

CCNP ISCW Portable Command Guide

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Scott Empson
Hans Roth



CCNP ISCW Portable Command Guide

**Scott Empson
Hans Roth**

Cisco Press

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Scott Empson, Hans Roth

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This book is designed to provide information about the Cisco Certified Network Professional (CCNP) Implementing Secure Converged Wide Area Networks (ISCW) exam (642-825) and the commands needed at this level of network administration. Every effort has been made to make this book as complete and as accurate as possible, but no warranty or fitness is implied.

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 Cisco Systems, Inc.
 170 West Tasman Drive
 San Jose, CA 95134-1706
 USA
www.cisco.com
 Tel: 408 526-4000
 800 553-NETS (6387)
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 Cisco Systems International BV
 Haarlerbergpark
 Haarlerbergweg 13-19
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Americas Headquarters
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About the Authors

Scott Empson is the associate chair of the bachelor of applied information systems technology degree program at the Northern Alberta Institute of Technology in Edmonton, Alberta, Canada, where he teaches Cisco routing, switching, and network design courses in a variety of different programs—certificate, diploma, and applied degree—at the post-secondary level. Scott is also the program coordinator of the Cisco Networking Academy at NAIT, a Regional Academy covering central and northern Alberta. He has earned three undergraduate degrees: a bachelor of arts, with a major in English; a bachelor of education, again with a major in English/language arts; and a bachelor of applied information systems technology, with a major in network management. He currently holds several industry certifications, including CCNP, CCAI, and Network+. Prior to instructing at NAIT, he was a junior/senior high school English/language arts/computer science teacher at different schools throughout northern Alberta. Scott lives in Edmonton, Alberta, with his wife Trina and two children Zachariah and Shaelyn, where he enjoys reading and training in the martial art of tae kwon do.

Hans Roth is an instructor in the Electrical/Electronic Engineering Technology department at Red River College in Winnipeg, Manitoba, Canada. Hans has been with the college for 11 years and teaches in both the electronic technology and IT areas. He has been with the Cisco Networking Academy since 2000, teaching CCNP curricula. Previous to teaching Hans spent 15 years in R&D/product development designing microcontroller-based control systems for consumer products as well as for the automotive and agricultural industries.

About the Technical Reviewer

Neil Lovering, CCIE No. 1772, works as a design consultant for Cisco. Neil has been with Cisco for more than three years and works on large-scale government networking solutions projects. Prior to Cisco, Neil was a network consultant and instructor for more than eight years and worked on various routing, switching, remote connectivity, and security projects for many customers all over North America.

Dedications

This book is dedicated to Trina, Zach, and Shae, without whom I couldn't have made it through those long nights of writing and editing.

—*Scott Empson*

I'd like to dedicate this book to my wife Carol and daughter Tess. I am thankful for their grace and patience with me during my many hours in the basement.

I'd also like to dedicate this book to my wife Carol. I'm hopeful two dedications are worth more than one.

—*Hans Roth*

Acknowledgments

Anyone who has ever had anything to do with the publishing industry knows that it takes many, many people to create a book. Our names may be on the cover, but there is no way that we can take credit for all that occurred in order to get this book from idea to publication. Therefore, we must thank:

From Scott Empson: To the team at Cisco Press, once again you amaze me with your professionalism and the ability to make me look good. Mary Beth, Chris, Patrick, Drew, San Dee, Bill, and Dayna—thank you for your continued support and belief in my little engineering journal.

To my technical reviewer, Neil, thanks for keeping me on track and making sure that what I wrote was correct and relevant.

To the staff of the Cisco office here in Edmonton, thanks for putting up with me and my continued requests to borrow equipment for development and validation of the concepts in this book.

A big thank you goes to my coauthor, Hans Roth, for helping me through this with all of your technical expertise and willingness to assist in trying to make my ideas a reality.

From Hans Roth: I don't exactly know how many people it takes to get a book on the shelf. The content must be written, the graphics drawn, each section verified technically, each part massaged in editing, the presentation layout manipulated and re-edited, and the pre- and post-press work completed, including the many marketing efforts. Of course, this process includes the organization and patience of the editor and editorial staff. Certainly, the writing part is only one effort in a large collection of efforts.

To the Cisco Press team, thank you for your patience and guidance—especially you, Mary Beth.

To the technical reviewer, Neil Lovering—thanks.

Lastly I would like to thank my colleague in education and cowriter, Scott Empson. Scott's boundless energy has helped me refocus when I needed to. Scott's positive attitude, tempered with his vast experience in education and technical areas, was an excellent rudder to help me stay on course. Finally, Scott's experience with the process of writing for Cisco Press saved me from many of the "newbie" writer foibles. Thank you Scott for freely sharing your experience with me.

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Icons Used in This Book



PC



Router

Workgroup
Switch

Firewall



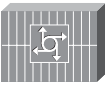
PIX Firewall



DSLAM



File Server

Access
Server

IP Phone

Cisco 5500
FamilyVPN
Concentrator

Modem

Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the *IOS Command Reference*. The *Command Reference* describes these conventions as follows:

- **Boldface** indicates commands and keywords that are entered literally as shown. In actual configuration examples and output (not general command syntax), boldface indicates commands that are manually input by the user (such as a **show** command).
- *Italics* indicate arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets [] indicate optional elements.
- Braces { } indicate a required choice.
- Braces within brackets [{ }] indicate a required choice within an optional element.

Introduction

Welcome to ISCW! In 2006, Cisco Press contacted Scott and told him, albeit very quietly, that there was going to be a major revision of the CCNP certification exams. They then asked whether he would be interested in working on a command guide in the same fashion as his previous books for Cisco Press: the Cisco Networking Academy Program *CCNA Command Quick Reference* and the *CCNA Portable Command Guide*. The original idea was to create a single-volume command summary for all four of the new CCNP exams. However, early on in his research, Scott quickly discovered that there was far too much information in the four exams to create a single volume—that would have resulted in a book that was neither portable nor quick as a reference. So, Scott jokingly suggested that Cisco Press let him author four books, one for each exam. Well, you have to be careful what you wish for, because Cisco Press readily agreed. Realizing that this was going to be too much for one part-time author to handle, Scott quickly got his colleague Hans Roth on board as a coauthor.

This book is the third in a four-volume set that attempts to summarize the commands and concepts that you need to understand to pass one of the CCNP certification exams—in this case, the Implementing Secure Converged WANs exam. It follows the format of Scott's previous books, which are in fact a cleaned-up version of his own personal engineering journal—a small notebook that you can carry around that contains little nuggets of information such as commands that you tend to forget, the IP addressing scheme of some remote part of the network, and little reminders about how to do something you need to do only once or twice a year that is vital to the integrity and maintenance of your network.

With the creation of two brand-new CCNP exams, the amount of new information out there is growing on an almost daily basis. There is always a new white paper to read, a new Webinar to view, another slideshow from a Networkers session that was never attended. The engineering journal can be that central repository of information that won't weigh you down as you carry it from the office or cubicle to the server and infrastructure room in some branch office.

To make this guide a more realistic one for you to use, the folks at Cisco Press have decided to continue with an appendix of blank pages—pages on which you can write your own personal notes, such as your own configurations, commands that are not in this book but are needed in your world, and so on. That way this book will look less like the authors' journals and more like your own.

Networking Devices Used in the Preparation of This Book

To verify the commands in this book, many different devices were used. The following is a list of the equipment used in the writing of this book:

- C2620 router running Cisco IOS Release 12.3(7)T, with a fixed Fast Ethernet interface, a WIC-2A/S serial interface card, and an NM-1E Ethernet interface
- C2811 ISR bundle with PVD M2, CMME, a WIC-2T, FXS and FXO VICs, running Cisco IOS Release 12.4(3g)
- C2821 ISR bundle with HWICD 9ESW, a WIC-2A/S, running 12.4(16) Advanced Security IOS
- WS-C3560-24-EMI Catalyst switch, running Cisco IOS Release 12.2(25)SE
- WS-C3550-24-EMI Catalyst switch, running Cisco IOS Release 12.1(9)EA1c
- WS-C2960-24TT-L Catalyst switch, running Cisco IOS Release 12.2(25)SE
- WS-C2950-12 Catalyst switch, running version C2950-C3.0(5.3)WC(1) Enterprise Edition software
- C1760 1FE VE 4SLOT DV Mainboard Port adapter with PVD M2, CMME, WIC-2A/S, WIC-4ESW, MOD1700_VPN with 32F/128D running c1700-bk9no3r2sy7-mz.124-15.T1

- C1751 1FE VE DV Mainboard with WIC-4ESW, MOD1700-VPN with 16F/64D running c1700-advsecurityk9-mz.124-5a
- Cisco 3640 with 32F/128DRAM memory, 3 Ethernet interfaces, 2-WIC-1T running c3640-jk9o3s-mz.124-12a

These devices were not running the latest and greatest versions of Cisco IOS Software. Some of the equipment is quite old.

Those of you familiar with Cisco devices will recognize that a majority of these commands work across the entire range of the Cisco product line. These commands are not limited to the platforms and IOS versions listed. In fact, in most cases, these devices are adequate for someone to continue their studies beyond the CCNP level.

Who Should Read This Book

This book is for those people preparing for the CCNP ISCW exam, whether through self-study, on-the-job training and practice, study within the Cisco Networking Academy, or study through the use of a Cisco Training Partner. There are also some handy hints and tips along the way to make life a bit easier for you in this endeavor. This book is small enough that you will find it easy to carry around with you. Big, heavy textbooks might look impressive on your bookshelf in your office, but can you really carry them all around with you when you are working in some server room or equipment closet somewhere?

Organization of This Book

This book follows the list of objectives for the CCNP ISCW exam:

- **Chapter 1, “Network Design Requirements”**—Offers an overview of the two different design models from Cisco: the Service-Oriented Network Architecture and the Enterprise Composite Network Model
- **Chapter 2, “Connecting Teleworkers”**—Describes how to provision a cable modem, and how to configure a Cisco router as a PPPoE client
- **Chapter 3, “Implementing Frame Mode MPLS”**—Describes how to configure MPLS on a router, including configuring CEF, configuring MPLS on a frame mode interface, and configuring MTU size in label switching
- **Chapter 4, “IPsec VLANs”**—Describes how to configure, verify, and troubleshoot IPsec VLANs, including topics such as configuring IPsec, configuring GRE tunnels, creating High Availability using HSRP and stateful failover, Cisco Easy VPN Server and client, and configuring Easy VPN Server using Cisco SDM
- **Chapter 5, “Cisco Device Hardening”**—Includes topics such as locking down routers with AutoSecure; setting login failure rates, timeouts, and multiple privilege levels; Role-Based CLI; securing your configuration files; and configuring SSH servers, syslog logging, NTP clients and servers, and AAA
- **Chapter 6, “Cisco IOS Threat Defense Features”**—Includes topics such as configuring a basic firewall from the CLI and SDM, configuring a DMZ, and configuring inspection rules as part of an Advanced Firewall

Did We Miss Anything?

As educators, we are always interested to hear how our students, and now readers of our books, do on both vendor exams and future studies. If you would like to contact either of us and let us know how this book helped you in your certification goals, please do so. Did we miss anything? Let us know. Contact us at ccnpguide@empson.ca.

<https://t.me/learningnets>



CHAPTER 1

Network Design Requirements

This chapter provides information concerning the following topics:

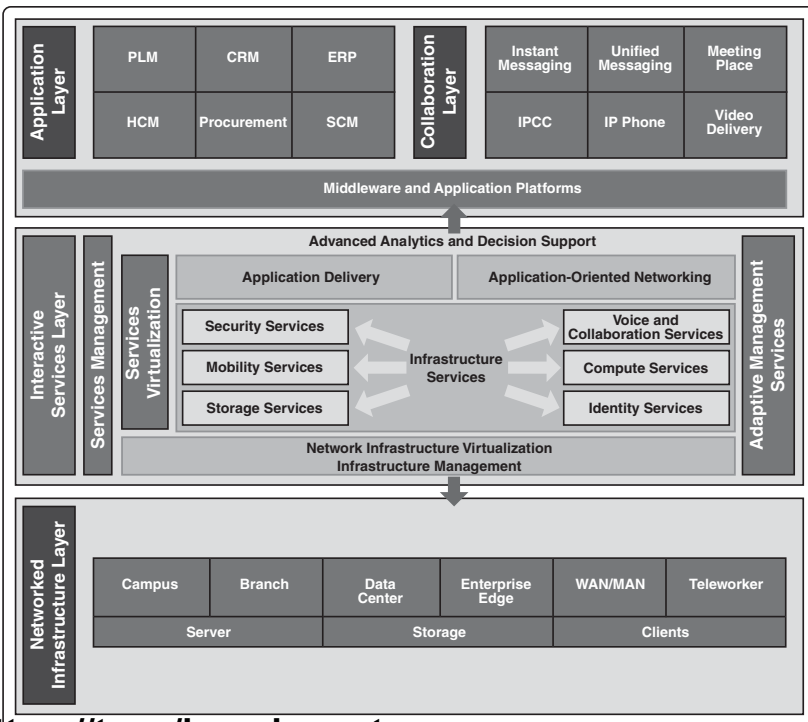
- Cisco Service-Oriented Network Architecture
- Cisco Enterprise Composite Network Model

No commands are associated with this module of the CCNP ISCW course objectives.

Cisco Service-Oriented Network Architecture

Figure 1-1 shows the Cisco Service-Oriented Network Architecture (SONA) framework.

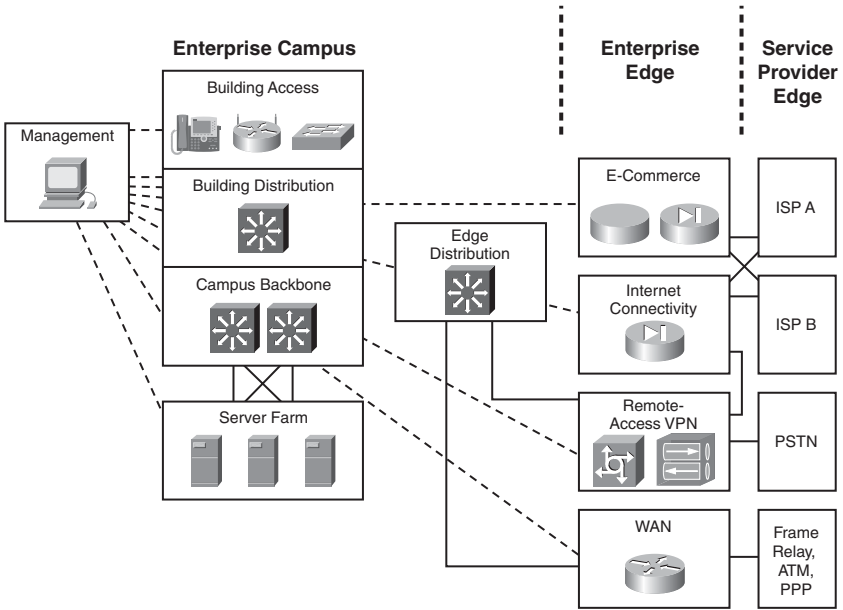
Figure 1-1 Cisco SONA Framework



Cisco Enterprise Composite Network Model

Figure 1-2 shows the Cisco Enterprise Composite Network Model.

Figure 1-2 Cisco Enterprise Composite Network Model





CHAPTER 2

Connecting Teleworkers

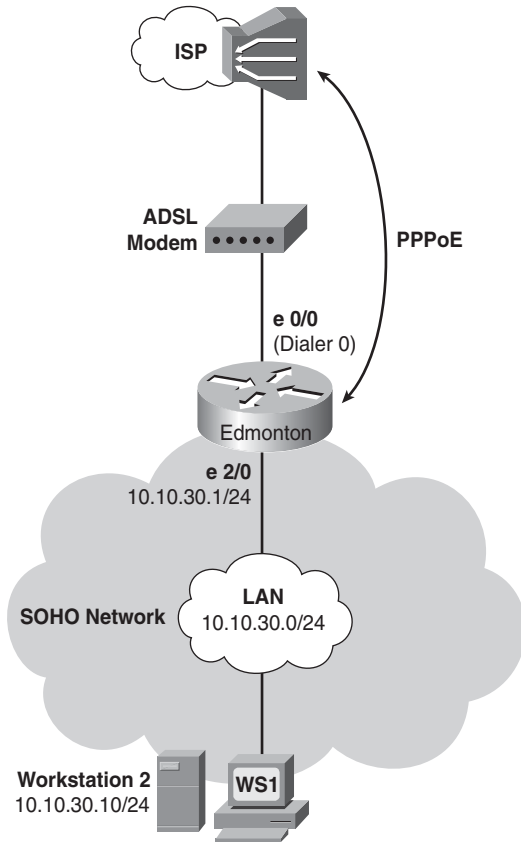
This chapter provides information and commands concerning the following topics:

- Configuration example: DSL using PPPoE
 - Basic router configuration
 - Understanding VPDN
 - Declaring PPPoE at the physical interface
 - Negotiating PPPoE addressing
 - Adjusting packet sizes
 - Creating a dialer interface
 - Declaring PPP at the logical dialer interface
 - Choosing “interesting” dialer traffic
 - Verifying PPPoE and PPP
- Configuring PPPoA
- Configuring a cable modem connection
 - Connection using an external cable modem
 - Bridging the cable and Ethernet interfaces (internal modem)
- Configuring L2 bridging using a Cisco cable modem HWIC
- Configuring L3 routing using a Cisco cable modem HWIC
 - Routing a Cisco cable modem HWIC and Ethernet interface

Configuration Example: DSL Using PPPoE

Figure 2-1 shows an asymmetric digital subscriber line (ADSL) connection to the ISP DSL address multiplexer.

Figure 2-1 PPPoE Reference Topology



The programming steps for configuring Point-to-Point Protocol over Ethernet (PPPoE) on an Ethernet interface are as follows:

- Step 1.** Configure PPPoE (external modem).
- Step 2.** Configure the dialer interface.
- Step 3.** Define interesting traffic and specify default routing.
- Step 4a.** Configure Network Address Translation (NAT) using an access control list (ACL).
- Step 4b.** Configure NAT using a route map.
- Step 5.** Configure Dynamic Host Configuration Protocol (DHCP) service.

Step 6. Apply NAT programming.

Step 7. Verify a PPPoE connection.

Step 1: Configure PPPoE (External Modem)

Edmonton(config)# interface ethernet0/0	Enters interface configuration mode
Edmonton(config-if)# pppoe enable	Enables PPPoE on the interface
Edmonton(config-if)# pppoe-client dial-pool-number 1	Chooses the physical Ethernet interface for the PPPoE client dialer interface
Edmonton(config-if)# no shutdown	Enables the interface
Edmonton(config-if)# exit	Returns to global configuration mode

Virtual Private Dial-Up Network (VPDN) Programming

Edmonton(config)# vpdn enable	Enables VPDN sessions on the network access server
Edmonton(config)# vpdn-group <i>PPPOE-GROUP</i>	Creates a VPDN group and assigns it a unique name
Edmonton(config-vpdn)# request-dialin	Initiates a dial-in tunnel
Edmonton(config-vpdn-req-in)# protocol pppoe	Specifies the tunnel protocol
Edmonton(config-vpdn-req-in)# exit	Exits request-dialin mode
Edmonton(config-vpdn)# exit	Exits vpdn mode and returns to global configuration mode

NOTE: VPDNs are legacy dial-in access services provided by ISPs to enterprise customers who chose not to purchase, configure, or maintain access servers or modem pools. A VPDN tunnel was built using Layer 2 Forwarding (L2F), Layer 2 Tunneling Protocol (L2TP), Point-to-Point Tunneling Protocol (PPTP), or Point-to-Point over Ethernet (PPPoE). The tunnel used UDP port 1702 to carry encapsulated PPP datagrams and control messages between the endpoints. Routers with Cisco IOS Release 12.2(13)T or earlier require the additional VPDN programming.

Step 2: Configure the Dialer Interface

Edmonton(config)# interface dialer0	Enters interface configuration mode
Edmonton(config-if)# ip address negotiated	Obtains IP address via PPP/IPC address negotiation
Edmonton(config-if)# ip mtu 1492	Accommodates for the 6-octet PPPoE header to eliminate fragmentation in the frame
Edmonton(config-if)# ip tcp adjust-mss 1452	Adjusts the maximum segment size (MSS) of TCP SYN packets going through a router to eliminate fragmentation in the frame
Edmonton(config-if)# encapsulation ppp	Enables PPP encapsulation on the dialer interface
Edmonton(config-if)# dialer pool 1	Links the dialer interface with the physical interface Ethernet 0/1 NOTE: The ISP defines the type of authentication to use.

For Password Authentication Protocol (PAP)

Edmonton(config-if)# ppp authentication pap callin	Uses PAP for authentication
Edmonton(config-if)# ppp pap sent-username pieman password bananacream	Enables outbound PAP user authentication with a username of pieman and a password of bananacream

For Challenge Handshake Authentication Protocol (CHAP)

Edmonton(config-if)# ppp authentication chap callin	Enables outbound CHAP user authentication
Edmonton(config-if)# ppp chap hostname pieman	Submits the CHAP username
Edmonton(config-if)# ppp chap password bananacream	Submits the CHAP password
Edmonton(config-if)# exit	Exits programming level

Step 3: Define Interesting Traffic and Specify Default Routing

Edmonton(config)# dialer-list 2 protocol ip permit	Declares which traffic will invoke the dialing mechanism
Edmonton(config)# interface dialer0	Enters interface mode
Edmonton(config-if)# dialer-group 2	Applies the “interesting traffic” rules in dialer-list 2
Edmonton(config)# ip route 0.0.0.0 0.0.0.0 dialer0	Specifies the dialer0 interface as the candidate default next-hop address

Step 4a: Configure NAT Using an ACL

<pre>Edmonton(config)#access-list 1 permit 10.10.30.0 0.0.0.255</pre>	<p>Specifies an access control entry (ACE) for NAT</p>
<pre>Edmonton(config)#ip nat pool NAT-POOL 192.31.7.1 192.31.7.2 netmask 255.255.255.0</pre>	<p>Defines the inside global (WAN side) NAT pool with subnet mask</p> <p>NOTE: When a range of public addresses is used for the NAT/PAT inside global (WAN) addresses, it is defined by an address pool and called in the NAT definition programming.</p>
<pre>Edmonton(config)#ip nat inside source list 1 pool NAT-POOL overload</pre>	<p>Specifies the NAT inside local addresses by ACL and the inside global addresses by address pool for the NAT process</p> <p>NOTE: In the case where the inside global (WAN) address is dynamically assigned by the ISP, the outbound WAN interface is named in the NAT definition programming.</p>
<pre>Edmonton(config)#ip nat inside source list 1 interface dialer0 overload</pre>	<p>Specifies the NAT inside local addresses (LAN) and inside global addresses (WAN) for the NAT process</p>

Step 4b: Configure NAT Using a Route Map

<pre>Edmonton(config)#access-list 3 permit 10.10.30.0 0.0.0.255</pre>	<p>Specifies the access control entry (ACE) for NAT</p> <p>NOTE: The route-map command is typically used when redistributing routes from one routing protocol into another or to enable policy routing. The most commonly used method for defining the traffic to be translated in the NAT process is to use an ACL to choose traffic and call the ACL directly in the NAT programming. When used for NAT, a route map allows you to match any combination of ACL, next-hop IP address, and output interface to determine which pool to use. The Cisco Router and Security Device Manager (SDM) uses a route map to select traffic for NAT.</p>
<pre>Edmonton(config)#route-map ROUTEMAP permit 1</pre>	<p>Declares route map name and enters route-map mode</p>
<pre>Edmonton(config-route-map)#match ip address 3</pre>	<p>Specifies the ACL that defines the dialer “interesting traffic”</p>
<pre>Edmonton(config-route-map)#exit</pre>	<p>Exits route-map mode</p>
<pre>Edmonton(config)#ip nat inside source route- map ROUTEMAP interface dialer0 overload</pre>	<p>Specifies the NAT inside local (as defined by the route map) and inside global (interface dialer0) linkage for the address translation</p>

Step 5: Configure DHCP Service

Edmonton(config)# ip dhcp excluded-address 10.10.30.1 10.10.30.5	Excludes an IP address range from being offered by the router's DHCP service
Edmonton(config)# ip dhcp pool CLIENT-30	Enters dhcp-config mode for the pool CLIENT-30
Edmonton(dhcp-config)# network 10.10.30.0 255.255.255.0	Defines the IP network address
Edmonton(dhcp-config)# default-router 10.10.30.1	Declares the router's vlan10 interface address as a gateway address
Edmonton(dhcp-config)# import all	Imports DHCP option parameters into the DHCP server database from external DHCP service NOTE: Any manually configured DHCP option parameters override the equivalent imported DHCP option parameters. Because they are obtained dynamically, these imported DHCP option parameters are not part of the router configuration and are not saved in NVRAM.
Edmonton(dhcp-config)# dns-server 10.10.30.2	Declares any required DNS server address(es)
Edmonton(dhcp-config)# exit	Exits dhcp-config mode

Step 6: Apply NAT Programming

Edmonton(config)# interface ethernet2/0	Enters interface mode
Edmonton(config-if)# ip nat inside	Specifies the interface as an inside local (LAN side) interface

Edmonton(config)# interface dialer0	Enters interface mode
Edmonton(config-if)# ip nat outside	Specifies the interface as an inside global (WAN side) interface
Edmonton(config-if)# end	Returns to privileged EXEC mode

Step 7: Verify a PPPoE Connection

Edmonton# debug pppoe events	Displays PPPoE protocol messages about events that are part of normal session establishment or shutdown
Edmonton# debug ppp authentication	Displays authentication protocol messages such as CHAP and PAP messages
Edmonton# show pppoe session	Displays information about currently active PPPoE sessions
Edmonton# show ip dhcp binding	Displays address bindings on the Cisco IOS DHCP server
Edmonton# show ip nat translations	Displays active NAT translations

Configuring PPPoA

The programming steps for configuring PPP over ATM (PPPoA) on an ATM interface are as follows:

- Step 1.** Configure PPPoA on the WAN Interface (Using Subinterfaces)
- Step 2.** Configure the dialer interface.
- Step 3.** Verify a PPPoA connection.

NOTE: The remaining programming is the same as the PPPoE programming.

Step 1: Configure PPPoA on the WAN Interface (Using Subinterfaces)

Edmonton(config)# interface atm0/0	Enters interface mode
Edmonton(config-if)# bundle-enable	Enables multiple PVCs on the interface
Edmonton(config-if)# dsl operating-mode auto	Automatically detects the DSL modulation scheme that the ISP is using
Edmonton(config-if)# interface atm0/0.1 pointtopoint	Creates virtual ATM point-to-point subinterface
Edmonton(config-if)# pvc 1/2	Assigns virtual circuit (VC) 2 on virtual path 1 to the subinterface NOTE: pvc 1/2 is an example value that must be changed to match the value used by the ISP.
Edmonton(config-if)# dialer pool-member 1	Links the ATM interface to the dialer interface
Edmonton(config-if)# encapsulation aal5mux	Configures the ATM adaptation layer (AAL) for multiplex (MUX)-type VCs NOTE: The global default encapsulation option is aal5snap .

Step 2: Configure the Dialer Interface

Edmonton(config)# interface dialer0	Enters interface mode NOTE: When configuring the dialer interface in an ATM environment, it is not necessary to configure the maximum transmission unit (MTU) and adjust the MSS. This is required only when configuring PPPoE.
Edmonton(config-if)# ip address negotiated	Obtains IP address via PPP/PCP address negotiation
Edmonton(config-if)# encapsulation ppp	Enables PPP encapsulation on the dialer interface
Edmonton(config-if)# dialer pool 1	Links the dialer interface with the physical interface ATM 0/0

For Password Authentication Protocol (PAP)

Edmonton(config-if)# ppp authentication pap callin	Uses PAP for authentication
Edmonton(config-if)# ppp pap sent-username pieman password bananacream	Enables outbound PAP user authentication

For Challenge Handshake Authentication Protocol (CHAP)

Edmonton(config-if)# ppp authentication chap callin	Enables outbound CHAP user authentication
Edmonton(config-if)# ppp chap hostname pieman	Submits the CHAP username
Edmonton(config-if)# ppp chap password bananacream	Submits the CHAP password
Edmonton(config-if)# exit	Returns to global configuration mode

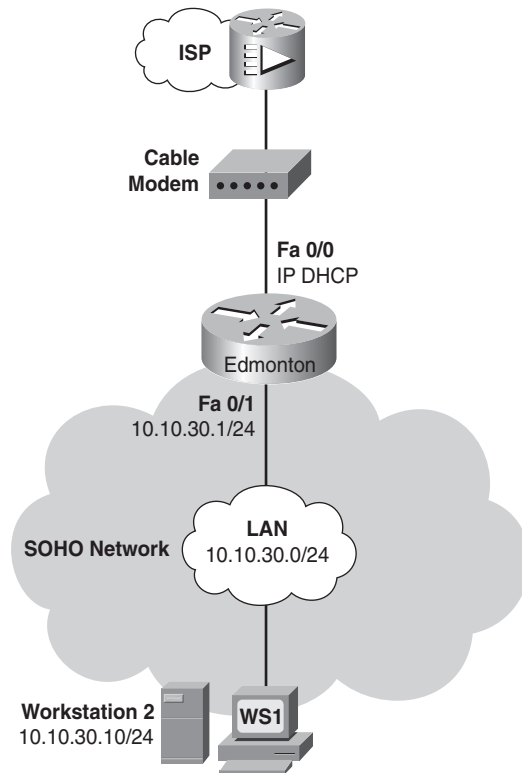
Step 3: Verify a PPPoA Connection

Edmonton# debug pppatm event vc 1/2	Displays events on virtual circuit 2 on virtual path 1
Edmonton# debug pppatm error vc 1/2	Displays errors on virtual circuit 2 on virtual path 1
Edmonton# show atm interface atm0/0	Displays ATM-specific information about an ATM interface
Edmonton# show dsl interface atm0/0.1	Displays information specific to the ADSL for a specified ATM interface
Edmonton# debug ppp authentication	Displays authentication protocol messages such as CHAP and PAP messages
Edmonton# show ip dhcp binding	Displays address bindings on the Cisco IOS DHCP server
Edmonton# show ip nat translations	Displays active NAT translations

Configuring a Cable Modem Connection

Figure 2-2 shows a LAN connection and a cable connection to the ISP broadband router.

Figure 2-2 Cable Modem Connection Reference Topology



The programming steps for configuring a cable modem connection are as follows:

- Step 1.** Configure WAN connectivity
- Step 2.** Configure local DHCP service.
- Step 3.** Configure NAT using a route map.
- Step 4.** Configure default routing.
- Step 5.** Apply NAT programming.

NOTE: Connection to a cable system using an external modem is simply a LAN connection with NAT, DHCP, and firewall programming.

