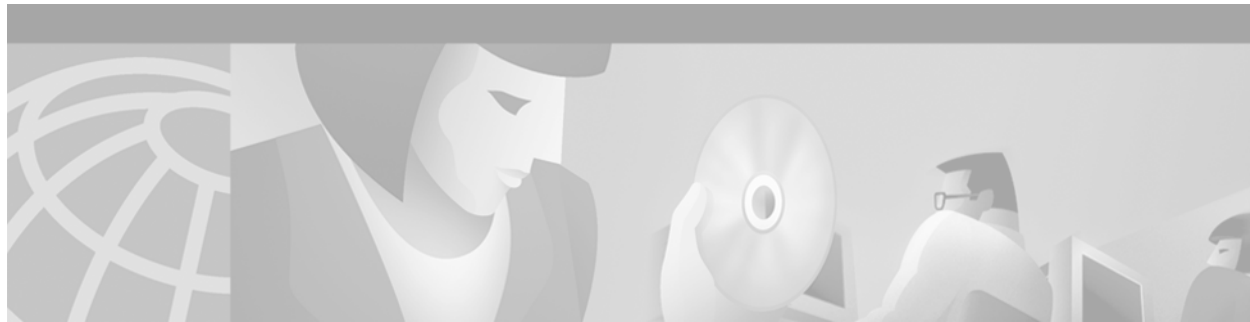




Access VPDN Dial-in Using IPsec Over L2TP

Version Number	Date	Notes
1	11/17/2000	This document was created.

This document describes how an Internet service provider (ISP) partners with one of its enterprise customers to add Internet Protocol Security (IPsec) encryption to an existing virtual private dial network (VPDN).

VPDNs are networks that extend dial access to users over a shared infrastructure. They use Layer 2 tunneling protocols L2F, L2TP or PPTP to tunnel user calls through the Internet. They are a cost-effective method of establishing long-distance point-to-point connections between remote users and a private network.

However, the Internet is subject to many security threats including loss of privacy, loss of data integrity, identity spoofing, and denial of service. The Layer 2 tunneling protocols do not offer protection from these threats. The goal of IPsec is to minimize all of these threats in the existing network infrastructure itself, without requiring expensive host and application modifications.



Note

Although the network used to document this solution is a fully functioning, end-to-end network and the complete configurations for the devices are included, this document focuses on the IPsec configurations. It does not discuss in detail such features as basic IP connectivity and VPDN configuration.

This document contains the following sections:

- Business Objectives
- Possible Solutions
- Proposed Solution No. 2: IPsec Tunnel Between the Peer and LNS
- Implementation
- Complete Configuration Files
- Debug Output
- Related Documents

Business Objectives

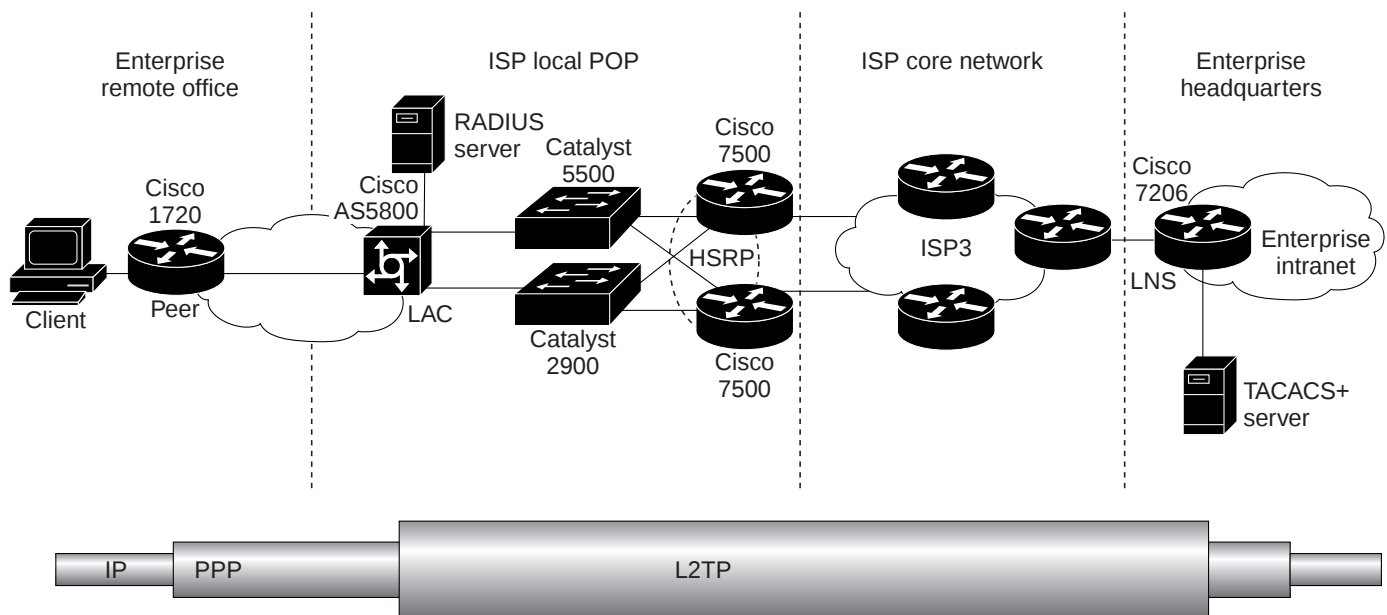
The ISP has established a VPN network to offer remote access service to its customers. It now wants to expand this VPN service to include encryption. The goal of the ISP is to implement this encryption service as quickly, easily, and inexpensively as possible without disrupting the existing network or purchasing new equipment.

The enterprise company has leased VPN service from the ISP to connect its remote office to its headquarters office. This VPN service is sufficient for nonsensitive traffic, but now the enterprise wants to be able to securely send sensitive traffic between the remote office and the headquarters. The enterprise determines that only the connection between the remote office and headquarters needs encryption—mobile users that dial-in from laptop PCs need not establish encrypted sessions.

Original Network Topology

The enterprise and ISP have already configured a VPN network. Figure 1 shows the original VPN network topology without IPSec.

Figure 1 Original Network Topology



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Figure 1 shows the entire end-to-end network topology; however, only the devices described in Table 1 are critical to the VPDN functionality.

Table 1 VPDN Devices

Device Name	Device Chassis	Location	Maintained by	Function
Peer	Cisco 1720 router	Enterprise remote office	Enterprise	Remote users are connected to the peer. The peer initiates VPDN calls from the remote office to the enterprise headquarters.
LAC	Cisco AS5800 access server	Local ISP point-of-presence (POP)	ISP	The L2TP access concentrator (LAC) receives calls from the peer and then negotiates L2TP tunnels and sessions with the L2TP network server (LNS) to forward the calls to the LNS.
LNS	Cisco 7206 router	Enterprise headquarters	Enterprise	The LNS negotiates L2TP tunnels and sessions with the LAC.
LNS TACACS+ server	UNIX server	Enterprise headquarters	Enterprise	User names, passwords, and accounting records for the LNS are stored on the LNS AAA server. When the LNS receives a request to establish an L2TP session from the LAC, it forwards the user information to the LNS AAA server for authentication and authorization.

In this network, users at the enterprise remote office are connected to the peer. When users need to connect to the headquarters office, the peer initiates a VPDN session that uses L2TP to tunnel the user session to the headquarters office. First the peer establishes a PPP session with the local LAC of the ISP. The LAC retrieves L2TP tunneling information from the LAC AAA server, and then establishes an L2TP tunnel and session with the LNS at the enterprise headquarters. The LNS forwards the user name and password to the LNS AAA server for authentication and authorization. Once the user is authenticated and authorized, the user has access to the headquarters network.

Business Drivers

The preexisting VPDN network uses L2TP to tunnel PPP traffic over the Internet. Because L2TP does not encrypt traffic, both the control and data packets of the L2TP protocol are vulnerable to the following types of attacks:

- Discovery of user identities by snooping data packets.
- Modification packets (both control and data).
- Hijacking of the L2TP tunnel or the PPP connection inside the tunnel.
- Denial of service attacks that terminate PPP connections or L2TP tunnels.
- Disruption of the PPP Encryption Control Protocol (ECP) negotiation in order to weaken or remove confidentiality protection.
- Disruption of the PPP Link Control Protocol (LCP) authentication negotiation so as to weaken the PPP authentication process or gain access to user passwords.

IPsec addresses these threats in the following ways:

- Providing authentication, integrity, and replay protection of control packets.

- Providing integrity and replay protection of data packets.
- Protecting control packet confidentiality.
- Providing the option of a scalable approach to key management.

L2TP tunnel authentication provides mutual authentication between the LAC and the LNS at tunnel origination. Therefore, it does not protect control and data traffic on a per-packet basis. PPP authenticates the client to the LNS, but also does not provide per-packet authentication, integrity, or replay protection.

We recommend IPSec as the best method to ensure per-packet authentication, integrity, and replay protection.

Possible Solutions

Possible Solution No. 1: IPSec Tunnel Between the LAC and LNS

The client initiates a PPP session (either by itself or by using a peer) to the LAC. The LAC negotiates an L2TP tunnel with the LNS and forwards the client PPP session to the LNS. The LAC and LNS then negotiate an IPSec tunnel to encrypt the client PPP session. The session is encrypted between the LAC and LNS, which is the segment of the network most susceptible to attack, but it is not encrypted between the client and the LAC.

Possible Solution No. 2: IPSec Tunnel Between the Peer and LNS

The client connects to the peer, and the peer initiates a PPP session to the LAC. The LAC negotiates an L2TP tunnel with the LNS and forwards the client PPP session to the LNS. The peer and LNS then negotiate an IPSec tunnel to encrypt the client PPP session. In this solution, the only segment of the network that is not encrypted is the connection between the client and the peer. But because the client and peer are typically in the same office, this solution usually is not a security risk.

Possible Solution No. 3: IPSec Tunnel Between the Client and LNS

The client initiates a PPP session (either by itself or by using a peer) to the LAC. The LAC negotiates an L2TP tunnel with the LNS and forwards the client PPP session to the LNS. The client and LNS then negotiate an IPSec tunnel to encrypt the client PPP session. In this solution, the entire network is encrypted. This solution is useful when a peer is shared by different parties. It is also useful for mobile users that do not have access to a peer but still need a secure remote connection. The disadvantages of this solution are that it requires that every client be configured for IPSec (instead of just the single peer), and that IPSec negotiation may take longer on clients than on the peer.

Proposed Solution No. 2: IPSec Tunnel Between the Peer and LNS

The enterprise company decides to implement solution no. 2 because it is the simplest solution that provides the encryption it needs: The enterprise requires that the entire session be encrypted—not just the link between the LAC and LNS. The enterprise maintains its own peer at the remote office, so it does not need to encrypt the connections between clients and the peer. The enterprise does not need encryption for its mobile users, so it does not need to configure client-initiated IPSec.

