (Tokyo)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. **Addresses**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Trust_LAN
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Paris_Office
   IP Address/Domain Name:
   IP/Netmask: (select), 10.2.2.0/24
   Zone: Untrust

3. **VPN**

   VPNs > Manual Key > New: Enter the following, then click OK:

   VPN Tunnel Name: Tokyo_Paris
   Gateway IP: 2.2.2.2
   Security Index: 3020 (Local), 3030 (Remote)
   Outgoing Interface: ethernet3
   ESP-CBC: (select)
   Encryption Algorithm: 3DES-CBC
   Generate Key by Password: asdlk24234
   Authentication Algorithm: SHA-1
   Generate Key by Password: PNas134a

   > Advanced: Enter the following advanced settings, then click Return to return to the basic Manual Key tunnel configuration page:

   Bind to: Tunnel Interface, tunnel.1

4. **Routes**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 1.1.1.250

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 10.2.2.0/24
   Gateway: (select)
   Interface: tunnel.1
   Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To Paris
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Paris_Office
Service: ANY
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Name: From Paris
Source Address:
Address Book Entry: (select), Paris_Office
Destination Address:
Address Book Entry: (select), Trust_LAN
Service: ANY
Action: Permit
Position at Top: (select)

WebUI (Paris)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Tokyo_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

3. VPN

VPNs > Manual Key > New: Enter the following, then click OK:

VPN Tunnel Name: Paris_Tokyo
Gateway IP: 1.1.1.1
Security Index: 3030 (Local), 3020 (Remote)
Outgoing Interface: ethernet3
ESP-CBC: (select)
Encryption Algorithm: 3DES-CBC
Generate Key by Password: asdlk24234
Authentication Algorithm: SHA-1
Generate Key by Password: PNas134a

> Advanced: Enter the following advanced settings, then click Return to return to the basic Manual Key tunnel configuration page:

Bind to: Tunnel Interface, tunnel.1

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To_Tokyo
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Tokyo_Office
Service: ANY
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Name: From_Tokyo
Source Address:
Address Book Entry: (select), Tokyo_Office
Destination Address:
Address Book Entry: (select), Trust_LAN
Service: ANY
Action: Permit
Position at Top: (select)

CLI (Tokyo)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust Paris_Office 10.2.2.0/24
```

3. VPN

```
set vpn Tokyo_Paris manual 3020 3030 gateway 2.2.2.2 outgoing-interface
    ethernet3 esp 3des password asdlk24234 auth sha-1 password PNas134a
set vpn Tokyo_Paris bind interface tunnel.1
```

4. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.2.2.0/24 interface tunnel.1
set vrouter trust-vr route 10.2.2.0/24 interface null metric 10
```

5. **Policies**

```
set policy top name “To Paris” from trust to untrust Trust_LAN Paris_Office any
    permit
set policy top name “From Paris” from untrust to trust Paris_Office Trust_LAN any
    permit
save
```

CLI (Paris)

1. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.2.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. **Addresses**

```
set address trust Trust_LAN 10.2.2.0/24
set address untrust Tokyo_Office 10.1.1.0/24
```

3. **VPN**

```
set vpn Paris_Tokyo manual 3030 3020 gateway 1.1.1.1 outgoing-interface
    ethernet3 esp 3des password asdlk24234 auth sha-1 password PNas134a
set vpn Paris_Tokyo bind interface tunnel.1
```

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.1.1.0/24 interface null metric 10
```

5. **Policies**

```
set policy top name “To Tokyo” from trust to untrust Trust_LAN Tokyo_Office any
    permit
set policy top name “From Tokyo” from untrust to trust Tokyo_Office Trust_LAN any
    permit
save
```

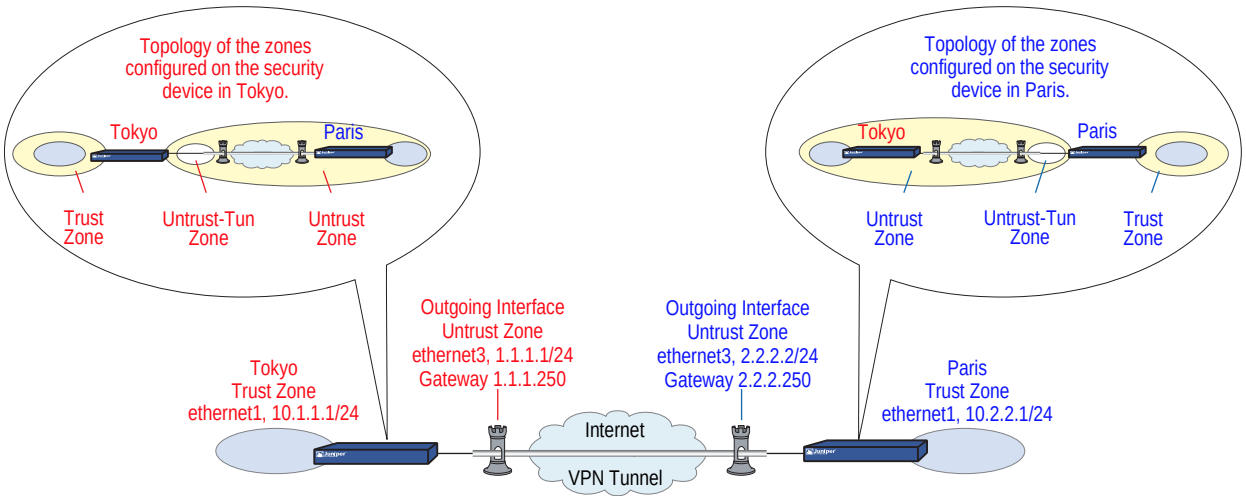
Policy-Based Site-to-Site VPN, Manual Key

In this example, a Manual Key tunnel provides a secure communication channel between offices in Tokyo and Paris, using ESP with 3DES encryption and SHA-1 authentication. The Trust zones at each site are in NAT mode. The addresses are as follows:

- Tokyo:
  - Trust interface (ethernet1): 10.1.1.1/24
  - Untrust interface (ethernet3): 1.1.1.1/24
- Paris:
  - Trust interface (ethernet1): 10.2.2.1/24
  - Untrust interface (ethernet3): 2.2.2.2/24

The Trust and Untrust security zones and the Untrust-Tun tunnel zone are in the trust-vr routing domain. The Untrust zone interface (ethernet3) serves as the outgoing interface for the VPN tunnel.

Figure 37: Policy-Based Site-to-Site VPN, Manual Key



To set up the tunnel, perform the following five steps on the security devices at both ends of the tunnel:

1. Assign IP addresses to the physical interfaces bound to the security zones.
2. Configure the VPN tunnel, and designate its outgoing interface in the Untrust zone.
3. Enter the IP addresses for the local and remote endpoints in the Trust and Untrust address books.
4. Enter a default route to the external router.
5. Set up policies for VPN traffic to pass bidirectionally through the tunnel.

WebUI (Tokyo)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

2. **Addresses**

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Paris_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Untrust

3. **VPN**

VPNs > Manual Key > New: Enter the following, then click OK:

VPN Tunnel Name: Tokyo_Paris
Gateway IP: 2.2.2.2
Security Index: 3020 (Local), 3030 (Remote)
Outgoing Interface: ethernet3
ESP-CBC: (select)
Encryption Algorithm: 3DES-CBC
Generate Key by Password: asdlk24234
Authentication Algorithm: SHA-1
Generate Key by Password: PNas134a

> Advanced: Enter the following advanced settings, then click Return to return to the basic Manual Key tunnel configuration page:

Bind to: Tunnel Zone, Untrust-Tun

4. **Route**

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To/From Paris
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Paris_Office
Service: ANY
Action: Tunnel
Tunnel VPN: Tokyo_Paris
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

WebUI (Paris)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click **OK**:
Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Tokyo_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

3. VPN

VPNs > Manual Key > New: Enter the following, then click OK:

VPN Tunnel Name: Paris_Tokyo
Gateway IP: 1.1.1.1
Security Index (HEX Number): 3030 (Local), 3020 (Remote)
Outgoing Interface: ethernet3

ESP-CBC: (select)
Encryption Algorithm: 3DES-CBC
Generate Key by Password: asdlk24234
Authentication Algorithm: SHA-1
Generate Key by Password: PNas134a

> Advanced: Enter the following advanced settings, then click Return to return to the basic Manual Key tunnel configuration page:

Bind to: Tunnel Zone, Untrust-Tun

4. **Route**

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

5. **Policies**

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To/From Tokyo
Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Tokyo_Office
Service: ANY
Action: Tunnel
Tunnel VPN: Paris_Tokyo
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

CLI (Tokyo)

1. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. **Addresses**

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust paris_office 10.2.2.0/24
```

3. **VPN**

```
set vpn tokyo_paris manual 3020 3030 gateway 2.2.2.2 outgoing-interface
    ethernet3 esp 3des password asdlk24234 auth sha-1 password PNas134a
set vpn tokyo_paris bind zone untrust-tun
```

4. **Route**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
```

5. **Policies**
   set policy top name “To/From Paris” from trust to untrust Trust_LAN paris_office any tunnel vpn tokyo_paris
   set policy top name “To/From Paris” from untrust to trust paris_office Trust_LAN any tunnel vpn tokyo_paris
   save

CLI (Paris)

1. **Interfaces**
   set interface ethernet1 zone trust
   set interface ethernet1 ip 10.2.2.1/24
   set interface ethernet1 nat
   set interface ethernet3 zone untrust
   set interface ethernet3 ip 2.2.2.2/24

2. **Addresses**
   set address trust Trust_LAN 10.2.2.0/24
   set address untrust tokyo_office 10.1.1.0/24

3. **VPN**
   set vpn paris_tokyo manual 3030 3020 gateway 1.1.1.1 outgoing-interface ethernet3 esp 3des password asdlk24234 auth sha-1 password PNas134a
   set vpn paris_tokyo bind zone untrust-tun

4. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250

5. **Policies**
   set policy top name “To/From Tokyo” from trust to untrust Trust_LAN tokyo_office any tunnel vpn paris_tokyo
   set policy top name “To/From Tokyo” from untrust to trust tokyo_office Trust_LAN any tunnel vpn paris_tokyo
   save

Dynamic IKE Gateways Using FQDN

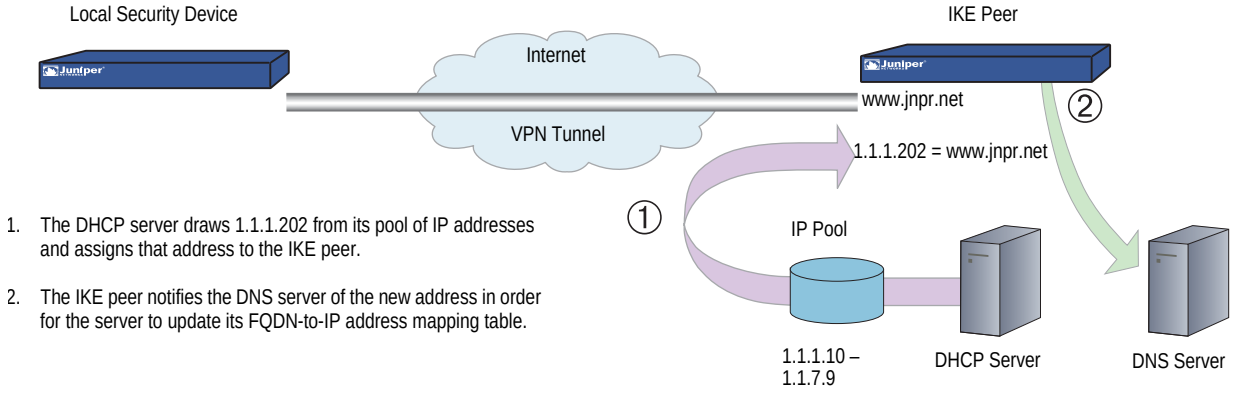
For an IKE peer that obtains its IP address dynamically, you can specify its fully qualified domain name (FQDN) in the local configuration for the remote gateway. For example, an Internet service provider (ISP) might assign IP addresses through DHCP to its customers. The ISP draws addresses from a large pool of addresses and assigns them when its customers come online. Although the IKE peer has an unchanging FQDN, it has an unpredictably changing IP address. The IKE peer has three methods available for maintaining a Domain Name System (DNS) mapping of its FQDN to its dynamically assigned IP address (a process known as dynamic DNS).

- If the remote IKE peer is a security device, the admin can manually notify the DNS server to update its FQDN-to-IP address mapping each time the security device receives a new IP address from its ISP.

- If the remote IKE peer is another kind of VPN termination device that has dynamic DNS software running on it, that software can automatically notify the DNS server of its address changes so the server can update its FQDN-to-IP address mapping table.

- If the remote IKE peer is a security device or any other kind of VPN termination device, a host behind it can run an FQDN-to-IP address automatic update program that alerts the DNS server of address changes.

Figure 38: IKE Peer with a Dynamic IP Address



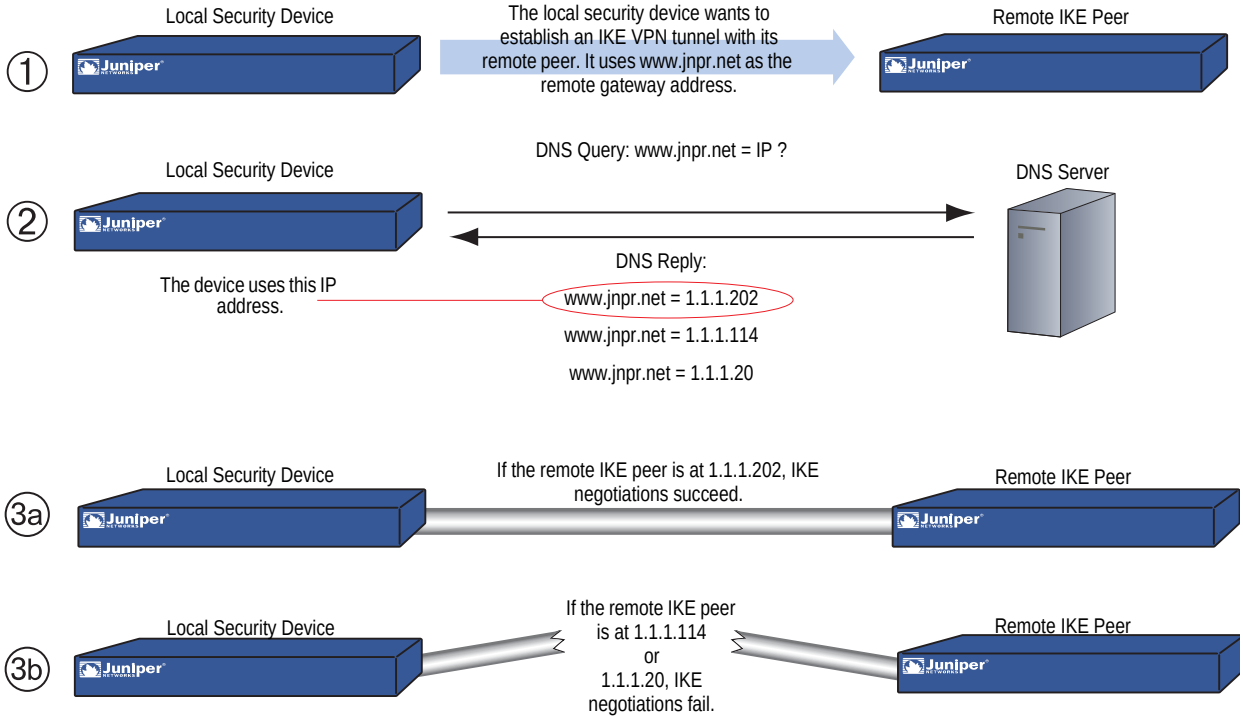
1. The DHCP server draws 1.1.1.202 from its pool of IP addresses and assigns that address to the IKE peer.
2. The IKE peer notifies the DNS server of the new address in order for the server to update its FQDN-to-IP address mapping table.

Without needing to know the current IP address of a remote IKE peer, you can now configure an AutoKey IKE VPN tunnel to that peer using its FQDN instead of an IP address.

Aliases

You can also use an alias for the FQDN of the remote IKE peer if the DNS server that the local security device queries returns only one IP address. If the DNS server returns several IP addresses, the local device uses the first one it receives. Because there is no guarantee for the order of the addresses in the response from the DNS server, the local security device might use the wrong IP address, and IKE negotiations might fail.

Figure 39: Multiple DNS Replies Leading to IKE Negotiation Success or Failure

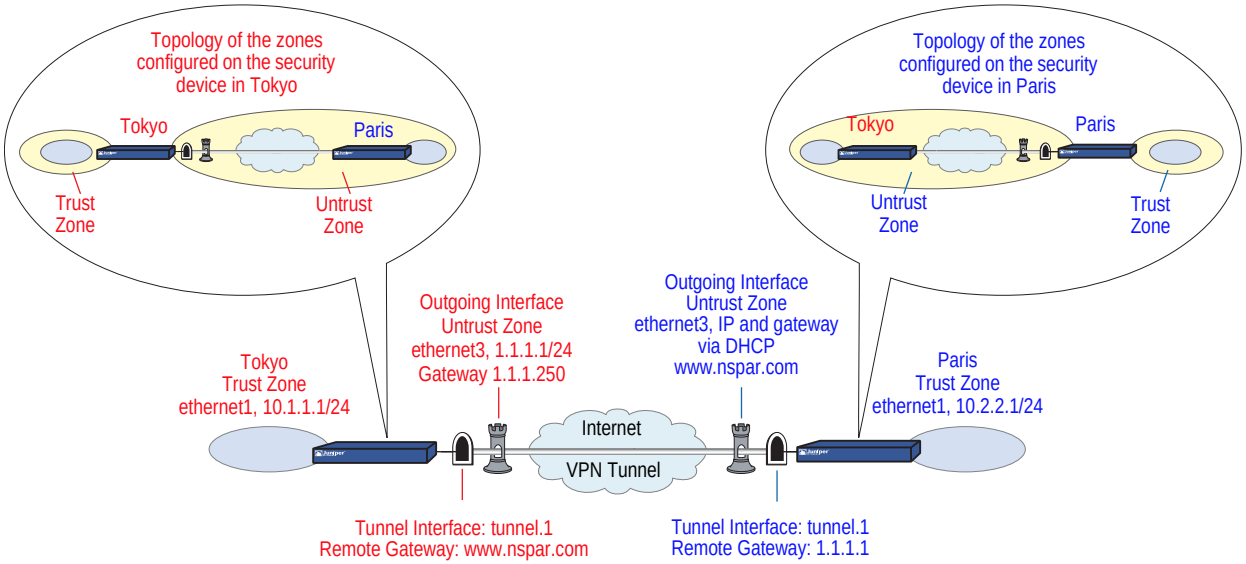


Setting AutoKey IKE Peer with FQDN

In this example, an AutoKey IKE VPN tunnel using either a preshared secret or a pair of certificates (one at each end of the tunnel) provides a secure connection between two offices in Tokyo and Paris. The Paris office has a dynamically assigned IP address, so the Tokyo office uses the remote peer's FQDN (www.nspar.com) as the address of the remote gateway in its VPN tunnel configuration.

The configuration shown in Figure 40 is for a route-based VPN tunnel. For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined "Compatible" set of proposals for Phase 2. All zones are in the trust-vr.

Figure 40: AutoKey IKE Peer with FQDN



Setting up a route-based AutoKey IKE tunnel using either a preshared secret or certificates involves the following steps:

1. Assign IP addresses to the physical interfaces bound to the security zones and to the tunnel interface.

2. Define the remote gateway and key exchange mode, and specify either a preshared secret or a certificate.

3. Configure the VPN tunnel, designate its outgoing interface in the Untrust zone, bind it to the tunnel interface, and configure its proxy-ID.

4. Enter the IP addresses for the local and remote endpoints in the Trust and Untrust address books.

5. Enter a default route to the external router in the trust-vr, a route to the destination through the tunnel interface, and a null route to the destination. You assign a higher metric (farther from zero) to the null route so that it becomes the next-choice route to the destination. Then, if the state of the tunnel interface changes to “down” and the route referencing that interface becomes inactive, the security device uses the null route, which essentially drops any traffic sent to it, rather than the default route, which forwards unencrypted traffic.

6. Set up policies for traffic to pass between each site.

In the following examples, the preshared key is h1p8A24nG5. It is assumed that both participants already have RSA certificates and are using Entrust as the certificate authority (CA). (For information about obtaining and loading certificates, see “Public Key Cryptography” on page 29.)

WebUI (Tokyo)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Paris_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Paris
Security Level: Custom
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: www.nspar.com

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (for Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Main (ID Protection)

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (for Custom Security Level): rsa-g2-3des-sha
Preferred certificate (optional)
Peer CA: Entrust
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Tokyo_Paris
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Paris

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Security Level: Compatible
Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.1.1.0/24
Remote IP / Netmask: 10.2.2.0/24
Service: ANY

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 0.0.0.0

NOTE: The ISP provides the gateway IP address dynamically through DHCP.

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.2.2.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To Paris
Source Address: Trust_LAN
Destination Address: Paris_Office
Service: ANY
Action: Permit
Position at Top: (select)

Policies > Policy (From: Untrust, To: Trust) > New Policy: Enter the following, then click OK:

Name: From Paris
Source Address: Paris_Office
Destination Address: Trust_LAN
Service: ANY
Action: Permit
Position at Top: (select)

WebUI (Paris)

1. Host Name and Domain Name

Network > DNS: Enter the following, then click Apply:

Host Name: www
Domain Name: nspar.com

2. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Obtain IP using DHCP: (select)

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

3. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.2.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Tokyo_Office
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

4. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Tokyo
Security Level: Custom
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 1.1.1.1

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Main (ID Protection)

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (for Custom Security Level): rsa-g2-3des-sha
Preferred certificate (optional)
Peer CA: Entrust
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

Name: Paris_Tokyo
Security Level: Custom
Remote Gateway:
Predefined: (select), To_Tokyo

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Security Level: Compatible
Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.2.2.0/24
Remote IP / Netmask: 10.1.1.0/24
Service: ANY

5. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

6. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Name: To Tokyo
Source Address: Trust_LAN
Destination Address: Tokyo_Office
Service: ANY
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Name: From Tokyo
Source Address: Tokyo_Office
Destination Address: Trust_LAN
Service: ANY
Action: Permit
Position at Top: (select)

CLI (Tokyo)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust paris_office 10.2.2.0/24
```

3. VPN

Preshared Key

```
set ike gateway to_paris address www.nspar.com main outgoing-interface
    ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn tokyo_paris gateway to_paris sec-level compatible
set vpn tokyo_paris bind interface tunnel.1
set vpn tokyo_paris proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.2.0/24 any
```

(or)

Certificate

```
set ike gateway to_paris address www.nspar.com main outgoing-interface
    ethernet3 proposal rsa-g2-3des-sha
set ike gateway to_paris cert peer-ca 1
set ike gateway to_paris cert peer-cert-type x509-sig
set vpn tokyo_paris gateway to_paris sec-level compatible
set vpn tokyo_paris bind interface tunnel.1
set vpn tokyo_paris proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.2.0/24 any
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: `get ike ca`.

---

4. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.2.2.0/24 interface tunnel.1
set vrouter trust-vr route 10.2.2.0/24 interface null metric 10
```

5. Policies

```
set policy top name “To Paris” from trust to untrust Trust_LAN paris_office any
    permit
set policy top name “From Paris” from untrust to trust paris_office Trust_LAN any
    permit
save
```

CLI (Paris)

1. Host Name and Domain Name

```
set hostname www
set domain nspar.com
```

2. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.2.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip dhcp-client enable
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

3. Addresses

```
set address trust Trust_LAN 10.2.2.0/24
set address untrust tokyo_office 10.1.1.0/24
```

4. VPN

Preshared Key

```
set ike gateway to_tokyo address 1.1.1.1 main outgoing-interface ethernet3
    preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn paris_tokyo gateway to_tokyo sec-level compatible
set vpn paris_tokyo bind interface tunnel.1
set vpn paris_tokyo proxy-id local-ip 10.2.2.0/24 remote-ip 10.1.1.0/24 any
```

(or)

Certificate

```
set ike gateway to_tokyo address 1.1.1.1 main outgoing-interface ethernet3
    proposal rsa-g2-3des-sha
set ike gateway to_tokyo cert peer-ca 1
set ike gateway to_tokyo cert peer-cert-type x509-sig
set vpn paris_tokyo gateway to_tokyo sec-level compatible
set vpn paris_tokyo bind interface tunnel.1
set vpn paris_tokyo proxy-id local-ip 10.2.2.0/24 remote-ip 10.1.1.0/24 any
```

5. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.1.1.0/24 interface null metric 10
```

6. Policies

```
set policy top name “To Tokyo” from trust to untrust Trust_LAN tokyo_office any
    permit
set policy top name “From Tokyo” from untrust to trust tokyo_office Trust_LAN any
    permit
save
```

VPN Sites with Overlapping Addresses

Because the range of private IP addresses is relatively small, there is a good chance that the addresses of protected networks of two VPN peers overlap. For bidirectional VPN traffic between two end entities with overlapping addresses, the security devices at both ends of the tunnel must apply Source Network Address Translation (NAT-src) and Destination Network Address Translation (NAT-dst) to the VPN traffic passing between them.

NOTE: An overlapping address space is when the IP address range in two networks are partially or completely the same.

For NAT-src, the interfaces at both ends of the tunnel must have IP addresses in mutually unique subnets, with a dynamic IP (DIP) pool in each of those subnets. The policies regulating outbound VPN traffic can then apply NAT-src using DIP pool addresses to translate original source addresses to those in a neutral address space.

NOTE: The range of addresses in a DIP pool must be in the same subnet as the tunnel interface, but the pool must not include the interface IP address or any MIP or VIP addresses that might also be in that subnet. For security zone interfaces, you can also define an extended IP address and an accompanying DIP pool in a different subnet from that of the interface IP address. For more information, see “Using DIP in a Different Subnet” on page 2-147.

To provide NAT-dst on inbound VPN traffic, there are two options:

- Policy-based NAT-dst: A policy can apply NAT-dst to translate inbound VPN traffic to an address that is either in the same subnet as the tunnel interface—but not in the same range as the local DIP pool used for outbound VPN traffic—or to an address in another subnet to which the security device has an entry in its route table. (For information about routing considerations when configuring NAT-dst, see “Routing for NAT-Dst” on page 8-32.)

- Mapped IP (MIP): A policy can reference a MIP as the destination address. The MIP uses an address in the same subnet as the tunnel interface—but not in the same range as the local DIP pool used for outbound VPN traffic. (For information about MIPs, see “Mapped IP Addresses” on page 8-63.)

VPN traffic between sites with overlapping addresses requires address translation in both directions. Because the source address on outbound traffic cannot be the same as the destination address on inbound traffic—the NAT-dst address or MIP cannot be in the DIP pool—the addresses referenced in the inbound and outbound policies cannot be symmetrical.

When you want the security device to perform source and destination address translation on bidirectional VPN traffic through the same tunnel, you have two choices:

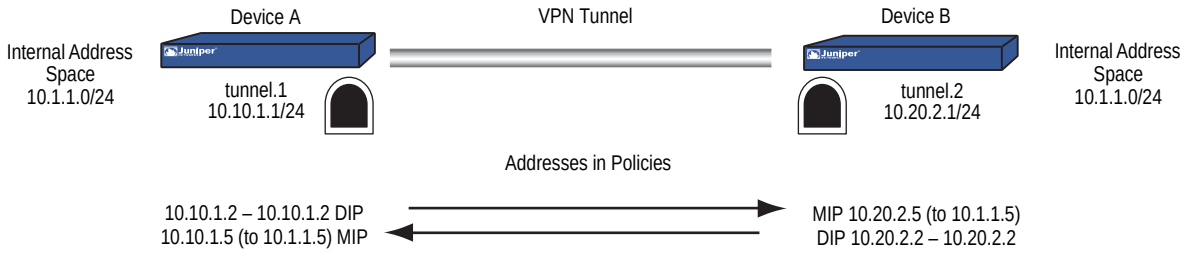
- You can define a proxy ID for a policy-based VPN configuration. When you specifically reference a VPN tunnel in a policy, the security device derives a proxy ID from the components in the policy that references that tunnel. The security device derives the proxy ID when you first create the policy, and each time the device reboots thereafter. However, if you manually define a proxy ID for a VPN tunnel that is referenced in a policy, the security device applies the user-defined proxy ID, not the proxy ID derived from the policy.

NOTE: A proxy ID is a kind of agreement between IKE peers to permit traffic through a tunnel if the traffic matches a specified tuple of local address, remote address, and service.

- You can use a route-based VPN tunnel configuration, which must have a user-defined proxy ID. With a route-based VPN tunnel configuration, you do not specifically reference a VPN tunnel in a policy. Instead, the policy controls access (permit or deny) to a particular destination. The route to that destination points to a tunnel interface that in turn is bound to a VPN tunnel. Because the VPN tunnel is not directly associated with a policy from which it can derive a proxy ID from the source address, destination address, and service, you must manually define a proxy ID for it. (Note that a route-based VPN configuration also allows you to create multiple policies that make use of a single VPN tunnel; that is, a single Phase 2 SA.)

Consider the addresses in Figure 41, which illustrates a VPN tunnel between two sites with overlapping address spaces.

Figure 41: Overlapping Addresses at Peer Sites



If the security devices in Figure 41 derive proxy IDs from the policies, as they do in policy-based VPN configurations, then the inbound and outbound policies produce the following proxy IDs:

Device A				**Device B**			
	Local	Remote	Service		Local	Remote	Service
Outbound	10.10.1.2/32	10.20.2.5/32	Any	Inbound	10.20.2.5/32	10.10.1.2/32	Any
Inbound	10.10.1.5/32	10.20.2.2/32	Any	Outbound	10.20.2.2/32	10.10.1.5/32	Any

As shown in the table, there are two proxy IDs: one for outbound VPN traffic and another for inbound. When Device A first sends traffic from 10.10.1.2/32 to 10.20.2.5/32, the two peers perform IKE negotiations and produce Phase 1 and Phase 2 security associations (SAs). The Phase 2 SA results in the above outbound proxy ID for Device A, and the inbound proxy ID for Device B.

If Device B then sends traffic to Device A, the policy lookup for traffic from 10.20.2.2/32 to 10.10.1.5/32 indicates that there is no active Phase 2 SA for such a proxy ID. Therefore, the two peers use the existing Phase 1 SA (assuming that its lifetime has not yet expired) to negotiate a different Phase 2 SA. The resulting proxy IDs are shown above as the inbound proxy ID for Device A and the outbound proxy ID for Device B. There are two Phase 2 SAs—two VPN tunnels—because the addresses are asymmetrical and require different proxy IDs.

To create just one tunnel for bidirectional VPN traffic, you can define the following proxy IDs with addresses whose scope includes both the translated source and destination addresses at each end of the tunnel:

Device A			**Device B**		
Local	Remote	Service	Local	Remote	Service
10.10.1.0/24	10.20.2.0/24	Any	10.20.2.0/24	10.10.1.0/24	Any
		or			
0.0.0.0/0	0.0.0.0/0	Any	0.0.0.0/0	0.0.0.0/0	Any

The above proxy IDs encompass addresses appearing in both inbound and outbound VPN traffic between the two sites. The address 10.10.1.0/24 includes both the DIP pool 10.10.1.2 – 10.10.1.2 and the MIP 10.10.1.5. Likewise, the address 10.20.2.0/24 includes both the DIP pool 10.20.2.2 – 10.20.2.2 and the MIP 10.20.2.5. The above proxy IDs are symmetrical; that is, the local address for Device A is the remote address for Device B, and vice versa. If Device A sends traffic to Device B, the Phase 2 SA and proxy ID also apply to traffic sent from Device B to Device A. Thus, a single Phase 2 SA—that is, a single VPN tunnel—is all that is required for bidirectional traffic between the two sites.

NOTE: The address 0.0.0.0/0 includes all IP addresses, and thus the addresses of the DIP pool and MIP.

To create one VPN tunnel for bidirectional traffic between sites with overlapping address spaces when the addresses for NAT-src and NAT-dst configured on the same device are in different subnets from each other, the proxy ID for the tunnel must be (local IP) 0.0.0.0/0 – (remote IP) 0.0.0.0/0 – *service type*. If you want to use more restrictive addresses in the proxy ID, then the addresses for NAT-src and NAT-dst must be in the same subnet.

In this example, you configure a VPN tunnel between Device A at a corporate site and Device B at a branch office. The address space for the VPN end entities overlaps; they both use addresses in the 10.1.1.0/24 subnet. To overcome this conflict, you use NAT-src to translate the source address on outbound VPN traffic

and NAT-dst to translate the destination address on inbound VPN traffic. The policies permit all addresses in the corporate LAN to reach an FTP server at the branch site, and for all addresses at the branch office site to reach an FTP server at the corporate site.

NOTE: For more information about Source Network Address Translation (NAT-src) and Destination Network Address Translation (NAT-dst), see *Volume 8: Address Translation*.

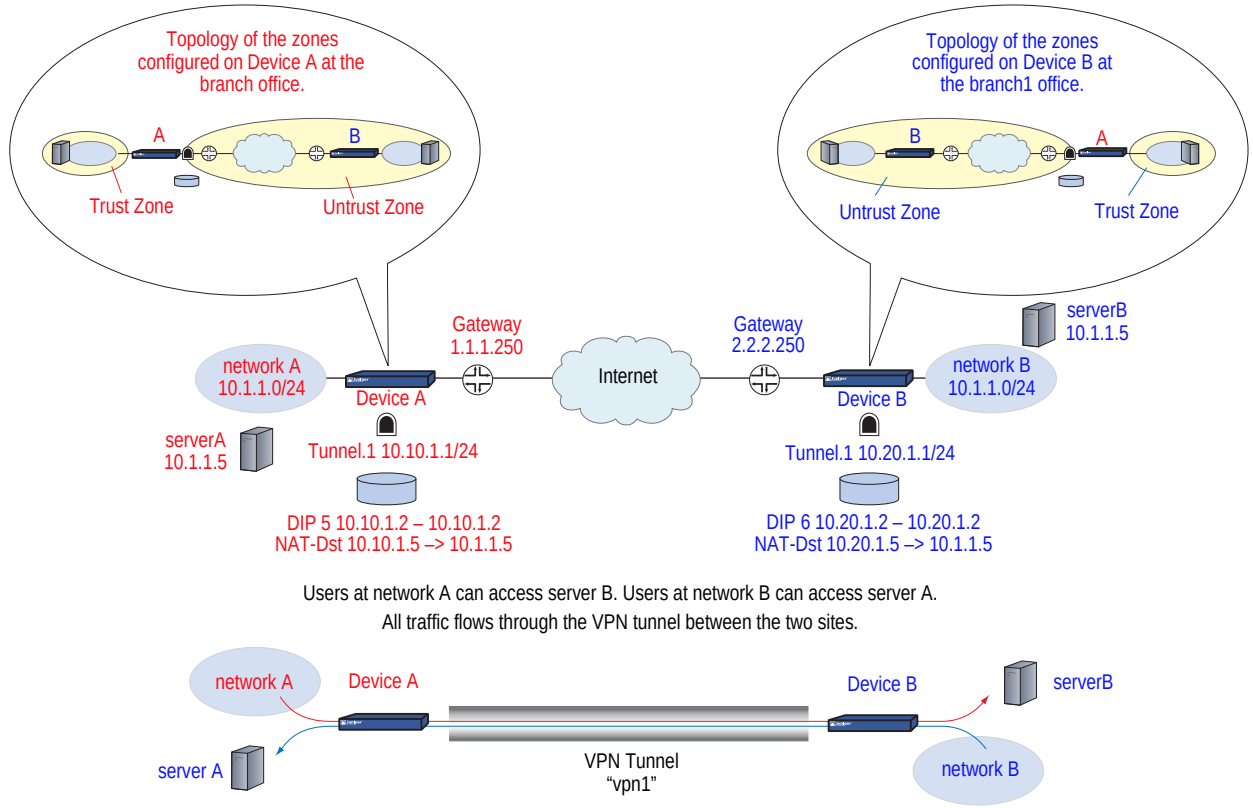
The tunnel configurations at both ends of the tunnel use the following parameters: AutoKey IKE, preshared key (“netscreen1”), and the security level predefined as “Compatible” for both Phase 1 and Phase 2 proposals. (For details about these proposals, see “Tunnel Negotiation” on page 9.)

The outgoing interface on Device A at the corporate site is ethernet3, which has IP address 1.1.1.1/24 and is bound to the Untrust zone. Device B at the branch office uses this address as its remote IKE gateway.

The outgoing interface on Device B at the branch office is ethernet3, which has IP address 2.2.2.2/24 and is bound to the Untrust zone. Device A at the corporate site uses this address as its remote IKE gateway.

The Trust zone interface on both security devices is ethernet1 and has IP address 10.1.1.1/24. All zones on both security devices are in the trust-vr routing domain.

Figure 42: Tunnel Interface with NAT-Src and NAT-Dst



WebUI (Device A)

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24

   Select the following, then click OK:

   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Untrust (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 10.10.1.1/24

2. **DIP**
   Network > Interfaces > Edit (for tunnel.1) > DIP > New: Enter the following, then click OK:

   ID: 5
   IP Address Range: (select), 10.10.1.2 ~ 10.10.1.2
   Port Translation: (select)
   In the same subnet as the interface IP or its secondary IPs: (select)

3. **Addresses**
   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: corp
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: virtualA
   IP Address/Domain Name:
   IP/Netmask: (select), 10.10.1.5/32
   Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: branch1
IP Address/Domain Name:
IP/Netmask: (select), 10.20.1.2/32
Zone: Untrust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: serverB
IP Address/Domain Name:
IP/Netmask: (select), 10.20.1.5/32
Zone: Untrust

4. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: branch1
Type: Static IP: (select), Address/Hostname: 2.2.2.2
Preshared Key: netscreen1
Security Level: Compatible
Outgoing Interface: ethernet3

NOTE: The outgoing interface does not have to be in the same zone to which the tunnel interface is bound, although in this case they are in the same zone.

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.10.1.0/24
Remote IP / Netmask: 10.20.1.0/24
Service: ANY

5. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.20.1.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.20.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

6. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), corp
Destination Address:
Address Book Entry: (select), serverB
Service: FTP
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Source Translation: (select)
DIP On: 5 (10.10.1.2–10.10.1.2)/X-late

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), branch1
Destination Address:
Address Book Entry: (select), virtualA
Service: FTP
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Destination Translation: (select)
Translate to IP: (select), 10.1.1.5
Map to Port: (clear)

WebUI (Device B)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24

Select the following, then click OK:

Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Fixed IP: (select)
IP Address / Netmask: 10.20.1.1/24

2. DIP

Network > Interfaces > Edit (for tunnel.1) > DIP > New: Enter the following, then click OK:

ID: 6
IP Address Range: (select), 10.20.1.2 ~ 10.20.1.2
Port Translation: (select)
In the same subnet as the interface IP or its secondary IPs: (select)

3. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: branch1
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: virtualB
IP Address/Domain Name:
IP/Netmask: (select), 10.20.1.5/32
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: corp
IP Address/Domain Name:
IP/Netmask: (select), 10.10.1.2/32
Zone: Untrust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: serverA
IP Address/Domain Name:
IP/Netmask: (select), 10.10.1.5/32
Zone: Untrust

4. **VPN**

   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   VPN Name: vpn1
   Security Level: Compatible
   Remote Gateway: Create a Simple Gateway: (select)
   Gateway Name: corp
   Type: Static IP: (select), Address/Hostname: 1.1.1.1
   Preshared Key: netscreen1
   Security Level: Compatible
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

   Bind to: Tunnel Interface, tunnel.1
   Proxy-ID: (select)
   Local IP / Netmask: 10.20.1.0/24
   Remote IP / Netmask: 10.10.1.0/24
   Service: ANY

NOTE: The outgoing interface does not have to be in the same zone to which the tunnel interface is bound, although in this case they are in the same zone.

---

5. **Routes**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 2.2.2.250

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 10.10.1.0/24
   Gateway: (select)
   Interface: tunnel.1
   Gateway IP Address: 0.0.0.0

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 10.10.1.0/24
   Gateway: (select)
   Interface: Null
   Gateway IP Address: 0.0.0.0
   Metric: 10

6. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), corp
Destination Address:
Address Book Entry: (select), serverA
Service: FTP
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Source Translation: (select)
DIP on: 6 (10.20.1.2–10.20.1.2)/X-late

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), corp
Destination Address:
Address Book Entry: (select), virtualB
Service: FTP
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Destination Translation: (select)
Translate to IP: 10.1.1.5
Map to Port: (clear)

CLI (Device A)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip 10.10.1.1/24
```

2. DIP

```
set interface tunnel.1 dip 5 10.10.1.2 10.10.1.2
```

3. Addresses

```
set address trust corp 10.1.1.0/24
set address trust virtualA 10.10.1.5/32
set address untrust branch1 10.20.1.2/32
set address untrust serverB 10.20.1.5/32
```

4. **VPN**

```
set ike gateway branch1 address 2.2.2.2 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn vpn1 gateway branch1 sec-level compatible
set vpn vpn1 bind interface tunnel.1
set vpn vpn1 proxy-id local-ip 10.10.1.0/24 remote-ip 10.20.1.0/24 any
```

NOTE: The outgoing interface does not have to be in the same zone to which the tunnel interface is bound, although in this case they are in the same zone.

5. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.20.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.20.1.0/24 interface null metric 10
```

6. **Policies**

```
set policy top from trust to untrust corp serverB ftp nat src dip-id 5 permit
set policy top from untrust to trust branch1 virtualA ftp nat dst ip 10.1.1.5 permit
save
```

CLI (Device B)

1. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip 10.20.1.1/24
```

2. **DIP**

```
set interface tunnel.1 dip 6 10.20.1.2 10.20.1.2
```

3. **Addresses**

```
set address trust branch1 10.1.1.0/24
set address trust virtualB 10.20.1.5/32
set address untrust corp 10.10.1.2/32
set address untrust serverA 10.10.1.5/32
```

4. **VPN**

```
set ike gateway corp address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn vpn1 gateway corp sec-level compatible
set vpn vpn1 bind interface tunnel.1
set vpn vpn1 proxy-id local-ip 10.20.1.0/24 remote-ip 10.10.1.0/24 any
```

NOTE: The outgoing interface does not have to be in the same zone to which the tunnel interface is bound, although in this case they are in the same zone.

5. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter trust-vr route 10.10.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.10.1.0/24 interface null metric 10
```

6. **Policies**
   set policy top from trust to untrust branch1 serverA ftp nat src dip-id 6 permit
   set policy top from untrust to trust corp virtualB ftp nat dst ip 10.1.1.5 permit
   save

Transparent Mode VPN

When the security device interfaces are in transparent mode (that is, they have no IP addresses and are operating at Layer 2 in the OSI Model), you can use the VLAN1 IP address as a VPN termination point. In place of an outgoing interface, as used when the interfaces are in route or NAT mode (that is, they have IP addresses and are operating at Layer 3), a VPN tunnel references an outgoing zone. By default, a tunnel uses the V1-Untrust zone as its outgoing zone. If you have multiple interfaces bound to the same outgoing zone, the VPN tunnel can use any one of them.

NOTE: The OSI Model is a networking industry standard model of network protocol architecture. The OSI Model consists of seven layers, in which Layer 2 is the Data-Link Layer and Layer 3 is the Network Layer.

At the time of this release, a security device whose interfaces are in transparent mode supports only policy-based VPNs. For more information about transparent mode, see “Transparent Mode” on page 2-82.

It is not necessary that the interfaces of both security devices be in transparent mode. The interfaces of the device at one end of the tunnel can be in transparent mode and those of the other device can be in route or NAT mode.

In this example, you set up a policy-based AutoKey IKE VPN tunnel between two security devices with interfaces operating in transparent mode.

NOTE: It is not necessary that the interfaces of both security devices be in transparent mode. The interfaces of the device at one end of the tunnel can be in transparent mode and those of the other device can be in route or NAT mode.

The key elements of the configuration for the security devices at both ends of the tunnel are as follows:

Configuration Elements	Device A	Device B
V1-Trust Zone	Interface: ethernet1, 0.0.0.0/0 (enable management for the local admin)	Interface: ethernet1, 0.0.0.0/0 (enable management for the local admin)
V1-Untrust Zone	Interface: ethernet3, 0.0.0.0/0	Interface: ethernet3, 0.0.0.0/0
VLAN1 Interface	IP Address: 1.1.1.1/24 Manage IP: 1.1.1.2 **Note:** You can separate administrative from VPN traffic by using the Manage IP address to receive administrative traffic and the VLAN1 address to terminate VPN traffic.	IP Address: 2.2.2.2/24 Manage IP: 2.2.2.3
Addresses	local_lan: 1.1.1.0/24 in V1-Trust peer_lan: 2.2.2.0/24 in V1-Untrust	local_lan: 2.2.2.0/24 in V1-Trust peer_lan: 1.1.1.0/24 in V1-Untrust

Configuration Elements	Device A	Device B
IKE Gateway	gw1, 2.2.2.2, preshared key h1p8A24nG5, security: compatible	gw1, 1.1.1.1, preshared key h1p8A24nG5, security: compatible
VPN tunnel	security: compatible	security: compatible
Policies	local_lan -> peer_lan, any service, vpn1 peer_lan -> local_lan, any service, vpn1	local_lan -> peer_lan, any service, vpn1 peer_lan -> local_lan, any service, vpn1
External Router	IP Address: 1.1.1.250	IP Address: 2.2.2.250
Route	0.0.0.0/0, use VLAN1 interface to gateway 1.1.1.250	0.0.0.0/0, use VLAN1 interface to gateway 2.2.2.250

Configuring a policy-based AutoKey IKE tunnel for a security device whose interfaces are in transparent mode involves the following steps:

1. Remove any IP addresses from the physical interfaces, and bind them to the Layer 2 security zones.
2. Assign an IP address and Manage IP address to the VLAN1 interface.
3. Enter the IP addresses for the local and remote endpoints in the address books for the V1-Trust and V1-Untrust zones.
4. Configure the VPN tunnel and designate its outgoing zone as the V1-Untrust zone.
5. Enter a default route to the external router in the trust-vr.
6. Set up policies for VPN traffic to pass between each site.

WebUI (Device A)

1. Interfaces

NOTE: Moving the VLAN1 IP address to a different subnet causes the security device to delete any routes involving the previous VLAN1 interface. When configuring a security device through the WebUI, your workstation must reach the first VLAN1 address and then be in the same subnet as the new address. After changing the VLAN1 address, you must then change the IP address of your workstation so that it is in the same subnet as the new VLAN1 address. You might also have to relocate your workstation to a subnet physically adjacent to the security device.

Network > Interfaces > Edit (for the VLAN1 interface): Enter the following, then click OK:

IP Address/Netmask: 1.1.1.1/24
Manage IP: 1.1.1.2
Management Services: WebUI, Telnet, Ping

NOTE: You enable the management options for WebUI, Telnet, and Ping on both the V1-Trust zone and the VLAN1 interface so that a local admin in the V1-Trust zone can reach the VLAN1 Manage IP address. If management through the WebUI is not already enabled on VLAN1 and the V1-Trust zone interfaces, you cannot reach the security device through the WebUI to make these settings. Instead, you must first set WebUI manageability on these interfaces through a console connection.

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Management Services: WebUI, Telnet
Other Services: Ping

Select the following, then click OK:

Zone Name: V1-Trust
IP Address/Netmask: 0.0.0.0/0

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: V1-Untrust
IP Address/Netmask: 0.0.0.0/0

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: local_lan
IP Address/Domain Name:
IP/Netmask: (select), 1.1.1.0/24
Zone: V1-Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: peer_lan
IP Address/Domain Name:
IP/Netmask: (select), 2.2.2.0/24
Zone: V1-Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: gw1
Security Level: Compatible
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 2.2.2.2
Preshared Key: h1p8A24nG5
Outgoing Zone: V1-Untrust

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway:
Predefined: (select), gw1

4. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: VLAN1 (VLAN)
Gateway IP Address: 1.1.1.250

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), local_lan
Destination Address:
Address Book Entry: (select), peer_lan
Service: ANY
Action: Tunnel
Tunnel VPN: vpn1
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

WebUI (Device B)

1. Interfaces

NOTE: Moving the VLAN1 IP address to a different subnet causes the security device to delete any routes involving the previous VLAN1 interface. When configuring a security device through the WebUI, your workstation must reach the first VLAN1 address and then be in the same subnet as the new address. After changing the VLAN1 address, you must then change the IP address of your workstation so that it is in the same subnet as the new VLAN1 address. You might also have to relocate your workstation to a subnet physically adjacent to the security device.

Network > Interfaces > Edit (for the VLAN1 interface): Enter the following, then click OK:

IP Address/Netmask: 2.2.2.2/24
Manage IP: 2.2.2.3
Management Services: WebUI, Telnet, Ping

NOTE: If management through the WebUI is not already enabled on VLAN1 and the V1-Trust zone interfaces, you cannot reach the security device through the WebUI to make these settings. Instead, you must first set WebUI manageability on these interfaces through a console connection.

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Management Services: WebUI, Telnet
Other Services: Ping

Select the following, then click OK:

Zone Name: V1-Trust
IP Address/Netmask: 0.0.0.0/0

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: V1-Untrust
IP Address/Netmask: 0.0.0.0/0

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: local_lan
IP Address/Domain Name:
IP/Netmask: (select), 2.2.2.0/24
Zone: V1-Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: peer_lan
IP Address/Domain Name:
IP/Netmask: (select), 1.1.1.0/24
Zone: V1-Untrust

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: gw1
Security Level: Compatible
Remote Gateway Type:
Static IP Address: (select), IP Address/Hostname: 1.1.1.1
Preshared Key: h1p8A24nG5
Outgoing Zone: V1-Untrust

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway:
Predefined: (select), gw1

4. **Route**
   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: VLAN1 (VLAN)
   Gateway IP Address: 2.2.2.250

5. **Policies**
   Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), local_lan
   Destination Address:
   Address Book Entry: (select), peer_lan
   Service: ANY
   Action: Tunnel
   Tunnel VPN: vpn1
   Modify matching bidirectional VPN policy: (select)
   Position at Top: (select)

CLI (Device A)

1. **Interfaces and Zones**

```
unset interface ethernet1 ip
unset interface ethernet1 zone
set interface ethernet1 zone v1-trust
set zone v1-trust manage web
set zone v1-trust manage telnet
set zone v1-trust manage ping
unset interface ethernet3 ip
unset interface ethernet3 zone
set interface ethernet3 zone v1-untrust
set interface vlan1 ip 1.1.1.1/24
set interface vlan1 manage-ip 1.1.1.2
set interface vlan1 manage web
set interface vlan1 manage telnet
set interface vlan1 manage ping
```

NOTE: You enable the management options for WebUI, Telnet, and Ping on both the V1-Trust zone and the VLAN1 interface so that a local admin in the V1-Trust zone can reach the VLAN1 Manage IP address.

---

2. **Addresses**

```
set address v1-trust local_lan 1.1.1.0/24
set address v1-untrust peer_lan 2.2.2.0/24
```

3. **VPN**

```
set ike gateway gw1 address 2.2.2.2 main outgoing-interface v1-untrust preshare
    h1p8A24nG5 sec-level compatible
set vpn vpn1 gateway gw1 sec-level compatible
```

4. **Routes**
   set vrouter trust-vr route 0.0.0.0/0 interface vlan1 gateway 1.1.1.250

5. **Policies**
   set policy top from v1-trust to v1-untrust local_lan peer_lan any tunnel vpn vpn1
   set policy top from v1-untrust to v1-trust peer_lan local_lan any tunnel vpn vpn1
   save

CLI (Device B)

1. **Interfaces and Zones**
   unset interface ethernet1 ip
   unset interface ethernet1 zone
   set interface ethernet1 zone v1-trust
   set zone v1-trust manage
   unset interface ethernet3 ip
   unset interface ethernet3 zone
   set interface ethernet3 zone v1-untrust
   set interface vlan1 ip 2.2.2.2/24
   set interface vlan1 manage-ip 2.2.2.3
   set interface vlan1 manage

2. **Addresses**
   set address v1-trust local_lan 2.2.2.0/24
   set address v1-untrust peer_lan 1.1.1.0/24

3. **VPN**
   set ike gateway gw1 address 1.1.1.1 main outgoing-interface v1-untrust preshare
   h1p8A24nG5 sec-level compatible
   set vpn vpn1 gateway gw1 sec-level compatible

4. **Routes**
   set vrouter trust-vr route 0.0.0.0/0 interface vlan1 gateway 2.2.2.250

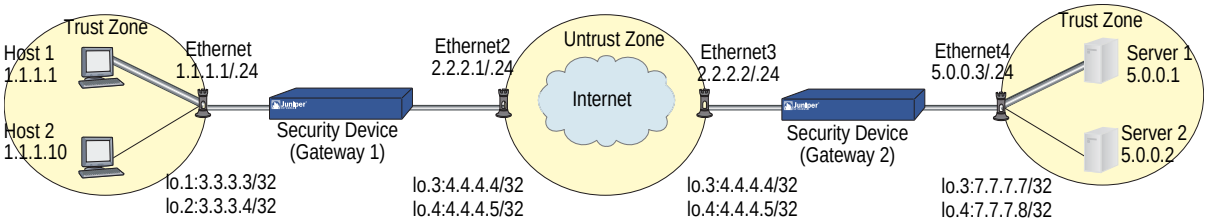
5. **Policies**
   set policy top from v1-trust to v1-untrust local_lan peer_lan any tunnel vpn vpn1
   set policy top from v1-untrust to v1-trust peer_lan local_lan any tunnel vpn vpn1
   save

Transport Mode IPsec VPN

Juniper Networks security devices support transport mode IPSec VPN for traffic between the security gateways. In order to support transport mode IPsec for traffic between the gateways, the security gateway meets the RFC standard that the source address for outgoing packets and the destination address for incoming packets is an address belonging to the security gateway.

Consider the scenario explained in Figure 43 on page 170, in which the two hosts (h-1 and h-2) are in one trust zone and the two servers (s-1 and s-2) are in another trust zone. GW -1 and GW -2 are in an untrust zone.

Figure 43: Transport Mode IPsec VPN



To configure NAT transport mode in the above scenario, perform the following steps:

1. Build transport mode IPSec VPN between host-1 and GW-1
2. Build transport or tunnel mode IPSec VPN between GW-1 and GW-2
3. Build transport mode IPSec VPN between GW -2 and server-1
4. Do source-NAT and MIP on GW-1
5. Do MIP (MIP and reversed MIP) on GW-2.

The following section explains the steps involved in configuring a transport mode IPsec VPN. GW-1 uses src-NAT when h-1 is accessing s-1, and GW-2 uses MIP when h-2 is accessing s-2.

GW-1 Configuration

1. IKE Configuration on host-1 and host-2

```
set ike gateway gateway1 address 1.1.1.1 aggressive outgoing-interface
    loopback.1 preshare test1 sec-level standard
set ike gateway gateway2 address 1.1.1.10 aggressive outgoing-interface
    loopback.2 preshare test1 sec-level standard
```

2. VPN Configuration on host-1 and host-2

```
set vpn v1 gateway gateway1 transport sec-level standard
set vpn v2 gateway gateway2 transport sec-level standard
```

3. MIP Configuration

```
set interface loopback.1 mip 3.3.3.3 host 6.6.6.6
set interface loopback.2 mip 3.3.3.4 host 6.6.6.7
```

4. IKE Configuration for GW-2

```
set ike gateway s1 address 6.6.6.6 aggressive outgoing-interface loopback.3
    preshare test1 sec-level standard
set ike gateway s2 address 6.6.6.7 aggressive outgoing-interface loopback.4
    preshare test1 sec-level standard
```

5. VPN Configuration for s1 and s2

```
set vpn v3 gateway s1 transport sec-level standard
set vpn v4 gateway s2 transport sec-level standard
```

6. DIP Configuration

```
set interface eth2 ext ip 4.4.4.4 255.255.255.255 dip 10 4.4.4.4 4.4.4.4
```

```
set interface eth2 ext ip 4.4.4.5 255.255.255.255 dip 11 4.4.4.5 4.4.4.5
```

7. Policy Setup

Outgoing policy

```
set policy id 3 from trust to untrust "1.1.1.1" "3.3.3.3" any nat src dip-id 10
    tunnel vpn v3
set policy id 4 from trust to untrust "1.1.1.10" "3.3.3.4" any nat src dip-id 11
    tunnel vpn v4
```

Incoming policy

```
set policy id 1 from trust to untrust "1.1.1.1" "(MIP)3.3.3.3" any tunnel vpn v1
set policy id 2 from trust to untrust "1.1.1.10" "(MIP)3.3.3.4" any tunnel vpn v2
```

NOTE: Users need to configure the outgoing policy before configuirng the incoming policy. This is because we do policy search twice, the first one is to check the incoming packet, and the second one is to find another VPN (the outgoing VPN) through which we send the packet.

GW-2 Configuration

8. IKE and VPN Configuration to Server-PC

```
set ike gateway gateway1 address  5.0.0.1 aggressive outgoing-interface lo.3
    preshare test sec-level standard
set ike gateway gateway2 address  5.0.0.2 aggressive outgoing-interface lo.4
    preshare test sec-level standard
```

9. VPN Configuration on server-1 and server-2

```
set vpn v3 gateway gateway1 transport sec-level standard
set vpn v4 gateway gateway2 transport sec-level standard
```

10. Reversed MIP (Traffic Is from Untrust to Trust)

```
set interface lo.3 mip 7.7.7.7 host 4.4.4.4
set interface lo.4 mip 7.7.7.8 host 4.4.4.5
```

11. IKE and VPN configuration to GW-1 (Client-PC)

```
set ike gateway h1 address 4.4.4.4 aggressive outgoing-interface lo.1 preshare
    test sec-level standard
set ike gateway h2 address 4.4.4.5 aggressive outgoing-interface lo.2 preshare
    test sec-level standard
```

12. VPN Configuration on host-1 and host-2

```
set vpn v1 gateway h1 transport sec-level standard
set vpn v2 gateway h2 transport sec-level standard
```

13. MIP

```
set interface lo.1 mip 6.6.6.6 host 5.0.0.1
set interface lo.2 mip 6.6.6.7 host 5.0.0.2
```

14. Policy Setup

Outgoing policy

```
set policy id 7 from untrust to trust "4.4.4.4" "6.6.6.6" any tunnel vpn v3
set policy id 8 from untrust to trust "4.4.4.5" "6.6.6.7" any tunnel vpn v4
```

Incoming policy

```
set policy id 5 from untrust to trust "4.4.4.4" "(MIP)6.6.6.6" any tunnel vpn v1
set policy id 6 from untrust to trust "4.4.4.5" "(MIP)6.6.6.7" any tunnel vpn v2
```

1. When a packet from h-1 arrives at GW-1, the GW-1 decrypts the packet and finds the destination MIP for the packet.

2. GW-1 matches the packet against the policy (policy 1) that defines the host VPN. It does a policy search again and finds the policy (policy 3) that defines the server VPN and src-nat.

3. GW-1 then does a destination MIP, which changes the destination IP address from 3.3.3.3 to 6.6.6.6 and the source NAT, which changes the source IP address from 1.1.1.1 to 4.4.4.4.

4. GW-2 decrypts the packet and finds the destination MIP for the packet. It matches the decrypted packet with the policy (policy 5) that defines the host VPN. It does a policy search again and finds the policy (policy 7) that defines the server VPN.

5. Before sending the packet out, GW-2 finds the reversed-MIP on lo.3 for packet's src-IP 4.4.4.4, so the src-ip is changed from 4.4.4.4 to 7.7.7.7

6. GW-2 forwards the packet to s-1 through interface 7.7.7.7

7. S-1 (5.0.0.1) processes the packet and sends it to GW-2 (6.6.6.6) through interface 7.7.7.7.

8. GW-2 identifies the reversed MIP (7.7.7.7 -> 4.4.4.4) and sends the packet to GW-1 (4.4.4.4). From GW-1, the packet is sent to h-1.

Chapter 5

Dialup Virtual Private Networks

Juniper Networks security devices can support dialup virtual private network (VPN) connections. You can configure a security device that has a static IP address to secure an IPsec tunnel with a NetScreen-Remote client or with another security device with a dynamic IP address.

This chapter contains the following sections:

Dialup

You can configure tunnels for VPN dialup users individually, or you can form users into a VPN dialup group for which you need only configure one tunnel. You can also create a group IKE ID user that allows you to define one user whose IKE ID is used as part of the IKE IDs of dialup IKE users. This approach is particularly timesaving when there are large groups of dialup users because you do not have to configure each IKE user individually.

NOTE: For more information about creating IKE user groups, see "IKE Users and User Groups" on page 9-73. For more information about the Group IKE ID feature, see "Group IKE ID" on page 197.

If the dialup client can support a virtual internal IP address, which the NetScreen-Remote does, you can also create a dynamic peer dialup VPN, AutoKey IKE tunnel (with a preshared key or certificates). You can configure a Juniper Networks security gateway with a static IP address to secure an IPsec tunnel with a NetScreen-Remote client or with another security device with a dynamic IP address.

NOTE: For background information about the available VPN options, see "Internet Protocol Security" on page 1. For guidance when choosing among the various options, see "Virtual Private Network Guidelines" on page 59.

You can configure policy-based VPN tunnels for VPN dialup users. For a dialup dynamic peer client, you can configure either a policy-based or route-based VPN. Because a dialup dynamic peer client can support a virtual internal IP address, which the NetScreen-Remote does, you can configure a routing table entry to that virtual internal address through a designated tunnel interface. Doing so allows you to configure a route-based VPN tunnel between the security device and that peer.

NOTE: A dialup dynamic peer client is a dialup client that supports a virtual internal IP address.

The dialup dynamic peer is nearly identical to the Site-to-Site dynamic peer except that the internal IP address for the dialup client is a virtual address.

Policy-Based Dialup VPN, AutoKey IKE

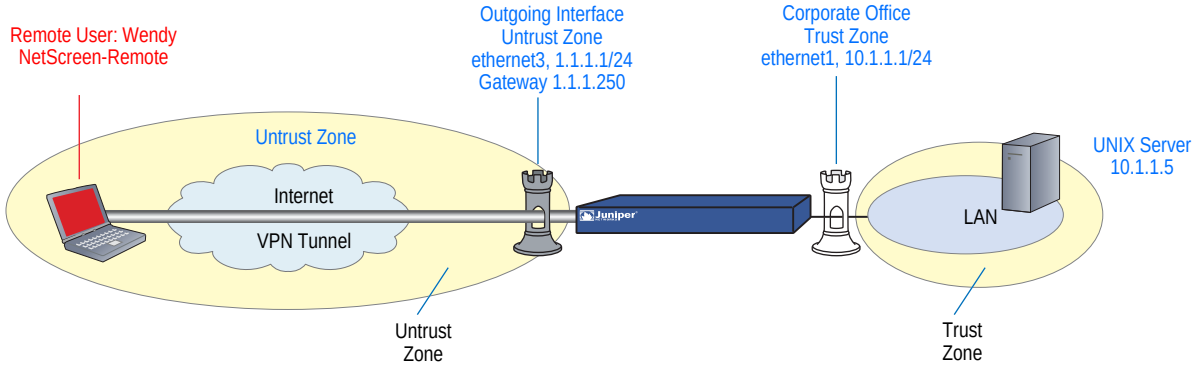
In this example, an AutoKey IKE tunnel using either a preshared key or a pair of certificates (one at each end of the tunnel) provides the secure communication channel between the IKE user Wendy and the UNIX server. The tunnel again uses ESP with 3DES encryption and SHA-1 authentication.

NOTE: The preshared key is h1p8A24nG5. It is assumed that both participants already have certificates. For more information about certificates, see "Certificates and CRLs" on page 35.

Setting up the AutoKey IKE tunnel using AutoKey IKE with either a preshared key or certificates requires the following configuration at the corporate site:

1. Configure interfaces for the Trust and Untrust zones, both of which are in the trust-vr routing domain.
2. Enter the address of the UNIX server in the Trust zone address book.
3. Define Wendy as an IKE user.
4. Configure the remote gateway and AutoKey IKE VPN.
5. Set up a default route.
6. Create a policy from the Untrust zone to the Trust zone permitting access to the UNIX from the dialup user.

Figure 44: Policy-Based Dialup VPN, AutoKey IKE



The preshared key is h1p8A24nG5. This example assumes that both participants already have RSA certificates issued by Verisign and that the local certificate on the NetScreen-Remote contains the U-FQDN wparker@email.com. (For information about obtaining and loading certificates, see “Certificates and CRLs” on page 35.) For the Phase 1 and 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined “Compatible” set of proposals for Phase 2.

WebUI

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24
Select the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

2. Address

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: UNIX
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.5/32
Zone: Trust

3. User

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Wendy
Status: Enable (select)
IKE User: (select)
Simple Identity: (select)
IKE Identity: wparker@email.com

4. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: Wendy_NSR
Security Level: Custom
Remote Gateway Type:
Dialup User: (select), User: Wendy

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Wendy_UNIX
Security Level: Compatible
Remote Gateway:
Predefined: (select), Wendy_NSR

(or)

Preshared Key

CAUTION: Aggressive mode is insecure. Because of protocol limitations, main mode IKE in combination with preshared key (PSK) is not possible for dialup VPN users. In addition, it is never advisable to use aggressive mode because this mode has inherent security problems. Consequently, it is strongly advisable to configure dialup VPN users with PKI certificates and main mode.

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

5. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

6. Policy

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Dial-Up VPN
Destination Address:
Address Book Entry: (select), UNIX
Service: ANY
Action: Tunnel
Tunnel VPN: Wendy_UNIX
Modify matching bidirectional VPN policy: (clear)
Position at Top: (select)

CLI

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. **Address**
   set address trust unix 10.1.1.5/32

3. **User**
   set user wendy ike-id u-fqdn wparker@email.com

4. **VPN**

Certificates

```
set ike gateway wendy_nsr dialup wendy aggressive outgoing-interface ethernet3
    proposal rsa-g2-3des-sha
set ike gateway wendy_nsr cert peer-ca 1
set ike gateway wendy_nsr cert peer-cert-type x509-sig
set vpn wendy_unix gateway wendy_nsr sec-level compatible
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get pki x509 list ca-cert.

(or)

Preshared Key

CAUTION: Aggressive mode is insecure. Due to protocol limitations, main mode IKE in combination with preshared key (PSK) is not possible for dialup VPN users. In addition, it is never advisable to use aggressive mode because this mode has inherent insecurity problems. Consequently, it is strongly advisable to configure dialup VPN users with PKI certificates and main mode.

```
set ike gateway wendy_nsr dialup wendy aggressive outgoing-interface ethernet3
    preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn wendy_unix gateway wendy_nsr sec-level compatible
```

5. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250

6. **Policy**
   set policy top from untrust to trust "Dial-Up VPN" unix any tunnel vpn wendy_unix save

NetScreen-Remote Security Policy Editor

1. Click Options > Secure > Specified Connections.

2. Click Add a new connection, and type UNIX next to the new connection icon that appears.

3. Configure the connection options:

   Connection Security: Secure
   Remote Party Identity and Addressing:
   ID Type: IP Address, 10.1.1.5
   Protocol: All
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address, 1.1.1.1

4. Click the PLUS symbol, located to the left of the UNIX icon, to expand the connection policy.

5. Click My Identity: Do either of the following:

   Click Pre-shared Key > Enter Key: Type h1p8A24nG5, then click OK.

   ID Type: (select E-mail Address), and type wparker@email.com.

   (or)

   Select a certificate from the Select Certificate drop-down list.

   ID Type: (select E-mail Address)

NOTE: The email address from the certificate automatically appears in the identifier field.

6. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

7. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

8. Click Authentication (Phase 1) > Proposal 1: Select the following authentication method and algorithms:

   Authentication Method: Pre-Shared Key

   (or)

   Authentication Method: RSA Signatures
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

9. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

   Encapsulation Protocol (ESP): (select)
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Encapsulation: Tunnel

10. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

13. Click File > Save Changes.

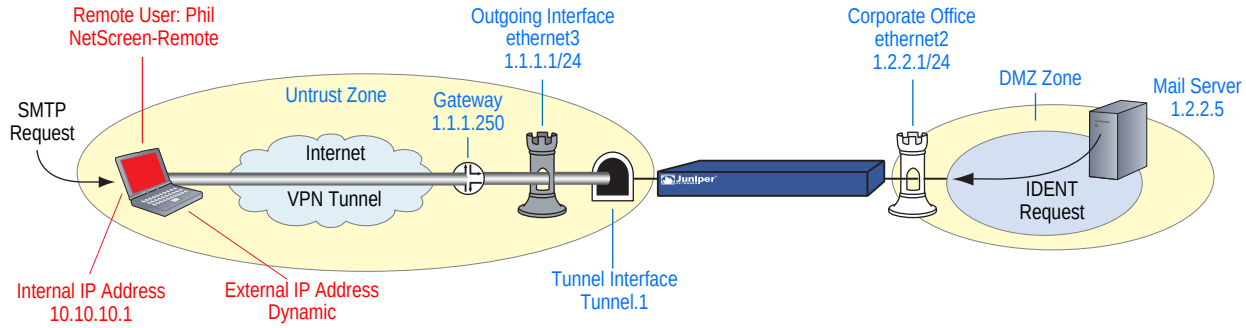
Route-Based Dialup VPN, Dynamic Peer

In this example, a VPN tunnel securely connects the user behind NetScreen-Remote to the Untrust zone interface of the security device protecting the mail server in the DMZ zone. The Untrust zone interface has a static IP address. The NetScreen-Remote client has a dynamically assigned external IP address and a static (virtual) internal IP address. The administrator of the security device must know the peer's internal IP address for the following two purposes:

- The admin can use it in policies.
- The admin can create a route linking the address with a tunnel interface bound to an appropriate tunnel.

After the NetScreen-Remote client establishes the tunnel, traffic through the tunnel can then originate from either end. All zones on the security device are in the trust-vr routing domain.

Figure 45: Route-Based Dialup VPN, Dynamic Peer



In this example, Phil wants to get his email from the mail server at the company site. When he attempts to do so, he is authenticated by the mail server program, which sends him an IDENT request through the tunnel.

NOTE: The mail server can send the IDENT request through the tunnel only if the security administrator adds a custom service for it (TCP, port 113) and sets up an outgoing policy allowing that traffic through the tunnel to 10.10.10.1.

The preshared key is h1p8A24nG5. It is assumed that both participants already have RSA certificates issued by Verisign and that the local certificate on the NetScreen-Remote contains the U-FQDN *pm@juniper.net*. (For information about obtaining and loading certificates, see "Certificates and CRLs" on page 35.) For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined "Compatible" set of proposals for Phase 2.

You enter the following three routes on the security device:

- A default route to the external router in the trust-vr
- A route to the destination through the tunnel interface
- A null route to the destination. You assign a higher metric (farther from zero) to the null route so that it becomes the next-choice route to the destination. Then, if the state of the tunnel interface changes to "down" and the route referencing that interface becomes inactive, the security device uses the null route, which essentially drops any traffic sent to it, rather than the default route, which forwards unencrypted traffic.

Finally, you create policies allowing traffic to flow in both directions between Phil and the mail server.

WebUI

1. Interfaces

Network > Interfaces > Edit (for ethernet2): Enter the following, then click OK:

Zone Name: DMZ
Static IP: (select this option when present)
IP Address/Netmask: 1.2.2.1/24

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (trust-vr)
Unnumbered: (select)
Interface: ethernet3 (trust-vr)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Mail Server
IP Address/Domain Name:
IP/Netmask: (select), 1.2.2.5/32
Zone: DMZ

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Phil
IP Address/Domain Name:
IP/Netmask: (select), 10.10.10.1/32
Zone: Untrust

3. Services

Policy > Policy Elements > Services > Custom > New: Enter the following, then click OK:

Service Name: Ident
Service Timeout:
Use protocol default: (select)
Transport Protocol: TCP (select)
Source Port: Low 1, High 65535
Destination Port: Low 113, High 113

Policy > Policy Elements > Services > Group > New: Enter the following, move the following services, then click OK:

Group Name: Remote_Mail
Group Members << Available Members:
Ident
MAIL
POP3

4. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Phil
Security Level: Custom
Remote Gateway Type:
Dynamic IP Address: (select), Peer ID: pm@juniper.net

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: corp_Phil
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Phil

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface: (select), tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 1.2.2.5/32
Remote IP / Netmask: 10.10.10.1/32
Service: Any

5. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.10.10.1/32
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 10.10.10.1/32
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

6. Policies

Policies > (From: Untrust, To: DMZ) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Phil
Destination Address:
Address Book Entry: (select), Mail Server
Service: Remote_Mail
Action: Permit
Position at Top: (select)

Policies > (From: DMZ, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Mail Server
Destination Address:
Address Book Entry: (select), Phil
Service: Remote_Mail
Action: Permit
Position at Top: (select)

CLI

1. Interfaces

```
set interface ethernet2 zone dmz
set interface ethernet2 ip 1.2.2.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

2. Addresses

```
set address dmz “Mail Server” 1.2.2.5/32
set address untrust phil 10.10.10.1/32
```

3. Services

```
set service ident protocol tcp src-port 1-65535 dst-port 113-113
set group service remote_mail
set group service remote_mail add ident
set group service remote_mail add mail
set group service remote_mail add pop3
```

4. VPN

Preshared Key

```
set ike gateway to_phil dynamic pm@juniper.net aggressive outgoing-interface
    ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn corp_phil gateway to_phil sec-level compatible
set vpn corp_phil bind interface tunnel.1
set vpn corp_phil proxy-id local-ip 1.2.2.5/32 remote-ip 10.10.10.1/32 any
```

(or)

Certificates

```
set ike gateway to_phil dynamic pm@juniper.net aggressive outgoing-interface
    ethernet3 proposal rsa-g2-3des-sha
set ike gateway to_phil cert peer-ca 1
set ike gateway to_phil cert peer-cert-type x509-sig
set vpn corp_phil gateway to_phil sec-level compatible
set vpn corp_phil bind interface tunnel.1
set vpn corp_phil proxy-id local-ip 1.2.2.5/32 remote-ip 10.10.10.1/32 any
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get pki x509 list ca-cert.

---

5. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.10.10.1/32 interface tunnel.1
set vrouter trust-vr route 10.10.10.1/32 interface null metric 10
```

6. **Policies**

```
set policy top from dmz to untrust "Mail Server" phil remote_mail permit
set policy top from untrust to dmz phil "Mail Server" remote_mail permit
save
```

NetScreen-Remote

1. Click Options > Global Policy Settings, and select the Allow to Specify Internal Network Address check box.

2. Options > Secure > Specified Connections.

3. Click the Add a new connection button, and type Mail next to the new connection icon that appears.

4. Configure the connection options:

   Connection Security: Secure
   Remote Party Identity and Addressing:
   ID Type: IP Address, 1.2.2.5
   Protocol: All
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address, 1.1.1.1

5. Click the PLUS symbol, located to the left of the UNIX icon, to expand the connection policy.

6. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

7. Click My Identity and do either of the following:

   Click Pre-shared Key > Enter Key: Type h1p8A24nG5, then click OK.

   ID Type: E-mail Address; pm@juniper.net
   Internal Network IP Address: 10.10.10.1

   (or)

Select the certificate that contains the email address “pm@juniper.net” from the Select Certificate drop-down list.

ID Type: E-mail Address; pm@juniper.net
Internal Network IP Address: 10.10.10.1

8. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

9. Click Authentication (Phase 1) > Proposal 1: Select the following Authentication Method and Algorithms:

   Authentication Method: Pre-Shared Key

   (or)

   Authentication Method: RSA Signatures
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

10. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

13. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

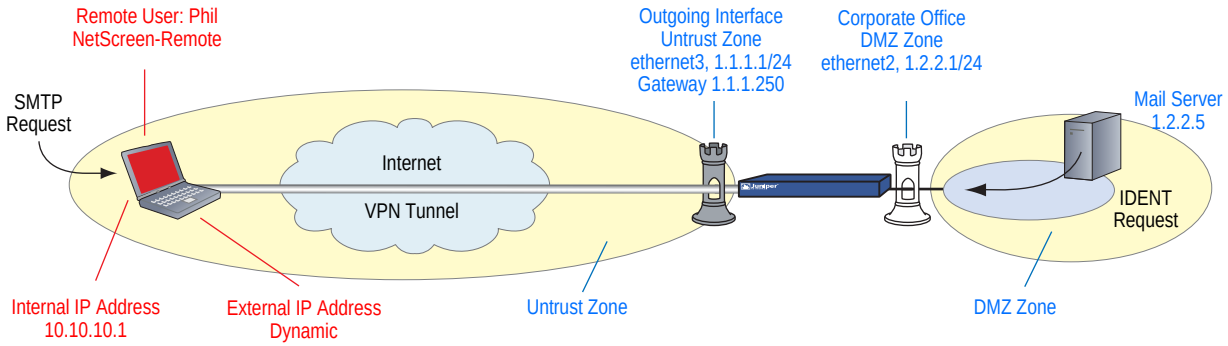
    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

14. Click File > Save Changes.

Policy-Based Dialup VPN, Dynamic Peer

In this example, a VPN tunnel securely connects the user behind the NetScreen-Remote to the Untrust zone interface of the security device protecting the mail server in the DMZ zone. The Untrust zone interface has a static IP address. The NetScreen-Remote client has a dynamically assigned external IP address and a static (virtual) internal IP address. The administrator of the security device must know the client's internal IP address so that he can add it to the Untrust address book for use in policies to tunnel traffic from that source. After the NetScreen-Remote client establishes the tunnel, traffic through the tunnel can originate from either end.

Figure 46: Policy-Based Dialup VPN, Dynamic Peer



In this example, Phil wants to get his email from the mail server at the company site. When he attempts to do so, he is authenticated by the mail server program, which sends him an IDENT request through the tunnel.

NOTE: The mail server can send the IDENT request through the tunnel only if the security administrator adds a custom service for it (TCP, port 113) and sets up an outgoing policy allowing that traffic through the tunnel to 10.10.10.1.

The preshared key is h1p8A24nG5. This example assumes that both participants have RSA certificates issued by Verisign and that the local certificate on the NetScreen-Remote contains the U-FQDN *pm@juniper.net*. (For more information about obtaining and loading certificates, see "Certificates and CRLs" on page 35.) For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal—either pre-g2-3des-sha for the preshared key method or rsa-g2-3des-sha for certificates—and select the predefined "Compatible" set of proposals for Phase 2.

WebUI

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet2): Enter the following, then click OK:

   Zone Name: DMZ
   Static IP: (select this option when present)
   IP Address/Netmask: 1.2.2.1/24

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Mail Server
IP Address/Domain Name:
IP/Netmask: (select), 1.2.2.5/32
Zone: DMZ

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Phil
IP Address/Domain Name:
IP/Netmask: (select), 10.10.10.1/32
Zone: Untrust

3. Services

Policy > Policy Elements > Services > Custom > New: Enter the following, then click OK:

Service Name: Ident
Service Timeout:
Use protocol default: (select)
Transport Protocol: TCP (select)
Source Port: Low 1, High 65535
Destination Port: Low 113, High 113

Policy > Policy Elements > Services > Group > New: Enter the following, move the following services, then click OK:

Group Name: Remote_Mail
Group Members << Available Members:
Ident
MAIL
POP3

4. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: To_Phil
Security Level: Custom
Remote Gateway Type:
Dynamic IP Address: (select), Peer ID: pm@juniper.net

Preshared Key

Preshared Key: h1p8A24nG5
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

(or)

Certificates

Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: corp_Phil
Security Level: Compatible
Remote Gateway:
Predefined: (select), To_Phil

5. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

6. Policies

Policies > (From: Untrust, To: DMZ) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Phil
Destination Address:
Address Book Entry: (select), Mail Server
Service: Remote_Mail
Action: Tunnel
VPN Tunnel: corp_Phil
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

CLI

1. Interfaces

```
set interface ethernet2 zone dmz
set interface ethernet2 ip 1.2.2.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. Addresses

```
set address dmz "mail server" 1.2.2.5/32
set address untrust phil 10.10.10.1/32
```

3. Services

```
set service ident protocol tcp src-port 1-65535 dst-port 113-113
set group service remote_mail
set group service remote_mail add ident
set group service remote_mail add mail
set group service remote_mail add pop3
```

4. VPN

Preshared Key

```
set ike gateway to_phil dynamic pm@juniper.net aggressive outgoing-interface
    ethernet3 preshare h1p8A24nG5 proposal pre-g2-3des-sha
set vpn corp_phil gateway to_phil sec-level compatible
```

(or)

Certificates

```
set ike gateway to_phil dynamic pm@juniper.net aggressive outgoing-interface
    ethernet3 proposal rsa-g2-3des-sha
set ike gateway to_phil cert peer-ca 1
set ike gateway to_phil cert peer-cert-type x509-sig
set vpn corp_phil gateway to_phil sec-level compatible
```

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get pki x509 list ca-cert.

---

5. Route

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
```

6. Policies

```
set policy top from untrust to dmz phil "mail server" remote_mail tunnel vpn
    corp_phil
set policy top from dmz to untrust "mail server" phil remote_mail tunnel vpn
    corp_phil
save
```

NetScreen-Remote

1. Click Options > Global Policy Settings, and select Allow to Specify Internal Network Address.
2. Options > Secure > Specified Connections.
3. Click Add a new connection, and type Mail next to the new connection icon that appears.

4. Configure the connection options:

   Connection Security: Secure
   Remote Party Identity and Addressing:
   ID Type: IP Address, 1.2.2.5
   Protocol: All
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address, 1.1.1.1

5. Click the PLUS symbol, located to the left of the UNIX icon, to expand the connection policy.

6. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

7. Click My Identity and do either of the following:

   Click Pre-shared Key > Enter Key: Type h1p8A24nG5, then click OK.

   Internal Network IP Address: 10.10.10.1
   ID Type: E-mail Address; pm@juniper.net

   (or)

   Select the certificate that contains the email address “pmason@email.com” from the Select Certificate drop-down list.

   Internal Network IP Address: 10.10.10.1
   ID Type: E-mail Address; pm@juniper.net

8. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

9. Click Authentication (Phase 1) > Proposal 1: Select the following Authentication Method and Algorithms:

   Authentication Method: Pre-Shared Key

   (or)

   Authentication Method: RSA Signatures
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

10. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

13. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

14. Click File > Save Changes.

Bidirectional Policies for Dialup VPN Users

You can create bidirectional policies for dialup VPNs. This configuration provides similar functionality as a dynamic peer VPN configuration. However, with a dynamic peer VPN configuration, the security device admin must know the internal IP address space of the dialup user, so that the admin can use it as the destination address when configuring an outgoing policy (see “Policy-Based Dialup VPN, Dynamic Peer” on page 187). With a dialup VPN user configuration, the admin at the LAN site does not need to know the internal address space of the dialup user. The security device protecting the LAN uses the predefined address “Dial-Up VPN” as the source address in the incoming policy and the destination in the outgoing policy.

The ability to create bidirectional policies for a dialup VPN tunnel allows traffic to originate from the LAN end of the VPN connection after the connection has been established. (The remote end must first initiate the tunnel creation.) Note that unlike a dialup dynamic peer VPN tunnel, this feature requires that the services on the incoming and outgoing policies be identical.

NOTE: ScreenOS does not support service groups and address groups in bidirectional policies that reference a dialup VPN configuration.

The internal address space of two or more concurrently connected dialup VPN users might overlap. For example, dialup users A and B might both have an internal IP address space of 10.2.2.0/24. If that happens, the security device sends all outbound VPN traffic to both user A and user B through the VPN referenced in the first policy it finds in the policy list. For example, if the outbound policy referencing the VPN to user A appears first in the policy list, then the security device sends all outbound VPN traffic intended for users A and B to user A.

Similarly, the internal address of a dialup user might happen to overlap an address in any other policy—whether or not that other policy references a VPN tunnel. If that occurs, the security device applies the first policy that matches the basic traffic attributes of source address, destination address, source port number, destination port number, service. To avoid a bidirectional dialup VPN policy with a dynamically derived address superseding another policy with a static address, Juniper Networks recommends positioning the bidirectional dialup VPN policy lower in the policy list.

In this example, you configure bidirectional policies for a dialup AutoKey IKE VPN tunnel named *VPN_dial* for IKE user *dialup-j* with IKE ID *jf@ns.com*. For Phase 1 negotiations, you use the proposal *pre-g2-3des-sha*, with the preshared key *Jf11d7uU*. You select the predefined "Compatible" set of proposals for Phase 2 negotiations.

The IKE user initiates a VPN connection to the security device from the Untrust zone to reach corporate servers in the Trust zone. After the IKE user establishes the VPN connection, traffic can initiate from either end of the tunnel.

The Trust zone interface is ethernet1, has IP address 10.1.1.1/24, and is in NAT mode. The Untrust zone interface is ethernet3 and has IP address 1.1.1.1/24. The default route points to the external router at 1.1.1.250.

WebUI

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24

   Select the following, then click OK:

   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

2. **Objects**
   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: trust_net
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

Policy > Policy Elements > Users > Local > New: Enter the following, then click OK:

User Name: dialup-j
Status: Enable
IKE User: (select)
Simple Identity: (select); jf@ns.com

3. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: dialup1
Security Level: Custom
Remote Gateway Type:
Dialup User: (select); dialup-j
Preshared Key: Jf11d7uU

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): pre-g2-3des-sha
Mode (Initiator): Aggressive

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: VPN_dial
Security Level: Compatible
Remote Gateway:
Create a Simple Gateway: (select)
Gateway Name: dialup1
Type:
Dialup User: (select); dialup-j
Preshared Key: Jf11d7uU
Security Level: Compatible
Outgoing Interface: ethernet3

4. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet1
Gateway IP Address: 1.1.1.250

5. Policies

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Dial-Up VPN
Destination Address:
Address Book Entry: (select), trust_net
Service: ANY
Action: Tunnel
VPN Tunnel: VPN_dial
Modify matching bidirectional VPN policy: (select)

CLI

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. Objects

```
set address trust trust_net 10.1.1.0/24
set user dialup-j ike-id u-fqdn jf@ns.com
```

3. VPN

```
set ike gateway dialup1 dialup dialup-j aggressive outgoing-interface ethernet3
    preshare Jf11d7uU proposal pre-g2-3des-sha
set vpn VPN_dial gateway dialup1 sec-level compatible
```

4. Route

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
```

5. Policies

```
set policy from untrust to trust “Dial-Up VPN” trust_net any tunnel vpn VPN_dial
set policy from trust to untrust trust_net “Dial-Up VPN” any tunnel vpn VPN_dial
save
```

NetScreen-Remote Security Policy Editor

1. Click Options > Secure > Specified Connections.

2. Click Add a new connection, and type Corp next to the new connection icon that appears.

3. Configure the connection options:

   Connection Security: Secure
   Remote Party Identity and Addressing
   ID Type: IP Subnet
   Subnet: 10.1.1.0
   Mask: 255.255.255.0
   Protocol: All
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address, 1.1.1.1

4. Click the PLUS symbol, located to the left of the UNIX icon, to expand the connection policy.

5. Click My Identity: Do either of the following:

   Click Pre-shared Key > Enter Key: Type Jf11d7uU, then click OK.

   ID Type: (select E-mail Address), and type jf@ns.com.

6. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

7. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

8. Click Authentication (Phase 1) > Proposal 1: Select the following Authentication Method and Algorithms:

   Authentication Method: Pre-Shared Key

   (or)

   Authentication Method: RSA Signatures
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

9. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

   Encapsulation Protocol (ESP): (select)
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Encapsulation: Tunnel

10. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

13. Click File > Save Changes.

Group IKE ID

Some organizations have many dialup VPN users. For example, a sales department might have hundreds of users, many of whom require secure dialup communication when off site. With so many users, it is impractical to create a separate user definition, dialup VPN configuration, and policy for each one.

To avoid this difficulty, the Group IKE ID method makes one user definition available for multiple users. The group IKE ID user definition applies to all users having certificates with specified values in the distinguished name (dn) or to all users whose full IKE ID and preshared key on their VPN client match a partial IKE ID and preshared key on the security device.

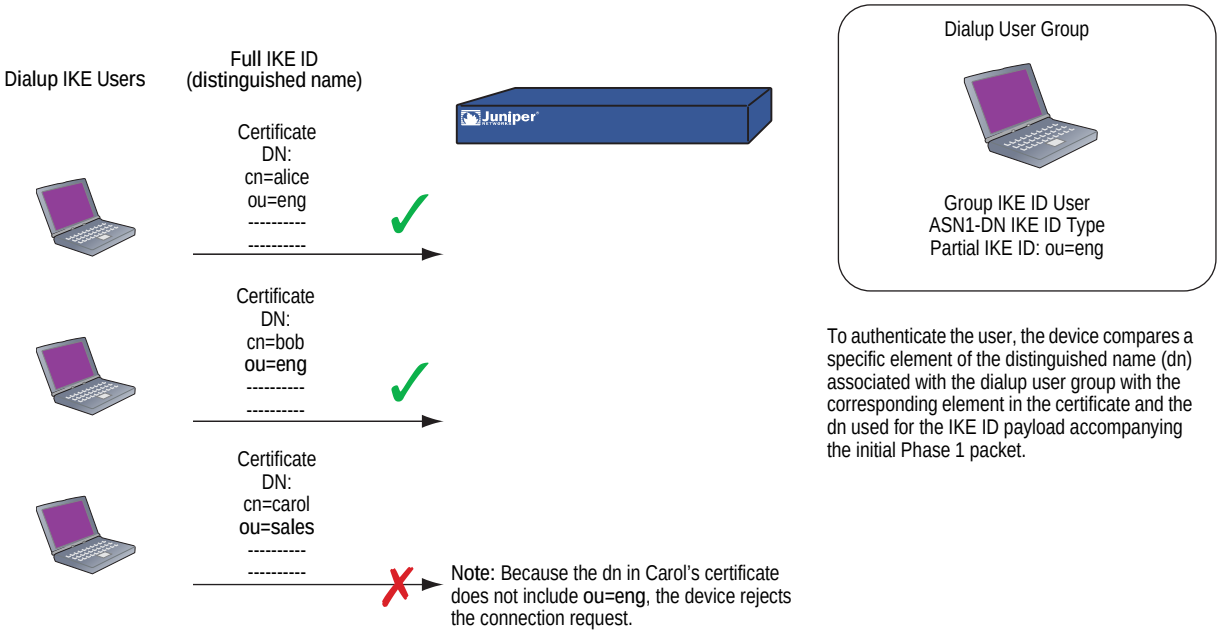
NOTE: When a dialup IKE user connects to the security device, the security device first extracts and uses the full IKE ID to search its peer gateway records in case the user does not belong to a group IKE ID user group. If the full IKE ID search produces no matching entry, the security device then checks for a partial IKE ID match between the incoming embedded IKE ID and a configured group IKE ID user.