Step 1: Configure WAN Connectivity

Edmonton(config)#interface fastethernet 0/0	Enters interface configuration mode
Edmonton(config-if)#no ip route-cache	Disables fast switching at this interface
Edmonton(config-if)#no cdp enable	Disables Cisco Discovery Protocol (CDP) at this interface
Edmonton(config-if)#mac-address 0017.31c0.9bfa	Manually sets a MAC address (for authentication purposes) NOTE: Some cable service providers use the MAC address of the host PC connected to the cable modem as authentication or link it with the DHCP process. Some cable modems have used the MAC address of their first connected host as the only valid user. Manual configuration of a MAC address at the router/modem interface can solve these problems.
Edmonton(config-if)#ip address dhcp	Sets the dynamic addressing as DHCP
Edmonton(config-if)#no shutdown	Enables the interface
Edmonton(config-if)#exit	Exits interface configuration mode

Step 2: Configure Local DHCP Service

Edmonton(config)# ip dhcp excluded-address 10.10.30.1 10.10.30.5	Excludes an IP address range from being offered by the router's DHCP service
Edmonton(config)# ip dhcp pool CLIENT-1	Enters dhcp-config mode for the pool CLIENT-1
Edmonton(dhcp-config)# import all	Imports DHCP option parameters into the DHCP server database from external DHCP server NOTE: Any manually configured DHCP option parameters override the equivalent imported DHCP option parameters. Because they are obtained dynamically, these imported DHCP option parameters are not part of the router configuration and are not saved in NVRAM.
Edmonton(dhcp-config)# network 10.10.30.0 255.255.255.0	Defines the IP network address
Edmonton(dhcp-config)# default-router 10.10.30.1	Declares the router's LAN interface address as a gateway address
Edmonton(dhcp-config)# dns-server 10.10.30.2	Declares any required DNS server address(es)
Edmonton(dhcp-config)# exit	Exits dhcp-config mode

Step 3: Configure NAT Using a Route Map

Edmonton(config)# access-list 100 permit ip 10.10.30.0 0.0.0.255 any	Creates an access list defining which addresses will be translated in the NAT process
Edmonton(config)# route-map ROUTEMAP permit 1	Enters route-map configuration mode
Edmonton(config-route-map)# match ip address 100	Chooses the access list that defines IP addresses for NAT
Edmonton(config-route-map)# exit	Exits route-map configuration mode
Edmonton(config)# ip nat inside source route-map ROUTEMAP interface fastethernet 0/0 overload	Specifies the NAT inside local (as defined by the route map) and inside global (interface fastethernet 0/0) linkage for the address translation

Step 4: Configure Default Routing

Edmonton(config)# ip route 0.0.0.0 0.0.0.0 fastethernet 0/0 A.B.C.D	<p>Sets the default route to the next-hop address of A.B.C.D</p> <p>NOTE: Packets from the internal network will be routed to the next hop at A.B.C.D. If interface FastEthernet 0/0 goes down, the route entry will be purged from the routing table and will be reinstated only when interface FastEthernet 0/0 goes back up. If only an outbound interface is specified in the static route, the router believes all destinations to be directly connected and will issue proxy ARP requests.</p>
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Step 5: Apply NAT Programming

Edmonton(config)# interface fastethernet 0/1	Enters interface configuration mode
Edmonton(config-if)# shutdown	Turns off the interface
Edmonton(config-if)# ip nat inside	Defines the interface as an internal interface for the NAT process
Edmonton(config-if)# no shutdown	Enables the interface
Edmonton(config-if)# interface fastethernet 0/0	Enters interface configuration mode for FastEthernet 0/0
Edmonton(config-if)# shutdown	Turns off the interface
Edmonton(config-if)# ip nat outside	Defines the interface as the external interface for the NAT process
Edmonton(config-if)# no shutdown	Enables the interface
Edmonton(config-if)# exit	Exits interface configuration mode
Edmonton(config)# exit	Exits global configuration mode

Configuring L2 Bridging Using a Cisco Cable Modem HWIC

The programming steps for setting up Layer 2 bridging using a Cisco cable modem High-Speed WAN Interface Card (HWIC) are as follows:

Step 1. Configure global bridging parameters.

Step 2. Configure WAN to LAN bridging.

Step 1: Configure Global Bridging Parameters

Router> enable	Moves to privileged mode
Router# configure terminal	Enters global configuration mode

Router(config)# bridge irb	Enables bridging between routed interfaces and bridge groups
Router(config)# bridge 59 protocol ieee	Defines Spanning Tree Protocol
Router(config)# bridge 59 route ip	Enables routing of IP in a bridge group

Step 2: Configure WAN to LAN Bridging

Router(config)# interface bvi 59	Creates a virtual interface for bridge group 59
Router(config-if)# interface fastethernet 0/1	Enters interface configuration mode
Router(config-if)# no ip address	Deletes any IP addressing
Router(config-if)# bridge-group 59	Assigns bridge group 59 to the interface
Router(config-if)# interface cable 0/2/0	Enters interface mode for cable connection
Router(config-if)# bridge-group 59	Assigns bridge group 59 to the interface
Router(config-if)# end	Returns to privileged mode Ends programming

Configuring L3 Routing Using a Cisco Cable Modem HWIC

The programming steps for setting up Layer 3 bridging using a Cisco cable modem HWIC are as follows:

- Step 1.** Remove bridge group programming from all interfaces.
- Step 2.** Configure LAN connectivity.
- Step 3.** Configure WAN connectivity.

Step 1: Remove Bridge Group Programming from All Interfaces

Router(config)# interface fastethernet 0/1	Enters interface configuration mode
Router(config-if)# no bridgegroup 59	Removes bridge group 59
Router(config-if)# no bridgegroup 59 ieee	Removes Spanning Tree programming
Router(config-if)# interface cable 0	Enters interface configuration mode
Router(config-if)# no bridgegroup 59 ieee	Removes Spanning Tree programming
Router(config-if)# no bridgegroup 59	Removes bridge group 59
Router(config-if)# exit	Returns to global configuration mode

Step 2: Configure LAN Connectivity

Router(config-if)# interface fastethernet 0/1	Creates virtual interface FastEthernet 0/1
Router(config-if)# ip address ip address subnet mask	Assigns interface address and netmask
Router(config-if)# no shutdown	Enables the interface

Step 3: Configure WAN Connectivity

Router(config)# interface cable-modem 0	Enters interface configuration mode
Router(config-if)# ip address dhcp	Requests IP configuration through DHCP
Router(config-if)# no shutdown	Enables the interface

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CHAPTER 3

Implementing Frame Mode MPLS

This chapter provides information and commands concerning the following topics:

- Configuring Cisco Express Forwarding
 - Verifying CEF
 - Troubleshooting CEF
- Configuring MPLS on a Frame Mode interface
- Configuring MTU size in label switching

Configuring Cisco Express Forwarding

To enable MPLS, you must first enable Cisco Express Forwarding (CEF) switching.

NOTE: CEF switching is enabled by default on the following platforms:

- Cisco 7100 series router
- Cisco 7200 series router
- Cisco 7500 series Internet router

dCEF Switching is enabled by default on the following platforms:

- Cisco 6500 series router
- Cisco 12000 series Internet router

Router(config)# ip cef	Enables standard CEF
Router(config)# ip cef distributed	Enables dCEF
Router(config)# no ip cef	Disables CEF globally
Router(config)# interface fastethernet 0/1	Moves to interface configuration mode
Router(config-if)# ip route-cache cef	Enables CEF on the interface

Verifying CEF

Router# show ip cef	Displays entries in the forwarding information base (FIB)
Router# show ip cef summary	Displays a summary of the FIB
Router# show ip cef unresolved	Displays unresolved FIB entries
Router# show ip cef fastethernet 0/1	Displays the FIB entry for the specified interface
Router# show ip cef fastethernet 0/1 detail	Displays detailed information about the FIB for the interface
Router# show cef drop	Displays packets that are dropped due to adjacencies that are incomplete or nonexistent

NOTE: CEF is not supported on logical interfaces, such as loopback interfaces.

Troubleshooting CEF

Router# debug ip cef	Displays debug information for CEF
Router# debug ip cef drop	Displays debug information about dropped packets
Router# debug ip cef access-list x	Displays information from specified access lists
Router# debug ip cef receive	Displays information about packets received by IP CEF

Router# debug ip cef events	Displays general CEF events
Router# debug ip cef prefix-ipc	Displays updates related to IP prefix information
Router# debug ip cef table	Produces a table showing events related to the FIB table

Configuring MPLS on a Frame Mode Interface

Router(config)# mpls ip	Enables MPLS globally on the router NOTE: MPLS is enabled by default on Cisco routers. However, if you need to re-enable it, use the global mpls ip command.
Router(config)# interface fastethernet 0/0	Moves to interface configuration mode
Router(config-if)# mpls ip	Enables MPLS on the specified interface
Router(config-if)# mpls label protocol tdp	Enables Tag Distribution Protocol (TDP) on this interface NOTE: TDP is Cisco proprietary. LDP is a superset of TDP. Cisco is changing from TDP to a fully compliant LDP.

<p>Router(config-if)#mpls label protocol ldp</p>	<p>Enables Label Distribution Protocol (LDP) on this interface</p> <p>NOTE: LDP is the default protocol on Cisco IOS Release 12.4(3) and later. In older releases, TDP was the default protocol.</p>
<p>Router(config-if)#mpls label protocol both</p>	<p>Enables both TDP and LDP on this interface</p>

NOTE: For backward compatibility, the **mpls** syntax will be entered as **tag-switching** syntax in the configuration by the Cisco IOS Software.

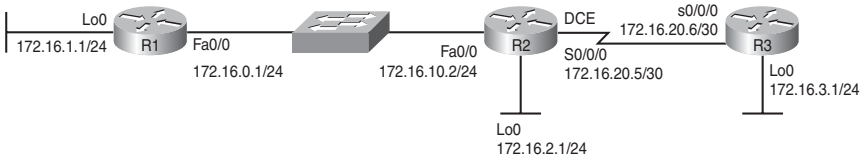
Configuring MTU Size in Label Switching

<p>Router(config)#interface fasthethernet 0/0</p>	<p>Moves to interface configuration mode</p>
<p>Router(config-if)#mpls mtu 1512</p>	<p>Changes the maximum size of an MPLS-labeled packet to 1512 bytes</p> <p>NOTE: The mpls mtu command is an optional command when working with MPLS. But because of the addition of the label header, the MTU on LAN interfaces should be increased to prevent IP fragmentation.</p> <p>NOTE: The minimum MTU is 64 bytes. The maximum MTU depends on the type of interface medium that is being used.</p>

Configuration Example: Configuring Frame Mode MPLS

Figure 3-1 shows the network topology for the configuration that follows, which shows how to configure Frame Mode MPLS using commands covered in this chapter.

Figure 3-1 Network Topology for Frame Mode MPLS Configuration Example



R1 Router

Router> enable	Moves to privileged mode
Router# configure terminal	Moves to global configuration mode
Router(config)# hostname R1	Assigns hostname to router
R1(config)# ip cef	Enables CEF on device (enabled by default)
R1(config)# mpls ip	Enables MPLS globally on device (enabled by default)
R1(config)# interface loopback 0	Moves to interface configuration mode
R1(config-if)# ip address 172.16.1.1 255.255.255.0	Assigns IP address and netmask
R1(config-if)# interface fastethernet 0/0	Moves to interface configuration mode
R1(config-if)# ip address 172.16.10.1 255.255.255.0	Assigns IP address and netmask
R1(config-if)# mpls ip	Enables MPLS on this interface

R1(config-if)# mpls mtu 1508	Changes the maximum size of the packet allowed on this interface to 1508 bytes
R1(config-if)# no shutdown	Activates interface
R1(config-if)# exit	Returns to global configuration mode
R1(config)# router eigrp 1	Enables the EIGRP routing process for AS 1
R1(config-router)# network 172.16.0.0	Specifies which network to advertise in EIGRP
R1(config-router)# no auto-summary	Turns off the auto-summarization feature
R1(config-router)# exit	Returns to global configuration mode
R1(config)# exit	Returns to privileged mode
R1# copy running-config startup-config	Saves configuration in NVRAM

R2 Router

Router> enable	Moves to privileged mode
Router# configure terminal	Moves to global configuration mode
Router(config)# hostname R2	Assigns hostname to router
R2(config)# ip cef	Enables CEF on device (enabled by default)
R2(config)# mpls ip	Enables MPLS globally on device (enabled by default)
R2(config)# interface loopback 0	Moves to interface configuration mode

R2(config-if)# ip address 172.16.2.1 255.255.255.0	Assigns IP address and netmask
R2(config-if)# interface fastethernet 0/0	Moves to interface configuration mode
R2(config-if)# ip address 172.16.10.2 255.255.255.0	Assigns IP address and netmask
R2(config-if)# mpls ip	Enables MPLS on this interface
R2(config-if)# mpls mtu 1508	Changes the maximum size of the packet allowed on this interface to 1508 bytes
R2(config-if)# no shutdown	Activates interface
R2(config-if)# interface serial 0/0/0	Moves to interface configuration mode
R2(config-if)# ip address 172.16.20.5 255.255.255.252	Assigns IP address and netmask
R2(config-if)# mpls ip	Enables MPLS on this interface
R2(config-if)# clock rate 64000	Enables clock rate for this interface
R2(config-if)# no shutdown	Activates interface
R2(config-if)# exit	Returns to global configuration mode
R2(config)# router eigrp 1	Enables the EIGRP routing process for AS 1
R2(config-router)# network 172.16.0.0	Specifies which network to advertise in EIGRP
R2(config-router)# no auto-summary	Turns off the auto-summarization feature
R2(config-router)# exit	Returns to global configuration mode

R2(config)# exit	Returns to privileged mode
R2# copy running-config startup-config	Saves configuration in NVRAM

R3 Router

Router> enable	Moves to privileged mode
Router# configure terminal	Moves to global configuration mode
Router(config)# hostname R3	Assigns hostname to router
R3(config)# ip cef	Enables CEF on device (enabled by default)
R3(config)# mpls ip	Enables MPLS globally on device (enabled by default)
R3(config)# interface loopback 0	Moves to interface configuration mode
R3(config-if)# ip address 172.16.3.1 255.255.255.0	Assigns IP address and netmask
R3(config-if)# interface serial 0/0/0	Moves to interface configuration mode
R3(config-if)# ip address 172.16.20.6 255.255.255.252	Assigns IP address and netmask
R3(config-if)# mpls ip	Enables MPLS on this interface
R3(config-if)# no shutdown	Activates interface
R3(config-if)# exit	Returns to global configuration mode
R3(config)# router eigrp 1	Enables the EIGRP routing process for AS 1
R3(config-router)# network 172.16.0.0	Specifies which network to advertise in EIGRP

R3(config-router)# no auto-summary	Turns off the auto-summarization feature
R3(config-router)# exit	Returns to global configuration mode
R3(config)# exit	Returns to privileged mode
R3# copy running-config startup-config	Saves configuration in NVRAM

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CHAPTER 4

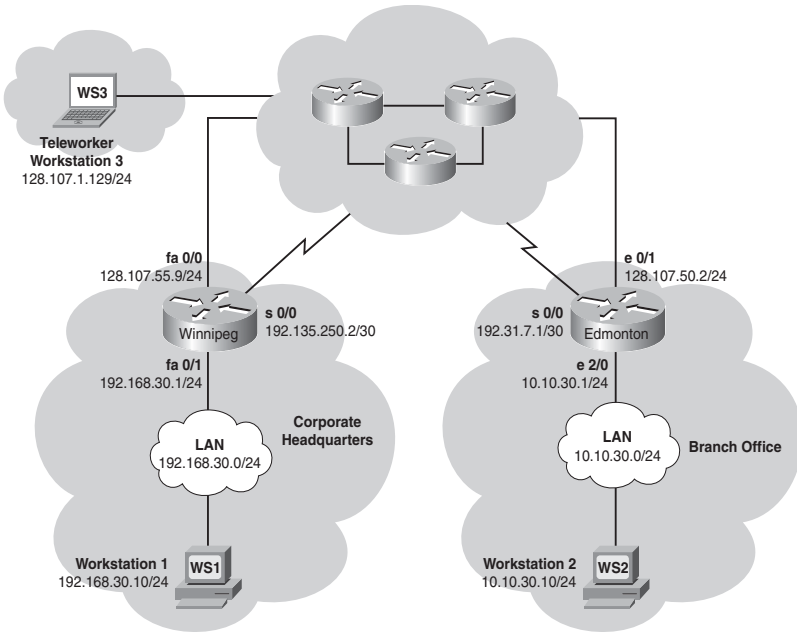
IPsec VPNs

This chapter provides information and commands concerning the following topics:

- Configuring a teleworker to branch office VPN using CLI
- Configuring IPsec site-to-site VPNs using CLI
- Configuring IPsec site-to-site VPNs using SDM
- Configuring GRE tunnels over IPsec
- Configuring a static IPsec virtual tunnel interface
- Configuring High Availability VPNs
 - IPsec backup peers
 - Hot Standby Routing Protocol (HSRP)
 - IPsec stateful failover
 - Backing Up WAN connections with IPsec VPNs
- Configuring Easy VPN Server using Cisco SDM
- Implementing the Cisco VPN Client

Much of this chapter references the network topology shown in Figure 4-1. The Winnipeg and Edmonton routers have a basic configuration to which additional programming will be added.

Figure 4-1 VPN Network Topology



Configuring a Teleworker to Branch Office VPN Using CLI

This section refers to Figure 4-1 and provides details about the configuration for the Edmonton router.

The following steps are used to configure the Edmonton router:

- Step 1.** Configure the Internet Security Association and Key Management Protocol (ISAKMP) policy (IKE phase 1).
- Step 2.** Configure policies for the client group(s).
- Step 3.** Configure the IPsec transform sets (IKE phase 2).
- Step 4.** Configure router AAA and add VPN client users.
- Step 5.** Create VPN client policy for security association negotiation.
- Step 6.** Configure the crypto map.
- Step 7.** Apply the crypto map to the interface.
- Step 8.** Verify the VPN service.

Step 1: Configure the ISAKMP Policy (IKE Phase 1)

Edmonton(config)# crypto isakmp policy 1	Creates an IKE phase 1 policy
Edmonton(config-isakmp)# encryption 3des	Selects 3DES as the encryption type
Edmonton(config-isakmp)# hash md5	Selects MD5 as the hashing algorithm
Edmonton(config-isakmp)# authentication pre-share	Uses a preshared encryption key
Edmonton(config-isakmp)# group 2	Uses Diffie-Hellman group 2 key exchange algorithm
Edmonton(config-isakmp)# exit	Exits isakmp mode and returns to global configuration mode

Step 2: Configure Policies for the Client Group(s)

Client Group(s)	
Edmonton(config)# crypto isakmp client configuration group VPNGROUP	Creates a group for VPN clients
Edmonton(config-isakmp-group)# key 12345678	Uses the key 12345678
Edmonton(config-isakmp-group)# pool VPNPOOL	Uses addresses defined in the address pool VPNPOOL
Edmonton(config-isakmp-group)# dns 192.31.7.1	Points the VPN client to a DNS service
Edmonton(config-isakmp-group)# wins 10.10.30.10	Points the VPN client at a WINS service
Edmonton(config-isakmp-group)# exit	Exits isakmp-group mode and returns to global configuration mode

Step 3: Configure the IPsec Transform Sets (IKE Phase 2, Tunnel Termination)

Edmonton(config)# crypto ipsec transform-set TRANSFORM-1 esp-3des esp-sha-hmac	Creates a transform set for the IKE phase 2 policy
Edmonton(cfg-crypto-trans)# exit	Exits cfg-crypto-trans mode

Step 4: Configure Router AAA and Add VPN Client Users

Edmonton(config)# aaa new-model	Starts the router AAA service NOTE: Cisco IOS-based VPNs require the router AAA service to be enabled. VPN client users can be defined locally in the router or on an AAA server. There are separate lists for authentication and authorization of VPN users.
Edmonton(config)# aaa authentication login default local	Verifies login authentication for the “default” group using the local user database
Edmonton(config)# aaa authentication login VPNAUTH local	Verifies login authentication for the VPNAUTH group using the local user database
Edmonton(config)# aaa authorization exec default local	Verifies EXEC authorization for the “default” group using the local user database
Edmonton(config)# aaa authorization network VPNAUTHOR local	Verifies network access authorization for the VPNAUTHOR group using the local user database

Edmonton(config)# username user1 secret password1	Creates user for VPN authentication
Edmonton(config)# username user2 secret password2	Creates user for VPN authentication

Step 5: Create VPN Client Policy for Security Association Negotiation

Edmonton(config)# crypto dynamic-map DYNMAP 1	Creates a dynamic crypto map
Edmonton(config-crypto-map)# set transform-set TRANSFORM-1	Defines the transform set the client must match to
Edmonton(config-crypto-map)# reverse-route	Has the router add a return route for the VPN client in the routing table
Edmonton(config-crypto-map)# exit	Exits config-crypto-map mode

Step 6: Configure the Crypto Map (IKE Phase 2)

Edmonton(config)# crypto map CRYPTOMAP client authentication list VPNAUTH	Configures IKE extended authentication (Xauth) for the VPN group VPNAUTH
Edmonton(config)# crypto map CRYPTOMAP isakmp authorization list VPNAUTHOR	Configures IKE key lookup from a AAA server for the VPN group VPNAUTHOR
Edmonton(config)# crypto map CRYPTOMAP client configuration address respond	Enables the router to accept IP address requests from any peer
Edmonton(config)# crypto map CRYPTOMAP 65535 ipsec-isakmp dynamic DYNMAP	Uses IKE to establish IPsec SAs as specified by crypto map DYNMAP

Step 7: Apply the Crypto Map to the Interface

Edmonton(config)# interface ethernet 2/0	Enters interface configuration mode
Edmonton(config-if)# crypto map CRYPTOMAP	Applies the crypto map CRYPTOMAP
Edmonton(config-if)# end	Exits to privileged mode

Step 8: Verify the VPN Service

Edmonton# show crypto ipsec sa	Displays the settings used by current security associations (SA)
Edmonton# show crypto isakmp sa	Displays current IKE SAs
Edmonton# show crypto session	Displays status information for active crypto sessions
Edmonton# show crypto dynamic-map	Displays a dynamic crypto map set
Edmonton# show crypto map	Displays the crypto map configuration NOTE: Before issuing a debug command, you should read the information for that command in the <i>Cisco IOS Debug Command Reference</i> for your IOS version to determine the impact on the device.
Edmonton# debug crypto ipsec	Displays IPsec
Edmonton# debug crypto isakmp	Displays messages about IKE events

Edmonton# debug crypto isakmp error	Displays error messages for IKE-related operations
Edmonton# debug crypto ipsec error	Displays error messages for IPsec-related operations

Configuring IPsec Site-to-Site VPNs Using CLI

This section refers to Figure 4-1 and provides details about the configuration for the Winnipeg router.

The programming steps for configuring the Winnipeg router are as follows:

- Step 1.** Configure the ISAKMP policy (IKE phase 1).
- Step 2.** Configure the IPsec transform sets (IKE phase 2, tunnel termination).
- Step 3.** Configure the crypto ACL (interesting traffic, secure data transfer).
- Step 4.** Configure the crypto map (IKE phase 2).
- Step 5.** Apply the crypto map to the interface (IKE phase 2).
- Step 6.** Configure the firewall interface ACL.
- Step 7.** Verify the VPN service.

Step 1: Configure the ISAKMP Policy (IKE Phase 1)

Winnipeg(config)# crypto isakmp policy 1	Creates an IKE policy
Winnipeg(config-isakmp)# encryption 3des	Defines 3DES encryption
Winnipeg(config-isakmp)# hash sha	Chooses sha as the hashing algorithm
Winnipeg(config-isakmp)# authentication pre-share	Specifies authentication with a preshared key
Winnipeg(config-isakmp)# group 2	Specifies Diffie-Hellman group 2 key exchange algorithm
Winnipeg(config-isakmp)# lifetime 86400	Specifies the lifetime of the IKE SA

Winnipeg(config-isakmp)# exit	Exits isakmp configuration mode
Winnipeg(config)# crypto isakmp key 12345678 address 192.31.7.1	Specifies the key required for the tunnel endpoint NOTE: The VPN tunnel peer (Edmonton router) must have one IKE phase 1 policy that matches the IKE phase 1 policy in the Winnipeg router.

Step 2: Configure the IPsec Transform Sets (IKE Phase 2, Tunnel Termination)

Winnipeg(config)# crypto ipsec transform-set TRANSFORM-0 esp-sha-hmac esp-3des	Creates a transform set for the IKE phase 2 policy
Winnipeg(cfg-crypto-trans)# mode tunnel	Encapsulates the entire datagram
Winnipeg(cfg-crypto-trans)# exit	Exits cfg-crypto-trans mode
Winnipeg(config)# crypto ipsec security-association lifetime seconds 1200	Defines a 20-minute SA lifetime

Step 3: Configure the Crypto ACL (Interesting Traffic, Secure Data Transfer)

Winnipeg# configure terminal	Enters global configuration mode
Winnipeg(config)# access-list 100 permit ip 192.168.30.0 0.0.0.255 10.10.30.0 0.0.0.255	Defines the source and destination of traffic that will use the IPsec tunnel

Step 4: Configure the Crypto Map (IKE Phase 2)

Winnipeg(config)# crypto map CRYPTO-MAP-0 1 ipsec-isakmp	Defines the crypto map CRYPTO-MAP-0 to use IPsec with ISAKMP
Winnipeg(config-crypto-map)# set peer 192.31.7.1	Specifies the IP address of the VPN peer
Winnipeg(config-crypto-map)# set transform-set TRANSFORM-0	Uses the transform set TRANSFORM-0 for IKE phase 2 policy
Winnipeg(config-crypto-map)# match address 100	Defines the IP addresses for the IPsec tunnel
Winnipeg(config-crypto-map)# exit	Exits crypto-map configuration mode

NOTE: The Edmonton tunnel termination router has the following mirrored programming: tunnel peer IP address, interesting traffic ACL, and firewall ACL permitting VPN protocols.

Edmonton(config)# access-list 101 permit ip 10.10.30.0 0.0.0.255 192.168.30.1 0.0.0.255	Defines the source and destination IP addresses of the VPN traffic
Edmonton(config-crypto-map)# match address 101	Defines the IP addresses for the IPsec tunnel
Edmonton(config-crypto-map)# set peer 128.107.55.9	Specifies the IP address of the IPsec peer
Edmonton(config)# access-list 120 permit ahp host 128.107.55.9 host 192.31.7.1	Permits VPN protocol: Authentication Header (AH)
Edmonton(config)# access-list 120 permit esp host 128.107.55.9 host 192.31.7.1	Permits VPN protocol: Encapsulating Security Payload (ESP)
Edmonton(config)# access-list 120 permit udp host 128.107.55.9 host 192.31.7.1 eq isakmp	Permits VPN protocol: ISAKMP

Step 5: Apply the Crypto Map to the Interface (IKE Phase 2)

Winnipeg(config)# interface fastethernet 0/0	Enters interface configuration mode
Winnipeg(config-if)# crypto map CRYPTO-MAP-0	Applies the crypto map at the terminating interface
Winnipeg(config-if)# exit	Exits interface configuration mode

Step 6: Configure the Firewall Interface ACL

Winnipeg(config)# access-list 120 permit ahp host 192.31.7.1 host 128.107.55.9	Permits VPN protocol: AH
Winnipeg(config)# access-list 120 permit esp host 192.31.7.1 host 128.107.55.9	Permits VPN protocol: ESP
Winnipeg(config)# access-list 120 permit udp host 192.31.7.1 host 128.107.55.9 eq isakmp	Permits VPN protocol: ISAKMP NOTE: The ACL permitting VPN protocols is applied inbound at the border router or firewall WAN interface.
Winnipeg(config)# interface fastethernet 0/0	Enters interface configuration mode
Winnipeg(config-if)# ip access-group 120 in	Applies VPN protocol ACL inbound at the local terminating interface

Step 7: Verify the VPN Service

Winnipeg# show crypto ipsec sa	Displays the settings used by current SAs
Winnipeg# show crypto isakmp sa	Displays current IKE SAs
Winnipeg# show crypto session	Displays status information for active crypto sessions

Winnipeg# show crypto dynamic-map	Displays a dynamic crypto map set
Winnipeg# show crypto map	Displays the crypto map configuration
Winnipeg# debug crypto ipsec	Displays IPsec events
Winnipeg# debug crypto isakmp	Displays messages about IKE events
Winnipeg# debug crypto isakmp error	Displays error messages for IKE-related operations
Winnipeg# debug crypto ipsec error	Displays error messages for IPsec-related operations

Configuring IPsec Site-to-Site VPNs Using SDM

Figure 4-1 shows the network topology for the configurations that follow, which describe how to use SDM to configure an IPsec site-to-site VPN.

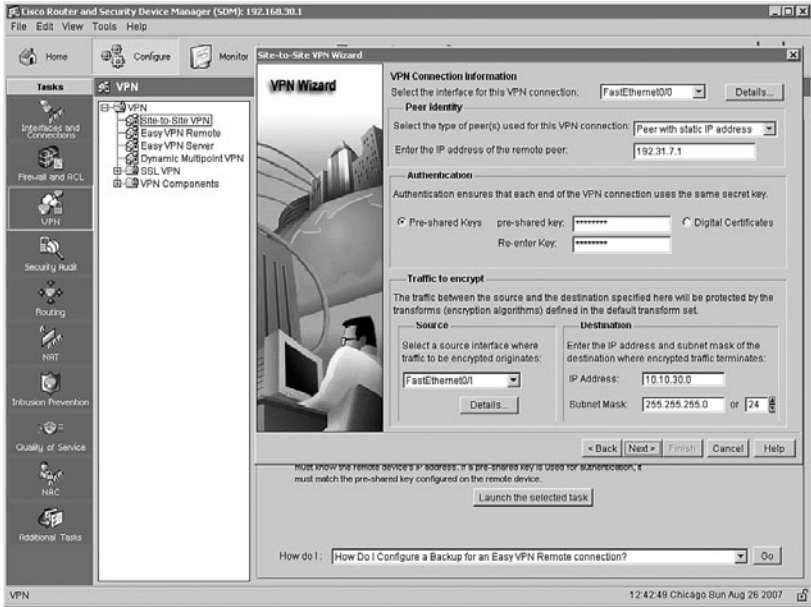
- Step 1.** Start the Cisco Security Device Manager (SDM) application on a workstation (WorkStation 1) on the 192.168.30.0/24 Winnipeg LAN segment.
- Step 2.** Choose **Configure > VPN > Tasks > Site-to-Site VPN**.
- Step 3.** Click the **Create a Site to Site VPN** radio button and then click the **Launch the Selected Task** button.
- Step 4.** Click the **View Defaults** button and peruse the SDM default crypto selections:

SDM Crypto/IPsec Default Values:

- Authentication Method: Pre-Shared Key
- Encryption: 3DES
- Negotiation Authentication: SHA (Hash)
- Public Key Cryptography: Diffie-Hellman Group 2

- Step 5.** Click **Next** to display the window shown in Figure 4-2.

