IBM eNetwork™ Firewall for Windows NT®

User's Guide

Version 3 Release 3

GC31-8658-02

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Note

Before using this information and the product it supports, be sure to read the general information under "Appendix. Notices" on page 161.

Third Edition (March 1999)

This edition applies to Version 3 Release 3 of the IBM eNetwork Firewall for Windows NT (product number 5765-C16). This edition replaces GC31-8658-01.

Contents

About This Book

This book describes how to configure and administer the IBM® eNetwork™ Firewall on a Microsoft Windows NT® system so that you can prevent unwanted or unauthorized communication into or out of your secure network.

This book is intended for network or system security administrators who install, administer, and use the IBM Firewall. Although we describe how to access the firewall using client programs, this is not a user's guide for client programs. To use client programs such as telnet or FTP, see the user's guide for your TCP/IP client programs.

Please refer to the Installation Instructions for information on how to set up and install this product.

After you start the configuration client, the online help information will help you fill in the configuration client fields and move from dialog box to dialog box.

Technical changes to the text are indicated by a vertical line to the left of the change.

Prerequisite Knowledge

It is important that you have a sound knowledge of TCP/IP addressing, masks, and network administration before you install and configure the IBM Firewall. Because you will set up and configure a firewall that controls the access in and out of your network, you must first understand how the network operates. Especially, you need to understand the basics of IP addresses, fully qualified names, and subnet masks.

A recommended book on TCP/IP that covers netstat, arp, ifconfig, ping, nslookup, DNS, sendmail, routing, and much more is *TCP/IP Network Administration*. See "Bibliography" on page 163 for more details.

A recommended book for those performing administration is the *Windows NT Server 4.0 Administrator's Bible*. See "Bibliography" on page 163 for more details.

Enhancements

The IBM eNetwork Firewall V3R3 for Windows NT offers several enhancements:

1. Virtual Private Networks with 3DES/DES/CDMF encryption and HMAC-MD5/HMAC-SHA authentication and compliant with the latest Internet Engineering Task Force RFCs
2. Secure Mail Proxy
3. Setup wizard
4. National Language Support for German

Virtual Private Networks

The IBM eNetwork Firewall V3R3 provides support for manually configured VPN tunnels. A Virtual Private Network (VPN) is an extension of an enterprise's private intranet across a backbone network, which typically will be a public backbone such as the Internet. A VPN allows you to create a secure connection to protect your data while it is in transit over the backbone. The VPN tunnel uses the open IPSec security standards to protect your data from modification or disclosure while it is travelling between firewalls. Your data will flow within a VPN tunnel, which can provide data origin authentication, confidentiality, and integrity checking on every packet. IPSec protocols can keep your data private, hiding it from any eavesdroppers on the public network. Packet filtering in the firewall can be used in conjunction with IPSec technologies to further protect your intranets from unwanted intrusions.

VPNs can be created by manually configuring VPN tunnels between pairs of IBM Firewalls or between an IBM Firewall and any other device (client, router, server, or firewall) that supports the latest open IPSec standards. Encryption support can include DES, 3DES, and CDMF. Authentication support includes HMAC-MD5 and HMAC-SHA. Filters for your VPN tunnels can be customized, or you can choose a default set of filter rules.

VPNs have a dynamic filters option, which saves the firewall administrator time because he or she does not have to create filter rules. If you select the dynamic filter rules option, filter rules are generated each time a tunnel is activated.

Secure Mail Proxy

The IBM Firewall Secure Mail Proxy is a new enhanced component that replaces SafeMail. The Secure Mail Proxy provides a gateway for SMTP traffic. It relays messages from the secure mailserver to the nonsecure side, hiding sensitive domain names as it goes. It relays messages from the nonsecure side in to the secure mail domain and insulates the secure network from attacks.

The Secure Mail Proxy acts as a real-time gateway between two or more e-mail domains. In contrast with a traditional SMTP relay, messages are not stored on the Firewall before being forwarded to the destinations. The SMTP conversation is interpreted as it happens, and the SMTP proxy conversation is proxied on to each of the necessary destination servers, command by command.

KeyWorks

The IBM Firewall uses a secure cryptographic toolkit called KeyWorks to provide the key recovery function. KeyWorks performs self-checking so that it can guarantee the authenticity of each of its components, through the use of digital certificates. KeyWorks' components expire when the certificates expire. After the installation of the Firewall is completed, a message is logged that displays the expiration date of the KeyWorks' components. Prior to expiration, it is necessary to refresh the authentication certificates.

Key recovery may be required to comply with US export regulations or your country's import regulations. It is intended for law enforcement purposes only. Key Recovery is a technique that permits recovery of encrypted data as it flows through VPN tunnels. Before strong encryption can be used, an encrypted block of data (called the key recovery block) containing the key to be used, is transmitted to the firewall at the tunnel partner. The key recovery block (KRB) must be acknowledged by the receiver. After the acknowledgement successfully reaches the sender, the key can be used.

The policy files may need to be refreshed either because the export/import regulations change, or because the policy expiration date has been reached. The policy expiration date appears as a message in the log when the policy files are installed.

Setup Wizard

A wizard has been provided to aid the user with the initial configuration of the IBM eNetwork Firewall. This setup wizard enables a user, who does not have extensive knowledge of the Firewall, to have a basic Firewall configuration up and running quickly after installation.

National Language Support for German

National language support for German is offered in addition to Brazilian Portugese, English, French, Italian, Japanese, Korean, simplified Chinese, Spanish, and traditional Chinese.

Terminology

You can access the IBM Software glossary at: **http://www.networking.ibm.com/nsg/nsgmain.htm**.

How to Contact IBM for Service

The IBM Support Center provides you with telephone assistance in problem diagnosis and resolution. You can call the IBM Support Center at any time; you will receive a return call within eight business hours (Monday–Friday, 8:00 a.m.–5:00 p.m., local customer time). The number to call is 1-800-237-5511. Or you can access the following web site: http://www.software.ibm.com/enetwork/support/ and specify the country where service is required.

Outside the United States or Puerto Rico, contact your local IBM representative or your authorized IBM supplier.

Chapter 1. Introducing the IBM Firewall

The IBM eNetwork Firewall for Windows NT® is a network security program running on the Windows NT operating system.

In essence, a firewall is a blockade between one or more secure, internal private networks and other (nonsecure) networks or the Internet. The purpose of a firewall is to prevent unwanted or unauthorized communication into or out of the secure network. The firewall has three jobs:

- Enforce your Internet security policies
- Let users in your own network use authorized resources from the outside network without compromising your network's data and other resources
- Keep unauthorized users outside of your network

Firewall Concepts

The any-to-any connectivity ty of the Internet can introduce many security risks. You need to protect your own private data and also protect access to the machines inside your private network to prevent abusive external use. The first step to achieving this protection is to limit the number of points at which the private network is connected to the Internet. A configuration where the private network is connected to the Internet by just one gateway gives you control over which traffic to allow into and out of the Internet. We call this gateway a firewall.

To understand how a firewall works, consider this example. Imagine a building where you want to restrict access and to control people who enter in. The building's single lobby is the only entrance point. In this lobby, you have some receptionists to welcome people who enter the building, some security guards to watch over them, some video cameras to record their actions, and some badge readers to authenticate their identity.

This works very well to control entry to a private building. But if a non-authorized person succeeds in getting past the lobby, there is no way to protect the building against any actions from this person. However, if you supervise the movement of this person, you might be able to detect any suspicious behavior.

When you are defining your firewall strategy, you may think it is sufficient to prohibit everything that presents a risk for the organization and allow the rest. However, because of new attack methods, you need to anticipate how to prevent these attacks and, as in the case of the building, you need to monitor for signs that somehow your defenses have been breached. Generally, it is much more damaging and costly to recover from a break-in than to prevent it in the first place.

IBM Firewall Tools

The IBM Firewall is like a tool box you use to implement different firewall architectures. Once you choose your architecture and your security strategy, you select the necessary IBM Firewall tools. The IBM Firewall configuration client provides a user-friendly graphical user interface for administration. The IBM Firewall provides comprehensive logging of all significant events, such as administration changes and attempts to breach security.

Because the IBM Firewall is, at heart, an IP gateway, it divides the world into two or more networks: one or more nonsecure networks and one or more secure networks. The nonsecure network is, for instance, the Internet. The secure networks are usually your corporate IP networks. Some of the tools that the IBM Firewall offers are:

- Static filters
- Proxy servers
- Socks servers
- Authentication
- Specific services such as domain name service (DNS) and Secure Mail Proxy
- Network Address Translation
- Virtual Private Networks

Static Filters

Static filters are tools that inspect packets at the session level based upon multiple criteria such as time of day, IP address, and subnet. The filter rules work with the IP gateway function so the machine is required to have two or more network interfaces, each in a separate IP network or subnetwork. One set of interfaces is declared nonsecure and the other set is declared secure. The filter acts between these two sets of interfaces, as illustrated in Figure 1 on page 3.

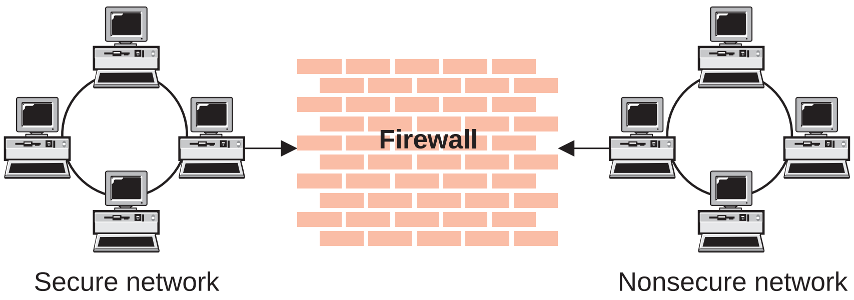


Figure 1. Firewall with Static Filtering

Objectives of Static Filters

Static filtering provides the basic protection mechanism for the firewall. Filters allow you to determine what traffic passes across the firewall based on IP session details, thereby protecting the secure network from external threats such as scanning for secure servers or IP address spoofing. Think of the filtering facility as the base on which the other tools are constructed.

Proxy Servers

Unlike filtering, which merely inspects packets passing through, proxy servers are applications that are part of the firewall and perform specific TCP/IP functions on behalf of a network user. The user contacts the proxy server using one of the TCP/IP applications (Telnet or FTP). The proxy server makes contact with the remote host on behalf of the user, thus controlling access while hiding your network structure from external users. Figure 2 illustrates a proxy Telnet server intercepting a request from an external user.

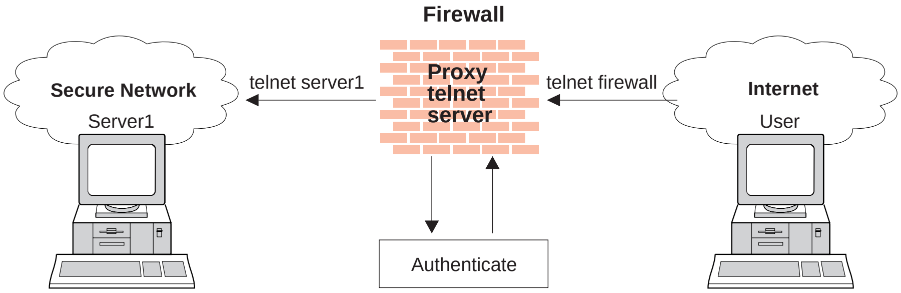


Figure 2. Firewall with a Proxy Server

The proxy services available are telnet, FTP, HTTP, WAIS, GOPHER, and HTTPS, and Secure Mail Proxy.

The IBM Firewall proxy servers can authenticate users with a variety of authentication methods. Users can access useful information on the Internet, without compromising the security of their internal networks.

Objectives of Proxy Servers

When you connect through a proxy server, the TCP/IP connections are broken at the firewall, so the potential for compromising the secure network is reduced. Users may be required to authenticate themselves, using one of a number of authentication methods.

One major advantage of proxy servers is address hiding. All outbound proxy connections use the firewall address. Another major advantage of the proxy server is security. IBM experts have developed these proxy servers to guard against security weaknesses, which might be on the client machine.

Another advantage of the proxy server is that you do not need a special version of the client program on the client machine. Therefore, once you have installed your firewall, every user recorded in the Firewall can have access to the nonsecure network without any additional software installation.

Socks Server

Socks is a standard for circuit-level gateways that provides address hiding but does not require the overhead of a more conventional proxy server.

The IBM Firewall provides the Socks Protocol Version 5, which enables clients inside the secure network to pass an authentication stage before accessing applications in the nonsecure network. It also provides for authenticated generic proxy and the proxy of some streaming audio and video protocols.

The Socks server is similar to a proxy server in that the session is broken at the firewall. The difference is that socks can support all applications instead of requiring a unique proxy for each application. Transparently, the socks client starts a session with the Windows NT socks service on the IBM Firewall host then validates that the source address and user ID are permitted to establish onward connection into the nonsecure network and then creates the second session. Figure 3 on page 5 illustrates a firewall with a socks server.

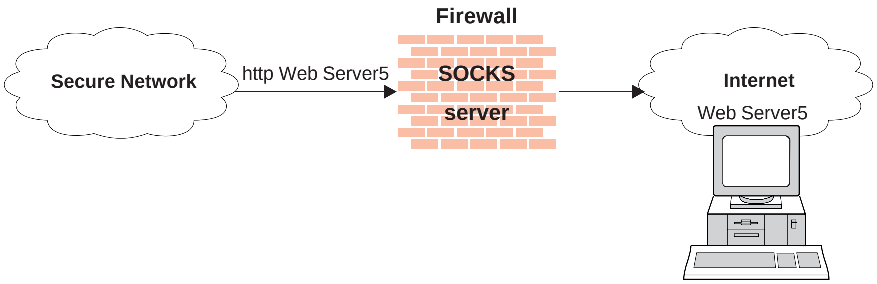


Figure 3. Firewall with a Socks Server

Socksified clients (clients, that are Socks-aware) are available with many applications like Netscape Navigator or Microsoft® Internet Explorer, or through TCP/IP software such as Aventail AutoSocks.

Objectives of the Socks Server

For outbound sessions (from a secure client to a nonsecure server) the socks server has the same objectives as a proxy server, that is to break the session at the firewall and provide a secure door where users must prove their identity in order to pass. It has the advantage of simplicity for the user, with little extra administrative work.

Authentication

Authentication means you can use a password or a stronger method to access your network. This is especially useful when you want to log in remotely, such as when you are traveling or working at home. The IBM Firewall lets you choose which method you need for authenticating clients. You can use just a password for access, or you can use more sophisticated methods, such as the Security Dynamics SecurID token.

The authentication method from Security Dynamics includes a user ID and a SecurID token. When you log in remotely, you get your password from the SecurID token. The password changes every 60 seconds and is good for one-time use only. So, even if someone does intercept your password over the open network, the password is not valid for additional use.

The IBM Firewall comes with the Security Dynamics ACE/Server with a two-user license.

You can also customize a user exit to support any other authentication mechanism. The IBM Firewall includes an application programing interface (API) to help you define your own authentication technique.

If you choose to authenticate users with passwords, the rules are robust. The IBM Firewall applies extensive password rules to ensure nontrivial passwords are used.

Domain Name Service

Access to the domain name records for the secure network is of great assistance to intruders, because it gives them a list of hosts to attack. A subverted domain name service server can also provide an access route for an intruder. From the external network, the name server on the firewall only knows itself and never gives out information on the internal IP network. From the internal network, this name server knows the Internet network and is very useful for accessing any machine on the Internet by its name.

Objectives of the DNS Server

Running the DNS server on the firewall has the dual advantage of preventing name resolution requests flowing across the firewall and hiding secure network hosts from the nonsecure world.

Secure Mail Proxy

Mail is one of the primary reasons why an organization would want to access the Internet. Secure Mail Proxy is an IBM mail gateway designed to hide the domain names of your internal network.

The Secure Mail Proxy function does not store mail on the gateway. The firewall gateway public domain name is substituted in place of the private domain names on outgoing mail so that mail appears to be coming from the firewall's address instead of the user's address. Secure Mail Proxy supports Simple Mail Transfer Protocol (SMTP) and Multipurpose Internet Mail Extensions (MIME).

Network Address Translation

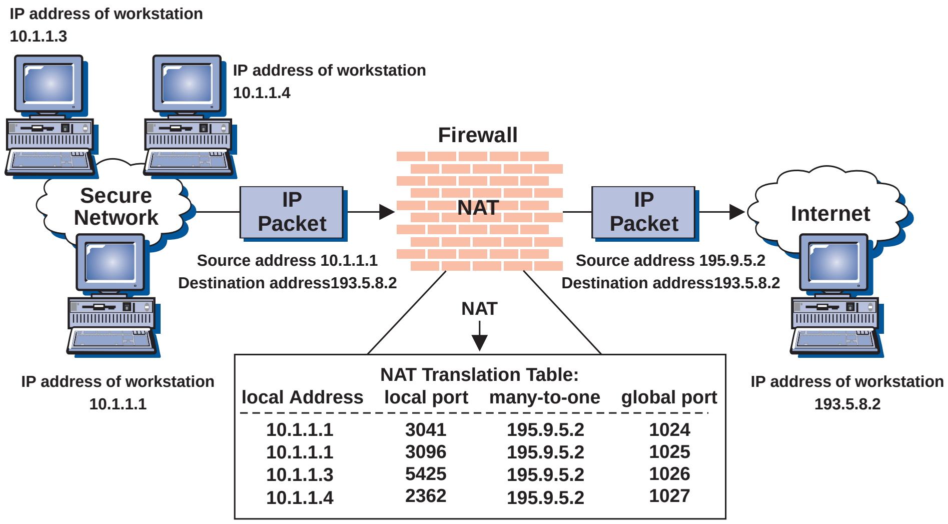
With network address translation (NAT), IP addresses on the secure side of the network are translated so that they are not exposed to the nonsecure side of the network or the Internet. Network address translation also solves the IP address depletion problem.

With the explosive growth of the Internet, IP address depletion problem has become significant. Network address translation (NAT) provides a solution to the IP address depletion problem based upon address reuse.

Addresses within a private network can be assigned out of a very large address space (typically a 10.0.0.0 class A address space). These addresses are private and are not exposed to the Internet. Therefore these addresses can be reused by another IP network. A single registered IP address is used to hide many private network addresses. NAT converts the unregistered addresses and port numbers into a valid registered Internet address and port numbers. In the inbound direction NAT converts the registered Internet address and port numbers back to the unregistered addresses and port numbers.

The advantage of NAT is that it transparently allows a network that uses private or illegal addresses to communicate with hosts on the Internet, effectively allowing the private network to have a large address space. Furthermore, by using NAT, addresses in the private network are hidden from the external world providing an additional level of security.

Figure 4 illustrates basic NAT operation in an IBM Firewall environment.


IP address of workstation
10.1.1.3
IP address of workstation
10.1.1.4
Secure Network
IP Packet
Source address 10.1.1.1
Destination address193.5.8.2
Firewall
NAT
IP Packet
Source address 195.9.5.2
Destination address193.5.8.2
Internet
NAT
IP address of workstation
10.1.1.1
IP address of workstation
193.5.8.2

NAT Translation Table:

local Address	local port	many-to-one	global port
10.1.1.1	3041	195.9.5.2	1024
10.1.1.1	3096	195.9.5.2	1025
10.1.1.3	5425	195.9.5.2	1026
10.1.1.4	2362	195.9.5.2	1027

Figure 4. Network Address Translation

NAT supports many UDP- and TCP-based applications.

Virtual Private Network

The IBM eNetwork Firewall V3R3 provides support for manually configured VPN tunnels. A Virtual Private Network (VPN) is an extension of an enterprise’s private intranet across a backbone network, which typically will be a public backbone such as the Internet. A VPN allows you to create a secure connection to protect your data while it is in transit over the backbone. The VPN tunnel uses the open IPSec security standards to protect your data from modification or disclosure while it is travelling between firewalls. Your data will flow within a VPN tunnel, which can provide data origin authentication, confidentiality, and integrity checking on every packet. IPSec protocols can keep your data private, hiding if from any eavesdroppers on the public network. Packet filtering in the firewall can be used in conjunction with IPSec technologies to further protect your intranets from unwanted intrusions.

VPNs can be created by manually configuring VPN tunnels between pairs of IBM Firewalls or between an IBM Firewall and any other device (client, router, server, or firewall) that supports the latest open IPSec standards. Encryption support can include DES, 3DES, and CDMF. Authentication support includes HMAC-MD5 and HMAC-SHA. Filters for your VPN tunnels can be customized, or you can choose a default set of filter rules.

Figure 5 illustrates a secure IP tunnel and a VPN.

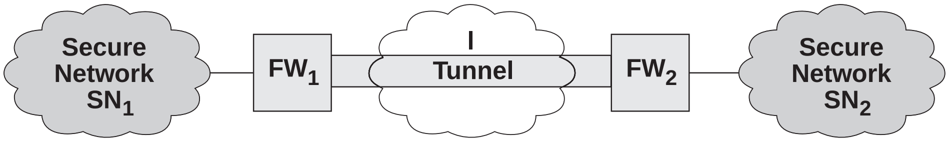


Figure 5. Tunnel, All IP Traffic between Two Secure Networks. FW_1 and FW_2 represent nonsecure interface IP address and mask. SN_1 and SN_2 represent any host in the secure network. The shaded area of the picture represents a VPN.

Objectives of the Virtual Private Network

The virtual private network allows you to obscure the real data being sent between two private networks and also allows you to be assured of the identity of the session partners and the authenticity of the messages.

Chapter 2. Planning

Before you configure the IBM Firewall, use the checklist and the planning worksheets to help you understand your network configuration.

Planning Checklist

1. Define your objective. Do you want to:
   - Access the Internet (telnet, anonymous FTP, etc.)?
   - Partition parts of your internal network?
   - Provide *external* access to your network?
2. For security reasons, the Firewall should not be a Primary or Backup Domain Controller (PDC). The Firewall can be a standalone machine or reside in an NT domain as a standalone server.
3. Evaluate the topology of your network at the IP subnetwork level.
   - Is one secure and one nonsecure interface a correct configuration?
   - Are your addresses able to support subnet masks in rules?
4. Decide how you will use DNS. Refer to "Chapter 6. Handling Domain Name Service" on page 37.
5. Decide how you will use SafeMail. Refer to "Chapter 7. Secure Mail Proxy" on page 47.
6. If you want to use socks, ensure socksified clients, such as the Netscape Navigator or the Microsoft Internet Explorer installed. For information on using socks, see "Chapter 11. Configuring the Socks Server" on page 81.
7. What type of authentication is required?
   - If you are going to use the Security Dynamics ACE/Server to authenticate users, we suggest that you install the ACE/Server server code on a non-IBM Firewall host inside the secure network.

     For information about installing and using a Security Dynamics ACE/Server and the SecurID card, see the information that is provided by Security Dynamics Technologies Inc.
   - If you use your own authentication method, see the chapter on ″Providing Your Own Authentication Methods″ in the *IBM eNetwork Firewall Reference*.
   - Because NETBIOS will be disabled by the hardening process, you must configure the Windows client code that implements the ability to search trusted Windows NT domains for authentication purposes, to use TCP instead of NETBIOS. The trusted Windows NT servers must have TCP/IP host names and addresses and have TCP/IP connectivity

between them and the firewall. The firewall administrator needs to create connections between the firewall and the trusted NT servers in order to permit traffic to flow between the two.

Set up this connection using the following predefined services:

a. Domain Controller Authentication - which allows the use of the Domain Controller for user authentication

b. NetBT Name Services broadcasts - which allows NetBIOS over TCP/IP Name Services broadcasts

And use the NT configuration utilities to define the trust relationships.

8. If you use filtering, start with simple filter rules and make them highly restrictive. Become familiar with ports and protocols used by services you need.
9. Decide on a method for archiving log files. Archiving is an ideal candidate for a scheduled job in the Windows NT Scheduler service. See “Chapter 16. Managing Log and Archive Files” on page 141.
10. If you are going to set up a virtual private network, decide on your tunnel end points and methods of encryption and authentication. See “Chapter 14. Creating a Virtual Private Network” on page 111
11. If you are using a version of the Firewall that requires key recovery to be installed for IPSec processing for export/import encryption regulations, then you need to obtain policy management configuration files. For more information, see your IBM Marketing representative.

Network Configuration Planning Worksheet

Fill in the following information as part of the planning for your IBM Firewall configuration.

Host name of firewall ______________________________

Secure network interface(s) (connected to internal secure network)

IP address ________________ Subnet Mask ________________

IP address ________________ Subnet Mask ________________

IP address ________________ Subnet Mask ________________

IP address ________________ Subnet Mask ________________

Nonsecure network interface(s) (connected to untrusted nonsecure network)

IP address ________________________ Subnet Mask ________________________

IP address ________________________ Subnet Mask ________________________

IP address ________________________ Subnet Mask ________________________

IP address ________________________ Subnet Mask ________________________

Name of router ____

Address of router ____

Secure domain name ____

IP address of secure domain name server (DNS) ____________________________

IP address of nonsecure domain name server(s) (DNS) ________________________

Secure Mail Server ____

Public Domain Name ____

IP address of the configuration client ____

IP address of the remote client(s) ____

Root directory of your Windows NT Firewall______________________________________
(We refer to this as ROOTDIR throughout the documentation)
(We assume that Windows NT is installed in c:\winnt)

Chapter 3. Setting Up the Configuration Server and the Configuration Client

This chapter tells you how to set up the configuration server and the configuration client, which is the graphical user interface (GUI) for the IBM Firewall.

Setting Up the Configuration Server

The configuration server is the configuration client’s interface to the Firewall. The configuration server processes requests from the configuration client. It runs on the Firewall machine and can handle requests from configuration clients that are on either local or remote machines. Once you have set it up, consider it part of the Firewall machine.

The configuration server’s port number is specified in the Windows NT services file located in the directory where you installed the Windows operating system: `c:\winnt\system32\drivers\etc\services`. The port number defaults to 1014, but you can change this, for added security, by stopping the configuration server service, modifying the services file, and restarting the configuration server service.

The configuration server is initially set up to only accept requests from configuration clients on the local machine. Initial requests are not encrypted. To change these options, use the following command from the command line:

```
fwcfgsrv cmd=change
```

localonly=

Indicates if the Firewall can only be administered from a local machine.

localonly=yes

The configuration can occur only on the local machine; this is the default.

localonly=no

The configuration can occur from any machine.

encryption

Indicates if the configuration server expects incoming data to be encrypted through secure sockets layer (SSL) or not.

If you change the encryption option or the sslfile, you must stop and restart the configuration server service.

encryption=none
No encryption will occur; this is the default.

encryption=ssl
SSL encryption will occur.

sslfile=
Indicates the name of the SSL keyfile to be used with SSL encryption; the default is `ROOTDIR\config\fwkey.kyr`. *ROOTDIR* is the directory that you have selected during the installation process as the target location for the IBM Firewall. For information on how to create the keyfile, see the *IBM eNetwork Firewall Reference*.

If a configuration client cannot connect to the Firewall machine, and is on a different machine, use `fwcfgsrv cmd=list` to check that `localonly=no` is set. Also, the language used by the client and the server must match. Finally, ensure that the configuration server service is running by bringing up the services panel and checking its status. To do this, go to the control panel, double-click the Services icon to check the status of each service. If it is not running, the service should be restarted.

Setting Up the Configuration Client (GUI)

When you install the IBM Firewall, the configuration client is automatically installed. The configuration client can also be separately installed on any Windows NT or 9X machine without the Firewall, which enables you to perform remote administration. To start the configuration client, select it from the start program menu. When the configuration client is started, you must first log on to the Firewall using a Windows NT administrator account.

Only Windows NT administrators and firewall administrators that have the appropriate administration authentication can use the configuration client to log on to the Firewall.

After the Firewall is installed, all Windows NT administrators are designated as primary firewall administrators. Use the configuration client to log on to the configuration server using a primary firewall administrator and define the additional firewall administrator usernames, if necessary. See “Chapter 12. Administering Users at the Firewall” on page 89 for information on how to define firewall administrators using the configuration client.

To set the logon timeout value for faster or slower machines, make the following change by clicking the IBM Firewall Configuration Client icon, then click **Properties**. Modify Properties by using the **Shortcut** tab. Change the parameter timeout to *20*, where 20 equals the number of seconds to wait for a connection to occur. Faster machines can be set to 10 and slower machines should accept the default value.

To increase the level of debug information in the Java console, run ibmfw.bat in ROOTDIR\cfgcli\gui instead of using the configuration client icon. Note however, that enabling console logging can degrade performance.

Logging On to the IBM eNetwork Firewall Using the Configuration Client

To log on to the IBM Firewall using the configuration client (on the local or remote machine):

- The user must be a firewall administrator
- The firewall administrator must have an authentication scheme defined. See “User Authentication Methods” on page 94.
- The user must have the authority to perform specific configuration functions

Enabling Remote Configuration through the Configuration Client

To enable remote configuration through the configuration client, make sure the administrator that is going to log on has the following attributes defined on the Firewall machine:

- If the administrator is on the secure side of the network and using a secure interface on the Firewall machine, then he or she must be defined with the appropriate authentication method for secure administration. (It cannot be set to deny all). This applies to logging on to the Firewall locally as well.
- Similarly, if the administrator is on the nonsecure side and using a nonsecure interface on the Firewall machine, then he or she must be defined with the appropriate authentication method for nonsecure administration. (It cannot be set to deny all).

All of the user attributes can be set through the Modify User dialog box in the configuration client or by using the command fwuser. All firewall administrators will have all of the above fields set appropriately after installation of the Firewall. Refer to “Chapter 12. Administering Users at the Firewall” on page 89 for more information.

Sample Logging Output for the Remote Configuration Server

The following is a sample of the logging output for the remote configuration server:

```
Feb 03 13:52:15 1998 mr16n18: ICA9005i: Starting remote configuration server.

Feb 03 13:52:21 1998 mr16n18: ICA2024i: User administrator successfully
authenticated using NT authentication from secure network:127.0.0.
Feb 03 13:52:21 1998 mr16n18: ICA2169i: User administrator successfully
authenticated for Remote Administration Server using NT from secure network:127.0.0.1.
```

Chapter 4. Using the Configuration Client

Use the configuration client, which is a graphical user interface, to configure and administer the IBM Firewall.

You must use the configuration client shipped with this IBM Firewall.

When you first install the IBM Firewall, it is initially set up to only accept requests from the configuration client on the local machine. However, you can install the configuration client on another machine and administer the Firewall remotely. See "Setting Up the Configuration Server" on page 13 for information on how to do this.

To set the configuration client to start in the language for your specific locale, click the IBM Firewall Configuration Client icon, then click **Properties**. Modify Properties by using the **Shortcut** tab. By default, the locale of the host machine is used. The IBM Firewall will support these locales:

- en_US - US English
- ja_JP - Japanese PC
- ko_KR - Korean
- zh_CN - Simplified Chinese EUC
- zh_TW - Traditional Chinese (Big 5)
- fr_FR - French
- it_IT - Italian
- pt_BR - Brazilian Portugese
- es_ES - Spanish PC
- de_DE - German

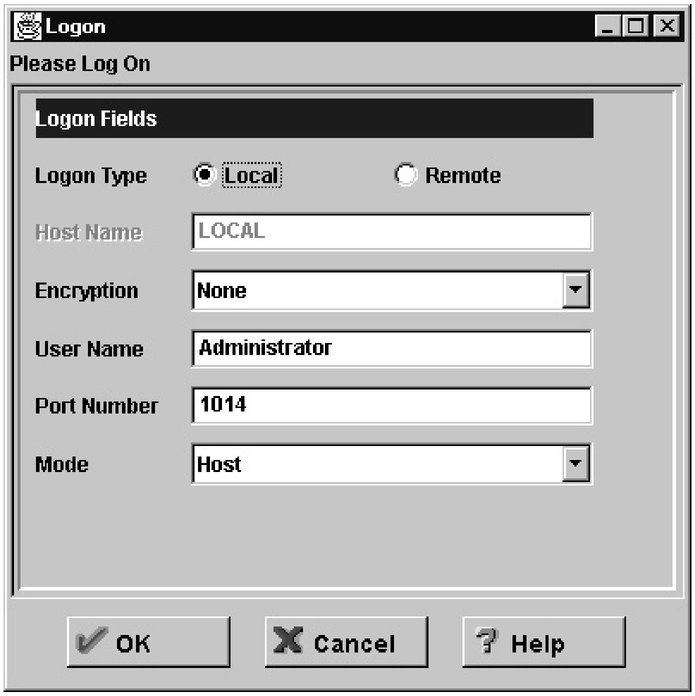
A mouse is required to use the configuration client.

A **Help** button is located near the top of the configuration client main panel. Click **Help** for information on any function.

How to Log On to the Firewall Using the Configuration Client

1. For Logon Type, select Local if you are on the same machine as the firewall. Local is the default. Select Remote if you want to remotely access another Firewall. Remote requires that you enter a host name.
2. If you selected Remote logon, you need to enter the host name or the IP address of the firewall machine you want to log on to.

3. Select either SSL or none depending upon which encryption is used for the Firewall. For the Client, the default for Local is None and the default for Remote is SSL.
4. Enter a user name of a firewall administrator or a Windows NT administrator.
5. Enter the port number on which the server is listening. The default is 1014.
6. For Mode, select Host if you want to configure a Windows NT firewall machine that you are logging on to. With host administration, the administrator can locally or remotely update one Firewall at a time.
7. After you log on, you will see authentication messages and you might be prompted to enter a password if that is the authentication method setup for your user name. If you are prompted for a password, enter your password in the User Response field and either press Enter or click Submit. If you enter an incorrect password, you get a message. Click Close and restart the logon process. If you are not prompted for a password, your user authentication method might be permit all. In this case you will immediately get the IBM Firewall configuration client panel.
8. After you have successfully been authenticated, you will see the main configuration panel.