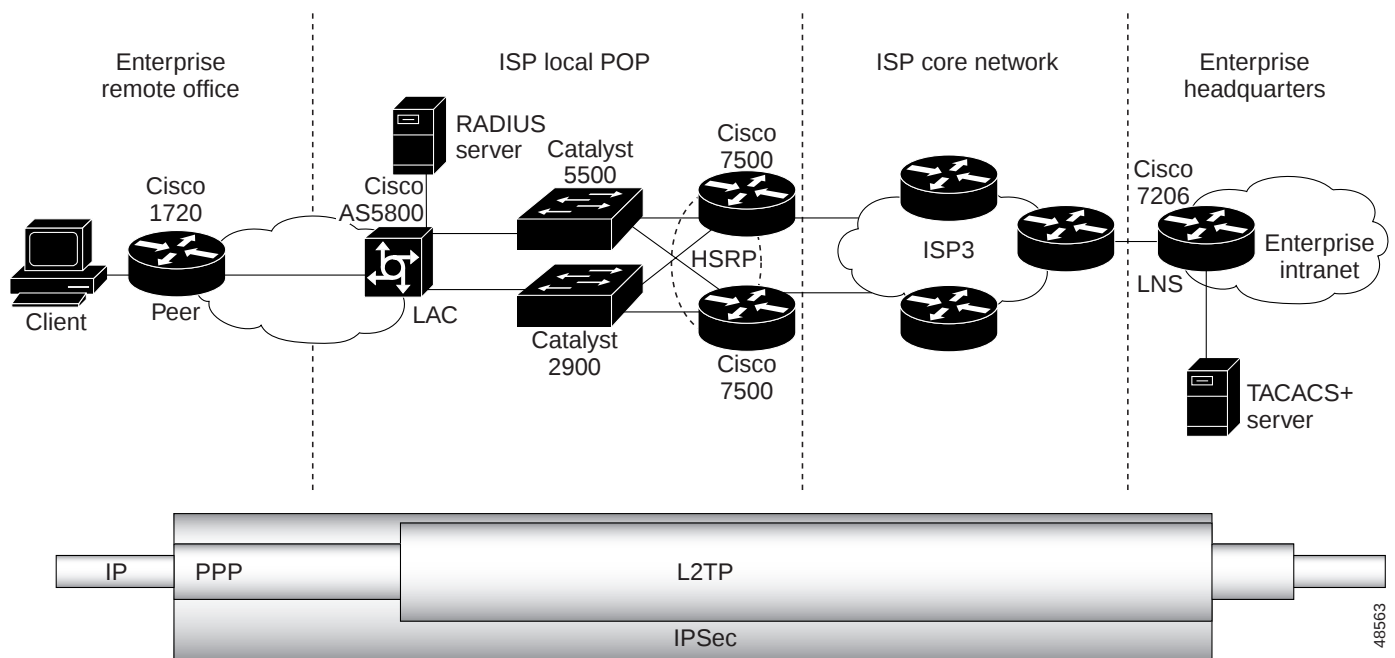
Overview

Adding IPSec to an existing VPDN network is a relatively simple process. Usually, no new equipment is required; the existing VPDN devices can be reconfigured to perform IPSec. The only situation in which you might need to purchase new equipment is if the existing equipment does not have enough CPU power to perform IPSec in addition to its existing responsibilities.

Network Topology

Figure 2 shows the end-to-end IPSec VPDN network.

Figure 2 Postimplementation Network Topology



In the new IPSec network, the peer, LAC, and LNS establish L2TP tunnels and sessions exactly as they did in the original network. Once the L2TP tunnel and session are established, the peer initiates IPSec negotiation with the LNS (the LAC is not involved in IPSec). Once the peer and LNS complete IPSec negotiation, the connection is secured from the peer in the remote office to the LNS at the headquarters office.

Benefits

- Because IPSec is standards-based, the network will be able to interoperate with other non-Cisco IPSec-compliant devices.
- Because IPSec does not require any additional devices or any changes to the network topology, it is fast, easy, and inexpensive to deploy on an existing VPDN network.
- Deploying IPSec on the ISDN router instead of on individual PCs eliminates the need to reconfigure every PC in the office.
- IPSec is a flexible security solution: multiple encryption types are supported

IPSec can be reconfigured for more complex, large-scale service that uses such features as digital certificates, dynamic crypto maps, dynamic tunnel endpoint discovery, wildcard pre-shared keys, multiple certificate authority roots support, and so on.

Functional Description

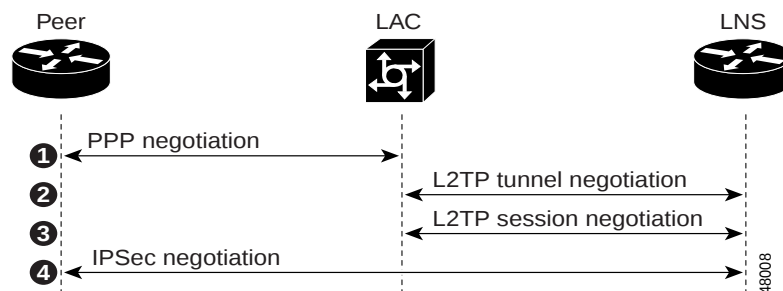
This section contains the following sections:

- Overview of Call Establishment
- IPSec Negotiation Process

Overview of Call Establishment

Figure 3 shows how an IPSec-encrypted call is established over the VPDN network.

Figure 3 *IPSec over VPDN Call Establishment*



The following list describes the sequence of events shown in Figure 3:

1. A user in the enterprise remote office initiates a call to the headquarters office from a PC connected to the peer. The peer places a call over the Public Switched Telephone Network (PSTN) to forward the user PPP session to the LAC.
2. When the LAC receives the PPP session, it negotiates an L2TP tunnel with the LNS at the enterprise headquarters.
3. After the LAC and LNS establish an L2TP tunnel, the LAC forwards the user information to the LNS. The LNS authenticates the user and establishes an L2TP session for the user.
4. Once the L2TP tunnel and session are established, the remote user has connectivity to the enterprise headquarters. The peer then initiates IPSec negotiation directly with the LNS (the LAC is not involved in IPSec).

IPSec Negotiation Process

IPSec negotiation is processed by the following three software components: IPSec, Internet Key Exchange (IKE), and the crypto engine.

- IPSec—Initiates IPSec negotiation, and then verifies and implements the IKE negotiations.
- IKE—Negotiates the security policies and security associations (SAs).
- Crypto engine—Performs the actual encryption tasks.

The following list describes how an IPSec session is negotiated by these three software components:

1. After the L2TP tunnel and session are established, IPSec on the peer initiates IPSec negotiation.
2. IKE verifies the pre-shared keys.
3. IKE verifies which SA it is configured to support.
4. The crypto engine generates ALG parameters for Dh phase 1.
5. IKE verifies the IKE policy of the other device.
6. The crypto engine creates the ISAKMP SKEYID, generates HMAC context, and clears the dh number.
7. IKE compares the incoming transform sets against its allowed transform sets and negotiates the appropriate SAs. IKE first compares the AH protocol transforms, and then the ESP protocol transforms.
8. IPSec accepts the SAs negotiated by IKE.
9. IKE creates four SAs:
 - AH protocol inbound
 - AH protocol outbound
 - ESP protocol inbound
 - ESP protocol outbound
10. IPSec initializes these SAs.
11. IPSec installs the new SA information into its SA database.

For detailed information about IPSec negotiation, see “Debug Output” later in this document.

Implementation

The following sections describe how the IPSec network is implemented:

- Prerequisites
- Design Considerations
- Ramifications
- Device Characteristics
- Configuration Summaries

Prerequisites

Before IPSec is configured, the ISP and enterprise need to establish VPDN connectivity between the enterprise remote office and the headquarters using the ISP LAC to establish L2TP tunnels with the enterprise LNS.

IPSec uses IP protocols 50 and 51, and IKE traffic passes on protocol 17, port 500 (UDP 500). Before configuring IPSec, you should ensure that these protocols and ports are permitted by access lists.

Before configuring IPSec, you also should ensure that the **any** keyword is not used in any access lists.

Design Considerations

When designing an IPSec network, you will make a number of decisions. Most involve choosing between increased performance and increased security. The following sections provide details on these decisions:

- Authentication only, or Authentication and Encryption
- Encryption Algorithm
- Hash Algorithm
- Authentication Method
- Diffie-Hellman Group Identifier Options
- Security Association Lifetimes

Authentication only, or Authentication and Encryption

IPSec can be configured to perform authentication only, or both authentication and encryption.

Decision: The enterprise decides that its data needs to be both authenticated and encrypted.

Encryption Algorithm

IPSec offers the choice of two encryption algorithms: 56-bit DES-CBC or 168-bit DES. 168-bit DES is the more secure of the two encryption algorithms, but it requires more time and processing power than 56-bit DES-CBC. Also, there are international restrictions on 168-bit encryption.

Decision: The enterprise decides that 56-bit DES-CBC encryption is sufficient for its needs.

Hash Algorithm

IPSec offers the choice of two hash algorithms: SHA-1 and MD5. MD5 is slightly faster. There has been a demonstrated successful (but extremely difficult) attack against MD5; however, the HMAC variant used by IKE prevents this attack.

Decision: The enterprise decides to use the SHA-1 hash algorithm.

Authentication Method

IPSec offers three authentication methods:

- Rivest, Shamir, and Adleman (RSA) signatures—The most secure and the most scalable. However they require the use of a certification authority, which makes RSA signatures the most difficult option to configure.
- RSA encrypted nonces—Do not require that the peers possess the public keys of each other, but do not require the use of a certification authority. They are easier to configure in a small network, but do not scale well for large-scale networks.
- Pre-shared keys—The simplest authentication method. They do not scale well for large-scale networks, and are not as secure as RSA signatures.

Decision: The enterprise decides to make its initial IPSec configuration as simple as possible, so it decides to use pre-shared keys.

Diffie-Hellman Group Identifier Options

The Diffie-Hellman identifier is used for deriving key materials between peers. IPSec offers the choice of 768-bit or 1024-bit Diffie-Hellman groups. The 1024-bit Diffie-Hellman group is more secure, but requires more CPU time to execute.

Decision: The enterprise decides that the 768-bit Diffie-Hellman group is sufficient.

Security Association Lifetimes

The lifetimes of IKE security associations can be configured to any desired value. The default value is 86,400 seconds, or one day. When the first IKE negotiation begins, SAs are negotiated. Each peer retains the SAs until the SA lifetime expires. Any subsequent IKE negotiations can reuse these SAs, which speeds future negotiations. Therefore, longer lifetimes can increase performance, but they also increase SAs exposure to attack. The longer an SA is used, the more encrypted traffic can be gathered by an attacker and used in an attack.

Decision: The enterprise decides to use the default value of 86,400-second SA lifetimes.

Ramifications

- Scaling limitations

Although using pre-shared authentication keys is the simplest way to implement IPSec, it is not a practical solution for large-scale networks. Therefore, if the ISP wants to expand its IPSec service, it should reconfigure IPSec to use digital certificates obtained from a certificate authority.

- Limitations of initiating IPSec at the ISDN router:

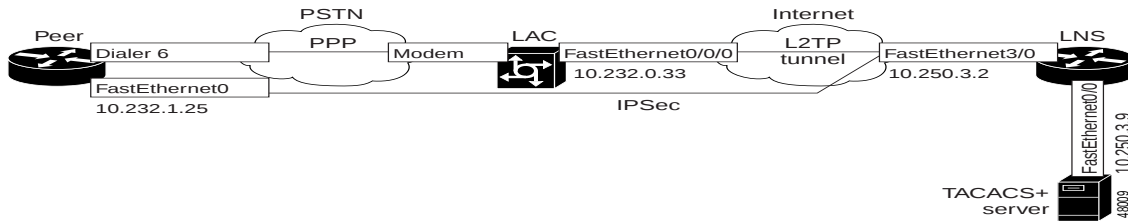
When IPSec is initiated at the ISDN router, the connection between the PC and the ISDN router is not encrypted. Usually, this un-encrypted link is not a security concern because the PC and ISDN router are both located in the same office. However, in some circumstances, the ISDN router may be shared by multiple parties. In this case, the connection between the PC and ISDN router could be subject to attack.

Also, initiating IPSec at the ISDN router limits security for mobile users. The connection between the mobile PC and the ISDN router will not be encrypted. This connection is over the PSTN, which is less susceptible to attack than is the Internet. Therefore it is not a critical security concern, but it is a concern for highly sensitive data.

Device Characteristics

Figure 4 shows added details of the devices critical to performing IPSec over VPDN.

Figure 4 Details of Network Topology



Device Characteristics

Table 2 describes the devices shown in Figure 4.