Figure 4-2 Site-to-Site VPN Connection Information



- Step 6.** In the VPN Connection Information area, click the drop-down arrow and choose **FastEthernet0/0**. FastEthernet 0/0 is the terminating interface on the Winnipeg router.
- Step 7.** In the Peer Identity area, click the drop-down arrow and choose **Peer with a Static Address**. Enter the IP address (192.31.7.1) of the Edmonton Serial 0/0 interface, which is the terminating interface on the Edmonton router.
- Step 8.** In the Authentication area, click the **Pre-shared Keys** radio button.
- Step 9.** In the Source area, enter the source of the VPN traffic. In this case, VPN traffic originates from FastEthernet 0/1 on the Winnipeg router.
- Step 10.** In the Destination area, enter the destination of the VPN traffic. In this case, the destination of Winnipeg VPN traffic on the Edmonton router is 10.10.30.0/24.
- Step 11.** Choose **Next > Next** to complete and implement the programming.

NOTE: The Generate Mirror button at the bottom of the page creates a configuration for the peer VPN router. This configuration is only a guide and should *not* be applied directly to the peer VPN router.

NOTE: The IKE policy and preshared keys must be the same on both routers. The ACL applied in the crypto map of each router permits traffic from each local LAN segment to each VPN peer LAN segment.

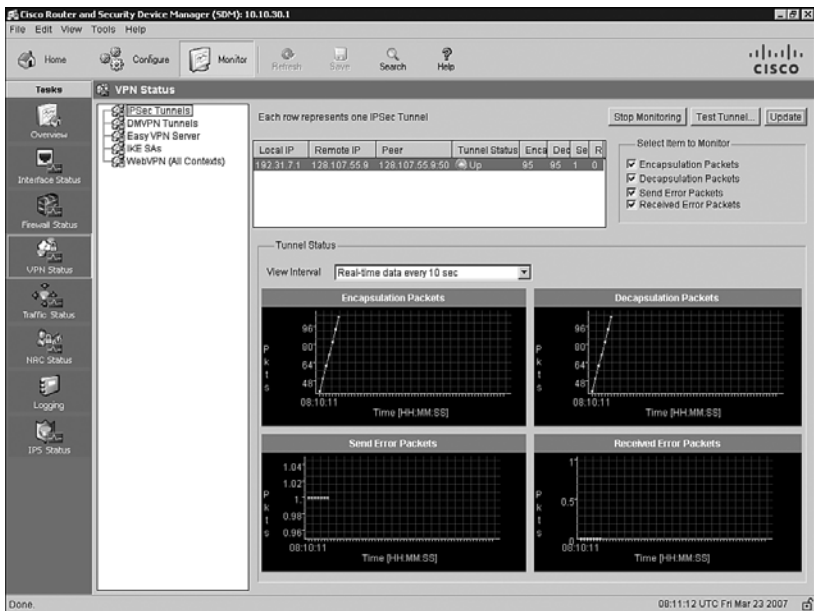
Step 12. To begin IPsec tunnel troubleshooting, from the window shown in Figure 4-3, click the **Test Tunnel** button and then click **Start**.

NOTE: SDM will attempt to activate the VPN tunnel. It will prompt for a destination host IP in the peer router's internal network and then generate traffic to that peer. SDM will generate an error report with suggested remedies if a tunnel error is encountered.

Step 13. Choose **Monitor > VPN Status > IPsec Tunnels**.

NOTE: Each VPN tunnel configured on the router can be monitored for throughput and errors.

Figure 4-3 SDM Monitoring IPsec Site-to-Site Tunnel



Configuring GRE Tunnels over IPsec

This section refers to Figure 4-1 and provides details about the configuration of a GRE over IPsec tunnel, in this case from Winnipeg to Edmonton.

The programming steps for configuring the Winnipeg router are as follows:

- Step 1.** Create the GRE tunnel.
- Step 2.** Specify the IPsec VPN authentication method.
- Step 3.** Specify the IPsec VPN IKE proposals.
- Step 4.** Specify the IPsec VPN transform sets.
- Step 5a.** Specify static routing for the GRE over IPsec tunnel.
- Step 5b.** Specify routing with OSPF for the GRE over IPsec tunnel.
- Step 6.** Enable the crypto programming at the interfaces.

NOTE: The Winnipeg and Edmonton routers are programmed to provide connectivity for LAN and WAN, including any public to private IP translation.

Step 1: Create the GRE Tunnel

Winnipeg(config)# interface tunnel0	Enters interface configuration mode (virtual GRE tunnel interface)
Winnipeg(config-if)# ip address 192.168.3.1 255.255.255.0	Assigns the tunnel IP address and netmask
Winnipeg(config-if)# tunnel source fastethernet 0/0	Defines the local tunnel interface
Winnipeg(config-if)# tunnel destination 192.31.7.1	Programs the far-end tunnel IP NOTE: The peer termination router has mirrored programming with "tunnel destination 128.107.55.9."
Winnipeg(config-if)# no shutdown	Turns on the tunnel interface

Step 2: Specify the IPsec VPN Authentication Method

Winnipeg# configure terminal	Enters global configuration mode
Winnipeg(config)# crypto isakmp policy 10	Creates an IKE phase 1 policy
Winnipeg(config-isakmp)# authentication pre-share	Specifies use of a preshared encryption key
Winnipeg(config-isakmp)# encryption 3des	Specifies use of 3DES encryption
Winnipeg(config-isakmp)# group 2	Specifies use of the Diffie-Hellman group 2 hashing algorithm
Winnipeg(config-isakmp)# exit	Exits isakmp configuration mode
Winnipeg(config)# crypto isakmp key 12345678 address 192.31.7.1	Specifies the key required for the tunnel endpoint
Edmonton(config)# crypto isakmp key 12345678 address 128.107.55.9	Specifies the key required for the tunnel endpoint NOTE: The peer termination router must have the same key and IP address of its peer termination router (128.107.55.9).

Step 3: Specify the IPsec VPN IKE Proposals

Winnipeg(config)# access-list 101 permit gre host 128.107.55.9 host 192.31.7.1	Allows GRE protocol traffic between GRE tunnel endpoints
Winnipeg(config)# crypto map VPN-1 10 ipsec-isakmp	Defines the crypto map VPN-1 to use IPsec with ISAKMP
Winnipeg(config-crypto-map)# set peer 192.31.7.1	Specifies the IP address of the IPsec peer

Winnipeg(config-crypto-map)#set transform-set TO-EDMONTON	Uses the transform set TO-EDMONTON for IKE phase 2 policy
Winnipeg(config-crypto-map)#match address 101	Defines the IP addresses for the IPsec tunnel
Winnipeg(config-crypto-map)#exit	Exits crypto-map configuration mode
Edmonton(config)#access-list 102 permit gre host 192.31.7.1 host 128.107.55.9	Allows GRE protocol traffic between GRE tunnel endpoints
Edmonton(config-crypto-map)#set peer 128.107.55.9	Specifies the IP address of the IPsec peer
Edmonton(config-crypto-map)#match address 102	Defines the IP addresses for the IPsec tunnel NOTE: The Edmonton tunnel termination router has the following mirrored programming: ACL permitting GRE inbound from the Winnipeg router, tunnel peer, and interesting traffic ACL.

Step 4: Specify the IPsec VPN Transform Sets

Winnipeg(config)#crypto ipsec transform-set TO-EDMONTON esp-des esp-md5-hmac	Creates the transform set TO-EDMONTON for the IKE phase 2 policy
Winnipeg(cfg-crypto-trans)#exit	Exits cfg-crypto-trans configuration mode

Step 5a: Specify Static Routing for the GRE over IPsec Tunnel

Winnipeg(config)# ip route 0.0.0.0 0.0.0.0 128.107.55.10	Configures a static default route to the physical next-hop IP address
Winnipeg(config)# ip route 10.10.30.0 255.255.255.0 192.168.3.2	Configures a static route for (local) tunnel traffic giving the far-end tunnel address as the next-hop IP address

Step 5b: Specify Routing with OSPF for the GRE over IPsec Tunnel

Winnipeg(config)# router ospf 1	Enables OSPF with process ID 1
Winnipeg(config-router)# passive-interface fastethernet 0/0	Disables OSPF routing updates on interface FastEthernet 0/0
Winnipeg(config-router)# passive-interface fastethernet 0/1	Disables OSPF routing updates on interface FastEthernet 0/1 NOTE: Interface Tunnel0 is the only interface participating in OSPF.
Winnipeg(config-router)# network 192.168.30.0 0.0.0.255 area 0	Configures 192.168.30.0/24 into OSPF area 0
Winnipeg(config-router)# network 192.168.3.0 0.0.0.255 area 0	Any interface with an address of 192.168.3.x is to be placed into area 0
Winnipeg(config-router)# exit	Returns to global configuration mode

NOTE: GRE is multiprotocol and can tunnel any OSI Layer 3 protocol.

Step 6: Enable the Crypto Programming at the Interfaces

Winnipeg(config-if)# interface fastethernet 0/0	Enters interface configuration mode
Winnipeg(config-if)# shutdown	Turns the interface off
Winnipeg(config-if)# crypto map VPN-1	Applies the crypto map to the WAN interface
Winnipeg(config-if)# no shutdown	Turns the interface on
Winnipeg(config-if)# exit	Returns to global configuration mode
Winnipeg(config)# interface tunnel0	Enters interface configuration mode
Winnipeg(config-if)# shutdown	Turns the interface off
Winnipeg(config-if)# crypto map VPN-1	Applies the crypto map to the tunnel interface
Winnipeg(config-if)# no shutdown	Turns the interface on

Configuring a Static IPsec Virtual Tunnel Interface

This section refers to Figure 4-1 and provides details about the configuration of an IPsec virtual tunnel interface (VTI).

NOTE: The VTI method to secure multiprotocol links is preferred over secure GRE tunnels. IPsec VTIs simplify the configuration of IPsec for protection of remote links. This feature may not be supported in older IOS releases. Please review the VTI restrictions in *Cisco IOS Security Configuration Guide, Release 12.4, "Part 4: Implementing IPsec and IKE"* (click the **Configuring Security for VPNs with IPsec** link and then click **IPsec Virtual Tunnel Interface**) at Cisco.com.

The programming steps for configuring a router (for this example, the Winnipeg and Edmonton routers) for a static IPsec VTI are as follows:

- Step 1.** Configure EIGRP AS 1.
- Step 2.** Configure Static Routing.
- Step 3.** Create IKE Policies and Peers.

- Step 4.** Create IPsec Transform Sets.
- Step 5.** Create an IPsec Profile.
- Step 6.** Create the IPsec Virtual Tunnel Interface.

Step 1: Configure EIGRP AS 1

Winnipeg(config)# router eigrp 1	Enters EIGRP routing configuration mode
Winnipeg(config-router)# no auto-summary	Turns off EIGRP's address summarization
Winnipeg(config-router)# network 192.168.3.0	Advertises the IP segment on the tunnel interface
Winnipeg(config-router)# network 192.168.30.0	Advertises the LAN IP segment
Edmonton(config)# router eigrp 1	Enters EIGRP routing configuration mode
Edmonton(config-router)# no auto-summary	Turns off EIGRP's address summarization
Edmonton(config-router)# network 192.168.3.0	Advertises the IP segment on the tunnel interface
Edmonton(config-router)# network 10.10.30.0	Advertises the LAN IP segment

Step 2: Configure Static Routing

Winnipeg(config)# ip route 0.0.0.0 0.0.0.0 128.107.55.10	Specifies default route to next-hop WAN address
Edmonton(config)# ip route 0.0.0.0 0.0.0.0 192.31.7.2	Specifies default route to next-hop WAN address NOTE: After Steps 1 through 3, connectivity and EIGRP neighbor relationships should be verified.

Step 3: Create IKE Policies and Peers

<p>Winnipeg(config)#crypto isakmp policy 10</p>	<p>Creates a policy to define the parameters used during the IKE negotiation.</p> <p>NOTE: All ISAKMP settings are not offered on all crypto-capable IOS images. Configure the settings supported by your IOS image.</p>
<p>Winnipeg(config-isakmp)#authentication pre-share</p>	<p>Specifies use of a shared common key</p>
<p>Winnipeg(config-isakmp)#encryption aes 256</p>	<p>Specifies use of 256-bit AES encryption</p>
<p>Winnipeg(config-isakmp)#hash sha</p>	<p>Specifies use of the SHA hashing algorithm</p>
<p>Winnipeg(config-isakmp)#group 5</p>	<p>Configures the IKE policy with the 1536-bit Diffie-Hellman group (group 5)</p>
<p>Winnipeg(config-isakmp)#lifetime 3600</p>	<p>Specifies the lifetime of an IKE SA</p> <p>NOTE: The IKE SA is bound to the VTI. Because the IKE SA is bound to the VTI, the same IKE SA cannot be used for a crypto map.</p>
<p>Winnipeg(config)#exit</p>	<p>Returns to global configuration mode</p>

<pre>Winnipeg(config)#crypto isakmp key KEY-1 address 0.0.0.0 0.0.0.0</pre>	<p>Assigns the common crypto key and specifies the interface IP address of the participating peer</p> <p>NOTE: The VTI programming steps for the Edmonton router are the same as those for the Winnipeg router using reciprocal (mirrored) addressing.</p>
<pre>Edmonton(config)#crypto isakmp policy 10</pre>	<p>Creates policy to define the parameters used during the IKE negotiation</p>
<pre>Edmonton(config-isakmp)#authentication pre-share</pre>	<p>Specifies use of a shared common key</p>
<pre>Edmonton(config-isakmp)#encryption aes 256</pre>	<p>Specifies use of 256-bit AES encryption</p>
<pre>Edmonton(config-isakmp)#hash sha</pre>	<p>Specifies use of the SHA hashing algorithm</p>
<pre>Edmonton(config-isakmp)#group 5</pre>	<p>Configures the IKE policy with the 1536-bit Diffie-Hellman group (group 5)</p>
<pre>Edmonton(config-isakmp)#lifetime 3600</pre>	<p>Specifies the lifetime of an IKE SA</p>
<pre>Edmonton(config)#exit</pre>	<p>Returns to global configuration mode</p>
<pre>Edmonton(config)#crypto isakmp key KEY-1 address 0.0.0.0 0.0.0.0</pre>	<p>Assigns the common crypto key and specifies the interface IP address of the participating peer</p>

Step 4: Create IPsec Transform Sets

NOTE: When IKE is not used to establish SAs, a single transform set must be used. The transform set is not negotiated, and the IPsec transform set must be configured in tunnel mode only.

Winnipeg(config)# crypto ipsec transform-set TRANSFORM-1 esp-aes 256 esp-sha-hmac ah-sha-hmac	Specifies the IPsec security protocol (AH or ESP) and the algorithm you want to use
Winnipeg(cfg-crypto-trans)# exit	Returns to global configuration mode
Winnipeg(config)#	NOTE: All IPsec transform settings are not offered on all crypto-capable IOS images. Configure the settings supported by your IOS image.
Edmonton(config)# crypto ipsec transform-set TRANSFORM-1 esp-aes 256 esp-sha-hmac ah-sha-hmac	Specifies the IPsec security protocol (AH or ESP) and the algorithm you want to use
Edmonton(cfg-crypto-trans)# exit	Returns to global configuration mode
Edmonton(config)#	

Step 5: Create an IPsec Profile

CAUTION: Static VTIs support only a single IPsec SA that is attached to the VTI interface. The traffic selector for the IPsec SA is always **"IP any any"**.

Winnipeg(config)# crypto ipsec profile PROFILE-1	Creates the Winnipeg IPsec profile PROFILE-1
Winnipeg(ipsec-profile)# set transform-set TRANSFORM-1	Links the transform TRANSFORM-1 to the profile PROFILE-1 NOTE: There are no match clauses in an IPsec profile, only set statements. Also, the <i>transform set</i> is the only parameter that <i>must</i> be defined under the profile.
Edmonton(config)# crypto ipsec profile PROFILE-1	Creates the Edmonton IPsec profile PROFILE-1 on the Edmonton router
Edmonton(ipsec-profile)# set transform-set TRANSFORM-1	Links the transform TRANSFORM-1 to the profile PROFILE-1

Step 6: Create the IPsec Virtual Tunnel Interface

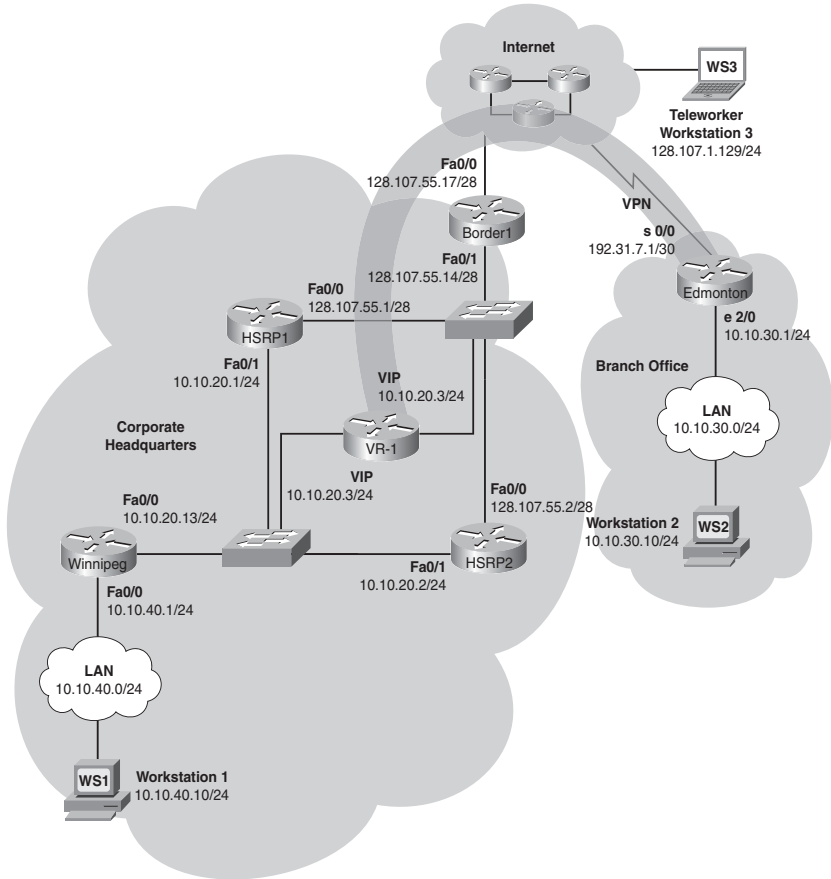
Winnipeg(config)# interface tunnel 0	Creates a “tunnel” interface
Winnipeg(config-if)# ip address 192.168.3.1 255.255.255.0	Assigns the tunnel IP address
Winnipeg(config-if)# tunnel source fastethernet 0/0	Declares the local physical interface used by the tunnel interface
Winnipeg(config-if)# tunnel destination 128.107.50.2	Names the IP address of the remote tunnel endpoint
Winnipeg(config-if)# tunnel mode ipsec ipv4	Sets IPsec using IPv4 as the encapsulation mode for the tunnel interface
Winnipeg(config-if)# tunnel protection ipsec profile PROFILE-1	Associates the tunnel interface with the IPsec profile

Edmonton(config)# interface tunnel 0	Creates a tunnel interface
Edmonton(config-if)# ip address 192.168.3.2 255.255.255.0	Assigns the tunnel IP address and netmask
Edmonton(config-if)# tunnel source ethernet 0/1	Declares the local physical interface used by the tunnel interface
Edmonton(config-if)# tunnel destination 128.107.55.9	Names the IP address of the remote tunnel endpoint
Edmonton(config-if)# tunnel mode ipsec ipv4	Sets IPsec using IPv4 as the encapsulation mode for the tunnel interface
Edmonton(config-if)# tunnel protection ipsec profile PROFILE-1	Associates the tunnel interface with the IPsec profile

Configuring High Availability VPNs

Figure 4-4 shows the network topology for IPsec stateful failover using the Hot Standby Router Protocol (HSRP).

Figure 4-4 HSRP Stateful Failover



The programming steps for configuring a router (for this example, the HSRP1 and HSRP2 routers) for IPsec HSRP stateful failover are as follows:

- Step 1.** Configure Hot Standby Router Protocol on HSRP1.
- Step 2.** Configure site-to-site VPN on HSRP1.
- Step 3.** Add programming for crypto redundancy configuration.
- Step 4.** Define the interdevice communication protocol (HSRP1 and HSRP).
- Step 5.** Apply the programming at the interface.

NOTE: There are design restrictions when configuring stateful redundancy for VPN connections. These encompass platform, IOS compatibility, and connection topology.

Step 1: Configure Hot Standby Routing Protocol Configuration on HSRP1

HSRP1(config)# interface fastethernet 0/0	Enters interface configuration mode
HSRP1(config-if)# standby 1 ip 128.107.55.3	Assigns 128.107.55.3 as the HSRP group 1 virtual router IP
HSRP1(config-if)# standby 1 preempt	Enables the active device to release control after an interface tracking event
HSRP1(config-if)# standby 1 name HSRP-OUT	Names the HSRP group
HSRP1(config-if)# standby 1 track fastethernet 1/0	Monitors the interface status to enable failover to an HSRP peer
HSRP1(config-if)# standby delay reload 120	Configures a delay before initializing HSRP groups
HSRP1(config)# interface fastethernet 0/1	Enters interface configuration mode
HSRP1(config-if)# standby 2 ip 10.10.20.3	Assigns s10.10.20.3 as the HSRP group 2 virtual router IP
HSRP1(config-if)# standby 2 preempt	Enables the active device to release control after an interface tracking event
HSRP1(config-if)# standby 2 name HSRP-IN	Names the HSRP group
HSRP1(config-if)# standby delay reload 120	Configures a delay before initializing HSRP groups
HSRP1(config-if)# standby 2 track fastethernet 0/0	Monitors the interface status to enable failover to an HSRP peer
HSRP2(config)# interface fastethernet 0/0	Enters interface configuration mode

<code>HSRP2(config-if)#standby 1 ip 128.107.55.3</code>	Assigns 128.107.55.3 as the HSRP group 1 virtual router IP
<code>HSRP2(config-if)#standby 1 preempt</code>	Enables the active device to release control after an interface tracking event
<code>HSRP2(config-if)#standby 1 name HSRP-OUT</code>	Names the HSRP group
<code>HSRP2(config-if)#standby 1 track fastethernet 1/0</code>	Monitors the interface status to enable failover to an HSRP peer
<code>HSRP2(config-if)#standby delay reload 120</code>	Configures a delay before initializing HSRP groups
<code>HSRP2(config)#interface fastethernet 0/1</code>	Enters interface configuration mode
<code>HSRP2(config-if)#standby 2 ip 10.10.20.3</code>	Assigns 10.10.20.3 as the HSRP group 2 virtual router IP
<code>HSRP2(config-if)#standby 2 preempt</code>	Enables the active device to release control after an interface tracking event
<code>HSRP2(config-if)#standby 2 name HSRP-IN</code>	Names the HSRP group
<code>HSRP2(config-if)#standby delay reload 120</code>	Configures a delay before initializing HSRP groups
<code>HSRP2(config-if)#standby 2 track fastethernet 0/0</code>	Monitors the interface status to enable failover to an HSRP peer

Step 2: Configure Site-to-Site VPN on HSRP1

HSRP1 Configuration

Tunnel Traffic Filter

<code>HSRP1(config)#ip access-list extended PEER-OUTSIDE</code>	Creates a named extended access list
<code>HSRP1(config-ext-nacl)#permit ip 10.10.40.1 0.0.0.255 10.10.30.0 0.0.0.255</code>	Defines traffic for the IPsec tunnel
<code>HSRP1(config-ext-nacl)#exit</code>	Exits to global configuration mode

Key Exchange Policy

HSRP1(config)# crypto isakmp policy 1	Creates IKE policy
HSRP1(config-isakmp)# authentication pre-share	Specifies use of a preshared key for authentication
HSRP1(config-isakmp)# exit	Exits to global configuration mode

Addressing, Authentication Credentials, and Transform Set

HSRP1(config)# crypto isakmp key 12345678 address 0.0.0.0 0.0.0.0 no-xauth	Specifies the key required for the tunnel endpoint (no user authentication)
HSRP1(config)# crypto ipsec transform-set TRANS-1 ah-md5-hmac esp-3des	Creates the transform set TRANS-1 for the IKE phase 2 policy
HSRP1(cfg-crypto-trans)# exit	Exits to global configuration mode

IPsec Tunnel

HSRP1(config)# crypto map TO-OUTSIDE 10 ipsec-isakmp	Defines the crypto map TO-OUTSIDE to use IPsec with ISAKMP
HSRP1(config-crypto-map)# set peer 192.31.7.1	Specifies the IP address of the remote IPsec peer
HSRP1(config-crypto-map)# set transform-set TRANS-1	Specifies use of the transform set TRANS-1 for IKE phase 2 policy
HSRP1(config-crypto-map)# match address PEER-OUTSIDE	Defines the IP addresses for the IPsec tunnel
HSRP1(config-crypto-map)# exit	Exits to global configuration mode

HSRP2 Configuration

Tunnel Traffic Filter

HSRP2(config)# ip access-list extended PEER-OUTSIDE	Creates named extended access list
HSRP2(config-ext-nacl)# permit ip 10.10.40.1 0.0.0.255 10.10.30.0 0.0.0.255	Defines traffic for the IPsec tunnel
HSRP2(config-ext-nacl)# exit	Exits to global configuration mode

Key Exchange Policy

HSRP2(config)# crypto isakmp policy 1	Creates IKE policy
HSRP2(config-isakmp)# authentication pre-share	Specifies the use of a preshared key for authentication
HSRP2(config-isakmp)# exit	Exits to global configuration mode

Addressing, Authentication Credentials, and Transform Set

HSRP2(config)# crypto isakmp key 12345678 address 0.0.0.0 0.0.0.0 no-xauth	Specifies the key required for the tunnel endpoint (no user authentication)
HSRP2(config)# crypto ipsec transform-set TRANS-1 ah-md5-hmac esp-3des	Creates the transform set TRANS-1 for the IKE phase 2 policy
HSRP2(cfg-crypto-trans)# exit	Exits to global configuration mode

IPsec Tunnel

HSRP2(config)# crypto map T0-OUTSIDE 10 ipsec-isakmp	Defines the crypto map VPN-2 to use IPsec with ISAKMP
HSRP2(config-crypto-map)# set peer 192.31.7.1	Specifies the IP address of the IPsec peer

HSRP2(config-crypto-map)# set transform-set TRANS-1	Specifies the use of the transform set TRANS-1 for IKE phase 2 policy
HSRP2(config-crypto-map)# match address PEER-OUTSIDE	Defines the IP addresses for the IPsec tunnel
HSRP2(config-crypto-map)# exit	Exits to global configuration mode

Step 3: Add Programming for Crypto Redundancy Configuration

HSRP1(config)# crypto ipsec transform-set TRANS-2 ah-md5-hmac esp-aes	Creates the transform set TRANS-2 for the IKE phase 2 policy
HSRP1(cfg-crypto-trans)# exit	Exits to global configuration mode
HSRP1(config)# crypto ipsec profile SS01-SECURE	Creates the general profile SSO1-SECURE for IPsec policy
HSRP1(ipsec-profile)# set transform-set TRANS-2	Specifies a transform set
HSRP1(ipsec-profile)# exit	Exits to global configuration mode
HSRP1(config)# redundancy inter-device	Enters interdevice configuration mode
HSRP1(config-red-interdevice)# scheme standby HSRP-IN	Names the redundancy scheme used between two devices
HSRP1(config-red-interdevice)# security ipsec SS01-SECURE	Specifies the IPsec profile
HSRP1(config-red-interdevice)# exit	Exits to global configuration mode
HSRP2(config)# crypto ipsec profile SS02-SECURE	Creates the general profile SSO1-SECURE for IPsec policy
HSRP2(ipsec-profile)# set transform-set TRANS-2	Specifies a transform set

HSRP2(ipsec-profile)# exit	Exits to global configuration mode
HSRP2(config)# redundancy inter-device	Enters interdevice configuration mode
HSRP2(config-red-interdevice)# scheme standby HSRP-IN	Names the redundancy scheme used between two devices
HSRP2(config-red-interdevice)# security ipsec SS02-SECURE	Specifies the IPsec profile
HSRP2(config-red-interdevice)# exit	Exits to global configuration mode

Step 4: Define the Interdevice Communication Protocol (HSRP1 and HSRP)

HSRP1(config)# ipc zone default	Configures the interdevice communication protocol
HSRP1(config-ipczone)# association 1	Creates an association between the two devices
HSRP1(config-ipczone-assoc)# no shutdown	Enables the association
HSRP1(config-ipczone-assoc)# protocol sctp	Configures Stream Control Transmission Protocol (SCTP)
HSRP1(config-ipc-protocol-sctp)# local-port 5000	Defines the local SCTP port number used to communicate with the redundant peer
HSRP1(config-ipc-local-sctp)# local-ip 10.10.20.1	Defines a local IP to communicate with the peer
HSRP1(config-ipc-local-sctp)# exit	Exits SCTP local configuration mode
HSRP1(config-ipc-protocol-sctp)# remote-port 5000	Defines the remote SCTP port number used to communicate with the redundant peer

HSRP1(config-ipc-remote-sctp)# remote-ip 10.10.20.2	Defines a remote IP to communicate with the peer
HSRP1(config-ipc-remote-sctp)# exit	Returns to local-ip configuration mode
HSRP1(config-ipc-protocol-sctp)# exit	Returns to config-ipczone- assoc mode
HSRP1(config-ipczone- assoc)# exit	Returns to config-ipczone mode
HSRP1(config-ipczone)# exit	Returns to global configuration mode
HSRP1(config)#	
HSRP2(config)# ipc zone default	Configures the interdevice communication protocol
HSRP2(config-ipczone)# association 1	Creates an association between the two devices
HSRP2(config-ipczone- assoc)# no shutdown	Enables the association
HSRP2(config-ipczone- assoc)# protocol sctp	Configures SCTP
HSRP2(config-ipc-protocol- sctp)# local-port 5000	Defines the local SCTP port number used to communicate with the redundant peer
HSRP2(config-ipc-local- sctp)# local-ip 10.10.20.2	Defines a/the local IP to communicate with the peer
HSRP2(config-ipc-local- sctp)# exit	Exits SCTP local configuration mode
HSRP2(config-ipc-protocol- sctp)# remote-port 5000	Defines the remote SCTP port number used to communicate with the redundant peer
HSRP2(config-ipc-remote- sctp)# remote-ip 10.10.20.1	Defines a remote IP to communicate with the peer

HSRP2(config-ipc-remote-sctp)#exit	Returns to local-ip configuration mode
HSRP2(config-ipc-protocol-sctp)#exit	Returns to config-ipczone- assoc mode
HSRP2(config-ipczone-assoc)#exit	Returns to config-ipczone mode
HSRP2(config-ipczone)#exit	Returns to global configuration mode
HSRP2(config)#	

Step 5: Apply the Programming at the Interface

HSRP1(config)# interface fastethernet 0/0	Enters interface configuration mode
HSRP1(config-if)# crypto map T0-OUTSIDE redundancy HSRP-OUT stateful	Applies the crypto map to the WAN-facing interface
HSRP1(config-if)# end	Returns to privileged EXEC mode
HSRP1#	
HSRP2(config)# interface fastethernet 0/0	Enters interface configuration mode
HSRP2(config-if)# crypto map T0-OUTSIDE redundancy HSRP-OUT stateful	Applies the crypto map to the WAN-facing interface
HSRP2(config-if)# end	Returns to privileged EXEC mode
HSRP2#	

Configuring Easy VPN Server Using Cisco SDM

This section refers to the network topology shown in Figure 4-1 and provides details about the configuration of Easy VPN Server:

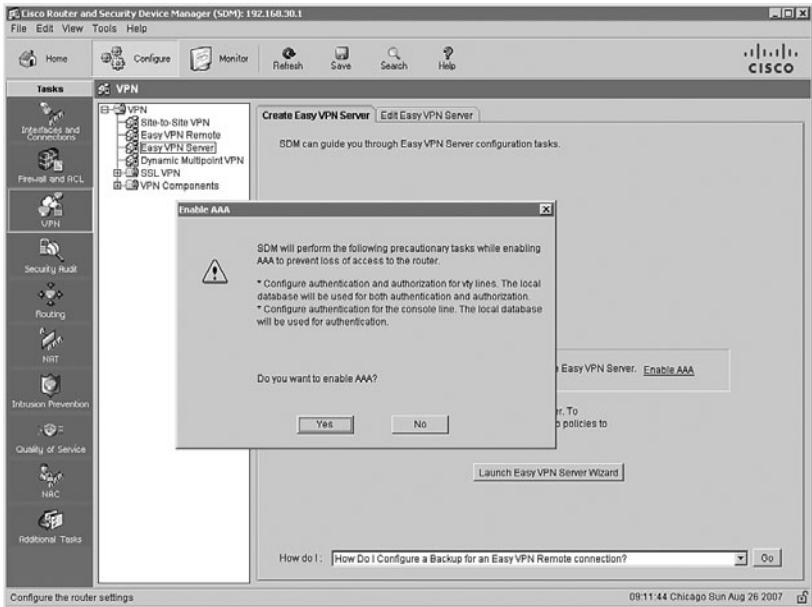
Step 1. Start the Cisco Security Device Manager application at 192.168.30.1, the Winnipeg router LAN segment interface.