Logon

Please Log On

Logon Fields

Logon Type ● Local ○ Remote

Host Name: LOCAL

Encryption: None

User Name: Administrator

Port Number: 1014

Mode: Host

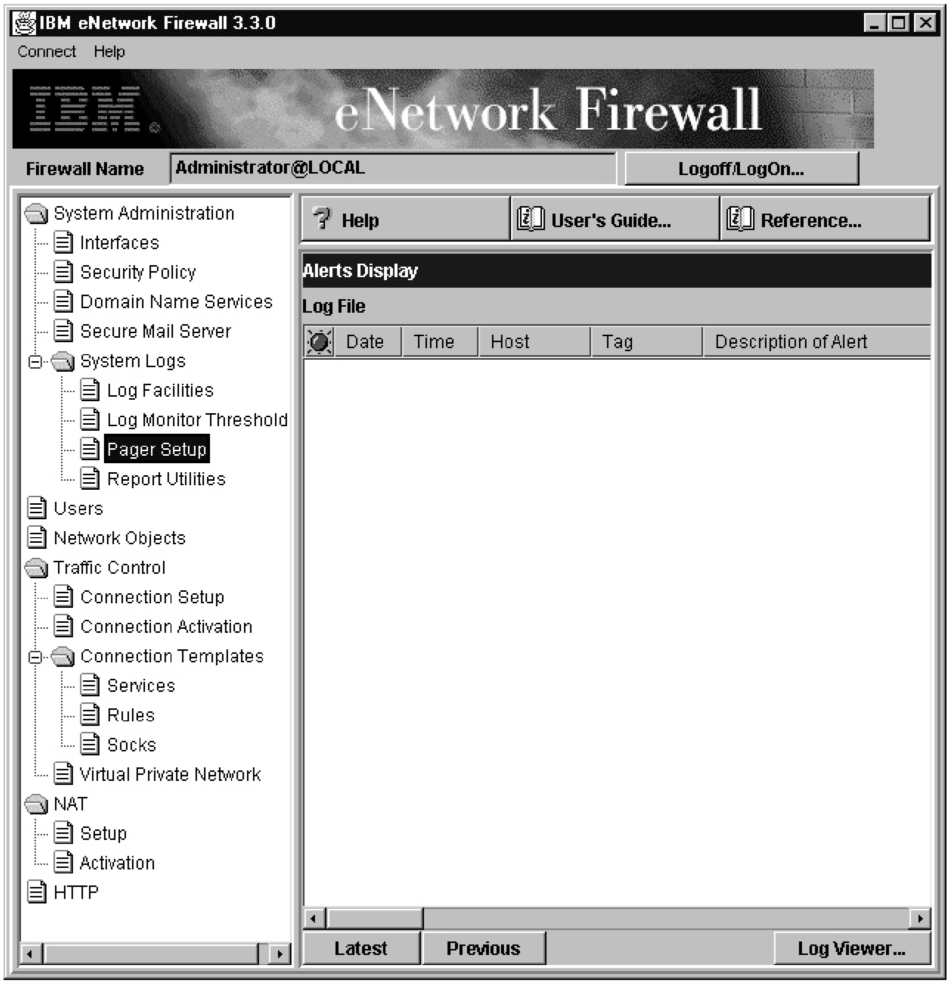
Figure 6. Configuration Client Logon Panel

The Navigation Tree

The configuration client has a collapsible tree-style navigation aid along the left side, as shown in Figure 7 on page 20.

If a node or function has items under it, a file folder icon appears at the left of the node. To see the subfunctions you can expand the view by double-clicking on the icon. Double-clicking on the icon again collapses the view of this node back to the original view.

Any function that you click is considered selected and is highlighted. You can expand and collapse the nodes without any change to the window view on the right. When the expanded tree exceeds the vertical space available, a scroll bar appears at the right of the navigation tree. A horizontal scroll bar appears if any of the function names do not fit into the navigation tree.



Firewall Name: Administrator@LOCAL

Figure 7. Configuration Client Navigation Tree

General Features on the Main Panel

Above the **Alerts Display** you will see the following three buttons, as shown in Figure 7.

Help A **Help** button is located near the top of the configuration client main panel. Click **Help** to see what to do to get your IBM Firewall up and running.

User’s Guide
A **Users Guide** button is located near the top of the configuration client main panel. Click **User’s Guide** to see the *IBM eNetwork Firewall User’s Guide* softcopy publication.

Reference
A **Reference** button is located near the top of the configuration client main panel. Click **Reference** to see the *IBM eNetwork Firewall Reference* softcopy publication.

Other buttons that you will encounter on the main panel are:

Logoff/LogOn
A **Logoff/LogOn** button is located in the upper right corner of the configuration client. It is a reconnect button. You can restart the logon sequence to connect to a different Firewall or to log on as a different administrator.

To log off, click Logoff, click Cancel on the logon panel, and the application.

Latest A **Latest** button is located at the bottom of the configuration client main panel. Click **Latest** to see the most recent alerts, if you have defined an alerts log.

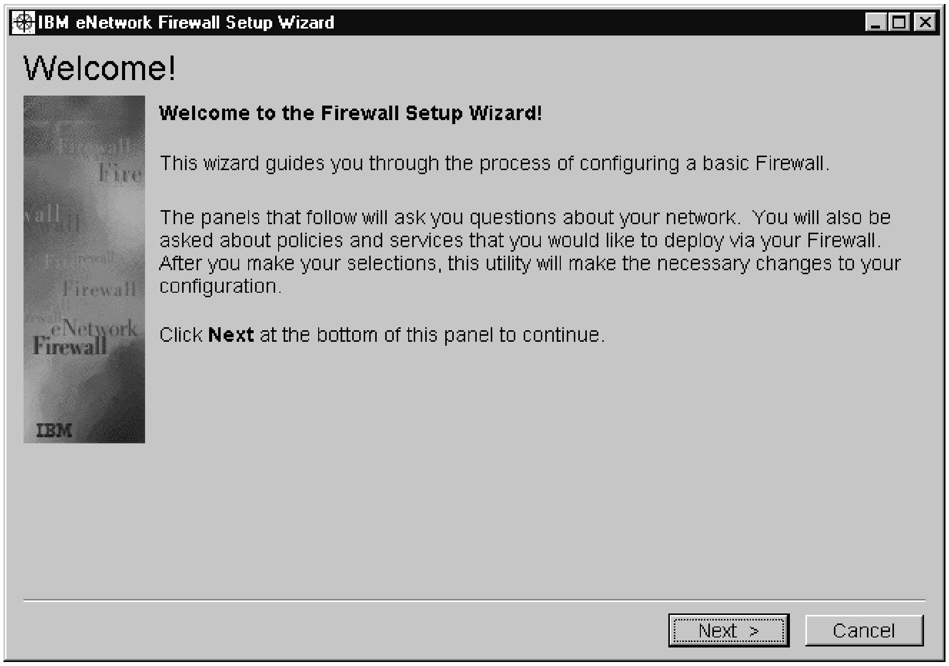
Previous
A **Previous** button is located at the bottom of the configuration client main panel. Click **Previous** to see earlier alerts, if you have defined an alerts log.

Log Viewer
A **Log Viewer** button is located in the lower right corner of the configuration client. It allows you to browse firewall logs.

The Setup Wizard

The setup wizard aids you with the initial configuration of the Firewall. It is especially helpful if you do not have an extensive knowlege of the firewall configuration, because it enables you to have a basic firewall configuration up and running quickly after installation.

The setup wizard appears automatically after you log onto the Firewall for the first time, as shown in Figure 8 on page 22.



Welcome!

Welcome to the Firewall Setup Wizard!

This wizard guides you through the process of configuring a basic Firewall.

The panels that follow will ask you questions about your network. You will also be asked about policies and services that you would like to deploy via your Firewall. After you make your selections, this utility will make the necessary changes to your configuration.

Click **Next** at the bottom of this panel to continue.

Figure 8. Setup Wizard

Thereafter, the setup wizard is available under the **Help** menu item on the GUI. The setup wizard is optional; you are not required to use it to configure the Firewall.

The setup wizard guides you through the following fundamental tasks:

- Basic security policies
- System administration tasks having to do with interfaces, DNS, mail, and log setup
- Setup to allow secure users to access nonsecure networks through the Web, telnet, and/or ftp
- Setting authentication methods for the default user based upon services that they enabled with the wizard
- Creating an alert log
- Setting up some basic log monitor thresholds

The setup wizard can be helpful for getting started on a variety of firewall installations. However, depending upon your circumstances, the wizard may not be recommended. The wizard is not recommended for:

- Multiple network components on the secure side of the firewall for which there are more than one security policy.

- Migrating a configuration from a previous version of the firewall.

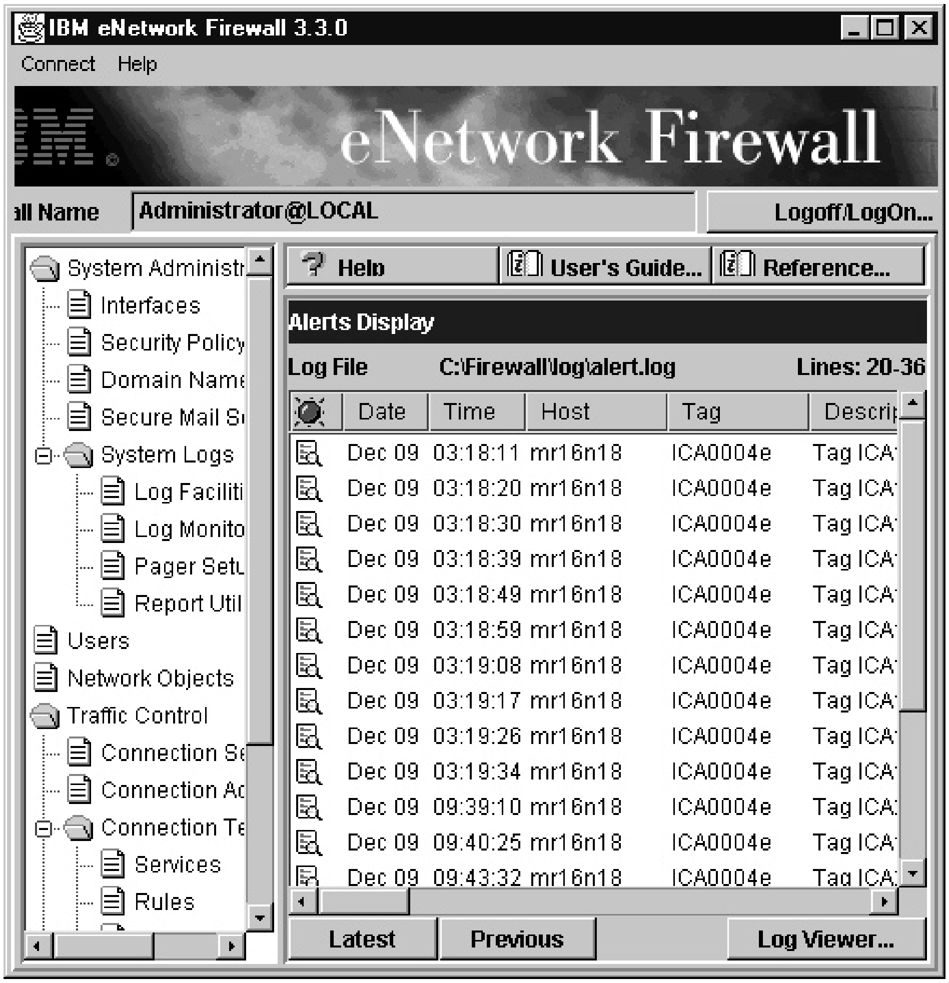
The Alerts Display

You can view alert records generated by the system log monitor in the lower right section of the main configuration client window, as shown in Figure 9 on page 24.

The alert records displayed are obtained from the file identified by the first `alert log` facility defined in `ROOTDIR\config\syslog.conf`. If no `alert log` facility is defined, you will see a blank display. See “Add Log Facilities” on page 142 for help in defining an `alert log` facility.

The panel shows you the name of the alerts file and the line numbers currently displayed from that file. You can click **Latest** to see the most recent alerts. Clicking **Previous** allows you to see earlier alerts.

Each line displayed shows the date and time of the alert, the host name of the firewall on which the alert occurred, the alert message tag, and the text of the alert message. The tag is an indication of the type of the alert.



ll Name Administrator@LOCAL

Log File C:\Firewall\log\alert.log Lines: 20-36

Date	Time	Host	Tag	Descri
Dec 09	03:18:11	mr16n18	ICA0004e	Tag ICA
Dec 09	03:18:20	mr16n18	ICA0004e	Tag ICA
Dec 09	03:18:30	mr16n18	ICA0004e	Tag ICA
Dec 09	03:18:39	mr16n18	ICA0004e	Tag ICA
Dec 09	03:18:49	mr16n18	ICA0004e	Tag ICA
Dec 09	03:18:59	mr16n18	ICA0004e	Tag ICA
Dec 09	03:19:08	mr16n18	ICA0004e	Tag ICA
Dec 09	03:19:17	mr16n18	ICA0004e	Tag ICA
Dec 09	03:19:26	mr16n18	ICA0004e	Tag ICA
Dec 09	03:19:34	mr16n18	ICA0004e	Tag ICA
Dec 09	09:39:10	mr16n18	ICA0004e	Tag ICA
Dec 09	09:40:25	mr16n18	ICA0004e	Tag ICA
Dec 09	09:43:32	mr16n18	ICA0004e	Tag ICA

Figure 9. The Alerts Display

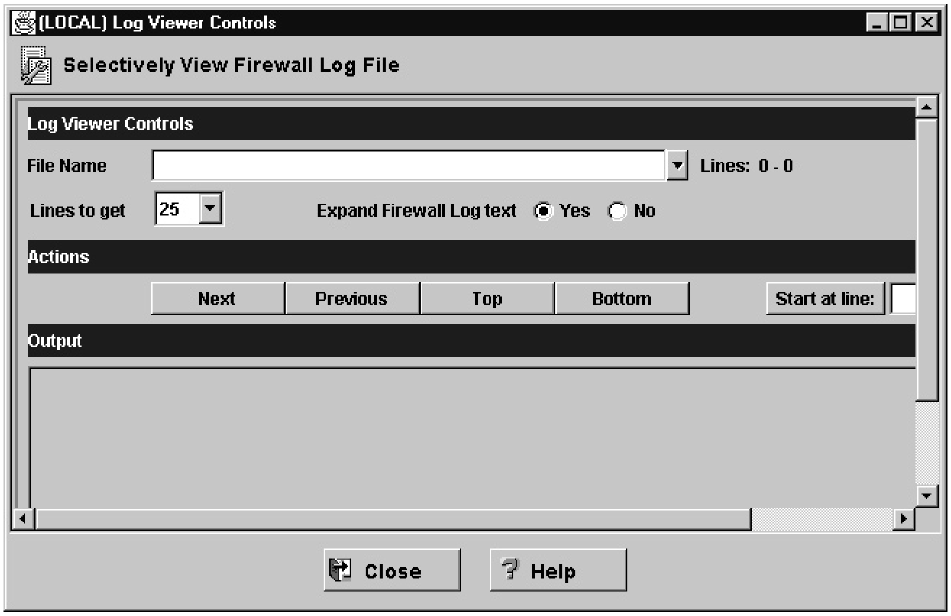
The Log Viewer

Clicking **Log Viewer** brings up a log viewer window, as shown in Figure 10 on page 25. The log viewer allows you to view firewall log records. You can specify a log file and a record count (default is 25).

The default log is the file identified by the first `firewall log` facility defined in `ROOTDIR\config\syslog.conf`. You can select a different target log file from the file name field’s pull-down menu or you can type in the name of a file to be viewed.

To request a specific start line, click **Start at Line:**, after typing the line number in the field next to it. To request the last so many lines, click **Bottom**, which takes you to the bottom of the file. **Next** advances you to the next set of lines in the file. **Previous** takes you back to the previous set of lines in the file. **Top** takes you to the top of the file. In the **Expand Firewall Log text** field, you can expand firewall logs to readable text by clicking **Yes**.

See “Log File Creation Using the Configuration Client” on page 141 and “Chapter 15. Monitoring the Firewall Logging” on page 129 for more information about log files, facilities, monitoring and alerts.



Lines: 0 - 0

Lines to get 25

Expand Firewall Log text ● Yes ○ No

Figure 10. Log Viewer

Other Features

A **Search** field is located near the top left corner of some of the panels. You can enter a search string and click **Find** or press Enter.

Other buttons that you will see on many of the configuration client dialog boxes are:

Apply Click **Apply** to populate the field on the previous panel with your current selection or to save changes you have made on a panel. The **Apply** button will not cause the window to disappear.

Bottom
Click **Bottom** to go to the bottom of a panel.

Cancel
Click **Cancel** to close the window without saving any changes.

Close Click **Close** to eliminate the window from your display.

Copy The **Copy** button saves time when adding new items to the list. After selecting an item on the list, click **Copy** to create an item that is similar to the selected item. When the new item is opened, it will copy field values from the selected item on the list. You will then be able to modify field values as needed for the new item.

Delete Click **Delete** to delete a selected item from the list.

Move Down
Select an item in the list and click **Move Down** to lower the item's relative position in the list. Each click will cause the item to move down one position.

Move Up
Select an item in the list and click **Move Up** to raise the item's relative position in a list. Each click will cause the item to move up one position.

OK Click **OK** to save changes and close the window.

Open After selecting an item on the list, click **Open** to view or modify that item. To add a new item, click **NEW** item on the list and click **Open**.

Refresh
Click **Refresh** to reaccess the data from the firewall and redisplay the data on the panel.

Remove
Click **Remove** to eliminate a selected item from a list. This action will only remove the item from the list. This action will have no effect on other places where the item is defined.

Select Click **Select** to access a list of candidate items that are valid for this function.

Top Click **Top** to go to the top of a panel.

Common Fields

Common fields that you will see on many of the configuration client dialog boxes are:

Output
As the command that you have initiated proceeds, progress information will appear here.

Name Provide a name for this item. This item name must be unique for this particular function in the firewall. The name should NOT contain a pipe symbol(|), a single quote (or apostrophe) character('), or a double quote(″) character. Use of these characters can result in unreliable data.

Description
This field is optional and is provided in case you want to provide a comment or additional information about this item.

Entering Text in Input Fields

All user-generated input is restricted to an invariant character set, a character set such as the syntactic character set, whose code point assignments do not change from code page to code page. Basically this means that user input is restricted to ASCII letters and numbers. For example, passwords, user IDs, user-defined object names, descriptions, and so forth are in this restricted set of characters even if messages and so forth are in a language other than English.

The syntactic character set is the set of graphic characters registered in the IBM registry with a GCSGID of 00640:

- All upper and lower case characters of the English alphabet
- 10 digits
- + < = > % & * ″ ' ( ) , - . / \ : ; ˜ ?

Chapter 5. Getting Started on the IBM Firewall

This chapter gives you the basic configuration steps you need to get your IBM Firewall set up. It explains how to define a secure interface, how to determine your security policy, and how to define network objects.

Basic Configuration Steps

For a basic IBM Firewall setup:

1. Plan for your IBM Firewall setup. Decide in advance which functions of the firewall you want to use and how you want to use them. These sections are helpful:
   - "Chapter 1. Introducing the IBM Firewall" on page 1
   - "Chapter 2. Planning" on page 9
   - "Planning Considerations" on page 63
2. Tell the Firewall which of its interfaces are connected to secure networks. You must have a secure interface and a nonsecure interface for your firewall to work properly. From the configuration client navigation tree, open the System Administration folder and click **Interfaces** to see a list of the network interfaces on your firewall. To change the security status of an interface, select an interface and click **Change**. See "Designating Your Network Interface" on page 31 for more information.

   If you are going to connect to the Internet, contact your Internet Service Provider (ISP) to obtain a registered IP address for the Firewall nonsecure interface.
3. Set up your general security policy by accessing the **Security Policy** dialog in the System Administration folder. For typical Firewall configurations:
   - Permit DNS queries
   - Deny broadcast message to nonsecure interface
   - Deny Socks to nonsecure adapters

   See "Using the Configuration Client to Define a Security Policy" on page 32 for more information.
4. Set up your domain name service and mail service. Very little communication will take place efficiently if you do not provide DNS resolution. Access these functions from the System Administration folder on the configuration client navigation tree. First read "Chapter 6. Handling Domain Name Service" on page 37.

5. Define key elements of your network(s) to the firewall using the **Network Objects** function in the configuration client navigation tree. Network Objects control traffic through the Firewall. Define the following key elements as network objects:
   - Secure Interface of the Firewall
   - Nonsecure Interface of the Firewall
   - Secure Network
   - Each subnet on your secure network
   - A host network object for your Security Dynamics servers and your Windows NT domain servers, if appropriate

   See “Network Objects” on page 34 for more information.
6. Enable services on the Firewall. These are the methods by which users in the secure network can access the nonsecure network (such as socks or proxy). Which services get implemented depend on decisions you made at the planning stage. Implementing a service often requires setting up some connection configurations to allow certain types of traffic. For example, if you want to allow your secure users to surf the web on the Internet by using HTTP Proxy, not only do you need to configure the HTTP Proxy daemon on the Firewall, but you also need to set up connections to allow HTTP traffic. See “Chapter 9. Examples of Services” on page 63 for information on how to set up connections that support certain services.
7. Set up firewall users. If you are going to require authentication for functions like outbound Web access or for firewall administrators, you need to define these users to the Firewall. See “Chapter 12. Administering Users at the Firewall” on page 89 for more information.
8. Because the hardening process disables NETBIOS, if you want to use Windows NT domain passwords for authentication, you must configure the Windows client code that implements the ability to search trusted Windows NT domains for authentication purposes, to use TCP instead of NETBIOS. The trusted Windows NT servers must have TCP/IP host names and addresses and have TCP/IP connectivity between them and the Firewall. The firewall administrator needs to create connections between the Firewall and the trusted Windows NT servers in order to permit traffic to flow between the two.
9. If you will be using network address translation, first contact your ISP to obtain a registered Internet address for use with many-to-one address translation. This address is in addition to the address you requested in step 2 on page 29. Then, go to the *Add NAT Configuration* panel to add the registered Internet address in the *Many-to-One IP Address* field. For more information, see “Chapter 17. Network Address Tranlsation” on page 149.

Following these steps should help you to get a basic firewall configuration up and running. The IBM Firewall provides other functions, such as system logs to help you ensure the security of your network. See “Chapter 16. Managing Log and Archive Files” on page 141 for more information.

If the Firewall shuts down either normally or abnormally, your configuration data will not be affected because it will be saved to the hard drive and will automatically be reactivated upon rebooting. However, certain firewall log messages will occur indicating that some active connections were interrupted; for example, an active FTP session.

Designating Your Network Interface

This book distinguishes between the secure and nonsecure interfaces, networks, and hosts. Secure interfaces connect the IBM Firewall host to the network of hosts in your internal network, the network that you want to protect. **You must have at least one secure interface for your firewall to work.** Nonsecure interfaces connect the IBM Firewall to one or more outside networks or to the Internet. The IBM Firewall must have at least one nonsecure interface.

All networks attached through a secure interface are considered secure networks. To discriminate between the various subnets attached to the secure interface, use the static filter rules to deny or permit access between several subnets on the same interface based on IP address or an address mask.

To designate secure and nonsecure interfaces, use the System Administration folder on the configuration client navigation tree. All known interfaces (adapters) will be shown and identified as secure or nonsecure.

You must provide a name for each interface before you can perform specific interface filtering.

To identify a network interface as either secure or nonsecure:

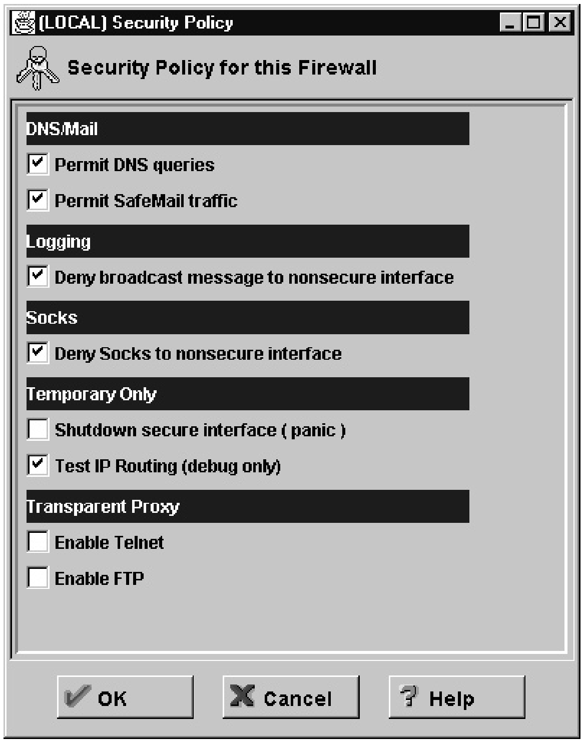
1. Select an interface and click **Change**.
2. Repeat as necessary.
3. Click **Close**.

To identify the interface as secure or nonsecure and to provide a meaningful name for that interface, click **Open**. This name will be used by filters for specific interface filtering.

Using the Configuration Client to Define a Security Policy

One of the first things to consider when configuring the IBM Firewall is the general security policy for your installation.

The IBM Firewall provides a dialog box to assist you in setting up your security policy, as shown in Figure 11.



(LOCAL) Security Policy

Security Policy for this Firewall

DNS/Mail

☑ Permit DNS queries

☑ Permit SafeMail traffic

Logging

☑ Deny broadcast message to nonsecure interface

Socks

☑ Deny Socks to nonsecure interface

Temporary Only

☐ Shutdown secure interface (panic)

☑ Test IP Routing (debug only)

Transparent Proxy

☐ Enable Telnet

☐ Enable FTP

Figure 11. Security Policy

Click Help to learn more about the security policy panel.

The Security Policy provides a quick and easy way for administrators to set blanket policies for the firewall. Most of the check boxes displayed in the security policy window provide a fast path to selecting certain Predefined Services that will apply to all network traffic received by the Firewall. The exceptions are the Transparent Proxy choices which simply act to enable or disable Transparent Telnet and Transparent FTP.

When you select a security policy, the Firewall builds the filter rules, which you then need to activate. The Firewall enables the services selected and makes them globally available.

Note that any time you select a check box that pertains to a Predefined Service and you click **OK**, you must activate these changes through the Connection Activation window. You do not need to activate the Transparent Proxy selections because these do not pertain to Predefined Services. See "Predefined Services" on page 75 for a list of predefined services.

You are presented with the following list of check boxes from which you can select attributes that reflect the security policy for your site. The attributes selected apply to all addresses on both sides of the IBM Firewall.

- Select **Permit DNS Queries** to allow Domain Name Service resolution requests and replies. Very little communication will take place efficiently if you do not provide DNS resolution. See "Chapter 6. Handling Domain Name Service" on page 37 for details on configuring DNS.
- Select **Secure SMTP Proxy** to allow mail traffic to flow through the Firewall.
- Select **Deny broadcast message to nonsecure interfaces** to prevent broadcast messages from being received at the nonsecure port. If your firewall's nonsecure interface is connected to the Internet, this service can help reduce the amount of logging on the Firewall.
- Select **Deny Socks to nonsecure interface** to disallow socks traffic to enter the Firewall from the nonsecure network. If you want to allow clients to enter your network from the nonsecure network, you must not turn on this checkbox.
- Select **Shutdown secure interface (panic)** to disallow all traffic to and from the Firewall over the secure interfaces. This is used for emergency purposes only.
- Select **Test IP Routing (debug only)** to allow all traffic to and from Firewall over any interface. Note that if you change the value of this check box, you must save it by clicking **OK** and activate it through the Connection Activation window. **Use of this Service can cause security exposures for your Firewall. Use it with extreme caution.**
- Select **Enable Telnet** to allow Transparent Proxy Telnets.
- Select **Enable FTP** to allow Transparent Proxy FTPs.

Network Objects

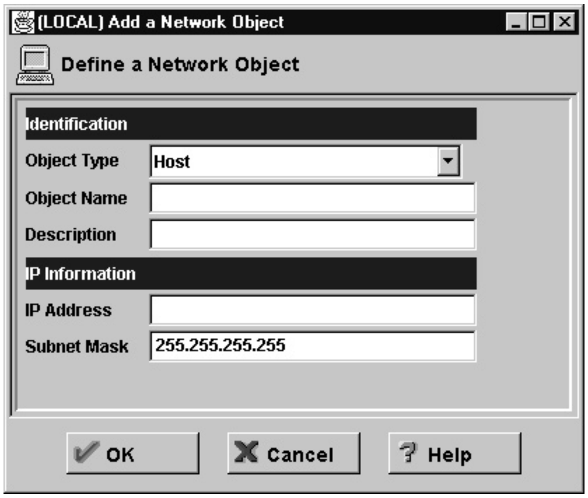
Network objects are representations of components that exist in your network such as hosts, networks, routers, virtual private networks, or users. Network objects designate source and destination addresses for services when you create your connections.

Objects can be identified by name, icon representation, type, and description. There are several types of network objects but Host and Firewall are the most common. The default network object shipped with the IBM Firewall is ″The World″. This is a global object that encompasses all possible IP addresses. After you have filled in the network configuration worksheets (see “Network Configuration Planning Worksheet” on page 10), you are ready to build objects.

You can create single or group objects. All network objects are defined by an IP address and an address mask (subnet mask) so that it is possible for one object to represent a range of network addresses.

Using the Configuration Client to Define Network Objects

To define a single network object, select **Network Objects** from the configuration client navigation tree. The Network Objects dialog box appears. Double-click **NEW**. The **Add a Network Object** dialog box appears, as shown in Figure 12.



Object Type: Host
Object Name:
Description:
IP Address:
Subnet Mask: 255.255.255.255

Figure 12. Add a Network Object

1. Enter the object type. Click the **Object Type** arrow to see the object types you can create. For performance reasons, it is better to create network type objects instead of host type objects. The object types you can create are:
   - Host - a particular node on your network with a mask of 255.255.255.255.
   - Network - a collective range of network addresses that is characterized by an address range and a specific subnet mask.
   - Firewall - a single machine with a firewall installed on it with a mask of 255.255.255.255.
   - Router - a host that routes traffic between two or more networks with a mask of 255.255.255.255.
   - Interface - a network adapter on a machine with a mask of 255.255.255.255. It does not have to be an adapter on the Firewall.
2. Fill in the object name. Use a single-byte character set to do this. Double-byte character sets are not supported.
3. Fill in the description. This field is optional but if you do fill it in use a single-byte character set to do this. Double-byte character sets are not supported.
4. Enter a dotted-decimal IP address for this object.
5. Enter a subnet mask that specifies the bits in the address to compare to the address of the IP packet.
6. Click **OK**.

Network Object Groups

A group represents a collection of network objects. Groups are used as a convenience in setting up connections and can eliminate repetitive work. An example would be to group some addresses, individually represented by network objects, into a network object group to represent a department. This department can be used as either the source or destination address for a connection.

To define a group of network objects, select Network Objects from the configuration client navigation tree. The **Network Objects** dialog box appears. Double-click **NEW GROUP**. The **Add a Network Object** dialog box appears.

1. Fill in the group name.
2. Fill in a description. This field is optional.
3. Click **Select** to select objects for the group.
4. Click **OK**.

Tip: It is a good idea to encompass contiguous address ranges into a single network object whenever possible. This will improve the performance of the connection rule processing. The following example illustrates this.

```
ACCOUNTING DEPARTMENT
  Kevin's machine  191.1.10.1
  Susan's machine  191.1.10.3
  Helen's machine  191.1.10.5
  Peter's machine  191.1.10.7
  Bob's machine    191.1.10.9
```

To create a network object for this accounting department, you would enter the IP address information for this group as: 191.1.10.0 with a Subnet Mask of: 255.255.255.0. This network object, accounting department, can be used as either the source or destination for a connection.

Chapter 6. Handling Domain Name Service

This chapter explains how to configure Domain Name Service (DNS) in relation to the IBM Firewall. The goal of DNS is to provide full-domain name service to hosts inside the secure network while providing no information to hosts outside the secure network. This allows users inside the secure network to access all the services the Internet has to offer. However, by refusing to divulge information about the secure network, it makes it more difficult for an intruder to locate a computer to attack.

Three domain name servers are required to accomplish this:

1. One at the IBM Firewall
2. One inside the secure network
3. One outside the secure network

Refer to Figure 13 to see how DNS works with the IBM Firewall.

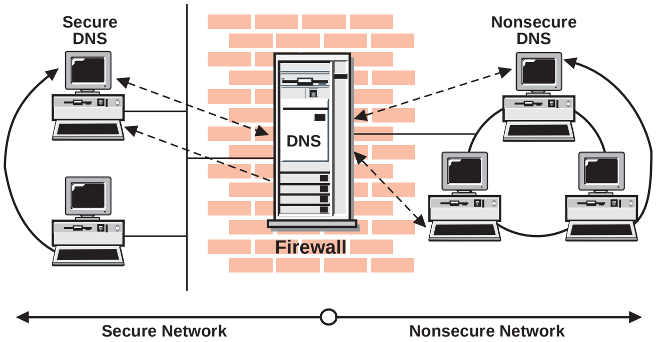


Figure 13. DNS

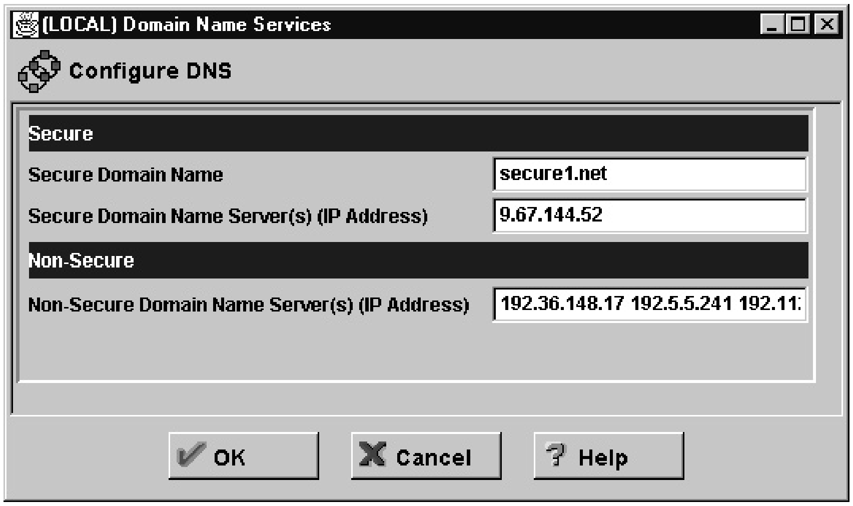
The Firewall is configured to act as a gateway between the nameserver(s) for the secure network and those serving the nonsecure network. The official term for the Firewall's role is *caching-only nameserver*, because the Firewall's DNS does not contain any database files itself.

Figure 13 illustrates the Firewall's role. Anytime the Firewall needs to resolve a name for its own use, it asks the secure-side nameservers. Anytime a query is forwarded to the Firewall, it in turn forwards the query to the nonsecure nameservers.