Table 2 Hardware and Software Used

	ISDN Router	LAC	LNS
Host Name	isdn4	NAS5-58-RS	ISP3AC5
Chassis Type	Cisco 1720 router	Cisco AS5800 access server	Cisco 7206 VXR router
Physical Interfaces	2 serial 1 BRI 1 Fast Ethernet 6 dialers	5 Fast Ethernet 6 Ethernet 6 serial 3 dialers	4 Fast Ethernet 5 Ethernet
Software Loaded	Cisco IOS Release 12.1(4)T	Cisco IOS Release 12.1(4)T	Cisco IOS Release 12.1(3)
Ethernet IP Address and IP Address Ranges	Fast Ethernet 0: 192.232.1.25	Fast Ethernet 0/0/0: 192.232.0.33 (primary) Fast Ethernet 0/5/0: 192.232.0.41 (secondary)	Fast Ethernet 0/0: 192.250.3.9 (to RADIUS server) Fast Ethernet 3/0: 192.250.3.2 (to ISP3DA4, used for VPDN traffic) IP local pool ISP3POOL: 192.239.192.1 192.239.199.254

Configuration Summaries

The following sections contain the sections of the device configurations needed to enable IPSec on an L2TP network:

- Configuring the Peer for IPSec over VPDN
- Configuring the LAC for IPSec over VPDN
- Configuring the LNS for IPSec over VPDN
- Configuring the LNS TACACS+ Server for VPDN

Configuring the Peer for IPsec over VPDN

The following commands are necessary to enable a peer to dial in to the LAC and negotiate IPsec with the LNS:

```
!Identifies the version of Cisco IOS software running on the LAC.
version 12.1
!Includes millisecond timestamps on log and debug entries that are useful for
!troubleshooting and optimizing the network.
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
!Specifies that passwords will not be encrypted in configuration output. This is useful
!when first configuring a network, but is a security risk when the network is
!operational.
no service password-encryption
!
!Configures the hostname of the router.
hostname isdn4
!
logging buffered 4096 debugging
enable secret 5 $1$r4OC$rE0tf7GTYYZFc80M5SRJL0
!
username nas2-52 password 0 lab
!
!
memory-size iomem 15
!Configures the timezone and Daylight Savings Time adjustment.
clock timezone PDT -8
clock summer-time PDT recurring
!Allows for the configuration of the first subnet in each classfull network.
ip subnet-zero
!
isdn switch-type basic-5ess
isdn voice-call-failure 0
!
!
!Creates IKE policy 1, which would be given highest priority if there were additional IKE
!policies.
crypto isakmp policy 1
!Specifies that IKE will use pre-shared keys for authentication.
 authentication pre-share
!By default, this IKE policy will use the 56-bit DES-CBC encryption algorithm, the SHA-1
!hash algorithm, the 768-bit Diffie-Hellman group, and 86400 second SA lifetimes.
!
!Specifies the pre-shared key as cisco123 for negotiation with the LNS at IP address
!192.250.3.2. This pre-shared key must also be specified on the LNS for the peer IP
!address.
crypto isakmp key cisco123 address 192.250.3.2
!By default, the peer's ISAKMP identity is set as its IP address, 192.232.1.25.
!
!Creates the transform set called e2e. It includes an AH transform, an ESP encryption
!transform, and an ESP authentication transform. The transform set on the LNS must
!include all three of these transforms for successful negotiation.
crypto ipsec transform-set e2e ah-md5-hmac esp-des esp-md5-hmac
!
!
```

```

!Creates the crypto map called vpdn-isg, gives it a sequence number (priority) of 10, and
!specifies that IKE will be used to establish IPSec security associations.
crypto map vpdn-isg 10 ipsec-isakmp
!Specifies the IP address of the LNS.
  set peer 192.250.3.2
!Instructs the crypto map to use the e2e transform set.
  set transform-set e2e
!Specifies that extended access list 101 will be used to determine which traffic is to be
!protected by IPSec.
  match address 101
!
cns event-service server
!
!
interface BRI0
  description "Lucent BRI # 60153"
  no ip address
  encapsulation ppp
  no ip route-cache
  no ip mroute-cache
  dialer pool-member 1
  isdn switch-type basic-5ess
  isdn incoming-voice modem
  no fair-queue
  no cdp enable
!Specifies that traffic using BRI 0 is to be encrypted by crypto map vpdn-isg.
  crypto map vpdn-isg
!
!FastEthernet 0 is the interface that is used for VPDN and IPSec traffic.
interface FastEthernet0
  ip address 192.232.1.25 255.255.255.248
  speed auto
  half-duplex
  no cdp enable
!
!Dialer 6 is used to establish the initial PPP connection to the LAC.
interface Dialer6
  description "vpdn dialup to ISP3AC5 192.250.3.0 via NAS5-58-RS"
  ip unnumbered FastEthernet0
  encapsulation ppp
  no ip route-cache
  no ip mroute-cache
  dialer pool 1
!Specifies the remote name of the LAC.
  dialer remote-name isp3ac5-hgw
!Specifies the PRI number of the LAC.
  dialer string 50127
  dialer-group 1
  no cdp enable
  ppp authentication chap pap callin
  ppp chap hostname isdn4@isp3-2.com
  ppp chap password 7 09404F0B
!Specifies that traffic using dialer 6 is to be encrypted by crypto map vpdn-isg.
  crypto map vpdn-isg
!
ip classless
ip route 192.232.1.24 255.255.255.248 FastEthernet0
ip route 192.250.3.2 255.255.255.255 Dialer6
ip route 0.0.0.0 0.0.0.0 Dialer6
no ip http server
!

```

```

!Specifies that traffic from 192.232.1.24 (the peer) to 192.250.3.0 (the LNS) is to be
!permitted. Because this access list is reference in crypto map vpdn-isg, traffic meeting
the requirements of this access list will be encrypted by crypto map vpdn-isg.
access-list 101 permit ip 192.232.1.24 0.0.0.7 192.250.3.0 0.0.0.7
dialer-list 1 protocol ip permit
!
!
end

```

For the complete configuration, see “Peer Configuration.”

Configuring the LAC for IPsec over VPDN

The following commands are necessary to enable the LAC to receive calls from the peer and forward them to the LNS using L2TP. The LAC is not involved in IPsec negotiation.

```

!Identifies the version of Cisco IOS software running on the LAC
version 12.1
!Includes millisecond timestamps on log and debug entries that are useful for
!troubleshooting and optimizing the network
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
!Specifies that passwords will not be encrypted in configuration output. This is useful
!when first configuring a network, but is a security risk when the network is
!operational.
no service password-encryption
!
!Configures the hostname for the LAC.
hostname NAS5-58-RS
!
boot system flash c5800-p456i-mz.121-4.0.1.T
!Configures AAA and specifies that the LAC will authenticate VPDN tunnels with RADIUS.
aaa new-model
aaa authentication ppp default if-needed local group radius
!
!Configures the usernames and passwords that are used for VPDN tunnel negotiation. These
!usernames and passwords are called tunnel secrets.
username isp3ac5-hgw password 0 lab
username isdn-nas5-isp3 password 0 lab
!
!
!Configures the timezone and Daylight Savings Time adjustment.
clock timezone PDT -8
clock summer-time PDT recurring
dial-tdm-clock priority 1 trunk-slot 0 port 0
!
!
!Allows for the configuration of the first subnet in each classfull network.
ip subnet-zero
ip cef
no ip domain-lookup
!
!Turns on VPDN.
vpdn enable
no vpdn logging
!Instructs the LAC to tunnel VPDN calls based on the user domain name.
vpdn search-order domain
!

```

```

!This is the VPDN group for the enterprise.
vpdn-group 1
!Configures a request dial-in VPDN subgroup.
  request-dialin
!Configures L2TP as the tunnel protocol.
  protocol l2tp
!Specifies that users with the domain name isp3-2.com will be tunneled by this VPDN
!group.
  domain isp3-2.com
!Specifies the IP address of the enterprise LNS.
!
  initiate-to ip 192.250.3.2
!Configures the local name that the ISP will use to identify itself for L2TP tunnel
!authentication with the service provider LNS. If the ISP expands to a stacked-LAC
!environment, it will need to use the same local name on all of the LACs.
  local name isdn-nas5-isp3
!
!Configures the telco switch type. When the switch type is configured in global
!configuration mode, it is automatically propagated into the individual serial
!interfaces.
isdn switch-type primary-5ess
!
!
!
controller T1 1/0/4
!Configures the T1 framing type as super frame (ESF).
  framing esf
!Configures the LAC to gets its primary clocking from T1 controller 0.
  clock source line primary
!Configures the T1 line code type as B8ZS.
  linecode b8zs
!Assigns all 24 T1 timeslots as ISDN PRI channels and creates a D-channel serial
!interface (Serial interface 0:23). Individual B-channel serial interfaces are also
!created (Serial interfaces 0:0 through 0:22), but they are not shown in the
!configuration.
  pri-group timeslots 1-24
!Includes the PRI number that corresponds to this controller in the configuration for
!easy reference.
  description LucentPRInumber = 50127
!
!
interface FastEthernet0/0/0
  description "This is the IP id for this router"
  ip address 192.232.0.33 255.255.255.248
  full-duplex
!
interface FastEthernet0/5/0
  description "This is the secondary interface for router"
  ip address 192.232.0.41 255.255.255.248
  full-duplex
!
!
!

```

```

!Serial interface 1/0/4:23 is the D channel that corresponds to controller T1 1/0/4. The
!behavior of the B-channel serial interfaces (1/0/4:0 through 1/0/4:22) is controlled by
!the configuration of Serial interface 1/0/4:23.
interface Serial1/0/4:23
!Includes the PRI number that corresponds to this interface in the configuration for
!easy reference.
description LucentPRInumber = 50127
!Specifies that the interface does not require an IP address.
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
!This command is automatically configured on all of the serial interfaces by the isdn
!switch-type global configuration mode command.
isdn switch-type primary-5ess
!
!
interface Dialer1
ip unnumbered FastEthernet0/0/0
encapsulation ppp
dialer in-band
dialer map ip 192.232.1.25 name isdn4
dialer-group 1
peer default ip address pool NAS5POOL
ppp authentication chap pap ms-chap
!
!
ip classless
ip route 192.232.1.24 255.255.255.248 192.232.1.25
ip route 192.232.1.25 255.255.255.255 Dialer1
ip route 192.250.3.0 255.255.255.248 192.232.0.38
ip route 192.250.3.0 255.255.255.248 192.232.0.44
no ip http server
!
access-list 10 permit 192.232.0.0 0.0.255.255
access-list 101 permit ip 192.232.0.32 0.0.0.7 192.232.1.40 0.0.0.7
dialer-list 1 protocol ip permit
!
!
!
!Specifies the IP address of the RADIUS server, and the ports that are to be sued for
!authorization and accounting.
radius-server host 192.232.0.122 auth-port 1645 acct-port 1646
!Specifies that
radius-server retransmit 5
!Configures the password for the RADIUS server.
radius-server key <key>
!
!
end

```

For the complete LAC configuration, see “LAC Configuration.”