Step 2. Choose **Home > Configure > VPN > Tasks > Easy VPN Server**.

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Step 3. Choose **Enable AAA** and click **Yes** in the resulting dialog box, shown in Figure 4-5.

Figure 4-5 Enabling AAA on Easy VPN Server



NOTE: One of the prerequisites of remote client authentication for the VPN service is enabling the AAA service on the target router.

Step 4. Click the **Launch Easy VPN Server Wizard** button and then click **Next**.

Step 5. Choose **FastEthernet0/0**. This is the VPN service termination interface.

Step 6. Click the **Pre-Shared Keys** radio button and then click **Next** to use preshared keys as the authentication method.

Step 7. Choose the default IKE proposal and click **Next**.

NOTE: The default SDM IKE policy is as follows:

- Authentication Method: Pre-Shared Key
- Encryption: 3DES
- Negotiation Authentication: SHA (Hash)
- Public Key Cryptography: Diffie-Hellman Group 2
- Security Association Lifetime: 1 hour

- Step 8.** Select **SDM Default Transform Set > Next**. Use the default encryption and authentication algorithms in the IPsec tunnel.
- Step 9.** Choose the **Local** radio button in the Group Authorization and Group Policy window and then click **Next**.
- Step 10.** Select **Enable User Authentication** in the User Authentication window and choose the **Local Only** radio button. Click **Next**. The router local user database will be used for authentication with the client policy group.
- Step 11.** Click the **Add** button in the Group Authorization and User Group Policy window to create a specific user policy group (see Figure 4-6).

Figure 4-6 Adding VPN Client Group Policies

Add Group Policy

General | DNS/WINS | Split Tunneling | Client Settings | XAuth Options | Client Update

Name of This Group:

Pre-shared Keys

Specify the key that will be used to authenticate the clients associated with this group.

Current Key:

Enter new pre-shared key:

Reenter new pre-shared key:

Pool Information

Specify a local pool containing a range of addresses that will be used to allocate an internal IP address to a client.

Create a new pool Select from an existing pool

Starting IP address:

Ending IP address:

Enter the subnet mask that should be sent to the client along with the IP address.

Subnet Mask: (Optional)

Maximum Connections Allowed:

- Step 12.** Enter a VPN client-group name and a chosen preshared key.
- Step 13.** Check the **Pool Information** check box, click the **Create a New Pool** radio button, and enter the Starting IP Address and Ending IP Address of the VPN client pool.

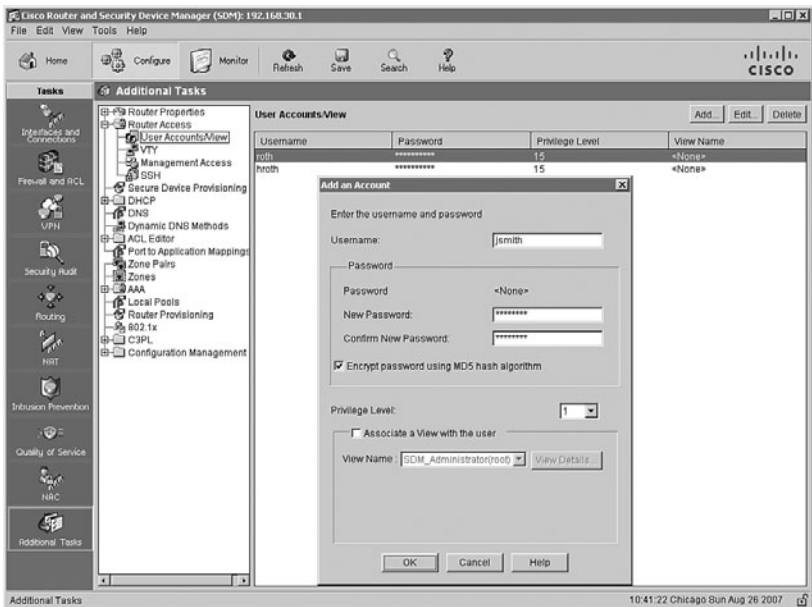
NOTE: The addresses in the pool are assigned to new VPN clients as they connect. Choose an address range or network that is not already in use and that can be accurately defined by a subnet mask. The addresses chosen do not need to be associated to a physical interface on the router.

CAUTION: Be sure to adjust/edit any ACL in a remote LAN segment or firewalls to accommodate the addresses programmed in any VPN address pool(s).

NOTE: On the DNS/WINS tab, configure any corporate DNS or WINS server addresses that the remote VPN client needs to reference.

- Step 14.** Click **OK** and then click **Next** in the Group Authorization and User Group Policies window.
- Step 15.** Review and verify the IPsec VPN choices and click **Finish** when completed.
- Step 16.** To add user accounts, choose **Configure > Additional Tasks**.
- Step 17.** In the Additional Tasks pane, choose **Router Access > User Accounts/View** and then click the **Add** button to display the window shown in Figure 4-7.

Figure 4-7 Adding VPN User to Router Local Database



Step 18. Create VPN client usernames and passwords and assign a privilege level. Click **OK** to add the user account to the local user database.

NOTE: Accept the default privilege level, 1, unless this user is required to program the router at the command prompt or through the SDM GUI.

Implementing the Cisco VPN Client

Step 1. Install and start the Cisco VPN Client application.

Step 2. Click the **New** connection entry icon.

Step 3. Complete the fields as shown in Figure 4-8.

NOTE: The Host field is the IP address at the VPN terminating interface of the router.

NOTE: The Group Authentication Name and Password must coincide with the Group and Key entries on the router.

Figure 4-8 Cisco VPN Client Create New VPN Connection Entry Dialog Box

The screenshot shows the 'Create New VPN Connection Entry' dialog box in the Cisco VPN Client. The 'Connection Entry' field is filled with 'Workshop'. The 'Description' field contains 'List Server and Stables'. The 'Host' field is set to '128.107.55.9'. The 'Authentication' tab is active, and 'Group Authentication' is selected. The 'Name' field is 'Teleworker', and the 'Password' and 'Confirm Password' fields are masked with asterisks. There is also a 'Certificate Authentication' section with a 'Name' dropdown and a 'Send CA Certificate Chain' checkbox. At the bottom, there are buttons for 'Erase User Password', 'Save', and 'Cancel'.

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CHAPTER 5

Cisco Device Hardening

This chapter provides information and commands concerning the following topics:

- Disabling unneeded services and interfaces
- Disabling commonly configured management services
- Disabling path integrity mechanisms
- Disabling features related to probes and scans
- Terminal access security
- Gratuitous and proxy Address Resolution Protocol
- Disabling IP directed broadcasts
- Locking down routers with AutoSecure
- Optional AutoSecure parameters
- Locking down routers with Cisco SDM
- Setting Cisco passwords and password security
- Securing ROMMON
- Setting a login failure rate
- Setting timeouts
- Setting multiple privilege levels
- Configuring banner messages
- Role-Based CLI
- Secure configuration files
- Tips for using Cisco access control lists
- Using ACLs to filter network traffic to mitigate threats
- Mitigating dedicated DoS (DDoS) attacks with ACLs
- Configuring an SSH server for secure management and reporting
- Configuring syslog logging
- Configuring an SNMP managed node
- Configuring NTP clients and servers
- Configuration example: NTP
- Configuring AAA on Cisco routers using CLI
- Configuring AAA on Cisco routers using SDM

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Disabling Unneeded Services and Interfaces

Router(config)# interface serial 0/0/0	Moves to interface configuration mode
Router(config-if)# shutdown	Logically disables the interface
Router(config-if)# exit	Returns to global configuration mode
Router(config)# no ip bootp server	Does not permit the router to act as a BOOTP server for other network devices
Router(config)# no cdp run	Do not advertise CDP information globally between Cisco devices.
Router(config)# interface gigabitethernet 0/1	Moves to interface configuration mode
Router(config-if)# no cdp enable	Instructs the router to not advertise CDP information between Cisco devices at the interface level
Router(config-if)# exit	Returns to global configuration mode
Router(config)# no service config	Disables the config service NOTE: The config service allows for the autoloading of configuration files from a network server.
Router(config)# no ftp-server enable	Globally disables the router FTP service

Router(config)# no tftp-server <i>file-sys:imagename</i>	Disables the TFTP service to serve the IOS image at the listed location
Router(config)# no ntp server <i>ip-address</i>	Disables both NTP server and client capabilities
Router(config)# no service pad	Disables X.25 packet assembler/disassembler (PAD) service
Router(config)# no service tcp-small-servers	Disables minor TCP services—echo, discard, chargen, and daytime—available from hosts on the network
Router(config)# no service udp-small-servers	Disables minor UDP services—echo, discard, chargen, and daytime—available from hosts on the network
Router(config-if)# no mop enabled	Disables the Digital Equipment Corporation (DEC) Maintenance Operations Protocol

NOTE: The BOOTP, CDP, and PAD services are enabled by default. Configuration auto-loading, FTP, TFTP, and NTP services are disabled by default. TCP and UDP minor services are enabled by default prior to Cisco IOS Release 11.3 and disabled by default in Cisco IOS Release 11.3 and later. The MOP service is enabled on most Ethernet interfaces.

Disabling Commonly Configured Management Services

<p>Router(config)#no snmp-server enable</p>	<p>Disables router response to SNMP queries and configuration requests</p> <p>NOTE: If SNMP is required, use SNMPv3 whenever possible. SNMPv3 offers secure communication previously unavailable in earlier versions. If HTTP or HTTPS service is required, use access control lists (ACL) to restrict access.</p>
<p>Router(config)#no ip http server</p>	<p>Disables monitoring and configuration from a web browser</p>
<p>Router(config)#no ip http secure-server</p>	<p>Disables monitoring and configuration from a secure (HTTPS) web browser</p>
<p>Router(config)#no ip domain-lookup</p>	<p>Disables undirected broadcast (255.255.255.255) as the default address to reach a DNS server</p>

NOTE: The `no ip domain-lookup` command also disables all DNS on the system.

Disabling Path Integrity Mechanisms

<p>Router(config)#no ip icmp redirect</p>	<p>Prevents the router from sending ICMP redirects</p>
<p>Router(config)#no ip source-route</p>	<p>Disables a sender from controlling the route that a packet travels through a network</p>

Disabling Features Related to Probes and Scans

Router(config)#no service finger	Disables the retrieval of user information from port 79
Router(config)#interface gigabitethernet 0/0	Moves to interface configuration mode
Router(config-if)#no ip unreachable	Disables the notification of invalid destination IP subnets or specific addresses
Router(config-if)#no ip mask-reply	Disables replies to an ICMP subnet mask query

Terminal Access Security

Router(config)#no ip identd	Do not report the identity of a TCP connection initiator.
Router(config)#service tcp-keepalives-in	Allows a router to detect when the host with which it is communicating experiences a failure
Router(config)#service tcp-keepalives-out	Allows a router to detect when the host with which it is communicating experiences a failure NOTE: TCP keepalives are sent once every minute and connection is closed if no keepalives are detected after 5 minutes.

Gratuitous and Proxy Address Resolution Protocol

Router(config)# no ip gratuitous-arps	Instructs the router to not generate gratuitous ARPs for PPP/SLIP peer addresses
Router(config)# interface serial 0/0/1	Moves to interface configuration mode
Router(config)# no ip proxy-arp	Disables proxy ARP on the specified interface

Disabling IP Directed Broadcasts

Router(config)# interface gigabitethernet 0/0	Moves to interface configuration mode
Router(config-if)# no ip directed-broadcast	Specifies that directed broadcasts destined for the subnet to which that interface is attached will be dropped, rather than being broadcast

Locking Down Routers with AutoSecure

AutoSecure is a single privileged EXEC program that allows you to eliminate many potential security threats quickly and easily. AutoSecure helps to make you more efficient at securing Cisco routers. Cisco AutoSecure is available in Cisco IOS Software Major Release 12.3 and subsequent 12.3 T releases for the Cisco 800, 1700, 2600, 3600, 3700, 7200, and 7500 Series routers.

2821Router# auto secure	Enters AutoSecure configuration mode
<pre> --- AutoSecure Configuration --- *** AutoSecure configuration enhances the security of the router, but it will not make it absolutely resistant to all security attacks *** AutoSecure will modify the configuration of your device. All configuration changes will be shown. For a detailed explanation of how the configuration changes enhance security and any possible side effects, please refer to Cisco.com for Autosecure documentation. At any prompt you may enter '?' for help. Use ctrl-c to abort this session at any prompt. Gathering information about the router for AutoSecure Is this router connected to internet? [no]: y Enter the number of interfaces facing the internet [1]: 1 </pre>	<p>Prompts the user to enter y if the device is connected to the Internet</p> <p>Prompts the user to enter the number of interfaces facing the Internet</p>

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	192.168.100.1	YES	NVRAM	up	up
GigabitEthernet0/1	192.31.7.1	YES	manual	up	up
FastEthernet0/1/0	unassigned	YES	unset	up	down
FastEthernet0/1/1	unassigned	YES	unset	up	down
FastEthernet0/1/2	unassigned	YES	unset	up	down
FastEthernet0/1/3	unassigned	YES	unset	up	down
FastEthernet0/1/4	unassigned	YES	unset	up	down
FastEthernet0/1/5	unassigned	YES	unset	up	down
FastEthernet0/1/6	unassigned	YES	unset	up	down
FastEthernet0/1/7	unassigned	YES	unset	up	down
FastEthernet0/1/8	unassigned	YES	unset	up	down
Serial0/2/0	unassigned	YES	NVRAM	administratively down	down
Serial0/2/1	unassigned	YES	NVRAM	administratively down	down
Vlan1	unassigned	YES	NVRAM	up	down

Enter the interface name that is facing the internet: **gigabitethernet0/1**

Prompts the user to enter the name of the interface that is facing the Internet.

Securing Management plane services...

Secures the management plane services

Disabling service finger
 Disabling service pad
 Disabling udp & tcp small servers
 Enabling service password encryption
 Enabling service tcp-keepalives-in
 Enabling service tcp-keepalives-out
 Disabling the cdp protocol

 Disabling the bootp server
 Disabling the http server
 Disabling the finger service
 Disabling source routing
 Disabling gratuitous arp

<p>Here is a sample Security Banner to be shown at every access to device. Modify it to suit your enterprise requirements.</p> <pre> Authorized Access only This system is the property of So-&-So-Enterprise. UNAUTHORIZED ACCESS TO THIS DEVICE IS PROHIBITED. You must have explicit permission to access this device. All activities performed on this device are logged. Any violations of access policy will result in disciplinary action. Enter the security banner {Put the banner between k and k, where k is any character}: #This system is the property of Rothson Educational Consulting. UNAUTHORIZED ACCESS TO THIS DEVICE IS PROHIBITED!# </pre>	<p>Allows you to create a security banner</p> <p>NOTE: Creating a security banner here is the same as using the banner command in global configuration mode</p>
<pre> Enable secret is either not configured or is the same as enable password Enter the new enable secret: xxxxxxxx Confirm the enable secret : xxxxxxxx </pre>	<p>AutoSecure checks to see if the enable secret password is set, or is the same as the enable password. If either is true, you are prompted to enter a new enable secret password.</p>

<pre>Enter the new enable password: xxxx % Password too short - must be at least 6 characters. Password configuration failed Enter the new enable password: xxxxxxxx Confirm the enable password: xxxxxxxx Configuring AAA local authentication Configuring Console, Aux and VTY lines for local authentication, exec-timeout, and transport Securing device against Login Attacks Configure the following parameters Blocking Period when Login Attack detected: 300 Maximum Login failures with the device: 3 Maximum time period for crossing the failed login attempts: 60 Configure SSH server? [yes]: y</pre>	<p>Prompts you to enter a new enable password, which must be at least six characters</p> <p>Checks for AAA local authentication and whether a local user account exists. If neither is true, you are prompted to enter a username and password.</p> <p>Sets the blocking period, in seconds—known as the <i>quiet period</i></p> <p>Sets the maximum number of failed login attempts that triggers the quiet period</p> <p>Sets the duration of time in which the allowed number of failed login attempts must be made before the blocking period is triggered</p> <p>Configures SSH functionality</p> <p>If you answer <i>yes</i>, AutoSecure automatically configures the SSH timeout to 60 seconds and the number of SSH authentication retries to two.</p> <p>If there is no hostname or domain name in the current configuration, you will be prompted to enter one here.</p>
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<p>Configuring interface specific AutoSecure services</p> <p>Disabling the following ip services on all interfaces:</p> <pre> no ip redirects no ip proxy-arp no ip unreachable no ip directed-broadcast no ip mask-reply </pre> <p>Disabling mop on Ethernet interfaces</p> <p>Securing Forwarding plane services...</p> <p>Enabling CEF (This might impact the memory requirements for your platform)</p> <p>Enabling unicast rpf on all interfaces connected to internet</p> <p>This is the configuration generated:</p> <pre> no service finger no service pad no service udp-small-servers no service tcp-small-servers service password-encryption service tcp-keepalives-in service tcp-keepalives-out end </pre>	<p>AutoSecure will automatically disable these services on all router interfaces.</p> <p>AutoSecure will secure the forwarding plane. Enables CEF (or dCEF if supported)) Enables unicast RPF (if supported) You are asked to enable the CBAC Firewall feature here if it is supported on the router.</p> <p>A summary is then listed for you to review.</p>
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<pre>Apply this configuration to running-config? [yes]: y Applying the config generated to running- config The name for the keys will be: 2821.yourdomain.com % The key modulus size is 1024 bits % Generating 1024 bit RSA keys, keys will be non-exportable...[OK] 2821#</pre>	<p>Type y or press Enter to accept the configuration and apply it to the running configuration.</p>
---	---

Optional AutoSecure Parameters

<pre>2821Router#auto secure management</pre>	<p>Secures only the management plane</p>
<pre>2821Router#auto secure forwarding</pre>	<p>Secures only the forwarding plane</p>
<pre>2821Router#auto secure no-interact</pre>	<p>Specifies that the user will not be prompted for any interactive configurations</p> <p>NOTE: Any parameters that need interactive dialog will not be configured, such as usernames or passwords.</p>
<pre>2821Router#auto secure full</pre>	<p>Specifies to prompt the user for all interactive questions</p> <p>NOTE: This is the same as the auto secure command shown in the previous example.</p>
<pre>2821Router#auto secure ntp</pre>	<p>Specifies the configuration of the NTP feature</p>

2821Router# auto secure login	Specifies the configuration of the Login feature
2821Router# auto secure ssh	Specifies the configuration of the SSH feature
2821Router# auto secure firewall	Specifies the configuration of the Firewall feature
2821Router# auto secure tcp-intercept	Specifies the configuration of the TCP-intercept feature

WARNING: If AutoSecure fails to complete its operation, you may end up with a corrupt running configuration. Depending on your release of IOS, the steps for recovery are as follows:

In Cisco IOS Release 12.3(8)T and later—Pre-AutoSecure configuration is stored in flash under the filename **pre_autosec.cfg**. Use the command **configure replace flash:pre_cautosec.cfg** to roll back the router to the pre-AutoSecure configuration. This will apply all necessary additions and deletions to replace the current running configuration (which may be corrupt) with the contents of the specified configuration file, which is assumed to be a complete configuration, not a partial configuration.

In Cisco IOS releases prior to 12.3(8T)—Save the running configuration to NVRAM first with the **copy running-config startup-config** command before running AutoSecure. There is no rollback feature available.

Locking Down Routers with Cisco SDM

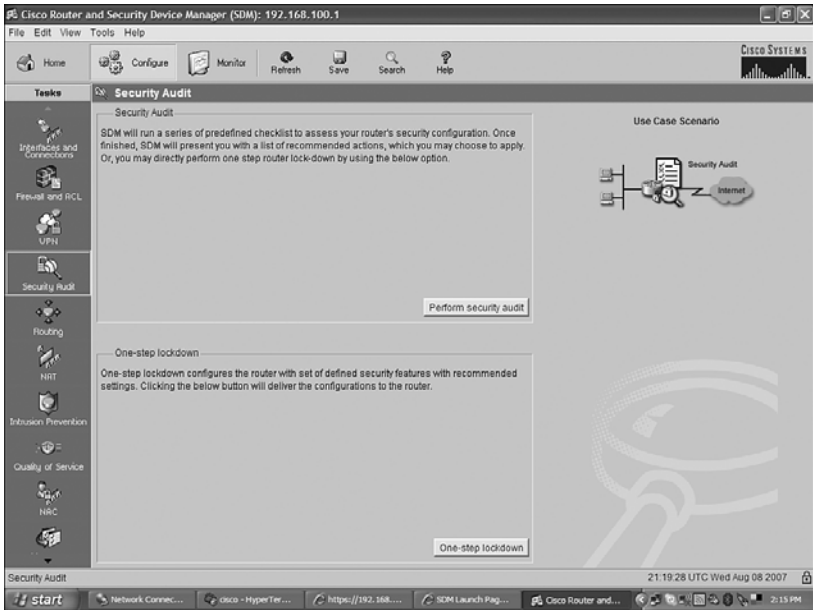
There are two options for securing your router using Cisco Router and Security Device Manager (SDM):

- **SDM Security Audit Wizard**—Compares router configurations to a predefined checklist of best practices. After comparison, a Report Card is displayed that shows a list of possible security problems. You then choose the vulnerabilities that you would like to lock down.
- **One-Step Lockdown**—Initiates an automatic lockdown using recommended settings.

SDM Security Audit Wizard

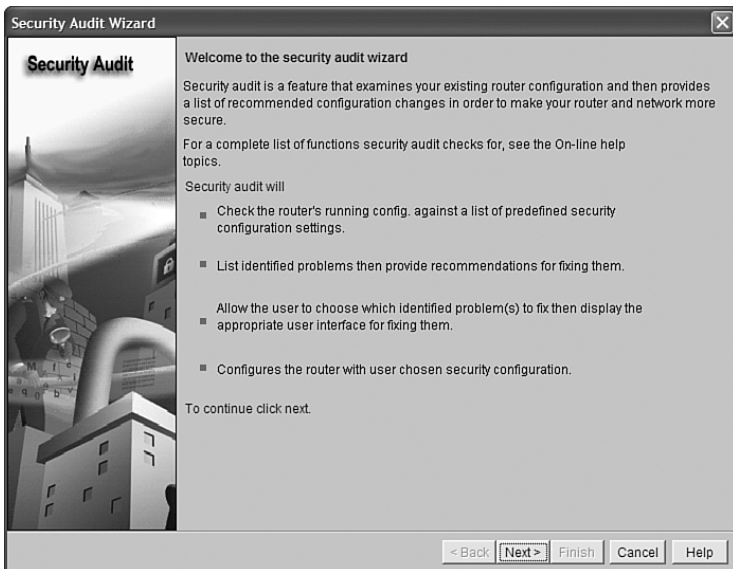
As shown in Figure 5-1, from the home page of SDM, click the **Configure** button at the top of the page, and then click the **Security Audit** icon in the Tasks toolbar.

Figure 5-1 Main Security Audit Window



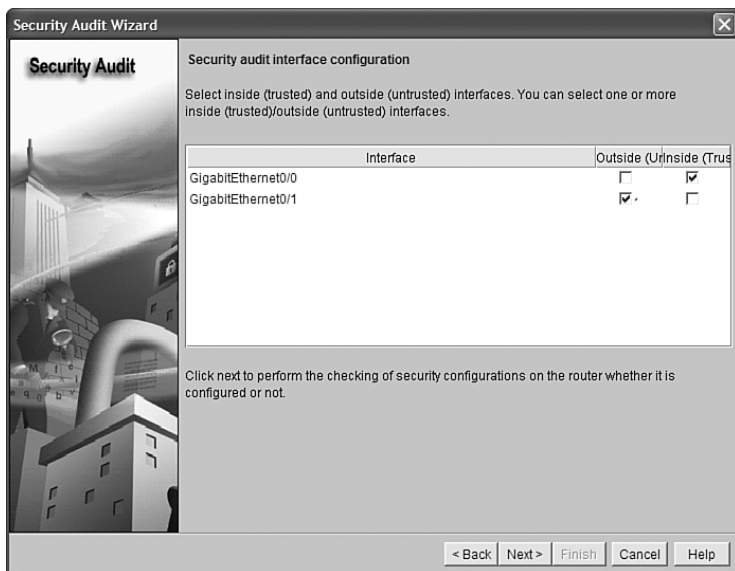
From this page you have two options: Perform Security Audit and One-Step Lockdown. Click **Perform Security Audit** to start the Security Audit Wizard, shown in Figure 5-2.

Figure 5-2 Security Audit Wizard



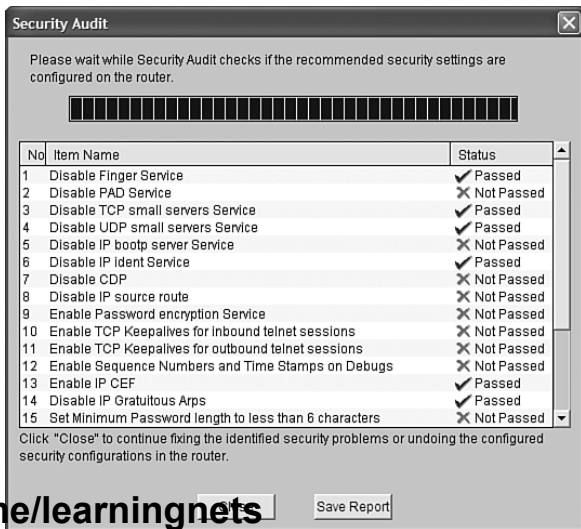
To continue with the wizard, click **Next**. This takes you to the second page of the wizard, the Interface Configuration page, shown in Figure 5-3. Choose your inside (trusted) and outside (untrusted) interfaces, and click **Next** to continue.

Figure 5-3 Security Audit Interface Configuration



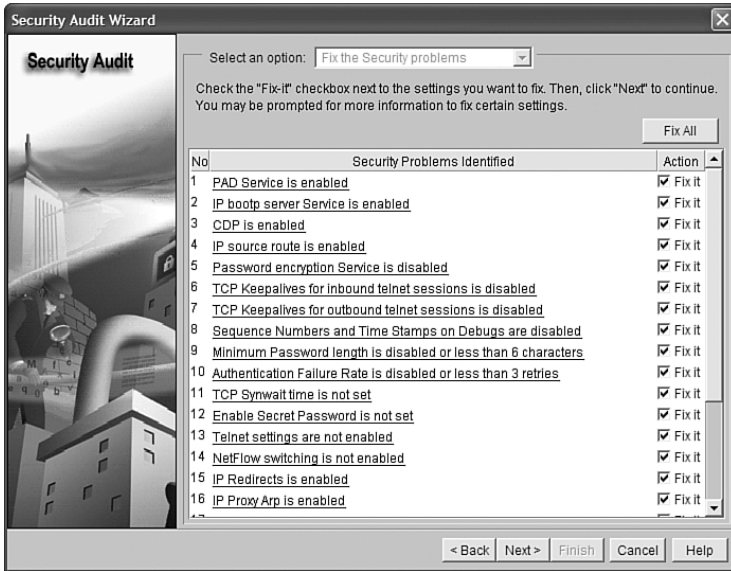
From here the Security Audit Wizard tests your router configuration and prepares a report of its findings, shown in Figure 5-4.

Figure 5-4 Security Audit Report



You have two choices at this point. Click **Close** to go on and fix the identified security problems, or click **Save Report** to save a copy of the report. Clicking Close opens the page shown in Figure 5-5, where you are given the option to either fix problems or undo something currently configured.

Figure 5-5 Security Audit Wizard—Fix the Security Problems



Depending on what you have chosen on the previous page, you are given wizard pages that allow you to correct these security violations. Figure 5-6 shows the page for entering the enable secret password.

Figure 5-6 Security Audit Wizard—Enable Secret Password

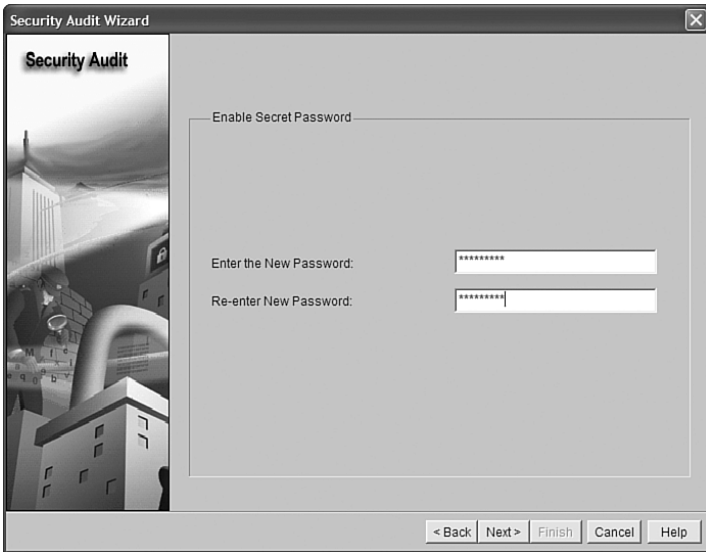


Figure 5-7 shows the Summary page of the Security Audit Wizard, which displays the changes that will be delivered to the router. After reviewing and verifying the list, click **Finish** to send these changes to the router. Figure 5-8 shows the delivery status after the commands have been sent to the router.