When a client on the secure network asks for secure-side information, it sends its request to the secure-side DNS, who answers. When the same client asks for nonsecure-side information, it sends the request to the same secure-side DNS. Because the query is for nonsecure information, the secure-side DNS cannot answer, so it forwards the query to the Firewall. In the event that a nonsecure DNS were to forward a request to the Firewall, that request would be forwarded to the nonsecure DNS domain, so again no sensitive information is divulged.

Configuring DNS Using the Configuration Client

Do not use Microsoft DNS Service Manager to configure DNS. Use the IBM Firewall configuration client. To configure DNS, select System Administration from the configuration client navigation tree. Double-click the file folder icon to expand the view. Select **Domain Name Services**. The IBM Firewall displays the current DNS configuration, which you can modify.



Secure

Secure Domain Name: secure1.net

Secure Domain Name Server(s) (IP Address): 9.67.144.52

Non-Secure

Non-Secure Domain Name Server(s) (IP Address): 192.36.148.17 192.5.5.241 192.11:

Figure 14. Domain Name Service

Note: When you add DNS, the firewall saves and renames any existing domain-name service configuration files.

1. The **Secure Domain Name** field identifies the domain name which the Firewall will append to any unqualified hostnames.
2. The **Secure Domain Name Server** field refers to the server that resolves names and IP addresses for the hosts protected from the Internet by the IBM Firewall. You can enter dotted-decimal IP addresses, separated by spaces.
3. The **Nonsecure Domain Name Server** field refers to the server(s) provided by your service provider to resolve information about the nonsecure network. You can enter dotted-decimal IP addresses, separated by spaces.

Note: When a nameserver initializes, it sends out a query to obtain the list of root nameservers. Most implementations retain this list in memory. Microsoft's implementation however, writes this list back to the configuration file. This does not modify the behavior of the nameserver, but will change the values displayed in the **Nonsecure Name Server** field. This is not cause for concern.

Configuring the Secure Name Server

The secure name server must be configured to forward unresolved queries to the Firewall. If you have a standard BIND implementation, add a *forwarders* statement and a *cache* statement to the *boot* file on your secure name server:

```
forwarders     aaa.bbb.ccc.ddd
cache          .              named.cache
```

Create the cache file, *named.cache*, to point to the Firewall:

```
. 99999999 IN NS firewall.private.com
firewall.private.com   99999999 IN A aaa.bbb.ccc.ddd
```

where *private.com* is the domain name used from the secure side and *aaa.bbb.ccc.ddd* is the Firewall's IP address.

In addition, you might want to add your firewall's host name to the DNS databases. This way your users can access the Firewall's Socks server, HTTP proxy, Telnet proxy, and FTP proxy using the Firewall's hostname instead of its IP address. This requires two additional steps as described in *Chapter 4* of *DNS and BIND*. See "Bibliography" on page 163 for more details about this book.

First add an A record to the domain database file:

```
firewall.private.com     IN A aaa.bbb.ccc.ddd
```

Then add a PTR record to the reverse-lookup file:

```
ddd.ccc.bbb.aaa.in-addr.arpa.   IN PTR  firewall.private.com.
```

If you do not use DNS for your secure network, your firewall must still be able to resolve its own information. Configure the firewall as described for the normal case, but list the firewall's secure interface in the **Secure Name Server** field. Then add the following line to c:\winnt\system32\dns\boot.

```
primary ccc.bbb.aaa.in-addr.arpa c:\winnt\system32\dns\fwnamed.rev
```

Then create *fwnamed.rev* to resemble the following:

```
ccc.bbb.aaa.in-addr.arpa  IN SOA firewall.private.com. root.public.com. (
                          9      ; Serial
                          86400  ; Refresh after 1 day
                          300     ; Retry after 5 minutes
                          654000  ; Expire after 1 week
                          3600  ) ; Minimum TTL of 1 day
ccc.bbb.aaa.in-addr.arpa.         IN NS    firewall.private.com.
ddd.ccc.bbb.aaa.in-addr.arpa      IN PTR   firewall.private.com.
```

Configuring the Secure Clients

Clients on the secure network must be configured to send their queries to the secure nameserver, not to the Firewall. This is important because it ensures that no secure-side information is stored in the Firewall's in-memory cache. Also, it saves workload on the Firewall because the Firewall will not get involved unless a query involves forwarding a query from the secure side to the nonsecure side.

If you do not use DNS for your secure network, your clients will have to point to the Firewall as their nameserver.

Publishing Services to the Public

Many organizations want to publish particular services to the Internet public. Often, these services include e-mail and Web servers, although any type of TCP/IP server could be used. In order to make such services available, you must not only place the server on the network where it can be reached, but you must also list that server with the public DNS, so that users can obtain the right information.

There are two ways to accomplish this. Either your service provider will list your servers as a part of their domain (and hence on their nameservers), or you must provide your own nameserver and register it with the Internet. It is by far easier for your Internet Service Provider (ISP) to provide this service for you. If you can choose this option, you need to provide them with the hostnames and IP addresses you wish to have listed. For example, if you operate your public Web server as *www.public.com* at IP address is *50.100.150.200*, you need to ask your ISP to list *www.public.com at 50.100.150.200*.

In addition, if you wish to receive e-mail, you should ask your ISP to list your firewall as the *mail exchanger* for your public e-mail domain. The ISP needs to know the hostname *(gateway.public.com)*, its IP address *(50.100.150.201)*, and the domain name by which you want to receive mail *(public.com)*.

If your ISP is not willing to provide these services for you, then you will have to do it yourself. Here again, you have two additional choices. You can place a DNS server in your DMZ or you can use your firewall as that nameserver.

Using the firewall does not open additional security risks because the database files you will put there do not contain any information about your secure network. The only information that will be stored will pertain to the public services you choose to offer.

The details involved in setting up a DNS server are contained in Chapter 4 of *DNS and BIND*, which is listed in the “Bibliography” on page 163. That chapter is highly-recommended reading, as are the preceding chapters, if necessary. Setting up a DNS server is not a trivial task and is often best left to experts. If you have such an expert available, seriously consider taking advantage of that expertise.

See “Sample Configurations” for more information.

Installing Microsoft’s DNS Server

To install Microsoft’s DNS Server, go to the control panel, click **Network**, click **Services tab**, click **Add**, and select **Microsoft DNS Server**. You will need the installation CD-ROM.

Troubleshooting DNS Problems

The *IBM eNetwork Firewall Reference* contains a chapter about troubleshooting the Firewall. There is a specific section in that chapter for DNS problems. This section provides suggestions for using the *nslookup* command to identify the failing segment of the DNS system.

Sample Configurations

This section illustrates some sample configurations in which a firewall might be deployed. Most of these examples focus on the configuration necessary for DNS operation. It is unlikely that one of these examples illustrates your network, so take care to understand each example and to apply the appropriate concepts to your particular installation.

Example 1: DNS Server in a DMZ on the Nonsecure Interface

The first example illustrates the files needed to operate the nameserver in a DMZ which is located inside the nonsecure network, as shown in Figure 15 on page 42.

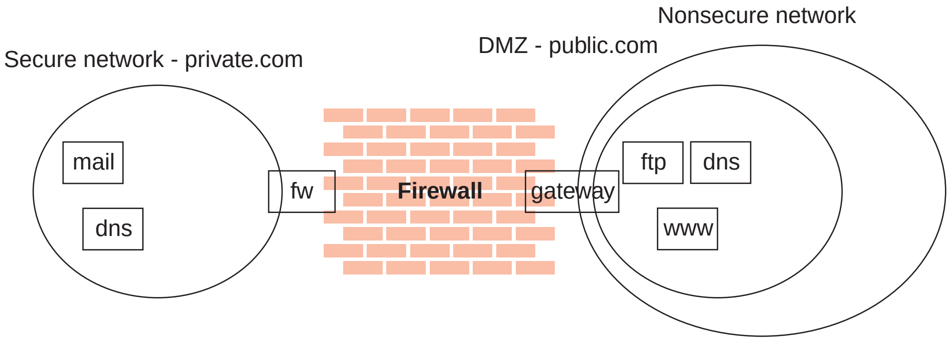


Figure 15. Nameserver in DMZ Inside Nonsecure Network

This figure illustrates a private network, *private.com*, behind an IBM Firewall whose secure interface is named *fw.private.com* and whose nonsecure interface is named *gateway.public.com*. The company's DMZ is attached to the nonsecure interface and contains a nameserver *dns.public.com*, an FTP server *ftp.public.com*, and a Web server *www.public.com*. The files on *dns.public.com* to implement this scenario are as follows:

db.public

```
public.com.   IN SOA dns.public.com. admin.public.com.  (
                  1           ; serial number
                  10800       ; refresh after 3 hours
                  3600        ; retry after 1 hour
                  604800      ; expire after 1 week
                  86400 )     ; minimum TTL 1 day
;
; Nameservers
;
public.com           IN NS  dns.public.com.
;
; Hosts in the DMZ
;
dns.public.com.      IN A 50.100.150.202
gateway.public.com.  IN A 50.100.150.201
www.public.com.      IN A 50.100.150.200
ftp.public.com.      IN A 50.100.150.203
;
; Mail-related entries
;
public.com.          IN MX  0  gateway.public.com.
public.com.          IN CNAME gateway.public.com.
```

db.50.100.150

```
150.100.50.in-addr.arpa.   IN SOA dns.public.com. admin.public.com.  (
                 1           ; serial number
                 10800       ; refresh after 3 hours
                 3600        ; retry after 1 week
                 604800      ; expire after 1 week
                 86400  )    ; minimum TTL 1 day
202.150.100.50.in-addr.arpa.      IN NS dns.public.com.
203.150.100.50.in-addr.arpa.      IN PTR  ftp.public.com.
202.150.100.50.in-addr.arpa.      IN PTR  dns.public.com.
201.150.100.50.in-addr.arpa.      IN PTR  gateway.public.com.
200.150.100.50.in-addr.arpa.      IN PTR  www.public.com.
```

db.127.0.0

```
0.0.127.in-addr.arpa.   IN SOA dns.public.com. admin.public.com.  (
                 1           ; serial number
                 10800       ; refresh after 3 hours
                 3600        ; retry after 1 week
                 604800      ; expire after 1 week
                 86400  )    ; minimum TTL 1 day
0.0.127.in-addr.arpa.   IN NS  dns.public.com.
1.0.0.127.in-addr.arpa.   IN PTR localhost.
```

db.cache

The best choice for this file is to FTP the current root nameserver list from *ftp://ftp.rs.internic.net/domain/named.root*.

boot

```
primary public.com                    db.public
primary 150.100.50.in-addr.arpa      db.50.100.150
primary 0.0.127.in-addr.arpa         db.127.0.0
cache   .                            db.cache
```

To set the traffic filter to allow the appropriate DNS traffic, enable *Permit DNS Queries* on the **Security Policy** panel.

Example 2: DNS in a DMZ on a Dedicated Interface

In the second example, the DNS for the DMZ is still on a dedicated nameserver, but this time the DMZ is attached to a distinct interface instead of the same interface as the nonsecure network.

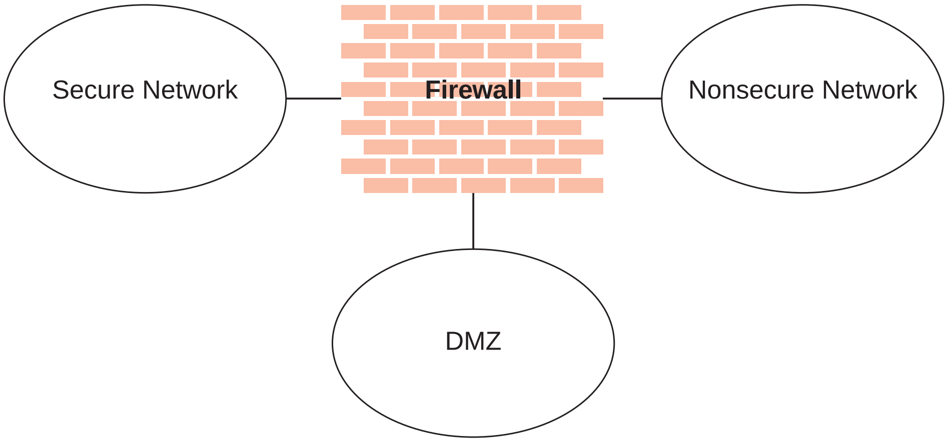


Figure 16. DNS in a DMZ on a Dedicated Interface

The DNS data files on *dns.public.com* are the same as in the preceding example. In order to make that nameserver accessible to the public network, though, it is necessary to either open the traffic filter or to perform a zone transfer to copy the data files to the Firewall.

To open the traffic filter, copy the three rule templates entitled *DNS Server queries*, *DNS Replies*, and *DNS Client queries*. Change the routing setting on each rule from *local* to *routed*. Then include the three new rule templates in a service and set the flow indicators as follows:

- DNS Client queries: --->
- DNS Replies: <---
- DNS Server queries: --->
- DNS Server queries: <---

Include this service in a connection which uses *The World* as the source object and *dns.public.com* as the destination object.

To perform a zone transfer, you need to both set the traffic filter and instruct the nameservers to copy the appropriate files. To set the traffic filter:

1. On the **Security Policy** panel, enable *Permit DNS Queries*.
2. Add a connection from *dns.public.com* (source object) to the Firewall's DMZ interface (destination object), which includes the service entitled *DNS Transfers*.

To activate the zone transfer, add the following lines to the Firewall's *boot* file in `c:\winnt\system32\dns`:

```
secondary public.com     50.100.150.202 db.public
secondary 150.100.50.in-addr.arpa  50.100.150.202 db.50.100.150
```

Then go to the Service Control Manager and stop and restart the DNS Server service.

Example 3: Using the Firewall as the Secure Nameserver

To use the Firewall as your secure name server, place the database files which would normally reside on the secure server, on the Firewall. Then your clients can point to the Firewall as their DNS server. The risks associated with this approach are that the DNS server cannot tell a request from the secure side from a request from the nonsecure side. Accordingly, it will provide this secure-side information to any client who asks; you no longer can hide your secure DNS information.

To implement this approach, start by configuring the Firewall DNS facility using the configuration client. For the *Secure Domain Name* field, list the domain name you will be using on your secure network. For *Secure Nameserver*, list the Firewall's secure interface. For *Nonsecure Nameserver*, list the nameserver provided by your ISP, as usual. Then you must create a reverse-lookup file on the Firewall to supplement this configuration.

Create the file `c:\winnt\system32\dns\fwnamed.rev` to resemble the following example.

For this example, the Firewall's secure interface is named *fw.private.com* and its IP address is *10.100.100.1*.

```
100.100.10.in-addr.arpa.   IN SOA fw.private.com. admin.fw.private.com. (
                 1           ; serial number
                 10800       ; refresh after 3 hours
                 3600        ; retry after 1 week
                 604800      ; expire after 1 week
                 86400  )    ; minimum TTL 1 day
1.100.100.10.in-addr.arpa.        IN NS fw.private.com.
1.100.100.10.in-addr.arpa         IN PTR fw.private.com.
```

Then add the following line to `c:\winnt\system32\dns\boot`:

```
primary 100.100.10.in-addr.arpa     fwnamed.rev
```

In this scenario, your clients must be configured to indicate the Firewall (10.100.100.1) as their DNS server. Your Firewall will assist with the resolution of external information, but there will be no resolution of secure-side information. This means that any secure-side client that wants to connect to the configuration server or any of the proxy servers on the Firewall, must refer to the Firewall by IP address, not by hostname.

Chapter 7. Secure Mail Proxy

The IBM Firewall Secure Mail Proxy provides a gateway for SMTP traffic. It relays messages from the secure mailserver to the nonsecure side, hiding sensitive domain names as it goes. It relays messages from the nonsecure side in to the secure mail domain and insulates the secure network from attacks.

The Secure Mail Proxy relays messages in real time from the sender to the receiver. This is to avoid the risks and complexity involved with maintaining a message queue on the Firewall. This necessitates certain configuration requirements upon the adjacent mail domains. Read this chapter thoroughly as you design your implementation.

How the Secure Mail Proxy Works

The Secure Mail Proxy acts as a real-time gateway between two or more e-mail domains. In contrast with a traditional SMTP relay, messages are not stored on the Firewall before being forwarded to the destinations. The SMTP conversation is interpreted as it happens, and the Secure Mail Proxy conversation is proxied on to each of the necessary destination servers, command by command.

When an SMTP server opens an SMTP conversation with the Firewall's Secure Mail Proxy, the SMTP conversation takes place between the proxy and the sending server until the sending server sends the list of recipients. Then, as each recipient is sent, the Secure Mail Proxy opens a new SMTP conversation with each of the necessary recipient servers. Then, as the body of the message is sent, it will be fanned out (as it comes in) to each of the recipient servers.

The benefits are:

- Because messages are not stored on the Firewall before transmittal, the messages need not be stored for long periods of time.
- Security exposures resulting from messages (and their attachments) being stored on the Firewall are reduced.
- The complexity of a queue-management component is unnecessary.
- False positive responses are not generated. If an error is encountered with one or more recipient, the sending Secure SMTP server can be notified of that error immediately. See "Error Handling" on page 48.

Error Handling

The SMTP world is an imperfect one. Errors occasionally occur. The proxy works in conjunction with a traditional store and forward mail server to recover from rare timing conditions and when it is unable to establish connections to a mail server.

The Firewall’s Secure Mail Proxy tries to be invisible to errors, so that a sending SMTP server is free to respond to any error it encounters according to the SMTP server’s own implementation, with no interference from the Firewall’s proxy. This approach is unsuitable for certain types of errors that might occur. In particular, errors which take place during transmission of the body of the message are difficult to handle, because such an error will usually affect only one recipient server, while the remaining recipient servers are unaffected.

To accommodate such a case, the Secure Mail Proxy will keep a copy of each message as it is being sent. In the case of an error, this copy will be sent after the successful transmission to all recipient servers that did not encounter an error to a configured overflow server. This overflow server must be a conventional store-and-forward type server, and must be configured to relay messages which might be addressed to either secure-side or nonsecure-side destinations. It will be this server which will implement the policy regarding retry attempts and delivery-failure notification.

Although the proxy does keep a copy of each note, it is important to note the distinction between the proxy’s behavior and that of a conventional store-and-forward server. After the normal SMTP conversation, if no errors are encountered, the Firewall’s copy of the message is immediately discarded. In the case of a store-and-forward server, the message must persist on the Firewall for the entire duration of:

- The SMTP conversation in which the message is received from the sender
- The latency time involved with the queueing system on the server
- The one or more SMTP conversations required to transmit the message to each receiving SMTP server, including potential additional queue latency while the list of recipient servers is processed.

In the case of an error, the store-and-forward server must store the message long enough to implement its retry policy, which could require hours or days. In the case of an error on the Firewall, the message is relayed immediately to the overflow server, and is therefore no longer consuming Firewall resources.

Note: The proxy keeps its copy of each message in the Firewall’s `tmp` subdirectory. There is only one copy of each message kept, regardless of the number of recipients on each message. These files are discarded immediately either after successful transmission or after being relayed to the overflow server.

Fan-Out Limit

As described above, when the Secure Mail Proxy receives a message destined to more than one destination domain, it will *fan-out* the message and deliver it simultaneously to each destination domain's mail server. The proxy will only open a certain number of these outbound connections; destinations exceeding that limit will be forwarded to the overflow server. Fan-out is limited due to the proxy's packet-by-packet transmission model. Each time a packet is received, it must be sent to the entire set of receiving servers. If the set of receiving servers is allowed to grow too large (or if that set contains exceptionally slow servers), the sender might time out, because the proxy cannot process the transmission quickly enough.

This fan-out limit **does not** affect the following types of messages:

- Messages sent to many users on a single domain (or a few domains)
- Messages sent to listservers (such as Majordomo)
- Messages sent into the secure network (generally; usually there are fewer secure-side domains than the fan-out limit)

The fan-out limit **does** affect the following types of messages:

- Messages sent from a secure-side listserver to a wide assortment of nonsecure-side participants
- Messages sent to a large number of nonsecure domains

The Overflow Server

The overflow server is responsible for handling any messages which, due to error conditions, the proxy was unable to handle. Messages are routed to the overflow server under two circumstances:

1. One or more receiving SMTP servers generates an error after the proxy begins to transmit the body of the message, while one or more receiving SMTP servers involved in the same transmission receives the message successfully
2. The note being sent exceeds the proxy's fan-out limit.

Aside from these two types of messages, the overflow server will not be used.

The overflow server can be coresident with the Firewall, or it can reside on a different computer. However, it should be placed on the secure side of the network. To colocate the overflow server with the Firewall, configure the overflow server to listen on a non-standard port (for example, 2500 instead of

25). Then configure the Firewall to use ″localhost″ on port 2500 (for example) as its overflow server. See below for instructions on how to configure the Firewall to use an overflow server. Consult your mail server’s documentation for instructions on how to make it listen on a particular port.

The overflow server must be configured as a store-and-forward mail relay. It must accept messages addressed to any destination. It is perfectly acceptable (and recommended, particularly in the coresident situation) to configure your Firewall’s Traffic Control facility to only allow the Firewall to send SMTP traffic to the overflow server.

The overflow server should configure the Firewall’s proxy as its outbound gateway; otherwise, a message could be forced to the overflow server as a means of bypassing the Firewall’s proxy. In the case in which messages are being sent to the overflow server as a result of exceeding the fan-out limit, the overflow server then becomes responsible for resending the message until the entire list of recipients has been processed. Sendmail and many other mail servers have a feature which allows them to automatically break a distribution list into batches of a specified number of recipients. If you depend on a high level of fan-out, investigate this feature on your secure-side mail servers and on your overflow server.

Configuring the Secure Mail Proxy Using the Configuration Client

Before you configure the Secure Mail Proxy, read the following configuration information which will help you when designing your installation.

1. Because the proxy is rewriting private domain names into public domain names, the set of private domains and the sets of users on those private domain names must be arranged to accommodate the ambiguity which can result from the domain-name rewrite operation. For example, if there is a user ″joe@hq.private.com″ and another user ″joe@sales.private.com″, and if the proxy is configured to rewrite ″private.com″ into ″public.com″, then both of these users will appear to the outside world as ″joe@public.com″. There is no way to distinguish these two users so that a recipient can reply to a received note.
2. If your network contains multiple Firewalls or other outbound mail gateways, particularly if these gateways (and the private networks) contain expensive network media (such as private transatlantic trunk lines), it is easy to introduce a situation in which replies get routed by the Internet to the wrong gateway, causing unnecessary cost on this expensive media. For example, a company with a North American Firewall and a European Firewall might choose to rewrite ″private.com″ to ″public.com″ across all of their Firewalls. In such a case, a European customer of this company might send a note to ″sales@public.com″, which could (based upon MX records) be sent to the North American Firewall instead of the European

Firewall causing the company to unnecessarily pay for the message to be routed over the transatlantic T1 back to Europe. To avoid this situation, consider using different public domain names for different proxies, if an expensive medium separates them (in this example, perhaps ″na.public.com″ and ″ec.public.com″).

To configure the Secure Mail Proxy, select System Administration from the configuration client navigation tree. Double-click the file folder icon to expand the view. Select **Secure Mail Server**. The IBM Firewall displays the list of configured mail servers and domains. You must configure one entry for each private-side mail domain being configured. Each entry consists of three fields:

1. The **Secure Mail Domain Name** field contains the name by which the mail domain being described is known to users on the secure side of the firewall. The value for this field must be unique among all entries.
2. The **Secure Mail Server Name** field contains the host name or dotted-decimal IP address of the mail server to which this entry applies. This server must be on one of the secure networks. You can list only a single mailserver for a given domain. If you specify an IP address instead of a hostname, enclose the IP address in square brackets.
3. The **Public Mail Domain Name** field contains the name by which the mail domain being described is known to users on the nonsecure side of the firewall. This name will be substituted in place of the secure domain name, in order to hide the topography of the secure network.

Add a Mail Configuration Entry

To add a domain, select **NEW** and click **Open**. The **Add Mail Server** dialog box appears.

1. Enter the correct values for Secure Mail Domain Name, Secure Mail Server Name, and Public Mail Domain Name.
2. Click **OK**.

Change a Mail Configuration Entry

To change a mail configuration entry, select an entry in the list and click **Open**. The **Change Mail Server Configuration** dialog box appears.

The **Secure Mail Domain Name** field is disabled, but you can change the other fields, as described in “Configuring the Secure Mail Proxy Using the Configuration Client” on page 50.

Delete a Mail Configuration Entry

To delete a mail configuration entry, select an entry in the list and click **Delete**. You will get a delete warning. Click **OK** to delete or **Cancel**, if you change your mind.

Configuring the Overflow Server

The overflow server should be placed on the secure side of the network.

To set up the overflow server, click **Advanced...** on the **Secure Mail Server** panel. You are prompted for the hostname (or address) and port number for the overflow server. If you provide the IP address of the server instead of its hostname, enclose the address in square brackets. You can use ″localhost″ or ″127.0.0.1″ if the overflow server resides on the Firewall machine. This IP address is not filtered by the Firewall’s traffic control.

Click **OK** to save your changes, or **Cancel**, if you change your mind.

Configuring the Secure Servers

You must configure your secure mail servers to list the Firewall as their gateway for unknown domains. This causes mail intended for the nonsecure network to be forwarded to the Firewall. Also, each server must be configured to accept messages addressed to their public domain name in addition to their private domain name. When the Firewall forwards a note from the nonsecure network, all recipients will be listed with their public-side domain names.

If you have more than a single distinct mail domain inside your secure network, you must also configure each server to forward mail intended for another secure-side domain directly to that server, not through the Firewall. This relieves the Firewall of unnecessary workload and allows the Firewall’s real-time delivery mechanism to function properly.

Configuring the Public Domain

The only configuration necessary in the nonsecure network is to list your Firewall as the mail exchanger for your network. Ask your service provider to add the necessary information to their DNS servers. See “Chapter 6. Handling Domain Name Service” on page 37 for additional specifics regarding the mechanics involved.

The objective is to list your Firewall as the *mail exchanger* for each public domain name for which you want to accept mail. For example, if you use the domain name *private.com* inside your secure network and *public.com* outside your secure network, you might name your firewall *gateway.public.com*. In such a case, you would ask your provider to list the Firewall's hostname and IP address as a host (which will usually be listed with ″A″ records and ″PTR″ records). Then, because you want to accept mail addressed to *user@public.com*, you would ask your provider to add an MX record for the domain *public.com* which lists *gateway.public.com* as the mail exchanger for that domain. If you also want to receive mail addressed to *user@somethingelse.com*, you can list an additional MX record which also points to the Firewall.

Using an SMTP Server Instead of the Secure Mail Proxy

The following sections tell you how to disable the Secure Mail Proxy and how to configure an SMTP server.

Disabling the Secure Mail Proxy

To disable the Secure Mail Proxy in order to avoid conflicts with another SMTP server product, disable the Secure Mail Proxy service from the **Service Control Manager**. From the Windows **Start** menu, select **Settings, Control Panel, Services.** Scroll to select *IBM Firewall SMTP Proxy*. Click **Startup**. In the **Startup Type** field, select **Disabled**. Click **OK**.

Configuring an SMTP Server

You need to consider several aspects when installing a full SMTP server in place of the Secure Mail Proxy. This section describes the security features of the Secure Mail Proxy, in an attempt to allow you to configure your SMTP server to perform similar functions. Certain SMTP server products might be unable to perform some of these tasks, so study the choices available and your needs carefully before purchasing a product.

There are certain attacks which attempt to overflow or otherwise corrupt the mail queue. Although no full-blown server can operate without a mail queue, the risks associated with the mail queue are reduced if you can dedicate a disk volume exclusively to that task. This minimizes the chances that an overflowed queue would impact other operations of your firewall.

It is also important that your mail server hide information about the secure network. The Secure Mail Proxy rewrites all private-side hostnames to the public domain name. This removes information that could be used to map your network.

Chapter 8. Controlling Traffic through the Firewall

This chapter tells you how to use the configuration client to control network traffic through the Firewall. Using expert filters, the firewall filters packets at the session level based upon multiple criteria such as time of day, IP address, and subnet. The filter acts between the secure and nonsecure network interfaces. Filters do not impact the firewall routing tables.

By default the Firewall does not allow any traffic to flow between the secure and nonsecure network. You must create connections to allow specific types of traffic to flow between the secure and nonsecure networks.

Using the Configuration Client to Build Connections

You use the components of the configuration client illustrated in Figure 17 on page 56 to create network objects, rule templates, services, and connections.

Connections
Associate network objects with services or socks templates to define the types of communications allowed between endpoints. Each connection defines a specific type of IP traffic to be allowed or denied between a source and destination network object.

Services
Are built of one or more rule templates. Defines the type of IP traffic that is permitted or denied between a source and destination object. For example, you could construct a service to permit Telnet or deny Ping. (One of the FTP services is comprised of eight rule templates). The IBM Firewall comes with a set of default services. You cannot delete these preloaded default services but you can modify certain fields. However, if these predefined services do not meet your needs you can add to services by using the rule templates to create new rules. See “Defining Services” on page 78 for more information.

Rule Templates
Provide instructions to the Firewall to permit or deny IP packets based upon their various attributes.

Socks Templates
Provide instructions to the firewall socks daemon to permit or deny IP packets based upon their various attributes.

Network Objects
Represent the various network components, like hosts, users, and subnets, that interact with the Firewall. They are defined by an IP

address and an address mask, so it is possible for one object to represent a whole range of network addresses. Network objects can be grouped.

Network Object Groups

Represent one or more network objects. They are used as a convenience in setting up connections and can eliminate repetitive work. An example would be to group several addresses together into a network object group to represent a department. This network object group can then be used as either the source or destination for a connection.

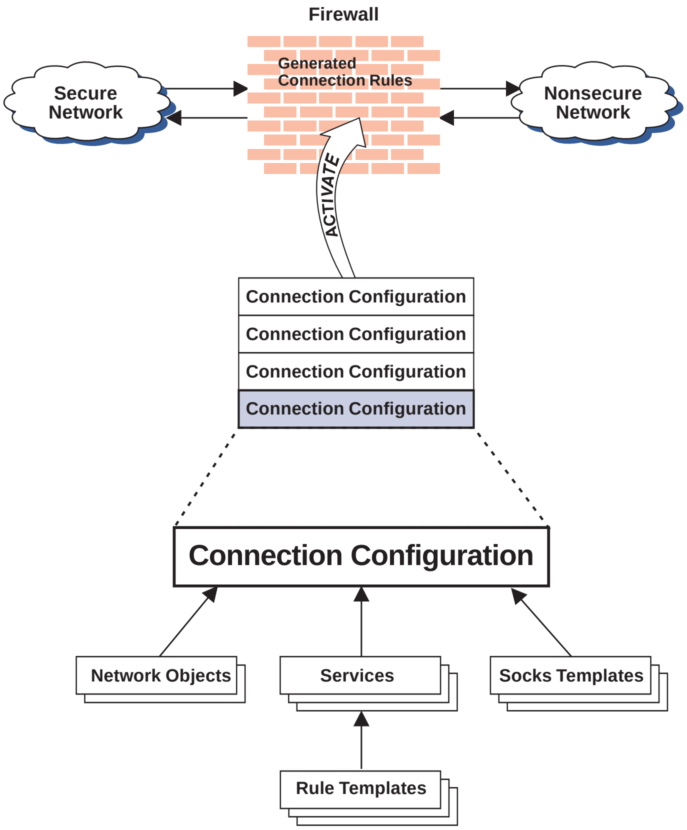


Figure 17. Building Connections

Building Connections Using Predefined Services

In order to permit or deny specific types of communications between two named network objects or network object groups that serve as endpoints, you need to build a connection.

After you have defined your network objects, you create connections. Select one network object or group to be the source and another network object or group to be the destination for the traffic flow through the Firewall.

To build a connection, select Traffic Control from the configuration client navigation tree and double-click the file folder icon to expand the view. Select **Connection Setup**. The **Connections List** dialog box appears. Select **NEW** and click **Open**. The **Add a Connection** dialog box appears, as shown in Figure 18.

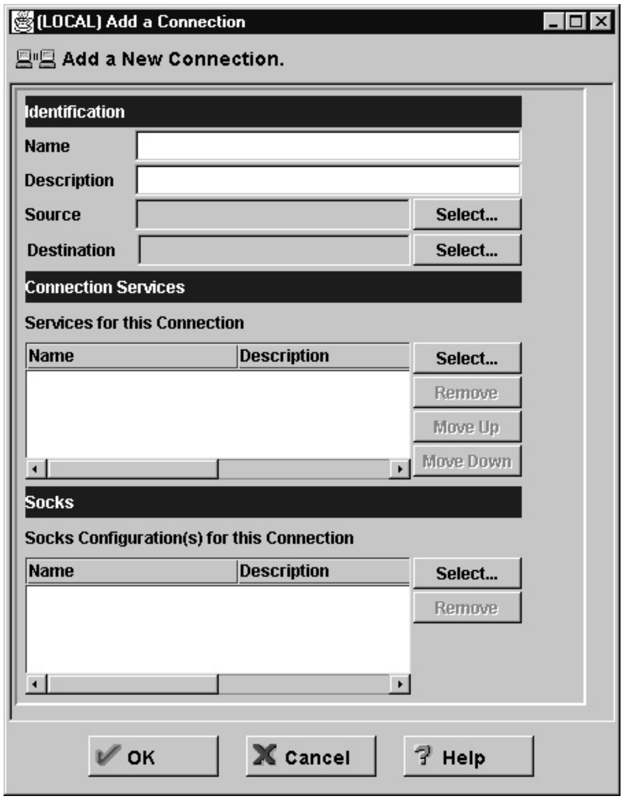


Figure 18. Add a Connection

1. Fill in a name for the connection.

2. Fill in a description of the connection.
3. For the source field, click **Select** and choose a network object from the **Network Object** dialog list.
4. For the destination field, click **Select** and choose a network object from the **Network Object** dialog list.
5. To choose the services for this connection, click **Select** and choose the type of traffic you wish to control between the endpoints.
6. Choose one or more services from the list to add the service to the Connection.
7. You can reorder the list by selecting a service and clicking **Move Up** or **Move Down**. See “Ordering Connections”.
8. You can remove a service by selecting it and clicking **Remove**.
9. Use **Socks Configuration for this Connection**. Follow steps 5–7 to make connections for Socks.
10. After you have everything defined, click **OK**.
11. Activate all of your connections. See “Connection Activation” on page 59.