Configuring the LNS for IPSec over VPDN

The following commands are necessary to enable the LNS to establish L2TP tunnels and sessions with the LAC and to negotiate IPSec with the peer:

```
!Identifies the version of Cisco IOS software running on the LAC.
version 12.1
!Includes millisecond timestamps on log and debug entries that are useful for
!troubleshooting and optimizing the network.
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
!Specifies that passwords will not be encrypted in configuration output. This is useful
!when first configuring a network, but is a security risk when the network is
!operational.
no service password-encryption
service udp-small-servers
service tcp-small-servers
!
!Configures the hostname of the router.
hostname ISP3AC5
!
boot system disk0:c7200-jo3s56i-mz.121-3.3
!
!Configures AAA and specifies that the LAC will authenticate VPDN tunnels with TACACS+.
aaa new-model
aaa authentication ppp default local group tacacs+
!
!
!
!Configures the usernames and passwords that are used for VPDN tunnel negotiation. These
!usernames and passwords are called tunnel secrets.
username isdn-nas5-isp3 password 0 lab
username isp3ac5-hgw password 0 lab
!
!
!Configures the timezone and Daylight Savings Time adjustment.
clock timezone PST -8
clock summer-time PST recurring
!Allows for the configuration of the first subnet in each classfull network.
ip subnet-zero
no ip finger
no ip domain-lookup
!
!Turns on VPDN.
vpdn enable
no vpdn logging
!
!
!This is the VPDN group that negotiates with the ISP LAC.
vpdn-group 2
!Configures an accept-dialin VPDN subgroup.
accept-dialin
!Specifies that this VPDN group will negotiate either L2F or L2TP tunnels.
protocol any
!Instructs the LNS to clone virtual access interfaces for VPDN sessions from virtual
!template 3.
virtual-template 3
!Specifies that this VPDN group will negotiate L2TP tunnels with LACs that identify
!themselves with the local name isdn-nas5-isp3.
terminate-from hostname isdn-nas5-isp3
local name isp3ac5-hgw
!
```

```

!Creates IKE policy 1, which would be given highest priority if there were additional IKE
!policies.
crypto isakmp policy 1
!Specifies that IKE will use pre-shared keys for authentication.
 authentication pre-share
!By default, this IKE policy will use the 56-bit DES-CBC encryption algorithm, the SHA-1
!hash algorithm, the 768-bit Diffie-Hellman group, and 86400 second SA lifetimes.
!
!Specifies the pre-shared key as cisco123 for negotiation with the peer at IP address
!192.232.1.25. This pre-shared key must also be specified on the peer for the LNS IP
!address.
!By default, the LNS's ISAKMP identity is set as its IP address, 192.250.3.2.
crypto isakmp key cisco123 address 192.232.1.25
!The next two pre-shared keys are for IPSec tunnels to other peers (not shown in this
!network) at the IP addresses 192.232.1.33.57, and 192.232.1.57.
crypto isakmp key cisco123 address 192.232.1.33
crypto isakmp key cisco123 address 192.232.1.57
!
!
!Creates the transform set called e2e. It includes an AH transform, an ESP encryption
!transform, and an ESP authentication transform. The transform set on the LNS must
!include all three of these transforms for successful negotiation.
crypto ipsec transform-set e2e ah-md5-hmac esp-des esp-md5-hmac
!
!Creates the crypto map called vpdn-isg, gives it a sequence number (priority) of 10, and
!specifies that IKE will be used to establish IPSec security associations.
crypto map vpdn-isg 10 ipsec-isakmp
!Specifies the IP address of the peer.
 set peer 192.232.1.25
!Instructs the crypto map to use the e2e transform set.
 set transform-set e2e
!Specifies that extended access list 102 will be used to determine which traffic is to be
!protected by IPSec.
 match address 102
!The next two crypto maps are for the IPSec tunnels to other peers not shown in this
!network.
crypto map vpdn-isg 20 ipsec-isakmp
 set peer 192.232.1.33
 set transform-set e2e
 match address 103
crypto map vpdn-isg 30 ipsec-isakmp
 set peer 192.232.1.57
 set transform-set e2e
 match address 104
!
cns event-service server
!
!
interface FastEthernet0/0
 description "network to the TACACS+ server - stss-ss20"
 ip address 192.250.3.9 255.255.255.248
 full-duplex
!
!
interface FastEthernet3/0
 description To ISP3DA4, Fa5/1
 ip address 192.250.3.2 255.255.255.248
 no ip route-cache
 no ip mroute-cache
 half-duplex
!
!
!

```

```

!Creates virtual template 3, which is used to clone virtual access interfaces for
!incoming VPDN sessions.
interface Virtual-Template3
!Specifies that the virtual access interfaces will use the IP address of Fast Ethernet
!interface 3/0.
    ip unnumbered FastEthernet3/0
    no ip route-cache
    no keepalive
!Enables CHAP and PAP authentication.
    ppp authentication chap
!Specifies that traffic using virtual-access interfaces cloned from virtual template 3 is
!to be encrypted by crypto map vpdn-isg.
    crypto map vpdn-isg
!
ip local pool ISP3POOL 192.239.192.1 192.239.199.254
ip kerberos source-interface any
no ip classless
ip route 0.0.0.0 0.0.0.0 192.250.3.1
ip route 192.232.1.0 255.255.255.248 192.232.1.1
ip route 192.232.1.8 255.255.255.248 192.232.1.9
ip route 192.232.1.16 255.255.255.248 192.232.1.17
ip route 192.232.1.24 255.255.255.248 192.232.1.25
ip route 192.232.1.32 255.255.255.248 192.232.1.33
ip route 192.232.1.40 255.255.255.248 192.232.1.41
ip route 192.232.1.48 255.255.255.248 192.232.1.49
ip route 192.232.1.56 255.255.255.248 192.232.1.57
no ip http server
!
!Specifies that traffic from 192.250.3.0 (the LNS) to 192.232.1.24 (the peer) is to be
!permitted. Because this access list is reference in crypto map vpdn-isg, traffic meeting
!the requirements of this access list will be encrypted by crypto map vpdn-isg.
access-list 102 permit ip 192.250.3.0 0.0.0.7 192.232.1.24 0.0.0.7
!The next two access lists are for the IPSec tunnels to other peers not shown in this
!network.
access-list 103 permit ip 192.250.3.0 0.0.0.7 192.232.1.32 0.0.0.7
access-list 104 permit ip 192.250.3.0 0.0.0.7 192.232.1.56 0.0.0.7
!
!Specifies the IP address of the TACACS+ server.
tacacs-server host 223.255.254.254
!Configures the password for the TACACS+ server.
tacacs-server key cisco12345
!
!
!
!
end

```

For the complete LNS configuration, see “LNS Configuration.”

Configuring the LNS TACACS+ Server for VPDN

The following user profile enables the LNS TACACS+ server to verify a user who dials in with the username isdn4@isp3-2com and the password lab.

```

user = isdn4@isp3-2com{
    password = chap "lab"
    service=ppp {
        protocol=lcp {
        }
        protocol=ip {
        }
    }
}

```

Complete Configuration Files

The following sections contain the complete device configurations:

- Peer Configuration
- LNS Configuration
- LAC Configuration
- LNS TACACS+ Server Configuration

Peer Configuration

```

!
hostname isdn4
!
logging buffered 4096 debugging
enable secret 5 $1$r40C$rE0tf7GTYYZFc80M5SRJL0
!
username nas2-52 password 0 lab
!
!
!
!
memory-size iomem 15
clock timezone PDT -8
clock summer-time PDT recurring
ip subnet-zero
no ip finger
ip ftp username anonymous
ip ftp password cywang@cisco.com
no ip domain-lookup
ip host tftp-ipc 223.255.254.254
ip host NAS3-53 192.232.0.17
ip host NAS2-52 192.232.0.9
!
ip audit notify log
ip audit po max-events 100
isdn switch-type basic-5ess
isdn voice-call-failure 0
!
!
!
!
!
!
crypto isakmp policy 1
 authentication pre-share
crypto isakmp key cisco123 address 192.250.3.2
!
!
crypto ipsec transform-set e2e ah-md5-hmac esp-des esp-md5-hmac
!
crypto map vpdn-isg 10 ipsec-isakmp
 set peer 192.250.3.2
 set transform-set e2e
 match address 101
!
cns event-service server

```

```

!
!
!
!
interface Serial0
 no ip address
 shutdown
 no fair-queue
 no cdp enable
!
interface Serial1
 no ip address
 shutdown
 no cdp enable
!
interface BRI0
 description "Lucent BRI # 60153"
 no ip address
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer pool-member 1
 isdn switch-type basic-5ess
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 crypto map vpdn-isg
!
interface FastEthernet0
 ip address 192.232.1.25 255.255.255.248
 speed auto
 half-duplex
 no cdp enable
!
interface Dialer1
 description "dialup to NAS2-52 to I & 192.232.0.8 network"
 ip unnumbered FastEthernet0
 encapsulation ppp
 no ip mroute-cache
 dialer pool 1
 dialer remote-name NAS2-52
 dialer idle-timeout 180
 dialer string 50151
 dialer-group 1
 pulse-time 0
 no cdp enable
 ppp authentication chap pap callin
 ppp chap hostname isdn4
!
interface Dialer5
 description "vpdn dialup to local1.com" via NAS5-58
 ip unnumbered FastEthernet0
 encapsulation ppp
 dialer pool 1
 dialer remote-name LOCAL1HGW-45
 dialer string 50120
 dialer-group 1
 no cdp enable
 ppp authentication chap pap callin
 ppp chap hostname isdn4@l2tplocal1.com
 ppp chap password 7 00081204
!
interface Dialer6
 description "vpdn dialup to ISP3AC5 192.250.3.0 via NAS5-58-RS"

```

```

ip unnumbered FastEthernet0
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer pool 1
dialer remote-name isp3ac5-hgw
dialer string 50127
dialer-group 1
no cdp enable
ppp authentication chap pap callin
ppp chap hostname isdn4@isp3-2.com
ppp chap password 7 09404F0B
crypto map vpdn-isg
!
ip default-gateway 192.232.0.17
ip kerberos source-interface any
ip classless
ip route 192.232.0.8 255.255.255.248 192.232.0.9
ip route 192.232.0.9 255.255.255.255 Dialer1
ip route 192.232.3.0 255.255.255.248 192.232.3.1
ip route 192.232.3.1 255.255.255.255 Dialer5
ip route 192.250.3.0 255.255.255.248 192.250.3.2
ip route 192.250.3.2 255.255.255.255 Dialer6
ip route 192.255.201.55 255.255.255.255 192.232.0.22
ip route 223.255.254.0 255.255.255.0 FastEthernet0
no ip http server
!
access-list 101 permit ip 192.232.1.24 0.0.0.7 192.250.3.0 0.0.0.7
dialer-list 1 protocol ip permit
no cdp run
!
!
line con 0
  exec-timeout 0 0
  transport input none
line aux 0
line vty 0 4
  exec-timeout 0 0
  password lab
  login
!
exception protocol ftp
exception dump 223.255.254.254
snmp server 223.255.254.254
no scheduler allocate
end

```

LAC Configuration

```

Current configuration : 20078 bytes
!
! Last configuration change at 11:13:34 PDT Fri Sep 29 2000
! NVRAM config last updated at 17:23:52 PDT Thu Sep 28 2000
!
version 12.1
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
service compress-config
!
hostname NAS5-58-RS
!

```

```

boot system flash c5800-p456i-mz.121-4.0.1.T
aaa new-model
aaa authentication login NO_Auth none
aaa authentication login VTY local-case group radius
aaa authentication ppp default if-needed local group radius
aaa authorization network default local group radius
aaa accounting suppress null-username
aaa accounting exec NO_Auth stop-only group radius
aaa accounting network default start-stop group radius
enable secret 5 $1$K7AO$bfpHNflllIAngDnnrC4lAK1
!
username cisco password 0 lab
username nas5-l2tp password 0 lab
username local1-hgw password 0 lab
username nas5 password 0 lab
username nas5-b2b password 0 lab
username isp3ac5-hgw password 0 lab
username isdn-nas5-isp3 password 0 lab
username linux-nas5-isp3 password 0 lab
username peer1-58-RS password 0 lab
username async4 password 0 lab
username CGb000 password 0 lab
!
!
!
!
shelf-id 0 router-shelf
shelf-id 1 dial-shelf
!
!
!
resource-pool disable
!
modem-pool Default
  pool-range 1/3/0-1/3/71,1/4/0-1/4/71,1/5/0-1/5/71,1/6/0-1/6/143,1/7/0-1/7/143
!
clock timezone PDT -8
clock summer-time PDT recurring
dial-tdm-clock priority 1 trunk-slot 0 port 0
!
!
!
!
ip subnet-zero
ip rcmd rsh-enable
ip cef
no ip domain-lookup
!
vpdn enable
no vpdn logging
vpdn search-order domain
!
vpdn-group 1
  request-dialin
  protocol l2tp
  domain isp3-1.com
  domain isp3-2.com
  initiate-to ip 192.250.3.2
  local name isdn-nas5-isp3
!
vpdn-group 2
  request-dialin
  protocol l2tp
  domain l2tplocal1.com

```

```

        initiate-to ip 192.232.3.1
        local name nas5-l2tp
    !
    vpdn-group 3
        request-dialin
        protocol l2f
        domain l2flocal1.com
        domain vpdn1.com
        initiate-to ip 192.232.3.1
        local name nas5
    !
    vpdn-group 4
        request-dialin
        protocol l2tp
        domain vpdn2.com
        initiate-to ip 192.232.3.1
        local name nas5
    !
    vpdn-group 5
        request-dialin
        protocol l2tp
        domain isp3-3.com
        initiate-to ip 192.250.3.2
        local name nas5-b2b
    !
    isdn switch-type primary-5ess
    chat-script dial ABORT "NO CARRIER" TIMEOUT 30 "" at OK "\datd \T" CONNECT
    !
    !
    !
    !
    !
    !
    !
    crypto isakmp policy 1
        authentication pre-share
    !
    crypto isakmp policy 2
        authentication pre-share
    crypto isakmp key cisco1234 address 192.232.1.41
    !
    !
    crypto ipsec transform-set dial esp-des esp-md5-hmac
    !
    crypto map toISDN6 20 ipsec-isakmp
        set peer 192.232.1.41
        set transform-set dial
        match address 101
    !
    !
    !
    controller T1 1/0/0
        framing esf
        linecode b8zs
        pri-group timeslots 1-24
        description LucentPRInumber = 50120
    !
    controller T1 1/0/1
        framing esf
        linecode b8zs
        pri-group timeslots 1-24
        description LucentPRInumber = 50121
    !
    controller T1 1/0/2

```

```

framing esf
linecode b8zs
pri-group timeslots 1-24
description LucentPRInumber = 50122
!
controller T1 1/0/3
framing esf
linecode b8zs
pri-group timeslots 1-24
description LucentPRInumber = 50126
!
controller T1 1/0/4
framing esf
linecode b8zs
pri-group timeslots 1-24
description LucentPRInumber = 50127
!
controller T1 1/0/5
framing esf
linecode b8zs
pri-group timeslots 1-24
description LucentPRInumber = 50128
!
controller T1 1/0/6
framing esf
linecode b8zs
pri-group timeslots 1-24
description LucentPRInumber = 50129
!
controller T1 1/0/7
framing esf
linecode b8zs
pri-group timeslots 1-24
description "btb to callgen router T1-1"
!
controller T1 1/0/8
framing esf
linecode b8zs
pri-group timeslots 1-24
description "btb to callgen router T1-2"
!
controller T1 1/0/9
framing esf
linecode b8zs
pri-group timeslots 1-24
description "btb to callgen router T1-3"
!
controller T1 1/0/10
framing esf
linecode b8zs
pri-group timeslots 1-24
description "btb to callgen router T1-5"
!
controller T1 1/0/11
framing esf
linecode b8zs
pri-group timeslots 1-3,24
!
controller T3 1/1/0
framing c-bit
clock source line
cablelength 224
t1 1-24,28 controller
!