You add a single group IKE ID user to an IKE dialup VPN user group and specify the maximum number of concurrent connections that the group supports. The maximum number of concurrent sessions cannot exceed the maximum number of allowed Phase 1 SAs or the maximum number of VPN tunnels allowed on the platform.

Group IKE ID with Certificates

Group IKE ID with certificates is a technique for performing IKE authentication for a group of dialup IKE users without configuring a separate user profile for each one. Instead, the security device uses a single group IKE ID user profile that contains a partial IKE ID. A dialup IKE user can successfully build a VPN tunnel to a security device if the VPN configuration on his VPN client specifies a certificate that contains distinguished name elements that match those configured as the partial IKE ID definition in the group IKE ID user profile on the security device.

Figure 47: Group IKE ID with Certificates



You can set up group IKE ID with certificates as follows:

On the Security Device:

1. Create a new group IKE ID user with a partial IKE identity (such as *ou = sales,o = netscreen*), and specify how many dialup users can use the group IKE ID profile to log on.

2. Assign the new group IKE ID user to a dialup user group, and name the group.

NOTE: You can put only one group IKE ID user in an IKE user group.

3. In the dialup AutoKey IKE VPN configuration, specify the name of the dialup user group, that the Phase 1 negotiations be in aggressive mode and that certificates (RSA or DSA, depending on the type of certificate loaded on the dialup VPN clients) be used for authentication.

4. Create a policy permitting inbound traffic through the specified dialup VPN.

On the VPN Client:

1. Obtain and load a certificate whose distinguished name contains the same information as defined in the partial IKE ID on the security device.

2. Configure a VPN tunnel to the security device using aggressive mode for Phase 1 negotiations, specify the certificate that you have previously loaded, and select *Distinguished Name* for the local IKE ID type.

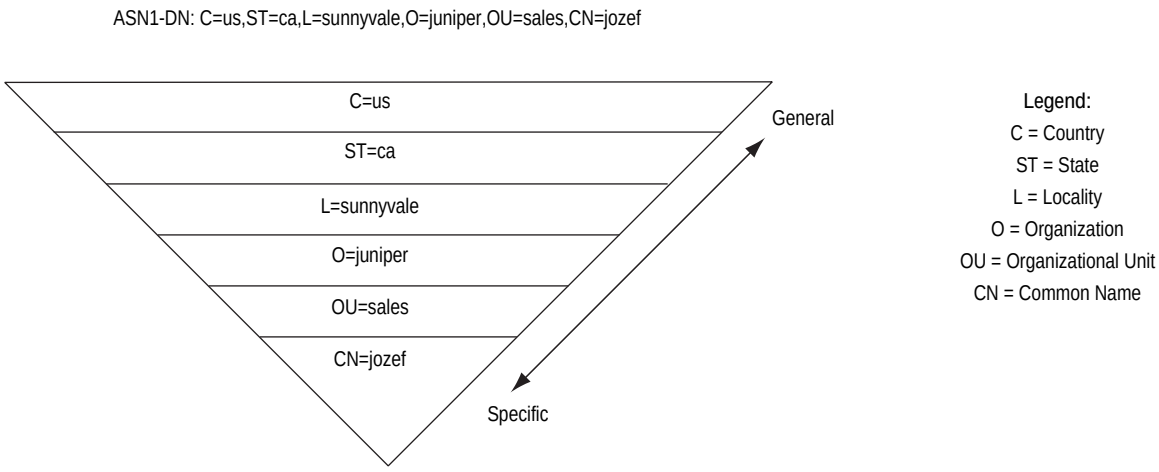
Thereafter, each individual dialup IKE user with a certificate with distinguished name elements that match the partial IKE ID defined in the group IKE ID user profile can successfully build a VPN tunnel to the security device. For example, if the group IKE ID user has IKE ID *OU = sales,O = netscreen,* the security device accepts

Phase 1 negotiations from any user with a certificate containing those elements in its distinguished name. The maximum number of such dialup IKE users that can connect to the security device depends upon the maximum number of concurrent sessions that you specify in the group IKE ID user profile.

Wildcard and Container ASN1-DN IKE ID Types

When you define the IKE ID for a group IKE user, you must use the Abstract Syntax Notation, version 1, distinguished name (ASN1-DN) as the IKE ID type of identity configuration. This notation is a string of values, which is frequently although not always ordered from general to specific. See Figure 48 for an example.

Figure 48: ASN1 Distinguished Name



When configuring the group IKE ID user, you must specify the peer's ASN1-DN ID as one of two types:

- Wildcard: ScreenOS authenticates a dialup IKE user's ID if the values in the dialup IKE user's ASN1-DN identity fields match those in the group IKE user's ASN1-DN identity fields. The wildcard ID type supports only one value per identity field (for example, "ou = eng" or "ou = sw" but not "ou = eng,ou = sw"). The ordering of the identity fields in the two ASN1-DN strings is inconsequential.

- Container: ScreenOS authenticates a dialup IKE user's ID if the values in the dialup IKE user's ASN1-DN identity fields exactly match the values in the group IKE user's ASN1-DN identity fields. The container ID type supports multiple entries for each identity field (for example, "ou = eng,ou = sw,ou = screenos"). The ordering of the values in the identity fields of the two ASN1-DN strings must be identical.

When configuring an ASN1-DN ID for a remote IKE user, specify the type as either "wildcard" or "container" and define the ASN1-DN ID that you expect to receive in the peer's certificate (for example, "c = us,st = ca,cn = kgreen"). When configuring an ASN1-DN ID for a local IKE ID, use the following keyword: [DistinguishedName]. Include the brackets and spell it exactly as shown.

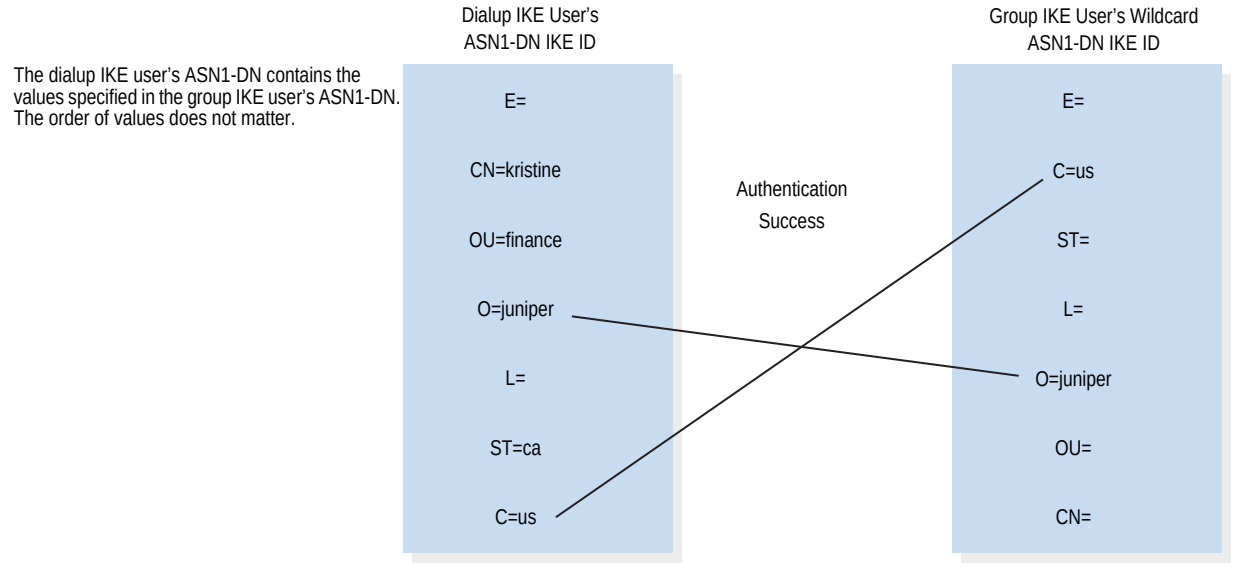
Wildcard ASN1-DN IKE ID

A wildcard ASN1-DN requires values in the remote peer's distinguished name IKE ID to match values in the group IKE user's partial ASN1-DN IKE ID. The sequencing of these values in the ASN1-DN string is inconsequential. For example, if the dialup IKE user's ID and the group IKE user's ID are as follows:

- Dialup IKE user's full ASN1-DN IKE ID:
  CN = kristine,OU = finance,O = juniper,ST = ca,C = us
- Group IKE user's partial ASN1-DN IKE ID: C = us,O = juniper

then a wildcard ASN1-DN IKE ID successfully matches the two IKE IDs, even though the order of values in the two IDs is different.

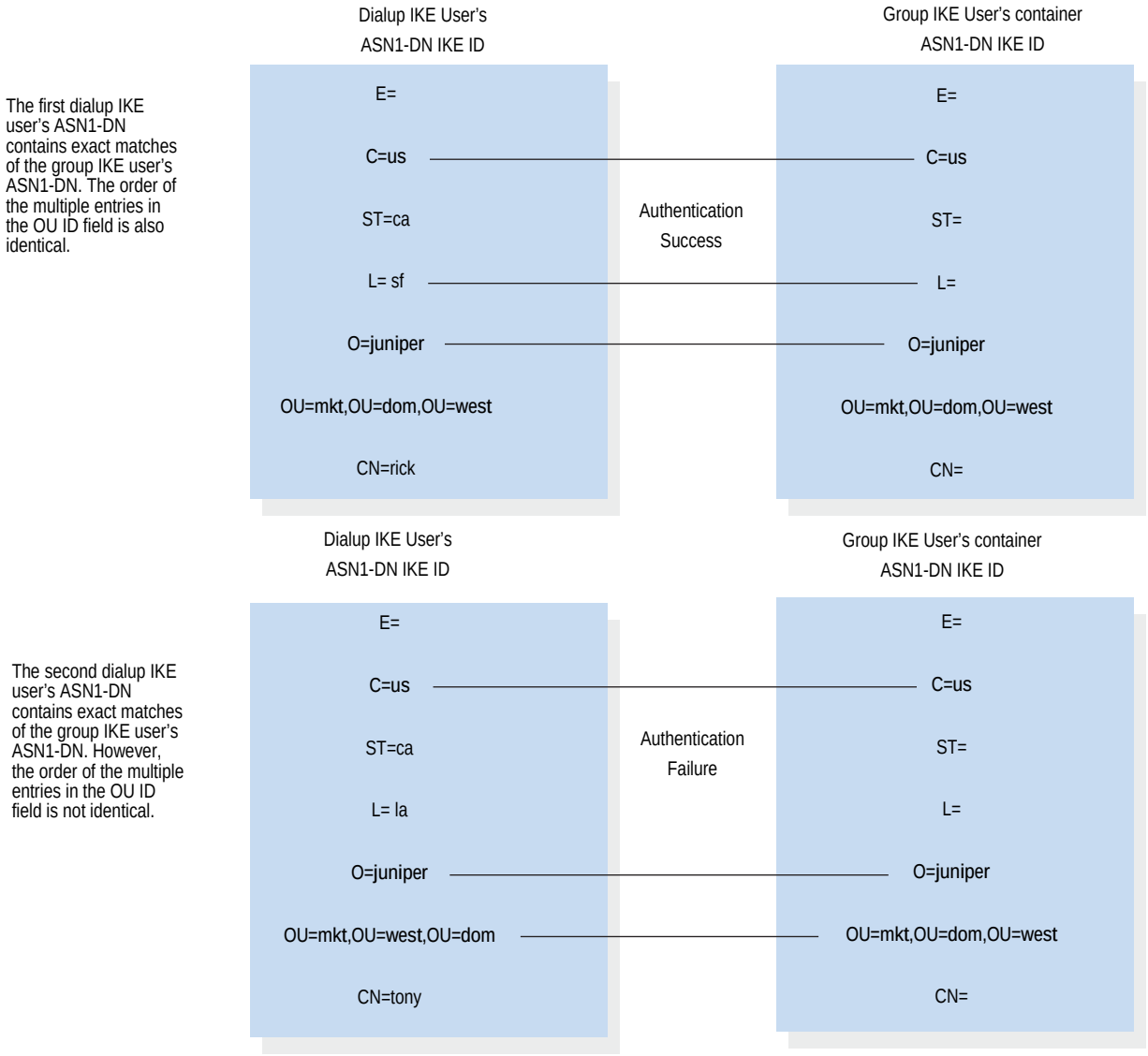
Figure 49: Successful Wildcard ASN1-DN Authentication



Container ASN1-DN IKE ID

A container ASN1-DN ID allows the group IKE user's ID to have multiple entries in each identity field. ScreenOS authenticates a dialup IKE user if the dialup user's ID contains values that exactly match the values in the group IKE user's ID. Unlike the wildcard type, the order of the ASN1-DN fields must be identical in both the dialup IKE user's and group IKE user's IDs and the order of multiple values in those fields must be identical.

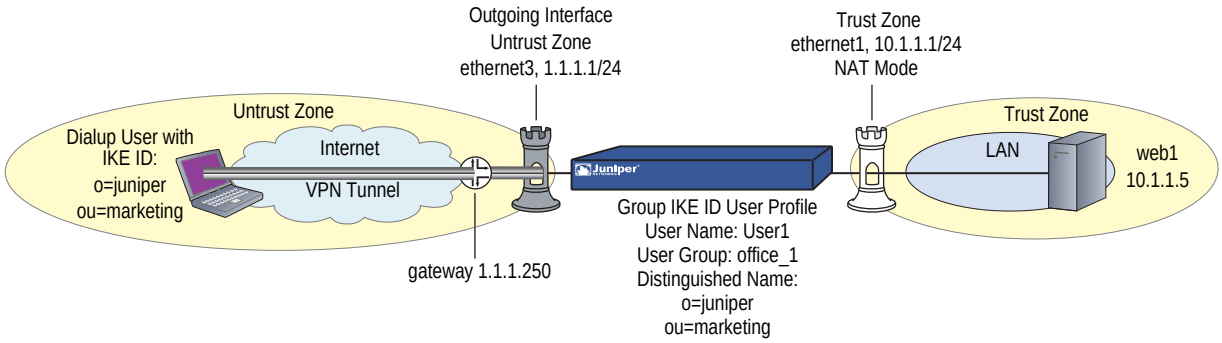
Figure 50: Authentication Success and Failure Using Container ASN1-DN IDs



Creating a Group IKE ID (Certificates)

In this example, you create a new group IKE ID user definition named *User1*. You configure it to accept up to 10 Phase 1 negotiations concurrently from VPN clients with RSA certificates containing *O = netscreen* and *OU = marketing*. The certificate authority (CA) is Verisign. You name the dialup IKE user group *office_1*.

Figure 51: Group IKE ID



The dialup IKE users send a distinguished name as their IKE ID. The distinguished name (dn) in a certificate for a dialup IKE user in this group might appear as the following concatenated string:

C=us,ST=ca,L=sunnyvale,**O=netscreen**,**OU=marketing**,CN=carrie nowocin,CN=a2010002,CN=ns500, CN=4085557800,CN=rsa-key,CN=10.10.5.44

Because the values *O = netscreen* and *OU = marketing* appear in the peer's certificate and the user uses the distinguished name as its IKE ID type, the security device authenticates the user.

For the Phase 1 and Phase 2 security levels, you specify one Phase 1 proposal — rsa-g2-3des-sha for certificates—and select the predefined "Compatible" set of proposals for Phase 2.

You configure a dialup VPN and a policy permitting HTTP traffic through the VPN tunnel to reach the Web server *Web1*. The configuration of the remote VPN client (using NetScreen-Remote) is also included.

WebUI

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet1): Enter the following, then click OK:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24
   Select the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

2. Address

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: web1
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.5/32
Zone: Trust

3. Users

Policy > Policy Elements > Users > Local > New: Enter the following, then click OK:

User Name: User1
Status Enable: (select)
IKE User: (select)
Number of Multiple Logins with same ID: 10
Use Distinguished Name For ID: (select)
OU: marketing
Organization: juniper

Objects > User Groups > Local > New: Type office_1 in the Group Name field, do the following, then click OK:

Select **User1** and use the **<<** button to move her from the Available Members column to the Group Members column.

4. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: Corp_GW
Security Level: Custom
Remote Gateway Type: Dialup User Group: (select), Group: office_1
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Custom
Phase 1 Proposal (For Custom Security Level): rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (optional):
Peer CA: Verisign
Peer Type: X509-SIG

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Corp_VPN
Security Level: Compatible
Remote Gateway: Predefined: (select), Corp_GW

5. **Route**
   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 1.1.1.250

6. **Policy**
   Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Dial-Up VPN
   Destination Address:
   Address Book Entry: (select), web1
   Service: HTTP
   Action: Tunnel
   Tunnel VPN: Corp_VPN
   Modify matching bidirectional VPN policy: (clear)
   Position at Top: (select)

CLI

1. **Interfaces**
   set interface ethernet1 zone trust
   set interface ethernet1 ip 10.1.1.1/24
   set interface ethernet1 nat
   set interface ethernet3 zone untrust
   set interface ethernet3 ip 1.1.1.1/24

2. **Address**
   set address trust web1 10.1.1.5/32

3. **Users**
   set user User1 ike-id asn1-dn wildcard o=juniper,ou=marketing share-limit 10
   set user-group office_1 user User1

4. **VPN**
   set ike gateway Corp_GW dialup office_1 aggressive outgoing-interface ethernet3 proposal rsa-g2-3des-sha
   set ike gateway Corp_GW cert peer-ca 1
   set ike gateway Corp_GW cert peer-cert-type x509-sig
   set vpn Corp_VPN gateway Corp_GW sec-level compatible

NOTE: The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get pki x509 list ca-cert.

---

5. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250

6. **Policy**
   set policy top from untrust to trust "Dial-Up VPN" web1 http tunnel vpn Corp_VPN save

NetScreen-Remote Security Policy Editor

1. Click Options > Secure > Specified Connections.

2. Click Add a new connection, and type web1 next to the new connection icon that appears.

3. Configure the connection options:

   Connection Security: Secure
   Remote Party Identity and Addressing
   ID Type: IP Address, 10.1.1.5
   Protocol: Highlight **All**, type **HTTP**, press the **Tab** key, and type **80**.
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address, 1.1.1.1

4. Click the PLUS symbol, located to the left of the web1 icon, to expand the connection policy.

5. Click My Identity: Select the certificate that has *o = netscreen,ou = marketing* as elements in its distinguished name from the Select Certificate drop-down list.

   ID Type: Select **Distinguished Name** from the drop-down list.

NOTE: This example assumes that you have already loaded a suitable certificate on the NetScreen-Remote client. For information about loading certificates on the NetScreen-Remote, refer to the NetScreen-Remote documentation.

---

6. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

7. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

8. Click Authentication (Phase 1) > Proposal 1: Select the following Encryption and Data Integrity Algorithms:

   Authentication Method: RSA Signatures
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

9. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

   Encapsulation Protocol (ESP): (select)
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Encapsulation: Tunnel

10. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

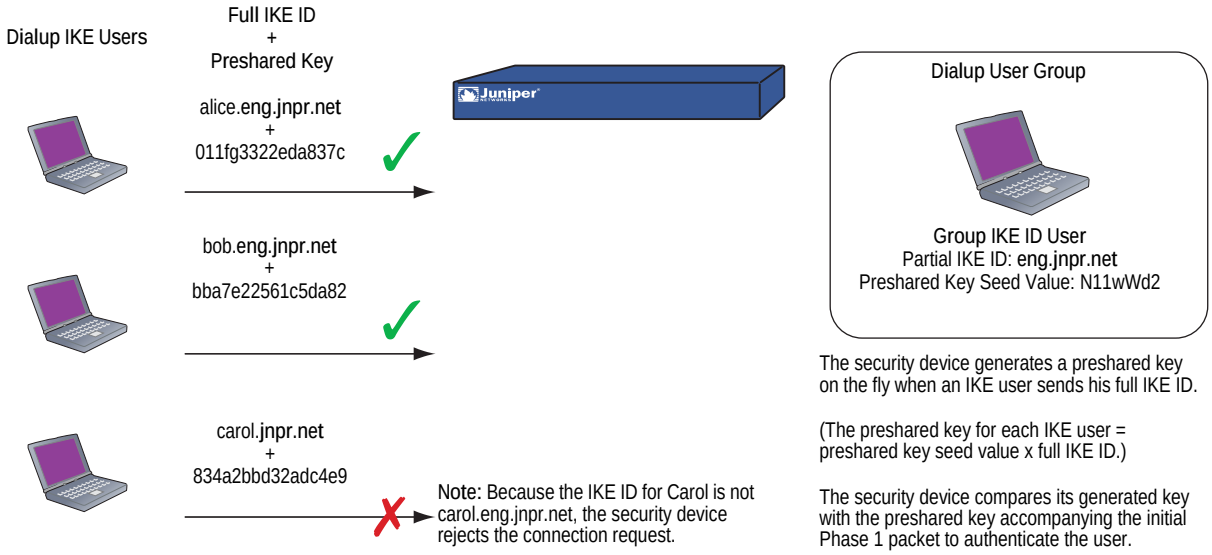
    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

13. Click File > Save Changes.

Setting a Group IKE ID with Preshared Keys

Group IKE ID with preshared keys is a technique for performing IKE authentication for a group of dialup IKE users without configuring a separate user profile for each one. Instead, the security device uses a single group IKE ID user profile, which contains a partial IKE ID. A dialup IKE user can successfully build a VPN tunnel to a security device if the VPN configuration on his VPN client has the correct preshared key and if the rightmost part of the user's full IKE ID matches the group IKE ID user profile's partial IKE ID.

Figure 52: Group IKE ID with Preshared Keys



The IKE ID type that you can use for the Group IKE ID with Preshared Key feature can be either an email address or a fully qualified domain name (FQDN).

You can set up group IKE ID with preshared keys as follows:

On the Security Device:

1. Create a new group IKE ID user with a partial IKE identity (such as juniper.net), and specify the number of dialup users that can use the group IKE ID profile to log on.

2. Assign the new group IKE ID user to a dialup user group.

3. In the dialup AutoKey IKE VPN configuration, assign a name for the remote gateway (such as road1), specify the dialup user group, and enter a preshared key seed value.

4. Use the following CLI command to generate an individual dialup user's preshared key using the preshared key seed value and the full user IKE ID (such as lisa@juniper.net)

   exec ike preshare-gen *name_str usr_name_str*
   (for example) **exec ike preshare-gen road1 lisa@juniper.net**

5. Record the preshared key for use when configuring the remote VPN client.

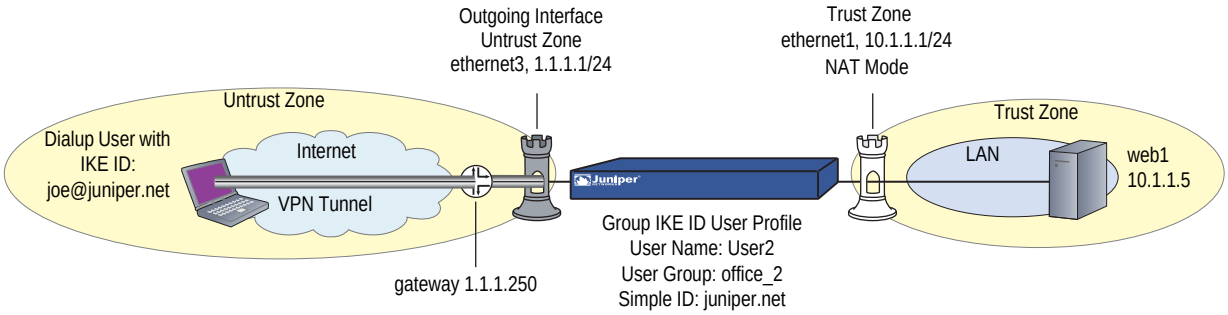
On the VPN Client:

Configure a VPN tunnel to the security device using aggressive mode for Phase 1 negotiations, and enter the preshared key that you previously generated on the security device.

Thereafter, the security device can successfully authenticate each individual user whose full IKE ID contains a section that matches the partial group IKE ID user profile. For example, if the group IKE ID user has IKE identity juniper.net, any user with that domain name in his IKE ID can initiate Phase 1 IKE negotiations in aggressive mode with the security device. For example: alice@juniper.net, bob@juniper.net, and carol@juniper.net. How many such users can log on depends upon a maximum number of concurrent sessions specified in the group IKE ID user profile.

In this example, you create a new group IKE ID user named User2. You configure it to accept up to 10 Phase 1 negotiations concurrently from VPN clients with preshared keys containing an IKE ID ending with the string juniper.net. The seed value for the preshared key is jk930k. You name the dialup IKE user group office_2.

Figure 53: Group IKE ID (Preshared Keys)



For both the Phase 1 and Phase 2 negotiations, you select the security level predefined as "Compatible." All the security zones are in the trust-vr routing domain.

WebUI

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click OK:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24
   Select the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

2. **Address**
   Policy > Policy Elements > Addresses > List > New : Enter the following, then click OK:

   Address Name: web1
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.5/32
   Zone: Trust

3. **Users**
   Policy > Policy Elements > Users > Local > New: Enter the following, then click OK:

   User Name: User2
   Status: Enable
   IKE User: (select)
   Number of Multiple Logins with same ID: 10
   Simple Identity: (select)
   IKE Identity: juniper.net

Policy > Policy Elements > User Groups > Local > New: Type office_2 in the Group Name field, do the following, then click OK:

Select **User2** and use the **<<** button to move him from the Available Members column to the Group Members column.

4. VPN

NOTE: The WebUI allows you to enter only a value for a preshared key, not a seed value from which the security device derives a preshared key. To enter a preshared key seed value when configuring an IKE gateway, you must use the CLI.

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: Corp_VPN
Security Level: Compatible
Remote Gateway: Predefined: (select), Corp_GW

5. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

6. Policy

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Dial-Up VPN
Destination Address:
Address Book Entry: (select), web1
Service: HTTP
Action: Tunnel
Tunnel VPN: Corp_VPN
Modify matching bidirectional VPN policy: (clear)
Position at Top: (select)

CLI

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. Address

```
set address trust web1 10.1.1.5/32
```

3. Users

```
set user User2 ike-id u-fqdn juniper.net share-limit 10
set user-group office_2 user User2
```

4. **VPN**
   set ike gateway Corp_GW dialup office_2 aggressive seed-preshare jk930k sec-level compatible
   set vpn Corp_VPN gateway Corp_GW sec-level compatible

5. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250

6. **Policy**
   set policy top from untrust to trust "Dial-Up VPN" web1 http tunnel vpn Corp_VPN save

Obtaining the Preshared Key

You can only obtain the preshared key by using the following CLI command:

exec ike preshare-gen *name_str usr_name_str*

The preshared key, based on the preshared key seed value *jk930k* (as specified in the configuration for the remote gateway named *Corp_GW*), and the full identity of individual user *heidi@juniper.net* is *11ccce1d396f8f29ffa93d11257f691af96916f2*.

NetScreen-Remote Security Policy Editor

1. Click Options > Secure > Specified Connections.

2. Click Add a new connection, and type web1 next to the new connection icon that appears.

3. Configure the connection options:

   Connection Security: Secure
   Remote Party Identity and Addressing
   ID Type: IP Address, 10.1.1.5
   Protocol: Highlight **All**, type **HTTP**, press the **Tab** key, and type **80**.
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address, 1.1.1.1

4. Click the PLUS symbol, located to the left of the web1 icon, to expand the connection policy.

5. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

6. Click My Identity: Click Pre-shared Key > Enter Key: Type 11ccce1d396f8f29ffa93d11257f691af96916f2, then click OK.

   ID Type: (select E-mail Address), and type heidi@juniper.net.

7. Click the PLUS symbol, located to the left of the Security Policy icon, then click the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

8. Click Authentication (Phase 1) > Proposal 1: Select the following Encryption and Data Integrity Algorithms:

   Authentication Method: Pre-Shared Key
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

9. Click Authentication (Phase 1) > Create New Proposal: Select the following IPsec protocols:

   Authentication Method: Pre-Shared Key
   Encrypt Alg: Triple DES
   Hash Alg: MD5
   Key Group: Diffie-Hellman Group 2

10. Click Authentication (Phase 1) > Create New Proposal: Select the following IPsec protocols:

    Authentication Method: Pre-Shared Key
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Key Group: Diffie-Hellman Group 2

11. Click Authentication (Phase 1) > Create New Proposal: Select the following IPsec protocols:

    Authentication Method: Pre-Shared Key
    Encrypt Alg: DES
    Hash Alg: MD5
    Key Group: Diffie-Hellman Group 2

12. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

13. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

14. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

15. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

16. Click File > Save Changes.

Shared IKE ID

The shared IKE ID feature facilitates the deployment of a large number of dialup users. With this feature, the security device authenticates multiple dialup VPN users using a single group IKE ID and preshared key. Thus, it provides IPsec protection for large remote user groups through a common VPN configuration.

This feature is similar to the Group IKE ID with pre-shared keys feature, with the following differences:

- With the group IKE ID feature, the IKE ID can be an email address or an FQDN (fully qualified domain name). For this feature, the IKE ID must be an email address.
- Instead of using the preshared key seed value and the full user IKE ID to generate a preshared key for each user, you specify a single preshared key for all users in the group.
- You must use XAuth to authenticate the individual users.

To set up a shared IKE ID and preshared key on the security device:

1. Create a new group IKE ID user, and specify how many dialup users can use the group IKE ID to log on. For this feature, use an email address as the IKE ID.
2. Assign the new group IKE ID to a dialup user group.
3. In the dialup-to-LAN AutoKey IKE VPN configuration, create a shared IKE ID gateway.
4. Define the XAuth users and enable XAuth on the remote IKE gateway.

On the VPN Client:

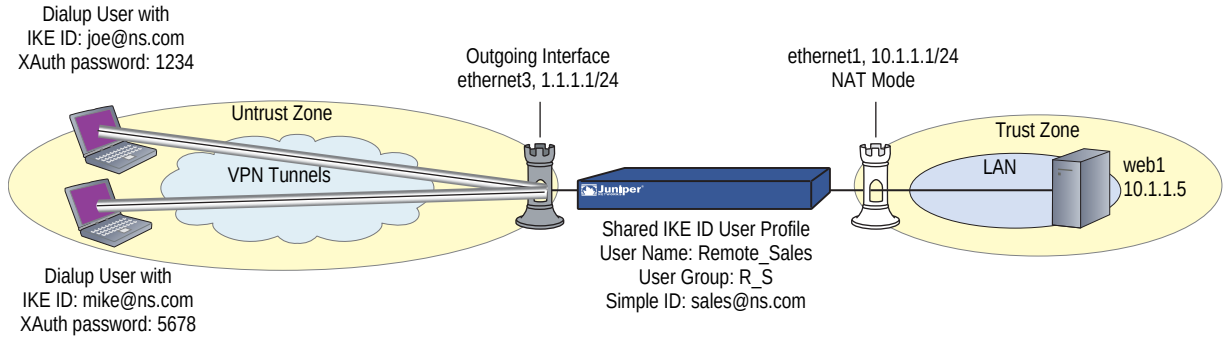
Configure a VPN tunnel to the security device using aggressive mode for Phase 1 negotiations, and enter the preshared key that you previously defined on the security device.Thereafter, the security device authenticates each remote user as follows:

During Phase 1 negotiations, the security device first authenticates the VPN client by matching the IKE ID and preshared key that the client sends with the IKE ID and preshared key on the security device. If there is a match, then the security device uses XAuth to authenticate the individual user. It sends a login prompt to the user at the remote site between Phase 1 and Phase 2 IKE negotiations. If the remote user successfully logs on with the correct username and password, Phase 2 negotiations begin.

In this example, you create a new group IKE ID user named Remote_Sales. It accepts up to 250 Phase 1 negotiations concurrently from VPN clients with the same preshared key (abcd1234). You name the dialup IKE user group R_S. In addition, you configure two XAuth users, Joe and Mike.

For both the Phase 1 and Phase 2 negotiations, you select the security level predefined as Compatible. All the security zones are in the trust-vr routing domain.

Figure 54: Shared IKE ID (Preshared Keys)



WebUI

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24
Select the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 1.1.1.1/24

2. **Address**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: web1
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.5/32
   Zone: Trust

3. **Users**

   Policy > Policy Elements > Users > Local > New: Enter the following, then click OK:

   User Name: Remote_Sales
   Status: Enable
   IKE User: (select)
   Number of Multiple Logins with same ID: 250
   Simple Identity: (select)
   IKE Identity: sales@ns.com

   Policy > Policy Elements > User Groups > Local > New: Type R_S in the Group Name field, do the following, then click OK:

   Select **Remote_sales** and use the **<<** button to move him from the Available Members column to the Group Members column.

   Policy > Policy Elements > Users > Local > New: Enter the following, then click OK:

   User Name: Joe
   Status: Enable
   XAuth User: (select)
   Password: 1234
   Confirm Password: 1234

   Policy > Policy Elements > Users > Local > New: Enter the following, then click OK:

   User Name: Mike
   Status: Enable
   XAuth User: (select)
   Password: 5678
   Confirm Password: 5678

4. **VPN**

   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gateway Name: sales_gateway
   Security Level: Compatible (select)
   Remote Gateway Type: Dialup Group (select), R_S
   Preshared Key: abcd1234
   Outgoing Interface: ethernet3

> Advanced: Enter the following, then click **Return** to return to the base Gateway configuration page:

Enable XAuth: (select)
Local Authentication: (select)
Allow Any: (select)

VPNs > AutoKey IKE > New: Enter the following, then click **OK**:

VPN Name: Sales_VPN
Security Level: Compatible
Remote Gateway: Predefined: (select) sales_gateway

> Advanced: Enter the following advanced settings, then click **Return** to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Zone, Untrust-Tun

5. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click **OK**:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

6. Policy

Policies > (From: Untrust, To: Trust) New: Enter the following, then click **OK**:

Source Address:
Address Book Entry: (select), Dial-Up VPN
Destination Address:
Address Book Entry: (select), web1
Service: HTTP
Action: Tunnel
Tunnel VPN: Sales_VPN
Modify matching bidirectional VPN policy: (clear)
Position at Top: (select)

CLI

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. Address

```
set address trust web1 10.1.1.5/32
```

3. **Users**
   set user Remote_Sales ike-id sales@ns.com share-limit 250
   set user-group R_S user Remote_Sales
   set user Joe password 1234
   set user Joe type xauth
   set user Mike password 5678
   set user Mike type xauth

4. **VPN**
   set ike gateway sales_gateway dialup R_S aggressive outgoing-interface ethernet3 preshare abcd1234 sec-level compatible
   set ike gateway sales_gateway xauth
   set vpn sales_vpn gateway sales_gateway sec-level compatible
   set vpn sales_vpn bind zone untrust-tun

5. **Route**
   set route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250

6. **Policy**
   set policy top from untrust to trust "Dial-Up VPN" web1 http tunnel vpn sales_vpn save

NetScreen-Remote Security Policy Editor

This example shows the configuration for the user named Joe.

1. Click Options > Secure > Specified Connections.

2. Click Add a new connection, and type web1 next to the new connection icon that appears.

3. Configure the connection options:

   Connection Security: Secure
   Remote Party ID Type: IP Address
   IP Address: 10.1.1.5
   Connect using Secure Gateway Tunnel: (select)
   ID Type: IP Address; 1.1.1.1

4. Click the PLUS symbol, located to the left of the web1 icon, to expand the connection policy.

5. Click the Security Policy icon, then select Aggressive Mode and clear Enable Perfect Forward Secrecy (PFS).

6. Click My Identity: Click Pre-shared Key > Enter Key: Type abcd1234, then click OK.

   ID Type: (select E-mail Address), and type sales@ns.com.

7. Click the PLUS symbol, located to the left of the Security Policy icon, then click the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

8. Click Authentication (Phase 1) > Proposal 1: Select the following Encryption and Data Integrity Algorithms:

   Authentication Method: Pre-Shared Key; Extended Authentication
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

9. Click Authentication (Phase 1) > Create New Proposal: Select the following IPsec protocols:

   Authentication Method: Pre-Shared Key; Extended Authentication
   Encrypt Alg: Triple DES
   Hash Alg: MD5
   Key Group: Diffie-Hellman Group 2

10. Click Authentication (Phase 1) > Create New Proposal: Select the following IPsec protocols:

    Authentication Method: Pre-Shared Key; Extended Authentication
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Key Group: Diffie-Hellman Group 2

11. Click Authentication (Phase 1) > Create New Proposal: Select the following IPsec protocols:

    Authentication Method: Pre-Shared Key; Extended Authentication
    Encrypt Alg: DES
    Hash Alg: MD5
    Key Group: Diffie-Hellman Group 2

12. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

13. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Tunnel

14. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Tunnel

15. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Tunnel

16. Click File > Save Changes.

Chapter 6

Layer 2 Tunneling Protocol

This chapter provides an introduction to Layer 2 Tunneling Protocol (L2TP), its use alone and with IPsec support, and some configuration examples for L2TP and L2TP-over-IPsec. It contains the following sections:

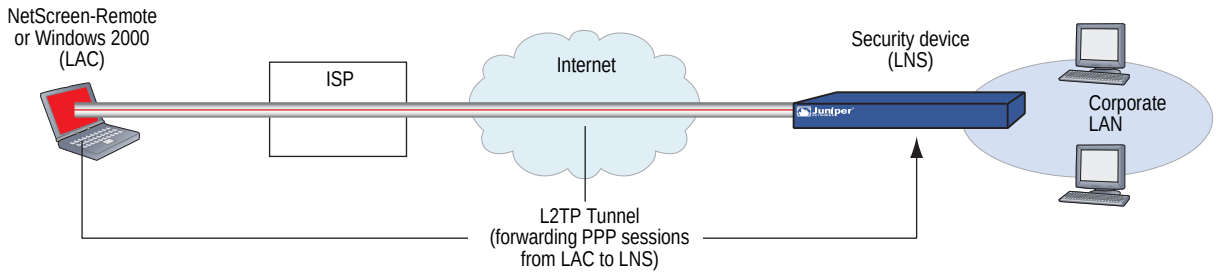
Introduction to L2TP

Layer 2 Tunneling Protocol (L2TP) provides a way for a dialup user to make a virtual Point-to-Point Protocol (PPP) connection to an L2TP network server (LNS), which can be a security device. L2TP sends PPP frames through a tunnel between an L2TP access concentrator (LAC) and the LNS.

Originally, L2TP was designed so that a LAC residing at an ISP site tunneled to an LNS at either another ISP or corporate site. The L2TP tunnel did not extend completely to the dialup user's computer, but only to the LAC at the dialup user's local ISP. (This is sometimes referred to as a compulsory L2TP configuration.)

A NetScreen-Remote client on Windows 2000 or Windows NT, or a Windows 2000 client by itself, can act as a LAC. The L2TP tunnel can extend directly to the dialup user's computer, thus providing end-to-end tunneling. (This approach is sometimes referred to as a voluntary L2TP configuration.)

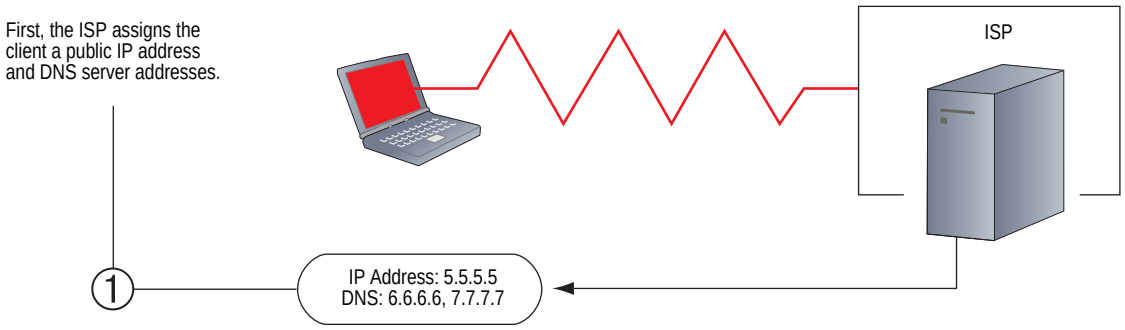
Figure 55: L2TP Tunnel Between VPN Client (LAC) and Security Device (LNS)



Because the PPP link extends from the dialup user across the Internet to the security device (LNS), it is the security device, not the ISP, that assigns the client its IP address, DNS and WINS servers addresses, and authenticates the user, either from the local database or from an external auth server (RADIUS, SecurID, or LDAP).

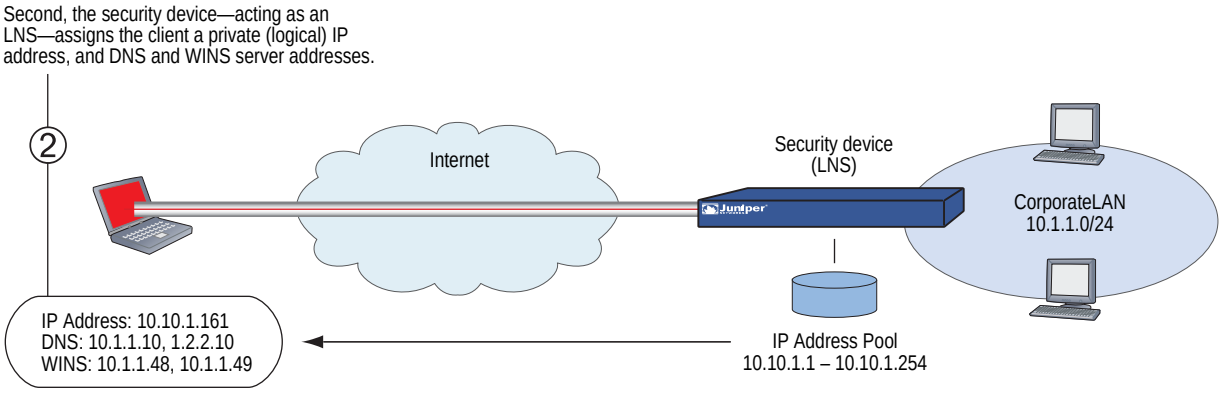
In fact, the client receives two IP addresses—one for its physical connection to the ISP, and a logical one from the LNS. When the client contacts its ISP, perhaps using PPP, the ISP makes IP and DNS assignments, and authenticates the client. This allows users to connect to the Internet with a public IP address, which becomes the outer IP address of the L2TP tunnel.

Figure 56: IP and DNS Assignments from ISP



Then, when the L2TP tunnel forwards the encapsulated PPP frames to the security device, the security device assigns the client an IP address, and DNS and WINS settings. The IP address can be from the set of private addresses not used on the Internet. This address becomes the inner IP address of the L2TP tunnel.

Figure 57: IP and DNS Assignments from LNS



NOTE: The IP addresses assigned to the L2TP client must be in a different subnet from the IP addresses in the corporate LAN.

The current version of ScreenOS provides the following L2TP support:

- L2TP tunnels originating from a host running Windows 2000

NOTE: By default, Windows 2000 performs L2TP-over-IPsec. To force it to use L2TP only, you must navigate to the ProhibitIPSec key in the registry and change 0 (L2TP-over-IPsec) to 1 (L2TP only). (Before performing this, Juniper Networks recommends that you back up your registry.) Click Start > Run: Type regedit. Double-click HKEY_LOCAL_MACHINE > System > CurrentControlSet > Services > RasMan > Parameters. Double-click ProhibitIPSec: Type 1 in the Value data field, select Hexadecimal as the base value, then click OK. Reboot. (If you do not find such an entry in the registry, see Microsoft WIndows documentation for information about how to create one.)

- Combination of L2TP and IPsec in transport mode (L2TP-over-IPsec)
  - For NetScreen-Remote: L2TP-over-IPsec with main mode negotiations using certificates, and aggressive mode using either a preshared key or certificates
  - For Windows 2000: L2TP-over-IPsec with main mode negotiations using certificates
- Outgoing dialup policy for L2TP and L2TP-over-IPsec tunnels (An outgoing dialup policy can be paired with an incoming policy to provide a bidirectional tunnel.)
- User authentication using either the Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP) from the local database or an external auth server (RADIUS, SecurID, or LDAP)

NOTE: The local database and RADIUS servers support both PAP and CHAP. SecurID and LDAP servers support PAP only.

- The assignment of dialup users' IP address, Domain Name System (DNS) servers, and Windows Internet Naming Service (WINS) servers from either the local database or a RADIUS server
- L2TP tunnels and L2TP-over-IPsec tunnels for the root system and virtual systems

NOTE: To use L2TP, the security device must be operating at Layer 3, with security zone interfaces in NAT or route mode. When the security device is operating at Layer 2, with security zone interfaces in transparent mode, no L2TP-related material appears in the WebUI, and L2TP-related CLI commands elicit error messages.

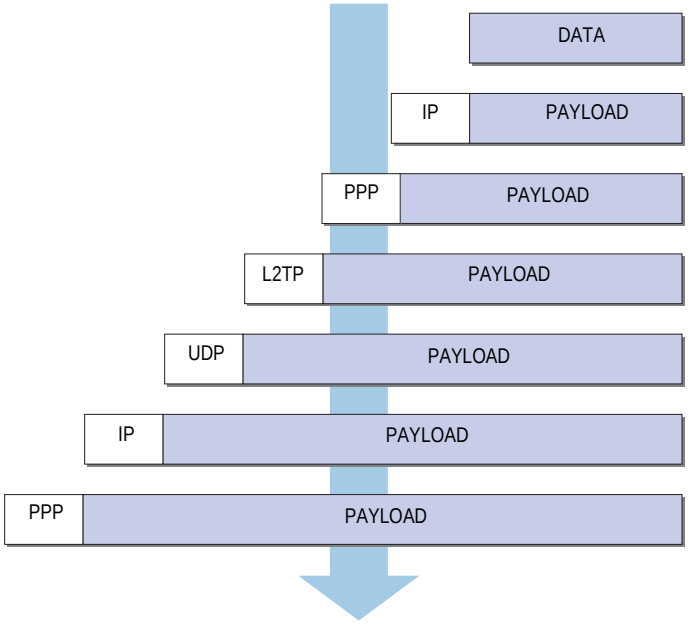
Packet Encapsulation and Decapsulation

L2TP employs encapsulation of packets as the means for transporting PPP frames from the LAC to the LNS. Before looking at specific examples for setting up L2TP and L2TP-over-IPsec, an overview of the encapsulation and decapsulation involved in the L2TP process is presented.