Ordering Connections

Most IBM Firewall users have less than 1000 rules. The more rules you have, the greater the impact there will be on performance.

When a packet is received at a network interface, whether going into or out of the firewall host, rules are applied starting at the top of the generated connection rules. When the information from the packet exactly matches the information in a rule, the action (permit or deny) is taken. If the entire file is searched without a match, the request is denied.

Tip: Place more specific connections closer to the top and less specific connections closer to the bottom. For example, you might have a Department ABC, with an address of 1.1.10.X and a machine that is used as a server inside of Department ABC, with an address of 1.1.10.7. If you want to exclude machine 1.1.10.7 because it is a server that should not be used for telnet traffic, you must place the connection `Deny telnet for Dept ABC server` before the `Permit telnet for Dept ABC` connections. If you reverse the order of the connections, the deny connection will never be encountered.

Connection Activation

Note: Before you activate connections, make sure your secure interface is defined.

Select **Connection Activation** from the configuration client navigation tree to do any of the following:

Regenerate and Activate Connection Rules
The Firewall builds the generated connection rules from the connection configuration and activates that rule set.

Deactivate Connection Rules
The Firewall is now protected by the default rules.

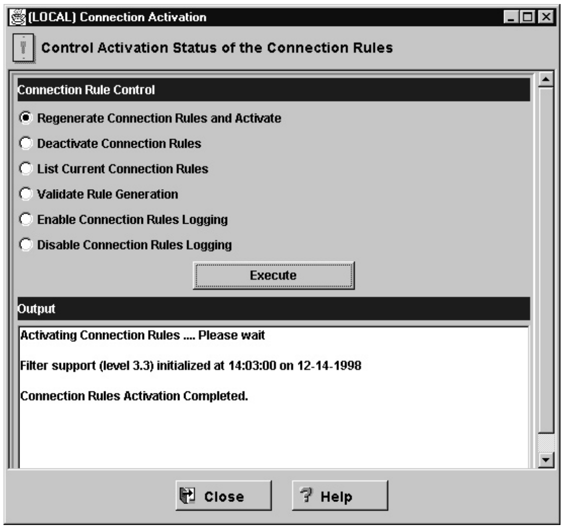
List Current Connection Rules
You see the most recently generated connection rules set. If you previously deactivate rules, they are not being used.

Validate Rule Generation
The rules you have created are either valid or invalid.

Enable Connection Rules Logging
The Firewall logs selected traffic to the `firewall log` facility.

Disable Connection Rules Logging
Stops the Firewall logging.

The **Connection Activation** dialog box appears, as shown in Figure 19 on page 60.


(LOCAL) Connection Activation
Control Activation Status of the Connection Rules
Connection Rule Control
Execute
Output
Close
Help

● Regenerate Connection Rules and Activate
○ Deactivate Connection Rules
○ List Current Connection Rules
○ Validate Rule Generation
○ Enable Connection Rules Logging
○ Disable Connection Rules Logging

```
Activating Connection Rules .... Please wait

Filter support (level 3.3) initialized at 14:03:00 on 12-14-1998

Connection Rules Activation Completed.
```

Figure 19. Connection Activation

After you make a selection, click **Execute**.

Sample Logging Output when Regenerating and Activating Connection Rules

The following is a sample of the logging output when you regenerate and activate connection rules.

```
Feb 03 13:46:53 1998 mr16n18: ICA9037i: Firewall interfaces being updated
automatically on Tue Feb  3 13:46:53 1998.

Feb 03 13:46:55 1998 mr16n18: ICA1032i: Filter rules updated at
13:46:55 on Feb-03-1998

Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:1 permit 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
udp eq  53 eq 53 both local both l=n f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:2 permit 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
udp gt  1023 eq 53 both local both l=n f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:3 permit 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
udp eq  53 gt  1023 both local both l=n f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:4 permit 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
tcp     gt  1023 eq 25 both local both l=y f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:5 permit 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
tcp/ack eq  25 gt 1023 both local both l=y f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:6 permit 9.67.144.49 255.255.255.240
9.67.130.154 255.255.248.0 all any 0 any 0 both both both l=y f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:7 permit 9.67.130.154 255.255.248.
0 9.67.144.49 255.255.255.240 all any 0 any 0 both both both l=y f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:8 permit 9.67.144.49 255.255.255.240
9.67.131.250 255.255.255.255 tcp     gt  1023 eq  21 secure local inbound
l=n f=y t=0 e=none a=none
```

```
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:9 permit 9.67.131.250 255.255.255.255
9.67.144.49 255.255.255.240 tcp/ack eq  21 gt  1023 secure local outbound
l=n f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:10 permit 9.67.131.250 255.255.255.
255 9.67.144.49 255.255.255.240 tcp     eq  20 gt  1023 secure local outbound
l=n f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:11 permit 9.67.144.49 255.255.255.
240 9.67.131.250 255.255.255.255 tcp/ack gt  1023 eq  20 secure local inbound
l=n f=y t=0 e=none a=none
Feb 03 13:46:55 1998 mr16n18: ICA1037i: #:12 permit 9.67.144.49 255.255.255.
240 9.67.131.250 255.255.255.255 tcp     gt  1023 gt  1023 secure local inbound
l=n f=y t=0 e=none a=none
.
.
.
Feb 03 13:46:58 1998 mr16n18: ICA1037i: #:100 deny 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
all any 0 any 0 both both both l=y f=y t=0 e=none a=none
```

Determining the Rule States

The IBM Firewall rules can be in one of these states:

1. The configuration is not active.

   You have not yet used the configuration client to activate the configuration or you have deactivated the configuration. This is the state of the configuration when you first install the IBM Firewall and boot your system or deactivate filter rules. Default filters are in place to protect your network from intrusion when you first install the Firewall.

   Firewall Access:

   - The default filter configuration permits all local inbound traffic and permits all outbound traffic.

2. The configuration is active but has errors.

   You have activated the configuration. Either there are errors (nonvalid rules) in the configuration or nothing has been configured. Errors and warnings are displayed in the Activation output window.

   Firewall Access:

   - Permit all local inbound traffic.
   - Permit all outbound traffic.

3. The configuration is active and valid. Note that there may have been some warnings, most notably, duplicate filter rules.

   You have activated the configuration that you defined using the traffic control section of the configuration client.

   Note: The configuration file can be valid and still contain no rules. In this case, an implied “deny all access” rule is in effect.

Firewall Access:

- Access determined by the configuration file.

  Each packet that is received by, or is about to be sent by, any network interface is examined and its contents compared against each rule in the generated connection rules. When a match is found, the action (permit or deny access) on that rule is carried out.
- If no rules match the packet, there is an implied “deny all” rule that denies access.

Chapter 9. Examples of Services

This chapter describes how to configure the Firewall to perform certain common tasks. The tasks listed are examples only, but after understanding these, you should be able to configure your firewall to use any service that has been provided.

Planning Considerations

The Firewall's traffic control is organized in terms of connections that define the types of communication allowed or prohibited between pairs of endpoints. Therefore, it is critical to plan your connections in terms of these endpoints.

As described in "Chapter 8. Controlling Traffic through the Firewall" on page 55, endpoints are represented to the Firewall by network objects. If you have not already done so, you should complete the network planning worksheet in "Chapter 2. Planning" on page 9 and create the network objects necessary to represent your network.

The examples in this chapter use the following network objects:

Secure Interface
The secure interface of the Firewall.

Nonsecure Interface
The nonsecure interface of the Firewall.

Secure Network

The range of addresses that are accessible through the Firewall's secure interface. This could be a network object group that could contain several distinct domains, each of which is represented by its own network object.

The World
The nonsecure network.

Each desired type of communication must be viewed in terms of the endpoint-to-endpoint communication involved. In this stage, consider whether your firewall will be providing these communications by proxy or whether the Firewall will route these communications.

If the firewall acts as a proxy, then the firewall will perform the necessary work on behalf of the secure user and the nonsecure host(s) will never know that the secure host exists. If the firewall is to route the traffic, then the secure host and the nonsecure host will speak directly to each other.

If you will use the Firewall as a proxy, then the endpoints of your communication will include the firewall, as shown in Figure 20.

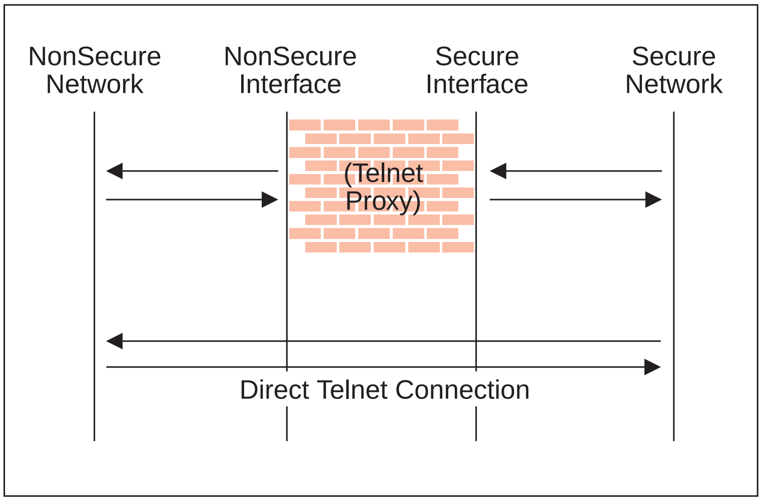


Figure 20. Telnet Proxy and Direct Telnet Connection

Example of Telnet Proxy

This first example is of a straightforward outbound telnet proxy connection. In this example, users on the secure network will be allowed to use the firewall's Telnet Proxy to access telnet services on the hosts in the nonsecure network.

As described in Figure 20, two connections are taking place:

1. The client inside the secure network is connected to the firewall's Telnet Proxy.
2. The firewall's Telnet Proxy is, on behalf of the secure user, connected to the host in the nonsecure network.

To configure the Firewall's traffic control for this communication, we need to set up two connections:

Table 1. Telnet Proxy

Source Object	**Destination Object**	**Services Required**
Secure Network	Secure Interface	Telnet Proxy out 1/2
NonSecure Interface	The World	Telnet Proxy out 2/2

Example of Filtered Telnet

Contrast the above example with a simple filtered telnet connection. In this case, the client on the secure side will connect directly with the host on the nonsecure side.

Table 2. Filtered Telnet

Source Object	Destination Object	Services Required
Secure Network	The World	Telnet direct out

As noted before, this configuration will expose the addresses of your secure clients as they connect to nonsecure hosts.

Example of Proxy HTTP

Most installations will want to allow at least some of their secure clients to surf the Web. The IBM Firewall provides a predefined HTTP outbound direct service to allow routed HTTP, which functions exactly like the filtered Telnet example. In addition, the Firewall provides an HTTP proxy.

The HTTP protocol differs from Telnet in that it may encapsulate other protocols. Even for simple surfing, most users will require not only HTTP but also FTP services. To provide the full range of HTTP function, Gopher and WAIS should also be permitted, although these are used much less frequently.

Note, though, that when these additional protocols are used, they are wrapped in HTTP between the client and the proxy. Therefore the communication would be similar to the diagram in Figure 21 on page 66.

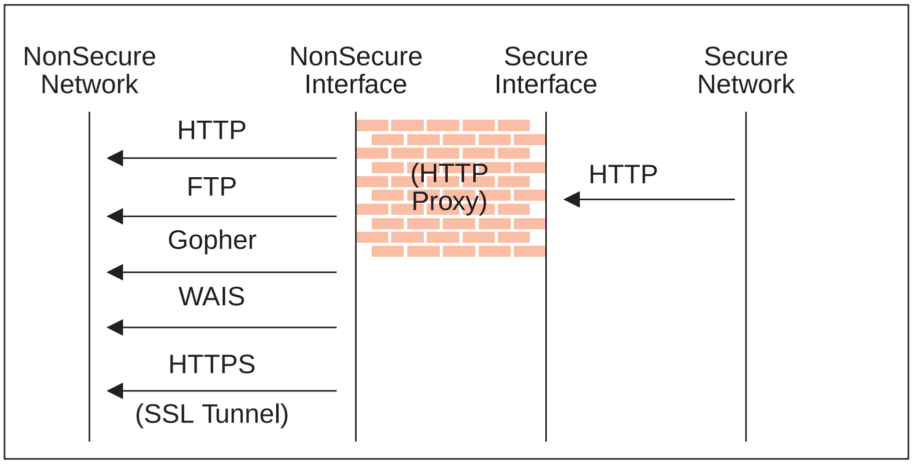


Figure 21. Proxy HTTP

Because we have two pairs of endpoints involved, we must code two connections.

Table 3. Proxy HTTP

Source Object	**Destination Object**	**Services Required**
Secure Network	Secure Interface	HTTP proxy outbound 1/2
NonSecure Interface	The World	Select from... • HTTP proxy out 2/2 • FTP proxy out 2/2 • Gopher proxy out 2/2 • WAIS proxy out 2/2 • HTTPS proxy out 2/2

For more information on HTTP Proxy, see “Chapter 13. Configuring Proxy Servers” on page 101.

Example of Socks

Socks presents a similar challenge to that of the HTTP proxy in that the socks daemon handles many different protocols and encapsulates them into a single data stream between the Firewall and the client. Socks is more flexible than the HTTP proxy because it can accommodate any TCP- or UDP-oriented protocol and because the Firewall can be configured independently of the filters to further control communications.

Because of this added flexibility, configuring socks requires a third connection in addition to those we demonstrated with the HTTP proxy. The two basic connections will allow the packets to flow to and from the Firewall; the third connection is required to tell the socks daemon to proxy the requests once it receives the packets.

Table 4. Socks

Source Object	**Destination Object**	**Services Required**
Secure Network	Secure Interface	Socks 1/2
NonSecure Interface	The World	Select from... • HTTP proxy out 2/2 • FTP proxy out 2/2 • Telnet proxy out 2/2 (Any second-half proxy service for which you wish to provide support)
Secure Network	The World	In the Socks Configuration window, select from... • permit socksified HTTP • permit socksified FTP • permit sockisfied Telnet

Of course, the clients inside your secure network must be socksified and must be configured to use your firewall as their socks server.

For more information on Socks, see “Chapter 11. Configuring the Socks Server” on page 81.

Example of Virtual Private Networks Using Static Filter Rules

To establish a Virtual Private Network requires an intricate configuration. In this case, the packets being sent between the client and the host are encapsulated for their journey between the two firewalls. For this reason, each packet passes through the filter mechanism twice: once in its encapsulated form and once in the clear. On each iteration, the packet looks completely different, and therefore requires a different connection to permit its passage.

The client, in the secure network, will be sending packets addressed to the Remote Host. These packets will be encrypted and will be permitted by the Service *VPN Traffic 1/2*. Next, the same packet, still addressed to the Remote Host from the client in the secure network, will be directed into its tunnel by the service *VPN Traffic 2/2*. (It is recommended to copy this service once for each tunnel being used. Each copy would reference a single tunnel ID, and any connections to that VPN would include the appropriate copy of this service). Once the packet has been encrypted, the Firewall now sends the encapsulated packet to the remote firewall directly, where the packet will be decapsulated and sent to its destination.

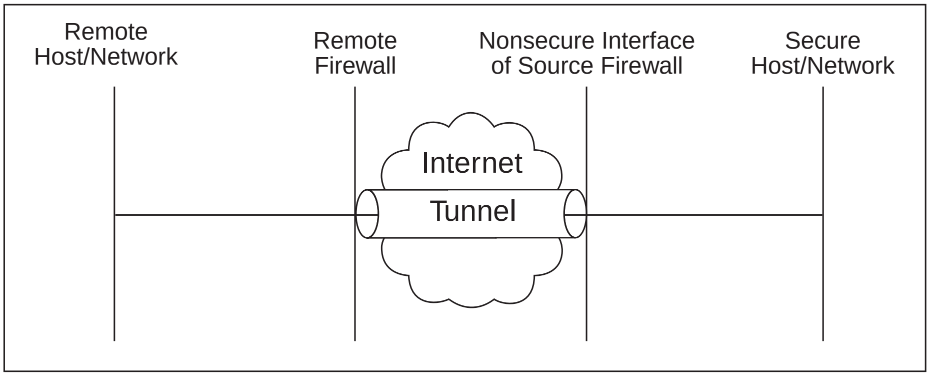


Figure 22. Virtual Private Networks

Such a configuration requires the following connections:

Table 5. Virtual Private Networks

Source Object	**Destination Object**	**Services Required**
Secure Host/Network	Remote Host/Network	• VPN traffic 1/2 • VPN traffic 2/2
NonSecure Interface of the Source Firewall	Remote Firewall	VPN encapsulation

For more information on VPNs, see “Chapter 14. Creating a Virtual Private Network” on page 111.

Chapter 10. Customizing Traffic Control

This chapter helps you to define filter rules and services. Services are a collection of rules or a set of instructions to permit or deny a particular type of traffic through the Firewall, for example, a telnet session. You can add to services by using the rule templates to create new rules. You can also delete services. Socks services apply to socksified connections.

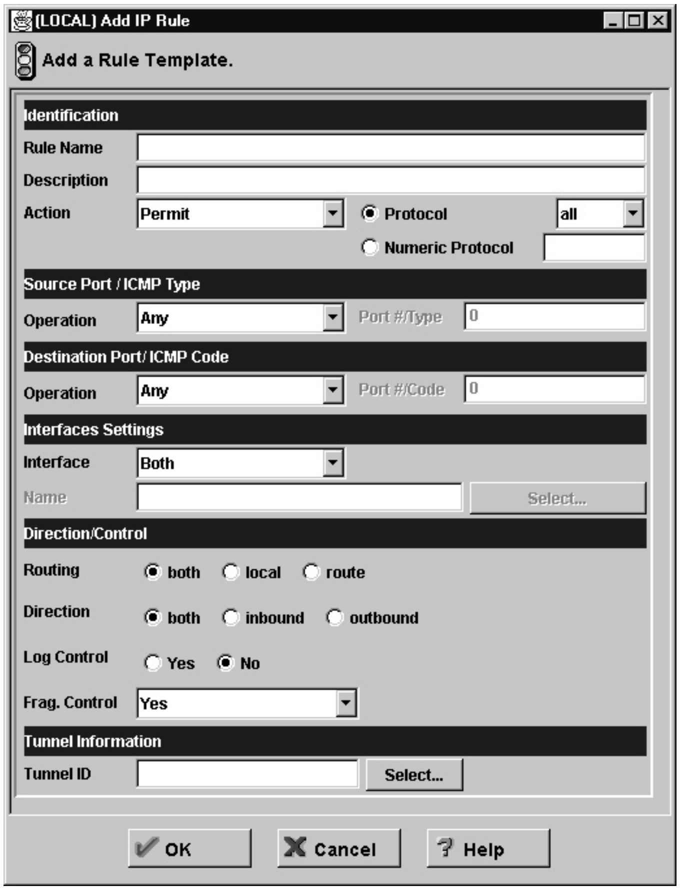
The IBM Firewall comes preloaded with a default set of services. You can tailor any predefined services to your particular needs or create new services.

Using the Configuration Client to Create Rule Templates

Use this procedure to add a new rule to the list of available rule templates.

1. From the configuration client navigation tree, select Traffic Control and double-click the file folder icon. Select **Connection Templates** and then select **Rules**.
2. On the **Rules List** dialog box, double-click **NEW**.

   The IBM Firewall displays an **Add IP Rule** dialog box, as shown in Figure 23 on page 70 so that you can define a rule.



(LOCAL) Add IP Rule

Add a Rule Template.

Identification

Rule Name

Description

Action: Permit ● Protocol: all

○ Numeric Protocol

Source Port / ICMP Type

Operation: Any Port #/Type: 0

Destination Port/ ICMP Code

Operation: Any Port #/Code: 0

Interfaces Settings

Interface: Both

Name

Direction/Control

Routing: ● both ○ local ○ route

Direction: ● both ○ inbound ○ outbound

Log Control: ○ Yes ● No

Frag. Control: Yes

Tunnel Information

Tunnel ID

Figure 23. Add IP Rule

3. Enter the Rule Name.
4. Enter the Rule Description. This field is optional.
5. Click the action arrow and choose to either permit or deny access to the Firewall.
6. Click the protocol arrow and select from the following list:

all Any protocol will match this rule.

tcp The packet protocol must be Transmission Control Protocol (TCP) to match this rule.

tcp/ack
The packet protocol must be TCP with acknowledgement to match this rule.

udp The packet protocol must be User Datagram Protocol (UDP) to match this rule.

icmp The packet protocol must be Internet Control Message Protocol (ICMP) to match this rule.

ospf The packet protocol must be Open Shortest Path First protocol (OSPF) to match this rule. When ospf is specified as the protocol, the source port operation and source port value is used for the ospf record type value. Filtering can also be performed on the ospf type. A type value of **any** can be specified and the destination port fields must be specified as **any 0**. Anything else is ignored.

ipip The packet protocol must be IP-in-IP protocol (IPIP) to match this rule. When IPIP is specified, the port fields must be specified as **any 0**.

esp The packet protocol must be encapsulating security protocol used by the virtual private network for sending encrypted or authenticated IP packets, to match this rule.

ah Authentication header protocol is the packet protocol used by the virtual private network for sending IP packets which have an associated authentication token.

7. The numeric protocol allows you to specify a protocol by using its decimal value (according to RFC-1700). Valid values are in the range of 1 to 252. Note that port fields for this rule must be specified as 0 (signifying any port) when using this option. See RFC-1700 for a list of all protocols. Or, you can access the Internet Assigned Numbers Authority (IANA) directly with a browser.

8. The operation and port number operands are used together. The source and logical operations state a relationship between the port number (destination or origin) for the packet and the source port# and destination port# operands. For example, if the packet destination port is port 20, and the destination operation and destination port# are “ge 15”, the packet matches (20 is greater than or equal to 15).

   If you use a source or destination operation of **any**, the filter does not look at the port number; any port will match. The port number cannot be changed in this case.

   For the ICMP protocol, rather than specifying a source port, specify an ICMP type and in place of a destination port, specify an ICMP code. The logical operator specified is applied to the type or code and, as for ports, an operator of **any**, means that any type or code value will match the rule. The port number cannot be changed in this case.

   The values for operation are:

   - Any

- Equal to
- Not equal to
- Less than
- Greater than
- Less than or equal to
- Greater than or equal to

Here are some of the more important ports to protect. The values for port numbers must be in the range 1 through 65535:

Port	Use
20	FTP data
21	FTP control
23	Telnet
25	Mail
53	Domain Name Server
70	Gopher
80	HTTP
111	RPC
161	SNMP
1080	socks

Here are some of the ICMP types and codes:

Type	Code and Description
0	0 - Ping reply
8	0 - Ping request
3	1 - Host unreachable
3	3 - Port unreachable
3	4 - Fragmentation needed but not allowed
5	1 - Redirect for host

9. Click the **Interface** arrow to select the type of interface (adapter).

   both For packets coming or going on either the secure or the nonsecure interface

   secure For packets coming or going on the secure interface

nonsecure
For packets coming or going on the nonsecure interface

specific
Use with the interface name field when selecting an interface, if you have assigned a name to the interface.

10. If you choose **specific**, for the interface type, the name of the specific interface will appear in the Name field.
11. Click the desired routing:

both Applies to all traffic.

local Implies that the packet is local to the firewall host. This means that:

- Incoming local packets are packets that are received by the interface and are destined for this firewall host; they will not be routed to another host. Their destination is local.
- Outgoing packets are transmitted from the interface, but originate on the firewall host. Their origin is local.

route Implies that the packet is routed by the firewall host. This means that:

- Incoming local packets are packets that are received by the interface and are destined for some other host; they will not remain on the Firewall. Their destination is remote.
- Outgoing packets are transmitted from the interface, and originated on some other host. Their origin is remote.

12. Click the desired direction:

both For packets going out from or into the selected interface

inbound
For packets coming into the selected interface from the network

outbound
For packets going out from the selected interface to the network

13. If you choose **Yes** for the Log Control field, every packet that matches that rule is recorded in the `firewall log` with priority level `Error`. If this parameter is not specified, the default is no.
14. Click the **Fragment Control** arrow to choose the desired fragment control. For IP packet information to match a rule fragmentation control specification, the control is interpreted as follows:

Yes The rule will match fragment headers, fragments and non-fragments. For fragments, the port information will be ignored and assumed to match.

Only Only fragments and fragment headers can match. For fragment headers, port information must match. For fragments, port information will be ignored.

No Only non-fragments can match. Fragment headers and fragments are excluded by this parameter.

Headers
Only non-fragments and fragment headers can match. Fragments are excluded by this parameter.

If this parameter is not specified, the default for both ″permit″ rules and ″deny″ rules is Yes.

Note: Regardless of the setting of this control, IP fragments with an offset of one (1) are discarded. This action eliminates a known attack of using packet fragments to overlay TCP header flags.

15. If this rule will be used with a tunnel, you can choose a tunnel ID. Click **Select** and choose a tunnel ID from the Select a Tunnel screen. Click **Apply**.

For a packet header to match a defined IP rule, the packet information must match all the parameters specified in the coded rule. For packet fragments, all parameters except port information is used to determine a match.

If the fragments were not permitted by an earlier rule, which had Yes or Only coded, the packet fragments will be denied by the final rule that is always appended to the bottom of the rule file.

Change IP Rule Configuration Entry

To modify an IP rule that you have created:

1. Double-click on an existing rule in the **Rules List**. The **Modify IP Rule Configuration** dialog box appears.
2. Modify the appropriate fields as described in “Chapter 10. Customizing Traffic Control” on page 69 and click **OK** to apply the changes.

Delete Rule Configuration Entry

To delete a rule , select a rule from the **Rules List** and click **Delete**.

Predefined Services

The IBM Firewall comes preloaded with a default set of services. Services are a collection of rules or a set of instructions to permit or deny a particular type of traffic through the Firewall, for example, a telnet session. You can add to services by using the rule templates to create new rules. The default services number 1 through 500.

The preloaded default services are:

All non-secure
Deny all traffic across nonsecure interface

All permit
Permit all traffic(for debugging purposes only)

All permit, in one direction
Permit all traffic(for debugging purposes only)

All secure
Deny all traffic across secure interface (in case of security violation)

All shutdown
Deny all packets (shutdown or debug)

Anti Spoofing
Deny inbound nonsecure packets with secure source address

Broadcasts
Deny broadcast messages to nonsecure interface

Config Client non-secure
Permit use of the configuration client from nonsecure network

Config Client secure
Permit use of the configuration client from secure network

CU-SeeMe
CU-SeeMe Video on default ports 7649 and 7648

DNS queries
(SECURITY POLICY) Permit DNS queries

DNS transfers
Permit DNS zone transfers (for secondary name servers)

Domain Controller Authentication
Allow use of Domain Controller for user authentication

FTP proxy in 1/2
Permit FTP inbound from nonsecure network to Firewall

FTP proxy in 2/2
Permit FTP inbound from Firewall to secure network

FTP proxy out 1/2
Permit FTP outbound from secure network to Firewall

FTP proxy out 2/2
Permit FTP outbound from Firewall to nonsecure network

Gopher proxy in 2/2
Permit gopher from Firewall to secure network

Gopher proxy out 2/2
Permit gopher from Firewall to nonsecure network

HTTP deny non-secure
Deny HTTP to nonsecure interfaces

HTTP direct out
Permit HTTP from secure network directly to nonsecure network

HTTP proxy in 2/2
Permit HTTP from Firewall to secure network

HTTP proxy out 1/2
Permit HTTP (port 8080) from secure network to the Firewall

HTTP proxy out 2/2
Permit HTTP from Firewall to nonsecure network

HTTPS direct out
Permit HTTPS (SSL) from secure network to nonsecure network

HTTPS Proxy in 2/2
Permit HTTPS (SSL tunnel) from Firewall to secure network

HTTPS proxy out 2/2
Permit HTTPS (SSL tunnel) from Firewall to nonsecure network

Mail (SECURITY POLICY) Permit Mail traffic through the Firewall

NetBT Name Services broadcasts
Allow NetBIOS over TCP/IP Name Services broadcasts

Ping Permit Ping outbound secure network to anywhere

SDI authentication
Permit connection to SecurID ACE server in the secure network

Socks 1/2
Permit use of Socks from secure network to the Firewall

Socks deny non-secure
Deny Socks from nonsecure adapters

Socks in 1/2
Permit use of Socks from nonsecure network to the firewall

Socks Monitor
Allow connection from Socks Monitor Clients

Socks Server Chaining
Allow Firewall Socks Server to chain to remote Socks server

Telnet direct out
Permit Telnet outbound from secure network to nonsecure network

Telnet proxy in 1/2
Permit Telnet inbound from nonsecure network to the Firewall

Telnet proxy in 2/2
Permit Telnet in from the Firewall to the secure network

Telnet proxy out 1/2
Permit Telnet out from secure network to Firewall

Telnet proxy out 2/2
Permit Telnet out from Firewall to nonsecure network

VDOLIVE Direct In
Permit nonsecure client to secure server

Note, users must configure individual player properties to use only UDP port 7001.

VDOLIVE Direct Out
Permit secure client to nonsecure server

VPN encapsulation
Permit encrypted data between firewalls

VPN traffic 1/2
Permit routed traffic on secure interface (non-encrypted)

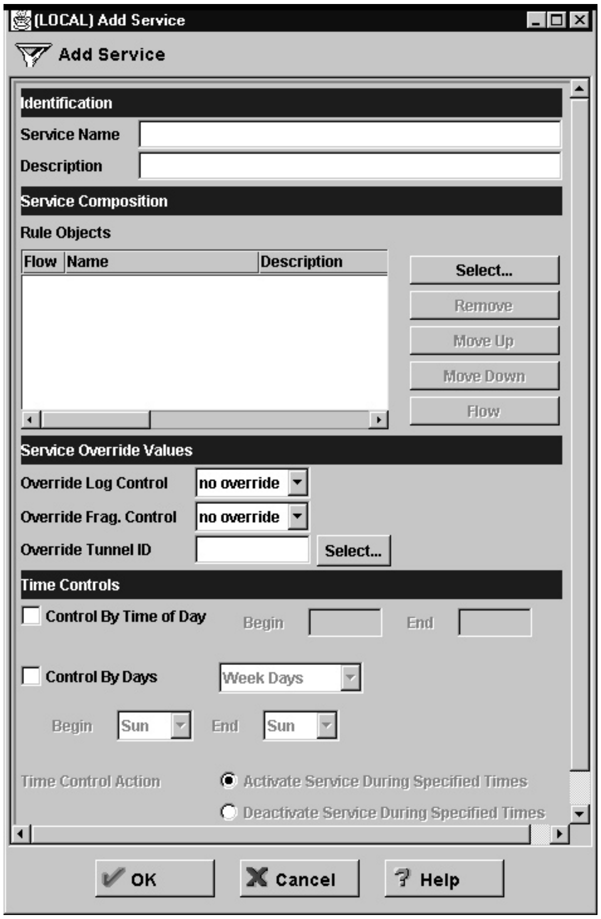
VPN traffic 2/2
Permit routed traffic on a non-secure interface (encrypted)

WAIS proxy in 2/2
Permit WAIS (z39.50) from the Firewall to the secure network

WAIS proxy out 2/2
Permit WAIS (z39.50) from the Firewall to the nonsecure network

Defining Services

After you have defined a rule(s), you need to add the rule(s) to a service. Select Traffic Control from the configuration client navigation tree and double-click on Connection Templates, then select Services. The Services List dialog box appears. Double click NEW to get the Add Service dialog box, as shown in Figure 24.



Service Name
Description
Override Log Control: no override
Override Frag. Control: no override
Override Tunnel ID
□ Control By Time of Day
□ Control By Days: Week Days
Begin: Sun End: Sun
● Activate Service During Specified Times
○ Deactivate Service During Specified Times

Figure 24. Add a Service

Using the Configuration Client to Create Services

1. Enter the service name.
2. Enter a description.
3. The **Override Log Control** field provides a means of overriding the log control setting in the rule templates that have been selected for this

service. For example, if you include a set of rule templates that ordinarily have log control set to no, you can override this setting to be yes for the purposes of this service. The override setting will act on all of the rules in this service. In the **Override Log Control** field, enter one of the following choices:

- no override - override is turned off, the settings in the rules themselves still apply
- yes - write a log record when any rule in this service is matched
- no - do not write a log record when any rule in this service is matched

When a log record is written for a filter rule, the values shown in the log record are the actual values from the IP packet. Logging matched filter rules can provide valuable information about the content of IP packets seen by the Firewall, for example, actual protocol and port numbers.

4. The **Override Frag. Control** field provides a means of overriding the Fragmentation Control setting in the rule templates that have been selected for this service. For example, if you include a set of rule templates that ordinarily have Frag, Control set to no, you can override this setting to be yes for the purposes of this service. The override setting will act on all of the rules in this service. In the Override Frag. Control field, enter one of the following:
   - no override - override is turned off, the settings in the rules themselves still apply
   - yes - match any IP packet, for example, non-fragments, fragment headers and fragments without headers
   - no - match only non-fragment packets, do not match the fragment headers or fragments without headers
   - only - match only fragment headers and fragments without a header, do not match non-fragments
   - headers - match only non-fragments and fragment headers, do not match fragments without headers
5. The **Override Tunnel ID** field provides a means of overriding the tunnel ID setting in the rule templates that have been selected for this service. For example, if you include a set of rule templates that ordinarily have no Tunnel Setting, you can override this setting to include a Tunnel ID for all of the rules in this service. If you leave the field blank, override is turned off. The settings in the rules themselves still apply. In the **Tunnel ID** field, select a tunnel by clicking Select.
6. The time controls allow you to associate a time range with each service. Therefore, this service will only be valid in a specified time period. If there is no time specification for a service, that service is valid all the time.

   Control by Time of Day

   Select if you want this service to be activated or deactivated according to begin and end times during the day. Use a 24-hour format. If this field is not enabled, the Time of Day fields will be in effect 24-hours a day.

Control by Days
Select if you want this service to be activated or deactivated according to a schedule based upon either days of the week or calendar dates. Note that whether a service is activated or deactivated depends on the value of the Time Control Action field.

Time Control Action
Choose **Activate Service During Specified Times** if you want this service to be activated during the specified times. This service will be deactivated during the times outside of those specified.

Choose **Deactivate Service During Specified Times** if you want this service to be deactivated during the specified times. This service will be activated during the times outside of those specified.