```

```
controller T1 1/1/0:1
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:2
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:3
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:4
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:5
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:6
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:7
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:8
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:9
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:10
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:11
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:12
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:13
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:14
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:15
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:16
    framing esf
    pri-group timeslots 1-24
!
```

```

controller T1 1/1/0:17
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:18
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:19
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:20
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:21
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:22
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:23
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:24
    framing esf
    pri-group timeslots 1-24
!
controller T1 1/1/0:28
    framing esf
    pri-group timeslots 1-24
!
!
!
interface Loopback0
    ip address 111.111.111.1 255.255.255.0
!
interface Loopback1
    ip address 222.222.222.1 255.255.255.0
!
interface FastEthernet0/0/0
    description "This is the IP id for this router"
    ip address 192.232.0.33 255.255.255.248
    full-duplex
!
interface FastEthernet0/5/0
    description "This is the secondary interface for router"
    ip address 192.232.0.41 255.255.255.248
    full-duplex
!
interface Ethernet0/6/0
    description "temporary connection to e4/0 of tftp-gw1 to tftp-server"
    ip address 192.232.2.4 255.255.255.248
    shutdown
!
interface Ethernet0/6/1
    description "Network to CG-TERM-5300 ethernet 0"
    ip address 193.0.1.2 255.255.255.0 secondary
    ip address 193.0.1.3 255.255.255.0 secondary
    ip address 193.0.1.1 255.255.255.0

```

```
no ip mroute-cache
no cdp enable
!
interface Ethernet0/6/2
ip address 131.3.81.58 255.255.255.0
!
interface Ethernet0/6/3
no ip address
!
interface Serial1/0/0:23
description LucentPRInumber = 50120
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
crypto map toISDN6
!
interface Serial1/0/1:23
description LucentPRInumber = 50121
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/2:23
description LucentPRInumber = 50122
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/3:23
description LucentPRInumber = 50126
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/4:23
description LucentPRInumber = 50127
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/5:23
description LucentPRI# = 50128 (huntgroup # = 50199)
no ip address
encapsulation ppp
```

```

ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/6:23
description LucentPRI# = 50129 (huntgroup # = 50199)
no ip address
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/7:23
description "btb to callgen router T1-1"
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/8:23
description "btb to callgen router T1-2"
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
!
interface Serial1/0/9:23
description "btb to callgen router T1-3"
no ip address
encapsulation ppp
no ip route-cache cef
ip mroute-cache
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no peer default ip address
ppp authentication chap pap
!
interface Serial1/0/10:23
no ip address
encapsulation ppp
no ip route-cache cef
ip mroute-cache
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no peer default ip address
ppp authentication chap pap
!
interface Serial1/0/11:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
dialer-group 1

```

```
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap
!
interface Serial1/1/0:1:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:2:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:3:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:4:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:5:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:6:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
```

```

interface Serial1/1/0:7:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:8:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:9:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:10:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:11:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:12:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:13:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache

```

```
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:14:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:15:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:16:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:17:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:18:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
ppp authentication chap pap
!
interface Serial1/1/0:19:23
ip unnumbered FastEthernet0/0/0
encapsulation ppp
ip mroute-cache
load-interval 30
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
```

```

    ppp authentication chap pap
!
interface Serial1/1/0:20:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:21:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:22:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:23:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:24:23
 ip unnumbered FastEthernet0/0/0
 encapsulation ppp
 ip mroute-cache
 load-interval 30
 dialer-group 1
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 ppp authentication chap pap
!
interface Serial1/1/0:28:23
 no ip address
 no ip route-cache cef
 isdn switch-type primary-5ess
 no cdp enable
!
interface Group-Async0
 no ip address
 no group-range
!
interface Group-Async1
 ip unnumbered FastEthernet0/0/0

```

```

encapsulation ppp
ip tcp header-compression passive
no ip mroute-cache
dialer in-band
dialer-group 1
ntp disable
async default routing
async mode dedicated
peer default ip address pool NAS5POOL
ppp authentication chap pap
group-range 1/3/00 1/7/143
!
interface Dialer1
ip unnumbered FastEthernet0/0/0
encapsulation ppp
no ip route-cache cef
no ip route-cache
no ip mroute-cache
dialer in-band
dialer map ip 192.232.1.25 name isdn4
dialer map ip 192.232.1.33 name isdn5
dialer map ip 192.232.2.33 name async3
dialer map ip 192.232.1.41 name isdn6
dialer map ip 192.232.1.49 name isdn7
dialer map ip 192.232.1.57 name isdn8
dialer map ip 192.232.1.1 name isdn1
dialer map ip 192.232.2.1 async1
dialer map ip 192.232.1.9 name isdn2
dialer map ip 192.232.1.17 name isdn3
dialer-group 1
peer default ip address pool NAS5POOL
ppp authentication chap pap ms-chap
crypto map toISDN6
!
interface Dialer2
no ip address
no ip route-cache cef
no cdp enable
!
interface Dialer3
no ip address
no ip route-cache cef
no cdp enable
!
router rip
version 2
redistribute connected
passive-interface Dialer1
network 192.232.0.0
network 192.239.224.0
network 192.239.225.0
network 192.239.226.0
network 192.239.227.0
no auto-summary
!
ip local pool NAS5POOL 192.239.224.2 192.239.227.254
ip kerberos source-interface any
ip classless
ip route 112.0.0.0 255.0.0.0 192.250.3.2
ip route 122.0.0.0 255.0.0.0 192.250.3.2
ip route 191.0.0.0 255.0.0.0 131.3.81.61
ip route 192.232.1.0 255.255.255.248 192.232.1.1
ip route 192.232.1.8 255.255.255.248 192.232.1.9
ip route 192.232.1.16 255.255.255.248 192.232.1.17

```

```

ip route 192.232.1.24 255.255.255.248 192.232.1.25
ip route 192.232.1.32 255.255.255.248 192.232.1.33
ip route 192.232.1.40 255.255.255.248 192.232.1.41
ip route 192.232.1.40 255.255.255.248 Dialer1
ip route 192.232.150.0 255.255.255.0 192.250.3.2
ip route 192.236.2.0 255.255.255.0 192.250.3.2
ip route 192.236.8.0 255.255.248.0 192.250.3.2
ip route 192.236.32.0 255.255.248.0 192.250.3.2
ip route 192.236.48.0 255.255.248.0 192.250.3.2
ip route 192.250.3.0 255.255.255.248 192.232.0.38
ip route 192.250.3.0 255.255.255.248 192.232.0.44 100
ip route 223.255.254.0 255.255.255.0 Ethernet0/6/2
no ip http server
!
access-list 10 permit 192.232.0.0 0.0.255.255
access-list 10 permit 192.239.0.0 0.0.255.255
access-list 101 permit ip 192.232.0.32 0.0.0.7 192.232.1.40 0.0.0.7
access-list 102 permit ip 192.232.0.0 0.0.0.255 192.232.1.0 0.0.0.255
dialer-list 1 protocol ip permit
route-map FILTER permit 10
  match ip address 10
!
!
!
radius-server host 192.232.0.122 auth-port 1645 acct-port 1646
radius-server retransmit 5
radius-server key ciscolab
!
voice-port 1/0/0:D
!
voice-port 1/0/1:D
!
voice-port 1/0/2:D
!
voice-port 1/0/3:D
!
voice-port 1/0/4:D
!
voice-port 1/0/5:D
!
voice-port 1/0/6:D
!
voice-port 1/0/7:D
!
voice-port 1/0/8:D
!
voice-port 1/0/9:D
!
voice-port 1/0/10:D
!
voice-port 1/0/11:D
!
voice-port 1/1/0:1:D
!
voice-port 1/1/0:2:D
!
voice-port 1/1/0:3:D
!
voice-port 1/1/0:4:D
!
voice-port 1/1/0:5:D
!
voice-port 1/1/0:6:D
!

```

```
voice-port 1/1/0:7:D
!
voice-port 1/1/0:8:D
!
voice-port 1/1/0:9:D
!
voice-port 1/1/0:10:D
!
voice-port 1/1/0:11:D
!
voice-port 1/1/0:12:D
!
voice-port 1/1/0:13:D
!
voice-port 1/1/0:14:D
!
voice-port 1/1/0:15:D
!
voice-port 1/1/0:16:D
!
voice-port 1/1/0:17:D
!
voice-port 1/1/0:18:D
!
voice-port 1/1/0:19:D
!
voice-port 1/1/0:20:D
!
voice-port 1/1/0:21:D
!
voice-port 1/1/0:22:D
!
voice-port 1/1/0:23:D
!
voice-port 1/1/0:24:D
!
voice-port 1/1/0:28:D
!
dial-peer cor custom
!
!
!
!
line con 0
  exec-timeout 0 0
  login authentication NO_Auth
  transport input none
line aux 0
line vty 0 4
  password lab
  login authentication VTY
line 1/3/00 1/3/71
  exec-timeout 0 0
  activation-character 0
  disconnect-character 0
  autoselect during-login
  autoselect ppp
  script dialer dial
  modem InOut
  no modem log rs232
  transport preferred none
  transport input all
  escape-character soft 0
  escape-character 0
```

```

autohangup
hold-character 0
line 1/4/00 1/4/71
exec-timeout 0 0
activation-character 0
disconnect-character 0
autoselect during-login
autoselect ppp
script dialer dial
modem InOut
no modem log rs232
transport preferred none
transport input all
escape-character soft 0
escape-character 0
autohangup
hold-character 0
line 1/5/00 1/5/71
exec-timeout 0 0
activation-character 0
disconnect-character 0
autoselect during-login
autoselect ppp
script dialer dial
modem InOut
no modem log rs232
transport preferred none
transport input all
escape-character soft 0
escape-character 0
autohangup
hold-character 0
line 1/6/00 1/6/143
exec-timeout 0 0
activation-character 0
disconnect-character 0
autoselect during-login
autoselect ppp
script dialer dial
modem InOut
no modem log rs232
transport preferred none
transport input all
escape-character soft 0
escape-character 0
autohangup
hold-character 0
line 1/7/00 1/7/143
exec-timeout 0 0
activation-character 0
disconnect-character 0
autoselect during-login
autoselect ppp
script dialer dial
modem InOut
no modem log rs232
transport preferred none
transport input all
escape-character soft 0
escape-character 0
autohangup
hold-character 0
!
ntp clock-period 17180177