Figure 5-7 Security Audit Wizard—Summary

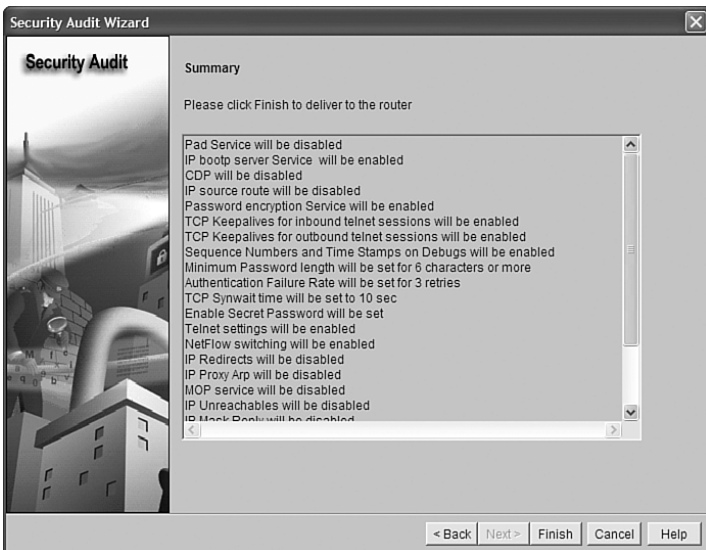
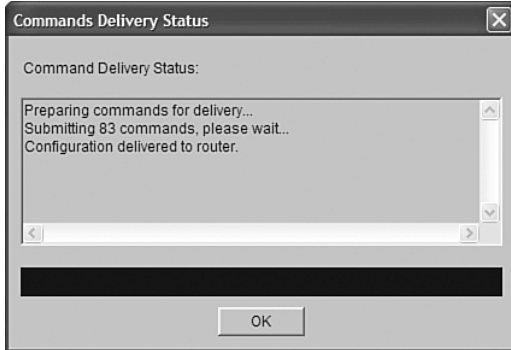


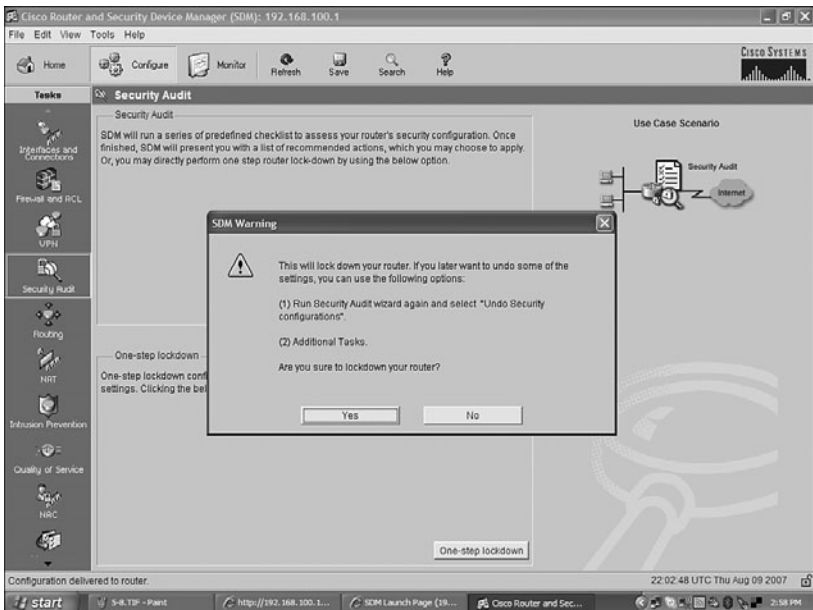
Figure 5-8 Commands Delivery Status



One-Step Lockdown

Cisco SDM also provides an easy One-Step Lockdown procedure for many security features. This option tests the router for potential problems and then automatically makes any necessary changes. Figure 5-9 shows the SDM Warning that appears if you click the **One-Step Lockdown** button on the main Security Audit page.

Figure 5-9 One-Step Lockdown—SDM Warning



Click the **Yes** button on the SDM Warning to get a summary of what the One-Step Lockdown will do to the router, shown in Figure 5-10. Click the **Deliver** button to move to the Commands Delivery Status dialog box, shown in Figure 5-11.

Figure 5-10 One-Step Lockdown

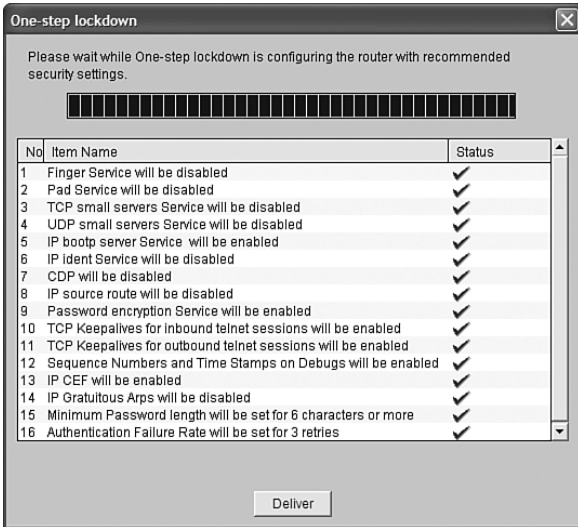
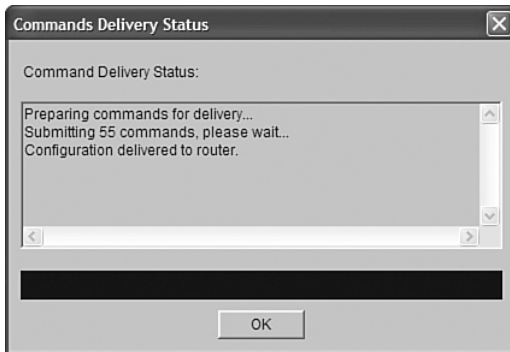


Figure 5-11 Commands Delivery Status



Setting Cisco Passwords and Password Security

Router(config)# enable password cisco	Sets the enable password to cisco
Router(config)# enable secret class	<p>Sets the enable secret password to class</p> <p>CAUTION: The enable secret password is encrypted by default. The enable password is not. For this reason, recommended practice is that you never use the enable password. Use the enable secret password only in a router configuration.</p> <p>CAUTION: You should not set both the enable password and the enable secret password to the same password. Although Cisco IOS will warn you to change your enable secret password, it will accept the same password. Doing so defeats the use of the encryption feature of the enable secret password.</p>
Router(config)# line console 0	Enters console line configuration mode
Router(config-line)# password darktower	Sets the console mode password to darktower
Router(config-line)# login	Enables password checking at login
Router(config)# line vty 0 4	Enters line vty mode for all five vty lines
Router(config-line)# password iscwguide	Sets vty password to iscwguide

Router(config-line)# login	Enables password checking at login
Router(config)# line aux 0	Enters auxiliary line mode
Router(config-line)# password backdoor	Sets console mode password to backdoor
Router(config-line)# login	Enables password checking at login
Router(config)# service password-encryption	<p>Applies a weak encryption to passwords</p> <p>NOTE: The service password-encryption command uses a Cisco proprietary algorithm based on the Vigenere cipher (as indicated by the number 7 when viewing the configuration). This is considered to be a relatively weak algorithm, and can be cracked easily. Therefore it is imperative to use other methods to secure your routers than just password encryption.</p>

<p>Router(config)#no service password-encryption</p>	<p>Turns off password encryption</p> <p>NOTE: If you use the service password-encryption command to encrypt your passwords, and then turn password encryption off with the no service password-encryption command, your passwords will remain encrypted; new passwords will be unencrypted, except for the enable secret password, which is always encrypted with the MD5 algorithm.</p>
<p>Router(config)#security passwords min-length 10</p>	<p>Sets a requirement for all user/enable passwords to be a minimum of ten characters in length</p> <p>NOTE: This command was introduced in Cisco IOS Release 12.3(1). Range is from 0 to 16 characters. Existing router passwords are not affected by this command. It is highly recommended to set a minimum password length of at least ten characters.</p>
<p>Router(config)#username roland password darktower</p>	<p>Creates a locally stored password of darktower for the username roland. The password is unencrypted but can be encrypted with the service password-encryption command.</p>

<pre>Router(config)#username roland password 7 darktower</pre>	<p>Creates a locally stored password of darktower for the username roland. The password is encrypted with the weak Vigenere algorithm.</p>
<pre>Router(config)#username roland secret 0 darktower</pre>	<p>Enables enhanced username password security that uses MD5 hashing on the plaintext password darktower</p>
<pre>Router(config)#username roland secret 5 \$1\$ExxV\$YMPap5SrXimAKcWi1h2Sp1</pre>	<p>Enables enhanced username password security that uses a previously encrypted MD5 secret</p> <p>NOTE: MD5 encryption is considered to be a strong encryption method and is therefore not retrievable. You cannot use MD5 encryption with protocols that require plaintext passwords, such as CHAP.</p>

Securing ROMMON

<pre>Router(config)#no service password-recovery</pre>	<p>Disables password-recovery capability at the system console</p> <p>NOTE: This feature is not available on all platforms. Use Cisco Feature Navigator on Cisco.com to ensure that it is available on your platform.</p>
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CAUTION: Using the **no service password-recovery** command prevents all access to ROMMON. You cannot perform a password recovery with the Break sequence to enter ROMMON.

A valid Cisco IOS image should be in flash memory before this command is entered. If you do not have a valid image in flash, you will not be able to use the ROMMON> **xmodem** command to load a new flash image.

NOTE: To recover a device once the **no service password-recovery** command has been entered, press the Break key within 5 seconds after the image decompresses during the boot. You are prompted to confirm the Break key action. When you confirm the action, the startup configuration is erased, the password-recovery procedure is enabled, and the router boots with the factory default configuration.

If you do not confirm the Break key action, the router boots normally with the No Service Password-Recovery feature enabled.

Setting a Login Failure Rate

```
Router(config)#security authentication failure  
rate 5 log
```

Configures the number of unsuccessful login attempts allowed to five

NOTE: This command is available starting with Cisco IOS Release 12.3(1). The default is ten attempts before initiating a 15-second delay. The range is from 2–1024. The **log** keyword is required because a syslog event will be generated under the name TOOMANY_AUTHFAILS.

<pre>Router(config)#login block-for 120 attempts 3 within 100</pre>	<p>Blocks access for 120 seconds after three failed login attempts within a 100-second period</p> <p>NOTE: This command was introduced in Cisco IOS Release 12.3(4)T. The duration of time in which login attempts are denied is known as the <i>quiet period</i>. The quiet period can be set from 1–65535 seconds. Failed login attempts range from 1–65535 tries. The amount of time in which the failed login attempts must be made before the quiet period is triggered ranges from 1–65535 seconds.</p> <p>NOTE: You must issue the login block-for command before using any other login commands.</p> <p>NOTE: All login attempts made via Telnet, Secure Shell (SSH), and HTTP are denied during the quiet period; no ACLs are exempt from the login period until the login quiet-mode access-class command is issued.</p>
<pre>Router(config)#login delay 10</pre>	<p>Sets a delay between successive login attempts</p> <p>NOTE: If the login delay command is not used, a default time of 1 second is set after the login block-for command is configured.</p>

Router# show login	Displays login parameters
Router# show login failures	Displays login failures

Setting Timeouts

Router(config)# line console 0	Moves to console line configuration mode
Router(config-line)# exec-timeout 2 30	<p>Sets the console to log out after 2 minutes and 30 seconds of inactivity</p> <p>NOTE: The exec-timeout command is read as minutes and seconds. exec-timeout 5 30 means 5 minutes and 30 seconds. exec-timeout 0 20 means 20 seconds. The default is 10 minutes. exec-timeout 0 1 is read as 1 second, and thus 1 second of inactivity triggers a logout.</p>

Setting Multiple Privilege Levels

Router(config)# privilege exec level 2 ping	Assigns the ping command to privilege level 2
Router(config)# privilege exec level 7 clear counters	Assigns the clear counters command to privilege level 7

<pre>Router(config)#privilege exec all level 7 reload</pre>	<p>Changes the privilege level of the reload command from level 15 to level 7</p> <p>NOTE: There are 16 levels of privileges that can be used on Cisco routers. Level 0 is predefined for user-level access privileges. Level 15 is predefined for enable mode—a user at level 15 can configure and monitor every part of the router. Levels 1–14 are customizable.</p>
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Configuring Banner Messages

<pre>Router(config)#banner motd % WARNING: This system is the property of Rothson Educational Consulting. UNAUTHORIZED ACCESS TO THIS DEVICE IS PROHIBITED! %</pre>	<p>Creates a message-of-the-day (MOTD) banner</p> <p>NOTE: In this example and the following example, % is a <i>delimiting character</i>. The delimiting character must surround the banner message and can be any character if it is not a character used within the body of the message.</p>
--	---

	<p>NOTE: The MOTD banner is displayed on all terminals and is useful for sending messages that affect all users. Use the no banner motd command to disable the MOTD banner. The MOTD banner will be displayed before the login prompt and the login banner, if one has been created.</p>
<pre>Router(config)#banner login % Authorized Personnel Only! Please enter your username and password. %</pre>	<p>Creates a login banner</p> <p>NOTE: The login banner is displayed before the username and password login prompts. Use the no banner login command to disable the login banner. The MOTD banner will be displayed before the login banner.</p>

TIP: Four valid wildcards can be used within the message section of the **banner** command:

- **\$(hostname)**—Displays the hostname for the router
- **\$(domain)**—Displays the domain name for the router
- **\$(line)**—Displays the vty or tty (asynchronous) line number
- **\$(line-desc)**—Displays the description attached to the line

```
Router(config)#banner motd %
```

```
You are connected to $(hostname) of the Rothson Educational
Consulting network. Authorized Personnel Only!
```

```
%
```

Role-Based CLI

The traditional approach of limiting CLI access based on privilege levels and enable passwords is considered to be very weak in terms of providing control. For example, there was no access control to specific interfaces, and commands placed on higher privilege levels could not be reused for lower privileged users. Role-Based CLI allows for the creation of a *view*, which is a set of commands and configuration capabilities that provides select or partial access to IOS commands.

2821(config)# aaa new-model	Enables AAA, which must be configured to create a view
2821(config)# exit	Returns to privileged mode
2821# disable	Returns to user mode
2821> enable view Password:xxxxxx %PARSER-6-VIEW_SWITCH: successfully set to view 'root' 2821#	Enters root view, which allows users to configure CLI views Prompts you to enter the enable secret password
2821# configure terminal	Moves to global configuration mode
2821(config)# parser view first %PARSER-6-VIEW_CREATED: view 'first' successfully created.	Creates a view named first and enters view configuration mode
2821(config-view)# secret firstpassword	Associates the CLI view with a secret password

<pre>2821(config-view)#secret 5 \$1\$ExxV\$YMPap5SrXimAKcWilh2Sp1</pre>	<p>Associates the CLI view with a secret password—5 indicates the password is encrypted with MD5—works for me</p> <p>NOTE: You must associate a password with a view. If you do not associate a password, and you attempt to add commands to the view via the commands command, a system message such as the following will be displayed:</p> <pre>%Password not set for view <viewname>.</pre>
<pre>2821(config-view)#commands exec include show version</pre>	<p>Adds the EXEC-level command show version to this view</p>
<pre>2821(config-view)#commands exec include configure terminal</pre>	<p>Adds the EXEC-level command configure terminal to this view</p>
<pre>2821(config-view)#commands exec include all show ip</pre>	<p>Adds all of the EXEC-level commands that start with show ip to this view</p>
<pre>2821(config-view)#commands exec include- exclusive show controllers</pre>	<p>Adds the EXEC-level command show controller to this view only. This command cannot be added to other views.</p>
<pre>2821(config-view)#commands exec exclude show protocols</pre>	<p>Excludes the EXEC-level command show protocols from this view. This command cannot be accessed when logged in under this view.</p>

2821(config-view)# exit	Exits view configuration mode
2821(config)# exit	Exits global configuration mode
2821#	
2821# enable view first	Prompts the user for a password in order to allow the user to access the view named first
2821# show parser view	Displays information about the view that the user is currently in
2821#? Exec commands: configure Enter configuration mode enable Turn on privileged commands exit Exit from the EXEC show Show running system information	Issuing a question mark (?) command here shows you what commands are available to use in this view

Secure Configuration Files

The Cisco IOS Resilient Configuration feature enables a router to secure and maintain a working copy of the running image and configuration so that those files can withstand malicious attempts to erase the contents of persistent storage in NVRAM and flash.

The Cisco IOS Resilient Configuration feature is available only on platforms that support a Personal Computer Memory Card International Association (PCMCIA) Advanced Technology Attachment (ATA) disk. There must be enough space on the storage device to accommodate at least one Cisco IOS image and a copy of the running configuration.

Secured files will not appear on the output of a **dir** command issued from an executive shell because the Cisco IOS File System (IFS) prevents secure files in a directory from being listed. ROM Monitor (ROMMON) mode does not have any such restriction and can be used to list and boot secured files. The running image and running configuration archives will not be visible in the Cisco IOS **dir** command output.

Router(config)# secure boot-image	Enables IOS image resilience and secures the running image
Router(config)# secure boot-config	Stores a secure copy of the primary bootset in persistent storage
Router(config)# exit	Returns to privileged EXEC mode
Router# show secure bootset	Displays the status of configuration resilience and the primary bootset filename

Tips for Using Access Control Lists

The Cisco Access Control List (ACL) is one of the most commonly used features in the IOS. ACLs can be used not only for packet filtering but also for selecting specific types of traffic for analysis. The following is a list of tips to consider when using ACLs:

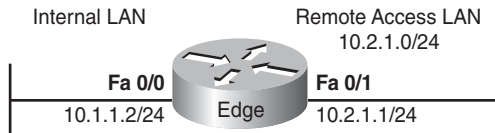
- If you want to deny or permit the entire IP protocol stack, use a standard ACL. If you want to deny or permit only part of the stack—only open up a single port, for example—use an extended ACL.
- Standard ACLs use numbers 1 to 99 and 1300 to 1999. Extended ACLs use numbers 100 to 100 and 2000 to 2699. If you are using names for your ACLs, the names cannot contain spaces or punctuation, and must begin with an alphabetic character.
- ACLs applied in an *inbound* direction apply to packets that are received on the router interface and are trying to travel *into* or *through* the router to a different exit interface. ACLs applied in an *outbound* direction apply to packets that are trying to leave the router through an exit interface.
- Disable unused services, ports, or protocols. If no one needs them, turn them off. If someone needs access to them, use an ACL.
- You can have only one ACL per interface, per direction, per protocol. Therefore, combine your requirements into a single ACL.
- All Cisco ACLs end with the *implicit deny* statement that denies everything. You will not see this statement in your ACL, but it does exist.
- Put your more-specific ACL statements at the top of your ACLs—if you have an ACL statement blocking all UDP traffic, and then a second statement that permits SNMP, the second statement will never be acted upon.

- Unless you use sequence numbers in your ACL, new ACL statements will be appended to the end of the ACL. Depending on the existing ACL statements, these new lines may never be acted upon. If necessary, write your ACLs in Notepad or some other text editor, verify them on paper first for proper syntax and order, and then cut-and-paste them into your router configuration.
- Router-generated packets are not subject to outbound ACL statements on the source router. Use the **extended ping** utility and test your ACLs by using a different source address.
- Place an extended ACL as close as possible to the source of traffic that the ACL is filtering. This is to prevent packets you know are going to be filtered out from traveling across your network, utilizing bandwidth.
- Place standard ACLs as close as possible to the destination. Placing them closer to the source may prevent legitimate packets from reaching their destinations.

Using ACLs to Filter Network Traffic to Mitigate Threats

Figure 5-12 shows the network topology for the configurations that follow, which demonstrate how to use ACLs to filter network traffic to mitigate threats to your network.

Figure 5-12 Network Edge



IP Address Spoofing: Inbound

As a rule, do not allow any IP packets that contain the source address of any internal hosts or networks inbound to a private network.

<pre>Edge(config)#access-list 101 deny ip 10.2.1.0 0.0.0.255 any log</pre>	<p>Denies any packet with a source IP address of 10.2.1.x from reaching any destination, and logs any instance in which this statement was used</p>
<pre>Edge(config)#access-list 101 deny ip 127.0.0.0 0.255.255.255 any log</pre>	<p>Denies any packet with a source IP address of 127.x.x.x from reaching any destination, and logs any instance in which this statement was used</p>

Edge(config)# access-list 101 deny ip 0.0.0.0 0.255.255.255 any log	Denies any packet with a source IP address of 0.x.x.x from reaching any destination, and logs any instance in which this statement was used
Edge(config)# access-list 101 deny ip 172.16.0.0 0.15.255.255 any log	Denies any packet with a source IP address of 172.16.0.0–172.31.255.255 from reaching any destination, and logs any instance in which this statement was used
Edge(config)# access-list 101 deny ip 192.168.0.0 0.0.255.255 any log	Denies any packet with a source IP address of 192.168.x.x from reaching any destination, and logs any instance in which this statement was used
Edge(config)# access-list 101 deny ip 224.0.0.0 31.255.255.255 any log	Denies any packet with a source IP address of 224–239.x.x.x from reaching any destination, and logs any instance in which this statement was used
Edge(config)# access-list 101 deny ip host 255.255.255.255 any log	Denies any packet with a source IP address of 255.255.255.255 from reaching any destination, and logs any instance in which this statement was used
Edge(config)# access-list 101 permit ip any 10.2.1.0 0.0.0.255	Permits any address to travel to the 10.2.1.0/24 network
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode

Edge(config-if)# ip access-group 101 in	Takes all access list lines that are defined as being part of group 101 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

IP Address Spoofing: Outbound

As a rule, you should not allow any outbound IP packets with a source address other than a valid IP address of the internal network. Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 102 permit ip 10.2.1.0 0.0.0.255 any	Permits packets with a source address of 10.2.1.x to travel to the internal network
Edge(config)# access-list 102 deny ip any any log	Denies all packets from any source to reach any destination, and logs any instance in which this statement was used NOTE: The second line of this access list is almost identical to the implicit deny statement. So why use it? The statement also has the log argument added to it, which the implicit deny statement does not have. Although the implicit deny statement could have been used here, there would be no record of how many times a packet was filtered out by the implicit deny statement.

Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 102 out	Takes all access list lines that are defined as being part of group 102 and applies them in an outbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

DoS TCP SYN Attacks: Blocking External Attacks

TCP SYN attacks involve sending large numbers of TCP SYN packets, often from a spoofed source, into the internal network, which results in the flooding of the TCP connection queues of the receiving nodes. Refer to Figure 5-12 for the network topology upon which the following configurations are based.

The following ACL prevents inbound packets, with the SYN flag set, from entering the router. However, the ACL does allow TCP responses from the outside network for TCP connections that originated on the inside network (keyword **established**). The **established** option is used for the TCP protocol only. This option indicates return traffic from an established connection. A match occurs if the TCP datagram has the ACK control bit set.

Edge(config)# access-list 103 permit tcp any 10.2.1.0 0.0.0.255 established	Permits packets with the ACK control bit set to enter the router
Edge(config)# access-list 103 deny ip any any log	Denies all other packets from entering the router, and logs any instance in which this statement was used
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode
Edge(config-if)# ip access-group 103 in	Takes all access list lines that are defined as being part of group 103 and applies them in an inbound manner

Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

DoS TCP SYN Attacks: Using TCP Intercept

TCP Intercept is a very effective tool for protecting internal network hosts from external TCP SYN attacks. TCP Intercept protects internal hosts from SYN flood attacks by intercepting and validating TCP connection requests before the requests reach the hosts. Valid connections (those connections established within the configured thresholds) are passed on to the host. Invalid connection attempts are dropped.

CAUTION: Because TCP Intercept examines every TCP connection attempt, TCP Intercept can impose a performance burden on your routers. Always test for any performance problems before using TCP Intercept in a production environment.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# ip tcp intercept list 104	Enables TCP intercept. Router IOS will intercept packets for all TCP servers based on information provided by ACL 104.
Edge(config)# access-list 104 permit tcp any 10.2.1.0 0.0.0.255	Permits packets with any source address to travel to the 10.2.1.0 network
Edge(config)# access-list 104 deny ip any any log	Denies all other packets from entering the router, and logs any instance in which this statement was used
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode
Edge(config-if)# ip access-group 104 in	Takes all access list lines that are defined as being part of group 104 and applies them in an inbound manner

Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

DoS Smurf Attacks

Smurf attacks consist of large numbers of ICMP packets sent to a router subnet broadcast address using a spoofed source IP address from that same subnet. Some routers may be configured to forward these broadcasts to other routers in the protected network, and this process causes performance degradation.

NOTE: Cisco IOS Release 12.0 and later now has the **no ip directed-broadcast** feature enabled by default, which prevents this type of ICMP attack.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 105 deny ip any host 10.2.1.255 log	Denies any packet with a destination address of 10.2.1.255
Edge(config)# access-list 105 permit ip any 10.2.1.0 0.0.0.255 log	Permits packets to any other destination address on the 10.2.1.0 network, and logs any instance in which this statement was used
Edge(config)# access-list 106 deny ip any host 10.1.1.255 log	Denies any a packet with a destination address of 10.1.1.255
Edge(config)# access-list 106 permit ip any 10.1.1.0 0.0.0.255 log	Permits packets to any other destination address on the 10.1.1.0 network, and logs any instance in which this statement was used
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode

Edge(config-if)# ip access-group 105 in	Takes all access list lines that are defined as being part of group 105 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 106 in	Takes all access list lines that are defined as being part of group 106 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Filtering ICMP Messages: Inbound

There are several Internet Control Message Protocol (ICMP) message types that attackers can use against your network. Programs use some of these messages; others are used for network management and so are automatically generated by the router.

ICMP echo packets can be used to discover subnets and hosts on the protected network and can also be used to generate DoS floods. ICMP redirect messages can be used to alter host routing tables. The router should block both ICMP echo and redirect messages that are inbound.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 107 deny icmp any any echo log	Blocks echo packets from anywhere going to anywhere, and logs any instance in which this statement was used
Edge(config)# access-list 107 deny icmp any any redirect log	Blocks redirect packets from anywhere going to anywhere, and logs any instance in which this statement was used

Edge(config)# access-list 107 deny icmp any any mask-request log	Blocks mask-request packets from anywhere going to anywhere, and logs any instance in which this statement was used
Edge(config)# access-list 107 permit icmp any 10.2.1.0 0.0.0.255	Permits all other ICMP messages from traveling to the 10.2.1.0 network
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode
Edge(config-if)# ip access-group 107 in	Takes all access list lines that are defined as being part of group 107 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Filtering ICMP Messages: Outbound

The following ICMP messages are required for proper network operation and should be allowed outbound:

- **Echo**—Allows users to ping external hosts
- **Parameter problem**—Informs host of packet header problems
- **Packet too big**—Required for packet maximum transmission unit (MTU) discovery
- **Source quench**—Throttles down traffic when necessary

As a general rule, you should block all other ICMP message types that are outbound.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 108 permit icmp 10.2.1.0 0.0.0.255 any echo	Permits echo packets from 10.2.1.x going to anywhere
Edge(config)# access-list 108 permit icmp 10.2.1.0 0.0.0.255 any parameter-problem	Permits parameter problem packets from 10.2.1.x going to anywhere

Edge(config)# access-list 108 permit icmp 10.2.1.0 0.0.0.255 any packet-too-big	Permits packet-too-big packets from 10.2.1.x going to anywhere
Edge(config)# access-list 108 permit icmp 10.2.1.0 0.0.0.255 any source-quench	Permits source-quench packets from 10.2.1.x going to anywhere
Edge(config)# access-list 108 deny icmp any any log	Denies all other ICMP packets from anywhere going to anywhere, and logs any instance in which this statement was used
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 108 in	Takes all access list lines that are defined as being part of group 108 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Filtering UDP Traceroute Messages

Traceroute displays the IP addresses of the routers that a packet encounters along the packet path (hops) from source to destination. Attackers can use ICMP responses to the UDP traceroute packets to discover subnets and hosts on the protected network.

As a rule, you should block all inbound traceroute UDP messages (UDP ports 33400 to 34400).

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 109 deny udp any any range 33400 34400 log	Denies all packets with ports in the range of 33400–34400, and logs any instance in which this statement was used NOTE: Make sure that the range of ports that you specify in this statement does not filter out any packets that you want to travel through the network.
Edge(config)# access-list 109 permit ip any 10.1.1.0 0.0.0.255 log	Permits any IP packets from anywhere destined for 10.1.1.x, and logs any instance in which this statement was used
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 109 in	Takes all access list lines that are defined as being part of group 109 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Mitigating Dedicated DoS Attacks with ACLs

Generally, routers cannot prevent all DDoS attacks, but they can help reduce the number of occurrences of attacks by building ACLs that filter known attack ports. Methods that you use to block DDoS by blocking selected ports aim at stopping TRIN00, Stacheldraht, Trinity v3, and SubSeven. ACL rules are generally applied to inbound and outbound traffic between the protected network and the Internet.

RFC 2827 recommends that ISPs police their customer traffic by dropping traffic that enters their networks from a source address that the customer network is not legitimately using. The filtering includes, but is not limited to, traffic whose source address is a “Martian

address”—a reserved address that includes any address within 0.0.0.0/8, 10.0.0.0/8, 127.0.0.0/8, 169.254.0.0/16, 172.16.0.0/12, 192.168.0.0/16, 224.0.0.0/4, or 240.0.0.0/4.

RFC 3704 is the update to RFC 2827.

Mitigating TRIN00

TRIN00 is a SYN DDoS attack. The attack method is a UDP flood.

The TRIN00 attack sets up communications between clients, handlers, and agents using these ports:

- 1524 TCP
- 27665 TCP
- 27444 UCP
- 31335 UCP

The mitigation tactic for the TRIN00 attack is to block both interfaces in the *inbound* direction. The goal is to prevent infected outside systems from sending messages to an internal network and to prevent any infected internal systems from sending messages out of an internal network to the vulnerable ports.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 150 deny tcp any any eq 1524 log	Denies any TCP traffic from any network from going to any network through port 1524, and logs any instance in which this statement was used
Edge(config)# access-list 150 deny tcp any any eq 27444 log	Denies any TCP traffic from any network from going to any network through port 27444, and logs any instance in which this statement was used
Edge(config)# access-list 150 deny tcp any any eq 27665 log	Denies any TCP traffic from any network from going to any network through port 27665, and logs any instance in which this statement was used

Edge(config)# access-list 150 deny tcp any any eq 31335 log	Denies any TCP traffic from any network from going to any network through port 31335, and logs any instance in which this statement was used
Edge(config)# access-list 150 permit ip any any	Allows all other traffic through
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode
Edge(config-if)# ip access-group 150 in	Takes all access list lines that are defined as being part of group 150 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 150 in	Takes all access list lines that are defined as being part of group 150 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Mitigating Stacheldraht

Stacheldraht is a DDoS tool that appeared in 1999 and combines features of TRIN00 and Tribe Flood Network (TFN). Possible Stacheldraht attacks are similar to the attacks of TFN; namely, ICMP flood, SYN flood, UDP flood, and smurf attacks.