Encapsulation

When a dialup user on an IP network sends data over an L2TP tunnel, the LAC encapsulates the IP packet within a series of Layer 2 frames, Layer 3 packets, and Layer 4 segments. Assuming that the dialup user connects to the local ISP over a PPP link, the encapsulation proceeds as shown in Figure 58 on page 223.

Figure 58: L2TP Packet Encapsulation

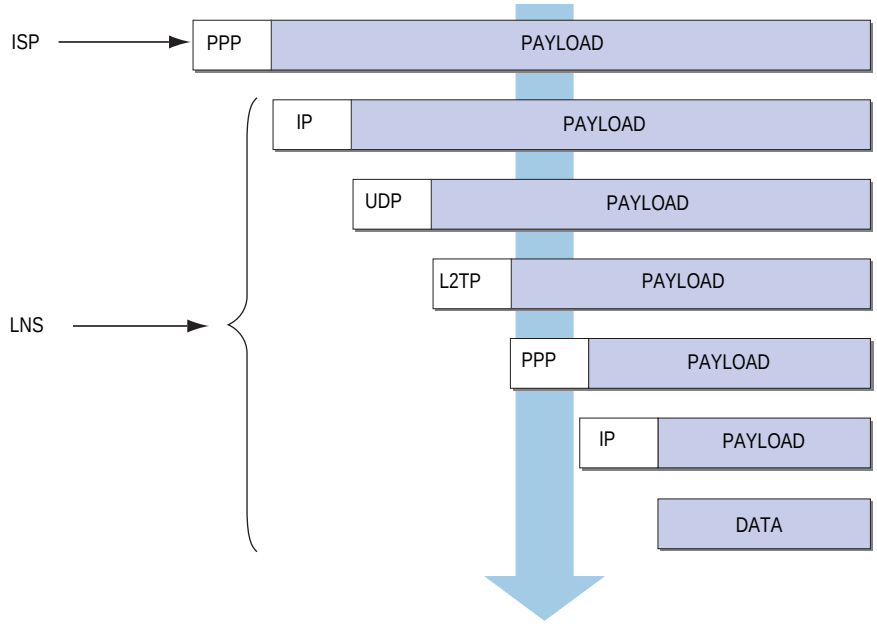


1. The data is placed in an IP payload.
2. The IP packet is encapsulated in a PPP frame.
3. The PPP frame is encapsulated in an L2TP frame.
4. The L2TP frame is encapsulated in a UDP segment.
5. The UDP segment is encapsulated in an IP packet.
6. The IP packet is encapsulated in a PPP frame to make the physical connection between the dialup user and the ISP.

Decapsulation

When the LAC initiates the PPP link to the ISP, the decapsulation and forwarding of the nested contents proceed as shown in Figure 59 on page 224.

Figure 59: L2TP Packet Decapsulation



1. The ISP completes the PPP link and assigns the user's computer an IP address.

   Inside the PPP payload is an IP packet.

2. The ISP removes the PPP header and forwards the IP packet to the LNS.

3. The LNS removes the IP header.

   Inside the IP payload is a UDP segment specifying port 1701, the port number reserved for L2TP.

4. The LNS removes the UDP header.

   Inside the UDP payload is an L2TP frame.

5. The LNS processes the L2TP frame, using the tunnel ID and call ID in the L2TP header to identify the specific L2TP tunnel. The LNS then removes the L2TP header.

   Inside the L2TP payload is a PPP frame.

6. The LNS processes the PPP frame, assigning the user's computer a logical IP address.

   Inside the PPP payload is an IP packet.

7. The LNS routes the IP packet to its ultimate destination, where the IP header is removed and the data in the IP packet is extracted.

Setting L2TP Parameters

The LNS uses L2TP to provide the PPP settings for a dialup user, which typically come from an ISP. These settings are as follows:

- IP address – The security device selects an address from a pool of IP addresses and assigns it to the dialup user's computer. The selection process operates cyclically through the IP address pool; that is, in a pool from 10.10.1.1 to 10.10.1.3, the addresses are selected in the following cycle: 10.10.1.1 – 10.10.1.2 – 10.10.1.3 – 10.10.1.1 – 10.10.1.2 …
- DNS primary and secondary server IP addresses – The security device provides these addresses to the dialup user's computer.
- WINS primary and secondary server IP addresses – The security device also provides these addresses to the dialup user's computer.

The LNS also authenticates the user through a username and password. You can enter the user in the local database or in an external auth server (RADIUS, SecurID, or LDAP).

NOTE: The RADIUS or SecurID server that you use for authenticating L2TP users can be the same server you use for network users, or it can be a different server.

In addition, you can specify one of the following schemes for the PPP authentication:

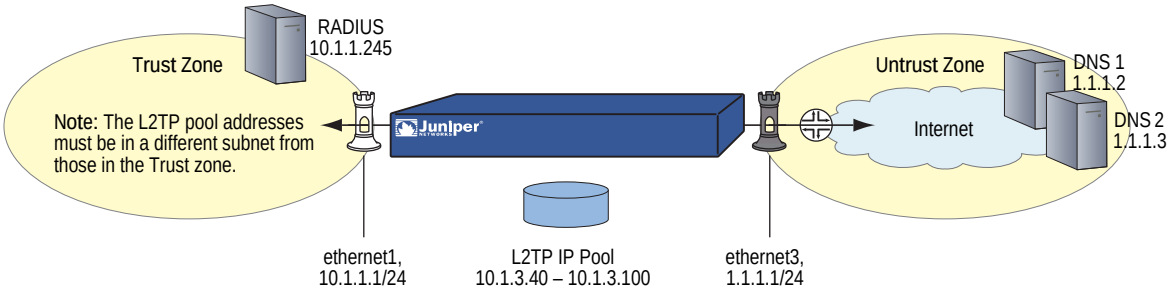
- Challenge Handshake Authentication Protocol (CHAP), in which the security device sends a challenge (encryption key) to the dialup user after he or she makes a PPP link request, and the user encrypts his or her login name and password with the key. The local database and RADIUS servers support CHAP.
- Password Authentication Protocol (PAP), which sends the dialup user's password in the clear along with the PPP link request. The local database and RADIUS, SecurID, and LDAP servers support PAP.
- "ANY", meaning that the security device negotiates CHAP, and then if that fails, PAP.

You can apply to dialup users and dialup user groups the default L2TP parameters that you configure on the L2TP Default Configuration page (VPNs > L2TP > Default Settings) or with the **set l2tp default** command. You can also apply L2TP parameters that you configure specifically for L2TP users on the User Configuration page (Users > Users > Local > New) or with the **set user** *name_str* **remote-settings** command. The user-specific L2TP settings supersede the default L2TP settings.

As shown in Figure 60 on page 226, you define an IP address pool with addresses ranging from 10.1.3.40 to 10.1.3.100. You specify DNS server IP addresses 1.1.1.2 (primary) and 1.1.1.3 (secondary). The security device performs PPP authentication using CHAP.

NOTE: You specify the auth server on a per-L2TP tunnel basis.

Figure 60: IP Pool and L2TP Default Settings



WebUI

1. **IP Pool**
   Objects > IP Pools > New: Enter the following, then click OK:

   IP Pool Name: Sutro
   Start IP: 10.1.3.40
   End IP: 10.1.3.100

2. **Default L2TP Settings**
   VPNs > L2TP > Default Settings: Enter the following, then click Apply:

   IP Pool Name: Sutro
   PPP Authentication: CHAP
   DNS Primary Server IP: 1.1.1.2
   DNS Secondary Server IP: 1.1.1.3
   WINS Primary Server IP: 0.0.0.0
   WINS Secondary Server IP: 0.0.0.0

CLI

1. **IP Pool**
   set ippool sutro 10.1.3.40 10.1.3.100

2. **Default L2TP Settings**
   set l2tp default ippool sutro
   set l2tp default ppp-auth chap
   set l2tp default dns1 1.1.1.2
   set l2tp default dns2 1.1.1.3
   save

L2TP and L2TP-over-IPsec

Although the dialup user can be authenticated using CHAP or PAP, an L2TP tunnel is not encrypted, and therefore is not a true VPN tunnel. The purpose of L2TP is simply to permit the administrator of the local security device to assign IP addresses to remote dialup users. These addresses can then be referenced in policies.

To encrypt an L2TP tunnel, you need to apply an encryption scheme to the L2TP tunnel. Because L2TP assumes that the network between the LAC and the LNS is IP, you can employ IPsec to provide encryption. This combination is called L2TP-over-IPsec. L2TP-over-IPsec requires setting up both an L2TP tunnel and an IPsec tunnel with the same endpoints, and then linking them together in a policy. L2TP-over-IPsec requires that the IPsec tunnel be in transport mode so that the tunnel endpoint addresses remain in the clear. (For information about transport and tunnel mode, see “Modes” on page 4.)

You can create an L2TP tunnel between a security device and a host running Windows 2000 if you change the Windows 2000 registry settings. (For instructions on how to change the registry, see the note on page 221.)

You can create an L2TP-over-IPsec tunnel between a security device and either of the following VPN clients:

- A host running NetScreen-Remote on a Windows 2000 or Windows NT operating system
- A host running Windows 2000 (without NetScreen-Remote)

NOTE: To provide authentication when using WIndows 2000 without NetScreen-Remote, you must use certificates.

Configuring L2TP

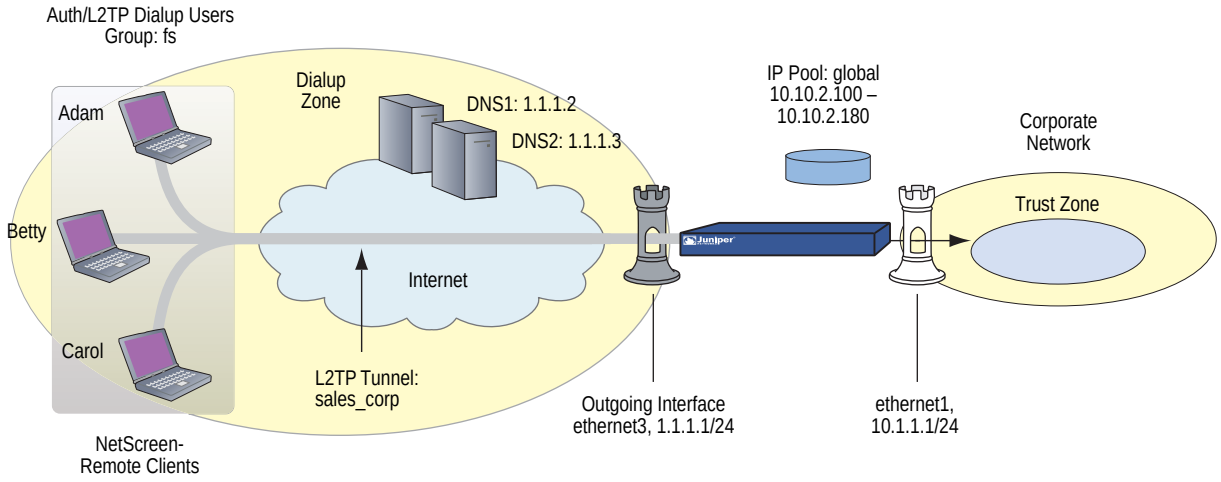
In this example, as illustrated in Figure 61 on page 228, you create a dialup user group called “fs” (for “field-sales”) and configure an L2TP tunnel called “sales_corp,” using ethernet3 (Untrust zone) as the outgoing interface for the L2TP tunnel. The security device applies the following default L2TP tunnel settings to the dialup user group:

- The L2TP users are authenticated through the local database.
- PPP authentication uses CHAP.
- The range of addresses in the IP pool (named “global”) is from 10.10.2.100 to 10.10.2.180.
- The DNS servers are 1.1.1.2 (primary) and 1.1.1.3 (secondary).

NOTE: An L2TP-only configuration is not secure. It is recommended only for debugging purposes.

The addresses in the L2TP IP pool must be in a different subnet than the addresses in the corporate network.

Figure 61: Configuring L2TP



The remote L2TP clients are on Windows 2000 operating systems. For information about how to configure L2TP on the remote clients, refer to your Windows 2000 documentation. Only the configuration for the security device end of the L2TP tunnel is provided below.

WebUI

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24

   Select the following, then click OK:

   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

2. L2TP Users

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Adam
Status: Enable
L2TP User: (select)
User Password: AJbioJ15
Confirm Password: AJbioJ15

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Betty
Status: Enable
L2TP User: (select)
User Password: BviPsoJ1
Confirm Password: BviPsoJ1

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Carol
Status: Enable
L2TP User: (select)
User Password: Cs10kdD3
Confirm Password: Cs10kdD3

3. L2TP User Group

Objects > User > Local Groups > New: Type fs in the Group Name field, do the following, then click OK:

Select Adam and use the < < button to move him from the Available Members column to the Group Members column.

Select Betty and use the < < button to move her from the Available Members column to the Group Members column.

Select Carol and use the < < button to move her from the Available Members column to the Group Members column.

4. Default L2TP Settings

Objects > IP Pools > New: Enter the following, then click OK:

IP Pool Name: global
Start IP: 10.10.2.100
End IP: 10.10.2.180

VPNs > L2TP > Default Settings: Enter the following, then click OK:

IP Pool Name: global
PPP Authentication: CHAP
DNS Primary Server IP: 1.1.1.2
DNS Secondary Server IP: 1.1.1.3
WINS Primary Server IP: 0.0.0.0
WINS Secondary Server IP: 0.0.0.0

5. L2TP Tunnel

VPNs > L2TP > Tunnel > New: Enter the following, then click OK:

Name: sales_corp
Use Custom Settings: (select)
Authentication Server: Local
Dialup Group: Local Dialup Group - fs
Outgoing Interface: ethernet3
Peer IP: 0.0.0.0
Host Name (optional): Enter the name of the computer acting as the LAC.
Secret (optional): Enter a secret shared between the LAC and the LNS.
Keep Alive: 60

Peer IP: Because the peer's ISP dynamically assigns it an IP address, you would enter 0.0.0.0 in the above example.

LAC: To find the name of a computer running Windows 2000, do the following: Click Start > Settings > Control Panel > System. The System Properties dialog box appears. Click the Network Identification tab, and see entry following Full computer name.

To add a secret to the LAC for authenticating the L2TP tunnel, you must modify the Windows 2000 registry as follows:

1. Click Start > Run, and then type regedit. The Registry Editor opens.
2. Click HKEY_LOCAL_MACHINE.
3. Right-click SYSTEM, and then select Find from the pop-up menu that appears.
4. Type ms_l2tpminiport, then click Find Next.
5. In the Edit menu, highlight New, and then select String Value.
6. Type Password.
7. Double-click Password. The Edit String dialog box appears.
8. Type the password in the Value data field. This must be the same as the word in the L2TP Tunnel Configuration Secret field on the security device.
9. Reboot the computer running Windows 2000.

   When using L2TP-over-IPsec, which is the Windows 2000 default, tunnel authentication is unnecessary; all L2TP messages are encrypted and authenticated inside IPsec.

Keep-Alive: The Keep Alive value is the number of seconds of inactivity before the security device sends an L2TP hello signal to the LAC.

6. Route

Network > Routing > Routing Entries > New: Enter the following, then click OK:

Network Address/Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

7. Policy

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Dial-Up VPN
Destination Address:
Address Book Entry: (select), Any
NAT: Off
Service: ANY
Action: Tunnel
Tunnel L2TP: sales_corp
Position at Top: (select)

CLI

1. Dialup Users

```
set user adam type l2tp
set user adam password AJbioJ15
unset user adam type auth
set user betty type l2tp
set user betty password BviPsoJ1
unset user betty type auth
set user carol type l2tp
set user carol password Cs10kdD3
unset user carol type auth
```

NOTE: Defining a password for a user automatically classifies the user as an auth user. Therefore, to define the user type strictly as L2TP, you must unset the auth user type.

2. L2TP User Group

```
set user-group fs location local
set user-group fs user adam
set user-group fs user betty
set user-group fs user carol
```

3. Default L2TP Settings

```
set ippool global 10.10.2.100 10.10.2.180
set l2tp default ippool global
set l2tp default auth server Local
set l2tp default ppp-auth chap
set l2tp default dns1 1.1.1.2
set l2tp default dns2 1.1.1.3
```

4. L2TP Tunnel

```
set l2tp sales_corp outgoing-interface ethernet3
set l2tp sales_corp auth server Local user-group fs
```

5. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250

6. **Policy**
   set policy top from untrust to trust “Dial-Up VPN” any any tunnel l2tp sales_corp save

Configuring L2TP-over-IPsec

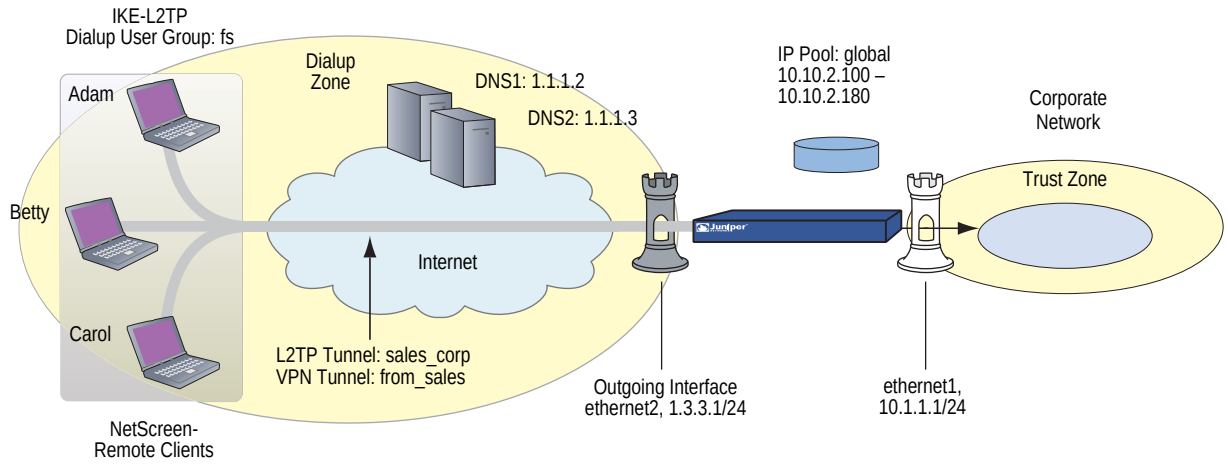
This example uses the same L2TP tunnel created in the previous example (“Configuring L2TP” on page 227). Additionally, you overlay an IPsec tunnel onto the L2TP tunnel to provide encryption. The IPsec tunnel negotiates Phase 1 in Aggressive Mode using a previously loaded RSA certificate, 3DES encryption and SHA-1 authentication. The certificate authority (CA) is Verisign. (For information about obtaining and loading certificates, see “Public Key Cryptography” on page 29.) The Phase 2 negotiation uses the security level predefined as “Compatible” for Phase 2 proposals. The IPsec tunnel is in transport mode.

The predefined Trust zone and the user-defined Dialup zone are in the trust-vr routing domain. The interfaces for the Dialup and Trust zones are ethernet2 (1.3.3.1/24) and ethernet1 (10.1.1.1/24), respectively. The Trust zone is in NAT mode.

The dialup users Adam, Betty, and Carol use NetScreen-Remote clients on a Windows 2000 operating system. The NetScreen-Remote configuration for dialup user Adam is also included below. (The NetScreen-Remote configuration for the other two dialup users is the same as that for Adam.)

NOTE: To configure an L2TP-over-IPsec tunnel for Windows 2000 (without NetScreen-Remote), the Phase 1 negotiations must be in main mode and the IKE ID type must be ASN1-DN.

Figure 62: Configuring L2TP-over-IPsec



WebUI

1. User-Defined Zone

Network > Zones > New: Enter the following, then click OK:

Zone Name: Dialup
Virtual Router Name: trust-vr
Zone Type: Layer 3 (select)
Block Intra-Zone Traffic: (select)
TCP/IP Reassembly for ALG: (clear)

NOTE: The Trust zone is preconfigured. You do not need to create it.

---

2. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24
Select the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet2): Enter the following, then click OK:

Zone Name: Dialup
Static IP: (select this option when present)
IP Address/Netmask: 1.3.3.1/24

3. IKE/L2TP Users

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Adam
Status: Enable
IKE User: (select)
    Simple Identity: (select)
      IKE Identity: ajackson@abc.com
L2TP User: (select)
    User Password: AJbioJ15
    Confirm Password: AJbioJ15

NOTE: The IKE ID that you enter must be the same as the one that the NetScreen-Remote client sends, which is the email address that appears in the certificate that the client uses for authentication.

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Betty
Status: Enable
IKE User: (select)
    Simple Identity: (select)
      IKE Identity: bdavis@abc.com
L2TP User: (select)
    User Password: BviPsoJ1
    Confirm Password: BviPsoJ1

Objects > Users > Local > New: Enter the following, then click OK:

User Name: Carol
Status: Enable
IKE User: (select)
Simple Identity: (select)
IKE Identity: cburnet@abc.com
L2TP User: (select)
User Password: Cs10kdD3
Confirm Password: Cs10kdD3

4. IKE / L2TP User Group

Objects > Users > Local Groups > New: Type fs in the Group Name field, do the following, then click OK:

Select Adam and use the < < button to move him from the Available Members column to the Group Members column.

Select Betty and use the < < button to move her from the Available Members column to the Group Members column.

Select Carol and use the < < button to move her from the Available Members column to the Group Members column.

5. IP Pool

Objects > IP Pools > New: Enter the following, then click OK:

IP Pool Name: global
Start IP: 10.10.2.100
End IP: 10.10.2.180

6. Default L2TP Settings

VPNs > L2TP > Default Settings: Enter the following, then click Apply:

IP Pool Name: global
PPP Authentication: CHAP
DNS Primary Server IP: 1.1.1.2
DNS Secondary Server IP: 1.1.1.3
WINS Primary Server IP: 0.0.0.0
WINS Secondary Server IP: 0.0.0.0

7. L2TP Tunnel

VPNs > L2TP > Tunnel > New: Enter the following, then click OK:

Name: sales_corp
Dialup Group: (select), Local Dialup Group - fs
Authentication Server: Local
Outgoing Interface: ethernet2
Peer IP: 0.0.0.0

Host Name (optional): If you want to restrict the L2TP tunnel to a specific host, enter the name of the computer acting as the LAC.

Secret (optional): Enter a secret shared between the LAC and the LNS.

Keep Alive: 60

LAC: To find the name of a computer running Windows 2000, do the following: Click Start > Settings > Control Panel > System. The System Properties dialog box appears. Click the Network Identification tab, and see entry following Full computer name.

Secret: To add a secret to the LAC for authenticating the L2TP tunnel, you must modify the Windows 2000 registry as follows:

1. Click Start > Run, and then type regedit. The Registry Editor opens.
2. Click HKEY_LOCAL_MACHINE.
3. Right-click SYSTEM, and then select Find from the pop-up menu that appears.
4. Type ms_l2tpminiport, then click Find Next.
5. In the Edit menu, highlight New, and then select String Value.
6. Type Password.
7. Double-click Password. The Edit String dialog box appears.
8. Type the password in the Value data field. This must be the same as the word in the L2TP Tunnel Configuration Secret field on the security device.
9. Reboot the computer running Windows 2000.

   When using L2TP-over-IPsec, which is the Windows 2000 default, tunnel authentication is unnecessary; all L2TP messages are encrypted and authenticated inside IPsec.

Keep-Alive: The Keep Alive value is the number of seconds of inactivity before the security device sends an L2TP hello signal to the LAC.

NOTE: The hostname and secret settings can usually be ignored. Only advanced users are recommended to use these settings.

---

8. VPN Tunnel

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: field
Security Level: Custom
Remote Gateway Type:
    Dialup User Group: (select), Group: fs
Outgoing Interface: ethernet2

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: User Defined: Custom
Phase 1 Proposal: rsa-g2-3des-sha
Mode (Initiator): Aggressive
Preferred Certificate (Optional):
Peer CA: Verisign
Peer Type: X509-SIG

NOTE: Windows 2000 (without NetScreen-Remote) supports main mode negotiations only.

VPNs > AutoKey IKE > New: Enter the following, then click OK:

Name: from_sales
Security Level: Compatible
Remote Gateway: Predefined: field

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Security Level: Compatible
Transport Mode: (select)

9. Policy

Policies > (From: Dialup, To: Trust) New: Enter the following, then click OK:

Source Address:
    Address Book Entry: (select), Dial-Up VPN
Destination Address:
    Address Book Entry: (select), Any
Service: ANY
Action: Tunnel
Tunnel VPN: from_sales
    Modify matching bidirectional VPN policy: (clear)
L2TP: sales_corp
Position at Top: (select)

CLI

1. User-Defined Zone

```
set zone name dialup
set zone dialup vrouter trust-vr
set zone dialup block
```

2. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet2 zone dialup
set interface ethernet2 ip 1.3.3.1/24
```

3. **L2TP / IKE Users**

```
set user adam type ike l2tp
set user adam password AJbioJ15
unset user adam type auth
set user adam ike-id u-fqdn ajackson@abc.com
set user betty type ike l2tp
set user betty password BviPsoJ1
unset user betty type auth
set user betty ike-id u-fqdn bdavis@abc.com
set user carol type ike l2tp
set user carol password Cs10kdD3
unset user carol type auth
set user carol ike-id u-fqdn cburnet@abc.com
```

4. **IKE / L2TP User Group**

```
set user-group fs location Local
set user-group fs user adam
set user-group fs user betty
set user-group fs user carol
```

5. **IP Pool**

```
set ippool global 10.10.2.100 10.10.2.180
```

6. **Default L2TP Settings**

```
set l2tp default ippool global
set l2tp default ppp-auth chap
set l2tp default dns1 1.1.1.2
set l2tp default dns2 1.1.1.3
```

7. **L2TP Tunnel**

```
set l2tp sales_corp outgoing-interface ethernet2
set l2tp sales_corp auth server Local user-group fs
```

8. **VPN Tunnel**

```
set ike gateway field dialup fs aggressive outgoing-interface ethernet2 proposal
    rsa-g2-3des-sha
set ike gateway field cert peer-ca1
set ike gateway field cert peer-cert-type x509-sig
set vpn from_sales gateway field transport sec-level compatible
```

NOTE: Windows 2000 (without NetScreen-Remote) supports main mode negotiations only.

The number 1 is the CA ID number. To discover the CA's ID number, use the following command: get pki x509 list ca-cert.

---

9. **Policy**

```
set policy top from dialup to trust "Dial-Up VPN" any any tunnel vpn from_sales
    l2tp sales_corp
save
```

NetScreen-Remote Security Policy Editor (Adam)

To configure L2TP-over-IPsec tunnels for Betty and Carol's NetScreen-Remote clients, follow the same procedure as that provided here for Adam.

1. Click Options > Secure > Specified Connections.
2. Click Add a new connection, and type AJ next to the new connection icon that appears.
3. Configure the connection options:

   Connection Security: Secure
   Remote Party ID Type: IP Address
   IP Address: 1.3.3.1
   Protocol: UDP
   Port: L2TP
   Connect using Secure Gateway Tunnel: (clear)

4. Click the PLUS symbol, located to the left of the AJ icon, to expand the connection policy.
5. Click My Identity, and configure the following:

   Select the certificate with the email address specified as the user's IKE ID on the security device from the Select Certificate drop-down list:

   ID Type: **E-mail Address**
   Port: L2TP

NOTE: The email address from the certificate appears in the identifier field automatically.

6. Click the Security Policy icon, and select Aggressive Mode.
7. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.
8. Click Authentication (Phase 1) > Proposal 1: Select the following Authentication Method and Algorithms:

   Authentication Method: Pre-Shared Key
   (or)
   Authentication Method: RSA Signatures
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

9. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

   Encapsulation Protocol (ESP): (select)
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Encapsulation: Transport

10. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Transport

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Transport

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Transport

13. Click File > Save Changes.

14. You also need to set up the network connection for your Windows 2000 operating system using the Network Connection Wizard.

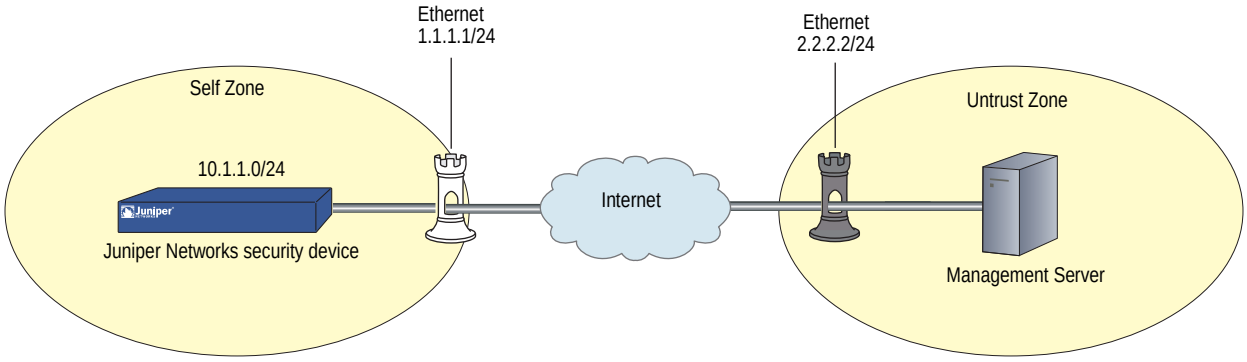
NOTE: When configuring the Network Connection Wizard, you must enter a destination hostname or IP address. Enter 1.3.3.1. Later, when initiating a connection and are prompted for a username and password, enter adam, AJbioJ15. For more information, consult Microsoft Windows 2000 documentation.

Configuring an IPsec Tunnel to Secure Management Traffic

To establish secure communications for management traffic such as Web, SNMP, and Telnet, the current ScreenOS release allows the management traffic to pass through an IPsec tunnel that is not bound to L2TP or Generic Routing Encapsulation (GRE). You can create and configure a policy for an IPsec tunnel to function in transport mode and thereby enable it to carry management traffic between the security gateway and the management server.

In this example, as illustrated in Figure 63 on page 240, you configure a VPN tunnel named “management-vpn” in transport mode.The outgoing interface ethernet0/1(1.1.1.1/24) is in Untrust zone, and the remote peer's IP address is 2.2.2.2/24. In this configuration, the telnet traffic matches the policy configured between the Untrust zone(1.1.1.1/24) and the management server (2.2.2.2) and successfully passes through the VPN tunnel created between the security gateway and the management server.

Figure 63: Configuring IPsec Tunnel for Management Traffic



WebUI

1. VPN Tunnel

VPN > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway name: management-gw
IPv4/v6 Address/Host name : 2.2.2.2

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Mode(Initiator): Aggressive
Outgoing Interface: ethernet0/1
Preshared Key: test
Security Level: basic

VPN > AutoKey > New: Enter the following, then click OK:

VPN name: management–vpn
Remote gateway: Predefined: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Replay Protection: (clear)
Security Level: basic
Transport Mode: (select)

2. Policy

Policies > (From: Self, To:Untrust) > New: Enter the following, then click OK:

Source Address:
Address book Entry: (select), Any-IPV4
Destination Address:
New Address: 2.2.2.2/32
Service : Telnet

Action : tunnel
Tunnel VPN : management-vpn

CLI

1. **Policy**
   set policy from self to untrust "Any" "2.2.2.2/32" telnet tunnel vpn management-vpn
   save

2. **VPN**
   set ike gateway management-gw address 2.2.2.2 aggressive outgoing-interface ethernet0/1 preshare test sec-level basic
   set vpn management-vpn gateway management-gw no-replay transport idletime 0 sec-level basic
   save

NOTE: ScreenOS allows management traffic to pass-through only a policy-based VPN established between the secured endpoints. You must specify the following when you configure the policy for management traffic:

- The source zone should be a self zone and the source IP address is "Any".
- The destination zone should be a MGT zone and the destination IP address should be "Any", if you configure the VPN in the management zone

---

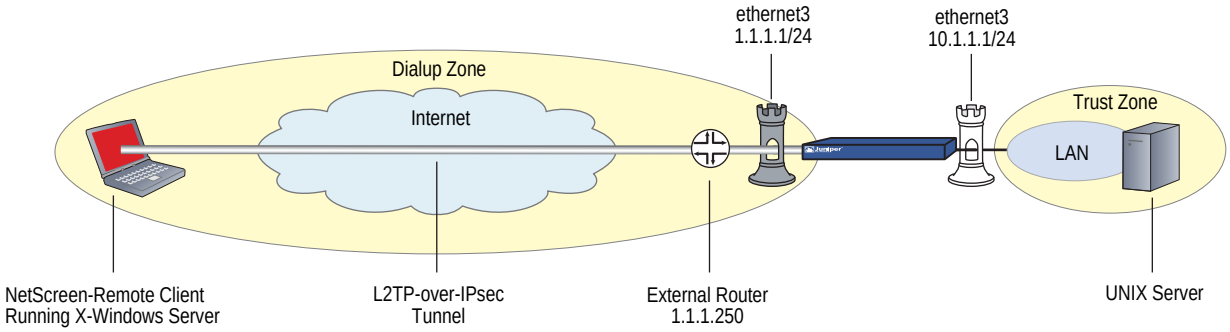
Bidirectional L2TP-over-IPsec

In this example, ethernet1 (10.1.1.1/24) is the Trust zone interface and is in NAT mode, and ethernet3 (1.1.1.1/24) is the Untrust zone interface. You create L2TP-over-IPsec tunnels between a NetScreen-Remote dialup user and a corporate LAN. The remote user is running an X-Windows application, which requires bidirectional policies.

You configure incoming and outgoing policies for the dialup AutoKey IKE VPN tunnel named *VPN_dial* for IKE user *dialup-j* with IKE ID *jf@ns.com.*, and the L2TP tunnel named tun1. The IKE user initiates a IPsec connection to the security device from the Untrust zone to reach corporate servers in the Trust zone. At this point, only L2TP communication is allowed. After L2TP/PPP negotiation, the L2TP tunnel is established. With bidirectional policies configured, traffic can initiate from either end of the tunnel.

The dialup user *dialup-j* uses a NetScreen-Remote client on a Windows 2000 operating system. The NetScreen-Remote configuration for dialup user *dialup-j* is included after Figure 64 on page 242.

Figure 64: Bidirectional L2TP-over-IPsec



NOTE: To configure an L2TP-over-IPsec tunnel for Windows 2000 (without NetScreen-Remote), the Phase 1 negotiations must be in main mode and the IKE ID type must be ASN1-DN.

WebUI

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24

   Select the following, then click OK:

   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

2. **Address**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: trust_net
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

3. L2TP / IKE User

Objects > Users > Local > New: Enter the following, then click OK:

User Name: dialup-j
Status: Enable
IKE User: (select)
Simple Identity: (select)
IKE Identity: jf@ns.com
Authentication User: (select)
L2TP User: (select)
User Password: abc123
Confirm Password: abc123

NOTE: The IKE ID that you enter must be the same as the one that the NetScreen-Remote client sends, which is the email address that appears in the certificate that the client uses for authentication.

---

4. L2TP

VPNs > L2TP > Tunnel > New: Enter the following, then click OK:

Name: tun1
Use Default Settings: (select)
Secret: netscreen
Keepalive: 60

5. VPN

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: dialup1
Security Level: (select), Standard
Remote Gateway Type: Dialup User; (select), dialup-j
Preshared Key: n3TsCr33N
Outgoing Interface: (select), ethernet3

> Advanced: Enter the following, and then click Return to return to the basic AutoKey IKE Gateway configuration page:

Mode (Initiator): Aggressive
Enable NAT-Traversal: (select)
UDP Checksum: (select)
Keepalive Frequency: 5

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: VPN_dial
Remote Gateway: Predefined: (select), dialup1

> Advanced: Enter the following, and then click Return to return to the basic AutoKey IKE configuration page:

Security Level: Standard (select)
Transport Mode (For L2TP-over-IPsec only): (select)

6. **Route**

   Network > Routing > Routing Entries > New: Enter the following, then click OK:

   Network Address/Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 1.1.1.250

7. **Policies**

   Policies > (From: Untrust, To: Trust) > New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Dial-Up VPN
   Destination Address:
   Address Book Entry: (select), trust_net
   Service: ANY
   Action: Tunnel
   Tunnel VPN: VPN_dial
   Modify matching bidirectional VPN policy: (select)
   L2tp: (select) tun1

   Policies > (From: Trust, To: Untrust) > New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), trust_net
   Destination Address:
   Address Book Entry: (select), Dial-Up VPN
   Service: ANY
   Action: Tunnel
   Tunnel VPN: VPN_dial
   Modify matching bidirectional VPN policy: (select)
   L2TP: tun1

CLI

1. **Interfaces**

   set interface ethernet1 zone trust
   set interface ethernet1 ip 10.1.1.1/24
   set interface ethernet1 nat
   set interface ethernet3 zone untrust
   set interface ethernet3 ip 1.1.1.1/24

2. **Address**

   set address trust trust_net 10.1.1.0/24

3. **L2TP/IKE User**

   set user dialup-j ike-id u-fqdn jf@ns.com
   set user dialup-j type auth ike l2tp
   set user dialup-j password abc123

4. **L2TP**

   set L2TP tun1 outgoing-interface ethernet3 secret "netscreen" keepalive 60

5. **VPN**

```
set ike gateway dialup1 dialup "dialup-j" aggressive outgoing-interface ethernet3
    preshare n3TsCr33N sec-level standard
set ike gateway dialup1 nat-traversal udp-checksum
set ike gateway dialup1 nat-traversal keepalive-frequency 5
set vpn VPN_dial gateway dialup1 no-replay transport idletime 0 sec-level standard
```

6. **Route**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
```

7. **Policies**

```
set policy from untrust to trust “Dial-Up VPN” “trust_net” any tunnel vpn VPN_dial
    tun1
set policy from trust to untrust trust_net “Dial-Up VPN” any tunnel vpn VPN_dial
    l2tp tun1
save
```

NetScreen-Remote Security Policy Editor (for User “dialup-j”)

1. Click Options > Secure > Specified Connections.

2. Click Add a new connection, and type dialup-j next to the new connection icon that appears.

3. Configure the connection options:

   Connection Security: Secure
   Remote Party ID Type: IP Address
   IP Address: 1.1.1.1
   Protocol: UDP
   Port: L2TP
   Connect using Secure Gateway Tunnel: (clear)

4. Click the PLUS symbol, located to the left of the dialup-j icon, to expand the connection policy.

5. Click My Identity, and configure the following:

   Select the certificate with the email address specified as the user’s IKE ID on the security device from the Select Certificate drop-down list

   ID Type: **E-mail Address**
   Port: L2TP

NOTE: The email address from the certificate appears in the identifier field automatically.

6. Click the Security Policy icon, and select Aggressive Mode.

7. Click the PLUS symbol, located to the left of the Security Policy icon, and then the PLUS symbol to the left of Authentication (Phase 1) and Key Exchange (Phase 2) to expand the policy further.

8. Click Authentication (Phase 1) > Proposal 1: Select the following Authentication method and algorithms:

   Authentication Method: Pre-Shared Key
   (or)
   Authentication Method: RSA Signatures
   Hash Alg: SHA-1
   Key Group: Diffie-Hellman Group 2

NOTE: When Perfect Forwarding Secrecy (PFS) is enabled on the security device (DF group 1,2, or 5), it must also be enabled for the VPN client in NetScreen-Remote.

9. Click Key Exchange (Phase 2) > Proposal 1: Select the following IPsec protocols:

   Encapsulation Protocol (ESP): (select)
   Encrypt Alg: Triple DES
   Hash Alg: SHA-1
   Encapsulation: Transport

10. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: Triple DES
    Hash Alg: MD5
    Encapsulation: Transport

11. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: SHA-1
    Encapsulation: Transport

12. Click Key Exchange (Phase 2) > Create New Proposal: Select the following IPsec protocols:

    Encapsulation Protocol (ESP): (select)
    Encrypt Alg: DES
    Hash Alg: MD5
    Encapsulation: Transport

13. Click File > Save Changes.

You also need to set up the network connection for your Windows 2000 operating system using the Network Connection Wizard.

NOTE: When you configure the Network Connection Wizard, you must enter a destination hostname or IP address. Enter 1.1.1.1. Later, when you initiate a connection and are prompted for a username and password, enter dialup-j, abc123. For more information, consult your Microsoft Windows 2000 documentation.

Chapter 7

Advanced Virtual Private Network Features

This chapter covers the following uses of virtual private network (VPN) technology:

NAT-Traversal

Network Address Translation (NAT) and Network Address Port Translation (NAPT) are Internet standards that allow a local-area network (LAN) to use one set of IP addresses for internal traffic and a second set of addresses for external traffic. NAT devices generate these external addresses from predetermined pools of IP addresses.

When setting up an IPsec tunnel, the presence of a NAT device along the data path has no effect on Phase 1 and Phase 2 IKE negotiations, which always encapsulate IKE packets within User Datagram Protocol (UDP) segments. However, after the Phase 2 negotiations complete, performing NAT on the IPsec packets causes the tunnel to fail. Of the many reasons why NAT causes disruption to IPsec, one reason is that, for the Encapsulating Security Protocol (ESP), NAT devices cannot discern the location of the Layer 4 header for port translation (because it is encrypted). For the Authentication Header (AH) protocol, NAT devices can modify the port number, but the authentication check, which includes the entire IPsec packet, fails.

NOTE: For a list of IPsec/NAT incompatibilities, refer to *draft-ietf-ipsec-nat-regts-00.txt* by Bernard Aboba.

To solve these problems, security devices and the NetScreen-Remote client (version 6.0 or later) can apply a NAT-Traversal (NAT-T) feature. NAT-T adds a layer of UDP encapsulation to IPsec packets after detecting one or more NAT devices along the data path during Phase 1 exchanges, as prescribed in the IETF drafts *draft-ietf-ipsec-nat-t-ike-00.txt* and *draft-ietf-ipsec-udp-encaps-00.txt*, as well as in later versions of these drafts.

NOTE: NetScreen-Remote 6 and NetScreen-Remote 7 support NAT-T as described in *draft-ietf-ipsec-nat-t-ike-00.txt* and *draft-ietf-ipsec-udp-encaps-00.txt*. NetScreen-Remote 8.2 supports *draft 02*.

NAT devices can create another problem if they are also IKE/IPsec-aware and attempt to process packets with the IKE port number of 500 or the IPsec protocol numbers 50 (for ESP) and 51 (for AH). To avoid such intermediary processing of IKE packets, version 2 of the previously mentioned IETF drafts proposes the shifting (or "floating") of UDP port numbers for IKE from 500 to 4500. To avoid intermediary processing of IPsec packets, both drafts 0 and 2 insert a UDP header between the outer IP header and the ESP or AH header, thereby changing the value in the

Protocol field from 50 or 51 (for ESP or AH, respectively) to 17 (for UDP). In addition, the inserted UDP header also uses port 4500. The current version of ScreenOS supports NAT-T based on *draft-ietf-ipsec-nat-t-ike-02.txt* and *draft-ietf-ipsec-udp-encaps-02.txt*, as well as version 0 of these drafts.

NOTE: ScreenOS does not support NAT-T for Manual Key tunnels nor for IPsec traffic using AH. ScreenOS only supports NAT-T for AutoKey IKE tunnels using ESP.

Probing for NAT

To check that both ends of the VPN tunnel support NAT-T, ScreenOS sends two MD-5 hashes in the vendor ID payload in the first two exchanges of Phase 1 negotiations—one hash for the title of draft 0 and one of the title for draft 2:

- "4485152d 18b6bbcd 0be8a846 9579ddcc"—which is an MD-5 hash of "draft-ietf-ipsec-nat-t-ike-00"
- "90cb8091 3ebb696e 086381b5 ec427b1f"—which is an MD-5 hash of "draft-ietf-ipsec-nat-t-ike-02"

Both peers must send and receive at least one of these values in the vendor payload ID for the NAT-T probe to continue. If they send hashes for both drafts, ScreenOS uses the NAT-T implementation for draft 2.

If the devices at each endpoint support NAT-T, they send each other NAT discovery (NAT-D) payloads in the third and fourth Phase 1 exchanges (main mode) or in the second and third exchanges (aggressive mode). The NAT discovery (NAT-D) payload is a IKE payload type for NAT-T. The NAT-D payload type number is 0130. For a list of other IKE payload types, see "IKE Packets" on page 13.

NOTE: ScreenOS can handle multiple NAT-Discovery (NAT-D) payloads in an IKE negotiation.

The NAT-D payloads contain a negotiated hash of the following information:

- Destination NAT-D hash:
  - Initiator's cookie (CKY-I)
  - Responder's cookie (CKY-R)
  - Remote (destination) IKE peer's IP address
  - Destination port number

- Source NAT-D hash (one or more):
  - Initiator's cookie (CKY-I)
  - Responder's cookie (CKY-R)
  - Local (source) IKE peer's IP address
  - Source port number

NOTE: NAT-T supports multiple source NAT-D hashes for devices with multiple interfaces and implementations that do not specify an outgoing interface.