```

```
ntp update-calendar
ntp server 223.255.254.254 version 1
end
```

LNS Configuration

```
Current configuration : 37589 bytes
!
! Last configuration change at 13:00:31 PST Tue Oct 3 2000
! NVRAM config last updated at 17:15:00 PST Fri Sep 29 2000 by hkonardi
!
version 12.1
service timestamps debug datetime localtime show-timezone
service timestamps log datetime localtime show-timezone
no service password-encryption
service udp-small-servers
service tcp-small-servers
!
hostname ISP3AC5
!
boot system disk0:c7200-jo3s56i-mz.121-3.3
aaa new-model
aaa authentication login default local-case group tacacs+
aaa authentication login NO_Auth none
aaa authentication ppp default local group tacacs+
aaa authorization network default if-authenticated local group tacacs+
aaa accounting exec default start-stop group acacs+
enable password lab
!
!
!
username isdn-nas5-isp3 password 0 lab
username isp3ac5-hgw password 0 lab

!
!
clock timezone PST -8
clock summer-time PST recurring
ip subnet-zero
no ip finger
ip ftp username dial
ip ftp password dial
no ip domain-lookup
ip host tftpserv 223.255.254.254
!
ip multicast-routing
vpdn enable
no vpdn logging
!
vpdn-group 1
 accept-dialin
  protocol any
  virtual-template 1
 terminate-from hostname nas5-to-isp3
 local name isp3ac5-hgw
!
vpdn-group 2
 accept-dialin
  protocol any
  virtual-template 3
 terminate-from hostname isdn-nas5-isp3
 local name isp3ac5-hgw
```

```

!
vpdn-group 3
 accept-dialin
  protocol any
  virtual-template 3
 terminate-from hostname nas3
 local name isp3ac5-hgw
!
vpdn-group 4
 accept-dialin
  protocol any
  virtual-template 3
 terminate-from hostname isdn-nas2-isp3
 local name isp3ac5-hgw
!
vpdn-group 5
 accept-dialin
  protocol any
  virtual-template 2
 terminate-from hostname nas5-b2b
 local name isp3ac5-hgw
!
vpdn-group 6
 accept-dialin
  protocol any
  virtual-template 3
 terminate-from hostname nas1
 local name isp3ac5-hgw
!
!
!
crypto isakmp policy 1
 authentication pre-share
crypto isakmp key cisco123 address 192.232.1.25
crypto isakmp key cisco123 address 192.232.1.33
crypto isakmp key cisco123 address 192.232.1.57
!
!
crypto ipsec transform-set e2e ah-md5-hmac esp-des esp-md5-hmac
!
crypto map vpdn-isg 10 ipsec-isakmp
 set peer 192.232.1.25
 set transform-set e2e
 match address 102
crypto map vpdn-isg 20 ipsec-isakmp
 set peer 192.232.1.33
 set transform-set e2e
 match address 103
crypto map vpdn-isg 30 ipsec-isakmp
 set peer 192.232.1.57
 set transform-set e2e
 match address 104
!
cns event-service server
!
!
!
!
!
!
!
!
interface Loopback0

```

```
ip address 192.232.150.2 255.255.255.0 secondary
ip address 192.232.150.230 255.255.255.0 secondary
ip address 192.232.150.1 255.255.255.0
no ip route-cache
no ip mroute-cache
no logging event link-status
!
interface FastEthernet0/0
description "network to the Radius server - stss-ss20"
ip address 192.250.3.9 255.255.255.248
full-duplex
!
interface FastEthernet1/0
no ip address
full-duplex
bridge-group 1
!
interface FastEthernet1/1
no ip address
bridge-group 1
!
interface Ethernet1/2
no ip address
bridge-group 1
!
interface Ethernet1/3
no ip address
shutdown
!
interface Ethernet1/4
no ip address
shutdown
!
interface Ethernet1/5
no ip address
shutdown
!
interface Ethernet1/6
no ip address
shutdown
!
interface Ethernet1/7
no ip address
shutdown
!
interface Ethernet1/8
no ip address
shutdown
!
interface Ethernet1/9
no ip address
shutdown
!
interface Ethernet1/10
no ip address
shutdown
!
interface Ethernet1/11
no ip address
shutdown
!
interface Ethernet1/12
no ip address
shutdown
```

```

!
interface Ethernet1/13
  no ip address
  shutdown
!
interface FastEthernet3/0
  description To ISP3DA4, Fa5/1
  ip address 192.250.3.2 255.255.255.248
  no ip route-cache
  no ip mroute-cache
  half-duplex
!
interface FastEthernet4/0
  description "to IXIA 01/07/04, the pair of 01/07/03"
  ip address 192.236.8.1 255.255.248.0
  no ip route-cache
  no ip mroute-cache
  load-interval 30
  full-duplex
  no cdp enable
!
interface Ethernet5/0
  no ip address
  no ip route-cache
  no ip mroute-cache
  shutdown
  no cdp enable
!
interface Ethernet5/1
  description To BACKDOOR NETWORK
  ip address 223.255.243.128 255.255.240.0
  no cdp enable
!
interface Ethernet5/2
  no ip address
  shutdown
!
interface Ethernet5/3
  description "to IXIA 01/08/02, the pair of 01/08/01"
  ip address 192.236.32.1 255.255.248.0
  no ip route-cache
  no ip mroute-cache
  no cdp enable
!
interface Ethernet5/4
  description "to IXIA 01/07/01, the pair of 01/07/02"
  ip address 192.236.48.1 255.255.248.0
  no ip route-cache
  no ip mroute-cache
  no cdp enable
!
interface Ethernet5/5
  no ip address
!
interface Ethernet5/6
  no ip address
  shutdown
!
interface Ethernet5/7
  ip address 10.10.10.13 255.255.255.0
!
interface Virtual-Template1
  ip unnumbered FastEthernet3/0
  no keepalive

```

```
peer default ip address pool ISP3POOL
ppp authentication chap pap
!
interface Virtual-Template2
 ip unnumbered FastEthernet3/0
 no ip route-cache
 load-interval 30
 no keepalive
 peer default ip address pool ISP3POOL
 ppp authentication chap pap
!
interface Virtual-Template3
 ip unnumbered FastEthernet3/0
 no ip route-cache
 no keepalive
 ppp authentication chap pap
 crypto map vpdn-isg
!
ip local pool ISP3POOL 192.239.192.1 192.239.199.254
ip kerberos source-interface any
no ip classless
ip route 0.0.0.0 0.0.0.0 192.250.3.1
ip route 192.232.1.0 255.255.255.248 192.232.1.1
ip route 192.232.1.8 255.255.255.248 192.232.1.9
ip route 192.232.1.16 255.255.255.248 192.232.1.17
ip route 192.232.1.24 255.255.255.248 192.232.1.25
ip route 192.232.1.32 255.255.255.248 192.232.1.33
ip route 192.232.1.40 255.255.255.248 192.232.1.41
ip route 192.232.1.48 255.255.255.248 192.232.1.49
ip route 192.232.1.56 255.255.255.248 192.232.1.57
no ip http server
!
access-list 102 permit ip 192.250.3.0 0.0.0.7 192.232.1.24 0.0.0.7
access-list 103 permit ip 192.250.3.0 0.0.0.7 192.232.1.32 0.0.0.7
access-list 104 permit ip 192.250.3.0 0.0.0.7 192.232.1.56 0.0.0.7
snmp-server engineID local 00000009020000027D419C00
snmp-server community public RO
snmp-server community STSS RW
snmp-server packetsize 2048
snmp-server contact Mark Manzanares (mmanzana@cisco.com)
snmp-server chassis-id ISP3AC5
snmp-server enable traps snmp authentication linkdown linkup coldstart
snmp-server enable traps casa
snmp-server enable traps gtp
snmp-server enable traps isdn call-information
snmp-server enable traps isdn layer2
snmp-server enable traps channel
snmp-server enable traps snasw alert
snmp-server enable traps hsrp
snmp-server enable traps config
snmp-server enable traps entity
snmp-server enable traps envmon
snmp-server enable traps bgp
snmp-server enable traps ipmulticast
snmp-server enable traps rsvp
snmp-server enable traps frame-relay
snmp-server enable traps syslog
snmp-server enable traps rtr
snmp-server enable traps dlsr
snmp-server enable traps dial
snmp-server enable traps voice poor-qov
snmp-server enable traps xgcp
!
tacacs-server host 223.255.254.254
```

```

tacacs-server key cisco12345
bridge 1 protocol ieee
!
alias exec int_desc show int | include Description
alias exec cpu show proc cpu | include CPU
alias exec mem show mem free | include Processor
!
line con 0
  exec-timeout 0 0
  login authentication NO_Auth
  transport input none
line aux 0
  exec-timeout 0 0
line vty 0 4
  exec-timeout 0 0
  password lab
line vty 5 15
  password lab
!
exception protocol ftp
exception region-size 36864
exception flash all disk0:
ntp clock-period 17180166
ntp update-calendar
ntp server 223.255.254.254 version 1
end

```

LNS TACACS+ Server Configuration

```

user = isdn4@isp3-2com{
  password = chap "lab"
  service=ppp {
    protocol=lcp {
    }
    protocol=ip {
    }
  }
}

```

Debug Output

The following sections shows debug output from successful IPsec negotiation between the peer and LNS:

- Peer Debug Output from Successful IPsec Negotiation
- LNS Debug Output From Successful IPsec Negotiation