A Stacheldraht attack sets up communication between clients, handlers, and agents using these ports:

- 16660 TCP
- 65000 TCP

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 151 deny tcp any any eq 16660 log	Denies any TCP traffic from any network from going to any network through port 16660, and logs any instance in which this statement was used
Edge(config)# access-list 151 deny tcp any any eq 65000 log	Denies any TCP traffic from any network from going to any network through port 65000, and logs any instance in which this statement was used NOTE: The ports listed above are the default ports for the Stacheldraht tool. Use these ports for orientation and example only, because the port numbers can easily be changed.
Edge(config)# access-list 151 permit ip any any	Allows all other traffic through
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode
Edge(config-if)# ip access-group 151 in	Takes all access list lines that are defined as being part of group 151 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode

Edge(config-if)# ip access-group 151 in	Takes all access list lines that are defined as being part of group 151 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

NOTE: If your port numbers change, and they can change, defending against this attack is rather challenging and means constant monitoring of the network.

Mitigating Trinity v3

Trinity is capable of launching several types of flooding attacks on a victim site, including UDP, fragment, SYN, restore (RST), acknowledgement (ACK), and other floods.

Communication from the handler or intruder to the agent is accomplished via Internet Relay Chat (IRC) or ICQ from AOL. Trinity appears to use primarily TCP port 6667 and also has a backdoor program that listens on TCP port 33270.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 152 deny tcp any any eq 6667 log	Denies any TCP traffic from any network from going to any network through port 6667, and logs any instance in which this statement was used
Edge(config)# access-list 152 deny tcp any any eq 32270 log	Denies any TCP traffic from any network from going to any network through port 32270, and logs any instance in which this statement was used
Edge(config)# access-list 152 permit ip any any	Allows all other traffic through
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode

Edge(config-if)# ip access-group 152 in	Takes all access list lines that are defined as being part of group 152 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 152 in	Takes all access list lines that are defined as being part of group 152 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Mitigating SubSeven

SubSeven is a backdoor Trojan horse program that targets Windows machines. When a machine is infected, the attacker can take complete control over the system and has full access as if they were a local user. Depending on the version, an attacker will try to exploit TCP ports 1243, 2773, 6711, 6712, 6713, 6776, 7000, 7215, 16959, 27374, 27573, and 54283.

Refer to Figure 5-12 for the network topology upon which the following configurations are based.

Edge(config)# access-list 153 deny tcp any any eq 1243 log	Denies any TCP traffic from any network from going to any network through port 1243, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 2773 log	Denies any TCP traffic from any network from going to any network through port 2773, and logs any instance in which this statement was used

Edge(config)# access-list 153 deny tcp any any range 6711 6713 log	Denies any TCP traffic from any network from going to any network through ports 6711–6713, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 6776 log	Denies any TCP traffic from any network from going to any network through port 6776, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 7000 log	Denies any TCP traffic from any network from going to any network through port 7000, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 7215 log	Denies any TCP traffic from any network from going to any network through port 7215, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 16959 log	Denies any TCP traffic from any network from going to any network through port 16959, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 27374 log	Denies any TCP traffic from any network from going to any network through port 27374, and logs any instance in which this statement was used

Edge(config)# access-list 153 deny tcp any any eq 27573 log	Denies any TCP traffic from any network from going to any network through port 27573, and logs any instance in which this statement was used
Edge(config)# access-list 153 deny tcp any any eq 54283 log	Denies any TCP traffic from any network from going to any network through port 54283, and logs any instance in which this statement was used
Edge(config)# access-list 153 permit ip any any	Allows all other traffic through
Edge(config)# interface fastethernet 0/0	Moves to interface configuration mode
Edge(config-if)# ip access-group 153 in	Takes all access list lines that are defined as being part of group 153 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)# interface fastethernet 0/1	Moves to interface configuration mode
Edge(config-if)# ip access-group 153 in	Takes all access list lines that are defined as being part of group 153 and applies them in an inbound manner
Edge(config-if)# exit	Returns to global configuration mode
Edge(config)#	

Configuring an SSH Server for Secure Management and Reporting

You should use SSH instead of Telnet to manage your Cisco routers whenever possible. SSH version 1 (SSHv1) is supported in Cisco IOS Release 12.1(1)T and later, while SSH version 2 (SSHv2) is supported in Cisco IOS Release 12.3(4)T and later.

Before you can configure your routers for SSH, be sure of the following:

- Target routers are running IOS 12(1)T image or later with the IPsec feature set
- Target routers are configured for local authentication
- The AAA server is configured for username and password authentication
- Target routers all have unique hostnames
- Target routers are all using the correct domain name of your network

Router(config)# ip domain-name yourdomain.com	Assigns a domain name to the router
Router(config)# crypto key generate rsa general-keys modulus 1024	Generates an RSA key that will be used for SSH. A minimum key length of modulus 1024 is recommended.
Router(config)# ip ssh time-out 100	Configures the time that the router will wait for the SSH client to respond. Time is measured in seconds and can be a number from 1–120.
Router(config)# ip ssh authentication-retries 3	Configures the number of retries allowed. The number can range from 0–5.
Router(config)# line vty 0 4	Moves to line configuration mode
Router(config-line)# no transport input telnet	Disables Telnet on all five vty lines NOTE: If you are going to use SSH, be sure to disable Telnet on all router vty lines.

Router(config-line)# transport input ssh	<p>Enables SSH on all five vty lines</p> <p>NOTE: Cisco routers with Cisco IOS Release 12.1(3)T and later can act as SSH clients as well as SSH servers. This means that you could initiate an SSH client-to-server session from your router to a central SSH server system.</p>
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Configuring Syslog Logging

Cisco routers are capable of logging information relating to a number of different kinds of events that occur on a router—configuration changes, ACL violations, interface status, and so on. Cisco routers can direct these log messages to several different locations: console, terminal lines, memory buffers, SNMP traps, or an external syslog server.

In order to get the most out of your router log messages, it is imperative that your routers display the correct time; using NTP will help facilitate your routers all having the correct time.

There are eight levels of severity in logging messages:

Level	Name	Definition	Example
0	emergencies	System is unusable	Cisco IOS Software could not load
1	alerts	Immediate action needed	Temperature too high
2	critical	Critical conditions	Unable to allocate memory
3	errors	Error conditions	Invalid memory size
4	warnings	Warning conditions	Crypto operation failed
5	notifications	Normal but significant conditions	Interface changed state, up or down
6	informational	Informational messages	Packet denied by ACL (default)
7	debugging	Debugging messages	Packet type invalid

Setting a level means you will get that level and everything below it. For example, level 6 means you will receive level 6 and 7 messages. Level 4 means you will get messages for levels 4–7.

<code>Router(config)#logging on</code>	Enables logging to all supported destinations
<code>Router(config)#logging 192.168.10.53</code>	Sends logging messages to a syslog server host at address 192.168.10.53
<code>Router(config)#logging sysadmin</code>	Sends logging messages to a syslog server host named sysadmin
<code>Router(config)#logging trap x</code>	Sets the syslog server logging level to value x , where x = a number between 0 and 7 or a word defining the level
<code>Router(config)#logging source-interface loopback 0</code>	Sets the source IP address of the syslog packets, regardless of the interface where the packets actually exit the router
<code>Router(config)#service timestamps log datetime</code>	Includes a timestamp in all subsequent syslog messages

Configuring an SNMP Managed Node

<code>Router(config)#snmp-server engineID local 1234</code>	Sets a string to identify the local device as 1234. If no engine ID is defined, one is generated for you.
<code>Router(config)#snmp-server group scottgroup v3 auth</code>	Defines an SNMP group named scottgroup for SNMPv3 using authentication

<code>Router(config)#snmp-server group hansgroup v3 auth priv</code>	Defines an SNMP group named hansgroup for SNMPv3 using authentication and encryption (privacy)
<code>Router(config)#snmp-server user Scott scottgroup v3 auth md5 scott2passwd</code>	Defines a user Scott belonging to the group scottgroup. Authentication uses MD5 for the password scott2passwd. No encryption parameters are set.
<code>Router(config)#snmp-server user Hans hansgroup v3 auth md5 hans2passwd priv des56 password2</code>	Defines a user Hans belonging to the group hansgroup. Authentication uses MD5 for the password hans2passwd. Encryption parameters use 56-bit DES with a password of password2.
<code>Router(config)#snmp-server host 172.16.31.200 inform version 3 noauth Hans</code>	Specifies the recipient—172.16.31.200—of an SNMP notification in the form of an inform. The SNMPv3 security level of noauth is used. The username is Hans.

Configuring NTP Clients and Servers

Use NTP to synchronize the clocks in the entire network.

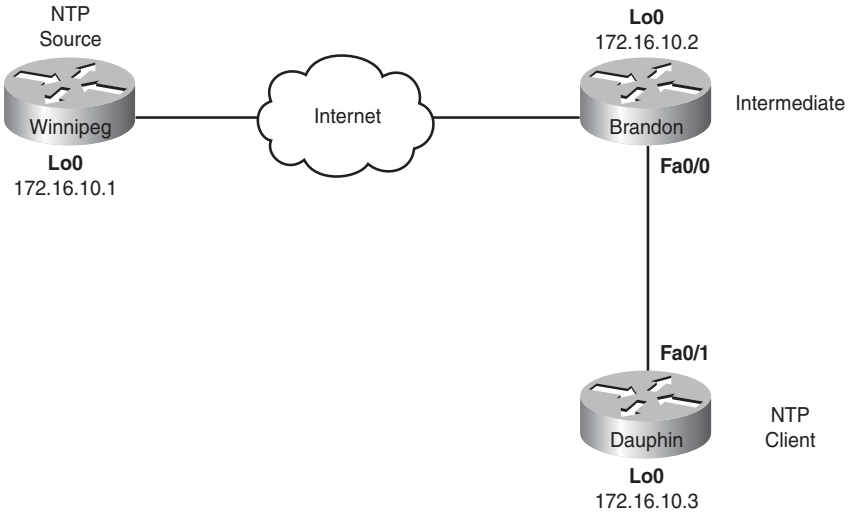
Router(config)# ntp authenticate	Enables NTP authentication for associations with other systems
Router(config)# ntp authentication-key 1 md5 wordpass	Defines the authentication key as number 1, MD5 support, and a key value of wordpass NOTE: The key number is a number between 1–4294967295. MD5 is the only key type supported. The key value is an arbitrary value of up to eight characters.
Router(config)# ntp trusted-key 1	Sets the trusted key number, which must match the authentication-key number
Router(config)# ntp server 192.168.100.15	Configures the location of the NTP server to be found at 192.168.100.15
Router(config)# ntp server 192.168.100.15 key 1	Configures the location of the NTP server to be found at 192.168.100.15 and defines the authentication key as 1
Router(config)# ntp server 192.168.100.15 key 1 prefer	Configures the location of the NTP server to be found at 192.168.100.15 and defines the authentication key as 1 NOTE: The prefer argument states that this server is preferred over other NTP servers.

Router(config)# interface gigabitethernet 0/0	Moves to interface configuration mode
Router(config-if)# ntp broadcast	Configures this interface to send NTP broadcast packets
Router(config-if)# ntp broadcast client	Configures this interface to listen to NTP broadcasts
Router(config-if)# exit	Returns to global configuration mode
Router(config)# access-list 1 permit host 192.168.100.15	Creates an ACL defining a specific address of 192.168.100.15
Router(config)# ntp access-group peer 1	Allows time requests and NTP control queries and allows the system to synchronize itself to a system whose address passes the ACL criteria—in this case ACL 1
Router(config)# ntp source loopback 0	This interface is used for the source address for all packets sent to all destinations
Router(config)# ntp peer 192.168.100.15	Configures the router's software clock to synchronize a peer or to be synchronized by a peer at 192.168.100.15
Router(config)# npt master 3	Makes this system an authoritative NTP server using NTP stratum 3 NOTE: The stratum number is a number from 1 to 15. The default stratum is 8.

Configuration Example: NTP

Figure 5-13 shows the network topology for the configuration that follows, which shows how to configure NTP using commands covered in this chapter. Note that only the NTP commands are shown.

Figure 5-13 Network Topology for NTP Configuration Example



Winnipeg Router (NTP Source)

Winnipeg(config)#ntp master 5	Makes this system an authoritative NTP server using NTP stratum 5
Winnipeg(config)#ntp authentication-key 1 md5 manitoba	Creates authentication key 1 with a password of manitoba
Winnipeg(config)#ntp peer 172.16.10.2 key 1	Creates a peer relationship with 172.16.10.2 using authentication key 1
Winnipeg(config)#ntp source loopback 0	This interface is used for the source address for all packets sent to all destinations

Brandon Router (Intermediate Router)

Brandon(config)# ntp authentication-key 1 md5 manitoba	Creates authentication key 1 with a password of manitoba
Brandon(config)# ntp authentication-key 2 md5 notsask	Creates authentication key 1 with a password of notsask
Brandon(config)# ntp trusted-key 1	Defines key 1 as trusted
Brandon(config)# ntp server 172.16.10.1	Identifies the NTP server by its address of 172.16.10.1
Brandon(config)# ntp source loopback 0	This interface is used for the source address for all packets sent to all destinations
Brandon(config)# interface fastethernet 0/0	Moves to interface configuration mode
Brandon(config-if)# ntp broadcast	Configures this interface to send NTP broadcast packets

Dauphin Router (Client Router)

Dauphin(config)# ntp authentication-key 2 md5 notsask	Creates authentication key 1 with a password of notsask
Dauphin(config)# ntp trusted-key 2	Defines key 2 as trusted
Dauphin(config)# interface fastethernet 0/1	Moves to interface configuration mode
Dauphin(config-if)# ntp broadcast client	Configures this interface to listen to NTP broadcasts

Configuring AAA on Cisco Routers Using CLI

TACACS+

Router(config)# aaa new-model	Enables AAA with the new access control commands and thereby disables old commands
Router(config)# tacacs-server host 192.168.100.100	Identifies the TACACS+ server at 192.168.100.100
Router(config)# tacacs-server host 192.168.100.100 single-connection	Identifies the TACACS+ server at 192.168.100.100 and multiplexes all packets over a single TCP connection to the server
Router(config)# tacacs-server host 192.168.100.100 key shared1	Identifies the TACACS+ server at 192.168.100.100, and identifies the shared secret key of shared1
Router(config)# tacacs-server key shared1	Enables the shared secret encryption key shared1 between the network access server and the Cisco Secure ACS server

RADIUS

Router(config)# aaa new-model	Enables AAA with the new access control commands and thereby disables old commands
Router(config)# radius-server host 192.168.100.100	Identifies the RADIUS server at 192.168.100.100
Router(config)# radius-server key shared1	Enables the shared secret encryption key shared1 to be used with the RADIUS AAA server

Authentication

Router(config)# aaa authentication login default group tacacs+ local line	Sets the default login location as the TACACS+ server. If there is no response from the server, use the local username and password database.
Router(config)# aaa authentication login default group radius local line	Sets the default login location as the RADIUS server. If there is no response from the server, use the local username and password database. NOTE: AAA authentication can be used for general login, privileged EXEC mode access, 802.1x, EAP over UDP, PPP, and Stack Group Bidding Protocol (SGBP).

Authorization

<pre>Router(config)#aaa authorization exec default group tacacs+ local none</pre>	<p>Sets that authorization will be performed by TACACS+. If no connection can be made, the local database will be used.</p>
<pre>Router(config)#aaa authorization exec default group radius local none</pre>	<p>Authorization will be performed by RADIUS. If no connection can be made, the local database will be used.</p>
<pre>Router(config)#aaa authorization commands 15 tacacs+ if-authenticated none</pre>	<p>Runs authorization for all commands at privilege level 15</p> <p>NOTE: The aaa authorization command can be used to authorize an EXEC shell, commands at a particular privilege level, network access (including SLIP, PPP, PPP-NCP and AppleTalk Remote Access), and reverse Telnet connections.</p>

Accounting

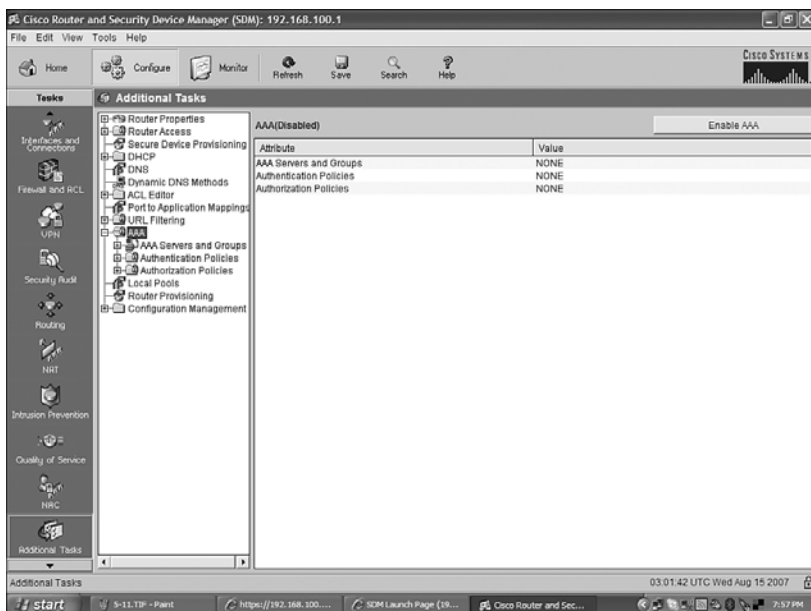
<pre>Router(config)#aaa accounting exec default start-stop group tacacs+</pre>	<p>Audits the EXEC process using a start-stop accounting notice with TACACS+</p>
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Router(config)# aaa accounting network default start-stop group radius	Audits network services using the default accounting list, using a start-stop accounting notice with RADIUS NOTE: The AAA accounting function can note authenticated-proxy user events, all system-level events, all network-related service requests, EXEC shell sessions, all commands at the specified privilege levels with accompanied start and stop process notices and send them to multiple AAA servers.
Router# debug aaa authentication	Displays information on authentication events
Router# debug aaa authorization	Displays information on authorization events
Router# debug aaa accounting	Displays information on accounting events
Router# debug radius	Displays information associated with RADIUS
Router# debug tacacs	Displays information associated with TACACS+

Configuring AAA on Cisco Routers Using SDM

From the home page of SDM, click the **Configure** button at the top of the page, and then click the **Additional Tasks** icon in the Tasks toolbar. You may need to scroll down to see the icon—it is below the NAC button. When you click the Additional Tasks icon, the window should look like the one shown in Figure 5-14.

Figure 5-14 Additional Tasks: AAA



Start the AAA process by clicking the **Enable AAA** button in the upper-right part of the window. The dialog box shown in Figure 5-15 appears, telling you that SDM is going to perform some precautionary tasks before starting. Click **Yes** to continue.

Figure 5-15 Enable AAA

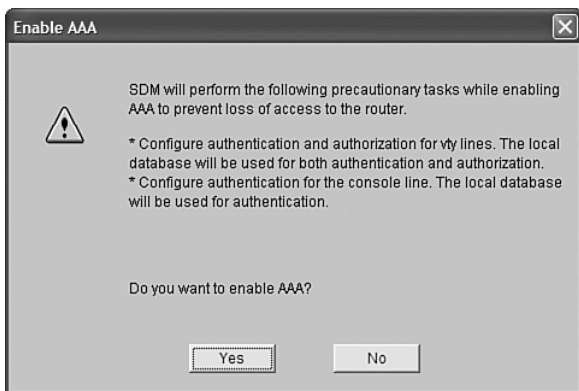
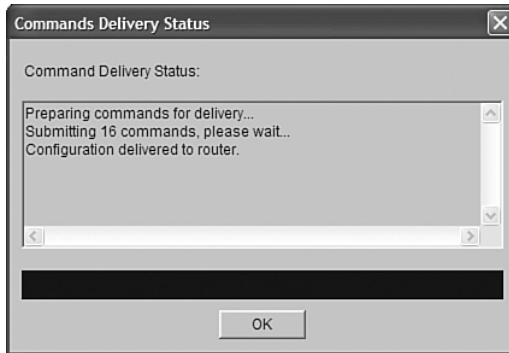


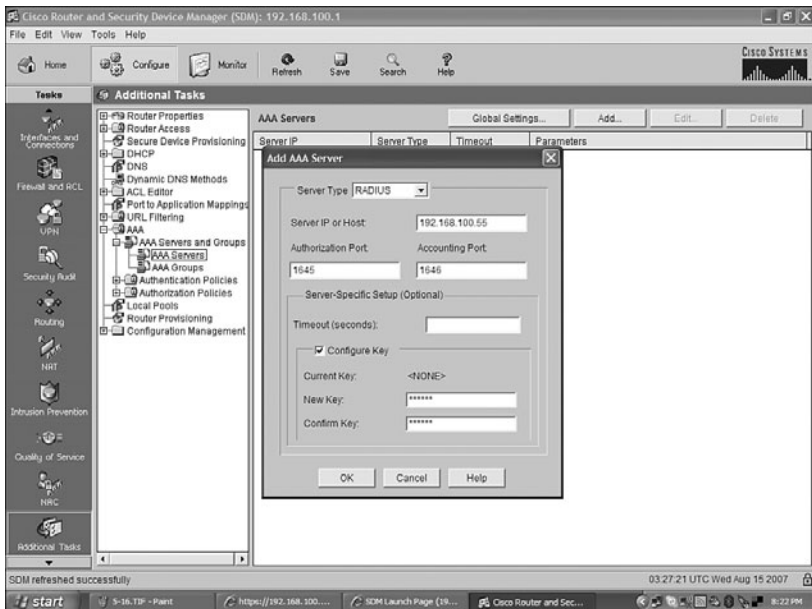
Figure 5-16 shows the Commands Delivery Status dialog box, showing that the commands needed to enable AAA have been delivered to your router.

Figure 5-16 AAA: Commands Delivery Status



After enabling AAA on the router, you need to define an AAA server. In the Additional Tasks window (see Figure 5-14), expand **AAA** and **AAA Servers and Groups** to expose the choice of AAA Servers and AAA Groups. Click **AAA Servers** and then click the **Add** button in the upper-right corner. The Add AAA Server dialog box appears, as shown in Figure 5-17. Fill in the fields with the appropriate information and then click **OK**. Another Command Delivery Status dialog box appears. Click **OK**.

Figure 5-17 Add AAA Server



Next you have to create (or modify) an authentication policy. In the Additional Tasks window (see Figure 5-14), under AAA, expand **Authentication Policies**. You can either edit an existing policy, by highlighting it and clicking the Edit button in the upper-right corner, or create a new policy, by clicking the Add button. When AAA is enabled, a default authentication policy is created, called default, which uses local authentication to prevent session lockout. Figure 5-18 shows how to create a new policy called radius_local that will use *group radius* as the first authentication method. Note that there are several authentication methods that are available.

Figure 5-18 Creating a Logging Authentication Policy—Group Radius

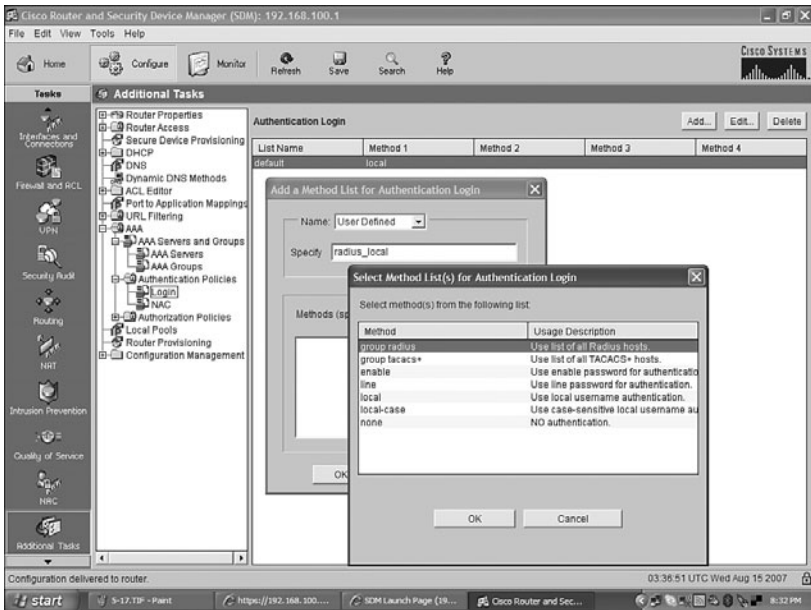
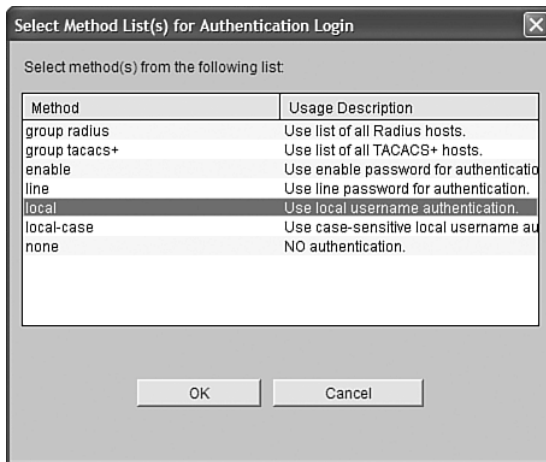


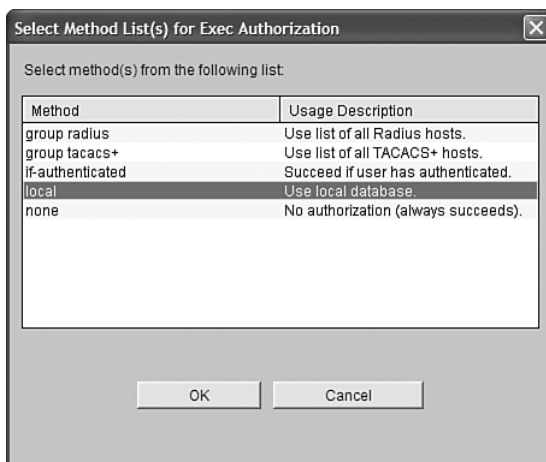
Figure 5-19 shows the addition of the *local* method as a second, backup authentication method in case RADIUS fails.

Figure 5-19 Creating a Logging Authentication Policy—Local



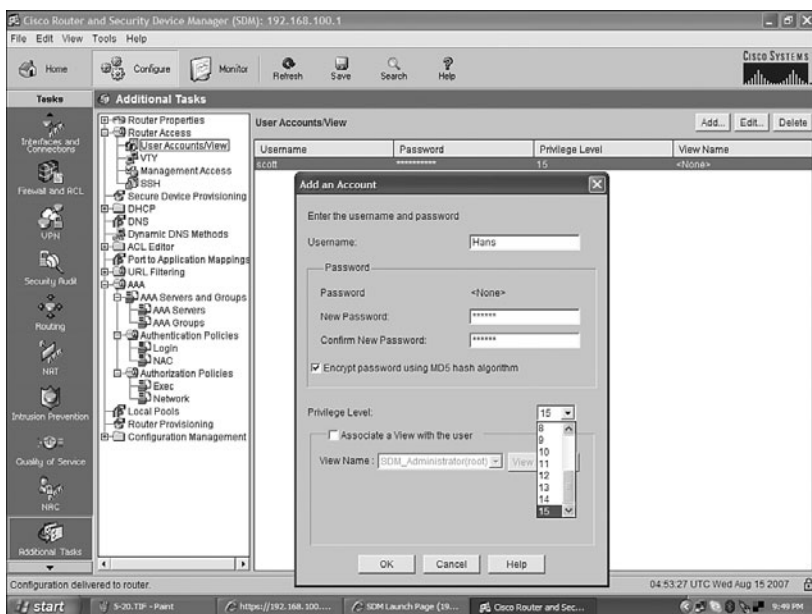
Now you need to create (or modify) an authorization policy. In the Additional Tasks window (see Figure 5-14), under AAA, expand **Authorization Policies**. You can either edit an existing policy, by highlighting it and selecting the Edit button in the upper-right corner, or create a new policy, by clicking the Add button. When AAA is enabled, a default authorization policy is created, called default. Figure 5-20 shows the creation of a new authorization policy called radius_local, which will use *group radius* as the first method for authorization, and *local* as the second, or backup method.

Figure 5-20 Creating a Logging Authorization Policy



After creating local authentication in the AAA configuration on the router, you need to add user accounts to the local database. In the Additional Tasks window, expand **Router Access** and select **User Accounts/View**. Click **Add**, and you see the Add an Account dialog box, shown in Figure 5-21. Enter in all appropriate information such as username, password, password encryption if required, and associated privilege level, if required. Click the OK button when finished. If you want to add another user account, click **ADD** again and repeat the process.

Figure 5-21 Adding an Account



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Cisco IOS Threat Defense Features

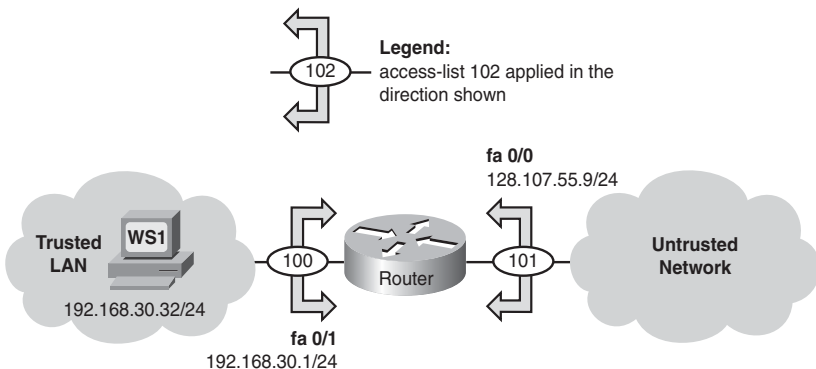
This chapter provides information and commands concerning the following topics:

- Configuring an IOS Firewall from the command-line interface (CLI)
- Configuring a Basic Firewall using Secure Device Manager (SDM)
- Configuring an Advanced Firewall using SDM
- Verifying firewall activity using the CLI
- Verifying firewall activity using SDM
- Configuring a Cisco IOS Intrusion Prevention System (IPS) from the CLI
- Configuring a Cisco IOS IPS from the SDM
- Viewing Security Device Event Exchange (SDEE) messages through SDM
- Tuning signatures through SDM

Configuring an IOS Firewall from the CLI

Figure 6-1 shows the network topology for the configuration that follows, which shows how to configure a Cisco IOS Firewall from the command-line interface (CLI).

Figure 6-1 Network Topology for IOS Firewall CLI Configuration



The six steps to implementing a Cisco IOS Firewall from the CLI follow:

Step 1. Choose the interface and packet direction to inspect.

Step 2. Configure an IP ACL for the interface.

Step 4. Define the inspection rules.