When each peer compares the hashes it receives with the ones it sends, it can tell if address translation has occurred between them. Distinguishing which packet has been modified also indicates the location of the NAT device:

If	Matches	Then
the local peer's destination hash	at least one of the remote peer's source hashes	no address translation has occurred.
at least one of the local peer's source hashes	the remote peer's destination hash	no address translation has occurred.

If	Does not match	Then
the local peer's destination hash	at least one of the remote peer's source hashes	no address translation has occurred.
at least one of the local peer's source hashes	the remote peer's destination hash	no address translation has occurred.

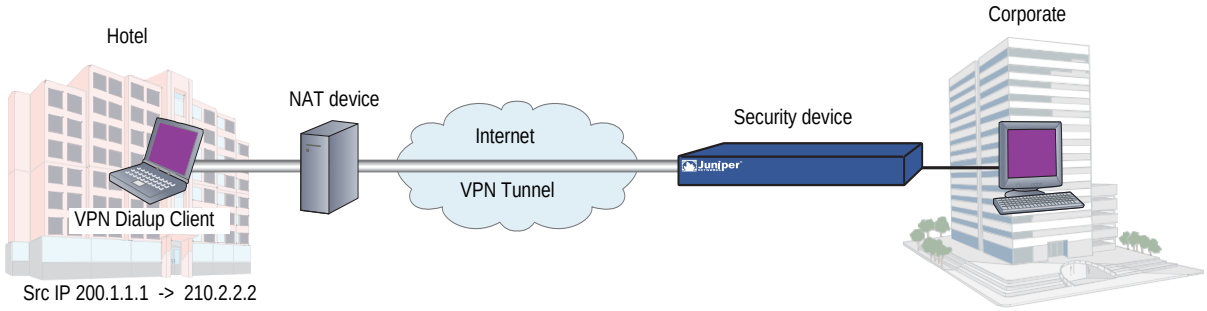
Knowing the location of the NAT device is important because IKE keepalives must initiate from the peer behind the NAT device. See "Keepalive Packets" on page 253.

If both peers support IETF draft 2, then they also float the IKE port number from 500 to 4500 as soon as they detect a NAT device between themselves during Phase 1 negotiations. In main mode, the port numbers float to 4500 in the fifth and sixth exchanges of Phase 1, and then for all Phase 2 exchanges. In aggressive mode, the port number floats to 4500 in the third—and final—exchange of Phase 1, and then for all Phase 2 exchanges. The peers also use 4500 for the UDP port number for all subsequent IPsec traffic.

Traversing a NAT Device

In Figure 65, a NAT device at the perimeter of a hotel LAN receives a packet from a VPN dialup client with IP address 2.1.1.5, assigned by the hotel. For all outbound traffic, the NAT device replaces the original source IP address in the outer header with a new address 2.2.2.2. During Phase 1 negotiations, the VPN client and the security device detect that both VPN participants support NAT-T, that a NAT device is present along the data path, and that it is located in front of the VPN client.

Figure 65: NAT-Traversal



Encapsulating the IPsec packets within UDP packets—which both the VPN client and the security device do—solves the problem of the authentication check failure. The NAT device processes them as UDP packets, changing the source port in the UDP header and leaving the SPI in the AH or ESP header unmodified. The VPN participants strip off the UDP layer and process the IPsec packets, which pass the authentication check because none of the authenticated content has been changed.

Another problem can arise if the NAT device is IKE/IPsec-aware. An IKE/IPsec-aware NAT device might attempt to process IKE/IPsec traffic instead of forwarding it. To prevent such intermediary processing, NAT-T (v2) changes the source and destination UDP port numbers for IKE from 500 to 4500. NAT-T also inserts a non-ESP marker in the UDP header just before the payload. For IPsec traffic, NAT-T (v0 and v2) inserts a UDP header between the outer IP header and the ESP header. The UDP packet also uses 4500 for both the source and destination port numbers.

As mentioned, NAT-T (v2) adds a non-ESP marker between the header and payload of the UDP segment encapsulating the ISAKMP packet. The non-ESP marker is 4 bytes of zero (0000), and is added to the UDP segment to distinguish an encapsulated ISAKMP packet from an encapsulated ESP packet, which does not have such a marker. Without the non-ESP marker, the recipient would be unsure if the encapsulated packet was an ISAKMP packet or an ESP packet because the UDP header uses 4500 for both types. Using this marker indicates the correct type of packet that is encapsulated so that the recipient can correctly demultiplex it.

As shown in Figure 66 on page 252, after detecting a NAT device in the data path, the source and destination port numbers in the UDP header of an IKE packet change from 500 to 4500. Also, the VPN tunnel endpoints insert a non-ESP marker between the UDP header and payload to distinguish the encapsulated ISAKMP packet from an ESP packet. The recipient can use this marker to distinguish the encapsulated ISAKMP packet from an ESP packet and demultiplex it correctly.

Figure 66: IKE Packet (for Phases 1 and 2)

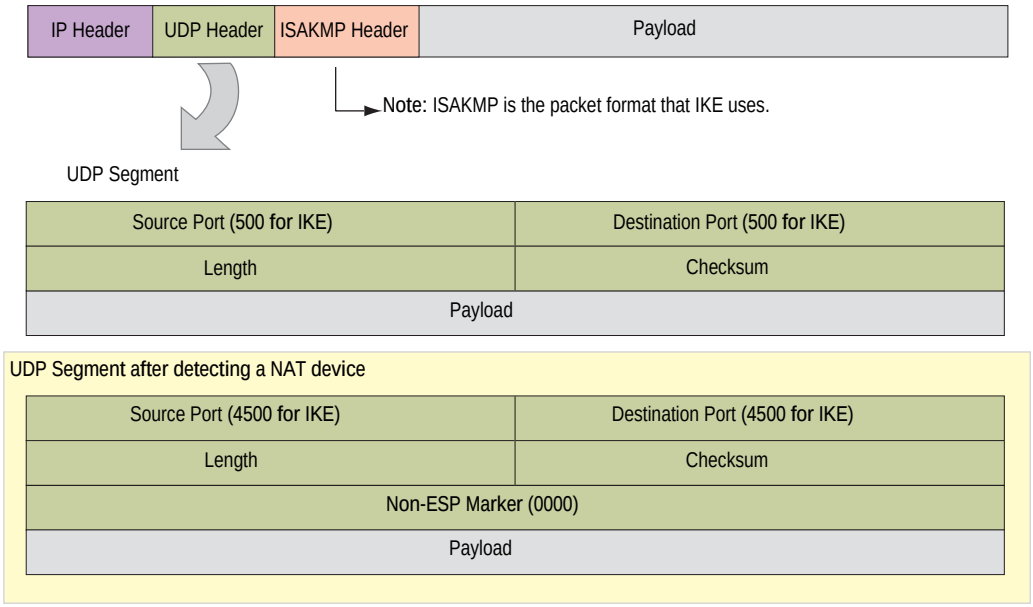
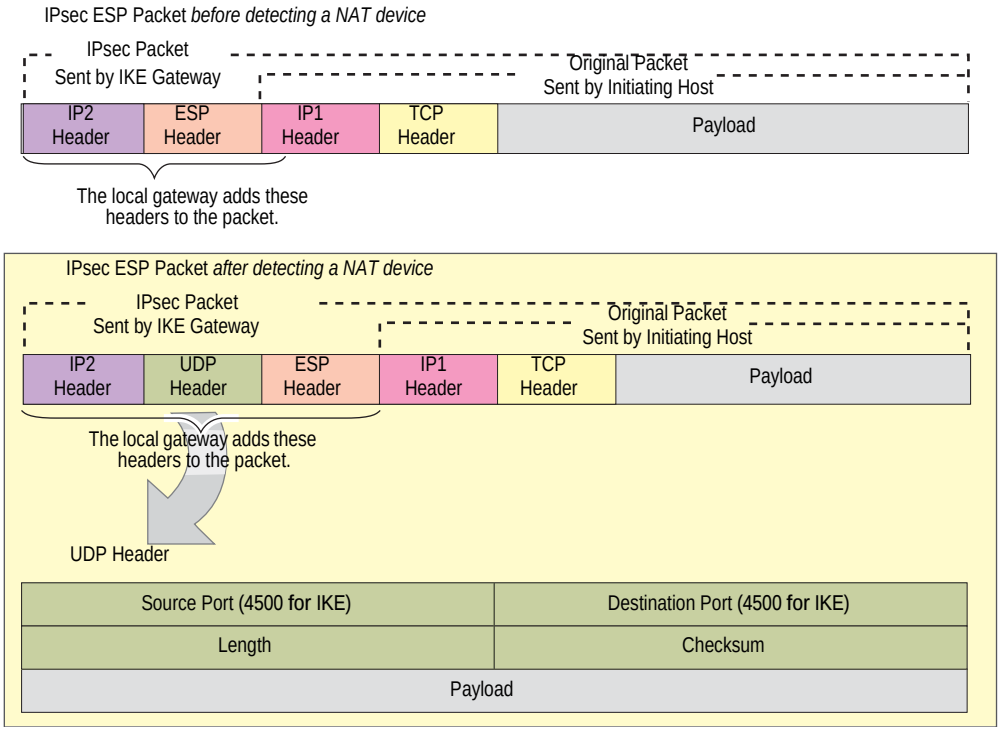


Figure 67 shows how, after detecting a NAT device in the data path, the VPN tunnel endpoints insert an additional UDP header between the outer IP header and the ESP header of an IPsec packet. Because there is no non-ESP marker, the recipient can distinguish the encapsulated ESP packet from an ISAKMP packet and demultiplex the ESP packet correctly.

Figure 67: IPsec ESP Packet Before and After NAT Detection



UDP Checksum

All UDP packets contain a UDP checksum, a calculated value that ensures UDP packets are free of transmission errors. A security device does not require use of the UDP checksum for NAT-T, so the WebUI and CLI present the checksum as an optional setting. Even so, some NAT devices require a checksum, so you might have to enable or disable this setting. By default, the UDP checksum is included when you enable NAT-T.

WebUI

VPNs > AutoKey Advanced > Gateway > New:

Enter the necessary parameters for the new tunnel gateway as described in "Site-to-Site Virtual Private Networks" on page 91 or "Dialup Virtual Private Networks" on page 173; enter the following, then click OK:

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Enable NAT-Traversal: (select)
UDP Checksum: Enable

CLI

set ike gateway *name* nat-traversal udp-checksum
unset ike gateway *name* nat-traversal udp-checksum

Keepalive Packets

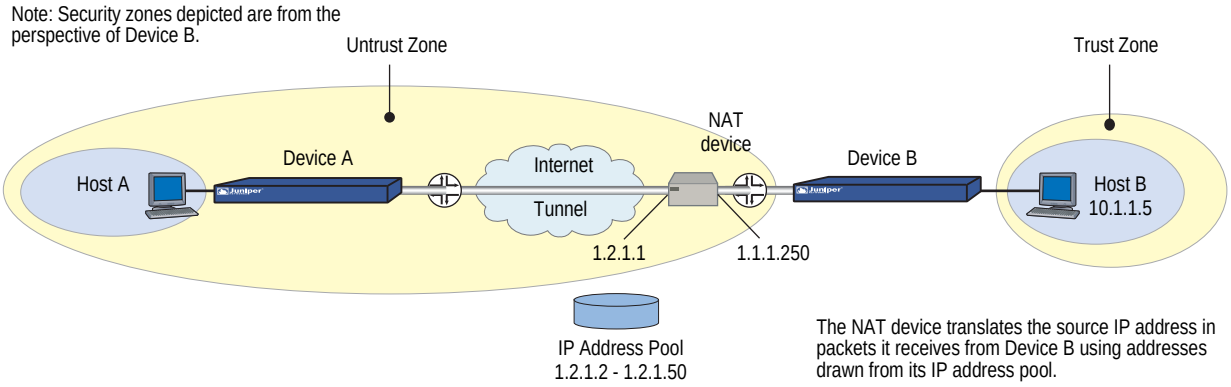
When a NAT device assigns an IP address to a host, the NAT device determines how long the new address remains valid when no traffic occurs. For example, a NAT device might invalidate any generated IP address that remains unused for 20 seconds. Therefore, it is usually necessary for the IPsec participants to send periodic keepalive packets—empty UDP packets—through the NAT device, so that the NAT mapping does not change until the Phase 1 and Phase 2 SAs expire.

NOTE: NAT devices have different session timeout intervals, depending on the manufacturer and model. It is important to determine what the interval is for the NAT device and to set the keepalive frequency value below that.

Initiator/Responder Symmetry

When two security devices establish a tunnel in the absence of a NAT device, either device can serve as initiator or responder. However, if either host resides behind a NAT device, such initiator/responder symmetry might be impossible. This happens whenever the NAT device generates IP addresses dynamically.

Figure 68: Security Device with a Dynamically Assigned IP Address Behind a NAT Device



In Figure 68, Device B resides in a subnet located behind a NAT device. If the NAT device generates new source IP addresses for packets it receives from Device B—drawing them dynamically from a pool of IP addresses—Device A cannot unambiguously identify Device B. Therefore, Device A cannot successfully initiate a tunnel with Device B. Device A must be the responder, Device B the initiator, and they must perform Phase 1 negotiations in aggressive mode.

However, if the NAT device generates the new IP address using a mapped IP (MIP) address, or some other one-to-one addressing method, Device A can unambiguously identify Device B. Consequently, either Device A or Device B can be the initiator, and both can use main or aggressive mode for Phase 1. Device B, which is not behind the NAT device, configures this new IP address as the IKE gateway address. At this time, the local ID or ID (peer ID) needs to be set.

NOTE: If you enable NAT-T on a security device acting as the responder and configure it to perform IKE negotiations in main mode, that device and all its peers of the following types that are configured on the same outgoing interface must use the same Phase 1 proposals presented in the same order as each other:

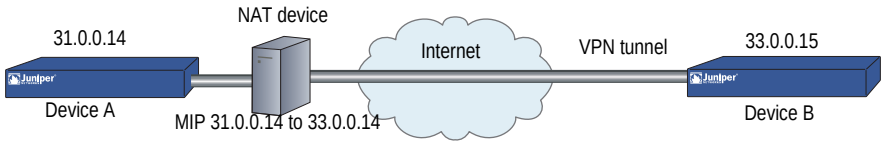
Dynamic peer (peers with dynamically assigned IP addresses)
Dialup VPN users
Peers with static IP addresses behind a NAT device

Because it is not possible to know the identity of a peer when negotiating Phase 1 in main mode until the last two messages, the Phase 1 proposals must all be the same so that IKE negotiations can proceed.

The security device automatically checks that all Phase 1 proposals are the same and in the same order when you configure IKE in main mode to one of the above peer types on the same outgoing interface. If the proposals are different, the security device generates an error message.

In the example shown in Figure 69, two devices, Device A and Device B, are connected by a VPN tunnel. Device A is behind a NAT and has a private IP 31.0.0.14. The NAT generates a new public IP using MIP for Device A. You use the MIP address as the gateway address while configuring IKEv2 gateway on Device B. For more information about MIPs, see “Mapped IP Addresses” on page 8-63.

Figure 69: Security Device with a Mapped IP Address Behind a NAT Device



Device A Configuration

```
set ike gateway ikev2 "dev-b" address 33.0.0.15 id "dev-b.net" local-id "dev-a.net"
    outgoing-interface "ethernet0/1" preshare
    "KghBa3TbNruG2Es6e2C5zkr83SnLzIy1MQ==" proposal "pre-g2-3des-md5"
set ike gateway ikev2 "dev-b" nat-traversal
set ike gateway ikev2 "dev-b" nat-traversal udp-checksum
set ike gateway ikev2 "dev-b" nat-traversal keepalive-frequency 5
set vpn "dev-b" gateway "dev-b" no-replay tunnel idletime 0 proposal
    "g2-esp-3des-md5"
set vpn "dev-b" id 0x1 bind interface tunnel.1
```

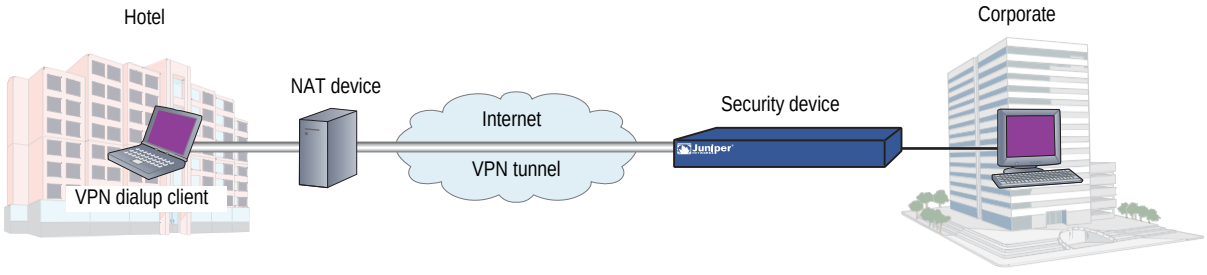
Device B Configuration

```
set ike gateway ikev2 "dev-a" address 33.0.0.14 id "dev-a.net" local-id "dev-b.net"
    outgoing-interface "ethernet2/3" preshare
    "5LXhnzFYNz8EO6srN9CgzDdrpKnEep28Uw==" proposal "pre-g2-3des-md5"
set ike gateway ikev2 "dev-a" nat-traversal
set ike gateway ikev2 "dev-a" nat-traversal udp-checksum
set ike gateway ikev2 "dev-a" nat-traversal keepalive-frequency 5
set vpn "dev-a" gateway "dev-a" no-replay tunnel idletime 0 proposal
    "g2-esp-3des-md5"
set vpn "dev-a" id 0x1 bind interface tunnel.1
```

Enabling NAT-Traversal

In Figure 70, a NAT device at the perimeter of a hotel LAN assigns an address to the VPN dialup client used by Jozef, a salesman attending a convention. For Jozef to reach the corporate LAN through a dialup VPN tunnel, you must enable NAT-T for the remote gateway “jozef,” configured on the security device, and for the remote gateway configured on the VPN dialup client. You also enable the security device to include a UDP checksum in its transmissions, and you set the keepalive frequency to 8 seconds.

Figure 70: Enabling NAT-Traversal



WebUI

VPNs > AutoKey Advanced > Gateway > New: Enter the necessary parameters for the new tunnel gateway (described in “Site-to-Site Virtual Private Networks ” on page 91 or “Dialup Virtual Private Networks ” on page 173), enter the following, then click OK:

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Enable NAT-Traversal: (select)
UDP Checksum: Enable
Keepalive Frequency: 8 Seconds (0~300 Sec)

NOTE: When you configure a dialup VPN through the CLI, the security device automatically enables NAT-Traversal.

CLI

```
set ike gateway jozef nat-traversal
set ike gateway jozef nat-traversal udp-checksum
set ike gateway jozef nat-traversal keepalive-frequency 8
save
```

Using IKE IDs with NAT-Traversal

When two VPN gateways negotiate in main mode, they exchange IP addresses in order to identify each other and activate the tunnel. When devices at either or both ends of the tunnel have dynamically assigned IP addresses, however, you must configure IKE IDs (local ID and peer ID) on the devices at both ends of the tunnel. An IKE ID is a unique identifier that remains static. The IKE ID is set up during the phase when you configure the IKE gateway.You configure IKE IDs instead of remote IP address.

Without NAT-T, a VPN tunnel can be activated using only the local ID on the local side and only the peer ID on the remote side. But when using NAT-Traversal with dynamic VPN in main mode using certificates, you must set both the local ID and peer ID on both sides of the VPN tunnel. The following example shows how you can configure local IDs and peer IDs on firewall1 and firewall2 so they can identify each other and activate a tunnel between them.

WebUI

On firewall1, enter the following:

VPNs > AutoKey IKE Advanced > Gateway > New: Enter the following, then click Advanced:

Gateway Name: test_gw
Address/Hostname: 0.0.0.0
Peer-ID: firewall2

Click Advanced, then enter the following:

Security Level: Standard
Local-ID: firewall1
Outgoing Interface: ethernet0/0

Mode: Main
Security Level: Standard

On firewall2, enter the following:

VPNs > AutoKey IKE Advanced > Gateway > New: Enter the following, then click Advanced:

Gateway Name: gw_bap15_p1
Address/Hostname: 1.1.1.1
Peer-ID: firewall1

Click Advanced, then enter the following:

Security Level: Standard
Local-ID: firewall2
Outgoing Interface: ethernet0/0
Mode: Main
Security Level: Standard

Cli

On firewall1, enter the following:

```
set ike gateway test-gw address 0.0.0.0 id firewall2 main local-id firewall1
    outgoing-interface ethernet0/0 proposal standard
```

On firewall2, enter the following

```
set ike gateway gw_bap15_p1 address 1.1.1.1 id firewall1 main local-id firewall2
    outgoing-interface ethernet0/0 proposal standard
```

The following table shows the CLI command for each of the IPsec NAT-T tasks:

To	Use This CLI Command
Enable IPsec NAT-T per gateway	set ike nat-t gateway name
Disable IPsec NAT-T per gateway	unset ike nat-t gateway name
Set the IPsec NAT-T keepalive per gateway	set ike nat-t keep-alive period seconds
Set the IPsec NAT-T keepalive count per gateway	set ike nat-t keep-alive count count
Get the IPsec NAT-T status	get ike nat-t gateway name

VPN Monitoring

When you enable VPN monitoring for a specific tunnel, the security device sends ICMP echo requests (or “pings”) through the tunnel at specified intervals (configured in seconds) to monitor network connectivity through the tunnel.

NOTE: To change the ping interval, you can use the following CLI command: set vpnmonitor interval *number*. The default is 10 seconds.

If the ping activity indicates that the VPN monitoring status has changed, the security device triggers one of the following Simple Network Management Protocol (SNMP) traps:

- Up to Down: This trap occurs when the state of VPN monitoring for the tunnel is up, but a specified consecutive number of ICMP echo requests does not elicit a reply and there is no other incoming VPN traffic. Then the state changes to down.
- Down to Up: When the state of VPN monitoring for the tunnel is down, but the ICMP echo request elicits a single response, then the state changes to up. The down-to-up trap occurs only if you have disabled the rekey option and the Phase 2 SA is still active when an ICMP echo request elicits a reply through the tunnel.

NOTE: To change the threshold for the number of consecutive unsuccessful ICMP echo requests, you can use the following CLI command: set vpnmonitor threshold *number*. The default is 10 consecutive requests.

For more information about the SNMP data that VPN monitoring provides, see “SNMP VPN Monitoring Objects and Traps” on page 269.

You apply VPN monitoring per VPN object, not necessarily per VPN tunnel. A VPN object is what you define with the set vpn command or with its WebUI counterpart. After you define one VPN object, you can then reference it in one or more policies (creating policy-based VPNs). Because ScreenOS derives a policy-based VPN tunnel from a VPN object plus the other policy parameters, a single VPN object can be an element in numerous VPN tunnels. This distinction between VPN object and VPN tunnel is important because Juniper Networks recommends that you apply VPN monitoring to no more than 100 IPsec VPN tunnels—if you do not enable optimization. If you do enable optimization, then there is no limitation to the number of VPN tunnels to which you can apply VPN monitoring. To learn about the optimization option, see “Rekey and Optimization Options” on page 259.

NOTE: VPN monitoring optimization operates on a per-object basis. You can enable it on all VPN objects, on none, or only on some.

Rekey and Optimization Options

If you enable the rekey option, the security device starts sending ICMP echo requests immediately upon completion of the tunnel configuration and continues to send them indefinitely. The echo requests trigger an attempt to initiate IKE negotiations to establish a VPN tunnel until the state of VPN monitoring for the tunnel is up. The security device then uses the pings for VPN monitoring purposes. If the state of VPN monitoring for the tunnel changes from up to down, the security device deactivates its Phase 2 security association (SA) for that peer. The security device continues to send echo requests to its peer at defined intervals, triggering attempts to reinitiate IKE Phase 2 negotiations—and Phase 1 negotiations, if necessary—until it succeeds. At that point, the security device reactivates the Phase 2 SA, generates a new key, and reestablishes the tunnel. A message appears in the event log stating that a successful rekey operation has occurred.

NOTE: If a security device is a DHCP client, a DHCP update to a different address causes IKE to rekey. However, a DHCP update to the same address does not provoke the IKE rekey operation.

You can use the rekey option to ensure that an AutoKey IKE tunnel is always up, perhaps to monitor devices at the remote site or to allow dynamic routing protocols to learn routes at a remote site and transmit messages through the tunnel. Another use to which you can apply VPN monitoring with the rekey option is for automatic population of the next-hop tunnel binding table (NHTB table) and the route table when multiple VPN tunnels are bound to a single tunnel interface. For an example of this last use, see “Multiple Tunnels per Tunnel Interface” on page 271.

If you disable the rekey option, the security device performs VPN monitoring only when the tunnel is active with user-generated traffic.

By default, VPN monitoring optimization is disabled. If you enable it (set vpn *name* monitor optimized), the VPN monitoring behavior changes as follows:

- The security device considers incoming traffic through the VPN tunnel to be the equivalent of ICMP echo replies. Accepting incoming traffic as a substitute for ICMP echo replies can reduce false alarms that might occur when traffic through the tunnel is heavy and the echo replies do not get through.
- If there is both incoming and outgoing traffic through the VPN tunnel, the security device suppresses VPN monitoring pings altogether. Doing so can help reduce network traffic.

Although VPN monitoring optimization offers some benefits, be aware that VPN monitoring can no longer provide accurate SNMP statistics, such as VPN network delay time, when the optimization option is active. Also, if you are using VPN monitoring to track the availability of a particular destination IP address at the remote end of a tunnel, the optimization feature can produce misleading results.

Source Interface and Destination Address

By default, the VPN monitoring feature uses the IP address of the local outgoing interface as the source address and the IP address of the remote gateway as the destination address. If the remote peer is a VPN dialup client—such as the NetScreen-Remote—that has an internal IP address, the security device automatically detects its internal address and uses that as the destination. The VPN client can be an XAuth user with an assigned internal IP address, or a dialup VPN user or a member of a dialup VPN group with an internal IP address. You can also specify the use of other source and destination IP addresses for VPN monitoring—mainly to provide support for VPN monitoring when the other end of a VPN tunnel is not a security device.

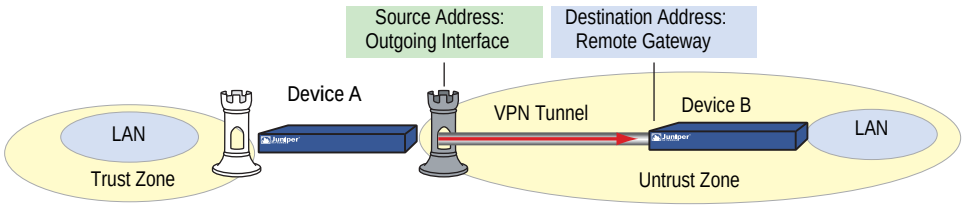
Because VPN monitoring operates independently at the local and remote sites, the source address configured on the device at one end of a tunnel does not have to be the destination address configured on the device at the other end. In fact, you can enable VPN monitoring at both ends of a tunnel or at only one end.

Figure 71: Source and Destination Addresses for VPN Monitoring

Device A –> Device B

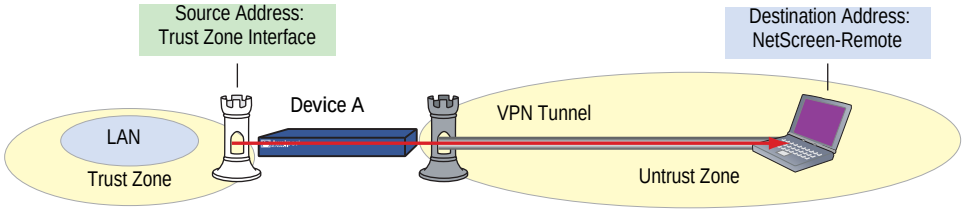
Device A pings from its outgoing interface to the remote gateway; that is, from the Untrust zone interface on Device A to the Untrust zone interface on Device B.

(Default Behavior)



Device A –> NetScreen-Remote

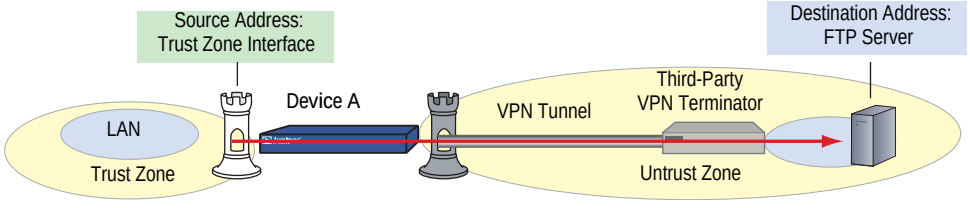
Device A pings from its Trust zone interface to the NetScreen-Remote. The NetScreen-Remote requires a policy permitting inbound ICMP traffic from an address beyond the remote gateway; that is, from beyond the Untrust zone interface of Device A.



Note: Device A requires a policy permitting ping traffic from the Trust to Untrust zones.

Device A –> Third-Party VPN Terminator

Device A pings from its Trust zone interface to a device beyond the remote gateway. This might be necessary if the remote peer does not respond to pings but can support policies permitting inbound ping traffic.



Note: Device A requires a policy permitting ping traffic from the Trust to Untrust zones.

NOTE: If the other end of a tunnel is the NetScreen-Remote VPN client that receives its address through XAuth, then the security device, by default, uses the XAuth-assigned IP address as the destination for VPN monitoring. For information about XAuth, see “XAuth Users and User Groups” on page 9-76.

Policy Considerations

You must create a policy on the sending device to permit pings from the zone containing the source interface to pass through the VPN tunnel to the zone containing the destination address if:

- The source interface is in a different zone from the destination address
- The source interface is in the same zone as the destination address, and intrazone blocking is enabled

Likewise, you must create a policy on the receiving device to permit pings from the zone containing the source address to pass through the VPN tunnel to the zone containing the destination address if:

- The destination address is in a different zone from the source address
- The destination address is in the same zone as the source address, and intrazone blocking is enabled

---

NOTE: If the receiving device is a third-party product that does not respond to the ICMP echo requests, change the destination to an internal host in the remote peer's LAN that does respond. The remote peer's firewall must have a policy permitting the ICMP echo requests to pass through it.

Configuring the VPN Monitoring Feature

To enable VPN monitoring, do the following:

WebUI

VPNs > AutoKey IKE > New: Configure the VPN, click Advanced, enter the following, click Return to go back to the basic VPN configuration page, then click OK:

VPN Monitor: Select to enable VPN monitoring of this VPN tunnel.

Source Interface: Choose an interface from the drop-down list. If you choose default, the security device uses the outgoing interface.

Destination IP: Enter a destination IP address. If you do not enter anything, the security device uses the remote gateway IP address.

Rekey: Select this option if you want the security device to attempt IKE Phase 2 negotiations—and IKE Phase 1 negotiations if necessary—if the tunnel status changes from up to down. When you select this option, the security device attempts IKE negotiations to set up the tunnel and begin VPN monitoring immediately after you finish configuring the tunnel.

Clear this option if you do not want the security device to attempt IKE negotiations if the tunnel status changes from up to down. When the rekey option is disabled, VPN monitoring begins after user-generated traffic has triggered IKE negotiations and stops when the tunnel status changes from up to down.

(Or)

VPNs > Manual Key > New: Configure the VPN, click Advanced, enter the following, click Return to go back to the basic VPN configuration page, then click OK:

VPN Monitor: Select to enable VPN monitoring of this VPN tunnel.

Source Interface: Choose an interface from the drop-down list. If you choose default, the security device uses the outgoing interface.

Destination IP: Enter a destination IP address. If you do not enter anything, the security device uses the remote gateway IP address.

CLI

```
set vpnmonitor frequency number
set vpnmonitor threshold number
set vpn name_str monitor [ source-interface interface [ destination-ip ip_addr ]
    [optimized] [ rekey ]
save
```

NOTE: The VPN monitoring frequency is in seconds. The default setting is 10-second intervals.

The VPN monitoring threshold number is the consecutive number of successful or unsuccessful ICMP echo requests that determines whether the remote gateway is reachable through the VPN tunnel or not. The default threshold is 10 consecutive successful or 10 consecutive unsuccessful ICMP echo requests.

If you do not choose a source interface, the security device uses the outgoing interface as the default.

If you do not choose a destination IP address, the security device uses the IP address for the remote gateway.

The rekey option is not available for Manual Key VPN tunnels.

In this example, you configure an AutoKey IKE VPN tunnel between two security devices (Device A and Device B). On Device A, you set up VPN monitoring from its Trust zone interface (ethernet1) to the Trust zone interface (10.2.1.1/24) on Device B. On the Device B, you set up VPN monitoring from its Trust zone interface (ethernet1) to a corporate intranet server (10.1.1.5) behind Device A.

NOTE: A Phase 1 security level of Compatible includes these proposals: pre-g2-3des-sha, pre-g2-3des-md5, pre-g2-des-sha, and pre-g2-des-md5.

A Phase 2 security level of Compatible includes these proposals: nopfs-esp-3des-sha, nopfs-esp-3des-md5, nopfs-esp-des-sha, and nopfs-esp-des-md5.

Device A	Device B
Zones and Interfaces	
■ ethernet1 ■ Zone: Trust ■ IP address: 10.1.1.1/24 ■ Interface mode: NAT ■ ethernet3 ■ Zone: Untrust ■ IP address: 1.1.1.1/24	■ ethernet1 ■ Zone: Trust ■ IP address: 10.2.1.1/24 ■ Interface mode: NAT ■ ethernet3 ■ Zone: Untrust ■ IP address: 2.2.2.2/24
Route-Based AutoKey IKE Tunnel Parameters	
■ Phase 1 ■ Gateway name: gw1 ■ Gateway static IP address: 2.2.2.2 ■ Security level: Compatible ■ Preshared Key: Ti82g4aX ■ Outgoing interface: ethernet3 ■ Mode: Main ■ Phase 2 ■ VPN tunnel name: vpn1 ■ Security level: Compatible ■ VPN Monitoring: src = ethernet1; dst = 10.2.1.1 ■ Bound to interface: tunnel.1	■ Phase 1 ■ Gateway name: gw1 ■ Gateway static IP address: 1.1.1.1 ■ Proposals: Compatible ■ Preshared Key: Ti82g4aX ■ Outgoing interface: ethernet3 ■ Mode: Main ■ Phase 2 ■ VPN tunnel name: vpn1 ■ Security level: Compatible ■ VPN Monitoring: src = ethernet1; dst = 10.1.1.5 ■ Bound to interface: tunnel.1

Device A	Device B
Routes	
To 0.0.0.0/0, use ethernet3, gateway 1.1.1.250 To 10.2.1.0/24, use tunnel.1, no gateway (Null route–to drop traffic to 10.2.1.0/24 if tunnel.1 goes down) To 10.2.1.0/24, use null interface, metric: 10	To 0.0.0.0/0, use ethernet3, gateway 2.2.2.250 To 10.1.1.0/24, use tunnel.1, no gateway (Null route–to drop traffic to 10.1.1.0/24 if tunnel.1 goes down) To 10.1.1.0/24, use null interface, metric: 10

Because both devices ping from an interface in their Trust zone to an address in their Untrust zone, the admins at both ends of the VPN tunnel must define policies permitting pings to pass from zone to zone.

NOTE: Because both VPN terminators are security devices in this example, you can use the default source and destination addresses for VPN monitoring. The use of other options is included purely to illustrate how you can configure a security device to use them.

WebUI (Device A)

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24
   Enter the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

   Network > Interfaces > Tunnel IF New: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Trust (trust-vr)
   Unnumbered: (select)
   Interface: ethernet1(trust-vr)

2. **Addresses**
   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Trust_LAN
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Remote_LAN
   IP Address/Domain Name:
   IP/Netmask: (select), 10.2.1.0/24
   Zone: Untrust

3. **VPN**
   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   VPN Name: vpn1
   Security Level: Compatible
   Remote Gateway:
   Create a Simple Gateway: (select)
   Gateway Name: gw1
   Type:
   Static IP: (select), Address/Hostname: 2.2.2.2
   Preshared Key: Ti82g4aX
   Security Level: Compatible
   Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.1.1.0/24
Remote IP / Netmask: 10.2.1.0/24
Service: ANY
VPN Monitor: (select)
Source Interface: ethernet1
Destination IP: 10.2.1.1
Rekey: (clear)

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 10.2.1.0/24
Gateway: (select)
Interface: Tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 10.2.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Trust_LAN
Destination Address:
Address Book Entry: (select), Remote_LAN
Service: ANY
Action: Permit
Position at Top: (select)

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Remote_LAN
Destination Address:
Address Book Entry: (select), Trust_LAN
Service: Any
Action: Permit
Position at Top: (select)

WebUI (Device B)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.1.1/24
Enter the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

Network > Interfaces > Tunnel IF New: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Trust (trust-vr)
Unnumbered: (select)
Interface: ethernet1(trust-vr)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Trust_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.2.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: Remote_LAN
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Untrust

3. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway:
Create a Simple Gateway: (select)
Gateway Name: gw1
Type:
Static IP: (select), Address/Hostname: 1.1.1.1
Preshared Key: Ti82g4aX
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 10.2.1.0/24
Remote IP / Netmask: 10.1.1.0/24
Service: ANY
VPN Monitor: (select)
Source Interface: ethernet1
Destination IP: 10.1.1.5
Rekey: (clear)

4. Routes

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 10.1.1.0/24
Gateway: (select)
Interface: Null
Gateway IP Address: 0.0.0.0
Metric: 10

5. **Policies**

   Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Trust_LAN
   Destination Address:
   Address Book Entry: (select), Remote_LAN
   Service: ANY
   Action: Permit
   Position at Top: (select)

   Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Remote_LAN
   Destination Address:
   Address Book Entry: (select), Trust_LAN
   Service: Any
   Action: Permit
   Position at Top: (select)

CLI (Device A)

1. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone trust
set interface tunnel.1 ip unnumbered interface ethernet1
```

2. **Addresses**

```
set address trust Trust_LAN 10.1.1.0/24
set address untrust Remote_LAN 10.2.1.0/24
```

3. **VPN**

```
set ike gateway gw1 address 2.2.2.2 main outgoing-interface ethernet3 preshare
    Ti82g4aX sec-level compatible
set vpn vpn1 gateway gw1 sec-level compatible
set vpn vpn1 bind interface tunnel.1
set vpn vpn1 proxy-id local-ip 10.1.1.0/24 remote-ip 10.2.1.0/24 any
set vpn vpn1 monitor source-interface ethernet1 destination-ip 10.2.1.1
```

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.2.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.2.1.0/24 interface null metric 10
```

5. **Policies**

```
set policy top from trust to untrust Trust_LAN Remote_LAN any permit
set policy top from untrust to trust Remote_LAN Trust_LAN any permit
save
```

CLI (Device B)

1. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.1 zone trust
set interface tunnel.1 ip unnumbered interface ethernet1
```

2. **Addresses**

```
set address trust Trust_LAN 10.2.1.0/24
set address untrust Remote_LAN 10.1.1.0/24
```

3. **VPN**

```
set ike gateway gw1 address 1.1.1.1 main outgoing-interface ethernet3 preshare
    Ti82g4aX sec-level compatible
set vpn vpn1 gateway gw1 sec-level compatible
set vpn vpn1 bind interface tunnel.1
set vpn vpn1 proxy-id local-ip 10.2.1.0/24 remote-ip 10.1.1.0/24 any
set vpn vpn1 monitor source-interface ethernet1 destination-ip 10.1.1.5
```

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.1
set vrouter trust-vr route 10.1.1.0/24 interface null metric 10
```

5. **Policies**

```
set policy top from trust to untrust Trust_LAN Remote_LAN any permit
set policy top from untrust to trust Remote_LAN Trust_LAN any permit
save
```

SNMP VPN Monitoring Objects and Traps

ScreenOS provides the ability to determine the status and condition of active VPNs through the use of Simple Network Management Protocol (SNMP) VPN monitoring objects and traps. The VPN monitoring MIB notes whether each ICMP echo request elicits a reply, a running average of successful replies, the latency of the reply, and the average latency over the last 30 attempts.

NOTE: To enable your SNMP manager application to recognize the VPN monitoring MIBs, you must import the ScreenOS-specific MIB extension files into the application. You can find the MIB extension files on the documentation CD that shipped with your security device.

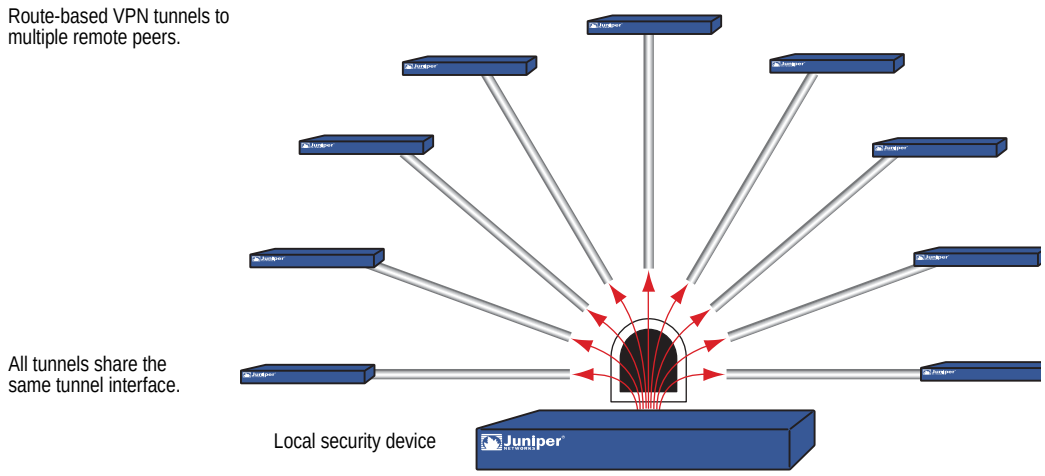
By enabling the VPN monitoring feature on an AutoKey IKE or Manual Key VPN tunnel, the security device activates its SNMP VPN monitoring objects, which include data on the following:

- The total number of active VPN sessions
- The time each session started
- The Security Association (SA) elements for each session:
  - ESP encryption (DES or 3DES) and authentication algorithm (MD5, SHA-1 or SHA2-256) types
  - AH algorithm type (MD5, SHA-1 or SHA2-256)
  - Key exchange protocol (AutoKey IKE or Manual Key)
  - Phase 1 authentication method (preshared key or certificates)
  - VPN type (dialup or peer-to-peer)
  - Peer and local gateway IP addresses
  - Peer and local gateway IDs
  - Security Parameter Index (SPI) numbers
- Session status parameters
  - VPN monitoring status (up or down)
  - Tunnel status (up or down)
  - Phase 1 and 2 status (inactive or active)
  - Phase 1 and 2 lifetime (time in seconds before rekeying; Phase 2 lifetime is also reported in remaining bytes before rekeying)

Multiple Tunnels per Tunnel Interface

You can bind multiple IPsec VPN tunnels to a single tunnel interface. To link a specific destination to one of a number of VPN tunnels bound to the same tunnel interface, the security device uses two tables: the route table and the next-hop tunnel binding (NHTB) table. The security device maps the next-hop gateway IP address specified in the route table entry to a particular VPN tunnel specified in the NHTB table. With this technique, a single tunnel interface can support many VPN tunnels. (See “Route-to-Tunnel Mapping” on page 271.)

Figure 72: One Tunnel Interface Bound to Multiple Tunnels



The security device can sort VPN traffic sent through a single tunnel interface to as many VPN tunnels as the route table or VPN tunnel capacity—whichever is lower—can support.