Peer Debug Output from Successful IPsec Negotiation

```

isdn4#show debug
Cryptographic Subsystem:
  Crypto ISAKMP debugging is on
  Crypto Engine debugging is on
  Crypto IPSEC debugging is on
isdn4#
isdn4#
*Mar  1 16:22:53 PDT: IPSEC(sa_request): ,
  (key eng. msg.) src= 192.232.1.25, dest= 192.250.3.2,
  src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
  dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
  protocol= AH, transform= ah-md5-hmac ,
  lifedur= 3600s and 4608000kb,
  spi= 0x87E2ABDD(2279779293), conn_id= 0, keysize= 0, flags= 0x4004
*Mar  1 16:22:53 PDT: IPSEC(sa_request): ,
  (key eng. msg.) src= 192.232.1.25, dest= 192.250.3.2,
  src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
  dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
  protocol= ESP, transform= esp-des esp-md5-hmac ,
  lifedur= 3600s and 4608000kb,
  spi= 0x9400618(155190808), conn_id= 0, keysize= 0, flags= 0x4004
*Mar  1 16:22:53 PDT: ISAKMP: received ke message (1/2)
*Mar  1 16:22:53 PDT: ISAKMP: local port 500, remote port 500
*Mar  1 16:22:53 PDT: ISAKMP (0:1): beginning Main Mode exchange
*Mar  1 16:22:53 PDT: ISAKMP (0:1): sending packet to 192.250.3.2 (I) MM_NO_STATE
.
*Mar  1 16:22:56 PDT: %LINK-3-UPDOWN: Interface BRI0:1, changed state to up.
*Mar  1 16:22:56 PDT: %DIALER-6-BIND: Interface BR0:1 bound to profile Di6...
Success rate is 0 percent (0/5)
isdn4#
*Mar  1 16:23:02 PDT: %ISDN-6-CONNECT: Interface BRI0:1 is now connected to 50127
unknown
*Mar  1 16:23:02 PDT: %LINEPROTO-5-UPDOWN: Line protocol on Interface BRI0:1, cha
nged state to up
*Mar  1 16:23:02 PDT: %CRYPTO-4-RECV_PKT_INV_SPI: decaps: rec'd IPSEC packet has
invalid spi for
  destaddr=192.232.1.25, prot=51, spi=0x1C080522(470287650)
*Mar  1 16:23:03 PDT: ISAKMP (0:1): retransmitting phase 1 MM_NO_STATE...
*Mar  1 16:23:03 PDT: ISAKMP (0:1): incrementing error counter on sa: retransmit
phase 1
*Mar  1 16:23:03 PDT: ISAKMP (0:1): retransmitting phase 1 MM_NO_STATE
*Mar  1 16:23:03 PDT: ISAKMP (0:1): sending packet to 192.250.3.2 (I) MM_NO_STATE
*Mar  1 16:23:03 PDT: ISAKMP (0:1): received packet from 192.250.3.2 (I) MM_NO_ST
ATE
*Mar  1 16:23:03 PDT: ISAKMP (0:1): processing SA payload. message ID = 0
*Mar  1 16:23:03 PDT: ISAKMP (0:1): found peer pre-shared key matching 192.250.3.
2
*Mar  1 16:23:03 PDT: ISAKMP (0:1): Checking ISAKMP transform 1 against priority
1 policy
*Mar  1 16:23:03 PDT: ISAKMP:          encryption DES-CBC

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*Mar 1 16:23:03 PDT: ISAKMP:      hash SHA
*Mar 1 16:23:03 PDT: ISAKMP:      default group 1
*Mar 1 16:23:03 PDT: ISAKMP:      auth pre-share
*Mar 1 16:23:03 PDT: ISAKMP (0:1): atts are acceptable. Next payload is 0
*Mar 1 16:23:03 PDT: CryptoEngine0: generate alg parameter
*Mar 1 16:23:03 PDT: CRYPTO_ENGINE: Dh phase 1 status: 0
*Mar 1 16:23:03 PDT: CRYPTO_ENGINE: Dh phase 1 status: 0
*Mar 1 16:23:03 PDT: ISAKMP (0:1): SA is doing pre-shared key authentication using id type ID_IPV4_ADDR
*Mar 1 16:23:03 PDT: ISAKMP (0:1): sending packet to 192.250.3.2 (I) MM_SA_SETUP
*Mar 1 16:23:03 PDT: ISAKMP (0:1): received packet from 192.250.3.2 (I) MM_SA_SETUP
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing KE payload. message ID = 0
*Mar 1 16:23:03 PDT: CryptoEngine0: generate alg parameter
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing NONCE payload. message ID = 0
*Mar 1 16:23:03 PDT: ISAKMP (0:1): found peer pre-shared key matching 192.250.3.2
*Mar 1 16:23:03 PDT: CryptoEngine0: create ISAKMP SKEYID for conn id 1
*Mar 1 16:23:03 PDT: ISAKMP (0:1): SKEYID state generated
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing vendor id payload
*Mar 1 16:23:03 PDT: ISAKMP (0:1): speaking to another IOS box!
*Mar 1 16:23:03 PDT: ISAKMP (1): ID payload
      next-payload : 8
      type          : 1
      protocol      : 17
      port          : 500
      length        : 8
*Mar 1 16:23:03 PDT: ISAKMP (1): Total payload length: 12
*Mar 1 16:23:03 PDT: CryptoEngine0: generate hmac context for conn id 1
*Mar 1 16:23:03 PDT: ISAKMP (0:1): sending packet to 192.250.3.2 (I) MM_KEY_EXCH
*Mar 1 16:23:03 PDT: ISAKMP (0:1): received packet from 192.250.3.2 (I) MM_KEY_EXCH
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing ID payload. message ID = 0
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing HASH payload. message ID = 0
*Mar 1 16:23:03 PDT: CryptoEngine0: generate hmac context for conn id 1
*Mar 1 16:23:03 PDT: ISAKMP (0:1): SA has been authenticated with 192.250.3.2
*Mar 1 16:23:03 PDT: ISAKMP (0:1): beginning Quick Mode exchange, M-ID of 211899060
*Mar 1 16:23:03 PDT: CryptoEngine0: generate hmac context for conn id 1
*Mar 1 16:23:03 PDT: ISAKMP (0:1): sending packet to 192.250.3.2 (I) QM_IDLE

*Mar 1 16:23:03 PDT: CryptoEngine0: clear dh number for conn id 1
*Mar 1 16:23:03 PDT: ISAKMP (0:1): received packet from 192.250.3.2 (I) QM_IDLE

*Mar 1 16:23:03 PDT: CryptoEngine0: generate hmac context for conn id 1
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing HASH payload. message ID = 211899060
*Mar 1 16:23:03 PDT: ISAKMP (0:1): processing SA payload. message ID = 211899060
*Mar 1 16:23:03 PDT: ISAKMP (0:1): Checking IPSec proposal 1
*Mar 1 16:23:03 PDT: ISAKMP: transform 1, AH_MD5
*Mar 1 16:23:03 PDT: ISAKMP:      attributes in transform:
*Mar 1 16:23:03 PDT: ISAKMP:      encaps is 1
*Mar 1 16:23:03 PDT: ISAKMP:      SA life type in seconds
*Mar 1 16:23:03 PDT: ISAKMP:      SA life duration (basic) of 3600
*Mar 1 16:23:03 PDT: ISAKMP:      SA life type in kilobytes
*Mar 1 16:23:03 PDT: ISAKMP:      SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Mar 1 16:23:03 PDT: ISAKMP:      authenticator is HMAC-MD5
*Mar 1 16:23:03 PDT: validate proposal 0
*Mar 1 16:23:03 PDT: ISAKMP (0:1): atts are acceptable.
*Mar 1 16:23:03 PDT: ISAKMP (0:1): Checking IPSec proposal 1
*Mar 1 16:23:03 PDT: ISAKMP: transform 1, ESP_DES
*Mar 1 16:23:03 PDT: ISAKMP:      attributes in transform:
*Mar 1 16:23:03 PDT: ISAKMP:      encaps is 1
*Mar 1 16:23:03 PDT: ISAKMP:      SA life type in seconds

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*Mar 1 16:23:03 PDT: ISAKMP: SA life duration (basic) of 3600
*Mar 1 16:23:03 PDT: ISAKMP: SA life type in kilobytes
*Mar 1 16:23:03 PDT: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Mar 1 16:23:03 PDT: ISAKMP: authenticator is HMAC-MD5
*Mar 1 16:23:03 PDT: validate proposal 0
*Mar 1 16:23:03 PDT: ISAKMP (0:1): atts are acceptable.
*Mar 1 16:23:03 PDT: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) dest= 192.250.3.2, src= 192.232.1.25,
dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
protocol= AH, transform= ah-md5-hmac ,
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4
*Mar 1 16:23:03 PDT: IPSEC(validate_proposal_request): proposal part #2,
(key eng. msg.) dest= 192.250.3.2, src= 192.232.1.25,
dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4
*Mar 1 16:23:03 PDT: validate proposal request 0
*Mar 1 16:23:04 PDT: ISAKMP (0:1): processing NONCE payload. message ID = 211899
060
*Mar 1 16:23:04 PDT: ISAKMP (0:1): processing ID payload. message ID = 211899060
*Mar 1 16:23:04 PDT: ISAKMP (0:1): processing ID payload. message ID = 211899060
*Mar 1 16:23:04 PDT: CryptoEngine0: generate hmac context for conn id 1
*Mar 1 16:23:04 PDT: ipsec allocate flow 0
*Mar 1 16:23:04 PDT: ipsec allocate flow 0
*Mar 1 16:23:04 PDT: ISAKMP (0:1): Creating IPSec SAs
*Mar 1 16:23:04 PDT: inbound SA from 192.250.3.2 to 192.232.1.25
(proxy 192.250.3.0 to 192.232.1.24)
*Mar 1 16:23:04 PDT: has spi 0x87E2ABDD and conn_id 2000 and flags 4
*Mar 1 16:23:04 PDT: lifetime of 3600 seconds
*Mar 1 16:23:04 PDT: lifetime of 4608000 kilobytes
*Mar 1 16:23:04 PDT: outbound SA from 192.232.1.25 to 192.250.3.2
(proxy 192.232.1.24 to 192.250.3.0 )
*Mar 1 16:23:04 PDT: has spi -213910971 and conn_id 2001 and flags 4
*Mar 1 16:23:04 PDT: lifetime of 3600 seconds
*Mar 1 16:23:04 PDT: lifetime of 4608000 kilobytes
*Mar 1 16:23:04 PDT: ISAKMP (0:1): Creating IPSec SAs
*Mar 1 16:23:04 PDT: inbound SA from 192.250.3.2 to 192.232.1.25
(proxy 192.250.3.0 to 192.232.1.24)
*Mar 1 16:23:04 PDT: has spi 0x9400618 and conn_id 2002 and flags 4
*Mar 1 16:23:04 PDT: lifetime of 3600 seconds
*Mar 1 16:23:04 PDT: lifetime of 4608000 kilobytes
*Mar 1 16:23:04 PDT: outbound SA from 192.232.1.25 to 192.250.3.2
(proxy 192.232.1.24 to 192.250.3.0 )
*Mar 1 16:23:04 PDT: has spi -1518012306 and conn_id 2003 and flags 4
*Mar 1 16:23:04 PDT: lifetime of 3600 seconds
*Mar 1 16:23:04 PDT: lifetime of 4608000 kilobytes
*Mar 1 16:23:04 PDT: ISAKMP (0:1): sending packet to 192.250.3.2 (I) QM_IDLE

*Mar 1 16:23:04 PDT: ISAKMP (0:1): deleting node 211899060 error FALSE reason ""
*Mar 1 16:23:04 PDT: IPSEC(key_engine): got a queue event...
*Mar 1 16:23:04 PDT: IPSEC(initialize_sas): ,
(key eng. msg.) dest= 192.232.1.25, src= 192.250.3.2,
dest_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
src_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
protocol= AH, transform= ah-md5-hmac ,
lifedur= 3600s and 4608000kb,
spi= 0x87E2ABDD(2279779293), conn_id= 2000, keysize= 0, flags= 0x4
*Mar 1 16:23:04 PDT: IPSEC(initialize_sas): ,
(key eng. msg.) src= 192.232.1.25, dest= 192.250.3.2,
src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),

```

```

dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
protocol= AH, transform= ah-md5-hmac ,
lifedur= 3600s and 4608000kb,
spi= 0xF33FFA45(4081056325), conn_id= 2001, keysize= 0, flags= 0x4
*Mar  1 16:23:04 PDT: IPSEC(initialize_sas): ,
(key eng. msg.) dest= 192.232.1.25, src= 192.250.3.2,
dest_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
src_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 3600s and 4608000kb,
spi= 0x9400618(155190808), conn_id= 2002, keysize= 0, flags= 0x4
*Mar  1 16:23:04 PDT: IPSEC(initialize_sas): ,
(key eng. msg.) src= 192.232.1.25, dest= 192.250.3.2,
src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 3600s and 4608000kb,
spi= 0xA584F86E(2776954990), conn_id= 2003, keysize= 0, flags= 0x4
*Mar  1 16:23:04 PDT: IPSEC(create_sa): sa created,
(sa) sa_dest= 192.232.1.25, sa_prot= 51,
sa_spi= 0x87E2ABDD(2279779293),
sa_trans= ah-md5-hmac , sa_conn_id= 2000
*Mar  1 16:23:04 PDT: IPSEC(create_sa): sa created,
(sa) sa_dest= 192.250.3.2, sa_prot= 51,
sa_spi= 0xF33FFA45(4081056325),
sa_trans= ah-md5-hmac , sa_conn_id= 2001
*Mar  1 16:23:04 PDT: IPSEC(create_sa): sa created,
(sa) sa_dest= 192.232.1.25, sa_prot= 50,
sa_spi= 0x9400618(155190808),
sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2002
*Mar  1 16:23:04 PDT: IPSEC(create_sa): sa created,
(sa) sa_dest= 192.250.3.2, sa_prot= 50,
sa_spi= 0xA584F86E(2776954990),
sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2003
isdn4#

```

LNS Debug Output From Successful IPSec Negotiation

```

ISP3AC5#show debug
Cryptographic Subsystem:
  Crypto ISAKMP debugging is on
  Crypto Engine debugging is on
  Crypto Key Exchange debugging is on
  Crypto IPSEC debugging is on
ISP3AC5#
ISP3AC5#
Oct  3 13:05:41 PST: %LINK-3-UPDOWN: Interface Virtual-Access152, changed state t
o up
Oct  3 13:05:47 PST: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Acce
ss152, changed state to up
Oct  3 13:05:48 PST: ISAKMP (0:0): received packet from 192.232.1.25 (N) NEW SA
Oct  3 13:05:48 PST: ISAKMP: local port 500, remote port 500
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing SA payload. message ID = 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): found peer pre-shared key matching 192.232.
1.25
Oct  3 13:05:48 PST: ISAKMP (0:1365): Checking ISAKMP transform 1 against priorit
y 1 policy
Oct  3 13:05:48 PST: ISAKMP:          encryption DES-CBC
Oct  3 13:05:48 PST: ISAKMP:          hash SHA
Oct  3 13:05:48 PST: ISAKMP:          default group 1
Oct  3 13:05:48 PST: ISAKMP:          auth pre-share
Oct  3 13:05:48 PST: ISAKMP (0:1365): atts are acceptable. Next payload is 0