Step 5. Apply the inspection rules and the ACL to the outside interface.

Step 6. Verify the configuration.

Following the presentation of these steps, this section lists and describes commands for troubleshooting the configuration.

Step 1: Choose the Interface and Packet Direction to Inspect

Choose inbound LAN traffic at FastEthernet 0/1 to the untrusted network for ACL 100. The direction of traffic is relative to the router. Choose inbound WAN traffic at FastEthernet 0/1 for ACL 101. ACL 101 permits traffic from the untrusted network that is not specifically handled by the stateful inspection outbound at FastEthernet 0/1.

Step 2: Configure an IP ACL for the Interface

Router(config)# accesslist 100 permit tcp 192.168.30.0 0.0.0.255 any	Allows inside legitimate traffic and prevents spoofing
Router(config)# accesslist 100 permit udp 192.168.30.0 0.0.0.255 any	Allows inside legitimate traffic and prevents spoofing
Router(config)# accesslist 100 permit icmp 192.168.30.0 0.0.0.255 any	Allows inside legitimate traffic and prevents spoofing
Router(config)# accesslist 100 deny ip any any	Allows inside legitimate traffic and prevents spoofing
Router(config)# access-list 101 deny ip 192.168.30.0 0.0.0.255 any	Denies a spoofed address (192.168.30.x/24)
Router(config)# access-list 101 permit icmp any host 128.107.55.9 echo-reply	Permits returning ICMP echo reply
Router(config)# access-list 101 permit icmp any host 128.107.55.9 time-exceeded	Permits returning ICMP time-exceeded message
Router(config)# access-list 101 permit icmp any host 128.107.55.9 unreachable	Permits returning ICMP host unreachable message
Router(config)# access-list 101 deny ip 10.0.0.0 0.255.255.255 any	Denies public IP 10.0.0.0/8

Router(config)# access-list 101 deny ip 172.16.0.0 0.15.255.255 any	Denies public IP 172.16.0.0/12
Router(config)# access-list 101 deny ip 192.168.0.0 0.0.255.255 any	Denies public IP 192.168.0.0/16
Router(config)# access-list 101 deny ip 127.0.0.0 0.255.255.255 any	Denies traffic from the loopback address
Router(config)# access-list 101 deny ip host 255.255.255.255 any	Denies any broadcast
Router(config)# access-list 101 deny ip 0.0.0.0 0.255.255.255 any	Denies traffic from any device with a source address of 0.x.x.x
Router(config)# access-list 101 deny ip any any log	Denies all other traffic and logs the results NOTE: Context-Based Access Control (CBAC) setup is provided in the following steps.

Step 3: Set Audit Trails and Alerts

Router(config)# logging on	Enables the logging service
Router(config)# logging host 192.168.30.33	Sets the syslog server IP address
Router(config)# ip inspect audit-trail	Turns on CBAC audit trail messages, which are displayed on the console
Router(config)# ip inspect dns-timeout 7	Specifies the DNS idle timeout (default is 5 seconds)
Router(config)# ip inspect tcp idle-time 14400	Specifies the TCP idle timeout (default is 3600 seconds)

Router(config)# ip inspect udp idle-time 1800	Specifies the UDP idle timeout (default is 30 seconds)
Router(config)# no ip inspect alert-off	Enables real-time alerts NOTE: Cisco IOS Firewall real-time alerts are off by default (the command ip inspect alert-off is active by default). To enable real-time alerts, the no version of the command is needed; use the no ip inspect alert-off command in global configuration mode.

Step 4: Define the Inspection Rules

NOTE: To override the global TCP, UDP, or Internet Control Message Protocol (ICMP) idle timeouts for the specified protocol, specify the number of seconds for a different idle timeout in the **ip inspect name** command.

Router(config)# ip inspect name INSPECTION-RULE tftp timeout 20	Instructs the router to inspect protocol TFTP with 20-second idle timeout
Router(config)# ip inspect name INSPECTION-RULE udp timeout 15	Instructs the router to inspect protocol UDP with 15-second idle timeout
Router(config)# ip inspect name INSPECTION-RULE tcp timeout 600	Instructs the router to inspect protocol TCP with 600-second idle timeout
Router(config)# ip inspect name INSPECTION-RULE ftp timeout 600	Instructs the router to inspect protocol FTP with 600-second idle timeout

Router(config)# ip inspect name INSPECTION-RULE http timeout 600	Instructs the router to inspect protocol HTTP with 600-second idle timeout
Router(config)# ip inspect name INSPECTION-RULE smtp alert on audit-trail on timeout 300	Instructs the router to inspect protocol SMTP, turns on alert messages, turns on the audit trail, and sets the timeout to 300 seconds NOTE: For both the alert and audit-trail arguments, if there is no option selected, alerts or messages will be generated based on the setting of the ip inspect alert-off command or the ip inspect audit-trail command.

Step 5: Apply the Inspection Rules and the ACL to the Outside Interface

Router(config)# interface fastethernet 0/1	Moves to interface configuration mode
Router(config-if)# ip access-group 100 in	Applies ACL 100 to this interface, which permits the specified traffic through the router to the untrusted network
Router(config)# interface fastethernet 0/0	Moves to interface configuration mode
Router(config-if)# ip inspect INSPECTION-RULE out	Instructs the router to maintain stateful session information for protocols named in INSPECTION-RULE for outbound traffic

<pre>Router(config-if)#ip access-group 101 in</pre>	<p>Permits inbound traffic not specifically handled by the CBAC</p> <p>NOTE: Inbound traffic not handled by the CBAC must be specifically permitted inbound at the outside WAN interface (ACL 101). All other protocols specified in the CBAC inspection rule will be “pinholed” through the firewall when there is a session match to the outbound requesting traffic (stateful inspection).</p>
---	--

Step 6: Verify the Configuration

<pre>Router#show ip inspect name INSPECTION-RULE</pre>	<p>Displays information about the inspection rule named INSPECTION-RULE</p>
<pre>Router#show ip inspect config</pre>	<p>Displays information about inspection configuration</p>
<pre>Router#show ip inspect interfaces</pre>	<p>Displays information about inspection interfaces</p>
<pre>Router#show ip inspect session</pre>	<p>Displays information about inspection sessions (use the detail argument for added information)</p>
<pre>Router#show ip inspect statistics</pre>	<p>Displays information about inspection statistics</p>
<pre>Router#show ip inspect all</pre>	<p>Displays all available inspection information</p>

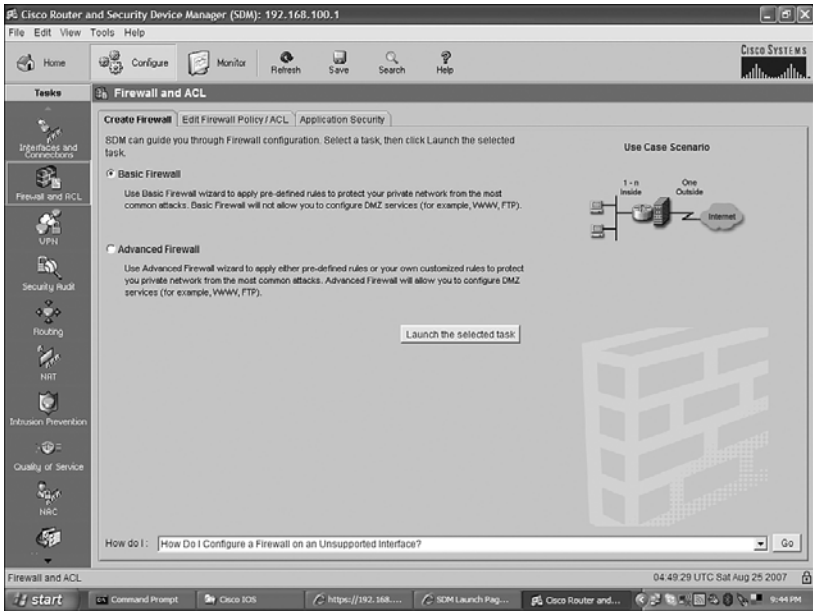
Troubleshooting the Configuration

Router# debug ip inspect function-trace	Displays messages about software functions that the firewall calls
Router# debug ip inspect object-creation	Displays messages about created software objects
Router# debug ip inspect object-deletion	Displays messages about deleted software objects
Router# debug ip inspect events	Displays messages about software events and packet processing
Router# debug ip inspect timers	Displays messages about timer events
Router# debug ip inspect detailed	Displays detailed information for all other enabled debugging
Router# debug ip inspect <i>protocol</i>	Displays messages about the specific protocol defined in the command

Configuring a Basic Firewall Using SDM

As shown in Figure 6-2, from the home page of Cisco Router and Security Device Manager (SDM), click the **Configure** button at the top of the page, and then click the **Firewall and ACL** icon in the Tasks toolbar on the left. You have two choices: Basic Firewall and Advanced Firewall. Click the **Basic Firewall** radio button and then click the **Launch the Selected Task** button to proceed to the Basic Firewall Configuration Wizard.

Figure 6-2 Launching the Basic Firewall Configuration Wizard



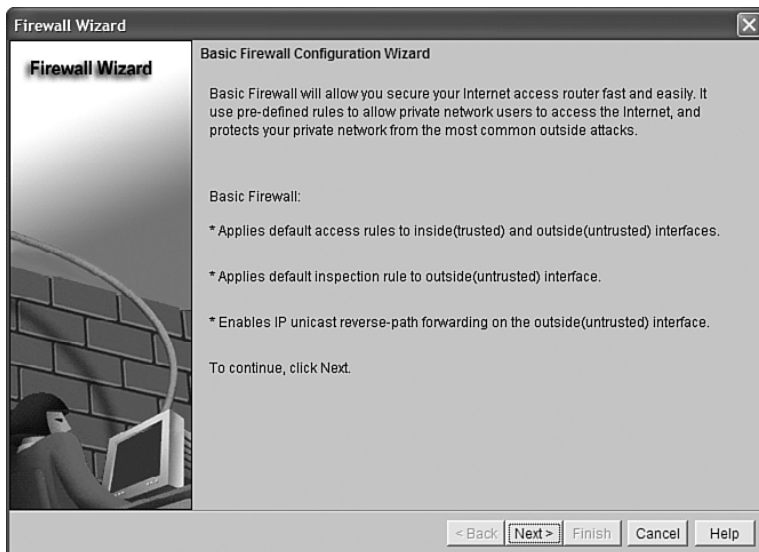
Note that you must have two interfaces configured with IP addresses in order to run this wizard. If you do not, you will be given an Information dialog box like the one shown in Figure 6-3. If this happens, you must go back and configure two interfaces before continuing.

Figure 6-3 Two Interfaces Configured with IP Required



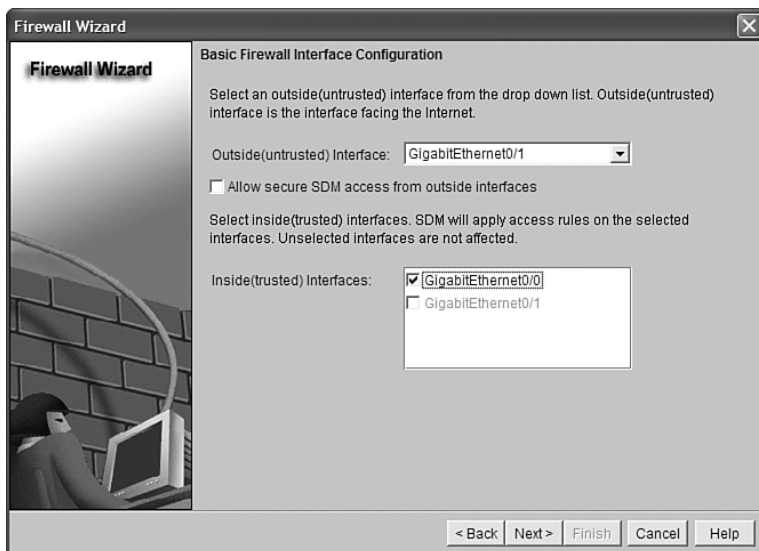
Figure 6-4 shows the start of the Basic Firewall Configuration Wizard. Click **Next** to continue.

Figure 6-4 Basic Firewall Configuration Wizard



On the next page of the wizard, shown in Figure 6-5, identify your inside and outside interfaces. You can have more than one inside (trusted) interface, and you have the choice of allowing secure SDM access from your outside interfaces.

Figure 6-5 Specifying Outside and Inside Interfaces



After you click **Next** to proceed to the next window, you receive a warning, shown in Figure 6-6, that you cannot launch SDM through the outside interface after the wizard completes. In this example, GigabitEthernet 0/1 is the outside interface. Ensure that you are not using your outside interface to access SDM and then click **OK** to continue to the next step of the wizard.

Figure 6-6 Configuration Warning

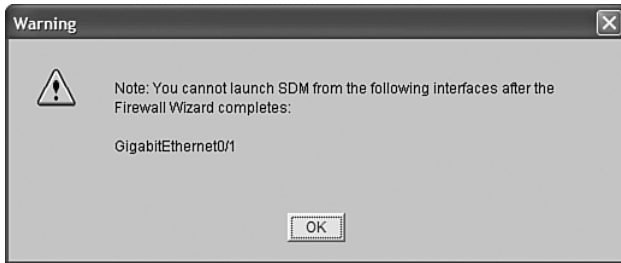


Figure 6-7 shows the final page of the wizard, the Internet Firewall Configuration Summary. Note that the wizard has created access rules to both the inside and outside interfaces to set up the firewall. Click **Finish** to complete the wizard, or click **Back** to return to the wizard to make any configuration changes.

Figure 6-7 Internet Firewall Configuration Summary—Basic Firewall

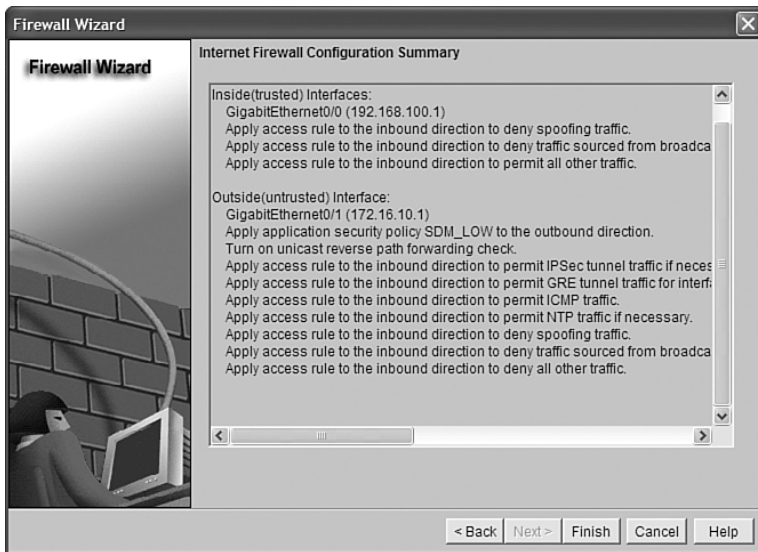
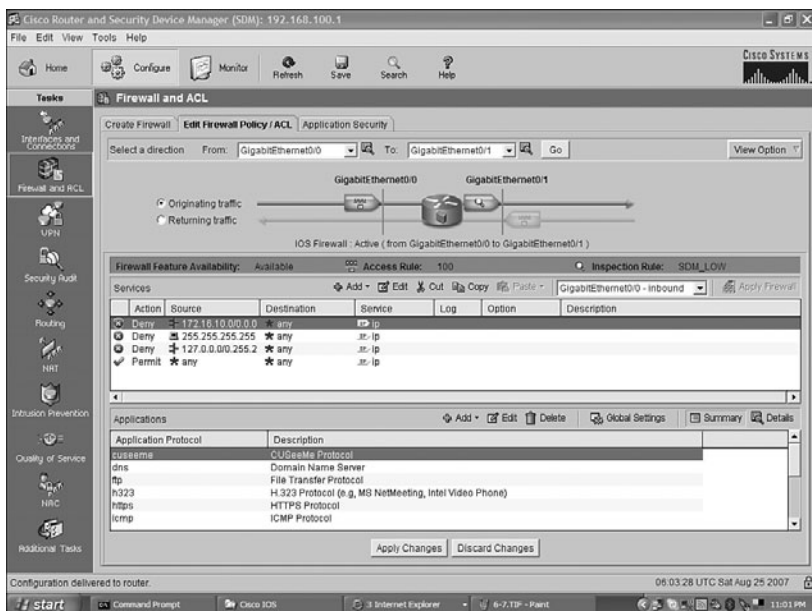


Figure 6-8 shows the Edit Firewall Policy/ACL tab, where you can verify and customize your firewall settings, such as adding, editing, or deleting applications or adding, editing, or deleting services.

Figure 6-8 Edit Firewall Policy/ACL Tab



Configuring an Advanced Firewall Using SDM

As shown in Figure 6-9, from the home page of SDM, click the **Configure** button at the top of the page, and then click the **Firewall and ACL** icon in the Tasks toolbar. You have two choices: Basic Firewall and Advanced Firewall. Click the **Advanced Firewall** radio button and then click the **Launch the Selected Task** button to proceed to the next window, shown in Figure 6-10.

Figure 6-9 Launching the Advanced Firewall Configuration Wizard

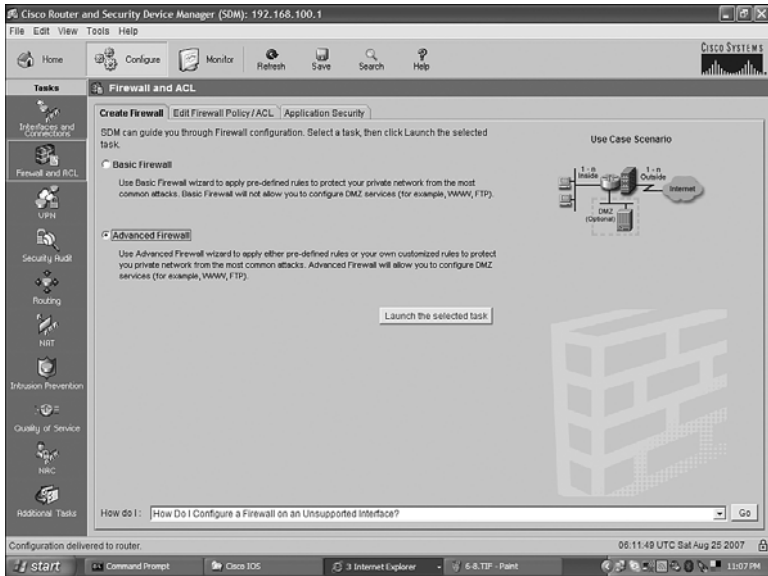
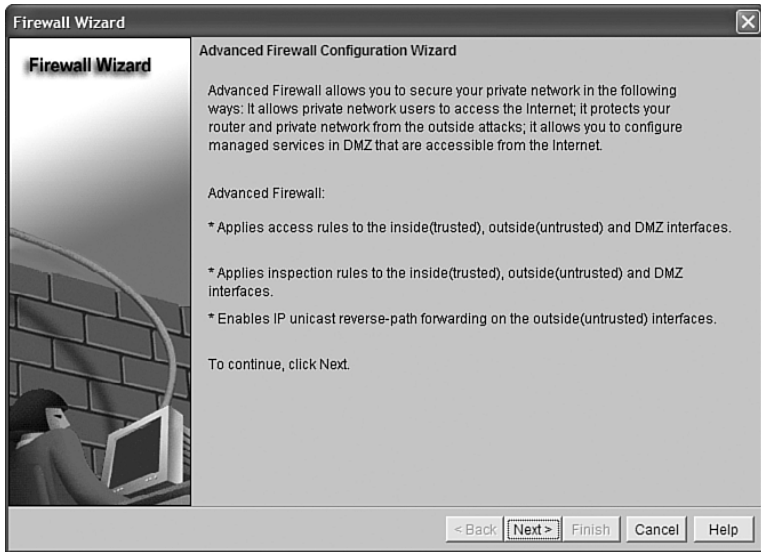
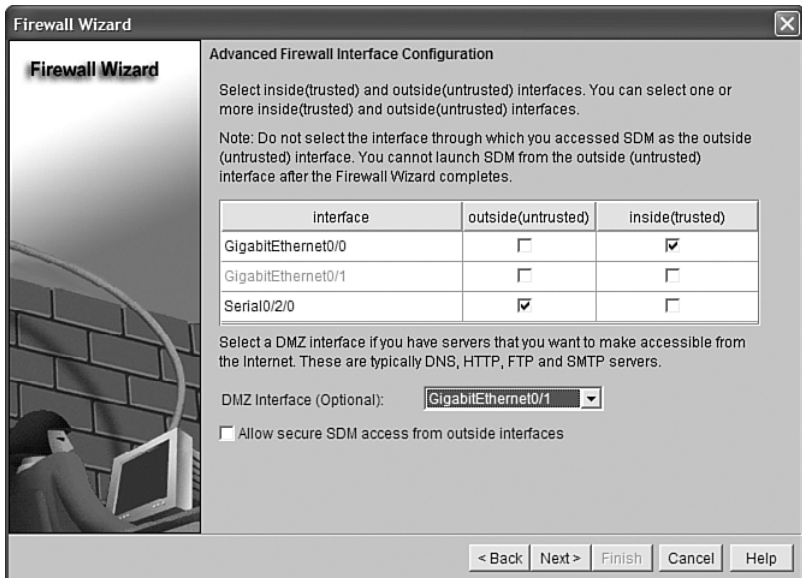


Figure 6-10 Advanced Firewall Configuration Wizard



Like the Basic Firewall Configuration Wizard, the Advanced Firewall Configuration Wizard also prompts you to choose your inside and outside interfaces, along with SDM access from your outside interfaces. If required, you can also define an interface for your DMZ, as demonstrated in Figure 6-11. Click **Next**, and a warning about launching SDM from an outside interface appears, similar to the one shown in the Basic Firewall Configuration Wizard (refer to Figure 6-6). Click **OK** to continue.

Figure 6-11 Advanced Firewall Interface Configuration



If you have selected an interface as a DMZ interface, you are shown the Advanced Firewall DMZ Service Configuration window, as shown in Figure 6-12. In this window, you can define DMZ services that are accessible from the outside network, such as mail, FTP, and VPN. Click **Add** to define a DMZ service.

Figure 6-12 Advanced Firewall DMZ Service Configuration

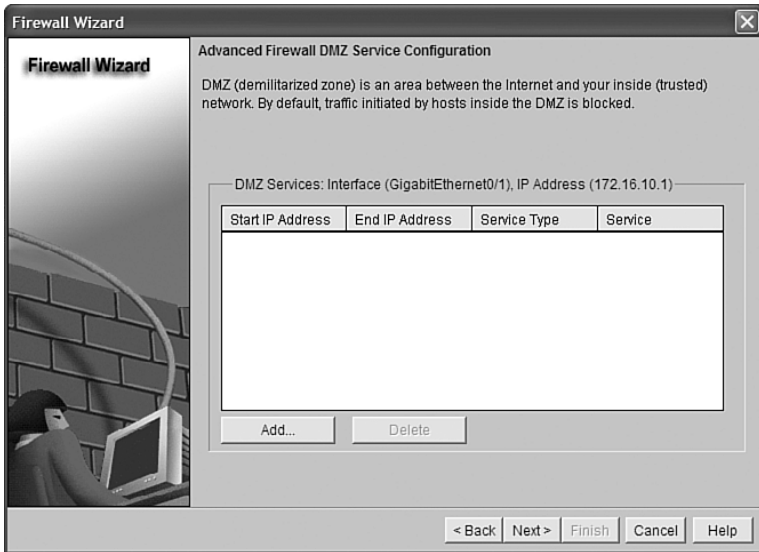
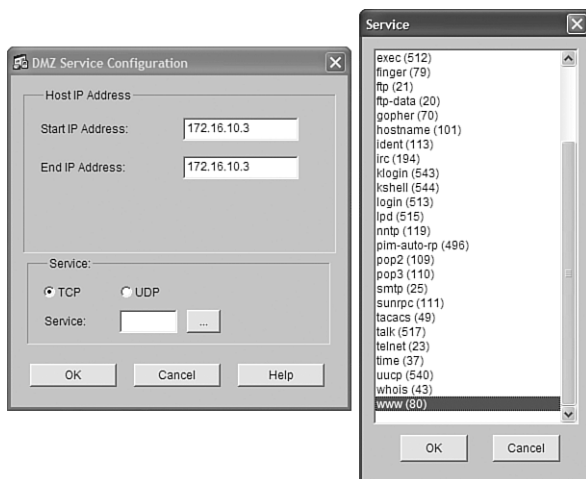


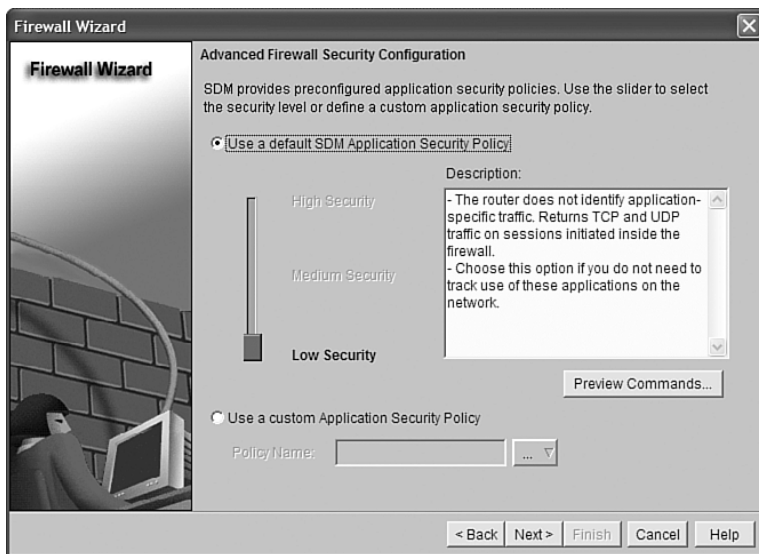
Figure 6-13 shows the DMZ Service Configuration dialog box. Enter the IP address of the server, followed by the service port number or well-known name. Clicking the ellipsis button opens the Service Menu where you can select the service from a list of well-known services. If you open this menu, click **OK** to return to the DMZ Service Configuration dialog box. After you have entered in all of the DMZ services required, click **Next** to continue.

Figure 6-13 DMZ Service Configuration and Service Dialog Boxes



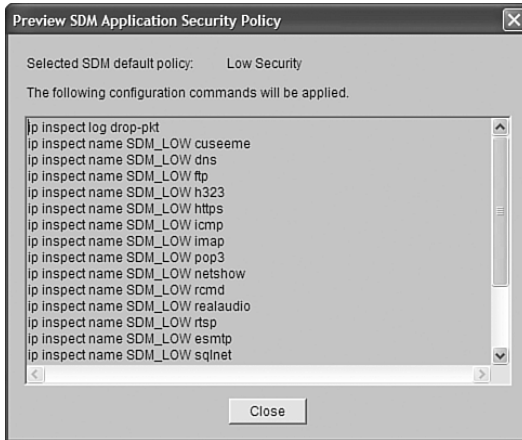
The next item to configure is the inspection granularity for services that are running in the DMZ. Figure 6-14 shows that you have the option of choosing a default SDM Application Security Policy or choosing a custom Application Security Policy.

Figure 6-14 Advanced Firewall Security Configuration—Using a Default Policy



If you use a default policy, click the **Use a Default SDM Application Security Policy** radio button and then click the **Preview Commands** button to see which specific configuration commands will be applied (shown in Figure 6-15).

Figure 6-15 Preview SDM Application Security Policy



If you choose to use a custom policy, you can either create a new policy or select an existing policy, as shown in Figure 6-16. Click **Create a New Policy** to open the Application Security window, shown in Figure 6-17, where you can choose the applications that should be inspected by the firewall.

Figure 6-16 Creating a New Custom Application Security Policy

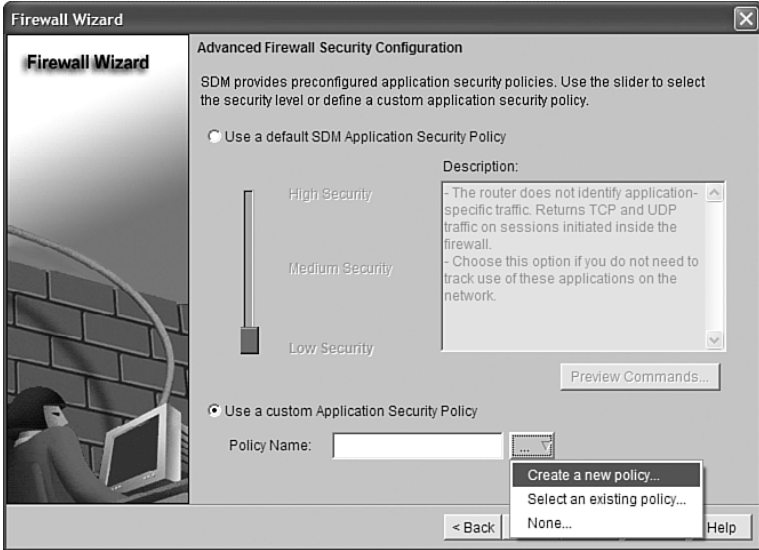
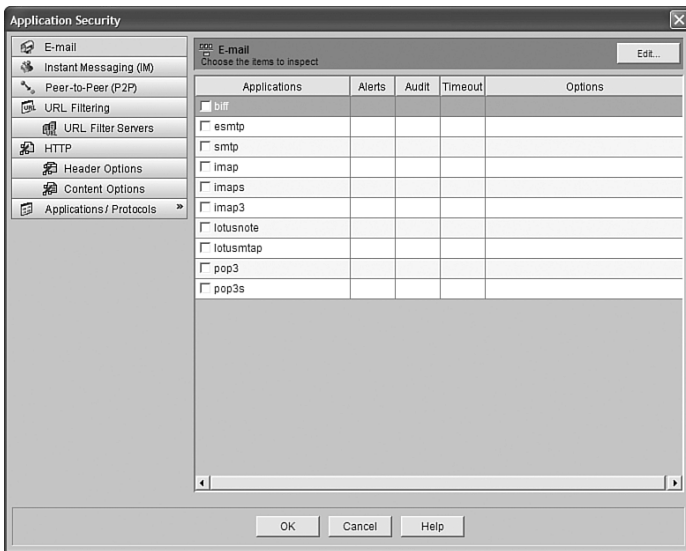


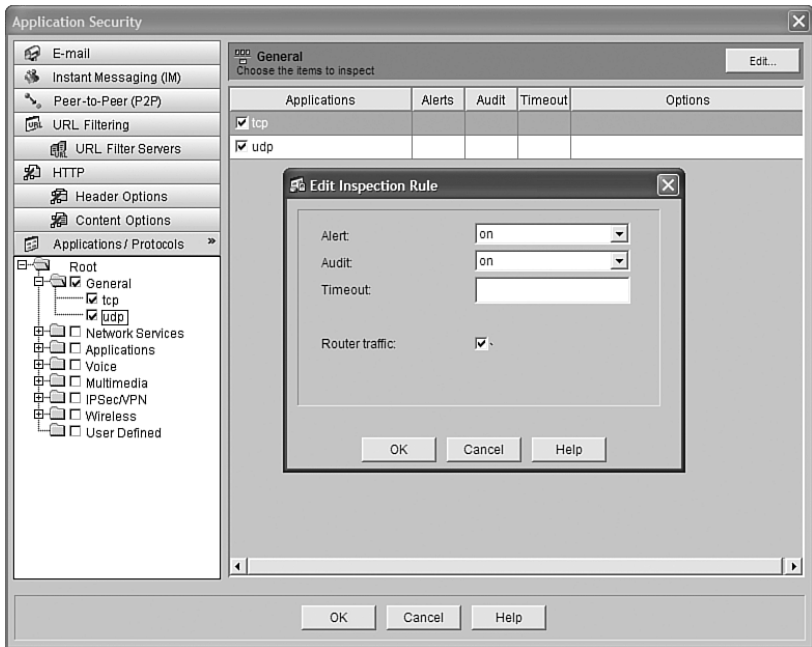
Figure 6-17 Application Security Inspection



The parameters of each protocol can be modified by checking the box next to the protocol and clicking the Edit button in the upper-right corner of the window. As shown in Figure 6-18, you can modify alerts, audits, and timeouts. Depending on the protocol, you

might be able to choose whether local router traffic should also be inspected by checking the Router Traffic check box.