7. Click **Select** to choose the rules that comprise this service.
8. Use the Flow toggle to determine how the Source and Destination values of the Connection should be assigned to the filters as they get written to the Rule Base file.

```
 ---> Left to Right indicates that the Source and Destination of the
      Connection gets written directly to the rule as it is written
      to the Rule Base File.

 <--- Right to Left indicates that the Source and Destination of the
      Connection gets reversed when it is written to the Rule Base
      File.
```

9. When a packet is received, the IBM Firewall compares the information in the packet to the rules in the rules configuration file starting at the top of the file. It stops comparing when the first match is found and performs the action contained in the rule.

   Once you have added a series of rules to the service, you can change their order. Select a rule from the **Service Objects** list and click the **Move Up** or **Move Down** buttons to reposition the rule. Or you can remove a rule by clicking **Remove**. The configuration client displays a refreshed list of rules. Click **OK** to save your changes.

Chapter 11. Configuring the Socks Server

Socks is an Internet standard for circuit-level gateways. You use the Socks server for address translation if your application uses TCP, such as Web browsers, FTP, or Telnet applications. Socks can help you access the Internet, while hiding your internal IP addresses.

For outbound requests, from a secure client to a nonsecure server, the Socks server has the same objectives as a proxy server: to break the session at the Firewall and provide a secure door where users can be allowed to access the external, nonsecure network while protecting the addressing and structure of the internal network. The Socks server has the advantage of simplicity for the user, with little extra administrative work.

The Socks server can intercept all outbound TCP requests that would cross between your network and the Internet. The Socks server provides a remote application program interface so that the functions executed by client programs in secure domains are piped through secure servers at the firewall workstations, hiding the client's IP address. Access is controlled by filters that are associated with the Socks rules.

The Socks server is similar to the proxy server. But while the proxy server actually performs the TCP/IP function at the Firewall, the Socks server just identifies the user and redirects the function through the Firewall. The actual TCP/IP function is performed at the client workstation, not at the firewall. This saves processing in the Firewall. The users in the secure network can use the many TCP/IP products that support the socks standard. Figure 25 illustrates the Socks server intercepting an HTTP request from a client within the secure network.

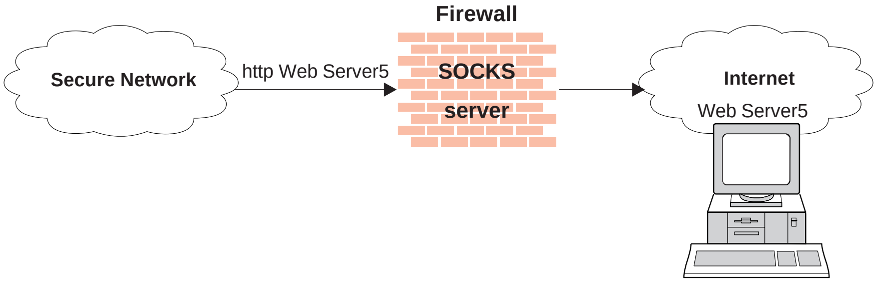


Figure 25. The Socks Server

The Socks server effectively hides your internal IP addresses from the outside world.

The IBM Firewall provides the Socks Protocol Version 5, which enables clients inside the secure network to pass an authentication stage before accessing applications in the nonsecure network. It also provides for authenticated generic proxy and the proxy of some streaming audio and video protocols.

The Socks daemon runs as a Windows NT Service, automatically starting when the system is started. In addition, a Watch Agent is provided to allow monitoring of the server. You can start the Watch Agent manually.

The IBM Firewall provides a smooth migration path in the form of three authentication profiles so that customers can continue to use installed Socks Protocol Version 4 clients as they introduce Socks Protocol Version 5 clients.

1. The most permissive profile does not enable outbound authentication and permits any user, whether using a Socks Protocol Version 4 or Socks Protocol Version 5 client to connect. In this scenario inbound connections are denied.
2. The migration profile allows Socks Protocol Version 4 users to pass unauthenticated, but requires Socks Protocol Version 5 users to authenticate. Inbound Socks Protocol Version 4 connections are denied and inbound Socks Protocol Version 5 connections are required to authenticate. This is the default profile.
3. The most secure profile requires that all users use Socks Protocol Version 5 clients and provide valid authentications.

To select among the three authentication profiles described above, you must modify the configuration file, `explode.cfg` in the firewall configuration directory. This file contains an entry *socks5profile=x*, where *x* indicates the authentication profile chosen. A value of *1* indicates *permissive*, a value of *2* indicates *migration*, which is the default, and a value of *3* indicates *strict*.

When the Firewall is installed, the socks server is enabled, but there are no rules in the socks configuration file. For socks clients to use the Socks server, configure socks using the configuration client. See “Example of Socks” on page 66, for an example of how to set up a socks service.

If you do not create socks rules using the configuration client, you can build your own by editing the `socks5.conf` file. See the *IBM eNetwork Firewall Reference* for more information.

How to Select Among the Three Authentication Profiles

In order to select among the three authentication profiles, you must modify the configuration file, `explode.cfg`. This file contains an entry `socks5profile=x`, where *x* indicates the authentication profile chosen. The values are as follows:

- 1 indicates permisssive
- 2 indicates migration, which is the default
- 3 indicates strict

Protocols Supported by Socks Protocol Version 5 Server

The Socks Protocol Version 5 server supports the following TCP and UDP protocols and many more:

- Archie
- Finger
- FTP
- Gopher
- HTTP
- HTTP Proxy
- News
- SNMP
- Telnet
- TFTP
- RealAudio
- RealPlayer
- Whois
- X-Windows

In addition, most e-mail clients are supported. Support for these protocols depends upon their actual implementation.

Configuring the Socks Server Using the Configuration Client

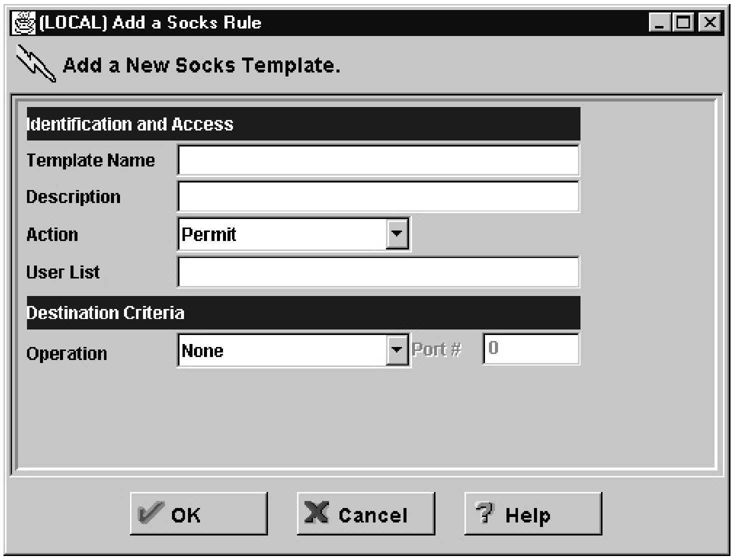
Socks templates are rules that control security through the socks server. The socks templates allow you to customize, add to, copy, or delete existing socks templates. These socks templates, in turn, can be used in the definitions of connections on the Firewall in the same way rules templates are used.

Add a New Socks Rule

To add a rule to the socks configuration file using a socks template provided by the configuration client, select Traffic Control from the configuration client navigation tree. Double-click on the file folder icon to expand the view. Select Connection Templates. Double-click on the file folder icon to expand the view. Select **Socks**. The **Socks** dialog box appears.

1. Double-click **NEW** to add a new socks template.

   The **Add a Socks Rule** dialog box appears, as shown in Figure 26.



(LOCAL) Add a Socks Rule

Add a New Socks Template.

Identification and Access

Template Name

Description

Action: Permit

User List

Destination Criteria

Operation: None

Port #: 0

Figure 26. Add a Socks Rule

2. In the **Template Name** field, enter the name of the socks entry. This name must be unique and should not contain a pipe symbol(|), a single quote (or apostrophe) character (’) or a double quote(″) character as these are used as file delimiters. Use of these characters will result in unreliable data.
3. Fill in a description.
4. Click the Action arrow and choose to either permit or deny access from a source to a destination.

   When a datagram comes into the socks server, the server compares the datagram specifications to each rule in the configuration file starting with the first rule until it finds a rule that matches exactly. Then it stops searching and performs the relevant action (either permit or deny access) on that rule. If no match is found, access is denied automatically.

5. In the **User List** field, you can enter a user ID or a list of user IDs. If you enter a list, separate the entries with commas. Do not use spaces, tabs, the pipe symbol (|), or double quotes(″) in the user list.
   - The user list is limited to 396 characters.
   - User IDs must be IDs of users on the requesting host, not those on the destination host or socks server host.
   - A user ID can consist of 1 to 8 characters, including:
     - a through z
     - A through Z
     - 0 through 9
     - _ (underscore)
6. A user ID should not contain a pipe symbol (|), or double quote character(″).
7. If file names are used, they must be fully qualified (with the leading ″/″ to prevent their being interpreted as user IDs). Each file can contain a list of user IDs, with one or more per line, separated by commas, and optionally including a comment that is delimited with the # character. Full comment lines (those that begin with the # character) are also supported. Each line in the file can be up to 1023 characters long and must be terminated by a ″newline″ character.
8. In the **Operation** field, enter the logical operation to be performed on the port number:

   eq Equal to

   neq Not equal to

   lt Less than

   gt Greater than

   le Less than or equal to

   ge Greater than or equal to

   When used with Port Number, the logical operation establishes a relationship that must be met. For example, if you enter the Operation gt and Port Number 23, then the port number must be greater than 23 for the rule to be invoked.
9. In the **Port #** field, enter the number of a port. The Port Number is used with the Operation to establish a relationship that must be met. For example, if you enter the Operation gt and Port Number 23, then the port number must be greater than 23 for the rule to be invoked. If operation and port number are omitted, the rule applies to all destination port numbers.

Use this **Add a Socks Rule** dialog box to permit or deny firewall access to network hosts based on the IP address.

Modify a Socks Rule

1. Double-click on an entry on the **Socks** dialog box.

   The **Modify a Socks Rule** dialog box appears.
2. Change the appropriate fields as described in "Add a New Socks Rule" on page 84, and click **OK**.

Delete a Socks Rule

Select an entry from the **Socks** dialog box and click **Delete**. You are asked if you are sure you want to delete this socks rule. Click **OK** to delete the rule.

Activate Connection Rules

As with the filter rules, you need to activate socks rules. Click **Connection Activation** on the configuration client navigation tree, select **Regenerate Connection Rules and Activate**, then click **Execute**.

The Firewall copies the rules from the socks configuration file to the firewall rules and activates the rules. When rules are activated, the new rules are recorded in the firewall log file.

Sample Logging Output for Socks

The following is a sample of the logging output for Socks.

```
Feb 03 13:46:20 1998 mr16n18: ICA3123i: Sockd server starting
Feb 03 13:47:31 1998 mr16n18: ICA3010i: Session start
Feb 03 13:47:31 1998 mr16n18: ICA3011i: Session start
Feb 03 13:49:15 1998 mr16n18: ICA3007i: Too many threads
Feb 03 13:58:31 1998 mr16n18: ICA3015i: Session termination
```

Client Considerations for Using the Socks Server

The majority of Web browsers are socksified and you can get socksified stacks for most platforms. Socksified clients for other TCP/IP applications are available from many sources. For a specific client that socks implements, refer to that client documentation. For additional information refer to:

http://www.raleigh.ibm.com/sng/sng-socks.html

http://www.socks.nec.com

Tuning the Socks Server

The socks server is configured initially to accept 64 concurrent user connections. If this threshold is exceeded, your Firewall log file will contain message ICA3007, which indicates that the maximum connection threshold has been exceeded. If you need to raise this limit, you may do so by adding the following line to socks.5.header.cfg:

```
SET SOCKS5_MAXCHILD x
```

where x is the number of concurrent sessions you wish to allow.

However, each session takes approximately 200K of available memory. In very high-usage situations, your Firewall may exhaust its available memory and you may see the Windows dialog indicating that you are almost out of virtual storage. Either close some applications, or increase the amount of virtual storage available. Once this dialog appears, various Firewall services could become unstable. Therefore, you should ensure that you do not set the number of concurrent sessions too high.

500 concurrent theads have been successfully run using 32 MB of real memory and a 100 MB page file.

Socks-Server Chaining

Socks-Server chaining is a feature by which one Socks server can reside behind another Socks server, yet still allow access to the network beyond the outermost Socks server. (It can be thought of as socksifying a socks server). This is a very useful intranet scenario.

To set up socks-server chaining with the Socks server, edit the socks5.header.cfg file. This file resides in the Firewall’s config subdirectory. Add the following:

- A *no proxy* directive - to indicate the subnet(s) to which your Firewall has direct access
- A *socks4* directive - to indicate the subnet(s) that are accessible through a SOCKS Protocol Version 4 server
- A *socks5* directive - to indicate the subnet(s) that are accessible through a Socks Protocol Version 5 server

For example, consider the following network. The Research department has a small private network, *q.private.com*, behind their own firewall. The Research department’s subnet is 10.007.007.0 / 255.255.255.0. The company’s private network, *private.com*, contains the entire 10.0.0.0/255.0.0.0 network. The company's SOCKS Protocol Version 4 server, *socks.private.com*, provides access to the Internet.

On Research's Socks server, *socks.q.private.com*, add the following two lines to socks5.header.cfg.

```
noproxy 10.0.0.0/255.0.0.0 - - -
socks4     0/0   - socks.private.com 1080
```

Lastly, add a Traffic Control connection to allow *socks.q.private.com* to communicate with *socks.private.com*. This might have already been done by a more general Service. Add a Connection whose source is the nonsecure interface of the *q.private.com* Firewall, whose destination is *socks.private.com*, and include the *Socks Proxy-Chaining* service. Then reactivate your Traffic Control rules.

Chapter 12. Administering Users at the Firewall

This chapter describes how to do the daily administrative tasks with the IBM Firewall, including:

- Adding users to the IBM Firewall so that they can access hosts outside your protected network
- Changing the attributes of the users who access the firewall
- Deleting users who no longer need access outside your network

Do not edit the configuration files directly; if you do, your IBM Firewall user attributes will not be set up correctly. Do all IBM Firewall administration using the configuration client dialogs or command line.

Adding a User to the IBM Firewall

The IBM Firewall defines three types of users and stores information about them in two different user databases.

Types of Users

The IBM Firewall divides users into three categories:

Proxy Users
Use firewall services, such as the HTTP proxy service to access Web sites on the Internet from within a corporate network. Proxy users are able to use services through the firewall but do not have access to the firewall machine and cannot perform local logins to the Firewall machine.

Firewall Administrators
Can use the Firewall proxy services, but they can also configure the Firewall by using the configuration client and by logging on to the Firewall from a remote host. Like proxy users, firewall administrators cannot perform local logins to the Windows NT operating system after the Firewall has been installed.

Firewall administrators can create and modify definitions for proxy users but they cannot create or modify the definitions of other firewall administrators.

Primary Firewall Administrators
Have the same capabilities as firewall administrators. They can also

perform local logins to the Firewall machine. Primary firewall administrators can create and modify definitions for other firewall administrators.

Types of Databases

There are two types of user databases.

Firewall User database

Contains firewall-related attributes for each proxy user and administrator. Includes attributes such as the user's firewall password and password rules and which authentication methods should be used to authenticate the user for each service.

If the proxy user is not defined in the firewall user database and the user tries to use firewall proxy services, the default user record, `fwdfusr` will be used to define the attributes and authentication schemes used to validate the user.

Primary firewall administrators cannot be defined in the firewall user database. Use the default firewall administrator record, `fwdfadm`, to assign attributes to administrators.

Like proxy users, if firewall administrators are also defined in the Windows NT user database, their Windows NT logon password will be used when the user requests services that must be authenticated using Windows NT logon passwords.

Windows NT User database

Contains the Windows NT logon passwords for users. In general, proxy users do not have to be defined in the Windows NT user database unless they are going to be authenticated using their Windows NT logon password.

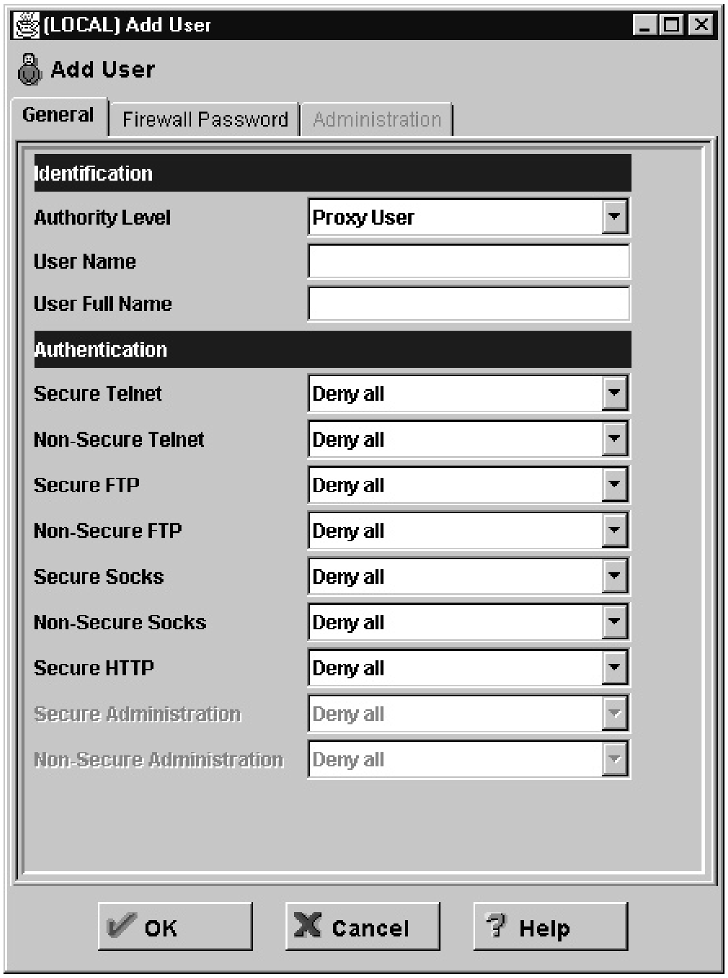
If other authentication methods are going to be used to authenticate proxy users, they do not have to be defined in the Windows NT User database.

Primary firewall administrators are synonymous with Windows NT users that are members of the Windows NT administrators group and must be defined in the Windows NT user database.

Using the Configuration Client to Add a User

Adding a user to the IBM Firewall gives them access to the external network.

1. From the configuration client navigation tree, select Users. The **User Administration** dialog box appears.
2. Select **New** from the **User Administration** dialog box and click **Open**. The **Add User** dialog box appears, as shown in Figure 27 on page 91.



Identification	
Authority Level	Proxy User
User Name	
User Full Name	
Authentication	
Secure Telnet	Deny all
Non-Secure Telnet	Deny all
Secure FTP	Deny all
Non-Secure FTP	Deny all
Secure Socks	Deny all
Non-Secure Socks	Deny all
Secure HTTP	Deny all
Secure Administration	Deny all
Non-Secure Administration	Deny all

Figure 27. Add User

3. Provide this information:

   Authority Level
   Specifies the authority level for this user. Click the **Authority Level** arrow to select user type.

   Socks/Proxy User
   The user being defined is for both Socks server access and proxy access. The user has no administration authority. This level is the default.

   Firewall Administrator
   Has all of the attributes of a user, but an administrator can also log in to the Firewall and perform administrative

tasks. An administrator has additional attributes that define what administrative functions he or she is allowed to perform. A firewall administrator can create firewall users but cannot create other firewall administrators. Firewall administrators cannot log in locally to the Firewall machine. They must access the configuration server from a remote machine.

Primary Firewall Administrator

The primary firewall administrator is allowed to log in locally to the Firewall machine. The primary firewall administrator has full access to all administrative functions and also can create other firewall administrators except for primary firewall administrators.

The primary firewall administrator is defined by creating a user in the NT database and making that user a member of the NT administrators group. Modify the `fwdfadm` record to define the attributes for the primary firewall administrator.

User Name

Specifies the name for this user. This is the user name with which this user will log into the telnet or FTP server on the IBM Firewall. This is not necessarily the user's TCP/IP user name or host name, but they can be the same.

A user name can consist of from 1 to 20 characters, including:

a through z

A through Z

0 through 9

_ (the underscore)

User names are not case sensitive.

The Firewall comes with two preinstalled users:

a. Default user or `fwdfuser`. If a user is not defined in the firewall database, `fwdfuser` is used to determine the user's firewall attributes, such as which authentication methods to use when authenticating the user.

   At installation, when the `fwdfuser` is created, all authentication methods are set to deny all. The permission for `fwdfuser` controls how the firewall processes undefined usernames.

   The administrator can view `fwdfuser` or change the assigned authentication method using the configuration client or the command line. However, `fwdfuser` cannot be deleted and must always exist at the firewall. In addition, firewall password is not a valid authentication type for `fwdfuser`.

b. Default Primary Firewall Administrator, `fwdfadm`, defines the firewall attributes for all primary firewall administrators. Because primary firewall administrators do not have user records of their own in the firewall database, this record is used to define the authentication methods used to authenticate primary firewall administrators.

   At installation, all the authentication methods for `fwdfadm` are set to *deny all* except for the secure and nonsecure administration authentication methods, which are set to NT logon password. The primary firewall administrators can view and modify this record, but it cannot be deleted. In addition, firewall password is not a valid authentication type for `fwdfadm`.

User Full Name
Specifies a description of the user.

The following fields refer to authentication methods. Click the arrows to select from the list of authentication methods. They are explained in “User Authentication Methods” on page 94.

Secure Telnet
Indicates whether this user’s identity, when logging in from the secure network, must be authenticated by some means.

Nonsecure Telnet
Indicates whether this user’s identity, when logging in from the nonsecure network, must be authenticated by some means.

Secure FTP
Specifies the level of authentication this user needs to use FTP to access the Firewall from the secure network.

Nonsecure FTP
Specifies the level of authentication this user needs to use FTP to access the Firewall from the nonsecure network.

Secure Socks
Specifies the Socks V5 authentication method for Socks client connections coming from the secure side of the firewall. Click the arrow to select from a list of choices. They are explained in “User Authentication Methods” on page 94.

Non-Secure Socks
Specifies the Socks V5 authentication method for Socks client connections coming from the nonsecure side of the firewall. Click

the arrow to select from a list of choices. They are explained in "User Authentication Methods" on page 94.

Note: Even if *permit all* is selected, if the socks server is set to authenticate users, it will still require a user name and will present a prompt to the user. The user need not provide a password at the prompt. To suppress the prompt, adjust your authentication profile as described in "Chapter 11. Configuring the Socks Server" on page 81.

Secure HTTP
Specifies a user ID / password type of authentication on outbound HTTP proxy requests. Click the arrow to select from a list of choices. They are explained in "User Authentication Methods" on page 94.

The browser prompts for user ID and password so if you are using SDI, fill in a passcode at the password prompt.

User-supplied must recognize that Socks / password cannot support interactive dialogs and behave accordingly.

Secure Administration
Specifies the authentication method used to log on from the configuration client through a secure interface. Note that when you log on locally (by choosing local on the logon panel) you are always in a secure environment, so this is the authentication method you would use.

Nonsecure Administration
Specifies the authentication method used to log on from the configuration client through a nonsecure interface.

User Authentication Methods

The choices for user authentication are:

Deny All
The user is denied access.

Permit All
No authentication is required. The server does not try to authenticate the user; but it proceeds with a command prompt so that the user can access a foreign host.

NT Logon Password
NT logon password is less secure than the firewall password. However, if users are already defined in a Windows NT domain, they can use the Windows NT logon password so they do not need multiple passwords.

If the user chooses this method of authentication, their user ID and password will be validated against the local Windows NT user database. If the Firewall is configured to trust other Windows NT servers, these trusted servers will be searched for user definitions.

Before trust relationships can be set up between the Windows NT Firewall and trusted Windows NT servers, a connection must be set up to allow TCP/IP communication traffic between the two machines.

Set up this connection using the following predefined services:

1. Domain Controller Authentication - which allows the use of the Domain Controller for user authentication
2. NetBT Name Services broadcasts - which allows NetBIOS over TCP/IP Name Services broadcasts

Use the Windows NT configuration utilities to define the trust relationships.

SecurID Card

Authentication is done using a Security Dynamics SecurID card or pinpad card. The PIN must be set before using this authentication method with the IBM Firewall. For FTP, the SDI new PIN mode and next token mode are not supported.

To use the Security Dynamics ACE/Server to authenticate users, refer to the *ACE/Client V.4.0 for Windows NT's* chapter entitled *Installing and Configuring the ACE/Client* to do the following:

1. Install the ACE/Server server code on a non-IBM Firewall host inside the secure network.
2. Point the SDI client to the SDI server.
3. Configure the SDI server to recognize the client and the users.

Then, configure the SDI server to recognize the client and the users by using the **Add User** panel of the configuration client to set the authentication to SecurID Card.

The proxy server asks for your PASSCODE (which will not be displayed) before letting you proceed.

```
Enter PASSCODE:
```

At this point, enter your 4-digit SecurID PIN code followed by a comma, and then the code from your SecurID card. For example, to log in as user NEWUSER with an assigned PIN of 1234, when your SecurID card shows the code 179091, you would enter:

```
login: NEWUSER
Enter PASSCODE: 1234,179091
```

If users use FTP initially, SecurID card authentication will fail because FTP does not have the option to allow a password change. Users must use telnet the first time they try to do SecurID card authentication through which they will create a PIN. Users can use that PIN subsequently for later authentications like FTP, HTTP, and so forth.

If the SecurID card is in new PIN mode, you have to set the PIN before using this authentication method with the IBM Firewall.

User-Supplied Authentication 1, 2, and 3

Authentication is supplied by the user. You can install up to three user-supplied authentication methods on the Firewall. For information on how to create and compile a subroutine for user-supplied authentication, refer to the *IBM eNetwork Firewall Reference*.

Firewall Password

The firewall password allows more secure passwords and password rules than the Windows NT logon password so this is the recommended choice for passwords.

Note: Give Telnet access to those users who will need to change their password and instruct them to Telnet to the Firewall and change their password when required. Remember, only the Telnet protocol will prompt the user to change their password.

Require User to Change

Click Yes or No to indicate whether the user is required to change their password the next time they are authenticated.

Lock Password

Click Yes or No to indicate whether the password is locked. This is set to Yes when the maximum number of failed logins is exceeded or when the password has not been used for the number of weeks specified in Maximum Time Before Lockout.

The administrator can set this field to yes to prevent a user from using password authentication.

Notes:

1. Passwords are case-sensitive. If you enter a user’s password in mixed-case, the user must then enter the password identically. If you have workstations that work in uppercase only, enter passwords for those users in uppercase.
2. The operating system allows you to define password rules. These password rules apply when a user changes his or her password but not when an administrator makes password changes. Password rules are:

Warning Days Before Expiration (days)
Number of days before a password expires in which the Firewall will give the user the option to change the password.

Maximum Weeks Before Expiration
Number of weeks before the user is required to change the password.

Maximum Weeks Before Lockout
Number of weeks in which the password is not used before it is locked out.

Maximum Login Retries Allowed
Maximum number of failed login attempts before the password is locked.

Passwords Before Reuse
Number of passwords stored in the password history list. The password cannot be changed to any password that is currently in the history list. This parameter is only valid if Weeks Before Password Reuse is zero.

Weeks Before Password Reuse
Number of weeks passwords are kept in the password history list. The password cannot be changed to any password that is currently in the history list.

Minimum Length
Minimum number of characters in a password.

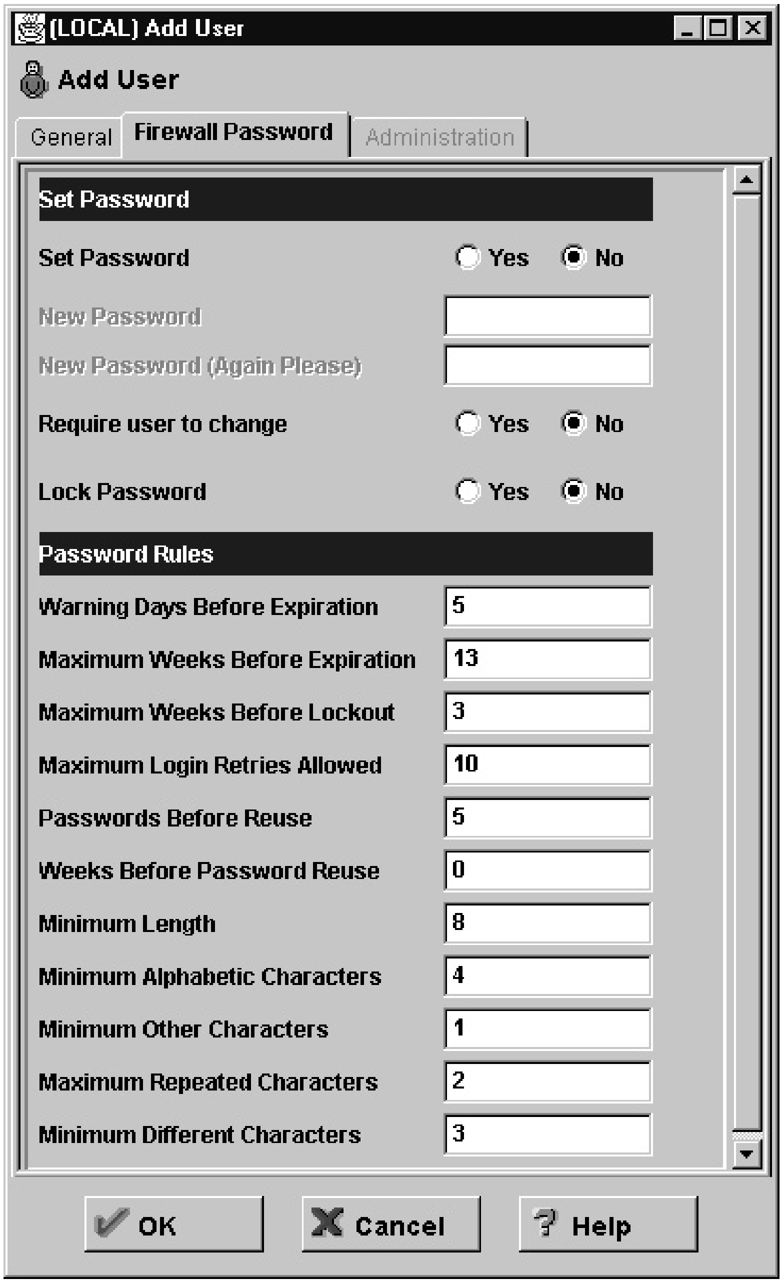
Minimum Alphabetic Characters
Minimum number of alphabetic characters in a password.

Minimum Other Characters
Minimum number of non-alphabetic characters in a password.

Maximum Repeated Characters
Maximum number of times any single character can be repeated in the password.

Minimum Different Characters
Minimum number of different characters in the password.

Click the **Firewall Password** tab to customize these values for each user, as shown in Figure 28 on page 98.



Set Password

Set Password	○ Yes ● No
New Password	
New Password (Again Please)	
Require user to change	○ Yes ● No
Lock Password	○ Yes ● No

Password Rules

Warning Days Before Expiration	5
Maximum Weeks Before Expiration	13
Maximum Weeks Before Lockout	3
Maximum Login Retries Allowed	10
Passwords Before Reuse	5
Weeks Before Password Reuse	0
Minimum Length	8
Minimum Alphabetic Characters	4
Minimum Other Characters	1
Maximum Repeated Characters	2
Minimum Different Characters	3

Figure 28. Firewall Password Tab

Changing a User’s Access

After you add a user to the Firewall, you can change that user’s security attributes from the **Modify User** dialog box.

1. Select the user you want to change from the **Users** dialog box and click **Open**.
2. When the **Modify User** dialog box appears, change the appropriate fields. See “Adding a User to the IBM Firewall” on page 89 for a list of user attributes that you can change.
3. When you have made the changes, click **OK**.

Deleting a User from the IBM Firewall

Note: Do not delete the users `fwdfuser` or `fwdfadm`.

To delete a user, click **Delete** on the **User’s List** panel.

Administrator Authority Level by Function

Only the *primary firewall administrator* can create and modify administrators and determine which firewall functions they will have authority over. For example, you can limit a particular administrator to just having the authority to perform the Users and Log Monitor functions.

On the **Add User** dialog box, select Firewall Administrator for the **Authority Level** field. See “Adding a User to the IBM Firewall” on page 89 for more details on completing the **Add User** dialog box.

Then, select the **Administrator** tab at the top of the **Add User** dialog box. Select which functions the administrator is authorized to use.

Chapter 13. Configuring Proxy Servers

This chapter contains general information about how to configure and use the proxy servers from workstations both inside and outside your secure network.

HTTP Proxy

HTTP proxy efficiently handles browser requests through the IBM Firewall eliminating the need for a socks server for Web browsing. Users can access useful information on the Internet, without compromising the security of their internal networks and without altering their client environment to implement HTTP proxy.

The HTTP proxy is not a server. The end user cannot load files off of the proxy or put files on the proxy. Also, it is not a caching proxy. Nothing is stored on the firewall on behalf of an HTTP request.

Persistent Connections

Persistent connections allow a client and a server to signal the close of a TCP connection. This signaling uses a connection header field.

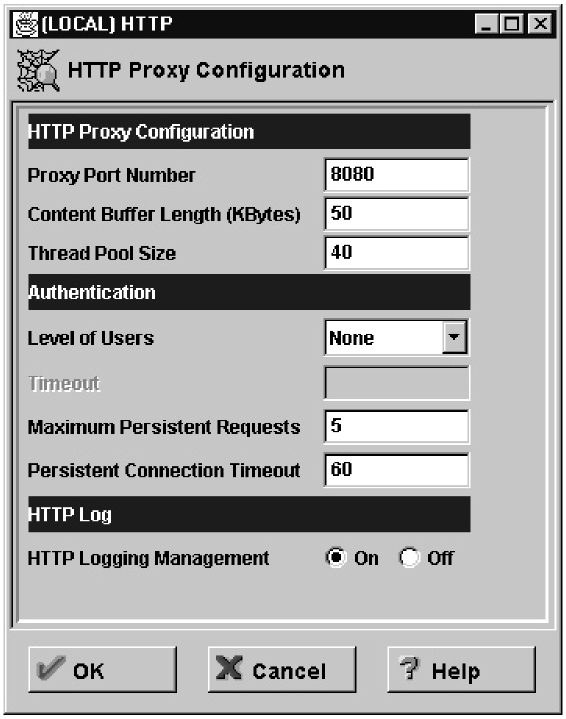
The IBM Firewall proxy supports persistent connections between a client and the proxy. The *maximum persistent requests* condition and the *persistent connection timeout* condition control how long that connection will exist. Should one of these conditions arise, the socket connection between the proxy and the client will close. If the *maximum persistent requests* condition and the *persistent connection timeout* condition are not met, the connection will remain open and it is the client's responsibility to determine when a request is complete.