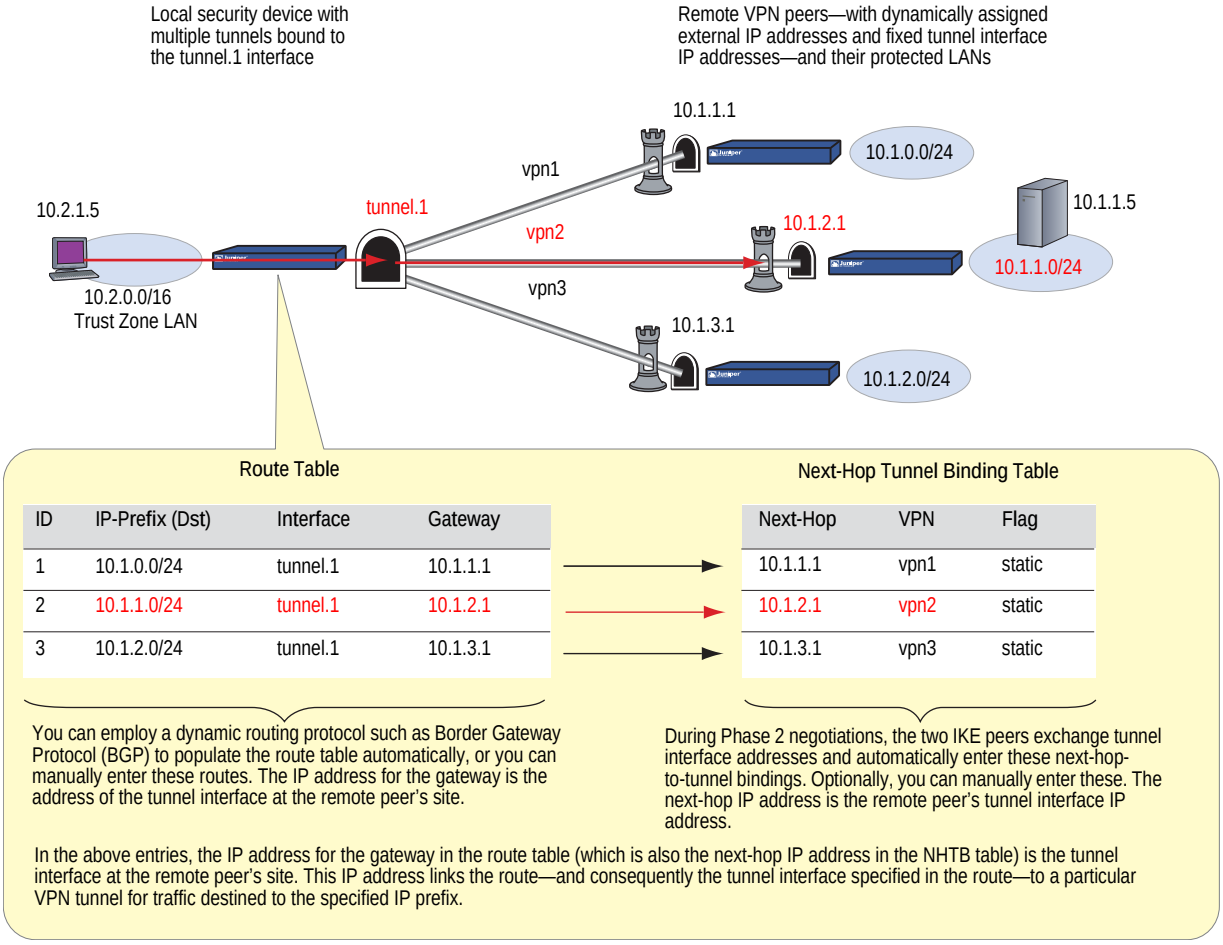
The maximum number of VPN tunnels is not limited by the number of tunnel interfaces that you can create, but by either route table capacity or the maximum number of dedicated VPN tunnels allowed—whichever is lower. For instance, if your security device supports 4000 routes and 1000 dedicated VPN tunnels, you can create 1000 VPN tunnels and bind them to a single tunnel interface. If your security device supports 8192 routes and 10,000 dedicated VPN tunnels, then you can create over 8000 VPN tunnels and bind them to a single tunnel interface. To see the maximum route and tunnel capacities for your security device, refer to the relevant product datasheet.

NOTE: If route-table capacity is the limiting factor, you must subtract the routes automatically generated by security zone interfaces and any other static routes—such as the route to the default gateway—that you might need to define from the total available for route-based VPN tunnels.

Route-to-Tunnel Mapping

To sort traffic among multiple VPN tunnels bound to the same tunnel interface, the security device maps the next-hop gateway IP address specified in the route to a particular VPN tunnel name. The mapping of entries in the route table to entries in the NHTB table is shown below. In Figure 73, the local security device routes traffic sent from 10.2.1.5 to 10.1.1.5 through the tunnel.1 interface and then through vpn2.

Figure 73: Route Table and Next-Hop Tunnel Binding (NHTB) Table



The security device uses the IP address of the remote peer's tunnel interface as the gateway and next-hop IP address. You can enter the route manually, or you can allow a dynamic routing protocol to enter a route referencing the peer's tunnel interface IP address as the gateway in the route table automatically. The same IP address must also be entered as the next hop, along with the appropriate VPN tunnel name, in the NHTB table. Again, there are two options: you can either enter it manually, or you can allow the security device to obtain it from the remote peer during Phase 2 negotiations and enter it automatically.

The security device uses the gateway IP address in the route table entry and the next-hop IP address in the NHTB table entry as the common element to link the tunnel interface with the corresponding VPN tunnel. The security device can then direct traffic destined for the IP-prefix specified in the route with the correct VPN tunnel specified in the NHTB table.

Remote Peers' Addresses

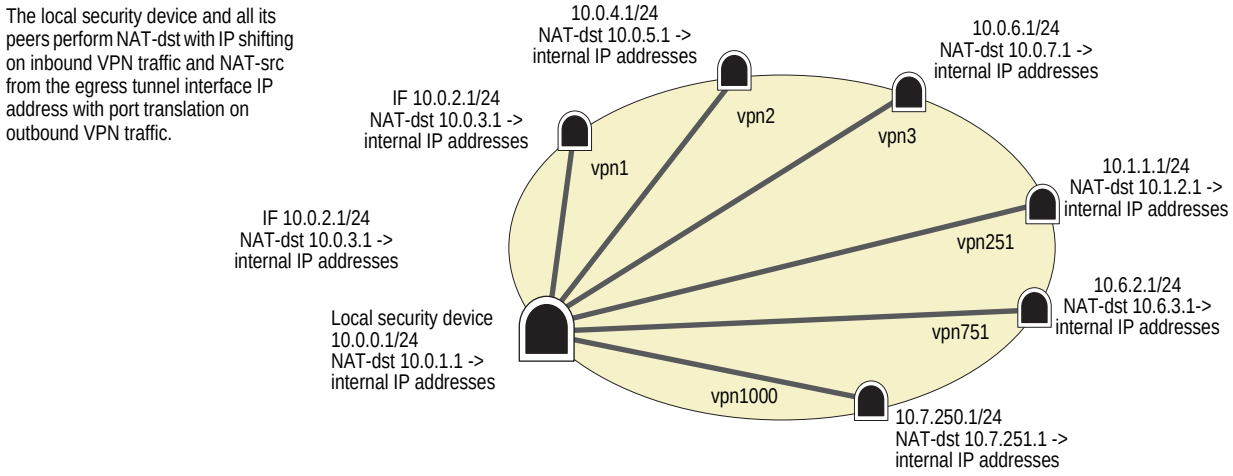
The internal addressing scheme for all remote peers reached through route-based VPNs must be unique among each other. One way to accomplish this is for each remote peer to perform Network Address Translation (NAT) for the source and destination addresses. In addition, the tunnel interface IP addresses must also be unique among all remote peers. If you intend to connect to large numbers of remote sites, an address plan becomes imperative. The following is a possible addressing plan for up to 1000 VPN tunnels:

Dst in Local Route Table	Local Tunnel Interface	Gateway / Next-Hop (Peer's Tunnel Interface)	VPN Tunnel
10.0.3.0/24	tunnel.1	10.0.2.1/24	vpn1
10.0.5.0/24	tunnel.1	10.0.4.1/24	vpn2
10.0.7.0/24	tunnel.1	10.0.6.1/24	vpn3
…	…	…	…
10.0.251.0/24	tunnel.1	10.0.250.1/24	vpn125
10.1.3.0/24	tunnel.1	10.1.2.1/24	vpn126
10.1.5.0/24	tunnel.1	10.1.4.1/24	vpn127
10.1.7.0/24	tunnel.1	10.1.6.1/24	vpn128
…	…	…	…
10.1.251.0/24	tunnel.1	10.1.250.1/24	vpn250
10.2.3.0/24	tunnel.1	10.2.2.1/24	vpn251
…	…	…	…
10.2.251.0/24	tunnel.1	10.2.250.1/24	vpn375
…	…	…	…
10.7.3.0/24	tunnel.1	10.7.2.1/24	vpn876
…	…	…	…
10.7.251.0/24	tunnel.1	10.7.250.1/24	vpn1000

The tunnel interface on the local security device: is 10.0.0.1/24. On all remote hosts, there is a tunnel interface with an IP address, which appears as the gateway/next-hop IP address in the local route table and NHTB table.

For an example illustrating multiple tunnels bound to a single tunnel interface with address translation, see "Setting VPNs on a Tunnel Interface to Overlapping Subnets" on page 276.

Figure 74: Multiple Tunnels Bound to a Single Tunnel Interface with Address Translation



Manual and Automatic Table Entries

You can make entries in the NHTB and route tables manually. You can also automate the populating of the NHTB and route tables. For a small number of tunnels bound to a single tunnel interface, the manual method works well. For a large number of tunnels, the automatic method reduces administrative setup and maintenance as the routes dynamically self-adjust if tunnels or interfaces become unavailable on the tunnel interface at the hub site.

Manual Table Entries

You can manually map a VPN tunnel to the IP address of a remote peer's tunnel interface in the next-hop tunnel binding (NHTB) table. First, you must contact the remote admin and learn the IP address used for the tunnel interface at that end of a tunnel. Then, you can associate that address with the VPN tunnel name in the NHTB table with the following command:

set interface tunnel.1 nhtb *peer's_tunnel_interface_addr* **vpn** *name_str*

After that, you can enter a static route in the route table that uses that tunnel interface IP address as the gateway. You can enter the route either through the WebUI or through the following CLI command:

set vrouter *name_str* **route** *dst_addr* **interface tunnel.1 gateway** *peer's_tunnel_interface_addr*

Automatic Table Entries

To make the population of both the NHTB and route tables automatic, the following conditions must be met:

- The remote peers for all VPN tunnels bound to a single local tunnel interface must be security devices running ScreenOS 5.0.0 or later.
- Each remote peer must bind its tunnel to a tunnel interface, and that interface must have an IP address unique among all peer tunnel interface addresses.

- At both ends of each VPN tunnel, enable VPN monitoring with the rekey option, or enable the IKE heartbeat reconnect option for each remote gateway.
- The local and remote peers must have an instance of a dynamic routing protocol enabled on their connecting tunnel interfaces.

The use of VPN monitoring with the rekey option allows the security devices at both ends of a tunnel to set up the tunnel without having to wait for user-originated VPN traffic. After you enable VPN monitoring with the rekey option at both ends of a VPN tunnel, the two security devices perform Phase 1 and Phase 2 IKE negotiations to establish the tunnel. (For more information, see "VPN Monitoring" on page 258.)

NOTE: If you are running a dynamic routing protocol on the tunnel interfaces, traffic generated by the protocol can trigger IKE negotiations even without enabling VPN monitoring with the rekey option or enabling the IKE heartbeat reconnect option. Still, we recommend that you not rely on dynamic routing traffic to trigger IKE negotiations. Instead use VPN monitoring with the rekey option or the IKE heartbeat reconnect option.

For Open Shortest Path First (OSPF), you must configure the tunnel interface on the local peer as a point-to-multipoint interface before you enable the routing protocol on the interface.

For remote peers with a dynamically assigned external IP address or with a fully qualified domain name (FQDN) mapped to a dynamic IP address, the remote peer must first initiate IKE negotiations. However, because the Phase 2 SA on the local security device caches the remote peer's dynamically assigned IP address, either peer can reinitiate IKE negotiations to reestablish a tunnel whose VPN monitoring state has changed from up to down.

During Phase 2 negotiations, the security devices exchange tunnel interface IP addresses with each other. Each IKE module can then automatically enter the tunnel interface IP address and its corresponding VPN tunnel name in the NHTB table.

To enable the local security device to enter routes to remote destinations automatically in its route table, you must enable an instance of BGP on the local and remote tunnel interfaces. The basic steps are as follows:

1. Create a BGP routing instance on the virtual router that contains the tunnel interface to which you have bound multiple VPN tunnels.
2. Enable the routing instance on the virtual router.
3. Enable the routing instance on the tunnel interface leading to the BPG peers.

The remote peers also perform these steps.

On the local (or hub) device, you must also define a default route and a static route to each peer's tunnel interface IP address. Static routes to the peers' tunnel interfaces are necessary for the hub device to reach its BGP neighbors initially through the correct VPN tunnel.

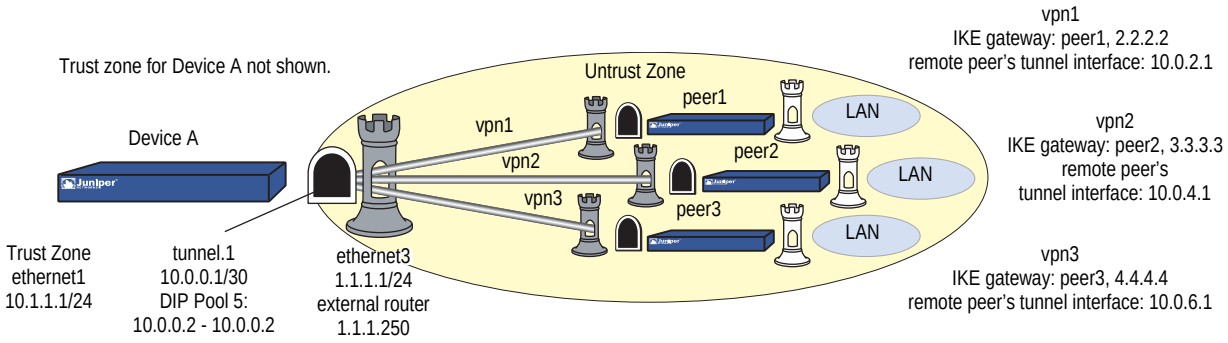
After establishing communications, the BGP neighbors exchange routing information so that they can each automatically populate their route tables. After the two peers establish a VPN tunnel between themselves, the remote peers can send and receive routing information to and from the local device. When the dynamic routing instance on the local security device learns a route to a peer through a local tunnel interface, it includes the IP address of the remote peer's tunnel interface as the gateway in the route.

For an example illustrating the configuration of multiple tunnels bound to a single tunnel interface where the "hub" device populates its NHTB and route tables automatically, see "Binding Automatic Route and NHTB Table Entries" on page 294.

Setting VPNs on a Tunnel Interface to Overlapping Subnets

In this example, you bind three route-based AutoKey IKE VPN tunnels—vpn1, vpn2, and vpn3—to a single tunnel interface—tunnel.1. The tunnels lead from Device A to three remote peers—peer1, peer2, and peer3. You manually add both the route table and NHTB table entries on Device A for all three peers. To see a configuration that provides an automatic means of populating the route and NHTB tables, see "Binding Automatic Route and NHTB Table Entries" on page 294.

Figure 75: Tunnel.1 interface Bound to Three VPN Tunnels



The VPN tunnel configurations at both ends of each tunnel use the following parameters:

- AutoKey IKE
- Preshared key for each peer:
  - peer1 uses "netscreen1"
  - peer2 uses "netscreen2"
  - peer3 uses "netscreen3"
- Security level predefined as "Compatible" for both Phase 1 and Phase 2 proposals. (For details about these proposals, see "Tunnel Negotiation" on page 9.)

All security zones and interfaces on each device are in the trust-vr virtual routing domain for that device.

This example uses the same address space—10.1.1.0/24—for every LAN to show how you can use Source Network Address Translation (NAT-src) and Destination Network Address Translation (NAT-dst) to overcome addressing conflicts among IPsec peers. For more information about NAT-src and NAT-dst, see *Volume 8: Address Translation*.

WebUI (Device A)

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24
   Enter the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Untrust (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 10.0.0.1/30

   Network > Interfaces > Edit (for tunnel.1) > DIP > New: Enter the following, then click OK:

   ID: 5
   IP Address Range: (select), 10.0.0.2 ~ 10.0.0.2
   Port Translation: (select)
   In the same subnet as the interface IP or its secondary IPs: (select)

2. **Addresses**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: corp
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Trust

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: oda1
   IP Address/Domain Name:
   IP/Netmask: (select), 10.0.1.0/24
   Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: peers
IP Address/Domain Name:
IP/Netmask: (select), 10.0.0.0/16
Zone: Untrust

3. VPNs

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: peer1
Type: Static IP: (select), Address/Hostname: 2.2.2.2
Preshared Key: netscreen1
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn2
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: peer2
Type: Static IP: (select), Address/Hostname: 3.3.3.3
Preshared Key: netscreen2
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn3
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: peer3
Type: Static IP: (select), Address/Hostname: 4.4.4.4
Preshared Key: netscreen3

Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. Routes

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.1.0/24
Gateway: (select)
Interface: ethernet1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.3.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 10.0.2.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.2.2/32
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 10.0.2.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.5.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 10.0.4.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.4.2/32
Gateway: (select)

Interface: tunnel.1
Gateway IP Address: 10.0.4.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.7.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 10.0.6.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.6.2/32
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 10.0.6.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.0.0/16
Gateway: (select)
Interface: null
Gateway IP Address: 0.0.0.0
Metric: 10

Network > Interfaces > Edit (for tunnel.1) > NHTB > New: Enter the following, then click Add:

New Next Hop Entry:
IP Address: 10.0.2.1
VPN: vpn1

Network > Interfaces > Edit (for tunnel.1) > NHTB: Enter the following, then click Add:

New Next Hop Entry:
IP Address: 10.0.4.1
VPN: vpn2

Network > Interfaces > Edit (for tunnel.1) > NHTB: Enter the following, then click Add:

New Next Hop Entry:
IP Address: 10.0.6.1
VPN: vpn3

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book: (select), corp
Destination Address:
Address Book: (select), peers
Service: Any

Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Source Translation: (select)
DIP On: 5 (10.0.0.2–10.0.0.2)/X-late

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), peers
Destination Address:
Address Book Entry: (select), oda1
Service: Any
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Destination Translation: (select)
Translate to IP Range: (select), 10.1.1.0 - 10.1.1.254

CLI (Device A)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip 10.0.0.1/30
set interface tunnel.1 dip 5 10.0.0.2 10.0.0.2
```

2. Addresses

```
set address trust corp 10.1.1.0/24
set address trust oda1 10.0.1.0/24
set address untrust peers 10.0.0.0/16
```

3. VPNs

```
set ike gateway peer1 address 2.2.2.2 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn vpn1 gateway peer1 sec-level compatible
set vpn vpn1 bind interface tunnel.1
set vpn vpn1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
set ike gateway peer2 address 3.3.3.3 outgoing-interface ethernet3 preshare
    netscreen2 sec-level compatible
set vpn vpn2 gateway peer2 sec-level compatible
set vpn vpn2 bind interface tunnel.1
set vpn vpn2 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
set ike gateway peer3 address 4.4.4.4 outgoing-interface ethernet3 preshare
    netscreen3 sec-level compatible
set vpn vpn3 gateway peer3 sec-level compatible
set vpn vpn3 bind interface tunnel.1
```

```
set vpn vpn3 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 10.0.1.0/24 interface ethernet1
set vrouter trust-vr route 10.0.3.0/24 interface tunnel.1 gateway 10.0.2.1
set vrouter trust-vr route 10.0.2.2/32 interface tunnel.1 gateway 10.0.2.1
set vrouter trust-vr route 10.0.5.0/24 interface tunnel.1 gateway 10.0.4.1
set vrouter trust-vr route 10.0.4.2/32 interface tunnel.1 gateway 10.0.4.1
set vrouter trust-vr route 10.0.7.0/24 interface tunnel.1 gateway 10.0.6.1
set vrouter trust-vr route 10.0.6.2/32 interface tunnel.1 gateway 10.0.6.1
set vrouter trust-vr route 10.0.0.0/16 interface null metric 10
set interface tunnel.1 nhtb 10.0.2.1 vpn vpn1
set interface tunnel.1 nhtb 10.0.4.1 vpn vpn2
set interface tunnel.1 nhtb 10.0.6.1 vpn vpn3
```

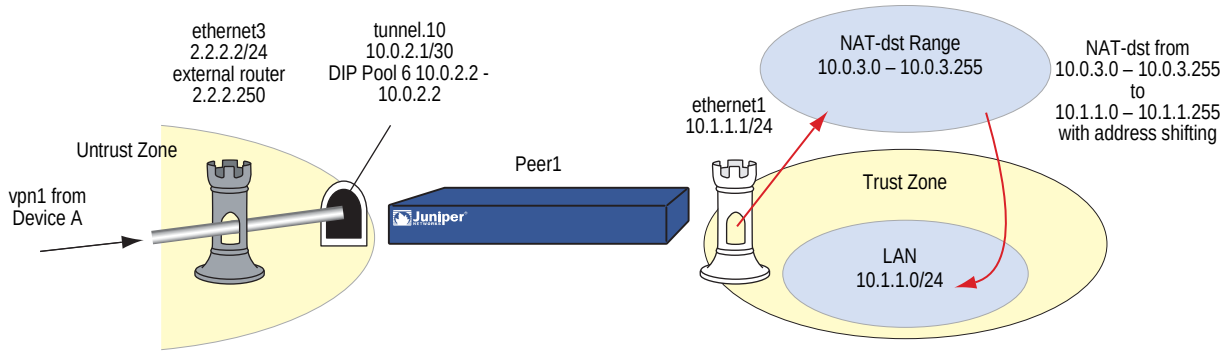
5. Policies

```
set policy from trust to untrust corp peers any nat src dip-id 5 permit
set policy from untrust to trust peers oda1 any nat dst ip 10.1.1.0 10.1.1.254
    permit
save
```

Peer1

The following configuration, as illustrated in Figure 76, is what the remote admin for the security device at the peer1 site must enter to create a VPN tunnel to Device A at the corporate site. The remote admin configures the security device to perform source and destination NAT (NAT-src and NAT-dst) because the internal addresses are in the same address space as those in the corporate LAN: 10.1.1.0/24. Peer1 performs NAT-src using DIP pool 6 to translate all internal source addresses to 10.0.2.2 when sending traffic through VPN1 to Device A. Peer1 performs NAT-dst on VPN traffic sent from Device A, translating addresses from 10.0.3.0/24 to 10.1.1.0/24 with address shifting in effect.

Figure 76: Peer1 Performing NAT-Dst



NOTE: For more information about NAT-src and NAT-dst, see *Volume 8: Address Translation*.

WebUI (Peer1)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24
Enter the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.10
Zone (VR): Untrust (trust-vr)
Fixed IP: (select)
IP Address / Netmask: 10.0.2.1/30

Network > Interfaces > Edit (for tunnel.10) > DIP > New: Enter the following, then click OK:

ID: 6
IP Address Range: (select), 10.0.2.2 ~ 10.0.2.2
Port Translation: (select)
In the same subnet as the interface IP or its secondary IPs: (select)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: lan
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: oda2
IP Address/Domain Name:
IP/Netmask: (select), 10.0.3.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: to_corp
IP Address/Domain Name:
IP/Netmask: (select), 10.0.1.0/24
Zone: Untrust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: fr_corp
IP Address/Domain Name:
IP/Netmask: (select), 10.0.0.2/32
Zone: Untrust

3. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: corp
Type: Static IP: (select), Address/Hostname: 1.1.1.1
Preshared Key: netscreen1
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.10
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. Routes

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.3.0/24
Gateway: (select)
Interface: ethernet1
Gateway IP Address: 0.0.0.0
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.0.0/8
Gateway: (select)
Interface: tunnel.10
Gateway IP Address: 0.0.0.0
Metric: 10

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.0.0/8
Gateway: (select)
Interface: null
Gateway IP Address: 0.0.0.0
Metric: 12

5. Policies

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), fr_corp
Destination Address:
Address Book Entry: (select), oda2
Service: Any
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Destination Translation: (select)
Translate to IP Range: (select), 10.1.1.0 - 10.1.1.254

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), lan
Destination Address:
Address Book Entry: (select), to_corp
Service: Any
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Source Translation: (select)
DIP On: 6 (10.0.2.2–10.0.2.2)/X-late

CLI (Peer1)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.10 zone untrust
set interface tunnel.10 ip 10.0.2.1/30
set interface tunnel.10 dip 6 10.0.2.2 10.0.2.2
```

2. **Addresses**

```
set address trust lan 10.1.1.0/24
set address trust oda2 10.0.3.0/24
set address untrust to_corp 10.0.1.0/24
set address untrust fr_corp 10.0.0.2/32
```

3. **VPN**

```
set ike gateway corp address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn vpn1 gateway corp sec-level compatible
set vpn vpn1 bind interface tunnel.10
set vpn vpn1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
    metric 1
set vrouter trust-vr route 10.0.3.0/24 interface ethernet1 metric 1
set vrouter trust-vr route 10.0.0.0/8 interface tunnel.10 metric 10
set vrouter trust-vr route 10.0.0.0/8 interface null metric 12
```

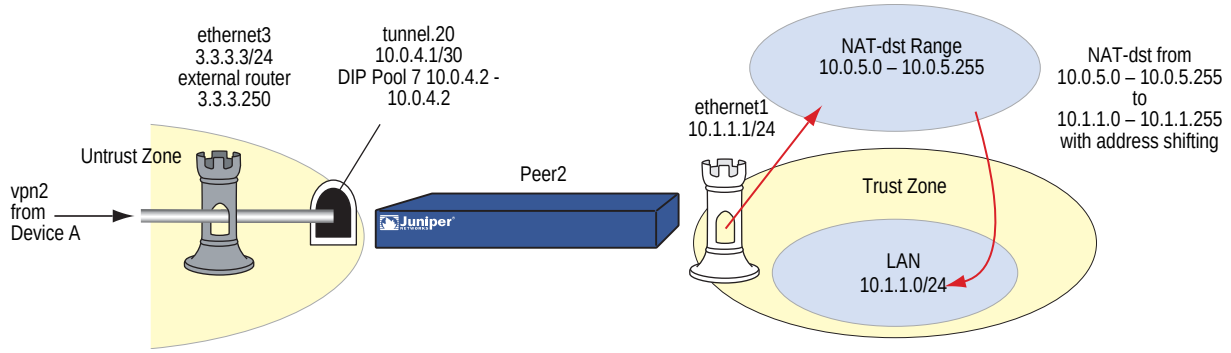
5. **Policies**

```
set policy from trust to untrust lan to_corp any nat src dip-id 6 permit
set policy from untrust to trust fr_corp oda2 any nat dst ip 10.1.1.0 10.1.1.254
    permit
save
```

Peer2

The following configuration, as illustrated in Figure 77, is what the remote admin for the security device at the peer2 site must enter to create a VPN tunnel to Device A at the corporate site. The remote admin configures the security device to perform source and destination NAT (NAT-src and NAT-dst) because the internal addresses are in the same address space as those in the corporate LAN: 10.1.1.0/24. Peer2 performs NAT-src using DIP pool 7 to translate all internal source addresses to 10.0.4.2 when sending traffic through VPN2 to Device A. Peer2 performs NAT-dst on VPN traffic sent from Device A, translating addresses from 10.0.5.0/24 to 10.1.1.0/24 with address shifting in effect.

Figure 77: Peer2



NOTE: For more information about NAT-src and NAT-dst, see *Volume 8: Address Translation*.

WebUI (Peer2)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24
Enter the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 3.3.3.3/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.20
Zone (VR): Untrust (trust-vr)
Fixed IP: (select)
IP Address / Netmask: 10.0.4.1/30

Network > Interfaces > Edit (for tunnel.20) > DIP > New: Enter the following, then click OK:

ID: 7
IP Address Range: (select), 10.0.4.2 ~ 10.0.4.2
Port Translation: (select)
In the same subnet as the interface IP or its secondary IPs: (select)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: lan
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: oda3
IP Address/Domain Name:
IP/Netmask: (select), 10.0.5.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: to_corp
IP Address/Domain Name:
IP/Netmask: (select), 10.0.1.0/24
Zone: Untrust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: fr_corp
IP Address/Domain Name:
IP/Netmask: (select), 10.0.0.2/32
Zone: Untrust

3. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn2
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: corp
Type: Static IP: (select), Address/Hostname: 1.1.1.1
Preshared Key: netscreen2
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.20
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. Routes

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 3.3.3.250
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.5.0/24
Gateway: (select)
Interface: ethernet1
Gateway IP Address: 0.0.0.0
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.1.0/24
Gateway: (select)
Interface: tunnel.20
Gateway IP Address: 0.0.0.0
Metric: 10

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.1.0/24
Gateway: (select)
Interface: null
Gateway IP Address: 0.0.0.0
Metric: 12

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), lan
Destination Address:
Address Book Entry: (select), to_corp
Service: Any
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Source Translation: (select)
DIP On: 7 (10.0.4.2–10.0.4.2)/X-late

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), fr_corp
Destination Address:
Address Book Entry: (select), oda3
Service: Any
Action: Permit
Position at Top: (select)

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

NAT:
Destination Translation: (select)
Translate to IP Range: (select), 10.1.1.0 - 10.1.1.254

CLI (Peer2)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 3.3.3.3/24
set interface tunnel.20 zone untrust
set interface tunnel.20 ip 10.0.4.1/30
set interface tunnel.20 dip 7 10.0.4.2 10.0.4.2
```

2. **Addresses**

```
set address trust lan 10.1.1.0/24
set address trust oda3 10.0.5.0/24
set address untrust to_corp 10.0.1.0/24
set address untrust fr_corp 10.0.0.2/32
```

3. **VPN**

```
set ike gateway corp address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen2 sec-level compatible
set vpn vpn2 gateway corp sec-level compatible
set vpn vpn2 bind interface tunnel.20
set vpn vpn2 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 3.3.3.250
    metric 1
set vrouter trust-vr route 10.0.5.0/24 interface ethernet1 metric 1
set vrouter trust-vr route 10.0.0.0/8 interface tunnel.20 metric 10
set vrouter trust-vr route 10.0.0.0/8 interface null metric 12
```

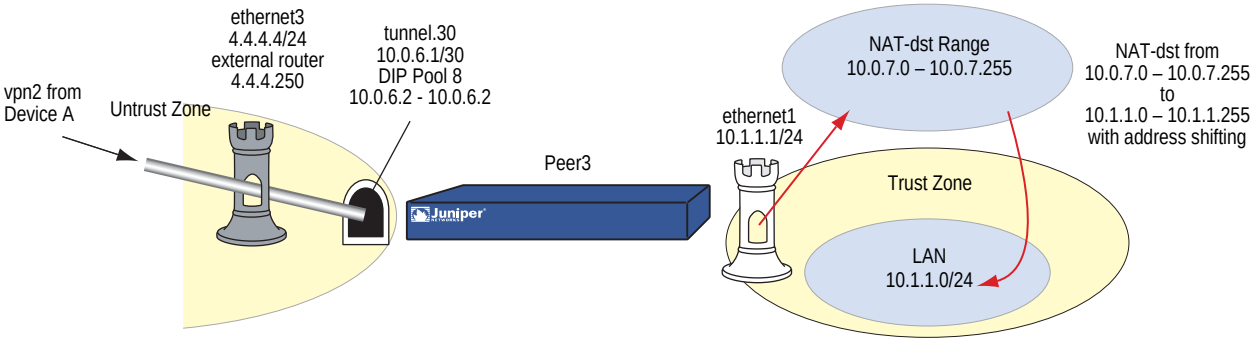
5. **Policies**

```
set policy from trust to untrust lan to_corp any nat src dip-id 7 permit
set policy from untrust to trust fr_corp oda3 any nat dst ip 10.1.1.0 10.1.1.254
    permit
save
```

Peer3

The following configuration, as illustrated in Figure 78, is what the remote admin for the security device at the peer3 site must enter to create a VPN tunnel to Device A at the corporate site. The remote admin configures the security device to perform source and destination NAT (NAT-src and NAT-dst) because the internal addresses are in the same address space as those in the corporate LAN: 10.1.1.0/24. Peer3 performs NAT-src using DIP pool 8 to translate all internal source addresses to 10.0.6.2 when sending traffic through VPN3 to Device A. Peer3 performs NAT-dst on VPN traffic sent from Device A, translating addresses from 10.0.7.0/24 to 10.1.1.0/24 with address shifting in effect.

Figure 78: Peer3



NOTE: For more information about NAT-dst, see *Volume 8: Address Translation*.

WebUI (Peer3)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/24
Enter the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 4.4.4.4/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.30
Zone (VR): Untrust (trust-vr)
Fixed IP: (select)
IP Address / Netmask: 10.0.6.1/30

Network > Interfaces > Edit (for tunnel.320) > DIP > New: Enter the following, then click OK:

ID: 7
IP Address Range: (select), 10.0.6.2 ~ 10.0.6.2
Port Translation: (select)
In the same subnet as the interface IP or its secondary IPs: (select)

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: lan
IP Address/Domain Name:
IP/Netmask: (select), 10.1.1.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: oda4
IP Address/Domain Name:
IP/Netmask: (select), 10.0.7.0/24
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: to_corp
IP Address/Domain Name:
IP/Netmask: (select), 10.0.1.0/24
Zone: Untrust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: fr_corp
IP Address/Domain Name:
IP/Netmask: (select), 10.0.0.2/32
Zone: Untrust

3. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn3
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: corp
Type: Static IP: (select), Address/Hostname: 1.1.1.1
Preshared Key: netscreen3
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.30
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. Routes

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 4.4.4.250
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.7.0/24
Gateway: (select)
Interface: ethernet1
Gateway IP Address: 0.0.0.0
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.0.0.0/8
Gateway: (select)
Interface: tunnel.20
Gateway IP Address: 10.0.0.1
Metric: 10

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

```
Network Address / Netmask: 10.0.0.0/8
Gateway: (select)
    Interface: null
    Gateway IP Address: 10.0.0.1
    Metric: 12
```

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

```
Source Address:
    Address Book Entry: (select), lan
Destination Address:
    Address Book Entry: (select), to_corp
Service: Any
Action: Permit
Position at Top: (select)
```

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

```
NAT:
  Source Translation: (select)
    DIP On: 8 (10.0.6.2–10.0.6.2)/X-late
```

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

```
Source Address:
    Address Book Entry: (select), fr_corp
Destination Address:
    Address Book Entry: (select), oda4
Service: Any
Action: Permit
Position at Top: (select)
```

> Advanced: Enter the following advanced settings, then click Return to return to the basic Policy configuration page:

```
NAT:
  Destination Translation: (select)
    Translate to IP Range: (select), 10.1.1.0 - 10.1.1.254
```

CLI (Peer3)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 4.4.4.4/24
set interface tunnel.30 zone untrust
set interface tunnel.30 ip 10.0.6.1/30
set interface tunnel.30 dip 8 10.0.6.2 10.0.6.2
```

2. **Addresses**

```
set address trust lan 10.1.1.0/24
set address trust oda4 10.0.7.0/24
set address untrust to_corp 10.0.1.0/24
set address untrust fr_corp 10.0.0.2/32
```

3. **VPN**

```
set ike gateway corp address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen3 sec-level compatible
set vpn vpn3 gateway corp sec-level compatible
set vpn vpn3 bind interface tunnel.30
set vpn vpn3 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 3.3.3.250 metric
    1
set vrouter trust-vr route 10.0.7.0/24 interface ethernet1 metric 1
set vrouter trust-vr route 10.0.0.0/8 interface tunnel.30 metric 10
set vrouter trust-vr route 10.0.0.0/8 interface null metric 12
```

5. **Policies**

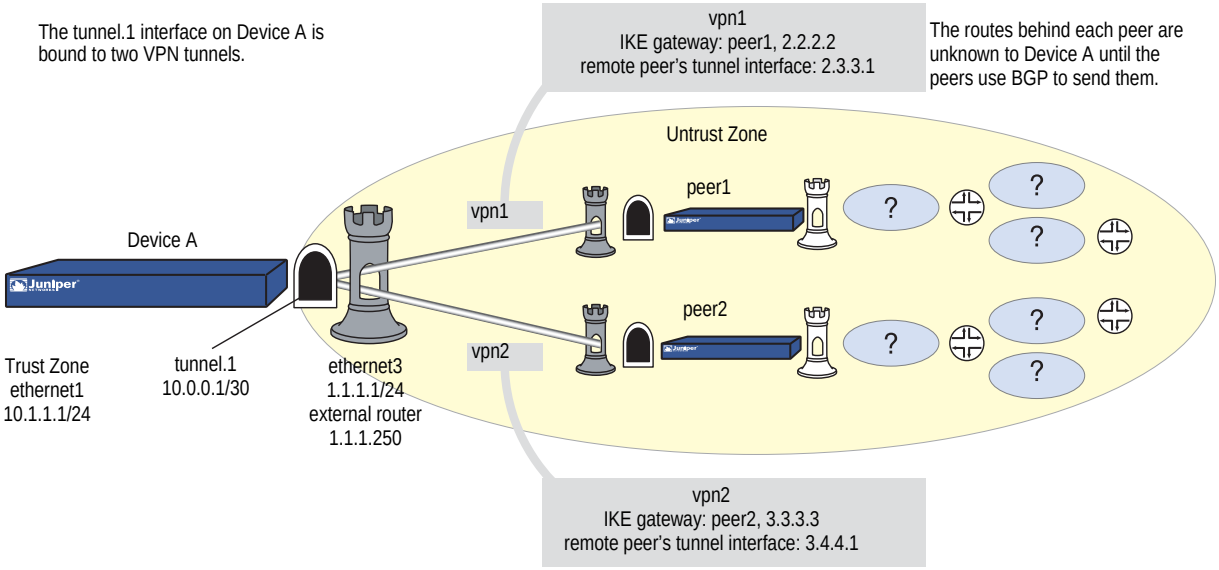
```
set policy from trust to untrust lan to_corp any nat src dip-id 8 permit
set policy from untrust to trust fr_corp oda4 any nat dst ip 10.1.1.0 10.1.1.254
    permit
save
```

Binding Automatic Route and NHTB Table Entries

In Figure 79 on page 295, you bind two route-based AutoKey IKE VPN tunnels—vpn1, vpn2—to a single tunnel interface—tunnel.1 on Device A at the corporate site. The network that each remote peer protects has multiple routes behind the connected route. Using Border Gateway Protocol (BGP), the peers communicate their routes to Device A. This example permits VPN traffic from the corporate site behind Device A to the peer sites.

NOTE: You can also use Open Shortest Path First (OSPF) instead of BGP as the routing protocol in this example. See “Using OSPF for Automatic Route Table Entries” on page 306 for the OSPF configurations.

Figure 79: Automatic Route and NHTB Table Entries (Device A)



The VPN tunnel configurations at both ends of each tunnel use the following parameters: AutoKey IKE, preshared key (peer1: "netscreen1", peer2: "netscreen2"), and the security level predefined as "Compatible" for both Phase 1 and Phase 2 proposals. (For details about these proposals, see "Tunnel Negotiation" on page 9.)

By configuring the following two features, you can enable Device A to populate its NHTB and route tables automatically:

- VPN monitoring with the rekey option (or the IKE heartbeats reconnect option)
- BGP dynamic routing on tunnel.1

NOTE: If you are running a dynamic routing protocol on the tunnel interfaces, traffic generated by the protocol can trigger IKE negotiations even without enabling VPN monitoring with the rekey option or enabling the IKE heartbeat reconnect option. Still, Juniper Networks recommends that you not rely on dynamic routing traffic to trigger IKE negotiations. Instead use VPN monitoring with the rekey option or the IKE heartbeat reconnect option.

If you are running BGP on the tunnel interfaces, the BGP-generated traffic can trigger IKE negotiations even without enabling VPN monitoring with the rekey option or enabling the IKE heartbeat reconnect option. Still, Juniper Networks recommends that you not rely on BGP traffic to trigger IKE negotiations. Instead, use VPN monitoring with the rekey option or the IKE heartbeat reconnect option.

When you enable VPN monitoring with the rekey option for an AutoKey IKE VPN tunnel, Device A establishes a VPN connection with its remote peer as soon as you and the admin at the remote site finish configuring the tunnel. The devices do not wait for user-generated VPN traffic to perform IKE negotiations. During Phase 2 negotiations, the security devices exchange their tunnel interface IP address, so that Device A can automatically make a VPN-to-next-hop mapping in its NHTB table.

The rekey option ensures that when the Phase 1 and Phase 2 key lifetimes expire, the devices automatically negotiate the generation of new keys without the need for human intervention. VPN monitoring with the rekey option enabled essentially provides a means for keeping a VPN tunnel up continually, even when there is no user-generated traffic. This is necessary so that the BGP dynamic routing instances that you and the remote admins create and enable on the tunnel interfaces at both ends of the tunnels can send routing information to Device A and automatically populate its route table with the routes it needs to direct traffic through the VPN tunnel before those routes are required for user-generated traffic. (The admins at the peer sites still need to enter a single static route to the rest of the virtual private network through the tunnel interface at each respective site.)

You enter a default route and static routes on Device A to reach its BGP neighbors through the correct VPN tunnels. All security zones and interfaces on each device are in the trust-vr virtual routing domain for that device.

WebUI (Device A)

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.1.1.1/24
   Enter the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Untrust (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 10.0.0.1/30

2. VPNs

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: peer1
Type: Static IP: (select), Address/Hostname: 2.2.2.2
Preshared Key: netscreen1
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY
VPN Monitor: (select)
Rekey: (select)

NOTE: Leave the Source Interface and Destination IP options at their default settings. For information about these options, see "VPN Monitoring" on page 258.

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn2
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: peer2
Type: Static IP: (select), Address/Hostname: 3.3.3.3
Preshared Key: netscreen2
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.1
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY
VPN Monitor: (select)
Rekey: (select)

NOTE: Leave the Source Interface and Destination IP options at their default settings. For information about these options, see "VPN Monitoring" on page 258.

---

3. Static Route

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 2.3.3.1/32
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 2.3.3.1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 3.4.4.1/32
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 3.4.4.1

4. Dynamic Routing

Network > Routing > Virtual Routers > Edit (for trust-vr) > Create BGP Instance: Enter the following, then click OK:

AS Number (required): 99
BGP Enabled: (select)

Network > Interfaces > Edit (for tunnel.1) > BGP: Select the Protocol BGP check box, then click OK.

Network > Routing > Virtual Routers > Edit (for trust-vr) > Edit BGP Instance > Neighbors: Enter the following, then click Add:

AS Number: 99
Remote IP: 2.3.3.1
Outgoing Interface: tunnel.1

Network > Routing > Virtual Routers > Edit (for trust-vr) > Edit BGP Instance > Neighbors: Enter the following, then click Add:

AS Number: 99
Remote IP: 3.4.4.1
Outgoing Interface: tunnel.1

5. Policy

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
Address Book: (select), Any
Destination Address:
Address Book: (select), Any
Service: ANY
Action: Permit

CLI (Device A)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip 10.0.0.1/30
```

2. VPNs

```
set ike gateway peer1 address 2.2.2.2 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn vpn1 gateway peer1 sec-level compatible
set vpn vpn1 bind interface tunnel.1
set vpn vpn1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
set vpn vpn1 monitor rekey
set ike gateway peer2 address 3.3.3.3 outgoing-interface ethernet3 preshare
    netscreen2 sec-level compatible
set vpn vpn2 gateway peer2 sec-level compatible
set vpn vpn2 bind interface tunnel.1
set vpn vpn2 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
set vpn vpn2 monitor rekey
```

3. Static Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
set vrouter trust-vr route 2.3.3.1/32 interface tunnel.1 gateway 2.3.3.1
set vrouter trust-vr route 2.4.4.1/32 interface tunnel.1 gateway 2.4.4.1
```

4. Dynamic Routing

```
device-> set vrouter trust-vr protocol bgp 99
device-> set vrouter trust-vr protocol bgp enable
device-> set interface tunnel.1 protocol bgp
device-> set vrouter trust-vr
device(trust-vr)-> set protocol bgp
device(trust-vr/bgp)-> set neighbor 2.3.3.1 remote-as 99 outgoing interface
    tunnel.1
device(trust-vr/bgp)-> set neighbor 2.3.3.1 enable
device(trust-vr/bgp)-> set neighbor 3.4.4.1 remote-as 99 outgoing interface
    tunnel.1
device(trust-vr/bgp)-> set neighbor 3.4.4.1 enable
device(trust-vr/bgp)-> exit
device(trust-vr)-> exit
```

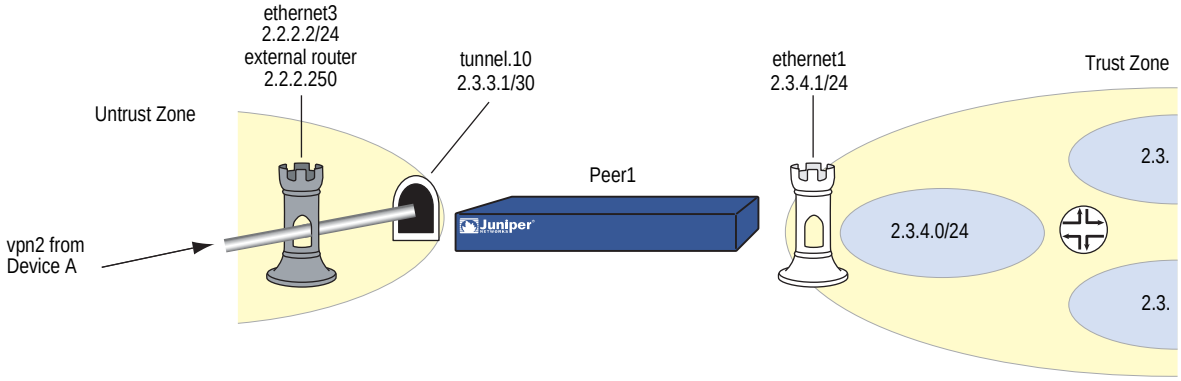
5. Policy

```
set policy from trust to untrust any any any permit
save
```

Peer1

The following configuration, as illustrated in Figure 80 on page 300, is what the remote admin for the security device at the peer1 site must enter to create a VPN tunnel to Device A at the corporate site. The remote admin configures the security device to permit inbound traffic from the corporate site and to communicate internal routes to its BGP neighbor through vpn1.