Figure 6-18 Edit Inspection Rule Dialog Box



When you finish choosing protocols and modifying the parameters, click **OK** to continue. You are returned to the Advanced Firewall Security Configuration Wizard page, where you can select which security policy you want to use on this router, as shown in Figure 6-19. The router produced a default name for the custom policy that you just created. Click **Next** to use this policy and proceed to the next wizard page.

Figure 6-19 Advanced Firewall Security Configuration—Using a Custom Policy

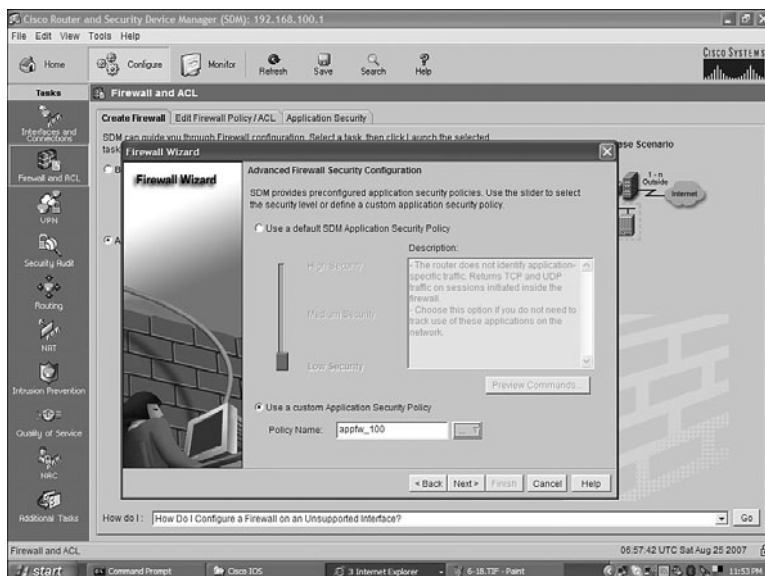
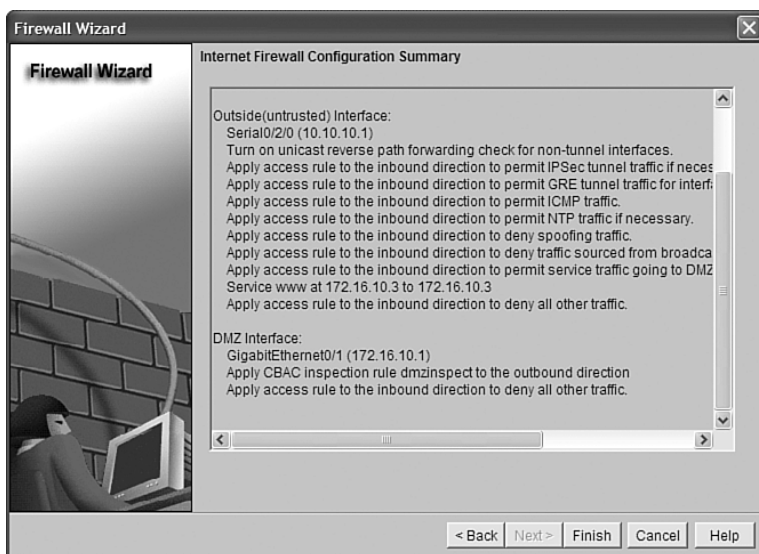


Figure 6-20 shows the last page of the wizard, the Internet Firewall Configuration Summary. This window lists all firewall rules that will be applied to this router. Click **Finish** to apply the configuration to the router.

Figure 6-20 Internet Firewall Configuration Summary—Advanced Firewall



Verifying Firewall Activity Using CLI

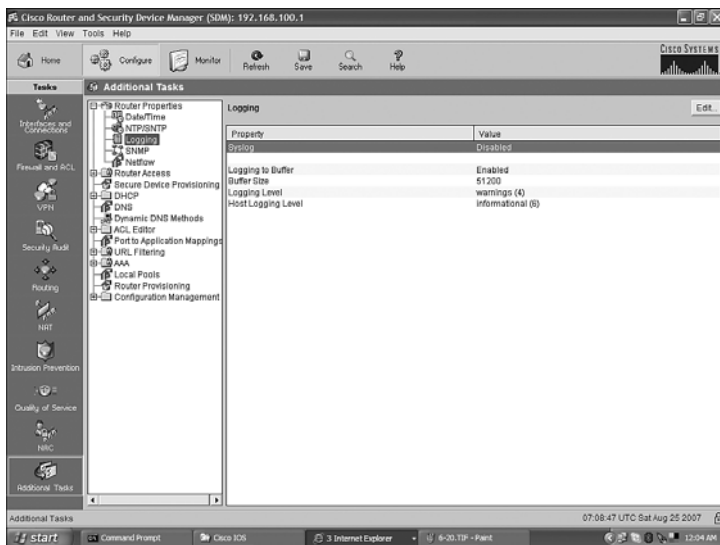
To verify the router configuration using the CLI, use the following commands.

Router# show running-config include ip inspect name	Displays only the lines in the running configuration that contain the string ip inspect name
Router# show running-config include access-list	Displays only the lines in the running configuration that contain the string access-list
Router# show running-config begin interface	Displays the running configuration beginning at the first instance of the word interface

Verifying Firewall Activity Using SDM

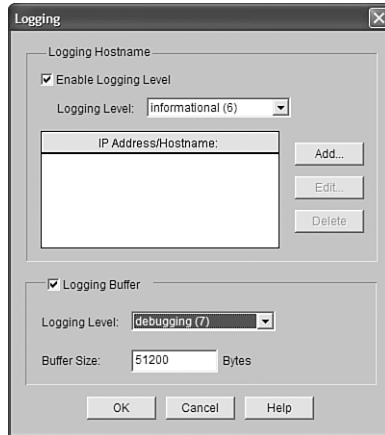
To activate logging using SDM, click the **Configure** button at the top of the SDM home page, and then click the **Additional Tasks** icon in the Tasks toolbar. In the Additional Tasks window, expand **Router Properties** and click **Logging**. The Logging window appears, as shown in Figure 6-21.

Figure 6-21 Logging



To modify your logging settings, click the **Edit** button in the upper-right corner of the window. Choose the Logging Level you want, as shown in Figure 6-22, and click **OK**.

Figure 6-22 Logging Level



After firewall logging has been activated, you can view the firewall log by clicking the **Monitor** icon in the top navigation bar, clicking the **Logging** icon in the Tasks toolbar on the left, and clicking the **Firewall Log** tab, as shown in Figure 6-23.

Figure 6-23 Firewall Log

Time	Description
Aug 25 07:16:40	! list 103 denied udp 0.0.0.0(0) -> 255.255.255.255(0), 36 packets
Aug 25 07:18:43	! list 103 denied udp 192.168.100.2(0) -> 192.168.100.255(0), 27 packets
Aug 25 07:18:48	! list 103 denied icmp 192.168.100.1 -> 172.16.10.1 (0/0), 1 packet
Aug 25 07:21:40	! list 103 denied udp 0.0.0.0(0) -> 255.255.255.255(0), 37 packets
Aug 25 07:21:40	! list 103 denied udp 192.168.100.2(0) -> 192.168.100.255(0), 21 packets

Port number	Number of Attacks	Number of Packets denied
0	5	122

Configuring Cisco IOS Intrusion Prevention System from the CLI

Cisco IOS can act as an inline intrusion detection sensor, watching packets as they flow through the router and scanning them to match anything from a Cisco IOS Intrusion Prevention System (IPS) signature. If the IPS detects suspicious activity, it can respond before the network can be compromised. A log of the event is then recorded through either syslog or the Security Device Event Exchange (SDEE) protocol.

Starting with Cisco IOS Release 12.4(11)T, Cisco IOS IPS introduces support for the Cisco IPS Software Version 5.x signature format, which is also used by other Cisco appliance-based IPS products. The Cisco IPS version 5.x signature format is improved to support encrypted signature parameters and other features such as signature Risk Rating.

Cisco Signature Definition Files (SDF) are updated and posted on Cisco.com. Default SDF files are shipped with routers, and larger ones that contain more signatures can be downloaded. Select the appropriate SDF file based on the amount of RAM in the router.

There are five steps to configure and verify a basic Cisco IOS IPS:

- Step 1.** Specify the location of the SDF.
- Step 2.** Configure the failure parameter.
- Step 3.** Create an IPS rule and optionally apply an ACL.
- Step 4.** Apply the IPS rule to an interface.
- Step 5.** Verify the IPS configuration.

Step 1: Specify the Location of the SDF

<pre>Router(config)#ip ips sdf builtin</pre>	<p>Specifies to use the built-in SDF</p> <p>NOTE: The ip ids sdf builtin command does not appear in the configuration file because it is the default command. This command appears in the file only if a nondefault SDF is used.</p>
<pre>Router(config)#ip ips sdf location flash:/ips5</pre>	<p>Specifies to use the SDF located in the folder named ips5 located in flash</p> <p>NOTE: To create the directory for the location of the nondefault SDF, use the mkdir command from privileged mode:</p> <pre>Router#mkdir flash:/ips</pre> <p>The SDF file can be located on the root of flash (flash:) if so desired.</p>

Step 2: Configure the Failure Parameter

<pre>Router(config)#ip ips fail closed</pre>	<p>Specifies to not forward traffic if a System Microengine (SME) fails</p> <p>NOTE: If the SME fails, and you still want to forward packets without scanning, remove this command with the no ip ips fail closed command.</p>
--	--

Step 3: Create an IPS Rule, and Optionally Apply an ACL

Router(config)# ip ips name ROUTER-IPS	Creates an IPS rule named ROUTER-IPS
Router(config)# ip ips name TEST-IPS list 123	Creates an IPS rule named TEST-IPS and applies ACL 123 for further scrutiny of scanned packets

Step 4: Apply the IPS Rule to an Interface

Router(config)# interface fastethernet 0/0	Moves to interface configuration mode
Router(config)# ip virtual-reassembly	Virtually reassembles fragments so packets can be scanned by the IPS NOTE: Cisco suggests that the ip virtual-reassembly command be applied to all interfaces where traffic comes into the router, to facilitate the IPS engines.
Router(config-if)# ip ips ROUTER-IPS in	Applies the IPS rule at the interface, loads the signatures, and builds the signature engines NOTE: This process can take up to 10 minutes depending on the router platform. It is recommended that you enable logging messages to monitor the engine building status.

NOTE: Enable logging with the following commands.

Router(config)# logging on	Enables logging to all supported destinations
Router(config)# logging 192.168.10.53	Sends logging messages to a syslog server host at address 192.168.10.53
Router(config)# logging sysadmin	Sends logging messages to a syslog server host named <i>sysadmin</i>

Step 5: Verify the IPS Configuration

Router(config)# exit	Returns to global configuration mode
Router# show ip ips configuration	Verifies that the IOS IPS is properly configured
Router# show ip ips signature	Verifies the number of signatures that are loaded into each SME

IPS Enhancements

Several enhancements that are possible with an IPS configuration follow:

- Merge SDFs
- Disable, delete, and filter selected signatures within an SDF
- Change the location of the SDF

Merge SDFs

Router# copy flash:attack-drop.sdf ips.sdf	Merges the attack-drop.sdf file with the default SDF stored in memory
Router# copy ips.sdf flash:newsignatures.sdf	Creates a new SDF in flash that can now be used when the router boots

Router# configure terminal	Moves to global configuration mode
Router(config)# ip ips sdf location flash:newsignatures.sdf	Modifies the location of the SDF NOTE: This location must be changed before any modifications to the SDF can be performed.

Disable, Delete, and Filter Selected Signatures Within an SDF

Router(config)# ip ips signature 1107 0 disable	Deactivates the signature with ID 1107 and subsignature 0. The signature remains in the SDF; it is just deactivated.
Router(config)# ip ips signature 5037 0 delete	Deletes the signature with ID 5037 and subsignature 0. The signature is removed from the SDF the next time the signatures are reloaded or saved.
Router(config)# ip ips signature 6190 0 list 145	Applies ACL 145 to signature 6190, subsignature 0 for specific packet scanning

Change the Location of the SDF

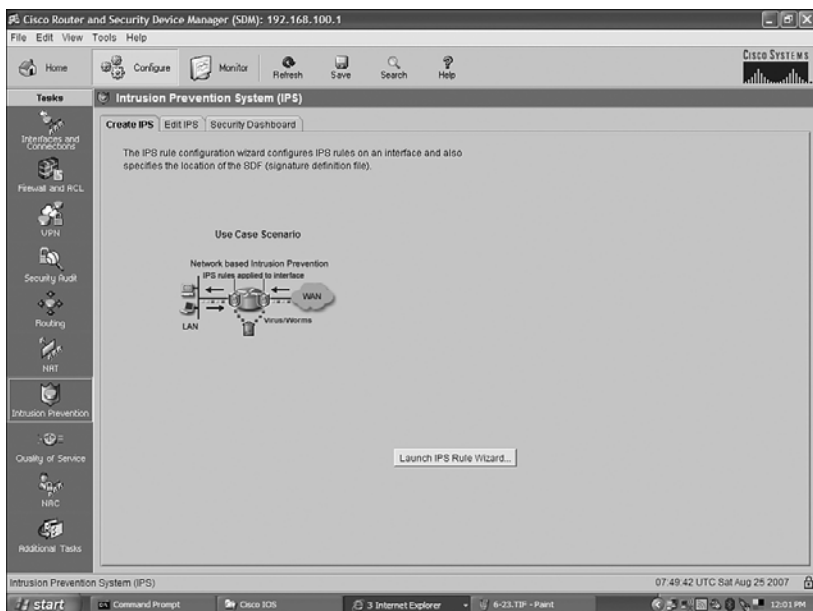
Router(config)# ip ips name NEW-IPS list 123	Creates an IPS rule named NEW-IPS and applies ACL 123 for further scrutiny of scanned packets
Router(config)# interface fastethernet 0/0	Moves to interface configuration mode

<pre>Router(config-if)#ip ips NEW-IPS in</pre>	<p>Applies the IPS rule at the interface, loads the signatures, and builds the signature engines</p> <p>NOTE: The original IPS name ROUTER-IPS could be used, but the ip ips name command must be executed again to map the new SDF into the IPS. If the original IPS name is remapped, it does not need to be reapplied to the interface.</p>
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Configuring Cisco IOS IPS from the SDM

SDM provides a useful set of wizards to configure IPS. To access these wizards, click the **Configure** button on the top of the SDM home page, and then click the **Intrusion Prevention** icon in the Tasks toolbar to display the window shown in Figure 6-24.

Figure 6-24 Intrusion Prevention System Home Page



Ensure that the Create IPS tab is shown. To activate IPS with the default signature parameters, click the **Launch IPS Rule Wizard** button to display the window in Figure 6-25. Click **Next** to proceed to the Select Interfaces page, shown in Figure 6-26, which allows you to choose the interfaces as well as the direction in which IPS rules will be applied.

Figure 6-25 IPS Policies Wizard

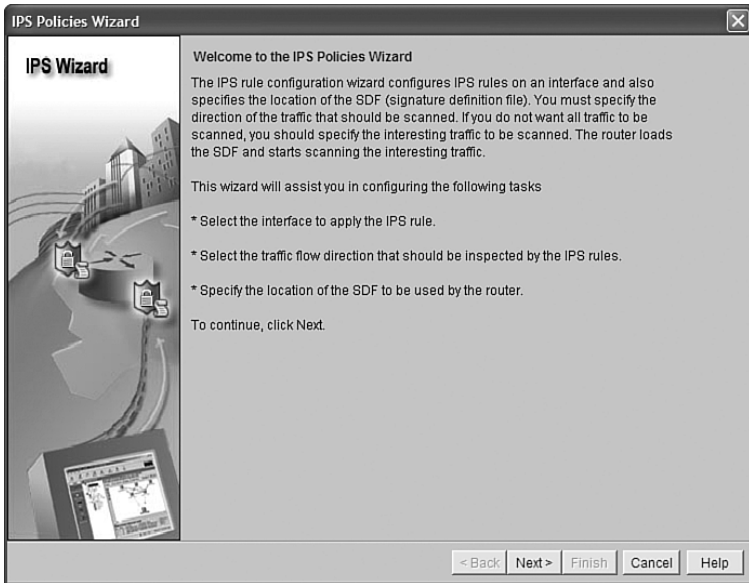


Figure 6-26 Select Interfaces—No Interfaces or Directions Chosen

IPS Wizard

Select Interfaces

Select the interfaces to which the IPS rule should be applied. Also choose whether the rule should be applied to inbound or outbound.

Interface Name	Inbound	Outbound
GigabitEthernet0/0	<input type="checkbox"/>	<input type="checkbox"/>
GigabitEthernet0/1	<input type="checkbox"/>	<input type="checkbox"/>
Serial0/2/0	<input type="checkbox"/>	<input type="checkbox"/>
Serial0/2/1	<input type="checkbox"/>	<input type="checkbox"/>
Vlan1	<input type="checkbox"/>	<input type="checkbox"/>

< Back Next > Finish Cancel Help

After you have chosen your interfaces and the appropriate direction (inbound or outbound), as shown in Figure 6-27, the IPS should be applied. Click **Next** to advance to the SDF Locations page, shown in Figure 6-28.

Figure 6-27 Select Interfaces—Interface and Direction Chosen

IPS Wizard

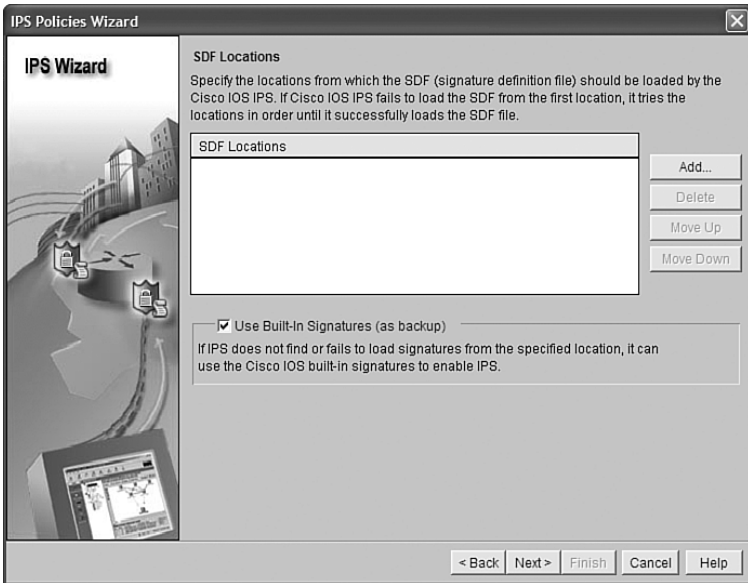
Select Interfaces

Select the interfaces to which the IPS rule should be applied. Also choose whether the rule should be applied to inbound or outbound.

Interface Name	Inbound	Outbound
GigabitEthernet0/0	<input type="checkbox"/>	<input type="checkbox"/>
GigabitEthernet0/1	<input type="checkbox"/>	<input type="checkbox"/>
Serial0/2/0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Serial0/2/1	<input type="checkbox"/>	<input type="checkbox"/>
Vlan1	<input type="checkbox"/>	<input type="checkbox"/>

< Back Next > Finish Cancel Help

Figure 6-28 SDF Locations



From the SDF Locations page, you can click the Add button to add a signature location. You can also use a built-in signature as a backup. The built-in signature is enabled by default; uncheck the check box if you do not wish to do this. Figure 6-29 shows the dialog box that appears for you to add a signature location. After you specify the SDF location, click **OK** to be returned to the SDF Location page, and then click **Next** to continue. A summary page will appear. Click **Finish** to apply the rule to the router, as shown in Figure 6-30.

Figure 6-29 Add a Signature Location

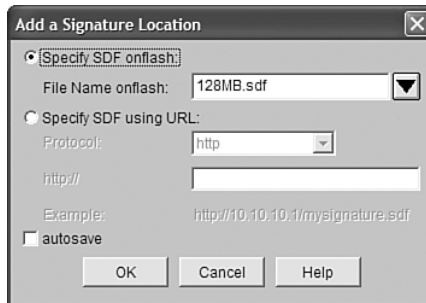
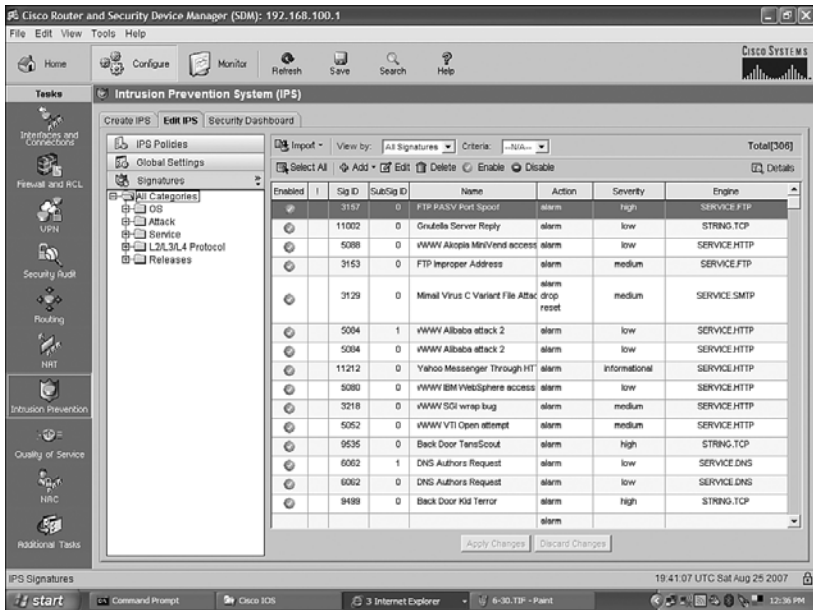


Figure 6-30 IPS Policies Wizard Summary

After you apply the rule to the router, you are taken to the Edit IPS tab of the IPS window, as shown in Figure 6-31. Here you can verify your IPS deployment in this router.

Figure 6-31 Verify IP Deployment



Viewing Security Device Event Exchange Messages Through SDM

To view Security Device Event Exchange (SDEE) messages through SDM, click the **Monitor** button at the top of the SDM home page, and then click the **Logging** icon in the Tasks toolbar. Click the **SDEE Message Log** tab, shown in Figure 6-32. In the upper-right corner of the tab, you have the option of selecting the message type you wish to view. Note that SDEE messages do not work in real time. If you want to see the most current messages, click the **Refresh** button.

Figure 6-32 SDEE Message Log

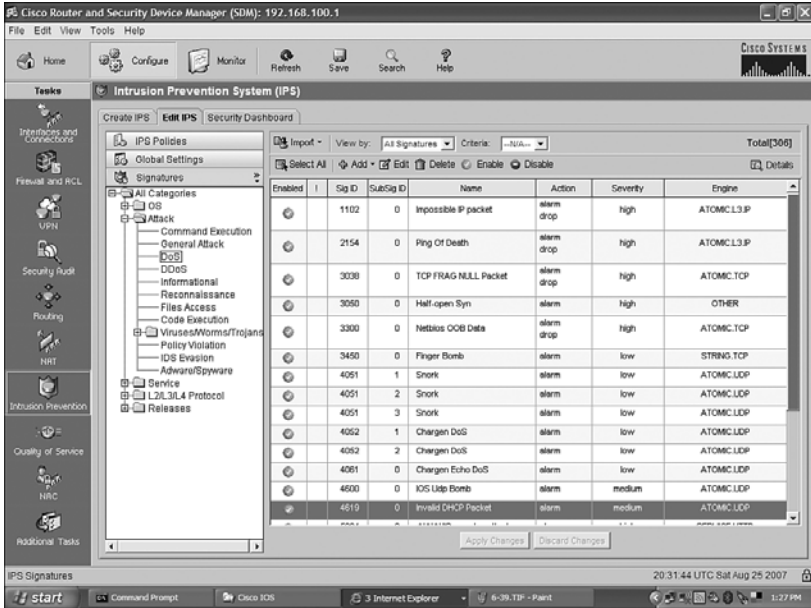
The screenshot shows the Cisco Router and Security Device Manager (SDM) interface. The main window displays the 'SDEE Message Log' with a table of log entries. The table has three columns: 'Time', 'Type', and 'Description'. The log entries show various engine building and ready messages for different services like SDF, ENGINE_BUILDING, ENGINE_READY, SERVICE, and ATOMIC. A context menu is open over the 'Error' column header, showing options: 'All', 'Error', 'Status', and 'Alerts'. The interface also includes a sidebar with navigation icons for Overview, Interface Status, Firewall Status, VPN Status, Traffic Status, NAC Status, Logging, and IPS Status. The bottom status bar shows the date and time: 20:24:03 UTC Sat Aug 25 2007.

Time	Type	Description
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	SDF_LOAD_SUCCESS: SDF loaded successfully from flash:JIT26MB.sof
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: OTHER - 4 signatures - 1 of 15 engines
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: OTHER - 0 ms - packets for this engine will be scanned
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: MULTI-STRING - 0 signatures - 2 of 15 engines
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILD_SKIPPED: MULTI-STRING - there are no new signature definitions for this engine
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: STRING ICMP - 1 signatures - 3 of 15 engines
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: STRING ICMP - 28 ms - packets for this engine will be scanned
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: STRING UDP - 18 signatures - 4 of 15 engines
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: STRING UDP - 280 ms - packets for this engine will be scanned
19:38:33 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: STRING TCP - 85 signatures - 5 of 15 engines
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: STRING TCP - 1960 ms - packets for this engine will be scanned
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: SERVICE FTP - 3 signatures - 6 of 15 engines
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: SERVICE FTP - 12 ms - packets for this engine will be scanned
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: SERVICE SMTP - 2 signatures - 7 of 15 engines
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: SERVICE SMTP - 28 ms - packets for this engine will be scanned
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: SERVICE RPC - 29 signatures - 8 of 15 engines
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: SERVICE RPC - 100 ms - packets for this engine will be scanned
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: SERVICE DNS - 31 signatures - 9 of 15 engines
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: SERVICE DNS - 20 ms - packets for this engine will be scanned
19:38:35 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: SERVICE HTTP - 132 signatures - 10 of 15 engines
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: SERVICE HTTP - 12644 ms - packets for this engine will be scanned
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: ATOMIC TCP - 9 signatures - 11 of 15 engines
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: ATOMIC TCP - 4 ms - packets for this engine will be scanned
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: ATOMIC UDP - 8 signatures - 12 of 15 engines
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_READY: ATOMIC UDP - 4 ms - packets for this engine will be scanned
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: ATOMIC ICMP - 0 signatures - 13 of 15 engines
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILD_SKIPPED: ATOMIC ICMP - there are no new signature definitions for this engine
19:38:49 GMT+00:00 Sat Aug 25 2007	Status	ENGINE_BUILDING: ATOMIC IPOPTIONS - 1 signatures - 14 of 15 engines

Tuning Signatures Through SDM

You might want to make changes to your defined signature. You can both edit a signature and disable a signature group. To edit a signature, click the **Configure** button at the top of the SDM home page, click the **Intrusion Prevention** icon in the Tasks toolbar, and click the **Edit IPS** tab of the IPS window, as shown in Figure 6-33. Click the **Signatures** dropdown arrow to open the directory tree of signatures.

Figure 6-33 Edit IPS



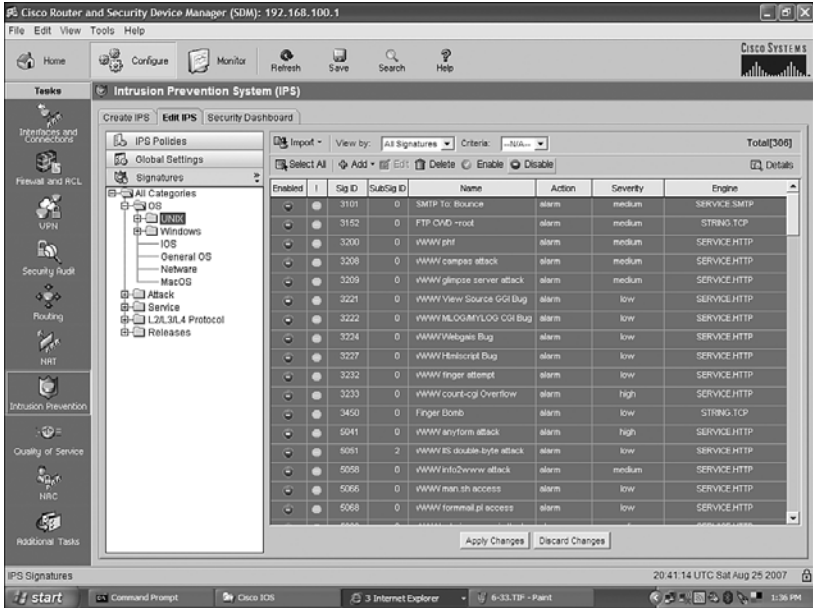
Select the signature you want to edit and then click the **Edit** button on the top of the tab. The Edit Signature dialog box appears, as shown in Figure 6-34. Default parameters are indicated with a green box. Altering parameter change the indicator icon to a red diamond. In this example, the AlarmSeverity parameter was changed from the default of Medium to a custom setting of High.

Figure 6-34 Editing a Signature



You can also disable a signature group from this spot in SDM. In Figure 6-35, all UNIX-related signatures are disabled. To accomplish this, click the category named **OS** and then select the **UNIX** subcategory. Click the **Select All** button at the top of the tab, and then click the **Disable** button to disable all UNIX-related signatures. Note that all green arrows have been changed to red circles. A yellow octagon appears in the next column to provide a visual clue that this is a custom setting.

Figure 6-35 Disabling a Signature Group



NOTE: You must click the Apply Changes button at the bottom of the tab for your changes to take effect.