If determined incorrectly, this could result in a display indicating traffic on the connection when there is none. An example of this is the animated icon of a browser that continually runs even though the complete page has been loaded. Click **Stop** to halt the animation. See "Maximum Persistent Requests" on page 104 and "Persistent Connection Timeout" on page 104 for information on these parameters.

Configuring HTTP Proxy Using the Configuration Client

To configure HTTP Proxy, do the following:

1. You must allow DNS queries before HTTP Proxy can work properly. An easy way to do this is to click Security Policy from inside the System Administration folder on the configuration client navigation tree and click Permit DNS Queries.
2. Activate filters
3. Add a connection. See “Example of Proxy HTTP” on page 65 for an example of how to set up a connection on the nonsecure side of your network.
4. To configure HTTP Proxy, select HTTP from the configuration client navigation tree. The IBM Firewall displays the **HTTP Proxy** dialog box, as shown in Figure 29.



HTTP Proxy Configuration

Proxy Port Number: 8080

Content Buffer Length (KBytes): 50

Thread Pool Size: 40

Authentication

Level of Users: None

Timeout:

Maximum Persistent Requests: 5

Persistent Connection Timeout: 60

HTTP Log

HTTP Logging Management: ● On ○ Off

Figure 29. HTTP

5. To stop the proxy, select `my computer/control panel/services`. Choose the IBM Firewall HTTP Proxy and click *Stop*.

   The executable phttpd is a system service that starts automatically when the system is started.

Configure the parameters on the **HTTP Proxy** dialog box. If you change any parameters, the Firewall HTTP proxy service will stop and start again. Active proxy users will have their requests terminated until the proxy restarts (a few seconds of time).

Proxy Port Number

Use this parameter to specify the port number the proxy should listen to for requests. If you change the port number, you must configure your filters to allow or disallow flow through the ports. Port numbers less than 1024 are reserved for TCP/IP applications. Common ports used for proxy Web servers are 8080 and 8088.

The default filter rules are set to disallow inbound, nonsecure traffic on port 8080, but allow secure traffic on that same port. The proxy will reject only nonsecure proxy requirements. The default is `8080`. If you change this, the port number must also be changed in the Services that are set up for this configuration. If you change any of these settings you must restart the phttpd process.

Max Content Buffer Length

Use this parameter to set the size of the buffer for dynamic data generated by a server. Dynamic data is output from CGI programs, server-side includes, and API programs. It is data that does not come from a proxy.

Specify the value in kilobytes (KB). The default is `50KB`.

Thread Pool Size

Use this parameter to set the fixed number of threads that you want to have active at one time. The proxy holds new requests until another request finishes and threads become available. Generally, the more power a machine has, the higher the value you should use for this parameter. If a machine starts to spend too much time on overhead tasks, such as swapping memory, try reducing this value. Specify a positive integer like 60, for example. The default is `40`.

Level of Users

This parameter tells the proxy what level of users to authenticate. Specify the value as either all, new, or none. The default is none. The values are:

all All browsers will be sent the proxy authenticate response to indicate that the browser should prompt the user for a user ID and password. If the browser does not support the proxy authenticate response, the error page displays indicating this. If the browser supports it, the user ID and password prompt will be displayed.

new Is used as a migration aid. It will only send back a 407 proxy authenticate response, to tell the browser to issue a userid/password prompt, to a client browser that identifies itself as an HTTP/1.1 browser. You can set a switch in Internet Explorer 4.0 so that it will broadcast requests with the HTTP/1.1 identifier. Netscape and others identify themselves as HTTP/1.0 requests.

none Does not check browser requests. Does not prompt for any userid/password.

Timeout

This parameter tells the proxy how much time to wait for a client request before requiring the user to reauthenticate himself. A user is authenticated from the specific IP address and userID given at the time of the original authentication for this period of idle time. Specify the time in minutes. The default is 60 minutes.

As long as the user is actively browsing, this time window will not expire.

Maximum Persistent Requests

This parameter indicates the maximum number of requests that a proxy can receive on an HTTP/1.1 persistent connection. This is a performance tool that directly impacts the authentication timeout. While in a persistent session, no test of the authentication of a user is done until the persistent session ends. Specify the value as a whole number, for example 25. The default is 5.

Persistent Connection Timeout

This parameter indicates the time in seconds to keep an HTTP/1.1 persistent connection with a client browser once an HTTP/1.1 compliant browser starts a session with the proxy. This is a performance tool that directly impacts the authentication timeout. While in a persistent session, no test of the authentication of a user is done until the persistent session ends. Specify the time in seconds. The default is 60.

HTTP Logging Management

This parameter tells the proxy to log startup/shutdown and all proxy requests to the firewall log. It uses the LOG_NOTICE level of logging. Set this to on if you wish to monitor HTTP request activity. Events are logged in the `firewall log` facility.

Browser Configuration

The client browser must be configured to connect to the port that the HTTP proxy is listening on.

If using HTTPS, point to the HTTP proxy on the IBM Firewall for security proxy also.

If you want to represent your Internet Explorer browser as an HTTP/1.1 browser to the proxy, do the following:

- Open the *View* pull-down.
- Select *Internet Options*.
- Select the *Advance Tab*.
- Scroll down to the HTTP 1.1 settings and set the switches to on.

SSL Connections

SSL tunneling for HTTP Secure Connection to other servers is supported. The IBM Firewall acts as a gateway in this case. The tunnel goes from the client through the firewall to the server. Use the standard port 443 for HTTP Secure Connection as shown in the following example:

```
https://www.ibm.com:443
```

Also, use the predefined service `HTTPS proxy out 2/2`.

If using HTTPS, point to the HTTP proxy on the IBM Firewall for security proxy also.

For more information, see “Example of Proxy HTTP” on page 65.

Methods Supported

The HTTP proxy supports the following methods, which are different ways of looking at the Internet:

- FTP
- Gopher
- HTTP
- HTTPS
- WAIS

Sample Logging Output for HTTP Proxy

The following is a sample of the logging output for HTTP Proxy authenticated get requests.

```
Mar 06 14:04:50 1998 fire3: ICA2140i: httpd --> HTTP Proxy authentication UNSUCCESSFUL
for user <Unknown>, on 9.67.140.162, thru secure network ... RC:30.
Mar 06 14:04:50 1998 fire3: ICA2099i: httpd --> Status: 407 from client
9.67.140.162, who requested "GET http://9.67.128.69/ HTTP/1.1" for 0 bytes.
Mar 06 14:05:05 1998 fire3: ICA2024i: User fred successfully authenticated
using NT authentication from secure network:9.67.140.162.
Mar 06 14:05:05 1998 fire3: ICA2169i: User fred successfully authenticated
for HTTP Server using NT from secure network:9.67.140.162.
Mar 06 14:05:05 1998 fire3: ICA2140i: httpd --> HTTP Proxy authentication
SUCCESSFUL for user (fred), on 9.67.140.162, thru secure network ...RC:1.
Mar 06 14:05:05 1998 fire3: ICA2099i: httpd --> Status: 200 from client
9.67.140.162, who requested "GET http://9.67.128.69/HTTP/1.1" for 2693 bytes.
Mar 06 14:05:05 1998 fire3: ICA2140i: httpd --> HTTP Proxy authentication
SUCCESSFUL for user (fred), on 9.67.140.162, thru secure network ...RC:1.
Mar 06 14:05:06 1998 fire3: ICA2099i: httpd --> Status: 200 from client
9.67.140.162, who requested "GET http://9.67.128.69/Admin/lgsplash.gif HTTP/1.1"
for 211 bytes.
Mar 06 14:05:10 1998 fire3: ICA2140i: httpd --> HTTP Proxy authentication
SUCCESSFUL for user fred, on 9.67.140.162, thru secure network ...RC:1.
Mar 06 14:05:10 1998 fire3: ICA2099i: httpd --> Status: 200 from client
9.67.140.162, who requested "GET http://9.67.128.69/Admin/lgmast.gif HTTP/1.1"
for 211 bytes.
```

Logging activity is explained as follows:

- ICA2099i - shows a return code of 407 and means that the authentication failed for that get request.

  The browser then asks the user for some authentication. The browser asks for a userid and password.
- ICA2140i - the authentication was successful for user fred.

The authentication occurs on each get request for every element on the Web page.

FTP

1. Use the FTP proxy to access the firewall host. (We will use `ftp_gw.domain.net.com` as the host name for the firewall).

   ```
   ftp ftp_gw.domain.net.com
   ```

   The proxy server will ask for your user name:

   ```
   login:
   ```
2. Enter your user name as authorized to use the Firewall:

   ```
   login: jane_doe
   ```

The server validates your identity depending on the authentication scheme selected when your user name was added to the Firewall (see “Adding a User to the IBM Firewall” on page 89).

After you are authenticated, the proxy server displays an FTP command prompt.

```
ftp>
```

Use the quote and site FTP commands to connect to the foreign host:

```
ftp> quote site forhost.network.outside.com
```

The foreign host will now ask for a user name and password for you to connect. This is probably a different user name and password from those you used to FTP to the Firewall.

The default timeout value for login is 60 seconds and for idle proxy is 7200 seconds. To change the default timeout values see “Overriding Timeout Values in FTP and Telnet Proxies” on page 109.

Transparent FTP

You can ftp transparently through the Firewall. Transparent proxies require no firewall authentication, therefore users of transparent proxies do not have to be defined as firewall proxy users. Transparent proxies are only allowed from the secure side of the firewall going out to the nonsecure side of the firewall. In order for transparent proxy to work, you have to select it on the Security Policy configuration client panel.

1. Use ftp to access the firewall host. (We will use ftp_gw.domain.net.com as the host name for the firewall.)

   ```
   ftp ftp_gw.domain.net.com
   ```

2. The proxy server will ask for your user name:

   ```
   USER:
   ```

3. Enter your user name at the nonsecure network:

   ```
   USER: username@remote_site_host_name
   ```

4. You are then prompted by the target host for your password of the user name entered in the previous step.

   ```
   password:
   ```

5. Enter your password.

The default timeout value for login is 60 seconds and for idle proxy is 7200 seconds (two hours). To change the default timeout values see “Overriding Timeout Values in FTP and Telnet Proxies” on page 109.

Telnet

Use the Telnet proxy to login to the firewall proxy server. You can use either the host name or Internet address. Then, after your credentials are authenticated, you use the Telnet command at the Firewall to log in to the intended host. For example, let’s use Telnet from inside the secure network, through the Firewall with the host name of `telnet_gw`, to access your ultimate destination, `forhost.network.outside.com`.

1. To start the process, use Telnet to access the firewall host. (We will use telnet_gw.domain.net.com as the host name for the Firewall.)

   ```
   telnet telnet_gw.domain.net.com
   ```

2. The proxy server will ask for your user name:

   ```
   login:
   ```

3. Enter your user name as authorized to use the Firewall:

   ```
   login: jane_doe
   ```

The server validates your identity depending on the authentication scheme selected when your user name was added to the Firewall, see “Adding a User to the IBM Firewall” on page 89 for more information.

You will be using the oneact shell. With the IBM Firewall proxy Telnet daemon, all communications pass through the firewall.

If you are using the oneact shell, after you are authenticated, the proxy server displays:

```
ENTER DESIRED HOST:
```

Type

```
telnet forhost.network.outside.com
```

The foreign host asks for your user name and password, as you are known on that host. These might be different from the user name and password that you used on the firewall proxy server.

The default timeout value for login is 60 seconds and for idle proxy is 7200 seconds. To change the default timeout values see “Overriding Timeout Values in FTP and Telnet Proxies” on page 109.

Transparent Telnet

You can telnet transparently through the Firewall. Transparent proxies require no firewall authentication, therefore users of transparent proxies do not have to be defined as firewall proxy users. Transparent proxies are only allowed from the secure side of the Firewall going out to the nonsecure side of the Firewall. In order for transparent proxy to work, you have to select it on the Security Policy configuration client panel.

1. Use Telnet to access the firewall host. (We will use `ftp_gw.domain.net.com` as our host name.)

   ```
   telnet telnet_gw.domain.net.com
   ```

2. The proxy server will ask for your user name:

   ```
   Login:
   ```

3. Enter your user name at the nonsecure network:

   ```
   Login@remote_host
   ```

The foreign host asks for your user name and password, as you are known on that host. These might be different from the user name and password that you used on the firewall proxy server.

The default timeout value for login is 60 seconds and for idle proxy is 7200 seconds. To change the default timeout values see “Overriding Timeout Values in FTP and Telnet Proxies”.

Overriding Timeout Values in FTP and Telnet Proxies

Both FTP and Telnet have timeout values for logging in and idle waits. By default, there must be session activity at least once every 60 seconds during login and user authentication. This is known as the loginTimeout.

Once the login has completed successfully, there must be activity on the session at least once every 7200 seconds or the session is disconnected.

You can override these defaults by creating an `fwTimeout.cfg` file in the `ROOTDIR\config` directory by specifying new timeout values in seconds. The `fwTimeout.cfg` file should have the following format.

```
telnet
proxyTimeout = 7200
loginTimeout = 60

ftp
proxyTimeout = 7200
loginTimeout = 60
```

Chapter 14. Creating a Virtual Private Network

The IBM Firewall provides support for manually configured VPN tunnels. A Virtual Private Network (VPN) is an extension of an enterprise's private intranet across a backbone network, which typically will be a public backbone such as the Internet. A VPN allows you to create a secure connection to protect your data while it is in transit over the backbone. The VPN tunnel uses the open IPSec security standards to protect your data from modification or disclosure while it is travelling between firewalls. Your data will flow within a VPN tunnel, which can provide data origin authentication, confidentiality, and integrity checking on every packet. IPSec protocols can keep your data private, hiding if from any eavesdroppers on the public network. Packet filtering in the firewall can be used in conjunction with IPSec technologies to further protect your intranets from unwanted intrusions.

VPNs can be created by manually configuring VPN tunnels between pairs of IBM Firewalls or between an IBM Firewall and any other device (client, router, server, or firewall) that supports the latest open IPSec standards. Encryption support includes DES, 3DES, and CDMF. Authentication support includes HMAC-MD5 and HMAC-SHA. Filters for your VPN tunnels can be customized, or you can choose a default set of filter rules.

The tunnel defined policy specifies that the data (original IP packets) be either:

- Encrypted
- Authenticated
- Encrypted and authenticated

The user determines the tunnel policy or level of protection based on security requirements. A different policy can be used for different IP protocols, for example, Telnet may be different from FTP. The concept of a tunnel carrying encrypted or authenticated data or both is integrated with the IP filtering rules.

Filters are used to permit or deny traffic and direct datagrams into or out of specific VPN tunnels. The IBM Firewall for Windows NT offers two types of filters: static and dynamic. Static filter rules are manually configured and must be explicitly activated for them to take effect. Dynamic filter rules are implicitly activated when a VPN tunnel is activated.

Currently the dynamic filter rules have very coarse granularity: they will direct all traffic between a given pair of endpoints into a specific tunnel. The static filter rules offer you the ability to have a much finer granularity. For example, you can define filter rules that will allow one set of applications to communicate over a given tunnel, while constraining a different set of applications to communicate over a different tunnel. Thus even if two tunnels have the same endpoints, they can support different policies. For example, one tunnel might use DES encryption, while the other uses 3DES. Examples of additional qualifiers that can be used to create static filter rules are protocols, ports, traffic, and direction.

Encryption and message authentication support requires that each of the two parties (tunnel endpoints) have shared secret keys. The tunnel definitions, including the values of the shared secret keys, must be manually administered at both Firewall endpoints for the tunnel to be activated.

Supported authentication algorithms are Hashed Message Authentication Code (HMAC) using Message Digest 5 (MD5) or Secure Hash Algorithm (SHA).

The supported encryption algorithms are:

- Commercial Data Masking Facility (CDMF)
- Data Encryption Standard (DES)
- Triple DES (3DES)

Encryption is a process of scrambling cleartext data so that it is very hard to infer from the encrypted data (or ciphertext) what the original data was. Encryption algorithms typically convert cleartext into what look like random bit patterns through a fairly complex mathematical process. The data is recoverable only because the ciphertext is not really random but, in fact, was created using a key. If the key is not known, then the process of analyzing the data and recovering cleartext can be difficult. One common cryptanalytic method is known as the brute force method, where all possible keys are used for decryption, until meaningful cleartext is obtained. If the key is short, the number of possible keys is small, and brute force can be a reasonably powerful attack strategy. If the key is long, the number of possible keys can be far too many to reasonably find the correct one in a short amount of time. CDMF has a 40-bit key length, while DES keys are 56 bits long, and 3DES keys are 168 bits long.

Notes:

1. CDMF keys are really 64 bits long, but many of the bits are duplicated in a known fashion so that the effective key length is 40 bits.
2. DES keys are converted from 56 bits to 64 bits, but again in a known process, so that the key length is effectively 56 bits.
3. Triple DES is actually performed with three DES keys, each of which is 56 bits long, so that the effective key length is 168 bits.

4. One of the weaknesses of a simple cryptographic system like CDMF, DES, 3DES and most others, is that the same cleartext yields the same ciphertext with the same key. So, if a ciphertext message has been compromised once (for example, the cleartext is known), then until the key is changed, the ciphertext is compromised. This weakness is overcome with a method known as cipher block chaining. All the encryption algorithms used in the IBM Firewall use cipher block chaining (CBC), so the algorithms are conventionally denoted DES_CBC and 3DES_CBC.

Because an operational IP tunnel requires administration definitions at both of the tunnel endpoints, those endpoints and the administration tasks associated with IP tunnel operations, are defined in terms of **tunnel owner** and **tunnel partner**.

Tunnel Type

The IBM Firewall allows you to create a manually configured VPN tunnel that uses the latest IPSec Authentication Header (AH) and Encapsulating Security Protocol (ESP) to protect your traffic while it is in transit over a nonsecure backbone. The IBM Firewall V3R3 can establish a VPN tunnel with another IBM Firewall V3R3 or any box (for example, other firewalls, routers, or hosts) that supports manual configuration of the latest AH and/or ESP protocols.

Figure 30 is an illustration of a tunnel and a VPN.

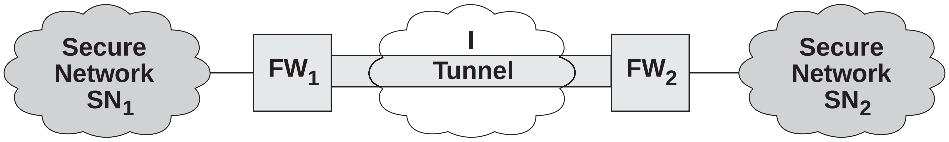


Figure 30. Tunnel, All IP Traffic between Two Secure Networks. FW $_1$ and FW_2 represent nonsecure interface IP address and mask. SN_1 and SN $_2$ represent any host in the secure network. The shaded area of the picture represents a VPN.

IP Tunnel Configuration and Activation

To configure and activate tunnels you have to take certain steps depending upon where you are in the configuration. Use the configuration client to do so.

For the tunnel owner:

- Define your tunnel. See “Add a Tunnel” on page 115.
- If you are using static filter rules, add connections to allow the required firewall-to-firewall communication.

- Export a tunnel from the tunnel owner to the tunnel partner.
- Activate the tunnel for both IP tunnel endpoints.
- Activate the filter rules if you are using static filters.

For the tunnel partner:

- Import (load) the tunnel.
- If you are using static filter rules, define the connections.
- Activate the tunnel for both IP tunnel endpoints.
- Activate the filter rules if you are using static filters.

If you are using dynamic filters and have a nested tunnel configuration, activate the outer tunnel before you activate the inner tunnel. Deactivate the inner tunnel before you deactivate the outer tunnel.

Note: Do NOT try to edit the tunnel file yourself. Do all IBM Firewall administration using the IBM Firewall configuration client.

Tunnel Configuration with Endpoints in the Same Subnet

If you have a tunnel with endpoints in the same subnet, you must create routing table entries for the clients on the secure side of the partner firewall, which indicate routing through the partner firewall. This will cause the TCP/IP stack to put the correct destination MAC address in the MAC headers. Otherwise, any time you have VPN tunnel traffic, the firewall will get ICMP Type=5 redirect messages from the router (one for every packet sent).

Example of Virtual Private Networks Using Static Filter Rules

To establish a Virtual Private Network requires an intricate configuration. In this case, the packets being sent between the client and the host are encapsulated for their journey between the two firewalls. For this reason, each packet passes through the filter mechanism twice: once in its encapsulated form and once in the clear. On each iteration, the packet looks completely different because the header is rewritten, and therefore requires a different connection to permit its passage.

The client, in the secure network, will be sending packets addressed to the Remote Host. These packets will be encrypted and will be permitted by the Service *VPN Traffic 1/2*. Next, the same packet, still addressed to the Remote Host from the client in the secure network, will be directed into its tunnel by the service *VPN Traffic 2/2*. (It is recommended to copy this service once for each tunnel being used. Each copy would reference a single tunnel ID, and any connections to that VPN would include the appropriate copy of this service). Once the packet has been encrypted, the Firewall now sends the encapsulated packet to the remote firewall directly, where the packet will be decapsulated and sent to its destination.

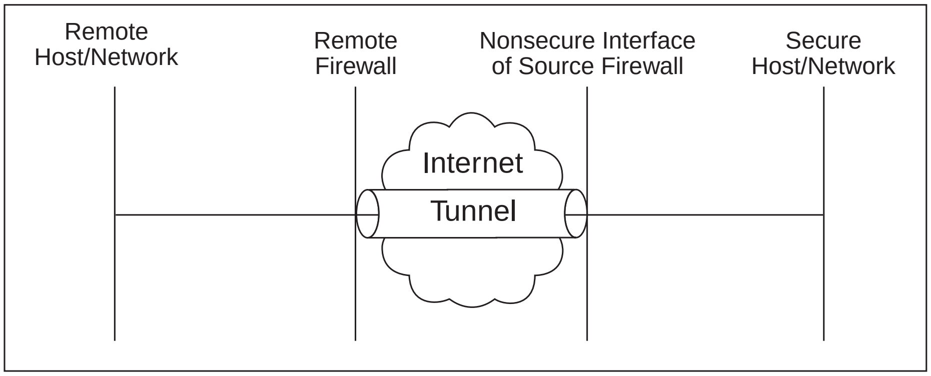


Figure 31. Virtual Private Networks

Such a configuration requires the following connections:

Table 6. Virtual Private Networks

Source Object	**Destination Object**	**Services Required**
Secure Host/Network	Remote Host/Network	• VPN traffic 1/2 • VPN traffic 2/2
NonSecure Interface of the Source Firewall	Remote Firewall	VPN encapsulation

Configuring Tunnels Using the Configuration Client

This section describes how to use the configuration client to configure your tunnels on the firewall.

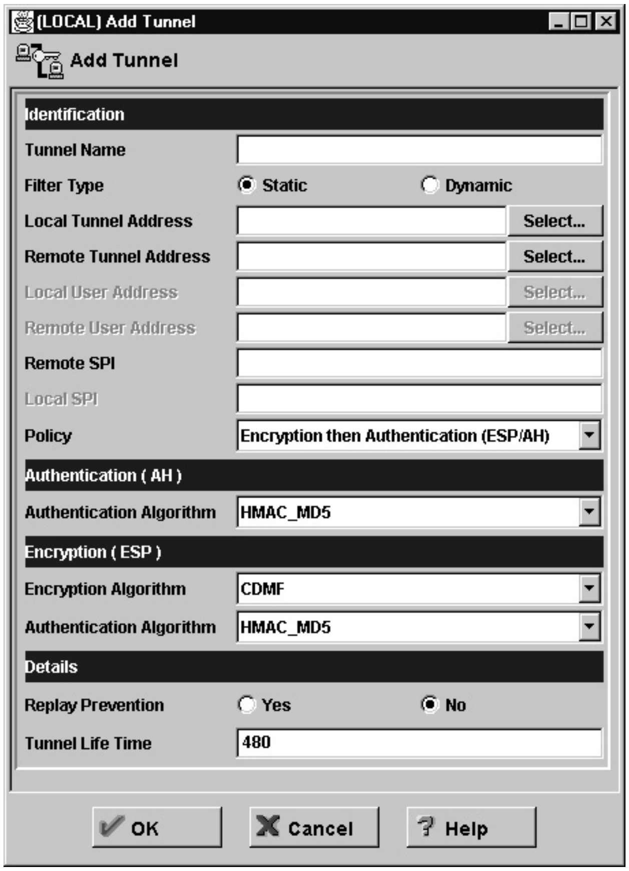
Select Traffic Control from the configuration client navigation tree. Double-click the file folder icon to expand the view. Select **Virtual Private Network**.

From the **Virtual Private Network Administration** dialog box, you can open, copy, delete, import, export, activate, and deactivate a tunnel.

Add a Tunnel

1. Select **NEW** from the **Tunnels** dialog box and click **Open**.

   A dialog asks you to specify the values required for a tunnel context ID specification, as shown in Figure 32 on page 116.



Identification

Tunnel Name:

Filter Type: ● Static ○ Dynamic

Local Tunnel Address: Select...

Remote Tunnel Address: Select...

Local User Address: Select...

Remote User Address: Select...

Remote SPI:

Local SPI:

Policy: Encryption then Authentication (ESP/AH)

Authentication (AH)

Authentication Algorithm: HMAC_MD5

Encryption (ESP)

Encryption Algorithm: CDMF

Authentication Algorithm: HMAC_MD5

Details

Replay Prevention: ○ Yes ● No

Tunnel Life Time: 480

Figure 32. Add a Tunnel

2. Enter the following values:

   Value Description

   Tunnel Name
   Enter the name of the tunnel.

   Filter Type
   Select either **static** or **dynamic**. If you select **static**, you must create the tunnels filter rules yourself. If you select **dynamic**, the Firewall will generate dynamic filters each time the tunnel is activated. Currently, selecting dynamic filters allows all supported protocols on any port through the specified tunnel.

   If you select the dynamic filters type, you are required to fill in the local and remote user address fields.

For special consideration when using NAT and tunnels together, see “NAT and Tunnels” on page 160.

Local Tunnel Address
IP address of the local firewall nonsecure interface to be used by the tunnel. Click **Select** to get the Interface list. Select a nonsecure interface and click **Apply** or enter an IP address directly. The local tunnel address will be added to the Tunnels screen.

Remote Tunnel Address
Click **Select** to select from a list of network objects or create a new one. Or enter an IP address directly. Click **OK**. The address of that network object is entered in the remote tunnel address field.

Local User Address
If you have selected the dynamic filters type, click **Select** to select from a list of network objects or create a new one. The local user address and the net mask are specified by selecting a network object.

Remote User Address
If you have selected the dynamic filters type, click **Select** to select from a list of network objects or create a new one. The remote user address and the net mask are specified by selecting a network object.

Remote SPI
Specifies the security parameter index (SPI) value the tunnel partner will use. It is usually agreed upon by you and the tunnel partner. This value can be entered in decimal format and must be greater than 255.

Local SPI
Firewall security parameter index is assigned by the firewall when you add a tunnel. You cannot set or change this value. All SPIs are 32 bit random numbers.

Policy Allows you to enter a combination of encryption and authentication values: AH only, ESP only, or ESP/AH. Click the arrow to select a particular policy. Click **OK** and your selection is added to the Tunnels Definition screen.

Authentication Algorithm (AH)
Authentication Header (AH) authentication algorithm is used for IP packet authentication. HMAC_MD5 or HMAC_SHA are the types available.

Replay Prevention
Replay prevention uses a sequence counter to prevent old packets from being replayed as a form of attack. The firewall tunnel will

always send out replay prevention information in the packet. Check Yes to turn on the replay checking of the receiving side.

Note: If you have a replay-enabled tunnel defined between an IBM 2210 or 2216 router and a Windows NT Firewall, the tunnel connection will be deactivated if you reboot the Firewall. You must reboot the 2210 or 2216 router to reactivate the tunnel.

Encryption Algorithm
The Encapsulating Security Payload (ESP) algorithm specifies the algorithm used for IP packet encryption. Specify either CDMF, DES_CBC, 3DES_CBC, or none. If you specify none, you cannot also specify none for **Authentication Algorithm (ESP)**.

Authentication Algorithm (ESP)
The Encapsulating Security Payload authentication algorithm is used for IP packet authentication. Choose from HMAC_MD5, HMAC_SHA, or none. If you specify none, you cannot also specify none for **Encryption Algorithm**.

Tunnel Life Time
Specifies the time in minutes that a tunnel will be operational. Put a value in the entry field. The default is 480 (8 hours) and the maximum time allowed is 99999. If you specify 0, it means the tunnel will not time out; the lifetime is unlimited.

3. Click **OK** and your entries are added to the Tunnels screen.

Modify a Tunnel

You cannot modify an active tunnel; you have to deactivate the tunnel first.

If you modify an encryption or authentication algorithm, you have to export and import again to your tunnel partner.

1. Select a tunnel from the **Tunnels** dialog box and click **Open**.
2. Modify the desired fields on the **Modify Tunnel** dialog box and click **OK**.

Delete a Tunnel

1. Select the tunnel you want to delete from the **Tunnels** dialog box and click **Delete**.

   The configuration client asks you to confirm your request.
2. Click **Yes** to confirm the delete.

   The configuration client confirms your request.

You will receive a warning message at filter activation time if rules are encountered which reference tunnel IDs that do not exist.

Note: If you delete a tunnel and then add it again, you have to re-export it.

Export Tunnel Definition Files

As a tunnel owner, after you have defined a set of tunnel definitions, you will export one or more of these definitions to a tunnel partner. The export function writes the tunnel definition to an export file. If the user is using the AIX® operating system or a Windows NT Firewall as the tunnel partner, you can use that file to import to the tunnel partner. Otherwise, follow the instructions in “Creating a Tunnel to a Product Other Than the Windows NT Firewall or the AIX Operating System” on page 124.

1. Select tunnels from the VPN Administration panel and click **Export**.
2. Verify the list of tunnel IDs.
3. Enter a directory name in the field.

   This directory must have already been created and must not contain an export file. The directory is where the file containing tunnel information is temporarily placed for export to a partner.
4. Click **OK**.

   The tunnel IDs that you have selected are added to the **Export Tun nel Definition Files** panel.
5. When you have completed this operation, the directory contains the file that needs to be moved to your tunnel partner’s machine. If a directory name of `c:\tmp` was used, the name for the export file would be:

   ```
   c:\tmp\ipsec_tun_manu.exp
   ```
6. Transfer the file to the tunnel partner’s machine by copying the file to a diskette. Note however, if you are exporting the file from a Windows NT Firewall to an AIX server the file format and name of the export file will be unreadable by the AIX server because the long filename is not properly read by the dosutils.

   To overcome this problem:

   a. Make sure that you have DOS utilities installed on the AIX server.

   b. Export the file from the Windows NT firewall

   c. Place the diskette in an AIX machine

   d. Issue the following DOS command: `dosread -a 8.3 filename unix long filename`.

      An example would be:

      ```
      dosread -a IPSEC_~1.EXP ipsec_tun_manu.exp
      ```

Import Tunnel Definition Files

Obtain the export file from your tunnel partner. Then:

1. Select **Traffic Control**, **Virtual Private Network**, and click **Import**.

A dialog box appears.

2. Enter the name of the directory where you have placed the file that you have obtained from the tunnel partner.
3. Click **Select**.
4. Select the desired tunnel and click **Apply**. (One or more items can be selected).
5. Click **OK** after making all selections.
6. Click **OK**.

Tunnel Activation Status

Use this procedure to activate or deactivate a tunnels. When you activate a tunnel, dynamic filter rules are automatically activated and the IBM Firewall enables the use of that tunnel. However, if you have static filter rules, you must activate them.

Activate a Tunnel

Select tunnels from the Tunnels dialog box and click **Activate**.

Deactivate a Tunnel

To stop communication at a tunnel, select tunnels from the **Tunnels** dialog box and click **Deactivate**.

Setting Up Static Filter Rules for a VPN

To set up static filter rules for a VPN, do the following:

1. From the configuration client navigation tree, select **Connection Setup**. The **Connections List** dialog box appears.
2. Double click **NEW**. The **Add a Connection** dialog box displays.
3. Under the heading **Identification**:
   - Enter the name of this connection, for example, *Encapsulation for My Tunnel.*
   - Enter a description of this connection that will be helpful to you in identifying it.
   - In the source field, enter the nonsecure IP address of the firewall machine you are entering this data into.
   - Click **Select**. The **Select Network Object** dialog box displays.
   - Click on the network object representing the nonsecure IP address (interface) of the firewall and click **OK**.

If a network object does not exist, you need to create one. See “Using the Configuration Client to Define Network Objects” on page 34.

- In the destination field, enter the nonsecure IP address of your tunnel partner at the other end of the VPN.
- Click **Select**. The **Select Network Object** dialog box displays.
- Click on the network object representing the nonsecure IP address (interface) of the Firewall and click **OK**.

  If a network object does not exist, you need to create one. See “Using the Configuration Client to Define Network Objects” on page 34.

4. Under the heading **Connection Services**:
   - Click **Select**. The **Select a Service from the List** dialog box displays.
   - In the **Search** field type **VPN**. Click **Find**.
   - Click on the Service: *VPN encapsulation* and then click **OK**.

     The **Add a Connection** panel redisplays.
   - Click **OK**.

     Your newly created connection now displays on the **Connection List** panel. Note that this connection permits encrypted data between the source and destination firewalls. See FW1 and FW2 in Figure 30 on page 113.

You need a second connection to allow a secure host or network the ability to pass data to another secure host or network. See SN1 and SN2 in Figure 30 on page 113.

1. From the configuration client navigation tree, select **Connection Setup**. The **Connections List** dialog box appears.
2. Double click **NEW**. The **Add a Connection** dialog box displays.
3. Under the heading **Identification**:
   - Enter the name of the connection, for example, *VPN traffic for My Tunnel*.
   - Enter a description of this connection that will be helpful to you in identifying it.
   - In the source field, enter the secure IP address of a host or a network on the secure side of the source firewall.