Figure 80: Peer1



WebUI (Peer1)

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click OK:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 2.3.4.1/24

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 2.2.2.2/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.10
   Zone (VR): Untrust (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 2.3.3.1/30

2. **Address**
   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: corp
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Untrust

3. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn1
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: corp
Type: Static IP: (select), Address/Hostname: 1.1.1.1
Preshared Key: netscreen1
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.10
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. Static Routes

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 2.2.2.250
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.1.1.0/24
Gateway: (select)
Interface: tunnel.10
Gateway IP Address: 0.0.0.0
Metric: 1

5. Dynamic Routing

Network > Routing > Virtual Routers > Edit (for trust-vr) > Create BGP Instance: Enter the following, then click OK:

AS Number (required): 99
BGP Enabled: (select)

Network > Interfaces > Edit (for tunnel.10) > BGP: Select the Protocol BGP check box, then click OK.

Network > Routing > Virtual Routers > Edit (for trust-vr) > Edit BGP Instance > Neighbors: Enter the following, then click Add:

AS Number: 99
Remote IP: 10.0.0.1
Outgoing Interface: tunnel.10

6. **Policy**

   Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), corp
   Destination Address:
   Address Book Entry: (select), Any
   Service: ANY
   Action: Permit

CLI (Peer1)

1. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 2.3.4.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.10 zone untrust
set interface tunnel.10 ip 2.3.3.1/30
```

2. **Address**

```
set address untrust corp 10.1.1.0/24
```

3. **VPN**

```
set ike gateway corp address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn vpn1 gateway corp sec-level compatible
set vpn vpn1 bind interface tunnel.10
set vpn vpn1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. **Static Routes**

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
    metric 1
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.10 metric 1
```

5. **Dynamic Routing**

```
device-> set vrouter trust-vr protocol bgp 99
device-> set vrouter trust-vr protocol bgp enable
device-> set interface tunnel.10 protocol bgp
device-> set vrouter trust-vr
device(trust-vr)-> set protocol bgp
device(trust-vr/bgp)-> set neighbor 10.0.0.1 remote-as 99 outgoing interface
    tunnel.10
device(trust-vr/bgp)-> set neighbor 10.0.0.1 enable
device(trust-vr/bgp)-> exit
device(trust-vr)-> exit
```

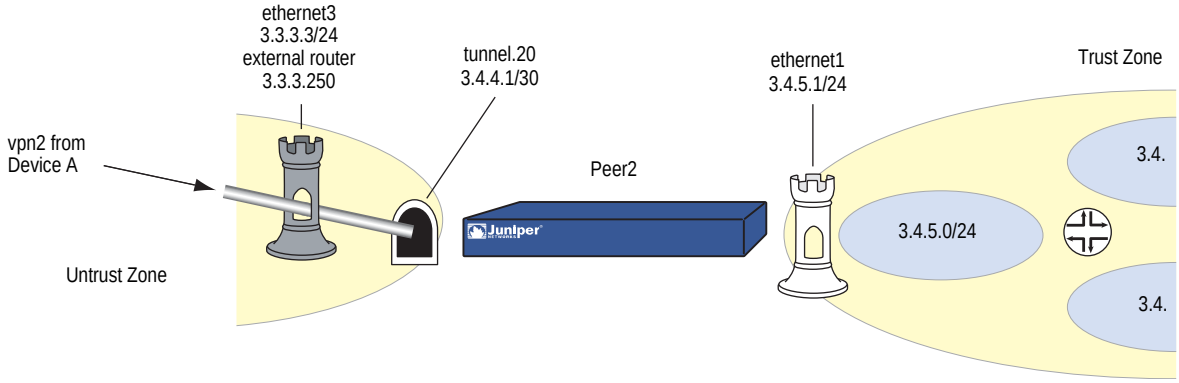
6. **Policy**

```
set policy from untrust to trust corp any any permit
save
```

Peer2

The following configuration, as illustrated in Figure 81, is what the remote admin for the security device at the peer2 site must enter to create a VPN tunnel to Device A at the corporate site. The remote admin configures the security device to permit inbound traffic from the corporate site and communicate internal routes to its BGP neighbor through vpn2.

Figure 81: Peer2



WebUI (Peer2)

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet1): Enter the following, then click OK:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 2.3.4.1/24

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 3.3.3.3/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.20
   Zone (VR): Untrust (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 3.4.4.1/30

2. **Address**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: corp
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.1.0/24
   Zone: Untrust

3. VPN

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: vpn2
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: corp
Type: Static IP: (select), Address/Hostname: 1.1.1.1
Preshared Key: netscreen2
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Bind to: Tunnel Interface, tunnel.20
Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. Static Routes

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 3.3.3.250
Metric: 1

Network > Routing > Routing Entries > (trust-vr) New: Enter the following, then click OK:

Network Address / Netmask: 10.1.1.0/24
Gateway: (select)
Interface: tunnel.20
Gateway IP Address: 0.0.0.0
Metric: 1

5. Dynamic Routing

Network > Routing > Virtual Routers > Edit (for trust-vr) > Create BGP Instance: Enter the following, then click OK:

AS Number (required): 99
BGP Enabled: (select)

Network > Interfaces > Edit (for tunnel.20) > BGP: Select the Protocol BGP check box, then click OK.

Network > Routing > Virtual Routers > Edit (for trust-vr) > Edit BGP Instance > Neighbors: Enter the following, then click Add:

AS Number: 99
Remote IP: 10.0.0.1
Outgoing Interface: tunnel.20

6. Policy

Policies > (From: Untrust, To: Trust) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), corp
Destination Address:
Address Book Entry: (select), Any
Service: ANY
Action: Permit

CLI (Peer2)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 3.4.5.1/24
set interface ethernet3 zone untrust
set interface ethernet3 ip 3.3.3.3/24
set interface tunnel.20 zone untrust
set interface tunnel.20 ip 3.4.4.1/30
```

2. Address

```
set address untrust corp 10.1.1.0/24
```

3. VPN

```
set ike gateway corp address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen2 sec-level compatible
set vpn vpn1 gateway corp sec-level compatible
set vpn vpn1 bind interface tunnel.20
set vpn vpn1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. Static Routes

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 3.3.3.250
    metric 1
set vrouter trust-vr route 10.1.1.0/24 interface tunnel.20 metric 1
```

5. Dynamic Routing

```
device-> set vrouter trust-vr protocol bgp 99
device-> set vrouter trust-vr protocol bgp enable
device-> set interface tunnel.20 protocol bgp
device-> set vrouter trust-vr
device(trust-vr)-> set protocol bgp
device(trust-vr/bgp)-> set neighbor 10.0.0.1 remote-as 99 outgoing interface
    tunnel.20
device(trust-vr/bgp)-> set neighbor 10.0.0.1 enable
device(trust-vr/bgp)-> exit
device(trust-vr)-> exit
```

6. Policy

```
set policy from untrust to trust corp any any permit
save
```

Using OSPF for Automatic Route Table Entries

You can also configure OSPF instead of BGP dynamic routing for the peers to communicate routes to Device A. To allow tunnel.1 on Device A to form OSPF adjacencies with its peers, you must configure the tunnel interface as a point-to-multipoint interface. The OSPF dynamic routing configuration for each device is shown below.

WebUI (Device A)

Dynamic Routing (OSPF)

Network > Routing > Virtual Routers > Edit (for trust-vr) > Create OSPF Instance: Select OSPF Enabled, then click Apply.

Area > Configure (for area 0.0.0.0): Click < < Add to move the tunnel.1 interface from the Available Interface(s) list to the Selected Interface(s) list, then click OK.

Network > Interfaces > Edit (for tunnel.1) > OSPF: Enter the following, then click Apply:

Bind to Area: (select), Select 0.0.0.0 from the drop down list
Protocol OSPF: Enable
Link Type: Point-to-Multipoint (select)

CLI (Device A)

Dynamic Routing (OSPF)

```
device-> set vrouter trust-vr protocol ospf
device-> set vrouter trust-vr protocol ospf enable
device-> set interface tunnel.1 protocol ospf area 0
device-> set interface tunnel.1 protocol ospf link-type p2mp
device-> set interface tunnel.1 protocol ospf enable
device-> save
```

WebUI (Peer1)

Dynamic Routing (OSPF)

Network > Routing > Virtual Routers > Edit (for trust-vr) > Create OSPF Instance: Select OSPF Enabled, then click Apply.

Area > Configure (for area 0.0.0.0): Click < < Add to move the tunnel.1 interface from the Available Interface(s) list to the Selected Interface(s) list, then click OK.

Network > Interfaces > Edit (for tunnel.1) > OSPF: Enter the following, then click Apply:

Bind to Area: (select), Select 0.0.0.0 from the drop down list
Protocol OSPF: Enable

CLI (Peer1)

Dynamic Routing (OSPF)

```
device-> set vrouter trust-vr protocol ospf
device-> set vrouter trust-vr protocol ospf enable
device-> set interface tunnel.1 protocol ospf area 0
device-> set interface tunnel.1 protocol ospf enable
device-> save
```

WebUI (Peer2)

Dynamic Routing (OSPF)

Network > Routing > Virtual Routers > Edit (for trust-vr) > Create OSPF Instance: Select OSPF Enabled, then click Apply.

Area > Configure (for area 0.0.0.0): Click < < Add to move the tunnel.1 interface from the Available Interface(s) list to the Selected Interface(s) list, then click OK.

Network > Interfaces > Edit (for tunnel.1) > OSPF: Enter the following, then click Apply:

Bind to Area: (select), Select 0.0.0.0 from the drop down list
Protocol OSPF: Enable

CLI (Peer2)

Dynamic Routing (OSPF)

```
device-> set vrouter trust-vr protocol ospf
device-> set vrouter trust-vr protocol ospf enable
device-> set interface tunnel.1 protocol ospf area 0
device-> set interface tunnel.1 protocol ospf enable
device-> save
```

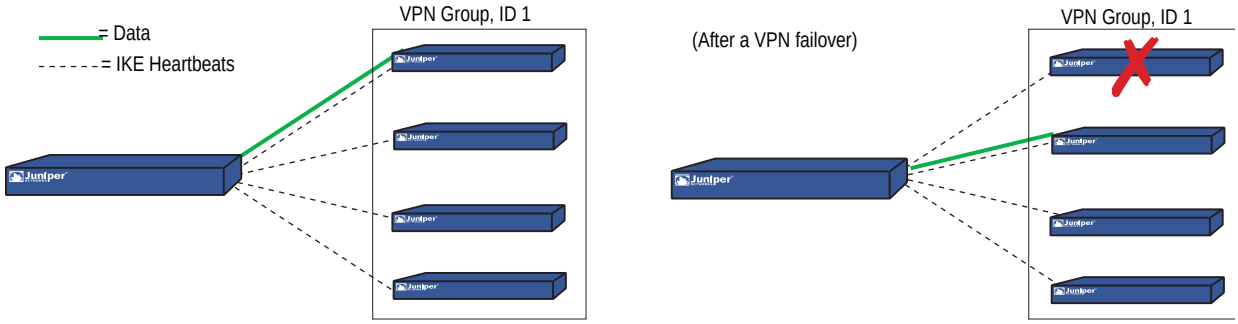
Redundant VPN Gateways

The redundant gateway feature provides a solution for continuous VPN connectivity during and after a site-to-site failover. You can create a VPN group to provide a set of up to four redundant gateways to which policy-based site-to-site or site-to-site dynamic peer AutoKey IKE IPsec VPN tunnels can connect. When the security device first receives traffic matching a policy referencing a VPN group, it performs Phase 1 and Phase 2 IKE negotiations with all members in that group. The security device sends data through the VPN tunnel to the gateway with the highest priority, or weight, in the group. For all other gateways in the group, the security device maintains the Phase 1 and 2 SAs and keeps the tunnels active by sending IKE keepalive packets through them. If the active VPN tunnel fails, the tunnel can fail over to the tunnel and gateway with the second highest priority in the group.

NOTE: VPN groups do not support L2TP, L2TP-over-IPsec, dialup, Manual Key, or route-based VPN tunnel types. In a Site-to-Site Dynamic Peer arrangement, the security device monitoring the VPN group must be the one whose untrust IP address is dynamically assigned, while the untrust IP addresses of the VPN group members must be static.

This scheme assumes that the sites behind the redundant gateways are connected so that data is mirrored among hosts at all sites. Furthermore, each site—being dedicated to high availability (HA)—has a redundant cluster of security devices operating in HA mode. Therefore, the VPN failover threshold must be set higher than the device failover threshold or VPN failovers might occur unnecessarily.

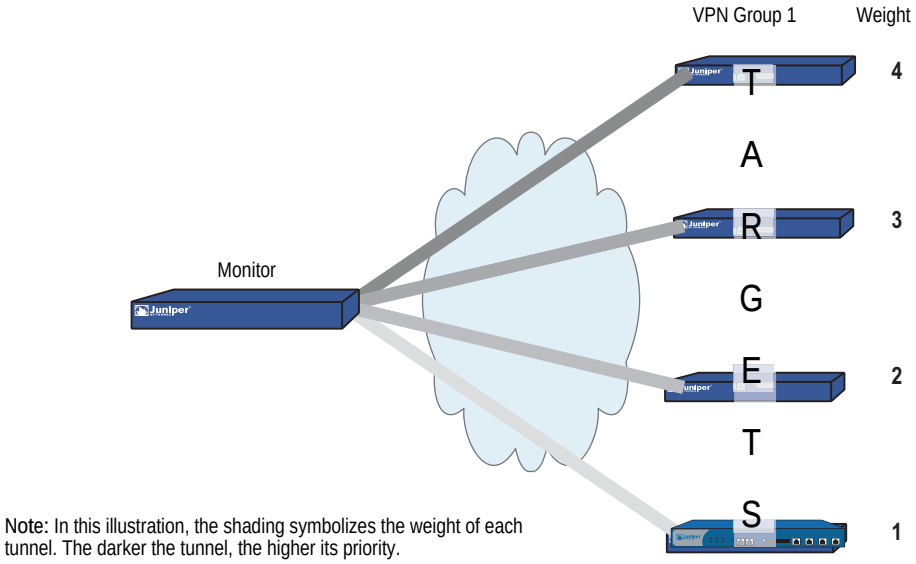
Figure 82: Redundant VPN Gateways for VPN Tunnel Failover



VPN Groups

A VPN group is a set of VPN tunnel configurations for up to four targeted remote gateways. The Phase 1 and Phase 2 security association (SA) parameters for each tunnel in a group can be different or identical (except for the IP address of the remote gateway, which obviously must be different). The VPN group, shown in Figure 83 on page 309, has a unique ID number, and each member in the group is assigned a unique weight to indicate its place in rank of preference to be the active tunnel. A value of 1 indicates the lowest, or least-preferred, ranking.

Figure 83: Targeted Remote Gateways



The security device communicating with VPN group members and the members themselves have a monitor-to-target relationship. The monitoring device continually monitors the connectivity and wellbeing of each targeted device. The tools that the monitor uses to do this are as follows:

- IKE heartbeats
- IKE recovery attempts

Both tools are presented in the next section, “Monitoring Mechanisms ” on page 309.

NOTE: The monitor-to-target relationship need not be one way. The monitoring device might also be a member of a VPN group and thus be the target of another monitoring device.

Monitoring Mechanisms

Two mechanisms monitor members of a VPN group to determine their ability to terminate VPN traffic:

- IKE heartbeats
- IKE recovery attempts

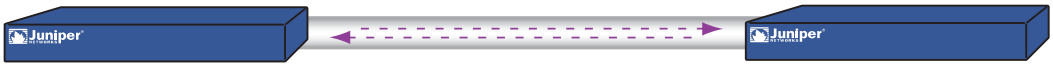
Using these two tools, plus the TCP application failover option (see “TCP SYN-Flag Checking” on page 313), security devices can detect when a VPN failover is required and shift traffic to the new tunnel without disrupting VPN service.

IKE Heartbeats

IKE heartbeats are hello messages that IKE peers send to each other under the protection of an established Phase 1 security association (SA) to confirm the connectivity and wellbeing of the other. If, for example, device_m (the "monitor") does not receive a specified number of heartbeats (the default is 5) from device_t (the "target"), device_m concludes that device_t is down. Device_m clears the corresponding Phase 1 and Phase 2 security associations (SAs) from its SA cache and begins the IKE recovery procedure. (See "IKE Recovery Procedure" on page 311.) Device_t also clears its SAs.

NOTE: The IKE heartbeats feature must be enabled on the devices at both ends of a VPN tunnel in a VPN group. If it is enabled on device_m but not on device_t, device_m suppresses IKE heartbeat transmission and generates the following message in the event log: "Heartbeats have been disabled because the peer is not sending them."

Figure 84: IKE Heartbeats Flow in Both Directions



IKE heartbeats must flow both ways through the VPN tunnel.

To define the IKE heartbeat interval and threshold for a specified VPN tunnel (the default is 5), do the following:

WebUI

VPNs > AutoKey Advanced > Gateway > Edit (for the gateway whose IKE heartbeat threshold you want to modify) > Advanced: Enter the new values in the Heartbeat Hello and Heartbeat Threshold fields, then click OK.

CLI

set ike gateway *name_str* heartbeat hello *number*
set ike gateway *name_str* heartbeat threshold *number*

Dead Peer Detection

DPD is a protocol used by network devices to verify the current existence and availability of other peer devices.

You can use DPD as an alternative to the IKE heartbeat feature (described above). However, you cannot use both features simultaneously. In addition, IKE heartbeat can be a global setting, which affects all IKE gateways configured in the device. The IKE heartbeat setting can also apply to an individual IKE gateway context, which affects an individual gateway only. By contrast, you can configure DPD only in an individual IKE gateway context, not as a global parameter.

A device performs DPD verification by sending encrypted IKE Phase 1 notification payloads (R-U-THERE) to peers, and waiting for DPD acknowledgements (R-U-THERE-ACK) from the peers. The device sends an R-U-THERE request if and only if it has not received any traffic from the peer during a specified DPD interval. If a DPD-enabled device receives traffic on a tunnel, it resets its R-U-THERE counter for that tunnel, thus starting a new interval. If the device receives an R-U-THERE-ACK from the peer during this interval, it considers the peer alive. If the device does not receive an R-U-THERE-ACK response during the interval, it considers the peer dead.

When the device deems a peer device to be dead, the device removes the Phase 1 SA and all Phase 2 SAs for the peer.

You can configure the following DPD parameters, either through the CLI or the WebUI:

- The interval parameter specifies the DPD interval. This interval is the amount of time (expressed in seconds) the device allows to pass before considering a peer to be dead.
- The always-send parameter instructs the device to send DPD requests regardless of whether there is IPsec traffic with the peer.
- The retry parameter specifies the maximum number of times to send the R-U-THERE request before considering the peer to be dead. As with an IKE heartbeat configuration, the default number of transmissions is 5 times, with a permissible range of 1-128 retries. A setting of zero disables DPD.

In the following example you create a gateway that uses a DPD interval of five seconds.

WebUI

VPNs > AutoKey Advanced > Gateway > Edit: Create a gateway by entering the following values, then clicking OK.

```
Gateway Name: our_gateway
Security Level: Standard
Remote Gateway Type: Static IP Address
    IP Address/Hostname: 1.1.1.1
Preshared Key: jun9345
```

VPNs > AutoKey Advanced > Gateway > Edit (our_gateway): Enter the following values, then click OK.

```
Predefined: Standard (select)
DPD:
    Interval: 5
```

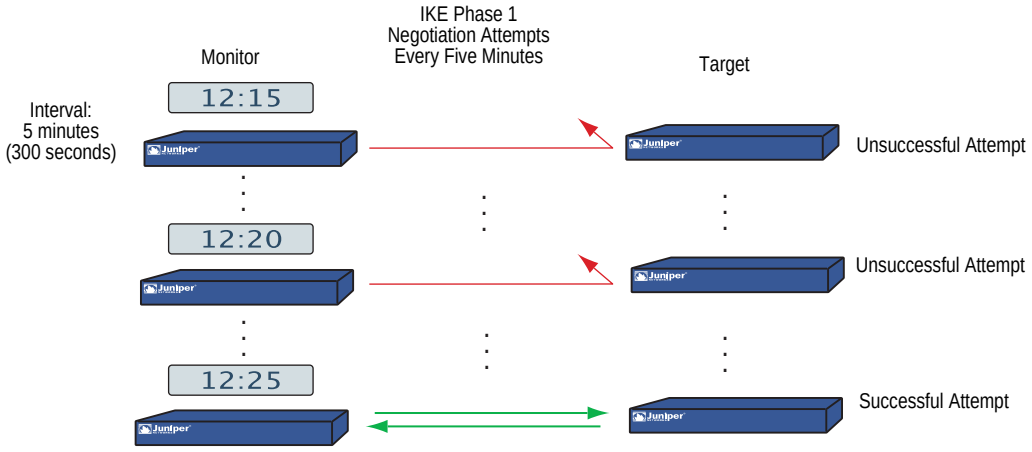
CLI

```
set ike gateway "our_gateway" address 1.1.1.1 main outgoing-interface "untrust"
    preshare "jun9345" sec-level standard
set ike gateway "our_gateway" dpd interval 5
```

IKE Recovery Procedure

After the monitoring security device determines that a targeted device is down, the monitor stops sending IKE heartbeats and clears the SAs for that peer from its SA cache. After a defined interval, the monitor attempts to initiate Phase 1 negotiations with the failed peer. If the first attempt is unsuccessful, the monitor continues to attempt Phase 1 negotiations at regular intervals until negotiations are successful.

Figure 85: Repeated IKE Phase 1 Negotiation Attempts



To define the IKE recovery interval for a specified VPN tunnel (the minimum setting is 60 seconds), do either of the following:

WebUI

VPNs > AutoKey Advanced > Gateway > Edit (for the gateway whose IKE reconnect interval you want to modify) > Advanced: Enter the value in seconds in the Heartbeat Reconnect field, then click OK.

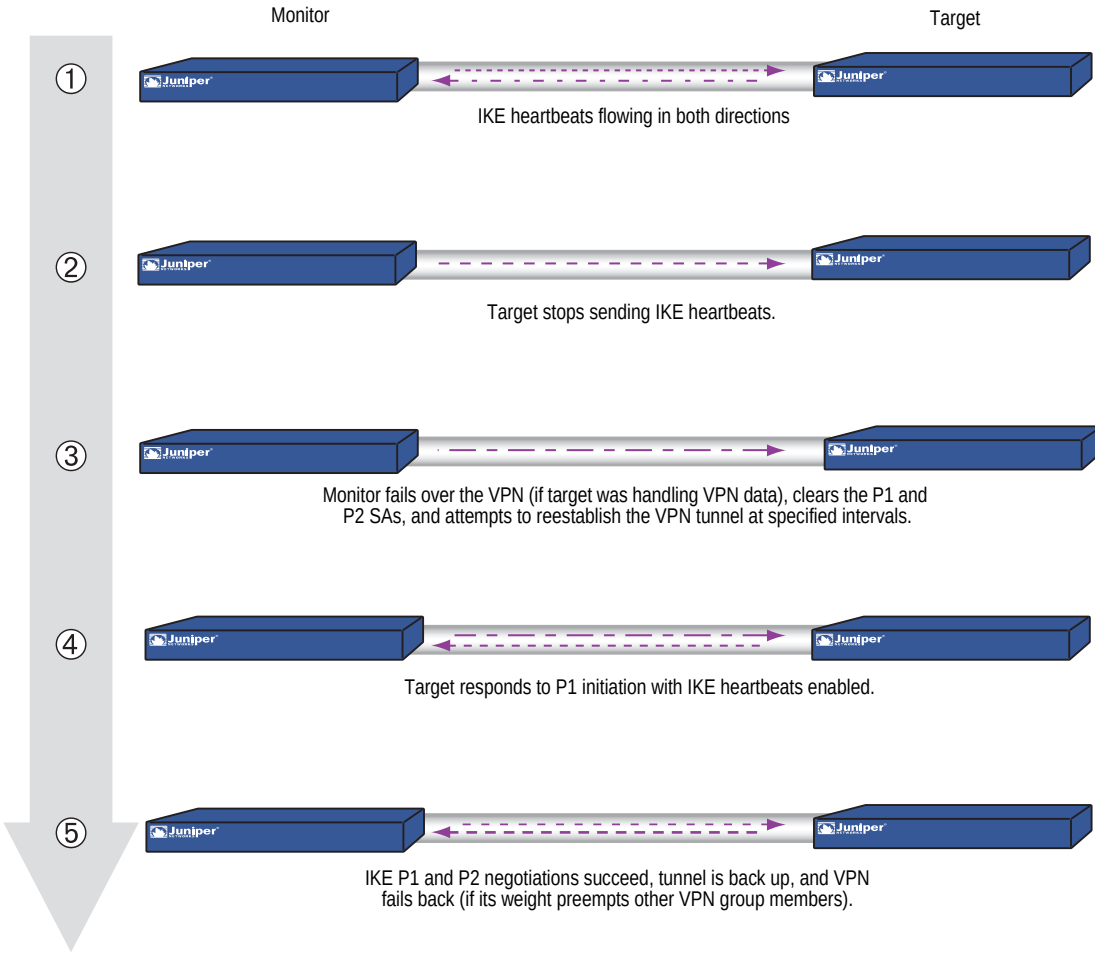
CLI

set ike gateway *name_str* heartbeat reconnect *number*

When a VPN group member with the highest weight fails over the tunnel to another group member and then reconnects with the monitoring device, the tunnel automatically fails back to the first member. The weighting system always causes the best ranking gateway in the group to handle the VPN data whenever it can do so.

Figure 86 on page 313 presents the process that a member of a VPN group undergoes when the missing heartbeats from a targeted gateway surpass the failure threshold.

Figure 86: Failover and Then Recovery



TCP SYN-Flag Checking

For a seamless VPN failover to occur, the handling of TCP sessions must be addressed. If, after a failover, the new active gateway receives a packet in an existing TCP session, the new gateway treats it as the first packet in a new TCP session and checks if the SYN flag is set in the packet header. Because this packet is really part of an existing session, it does not have the SYN flag set. Consequently, the new gateway rejects the packet. With TCP SYN flag checking enabled, all TCP applications have to reconnect after the failover occurs.

To resolve this, you can disable SYN-flag checking for TCP sessions in VPN tunnels, as follows:

WebUI

You cannot disable SYN-flag checking through the WebUI.

CLI

unset flow tcp-syn-check-in-tunnel

NOTE: By default, SYN-flag checking is enabled.

Creating Redundant VPN Gateways

In this example, a corporate site has one VPN tunnel to a data center and a second tunnel to a backup data center. All the data is mirrored through a leased line connection between the two data center sites. The data centers are physically separate to provide continuous service even in the event of a catastrophic failure such as an all-day power outage or a natural disaster.

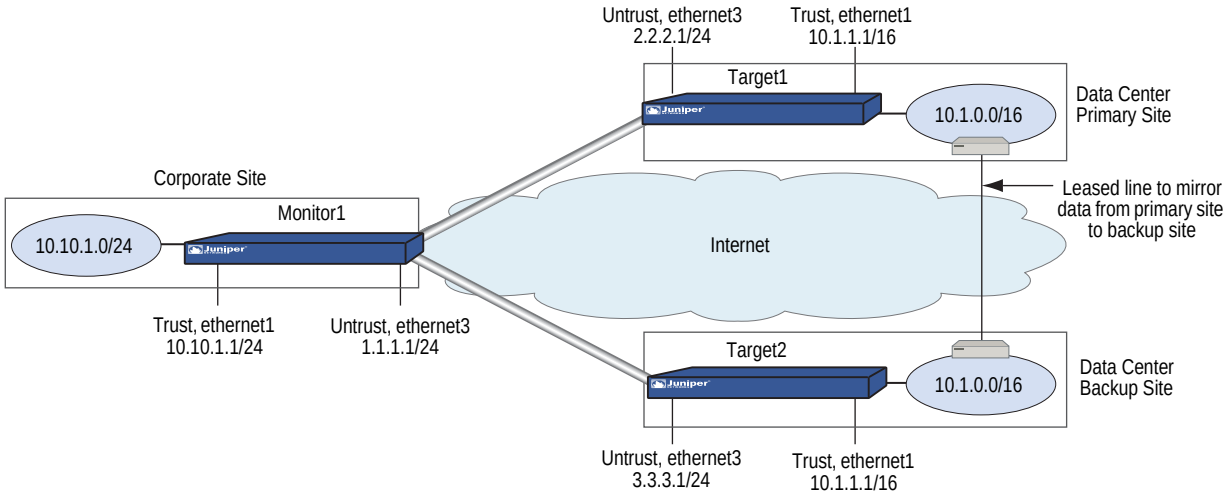
The device location and name, the physical interfaces and their IP addresses for the Trust and Untrust zones, and the VPN group ID and weight for each security device are as follows:

Device Location	Device Name	Physical Interface and IP Address (Trust Zone)	Physical Interface, IP Address, Default Gateway (Untrust Zone)	VPN Group ID and Weight
Corporate	Monitor1	ethernet1, 10.10.1.1/24	ethernet3, 1.1.1.1/24, (GW) 1.1.1.2	– –
Data Center (Primary)	Target1	ethernet1, 10.1.1.1/16	ethernet3, 2.2.2.1/24, (GW) 2.2.2.2	ID = 1, Weight = 2
Data Center (Backup)	Target2	ethernet1, 10.1.1.1/16	ethernet3, 3.3.3.1/24, (GW) 3.3.3.2	ID = 1, Weight = 1

NOTE: The internal address space at both data center sites must be identical.

All security zones are in the trust-vr routing domain. All the Site-to-Site AutoKey IKE tunnels use the security level predefined as “Compatible” for both Phase 1 and Phase 2 proposals. Preshared keys authenticate the participants.

Figure 87: Redundant VPN Gateways



WebUI (Monitor1)

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.10.1.1/24
   Enter the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

2. **Addresses**
   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: in_trust
   IP Address/Domain Name:
   IP/Netmask: (select), 10.10.1.0/24
   Zone: Trust

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: data_ctr
   IP Address/Domain Name:
   IP/Netmask: (select), 10.1.0.0/16
   Zone: Untrust

3. **VPNs**
   VPNs > AutoKey Advanced > VPN Group: Enter 1 in the VPN Group ID field, then click Add.

   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gateway Name: target1
   Security Level: Compatible
   Remote Gateway Type: Static IP Address: (select), IP Address: 2.2.2.1
   Preshared Key: SLi1yoo129
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

   Security Level: Compatible
   Mode (Initiator): Main (ID Protection)
   Heartbeat:
   Hello: 3 Seconds
   Reconnect: 60 seconds
   Threshold: 5

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: to_target1
Security Level: Compatible
Remote Gateway: Predefined: (select), target1

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

VPN Group: VPN Group-1
Weight: 2

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: target2
Security Level: Compatible
Remote Gateway Type: Static IP Address: (select), IP Address: 3.3.3.1
Preshared Key: CMFwb7oN23
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

Security Level: Compatible
Mode (Initiator): Main (ID Protection)
Heartbeat:
Hello: 3 Seconds
Reconnect: 60 seconds
Threshold: 5

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: to_target2
Security Level: Compatible
Remote Gateway: Predefined: (select), target2

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

VPN Group: VPN Group-1
Weight: 1

4. Route

Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.2(untrust)

5. Policies

Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

Source Address:
    Address Book Entry: (select), in_trust
Destination Address:
    Address Book Entry: (select), data_ctr
Service: ANY
Action: Tunnel
VPN: VPN Group-1
Modify matching bidirectional VPN policy: (select)
Position at Top: (select)

WebUI (Target1)

1. Interfaces

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.1.1.1/16
Enter the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.1/24

2. Addresses

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: in_trust
IP Address/Domain Name:
    IP/Netmask: (select), 10.1.0.0/16
Zone: Trust

Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

Address Name: corp
IP Address/Domain Name:
    IP/Netmask: (select), 10.10.1.0/24
Zone: Untrust

3. **VPN**
   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gateway Name: monitor1
   Security Level: Compatible
   Remote Gateway Type:
   Static IP Address: (select), IP Address/Hostname: 1.1.1.1
   Preshared Key: SLi1yoo129
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic Gateway configuration page:

   Security Level: Compatible
   Mode (Initiator): Main (ID Protection)
   Heartbeat:
   Hello: 3 Seconds
   Reconnect: 0 seconds

   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   Name: to_monitor1
   Security Level: Compatible
   Remote Gateway: Predefined: (select), monitor1

4. **Route**
   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 2.2.2.2

5. **Policies**
   Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), in_trust
   Destination Address:
   Address Book Entry: (select), corp
   Service: ANY
   Action: Tunnel
   Tunnel VPN: monitor1
   Modify matching bidirectional VPN policy: (select)
   Position at Top: (select)

WebUI (Target2)

NOTE: Follow the Target1 configuration steps to configure Target2, but define the Untrust zone interface IP address as 3.3.3.1/24, the default gateway IP address as 3.3.3.2, and use CMFwb7oN23 to generate the preshared key.

CLI (Monitor1)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.10.1.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
```

2. Addresses

```
set address trust in_trust 10.10.1.0/24
set address untrust data_ctr 10.1.0.0/16
```

3. VPNs

```
set ike gateway target1 address 2.2.2.1 main outgoing-interface ethernet3
    preshare SLi1yoo129 sec-level compatible
set ike gateway target1 heartbeat hello 3
set ike gateway target1 heartbeat reconnect 60
set ike gateway target1 heartbeat threshold 5
set vpn to_target1 gateway target1 sec-level compatible
set ike gateway target2 address 3.3.3.1 main outgoing-interface ethernet3
    preshare CMFwb7oN23 sec-level compatible
set ike gateway target2 heartbeat hello 3
set ike gateway target2 heartbeat reconnect 60
set ike gateway target2 heartbeat threshold 5
set vpn to_target2 gateway target2 sec-level compatible
set vpn-group id 1 vpn to_target1 weight 2
set vpn-group id 1 vpn to_target2 weight 1
unset flow tcp-syn-check-in-tunnel
```

4. Route

```
set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.2
```

5. Policies

```
set policy top from trust to untrust in_trust data_ctr any tunnel “vpn-group 1”
set policy top from untrust to trust data_ctr in_trust any tunnel “vpn-group 1”
save
```

CLI (Target1)

1. Interfaces

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.1.1.1/16
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.1/24
```

2. Addresses

```
set address trust in_trust 10.1.0.0/16
set address untrust corp 10.10.1.0/24
```

3. VPN

```
set ike gateway monitor1 address 1.1.1.1 main outgoing-interface ethernet3
    preshare SLi1yoo129 sec-level compatible
set ike gateway monitor1 heartbeat hello 3
set ike gateway monitor1 heartbeat threshold 5
set vpn to_monitor1 gateway monitor1 sec-level compatible
```

4. **Route**
   set vrouter trust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.2

5. **Policies**
   set policy top from trust to untrust in_trust corp any tunnel vpn to_monitor
   set policy top from untrust to trust corp in_trust any tunnel vpn to_monitor
   save

CLI (Target2)

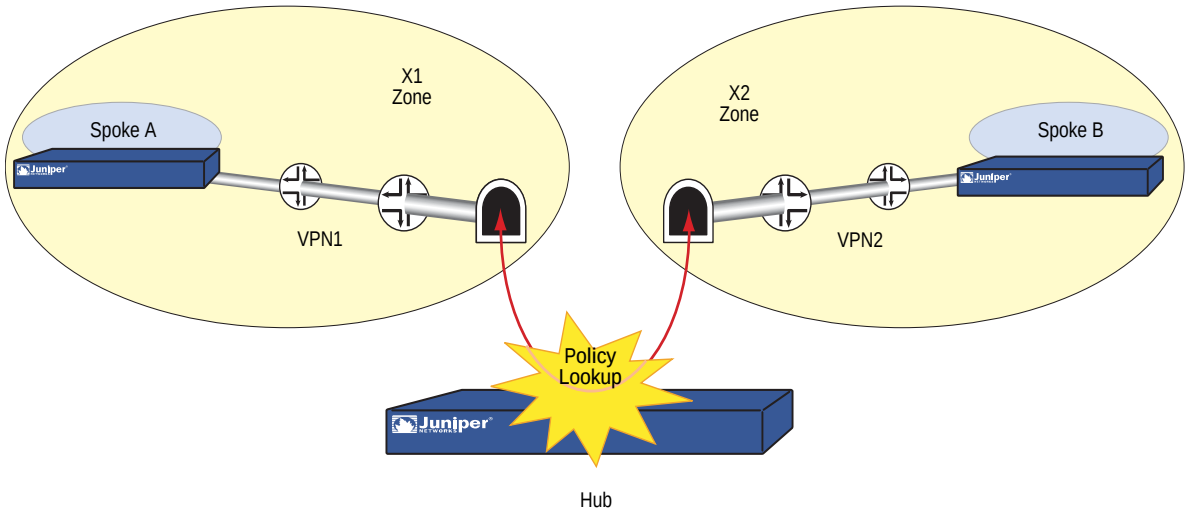
NOTE: Follow the Target1 configuration steps to configure Target2, but define the Untrust zone interface IP address as 3.3.3.1/24, the default gateway IP address as 3.3.3.2, and use CMFwb7oN23 to generate the preshared key.

Creating Back-to-Back VPNs

You can enforce interzone policies at the hub site for traffic passing from one VPN tunnel to another by putting the spoke sites in different zones. Because they are in different zones, the security device at the hub must do a policy lookup before routing the traffic from one tunnel to another. You can control the traffic flowing through the VPN tunnels between the spoke sites. This arrangement is called *back-to-back VPNs*.

NOTE: Optionally, you can enable intrazone blocking and define an intrazone policy to control traffic between the two tunnel interfaces within the same zone.

Figure 88: Back-to-Back VPNs



Following are a few benefits of back-to-back VPNs:

- You can conserve the number of VPNs you need to create. For example, perimeter site A can link to the hub and to perimeter sites B, C, D…, but A only has to set up one VPN tunnel. Especially for NetScreen-5XP users, who can use a maximum of ten VPN tunnels concurrently, applying the hub-and-spoke method dramatically increases their VPN options and capabilities.

- The administrator (admin) at the hub device can completely control VPN traffic between perimeter sites. For example,
  - The admin might permit only HTTP traffic to flow from sites A to B, but allow any kind of traffic to flow from B to A.
  - The admin can allow traffic originating from A to reach C, but deny traffic originating from C to reach A.
  - The admin can allow a specific host at A to reach the entire D network, while allowing only a specific host at D to reach a different host at A.
- The administrator at the hub device can completely control outbound traffic from all perimeter networks. At each perimeter site, there must first be a policy that tunnels all outbound traffic through the spoke VPNs to the hub; for example: set policy top from trust to untrust any any any tunnel vpn *name_str* (where *name_str* defines the specific VPN tunnel from each perimeter site to the hub). At the hub, the administrator can control Internet access, allowing certain kinds of traffic (such as HTTP only), performing URL blocking on undesirable websites, and so on.
- Regional hubs can be used and interconnected through spoke tunnels, allowing spoke sites in one region to reach spoke sites in another.

The following example is similar to “Creating Hub-and-Spoke VPNs” on page 327 except that the security device at the hub site in New York performs policy checking on the traffic it routes between the two tunnels to the branch offices in Tokyo and Paris. By putting each remote site in a different zone, you control the VPN traffic at the hub.

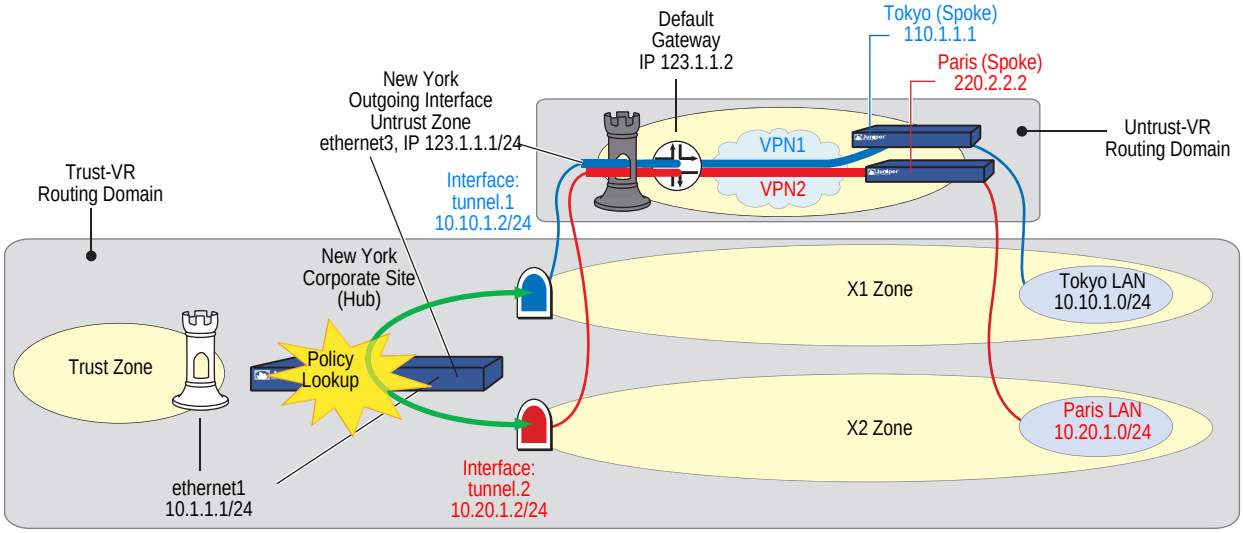
The Tokyo LAN address is in the user-defined X1 zone, and the Paris LAN address is in the user-defined X2 zone. Both zones are in the Trust-VR routing domain.

NOTE: To create user-defined zones, you might first need to obtain and load a zone software key on the security device.

You bind the VPN1 tunnel to the tunnel.1 interface and the VPN2 tunnel to the tunnel.2 interface. Although you do not assign IP addresses to the X1 and X2 zone interfaces, you do give addresses to both tunnel interfaces. Routes for these interfaces automatically appear in the Trust-VR routing table. By putting the IP address for a tunnel interface in the same subnet as that of the destination, traffic destined for that subnet is routed to the tunnel interface.

The outgoing interface is ethernet3, which is bound to the Untrust zone. As you can see in Figure 89, both tunnels terminate in the Untrust zone; however, the endpoints for the traffic that makes use of the tunnels are in the X1 and X2 zones. The tunnels use AutoKey IKE, with preshared keys. You select the security level predefined as “Compatible” for both Phase 1 and Phase 2 proposals. You bind the Untrust zone to the untrust-vr. Because the tunnels are route-based (that is, the correct tunnel is determined by routing, not by a tunnel name specified in a policy), proxy IDs are included in the configuration of each tunnel.

Figure 89: Back-to-Back VPNs with Two Routing Domains and Multiple Security Zones



WebUI

1. Security Zones and Virtual Routers

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

IP Address/Netmask: 0.0.0.0/0
Manage IP: 0.0.0.0

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Null

Network > Zones > Edit (for Untrust): Enter the following, then click OK:

Virtual Router Name: untrust-vr
Block Intra-Zone Traffic: (select)

Network > Zones > New: Enter the following, then click OK:

Zone Name: X1
Virtual Router Name: trust-vr
Block Intra-Zone Traffic: (select)

Network > Zones > New: Enter the following, then click OK:

Name: X2
Virtual Router Name: trust-vr
Block Intra-Zone Traffic: (select)

2. **Interfaces**

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 123.1.1.1/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): X1 (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 10.10.1.2/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.2
   Zone (VR): X2 (trust-vr)
   Fixed IP: (select)
   IP Address / Netmask: 10.20.1.2/24

3. **VPN for Tokyo Office**

   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   VPN Name: VPN1
   Security Level: Compatible
   Remote Gateway: Create a Simple Gateway: (select)
   Gateway Name: Tokyo
   Type: Static IP: (select), Address/Hostname: 110.1.1.1
   Preshared Key: netscreen1
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

   Proxy-ID: (select)
   Local IP / Netmask: 10.20.1.0/24
   Remote IP / Netmask: 10.10.1.0/24
   Service: ANY

NOTE: When configuring the VPN tunnel on the security device protecting the Tokyo and Paris offices, do either of the following:

(Route-based VPN) Select the Enable Proxy-ID check box, and enter 10.10.1.0/24 (Tokyo) and 10.20.1.0/24 (Paris) for the Local IP and Netmask and 10.20.1.0/24 (Tokyo) and 10.10.1.0/24 (Paris) for the Remote IP and Netmask.

(Policy-based VPN) Make an entry in the Trust zone address book for 10.10.1.0/24 (Tokyo) and 10.20.1.0/24 (Paris) and another in the Untrust zone address book for 10.20.1.0/24 (Tokyo) and 10.10.1.0/24 (Paris). Use those as the source and destination addresses in the policy referencing the VPN tunnel to the hub site.