```

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Oct  3 13:05:48 PST: CryptoEngine0: generate alg parameter
Oct  3 13:05:48 PST: CRYPTO_ENGINE: Dh phase 1 status: 0
Oct  3 13:05:48 PST: CRYPTO_ENGINE: Dh phase 1 status: 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): SA is doing pre-shared key authentication u
sing id type ID_IPV4_ADDR
Oct  3 13:05:48 PST: ISAKMP (0:1365): sending packet to 192.232.1.25 (R) MM_SA_SE
TUP
Oct  3 13:05:48 PST: ISAKMP (0:1365): received packet from 192.232.1.25 (R) MM_SA
_SETUP
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing KE payload. message ID = 0
Oct  3 13:05:48 PST: CryptoEngine0: generate alg parameter
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing NONCE payload. message ID = 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): found peer pre-shared key matching 192.232.
1.25
Oct  3 13:05:48 PST: CryptoEngine0: create ISAKMP SKEYID for conn id 1365
Oct  3 13:05:48 PST: ISAKMP (0:1365): SKEYID state generated
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing vendor id payload
Oct  3 13:05:48 PST: ISAKMP (0:1365): speaking to another IOS box!
Oct  3 13:05:48 PST: ISAKMP (0:1365): sending packet to 192.232.1.25 (R) MM_KEY_E
XCH
Oct  3 13:05:48 PST: ISAKMP (0:1365): received packet from 192.232.1.25 (R) MM_KEY
_EXCH
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing ID payload. message ID = 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing HASH payload. message ID = 0
Oct  3 13:05:48 PST: CryptoEngine0: generate hmac context for conn id 1365
Oct  3 13:05:48 PST: ISAKMP (0:1365): SA has been authenticated with 192.232.1.25
Oct  3 13:05:48 PST: ISAKMP (1365): ID payload
      next-payload : 8
      type          : 1
      protocol      : 17
      port          : 500
      length        : 8
Oct  3 13:05:48 PST: ISAKMP (1365): Total payload length: 12
Oct  3 13:05:48 PST: CryptoEngine0: generate hmac context for conn id 1365
Oct  3 13:05:48 PST: CryptoEngine0: clear dh number for conn id 1
Oct  3 13:05:48 PST: ISAKMP (0:1365): sending packet to 192.232.1.25 (R) QM_IDLE

Oct  3 13:05:48 PST: ISAKMP (0:1365): received packet from 192.232.1.25 (R) QM_ID
LE
Oct  3 13:05:48 PST: CryptoEngine0: generate hmac context for conn id 1365
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing HASH payload. message ID = 21189
9060
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing SA payload. message ID = 2118990
60
Oct  3 13:05:48 PST: ISAKMP (0:1365): Checking IPSec proposal 1
Oct  3 13:05:48 PST: ISAKMP: transform 1, AH_MD5
Oct  3 13:05:48 PST: ISAKMP:   attributes in transform:
Oct  3 13:05:48 PST: ISAKMP:     encaps is 1
Oct  3 13:05:48 PST: ISAKMP:     SA life type in seconds
Oct  3 13:05:48 PST: ISAKMP:     SA life duration (basic) of 3600
Oct  3 13:05:48 PST: ISAKMP:     SA life type in kilobytes
Oct  3 13:05:48 PST: ISAKMP:     SA life duration (VPI) of  0x0 0x46 0x50 0x0
Oct  3 13:05:48 PST: ISAKMP:     authenticator is HMAC-MD5
Oct  3 13:05:48 PST: validate proposal 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): atts are acceptable.
Oct  3 13:05:48 PST: ISAKMP (0:1365): Checking IPSec proposal 1
Oct  3 13:05:48 PST: ISAKMP: transform 1, ESP_DES
Oct  3 13:05:48 PST: ISAKMP:   attributes in transform:
Oct  3 13:05:48 PST: ISAKMP:     encaps is 1
Oct  3 13:05:48 PST: ISAKMP:     SA life type in seconds
Oct  3 13:05:48 PST: ISAKMP:     SA life duration (basic) of 3600
Oct  3 13:05:48 PST: ISAKMP:     SA life type in kilobytes
Oct  3 13:05:48 PST: ISAKMP:     SA life duration (VPI) of  0x0 0x46 0x50 0x0
Oct  3 13:05:48 PST: ISAKMP:     authenticator is HMAC-MD5

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Oct  3 13:05:48 PST: validate proposal 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): atts are acceptable.
Oct  3 13:05:48 PST: IPSEC(validate_proposal_request): proposal part #1,
    (key eng. msg.) dest= 192.250.3.2, src= 192.232.1.25,
    dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
    protocol= AH, transform= ah-md5-hmac ,
    lifedur= 0s and 0kb,
    spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4
Oct  3 13:05:48 PST: IPSEC(validate_proposal_request): proposal part #2,
    (key eng. msg.) dest= 192.250.3.2, src= 192.232.1.25,
    dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 0s and 0kb,
    spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4
Oct  3 13:05:48 PST: validate proposal request 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing NONCE payload. message ID = 2118
99060
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing ID payload. message ID = 2118990
60
Oct  3 13:05:48 PST: ISAKMP (1365): ID_IPV4_ADDR_SUBNET src 192.232.1.24/255.255.
255.248 prot 0 port 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): processing ID payload. message ID = 2118990
60
Oct  3 13:05:48 PST: ISAKMP (1365): ID_IPV4_ADDR_SUBNET dst 192.250.3.0/255.255.2
55.248 prot 0 port 0
Oct  3 13:05:48 PST: ISAKMP (0:1365): asking for 2 spis from ipsec
Oct  3 13:05:48 PST: IPSEC(key_engine): got a queue event...
Oct  3 13:05:48 PST: IPSEC(spi_response): getting spi 4081056325 for SA
    from 192.232.1.25    to 192.250.3.2    for prot 2
Oct  3 13:05:48 PST: IPSEC(spi_response): getting spi 2776954990 for SA
    from 192.232.1.25    to 192.250.3.2    for prot 3
Oct  3 13:05:48 PST: ISAKMP: received ke message (2/2)
Oct  3 13:05:49 PST: CryptoEngine0: generate hmac context for conn id 1365
Oct  3 13:05:49 PST: ISAKMP (0:1365): sending packet to 192.232.1.25 (R) QM_IDLE

Oct  3 13:05:49 PST: ISAKMP (0:1365): received packet from 192.232.1.25 (R) QM_ID
LE
Oct  3 13:05:49 PST: CryptoEngine0: generate hmac context for conn id 1365
Oct  3 13:05:49 PST: ipsec allocate flow 0
Oct  3 13:05:49 PST: ipsec allocate flow 0
Oct  3 13:05:49 PST: ISAKMP (0:1365): Creating IPSec SAs
Oct  3 13:05:49 PST:      inbound SA from 192.232.1.25 to 192.250.3.2
    (proxy 192.232.1.24 to 192.250.3.0)
Oct  3 13:05:49 PST:      has spi 0xF33FFA45 and conn_id 2218 and flags 4
Oct  3 13:05:49 PST:      lifetime of 3600 seconds
Oct  3 13:05:49 PST:      lifetime of 4608000 kilobytes
Oct  3 13:05:49 PST:      outbound SA from 192.250.3.2    to 192.232.1.25
    (proxy 192.250.3.0    to 192.232.1.24    )
Oct  3 13:05:49 PST:      has spi -2015188003 and conn_id 2219 and flags 4
Oct  3 13:05:49 PST:      lifetime of 3600 seconds
Oct  3 13:05:49 PST:      lifetime of 4608000 kilobytes
Oct  3 13:05:49 PST: ISAKMP (0:1365): Creating IPSec SAs
Oct  3 13:05:49 PST:      inbound SA from 192.232.1.25 to 192.250.3.2
    (proxy 192.232.1.24 to 192.250.3.0)
Oct  3 13:05:49 PST:      has spi 0xA584F86E and conn_id 2220 and flags 4
Oct  3 13:05:49 PST:      lifetime of 3600 seconds
Oct  3 13:05:49 PST:      lifetime of 4608000 kilobytes
Oct  3 13:05:49 PST:      outbound SA from 192.250.3.2    to 192.232.1.25
    (proxy 192.250.3.0    to 192.232.1.24    )
Oct  3 13:05:49 PST:      has spi 155190808 and conn_id 2221 and flags 4
Oct  3 13:05:49 PST:      lifetime of 3600 seconds
Oct  3 13:05:49 PST:      lifetime of 4608000 kilobytes

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Oct  3 13:05:49 PST: ISAKMP (0:1365): deleting node 211899060 error FALSE reason
"quick mode done (await())"
Oct  3 13:05:49 PST: IPSEC(key_engine): got a queue event...
Oct  3 13:05:49 PST: IPSEC(initialize_sas): ,
    (key eng. msg.) dest= 192.250.3.2, src= 192.232.1.25,
    dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
    protocol= AH, transform= ah-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0xF33FFA45(4081056325), conn_id= 2218, keysizes= 0, flags= 0x4
Oct  3 13:05:49 PST: IPSEC(initialize_sas): ,
    (key eng. msg.) src= 192.250.3.2, dest= 192.232.1.25,
    src_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    dest_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
    protocol= AH, transform= ah-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0x87E2ABDD(2279779293), conn_id= 2219, keysizes= 0, flags= 0x4
Oct  3 13:05:49 PST: IPSEC(initialize_sas): ,
    (key eng. msg.) dest= 192.250.3.2, src= 192.232.1.25,
    dest_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    src_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0xA584F86E(2776954990), conn_id= 2220, keysizes= 0, flags= 0x4
Oct  3 13:05:49 PST: IPSEC(initialize_sas): ,
    (key eng. msg.) src= 192.250.3.2, dest= 192.232.1.25,
    src_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    dest_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0x9400618(155190808), conn_id= 2221, keysizes= 0, flags= 0x4
Oct  3 13:05:49 PST: IPSEC(create_sa): sa created,
    (sa) sa_dest= 192.250.3.2, sa_prot= 51,
    sa_spi= 0xF33FFA45(4081056325),
    sa_trans= ah-md5-hmac , sa_conn_id= 2218
Oct  3 13:05:49 PST: IPSEC(create_sa): sa created,
    (sa) sa_dest= 192.232.1.25, sa_prot= 51,
    sa_spi= 0x87E2ABDD(2279779293),
    sa_trans= ah-md5-hmac , sa_conn_id= 2219
Oct  3 13:05:49 PST: IPSEC(create_sa): sa created,
    (sa) sa_dest= 192.250.3.2, sa_prot= 50,
    sa_spi= 0xA584F86E(2776954990),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2220
Oct  3 13:05:49 PST: IPSEC(create_sa): sa created,
    (sa) sa_dest= 192.232.1.25, sa_prot= 50,
    sa_spi= 0x9400618(155190808),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2221
Oct  3 13:05:49 PST: IPSEC(add_sa): peer asks for new SAs -- expire current in 12
0 sec.,
    (sa) sa_dest= 192.232.1.25, sa_prot= 50,
    sa_spi= 0xE1DAEAC0(3789220544),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2213,
    (identity) local= 192.250.3.2, remote= 192.232.1.25,
    local_proxy= 192.250.3.0/255.255.255.248/0/0 (type=4),
    remote_proxy= 192.232.1.24/255.255.255.248/0/0 (type=4)

```

Related Documents

- IPSec Overview:
http://www.cisco.com/warp/customer/cc/techno/protocol/ipsecur/prodlit/ipsec_ov.htm
- IPSec White Paper:
http://www.cisco.com/warp/customer/cc/techno/protocol/ipsecur/ipsec/tech/ipsec_wp.htm
- Securing L2TP Using IPSec: <http://search.ietf.org/internet-drafts/draft-ietf-l2tpext-security-01.txt>
- Configuring IPSec Network Security:
http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/secur_c/scprt4/scdipse.htm
- IPSec Network Security Commands:
http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/secur_r/srprt4/srdipse.htm
- Configuring Internet Key Exchange Security Protocol:
http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/secur_c/scprt4/scdike.htm
- Internet Key Exchange Security Protocol Commands:
http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/secur_r/srprt4/srdike.htm
- L2TP over IPSec configurations for IPSec between the LAC and LNS:
<http://www.cisco.com/warp/public/707/24.html>