     Note: If you are using network address translation, make sure you enter the private untranslated address of the host or network in the source field.
   - Click **Select**. The **Select Network Object** dialog box displays.
   - Click on the network object representing the secure IP address (interface) of the host or network and click **OK**.

If a network object does not exist, you need to create one. See “Using the Configuration Client to Define Network Objects” on page 34.

- In the destination field, enter the secure IP address of a host or a secure network on the secure side of the partner firewall.
- Click **Select**. The **Select Network Object** dialog box displays.
- Click on the network object representing the secure IP address (interface) of the host or network and click **OK**.

  If a network object does not exist, you need to create one. See “Using the Configuration Client to Define Network Objects” on page 34.

4. Under the heading **Connection Services**:
   - Click **Select**. The **Select a Service from the List** dialog box displays.
   - In the **Search** field type **VPN**. Click **Find**.
   - Click on the Service: *VPN traffic 1/2* and then click **Apply**.
   - Click on the Service: *VPN traffic 2/2* and then click **Copy**.
5. Under the heading **Identification**, enter the the name of this service in the service name field. For example, *VPN Traffic 2/2 for My Tunnel*.
6. Under the heading **Service Override Values**:
   - In the **Override Log Control** field, you can choose whether or not to log this service to your log file.
   - In the **Override Frag. Control** field, you can choose whether or not to allow packets to be fragmented.
   - In the **Override Tunnel ID** field, click **Select**. The **Select a Tunnel** screen displays.
   - Select the tunnel ID that will be used between the two secure clients or networks previously defined in this second connection.
   - Click **OK**.
7. The **Select a Service from the List** screen redisplays. Click on the service you just created and then click **OK**.
8. The **Add a Connection** screen redisplays. Click **OK**.
9. Reactivate filter rules.

Setting Up Tunnels Using Dynamic Filters

To set up a tunnel using dynamic filters:

1. On the **Add Tunnel** dialog box, select **Filter Type Dynamic**.
2. Click **Select** in the **Local User Address** field to select from a list of network objects or create a new one. By selecting a network object, you are specifying the secure local host address or subnet.

3. Click **Select** in the **Remote User Address** field to select from a list of network objects or create a new one. By selecting a network object, you are specifying the destination host address or subnet.
4. Export the tunnel definition to your tunnel partner. See “Export Tunnel Definition Files” on page 119.
5. Activate tunnels. See “Tunnel Activation Status” on page 120.

On the partner firewall:

1. Obtain the export file from your tunnel partner. See “Import Tunnel Definition Files” on page 119.

   Note: If the tunnel owner is using network address translation, change the remote user address to the translated NAT address. See “NAT and Tunnels” on page 160 for more information.
2. Activate tunnels. See “Tunnel Activation Status” on page 120.

Firewall Interoperability

Because the IBM Firewall for Windows NT supports standard IPSec headers and the IBM Firewall for AIX supports the now obsolete IPSec headers, an IBM Firewall for Windows NT cannot establish a tunnel session with an AIX Firewall. However, the IBM Firewall for Windows NT can establish a manual tunnel connection with any competitor firewall, router, or host, or another IBM Windows NT Firewall and AIX 4.3.0 or 4.3.1. that supports new IPSec headers.

How to Use the Windows NT Firewall with the AIX Operating System

To establish a tunnel between an IBM Firewall for Windows NT and the AIX operating system 4.3.1:

1. Create a tunnel on the IBM Firewall for Windows NT.
2. Export the tunnel definition into a file following the instructions in “Export Tunnel Definition Files” on page 119.
3. Run the **conv_export_file** utility on the file to convert it to a format that AIX can understand. See “How to Use the conv_export_file Utility” on page 124.
4. Go to the AIX operating system to import the file in order to set up a tunnel definition.

Note: We recommend that you create the tunnel on the Windows NT Firewall and export it to the AIX operating system. This is because for host-host tunnels and host-firewall-host tunnels, AIX will default the destination policy to auth/encr for an Authentication with AH, Encryption with ESP tunnel. When the tunnel is imported to Windows NT, it fails because Windows NT does not support auth/encr. To make it work you must go to the *Change a Manual Tunnel* SMIT panel and switch the destination policy back to encr/auth.

How to Use the conv_export_file Utility

Use the **conv_export_file** utility to convert from the Windows NT export file format to the AIX 4.3 file format. It is a utility that runs on Windows NT. The command syntax is:

```
conv_export_file [dir=ddddd]
```

The parameter definition is:

dir=ddddd
Specifies the directory of the location of the export file to be converted. It defaults to the current directory.

Creating a Tunnel to a Product Other Than the Windows NT Firewall or the AIX Operating System

If you want to create a tunnel between a Windows NT Firewall and a VPN endpoint that is not the AIX operating system or another Windows NT Firewall, do the following:

1. Create the tunnel definition on the Windows NT Firewall.
2. Export the tunnel definition into an export file.
3. Use the information in the export file to configure the tunnel partner.

The following table describes each line in the **export file,** including what it is and any restrictions on it. The **tunnel owner** is the Windows NT Firewall. The **tunnel partner** is the other end of the tunnel. Each tunnel exported to the export file will have its own set of information in the file.

Keep in mind that the tunnel owner and tunnel partner need to be reversed on another firewall.

Field in Export File	**Restrictions**
String indicating start of new tunnel definition	Starts with ″#″
IP version number	Windows NT Firewall only supports version 4
IP address of tunnel endpoint of tunnel owner	IP address is in dotted decimal format

Field in Export File	**Restrictions**
IP address of tunnel endpoint of tunnel partner	IP address is in dotted decimal format
Tunnel identifier used internally by tunnel owner	
Security Parameter Index (SPI) AH used by the tunnel partner	Must be greater than 255
Security Parameter Index (SPI) ESP used by the tunnel partner	Must be greater than 255
Security Parameter Index (SPI) AH used by the tunnel owner	Must be greater than 255
Security Parameter Index (SPI) ESP used by the tunnel owner	Must be greater than 255
Encryption algorithm used by the tunnel partner	Either: • CDMF - Commerical Data Masking Facility • DES_CBC - Data Encryption Standard encryption (56 bit) • 3DES_CBC - Data Encryption Standard encryption (168 bit) • None - No encryption being used
Length of key used by tunnel partner encryption algorithm	Length of key in bytes
Key used by tunnel partner for encryption algorithm	Values in hex with 0x preceding it
Encryption algorithm used by the tunnel owner	Either: • CDMF - Commerical Data Masking Facility • DES_CBC - Data Encryption Standard encryption (56 bit) • 3DES_CBC - Data Encryption Standard encryption (168 bit) • None - No encryption being used
Length of key used by tunnel owner encryption algorithm	Length of key in bytes
Key used by tunnel owner for encryption algorithm	Values in hex with 0x preceding it

Field in Export File	**Restrictions**
Authentication algorithm used by the tunnel partner for AH	Either: • HMAC_MD5 - Hashed Message Authentication code using Message Digest 5 • HMAC_SHA - Hashed Message Authentication code using Secure Hash Algorithm • None - AH protocol not being used
Length of key used by tunnel partner for AH authentication algorithm	Length of key in bytes
Key used by tunnel partner for AH authentication algorithm	Values in hex with 0x preceding it
Authentication algorithm used by the tunnel owner for AH	Either: • HMAC_MD5 - Hashed Message Authentication code using Message Digest 5 • HMAC_SHA - Hashed Message Authentication code using Secure Hash Algorithm • None - AH protocol not being used
Length of key used by tunnel owner for AH authentication algorithm	Length of key in bytes
Key used by tunnel owner for AH authentication algorithm	Values in hex with 0x preceding it
Unused	Always 0
Time (in seconds) that tunnel will be operational	Must be a positive integer. Use 0 to indicate the tunnel will remain operational indefinitely
Encapsulation mode for ESP protocol	Windows NT Firewall only supports tunnel mode
Encapsulation mode for AH protocol	Windows NT Firewall only supports tunnel mode
Policy - specifies which protocols to use for this tunnel	First 2 characters of string will be either: • ae - Use both AH and ESP protocols • ex - Use only ESP protocol • ax - Use only AH protocol
Replay prevention indicator	Either: • 0 - Do not enforce replay prevention • 1 - Enforce replay prevention

Field in Export File	Restrictions
Header structure indicator. Determines which set of RFCs to follow when generating structure of protocol headers.	Value is always 1. Windows NT Firewall only supports headers format described in RFCs issued in September 1998.
Authentication algorithm used by the tunnel partner for ESP	Either: • HMAC_MD5 - Hashed Message Authentication code using Message Digest 5 • HMAC_SHA - Hashed Message Authentication code using Secure Hash Algorithm • None - Authentication not used by ESP protocol
Length of key used by tunnel partner for ESP authentication algorithm	Length of key in bytes
Key used by tunnel partner for ESP authentication algorithm	Values in hex with 0x preceding it
Authentication algorithm used by the tunnel owner for ESP	Either: • HMAC_MD5 - Hashed Message Authentication code using Message Digest 5 • HMAC_SHA - Hashed Message Authentication code using Secure Hash Algorithm • None - Authentication not used by ESP protocol
Length of key used by tunnel owner for ESP authentication algorithm	Length of key in bytes
Key used by tunnel owner for ESP authentication algorithm	Values in hex with 0x preceding it
Unused	Always 0
Unused	Always ″-″
Unused	Always ″-″
Tunnel name used by tunnel owner	
Type of filters used internally by tunnel owner	Either: • 0 - static filters • 1 - dynamic filters
IP address of machine allowed to send/receive traffic through tunnel. This machine is protected by the tunnel owner.	Only valid when dynamic filters are used.

Field in Export File	Restrictions
Mask used in combination with previous field to determine a series of machines allowed to send / receive traffic through the tunnel on the tunnel owner side.	Only valid when dynamic filters are used.
IP address of machine allowed to send / receive traffic through tunnel. This machine is protected by the tunnel partner.	Only valid when dynamic filters are used.
Mask used in combination with previous field to determine a series of machines allowed to send / receive traffic through the tunnel on the tunnel partner side.	Only valid when dynamic filters are used.

Unique SPI Values

When you import a tunnel definition into a Windows NT Firewall, you may get a message indicating that a duplicate SPI was found. An SPI is a Security Parameter Index. Two SPIs are used by a tunnel: one is used by the tunnel owner, and one is used by the tunnel partner. The SPI used by the tunnel owner must be unique on a Windows NT Firewall.

When you create a tunnel, the SPI used by the tunnel owner is generated for you and guaranteed to be unique. You must specify an SPI for the tunnel partner. When the tunnel definition is imported into the tunnel partner, the tunnel partner’s SPI is checked for uniqueness. If the value was not unique, it will be regenerated. You will get a message indicating that you need to go back to the tunnel owner and change the value you specified for the tunnel partner’s SPI, to this new value. If you do not do this, the SPIs will not match, and the tunnel will not work.

Chapter 15. Monitoring the Firewall Logging

This chapter describes how to monitor the logging of alerts in real time. An alert is generated when a configured threshold is violated.

The IBM Firewall monitors the messages sent to the firewall log for potential crisis situations, based upon user-defined thresholds. In the event of a threshold violation, the Firewall delivers an alert, in a manner specified by the firewall administrator.

Threshold Definitions

A threshold consists of count and time parameters — if a count (number of specific logon failures (events)) is exceeded in the specified time (minutes), the threshold has been violated and an alert message is generated. Log monitor recognizes four types of thresholds:

1. Total authentication failures - total number of authentication failures by any user ID or host
2. Authentication failures against any user ID
3. Authentication failures originating from any host
4. Occurrences of a message tag in the log

All thresholds can be configured using the configuration client or the command line interface. Any changes to the threshold definitions are picked up automatically by the IBM Firewall.

Note: Any logon failure event that triggers an alert will be removed from the list of logon failure events tracked by the monitor. If you want to see a user ID or host failure alert, we recommend that you set the total number of authentication failures to a high threshold.

Alert Messages

When a threshold has been reached, the IBM Firewall generates an alert message. Delivery of the alert message can take any of the following four forms:

1. Entry in a log file:
   - Through the `alert log` facility configurable through the configuration client or the command line.
   - In the `firewall log`

2. Send an e-mail message to a list of users
3. Pager, as configured. See “Pager Notification Support” on page 131.
4. Execution of a user-defined command, with the alert message as the first parameter

The alert message contains information relevant to the particular threshold violation. For example:

```
ICA0001e: ALERT — 20 authentication failures.
ICA0002e: ALERT — 10 authentication failures for user root.
ICA0003e: ALERT — 15 authentication failures from host 56.67.78.89
ICA0004e: ALERT — Tag ICA1234e with 3 log entries.
```

Alert messages and other messages originated by the Log Monitor are not monitored.

Configuring Log Monitor Using the Configuration Client

This section describes how to use the configuration client to configure the real-time log monitor. Select System Logs from the configuration client navigation tree. Double-click the file folder icon to expand the view. Click **Log Monitor Thresholds**.

From the **Log Monitor Threshold Administration** dialog box, you can add, change, or delete a threshold definition.

Add Log Monitor

To add a threshold definition, select **NEW** from the **Log Monitor Threshold Administration** dialog box and click **Open**. The **Add Log Monitor** dialog box appears. Fill in the following fields:

1. Click the **Class type** arrow to choose from the list of class types. Class types are:
   - Mail notification
   - Execute command
   - Per User Authentication Failure Threshold
   - Total Authentication Failure Threshold
   - Per Host Authentication Failure Threshold
   - Message Threshold
2. If you selected class type: Mail Notification, enter an e-mail address. You can define multiple mail notification classes.

   All threshold violation messages are sent to the specified e-mail address.
3. If you selected class type: Execute Command, fill in a command filename.

The log monitor will execute this command with the alert message as its first parameter. You can only define one execute command class.

4. If you selected class type: Message Threshold, fill in a message tag, a standard tag from the IBM Firewall log messages that you want to be monitored.
5. If you selected one of the threshold classes, fill in the threshold count field.

   The threshold count is the maximum number of failed events allowed within the specified time period.
6. If you selected one of the threshold classes, fill in the threshold time field.

   The threshold time is the number of minutes beginning with the first occurrence of an event.
7. If you selected one of the threshold classes, click Yes or No to indicate whether you want pager notification to be active.
8. Filling in a comment is optional.
9. Click **OK**.

Change a Threshold Definition

To change a threshold definition, select the item to be changed from the **Log Monitor Threshold Administration** dialog box and click **Open**. The **Change Log Monitor** dialog box appears.

1. Enter the changes you want for the threshold count and threshold time fields.

   The threshold count is the maximum number of failed authentication messages to be detected within the specified time period. The threshold time is the number of minutes beginning with the first occurrence of a message.
2. Click **OK**.

Delete a Threshold Definition

To delete a threshold definition, select the item to be deleted from the **Log Monitor Thresholds** dialog box and click **Delete**. You will be asked to confirm the deletion. Click **Yes** to confirm. Note that delete does not mean delete from the log file. It means delete the definition.

Pager Notification Support

The Firewall can page a system administrator by sending a message to the administrator’s beeper when there are intrusion alerts on the Firewall. To set up pager notification support, you need to configure the following three pager components.

1. Command Customization - This component must be created and modified using the configuration client. It sets defaults for the pager command, which is used by the log monitor and can be used from the command line. This component will contain a unique entry that defines the pager environment. See “Command Customization” on page 133 for more information on defining and customizing this component.
2. Carrier Administration - You must define a suitable carrier before connecting your modem. This component contains a list of default carriers used in the U.S. If the carrier you are using is not one of these, then add your carrier in this component. See “Carrier Administration” on page 135 for more information.

   Validate the existing phone numbers for the carriers by getting these numbers from your carriers. When talking with your carriers, be sure to get the carrier’s modem phone number and other settings that are valid for the particular service you have purchased.
3. Modem Administration - Before connecting your modem, you must create suitable modem definitions. These definitions will contain all relevant modem information that pager notification support will use. This component contains a list of modems that you can choose from. You can add to this list, however some modems might not be compatible with your carrier’s support. See “Modem Administration” on page 136 for information on maintaining modem definitions.

Note: IBM Firewall supports the Tele-AlphaNumeric Protocol (TAP) communications protocol for pager notification support.

What Carriers and Modems are Supported

The carriers database file contains a list of the carriers and related transmission parameters. You can add other carriers. Some of the parameters, besides the carrier’s name and modem phone number are:

- The maximum message length for an alphanumeric pager and the maximum digits for a numeric pager
- The baud rate, parity, data and stop bits length

Before using a particular carrier, make sure that the carrier uses the TAP protocol.

The pager code comes with default modem definitions. These are:

- IBM MOD 448 14400 bps
- IBM 5853 2400 bps
- IBM 7852 28800 bps
- IBM 7855 2400 bps

- Generic Hayes compatible
- US Robotics Courier 9600 bps
- Zoom V.34

The paging facility might not work with all modem/carrier combinations even though they may be ″Hayes compatible″ and support the TAP protocol. Modems designated V.34bis have proven the most successful. Older, V.32bis modems have worked with some services provided by a carrier but not with other services, even if provided by the same carrier.

Default Configuration Files Supplied with the Firewall

There are several default configuration files that come with the Firewall. For example, sample templates are provided for carriers, modems, and pager configurations. These are provided as samples only and likely require modifications for international users.

Configuring Pager Notification Support

Pager Setup is used to configure the command customization file and to maintain carriers and modems. If you are using a pager, you must use Pager Setup to customize your pager environment before using Log Monitor.

Before starting, you need to get the correct modem phone numbers, pager ID, and modem parameters from your carrier.

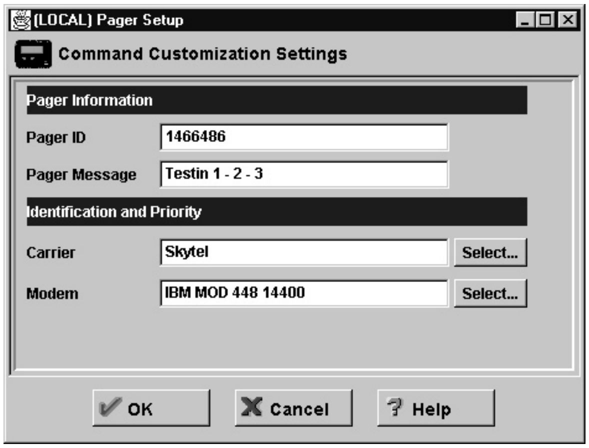
To configure pager notification support, select System Administration from the configuration client navigation tree. Double-click the file folder icon to expand the view. Select **System Logs**. Double-click the file folder icon to expand the view. Select **Pager Setup**.

Command Customization

When you select **Pager Setup** you can select a carrier and modem to use and write a pager message.

Command Customization Settings

When you select **Pager Setup** from the navigation tree you get a **Pager Setup** dialog box with Command Customization Settings similar to the dialog box shown in Figure 33 on page 134.



Command Customization Settings

Pager Information

Pager ID: 1466486

Pager Message: Testin 1 - 2 - 3

Identification and Priority

Carrier: Skytel

Modem: IBM MOD 448 14400

Figure 33. Pager Setup

Type or select values in the entry fields to be added.

1. Enter the pager ID. This is usually a unique PIN assigned to your pager by your carrier company.
2. Enter the pager message. This is a string containing the default message the user wants to send. For numeric pagers, this must be a number only. For alphanumeric pagers, this can be a text message. Do not exceed the maximum message length specified in your carrier setup or your message might be truncated. Do not use a colon (:). If you do, it will be replaced by a blank space character.
3. If there is no carrier name, click **Select** to define a carrier. You will get the **Pager Carrier Administration** dialog box. See “Carrier Administration” on page 135 for details on how to fill in this panel.
4. If there is no modem name, click **Select** to define the modem. You will get the **Pager Modem Administration** dialog box. See “Modem Administration” on page 136 for details on how to fill in this panel.
5. Click **OK**.

Change Command Customization

When you select Pager Setup from the navigation tree you get the **Pager Setup** dialog box with Command Customization Settings.

1. Type or select values in the entry fields to modify the values of the existing customization entry fields.
2. Click **OK**.

Delete Command Customization

1. You can delete an entry on the **Pager Carrier Administration** dialog box or the **Pager Modem Administration** dialog box by selecting an item from the list and double-clicking **Delete**.

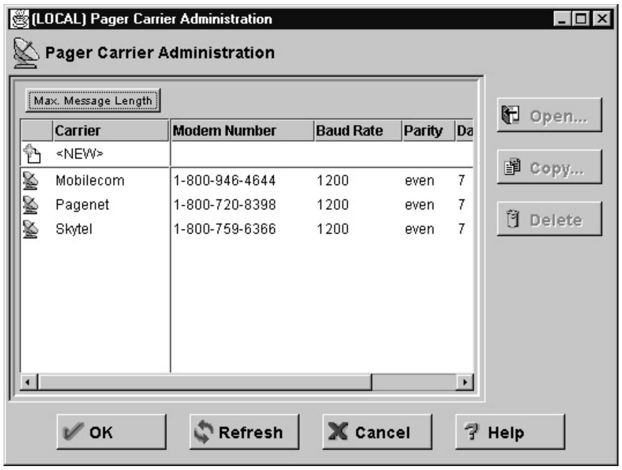
   You will be asked to confirm the deletion.

2. Click **Yes** to confirm the deletion or **No** to return to the **Pager Setup** dialog box.

If no customization entry exists, then pager notification support will not be able to send a page.

Carrier Administration

From the **Pager Setup** dialog box, go to the carrier name field and click **Select**. You get a **Pager Carrier Administration** dialog box similar to the one shown in Figure 34.



(LOCAL) Pager Carrier Administration
Pager Carrier Administration
Max. Message Length
Open...
Copy...
Delete
OK
Refresh
Cancel
Help

	Carrier	Modem Number	Baud Rate	Parity	Da
	<NEW>				
	Mobilecom	1-800-946-4644	1200	even	7
	Pagenet	1-800-720-8398	1200	even	7
	Skytel	1-800-759-6366	1200	even	7

Figure 34. Pager Carrier Administration

Add a Carrier

To add a new carrier select **NEW** on the **Pager Carrier Administration** dialog box and click **Open**. Type or select values in the appropriate entry fields:

1. Enter the carrier name. This can be anything as long as it is unique and provides enough information for you to recognize which carrier it is.
2. Enter the carrier phone number, which is the phone number for a modem at the carrier company, as opposed to their voice paging or other service number. It must be the right modem number for regional or national coverage and for a numeric or alpha pager, as required by the paging device and the service you have contracted.

3. Enter TAP for paging method, the only value allowed.
4. Enter the password if the carrier allows or requires one.
5. Enter the maximum message length for an alphanumeric pager and the maximum digits for a numeric pager.
6. Enter the baud rate. Click the arrow and choose a value from the list.
7. Click **Even**, **Odd**, or **None** for the parity field.
8. Choose the default data bits; click either **7** or **8**.
9. Choose the default stop bits; click either **1** or **2**.
10. Click **OK**.

Change Carrier

1. Select the carrier you want to change from the **Pager Carrier Administration** dialog box and click **Open**.
2. Refer to “Add a Carrier” on page 135 for an explanation of the fields you can change. The carrier name itself cannot be changed. This field will be disabled.
3. Make your desired changes.
4. Click **OK**.

Delete Carrier

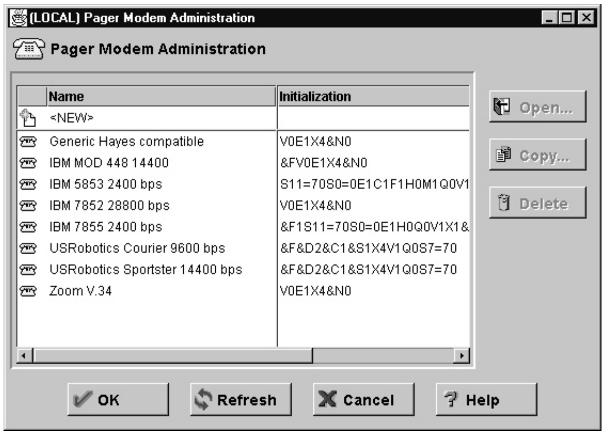
1. Select the carrier you want to delete from the **Pager Carrier Administration** dialog box and click **Delete**.
2. You will be asked to confirm the deletion. Click **Yes** to confirm.

Note: The carrier database must always contain at least one carrier. If no carriers are defined, then pager notification support will fail.

Modem Administration

Your modem manual will contain relevant information about how to initialize your modem. You might need to coordinate modem settings with your carrier. In general, only Hayes-compatible modems, that use the standard modem commands are supported.

From the **Pager Setup** dialog box, go to the modem name field and click **Select**. You get a **Pager Modem Administration** dialog box similar to the one shown in Figure 35 on page 137.



(LOCAL) Pager Modem Administration
Pager Modem Administration
Open...
Copy...
Delete
OK
Refresh
Cancel
Help

Name	Initialization
<NEW>	
Generic Hayes compatible	V0E1X4&N0
IBM MOD 448 14400	&FV0E1X4&N0
IBM 5853 2400 bps	S11=70S0=0E1C1F1H0M1Q0V1
IBM 7852 28800 bps	V0E1X4&N0
IBM 7855 2400 bps	&F1S11=70S0=0E1H0Q0V1X1&
USRobotics Courier 9600 bps	&F&D2&C1&S1X4V1Q0S7=70
USRobotics Sportster 14400 bps	&F&D2&C1&S1X4V1Q0S7=70
Zoom V.34	V0E1X4&N0

Figure 35. Pager Modem Administration

You can add, change, or delete various modems using this dialog box.

Add a Modem

To add a new modem definition file, select **NEW** from the **Pager Modem Administration** dialog box and click **Open**. On the **Add Modem** dialog box, type or select values in the entry fields.

1. Enter the modem name. This can be anything as long as it is unique among the other definitions and provides enough information for you to recognize which modem it is.
2. Enter the COM Port number, which defines the serial COM Port to which the modem is attached. Enter a number less than 10. While the modem must be hardware-configured to this port, it must not be defined to Windows NT; doing so will cause the pager functions to be denied access to the port. If the modem does not match the hardware settings, the pager code will retry for a long time and eventually fail.
3. Enter the initialization string, which should define the modem as a data modem with an echo on X level4 and a fixed baud rate defined by the local site. Do not include the AT command. The pager function will put it at the beginning of the initialization string.
4. Enter the outside line prefix. This is the number you dial to get outside of your company.
5. Click **OK**.

Change Modem

1. Select a modem name from the **Pager Modem Administration** dialog box and click **Open** to change a modem definition file.

On the **Change Modem** dialog box you will see a list of fields you can change for the modem definition. Refer to “Add a Modem” on page 137 for explanations of these fields.

2. Click **OK**.

Delete Modem

1. Select a modem name from the **Pager Modem Administration** dialog box and click **Delete** to delete a modem definition file.
2. You will be asked to confirm the deletion. Click **Yes** to confirm.

Pager Notification Logging

The pager notification process uses the firewall log utility to write output logs. All pager messages and errors are written to the general firewall syslog facility. For more information on how to set up and use your firewall log files, see “Chapter 16. Managing Log and Archive Files” on page 141.

Testing Pager Setup

You can verify your pager setup by using the `pager` command. See the *IBM eNetwork Firewall Reference* for details. It is strongly recommended that you use the pager command any time you define or change the setup to be sure your system, modem, carrier, and paging devices all talk with each other correctly and that pages can actually be sent and received.

Execute Commands

You can specify a program that is invoked each time an alert theshold is reached. To specify a program:

1. Click **Log Monitor Administration** and then double-click **NEW**.

   The **Add Log Monitor** dialog box appears.
2. In the **Class Type** drop-down box, select **Execute Command**. This enables the **Command Filename** field of the panel.
3. In the **Command Filename** field, enter the fully-qualified pathname of the program you want to invoke when an alert threshold is reached.

   The working directory for the commands executed by the log monitor is `\winnt\system32`. Because the command shell is launched from a system process, only system environment variables are set. User environment variables are not set. In general, the launched program should use fully qualified file names instead of relying on path variables.

   The Firewall will pass the full Alert message as the first parameter of the program as follows:

```
Total Authentication Failure Alerts: ICA0001e
Per User Auhentication Failure Alerts: ICA0002e
Per Host Auhentication Failure Alerts: ICA0003e
Message Threshold Alerts: ICA0004e
```

See the *IBM eNetwork Firewall Reference* for a complete description of these messages.

Chapter 16. Managing Log and Archive Files

This chapter describes how to use the log facilities through the configuration client. As users try to access hosts through the various IBM Firewall servers, the IBM Firewall writes entries in the log file maintained by the `IBM Firewall logging service`.

The IBM Firewall can generate large volumes of logging information depending on how you configure your firewall. Log entries can come from a variety of places such as socks and static filters. Additionally, log files can be written to at a variety of severity levels; for example, *debug, information*, or *error*. This chapter also tells you how to use the log management and log archive management facilities to manage the size of your log and archive files.

Log File Creation Using the Configuration Client

You can use the configuration client for log management and log archive management. It is assumed that your available disk space is sufficient to contain all the log information. The Firewall generates routine debug and error information to the `firewall log` facility. Only the primary firewall administrator has access to the `firewall log` facility. Alert messages go to the alert log facility. Administrative audit log information goes to the audit log facility.

For report utilities to function properly, it is important that only firewall log messages appear in their input files. No other facility should be directed to the same file as `firewall log` so set firewall logging accordingly.

If you want to see alerts on the main configuration client panel, you have to direct your alerts to a file designated as an `alert log` facility. Nothing else should be designated for that file.

The following priority levels are cumulative with *debug* capturing the most information. *Critical* captures only the most severe firewall events.

- Debug
- Information
- Warning
- Error
- Critical

It is suggested that you begin with the *information* level until your firewall procedures are stable. Then you can change to *warning* or *error* to reduce the logging activity and the size of the system log.

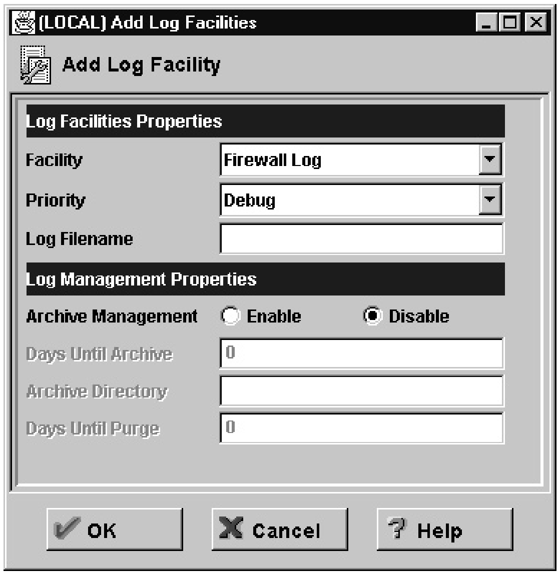
The priority levels do not correspond precisely to the message tag suffix *(i,e,w,s..)*. You might need to experiment to determine how to *shut off* certain messages.

Add Log Facilities

From the configuration client navigation tree, double-click the System Administration file folder icon to expand the view. Double-click the System Logs file folder icon to expand the view. Select Log Facilities. The **Log Facilities** dialog box appears displaying the set of log facilities currently enabled.

1. Select **NEW** from the **Log Facilities** dialog box and click **Open** to add a syslog entry to those currently enabled.

   The **Add Log Facilities** dialog box appears, as shown in Figure 36.



(LOCAL) Add Log Facilities

Add Log Facility

Log Facilities Properties

Facility	Firewall Log
Priority	Debug
Log Filename	

Log Management Properties

Archive Management ○ Enable ● Disable

Days Until Archive	0
Archive Directory	
Days Until Purge	0

Figure 36. Add Log Facilities

2. The log facility determines the type and source of information that gets logged. Click the **Facility** arrow to select one of the following log facilities:
   - Firewall log - general firewall logs, including filter logging

- Alert log - log monitor daemon status and threshold violation warnings used to populate the Alerts Display

3. Click the **Priority** arrow to choose the priority. The logging priorities are listed in order of increasing severity. The priority you select will be the minimum severity level to be logged because prior levels are cumulative.
4. Fill in the log filename. The log filename must have an absolute path (beginning with a drive, colon, and a backslash \) and the path to the file must exist.
5. Archive management only works with the Firewall log. When enabled, the log file size can be reduced on a periodic basis. Enabling archive management means that you set parameters upon which the `fwlogmgmt` command depends. See "Archiving Logs Using the Configuration Client" on page 144.
6. In the **Days Until Archive** field, enter the number of full days, until record(s) in the active log should be archived. The value must be zero or greater. Archival will occur when an `fwlogmgmt -l` command is issued and records in the active log meet the specified criteria. For example, with a 2 in this field, active log entries that are more than 2 days old will be moved to an archive file.
7. Enter the name of an archive directory. The IBM Firewall provides an archiving function, which uses the directory you named. However, you can write a Log Archiver plug-in to replace the IBM Firewall archiving function. See the *IBM eNetwork Firewall Reference* for information on the Log Archiver Plug-in software development kit.
8. In the **Days Until Purge** field, enter the number of full days until an archived log file should be deleted from the archive directory. The value must be zero or greater. Purge will occur when an `fwlogmgmt -a` command is issued and an archived file exists that is older than the specified number of days.
9. Click **OK**.

Change Log Facilities

1. Select the firewall logging entry you want to change from the **Log Facilities** dialog box and click **Open**.

   The **Change Log Facilities** dialog box will appear.
2. Change the desired fields. See "Add Log Facilities" on page 142 for an explanation of the fields.
3. Click **OK**.

Delete Log Facilities

1. Select a firewall logging entry from those currently enabled on the **Log Facilities** dialog box and click **Delete**.

   The **Delete Warning** panel appears.

2. Click **OK** if you want to continue with the delete. Click **Cancel** if you change your mind.

Archiving Logs Using the Configuration Client

The archival process:

- Moves qualifying records from the active log to a separate file
- Compacts the resulting file with the Windows NT compact command

To reduce the size of your active log file:

1. Run the `fwlogmgmt -l` command from the command line periodically, or
2. Set up the `fwlogmgmt -l` command as an NT Schedule Service.

To keep the number of archived files to a minimum:

1. Run the `fwlogmgmt -a` command from the command line periodically, or
2. Set up the `fwlogmgmt -a` command as an NT Scheduled Service.

Qualifying records and files are determined by the values specified in the log facilities definitions, as described in “Add Log Facilities” on page 142.

The most efficient and convenient means of running the log management process is to set it up as a Windows NT Schedule Service event. Start the Windows NT Schedule Service by using the Services object on the control panel. Click Startup and set the startup to automatic. When the Windows NT machine starts, this service will start also. Click Start to start the service and continue.