---

4. **VPN for Paris Office**

   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   VPN Name: VPN2
   Security Level: Compatible
   Remote Gateway: Create a Simple Gateway: (select)
   Gateway Name: Paris
   Type: Static IP: (select), Address/Hostname: 220.2.2.2
   Preshared Key: netscreen2
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

   Proxy-ID: (select)
   Local IP / Netmask: 10.10.1.0/24
   Remote IP / Netmask: 10.20.1.0/24
   Service: ANY

5. **Routes**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Next Hop Virtual Router Name: (select), untrust-vr

   Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 123.1.1.2

6. **Addresses**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Tokyo LAN
   IP Address/Domain Name:
   IP/Netmask: (select), 10.10.1.0/24
   Zone: X1

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Paris LAN
   IP Address/Domain Name:
   IP/Netmask: (select), 10.20.1.0/24
   Zone: X2

7. Policies

Policy > (From: X1, To: X2) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Tokyo LAN
Destination Address:
Address Book Entry: (select), Paris LAN
Service: ANY
Action: Permit
Position at Top: (select)

Policy > (From: X2, To: X1) New: Enter the following, then click OK:

Source Address:
Address Book Entry: (select), Paris LAN
Destination Address:
Address Book Entry: (select), Tokyo LAN
Service: ANY
Action: Permit
Position at Top: (select)

CLI

1. Security Zones and Virtual Routers

```
unset interface ethernet3 ip
unset interface ethernet3 zone
set zone untrust vrouter untrust-vr
set zone untrust block
set zone name X1
set zone x1 vrouter trust-vr
set zone x1 block
set zone name x2
set zone x2 vrouter trust-vr
set zone x2 block
```

2. Interfaces

```
set interface ethernet3 zone untrust
set interface ethernet3 ip 123.1.1.1/24
set interface tunnel.1 zone x1
set interface tunnel.1 ip 10.10.1.2/24
set interface tunnel.2 zone x2
set interface tunnel.2 ip 10.20.1.2/24
```

3. VPN for Tokyo Office

```
set ike gateway Tokyo address 110.1.1.1 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn VPN1 gateway Tokyo sec-level compatible
set vpn VPN1 bind interface tunnel.1
set vpn VPN1 proxy-id local-ip 10.20.1.0/24 remote-ip 10.10.1.0/24 any
```

NOTE: When configuring the VPN tunnel on the security device protecting the Tokyo and Paris offices, do either of the following:

(Route-based VPN) Enter the following commands: set vpn VPN1 proxy-id local-ip 10.20.1.0/24 remote-ip 10.10.1.0/24 (Tokyo) and set vpn VPN1 proxy-id local-ip 10.10.1.0/24 remote-ip 10.20.1.0/24 (Paris).

(Policy-based VPN) Make an entry in the Trust zone address book for 10.10.1.0/24 (Tokyo) and 10.20.1.0/24 (Paris) and another in the Untrust zone address book for 10.20.1.0/24 (Tokyo) and 10.10.1.0/24 (Paris). Use those as the source and destination addresses in the policies referencing the VPN tunnel to the hub site.

4. **VPN for Paris Office**

```
set ike gateway Paris address 220.2.2.2 outgoing-interface ethernet3 preshare
    netscreen2 sec-level compatible
set vpn VPN2 gateway Paris sec-level compatible
set vpn VPN2 bind interface tunnel.2
set vpn VPN2 proxy-id local-ip 10.10.1.0/24 remote-ip 10.20.1.0/24 any
```

5. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 vrouter untrust-vr
set vrouter untrust-vr route 0.0.0.0/0 interface ethernet3 gateway 123.1.1.2
```

6. **Addresses**

```
set address x1 “Tokyo LAN” 10.10.1.0/24
set address x2 “Paris LAN” 10.20.1.0/24
```

7. **Policies**

```
set policy top from x1 to x2 “Tokyo LAN” “Paris LAN” any permit
set policy top from x2 to x1 “Paris LAN” “Tokyo LAN” any permit
save
```

NOTE: You can ignore the following message, which appears because tunnel interfaces are in NAT mode:

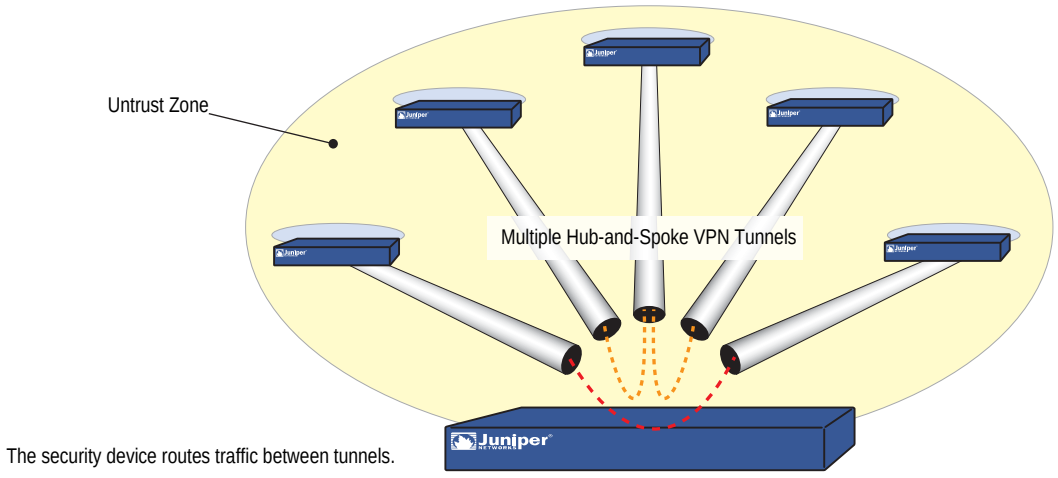
Warning: Some interfaces in the *zone_name* zone are in NAT mode. Traffic might not pass through them!

Creating Hub-and-Spoke VPNs

If you create two VPN tunnels that terminate at a security device, you can set up a pair of routes so that the security device directs traffic exiting one tunnel to the other tunnel. If both tunnels are contained within a single zone, you do not need to create a policy to permit the traffic to pass from one tunnel to the other. You only need to define the routes. Such an arrangement is known as a *hub-and-spoke VPN*.

You can also configure multiple VPNs in one zone and route traffic between any two tunnels.

Figure 90: Multiple Tunnels in a Hub-and-Spoke VPN Configuration



In this example, two branch offices in Tokyo and Paris communicate with each other through a pair of VPN tunnels—VPN1 and VPN2. Each tunnel originates at the remote site and terminates at the corporate site in New York. The security device at the corporate site routes traffic exiting one tunnel into the other tunnel.

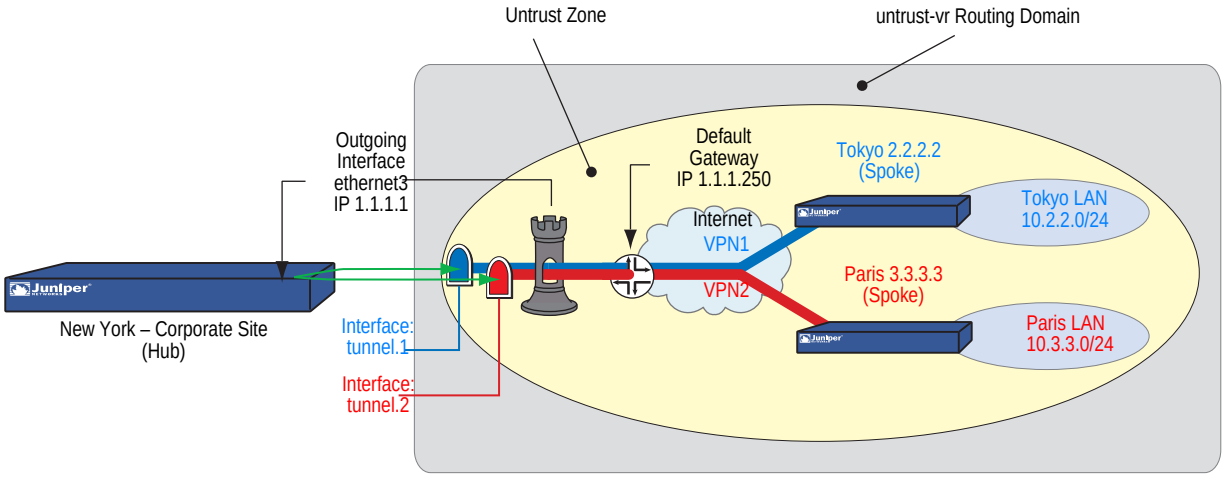
By disabling intrazone blocking, the security device at the corporate site only needs to do a route lookup—not a policy lookup—when conducting traffic from tunnel to tunnel because both remote endpoints are in the same zone (the Untrust Zone).

NOTE: Optionally, you can leave intrazone blocking enabled and define an intrazone policy permitting traffic between the two tunnel interfaces.

You bind the tunnels to the tunnel interfaces—tunnel.1 and tunnel.2—which are both unnumbered. The tunnels use AutoKey IKE, with the preshared keys. You select the security level predefined as “Compatible” for both Phase 1 and Phase 2 proposals. You bind the Untrust zone to the untrust-vr. The Untrust zone interface is ethernet3.

NOTE: The following configuration is for route-based VPNs. If you configure policy-based hub-and-spoke VPNs, you must use the Trust and Untrust zones in the policies; you cannot use user-defined security zones.

Figure 91: Hub-and-Spoke VPNs



WebUI (New York)

1. **Security Zones and Virtual Routers**

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   IP Address/Netmask: 0.0.0.0/0
   Manage IP: 0.0.0.0

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Null

   Network > Zones > Edit (for Untrust): Enter the following, then click OK:

   Virtual Router Name: untrust-vr
   Block Intra-Zone Traffic: (clear)

2. **Interfaces**

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 1.1.1.1/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Untrust (untrust-vr)
   Unnumbered: (select)
   Interface: ethernet3 (untrust-vr)

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.2
Zone (VR): Untrust (untrust-vr)
Unnumbered: (select)
Interface: ethernet3 (untrust-vr)

3. VPN for Tokyo Office

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: VPN1
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: Tokyo
Type: Static IP: (select), Address/Hostname: 2.2.2.2
Preshared Key: netscreen1
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

4. VPN for Paris Office

VPNs > AutoKey IKE > New: Enter the following, then click OK:

VPN Name: VPN2
Security Level: Compatible
Remote Gateway: Create a Simple Gateway: (select)
Gateway Name: Paris
Type: Static IP: (select), Address/Hostname: 3.3.3.3
Preshared Key: netscreen2
Security Level: Compatible
Outgoing Interface: ethernet3

> Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

Proxy-ID: (select)
Local IP / Netmask: 0.0.0.0/0
Remote IP / Netmask: 0.0.0.0/0
Service: ANY

5. Routes

Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

Network Address / Netmask: 10.2.2.0/24
Gateway: (select)
Interface: tunnel.1
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

Network Address / Netmask: 10.3.3.0/24
Gateway: (select)
Interface: tunnel.2
Gateway IP Address: 0.0.0.0

Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

Network Address / Netmask: 0.0.0.0/0
Gateway: (select)
Interface: ethernet3
Gateway IP Address: 1.1.1.250

WebUI (Tokyo)

1. **Security Zones and Virtual Routers**

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

IP Address/Netmask: 0.0.0.0/0
Manage IP: 0.0.0.0

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Null

Network > Zones > Edit (for Untrust): Enter the following, then click OK:

Virtual Router Name: untrust-vr
Block Intra-Zone Traffic: (select)

2. **Interfaces**

Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

Zone Name: Trust
Static IP: (select this option when present)
IP Address/Netmask: 10.2.2.1/24
Select the following, then click **OK**:
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

Zone Name: Untrust
Static IP: (select this option when present)
IP Address/Netmask: 2.2.2.2/24

Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

Tunnel Interface Name: tunnel.1
Zone (VR): Untrust (untrust-vr)
Unnumbered: (select)
Interface: ethernet3 (untrust-vr)

3. **Address**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Paris
   IP Address/Domain Name:
   IP/Netmask: (select), 10.3.3.0/24
   Zone: Untrust

4. **VPN**

   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   VPN Name: VPN1
   Security Level: Compatible
   Remote Gateway: Create a Simple Gateway: (select)
   Gateway Name: New York
   Type: Static IP: (select), Address/Hostname: 1.1.1.1
   Preshared Key: netscreen1
   Security Level: Compatible
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

   Proxy-ID: (select)
   Local IP / Netmask: 0.0.0.0/0
   Remote IP / Netmask: 0.0.0.0/0
   Service: ANY

5. **Routes**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Next Hop Virtual Router Name: (select); untrust-vr

   Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 2.2.2.250

   Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 10.3.3.0/24
   Gateway: (select)
   Interface: tunnel.1
   Gateway IP Address: 0.0.0.0

6. **Policies**
   Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Any
   Destination Address:
   Address Book Entry: (select), Paris
   Service: ANY
   Action: Permit

WebUI (Paris)

1. **Security Zones and Virtual Routers**
   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   IP Address/Netmask: 0.0.0.0/0
   Manage IP: 0.0.0.0

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Null

   Network > Zones > Edit (for Untrust): Enter the following, then click OK:

   Virtual Router Name: untrust-vr
   Block Intra-Zone Traffic: (select)

2. **Interfaces**
   Network > Interfaces > Edit (for ethernet1): Enter the following, then click Apply:

   Zone Name: Trust
   Static IP: (select this option when present)
   IP Address/Netmask: 10.3.3.1/24
   Select the following, then click **OK**:
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet3): Enter the following, then click OK:

   Zone Name: Untrust
   Static IP: (select this option when present)
   IP Address/Netmask: 3.3.3.3/24

   Network > Interfaces > New Tunnel IF: Enter the following, then click OK:

   Tunnel Interface Name: tunnel.1
   Zone (VR): Untrust (untrust-vr)
   Unnumbered: (select)
   Interface: ethernet3 (untrust-vr)

3. **Address**

   Policy > Policy Elements > Addresses > List > New: Enter the following, then click OK:

   Address Name: Tokyo
   IP Address/Domain Name:
   IP/Netmask: (select), 10.2.2.0/24
   Zone: Untrust

4. **VPN**

   VPNs > AutoKey IKE > New: Enter the following, then click OK:

   VPN Name: VPN2
   Security Level: Compatible
   Remote Gateway: Create a Simple Gateway: (select)
   Gateway Name: New York
   Type: Static IP: (select), Address/Hostname: 1.1.1.1
   Preshared Key: netscreen2
   Security Level: Compatible
   Outgoing Interface: ethernet3

   > Advanced: Enter the following advanced settings, then click Return to return to the basic AutoKey IKE configuration page:

   Proxy-ID: (select)
   Local IP / Netmask: 0.0.0.0/0
   Remote IP / Netmask: 0.0.0.0/0
   Service: ANY

5. **Routes**

   Network > Routing > Routing Entries > trust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Next Hop Virtual Router Name: (select); untrust-vr

   Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 0.0.0.0/0
   Gateway: (select)
   Interface: ethernet3
   Gateway IP Address: 3.3.3.250

   Network > Routing > Routing Entries > untrust-vr New: Enter the following, then click OK:

   Network Address / Netmask: 10.2.2.0/24
   Gateway: (select)
   Interface: tunnel.1
   Gateway IP Address: 0.0.0.0

6. **Policies**

   Policies > (From: Trust, To: Untrust) New: Enter the following, then click OK:

   Source Address:
   Address Book Entry: (select), Any
   Destination Address:
   Address Book Entry: (select), Tokyo
   Service: ANY
   Action: Permit

CLI (New York)

1. **Security Zones and Virtual Routers**

```
unset interface ethernet3 ip
unset interface ethernet3 zone
set zone untrust vrouter untrust-vr
unset zone untrust block
```

2. **Interfaces**

```
set interface ethernet3 zone untrust
set interface ethernet3 ip 1.1.1.1/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
set interface tunnel.2 zone untrust
set interface tunnel.2 ip unnumbered interface ethernet3
```

3. **VPN for Tokyo Office**

```
set ike gateway Tokyo address 2.2.2.2 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn VPN1 gateway Tokyo sec-level compatible
set vpn VPN1 bind interface tunnel.1
set vpn VPN1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

4. **VPN for Paris Office**

```
set ike gateway Paris address 3.3.3.3 outgoing-interface ethernet3 preshare
    netscreen2 sec-level compatible
set vpn VPN2 gateway Paris sec-level compatible
set vpn VPN2 bind interface tunnel.2
set vpn VPN2 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

5. **Routes**

```
set vrouter untrust-vr route 10.2.2.0/24 interface tunnel.1
set vrouter untrust-vr route 10.3.3.0/24 interface tunnel.2
set vrouter untrust-vr route 0.0.0.0/0 interface ethernet3 gateway 1.1.1.250
save
```

CLI (Tokyo)

1. **Security Zones and Virtual Routers**

```
unset interface ethernet3 ip
unset interface ethernet3 zone
set zone untrust vrouter untrust-vr
```

2. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.2.2.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 2.2.2.2/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

3. **Address**

```
set address untrust Paris 10.3.3.0/24
```

4. **VPN**

```
set ike gateway "New York" address 1.1.1.1 outgoing-interface ethernet3 preshare
    netscreen1 sec-level compatible
set vpn VPN1 gateway "New York" sec-level compatible
set vpn VPN1 bind interface tunnel.1
set vpn VPN1 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 any
```

5. **Routes**

```
set vrouter trust-vr route 0.0.0.0/0 vrouter untrust-vr
set vrouter untrust-vr route 0.0.0.0/0 interface ethernet3 gateway 2.2.2.250
set vrouter untrust-vr route 10.3.3.0/24 interface tunnel.1
```

6. **Policies**

```
set policy from trust to untrust any Paris any permit
set policy from untrust to trust Paris any any permit
save
```

CLI (Paris)

1. **Security Zones and Virtual Routers**

```
unset interface ethernet3 ip
unset interface ethernet3 zone
set zone untrust vrouter untrust-vr
```

2. **Interfaces**

```
set interface ethernet1 zone trust
set interface ethernet1 ip 10.3.3.1/24
set interface ethernet1 nat
set interface ethernet3 zone untrust
set interface ethernet3 ip 3.3.3.3/24
set interface tunnel.1 zone untrust
set interface tunnel.1 ip unnumbered interface ethernet3
```

3. **Address**

```
set address untrust Tokyo 10.2.2.0/24
```

4. **VPN**

   set ike gateway “New York” address 1.1.1.1 outgoing-interface ethernet3 preshare
   netscreen2 sec-level compatible
   set vpn VPN2 gateway “New York” sec-level compatible
   set vpn VPN2 bind interface tunnel.1
   set vpn VPN2 proxy-id local-ip 0.0.0.0/0 remote-ip 0.0.0.0/0 an

5. **Routes**

   set vrouter trust-vr route 0.0.0.0/0 vrouter untrust-vr
   set vrouter untrust-vr route 0.0.0.0/0 interface ethernet3 gateway 3.3.3.250
   set vrouter untrust-vr route 10.2.2.0/24 interface tunnel.1

6. **Policies**

   set policy from trust to untrust any Tokyo any permit
   set policy from untrust to trust Tokyo any any permit
   save

Chapter 8
AutoConnect-Virtual Private Networks

This chapter describes the AutoConnect-virtual private network (AC-VPN) feature in ScreenOS, explains how it works in a hub-and-spoke network topology, and provides a configuration example of a typical scenario in which it might be used.

Overview

Small enterprise organizations that secure their remote satellite sites with virtual private network (VPN) tunnels typically interconnect all sites in a full-mesh VPN, because remote sites need to communicate with each other as well as with headquarters. In this type of network, remote sites usually run low-end security devices that support a maximum of 25 VPN tunnels. When the total number of sites exceeds 25, however, the enterprise must either place security devices with greater capacity at its remote sites (at considerable cost) or switch from full-mesh to a hub-and-spoke network topology.

A hub-and-spoke configuration solves the problem of scalability, but its principle drawback is that all communication between spokes must go through the hub. This generally is not an issue when traffic is simple data, even with more than one thousand spokes. However, if traffic is video or Voice over Internet Protocol (VoIP), the processing overhead on the hub can cause latency, a critical problem for such applications.

AC-VPN provides a way for you to configure your hub-and-spoke network so that spokes can dynamically create VPN tunnels directly between each other as needed. This not only solves the problem of latency between spokes but also reduces processing overhead on the hub and thus improves overall network performance. Additionally, because AC-VPN creates dynamic tunnels that time out when traffic ceases to flow through them, network administrators are freed from the time-consuming task of maintaining a complex network of static VPN tunnels.

How It Works

AC-VPN is designed to be implemented in a hub-and-spoke network in which all spokes are connected to the hub by VPN tunnels. After you set up a static VPN tunnel between the hub and each of the spokes, you configure AC-VPN on the hub and the spokes and then enable the Next Hop Resolution Protocol (NHRP). The hub uses NHRP to obtain a range of information about each spoke, including its public-to-private address mappings, subnetmask length, and routing and hop count information, which the hub caches. Then, when any spoke begins communicating with another spoke (through the hub), the hub uses this information, in

combination with information obtained from the AC-VPN configuration on the spokes, to enable the spokes to set up an AC-VPN tunnel between themselves. While the tunnel is being negotiated, communication continues to flow between the two spokes through the hub. When the dynamic tunnel becomes active, the hub drops out of the link and traffic flows directly between the two spokes. When traffic ceases to flow through the dynamic tunnel, the tunnel times out.

NHRP Messages

In the context of NHRP, the hub in a hub-and-spoke network is called the Next Hop Server (NHS), and the spoke is called the Next Hop Client (NHC). NHRP communication between NHS and NHC takes place though a formal exchange of NHRP messages. The nonbroadcast multi access (NBMA) Next Hop Resolution Protocol (RFC 2332) defines seven NHRP messages. To these seven messages, ScreenOS adds two more. These nine messages and their operation in an AC-VPN hub-and-spoke network are defined as follows:

- Registration Request—After a static VPN tunnel becomes active between an NHC and its NHS, the NHC sends an NHRP Registration Request message to the NHS. The message contains a number of Client Information Entries (CIEs), which include such things as the NHC's public-to-private address mappings, subnetmask length, and routing and hop-count information.

NOTE: In the current ScreenOS implementation, NHRP does not redistribute any routes to its peers, and BGP and OSPF do not redistribute NHRP routes to their peers.

- Registration Reply—The NHS can ACK or NAK a registration request. If the NHS does not recognize the packet, the packet is not acknowledged (NAK) and is dropped. Upon successful registration, the NHS caches the CIEs contained in the registration request and sends a Registration Reply ACK.

- Resolution Request, Resolution Reply—With the introduction of the ScreenOS proprietary Resolution-set and Resolution-ack messages, the function of the NHRP Resolution Request and Resolution Reply message pair is relegated to keeping cached CIEs on the NHS current. The NHCs do this in conjunction with the holding time configured on the NHS, which specifies the lifetime of cached entries for each NHC. To ensure that the NHS has current information about their subnetworks, NHCs periodically send Resolution Request messages to the NHS. If any devices have been added to or removed from their subnetworks, that information is contained in the Resolution Request message, and the NHS updates its cache and sends a Resolution Reply.

- Purge Request, Purge Reply—When an administrator shuts down an NHC, the device sends a Purge Request message to the NHS. Upon receipt of the Purge Request, the NHS removes all cached entries for that NHC and sends a Purge Reply. If the NHC experiences system failure and goes off line, the NHS removes cached entries for the device after the configured lifetime for the cache expires.

- Error Indication—This message logs NHRP error conditions.

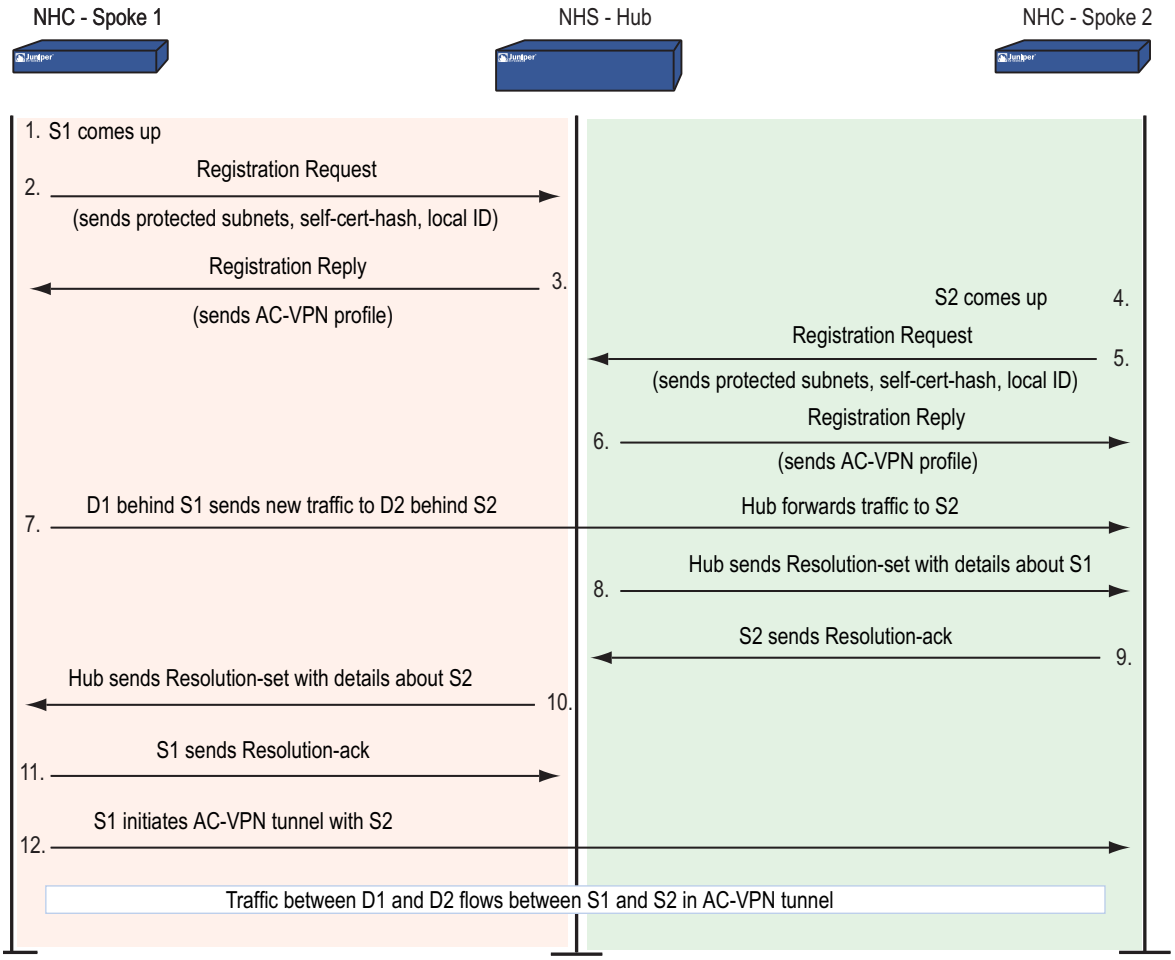
To support AC-VPN, ScreenOS adds the following message pair:

- Resolution-set, Resolution-ack—When the NHS detects traffic from one static VPN tunnel to another, it sends Resolution-set messages to the NHCs at the end of each static tunnel. These messages contain all the information each NHC needs about the other to set up an AC-VPN tunnel. When the NHCs reply with Resolution-ack messages, the NHS directs one of the NHCs to initiate AC-VPN tunnel negotiation.

AC-VPN Tunnel Initiation

Figure 92 illustrates how ScreenOS triggers the setup of an AC-VPN tunnel using the NHRP Registration Request and Registration Reply messages, and the custom ScreenOS Resolution-set and Resolution-ack messages. For simplification, the figure does not show the exchange of Resolution Request and Resolution Reply messages, nor the Purge and Error messages. (The abbreviations S1 and S2 refer to Spoke 1 and Spoke 2, respectively; D1 and D2 refer to destinations behind those spokes.)

Figure 92: AC-VPN Set Up Via NHRP



Configuring AC-VPN

The following general restrictions apply:

- All VPN tunnels configured toward the hub must be route based.
- Automatic key management in phase 1 must be in aggressive mode.
- The authentication method must be self-signed certificate and generic PKI.
- All spokes must be connected to a single zone on the hub.
- Configuring NHRP in multiple instances of virtual routers is supported only on the NHS.
- Dynamic routing protocols are not supported for NHC-to-NHS registration. When configuring the spokes, you must use the **set protocol nhrp cache** *ip_addr/mask* command to add routes.

Network Address Translation

The following restrictions apply with NAT:

- Nat-Traversal—AC-VPN can create a dynamic tunnel between two spokes if one of the spokes is behind a NAT device in the path toward the hub; if both spokes are behind NAT devices, however, a dynamic tunnel will not be created and communication between the spokes will proceed through the hub. See NAT-Traversal on page 248 for a discussion of NAT-Traversal.
- NAT is supported only with mapped Internet Protocol (MIP) addressing.
- Port Address Translation (PAT) is supported only between one spoke and the hub. For example, you can have a NAT device between one spoke and the hub and a dynamic tunnel can be created between that spoke and another spoke as long as there is no NAT device between that other spoke and the hub. In this scenario, the hub will force the spoke behind the NAT device to initiate the tunnel to the other spoke.
- PAT directly in front of the hub is supported.
- PAT between spokes is not supported.

Configuration on the Hub

The spoke configuration includes the following:

1. Create a static gateway and VPN.
2. Create static tunnels to the spokes and bind the VPNs to the tunnels.
3. Create an AC-VPN gateway profile.
4. Create an AC-VPN VPN profile.
5. Enable NHRP on the virtual router.
6. Select the ACVPN-Profile for NHRP.

7. Enable NHRP on the tunnel interface.
8. Configure routing.

Configuration on Each Spoke

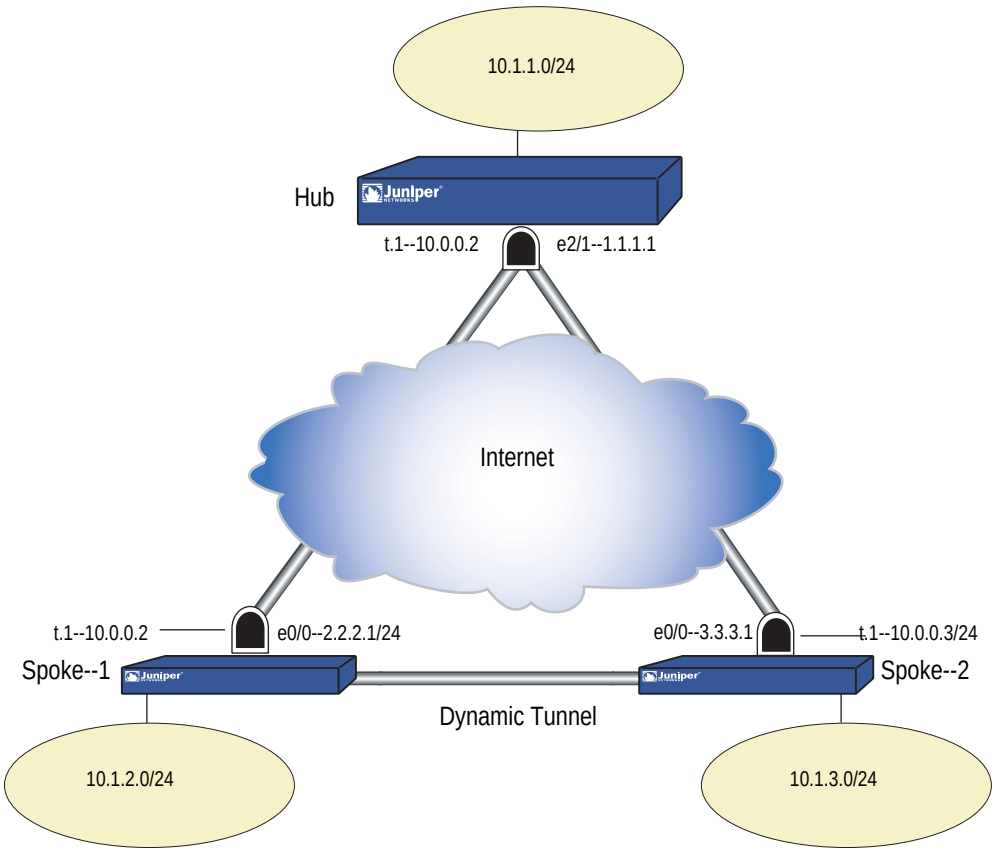
The hub includes the following:

1. Create a static tunnel to the hub.
2. Create a gateway.
3. Create a VPN gateway.
4. Create an ACVPN-Dynamic gateway.
5. Create ACVPN-Dynamic VPN
6. Enable NHRP on the virtual router
7. Configure the NHS IP address
8. Configure the local cache.
9. Enable NHRP on the tunnel interface.
10. Configure routing.

Example

In this example, a high-end security device acting as the hub in a hub and spoke network is configured to act as the Next Hop Server (NHS) in an AC-VPN configuration in which Spoke1 and Spoke2 (low-end security devices) are Next Hop Clients (NHCs). After configuring interfaces on the devices, you configure static VPN tunnels between the hub and each of the spokes, then configure AC-VPN and enable NHRP on the connecting interfaces. Although this example uses the Open Shortest Path First (OSPF) routing protocol, ScreenOS supports all dynamic routing protocols with AC-VPN.

NOTE:AC-VPN also supports Dynamic Host Control Protocol (DHCP).



WebUI (Hub)

NOTE: After you configure static gateways and static VPNs from the hub to the spokes and from the spokes to the hub, you can use the AC-VPN wizard to complete the AC-VPN configuration.

1. **Interfaces**
   Network > Interfaces > Edit (for ethernet2/1): Enter the following, then click Apply:

   Zone Name: Untrust
   IP Address/Netmask: 1.1.1.1/24
   Interface Mode: Route

Network > Interfaces > Edit (for ethernet2/2): Enter the following, then click Apply:

Zone Name: Trust
IP Address/Netmask: 10.1.1.1/24
Interface Mode: NAT

Network > Interfaces > New (Tunnel IF): Enter the following, then click Apply:

Tunnel Interface Name: 1
Zone (VR): Trust-vr
Fixed IP
IP Address/Netmask: 10.0.0.1/24
Unnumbered
Interface:
NHRP Enable: (Select)

2. Configure Tunnels to Spoke1 and Spoke2

VPNs > AutoKey Advanced > Gateway > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

Gateway Name: Spoke1
Remote Gateway: (Select)
Static IP Address: (Select) IPv4/v6 Address/Hostname: 2.2.2.1

Preshare key: Juniper
Outgoing interface: (select) ethernet2/1
Security Level: Standard

VPNs > AutoKey Advanced > Gateway > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

Gateway Name: Spoke2
Remote Gateway: (Select)
Static IP Address: (Select) IPv4/v6 Address/Hostname: 3.3.3.1

Preshare key: Juniper
Outgoing interface: (select) ethernet2/1
Security Level: Standard

3. Configure VPN Spoke to Gateway

VPNs > AutoKey IKE > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

VPN Name: spoke1
Remote Gateway: (select) Predefined
(select appropriate gateway name from predefined list in drop-down list)
Security Level (select) Standard
Bind To: (select) Tunnel Interface
(select Tunnel.1 from the drop-down list)

VPNs > AutoKey IKE > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

VPN Name: spoke2
Remote Gateway: (select) Predefined
(select appropriate gateway name from predefined list from drop-down list)

Security Level (select) Standard)
Bind To: (select) Tunnel Interface
(select Tunnel.1 from the drop-down list)

4. Configure the ACVPN-Profile

VPNs > AutoKey Advanced > Gateway > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

Gatewary Name: ac-spoke-gw
ACVPN-Profile: (select)

Security Level: (select) Standard

VPNs > AutoKey IKE > New: Configure the ACVPN Profile, click Advanced and set the security level and Replay Protection, then click Return to go back to the VPN configuration page and click OK

VPN Name: ac-vpn
ACVPN-Profile: (select)
Binding to tunnel: (select) ac-spoke-gw

Security Level: (select) Standard
Replay Protection: (select)

5. Configure Vrouter

Network > Routing > Virtual Router > (for trust-vr) Edit: Enter the following, then click Apply:

Next Hop Resolution Protocol(NHRP) Support
NHRP: (select) NHRP Setting
NHS Setting: (select)
Profile: (select) ACVPN-Profile name

6. Enable NHRP on the Tunnel Interface

Network > Interfaces > New (for TunnelIF): Enter the following, then click Apply:

Tunnel Interface Name: 1
NHRP Enable: (select)

7. Configure Routing

Network > Routing > Destination > New: Enter the following, then click Apply:

IP Address/netmask: 0.0.0.0
Gateway (select)
Gateway IP Address: 1.1.1.2

CLI (Hub)

```
set interface ethernet2/1 zone Untrust
set interface ethernet2/2 zone Trust
set interface tunnel.1 zone Trust

set interface ethernet2/1 ip 1.1.1.1/24
set interface ethernet2/1 route
set interface ethernet2/2 ip 10.1.1.1/24
set interface ethernet2/2 nat
set interface tunnel.1 ip 10.0.0.1/24

set ike gateway spoke2 address 3.3.3.1 Main outgoing-interface ethernet2/1
    preshare juniper== sec-level standard
set ike gateway spoke1 address 2.2.2.1 Main outgoing-interface ethernet2/1
    preshare juniper== sec-level standard

set vpn spoke2 gateway spoke2 no-replay tunnel idletime 0 sec-level standard
set vpn spoke2 id 1 bind interface tunnel.1
set vpn spoke1 gateway spoke1 no-replay tunnel idletime 0 sec-level standard
set vpn spoke1 id 2 bind interface tunnel.1

set ike gateway ac-spoke-gw acvpn-profile sec-level standard
set vpn ac-vpn acvpn-profile ac-spoke-gw no-replay tunnel idletime 0 sec-level
    standard

set vrouter trust-vr
set protocol nhrp
set protocol nhrp acvpn-profile ac-vpn
exit
set interface tunnel.1 protocol nhrp enable

set vr trust protocol ospf
set vr trust protocol ospf enable
set vr trust protocol ospf area 10
set interface ethernet2/2 protocol ospf area 0.0.0.10
set interface ethernet2/2 protocol ospf enable
set interface tunnel.1 protocol ospf area 0.0.0.0
set interface tunnel.1 protocol ospf link-type p2mp
set interface tunnel.1 protocol ospf enable

set route 0.0.0.0/0 gateway 1.1.1.2
```

WebUI (Spoke1)

1. Interfaces

Network > Interfaces > Edit (for ethernet0/0): Enter the following, then click Apply:

Zone Name: Untrust
IP Address/Netmask: 2.2.2.1/24
Interface Mode: Route

Network > Interfaces > Edit (for bgroup0): Enter the following, then click Apply:

Zone Name: Trust

Network > Interfaces > Edit (for ethernet2/2): Enter the following, then click Apply:

Zone Name: Trust
IP Address/Netmask: 10.1.2.1/24
Interface Mode: NAT

Network > Interfaces > Edit (for ethernet2/2), Select Bind Port, enter the following, then click Apply:

ethernet0/2 bgroup0: (select) Bind to Current Bgroup

Network > Interfaces > New (Tunnel IF): Enter the following, then click Apply:

Tunnel Interface Name: 1
Zone (VR): Trust-vr
Fixed IP
IP Address/Netmask: 10.0.0.2/24
NHRP Enable: (Select)

2. Configure Tunnel to the Hub

VPNs > AutoKey Advanced > Gateway > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

Gateway Name: hub-gw
Remote Gateway: (Select)
Static IP Address: (Select) IPv4/v6 Address/Hostname: 1.1.1.1

Preshare key: Juniper
Outgoing interface: (select) ethernet2/1
Security Level: Standard

3. Configure VPN Spoke to Gateway

VPNs > AutoKey IKE > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

VPN Name: vpn-hub
Remote Gateway: (select) Predefined
(select appropriate gateway name from predefined list from drop-down list)

Security Level (select) Standard
Bind To: (select) Tunnel Interface
(select Tunnel.1 from the drop-down list)

4. Configure ACVPN-Dynamic

VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

Gateway Name: ac-hub-gw
ACVPN-Dynamic: (select)

VPNs > AutoKey > New: Enter the following, then click OK:

VPN Name: ac-hub-vpn
ACVPN-Dynamic: (select)
Gateway (select): ac-hub-gw
Tunnel Towards Hub: (select) vpn-hub

5. Configure the Virtual Router

Network > Routing > Virtual Router > (for trust-vr) Edit: Enter the following, then click Apply:

Next Hop Resolution Protocol(NHRP) Support
NHRP Enable: (select)
NHC Setting: (select)
NHS IP Address: 10.1.1.1

6. Enable NHRP on the Tunnel Interface

Network > Interfaces > New (for TunnelIF): Enter the following, then click Apply:

Tunnel Interface Name: 1
NHRP Enable: (select)

7. Configure Routing

Network > Routing > Destination > New: Enter the following, then click Apply:

IP Address/netmask: 0.0.0.0
Gateway (select)
Gateway IP Address: 2.2.2.2

CLI (Spoke1)

```
set interface ethernet0/0 zone Untrust
set interface bgroup0 zone Trust
set interface bgroup0 port ethernet0/2
set interface tunnel.1 zone Trust

set interface ethernet0/0 ip 2.2.2.1/24
set interface ethernet0/0 route
set interface bgroup0 ip 10.1.2.1/24
set interface bgroup0 nat
set interface tunnel.1 ip 10.0.0.2/24

set ike gateway hub-gw address 1.1.1.1 Main outgoing-interface ethernet0/0
    preshare juniper== sec-level standard
set vpn vpn-hub id 1 bind interface tunnel.1

set ike gateway ac-hub-gw acvpn-dynamic
set vpn ac-hub-vpn acvpn-dynamic ac-hub-gw vpn-hub

set vrouter trust-vr
set protocol nhrp
set protocol nhrp nhs 10.0.0.1
set protocol nhrp cache 10.1.2.0/24
exit
set interface tunnel.1 protocol nhrp enable
```

```
set vr trust protocol ospf
set vr trust protocol ospf enable
set vr trust protocol ospf area 20

set interface bgroup0 protocol ospf area 0.0.0.20
set interface bgroup0 protocol ospf enable
set interface tunnel.1 protocol ospf area 0.0.0.0
set interface tunnel.1 protocol ospf enable
set route 0.0.0.0/0 gateway 2.2.2.2
```

WebUI (Spoke2)

1. **Interfaces**

   Network > Interfaces > Edit (for ethernet0/0): Enter the following, then click Apply:

   Zone Name: Untrust
   IP Address/Netmask: 3.3.3.1/24
   Interface Mode: Route

   Network > Interfaces > Edit (for bgroup0): Enter the following, then click Apply:

   Zone Name: Trust

   Network > Interfaces > Edit (for ethernet2/2): Enter the following, then click Apply:

   Zone Name: Trust
   IP Address/Netmask: 10.1.3.1/24
   Interface Mode: NAT

   Network > Interfaces > Edit (for ethernet2/2), Select Bind Port, enter the following, then click Apply:

   ethernet0/2 bgroup0: (select) Bind to Current Bgroup

   Network > Interfaces > New (Tunnel IF): Enter the following, then click Apply:

   Tunnel Interface Name: 1
   Zone (VR): Trust-vr
   Fixed IP
   IP Address/Netmask: 10.0.0.3/24
   NHRP Enable: (Select)

2. **Configure Tunnel to the Hub**

   VPNs > AutoKey Advanced > Gateway > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

   Gateway Name: hub-gw
   Remote Gateway: (Select)
   Static IP Address: (Select) IPv4/v6 Address/Hostname: 1.1.1.1

   Preshare key: Juniper
   Outgoing interface: (select) ethernet2/1
   Security Level: Standard

3. **Configure VPN Spoke to Gateway**
   VPNs > AutoKey IKE > New: Configure the IKE gateway, click Advanced and set the security level, then click Return to go back to the IKE gateway configuration page and click OK:

   VPN Name: vpn-hub
   Remote Gateway: (select) Predefined
   (select appropriate gateway name from predefined list from drop-down list)

   Security Level (select) Standard
   Bind To: (select) Tunnel Interface
   (select Tunnel.1 from the drop-down list)

4. **Configure ACVPN-Dynamic**
   VPNs > AutoKey Advanced > Gateway > New: Enter the following, then click OK:

   Gatewary Name: ac-hub-gw
   ACVPN-Dynamic: (select)

   VPNs > AutoKey > New: Enter the following, then click OK:

   VPN Name: ac-hub-vpn
   ACVPN-Dynamic: (select)
   Gateway (select): ac-hub-gw
   Tunnel Towards Hub: (select) vpn-hub

5. **Configure Vrouter**
   Network > Routing > Virtual Router > (for trust-vr) Edit: Enter the following, then click Apply:

   Next Hop Resolution Protocol(NHRP) Support
   NHRP Enable: (select)
   NHC Setting: (select)
   NHS IP Address: 1.1.1.1

6. **Enable NHRP on the Tunnel Interface**
   Network > Interfaces > New (for TunnelIF): Enter the following, then click Apply:

   Tunnel Interface Name: 1
   NHRP Enable: (select)

7. **Configure Routing**
   Network > Routing > Destination > New: Enter the following, then click Apply:

   IP Address/netmask: 0.0.0.0
   Gateway (select)
   Gateway IP Address: 3.3.3.3

CLI (Spoke2)

```
set interface ethernet0/0 zone Untrust
set interface bgroup0 zone Trust
set interface bgroup0 port ethernet0/2
set interface tunnel.1 zone Trust

set interface ethernet0/0 ip 3.3.3.1/24
set interface ethernet0/0 route
set interface bgroup0 ip 10.1.3.1/24
set interface bgroup0 nat
set interface tunnel.1 ip 10.0.0.3/24

set ike gateway hub-gw address 1.1.1.1 Main outgoing-interface ethernet0/0
    preshare juniper== sec-level standard
set vpn vpn-hub id 1 bind interface tunnel.1

set ike gateway ac-hub-gw acvpn-dynamic
set vpn ac-hub-vpn acvpn-dynamic ac-hub-gw vpn-hub

set vrouter trust-vr
set protocol nhrp
set protocol nhrp nhs 10.0.0.1
set protocol nhrp cache 10.1.3.0/24
exit

set interface tunnel.1 protocol nhrp enable

set vr trust protocol ospf
set vr trust protocol ospf enable
set vr trust protocol ospf area 30
set interface bgroup0 protocol ospf area 0.0.0.30
set interface bgroup0 protocol ospf enable
set interface tunnel.1 protocol ospf area 0.0.0.0
set interface tunnel.1 protocol ospf enable
set route 0.0.0.0/0 gateway 3.3.3.3
```

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