To schedule fwlogmgmt events, you must issue a command string at the command line. For example, to schedule log management to archive active log records at 3:00 AM every day, type:

```
at 3:00 /every:M,T,W,Th,F,S,Su fwlogmgmt -l
```

Or, to schedule the deletion of old archive files every Sunday, type:

```
at 4:00 /every:Su fwlogmgmt -a
```

Plug-in DLL

See the *IBM eNetwork Firewall Reference* for information on the log archiver plug-in DLL that you can use to replace the Firewall default DLL.

Log Management Outputs

The log management facility does some preliminary integrity checks before proceeding with any log management activities. If any problems are found, diagnostics are sent to the firewall log facility when you run the `fwlogmgmt` command from the command line.

The admin audit (local0) log facility is subject to different archival rules than other facilities. All log facilities require that archival be enabled in order to be archived. However, firewall (local4) and alert (local1) log records are only archived if their dates exceed criteria specified in the facilities definition at the time the archive process is run; whereas the *entire* audit log file will be archived each time.

Report Utilities

You can use the report utility functions to assist you in generating reports from current or archived log files. Report utilities generate tabulated files of administrative information that are organized and formatted for easy mapping to relational database tables. These tables help the firewall administrator to analyze:

- General usage of the Firewall
- Errors in the firewall process
- Attempts at unauthorized access to the secured network

Using the utilities and the firewall log, the administrator can create a regular text file of the messages. Additionally, tabulated files can be generated and imported into tables in a relational database system, such as the DB2® family of products. The administrator can then use the Structured Query Language (SQL) to query the data and generate reports.

Report Utilities are installed as part of the Firewall installation. They can also be separately installed and run on a non-firewall host. The configuration client can be used to run them on a firewall. On a non-firewall machine, use the command line.

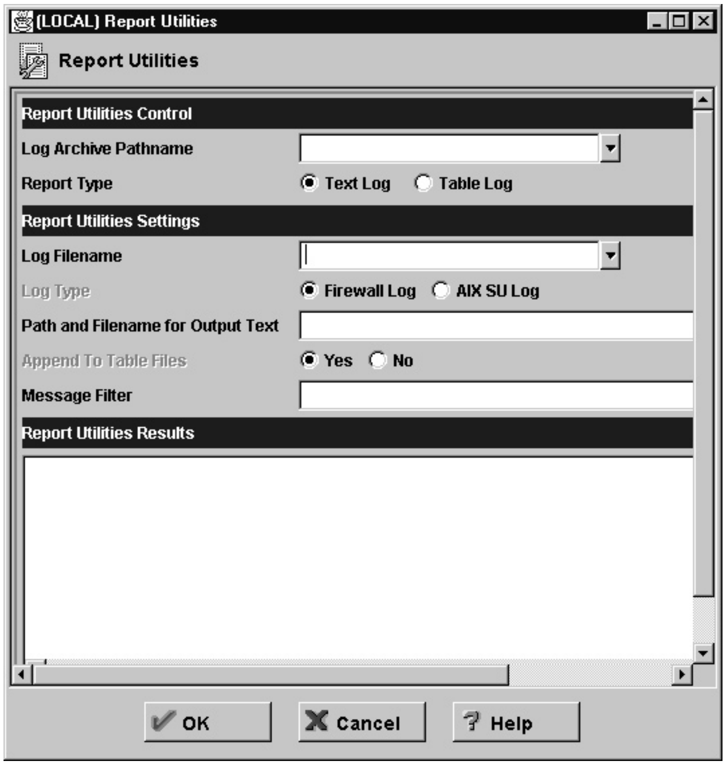
For report utilities to function properly, it is important that only `firewall log` messages appear in their input files. No other facility should be directed to the same file as `firewall log`, so set firewall logging accordingly.

Do not try to use report utilities on any log files prior to the IBM Firewall for AIX V3R1. You can however, use report utilities to process log files from the

IBM Firewall for AIX V3R1 or later. You can also use them to process the AIX su log. See the *IBM eNetwork Firewall Reference* for more detailed information on report utilities.

Running Report Utilities Using the Configuration Client

From the configuration client navigation tree, double-click the System Administration file folder icon to expand the view. Double-click the System Logs file folder icon to expand the view. Select **Report Utilities**. The **Report Utilities** dialog box appears, as shown in Figure 37.



(LOCAL) Report Utilities

Report Utilities

Report Utilities Control

Log Archive Pathname

Report Type ● Text Log ○ Table Log

Report Utilities Settings

Log Filename

Log Type ● Firewall Log ○ AIX SU Log

Path and Filename for Output Text

Append To Table Files ● Yes ○ No

Message Filter

Report Utilities Results

Figure 37. Report Utilities

1. For the default archiver provided with the IBM Firewall, the log archive pathname is the directory that contains compressed log files. In the log archive pathname field, enter the directory that you specified in the archive directory field on the **Log Facilities** dialog box. Enter the absolute path name to the archive directory. If you want to view a log file that is not archived, leave this field blank.
2. Select the **Report Type**. To produce the expanded log message text, select **Text Log**. To create tabulated files for DB2 usage, select **Table Log**. If you

import the resulting files into DB2, you can perform SQL queries on the log data. Refer to the *IBM eNetwork Firewall Reference* for more information.

3. The log filename is any one of the compressed archived log files or other valid `firewall log`, or the name of an AIX su log file. If you made an entry in the log archive directory field, you can click the **Log Filename** arrow to choose which log to work with. If you do not enter a log archive in step 1, the log file name you enter here must be the name of a valid, uncompressed firewall log file or an AIX su log file. You must specify a full path.
4. Select the **log type**, either **firewall** or **AIX su**.
5. Enter the **Path and Filename for Output Text**.
6. Select **Yes** to append the results of a table log request to existing tabulated files or **No** to replace the existing files.
7. This field allows you to select certain types of messages to be placed in the output text file. The contents of this field are treated as parameters that are placed into a standard Windows NT `Find` command. For example, if you type ″ICA0″ into the field (you must include the quotes), it is as though you are running the following command:

   ```
   fwlogtxt < my.log | find "ICA0"
   ```

   Here are some example entries that you can place into this field and the results:

FILTER	RESULT
"ICA0"	Lists log monitor threshold alert messages
"ICA3"	Lists Socks-related messages (#ICA3000 - 3999)
"ICA2010"	Only lists occurrences of the ICA2010 message
/V "ICA3"	Lists all messages except Socks messages
/C "ICA001"	Counts the number of ICA0001 messages

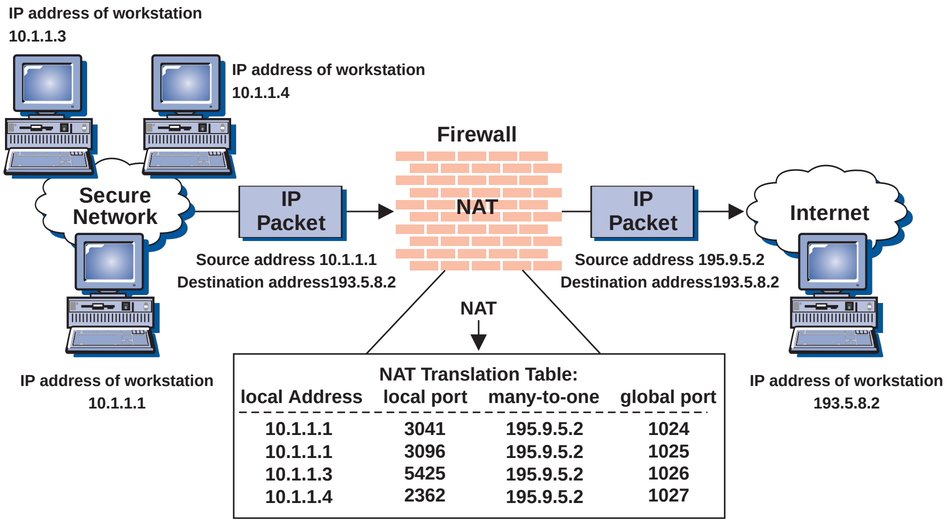
8. Clicking **OK** produces the requested file(s) in the specified output directory on the firewall machine.
9. The Report Utilities Results area shows any error message from the report utility that was run. To view the log text resulting from a Text Log report type, click **Log Viewer** on the main Firewall configuration client panel, and enter the fully- qualified output file name. The .tbl files resulting from a Table Log report type can be loaded into a database as described in the *IBM eNetwork Firewall Reference.*

Chapter 17. Network Address Tranlsation

With the explosive growth of the Internet, IP address depletion problem has become significant. Network address translation (NAT) provides a solution to the IP address depletion problem based upon address reuse.

Addresses within a private network can be assigned out of a very large address space (typically a 10.0.0.0 class A address space). These addresses are private and are not exposed to the Internet. Therefore these addresses can be reused by another IP network. A single registered IP address is used to hide many private network addresses. NAT converts the unregistered addresses and port numbers into a valid registered Internet address and port numbers. In the inbound direction NAT converts the registered Internet address and port numbers back to the unregistered addresses and port numbers. The advantage of NAT is that it transparently allows a network that uses private or illegal addresses to communicate with hosts on the Internet, effectively allowing the private network to have a large address space. Furthermore, by using NAT, addresses in the private network are hidden from the external world providing an additional level of security.

Figure 38 illustrates basic NAT operation in an IBM Firewall environment.


IP address of workstation
10.1.1.3
IP address of workstation
10.1.1.4
Firewall
Secure Network
IP Packet
NAT
IP Packet
Internet
Source address 10.1.1.1
Destination address193.5.8.2
Source address 195.9.5.2
Destination address193.5.8.2
NAT
IP address of workstation
10.1.1.1
IP address of workstation
193.5.8.2

NAT Translation Table:

local Address	local port	many-to-one	global port
10.1.1.1	3041	195.9.5.2	1024
10.1.1.1	3096	195.9.5.2	1025
10.1.1.3	5425	195.9.5.2	1026
10.1.1.4	2362	195.9.5.2	1027

Figure 38. Network Address Translation

TCP and UDP packets generated by secure hosts have their source address replaced with a registered Internet address. The secure host's port will be translated to a unique port number. All outbound packets will have the same source address but a unique port number. This form of translation, referred to as many-to-one translation, allows many secure hosts to hide behind a single address. The packet's checksums in the IP header and TCP and UDP pseudo header are updated. The maximum number of concurrent connections is limited to 64512. Inbound connections are supported with static (rather than dynamic) translation table entries. For example, host 193.5.8.2 can initiate a TCP connection with host 10.1.1.1 (using the global address 195.9.5.2) only if a static entry exists in the NAT translation table that maps 195.9.5.2 to 10.1.1.1.

Not all packets generated by TCP and UDP applications are supported by NAT. Difficulties arise if the application data contained in the IP packet contains an IP address. One particularly troublesome application for address translation is FTP. The FTP control connection issues ″PORT″ commands or ″PASV″ replies that contain an ASCII encoded IP address in the message. In this case NAT must modify not only the addresses in the IP header but also the ASCII address and the port number in the payload.

The IBM eNetwork Firewall NAT Implementation

The IBM Firewall NAT implementation supports basic address translation as described above with the following caveats:

- TCP/UDP applications (except for FTP as described below) that contain IP address information in the payload will only have the packet header fields translated as described above. This implies that UDP applications such as DNS or SNMP will not have address information contained in the payload translated.
- FTP PORT commands are fully translated. However, the address embedded in a PASV response packet is not translated.
- NAT does not perform translation on ICMP packets. To ensure that secure data does not get exposed to the nonsecure network, NAT will discard ICMP packets if the IP address (including the packet-in-error IP address) was supposed to be translated based upon NAT configuration data.

More About NAT

Use NAT if you want to allow:

- Direct access for a machine behind a firewall to a nonsecure site while protecting the address of that secure machine
- A number of machines without registered addresses to share a registered address so that they can reach sites on the Internet
- Others from unsecure locations access to a server behind a firewall

Obtain the registered addresses for NAT from your ISP. All addresses used for NAT cannot be used for any other purpose.

There are four options for NAT:

Many-to-One
Involves translating a packet's secure address and port number so that many (up to 64512) internal addresses can share one registered IP address. This one shared registered IP address will hide local addresses but in addition to it, you need another registered Internet address, for the Firewall's nonsecure address. The NAT configuration will identify the registered Internet address that is used for port translation using a many-to-one entry.

Translate
Used to create a list of secure addresses that will be translated.

Exclude
Used to create a list of secure addresses that will not be translated.

Map Used to reserve a specific registered address for a specific secure address.

Currently, NAT does not perform translation on the IP Headers, which appear in an ICMP error datagram payload. An immediate result from this is that Path MTU Discovery will not work through Firewall systems that are using NAT. Some client/server transactions might have difficulty passing data across a Firewall system performing NAT.

If you suspect that data traffic might have been discarded due to a disruption in ICMP error datagrams flowing to a server using Path MTU Discovery, use one of the following workarounds:

- Disable Path MTU Discovery on the server end of the connection. On Windows NT, this is controlled by registry value EnablePMTUDiscovery. Refer to Microsoft KnowledgeBase article Q120642 for a discussion on TCP/IP Configuration Parameters.
- Lower the MTU used by the server for its connections that pass through the Firewall. On Windows NT, this is controlled by registry value MTU. Refer to Microsoft KnowledgeBase article Q120642 for a discussion on TCP/IP Configuration Parameters.

  To avoid having an ICMP error datagram (fragmentation needed but don't-fragment bit set) sent through the Firewall, the MTU of the network interface should be as small as the smallest MTU of each host that routes to or through the Firewall. On Ethernet networks, 1492 (decimal) is a value that usually accomplishes this goal. On Token Ring networks, MTUs are usually larger than 1492 so setting the value to 1492 should also meet the goal.

- Lower the MTU used by the client as it sets up connections with the server. Refer to the previous paragraph about how to adjust the MTU value.

Configuring Network Address Translation Using the Configuration Client

1. From the configuration client navigation tree, double-click the Address Translation file folder icon to expand the view. Double-click the NAT file folder icon to expand the view.
2. Select **NAT Setup** to configure the network address translation module.

   The **Network Address Translation List** appears, as shown in Figure 39.

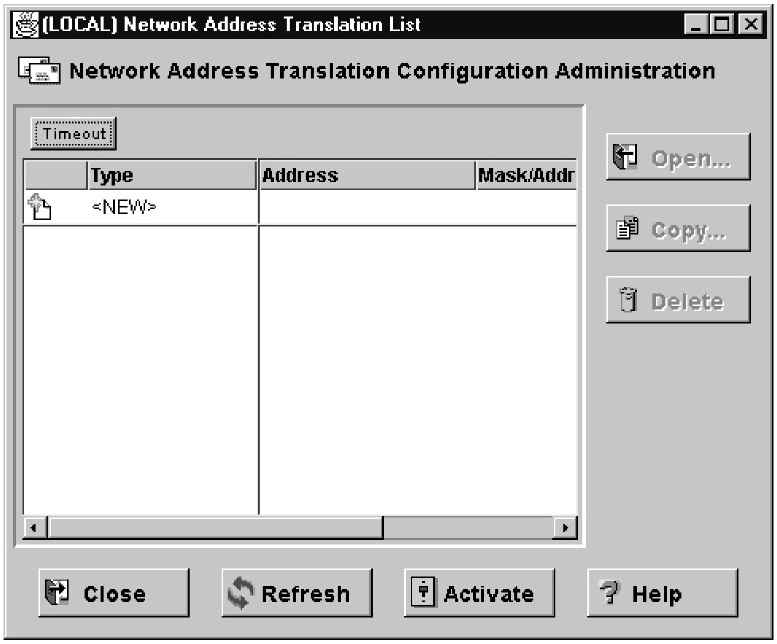

(LOCAL) Network Address Translation List
Network Address Translation Configuration Administration
Timeout
Type
Address
Mask/Addr
<NEW>
Open...
Copy...
Delete
Close
Refresh
Activate
Help

Figure 39. Network Address Translation List

3. Network address translation entries contained in the NAT configuration file are displayed on this dialog box. You can also add, change, or delete NAT entries.

Add NAT Entry

1. Select **New** from the **Network Address Translation List** and click **Open** to add new entries to the NAT configuration file.

   The **Add NAT** dialog box appears.

2. From the **Add NAT** dialog box, click the arrow in the Type of NAT field and select from the following:
   - Many-to-One Registered Network Address: Adds the IP addresses specified to the reserved IP address. The parameters are reserved IP address and time-out accociated with the translation table.
   - Translate Secured Network Address: Specifies a range of secure IP addresses that require network address translation.
   - Exclude Secured Network Address: Specifies a range of secure IP addresses that should be excluded from network address translation.
   - Map Secured Network Address: Defines a one-to-one secure-to-registered IP address static translation.

Many-to-One Registered Network Address

A many-to-one registered address entry translates a packet's secure address and port number so that many (up to 64512) internal addresses can share one registered IP address. Thus you can hide many local addresses with the one registered IP address. (You will need one additional registered Internet address for the firewall's nonsecure address).

When a secure host sends packets to a nonsecure network, one registered IP address is allocated. This unique registered IP address is used to transport an IP frame between the IBM Firewall and machines outside of the secure network.

If you selected Many-to-One from the Add NAT screen, enter the following values:

Registered IP Address

Obtain this from your ISP. This will be a dotted-decimal IP address that all secure adresses will hide behind.

Choose a network object by clicking **Select** to get the **Select Network Object** dialog box. Select a network object and click **OK**. The network object is added to the Network Object field on the **Add NAT Configuration** dialog box. Or, type a value directly into the field if you have not previously created a network object.

Timeout Value

Enter the number of minutes an address translation can remain idle before NAT can free the registered IP address. This timeout value only applies to the address translation that uses a registered IP address within the range of IP addresses specified by this entry.

The default is 15 minutes. The range of values is 5 through 45. NAT translation tables can grow very large, especially in high load environments dominated by HTTP traffic. As the table grows, the processing time associated with address translation increases. In high load situations, a timeout value of 5 minutes is recommended to keep the translation table size low.

Translate Secured Network Address

A translate secured IP address entry defines a set of secure network addresses that require NAT to perform IP address translation. By default, NAT performs address translation on all secure IP addresses in the translate secured IP address set.

If you selected Translate from the Add NAT screen, enter the following values:

Secured IP Address
Specify a dotted-decimal IP address that identifies a range of secure IP addresses that require network address translation.

Choose a network object by clicking **Select** to get the **Select Network Object** dialog box. Select a network object and click **OK**. The network object is added to the Network Object field on the **Add NAT Configuration** dialog box. Or, type a value directly into the field if you have not previously created a network object.

Secured IP Address Mask
Specify a mask, like a subnet mask that specifies the bits in the secure IP address used to identify a range of IP addresses. Bits in these masks that are set to 0 indicate that bit positions that have 0 or 1 are included in the range of IP addresses. So, specifying 255.255.255.255 in the mask indicates that only one secure IP address is included in this translation entry, whereas a mask of 255.255.255.0 indicates class C IP addresses require address translation.

Exclude Secured Network Address

An exclude secure IP address entry defines a set of secure network addresses that does not require NAT to perform IP address translation. By default, NAT performs address translation on all secure IP addresses in the translate secured IP address set.

If you selected Exclude from the **Add NAT** dialog screen, enter the following values:

Secured IP Address
Specify a dotted-decimal IP address that identifies a range of secure IP addresses that should be excluded from network address translation.

Choose a network object by clicking **Select** to get the **Select Network Object** dialog box. Select a network object and click **OK**. The network object is added to the Network Object field on the **Add NAT Configuration** dialog box. Or, type a value directly into the field if you have not previously created a network object.

Secured IP Address Mask

Specify a mask, like a subnet mask that specifies the bits in the secured IP address used to identify a range of IP addresses. Bits in these masks that are set to 0 indicate that bit positions that have 0 or 1 are included in the range of IP addresses. So, specifying 255.255.255.255 in the mask indicates that only one secure IP address is specified in this entry, whereas a mask of 255.255.255.0 indicates class C IP addresses are excluded from address translation.

Map Secured Network Address

A map secured IP address entry defines a one-to-one mapping from a secure IP address to a registered IP address. This one-to-one IP address mapping allows external application clients, such as FTP or telnet clients, to set up TCP sessions with server machines that reside within the secured network. The registered IP addresses in the map secure IP address entries can overlap the IP address space specified by the reserve registered IP address entries.

If you selected Map from the **Add NAT Configuration** dialog box, enter the following values:

Secured IP Address

A dotted-decimal IP address that should be translated into a specified registered IP address.

Choose a network object by clicking **Select** to get the **Select Network Object** dialog box. Select a network object and click **OK**. The network object is added to the Network Object field on the **Add NAT Configuration** dialog box. Or, type a value directly into the field if you have not previously created a network object.

Registered IP Address field

A dotted-decimal IP address into which a specified secure IP address should be translated.

You can choose a network object by clicking **Select** to get the **Select Network Object** dialog box. Select a network object and click **OK**. The network object is added to the Network Object field on the **Add NAT Configuration** dialog box.

Change NAT Entry

Select an existing NAT entry from the **NAT Configuration** dialog box and click **Open** to change Network Translation entries in the NAT configuration file.

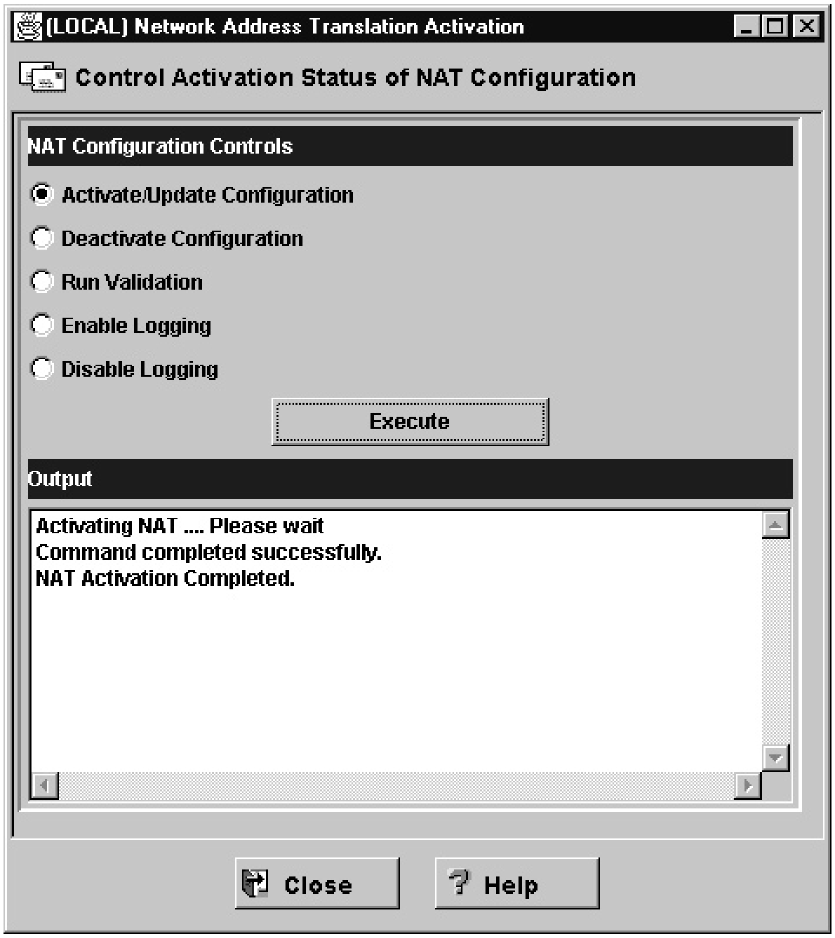
Delete NAT Entry

1. Select an existing NAT entry from the **NAT Configuration** dialog box and click **Delete** to remove a Network Translation entry from the NAT configuration file.

   A confirmation dialog box appears.
2. Select Yes or No.

NAT Activation

1. From the configuration client navigation tree, double-click the Address Translation file folder icon to expand the view. Double-click the NAT file folder icon to expand the view.
2. Select **NAT Activation** and a dialog box similar to the one shown in Figure 40 on page 157 appears.


(LOCAL) Network Address Translation Activation
Control Activation Status of NAT Configuration
NAT Configuration Controls
● Activate/Update Configuration
○ Deactivate Configuration
○ Run Validation
○ Enable Logging
○ Disable Logging
Execute
Output
Close
Help

```
Activating NAT .... Please wait
Command completed successfully.
NAT Activation Completed.
```

Figure 40. NAT Activation

3. You can select any of the following and then click **Execute**:
   - Validate network address translation entries contained in a specified NAT configuration file.
   - Activate/Update the configuration to display Network Address Translation entries currently used by the NAT module.
   - Deactivate NAT to disable network address translation.
   - Enable Logging to enable network address translation logging.
   - Disable Logging to disable network address translation logging.

Logging

NAT will log a variety of error conditions provided that both NAT logging and filter logging are enabled. NAT logging is enabled through the **NAT Activation** panel or by using the **fwnat** command. Filter logging is enabled through the **Log Facility** panel or by using the **fwlog** command.

The following activities will be logged to the firewall log facility:

- Updates to the NAT tables from the Administrator (for example, static or MAP entries)
- Dynamic updates to the NAT translation table
- Error messages
- Failed translation attempts that result in the packet being discarded
- Each time NAT is activated and deactivated

Create Filter Rules for NAT

After you have completed the NAT configuration, you have to create the filter rules for the connections that are going to use NAT. Review “Chapter 8. Controlling Traffic through the Firewall” on page 55 and use the predefined services that are for direct connections. Examples of predefined services that are for direct connections are:

- HTTP direct out
- Telnet direct out

See “Building Connections Using Predefined Services” on page 57 for more information.

If you want a service to come directly into your network, you will have to create one. See “Using the Configuration Client to Create Services” on page 78 for information on how to do this.

Example Interaction Between NAT, Filters, and Tunnels

Figure 41 on page 159 illustrates an example interaction between NAT, filters, and tunnels.

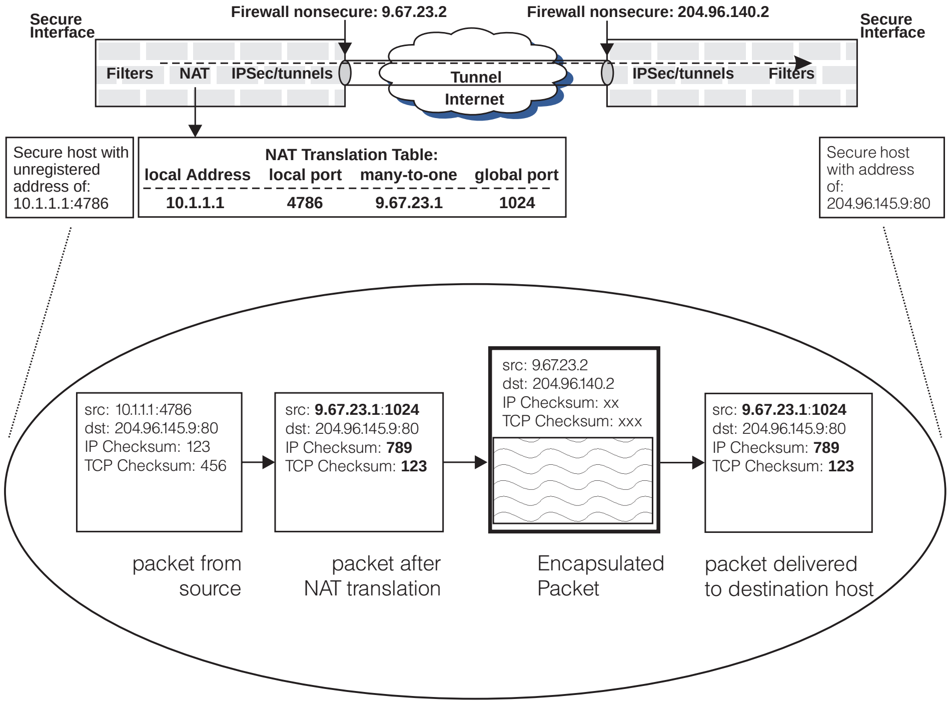


Figure 41. Example Interaction between NAT, Filters and Tunnels

Assume an IPSec ESP tunnel is manually established between firewalls 9.67.23.2 and 204.96.140.2. NAT is active only at the 9.67.23.2 firewall because this secure network uses private addresses. The secure network at the other end of the tunnel is not using NAT. In addition to illustrating basic NAT translation (the bold fields in the second packet from the left illustrate the fields in the packet that are modified during outbound address translation), Figure 41 also illustrates that the translated packet from the host is encapsulated in an IP packet that is *not* translated.

In general, filtering is applied to outbound packets prior to NAT and to inbound packets after NAT translation. Therefore the filter rules are based on untranslated addresses. When NAT and tunnels are involved, the filter rules at the firewall that has NAT active are also based on untranslated addresses. At the other end of the tunnel (assuming NAT is not active at this firewall), the filter rules for inbound packets are based on translated source and destination addresses (for the inbound and outbound cases respectively). If NAT is active at both ends of the tunnel the discussion above applies in both directions.

Using the scenario illustrated in Figure 41 as an example, and assuming that the goal is to allow secure host 10.1.1.1 to communicate with secure host

204.96.145.9 over a tunnel, the firewall attached to 10.1.1.1 must have a filter rule permitting 10.1.1.1 to communicate with 204.96.145.9 over a tunnel. At the other firewall connected to the destination host, a filter rule is required permitting communication between 9.67.23.1 and 204.96.145.9 through the tunnel.

NAT and Tunnels

Tunnels can be created with the dynamic filters feature. This means that the IP filters necessary to allow packets to flow through the tunnel and to continue into and out of the secure side of your network are automatically generated in addition to the tunnel definition information.

When a tunnel definition with dynamic filters is activated on the Firewall, the corresponding dynamic filter rules are activated as well and when the tunnel is deactivated the corresponding dynamic filter rules are deactivated. The tunnel definition is then exported on the tunnel owning firewall and imported on the tunnel partner firewall. The dynamic filters are imported along with the tunnel definition. This feature saves the firewall administrator time and configuration problems when using tunnels.

NAT's purpose is to shield the IP addresses on the secure side of the Firewall from the nonsecure side. This solves two problems. It allows you to use unregistered IP addresses in your secure network and still access the nonsecure network without conflict. It also keeps the nonsecure network hosts from knowing about any of your secure side host IP addresses. To do this, NAT has to alter the source IP address and port of outgoing packets. When response packets come inbound on the connection, NAT reverses the translation it performed when the packet was outbound and resets the proper secure host's IP address and port in the packet's destination fields. NAT does this even for packets that travel through tunnels.

The difficulty is that if the tunnel owning firewall also has NAT configured and active, the dynamic filters imported and activated with the tunnel definition on the tunnel partner firewall do not include filters to allow the NAT-translated IP addresses to flow into and out of your partner's secure network.

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Bibliography

For additional information about security on the Internet, visit the IBM eNetwork Firewall home page at: http://www.software.ibm.com/enetwork/firewall.

Information in IBM Publications

Other IBM sources of information on firewalls, Internet security, and general security topics are listed here.

Firewall Topics

The following documents are available on the IBM Firewall CD-ROM and the IBM eNetwork Firewall home page.

- *IBM eNetwork Firewall User's Guide*, GC31-8658
- *IBM eNetwork Firewall Reference*, SC31-8659
- *Guarding the Gates Using the IBM eNetwork Firewall for NT 3.2*, SG24-5209

Internet and World Wide Web Topics

- *A Comprehensive Guide to Virtual Private Networks, Volume 1: IBM Firewall, Server and Client Solutions*, SG24-5201
- *A Guide to the Internet Connection Servers*, SG24-4805
- *Accessing CICS Business Applications from the World Wide Web*, SG24-4547
- *Accessing OS/390 OpenEdition MVS from the Internet*, SG24-4721
- *Accessing the Internet*, SG24-2597
- *Building the Infrastructure for the Internet*, SG24-4824
- *Cool Title about the AS/400 and Internet*, SG24-4815
- *The Domino Defense: Security in Lotus Notes and the Internet*, SG24-4848
- *Examples of Using MQSeries on WWW*, SG24-4882
- *How to Secure the Internet Connection Server for MVS/ESA*, SG24-4803
- *Lotus Domino Server Release 4.5 on AIX Systems: Installation, Customization, and Administration*, SG24-4694
- *Netscape Proxy Server*, SK2T-7444
- *Running CICS Transactions through the Web: The CICS Internet Gateway to VSE/ESA*, SG24-4799
- *Safe Surfing: How to Build a Secure World Wide Web Connection*, SG24-4564
- *Teach Yourself CGI Programming with PERL in a Week*, SR23-7343
- *Using the Information Super Highway*, GG24-2499
- *World Wide Web Access to DB2*, SG24-4716

General Security Topics

- *The Basics of IP Network Design*, SG24-2580
- *Elements of Security: AIX V4.1*, GG24-4433
- *Enterprise-Wide Security Architecture and Solutions Presentation Guide*, SG24-4579
- *HACMP/6000 Customization Examples*, SG24-4498
- *IBM Global Network (IGN) Security Policy*, GC34-2206
- *IBM Security Architecture: Securing the Open Client/Server Distributed Enterprise*, SC24-8135
- *IBM Systems Monitor: Anatomy of a Smart Agent*, SG24-4398
- *Security Overview of Open Systems Networking*, GG24-3815

- *Systems Monitor for AIX User's Guide*, SC31-8173
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Information in Industry Publications

These industry publications pertain to TCP/IP and UNIX:

- Albitz, Paul, and Cricket Liu. *DNS and BIND*. Sebastopol, CA: O'Reilly and Associates, 1997. (ISBN: 1-56592-236-0)
- Costales, Brian with Eric Allman. *Sendmail*. O'Reilly and Associates, Inc. (ISBN: 1-56592-222-0)
- Hunt, Craig. *TCP/IP Network Administration*. O'Reilly and Associates, Inc. (ISBN: 0-937175-82-X)
- Nemeth, Snyder, et al. *UNIX System Administration Handbook*. Prentice Hall. (ISBN: 0-13-151051-7

This industry publication pertains to Windows NT:

Cowart, Robert. *Windows NT Server 4.0 Administrator's Bible*. IDG Books Worldwide, 1996. (ISBN: 0764580094)

These industry publications pertain to firewalls and security on the Internet:

- Ahuja, Vijay. *Network and Internet Security*. Boston: Academic Press Professional, 1996. (ISBN: 0120455951)
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